

Water Supply Project Eastern and Midlands Region - SID Engineering Report

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Acronyms and Abbreviations

Acronym	Meaning
AAAC	All Aluminium Alloy Conductor
ACSR	Aluminium Conductor Steel Reinforced
AE	Access and Egress Point
BESS	Battery Energy Storage System
BPT	Break Pressure Tank
BPS	Booster Pumping Station
BSI	British Standards Institution
CC	Construction Compound
CEMP	Construction Environmental Management Plan
CFC	Coagulation Flocculation Clarification
CIRIA	Construction Industry Research and Information Association
CP	Cathodic Protection
CPO	Compulsory Purchase Order
CWSTs	Clear Water Storage Tank
DB	Design Build
DBO	Design Build Operate
DYAA	Dry Year Annual Average
DYCP	Dry Year Critical Period
EIAR	Environmental Impact Assessment Report
ESB	Electricity Supply Board
ESBN	Electricity Supply Board Network
FAT	Factory Acceptance Testing
FCV	Flow Control Valve
FOAR	Final Options Appraisal Report
GAC	Granular Activated Carbon
GDA WRZ	Greater Dublin Area Water Resource Zone
GWh	Gigawatt-hour
ha	Hectare
HAP	Heavy Angle Portal
HR	Head Room
HLPS	High Lift Pumping Station
HV	High Voltage
ISO	International Organization for Standardization
kV	Kilovolt
kW	Kilowatt
kWh	Kilowatt-hour
LED	Light-emitting diode

Acronym	Meaning
LoS	Level of Service
LV	Low Voltage
MCA	Multi-criteria analysis
MEICA	Mechanical, Electrical, Instrumentation, Control and Automation
MI	Megalitre
Mld	Megalitres per day
mAOD	Metres Above Ordnance Datum
MV	Medium Voltage
NHA	Natural Heritage Area
nm	Nanometre
NWRP	National Water Resources Plan
NYAA	Normal Year Annual Average
OHL	Overhead Line
OHX	Overhead Power Crossing
OPEX	Operational Expenditure
OSEC	On-site Electro Chlorination
pH	Potential of Hydrogen
PLC	Programmable Logic Controller
pNHA	Proposed Natural Heritage Area
POAR	Preliminary Options Appraisal Report
PSD	Pipe Storage Depot
PV	Photovoltaic
PWWC	Passive Wedge-wire Cylinder
RDX	Road Crossing
RGF	Rapid Gravity Filtration
RW	Raw Water
RWBT	Raw Water Balancing Tank
RWI&PS	Raw Water Intake and Pumping Station
RWRM	Raw Water Rising Main
RYX	Rail Crossing
SAC	Special Area of Conservation
SAT	Site Acceptance Testing
SCADA	Supervisory Control and Data Acquisition
SDB	Supply Demand Balance
SEAI	Sustainable Energy Authority of Ireland
SPA	Special Protection Area
SPF	Set Point Flow
SuDS	Sustainable Drainage Systems
THM	Trihalomethanes

Acronym	Meaning
THMFP	Trihalomethane Formation Potential
TII	Transport Infrastructure Ireland
TMP	Traffic Management Plan
TPR	Termination Point Reservoir
TOTEX	Total Expenditure
TW	Treated Water
TWh	Terrawatt-hour
TWL	Top Water Level
UPS	Uninterruptible Power Supply
UV	Ultraviolet
UVT	Ultraviolet Transmission
UWWEST	Used Washwater Equalisation and Settlement Tanks
WA	Washout Valve – Permanent Discharge Location with a Permanent Outfall
WAFU	Water Available for Use
WB	Washout Valve – With no Permanent Outfall
WBP	Watercourse Crossing – Ditch which has been noted as having some water during the field survey
WBX	Watercourse Crossing – Smaller watercourse or stream
WCP	Winter Critical Period
WCW	Watercourse Washout Location – Permanent Outfall Locations
WCX	Watercourse Crossing – Watercourse with Environmental Protection Agency segment code
WTP	Water Treatment Plant
WwTP	Wastewater Treatment Plant

1. Introduction

1. The Proposed Project is a water supply project involving the abstraction and pumping of raw water from the Lower River Shannon at Parteen Basin, treatment of the water nearby at Birdhill, County Tipperary, and pumping of the treated water via the High Lift Pumping Station (HLPS) through an underground Pressure Pipeline to a Break Pressure Tank (BPT) located at a high point near Cloughjordan, County Tipperary. From this high point near Cloughjordan, the treated water will flow via an underground pipeline through the Midlands to a termination point at the Termination Point Reservoir (TPR) at Peamount, in County Dublin (within the administrative area of South Dublin County Council), where it will connect into the existing Greater Dublin Area Water Resource Zone (GDA WRZ).
2. In total the pipeline would be approximately 172km in length and would be supported by six permanent Infrastructure Sites, of varying sizes and purposes. The pipeline would traverse the administrative areas of Tipperary County Council, Offaly County Council, Kildare County Council and South Dublin County Council. In addition, the works needed to provide power to two of the Infrastructure Sites (referred to as the 38 kV Uprate Works and described in Section 12) would cross Clare County Council, Limerick City and County Council, (as well as Tipperary). Therefore, six Local Authorities are partly within the Planning Application Boundary.
3. This report provides a description of the key design infrastructure that is the subject of the Strategic Infrastructure Development Planning Application.
4. The Proposed Project is designed to meet the demand requirements of the GDA WRZ and a further 36 WRZs as presented in the Regional Water Resources Plan – Eastern and Midlands (the Eastern and Midlands Plan) (Irish Water 2022), which collectively have been defined as the Water Supply Area.¹
5. This report distinguishes between different stages of the development of the project by adopting the following terminology: ‘Previous iterations of the Proposed Project’ refers to the In-flight Water Supply Project developed prior to the adoption of the National Water Resources Plan (Irish Water 2021 and 2022) including the Eastern and Midlands Plan (Irish Water 2022). The ‘Proposed Project’ refers to the project that planning permission is being sought for and that has taken account of the conclusions of the National Water Resources Plan (Irish Water 2021 and 2022) including the Eastern and Midlands Plan (Irish Water 2022). The Proposed Project aligns with the Preferred Approach for the Eastern and Midlands Region, a New Shannon Source with transfers as set out in the Eastern and Midlands Plan (Irish Water 2022).
6. This report is supported by the following documents:
 - Appendix A: Architectural Statement
 - Appendix B: Standard Specification for ESB 38 kV Networks.
7. All figures showing the Proposed Project are contained in in Volume 5 of the Environmental Impact Assessment Report (EIAR).

1.1 Extent of the Proposed Project

8. The Proposed Project has been developed to deliver a long-term, sustainable and resilient water supply for the Eastern and Midlands Region, to meet the water demand from residential, commercial and industrial development to the year 2050 and beyond. The Proposed Project infrastructure would have the

¹ Two of the 37 WRZs were subsequently consolidated and so the Proposed Project is to meet the need for the GDA WRZ and a further 35 WRZs.

capacity to deliver water to meet the projected peak deficit of 280 million litres per day (Mld) of treated water in 2050, as set out in the Eastern and Midlands Plan (Irish Water 2022). A raw water abstraction consent of 300Mld is being sought to cover the operational requirements of providing up to 280Mld of treated water in 2050, with a provision of a further 20Mld to allow for potential future sustainability reductions from existing supply volumes. Although the peak output would be 300Mld, under normal conditions the Proposed Project would provide a treated water supply of typically 154Mld.

9. The Proposed Project would consist of the following main features:

- Abstraction of raw water from Parteen Basin on the Lower River Shannon downstream of Lough Derg and the towns of Ballina and Killaloe
- A Raw Water Intake and Pumping Station (RWI&PS) on the eastern shore of Parteen Basin would facilitate a maximum abstraction of up to 300Mld, during peak demand periods from the Lower River Shannon, downstream of Lough Derg
- Two steel pipelines, approximately 2km in length, and each 1,500mm in diameter, referred to as the Raw Water Rising Mains (RWRMs). These would transfer raw water from the RWI&PS to a Water Treatment Plant (WTP) near Birdhill, County Tipperary and each pipe would be capable of transferring raw water up to a maximum throughput of 300Mld
- The WTP would provide the infrastructure needed to clean the water to drinking standards and the capacity to pump the water through the Treated Water Pipeline
- Approximately 170km of 1,600mm diameter single steel pipeline, comprising:
 - A Treated Water Pipeline from the WTP to a Break Pressure Tank (BPT) near Cloughjordan, County Tipperary, approximately 37km long
 - A Treated Water Pipeline from the BPT to the Termination Point Reservoir (TPR) at Peamount, County Dublin, approximately 133km in length.²
- The TPR would have a capacity of 75 megalitres (MI) and would provide the location for the Proposed Project to connect into the existing drinking water network
- Pipeline infrastructure including a BPT near Cloughjordan, County Tipperary; a Booster Pumping Station (BPS) east of Birr, County Offaly; and a Flow Control Valve (FCV) south of Newtown in County Kildare, approximately 5km west of the TPR
- Operational ancillary infrastructure at frequent intervals along the length of the pipeline including Line Valves, Air Valves, water discharge points (referred to as “Washouts”), access points (referred to as Manways), parking Lay-Bys for maintenance access and power connections to the Line Valves
- Power connections to the Infrastructure Sites³ and Line Valves, including uprating of the existing Ardnacrusha – Birdhill 38 kilovolt (kV) overhead line to deliver adequate electrical power to the RWI&PS and WTP and providing a new connection from a sub-station at Birr to the BPS.

10. In addition to this infrastructure provision has been made for take-off points at strategic locations between the WTP and TPR. These would facilitate future potential connections to supply communities in the Midlands within the Water Supply Area⁴ without disruption to the operation of the pipeline. The location of these future potential connections align with the Eastern and Midlands Plan (Irish Water 2022). The

² A combination of pumping and gravity would be used to transfer water through the pipeline. Water would be pumped from the RWI&PS to the WTP and from the WTP to the BPT which is the high point along the pipeline. From the BPT, the water would usually flow by gravity along the remaining 133km to the TPR. However, at times when the volume of water needed is higher than approximately 165Mld, the water would be pumped through the whole length of the pipeline. The BPS provides the capacity to do this additional pumping when it is required.

³ Infrastructure sites' is the collective term that has been used for the RWI&PS, WTP, BPT, BPS, FCV and TPR.

⁴ The Water Supply Area is an area defined by the infrastructure and transfer pipeline, where the proximity of treated water supplies from the Proposed Project offers opportunities for potential future consolidation of existing smaller and more vulnerable public water supply schemes, in a resilient, well-supported configuration. Potential future connecting infrastructure would be subject to separate consenting processes.

connecting pipelines and associated infrastructure would be delivered by Uisce Éireann through separate projects, yet to be designed, and would be subject to their own separate consenting processes.

11. Water would be pumped through the RWRMs from the RWI&PS to the WTP using the pumping station at the RWI&PS. After treatment the water would be stored in the Clear Water Storage Tanks (CWSTs) at the WTP. It would then be pumped approximately 37km through the Treated Water Pipeline to the BPT using the high lift pumps at the WTP. The BPT would be the high point along the pipeline and from there the water would usually flow by gravity along, approximately 133km of the Treated Water Pipeline from the BPT to the TPR. However, at times when the volume of water needed is higher than, approximately 165Mld supplementary pumping would be needed to achieve the required supply. The BPS would provide this additional pumping capacity to increase the flow within the Treated Water Pipeline between the BPT and the TPR.
12. Image 1.1 provides a summary of the different elements of the Proposed Project. These are then shown geographically in Image 1.2.

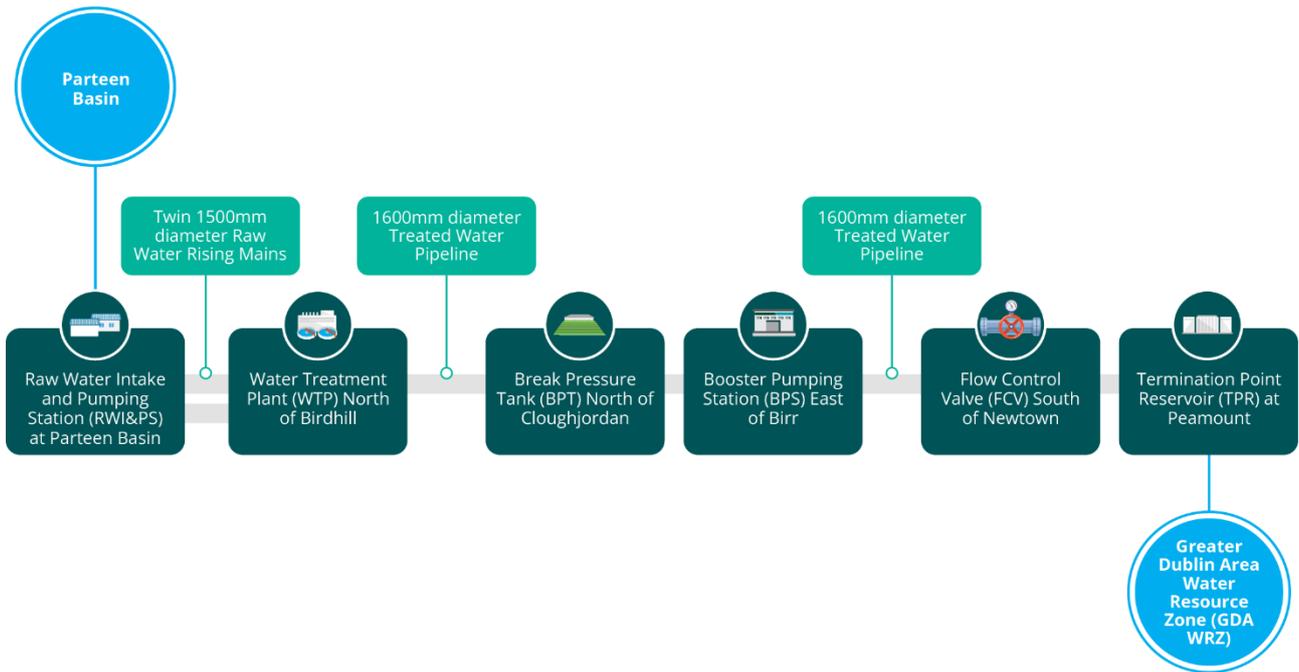


Image 1.1: Overview of the Principal Infrastructure and Pipeline Elements of the Proposed Project

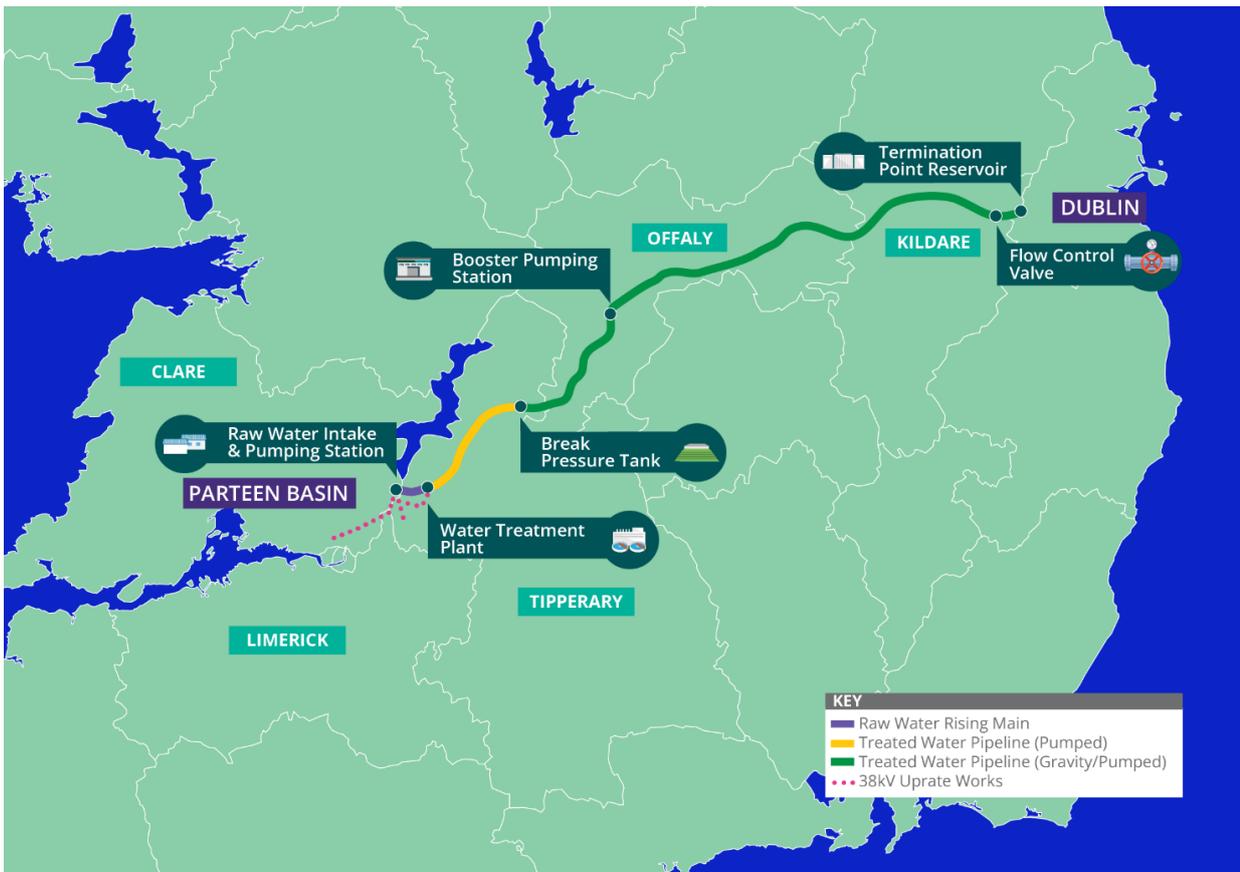


Image 1.2: Graphical Overview of the Proposed Water Supply Infrastructure

13. The principal elements of the Proposed Project are identified in Table 1.1.

Table 1.1: Summary of Principal Project Infrastructure

Proposed Project Infrastructure	Outline Description of Proposed Project Infrastructure*
Permanent Infrastructure	
Raw Water Intake and Pumping Station (RWI&PS) (Infrastructure Site) County Tipperary	<ul style="list-style-type: none"> The RWI&PS would be located on a permanent site of approximately 4ha on the eastern shore of Parteen Basin in the townland of Garrynatineel, County Tipperary. In addition, approximately 1ha of land would be required on a temporary basis during construction. The RWI&PS has been designed to abstract enough raw water from the River Shannon at Parteen Basin to provide up to 300Mld of treated water by 2050. The RWI&PS site would include a bankside Inlet Chamber, the Raw Water Pumping Station Building, two Microfiltration Buildings, an Electricity Substation and Power Distribution Building, and Dewatering Settlement Basins. The tallest building on the RWI&PS site would be the Microfiltration Buildings which would be 10.9m above finished ground level. Additionally, there would be a telemetry mast, the top of which would be 14m above finished ground level. Power for the RWI&PS would be supplied via an underground connection to the existing Birdhill 38 kV electricity substation. A new permanent access road from the R494 would be constructed to access the proposed RWI&PS site. This access road would be 5m in width and 670m in length. The RWI&PS site boundary would be fenced with a stock proof fence and a 2.4m high paladin security fence 5m inside the boundary. The site would be landscaped in line with the surrounding environment to reduce its visual impact.
Raw Water Rising Mains (RWRMs) (Pipeline) County Tipperary	<ul style="list-style-type: none"> The RWRMs would consist of two 1,500mm underground pipelines made from steel that would carry the raw water approximately 2km from the RWI&PS to the Water Treatment Plant (WTP) at Incha Beg, County Tipperary. The water would be pumped from the pumping station at the RWI&PS to the WTP. Twin RWRMs have been proposed so that one RWRM can be taken out of service for cleaning and maintenance while still providing an uninterrupted flow of raw water through the other RWRM. The RWRMs would include Line Valves, a Lay-By, Air Valves and Cathodic Protection. A 20m wide Permanent Wayleave would provide Uisce Éireann with operational access to the RWRMs.
Water Treatment Plant (WTP) (Infrastructure Site) County Tipperary	<ul style="list-style-type: none"> The WTP would be located on a permanent site of approximately 31ha at Incha Beg, County Tipperary, 2.6km north-east of the village of Birdhill, and 2km east of the proposed RWI&PS. In addition, approximately 2.5ha of land would be required on a temporary basis during construction. The WTP would treat the raw water received from the RWI&PS via the RWRMs. Once treated, the High Lift Pumping Station (HLPS) would deliver the treated water onwards from the WTP to the Break Pressure Tank (BPT) at Knockanacree, County Tipperary, via the Treated Water Pipeline. The WTP would comprise of a series of tanks and buildings including the Raw Water Balancing Tanks, Water Treatment Module Buildings, Sludge Dewatering Buildings, Sludge Storage Buildings, Clear Water Storage Tanks and HLPS, an Electricity Substation and Power Distribution Building, and the Control Building. The tallest building on the WTP site would be the Water Treatment Module Buildings which would be up to 15.6m above finished ground level. Additionally, there would be a telemetry mast, the top of which would be 14m above finished ground level. There would also be a potential future water supply connection point at the junction between the permanent access road and the R445. Power for the WTP would be supplied via an underground connection to the existing Birdhill 38 kV electricity substation. Solar panels would be placed on the roofs of the Chemical Dosing Manifold Building, the Water Treatment Module Buildings, Clear Water Storage Tanks and Sludge Storage Buildings, and at a number of locations on the ground to supplement the mains power supply. A new permanent access road from the R445 would be constructed and would be 6m in width and 640m in length. The WTP site boundary would be fenced with a stock proof fence and a 2.4m high palisade security fence 5m inside the boundary. The site would be landscaped in line with the surrounding environment to reduce its visual impact.

Proposed Project Infrastructure	Outline Description of Proposed Project Infrastructure*
<p>Treated Water Pipeline from the WTP to the BPT (Pipeline) County Tipperary</p>	<ul style="list-style-type: none"> The Treated Water Pipeline from the WTP to the BPT would consist of a single 1,600mm underground steel pipeline which would be approximately 37km long. The water would be pumped through this section of the Treated Water Pipeline by the HLPS. The Treated Water Pipeline would include Line Valves, Washout Valves, Air Valves, Manways, Cathodic Protection and Lay-Bys. A 20m wide Permanent Wayleave would provide Uisce Éireann with operational access to the pipeline (this Wayleave has been extended to approximately 30m at some Line Valves to provide access between the Lay-Bys and Line Valves). There would be an additional 10m wide Permanent Wayleave at certain locations for operational access to smaller pipes connecting Washout Valves with permanent discharge locations.
<p>Break Pressure Tank (BPT) (Infrastructure Site) County Tipperary</p>	<ul style="list-style-type: none"> The BPT would be located on a permanent site of approximately 7ha in the townland of Knockanacree, County Tipperary. In addition, approximately 0.8ha of land would be required on a temporary basis during construction. The BPT would be located at the highest point of the pipeline. It marks the end of the Treated Water Pipeline from the WTP to the BPT and the start of the Treated Water Pipeline from the BPT to the Termination Point Reservoir (TPR) in the townland of Loughtown Upper, at Peamount, County Dublin. It would act as a balancing tank and would be required to manage the water pressures in the entire Treated Water Pipeline during flow changes, particularly during start-up and shut-down. The BPT site would include the BPT and a Control Building. The BPT would be a concrete tank divided into three cells covered with an earth embankment. The BPT tanks would be 5m in height and partially buried below finished ground levels. The Control Building would be 7.5m over finished ground level. Additionally, there would be a telemetry mast, the top of which would be 14m above finished ground level. Access to the BPT site would be via a new permanent access road from the L1064 which would be 5m wide and 794m in length. Power for the BPT would be supplied via an underground connection from the existing overhead power line. Solar panels would be placed on the south facing side of the control building roof, on the BPT and at ground level to the south of the site to supplement the mains power supply. The BPT site boundary would be bounded by the existing hedgerow / tree line with a 2.4m high palisade security fence around the permanent infrastructure. The site would be landscaped in line with the surrounding environment to reduce its visual impact.
<p>Treated Water Pipeline from the BPT to the TPR (Pipeline) Counties Tipperary, Offaly, Kildare and Dublin (within the administrative area of South Dublin County Council)</p>	<ul style="list-style-type: none"> The Treated Water Pipeline from the BPT to the TPR would consist of a single 1,600mm underground steel pipeline, approximately 133km long. The water would normally travel through the Treated Water Pipeline by gravity; however, flows greater than approximately 165Mld would require additional pumping from the Booster Pumping Station (BPS) in the townland of Coagh Upper, County Offaly. The Treated Water Pipeline would include Line Valves, Washout Valves, Air Valves, Manways, Cathodic Protection, Lay-Bys and potential future connection points. A 20m wide Permanent Wayleave would provide Uisce Éireann with operational access to the pipeline (this Wayleave has been extended to approximately 30m at some Line Valves to provide access between the Lay-Bys and Line Valves). There would be an additional 10m wide Permanent Wayleave at certain locations for operational access to smaller pipes connecting Washout Valves with permanent discharge locations.
<p>Booster Pumping Station (BPS) (Infrastructure Site) County Offaly</p>	<ul style="list-style-type: none"> The BPS would be located on a permanent site of approximately 2.6ha in the townland of Coagh Upper, County Offaly. It would be located approximately 30km downstream from the BPT. In addition, approximately 3ha of land would be required on a temporary basis during construction. The BPS would be required when the demand for water causes the flow through the pipeline to exceed approximately 165Mld. The BPS site would consist of a single-storey Control Building with a basement below. It would have a finished height of 7.6m above finished ground level. There would also be a separate Electricity Substation and Power Distribution Building. Additionally, there would be a telemetry mast, the top of which would be 14m above finished ground level. Power to the BPS would be supplied from an existing 38 kV electricity substation at Birr, through cable ducting laid within the public road network. There would be ground mounted solar panels on the southern side of the BPS site to supplement the mains power supply. The site would be accessed directly from the L3003. The BPS site boundary would be fenced with a stock proof fence and a 2.4m high palisade security fence between 5m -12m inside the boundary. The site itself would be landscaped in line with the surrounding environment to reduce its visual impact.

Proposed Project Infrastructure	Outline Description of Proposed Project Infrastructure*
Flow Control Valve (FCV) (Infrastructure Site) County Kildare	<ul style="list-style-type: none"> The FCV controls the flows in the Treated Water Pipeline from the BPT to the TPR. It would be a small permanent site of approximately 0.5ha in the townland of Commons Upper in County Kildare. In addition, approximately 0.6ha of land would be required on a temporary basis during construction. It would consist of three 700mm diameter FCVs and three flow meters installed in parallel with the Line Valve and housed within an underground chamber. Access to the FCV site would be directly off the L1016 Commons Road Upper. Power supply to the FCV site would be provided from the existing low voltage network via a combination of overhead lines and buried cables. There would be ground mounted solar panels on the north-eastern side of the site to supplement the mains power supply. Kiosks at the FCV site would house the Programmable Logic Controller, telemetry and power supply for the Line Valve. There would also be a telemetry mast, the top of which would be 14m above finished ground level. The site boundary would be fenced with a stock proof fence and a 2.4m high palisade security fence 5m inside the boundary.
Termination Point Reservoir (TPR) (Infrastructure Site) County Dublin (within the administrative area of South Dublin County Council)	<ul style="list-style-type: none"> The TPR would be located on a permanent site of approximately 8.3ha adjacent to an existing treated water reservoir in the townland of Loughtown Upper, at Peamount, County Dublin (within the administrative area of South Dublin County Council) and would have capacity for 75ML of treated water supply. In addition, approximately 1.1ha of land would be required on a temporary basis during construction. It would be located at the downstream end of the Treated Water Pipeline from the BPT to the TPR and would be the termination point for the Proposed Project. It would be at this location that the Proposed Project would connect to the existing water supply network of the Greater Dublin Area Water Resource Zone (GDA WRZ). The TPR would consist of an above-ground storage structure, associated underground Scour Water and Overflow Water tanks and a Chlorine Dosing Control Building. The TPR would be a concrete tank divided into three cells and covered with an earth embankment. The top of the TPR would be 11.2m above finished ground level. The Chlorine Dosing Control Building would be 8.4m over finished ground level. Additionally, there would be a telemetry mast, the top of which would be 14m above finished ground level. Power for the TPR would be supplied via an underground connection to the existing electricity substation at Peamount Reservoir. There would be solar panels on top of a portion of the northern cell of the TPR to supplement the mains power supply. A new permanent access road from the R120 would be constructed and would be 5m wide and 342m in length. The TPR site would be bounded by the existing hedgerow to the west and existing fence to the east with a 2.4m high palisade security fence around the permanent infrastructure. The site itself would be landscaped in line with the surrounding environment to reduce its visual impact.
Proposed 38 kV Uprate Works – Power Supply to RWI&PS and WTP	
Proposed 38 kV Uprate Works Ardnacrusha – Birdhill (Power Supply) Counties Clare, Limerick and Tipperary	<ul style="list-style-type: none"> The proposed 38 kV Uprate Works would be necessary to deliver adequate electrical power to the RWI&PS and WTP. The proposed works would include the uprating of the existing Ardnacrusha – Birdhill Line and the replacement of polesets/structures with an underground cable along a section of the Ardnacrusha – Birdhill – Nenagh Line. There would also be works at the existing Birdhill 38 kV electricity substation including the provision of a new 38 kV Gas Insulated Switchgear Modular Building, new electrical equipment and lighting, together with new fencing and associated works.
Temporary Infrastructure – Required for Construction Phase Only	
Construction Working Width Counties Tipperary, Offaly, Kildare and Dublin (within the administrative area of South Dublin County Council)	<ul style="list-style-type: none"> A Construction Working Width would be temporarily required for the construction of the RWRMs and the Treated Water Pipeline, and the subsequent reinstatement of the land. The Construction Working Width would generally be 50m in width but would be locally wider near features such as crossings, access and egress points from the public road network, Construction Compounds and Pipe Storage Depots.

Proposed Project Infrastructure	Outline Description of Proposed Project Infrastructure*
Construction Compounds Counties Tipperary, Offaly, Kildare and Dublin (within the administrative area of South Dublin County Council)	<ul style="list-style-type: none"> • Eight Construction Compounds would be temporarily required to facilitate the works to construct the Proposed Project. Five Construction Compounds would be located along the route of the Treated Water Pipeline at the following Infrastructure Sites: RWI&PS, WTP, BPT, BPS and TPR, with an additional three Construction Compounds located at Lisgarraff (County Tipperary), Killananny (County Offaly) and Drummond (County Kildare). Construction Compounds would act as a hub for managing the works including plant/material/worker movement, general storage, administration and logistical support. • The Principal Construction Compound at the WTP would require 30ha of land during construction. • The other three Principal Construction Compounds would require land temporarily during construction ranging between approximately 12ha and 16ha. • The four Satellite Construction Compounds at the other permanent Infrastructure Sites (excluding the FCV) would require land during construction ranging between approximately 3ha and 12ha.
Pipe Storage Depots Counties Tipperary, Offaly and Kildare	<ul style="list-style-type: none"> • Nine Pipe Storage Depots would be temporarily required to supplement the Construction Compounds and would serve the installation of pipe between the WTP and the TPR. • Pipe Storage Depots would take direct delivery of the pipe for storage before onward journey to the required location along the Construction Working Width. • The Pipe Storage Depots would vary in size and require land temporarily during construction generally ranging between approximately 2ha and 7ha but with one site being larger at 11ha.

* Note all land take numbers in this table are affected by rounding to one decimal place.

1.2 Objectives of Report

14. The objectives of this Engineering Report are to:

- Explain the proposed infrastructural requirements of the Proposed Project
- Support its Strategic Infrastructure Development Planning Application.

15. The report is focused on the need for the proposed infrastructure and how it has been designed. Therefore, only high level construction information is supplied that relates to the engineering design. Full details on the construction of the Proposed Project are provided in Chapter 5 (Construction and Commissioning) in the Environmental Impact Assessment Report (EIAR) and have not been replicated in this document.

2. Water Supply Requirement – The Project Need

16. The Eastern and Midlands Plan (Irish Water 2022) identified that a new source from the River Shannon is the Preferred Approach at Regional Level for supplying the GDA WRZ and a further 36 WRZs in the Midlands and East, with those 36 WRZs supplied through the Greater Dublin Area water network and through offtakes from the transfer pipeline from the River Shannon en route to the Greater Dublin Area.
17. Having examined the outcomes of the Framework Plan (Irish Water 2021b) and Eastern and Midlands Plan (Irish Water 2022), it was concluded that the In-flight Water Supply Project consisting of a new water supply abstraction at Parteen Basin on the Lower River Shannon and a treated water pipeline to Dublin, with potential to supply a number of locations across the Midlands and East, was substantially consistent with the Preferred Approach identified in the Eastern and Midlands Plan (Irish Water 2022) consisting of the New Shannon Source with transfers.
18. This section presents the water supply requirement ('volume') which the Proposed Project infrastructure would be required to have the capacity to abstract and deliver.

2.1 Project Objectives

19. The objectives of the Proposed Project, taking account of the Eastern and Midlands Plan (Irish Water 2022), are to:
 - Provide a sustainable water supply from a New Shannon Source
 - Address critical supply issues in the Greater Dublin Area with provision for future supplies to multiple Water Resource Zones in the Region
 - Increase resilience of supplies and Levels of Service
 - Deliver a flexible, future-proofed solution that is responsive to change.
20. Once completed, the Proposed Project infrastructure will provide the capacity to meet the needs of 36 WRZs across the Eastern and Midlands Region in order to align with the Eastern and Midlands Plan (Irish Water 2022). It would do this by securing a new source of drinking water from the River Shannon at Parteen Basin. This would provide the capacity to supply up to 300Mld to the GDA WRZ and the Proposed Project's wider Water Supply Area. Overall, this volume of water would:
 - Immediately meet the identified need for water within the GDA WRZ to 2050 and beyond
 - Enable the future supply to 17 other WRZs by re-directing supplies within the GDA WRZ and expanding the GDA WRZ by incorporating these WRZs into the GDA Regional WRZ, when future projects are brought forward by Uisce Éireann
 - Enable the future supply to a further 18 WRZs across the Midlands from take-off points along the pipeline and facilitate the consolidation of those WRZs into four new WRZs, when future projects are brought forward by Uisce Éireann
 - Make provision for potential reductions in existing supply volumes due to sustainability requirements anticipated under the new abstraction licensing regime.

2.2 Water Supply Area

21. The Proposed Project must provide the infrastructure with the capacity to be able to supply sufficient water to meet a deficit in supply for 36 WRZs, which once connected to the new supply from the River Shannon, would be rationalised into five WRZs as follows:
 - GDA Regional WRZ

- Tullamore/ Mountbolus WRZ
- Mullingar Regional WRZ
- Dunkerrin/Moneygall/ Borrisokane WRZ
- Newport / Killaloe WRZ.

2.2.1 GDA WRZ

22. The GDA WRZ is the WRZ which includes the vast majority of County Dublin, including Dublin City, along with significant parts of the population in Counties Kildare, Meath and Wicklow. The GDA WRZ serves an estimated 1.7 million people⁵ with estimated growth to 2.1 million by 2050.
23. The GDA WRZ comprises a range of infrastructure elements covering water abstraction, treatment, storage and distribution networks. The water treatment plants, reservoirs and the geographical extent of the GDA WRZ is illustrated in Image 2.1.

⁵ Population data for the GDA WRZ, Central Statistics Office, 2016. National Census of Ireland. [online] [Accessed 10 May 2021].

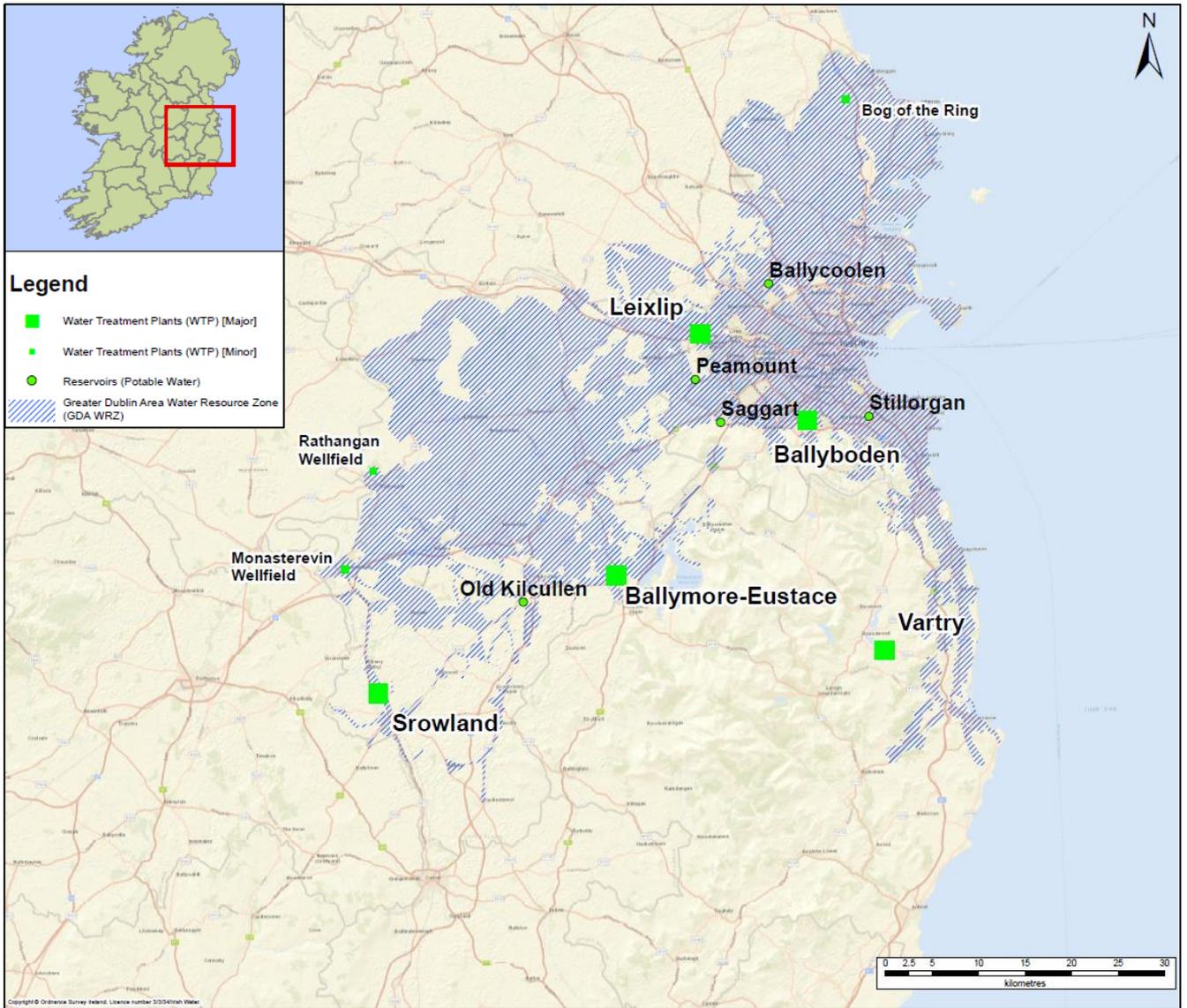


Image 2.1: GDA WRZ and Major WTPs

2.2.2 Overall Water Supply Area

24. Image 2.2 provides an overview of the pipeline and the proposed take-off points needed to facilitate transfers via future connections and future projects to deliver water within the Water Supply Area.

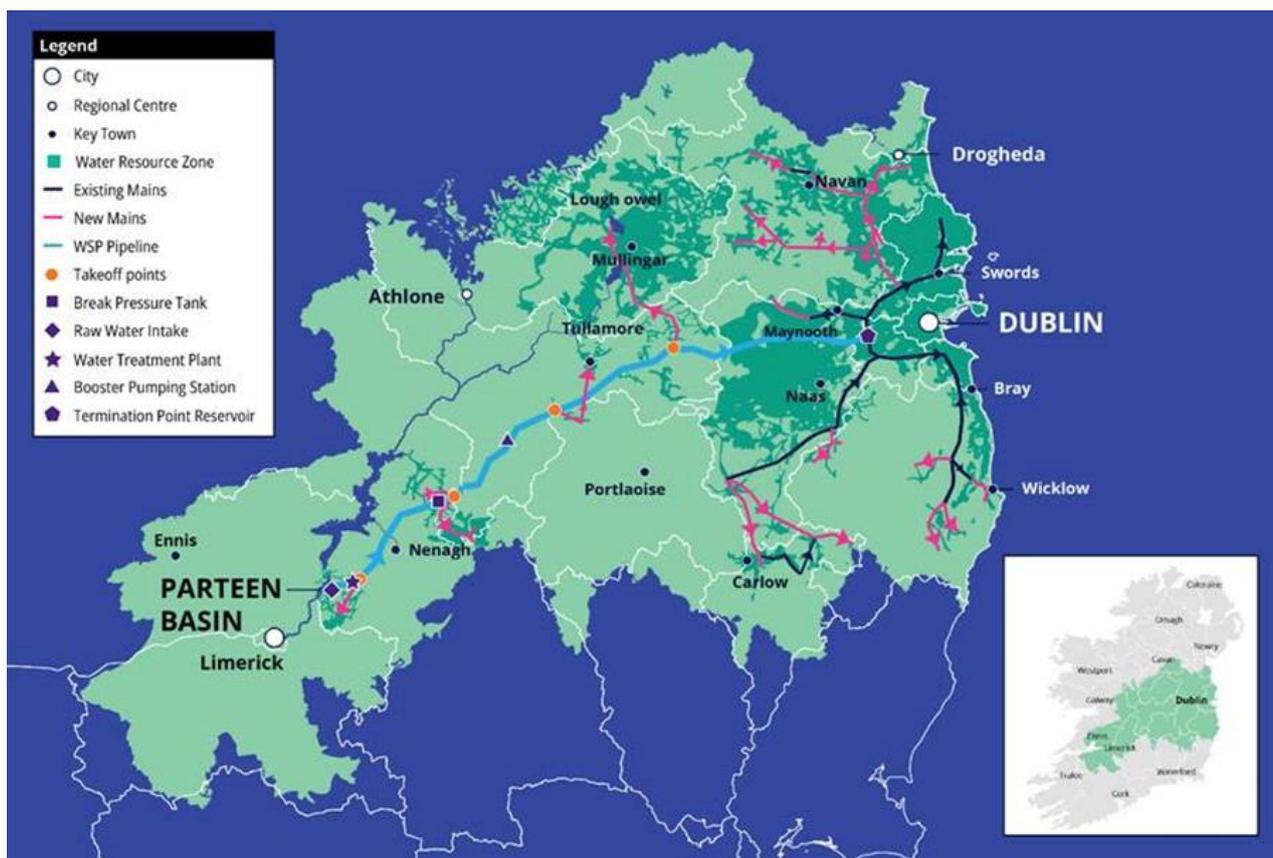


Image 2.2: Overview of the Water Supply Area

25. Regarding the composition of the Water Supply Area, Barndarrig WRZ and Redcross WRZ have subsequently been rationalised and combined. Therefore, there are 35 Water Resource Zones and the GDA, within the Water Supply Area that the Proposed Project is to meet the water supply requirement for, a combined total of 36 WRZs. This does not affect the volume of water to be supplied.

2.3 Target Level of Service

26. The Level of Service (LoS) refers to the reliability of the supply that Uisce Éireann’s customers can expect to receive and is expressed as a frequency or return period of supply failure. Further details of LoS may be found in Appendix D of the National Water Resources Plan Framework Plan (Irish Water 2021b). For example, if the LoS is stated as 1 in 50, as a consumer, statistically, you would only ever expect to experience a water outage or severe limitations to your supply, on average, once every 50 years. This would be a 2% chance that in any given year that there would be a supply failure.

27. A failure in supply could result in increased ‘outages’ (where water is not available), ‘do not drink’ notices or ‘boil’ notices (where water must be boiled before it is drunk).

28. In the National Water Resources Plan Framework Plan (Irish Water 2021b), Supply Demand Balance (SDB) assessments have been developed for each WRZ based on a 1 in 50-year LoS. This means Uisce Éireann would aim to provide a uniform minimum of 1 in 50-year LoS across the entire public water supply over time.

29. The current LoS in Ireland varies according to location, ranging from lower than 1 in 10 to better than 1 in 50.

30. A target LoS had not previously been incorporated in SDB calculations for previous iterations of the project. However, a 1 in 50-year target is an input to the National Water Resources Plan (Irish Water 2021 and 2022) methodology and calculations and therefore has been adopted in the underlying assumption for the assessment of need to be addressed by the Proposed Project.
31. This is directly linked to the yield assessments for raw water sources, which calculate the estimated yields for a range of return periods based on analysis of historic records. The SDB is then developed using a given LoS from the yields calculated for the corresponding return period.

2.4 Resilience

32. The National Water Resources Plan (Irish Water 2021 and 2022) defined a resilient water resource as one with enough capacity to mitigate the impacts to water supply when operational issues occur, which includes:
 - Unplanned outages
 - Low flows exacerbated by climate change
 - Regulatory changes.
33. Uisce Éireann states that a key constituent of resilience is plant and network performance, wherein it emphasises that reliance on a single source or treatment plant renders a WRZ vulnerable to not maintaining service levels in the event of an outage.
34. The GDA WRZ is not currently resilient, as defined by the criteria in the National Water Resources Plan (Irish Water 2021 and 2022), as it is heavily reliant on a single source, the River Liffey, for its water supply. Approximately 85% of water to the GDA WRZ comes from this one source.
35. Being heavily dependent on one source of water supply means that there is very limited resilience within the existing system. An emergency event on the River Liffey or an extended outage at Leixlip or Ballymore Eustace Water Treatment Plants, would result in a shortage of water supply to the GDA WRZ, resulting in social, economic and public health issues.
36. The Proposed Project would introduce a significant increase in water supply to the GDA WRZ from a new source, the River Shannon, thereby increasing resilience within the Water Supply Area including the GDA WRZ.

2.5 Supply Demand Balance

37. The forecast increase in domestic and non-domestic water demand combined with operational requirements, illegal connections, leakage, required headroom allowances and peaking results in an increase in the Dry Year Critical Peak (DYCP) water demand for the GDA WRZ to 774Mld by 2050 as shown in Table 2.1.

Table 2.1: GDA WRZ Supply Demand Balance

	Supply Demand Balance Mid						
	2019	2025	2030	2035	2040	2044	2050
Demand:-							
Domestic	207	221	232	241	250	257	257
Non-Domestic	139	200	208	216	225	231	241
Water Taken Unbilled – Illegally	6	6	6	6	6	6	6
Operational Use	6	6	6	6	6	6	6
Leakage	215	165	122	122	122	122	122
Average Demand	572	598	574	591	609	623	633
Normal Year Annual Average (NYAA) Water Available for Use (WAFU)	571	599	595	594	593	593	592
NYAA Demand	618	645	620	639	658	673	683
NYAA Deficit	-48	-47	-25	-45	-65	-80	-92
Dry Year Annual Average (DYAA) WAFU	516	539	533	532	530	529	528
DYAA Demand	630	658	633	653	673	689	700
DYAA Deficit	-114	-120	-100	-122	-144	-160	-172
Dry Year Critical Peak (DYCP) WAFU	565	590	584	582	581	580	578
DYCP Demand	697	728	700	722	745	762	774
DYCP Deficit	-132	-139	-117	-141	-164	-183	-197
Winter Critical Peak (WCP) WAFU	595	629	629	629	629	629	629
WCP Demand	742	775	744	766	789	807	820
WCP Deficit	-147	-146	-115	-137	-160	-178	-191

38. There is a need for 34% more water to be available to meet the needs of the GDA by 2050 than there is forecast to be available⁶. The need is based on the maximum or critical supply demand deficit (i.e. the DYCP scenario) to ensure there is adequate water for all weather planning scenarios and to deliver a 1 in 50-year LoS.

⁶ Based on DYCP WAFU in 2050 vs. DYCP demand in 2050.

39. The deficits in the GDA in the NYAA and DYCP scenarios are shown graphically in Image 2.3 and Image 2.4 respectively.

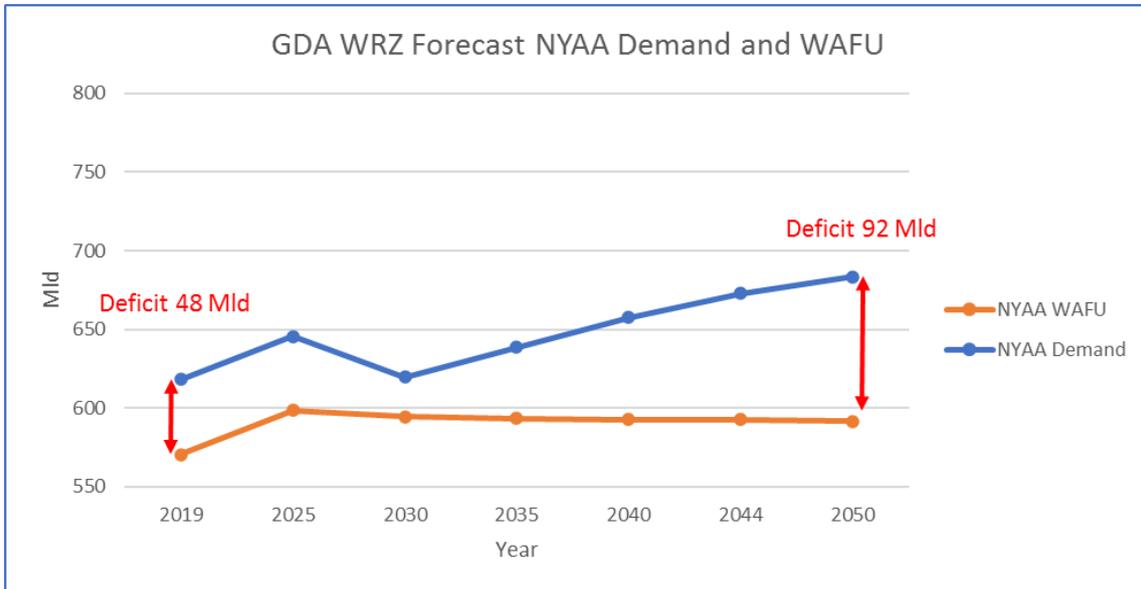


Image 2.3: GDA WRZ Forecast NYAA Demand and WAFU

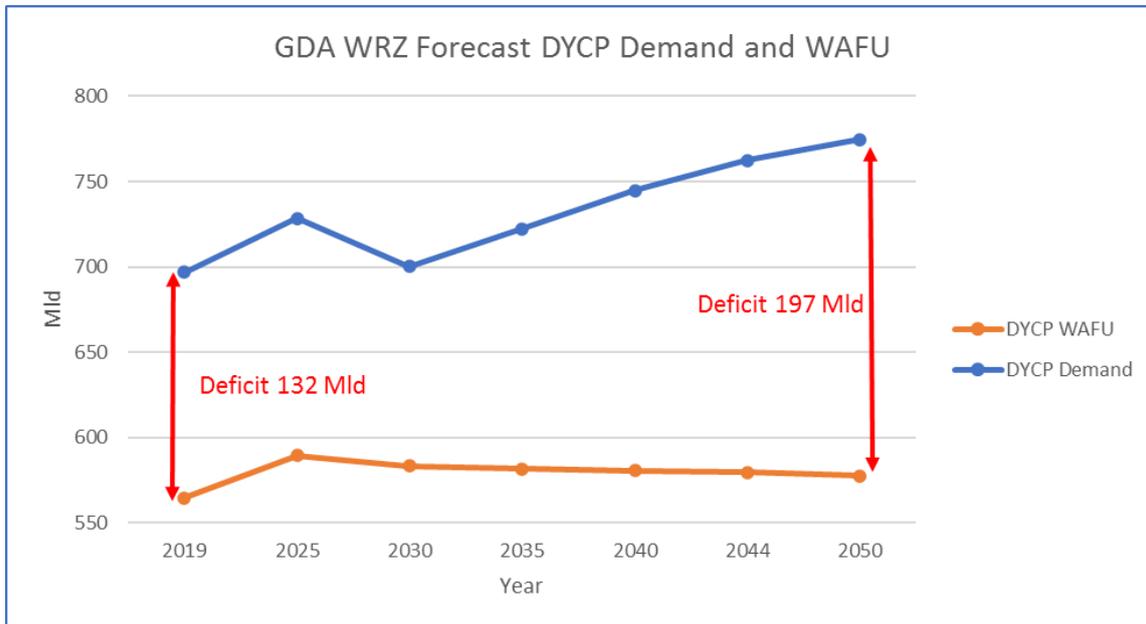


Image 2.4: GDA WRZ Forecast DYCP Demand and WAFU

40. With 578Mld of water available (DYCP) for the GDA WRZ projected for 2050, this results in a 197Mld water supply deficit in the GDA WRZ. There is also projected to be an 83Mld deficit (as calculated post-connection to the New Shannon Source) in the other 36 WRZs⁷ that would make up the Water Supply

⁷ 37 Water Resource Zones were identified in the Regional Water Resource Plan - Eastern and Midlands consisting of the GDA WRZ and 36 other WRZs. Subsequently Bardarrig WRZ and Redcross WRZ have been rationalised and combined and so the total is now 36 Water Resource Zones consisting of the GDA WRZ and 35 other WRZs.

Area, in the same timeframe. By 2050, there would be a total DYCP deficit of 280Mld to be addressed as shown in Table 2.2.

Table 2.2: Treated Water Requirement in the GDA and 36⁸ Other WRZs by 2050⁹

Component – GDA	2020 (Mld*)		Component – GDA	2050 (Mld*)
Domestic Usage	209		Domestic Usage	257
Non-Domestic Usage	142		Non-Domestic Usage	241
Operational	6		Operational	6
Illegal Connections	6		Illegal Connections	6
Leakage	207		Leakage	122
Total Distribution Input	569		Total NYAA Demand	633
Headroom 8%				51
Peaking (DYCP)				91
Water Requirement for GDA (DYCP)				774
Water available for GDA (DYCP)				578
GDA Deficit (DYCP)				-197
Deficit in 36 ¹⁰ other WRZs (DYCP)				-83
Total Deficit (DYCP)				-280

(*Note: Rounding may apply)

2.6 Provision for Reductions in Existing Supplies

41. The National Water Resources Plan (Irish Water 2021 and 2022) baseline SDB projections could not take account of some anticipated reductions in the amount of water that the Environmental Protection Agency (EPA) would permit to be abstracted from some existing sources for sustainability reasons under the incoming abstraction licensing regime.
42. It has been acknowledged in the National Water Resources Plan (Irish Water 2021 and 2022), that a risk of reductions in volumes of water available from the current levels of abstraction from a number of existing sources is possible when they are licensed. It is known that this would occur but it is uncertain as to the extent of these reductions and therefore, the reduction is currently unquantifiable. Nevertheless, it is considered prudent that Uisce Éireann should make an allowance for sustainability reductions to existing

⁸ 37 Water Resource Zones were identified in the Regional Water Resource Plan - Eastern and Midlands consisting of the GDA WRZ and 36 other WRZs. Subsequently Bardarrig WRZ and Redcross WRZ have been rationalised and combined and so the total is now 36 Water Resource Zones consisting of the GDA WRZ and 35 other WRZs.

⁹ Supply Demand Balance based on adopted Regional Water Resources Plan – Eastern and Midlands Region projected to 2050.

¹⁰ 37 Water Resource Zones were identified in the Regional Water Resource Plan - Eastern and Midlands consisting of the GDA WRZ and 36 other WRZs. Subsequently Bardarrig WRZ and Redcross WRZ have been rationalised and combined and so the total is now 36 Water Resource Zones consisting of the GDA WRZ and 35 other WRZs.

sources when determining its maximum abstraction required from the Lower Shannon for the purposes of progressing the design and statutory consents for the Proposed Project.

43. It is not possible to determine a precise figure, (because the extent of any reductions in abstraction volumes as a result of the EPA licensing regime is not information that is currently known), and it is impossible to predict. Given that, provision must be made for this eventuality, Uisce Éireann considered that an allowance of an additional 20Mld to the forecast deficit of 280Mld at 2050 is appropriate on a prudent provision basis. This allowance of 20Mld is Uisce Éireann’s best current estimate of what would be required to address these potential reductions to existing supplies.

2.7 Summary of the Project Need

44. On the basis of a current forecast supply demand balance deficit of 280Mld and an additional prudent provision of 20Mld the Proposed Project infrastructure is designed and developed on the basis of having the capacity to abstract and deliver 300Mld as set out in Table 2.3. This aligns with the Preferred Approach identified in the National Water Resources Plan (Irish Water 2021 and 2022) and the Eastern and Midlands Plan (Irish Water 2022).

Table 2.3: Total Volume of Water to be Supplied by the Proposed Project

Demand	2050 Mld*
GDA	197
35 WRZs ¹¹	83
Provision for potential sustainability reductions from existing supply volumes due to future abstraction licensing	20
Total Peak Volume of Water	300

¹¹ 37 Water Resource Zones were identified in the Eastern and Midlands Plan consisting of the GDA WRZ and 36 other WRZs. Subsequently Barnarrig WRZ and Redcross WRZ have been rationalised and combined and so the total is now 36 Water Resource Zones consisting of the GDA WRZ and 35 other WRZs.

3. Raw Water Intake & Pumping Station

3.1 Purpose

45. The RWI&PS is needed to:
- Abstract raw water from Parteen Basin
 - Pump raw water to the WTP.
46. Parteen Basin forms part of the Lower River Shannon Special Area of Conservation (SAC) and, consequently, the proposals for the design, construction, operation and maintenance of the proposed raw water intake have taken consideration of the qualifying interests in the SAC.
47. Water levels in Parteen Basin vary both seasonally and annually, depending on climatic conditions. ESB controls the water levels in Parteen Basin by closely matching the amount of water taken by Ardnacrusha and the Old River Shannon with the amount of water flowing into Parteen Basin each day. The water levels on Lough Derg are managed within a Normal Operating Band 460mm (18 inches approximately) in depth, across a wide range of flows.
48. At present, the normal water level on Lough Derg and on Parteen Basin is managed to be between the following limits:
- Parteen Basin: Upper level 30.86mOD Malin Head (33.56mAOD Poolbeg). Lower level: 30.00mAOD Malin Head (32.70mAOD Poolbeg)
 - Lough Derg: Upper level 30.86mAOD Malin Head (33.56mOD Poolbeg). Lower level: 30.40mAOD Malin Head (33.10mAOD Poolbeg).
49. Parteen Weir acts as the downstream control structure for water levels in the system. Water levels in Parteen Basin are maintained within the upper and lower levels at all times. During low flow conditions, the lower water level at Parteen Basin (30.0mAOD Malin / 32.70mAOD Poolbeg), must be maintained for dam safety purposes and in doing this ESB ensures that water levels in Lough Derg are within the Normal Operating Band as the waterbodies broadly operate as a combined system, in these conditions.
50. ESB will continue to maintain water levels as it does today, within its Normal Operating Band and therefore, ESB will facilitate the proposed abstraction of water by the Proposed Project within its current operating practices. There will be no change in ESB's current operational management of water levels as a result of the Proposed Project.
51. The RWI&PS is designed to abstract from Parteen Basin a range of flows, up to a peak flow of 300Mld during a dry year critical peak period (DYCP, including head room (HR)).
52. The main components of the RWI&PS are illustrated in Image 3.1.
53. The RWI&PS site would be approximately 3.3ha, (excluding the access road described in Section 3.2.15). This would comprise approximately 2.6ha of permanent land take and a further approximately 0.8ha of land only required temporarily during construction.¹²
54. As shown in Image 3.1 the raw water would enter the Intake Chamber and then pass through the Passive Wedge-Wire Cylinder (PWWC) Intake Screens into the Inlet Chambers before entering the pumping hall. Water pumped from here can be passed through the microfiltration process as required before being

¹² These totals are affected by rounding to one decimal place.

delivered to the WTP. Raw water would be pumped from the RWI&PS at Parteen Basin to the WTP at Incha Beg via twin RWRMs.

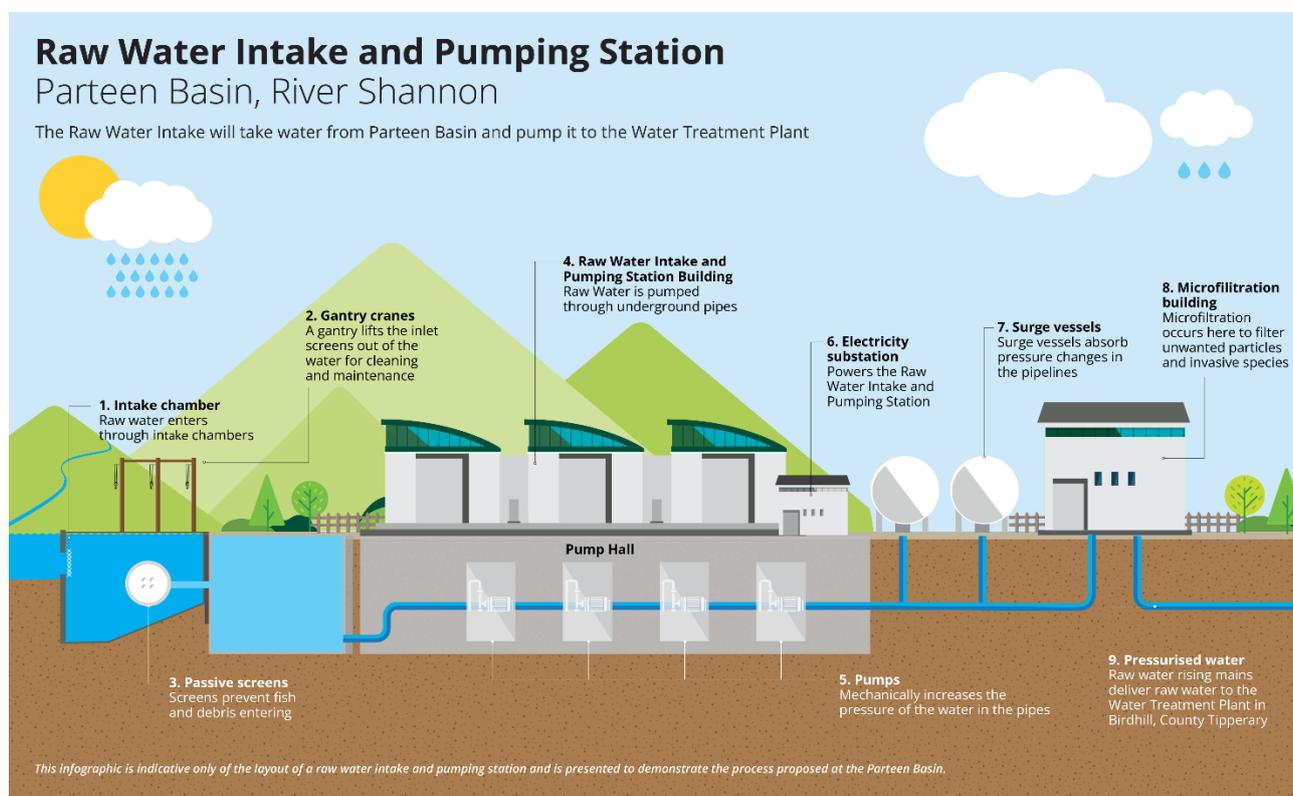


Image 3.1: Infographic Overview of the Raw Water Intake and Pumping Station

3.2 Design

55. The main Infrastructure elements of the RWI&PS are shown in Image 3.1 and are detailed in Table 3.1.

Table 3.1: Main Infrastructure Elements – Raw Water Intake and Pumping Station Site

Infrastructure Element	No.	Length	Width	Height Over Finished Ground Level	Plan Area	
					Each	Overall
Raw Water Intake Chamber (with Passive Wedge-Wire Screens)	1 No.	39.9m (average)	10.4m (average)	7.2m (depth)	416m ²	416m ²
Inlet Chambers	3 No.	5.0m	11.8m	13.0m (depth)	59m ²	176m ²
Inlet Revetment	1 No.	55.0m	27.0m	6.2m (depth)	1,040m ²	1,040m ²
Raw Water Pumping Station Building	1 No.	Superstructure 30.9m	Superstructure 37.5m	Superstructure 9.8m	1,159m ²	1,159m ²
		Substructure 45.4m	Substructure 37.5m	Substructure 13.0m (depth)	1,714m ²	1,714m ²

Infrastructure Element	No.	Length	Width	Height Over Finished Ground Level	Plan Area	
					Each	Overall
Microfiltration Buildings	2 No.	21.2m	16.2m	Superstructure 10.9m	345m ²	690m ²
				Substructure 10.4m (depth) ¹³	104m ²	104m ²
Surge Vessel	4 No.	7.5m	3.8m	5.0m	30m ²	120m ²
Concrete Revetment Mats	n/a	73.0m	20.0m	5.0m (depth)	n/a	1,460m ²
Raw Water Rising Mains Scour Tank	1 No.	44.7m	20m	Substructure 10.4m (depth) ¹⁴	4,109m ²	4,109m ²
20 kV Electricity Substation site	1 No.	40.2m	36.0m	4.7m for the Switchgear	1,447m ²	1,447m ²
Switchgear Building	1 No.	14.8m	9.3m	3.5m	138m ²	138m ²
Invasive Species Debris Retention Tank	1 No.	16.2m	13.8m	7.4m (depth)	224m ²	224m ²

3.2.1 Intake Chamber at the RWI&PS

56. An Intake Chamber is proposed on the bankside of Parteen Basin. Existing ground levels on the bank at the proposed intake site at Parteen Basin are approximately 31.0mAOD (Malin Head) (33.7mAOD Poolbeg).
57. The bankside structure would include the ‘wet infrastructure’, including the Intake Chamber with PWWC Intake Screens, located within a substructure, with a roof slab at finished ground level, and with lifting beams visible above ground. The lifting beams would allow the safe removal of the screens for periodic cleaning and maintenance.
58. At the Intake Chamber the ground would be excavated to a depth of 7.7m below the existing ground level, to approximately 23.3mAOD (Malin Head) (26.0mAOD Poolbeg), and the intake chamber constructed with an invert level of approximately 25.3mAOD (Malin Head) (28.0mAOD Poolbeg) in the central silt channel. The cill wall would be constructed along the line of the existing shore. There would be seven separate inlet openings from Parteen Basin into the Intake Chamber, each measuring 1.7m high and 4.0m wide. These openings would be below the low water level in Parteen Basin. Penstocks at each opening can be closed to isolate the Intake Chamber from Parteen Basin, if necessary.
59. The wet chambers of the Intake Chamber would be able to accept inflow throughout the Normal Operating Water Level Band, and in flood conditions, on Parteen Basin.
60. A Bubble Curtain would also be provided at the inlet openings to the Intake Chamber, between the Intake Chamber and Parteen Basin. A Bubble Curtain is a system that produces fine bubbles of air across the entrance to the intake structure, which act as a barrier (a curtain) discouraging fish from entering the intake.

¹³ The Microfiltration substructure would be 5.8m deep. The RWRM Scour Tanks would be below this, a further 4.6m deep. Therefore, the total depth of the Microfiltration Building and Scour Tank structure would be 10.4m.

¹⁴ The Microfiltration substructure would be 5.8m deep. The RWRM Scour Tanks would be below this, a further 4.6m deep. Therefore, the total depth of the Microfiltration Building and Scour Tank structure would be 10.4m.

3.2.1.1 Protecting the Intake

61. To prevent boats or floating debris from entering the Intake Chamber, a baffle wall would be constructed across the Intake Chamber, above the submerged cill wall. There would also be a line of protective buoys put in Parteen Basin outside the Intake Chamber, to mark the location of the underwater section and prevent boats from approaching the structure.

3.2.1.2 Intake Screens

62. The Intake Chamber would be fitted with three PWWC Intake Screens (between the Intake Chamber and the Inlet Chamber), to avoid debris and/or fish or eels being taken up into the raw water pumps. Intake velocities through the screen slots must:
 - Be limited to 0.15m/s, the velocity at which juvenile fish can swim away without being trapped/held by the screen.
63. This would be achieved by using 3mm slot size in the screens.
64. The screens would feed into three separate but interconnected Inlet Chambers, from which water would be drawn by the pumps, via a manifold suction pipe.
65. The surface area of each screen would be 37m².
66. The intake screens have been designed to pass 300Mld (3.47m³/s) through any two out of three screens.
67. The PWWC Intake Screens would be 2.0m in diameter and would be set at an invert level (base interior level) of 27.0mAOD (Malin Head) (29.7mAOD Poolbeg) at the abstraction point.
68. The level of the screens has been set so that there would be a water depth of at least 1.0m above the crown (top) of the screens.
69. The PWWC Screens would be cleaned regularly using an air burst system. They can also be removed from the intake basin for maintenance and cleaning. The screens can operate to the required capacity with up to 25% of their surface areas clogged.

3.2.1.3 Inlet Chamber

70. The three inlet chambers would be located adjacent to the intake chamber and would receive flows through the PWCC Intake Screens.

3.2.1.4 Bed Reprofiling

71. On the outside of the intake chamber the existing bed of Parteen Basin itself would be reprofiled to finished levels (along the wall of the intake chamber) of between 26.0mAOD and 25.5mAOD (Malin Head) (28.7mAOD to 28.2mAOD Poolbeg) and tapered over an area of 55m by 27m at the intake site. Flexible concrete revetment mats would be placed on that area and covered with gravel and native bed material.
72. The reprofiling of the lake bed is based on achieving a maximum slope of 10% (west to east) across the revetment mats. The side slopes on the north and southern side would be 25% and given the depth of the reprofiled bed, which would be up to 5m, a retaining wall would be required on the bank of Parteen Basin 20m upstream and downstream of the Intake Chamber.

3.2.2 Raw Water Pumping Station Building

73. The Raw Water Pumping Station Building has been sized to provide:

- Entrance foyer
- Inlet chambers
- Pump room
- Control/data telemetry room
- Office
- Air burst and Raw Water Surge Vessel compressor room with provision for air receivers
- Medium Voltage switchroom
- Low Voltage switchroom
- BioBullet¹⁵ storage and dosing room (for zebra mussel (*Dreissena polymorpha*) control)
- Toilet and washing facilities with an associated Wastewater Holding Tank external to the Raw Water Pumping Station Building.

74. The superstructure of the Raw Water Pumping Station Building would have a ridge line 9.8m over finished ground level at its highest point. The depth of the dry well is dictated by the headroom required between the pumps and the gantry to remove the pumps for maintenance.

3.2.3 RWI&PS Pumping Plant

75. The pumping station has been designed to meet the requirements of the NYAA + HR and DYCP profiles, as well as the DYCP + HR profile.

76. The raw water pumps and pipework would be located in a 13.0m deep dry well installation in the basement of the Raw Water Pumping Station Building.

77. The design is based on a configuration of two sets of four 640kW pumps operating on variable speed drives. Each set of pumps would be capable of pumping the peak flow of 300Mld based on 24-hour operation. The exact configuration of duty and assist pumps would evolve in response to the growth in demand. There would always be one pump on standby.

78. Raw water pumps have been sized to deliver the peak output of 300Mld (12,500m³/h), with both rising mains in operation (normal mode) or with one rising main out of service (e.g. for cleaning). To allow for maximum flexibility in operation, the suction pipe manifold would allow each set of pumps to draw water from any combination of Inlet Chambers, such that when one Inlet Chamber is out of service, there is no loss in pumping capacity.

79. Communications links to the RWI&PS would be provided by a telemetry mast, the top of which would be 14m above finished ground level.

¹⁵ BioBullets are microscopic particles created by coating chemicals which are noxious to zebra mussels in a material that appears edible to the mussels. The noxious chemical is not detected and the filter feeder would continue to ingest the particles and not close down in self-defence, as they do when they detect, for example, heightened chlorine levels. BioBullets are approved by the UK Drinking Water Inspectorate for safe use in drinking water facilities. Uneaten BioBullets degrade to harmless concentrations within a few hours of entering the water, and do not bioaccumulate.

3.2.4 Surge Vessels

80. Four Surge Vessels are included at the RWI&PS, two for each RWRM. Each vessel would require compressed air with a permanent compressor to maintain air volumes at pressure within the air vessel, and these have been included in the RWI&PS layout.
81. Two surge vessels with a total vessel volume of 178m³ (89m³ each) have been included on each RWRM.
82. The Raw Water Surge Vessels would be located externally to the Raw Water Pumping Station Building superstructure and would have a height above ground of 5.0m.

3.2.5 Microfiltration Buildings

83. Two buildings, each housing microfiltration units and associated pipework, would be constructed to the east of the main Raw Water Pumping Station Building. The buildings would each consist of a single room with a floor level 5.8m below finished ground level. (The RWRM Scour Tank would be below this floor level a further 4.6m deep and so the total depth of the combined structures would be 10.4m). The floor level was set based on the hydraulic profile through the site and the need to have sufficient headroom between the microfiltration units and the gantry to remove the units for maintenance.
84. The Microfiltration Buildings would be the tallest structures at this site with an approximate height of 10.9m over finished ground level. The microfiltration units would be part of the control of invasive species and are described in Section 3.2.6.

3.2.6 Design for Invasive Species Control

85. The RWI&PS has been designed to incorporate measures to reduce the risk of transfer of invasive species beyond Parteen Basin as a result of the Proposed Project.
86. The zebra mussel (*Dreissena polymorpha*) and quagga mussel (*Dreissena bugensis*) are small freshwater mussels which are not native to Ireland, but which have been found in various watercourses including the River Shannon. In addition, quagga mussel has also been found in Lough Derg in recent years. Similarly, the Asian clam (*Corbicula fluminea*), like the zebra mussel, is an invasive mollusc which has been found in Irish watercourses including the River Shannon.
87. The PWWC Intake Screens would be manufactured entirely of a copper-nickel alloy to inhibit attachment by zebra mussels, quagga mussels and Asian clams. There would be three screens, and this allows for any one screen to be lifted out for inspection and cleaned while the full abstraction volume flows through the other two screens. Each screen serves its own Inlet Chamber, which can also be isolated for cleaning from the other chambers while the full flow is passing through.
88. While the PWWC Intake Screens would be made of a copper-nickel alloy to minimise the risk of zebra mussel attachment, some pro-active anti-fouling measures would also be needed to protect the intake pipes from becoming clogged. The pipes would be internally coated with proprietary products to discourage zebra mussels from attaching to the pipe wall.
89. The Raw Water Pumping Station pump sets would deliver water into common manifolds which feed the twin RWRMs. Each RWRM can be taken out of service for maintenance, while delivering the full required flow through the other one. The pumping system is configured in such a way that not just the RWRM but each piece of pipework in the station can be accessed for maintenance without interruption of supply. In the event of invasive species infestation, either of the RWRMs could be taken out of service for days or

weeks, as may be required for short-term 'pigging'¹⁶ or occasional longer standing chemical treatment, or for creating prolonged fully drained conditions which would inhibit the establishment of zebra mussels or other invasive species.

90. In order to protect from zebra mussel infestation, it would be possible to dose invasive species control chemicals directly into the raw water using control chemicals approved for use in water treatment of potable water. Provision has been made within the Raw Water Pumping Station Building for the storage and dosing of BioBullets or similar approved chemicals into the raw water.
91. The two microfiltration plants, one on each RWRM, housed in separate Microfiltration Buildings would provide further protection against invasive species.
92. Each microfiltration module incorporates five filter units: four duty and one standby.
93. The microfiltration size has been based on 40 microns, which is below the size at which zebra mussel juveniles, called 'veligers', are usually observed to settle.
94. The microfiltration modules would be equipped with protective non-return valves to prevent damage from surge backflows through the units.
95. The microfilters (Amiad Filters or equivalent), would sit on a manifold located on a loop off each RWRM. Raw water would pass through these units and dirt particles and juvenile mussels would be trapped in the unit, forming a 'filtration cake'. This cake would cause a pressure drop across the unit and a self-cleaning process would be triggered. The self-cleaning process would involve the units being flushed regularly to clean away any zebra mussels or other waste material trapped in the filters. A filter flush-out pipe would carry the washwater to an Invasive Species Debris Retention Tank, located to the east of the Microfiltration Buildings. This washwater volume would be approximately 1% of the maximum abstracted volume (i.e. up to 3,000m³/day) based on an output of 300Mld.
96. This washwater would be subject to ultraviolet (UV) treatment to kill mussel juvenile forms (veligers) before settlement in the Invasive Species Debris Retention Tank. A floating-arm draw-off pipe would take supernatant liquid (the clear liquid that lies above the solid residue) from the tank and transfer it back to the raw water intake, from where it would be pumped onwards for treatment at the WTP. Rejected solid material settled out in the Invasive Species Debris Retention Tank would be removed from site to an appropriately authorised facility in accordance with the requirements of the Waste Management Act 1996 (as amended).
97. Two Raw Water Balancing Tanks are also proposed in the WTP, described further in Section 5.2.4, so that in the event of an invasive species breakthrough, one can be taken out of service for inspection, cleaning and maintenance, while the full flow is passing through the other tank.

3.2.7 Invasive Species Debris Retention Tank

98. The Invasive Species Debris Retention Tank has a design capacity of 500m³ based on a retention time of four hours for the peak volume of washwater generated through backwashing the microfilters, i.e. 1% of peak throughput of 12,500m³/h. Daily washwater volume would be 3,000m³ at peak throughput.

¹⁶ The practice of using devices known as 'pigs' to perform various maintenance operations.

3.2.8 Raw Water Rising Mains Scour Tank

99. A RWRMs Scour Tank would be located at the RWI&PS below the Microfiltration Buildings. The RWRMs Scour Tank would be used to receive water from the RWRMs and its swabbing chambers when the pipes are being cleaned.
100. The capacity of the RWRMs Scour Tank, at just over 3,000m³, would allow for either RWRM to be emptied in sections. In a situation where a RWRM needs to be emptied, the section between the pumping station and the line valve located adjacent to the R494 public road would be emptied first. Once this has been emptied and the scour tank drawn down, the section between the Line Valve at the R494 and the Air Valve at the Chainage RW – 1590 of the RWRMs would be emptied. The final section between this Air Valve and the WTP site can be scoured to the Tank Draindown Management and Commissioning Lagoons on the WTP site.
101. The contents of the RWRMs Scour Tank would be pumped back to the pumping station Inlet Chambers, so that no water would be returned to Parteen Basin itself.

3.2.9 Power Requirement

102. The connected mechanical and electrical plant for the RWI&PS site would require a total of 26,946kWh/d at an output of 154Mld, the annual average flow, and 52,401kWh/d at the peak demand of 300Mld.

3.2.10 Power Connection

103. The power supply to the RWI&PS would be provided by ESB Networks from the Birdhill 38 kV Substation, through two underground cable ducts laid along the R494 from Birdhill to the entrance of the RWI&PS access road. From there, the ducts would be routed along the access road into the electricity substation on the RWI&PS site. The cables would consist of two 125mm ducts laid in one horizontal row with 75mm clear spacing from each other as per ESB Standard Specification for ESB 38 kV Networks Ducting/Cabling (Minimum Standards) (ESB Networks 2009).
104. In order to provide the power required for the RWI&PS, ESB Networks would need to uprate the existing 38 kV overhead lines between Ardnacrusha and Birdhill. This is described in Section 12.

3.2.11 Electricity Substation

105. The RWI&PS site would contain a 20 kV electricity substation site. This would consist of a fenced area within which there would be a Switchgear Building and two 20 kV to 6.6 kV transformers.
106. The Switchgear Building, located within the electricity substation site, would include a control room, a battery room and a switchgear room. The two transformers would be mounted externally on two 6.5m by 6.5m concrete plinths. Each transformer would have a height of 4.7m above the finished ground level.
107. The 20 kV electricity substation design is based on the requirements of Construction Standards for MV Substation Buildings (ESB Networks 2019).
108. In addition to the power supply to the site there are two existing overhead MV lines which cross the access road to the RWI&PS. One of these would need a minor permanent diversion because there is a poleset that would be affected by the alignment of the permanent access road. The poleset would be relocated to the edge of the access road which would very slightly change the alignment of the overhead line. There would be no permanent works required for the second overhead line. A third line crosses underneath the access road and no permanent works would be required for this line either.

3.2.12 On-Site Solar Photovoltaic (PV)

109. There are no solar panels proposed at the RWI&PS.

3.2.13 On-Site Water Supply

110. A potable water supply for the welfare facilities at the RWI&PS would be required. The water would be brought to the RWI&PS site along the proposed access road from a connection to an existing 200mm diameter watermain, laid along the R494 as part of the Killaloe Bypass, Shannon Bridge Crossing and R494 Improvement Scheme.

3.2.14 Surface Water Management and Drainage

111. The RWI&PS access road, and other paved areas, have been designed to incorporate Sustainable Drainage Systems (SuDS) principles as recommended in the SuDS Manual (Construction Industry Research and Information Association (CIRIA) 2015) in order to limit discharges from the site to the equivalent green field site flow rate.

112. As part of this strategy rainwater runoff from the roofs of the Raw Water Pumping Station Building and the two Microfiltration Buildings would be harvested and taken into the Raw Water Intake Basin and the RWRMs Scour Tank respectively.

113. Rainfall runoff from roads and impermeable areas within the RWI&PS site would be conveyed via a drainage system to a stormwater attenuation tank. Runoff entering the attenuation pond would be pre-treated in a Class 2 By-Pass Hydrocarbon Interceptor. This allows for any build-up of pollutants on an internal roadway or working surface that could be washed off in the early part of a storm to be treated. The outfall from the attenuation pond would be fitted with a penstock which can be used to isolate the attenuation pond and so contain pollutants in the event of an accidental spillage. The volume of the attenuation tank required to accommodate flows from a 1 in 100-year storm event, with an allowance for climate change, is 125m³, using the Institute of Hydrology Report 124 Flood estimation for small catchments (1994). A flow control device on the outlet of the tank would limit discharge stormwater flow leaving the tank to 17.35l/s, equivalent to the green field runoff from the entire RWI&PS site.

114. Flow from the attenuation lagoon would be conveyed by a 200mm diameter drain along the RWI&PS access road to a local watercourse approximately 350m from the R494.

115. The site would not be permanently staffed and so foul wastewater generated by operational staff on the site would be less than 1m³/d and would be tankered from the Wastewater Holding Tank to a licensed Wastewater Treatment Plant (WwTP).

3.2.15 Access

116. In order to provide permanent access to the site, it is proposed to construct a new access road from the R494 to the RWI&PS. The road would be 5m in width and would have a length of 670m. The permanent access would require 1.5ha of land. In addition, a further 0.3ha would be required temporarily during construction to build the access road.¹⁷ This would be in addition to the land defined in Section 3.1.

117. The permanent access road would be within an area of surface water flood risk and a Flood Risk Assessment has been undertaken and reported in Chapter 9 (Water) of the EIAR.

¹⁷ These totals are affected by rounding to one decimal place.

118. The access road junction would include a pull-in area before the security gates and appropriate signage when emerging onto the R494¹⁸, in accordance with Transport Infrastructure Ireland's (TII) Geometric Design of Junctions, DN-GEO-03060, (TII 2023). Sightlines at the access road entrance on the R494 have been facilitated by the recent Killaloe Bypass, Shannon Bridge Crossing and R494 Improvement Scheme. These would also comply with DN-GEO-03060 (TII 2023). No further works or land would be required to provide these sight lines. The RWI&PS site and access road would also include lighting as described in Section 3.2.16.
119. Car park spaces would be provided on-site for sixteen vehicles, two of which would include a charging point for electric vehicles, in accordance with the Tipperary County Development Plan 2022-2028 (Tipperary County Council 2022).

3.2.16 Lighting

120. At the RWI&PS site, light-emitting diode (LED) external lighting would be provided at the perimeter of the Raw Water Pumping Station Building and the two Microfiltration Buildings, on interconnecting footpaths, on traffic circulation areas around the site, in the car parking area and at the entrance to the site. In addition, exterior lighting would be provided to illuminate particular work areas to facilitate operational maintenance.
121. The design of external lighting at the RWI&PS site would be carried out with reference to the following Standards:
- Lighting Guide LG06: The Exterior Environment (Chartered Institution of Building Services Engineers 2016)
 - 150:2017 Guide on the Limitation of Effects of Obtrusive Lighting from Outdoor Lighting Installations 2nd Edition (Commission Internationale de l'Eclairage 2017)
 - Bats and Artificial Lighting at Night. Guidance Note 08/23 (Bat Conservation Trust 2023).
122. The lighting installation would provide a safe and secure environment for both pedestrians and drivers at the sites and facilitate ongoing operational and maintenance works associated with the RWI&PS. To reduce impacts on areas adjacent to the RWI&PS site and light sensitivity species such as bats the following measures would be adopted:
- Luminaires (light fixtures), light standards (poles) and all other fixtures would be selected to complement the architecture of the buildings and would be sensitive to the surrounding environment
 - The required luminance levels would be achieved by selecting the most appropriate luminaires and lamp sources and carefully implementing the agreed control philosophy for operation of exterior lighting
 - External lighting would be designed to avoid night sky pollution/upward spill, and overspill into adjacent properties. This could include downward directional lighting and use of accessories such as hoods, cowls, louvres and shields to direct the light
 - Exterior lighting would be automatically controlled and would be turned off unless operational staff are present on-site
 - All luminaires used would lack UV/IR elements
 - LED luminaires would be used due to the fact that they are highly directional, lower intensity, good colour rendition and dimming capability

¹⁸ Consultation has taken place with the Killaloe Bypass, Shannon Bridge Crossing and R494 Improvement Scheme Design Team related to the access road junction.

- A warm white spectrum (<2,700 kelvins would be used to reduce the blue light component of the LED spectrum). This kelvin level is required to be reduced to 2,200 in lesser horseshoe bat zones
- Luminaires would feature peak wavelengths higher than 550 nanometre (nm) (a nanometre is a length equal to one thousand-millionth of a metre). This is to avoid the component of light most disturbing to bats
- Column heights would be carefully considered to minimise light spill. The shortest column height allowed would be used where possible
- Only luminaires with an upward light ratio of 0% and with good optical control would be used
- Luminaires would be mounted on the horizontal, i.e. no upward tilt
- Any external security lighting would be set on motion-sensors and short (one minute) timers
- The positioning of outdoor lighting would be directed away from any adjacent linear habitats (e.g. hedgerows, treelines, rivers, woodland edge) to ensure that there is no light spill onto such habitats.

3.2.17 Architectural Design Concept

123. The Raw Water Intake Pumping Station Building has been designed to blend into the local landscape, with the pumping station's housing located at the front of Parteen Basin and intentionally incorporating three simple repeated regular forms emphasised by the curved roofline sections to create a 'boathouse' architectural form. As set in the Infrastructure Sites Architectural Statement contained in Appendix A, this is intended to be in keeping with the setting of the building and reduce the visual impact of the structure.

3.2.18 Environmental Design Considerations

124. In accordance with the mitigation hierarchy potential environmental impacts were avoided or reduced through the siting and sizing of the RWI&PS and the proposed infrastructure. At the RWI&PS this specifically included locating the site to reduce potential effects on the Lower River Shannon SAC and on human receptors. In addition, and further to the matters set out under Section 3.2.6 regarding the management of invasive species and in Section 3.2.1.2 on the design of the intake screens, the following environmental considerations have been included in the design of the RWI&PS:

- Space has been provided for an otter run between the site security fence and the edge of the Intake Chamber structure. The size of the ledge has been based on the advice of the biodiversity specialist
- Re-circulation of process wastewater to avoid a discharge of wastewater
- Lighting design to reduce nighttime disturbance and potential impacts on bats.

3.2.19 Sustainability Design Considerations

125. The main sustainability considerations incorporated into the RWI&PS design were:

- Rainwater from the roofs of the Raw Water Pumping Station Building and the two Microfiltration Buildings would be harvested and taken into the Intake Chamber and the Raw Water Rising Mains Scour Tank respectively
- SUDS including an attenuation pond would manage surface water runoff and have been sized to accommodate future climate change
- The landscape planting / reinstatement design, as summarised in Section 3.2.20, aims to maximise opportunities for biodiversity.

126. There are no solar panels proposed at this location as it was considered inconsistent with the architectural concept to propose them on top of the buildings.

3.2.20 Landscaping / Reinstatement Design

127. Site landscaping would seek generally to maintain existing ground levels across the site. However, the western area of the site adjacent to Parteen Basin would be raised from 31.5mAOD to a finished ground level of 32.3mAOD (Malin Head) (35.0mAOD Poolbeg).
128. Woodland planting is proposed within the south-eastern area of the site and a mixed mosaic habitat proposed in the north-eastern part of the site (due to restrictions on planting as a result of below ground infrastructure including the RWRMs) as part of the ecological reinstatement of construction working areas and to help to further screen the buildings.

3.2.21 Boundary Treatment

129. The RWI&PS site boundary would be fenced with a 1.2m post and rail stockproof fence with a second, 2.4m-high polyester powder-coated Paladin security fence set back 5m from the boundary fence. The overall expected length of the security fencing would be 689m. Paladin fencing was specified for this site following engagement with the Local Authority on the architectural treatment of the site.
130. There would also be two 2.4m-high polyester powder-coated security gates. One would be a set of 2.4m paladin gates at the entrance to the RWI&PS site. The second would be at the junction with the R494. This would be 2.4m high and integrated into the boundary wall which would consist of a 1.0m high block wall faced in local stone with a paladin security fence on top, to an overall height of 2.4m. There would also be a site entrance signage board incorporated into this boundary wall.
131. Along the boundary facing into Parteen Basin, the perimeter of the site would be a concrete wall and this would be faced in local stone with the paladin fence on top. Section 3.2.1.1 includes details on the boundary measures within Parteen Basin to protect the intake.
132. The permanent access road between the R494 and the RWI&PS site would have a post and rail fence only on its boundary.
133. CCTV cameras on 6m tall poles would provide security coverage of the access gates and buildings.

3.3 Construction

134. The proposed site for the RWI&PS is adjacent to the Fort Henry Embankment, which is a Category A embankment forming part of the Parteen Basin impoundment which is designated as an SAC. These two considerations underpin the key construction matters:
- Rock breakout, piling and ground anchors
 - Bed reprofiling
 - Managing silt mobilisation
 - Monitoring of construction of the RWI&PS.
135. The more general construction techniques and the wider construction of the RWI&PS are described in Chapter 5 (Construction and Commissioning) of the EIAR.

3.3.1 Rock Breakout, Piling and Ground Anchors

136. The structures at the RWI&PS, except for the Electricity Substation require deep excavations:

- The Raw Water Intake and Pumping Station building requires to be excavated to a depth of about 14.2m, to a level of 17.8mAOD (20.7mAOD Poolbeg)
- The RWRMs Scour Tank requires to be excavated to a depth of about 11m to a level of about 21.5mAOD (24.2mAOD Poolbeg)
- The Invasive Species Debris Retention Tank requires to be excavated to a depth of about 8m to a level of about 24.0mAOD (26.7mAOD Poolbeg).

137. These excavations would require the measures to retain soil and water and withstand lateral pressure. It has been calculated that the temporary works would be required to resist lateral loads estimated to be up to 200kN/m² in the case of the Raw Water Pumping Station.

3.3.1.1 Secant Piling

138. To withstand the lateral pressures and reduce the extent of excavation the boundary of the structures would be constructed using secant piling, an example of which is shown in Image 3.2. These would be supported by the use of Ground Anchors. The material inside the piled walls, including rock would then be excavated/broken out. Rockhead was generally encountered 11.30m to 14.60m below ground during ground investigation.

139. Based on tests carried out on rock samples extracted from the boreholes, the rock can be removed by mechanical means. To reduce the potential for vibration affecting the Fort Henry Embankment the rock breaking towards the southern boundary will be done using:

- Hydraulic rock breaking equipment
- Lower vibration emitting breakers.



Image 3.2: Example of Construction of Below Ground Substructures Using Secant Piled Wall Construction

140. To construct the secant pile walls a shallow guide wall would first be constructed at ground level around the perimeter of the underground structures, to set out the position of the secant piles. On the southern and northern sides of the Pumping Station and the Microfiltration Building the secant piles would be offset by 3m from the concrete substructures. For the eastern and western sides of both buildings the secant piles and the concrete substructure would be adjacent to each other. The primary piles would then be formed by first drilling a series of boreholes into the ground down to the bedrock level at every second pile location and then filling the boreholes with concrete. The primary piles would be drilled using a standard bored piling rig, operating from a temporary piling platform. Once the primary piles are cast the secondary piles would be formed using the same hydraulic bored piling rig as for the primary piles but

with a toothed cutting edge to cut through the edges of the primary piles and to remove the soil between the primary piles. A steel reinforcement cage would be lowered into the secondary borehole and then it would be filled with concrete to form the secondary pile, which intersects with the primary piles, as shown in Image 3.3, to form a continuous structure. This process would be repeated around the perimeter of the structure until the secant pile wall is complete. The area within the pile wall would then be excavated and the Raw Water Intake and Pumping Station building substructure can be constructed. Ground anchors would be installed sequentially, in three rows, as the excavation is progressed. The exception to this is the western side of the Intake Chamber which would have one row. Continuous dewatering facilities would be provided until the structure is watertight.

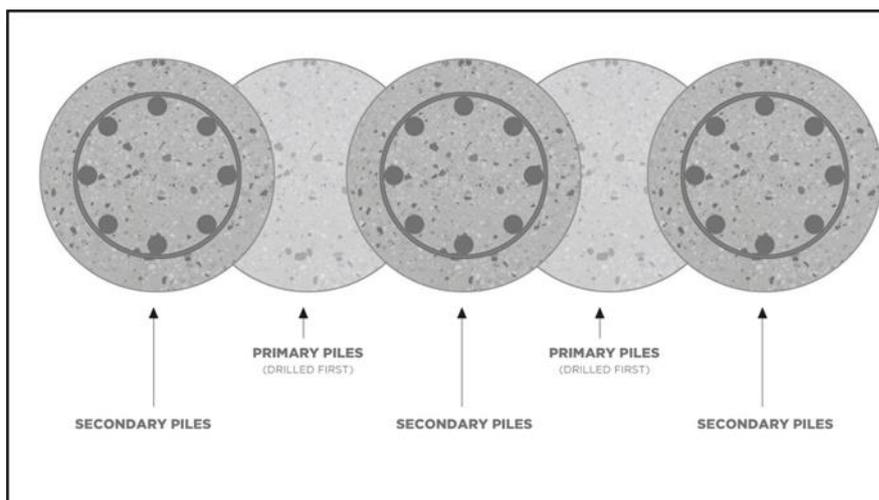


Image 3.3: Secant Pile Wall Construction

141. This secant piled wall method of construction would be used for all of the building substructures. The sequence of the construction for these would be the raw water Intake Chamber and Raw Water Pumping Station substructure first, then the Raw Water Rising Mains Scour Tank and Microfiltration Buildings basements, and finally, the Invasive Species Debris Retention Tank.
142. All the underground structures would be constructed with in situ reinforced concrete.
143. The shoreline would be stabilised using a sheet pile retaining wall, north and south of the Intake Chamber. The piles would be pre-augered to facilitate installation. Following pre-augering the sheet piles would be driven (using vibratory piling) to the required depth. When the sheet piles are in place a capping beam would be cast along the top of the retaining wall.
144. Superstructures would be constructed with structural steel frames, blockwork and architectural cladding. The twin 1,500mm rising mains would be laid sequentially as working areas become available, working from the Pumping Station through to the Microfiltration Buildings and Raw Water Rising Main Scour Tanks and on to the Flow Meter and Swabbing Chambers.
145. A temporary piling platform would be constructed in Parteen Basin to accommodate the placing of the secant piles along the existing shoreline in constructing the Intake Chamber. This platform would consist of an inner and outer sheet pile wall, containing stone fill between the two walls. The inner sheet pile wall would be tied into the sheet pile of the retaining wall along the shoreline such that a dry working area is formed to allow the secant piles along the platform to be constructed. The piling platform would be removed once the secant pile wall has been installed.

3.3.1.2 Ground Anchors

146. In addition to the lateral pressure during construction, a feature of the design is the prevention of hydraulic uplift (flotation). To prevent uplift, as well as lateral movement, ground anchors would be used.
147. The ground anchor system to be used would be a Dywidag Threadbar Anchor system using 63mm bars, or equivalent. The anchors need to be sufficiently deep to cause the underlying soil/rock to provide sufficient downward weight to counteract uplift. The base itself is designed as an upside-down reinforced concrete flat slab.
148. The number of anchors varies depending on the structure. The Intake would initially have one row of anchors, which would be severed when the bed reprofiling is completed.
149. The retaining walls either side of the Intake would have a single row of rock anchors that would be installed at 3m centres, running eastwards away from the shoreline and tying into competent rock, similar to the rock anchors on the pumping station and microfiltration buildings.
150. The substructure external walls for the Pumping Station and Microfiltration buildings would have three rows of anchors.

3.3.2 Bed Reprofiling

151. Once the Intake Chamber and Pumping Station substructure is completed, the Parteen Basin bed would be reprofiled in the area immediately outside the Intake Chamber. Examples of this are shown in Image 3.4 and 3.5. Dredging equipment would be used for the reprofiling over a semi-circular area extending with a width of 27m and a length of 55m along the shoreline to accommodate revetment mats. The silt curtains would remain in place until this operation has been completed, and silt has settled out.
152. The bed of Parteen Basin would be reprofiled away from the shoreline at an approximate gradient of 1 in 10. From the northern and southern corners of the intake chamber, the gradient would be steeper, at 1 in 4. Consequently, it is proposed to install a sheet pile retaining wall on both sides of the intake chamber. These retaining walls would be approximately 20m long. They would be 8m deep at the corners of the intake chamber, reducing in depth towards the edges to match the excavation profile.
153. Once the bed has been reprofiled, a concrete revetment mat (a flexible mat of meshed thin concrete segments with voids) would be threaded by non-corroding heavy duty nylon rope and lifted into place by a crane and lifting bracket. It would be placed on the reprofiled bed and used for erosion control in the area immediately outside the Intake Chamber. It can be provided with a small cover layer of granular or other native bed material of approximately 300mm in depth to provide a surface, which can be recolonised by native fauna.



Image 3.4: Revetment Mat Being Lifted into Position (Wet Installation)



Image 3.5: Stacked Multiple Concrete Revetment Mats (with Pontoon Crane and Suction Dredger)

3.3.3 Silt Management

154. A key requirement of the Construction Phase is that there is no significant impact on the quality of water within the Lower River Shannon SAC, e.g. due to mobilisation of silt. Therefore, a double row of heavy-duty Type 3 silt curtains would be placed around the construction area to prevent silt from entering the main Parteen Basin body of water. The specifications for the silt curtains are that:

- Beyond the silt curtains, total suspended solids are kept within the prescribed limit (i.e. $\leq 25\text{mg/L}$, in accordance with the Quality of Salmonid Waters Regulations 1988). Turbidity measurements (suspended sediment concentration) would be taken inside and outside the curtain to assess its effectiveness in containing sediment
- Accumulated sediment/silt behind the first curtain would be removed periodically to maintain the curtain's effectiveness. The rate of silt accumulation would vary depending on factors such as water currents, the type of sediment, and the depth of the curtain. Silt curtains would be inspected daily during construction activities with the potential to generate silt and immediately after heavy rainfall/flooding to assess the curtain's condition and identify sediment buildup and excessive drag. Monitoring would be weekly at other times
- The design of the connection to the bank / land must be able to withstand the water velocity of a 1 in 100 flood flow (with an allowance for Climate Change)
- The top of the curtain would be buoyant and must move with fluctuations in the water level up to a 1 in 100 flood event (with an allowance for Climate Change)
- The bottom of the curtain must be secure and prevent silt egress underneath. This would be done using a steel ballast chain or equivalent to maintain the curtain's vertical position in the water.

155. The intention is that the works can be sequenced to reduce the dependency on the double silt curtain as follows:

- Install double silt curtain around the working area as part of site mobilisation
- Install temporary sheet piling to retain the temporary piling platform (this would be on both sides of the piling platform and must form a continuous barrier around the temporary works at the intake)
- The silt curtain would be used to manage silt during the temporary sheet piling; however, the piling platform becomes the primary silt retention barrier with the two silt curtains providing back-up during the secant piling and all construction works required for the intake and pumping station, (except for the installation of the rock revetment)

- When the temporary works on the ‘wet side’ of the intake are completed the piling platform would be removed. During this phase the silt curtains act as the primary containment measure
- In preparation for the dredging and placement of the revetment matting a physical barrier consisting of a silt curtain or a structure performing an equivalent function would be placed around, and close to the perimeter of the dredging / rock revetment area. This provides the primary containment and the double silt curtain provides the back-up
- Once the revetment matting is complete and all works on site complete the double silt curtain can be removed.

3.3.4 Construction Monitoring

156. Prior to construction works commencing on site a monitoring plan for the works will be implemented. This will include:

- Installing piezometers, in agreement with ESB to monitor groundwater during construction and into the operational phase of the Proposed Project. These will be connected individually to a modem logger and this will allow the data to be transferred over a mobile phone network to a shared platform for relevant stakeholders
- Ground movement monitoring and vibration monitoring.

157. These measures will be agreed with ESB and will continue through into the testing and commissioning phase and then into the operation of the Proposed Project.

158. In addition, during construction there will be monitoring of silt levels as part of the silt management set out in Section 3.3.3 and other discharges including monitoring the quality of surface water discharges from settlement basins. Regular inspections will be required of fuel storage areas, bunding and interceptors to check they are operating and there are no issues with the integrity of the storage / accidental spills / leaks.

3.4 Testing and Commissioning

159. Following dry inspection of the Raw Water Intake Basin and Intake Chamber, and of the functioning of the penstocks in the chambers, the Intake Chamber would be filled with water from Parteen Basin. The area outside the Raw Water Intake Basin in Parteen Basin would be subsequently inspected by divers for integrity of the concrete revetment mats. The Raw Water Intake Basin would remain full, as far as closed penstocks on the Inlet Chambers, until the wet wells are filled with water immediately prior to commissioning.

160. The membrane filters and UV units would be commissioned so that water pumped forward is free of invasive species.

161. ESN would be informed of a time profile of test/commissioning loads and, following this, pumps would be commissioned individually and in parallel. Raw water drawn into the intake would be used to commission the pumps and RWRMs. The water would be reused to test both RWRMs initially, i.e. transferred from one main to the other. Once the pump sets and RWRMs have been tested individually, more water would be drawn in and commissioning and testing would take place, in parallel. This phase would include for example:

- Monitoring the velocity of the intake
- The effectiveness of the bubble curtain
- Monitoring ground water levels.

3.5 Operation and Maintenance

3.5.1 Operation

162. During operation, water would be abstracted from Parteen Basin at the Intake Chamber. The volume of water to be abstracted would be determined using a predictive model that calculates how much water would be needed.
163. The volume of water taken into the Intake Chamber would all be automated and controlled by the rate of pumping in the pumping hall. This process is described further in Section 10.8.2.
164. Raw water would enter the Inlet Chamber of the Raw Water Pumping Station from the Intake Chamber via the passive intake screens. .
165. The number of pumps that are operating would vary depending on the volume of water required. A single set of pumps could deliver the required volume of water in 2050 under normal or average demand conditions. However, two sets of pumps would be needed to deliver the peak flow of 300Mld over a 24-hour period. The number of pumps, eight in total would allow for the plant to be rotated, providing downtime for the pumps and avoiding overheating. This would also allow for routine maintenance to take place with no impact on the operation of the Proposed Project. There would always be one pump available on stand-by. The pumps would operate with variable speed drives, allowing pumped flows to be regulated as required.
166. The intake velocity must be below 0.15m/s as described in Section 3.2.1.2. The operational velocity through the screens has been calculated as 0.047m/s based on the peak abstraction of 300Mld (3.47m³/s). This was based on two out of three screens operating and each screen having a surface area of 37m². The maximum flow of 1.74m³/s divided by the surface area of each screen gives a velocity of only 0.047m/s. This would be the velocity if the raw water pumps were operating continuously, which they would not be, so the actual velocity would typically be lower than this.
167. The operational process for the initial treatment of raw water for invasive species at the RWI&PS is described in Section 3.2.6.
168. The site would not be permanently staffed and operatives would only need to be on site intermittently for routine inspection and maintenance.
169. The role of the RWI&PS in the operation and maintenance of the RWRMs is described in Section 4.7.

3.5.2 Surge Management

170. Surge management would be provided through the surge vessel described in Sections 3.2.4 and 4.7.2.
171. The surge protection system is passive and requires no active intervention. It would run fully automatically with its own Programmable Logic Controller (PLC) and electrical power supply.

3.5.3 Residues

172. There would be periodic removal of any debris / materials taken out of the raw water to a licensed waste disposal facility, this could include removal of residues from the Invasive Species Debris Retention Tank and debris cleared from the PWWC screens.

3.5.4 Third Party Access

173. The ESB would have access to the RWI&PS site to maintain the Electricity Substation and Power Distribution Building on-site. This would be via shared use of the permanent access road from the R494.

174. In addition, an access has been provided within the design for a landowner to be able to cross the permanent access road in order to access land on the southern side of it.

3.5.5 Recreational Safety

175. Swimmers and other recreational users of Parteen Basin would be alerted to the presence of the raw water intake through the positioning of a line of buoys set in an arc in the vicinity of the intake point.

3.5.6 Maintenance

176. All of the infrastructure has been designed to allow for routine maintenance and replacement. At the Raw Water Intake this includes:

- Being able to isolate each opening within the Intake Chamber
- Allowing each set of pumps to draw water from any combination of Inlet Chambers, such that when one Inlet Chamber is out of service, there is no loss in pumping capacity.

177. The design also provides redundancy to allow individual screens or pumps to be taken out of service with no interruption of the operation of the RWI&PS.

178. The design of the RWI&PS includes the following for maintenance purposes:

- Gantry Cranes above the Passive Intake Screens, at raw water pumps and within the microfiltration units.

179. Routine maintenance and cleaning at this site would include:

- Cleaning of the microfiltration screens
- Automatic cleaning of the PWWC Intake Screens using an air blast (debris collected and removed from Intake Chamber).

3.5.7 Monitoring

180. The operation of the intake and the pumps would be continually monitored from the Control System and operatives at the WTP. Routine monitoring on site would include:

- Inspection of the microfiltration screens
- Inspection of the bubble curtain
- Inspection of the PWWC screens
- Monitoring of groundwater
- Checking the speed of the pumps, the volume of water being moved and the pressure in the pipeline.

4. Raw Water Rising Mains

4.1 Purpose

181. The RWRMs would transfer raw water from the RWI&PS to the WTP up to a maximum flow of 300Mld during a dry year critical peak period.

4.2 Pipeline Corridor

182. Section 10.2 defines the Pipeline Corridor for the Treated Water Pipeline design and this corridor and the construction flexibility that it provides also apply to the RWRM. Specifically the 20m Pipeline Corridor provides horizontal construction flexibility, as described in Section 10.2.1, to amend the alignment of the RWRM in order to overcome on-site obstacles / constraints. This level of construction flexibility is within normal construction practice.

183. Similarly, the same vertical construction flexibility defined in Section 10.2.3 provides the scope to amend the vertical alignment of the RWRM in order to overcome on-site obstacles.

184. Due to the short length of this section of the pipeline forming the RWRMs, the fact that it would be a twin pipeline and the comparatively long section of trenchless crossing within the RWRMs, means that the practical level of construction flexibility would be less for the RWRM compared with the Treated Water Pipeline.

4.3 Design

185. The RWRM would consist of two 1,500mm steel pipes. These would be approximately 2km in length and would run in parallel with one another with a minimum separation distance of 2-6m.

186. The design for the RWRMs has been focused on ensuring a reliable supply, taking account of the fact that the RWRMs have to transport raw water. Consequently, twin pipelines have been chosen for the design of the RWRMs, to enable cleaning or maintenance of one main, while the other is still in operation. The RWRMs would be cross connected within the RWI&PS Building substructure. A second cross connection would be made immediately upstream of the Raw Water Balancing Tanks (RWBTs) at the WTP site. As a result, it would be possible for either RWRM to be taken out of service for cleaning, without interruption of raw water supply to the WTP.

187. The RWRMs would be laid generally at a minimum depth of cover of 1.2m above the crown of the pipe. Two sections of the RWRMs would be laid with deep cover. The first section would be adjacent to the RWI&PS and would form part of the deep excavation for the substructure. The second section, at a depth of 8.8m, lies east of the R494 crossing and would be installed using trenchless construction.

188. Each 1,500mm nominal diameter steel pipe has been designed to be able to withstand the pressure needed to pump the peak volume of water needed in 2050 (i.e.300Mld).

189. Ancillary pipeline features for the RWRM such as Line Valves and Lay-Bys are described in Section 11. The RWRM would have one Line Valve on each pipe immediate west of the R494 crossing and two air valves on each pipe. The Line Valve would be in a permanent below ground chamber. A permanent lay-by would be required at the Line Valve. This would be on the R494, adjacent to the Line Valve and would be used to facilitate safe access off the road for inspection and maintenance purposes. Cathodic Protection would be used on the RWRM as described in Section 10.8.5.

4.4 Pipeline Alignment

190. The proposed RWRMs would extend in a generally east-south-easterly direction from the RWI&PS for 850m through local forestry and open agricultural grassland, crossing a disused railway, within the townland of Coolnadornory as far as the R494 (RDX001).
191. From the R494, the proposed RWRMs would continue in an east-north-easterly direction, through further agricultural grassland and forestry in the townlands of Kilmaglasderry and Knockadromin, before entering the WTP at Incha Beg.

4.5 Construction

192. The method of construction would be consistent with that set out for the Treated Water Pipeline in Section 10.6.

4.6 Testing and Commissioning

193. The testing and commissioning of the RWRMs would be consistent with that described for the Treated Water Pipeline in Section 10.7.

4.7 Operation and Maintenance

4.7.1 Operation

194. The general operation and maintenance requirements for the RWRMs are the same as the Treated Water Pipeline as described in Section 10.8.
195. The RWRMs would allow the transfer of up to 300Mld of raw water. The twin pipeline design allows for one RWRM to be taken out of service for cleaning and maintenance while still providing the uninterrupted raw water requirement through the other RWRM. The RWRMs would be cross connected to allow flow to be diverted into one single rising main if the other is out of service for cleaning or maintenance.
196. The RWRMs would deliver raw water into the RWBTs via cascade chambers at the head of the WTP. The cascade chambers would aerate the water and assist in precipitation of iron or manganese prior to entry into the treatment process.
197. The operational control of the water within the RWRM would be at the infrastructure sites at either end i.e. the RWI&PS and WTP.

4.7.2 Surge Management

198. Raw Water Surge Vessels are included at the RWI&PS to control the normal transient pressures arising from start-up, shut-down and trip of the pumps. Four Raw Water Surge Vessels, two for each RWRM, are proposed each with a capacity of 89m³. Each vessel would require compressed air with a permanent compressor to maintain air volumes at pressure within the air vessel, and these have been included in the RWI&PS layout.

4.7.3 Maintenance

199. The RWRMs would require cleaning and maintenance as they would transfer raw water from Parteen Basin which would include silts and suspended solids. These would accumulate in the pipes over time

and the pipes would need to be cleaned on a planned, intermittent basis. Experience in the operation of the RWRMs would dictate the frequency of cleaning but it is anticipated that this would occur once a year.

200. Provision has been made to allow each of the twin RWRMs to be emptied to a RWRMs Scour Tank. This tank would be located underneath the microfiltration buildings at the RWI&PS and would allow the RWRMs to be emptied for maintenance or in emergency without having to discharge any water back to Parteen Basin. The capacity of the RWRMs Scour Tank, at approximately 3,000m³, would allow for either RWRM to be emptied in sections.
201. The RWRMs would be laid at gradients that would allow approximately a 1,500m length of mains (from the RWI&PS to the Air Valve at Chainage RW – 1590) to be drained by gravity back to the RWRMs Scour Tank.
202. Drained water can then be pumped through the second operational RWRM to the WTP.
203. The section of RWRMs from the Air Valve (at RW – 1590) to the WTP would be drained by gravity to the Tank Draindown Management and Commissioning Lagoons in the WTP site.
204. Two RWRMs Swab Chambers would be constructed on each RWRM: one at the RWI&PS site and one within the boundary of the WTP site. These chambers would allow pipe cleaning ‘swab’ devices, colloquially known as ‘pigs’, to be inserted into the pipes from time to time to clean the internal walls of the pipes. The ‘pigs’ fit snugly within the pipe, dislodging deposits on the inner walls while being driven by water pressure from behind, and flushing water delivered through nozzles in the ‘pig’ serves to move dislodged deposits in a flushing flow ahead of the moving ‘pig’.
205. When one of the RWRMs is being cleaned with swabs, these would be introduced into the mains at the WTP site and driven down towards the RWI&PS site. Any debris from the pipe would be drained, via the RWRMs Swab Chambers at the RWI&PS site, to the RWRMs Scour Tank. From there it would be returned to the Inlet Chambers and recirculated.
206. Settled washwater would be pumped from the RWRMs Scour Tank, via a floating-arm draw-off, back to the Inlet Chambers from where it would be pumped onward to the WTP via the other, operational RWRM. Solids settled out in the RWRMs Scour Tank would be removed periodically from site to an appropriately authorised facility in accordance with the requirements of the Waste Management Act 1996 (as amended).
207. Other maintenance activities would be the same as set out in Section 10.8 and Section 11.

4.7.4 Monitoring

208. The main monitoring on the RWRM would be to check for a breakout and build-up of invasive species. Otherwise, the only monitoring would be the system wide operational monitoring using the SCADA system.
209. The Cathodic Protection would provide advance warning on any deterioration in the integrity of the pipeline.

5. Water Treatment Plant

5.1 Purpose

210. The purpose of the WTP is to treat the raw water, pumped from the RWI&PS in order to achieve the drinking water standard set out in the European Union (Drinking Water) Regulations 2014 (as amended).

211. The WTP has been designed to be able to produce a peak output of 300Mld. The design of certain process units is based on 317Mld to account for the re-circulation of process washwater.

212. The HLPS at the site would then deliver the treated water to the BPT via the first section of the Treated Water Pipeline. The main components of the WTP and HLPS are illustrated in Image 5.1. The WTP site is located immediately north of dense woodland in open fields. The site would be approximately 30ha, (excluding the access road described in Section 5.2.20). This would comprise of approximately 29.1ha of permanent land take and a further, approximately 0.9ha of land only required temporarily during construction.¹⁹

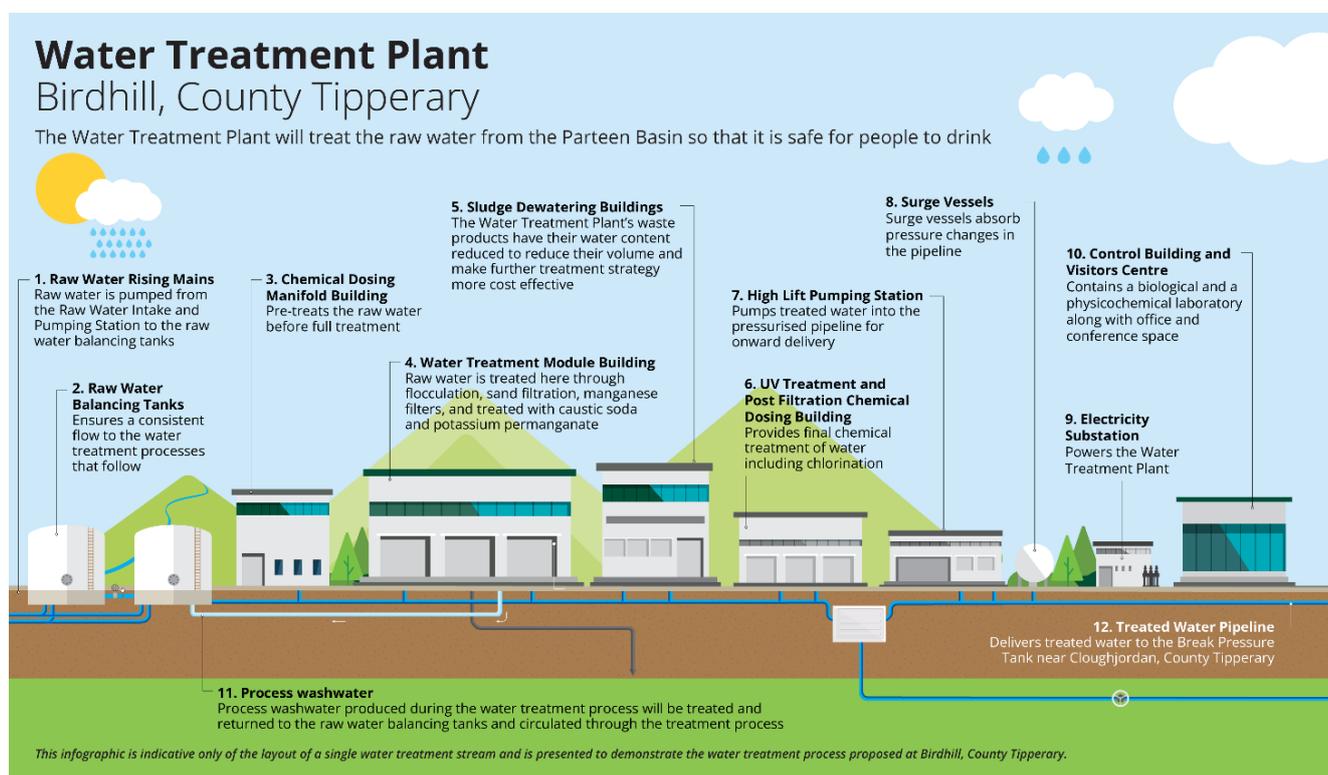


Image 5.1: Infographic Overview of the Water Treatment Plant

5.2 Design

5.2.1 Treatment Process

213. The proposed treatment process is based on three treatment streams, one through each of the treatment modules. The proposed treatment process streams include:

¹⁹ These totals are affected by rounding to one decimal place.

- pH correction
- Enhanced coagulant and polyelectrolyte dosing
- Flocculation and clarification
- First stage filtration (Rapid Gravity Filtration (RGF) – enhanced individual filtration)
- Second stage filtration through Granular Activated Carbon (GAC) filters and iron and manganese rapid gravity filters
- Disinfection with UV and dosing of low levels of chlorine into the final water, to prevent build-up of slime in the treated water pipe.

214. The main Infrastructure elements of the WTP are detailed in Table 5.1.

Table 5.1: Main Infrastructure Elements – Water Treatment Plant

Infrastructure Element	No.	Length	Width	Height Over Finished Ground Level	Plan Area	
					Each	Overall
RWRM Swab Chambers	2 No.	26.0m	21.0m	1.2m	n/a	n/a
Raw Water Balancing Tanks	2 No.	65m Φ^{20}	n/a	Roof Slab 4.8m	3,318m ²	6,636m ²
				Cascade 8.5m		
Chemical Dosing Manifold Building	1 No.	Superstructure 76.8m	Superstructure 35.0m	11.2m	2,310m ²	2,310m ²
		Substructure 76.4m	Substructure 42.4m	5.5m (depth)	2,184m ²	2,184m ²
Water Treatment Module Buildings	3 No.	141.3m	58.6m	15.6m	8,280m ²	24,841m ²
Used Washwater Equalisation and Settlement Tanks	8 No.	30.0m (internal)	20.0m (internal)	10.4m	600m ²	4,800m ²
Post Filtration Chemical Dosing Building	1 No.	Superstructure 70.0m	Superstructure 39.3m	7.6m	2,749m ²	2,749m ²
		Substructure 28.0m	Substructure 38.0m	5.6m (depth)	1,064m ²	1,064m ²
Backwash Water Tank and Pumping Station	1 No.	Superstructure 31.2m	Superstructure 14.8m	6.0m	462m ²	462m ²
		Substructure 43.4m	Substructure 30.9m	10.4m (depth)	1,341m ²	1,341m ²
Clear Water Storage Tank	2 No. with 4 No. Cells	40m (internal)	65.6m (internal)	1.3m	2,624m ²	10,496m ²
High Lift Pumping Station	1 No.	Superstructure 43.8m	Superstructure 24.8m	6.2m	1,083m ²	1,083m ²
		Substructure 43.8m	Substructure 24.8m	12.5m (depth)		
High Lift Surge Vessels	5 No.	8.8m	3.8m Φ (external)	5.0m	33m ²	165m ²
Sludge Balancing Tanks	4 No.	n/a	10.0m Φ (internal)	0.2m	79m ²	314m ²

²⁰ Φ symbolises diameter

Infrastructure Element	No.	Length	Width	Height Over Finished Ground Level	Plan Area	
					Each	Overall
Sludge Thickeners	4 No.	n/a	12.0m Φ (internal)	3.0m	113m ²	452m ²
Sludge Forward Pumping Station	2 No.	12.2m	7.4m	2.5m	90.5m ²	181m ²
Sludge Storage Tanks	6 No.	8.8m (internal)	8.8m (internal)	5.7m	77.5m ²	465m ²
Sludge Storage Silo	2 No.	n/a	4.0m Φ	13.9m	12.5m ²	25m ²
Sludge Dewatering Buildings	2 No.	38.8m	28.1m	13.1m	1,093m ²	2,185m ²
Washwater Settlement Building	1 No.	50.8m	29.7m	13.5m	1,511m ²	1,511m ²
Tank Draindown Lagoons	2 No.	77.6m	43m	7.0m (depth)	3,337m ²	6,674m ²
Lagoon Pumping Station	1 No.	12.0m (internal)	10.4m (internal)	0.2m	125m ²	125m ²
Control Building (2 storeys) (including Visitor Centre)	1 No (internally separated)	72.7m	30.0m	10.2m	2,181m ²	4,362m ² (Both parts)
38 kV electricity substation site	1 No.	40.2m	36.0m	4.7m for the Switchgear	1,447m ²	1,447m ²
Switchgear Building	1 No.	14.8m	9.3m	3.5m	138m ²	138m ²
Power Distribution Building	1 No.	43.5m	11.0m	6.3m	483m ²	483m ²
Sludge Storage Buildings	2 No.	72.9m	40.0m	8.1m	2,916m ²	5,832m ²
Bat House	1 No.	3.3m	3.3m	3.8m	10.9m ²	10.9m ²

215. The main and substantial overground structures at the WTP include:

- Water Treatment Module Buildings
- RWBTs
- Sludge Storage Buildings
- Sludge Dewatering Buildings with adjacent holding tanks and sludge silos
- HLPS and Surge Vessels
- Control Building integrated with Visitor/Interpretive Centre.

5.2.2 Treatment Streams

216. Three treatment modules have been included in the proposed layout, each with a treated water design output capacity of 100Mld under peak operating conditions, with sufficient operational redundancy and resilience for cleaning and maintenance. The three treatment modules would operate as three discrete process streams, each operating independently and in parallel.

217. Table 5.2 summarises the output capacity of the WTP under normal operations and the maximum output capacity achievable.

Table 5.2: Summary of Design Criteria and Capacities of the Proposed Treatment Process

No. of Modules	No. of Clarifiers (and in Operation)	Clarification Rate (m/hr)	No. of Filters (and in Operation)	Filtration Rate (m/hr)	Maximum Output Capacity (Mld)
3	18 (14)	5.82	24 (18)	9.48	300

5.2.2.1 Raw Water pH Correction

218. The raw water pH correction design is based on dosing sulphuric acid (96%) at a dose rate of 30mg/l in order to achieve a pH level of 6.2 to 6.5 to optimise coagulation.

5.2.2.2 Coagulation and Flocculation

219. The coagulation design is based on dosing 8% liquid aluminium sulphate $Al_2(SO_4)_3$ at a dose rate of 250mg/l, as per IW-TEC-900-03 (Uisce Éireann 2023b). Aluminium sulphate was chosen as it is the most effective for charge neutralisation at a pH of between 5.00 – 5.50 but should be maintained at approximately 6.2 to balance the risk of soluble aluminium at lower pH.

220. The flocculation design is based on dosing polyelectrolyte at a dose rate of 0.3mg/l and a retention time of 30mins in the flocculation tank.

5.2.2.3 Clarification

221. The clarifier design is based on delivering an output of 300Mld with 14 out of 18 clarifiers in operation (n-1 in each building, minus another one), based on throughput divided by 20hrs and incorporation of tube settlers. This equates to a surface loading rate of 5.82m/h.

5.2.2.4 Rapid Gravity Filters (First Stage)

222. RGF (first stage) design is based on delivering an output of 300Mld with 18 out of 24 filters in operation (n-2 in each building), based on throughput divided by 20 hrs. This equates to a filter loading rate of 9.5m/h.

5.2.2.5 Manganese Filters

223. Manganese filters have been included even though the range of manganese in the raw water is 0.5µg/l to 10.0µg/l, with a 95%ile value of 6.8µg/l. Design is based on the Uisce Éireann performance target for manganese, i.e. 25.0µg/l in 99% of samples. The design is based on 20 out of 24 filters in operation (n-1 in each building, minus another one).

5.2.2.6 GAC Filters

224. The filtration design is primarily based on optimising the coagulation flocculation clarification (CFC) process such that organics are removed to an extent that Trihalomethane Formation Potential (THMFP) is sufficiently low. To further reduce the organic carbon present in the raw water, GAC filters have been incorporated as second stage filters.

225. A pilot water treatment plant was set up by Uisce Éireann at Clareville to treat the source water from the Lower Shannon and the Ardnacrusha Headrace Canal across seasonal and quality variances. Results from a range of operating scenarios at Clareville WTP between 2019 and 2021 were used in assessing

the use of GAC filters as part of the specimen design. GAC filters are designed based on achieving 20 minutes Empty Bed Contact Time for 30% of total flow, with n-2 filters in operation. The design includes seven filters in each building, with a media depth of 2.5m (total media volume 1,583m³).

226. GAC filter media needs to be replenished periodically as it loses its effectiveness over time. This is described in Section 5.5.3.

5.2.2.7 pH Correction (Post First Stage Rapid Gravity Filters)

227. The final pH correction would be achieved by dosing liquid sodium hydroxide (25%) at 35mg/l downstream of manganese and GAC filters, as per IW-TEC-900-11-01 (Uisce Éireann 2023a). This would be mixed by a paddle mixer.

228. The target pH requirements are:

- 7.5 to 8.0 (Table 12 IW-TEC-900-11-01 (Uisce Éireann 2023a) for alkalinity > 50mg/l
- Target final water alkalinity is 30 to 150 mg/l.

229. From jar tests (2017 to 2024) pH is to be elevated from 6.4 to 8.0.

230. The bulk storage requirements were as per IW-TEC-600-06-01 Chemical Storage Systems – Bulk Storage of Liquid Chemicals (Uisce Éireann 2023d). It was calculated that:

- Daily use of caustic soda 4.7m³/d (at 154Mld), 40 days storage = 188m³
- Daily use of caustic soda 8.7m³/d (at 300Mld), 40 days storage = 348m³.

231. The current design has six caustic soda storage tanks each with a capacity of 10m³ giving a total capacity of 60m³.

5.2.3 Treatment Module Buildings

232. Each treatment stream has its own Water Treatment Module Building, with each housing the main stages of treatment including flocculation, settlement, RGF, and manganese and GAC filtration. Each building would include six settlement tanks and eight filter units and solar panels on the south-facing roof sections. Circulation walkways and safety railings around all the tanks would also be included in these buildings.

233. Each building would be 141.3m long, 58.6m wide and up to 15.6m tall.

234. The Water Treatment Module Buildings would also house an inflow splitting chamber; a flocculation tank; polyelectrolyte, caustic soda, and brine/hypochlorite storage and dosing areas; a chemical reception area for these; space for air compressors and air blowers; a wet chemistry room; a main control and data room; and an instrumentation/inverter room for solar panel electricity management. All chemical storage areas within each of the buildings would be bunded.

235. At low level, waterworks sludge draw-off pipework from the settlement tanks would be provided in desludging galleries between the settlement tanks, and water at different stages of treatment would be decanted at high level and channelled to downstream stages of the process.

5.2.4 Raw Water Balancing Tanks

236. Two RWBTs, each with a 65m diameter and a water depth of 4.4m would have a total volume of 29,466m³. The purpose of the RWBTs is to permit the WTP to operate at a steady continuous pace, even if the raw

water pumps at the RWI&PS are not operational. Each tank can be isolated, if required, and drained for maintenance to the tank draindown and commissioning lagoons, which would be located in the south-eastern area of the WTP site. The tanks would be capable of storing approximately 4.5 hours of water at an output of 154Mld and approximately 2.25 hours of storage at peak output of 300Mld.

237. The RWBTs would be located at the highest point in the WTP site, with a Top Water Level of 59.9mAOD, to facilitate gravity flow through the treatment works.
238. The roof of the raw water balancing tank would be 4.8m over finished ground level, and a smaller Inlet Cascade Structure would sit above the inlet, with a height of 3.6m over the roof level. This inlet cascade structure would have louvred vents and would house the inlet pipe, and the cascade structure, to aerate and disperse the inflow and absorb the kinetic energy of the pumped inflow.
239. In the event of an invasive species breakthrough, one of the Raw Water Balancing Tanks can be taken out of service for inspection, cleaning and maintenance, while the full flow is passing through the other tank.
240. Co-settled supernatants, filtrates/centrates, backwash waters and filter run to waste waters would be returned to the head of the works. These would be blended with the incoming raw water in the incoming raw water pipelines and provided with a nominal 15 to 30 minute retention time in the RWBTs at the head of the works.

5.2.5 Chemical Dosing Manifold Building

241. The Chemical Dosing Manifold Building would house the preliminary stages of treatment which would bring the water to an optimum pH for the later stages of treatment to operate most efficiently. Each of the treatment modules would have a 1,400mm nominal diameter inlet pipe, dosing point with sulphuric acid for pH adjustment, regulating flow meter and valve, and aluminium sulphate (also known as 'alum') dosing. This building also houses the reception area for, and storage of, chemicals with eight sulphuric acid storage tanks and eight liquid alum bulk storage tanks. It includes a raw water quality instrumentation room, a motor control centre and instrumentation panel.
242. Chemical storage tanks typically hold approximately 40 days' supply. Sulphuric acid storage volume is based on 40 days storage at a daily use of 5.2m³. Alum storage volume is based on 40 days storage at a daily use of 59m³.
243. The Chemical Dosing Manifold Building is designed to house the main flow pipework in a central basement 5.5m below external finished ground level and would also include a gantry crane. Chemical storage tanks would be located on either side of the central basement and be banded in an area below external finished ground level. The instrumentation and control room would be positioned above the central basement, with a roof ridge line in this area of 11.2m over finished ground level.

5.2.6 UV Dosing and Post Filtration Chemical Dosing Building

244. To protect against pathogenic bacteria, viruses and protozoa in the treated water leaving the plant, UV light treatment has been allowed for. The UV Dosing and Post Filtration Chemical Dosing Building would sit downstream of the Water Treatment Module Buildings, and houses equipment for UV disinfection of the treated water, as well as chlorination, fluoridation and pH adjustment of the treated water.
245. In addition, the building would house an OSEC (on-site electro chlorination) plant together with banded brine storage tanks, and sodium hypochlorite storage tanks. The storage would provide 52 days of sodium hypochlorite at 154Mld and 30 days of brine storage at 154Mld.

246. To minimise the risk of disinfectant by products such as trihalomethanes (THM), the level of chlorination at the WTP will be at the lowest possible level needed to maintain the Treated Water Pipeline in a clean state.

247. The banded sodium hypochlorite dosing system is required to maintain:

- A minimum 'chlorine residual' of between 0.1mg/l and 0.2mg/l in the treated water pipeline to prevent biofilm growth.

248. The building would also house automatic monitoring and testing equipment to measure residual chlorine in the treated water from the WTP, and automatic dosing pipework.

249. Based on the design, it is expected that chlorine would be dosed at approximately 1.43mg/l at the WTP, such that a free chlorine residual of 0.1mg/l would be achieved at the inlet to the BPT.

250. Chlorination boosting would also take place at the BPT and TPR to maintain an adequate chlorine residual.

251. The overall requirements in relation to the residual chlorine levels and inlets and outlets of the sites (including the WTP) are set out in Table 5.3.

Table 5.3: Summary of Chlorination Design

Section	From	To	Length (m)	Diameter (m)	Volume (m ³)	Flow (m ³ /d)	Free Chlorine Residual u/s of Dose Point (mg/l)	Chlorine Dose Rate (mg/l)	Initial Free Chlorine Residual (mg/l)	Water Age (h) for this Section	Final Free Chlorine Residual (mg/l)
Section 1	WTP	BPT	36,900	1.6	74,192	154,000	N/A	1.43	0.68	11	0.125
Section 2	BPT	TPR	133,736	1.6	268,892	154,000	0.125	1.48	0.73	41	0.143
Section 3	TPR inlet	TPR outlet			75,000	156,000	0.143	1.43	0.68	12	N/A

5.2.7 Clear Water Storage Tanks

252. The Clear Water Storage Tank (CWSTs) are arranged in four cells that store approximately 3.7 hours' production at full output (46,820m³), and they are designed to facilitate continuous operation of the WTP, including during periods where the High Lift Pumps are not operating. Each cell can be individually isolated, and each has individual overflow arrangements. Each cell has a water depth of 4.4m, and each is provided with chlorine dosing static mixers on the inlet side.

5.2.8 Process Water

253. Treated washwater, supernatants, etc., cannot be returned to Parteen Basin due to its environmental designation and would therefore be returned to the head of the treatment works following suitable treatment consisting of settlement, to limit the turbidity of the return water, and UV disinfection. This is achieved via the Backwash Water Tank and Pumping Station and Used Washwater and Settlement Tanks.

254. The Backwash Water Tank and Pumping Station substructure would consist of two tanks to balance and store the washwater used for filter backwashing. Its plan area is substantively below ground, with a superstructure housing a workshop and stores and a control and instrumentation panel room. The basement area includes eight washwater pumps, as well as service water pumps and pressure vessels. The superstructure roof ridge line would be 6m over finished ground level. The height of this building is dictated by the height of the panels in the Motor Control Centre.
255. The site layout includes eight Used Washwater Equalisation and Settlement Tanks (UWWEST) to balance the flush of backwash water from each filter. It also contains two Filter ‘Run to Waste’ Equalisation and Settlement Tanks, which permit the filters coming back into service to be run to waste for a period, as required until the filtration barrier has re-established itself, in order to bring the filtered water passing through up to required standards of protection against pathogenic organisms. The ‘Run to Waste’ would not result in a discharge as it would be re-circulated as described for the washwater.
256. The UWWEST capacity is based on providing 4.5hrs retention time for 300Mld. Flows of settled treatment process waters including settlement tank sludge bleeds, filter backwash water, filter ‘run to waste’ flows, and supernatants from the sludge thickening and dewatering processes are delivered forward to the Wastewater Settlement Clarifiers Building for treatment and return to the RWBTs. Underflow sludges of settled material are delivered to the Sludge Thickeners.

5.2.9 Sludge

257. The sludge treatment facilities at the WTP are summarised in Table 5.4. Sludges would be thickened in four 12m diameter Sludge Thickeners and sludge volumes would be balanced in four 10m diameter Sludge Balancing Tanks. There would be two Sludge Forward Pumping Stations which would deliver to six Sludge Storage Tanks and two Sludge Storage Silos attached to the Sludge Dewatering Buildings, which would allow sludge to be taken in liquid form, if necessary.
258. The required volumes of the tanks have been designed in accordance with Uisce Éireann requirements as per Treatment and Disposal of Water Treatment Plant Residuals IW-TEC-900-07-1 (Irish Water 2017b). Sludge thickening tanks have been based on thickening sludge to 1-3% dry solids, total capacity 452m³.

Table 5.4: Summary of Sludge Treatment Facilities at the WTP

Sludge Treatment Facility	Number of Cells/Tanks/Presses	Total Volume (Where Applicable) (m ³)
Used Wash Water Equalisation and Settlement Tanks (UWWEST)	8	28,422
Sludge Balancing Tanks	4	255
Sludge Thickening Tanks	4	1,812
Sludge Holding Tanks	6	2,556
Sludge Presses	6	N/A

5.2.9.1 Sludge Dewatering

259. Two separate sludge dewatering buildings have been included in the design, each housing four plate presses, three duty and one standby. Sludge thickened to 1–3% dry solids would be fed from the sludge thickening tanks to sludge tanks immediately outside the dewatering buildings. From there it would be fed to the presses where it would be dewatered to a 25% dry solids content, in line with Uisce Éireann requirements. The 25% dry solids cake would then be fed into silos, from where it is loaded into trucks for transport to the sludge storage buildings.

5.2.9.2 Sludge Storage

260. The two Sludge Storage Buildings would be covered structures to hold sludge which has been dewatered to a sludge cake of approximately 25% dry solids. Uisce Éireann requires six months' storage capacity be provided for the dewatered sludge, and two storage buildings are proposed as part of the Proposed Project.

261. Each building would be 72.9m long by 40m wide and partitioned into eight bays, accessible by a front-loader. Each bay would be capable of holding a minimum of 580m³ of sludge. The capacity is calculated on an average storage height of 2.35m in each of the storage bays, which are 5m high.

262. Total sludge cake storage volume is 9,280m³, which equates to six months storage at the 2050 NYAA + HR requirement.

263. At a sustained operation at an output of 300Mld, the volume of sludge storage would reduce to three months. However, in the event of treated water output increasing for a period to the DYCP or DYCP + HR profiles, this reduction in the duration of storage could be offset through a temporary increase in the height of sludge stored, above 2.35m in height.

264. The buildings would be covered, primarily to prevent contaminated rainwater runoff from the stored sludge being generated but also to maintain the sludge at the approximately 25% dry solids content produced from the dewatering process. Supernatant from the sludge thickener and expressate from the sludge dewatering process would be pumped, via the washwater treatment side stream, to the RWBTs at the head of the treatment process.

265. The sludge would be periodically removed for beneficial reuse in line with Uisce Éireann's preferred management approach for WTP solid residuals, as outlined in Appendix K: Residuals of the National Water Resources Plan Framework Plan (Irish Water 2021b).

5.2.10 High Lift Pumping Station (HLPS)

266. The HLPS would deliver treated water onwards from the WTP through the Treated Water Pipeline. It would have a substructure, with a basement depth of 12.5m below finished ground level, and a superstructure ridge line 6.2m over finished ground level. The height of the superstructure is dictated by the height of the panels in the Motor Control Centre room. It would house a 2,000mm nominal diameter suction manifold or 'common' pipe, serving six high lift pumps, (1,800kW) and deliver treated water to the 1,600mm nominal diameter Treated Water Pipeline from the WTP to the BPT at Cloughjordan.

267. The basement also includes a crane to permit pumps, valves and motors to be installed and extracted, as necessary. The superstructure also houses the Medium and Low Voltage switchrooms for the pumping station.

268. The HLPS has provision to draindown water from Treated Water Pipeline if required, towards the lagoons provided for drainage water on-site.
269. The number of pumps running at any given time would be dependent on the flow rate. One backup/standby pump over those necessary to deliver the full flow is included to provide resilience in the case of a pump fault requiring it to be offline. Variable speed pumps would be installed to allow control start and shut down of the system as well as the flow output of the HLPS to be matched more precisely to the output of the WTP.
270. The pump capacity and configuration would be determined at the detailed design phase. The selected pump manufacturer would determine the size, power and mechanical/ICA requirements. Pumps shall be designed to ISO 9906 Grade 1B.
271. The high lift pumping station has been designed on the basis of six installed pumps, with three 1,800kW duty pumps to deliver a peak flow of 300Mld.

5.2.11 Control Building Including Visitor Centre

272. The WTP would include a Control Building incorporating laboratories, a workshop, storage and welfare facilities for operational staff.
273. This two-storey building would contain:
- Entrance foyer and lobby
 - Reception area
 - Toilets, changing rooms and welfare facilities
 - Canteen
 - Document storage room
 - Biological and physicochemical laboratories
 - SCADA room and control centre
 - Conference room and offices
 - Workshop and stores
 - Solar array control.

274. A Visitor/Interpretive Centre would be located at the southern end of the Control Building. They would be part of the same overall structure and the combined length of the building would be 72.7m. It would be 30.0m wide and 10.2m high. Additionally, there would be a telemetry mast to provide communications links to the WTP. This would be 14m tall, above finished ground level.

275. While the Visitor/Interpretive Centre would be part of the same structure as the Control Building, for security reasons there would be no internal access from the Visitor/Interpretive Centre into the Control Building; the two would be entirely independent of one another. The Visitor/Interpretive Centre would contain a reception area and foyer, lecture theatre, display/exhibition area and offices.

5.2.12 Surge Vessels

276. The pressure in the Treated Water Pipeline from the WTP to the BPT, and the conditions which arise on pump start-up and shut-down, and which would create transient surge pressures, which would be balanced by the High Lift Surge Vessels. These would operate by gradually emptying and filling in order

to dissipate the transient pressure wave on start-up and shut-down. These would be located beside the HLPS and arranged so that periodic inspection and maintenance may be performed without disrupting the operation of the pipeline.

277. The vessels would be pressurised steel and would require compressed air with a permanent compressor to maintain air volumes at pressure within the vessel. The required pressure vessel volume at the HLPS is 282m³ and it is proposed to construct five similar 94m³ units, each 3.8m diameter and 8.8m long, to provide the necessary volume. This would allow three duty units and two on standby at peak output which would then facilitate routine maintenance and inspections.

5.2.13 Bat House

278. As part of the WTP site a bat house has been included in the layout. This is required to mitigate for the impacts of the Proposed Project on bats, including the loss of a roost at the WTP. The location and requirements have been specified by the project ecologist and further details on the design of the bat house are included in the EIAR.

279. This would be a building constructed from concrete block and timber frame structure (with insulation between the timber frame and block walls). It would be 3.3m in length and 3.3m wide. It would be a single storey building of 3.8m high with an A-frame roof.

280. Two bat entrance points to the building would be inserted into the east facing and north facing walls.

281. Within the bat house building, the following would be required:

- The floor of the building would be a layer of crushed stone (circa 10cm down) (minimum use of concrete would be used in order to reduce the negative impact of this material on the thermal conditions of the building) with an upper layer of 804 Clause (crushed) stone
- A partition box would be required to be constructed (marine ply) around the entrance point to reduce light penetrating the loft space. This would be open at the bottom of the box so the bats can enter the box and fly down. The box would be 75cm by 75cm.

282. Additional roosting would be required on the bat house external walls. This would consist of four units of bat tubes positioned as high as possible.

283. Woodland planting has been specified around the bat house to provide screening, commuting and foraging.

284. The establishment of the bat house would be undertaken in consultation with a bat specialist to ensure the works are completed correctly and that the location of the bat roost is appropriate.

5.2.14 Power Requirement

285. The connected mechanical and electrical plant for the WTP site would require 132,975kWh/d at an output of 154Mld, the annual average flow, and 191,601kWh/d at the peak demand of 300Mld.

5.2.15 Power Connection

286. The power supply would be provided by ESB Networks from the Birdhill 38 kV Substation, through two bundles of underground cable ducts laid in the R445 from Birdhill to the entrance of the WTP Access Road, and from there the ducts would be routed along the access road into the Electricity Substation on

the WTP site. The cable connection would consist of eight cable ducts laid in two bundles of 3 x 110mm ducts in trefoil arrangement plus two further single 110mm ducts as per Detail 1B in Appendix B.

287. Along a section of the WTP Access Road, the ducts would be laid in a single horizontal row in accordance with Detail 5A in Appendix B (Standard Specification for ESB 38 kV Networks) and Standard Specification for ESB Medium Voltage/Low Voltage Networks Ducting (Minimum Standards)). This would be required to accommodate the construction of this section of the access road over concrete box culverts.

288. In order to provide the power required for the Proposed Project WTP, ESB Networks would uprate the existing 38 kV overhead lines between Ardnacrusha and Birdhill, as described in Section 12.

289. In addition, to facilitate the construction of the WTP infrastructure there would be a permanent diversion of an existing 20kV overhead powerline on the north-western side of the site

5.2.16 Electricity Substation

290. A 38 kV electricity substation site is proposed at a location adjacent to the HLPS. This substation would be similar to that proposed for the RWI&PS site, incorporating a fenced area of 40.2m by 36.0m within which a Switchgear Building and two external transformers would be located.

291. The Switchgear Building, located within the electricity substation site, would include a control room, a battery room and a switchgear room. The two transformers would be mounted externally on two 6.5m by 6.5m concrete plinths.

292. Each transformer would have a height of 4.7m above the finished ground level.

293. The Medium Voltage/Low Voltage Power Distribution Building would be located adjacent to the ESB 38 kV Substation and would contain the switchgear room (from 38 kV to 6.6 kV), a medium voltage transformer room and a low voltage power distribution room. The building would measure 11.0m by 43.5m and would have an overall height above finished ground level of 6.3m.

5.2.17 On-Site Solar Photovoltaic

294. Both ground mounted and roof mounted solar PV is to be provided at the WTP. It is proposed to place solar panels on the roofs of the Chemical Dosing Manifold Building, the Water Treatment Module Buildings and Sludge Storage Buildings, and at a number of locations on the ground, including on top of the CWSTs, to supplement the main power supply. These would help to power the operation of the buildings on site and to supplement the mains power supply. Consequently, this would reduce the energy required from mains supply.

295. The total area of solar PV to be provided is 40,357m² and will have a peak power output of 4,200kWp.

296. A glint and glare assessment has been undertaken and is contained in the Chapter 18 (Material Assets) of the EIAR.

5.2.18 On-Site Water Supply

297. A potable water supply to the WTP would be required during the Construction Phase for staff welfare facilities and construction activities. A connection to an existing 100mm uPVC watermain located on the R445 has been identified in consultation with Uisce Éireann, consisting of new pipe along the permanent access road. This new pipe would be of polyethylene material.

298. This connection will remain as the permanent supply required for the Operational Phase.
299. To allow for a potential future connection to the Proposed Project a 1050mm pipe would be included in the access track from the WTP to the R445. This would enable a connection to be made by a future project under a separate consenting process at the R445.

5.2.19 Surface Water Management and Drainage

300. The WTP access road, and other paved areas, have been designed to incorporate SuDS principles as recommended in the SuDS Manual (CIRIA, 20015) in order to limit discharges from the site to the equivalent green field site flow rate. As part of this drainage strategy the CWSTs would have a 'green roof' on top which would have a biodiversity benefit as well as reducing the rate of surface water runoff.
301. There would be two drainage systems in place at the WTP. Firstly, harvested runoff, from roofs of buildings and tanks, would drain to the commissioning lagoons. Secondly, general site runoff from internal roads would be taken to an attenuation pond in the south-eastern corner of the WTP site.

5.2.19.1 Rainwater Harvesting

302. At the WTP building, roofs and tank covers would account for approximately 55% of the impervious area of the site. Rainfall runoff from these particular surfaces is considered to be of sufficiently consistent quality to be harvested as a source of raw water. Therefore, roof and tank cover runoff would be collected in a dedicated, separate pipe network which would outfall into the commissioning lagoons and would ultimately be pumped to the RWBTs.
303. It is expected that approximately 145,160m³ per year of runoff from roofs and tank covers would be harvested and treated to produce treated water. Harvesting rainwater in this manner would reduce stormwater runoff from the WTP site that would otherwise have to be managed, and it marginally reduces the volume of pumping required from the RWI&PS.

5.2.19.2 Tank Draindown Management and Commissioning Lagoons

304. Two Tank Draindown Management and Commissioning Lagoons, each with a capacity of 15,000m³ (a total capacity of 30,000m³), have been provided for commissioning purposes, for drawing down of a RWRM or other water tank, for acceptance of surface water runoff, or for emergency storage of washwater. The lagoons have an associated pumping station to allow the supernatant contents to be recirculated to the RWBTs.
305. The commissioning lagoons and the associated return pumping system have been appropriately sized for the probability of extreme rainfall events (1 in 100 year return event with 30% allowance for climate change, (in accordance with a High End Future Scenario set out in Flood Risk Management: Climate Change Sectoral Adaptation Plan (Office of Public Works 2019))) occurring concurrently with commissioning or operational requirements.

5.2.19.3 Stormwater Attenuation Pond

306. The roads and hard-standing working areas within the WTP site would be mainly drained via a gully and pipe system. Two main arterial surface water pipelines are proposed. One arterial pipeline would drain the north and east of the site. The second arterial pipeline would drain the west and south of the site. Both pipelines would range from 300mm diameter at the top of each run to 600mm before the outfall. Both surface water pipelines would terminate at an attenuation pond at the south-east corner of the site, adjacent to the access road. The purpose of the pond is to attenuate runoff to greenfield runoff rates.

307. The attenuation pond has been designed following the guidance of the SuDS Manual ((CIRIA) 2015). The length/width ratio of the basin is limited to 3:1, and the maximum depth would be limited to 2m during the most extreme design event, which is a 100-year event with a 30% allowance for climate change. The attenuation pond would be planted with vegetation and the bed slope would be limited to 1:1,000. The principal water quality benefits of vegetated detention basins are associated with the removal of sediment and buoyant materials, but levels of nutrients, heavy metals, and oxygen-demanding material can also be removed if present.
308. Runoff entering the attenuation pond would be pre-treated in a Class 2 By-Pass Hydrocarbon Interceptor. This allows for any build-up of pollutants on an internal roadway or working surface that would be washed off in the early part of a storm to be treated. The outfall from the attenuation pond would be fitted with a penstock which can be used to isolate the attenuation pond and so contain pollutants in the event of an accidental spillage.
309. Stormwater from the attenuation pond would be discharged into a manhole at the head of the WTP Access Road. This manhole would contain a flow control device which would control discharge from the system, limiting it to the maximum flow that would be expected from the greenfield site calculated as 239l/s. The flow would then be conveyed by a 600mm diameter stormwater drain running along the route of the WTP access road to discharge into the stream crossed by the proposed access road approximately 220m north of its junction with the R445.
310. The access road to the WTP would drain via filter drains running on either side of the road. Pea-gravel is a permeable material and would allow storage of excess rainwater before it infiltrates into the subsoil. This process replicates the existing greenfield drainage regime on the site.
311. Foul wastewater generated on the WTP site, which is estimated to be approximately 1m³/d in normal operation and 2.4m³/d with visitors to the site, would be tankered from a wastewater tank installed at the WTP to a licensed WwTP.

5.2.20 Access

312. To provide permanent access to the WTP site it is proposed that a new permanent access road from the R445 would be constructed. The proposed access road would be 6m in width and 640m in length. The permanent access would require approximately 1.9ha of land. In addition, a further, approximately 1.6ha would be required temporarily during construction to build the access road.²¹ This would be in addition to the land defined in Section 5.1.
313. The access road junction includes a pull-in area before the security gates, safe sight lines and appropriate signage when emerging onto the R445, in accordance with Geometric Design of Junctions, DN-GEO-03060, (TII 2023). The sight lines would be partially provided by the existing curtilage of the road.
314. The proposed access road would cross a tributary of the Kilmastulla River, immediately north of the R445, by way of a clear span bridge. A Flood Risk Assessment has been undertaken and based on the findings of this assessment the access road would include the installation of four box culverts along its length to accommodate passage of flood water within the floodplain of the Kilmastulla River.
315. Construction of the access road junction with the R445 public road would require the demolition of some disused and derelict buildings and old petrol pumps associated with a disused petrol station on the north-western side of the R445. It is important to note that only above ground structures need to be cleared

²¹ These totals are affected by rounding to one decimal place.

from the petrol station site, to allow construction of the access road junction and provide the required safe sight distances.

316. There would be a total of 50 car parking spaces provided on the WTP site itself, ten of which would include charging points (fast charge) for electric vehicles in accordance with the Tipperary County Development Plan 2022-2028.

5.2.21 Lighting

317. At the WTP site, LED external lighting would be provided at the perimeter of each of the buildings, on interconnecting footpaths, on traffic circulation routes around the site, in car parking areas and at the entrance to the site.

318. In addition, exterior lighting would be provided at loading bay doorways in buildings as applicable, and for task lighting to facilitate operational maintenance of the plant. The lighting installation would provide a safe and secure environment for both pedestrians and drivers at the sites and also to facilitate ongoing operational and maintenance works associated with the WTP.

319. The design of the lighting at the WTP site would be carried out with reference to the standards and requirements listed for the RWI&PS in Section 3.2.16. In addition, the following measures would be adopted:

- The kelvin level to be 2,200 within the 2km Core Sustenance Zone for lesser horseshoe bat zone around the building to be demolished within the WTP site.
- Exterior lighting to building exteriors, footpaths, circulation routes and car parks would be automatically controlled and would be subject to curfew with the exception of when work is required at discrete locations where illumination is required
- Lighting at loading bays and for close work (task lighting) and internal light in all process buildings would normally be switched off and only used as dictated by operational requirements
- Certain areas of the Control Building would be lit at all times and, where necessary, the overspill of light coming from within the building would be mitigated through selection of appropriate window blinds.

5.2.22 Architectural Design Concept

320. An architectural design has been undertaken for the Control Building / Visitors Centre at the WTP. The factors considered have been set out in the Infrastructure Sites Architectural Statement contained in Appendix A.

321. The building has been designed with high quality architectural form and finish to present as the public face of the WTP and the Proposed Project as a whole.

5.2.23 Environmental Design Considerations

322. In accordance with the mitigation hierarchy potential environmental impacts were avoided or reduced through the siting and sizing of the WTP and the proposed infrastructure. At the WTP this specifically included locating the site to reduce potential landscape and visual effects and the impact on flood risk. In addition, the following environmental considerations have been included within the design of the WTP:

- Re-circulate process wastewater to avoid a discharge of wastewater
- Lighting design to reduce nighttime disturbance and bat impacts

- Avoiding an increase in flood risk due to the crossing of the tributary of the Kilmastulla
- Reinstatement of wetland habitat as part of the landscape planting / habitat creation
- Inclusion of a bat house within the site to mitigate the impact on bats at the RWI&PS and WTP as described in Section 5.2.13.

5.2.24 Sustainability Design Considerations

323. The main sustainability considerations incorporated into the WTP design were:

- The use of solar power generation, described in Section 5.2.17
- The use of rainwater harvesting, described in Section 5.2.19
- The incorporation of green roofs into the design of the CWSTs which would have a biodiversity benefit as well as reducing the rate of surface water runoff
- SUDS including attenuation ponds would manage surface water runoff and have been sized to accommodate future climate change, described in Section 5.2.19
- The landscape planting / reinstatement design, as summarised in Section 5.2.25, aims to maximise opportunities for biodiversity.

5.2.25 Landscaping / Reinstatement Design

324. The site would be landscaped to reduce the visual effect of the WTP site as a whole. This would include retaining hedgerows along the perimeter and planting native species rich meadow and trees within the site boundary. Further, wet grassland and woodland would be planted in an area to the north-east of the site. Specific woodland and hedgerow planting would be installed to support commuting and foraging for bats using the bat house described in Section 5.2.13. This would include planting to screen activity from the WTP itself.

5.2.26 Boundary Treatment

325. The boundary of the site would be fenced with a 1.2m post and rail, stock proof fence, with a 2.4m-high polyester powder-coated palisade security fence set 5m within the boundary. The expected overall length of the security fence would be 2,224m. All security fencing would be compliant with IW-TEC-600-01 (Physical Site Security) (Irish Water, 2018). There would also be two 2.4m-high polyester powder-coated security gates. One would be a set of 2.4m palisade gates at the entrance to the WTP site. The second would be at the junction with the R445. This would be 2.4m high and integrated into the boundary wall which would consist of a 1.0m high block wall faced in local stone with a paladin security fence on top, to an overall height of 2.4m. There would also be a site entrance signage board incorporated into this boundary wall.

326. The permanent access road between the R445 and the WTP site would have a post and rail fence only.

327. CCTV cameras on 6m tall poles would provide security coverage of the access gates and buildings.

5.3 Construction

328. The WTP is a large site, compared with the other infrastructure sites and the temporary works involve extensive phasing of activities. It would generally be built using standard civil engineering construction techniques, and these techniques and the wider construction of the WTP are described in Chapter 5 (Construction and Commissioning) of the EIAR.

329. Three key issues for the construction of the WPT would be:

- Crossing of the tributary of the Kilmastulla and associated flood risk
- Demolition of buildings
- Ground treatment and earthworks.

5.3.1 Crossing of the Tributary of the Kilmastulla

330. During this pre-commencement phase at the WTP further ground investigation would be undertaken to inform the detailed design process. Part of these pre-commencement activities would include investigation of the disused petrol station at the entrance to the permanent access and the bank / channel of the tributary to the Kilmastulla River.

331. Similar to the access road for the RWI&PS, the access road for the WTP would serve a dual purpose as it would initially serve as a temporary road, becoming a permanent road upon completion of the works. The access road would cross a tributary of the Kilmastulla and the design includes a clear span bridge over the watercourse and an embankment with culverts through the associated floodplain. Building this would require working in the floodplain and close to the watercourse and management measures would need to be put in place to avoid an impact on the watercourse. These measures are set out in the Surface Water Management Plan which is part of the Construction Environmental Management Plan (Appendix 5.1, Annex A of the EIAR).

332. The construction sequence for the temporary road would be as follows:

- Site preparation works would include fencing off boundaries and any environmentally sensitive areas around the Kilmastulla River or its tributaries
- Demolition of properties at the former petrol station and filling of the underground tanks at the junction between the access road and the R445.
- A temporary Bailey bridge or similar would be put in place to provide initial access over the tributary of the Kilmastulla River
- A route of the access road up to the WTP would be levelled and cleared of all obstructions. There is existing commercial forestation along approximately 425m of the access road route, and the trees along this section would be felled and the site cleared to allow for construction of the road. Temporary traffic management would be required to establish this area and a comprehensive TMP would be put in place for the Construction Phase. This would incorporate removal of overhanging tree branches and removal of overhead cables which cross the route of the road.
- Surplus excavated material would be used to create the earth embankment on which the access track would sit
- Pre-cast concrete culverts would be brought to site and placed within the formation of the embankment
- Cable ducts and the 1050mm diameter pipe for the future connection would be laid within the embankment
- The open span bridge would be constructed using either precast concrete or steel sections. There would not be any in-stream works required. The bridge abutments would be constructed at least 5m back from each bank of the stream.
- A 500mm deep layer of stone hardcore (typically 75mm in size) overlaying a geogrid mattress would be placed along the full length of the access road alignment, and compacted with a road roller
- The hardcore would then be topped off with a stone dust and compacted again. Enough stone dust would be added to ensure that there is a clean level surface for trafficking.

5.3.2 Demolition of Buildings

333. In order to construct the proposed access, it is necessary to remove three buildings and above ground petrol pumps associated with a disused petrol station that are on land at the junction of the access road and the R445 Regional Road. The buildings in question are a derelict stone building, a roofed storage shed/garage, and a roofed office building. The disused petrol station is located on the southern bank of a local stream which is a tributary of the Kilmastulla River. Only the above ground structures need to be cleared from the petrol station site, to allow construction of the access road junction and provide the required safe sight distances. The proposed works include cleaning out and backfilling the tanks with either sand and cement or foam concrete.
334. Preliminary, non-intrusive site investigation works indicate that the tanks are located less than 0.5m from the southern bank of the adjacent watercourse and that the tops of the tanks are approximately 0.75m below existing ground level.
335. The underground fuel storage tanks and surrounding soils at the disused petrol station could potentially be contaminated with hydrocarbons and therefore works would be monitored to prevent any pollution incident. However, site investigation has indicated the risk would be low as soil and water sampling around the tanks and in the adjacent watercourse has indicated no presence of contamination.
336. Nevertheless, in order to protect the watercourse immediately adjacent to the buildings, the watercourse would be dammed and flow diverted either by fluming or over pumping, for the duration of the demolition works. This would involve constructing a dam (using sandbags and suitable clay material) across the existing watercourse upstream of the proposed demolition works. A suitably sized pump sump would then be used to extract the water and convey it around the demolition works area to a point downstream of the works. Alternatively, the flows could be conveyed by a suitably sized pipe to downstream of the works..
337. A single farm shed located toward the centre of the WTP site would also be demolished to accommodate construction of the WTP itself. Therefore, in total there are four buildings to be demolished at the WTP.

5.3.3 Ground Treatment and Earthworks

338. There is no requirement for specific ground treatment at this location. However, extensive earthworks would be required to create the correct formation levels for all permanent infrastructure.
339. The earthworks operations at the WTP would entail large-scale excavations and reprofiling of ground levels across the site. Operations would generally be carried out using excavators and dump trucks that would transport excavated material to locations on the site where levels are to be raised. Filling operations would involve using bulldozers and vibratory rollers.
340. Suitable excavated material would be reused on-site in cut and fill operations and reprofiling the site. This material would be selected and managed for storage, and consolidated properly at the correct moisture content, and soils at source would be verified as free of contamination arising from any previous land use, before being reused. This would allow for excavated material from construction on the WTP site to be effectively managed, as the quantities of excavated material and imported material would balance the fill material required to make up finished levels on-site, and site landscaping. It is expected that all excavated material arising on the WTP site would be reused there.
341. It is anticipated that the Construction Phase of the WTP would result in a material deficit of approximately 99,500m³. This shortfall would be made up using surplus excavated material from the RWRMs, RWI&PS, and the Treated Water Pipeline.

342. Imported fill brought to the WTP site would be firstly deposited in the area denoted as Construction Sequence 2 (refer to EIAR Figure 5.29 for further detail) to raise site levels to the required level to allow construction of the Water Treatment Module Buildings. Once this has been achieved, further imported material would be deposited in the area denoted as Construction Sequence 3 (EIAR Figure 5.29), bringing the site levels in this area up to that required to allow construction of the UWWESTs, and other tanks, the Sludge Storage Tanks, the Sludge Dewatering Buildings and the Sludge Storage Buildings, and the UV Dosing and Post Filtration Chemical Dosing Building.

5.4 Testing and Commissioning

343. WTP testing and commissioning can only be carried out once the RWI&PS and RWRM have been tested and commissioned.

344. Commissioning and test water for the WTP would be provided from Parteen Basin, via the RWI&PS and the RWRM.

345. All major plant, pumps and motors, transformers, and high voltage (HV) and low voltage (LV) control panels to be installed in the WTP would be witness-tested at their respective places of manufacture prior to shipping to site.

346. All control system PLCs and I/O panels would be bench-tested with a comprehensive suite of simulated inputs to confirm that the outputs and alarms are in accordance with the detailed Functional Design Specification developed from the Control Philosophy during detailed design and subject to rigorous formal safety reviews.

347. Following cleaning and dry inspection of all tanks, penstocks and chambers in the WTP, the RWBTs would be filled by forward pumping from the RWI&PS. Once these tanks are tested and passed for water tightness, the water can be used to test the individual tanks and treatment units in the plant and to commission the treatment processes themselves.

348. Initial commissioning of the treatment works would be carried out incrementally and using only a fraction of the ultimate flow. The process commissioning phase would begin with a single treatment sub-stream within Treatment Module 1, using a single settlement tank with two rapid gravity filters at 50% of their design capacity.

349. Commissioning would be possible at a low rate (approximately 10Mld) and initially the water used in commissioning would be re-circulated through the plant. This would be done by discharging the treated water to one cell of the CWSTs and rather than pumping it forward to the BPT, it would be drained back to the Tank Draindown and Commissioning Lagoons on site and recirculated to the RWBT at the head of the works.

350. When the water quality has reached a sufficient standard, it would be used initially as test water for tanks throughout the WTP site, and finally the through flow would be allowed to discharge forward to the CWSTs, available for testing and commissioning of the HLPS.

351. For the rest of the process commissioning, flows would gradually be increased (by activating further treatment sub-streams within Treatment Module 1) until the full Module is operational.

352. In the second stage of the commissioning process, the flow would be increased from 10Mld to 20Mld and flows at this level would be monitored and increased as required so that the flow from one full treatment module would be available for the commissioning of the Treated Water Pipeline from the WTP to the BPT and the HLPS. The same procedure would be followed for the second and third treatment modules.

5.5 Operation and Maintenance

5.5.1 Operation

353. The WTP would be configured as three separate treatment modules, each operating independently and in parallel. Each of the three treatment modules in the WTP would be able to deliver up to 100Mld with some units offline in each module for cleaning or maintenance.
354. Any one treatment module may be isolated for investigation, or taken out of service, and returned to service under proper ramping up and 'run to waste' protocols.
355. Raw water would enter the WTP at the RWBTs. The RWBTs would control the flow of the water coming into the WTP and would allow water to be stored temporarily. This would manage the rate of water flowing through the WTP and allow the WTP to operate at a steady continuous pace.
356. The water would then pass through chemical dosing, the water treatment process and the UV Treatment and Post Filtration Chemical Dosing Building.
357. The CWSTs and HLPS sit at the end of the treatment process. The CWSTs store clean water temporarily so that the onward flow of water through the pipeline can be controlled. The HLPS would pump the water through the Treated Water Pipeline from the WTP to the BPT.
358. The HLPS would be the interface between the CWSTs at the WTP and the Treated Water Pipeline from the WTP to the BPT. It would be fully automated with all alarms and signals being fed back via the SCADA system to the main control room.
359. The number of pumps running at any given time would be dependent on the flow rate. One backup/standby pump over those necessary to deliver the full flow has been included to provide resilience in the case of a pump fault requiring it to be offline. Variable speed pumps would be installed to allow control start and shut down of the system as well as the flow output of the HLPS to be matched more precisely to the output of the WTP.
360. Automatic duty rotation of the pumps and other plant would ensure reasonably consistent wear; although for large pump installations such as this, it is becoming normal practice to have asymmetric rotation so that not all planned plant replacement falls at the same time, thus improving resilience.
361. The WTP would be permanently staffed and would control the operation of the whole of the Proposed Project, on a day to day basis. Therefore, the tasks set out in Section 10.8 would be managed from the WTP. In particular, the WTP would control abstraction, RWI&PS and the WTP processes to provide the Set Point Flow (SPF)²² into the CWSTs. Usual minor variations would be accommodated within the operating range of the CWSTs.

5.5.2 Surge Management

362. Surge management would be provided through the surge vessel described in Section 5.2.12.
363. The surge protection system is passive and requires no active intervention. It would run fully automatically with its own PLC and electrical power supply.

²² Uisce Éireann would determine the required daily output from the Proposed Project up to a week in advance with only relatively minor adjustments 12 hours in advance. This required output is the Set Point Flow.

5.5.3 Residues

364. Residues would be produced at the WTP from the following processes:

- Coagulation sludges produced by the coagulation and settling of natural turbidity
- Liquid and particulate waste produced from the cleaning of the sand filters
- GAC media would be taken off site periodically for replenishment
- Other chemical additions such as the addition of polyelectrolyte.

365. The water treatment process creates a residual waterworks sludge, as the coagulant chemical binds up the organic material into an insoluble form, which is then removed from the settlement tanks. The material backwashed from the various filtration stages also contributes to the volume of sludge from the water treatment process.

366. All residual solids would be thickened, after being balanced in a Sludge Balancing Tank. The sludge draw-off from the sludge blanket clarifiers would drain to Sludge Balancing Tanks before being pumped to picket fence thickeners. Settled sludge would also be pumped to the Sludge Balancing Tanks before being pumped to picket fence thickeners.

367. Sludge from the picket fence thickeners, at typically 1-3% dry solids, would be pumped to a sludge dewatering plant, which would include plate presses to bring the dry solids content of the sludge cake to approximately 25%. Supernatant from the picket fence thickener and expressate from the sludge dewatering process would be pumped, via the washwater treatment side stream, to the RWBTs at the head of the treatment process. The total sludge cake storage volume is 9,280m³, which equates to six months storage at 154Mld.

368. GAC filter media needs to be replenished periodically as it loses its effectiveness over time. Based on pilot trials undertaken at Clareville WTP, the media would require replenishment every 20 months at normal plant output. In practice the replacement of GAC media would not be a single operation taking place every 20 months but would be undertaken on rotation across a number of filters. The total mass of GAC filter media that would be replaced annually would be 420 tonnes. This material would be transported off site and brought to a specialist offsite facility where it would be regenerated by heating it to high temperatures. Following this process the GAC media would be transported back to the WTP for reuse.

369. Process waters from the treatment process would not be discharged back to the environmentally sensitive Lower River Shannon SAC. The process waters generated in the treatment process itself would be treated on-site and recirculated through the WTP. Process waters from the treatment process would be generated from the following sources:

- Backwash water from rapid gravity filters
- Filter 'run to waste' water
- Supernatant returned from sludge thickening
- Expressate from the sludge dewatering process.

370. The volume of recirculated water would be variable; it would depend on filter backwash frequency, the length of the 'run to waste' cycle and the rate of sludge generation in the settlement tanks. The 'Run to Waste' would not result in a discharge as it would be within the re-circulation process.

371. It is proposed to tanker foul wastewater produced by Construction Phase staff and, later, Operational Phase staff to a licensed WwTP.

5.5.4 Third Party Access

372. The ESB would have access to the WTP site to maintain the 38 kV Electricity Substation. This would be achieved via shared use of the permanent access road from the R445 to the site.

373. A number of additional access points have been included within the design in order to maintain landowner access to land / infrastructure. These are:

- A gate within the entrance from the R445 to the WTP to provide access to the land to the east of the permanent access road
- A gate within the entrance from the R445 to the WTP to provide access to the land to the west of the permanent access road.

374. In addition, an agricultural crossing would be provided from one side of the permanent access road to the other in order to allow the landowner to access the land on either side of the embankment.

5.5.5 Maintenance

375. All of the infrastructure has been designed to allow for routine maintenance and replacement. At the WPT this includes the following:

- The Water Treatment Module Buildings would be self-contained parallel treatment streams, each of which can be isolated and taken out of service
- Each stage of the treatment process within each module has been designed to deliver the peak supply of 300Mld whilst allowing for routine maintenance to be undertaken.

376. The design of the WTP includes the following for maintenance purposes:

- Gantry Cranes at all the main pumpsets and for GAC, RGF or manganese filter removal
- Pathways around the Main Treatment Module Buildings to facilitate solar PV panel cleaning using a cherry picker.

377. Routine maintenance and cleaning would include:

- Periodic regeneration of the GAC; the frequency would be dependent on the input water quality and target output water quality
- All tanks in the WTP would need to be drawn down, taken out of service and cleaned at least once per year. The plant has been designed to allow for the planned maintenance and servicing of tanks, where tanks can be taken out of service without reducing the throughput of the plant. The water content of tanks on the WTP site would generally be drained to the Tank Draindown Management and Commissioning Lagoons in the south-east quadrant of the site, which have a combined volume of 30,000m³
- In the event of an invasive species breakthrough, one of the RWBTs can be taken out of service for inspection, cleaning and maintenance, while the full flow is passing through the other tank
- Maintenance tasks for the HLPS pumps would include weekly checks of all the main items of plant, but with no expected significant maintenance required for 10 years or more.

5.5.6 Monitoring

378. The monitoring of the WTP and the treatment processes would be automated however; it would be backed up by routine audits and inspections including:

- Inspection of the sludge blanket at the coagulation plant

- Inspection of the rapid gravity filters
- Inspection of chemical dosing points
- Inspection of disinfection systems
- Monitoring water quality post treatment including residual pH level
- Checking the speed of the pumps, the volume of water being moved and the pressure in the pipeline.

5.6 Potential Future Connection

379. Provision has been made within the design of the WTP and its access road to include a watermain with a take-off to enable the provision of a strategic connection to the Limerick area at some point in the future. This is one of the Take-Offs described in Section 11.7 that allow for a potential connection to be made in the future to provide a supply into Water Resource Zones in the Midlands Region in accordance with the Eastern and Midlands Plan (Irish Water 2022). This future connection would be a stand-alone project with a separate consenting process.

6. Break Pressure Tank

6.1 Purpose

380. To deliver treated water from the WTP at Birdhill to the TPR at Peamount, the pipeline must traverse an undulating route across hills of varying elevation. To safely and efficiently operate a pipeline capable of transferring up to 300Mld, a BPT is proposed. Its purpose is to provide hydraulic stability and mitigate transient pressures within the system to allow for safe start-up and shut down of the entire pipeline.
381. The BPT would provide a constant head of water within the Treated Water Pipeline to the TPR. This would largely eliminate the potential for air admission to the Treated Water Pipeline.
382. The BPT also provides the point where the pressure in the pipeline can be managed and would enable the transition to the use of gravity to maintain a flow of water in the pipeline under normal conditions. The water would be pumped from the WTP to the BPT but from the BPT the water would usually be moved through the pipe by gravity pressure.
383. In order to do this the BPT is intentionally located at the highest point on the route of the Proposed Project. This would allow the BPT to provide hydraulic stability for both elements of the Treated Water Pipeline (from the WTP to the BPT and from the BPT to the TPR) and as such it is an essential part of the control system for the pipeline ensuring that it would remain full at all times.
384. An illustration of the BPT is provided in Image 6.1. The BTP site is located immediately north of dense woodland in open fields. The site would be 5.5ha, (excluding the access road described in Section 6.2.12). This would comprise 5.2ha of permanent land take and a further 0.3ha of land only required temporarily during construction.²³

²³ These totals are affected by rounding to one decimal place.

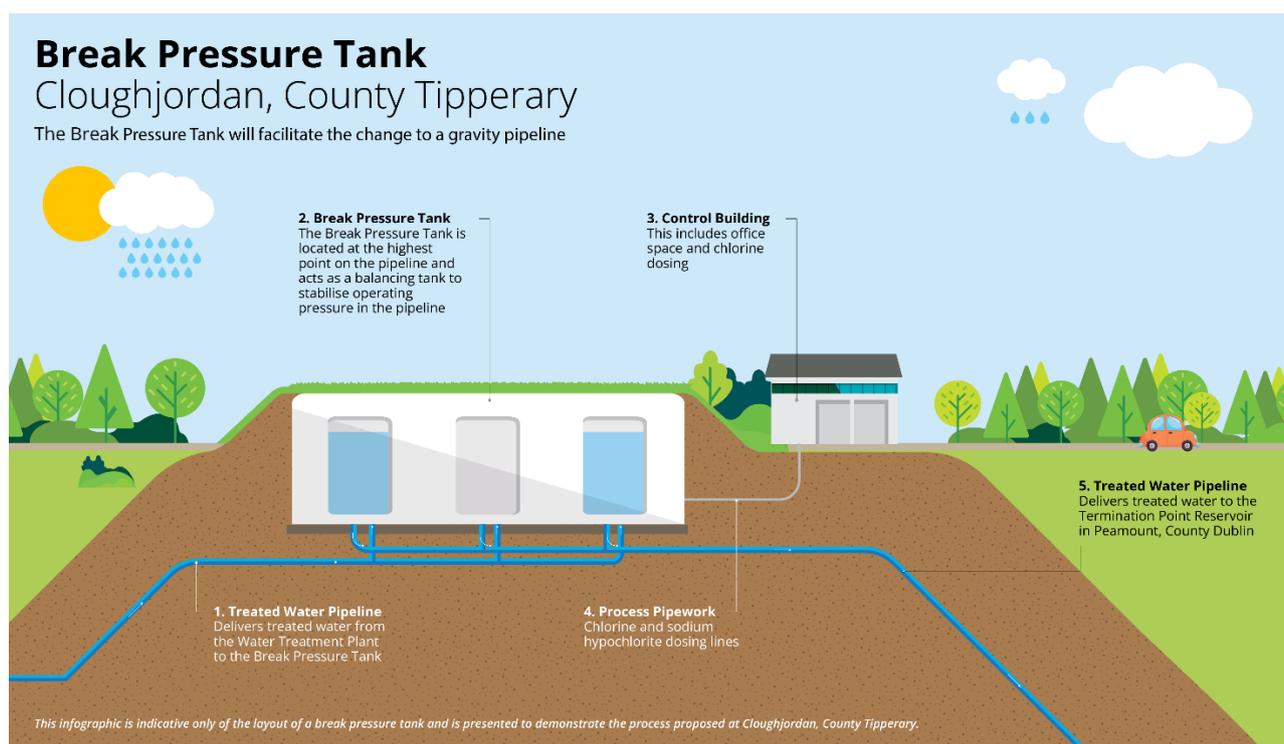


Image 6.1: Infographic Overview of the Break Pressure Tank

6.2 Design

385. The main elements of the BPT site are detailed in Table 6.1.

Table 6.1: Infrastructure Elements – Break Pressure Tank

Infrastructure Element	No.	Length	Width	Operating Depth of Water	Height Over Finished Ground Level	Plan Area		Volumes	
						Each	Overall	Unit	Overall
Break Pressure Tank	1 No. (3 No. Cells)	23.0m each cell	41.7m each cell	4.15m	4.9m (depth)	959m ² (each cell)	2,877m ²	4,593m ³ (each cell)	13,776m ³
Control Building	1 No.	40m	20m	n/a	7.5m	800m ²	800m ²	n/a	n/a
Chlorine Dosing Kiosk	1 No.	4m	2.5m	n/a	3m	10m ²	10m ²	n/a	n/a

6.2.1 Break Pressure Tank

386. The BPT is a single structure containing three equal sized cells or compartments, each with a volume capacity of 4.6MI (giving a total volume of 13.8MI). Each cell would be 41.7m long and 23.0m wide.

387. One of the cells would act as an emergency overflow in the event of system failure. Therefore, the operational capacity in the remaining two tanks would be 9.2MI.

388. The BPT and the three cells have been sized based on:

- Having sufficient capacity to facilitate the safe start-up / shut-down time of the FCV and BPS pumps which has been determined by detailed transient analysis. Safe shut-down conditions require an approximate timeframe of 18 minutes during a peak output of 300Mld. This equates to approximately 4,200m³ of water. The two outer cells would have a volume of storage capacity within them, with the volume of storage depending on where the water level was within the cell and the middle cell would provide back-up overflow capacity of 4,600m³ (4.6MI) of water storage.
- Accommodating pressure changes associated with normal start-up and shut-down. t
- To provide a 4,600m³ (4.6MI) emergency overflow capacity in the event of system failure.

389. The BPT would have the following features:

- The bottom water level in the compartment would be set above the soffit level of the incoming and outgoing pipes, thereby creating submerged inlet / outlet conditions
- Covered vents to allow air in and out as the water level changes, but these are designed to prevent water ingress with a fine mesh to prevent any insects or animals entering
- Baffles ensuring that there are no 'dead' areas and mitigate potential reduction in water quality
- Level measurement, connected to the SCADA control system, to inform the HLPS and FCV operation
- The normal operating level of each compartment would be 139.4mAOD, with a maximum water level of 141.4mAOD
- Drainage to allow tank to be emptied for maintenance
- The roof level of each compartment would be 142.7mAOD which would allow sufficient ventilation above the maximum water level.

390. The BPT would be partially buried and covered in earth. The ground level would, generally, be lowered at the site, as a result of the Proposed Project. However, finished ground levels would slope uphill in a northerly direction across the site. Consequently, the cell at the southern end would be above finished ground level and the northern cell would be close to finished ground level.

6.2.2 Control Building

391. The BPT would have a Control Building measuring 40m long, 20m wide and 7.5m high.

392. The building has been sized based on the need to have sufficient capacity to house the following:

- Water quality monitors
- Equipment for topping up the level of disinfection
- Chemical storage for chlorine dosing
- The on-site electro-chlorination (OSEC) system
- Power supply and uninterruptible power supply
- BPT level monitoring
- Security
- Telemetry
- Valve controls
- Solar array control.

393. The Control Building would include a water quality instrumentation room, a motor control centre and instrumentation panel, as well as toilet and welfare facilities. It would also be used for chemical storage and the OSEC system, as described in Section 6.2.4.
394. Access to the Control Building would be through a personnel door and through roller shutter doors for equipment. Emergency fire exit doors would be provided to comply with Part B of the Second Schedule to the Building Regulations 1997 (as amended).
395. Communications links to the BPT would be provided by a telemetry mast, the top of which would be 14m above finished ground level.
396. A single storey walk-in kiosk would be needed within the BPT site to house the chlorine sample monitor, the duty standby dosing pumps and a wash station. The kiosk would be 4m long and 2.5m wide and would be within the side slope of the northern most cell of the BPT. A separate 10m³ tank would need to be located close to the inlet mains along with a static mixer to allow the chlorine dosing to be undertaken. The tank would have a diameter of 2.4m and be 2.6m high. It would be within a bunded area.

6.2.3 Surge Management

397. There would be no requirement to provide surge protection at the BPT site.

6.2.4 Chemical Dosing

398. The water arriving at the BPT would contain a trace level of chlorine and chemical dosing would be required in accordance with Uisce Éireann technical design standard TEC-900-05-02 (Disinfection: Secondary Chlorination) Uisce Éireann (2023c).
399. To ensure that the levels of chlorine residual are accurately controlled, water quality sampling would be automatically undertaken on the inlet and the outlet to the BPT and would determine the level of dose required at the BPT inlet pipework. A bunded sodium hypochlorite dosing system would maintain a minimum 'chlorine residual' between 0.1mg/l and 0.2mg/l.
400. As set out in Table 5.3, water that arrives to the BPT site from the WTP would have an expected free chlorine residual concentration of 0.12mg/l.
401. Chemical dosing would be necessary at the BPT site to ensure a free chlorine residual concentration of 0.73mg/l at the point of departure from the site.
402. This would be achieved by dosing sodium hypochlorite at a dose rate of 1.48mg/l. To ensure thorough mixing, a static mixer is proposed immediately downstream of the dosing point.
403. The Control Building would be used for chemical storage as well as to house the chemical dosing plant. Therefore, the site has been sized to include sodium hypochlorite storage (52 days at 154Mld) and storage of brine needed in the OSEC process (30 days at 154Mld).

6.2.5 Pumping / Mechanical

404. The BPT site includes two small scale pumps that would pump surface water to the on-site infiltration pond. They would need to be sufficiently sized to manage surface water runoff and discharge of the overflow tank.

405. In addition, the walk-in kiosk, dosing and sampling room, would contain a dosing pump cabinet which would house the necessary pumps for the dosing from the storage tank to the injection points. A duty/standby dosing pump arrangement shall abstract chemical directly from the day tank.

6.2.6 Power Requirement

406. For a peak flow of 300Mld, the BPT site would have a power demand of 2,757kWh/d. For the annual average demand of 154Mld this would be 1,496kWh/d.

6.2.7 Power Connection

407. The power supply would be provided by ESB Networks from the existing medium voltage overhead power line which crosses the proposed BPT access road. A connection for the BPT would be made from this overhead line and routed via two underground cable ducts laid along the access road to the Control Building within the BPT site.

408. The two underground cable ducts would be 125mm diameter 20 kV uPVC ducts and would be laid with a minimum cover of 750mm and a minimum spacing of 75mm between the ducts, in accordance with ESB standards in Appendix B.

409. In addition to the permanent power connection for the BPT, a separate new connection is required for the radio mast on site (because the existing supply is severed by the Proposed Project). The replacement connection would be via an overhead line along the northern boundary of the site.

410. Along the access road to the BPT there would be a permanent diversion of an existing overhead line required because the poles for the current line are impacted by the access road.

6.2.8 Electricity Substation

411. There is no electricity substation required at the BPT site.

6.2.9 On-Site Solar Photovoltaic

412. Three stands of solar panels are proposed at the BPT site. These would include:

- A stand of ground mounted solar cells to the south of the control building, 596m² in extent
- Roof mounted cells on the south facing side of the control building roof, 278m² in extent
- Roof mounted cells on top of the three BPT cells, 3,008m².

413. The proposed stands would consist of PV cells and Battery Energy Storage Systems (BESS) to store excess electricity generated for later use.

414. The PV cells would have a peak power output of 200kWp and the BESS would have a storage capacity of 200kWh.

415. The proposed PV cells and BESS would provide power to help run the water quality monitoring, telemetry and SCADA systems for a portion of each day. This will reduce the energy required from the mains supply.

416. A glint and glare assessment has been undertaken and is contained in Chapter 18 (Material Assets) of the EIAR.

6.2.10 On-Site Water Supply

417. A permanent potable water supply would be required at the BPT. This is to be taken from the Treated Water Pipeline via a connection to the inlet valve.

6.2.11 Surface Water Management and Drainage

418. The BPT access road, and other paved areas have been designed to incorporate SuDS principles as recommended by the SuDS Manual (CIRIA 2015) in order to limit discharges of rainwater runoff from the BPT site to the equivalent green field site flow rate.

419. As part of this drainage strategy the BPT would also have a 'green roof' on top, which would have a biodiversity benefit as well as reducing the rate of surface water runoff.

420. Filter drains within the site boundary fence would collect surface water and direct it to the infiltration pond via two small pumps (Duty / Standby) in an underground chamber. Runoff from the roof of the Control Building would also be directed to the infiltration basin

421. Surface water runoff entering the infiltration basin would be pre-treated in a Class 2 By-Pass Hydrocarbon Interceptor. This allows for any build-up of pollutants on the internal roadway or hard standing working areas that would be washed off in the early part of a storm to be treated.

422. The infiltration basin has been designed with a volume of 273m³, to accommodate flows from a 1 in 100-year storm, with a 30% uplift for climate change. The infiltration basin would be lined with a permeable geotextile membrane/filter material which would be used to control sediment from the excavation. This is shown in Image 6.2.

423. Filter drains with soakaways would provide drainage along the access road between the BPT and the L1064. These would collect surface water and direct it to one of four infiltration sumps located along the access road. These sumps have been sized to accommodate flows from a 1 in 100 year rainfall event with a 30% climate change uptake.

424. Foul wastewater generated on the site would be directed to a holding tank with a level sensor to alert when emptying is required. It would then be tankered away for disposal at a licensed WwTP. The site would not be permanently staffed and so foul wastewater generated by operational staff on the site would be less than 1m³/d.

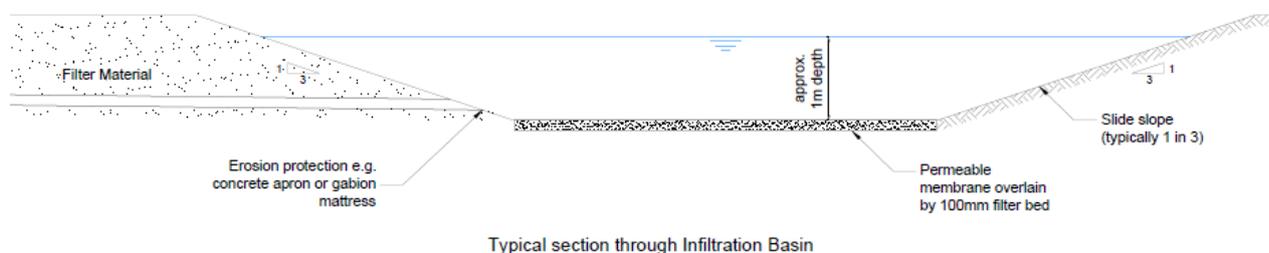


Image 6.2: Typical Section Through Infiltration Basin

6.2.12 Access

425. The BPT site is currently accessed from the L1064 road via an unpaved farm track. This unpaved farm track is used by a telecoms provider to gain access to their mast, which is located immediately north-west

of the proposed BPT site. Construction of the BPT has the potential to impact access to the mast location. However, provision would be made for the telecoms provider to maintain access their mast. During operation, the proposed BPT site layout would allow for the continued use of a dedicated access to the mast.

426. A new access road from the L1064 to the entrance of the BPT site would be constructed, which would be 5m in width, 794m in length. The permanent access would require 1.8ha of land. In addition, a further 0.5ha would be required temporarily during construction to build the access road.²⁴ This would be in addition to the land defined in Section 6.1.
427. The new access road would begin at an elevation of 91.1mAOD at the L1064, would continue to the entrance of the BPT site at an approximate elevation of 133.2mAOD and would have an approximate average gradient of 1:18. The maximum gradient along this access road would be 1:12 and the minimum gradient would be 1:60. This would enable safe access for HGVs to the BPT site.
428. The access road junction includes for safe sight lines of at least 90m and appropriate signage when emerging onto the L1064, in accordance with TII's Geometric Design of Junctions, DN-GEO-03060, (TII 2023). The sightline on the western side of the entrance would be constrained by the existing properties and so would not reach the full length required.
429. There would be a total of ten car parking spaces provided at the BPT site with three including a charging point (fast charge) for electric vehicles, in accordance with the Tipperary County Development Plan 2022-2028 (Tipperary County Council 2022).

6.2.13 Lighting

430. At the BPT site, LED external lighting would be provided at the Control Building and chemical delivery area. It would also be required for traffic circulation areas around the BPT including in the parking area and at the entrance to the site. It is not proposed to put external lighting along the access road to the BPT site.
431. The design of the lighting at the BPT site would be carried out with reference to the standards and requirements listed for the RWI&PS in Section 3.2.16.

6.2.14 Architectural Design Concept

432. The factors considered in designing the structures at the BPT have been set out in the Infrastructure Sites Architectural Statement contained in Appendix A.
433. The barrel-vaulted steel portal framed building is designed to invoke an agricultural building aesthetic, while the muted colour palette proposed is sensitive to the rural context. The façades would be overlaid using robust thermally treated timber battens, fitted vertically, and spaced to give a three-dimensional effect and soften the visual appearance of the building.

6.2.15 Environmental Design Considerations

434. In accordance with the mitigation hierarchy potential environmental impacts were avoided or reduced through the siting and sizing of the BTP and the proposed infrastructure. At the BPT specifically this focused on locating the site and buildings to reduce landscape and visual effects. In addition, the following environmental considerations have been included in the design of the BPT:

²⁴ These totals are affected by rounding to one decimal place.

- Retaining existing vegetation on the south-western boundary of the site and to the north of the site
- Excluding a historic monument from the proposed woodland planting area on the eastern side of the site
- Planting proposals to create woodland habitat.

6.2.16 Sustainability Design Considerations

435. The main sustainability considerations incorporated into the BTP design were:

- The use of solar power generation as set out in Section 6.2.9
- The incorporation of green roofs into the design of the three BTP tanks. This would have a biodiversity benefit and reduce the rate of surface water runoff. (It has been confirmed that solar panels above a green roof are compatible)
- SUDS including an infiltration pond would manage surface water runoff and have been sized to accommodate future climate change as described in Section 6.2.11
- The landscape planting / reinstatement design, as summarised in Section 6.2.17, aims to maximise opportunities for biodiversity.

6.2.17 Landscaping / Reinstatement Design

436. During construction screening embankments / berms would be constructed by the appointed Contractor using surplus excavated material from the tank excavation in the hillside to reduce visual effects.

437. The BPT would be contained within an earthen embankment and the site would be landscaped to reduce the visual effect of the BPT site as a whole.

438. Land to the east of the BPT has been incorporated into the Proposed Project to allow for woodland habitat creation as part of the overall ecological reinstatement plans. This planting will avoid the historic monument within this part of the site. Additional woodland is proposed along the western boundary and to the north of the site. There is existing woodland to the south of the site and so the planting proposals would connect the BPT site into this woodland. Additionally, a circular walk would be provided within the planting on the south eastern side of the BPT site and this walk would link into existing paths within Knockanacree Wood. The perimeter of the woodland planting area would not be fenced but would be demarked by existing hedgerows which would remain in -situ.

439. Mixed mosaic habitat is proposed in the north-eastern and north-western parts of the site (due to restrictions on planting as a result of the below ground pipeline).

6.2.18 Boundary Treatment

440. The BPT site would feature a double fence. There would be a 2.4m-high polyester powder-coated palisade security fence around the site. The overall length of the security fence would be 598m. All security fencing would be compliant with IW-TEC-600-01 (Physical Site Security) (Irish Water, 2018). This would be followed by a 1.2m high stock proof post and rail boundary fence on the outside of the proposed access track to the existing radio mast. The perimeter of the BPT would be marked by the existing woodland / hedgerow boundaries which would be retained.

441. There would be a post and rail fence on the eastern side only of the boundary of the permanent access road from the L1064 to the site. On the western side of the access road the existing tree / hedgerow boundary would be retained.

442. There would also be a 2.4m high palisade security gate at the entrance to the BPT site and further, at the junction between the permanent access road and the L1064 there would be an agricultural gate matching the existing gates along the same road. Two further gates would be provided for third party access, One at the junction with the L1064 to provide landowner access and another at the entrance to the track to the radio mast.

443. CCTV cameras on 6m tall poles would provide security coverage of the access gates and buildings.

6.3 Construction

444. The BPT would generally be built using standard civil engineering construction techniques, in particular, the BPT itself would be constructed using reinforced concrete poured in situ. These techniques and the wider construction of the BPT are described in Chapter 5 (Construction and Commissioning) of the EIAR.

445. Three key issues for the construction of the BPT would be:

- Ground Treatment
- Earthworks
- Traffic Management.

6.3.1 Ground Treatment

446. Non-intrusive, geophysical surveys, undertaken along transects through the proposed BPT site identified chimney features from the surface to depth which are considered to be infilled karst features. An intrusive Ground Investigation was also undertaken which concurred with the previous assessment that the limestone is shallow and that potential Karst features are present. The intrusive Ground Investigation (i.e. rotary cored boreholes) shows significant variation in engineering rockhead (i.e. described as a rock to BS 5930 (British Standards Institution (BSI) 2015) and Solid Core Recovery >50%) below the proposed BPT as shown in Image 6.3.

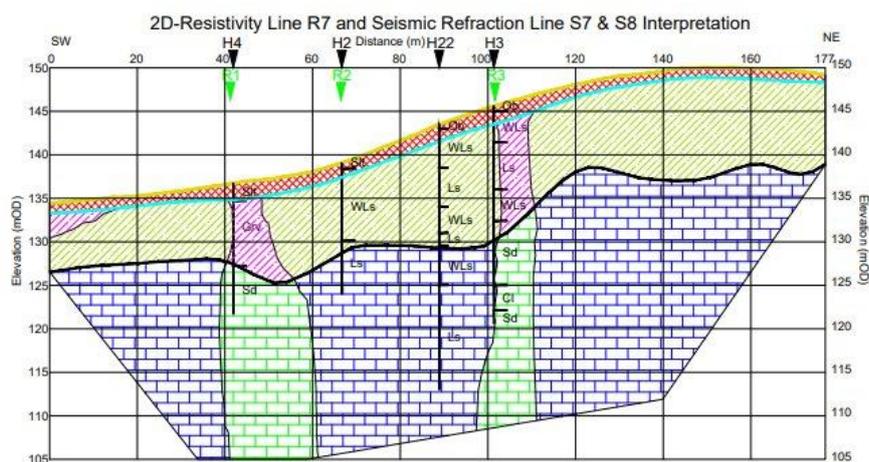


Image 6.3: Interpretation of Ground Investigation Showing Karst Features Beneath the BPT Site

447. These features could result in differential settlement across the BPT. To prevent this a combination of compensation grouting, excavation and replacement would be used to stabilise the ground conditions.

448. Compensation grouting involves injecting cement slurry into the soil, filling any voids and densifying the surrounding soil. Compensation grouting the infilled karstic features would likely improve the homogeneity of the formation, reducing the risk of settlement to the BPT.
449. The site is underlain by Limestone, a principal aquifer so careful consideration must be taken to prevent aquifer pollution. A karst protocol would be employed during construction and involves a series of steps and methodologies to ensure stability in karst areas. The karst feature inspection protocol is documented by Madden & O'Hara (2016). Where weathered limestone or karst is encountered at formation level, the feature would be mapped in detail. The stabilisation measures would be approved by a geotechnical engineer. Where infilling or grouting is undertaken, works would be supervised by a suitably qualified hydrogeologist to ensure there is no effect on groundwater.
450. Excavate and repair would involve earthworks to excavate the karstic infill material and replace it with a suitable aggregate. The BPT tank formation level is between 1m–15m below the shallow rockhead. As such the limestone excavated to achieve tank formation level could be processed and utilised as backfill material.
451. Prior to the full site establishment at the BPT there would be further ground investigation undertaken to inform the detailed design process for the ground treatment and earthworks.

6.3.2 Earthworks

452. Construction of the proposed BPT would involve excavating the slope of the hill on which it is to be sited, which involves extracting overburden and rock. The tank would be partially recessed into the hill side, and the excavated topsoil would be used to cover the roof of the tank. All excavated material would be reused on-site to backfill the BPT once water testing has been carried out and for landscaping, such that quantities of excavated material would balance the fill material required in the screening berms and site landscaping.
453. The excavation of the hill slope would expose rock close to the surface. The rock face would only be exposed temporarily to allow the construction of the BPT structure before it is backfilled and the ground level reprofiled to integrate the proposed structure into the landscape. The exposed rock face would act as a stable face for construction along the western side of the BPT structure but may need to be stabilised depending on rock discontinuity. This may involve drilling and grouting in of passive rock dowels and finishing in hexagonal wire mesh to contain any possible loose debris on the face. As an additional precaution, it may also be sprayed with concrete or mortar (i.e. pneumatically projected at high velocity onto the surface of the rock face). In addition, a subsurface drain would be placed at the foot of the rock slope to catch any surface water or water seeping from rock joints, directing it to the infiltration pond on-site.
454. These works would be planned and undertaken using a methodology that will take account of the proximity of the radio mast and associated building. In particular, the distance between rock break activities will be maximised as far as reasonably practicable and hydraulic rock breaking equipment or lower vibration emitting breakers will be used at the points closest to the buildings in order to keep the potential level of vibration below 8mm/s ppv. Further information on vibration is provided in Chapter 6 (Noise and Vibration) of the EIAR.
455. Imported soil would be required to build the earthen embankments. Initially, an impermeable membrane would be applied to the roof structure before the green roof is laid. Light load bearing plant would be used to place the materials on top of the structure. The earthen side slopes would be formed in layers with the

use of earth-moving equipment such as excavators; vertical drainage would be incorporated into the earthen slopes. This would ensure the stability of the side slopes.

6.3.3 Traffic Management

456. A comprehensive Traffic Management Plan (TMP) for the L1064 Local Road, L1060 Road and R490 Regional Road would be put in place for the Construction Phase.

457. A specific feature of the construction of the BPT is that to assist the movement of large vehicles during construction, five Temporary Lay-Bys would be constructed along the L1064. These Lay-Bys are intended for use during the construction of the BPT only and would be removed when construction is complete, with existing hedgerows reinstated.

6.4 Testing and Commissioning

458. As part of the testing and commissioning of the Proposed Project all power, control and instrumentation systems would need to pass the Factory Acceptance Testing (FAT) and, once installed, site acceptance testing (SAT). These would all be undertaken 'dry'. This would include all comms links to the other infrastructure sites.

459. Full 'wet' commissioning of the BPT can only take place once the pipeline from the WTP to the BPT is operational and water available from the WTP. A pre-requisite of this would be, at least partial commissioning of the RWI&PS, WTP and pipeline in order to provide water for testing.

460. A hydraulic test would be required on the completed BPT structure to confirm that there are no leaks in the structure. The hydraulic procedure for testing the BPT would be carried out in the following sequence:

1. Conduct a water ingress test on the structure
2. Thoroughly clean the structure of all construction materials, dirt and dust
3. Clean the internal faces with high pressure water jets
4. Disinfect the internal faces of the structure with super chlorinated water
5. Fill one cell to the overflow level with water from the WTP via the Treated Water Pipeline from the WTP to the BPT. Each cell would be tested independently, and the same water would be used for the three cells
6. Leave cell for a minimum 24-hour period as there would be a certain degree of absorption by the concrete structure, and then take a water level measurement
7. Begin test for a set period (typically seven days) and then remeasure the water level. If the water level drop is within the set limits, then the structure has passed the hydraulic test. If not, identify cause of water loss, remedy and repeat Step 7 until a successful test has been concluded.

461. The BPT would then be available as a balancing and storage tank for both testing the HLPS and for providing water to fill the pipeline from the BPT to the TPR.

6.5 Operation and Maintenance

6.5.1 Operation

462. The BPT has been sited at the proposed location in order to achieve a normal operating water level of 139.4mAOD. This would mean that the roof level of the BPT would be 142.7mAOD. At this elevation flows, from the BPT to the TPR, of up to approximately 165Mld would be achieved without supplementary pumping. Once the flows exceed 165Mld, additional pressure would be required to move the higher flows through the pipe. This would be provided by supplementary pumping from BPS.

463. The Treated Water Pipeline from the WTP would enter the BPT site from the south-west and would connect to the inlet side of the BPT. The Treated Water Pipeline to the TPR would exit the BPT site to the north-east.
464. In normal operation the control system keeps the level in the BPT at a constant level. Should this level vary outside the pre-set control band, the operators would be notified by alarms and a sequence of controlled shut downs would occur to prevent the levels rising further.
465. Only the two outermost cells would be active. An overflow, if one occurs, would be to the middle cell within the BPT.
466. Similarly, in the event that the signal to/from the BPT is lost then the system would shut down as a safety precaution.
467. In the event that the high lift pumps at the WTP trip, for whatever reason, the FCV near the TPR would signal to close. During this controlled shut-down, the BPT would play an integral part by ensuring that, in particular, the pipeline is always fully charged with water. This is important to avoid air entrainment, i.e. the creation of pockets of air in the Treated Water Pipeline, which would otherwise have to be bled and sterilised before they could be brought back into service.
468. Safety Integrity Level rated valves and instruments with appropriate standby would be installed on the inlet and outlet pipework to the BPT.
469. The BPT would not require a full-time presence during normal operation. Monitoring would be provided by telemetry systems, supported by standard monitoring and maintenance. Operatives would come to site when required as part of the standard monitoring and maintenance regime.

6.5.2 Chlorine Dosing

470. Chlorine dosing would be undertaken at the BPT. This is described in Section 6.2.4.

6.5.3 Surge

471. There is no surge management proposed at the BPT.

6.5.4 Waste and Residues

472. The only residues during operation would be a small amount arising from the chlorine dosing process.

6.5.5 Third Party Access

473. A number of access points have been included within the design in order to maintain access to land / infrastructure. These are:
- A replacement access (and power supply) to the existing radio mast at the northern end of the site. This would be via shared use of the permanent access road to the L1064
 - A landowner access point at the entrance from the L1064 to the BPT and an agricultural track to the east of the permanent access road from the L1064 to the BPT.
474. In addition, it is proposed to provide public access to the planting area to the east of the site. This would involve a circular walk within the planting proposals and linking to the existing trail within Knockanacree Wood.

6.5.6 Maintenance

475. The maintenance strategy for the BPT is that while one of the outermost cells is being operated, the other can be isolated for cleaning or maintenance.

6.5.7 Monitoring

476. The on-going monitoring at the BPT would consist of checking:

- Water levels in the tanks
- Chlorine levels in the water
- Water pressure in the pipeline.

7. Booster Pumping Station

7.1 Purpose

477. The purpose of the BPS is to facilitate the movement of the water along the Treated Water Pipeline from the BPT to the TPR at higher flow rates. Flows up to approximately 165Mld can gravitate from the BPT to the TPR. However, when demand for water increases above 165Mld, pipeline frictional losses increase to the point where there is insufficient elevation difference to deliver the water to the TPR. To provide the additional pressure required to deliver flows up to the peak demand of 300Mld, booster pumps are required.

478. The BPS is illustrated in Image 7.1. The BPS site is located in open fields. The site would be 5.1ha, (excluding the access road described in Section 7.2.11). This would comprise 2.2ha of permanent land take and a further 2.9ha of land only required temporarily during construction.²⁵

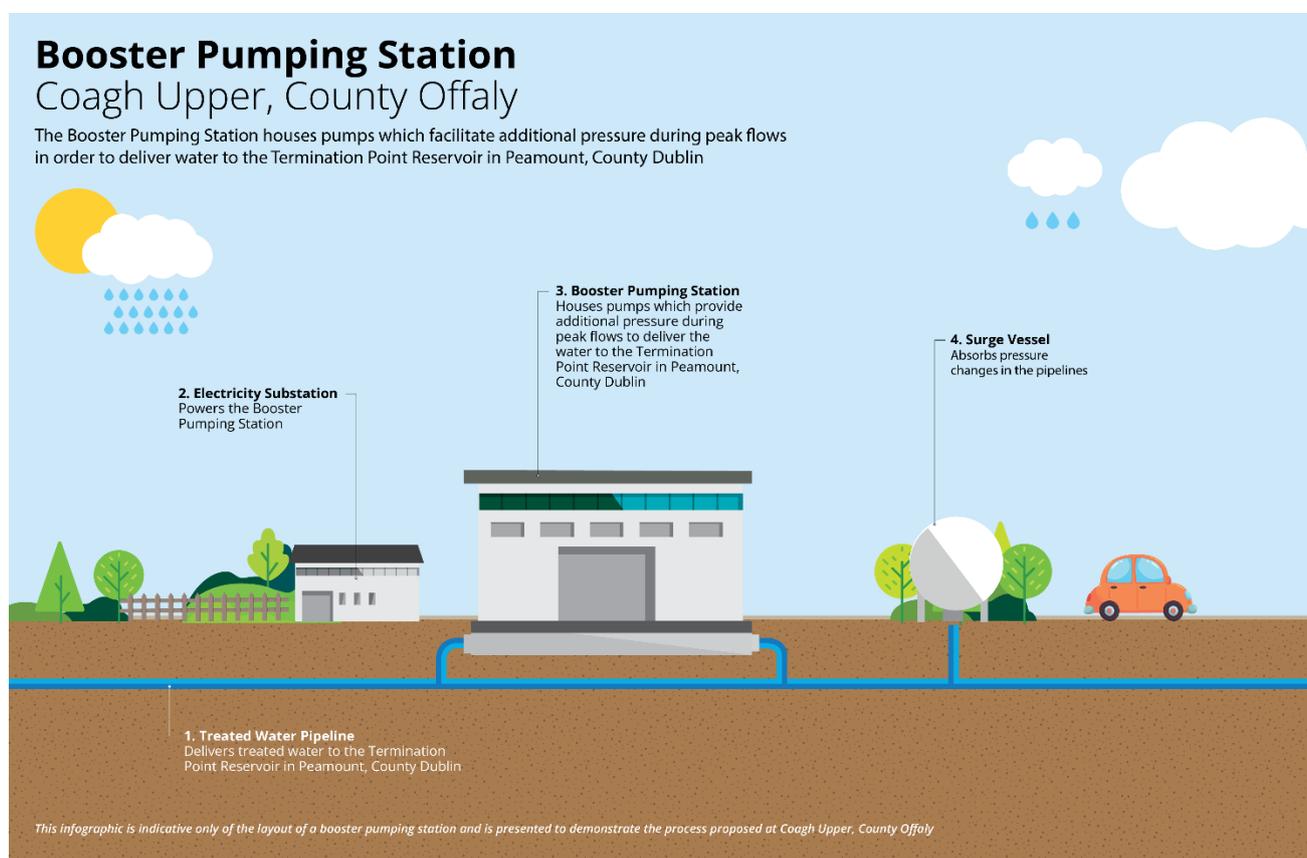


Image 7.1: Infographic Overview of the Booster Pumping Station

7.2 Design

479. The main elements of the BPS are detailed in Table 7.1.

²⁵ These totals are affected by rounding to one decimal place.

Table 7.1: Infrastructure Elements – Booster Pumping Station

Infrastructure Element	No.	Length	Width	Depth	Height Over Finished Ground Level	Plan Area Overall
Booster Pumping Station	1 No.	60m	36m	3.9m	7.6m	2,160m ²
38kV Electricity Substation and Power Distribution Building	1 No.	14.8m	9.3m	n/a	3.5m for the building 4.2m for the Transformer	148m ²
Surge Vessel	1 No.	10m	3m Φ^{26}	n/a	4.5m	30m ²

7.2.1 Booster Pumping Station

480. The Treated Water Pipeline from the BPT would enter the BPS site from the south and would connect to the dry well of the BPS. The pipeline would exit the BPS site to the north.

481. The BPS Building is designed as a single-storey building, 60m long, 36m wide and 7.6m above finished ground level with a basement below. The building has been sized based on the need to have sufficient capacity to house the following:

- Welfare facilities
- Office facilities
- HV and LV electrical controls
- An overhead gantry crane is provided to remove pumps, motors and pipework
- Space for an internal vehicle loading bay.

482. The basement of the BPS would contain the Pump Hall which would be open to the ground floor of the building with walkways running on either side. It would contain:

- Space for six split case centrifugal pumps (four duty and two standby)
- The incoming Treated Water Pipeline
- The outgoing pump manifold to the Treated Water Pipeline.

483. Access to the building would be at ground level through a personnel door and through roller shutter doors for equipment. Emergency fire exit doors would be provided to comply with Part B of the Second Schedule to the Building Regulations 1997 (as amended). Removable acoustic louvres would be provided to facilitate the maintenance and replacement of plant.

484. Communications links to the BPS would be provided by a telemetry mast, the top of which would be 14m above finished ground level.

7.2.2 Chemical Dosing

485. No chemical dosing would be required at the BPS site.

7.2.3 Surge Management

486. Hydraulic analysis of the BPS and Treated Water Pipeline between the BPT and TPR was undertaken. To prevent pressures falling below 5m in the Treated Water Pipeline between the BPT and TPR, as a result of an uncontrolled and simultaneous trip of all pumps during maximum flow, a surge vessel has

²⁶ Φ symbolises diameter

been proposed, with a total volume of 71m³. The surge vessel would be located outside the BPS building and would be 10m long, 3m wide and 4.5m high.

487. The vessel would require compressed air provided by a compressor to maintain air volumes and pressure within the air vessel, and these have been included in the BPS Building layout.

488. An actuated valve would be located at the BPS bypass, parallel to the pumps, to prevent backflow along the pipeline when the BPS is operational. A sudden opening or closing of this valve would cause a rapid deceleration in flow along the pipeline, creating transient surge pressures. An actuated 'butterfly valve' is included in the design, which would be capable of opening and closing progressively, mitigating the creation of surge pressures. This valve would be similar to the Line Valves, described in Section 11.3.

7.2.4 Pumping

489. The six pumps at the BPS would operate with four on duty and two standby. Each of these pumps would have an overall power rating of 1,200kW.

490. To allow for pumped flows to be regulated as required, the pumps would be variable speed.

7.2.5 Power Requirement

491. For peak output of 300Mld, the BPS would have a power demand of 111,144kWh/d and at the annual average flow of 154Mld it would be 463kWh/d. This reflects the fact that at 154Mld the pumps would not be required to operate.

7.2.6 Power Connection

492. The power supply would be provided by ESB Networks from the Birr 38 kV electricity station to a substation at the BPS site through underground cable ducts laid along the R440, L7004 and L3003 roads in Co. Offaly. This would be a length of approximately 9km. The cable ducts would consist of two 38 kV circuits laid as per ESB Standard Specification for ESB 38 kV Networks Ducting/Cabling included in Appendix B.

493. In addition to the permanent power supply to the site there would be the permanent diversion of an existing LV overhead line which crosses the proposed site of the BPS and so would need to be moved. This would be diverted around the eastern side of the BPS.

7.2.7 Electricity Substation

494. To facilitate this connection, a new 38 kV electricity substation would be constructed at the BPS site. This 38 kV Substation would be located in a fenced area within the BPS site which would contain a Switchgear Building and two external transformers. Furthermore, this 38 kV Substation would include:

- A control room
- A 38 kV busbar
- Two line bays
- A sectionaliser bay
- Two customer bays.

495. The Switchgear Building, located within the electricity substation, would include a control room, a battery room and a switchgear room.

496. Two transformers would be mounted externally on two 6.5m by 6.5m concrete plinths. Each transformer would have a height of 4.2m above the finished ground level.

497. The finishes of the electricity substation would be in accordance with the Standard Specification for ESB 38 kV Networks.

7.2.8 On-Site Solar Photovoltaic

498. One stand of ground mounted solar panels is proposed on the south-east side of the BPS site. This would consist of PV cells and BESS.

499. The total area of solar PV to be provided would be 278m².

500. The PV cells would have a peak power output of 20kWp and the BESS would have a storage capacity of 40kWh.

501. The proposed PV cells and BESS would provide power to help run the telemetry and SCADA systems for a portion of each day. This would reduce the energy required from the mains supply.

502. A glint and glare assessment has been undertaken and is contained in Chapter 18 (Material Assets) of the EIAR .

7.2.9 On-Site Water Supply

503. A potable water connection would be taken directly from the pipeline and no additional connection into existing supplies would be required for the BPS.

7.2.10 Surface Water Management and Drainage

504. The BPS access road, and other paved areas have been designed to incorporate SuDS principles as recommended by the SuDS Manual (CIRIA 2015) in order to limit discharges of rainwater runoff from the BPS site to the equivalent greenfield site flow rate.

505. Surface water runoff from impermeable areas would be conveyed via an underground drainage system to an attenuation basin located to the front of the BPS site. The volume of the attenuation basin required to accommodate flows from a 1 in 100-year storm event and a 30% uplift in rainfall for climate change has been calculated as 600m³.

506. Surface water runoff entering the attenuation basin would be pre-treated in a Class 2 By-Pass Hydrocarbon Interceptor. This allows for any build-up of pollutants on the internal roadway or hard standing working areas that would be washed off in the early part of a storm to be treated. The outfall from the attenuation basin would be fitted with a penstock which can be used to isolate the attenuation basin and so contain pollutants in the event of an accidental spillage.

507. Water from the attenuation basin would be discharged at greenfield run-off rates via a 200mm diameter underground pipe to the small stream, an un-named tributary of the Camcor River, located approximately 200m east of the BPS site.

508. The head manhole on the discharge pipe would contain a flow control device which would control discharge from the system, limiting it to the maximum flow that would be expected from the greenfield site.

509. Foul wastewater generated on the site would be directed to a holding tank with a level sensor to alert when emptying is required. It would then be tankered away for disposal at a licensed WWTP. The site would not be permanently staffed and so foul wastewater generated by operational staff on the site would be less than 1m³/d.

7.2.11 Access

510. Access to the BPS site would be directly off the L3003. There would be traffic circulation areas within the site including around the perimeter of the BPS. The access includes for safe sight lines and appropriate signage when emerging onto the L3003, in accordance with TII's Geometric Design of Junctions, DN-GEO-03060, (TII 2023). The sight lines would be partially provided by the existing curtilage of the road.

511. The permanent access would require 0.4ha of land. In addition, a further 0.1ha would be required temporarily during construction to build the access road.²⁷ This would be in addition to the land defined in Section 7.1.

512. There would be four car parking spaces provided at the BPS site, with one including a charging point (fast charge) for electric vehicles in accordance with the Offaly County Development Plan 2021 – 2027 (Offaly County Council 2021).

7.2.12 Lighting

513. At the BPS site, LED external lighting would be provided for the BPS Building and on traffic circulation areas within the site, in the parking area and at the entrance to the BPS site.

514. The design of the lighting at the BPS site would be carried out with reference to the standards and requirements listed for the RWI&PS in Section 3.2.16.

7.2.13 Architectural Design Concept

515. The factors considered in designing the structures at the BPS have been set out in the Infrastructure Sites Architectural Statement contained in Appendix A.

516. The barrel-vaulted, steel, portal-framed building is designed to invoke an agricultural building aesthetic, while the muted colour palette proposed is sensitive to the rural context. The façades would be overclad using robust thermally treated timber battens, fitted vertically, and spaced to give a three-dimensional effect and soften the visual appearance of the building.

7.2.14 Environmental Design Considerations

517. In accordance with the mitigation hierarchy potential environmental impacts were avoided or reduced through the siting and sizing of the BPS and the proposed infrastructure. In particular, the BPS has been designed to site the buildings away from the adjacent watercourse.

518. In addition, reinstatement planting is to be used to soften the visual appearance of the site and additionally the proposals include for native species rich meadow planting within the site.

7.2.15 Sustainability Design Considerations

519. The main sustainability considerations incorporated into the design of the BPS were:

²⁷ These totals are affected by rounding to one decimal place.

- The use of solar power generation as set out in Section 7.2.8
- SUDS including an attenuation pond would manage surface water runoff and has been sized to accommodate future climate change as described in Section 7.2.10
- The landscape planting / reinstatement design, as summarised in Section 7.2.16, aims to maximise opportunities for biodiversity.

7.2.16 Landscaping / Reinstatement Design

520. Excavated material from the construction of the BPS would be used on site to reprofile the site during construction and reinstate the construction working area and achieve finished ground levels.

521. The landscape reinstatement planting proposals include native species rich meadow planting within the site and a thick hedgerow around the perimeter of the site to reduce visual effects.

7.2.17 Boundary Treatment

522. The BPS site would feature a double fence on its boundary. There would be a stock proof 1.2m high post and rail boundary fence, with a 2.4m-high polyester powder-coated palisade security fence set within the boundary. The offset distance varies between approximately 5 – 12m. The overall length of the security fence would be 601m. All security fencing would be compliant with IW-TEC-600-01 (Physical Site Security) (Irish Water, 2018).

523. There would be two security gates provided at the BPS site. One would be provided at the site entrance and the other at the entrance to the 38 kV Substation. CCTV cameras on 6m tall poles would provide security coverage of the access gates and buildings.

7.3 Construction

524. The BPS would generally be built using standard civil engineering construction techniques and would not involve any unique or unusual activities. The general construction techniques and the construction of the BPS are described in Chapter 5 (Construction and Commissioning) of the EIAR.

7.4 Testing and Commissioning

525. As part of the testing and commissioning of the Proposed Project all control systems would need to pass the FAT and once installed, SAT. These would all be undertaken 'dry'. This would include all comms links to the other infrastructure sites.

526. Full 'wet' commissioning of the BPS can only take place once the pipeline from the BPT to the TPR is operational and water available from the WTP. A pre-requisite of this would be the full commissioning of the RWI&PS, WTP, pipelines, BPT, FCV and TPR.

527. Following disinfection of pipework, the next step would be commissioning the surge protection system.

528. The BPS pumps would then be commissioned individually, first spinning against closed valves and then in various combinations and finally into supply with combinations of three pumps to achieve the full range of flows.

529. Finally, acceptance testing would include an endurance test whereby the pumps are required to successfully run for extended period.

7.5 Operation and Maintenance

7.5.1 Operation

530. During operation, above flows of approximately 165Mld the BPS would push the water through the pipeline from the BPT to the TPR to deliver the required flow, up to 300Mld. To achieve this, the pumps in the BPS would link to pressure and flow monitors on the pipeline, both upstream and downstream of the site. They would initiate when the pressure in the pipeline started to drop below a set point. When the pumps activate, they would mechanically increase the water pressure in the pipe.

531. Use of the BPS would be restricted, in any given year, to periods of routine testing and maintenance of the BPS or when demand for water increases above 165Mld. In this latter scenario, the BPS would operate for as long as necessary to meet the increased water demand.

532. At all other times during the operation of the pipeline, the BPS would be switched off and the Treated Water Pipeline from the BPT to the TPR would run in gravity mode on a bypass.

533. When required to run, two or three pumps would run in parallel to provide the required additional flow beyond the maximum gravity flow.

534. The pumps would be variable speed and provide coarse control of the flows in the pipeline.

535. The site is intended for remote operation and would be provided with actuated valves and flow meters to facilitate the transition from gravity to pumped modes of operation.

536. A SCADA system would communicate with and provide control from the WTP.

537. The site would not have staff permanently on site. Operatives would come to site when required as part of the standard monitoring and maintenance regime.

7.5.2 Chlorine Dosing

538. There would be no chlorine dosing at the BPS.

7.5.3 Surge

539. The surge management would be via the surge vessel as described in Section 7.2.3.

7.5.4 Waste and Residues

540. There are no specific waste / residue streams generated at the BPS during the operation of the Proposed Project.

7.5.5 Third Party Access

541. ESB would need access to the substation described in Section 7.2.7 and a separate entrance and access have been provided for this within the design.

542. A number of additional access points have been included within the design in order to maintain landowner access to land / infrastructure. These are:

- A gate within the entrance from the L3003 to the electricity sub-station to provide access to the land to the south of the BPS

- A gate within the entrance from the L3003 to the BPS to provide access to the land to the north of the BPS.

7.5.6 Maintenance

543. The BPS has been designed so that a pump can be taken out of service for maintenance and / repair and the remaining pumps can deliver the peak demand of 300Mld.

544. When not in service, the BPS would require approximately weekly maintenance runs for each of the pumps to avoid damage to bearings and drive systems. This can be achieved without the need for a full transition to pumped mode since individual pumps can be spun without impacting on the normal gravity flows.

545. The by-pass would also have to be tested at regular intervals.

546. Replacement of the pumps would be needed at the end of their life which would typically be 15-25 years.

547. The surge vessel would be maintained whilst not in operation, which would be when flows through the pipeline would be below approximately 165Mld. Maintenance of the surge vessel would be carried out via a personal access hatch. The vessel would be drained and taken off line prior to any works. The surge vessel will require an annual inspection by a qualified organisation to meet the Pressure Equipment Directive (2014/68/EU).

7.5.7 Monitoring

548. The on-going monitoring at the BPS would consist of:

- Checking the speed of the pumps, the volume of water being moved and the pressure in the pipeline.

8. Flow Control Valve

8.1 Purpose

549. The FCV is a specific valve that would be the main control and safety device on the system. It would provide fine control of flows out of the BPT and safe emergency shut down while avoiding surge pressure issues within the pipeline. In this way it would also, therefore, manage the water level at the BPT and the volume of water arriving at the TPR.

550. The FCV site would be 0.9ha, (excluding the access road described in Section 8.2.11). This would comprise 0.5ha of permanent land take and a further 0.4ha of land only required temporarily during construction.²⁸

8.2 Design

551. The main elements of the FCV are detailed in Table 8.1. There is no above ground building. Rather, it is a below ground chamber with above ground kiosks.

Table 8.1: Infrastructure Elements – Flow Control Valve

Infrastructure Element	No.	Length	Width	Depth	Height Over Finished Ground Level	Plan Area Overall
Flow Control Valves	3 no.	N/A	N/A	N/A	N/A	N/A
Chamber	1 no.	23.5m	13m	4.5m	N/A	306m ²

8.2.1 Flow Control Valve

552. The FCV site would consist of three, 700mm diameter FCVs and three flow meters installed in parallel with the Line Valve, housed within an underground chamber to allow for the higher SPF range whilst providing fine control throughout. The chamber would be 4.5m deep and 23.5m long by 13m wide. It would contain the principal valve and associated powered actuator along with pressure instruments, flood detection and control equipment. The chamber allows this equipment to be protected and to be more easily accessed during the operation of the pipeline.

553. Above ground there would be a small compound, drainage pond, kiosks, solar panels and parking.

554. The site would include one kiosk for the power supply to the FCV and one other kiosk which would house the control Programmable Logic Controller telemetry and SCADA system.

555. Communications links to the FCV would be provided by a telemetry mast, the top of which would be 14m above finished ground level.

8.2.2 Chemical Dosing

556. No chemical dosing would be required at the FCV site.

8.2.3 Surge

557. There would be no requirement to provide surge protection at the FCV site.

²⁸ These totals are affected by rounding to one decimal place.

8.2.4 Pumping

558. There would be no requirement to provide additional pumping at the FCV site.

8.2.5 Power Requirements

559. For a peak flow of 300Mld, the FCV would have a peak power demand of 365kWh/d and at annual average flow of 154Mld this would be 188kWh/d.

8.2.6 Power Connection

560. Power supply to the FCV site would be provided by ESB Networks from their Low Voltage network via a combination of overhead lines and buried cables routed to a control kiosk on the site.

561. Ducting would be provided within the site. Ducts would be laid with a minimum cover of 750mm and a minimum spacing of 75mm between the ducts, in accordance with the ESB standards contained in Appendix B.

8.2.7 Electricity Substation

562. There would be no requirement for a substation at the FCV site.

8.2.8 On-Site Solar Photovoltaic

563. There would be a small ground mounted PV array and BESS on the north-east side of the FCV site. The PV cells would have a peak power output of 20kWp and the BESS would have a storage capacity of 40kWh.

564. The total area of solar PV would be 556m².

565. This would reduce the energy required from the mains supply.

566. A glint and glare assessment has been undertaken and is contained in Chapter 18 (Material Assets) of the EIAR.

8.2.9 On-Site Water Supply

567. There would be no potable water supply at the FCV site.

568. There would be no need to treat or tanker away foul water from the FCV site.

8.2.10 Surface Water Management and Drainage

569. The FCV access road, and other paved areas have been designed to incorporate SuDS principles as recommended by the SuDS Manual (CIRIA 2015) in order to limit discharges of rainwater runoff from the FCV site to the equivalent greenfield site flow rate. This would include provision of filter drains to act as an attenuation device and would convey surface and stormwater in a controlled manner to the attenuation basin located to the north-west of the site. The volume of the attenuation basin required to accommodate flows from a 1 in 100-year storm event and a 30% uplift in rainfall for climate change has been calculated as 52m³.

570. Surface water runoff entering the attenuation basin would be pre-treated in a Class 2 By-Pass Hydrocarbon Interceptor. This allows for any build-up of pollutants on the internal roadway or hard

standing working areas that will be washed off in the early part of a storm to be treated. The outfall from the attenuation basin would be fitted with a penstock which can be used to isolate the attenuation basin and so contain pollutants in the event of an accidental spillage.

571. Water from the attenuation basin would be discharged at greenfield run-off rates via a 200mm diameter underground pipe to the roadside drain.

572. The head manhole on the discharge pipe would contain a flow control device which would control discharge from the system, limiting it to the maximum flow that would be expected from the greenfield site.

8.2.11 Access

573. Access to the FCV site would be directly off the L1016 Commons Road Upper. There would be paved traffic circulation areas to all the elements of the FCV site. A Lay-By adjacent to the public road would allow for safe parking during access and egress.

574. The permanent access would not require additional land beyond that allowed for the site, however; in order to build the access point from the L1016 there would be a further, 0.3ha of land required temporarily during construction in addition to that described in Section 8.1.²⁹

575. The site security gates would be set back from the L1016 behind the Lay-By to allow vehicles attending the site to pull off the road and not cause a hazard whilst the gates are being opened. The access would include safe sight lines and appropriate signage when emerging onto the L1016, in accordance with TII's Geometric Design of Junctions, DN-GEO-03060, (TII 2023).

576. There would be four car parking spaces provided at the FCV site.

8.2.12 Lighting

577. Lighting would be installed at the FCV in order to provide a safe and secure environment for both pedestrians and drivers at the sites and to facilitate ongoing operational and maintenance works associated with the FCV.

578. This would be supplemented with task lighting in activities being undertaken during periods of darkness, e.g. during the winter. Task lighting inside the kiosks and chambers would be provided to facilitate operational maintenance. All task lighting would normally be switched off and only used when personnel are on site. The design of the lighting at the FCV site would be carried out with reference to the standards and requirements listed for the RWI&PS in Section 3.2.16.

8.2.13 Architectural Design Concept

579. The FCV is an underground chamber and, therefore, there is no architectural concept for this site.

8.2.14 Environmental Design Considerations

580. In accordance with the mitigation hierarchy potential environmental impacts were avoided or reduced through the siting and sizing of the FCV and the proposed infrastructure.

²⁹ These totals are affected by rounding to one decimal place.

581. In addition, reinstatement planting would soften the visual appearance of the site and the proposals include for native species rich meadow planting within the site.

8.2.15 Sustainability Design Considerations

582. The main sustainability considerations incorporated into the design of the FCV were:

- The use of solar power generation as set out in Section 8.2.8
- SUDS including an attenuation pond would manage surface water runoff and have been sized to accommodate future climate change as described in Section 8.2.10
- The landscape planting / reinstatement design, as summarised in Section 8.2.16, aims to maximise opportunities for biodiversity.

8.2.16 Landscaping / Reinstatement Design

583. The site would be landscaped to reduce the visual effect of the FCV site as a whole. The proposals include for native species rich meadow planting within the site and a thick hedgerow around the perimeter of the site.

8.2.17 Boundary Treatment

584. The FCV site would feature a double fence on its boundary. There would be a 1.2m-high post and rail, stock proof boundary fence with a 2.4m-high polyester powder-coated palisade security fence set 5m within the boundary. The overall length of the security fence would be 216m. All security fencing would be compliant with IW-TEC-600-01 (Physical Site Security) (Irish Water, 2018).

585. A security gate would be provided at the site entrance. The access gate would be set back to allow vehicles to park off the public road completely. The gate would be 2.4m high to suitably match the perimeter palisade fence. CCTV cameras on 6m tall poles would provide security coverage of the access gates and the site.

8.3 Construction

586. The construction of the FCV would be similar to the Line Valves along the pipeline and would use standard construction techniques. It would not involve any unique or unusual activities. The general construction techniques and the construction of the FCV are described in Chapter 5 (Construction and Commissioning) of the EIAR.

8.4 Testing and Commissioning

587. As part of the testing and commissioning of the Proposed Project all control systems would need to pass the FAT and, once installed, SAT. These would all be undertaken 'dry'. This would include all comms links to the other infrastructure sites.

588. Full 'wet' commissioning of the FCV can only take place once the pipeline is fully charged with water. A pre-requisite of this would be the full commissioning of the RWI&PS, WTP, pipeline, BPT and TPR.

589. The three individual FCVs would then be commissioning individually then in various combinations and finally into supply with combinations of two out of three operating to achieve the full range of flows.

8.5 Operation and Maintenance

8.5.1 Operation

590. The FCV would operate 24 hours a day to control water flows through the pipeline. This would be done remotely and using an automated system. This would be controlled through the SCADA system.

591. The primary function of the FCV would be to match the pumped flow of water from the WTP with the flow in the Treated Water Pipeline as it leaves the BPT.

592. The site would not have staff permanently on site. Operatives would come to site when required as part of the standard monitoring and maintenance regime.

8.5.2 Surge

593. There is no surge management at the FCV.

8.5.3 Waste and Residues

594. There would be no specific waste / residue streams generated at the FCV during the operation of the Proposed Project.

8.5.4 Third Party Access

595. Additional access points have been included within the design in order to maintain landowner access to land / infrastructure. These are:

- A new entrance, gate and sightlines to provide access to land to the north of the FCV.

8.5.5 Maintenance

596. The valves would require regular inspection and replacement of perishable elements such as seals at prescribed intervals.

597. The FCV site would include an area of hardstanding to accommodate the installation of a temporary crane for maintenance works as and when required. The crane would be brought to and removed from the FCV site on completion of maintenance works.

8.5.6 Monitoring

598. The monitoring at the FCV would consist of checking the velocity and pressure of the water in the pipeline.

9. Termination Point Reservoir

9.1 Purpose

599. The purpose of the TPR is to provide the link between the Treated Water Pipeline and the existing local distribution network in the GDA WRZ. There is an existing drinking water reservoir with a capacity of 40MI and an existing control building operated by Uisce Éireann at this site. The TPR would have a capacity of 75MI.
600. The TPR would temporarily store treated water supplied through the pipeline so that it is ready to be used by consumers.
601. In providing termination point storage capacity, the reservoir would allow the hourly variability in the water demand profile of the distribution network to be served by a stable incoming pressure and flow. The chlorine levels of the water would be adjustable at the TPR site to control water quality and facilitate its use for final consumption in the GDA WRZ.
602. The TPR site is illustrated in Image 9.1. The proposed site area for the TPR is currently in agricultural use. The site would be 8.6ha,³⁰ (excluding the access road described in Section 9.2.13). This would comprise 7.5ha of permanent land take and a further 1.1ha of land only required temporarily during construction.³¹

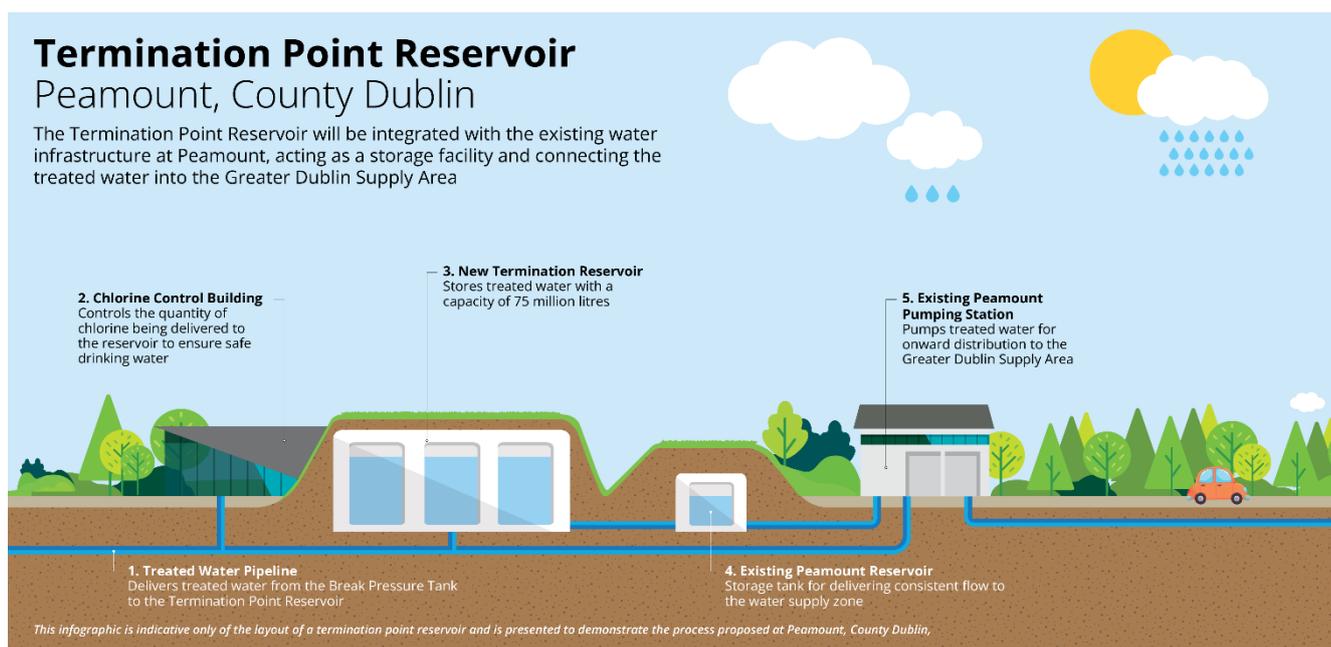


Image 9.1: Infographic Overview of the Termination Point Reservoir

9.2 Design

603. The main elements of the FCV are detailed in Table 9.1.

³⁰ This calculation does not include the existing site that is in Uisce Éireann ownership as it is not additional land required for the Proposed Project. The existing site has been included within the Proposed Project Boundary as there are connections into it from the Proposed Project and some habitat planting to be done within the boundary.

³¹ These totals are affected by rounding to one decimal place.

Table 9.1: Infrastructure Elements – Termination Point Reservoir

Infrastructure Element	No.	Length	Width	Operating Depth	Free-board (m)	Height Over Finished Ground Level	Plan Area		Volume	
							Each	Overall	Each	Overall
Termination Point Reservoir	3 No. Cells	90m (Each cell)	40m (Each cell)	7m	0.5m	11.2m	3,600m ²	10,800m ²	25,000m ³	75,000m ³
Emergency Overflow Storage Tank (underground)	1 No.	40m	40m	3.1m	0.3m	n/a	1,600m ²	1,600m ²	n/a	5,000m ³
Chlorine Dosing Control Building	1 No.	40m	40m	n/a	n/a	8.4m	1,600m ²	1,600m ²	n/a	n/a
Chlorine Dosing Kiosk	1 No.	4m	2.5m	n/a	n/a	3m	10m ²	10m ²	n/a	n/a

9.2.1 Termination Point Reservoir

604. The TPR would be similar in shape and form to the existing 40MI reservoir structures on the adjacent site, i.e. of concrete construction, rectangular in plan within an earthen embankment. The proposed new reservoir site would be integrated with the existing reservoir layout so that it becomes one larger water storage facility, incorporating common means of access, site road layout and power supply, while meeting the same cover level as the existing reservoir structures. There is a Control Building within the existing 40MI reservoir facility that would be used to accommodate some of the required instruments. This existing building incorporates toilet and welfare facilities and would serve the existing reservoir and the proposed TPR.

605. The TPR would consist of three equal cells constructed in reinforced concrete. The top of the TPR would be 11.2m above finished ground level.

606. Connection from the TPR to the existing GDA WRZ network would facilitate the following:

- Supply of the direct demand from the existing 40MI Peamount Reservoir
- Connection to Peamount Pumping Station for onward transfer to Saggart Reservoir and its supply area
- Connection to the pressure pipeline from Leixlip WTP which would provide the option to reverse the flow to Leixlip for onward supply to North Dublin.

9.2.2 Emergency Overflow

607. To limit overflow events, the TPR has the capacity to store an additional 5,000m³ of water over and above its normal operating capacity, and is incorporated into the freeboard³² of the structure. This additional capacity, or buffer, is broadly equivalent to the time taken for the inlet FCVs to the TPR to close at maximum flow of 300Mld without any water spilling into the emergency overflow. Should water levels rise into the buffer then a signal would be sent to the FCV, WTP, BPT and BPS to stop transferring flows. Similarly, in the event that the signal to/from the TPR is lost, the system would shut-down as a safety precaution, including the actuators on the inlet valves to the TPR.

³² The freeboard is the available capacity between the top water level and the emergency overflow.

608. It is best practice for these kinds of treated water storage structures to incorporate an emergency overflow to act as a further failsafe mechanism in the unlikely event that this buffer capacity is exceeded. An Emergency Overflow Storage Tank with a further 5,000m³ capacity has been provided to accept any exceedance.

9.2.3 Chemical Dosing

609. The water arriving at the TPR would contain a trace level of chlorine and chemical dosing would be required in accordance with Uisce Éireann technical design standard TEC-900-05-02 (Disinfection: Secondary Chlorination).

610. To ensure that the levels of chlorine residual are accurately controlled, water quality sampling would be automatically undertaken on the inlet and the outlet to the TPR and would determine the level of dose required at the BPT inlet pipework. A banded sodium hypochlorite dosing system would maintain a minimum 'chlorine residual' between 0.1mg/l and 0.2mg/l.

611. As set out in Table 5.3, water that arrives to the TPR site will have an expected free chlorine residual concentration of 0.14mg/l.

612. Chemical dosing would be necessary at the TPR site to ensure a free chlorine residual concentration of 0.68mg/l at the point of departure from the site.

613. This would be achieved by dosing sodium hypochlorite at a dose rate of 1.43mg/l . To ensure thorough mixing, a static mixer is proposed immediately downstream of the dosing point.

614. The Chlorine Dosing Control Building would be used for chemical storage as well as to house the chemical dosing plant.

9.2.4 Chlorine Dosing Control Building

615. The Chlorine Dosing Control Building would be used for chemical storage and the OSEC system and provides 52 days storage of sodium hypochlorite (at 154Mld) and 30 days of brine storage (154Mld).

616. It would house automatic monitoring and testing equipment to measure residual chlorine in the treated water from the WTP, and automatic dosing pipework. It would also include:

- A water quality instrumentation room
- A motor control centre
- Instrumentation panel
- Solar panel controls
- Level monitoring
- Water Quality Monitoring

617. The Chlorine Dosing Control Building would be 40m wide by 40m long and 8.4m high with a flat roof design to tie in with the reservoir.

618. Access to the building would be through a personnel access door and through two roller shutter doors to bring equipment into the office and into the Chlorine Dosing Room. Emergency fire exit doors would be provided to comply with Part B of the Second Schedule to the Building Regulations 1997 (as amended).

619. Communications links to the TPR would be provided by a telemetry mast, the top of which would be 14m above finished ground level.

620. A single storey walk-in kiosk would be needed within the TPR site to house the chlorine sample monitor, the duty standby dosing pumps and a wash station. The kiosk would be 4m long and 2.5m wide and would be within the side slope of the southwest corner of the TPR site. A separate 10m³ tank would need to be located close to the inlet mains along with a static mixer to allow the chlorine dosing to be undertaken. The tank would have a diameter of 2.4m and be 2.6m high. It would be within a bunded area.

9.2.5 Pumping / Mechanical

621. No additional pumping is required at the TPR.

9.2.6 Surge

622. There would be no requirement to provide surge protection at the TPR.

9.2.7 Power Requirements

623. For a peak flow of 300Mld, the TPR site would have a peak power demand of 2,757kWh/d. At the annual average flow of 154Mld it would be 1,232kWh/d.

9.2.8 Power Connection

624. The power supply for the TPR would be provided from the existing Uisce Éireann 40MI service reservoir facility, adjacent to the site. This facility includes an existing pumping station which is supplied by ESB Networks from an existing medium voltage overhead power line which traverses the TPR site. This power line would be re-routed underground around the southern and eastern perimeter of the site to the existing pumping station which houses the ESB control panel.

625. In addition to the permanent supply to the site, there is an existing overhead line which crosses the proposed TPR site and so this would be diverted around the site.

9.2.9 Electricity Substation

626. There is no substation required at the TPR site.

9.2.10 On-Site Solar Photovoltaic

627. Roof mounted solar panels have been proposed on the top of the most northerly TPR tank roof which would provide power to help run the water quality monitoring, telemetry and SCADA systems for a portion of each day. This would consist of PV cells and a small BESS and would reduce the energy required from the mains supply.

628. The total area of solar PV to be provided is 2,152m².

629. The PV cells would have a peak power output of 300kWp and the BESS would have a storage capacity of 300kWh.

630. A glint and glare assessment has been undertaken and is contained in Chapter 18 (Material Assets) of the EIAR.

9.2.11 On-Site Water Supply

631. There is an existing potable water supply on the site, terminating at the existing pumping station building.

632. There is no requirement for foul drainage as part of the proposed TPR.

9.2.12 Surface Water Management and Drainage

633. The TPR access road, and other paved areas, have been designed to incorporate SuDS principles as recommended in the SuDS Manual (CIRIA, 2015) in order to limit discharges from the TPR site to the equivalent green field site flow rate. This would include provision of filter drains to accept surface water runoff from the proposed access road and paved areas. The filter drains would act as attenuation/infiltration devices and would disperse surface and stormwater in a controlled manner to the attenuation basins located to the south-west of and north-west of the site. As part of this approach the TPR would have a 'green roof' on top which would have a biodiversity benefit as well as reducing the rate of surface water runoff.

634. There would be two attenuation ponds at the TPR site. One of these would be on the northern side of the site and have a capacity of 1,229m³. The second infiltration pond would be located to the southern end of the site beside the entrance and have a capacity of 1,329m³. Both of these ponds have been sized to accommodate flows from a 1 in 100-year storm event with a 30% Climate Change uplift.

635. Filter drains within the site boundary fence would collect surface water and direct it to the proposed attenuation ponds.

636. Surface Water runoff entering the attenuation basin would be pre-treated in a Class 2 By-Pass Hydrocarbon Interceptor. This allows for any build-up of pollutants on the internal roadway or hard standing working areas that would be washed off in the early part of a storm to be treated. The outfall from the attenuation basins would be fitted with a penstock which can be used to isolate the attenuation basin and so contain pollutants in the event of an accidental spillage.

637. Water from the attenuation ponds would be discharged at greenfield run-off rates via 200mm diameter underground pipework to the network of field ditches / drains located to the north and west of the site.

638. The existing foul sewer crossing the TPR site would be diverted as part of the Proposed Project.

639. There is no requirement for foul drainage as part of the proposed TPR. The existing facilities would be used by site operatives.

9.2.13 Access

640. A new access road, 5m in width and 342m in length, is proposed to be constructed off the R120 regional road, and adjacent to the western and northern perimeter of Peamount Hospital. The new road is required due to the number of domestic properties along the existing access road which render it unsuitable for construction traffic.

641. The permanent access would require 0.9ha of land. This would be in addition to the land defined in Section 9.1.³³ There would be no additional land required temporarily to build the access.

³³ These totals are affected by rounding to one decimal place.

642. The access road junction would include a pull-in area before the security gates, safe sight lines and appropriate signage when emerging onto the R120, in accordance with TII's Geometric Design of Junctions, DN-GEO-03060, (TII 2023). The sight lines would largely be provided by the existing curtilage of the road. Car parking would be available at the existing Uisce Éireann reservoir.

9.2.14 Lighting

643. At the TPR site, LED external lighting would be provided on the buildings and on traffic circulation areas around the site, in the parking area and at the entrance to the TPR site. Task lighting would be provided to facilitate operational maintenance. It is not proposed to put external lighting along the access road to the TPR.

644. The design of the lighting at the TPR site would be carried out with reference to the standards and requirements listed for the RWI&PS in Section 3.2.16.

9.2.15 Architectural Design Concept

645. The factors considered in designing the structures at the TPR have been set out in the Infrastructure Sites Architectural Statement contained in Appendix A.

646. The Chlorine Dosing Control Building has been designed with the proposed sheer concrete retaining wall of the TPR in mind and is intended to make the building homogeneous with the wall. The angle of the retaining wall's buttressing is inverted in the building by removing a 'wedge' underneath, and the concrete form extends, dramatically, at eaves level past the curtain wall façade. This echoes the form of the proposed Visitor Centre at the WTP. The lower wedge is clad with curtain walling, glazed with ceramic-backed spandrel panels which gives the effect of glass (light versus the heaviness of the monolithic concrete) but is non-transparent.

9.2.16 Environmental Design Considerations

647. In accordance with the mitigation hierarchy potential environmental impacts were avoided or reduced through the siting and sizing of the TPR and the proposed infrastructure. At the TPR this has included designing the tanks to match the height of the existing reservoir to reduce the visual effects of the site.

648. Temporary construction impacts will be carefully managed to avoid, where reasonably practicable and reduce effects on receptors on the eastern side of the TPR include Peamount Hospital. In particular, rock breaking will not be undertaken along the south east perimeter of the site and activities generating high levels of airborne noise will also be restricted in this area as set out in the CEMP (Appendix A5.1 including measures in Annex G) in the EIAR.

649. In addition, the CEMP also requires, among other matters, an Aspergillus Prevention Plan to be developed by a suitably qualified specialist prior to commencement of works on the site to prevent Aspergillus spores spreading (Appendix A5.1 including measures in Annex G).

9.2.17 Sustainability Design Considerations

650. The main sustainability considerations within the design of the TPR were:

- The use of solar power generation as set out in in Section 9.2.10
- SUDS including attenuation ponds would manage surface water runoff and have been sized to accommodate future climate change as described in Section 9.2.12

- Proposals for a green roof on top of the TPR tank. This would have a biodiversity benefit and reduce the rate of surface water runoff. (It has been confirmed that solar panels above a green roof are compatible)
- The landscape planting / reinstatement design, as summarised in Section 9.2.18, aims to maximise opportunities for biodiversity.

9.2.18 Landscaping / Reinstatement Design

651. As part of the completion of the construction phase, habitat planting including a new woodland and native species rich meadow would be planted. The area around and to the south of the new reservoir would be reinstated to create a native species rich meadow as part of the overall ecological reinstatement plans. Woodland planting is proposed within the site of the existing reservoir combined with mixed mosaic planting. In addition, mixed mosaic habitat is proposed where below ground infrastructure places restrictions on what can be planted at the surface.

9.2.19 Boundary Treatment

652. The TPR site would feature a single fence. This would be a 2.4m-high polyester powder-coated palisade security fence set 3m within the boundary. The expected overall length of the security fence would be 973m. This would tie into the security fencing for the existing site. All security fencing would be compliant with IW-TEC-600-01 (Physical Site Security) (Irish Water, 2018). A 2.4m high security gate would be provided at the entrance to the site. There would be a security gate at the northern end of the permanent access road at the entrance to the site. CCTV cameras on 6m tall poles would provide security coverage of the access gates and the site.

653. On the boundary of the east of the site, the existing fence / boundary with the hospital would be retained. On the western side of the site the existing hedgerow would be retained along the boundary.

654. Alongside the access road connecting the site and the R120 there would be a post and rail fence installed on the western side and the existing wall, and fence would be reinstated on a slightly amended alignment on the eastern side. At the road junction with the R120, there would be an agricultural gate matching the existing one on site.

9.3 Construction

655. The construction of the TPR tank would be very similar to the construction of the BPT. This would be constructed using reinforced concrete poured in situ. Standard construction techniques would be used and it would not involve any unique or unusual activities. The general construction techniques and the construction of the TPR are described in Chapter 5 (Construction and Commissioning) of the EIAR.

9.4 Testing and Commissioning

656. As part of the testing and commissioning of the Proposed Project all power, control and instrumentation systems would need to pass the FAT and, once installed, SAT. These would all be undertaken 'dry'. This would include all communications links to the other infrastructure sites.

657. Full 'wet' commissioning of the TPR can only take place once the pipeline from the BPT to the TPR is operational and water is available from the WTP. A pre-requisite of this would be at least partial commissioning of the RWI&PS, WTP, BPT and pipelines in order to provide water for testing.

658. A hydraulic test would be required on the completed TPR structure to confirm that there are no leaks in the structure. The hydraulic procedure for testing the TPR would be carried out in the following sequence:

1. Conduct a water ingress test on the structure, especially the roof
2. Thoroughly clean the structure of all construction materials, dirt and dust
3. Clean the internal faces with high pressure water jets
4. Disinfect the internal faces of the structure with super chlorinated water
5. Fill one cell to the overflow level with water from the WTP via the Treated Water Pipeline. Each cell would be tested independently, and the same water would be used for the three cells
6. Leave cell for a minimum 24-hour period as there would be a certain degree of absorption by the concrete structure, and then take a water level measurement
7. Begin test for a set period (typically seven days) and then remeasure the water level. If the water level drop is within the set limits, then the structure has passed the hydraulic test. If not, identify cause of water loss, remedy and repeat Step 7 until a successful test has been concluded.

659. The TPR would then require a sweetening flow to prevent stagnation and, subject to acceptable water quality testing, this flow would be passed forward into supply via the existing Peamount Reservoir.

660. The TPR would then be available to facilitate commissioning of the FCV and subsequently, the BPS.

9.5 Operation and Maintenance

9.5.1 Operation

661. Treated water would arrive at the TPR through the pipeline and then be stored in the reservoir. In providing termination point storage capacity, the reservoir would allow the hourly variability in the water demand profile of the distribution network in the GDA WRZ to be served by a stable incoming pressure and flow.

662. If the TPR requires more or less water, then the operators of the system would instruct the WTP to adjust production, which in turn would:

- Alter the output flow from the HLPS to the BPT
- Which would cause the BPT level to rise or fall
- Which would cause the FCV to automatically adjust to maintain the BPT level
- Which would adjust the flow into the TPR.

663. If one of the three cells of the TPR needs to be emptied, this would be done by drawing it down as part of the normal operational service. Each reservoir cell would have a scour valve at floor level to enable maintenance and reservoir cleaning of any fine particle deposits, and a high-level overflow pipe to control the maximum safe storage capacity.

664. The inlet pipe to each cell would be low level to allow recharge of the pipe during transient events and greater hydraulic stability.

665. The Emergency Overflow Tank would provide a buffer for scour or overflow from the TPR cells for dechlorination prior to disposal from the site by tanker to a licensed waste facility.

666. Control of inflow and water levels within the TPR would be provided by telemetry systems, supported by visits by maintenance operatives. A standing maintenance presence would not be required on-site. Maintenance would be mostly planned with regular tank cleaning required, with due regard to the treated water being stored, to support effective operation.

667. The 5,000m³ underground Emergency Overflow Storage Tank has been provided within the design in case of an emergency overflow from the reservoir. Due to the 'depth of freeboard' within the TPR design

itself and the high-water level alarms within the reservoir, an overflow event would be unlikely to occur. However, should an emergency overflow event occur, the retained volume in the Emergency Overflow Storage Tank would be tankered directly off site from the Emergency Overflow Storage Tank for disposal at a licensed facility.

9.5.2 Chlorine Dosing

668. Chlorine dosing would be undertaken at the TPR. This is described in Section 9.2.3.

9.5.3 Surge

669. There is no surge management at the TPR.

9.5.4 Waste and Residues

670. There are no specific waste / residue streams generated at the TPR during the operation of the Proposed Project.

9.5.5 Third Party Access

671. There is no additional third party access required at the TPR.

9.5.6 Maintenance

672. Consideration has been given to enabling maintenance of the TPR, without the requirement to temporarily take the entire TPR out of service.

673. The maintenance strategy for the TPR is that each cell can be drained down, whilst the others remain in operation in order to isolate it for cleaning or maintenance.

674. Cleaning of the reservoir, when required, would take place in a carefully controlled and well-planned environment. The cleaning regime would depend primarily on the quality of the water entering the tank, and the frequency of cleaning is expected to be low given the quality of treated water flows passing through it. Experience in the operation of the TPR would dictate the frequency of cleaning, but it is anticipated that this would occur every 10 to 15 years.

675. If one of the three cells of the TPR needs to be emptied, this would first be done by drawing it down in normal service. The actual cleaning process would involve the valving-off of a single reservoir cell, emptying, manual cleaning, disinfection and then refilling. Double isolation on both inlet and outlet for each cell for safety of those working in the cell has also been provided. Each reservoir cell would have a scour valve at floor level to enable maintenance and reservoir cleaning of any fine particle deposits, and a high-level overflow pipe to control the maximum safe storage capacity.

9.5.7 Monitoring

676. The Chlorine Dosing Control Building would house automatic monitoring and testing equipment to measure residual chlorine in the treated water from the WTP, and automatic dosing pipework.

677. In addition, there would be monitoring of the water pressure within the pipeline.

10. Treated Water Pipeline

10.1 Purpose

678. The purpose of the Treated Water Pipeline is to transfer up to 300Mld of treated water from the WTP at Inchabeg, near Birdhill, in County Tipperary to the proposed TPR adjacent to, and immediately west of, Peamount Hospital in County Dublin.

679. There are two sections to the Treated Water Pipeline:

- The Treated Water Pipeline between the WTP and BPT
- The Treated Water Pipeline between the BPT and the TPR.

680. The design of both sections is the same. However, the method used to move the water through the two sections of pipe is slightly different as described in Sections 10.5.2 and 10.5.3.

681. To deliver treated water from the WTP at Birdhill to the TPR at Peamount, the High Lift Pumping Station would be required at the WTP that would lift the flow to the BPT at a high point near the Tipperary and Offaly border. Thereafter, flow would be conveyed generally by gravity through the Midlands to the TPR, unless flows exceed 165Mld, at which point the BPS in Co. Offaly would become operational to deliver all flows.

682. This design approach results in two distinct pipelines – the Treated Water Pipeline between the WTP and the BPT, (which would always be a pumped flow) and the Treated Water Pipeline between the BPT and the TPR (which would typically be a gravity driven flow but supplemented with pumping when required). The design of the Treated Water Pipeline is consistent for both sections of the pipeline.

10.2 Pipeline Corridor

683. The Pipeline Corridor is a 20m wide area within which the final alignment of the pipeline would be located. This corridor has been defined by a 10m width in either direction from the current, proposed centreline of the pipeline, giving a total width of 20m.

684. This Pipeline Corridor provides a level of construction flexibility within normal construction practice.

10.2.1 Construction Flexibility

685. At this stage of the development of the Proposed Project there are a number of points of detail which cannot be finalised. This is due to factors such as unknown site constraints or obstacles that may affect the construction of the permanent infrastructure (e.g. unknown archaeology, unknown services, new badger setts). Although a high level of ground investigation and survey work has been undertaken to inform the planning application for the Proposed Project, further site investigations will be undertaken following grant of planning permission. This will inform a confirmed design for construction. This is a standard delivery approach and as a result, for a linear project of this nature, scale and complexity, it is typical that a level of construction flexibility is required. This flexibility in construction is necessary to provide a mechanism to overcome these constraints or obstacles during the later stages of the Proposed Project.

686. The 20m Pipeline Corridor provides the horizontal construction flexibility required by the Proposed Project to allow the final alignment of the pipeline to be refined. A vertical construction flexibility has also been defined to allow for similar refinement of the vertical alignment of the pipeline.

10.2.2 Horizontal Pipeline Alignment

687. To allow for construction flexibility to overcome site constraints or obstacles, a 20m Pipeline Corridor has been defined for the pipeline (including both the RWRMs and the Treated Water Pipeline), within which the pipe would be located. This corridor has been defined by a 10m width either side of the centre of the pipeline alignment as currently proposed i.e. 20m in total.

688. Horizontal construction flexibility within the 20m Pipeline Corridor is necessary and appropriate for the Proposed Project for the following reasons:

- To overcome unknown construction obstacles, particularly buried ones, including for instance e.g. unknown archaeology, unknown services, ground conditions, ecological constraints identified during pre-construction surveys e.g. badger setts, it would be necessary to be able to slightly alter the final alignment of the pipeline.
- For some of these potential constraints / obstacles there would need to be separation from the pipeline and therefore, the construction flexibility needs to allow to the pipeline to be re-aligned and sufficient space to be left between the obstacle or constraint and the pipe
- To overcome any obstacles the contractor would have to determine the precise angle, position and number of bends needed within the pipeline and sufficient space is needed within the construction flexibility to allow for this.

689. The 20m Pipeline Corridor defining the horizontal construction flexibility is shown indicatively in Image 10.1.

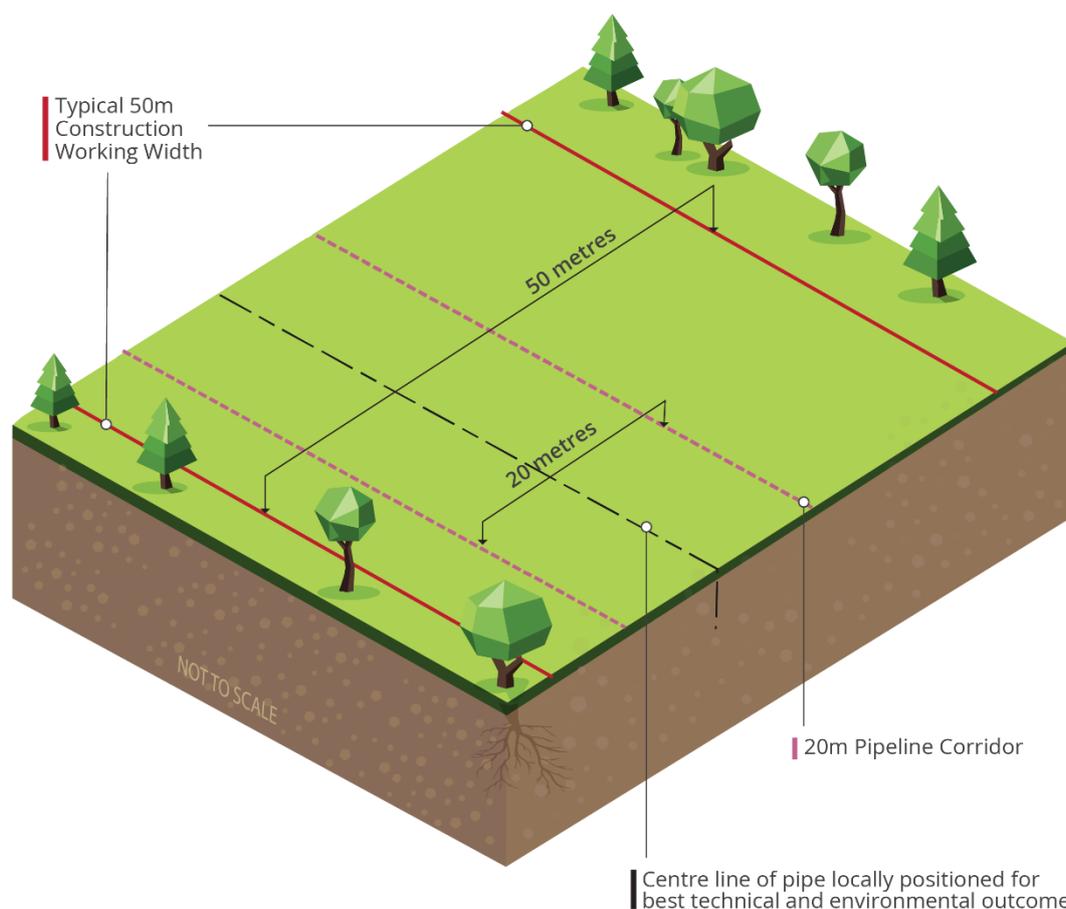


Image 10.1: Indicative representation of the 20m Pipeline Corridor within the wider Construction Working Width

10.2.3 Vertical Pipeline Alignment

690. To allow construction flexibility to overcome site constraints or obstacles, the vertical alignment of the pipeline could vary between the following:

- The crown (or top) of the pipeline (excluding collars or other anti-floatation measure) being no shallower than 1.2m below current ground level
- The crown (or top) of the pipeline would not be deeper than 4.4m below current ground level.

691. This construction flexibility is subject to some exceptions which constrain or alter the level of flexibility in certain locations or circumstances. These are:

- At trenchless crossings under major rivers, roads, railways and canals which would be deeper than 4.4m to the crown (or top) of the pipe. These would be no deeper than as set out in the Planning Application Drawings submitted as part of the Planning Application for the Proposed Project
- At major watercourse crossings the crown of the pipe would be at least 1.6m below the bottom of the bed of the river
- Similar minimum depth restrictions apply at rail, strategic road and canal crossings
- Sections of the pipeline where it has been identified that for hydraulic purposes the crown of the pipeline would need to be deeper than 4.4m. These have been included in the Planning Application Drawings submitted as part of the Planning Application for the Proposed Project and consequently

assessed for significant environmental effects as reported in this EIAR. These include, e.g. TWB – 27100 to TWB – 27700 and TWC – 2600 to TWC – 2750. In these instances, the parameters assessed have been the crown of the pipe not being deeper than that shown in the Planning Application Drawings submitted as part of the Planning Application for the Proposed Project, and not shallower than 1.2m.

692. The list of the locations where the proposed pipeline would be deeper than 4.4m to the crown (the top) of the pipe is set out in Table 10.1. This excludes include sections of pipeline proposed to be constructed using trenchless techniques which would also be deeper than 4.4m to the crown of the pipe.

Table 10.1: Vertical Alignment of Pipeline in Open Excavation Deeper than 4.4m to the Crown of the Pipe

Pipeline Sections	Starting Chainage	Ending Chainage	Approximate Length (m)
TW	TW - 5700	TW - 5800	100
	TW - 8480	TW - 8500	20
	TW - 15560	TW - 15610	50
	TW - 23030	TW -23080	50
	TW - 24510	TW - 24580	70
TWA	TWA - 4000	TWA - 4100	100
TWB	TWB - 27190	TWB - 27690	500
TWC	TWC - 2570	TWC - 2630	60
	TWC - 7000	TWC - 7030	30
	TWC - 12040	TWC - 12050	10
	TWC - 13660	TWC - 13670	10
	TWC - 14930	TWC - 15030	100
TWD	TWD - 3570	TWD - 3590	20
	TWD - 7670	TWD - 7680	10
	TWD - 18160	TWD - 18170	10
TWE	n/a		

693. This vertical construction flexibility is necessary and appropriate for the Proposed Project for the following reasons:

- The pipeline is 1.6m in diameter. Therefore, moving the pipe vertically requires sufficient space to be able to move a pipe of this size up or down
- For some of these potential constraints / obstacles there would need to be sufficient separation between the pipeline and therefore, the construction flexibility needs to allow to the pipeline to be re-aligned and sufficient space to be left between the obstacle or constraint and the pipe
- To overcome any obstacles the contractor would have to determine the precise angle, position and number of bends needed within the pipeline and sufficient space is needed within the construction flexibility to allow for this.

10.3 Permanent Wayleave

694. In order to deliver the Proposed Project Uisce Éireann is seeking to acquire a 20m Permanent Wayleave along the line of the pipeline. This Wayleave would give Uisce Éireann the right to construct, inspect, operate and maintain the pipelines (RWRM and Treated Water Pipeline). The 20m Permanent Wayleave would be required in order to:

- Accommodate the construction, operation and maintenance of 2 x 1500mm diameter raw water pipelines and 1 x 1600mm treated water pipeline.

- Provide sufficient clear distances (10m either side of the centre line of the pipe) between the pipe and future building / construction works, that will allow such works to be carried out safely and without impacting the structural integrity of the pipeline.
- Allow access to the pipeline for inspections and maintenance work.
- Provide sufficient room for repair work to be carried out on the pipe should this be necessary. The 20m width allows access for machinery to carry out excavations safely and for stockpiling of excavated material within the wayleave adjacent to the trench. It also allows working room to bring in replacement sections of pipe should this be necessary.

695. At the Line Valves the permanent wayleave would be slightly widened to up to approximately 30m (it varies at each Line Valve) to provide the space needed to take account of additional permanent features including the kiosks and to provide operational access.

696. In addition to the 20m Permanent Wayleave above the pipeline there would be a second Wayleave needed for connections from Wash Out Valves to Wash Out Outfalls. This Permanent Wayleave would be 10m wide and has been centred on the pipeline between these two points. This Wayleave has been widened to 20m around the outfalls themselves to enable the siting of the outfall headwall.

10.4 Pipeline Design

697. A 1,600mm diameter pipe, rated at 16Bar has been selected as the preferred design for both the Treated Water Pipeline between the WTP and BPT, and for the Treated Water Pipeline between the BPT and TPR.

698. The operational design criteria is that the Treated Water Pipeline has a minimum velocity to prevent any sediment in the treated water settling out along the pipeline. The minimum velocity would need to be 0.3m/s and does not depend on the diameter of the pipeline.

699. To achieve a minimum velocity of 0.3m/s the minimum volume of water required in a 1,600mm diameter pipeline is 0.604m³/s or 52Mld.

700. The engineered rise and fall of the pipeline along its longitudinal length has been influenced by the natural topography of the land, maximum depths of excavation and minimum depth of cover. Typically, these pipelines have been designed to be laid at gradients not less than 1:500 rising in the direction of flow and 1:300 falling from the direction of flow to encourage air removal. To allow for a reasonable tolerance during construction, a gradient of 1:250 has been adopted where feasible. However, a relaxation to 1:500 in the falling direction has been permitted in peat.

10.5 Pipeline Alignment

10.5.1 Basis of Alignment

701. The alignment of the Treated Water Pipeline was developed through the Preliminary Options Appraisal Report (Irish Water 2015) and the Final Options Appraisal Report (Irish Water 2016) as reported in the Pipeline Routing Report contained in Appendix A3.1 of the EIAR.

702. The basis of the design was developed over a series of stages referred to as 'steps'. Each step refined the pipeline design further, ultimately resulting in the alignment included within the Strategic Infrastructure Development Planning Application. These steps were :

- Mapping of primary and secondary constraints

- Identification of a 2km corridor
- Identification of a preliminary 200m corridor
- Confirmation of a preferred 200m corridor
- Identification of an indicative 50m corridor
- Refinement of the 50m corridor including through consideration of re-route requests from landowners.

10.5.2 Treated Water Pipeline Between the WTP and BPT

703. The Treated Water Pipeline from the WTP to the BPT would be a single 1,600mm nominal diameter welded steel pipeline rising in elevation from a ground level of approximately 48mAOD at the WTP to 143mAOD at the BPT.

704. The water in this section of the pipe would always be pumped to the BPT by the HLPS at the WTP.

705. The length of this section of the pipeline would be approximately 37km and located wholly within County Tipperary. It would extend from the WTP in an east to north-east direction generally through open agricultural grassland. It would cross a number of local, regional and national roads and a number of watercourses including the Nenagh River (Reference: WCX016).

706. From the WTP the pipeline would initially run north of, and parallel to, the Kilmastulla River and the Dublin – Limerick Railway, until the first of two crossings of the M7 Motorway (RDX007) in the townland of Kilnacrauna. From the M7, it would then continue in a north-easterly direction, south of the M7 Motorway, and north of the Slievefelim to Silvermines Mountains Special Protection Area (SPA) (Site Code 004165) and Silvermines Mountains West SAC (Site Code 002258) (approximately 1.5km and 1.8km distant respectively), passing north of the tailings pond at Gortmore towards Carrigatogher Bog. The route of the proposed pipeline would then continue north of Carrigatogher Bog, crossing the M7 Motorway (RDX015) for a second time approximately 13.1km from the WTP. The route travels in a northerly direction, passing west of the town of Nenagh, and then turns in a north-easterly direction and crosses the Nenagh River (WCX016). The route continues in a north easterly direction, passing within 700m to the west of Lough Ourna Proposed Natural Heritage Area (pNHA) (Site Code 000650). The route turns east where it would cross a local road (RDX025), at Ballythomas and then cross the N52 (RDX026), north-east of Ardcroney village, while extending in a more easterly direction. From the crossing of the N52, the proposed pipeline would continue for a further 8km before connecting into the BPT at Knockanacree Hill, adjacent to Knockanacree Wood north of Cloughjordan.

707. The proposed alignment is shown in the planning drawings that accompany the planning application.

10.5.3 Treated Water Pipeline Between the BPT and TPR

708. The second section of the Treated Water Pipeline commences at the BPT, at an invert level of 131.9mAOD, and would be routed through counties Tipperary, Offaly, Kildare and Dublin to the TPR at an invert level of 75.2mAOD. It would be a single 1,600mm nominal diameter welded steel pipeline, approximately 133km in length. Up to approximately 165Mld can be transferred without supplementary pumping, with the water moved via gravity pressure. Above this flow rate, additional pressure would be required to move the higher flows through the pipe. This would be provided by supplementary pumping from the BPS. For ease of reference, this section of the Treated Water Pipeline has been separated into five sections: A to E. Table 10.2 outlines the chainages associated with each section.

Table 10.2: Sections of the Treated Water Pipeline between the BPT and TPR

Treated Water Pipeline Sections between the BPT and TPR	Approximate Start	Approximate End	Starting Chainage	Ending Chainage	Approximate Length (km)
A	BPT	R440	TWA – 0	TWA – 28100	28.1km
B	R440	N80	TWB – 0	TWB – 28200	28.2km
C	N80	R402	TWC – 0	TWC – 24800	24.8km
D	R402	R407	TWD – 0	TWD – 34200	34.2km
E	R407	TPR	TWE – 0	TWE – 17600	17.6km

709. The proposed Treated Water Pipeline from the BPT to the TPR extends in an east to north-east direction through northern County Tipperary and Counties Offaly and Kildare before terminating in County Dublin. The pipeline would be primarily routed through agricultural grassland, but there are extensive areas of peatland in County Offaly and eastern County Kildare through which the pipeline would be constructed.

710. The approximate length of the Treated Water Pipeline from the BPT to the TPR within each county is presented in Table 10.3.

Table 10.3: Approximate Length of Treated Water Pipeline from the BPT to the TPR in Each County

County	Approximate Chainages	Approximate Length of Pipeline
County Tipperary	TWA – 0 to TWA – 4780	4.8km
	TWA – 7960 to TWA – 9090	1.1km
	Combined length	5.9km
	Note: Tipperary also has the RWRM (2km) and the Treated Water Pipeline between the WTP and the BPT (36.8km) so overall length of the pipeline in Tipperary is 44.7km	
County Offaly	TWA – 4830 to TWA – 7960	3.1km
	TWA – 9090 to TWD – 10300	82.4km
	Combined length	85.5km
County Kildare	TWD – 10300 to TWE – 13930	37.8km
County Dublin	TWE – 13930 to TWE – 17590	3.7km

711. From the BPT, the Treated Water Pipeline extends in an easterly direction before crossing the minor road L5020 (RDX033) (which includes the Beara-Breifne Way and Ormond Way) and then the R491 (RDX035), approximately 2km from the BPT, near Garraun and Newtown. The pipeline then turns north-eastwards towards the County Tipperary/County Offaly border, in the townland of Behamore (Hawkshaw), where it diverts northwards, following the county boundary for a short distance before crossing into County Offaly in the townland of Derrinclare. From the townland of Derrinclare, the pipeline crosses the R491 (RDX037) regional road for a second time and continues in a north-easterly direction for approximately 3km before again passing into County Tipperary in the townland of Quakerstown, approximately 90m north-west of Cangort Bog NHA (Site Code 000890). The pipeline extends for a further 1km prior to re-entering County Offaly in the townland of Ballaghboy, approximately 2km south of Sharavogue Bog SAC (Site Code 000585). From the county boundary at Ballaghboy, the route of the Treated Water Pipeline from the BPT to the TPR generally follows a north-easterly to easterly route for approximately 82km through County Offaly.

712. From Ballaghboy, the route of the pipeline extends through the townland of Galbally, before crossing the R492 (RDX043), approximately 2.5km north of Shinrone, in the townland of Curralanty; the Little Brosna River (WCX026) in the townland of Tubbrid; and then the N62 (RDX044) national secondary road at Boveen. From the N62, the pipeline continues in a north-easterly direction, crossing over an unnamed local road in the townland of Ballyatty. From here, the pipeline continues in a northerly and then a north-easterly direction, passing within 500m of the Lisduff Fen SAC (Site Code 002147), through Castletown which is approximately 5.5km south-east of Birr.
713. The pipeline then proceeds to cross the Clareen Stream (WCX029) in the townland of Kilmaine, before also crossing and being routed parallel to the Breaghmore River in the townlands of Breaghmore and Killinure. The pipeline then crosses the Camcor River (WCX032) in the townland of Cloghanmore, which is approximately 9km due east of Birr.
714. After reaching the BPS, located in the townland of Coagh Upper the pipeline is then routed in a north-easterly direction, reaching the northern perimeter of Derrinboy Bog. It continues through open countryside crossing the Silver River (WCX036) in the townland of Ballynacarrig and taking a route that is approximately 1km south of the village of Mountbolus. From this position it veers eastwards, crossing the R421 (RDX068) regional road in the townland of Killananny, and continuing east to just south of Gorteen.
715. At Gorteen, the pipeline crosses the Clodiagh River (WCX039) before proceeding north-east through open agricultural land, between Monietta Bog (southside) and the L2002 (northside), before passing to the south of Killeigh village and crossing the N80 (RDX071) national secondary road and the nearby L5035 local road (RDX072). The latter two roads, which converge within Killeigh, are crossed on the south-eastern village limits. The crossing of the Clodiagh River (WCX039) would be carried out using a trenchless construction technique, as would be required at other significant crossings. The pipeline continues north-eastwards for another 4.5km before meeting the first of two railway crossings (RYX005). This crossing of the Tullamore – Portarlinton railway line would be carried out by using trenchless construction. Progressing onwards toward Ballinagar, the pipeline crosses the R420 (RDX076) regional road in the townland of Curragh before a further trenchless crossing is required of the L1020 (RDX077) in Lugmore townland. The crossing of the L1020 is located 2.5km south of Ballinagar village and approximately 1km north of Geashill village. There are three crossings of the L5034 local road (RDX078, RDX079 and RDX080) before the pipeline enters Clonad Bog. The pipeline is then routed through Mount Lucas Bog and crossing the R402 (RDX083) and R400 (RDX084) regional roads in the townland of Esker Beg. The pipeline is then routed along the southern perimeter of Esker Bog before crossing the R402 (RDX085) again in Rathvilla townland, approximately 7.5km south-west of Edenderry, and continuing eastwards, passing through the north-east corner of Cloncreen Bog. Edenderry power station is 1km south of this location. The R401 (RDX087) regional road is crossed in the townland of Shean, at a point 6km south-west of Edenderry and 1km north-east of Edenderry power station. A further 0.5km east of the R401, the first of two trenchless crossings of the Figile River (WCX056) would be required; the second (WCX057) is 2.5km beyond the adjacent crossing of the R401. From the first crossing of the Figile River (WCX056), and for the next 10km, the pipeline is routed through the extensive Ballydermot Bog.
716. The Ballydermot Bog straddles the County Offaly/County Kildare border at Ticknevin townland, County Kildare. The Treated Water Pipeline from the BPT to the TPR traverses County Kildare for approximately 37.8km, generally in a north-easterly to easterly direction. The pipeline passes through Ballydermot Bog before exiting in the townland of Kilpatrick where the first of the two trenchless crossings of the Grand Canal (WBX078) are required, adjacent to Bord na Móna's Lullymore facility. A further short distance onwards, the route crosses R403 (RDX090), approximately 6km north-west of Allenwood. The pipeline skirts the northern edge of Timahoe South Bog (which contains the Drehid Waste Management Facility) and Timahoe North Bog exiting at the L5013 local road, approximately 4km north-east of the waste

management facility. A further 2km eastwards, the route traverses the northernmost part of Gilltown Bog, the last of the large peat areas. The pipeline continues eastwards, crossing the Blackwater River in the townland of Newtownmoneenluggagh, routing north and eastwards of Ballagh Wood, before crossing the R407 (RDX100) regional road at a point 5km south-west of Kilcock. It then continues east and south-eastwards through the townlands of Baltracey (where it crosses the R408 (RDX103) regional road at a point 2km north-west of Rathcoffey village) and Raheen (Figure 4.56). A short distance further east the R406 (RDX106) and R403 (RDX107) regional roads are crossed in the townland of Barberstown Upper and Lower, 0.5km north and east of the Barberstown roundabout respectively. The nearby River Liffey (WCX073), in the townland of Castledillon Upper, would be crossed using a trenchless construction technique. The pipeline continues eastwards on the southside of the River Liffey, before crossing the Celbridge to Ardclough road (L1016) and then the Dublin – Newbridge railway line (RYX006) in Kearneystown Upper townland.

717. The pipeline enters County Dublin in the townland of Ringwood, near Hazelhatch, County Dublin. Immediately upon passing the Kildare–Dublin county boundary, the second of two crossings of the Grand Canal (WBX088) would be carried out. After this, the Treated Water Pipeline from the BPT to the TPR is routed parallel to the canal until the townland of Commons. From here it is routed north-east under the R405 (RDX112), travelling through primarily farmland, with two local road crossings (RDX113 and RDX114), until it approaches the R120. The pipeline route then travels parallel to the R120 until it reaches the existing Peamount Reservoir access road and then follows the route of the access road to the proposed TPR site at Peamount. The length of the pipeline in County Dublin would be approximately 3.7km.

718. The proposed alignment is shown in the planning drawings that accompany the planning application.

10.6 Construction

719. The main pipeline construction would be predominantly by open-cut trenching and would be carried out with plant such as excavators, as appropriate to the identified soils and ground conditions. Initially three or four lengths of pipe are welded together at ground level beside the pipe trench to form a longer pipe string which is then lifted and lowered into the trench with side booms/excavators. Once the pipe string is in the trench, the ends of adjacent pipe strings are welded together in the trench to form a continuous pipeline. Specific methodologies for working within peat have been provided as indicative notes on the drawings.

720. Trenchless crossing construction techniques would be utilised at major crossings and is an excavation method that installs the pipe behind the tunnel face shield by pushing, or ‘jacking’, pipes from a drive shaft or jacking platform. There would be 44 trenchless crossings along the length the pipeline (noting that there would be flexibility in the construction methodology for the MV/LV power line crossings). Of these tunnelled segments, Of these trenchless crossings, 11 would primarily be for water crossings, 9 would primarily be for road crossings, 18 would be for overhead powerline crossings, 2 would be rail crossings, 3 would primarily avoid a steep slope and 1 would be due to existing land use.

721. The pipeline would be laid at a minimum depth of cover of 1.2m above the crown of the pipe and generally would follow the existing ground profile to limit depths of excavation.

10.6.1 Construction Working Width

722. The Construction Working Width refers to the extent of temporary works area required for the construction of the RWRMs and the Treated Water Pipeline and their subsequent reinstatement. It would typically be 50m in width.

723. An indicative, typical cross section of the Construction Working Width for the pipeline between the WTP and the TPR is shown in Image 10.2.

724. The Construction Working Width needs to be 50m in width in order to provide sufficient space for:

- Excavating the trench for the pipeline
- Storing material that has been excavated including the separation of topsoil and sub-soil
- Managing surface water including drainage channels
- A construction road to move construction vehicles up and down the construction corridor.

725. Exceptions to this are areas where it has been narrowed in a localised area to avoid areas such as watercourses or archaeological features, or in areas where it has been widened due to a greater land extent being required to facilitate certain construction activities.

726. Activities and areas which require widening of the Construction Working Width include:

- Access and egress to the public road network which have been based on an area of land approximately 50m by 50m, in addition to the typical Construction Working Width, to allow for turning areas, waiting areas and space for deliveries. In addition some access points need sightlines to allow for safe access.
- Construction of trenchless crossings for high voltage power lines, railway, road and watercourse crossings which require an area of land approximately 80m by 80m for the construction working area to support the launch and reception shafts at either end of a trenchless crossing.
- Areas required for surface water management. The area of land for this has been based on the likely rate of runoff and the area of land needed to be drained.
- Temporary abstraction and discharge points. The area of land for this has been based on provision of the temporary working area needed to manage the water within these processes
- Additional working width for ground conditions such as topography and soft ground, such as peat.

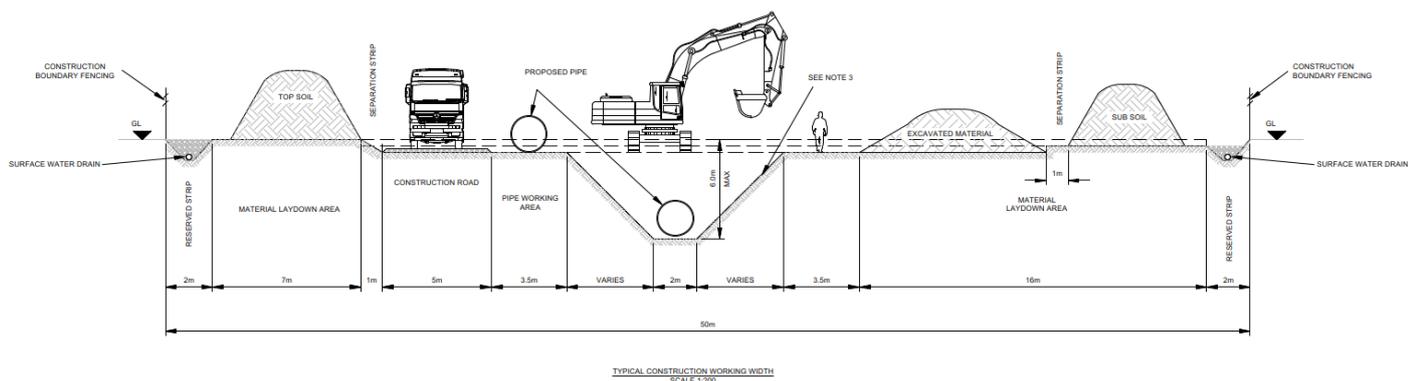


Image 10.2: Indicative Construction Working Width Cross Section

10.6.1.1 Temporary Use of Land

727. For each geographical sections of the Proposed Project summarised in Table 14.1 the main pipeline construction would be over a total period of three years (excluding testing and commissioning).

728. Therefore, for each of the geographical sections 2, 3 and 4 of the pipeline, as defined in Table 5.4, each Contractor would have three years of dry period working (assumed to be spring through to autumn) to lay approximately 40 - 70km of pipeline each. Therefore, very approximately, each Contractor would need to deliver between 12 - 25km of pipeline each year of that three year period.

729. Not all land would be required for the whole three-year period and further sub-division of the sections or phases into smaller, more manageable lengths (works packages) would allow this to be achieved. For example, the contractors would aim to complete a length of pipeline construction between two designated access points in a single year. As a result the works would be planned to reduce the period of time that land is out of agricultural use so that each landowner would not be affected for a period of more than 18–24 months (excluding returning to the land during the commissioning phase of the works).

10.6.1.2 Reinstatement of the Construction Working Width

730. Following completion of the construction works the general principle is that the land within the Construction Working Width would be reinstated to the conditions which existed on site prior to the construction of the Proposed Project. This would be based on the material, habitat, on-site features and surface water management measures that were on site before the works commenced. This would include the reinstatement of the soils, drainage, fencing and vegetation. However, this would be subject to:

- Variations agreed with the relevant landowner regarding matters such as the location or type of gates, fencing or drainage
- Restrictions on structures that can be placed above the pipeline
- Restrictions on the type of planting that can be put over the top of the pipeline including, specifically not planting trees that would grow to more than 4m in height. A mosaic habitat would be reinstated in place of, for example, woodland / forestry plantations that would include such tree species.

731. Section 10.6.1.3 provides further details on the specific approach to sections of the pipeline within areas of peat soils.

10.6.1.3 Habitat Reinstatement and Landscaping

732. The proposals for the landscape planting and habitat creation at each of the Infrastructure Sites are summarised set out in Sections 3.2.20, 5.2.25, 6.2.17, 7.2.16, 8.2.16, and 9.2.18.

733. These proposals are underpinned by the general approach to habitat reinstatement and planting that will be adopted along the length of the Construction Working Width.

10.6.1.3.1 Reducing Effects

734. In accordance with the mitigation hierarchy, the Proposed Project has been designed to avoid or reduce environmental effects where reasonably practicable. The mitigation hierarchy will continue to be applied during subsequent stages of the project. As set out in the CEMP (Appendix A5.1 in the EIAR), opportunities to avoid or reduce the potential environmental effects of the Proposed Project will be identified at each of the subsequent phases of the development of the Proposed Project, including detailed design and construction. This will include, but will not be limited to:

- Seeking opportunities to avoid removing all habitat within the Construction Working Width (i.e. retaining more habitat within the Planning Application Boundary). In particular, avoiding or reducing the loss of high value habitat, such as woodland, and habitat that supports protected species (such as Devil's-bit scabious, which supports marsh fritillary)

- Seeking opportunities to avoid removing, damaging or disturbing breeding sites of protected species such as badger setts, otter holts and bat roosts
- Seeking opportunities to retain vegetation or other features that provide visual screening or landscape value.

735. Any habitats, including trees, scrub or hedgerows adjacent to, or within, the Proposed Project which are intended to be retained will be afforded adequate protection, by complying with National Roads Authority Guidelines for the Protection and Preservation of Trees, Hedgerows and Scrub Prior to, During and Post Construction of National Road Schemes (National Roads Authority 2006), prior to construction works commencing. The mitigation measures related to this are set out in the Register of Environmental Actions and Commitments, which is Annex G of the CEMP (Appendix 5.1 of the EIAR).

10.6.1.3.2 *Route-wide principles*

736. The general route-wide principles for the landscape strategy for the Proposed Project are:

- Retain existing landscape features and biodiversity assets, including existing habitat, as far as reasonably practicable, taking account of the overall requirements of the Project Proposed and the construction works needed to deliver it
- The reinstatement earthworks and planting should be in keeping with, and integrated into, the surrounding landscape
- The planting proposals should promote habitat creation and biodiversity using native species that will support, compliment and connect into existing habitat beyond the Planning Application Boundary.

737. The general principles for reinstatement involve the replacement of the excavated soils in the order in which they were excavated. The following measures will be observed during this phase of the works:

- Reinstatement will occur as soon as reasonably practicable upon completion of the works in order to minimise the time for which soil or peat are required to be stored and the period of exposed excavations. However, this will be subject to careful planning by the Contractor to avoid the necessity to track back over areas of previously restored ground or further disturbance of recovering areas
- As far as reasonably practicable, creation of slopes at gradients suitable for the placement of soils/peat and where necessary, suitable slope stabilisation measures to assist revegetation and prevent erosion
- Replacement of soils/peat in the correct horizons
- Avoidance of compaction of soil or peat
- Adoption of a phased approach to avoid tracking back or disturbing areas previously reinstated
- Natural regeneration of vegetation, where feasible, by reusing the stored topsoil seedbank from its original location for reinstatement
- For semi-natural grassland habitats, where necessary, the locally sourced seedbank present within the surrounding land will be used for grassland restoration following the green hay transfer method (as per Great Irish Grassland guidance), to assist the natural regeneration
- Where natural regeneration is not feasible, or where specific plant species need to establish quickly, habitats will be reinstated by preparing the soil appropriately (i.e. with the existing soil geographic factors, including soil type, soil pH and nutrient content) and reseeded with native locally sourced species specific to the habitat in question.

10.6.1.3.3 Pipeline

738. Within the Construction Working Width along the length of the pipeline, including areas of land required temporarily for construction including the Construction Compounds and Pipe Storage Depots, the following approach will be adopted:

- Retain hedgerows / tree lines that form the linear boundary of the Planning Application Boundary as far as reasonably practicable
- Retain hedgerows / tree lines that cross the Planning Application Boundary as far as reasonably practicable
- Reinstatement habitats and linear habitats as far as reasonably practicable
- Reinstatement areas disturbed temporarily to the pre-construction conditions.

739. Where avoidance and minimisation are not feasible, in order to mitigate for the temporary loss of habitats and reduce significant negative effects, following completion of the construction works the general principle is that the land would be reinstated/restored to the pre-construction position, based on the habitat/features that were on site before the works commenced.

740. The replanting of habitats will be in accordance with recommendations by an Ecological Clerk of Works (ECoW), taking into consideration the All-Ireland Pollinator Plan 2021-2025 (NBDC 2021) and the Pollinator Friendly Planting Code (NBDC 2022), to ensure locally sourced appropriate native species which are in line with the existing genetic strain are used. Replanting of vegetation and general landscaping will be monitored by the ECoW.

741. The exception to this would be the 20m Permanent Wayleave over which trees growing to more than 4m in height would not be planted (as per Uisce Éireann Tree Protection Guidance (Uisce Éireann (2022))). Therefore, in areas of existing woodland a mosaic habitat species mix of scrub and native trees would be planted. The mosaic species mix has been developed to maximise habitat creation, biodiversity and native species planting that would be appropriate for the surrounding habitat, allow for flexibility in which species are planted in which location along the route of the pipeline in order to take account of local / regional diversification or appropriateness of planting whilst taking account of the restrictions on the planting above the permanent pipeline.

742. Furthermore, habitats which cannot be reinstated like-for-like due to their unique nature, complex underlying processes which contribute to their existence, and/or time required to re-establish (such as degraded raised bog) will be replaced with lower ecological value habitat (e.g. cut over bog), as described in EIAR Chapter 8 (Biodiversity) of the EIAR.

10.6.2 Infrastructure Sites

743. Within the permanent Infrastructure Sites the following will be adopted:

- Retain hedgerows / tree lines that form the linear boundary of the Infrastructure Sites as far as reasonably practicable
- Retain habitat specifically identified at the BPT
- Implement screen planting to reduce visual effects, as per the planting proposals for each Infrastructure site
- Implement planting / habitat creation to replace habitat lost as a result of the permanent infrastructure at each of the Infrastructure Sites, as per the planting proposals for each Infrastructure site

- Seek opportunities for habitat creation within each of the Infrastructure Sites taking account of the overall requirements of the Project Proposed and the construction works needed to deliver it.

10.6.3 Monitoring / Management

744. Habitat removal and creation on-site would be subject to agreement and supervision of an ECoW.

745. No more habitat or vegetation would be removed than identified on pre-commencement vegetation removal plans.

746. Opportunities to increase or improve habitat created or reinstated will be proactively sought.

747. Habitats reinstated post-construction will be monitored to determine the overall success of the reinstatement process. The monitoring programme will require annual monitoring, for a minimum period of five years to confirm viable growth is occurring, to undertake remedial works if deemed necessary, and to determine any need to extend the monitoring.

10.6.3.1 Working in Peat

748. In areas of land along the route of the pipeline where peat could be encountered, it is expected that a slightly different construction method would be used compared with that described in this section for the pipeline, generally. Appendix A5.3 (Methods of Working in Peat) of the EIAR describes the various proposed techniques involved in working these areas based on the depths of peat that might be expected to be encountered and the experience of Bord na Móna in traversing these areas.

749. There is approximately 53km of the pipeline construction which would be within areas identified as peat soils (a further 2km would be in alluvium requiring the same construction methods as those described in Appendix A5.3 (Methods of Working in Peat). Approximately 47km of this has been verified by Teagasc data and ground investigation, albeit that inferences have had to be drawn for lengths of up to around 150m of the alignment of the Proposed Project from individual points of ground investigation. A further, approximately 6km is based on Ground Investigation only. This is summarised in Table 10.4.

Table 10.4: Summary of Basis for Length of the Proposed Pipeline Routed Through Peat Soils

Description	Length (km)*	Construction Method	Proportion of whole pipeline (%)	Proportion of length of pipeline in peat (%)
Pipeline length (km) (the Raw Water Rising Mains and Treated Water pipeline)	172.0	-	-	-
Pipeline length identified as potentially within peat soils using Teagasc dataset (km)	49.0	-	29%	-
Length in pipeline route within Teagasc dataset not considered to be peat based on the results of Ground Investigation	1.8	-	-	-
Overall length of pipeline route within Teagasc dataset that is verified as peat by the Ground Investigation	47.2	-	-	-
Length of route not identified as potentially peat by Teagasc dataset but is identified as such based on Ground Investigation	5.7	-	-	-
Total length of pipeline in peat (combining Teagasc dataset and results of Ground Investigation)	52.9	-	31%	
The length of pipeline where the peat depth is less than 0.5m	16.3	Method 0	9%	31%
The length of pipeline where the peat depth is greater than 0.5m but less than 1m	14.0	Method 1	8%	27%
The length of pipeline where the peat depth is greater than 1m but less than 2.5m	15.7	Method 2	9%	30%
The length of pipeline where the peat depth is greater than 2.5m but less than 4.5m	5.7	Method 3	3%	11%
The length of pipeline where the peat depth is greater than 4.5m.	1.1	Method 4	0.6%	2%
No data available		None		

*Sub-total affected by rounding

** In addition to the lengths of peat set out in this table there would be a further 2.2km of alluvium / soft ground where Methods 1 – 4 would be used for the construction of the pipeline. These are set out in Appendix 5.3A (Methods of Working in Peat) in the EIAR.

750. Approximately 16km of the alignment in peat soils would be peat of less than 500mm in depth. A further, approximately, 14km would be more than 500mm but less than 1m in depth. Therefore, around 30km of the 53km in peat soils is in a depth of soil less than 1m which would generally have been drained and the construction approach to be adopted would be very similar to the general construction for the rest of the pipeline.

751. As a result of the overall 53km of the pipeline within peat soils, there is approximately 23km of deeper peat (greater in depth than 1m) and this is generally within areas of land that have been subject to peat extraction including within Bord Na Mona lands. (Approximately 18.6km of the pipeline would pass through Bord Na Mona land and of this, approximately 13.2km would be deeper than 1m).

752. Four similar but different construction methods for working in peat have been set out in Appendix A5.3. These are referred to as Methods 1-4. The selection of which of those methods would be used for each

section of the pipeline will be undertaken during detailed design. These decisions will be based on the depth of the peat and the conditions on site at the time of construction.

753. Method 0 is a reference to the construction approach in areas of peat that would be less than 0.5m. This would not be a construction method specific to peat rather the construction approach for the pipeline within these sections would be the same general pipeline construction for the Treated Water Pipeline. The reference to Method 0 is necessary to explain the difference between the total length of the pipeline proposed to be constructed using Methods 1-4 compared with the total length of pipeline within areas of peat soils as summarised in Table 10.4.

754. Method 1 is proposed to be used where the peat is 0.5m – 1m deep and it is not expected that there would be any deviation from this methodology. Method 1 would involve the excavation of the peat down to good ground, below which could then support the pipe (and the temporary construction road). It has been assumed that Method 1 would be used in all instances where it is proposed.

755. However, for sections of peat greater than a depth of 1m it is uncertain which method may be adopted. Therefore, for sections of the pipeline length currently proposed as Method 2, 3 or 4 any one of those Methods could actually be adopted during subsequent stages of the Proposed Project, as informed by pre-construction site investigation and detailed design. Methods 2–4 all use a ‘floating road’. The difference between Methods 2–4 is whether support would be required for the pipeline. For Method 2 it would not, because suitable ground below the peat would provide the support, whereas for Method 3 and Method 4 there would be the installation of stone pillars or concrete piles, at intervals along the length of the pipeline to provide sufficient support in the poor ground conditions.

756. Some of the general working arrangements, such as only undertaking earthworks in suitable weather conditions and keeping the pipeline excavation open for the shortest period practicable would be important for the sections of the pipeline in peat soils. Similarly, consistent with the general construction approach a surface water filter drain would be used to intercept land drainage and direct it away from the trench towards the settlement lagoons. However, in addition there are a number of key differences compared with the installation for non-peat areas. These are:

- Use of a ‘floating road’ for access to avoid removing peat for the purpose of the Temporary Construction Road. The ‘floating road’ would be removed after construction
- Some areas of peat would not require topsoil stripping and so construction working areas that would usually be used for topsoil storage could be used for storage of layers of peat material, widened excavation and additional drainage, where required. Note that some areas of peatland do have topsoil, notably where grassland overlies peat in agricultural areas. Where this would be the case topsoil or other overlaying material that has to be excavated would be stored separately
- During the construction of the pipeline the excavated peat would be stored separately to any acrotelm layer or amorphous layer / vegetated fibrous layer, kept wetted (if appropriate) and the different layers, where they exist reinstated in the same order that it was extracted
- Additional temporary surface water measures / land required due to the saturated nature of the ground
- De-watering only for deep sections >2.5m depth of peat
- De-watered water would be treated through temporary treatment facilities such as a ‘silt buster’ prior to discharge through the existing on-site drainage
- Greater use of side-boom cranes or gantry cranes to lift the pipe into place rather than using standard excavators
- Side slope angles would be made shallower to allow for safe construction in less stable ground conditions

- Retaining measures, such as temporary piles or a trench box may be adopted if slacker side slopes were not sufficient
- The cover over the permanent concrete collars would be a minimum of 0.8m and 1.2m over the top of the pipe itself
- Piling may also be installed under the pipe for areas where Method 4, as described in Appendix A5.3 of the EIAR is adopted. As an alternative to piling there could be additional excavation for the stone piles to be placed under sections of the pipe in deeper peat; this is Method 3, as described in Appendix A5.3 of the EIAR
- The pipeline is not anticipated to create new preferential flow paths; however, as a precautionary measure drain 'plugs' would be installed to prevent this.

757. Localised peat instability within exposed trenches would be a risk and the construction approach for sections of peat has been developed in response to this. In particular, in order to prevent peat movements into the trench the following approach would be adopted:

- Work in dry weather conditions as far as reasonably practicable with earthworks planned for summer months and movement of machinery to be suspended during heavy rainfall / high water levels (other than as required to respond to a potential incident).
- Interceptor drains on the perimeter of the Construction Working Width and dewatering of the excavation for the pipeline, will be used as part of the temporary drainage plan in areas of peat and / or land with high ground water table to create 'dry' conditions as far as reasonably practicable, (definition of 'dry' as per (CIRIA 2001))
- Slacken side slopes on the batter of the trench excavation as informed by peat probes / further Ground Investigation undertaken as part of the preparation of the construction phase. This is to be as determined through a detailed slope stability assessment by a competent temporary works designer and is to be set out in construction Method Statement for each section of pipeline construction within peat soils
- Utilise land within the Construction Working Width upstream and downstream of the section of pipeline being constructed for activities which there is flexibility over their location such as the temporary stock piling of material and drainage ponds. This would be done to maximise the land available at the section of pipeline being built that could be utilised in slackening side slopes
- For sections of construction where there would be deep peat and/or dewatering proves not to be effective, or slacker side slopes cannot be adopted the contractor would adopt a trench box / temporary sheet piled coffer dam (this would be installed using a vibratory plate method / press piling³⁴) in order to retain the side slopes
- Each section of excavation is to be left open for as short a period of time as reasonably practicable.

758. In addition the following would be adopted:

- Limiting stockpiling of materials in any specific areas
- No stockpiling in areas of degraded raised bog
- Excavated material to be removed to designated deposition areas
- Implementation of monitoring regime for peat movement
- Frequent monitoring and inspection during construction and operation of access roads and temporary peat storage areas

³⁴ Press piling (or press-in piling) is a civil engineering technique for installing foundation piles or sheet piles using a static hydraulic press instead of dynamic hammering or vibrating. This would be adopted where there were receptors in close proximity that could be at risk of vibration effects as detailed further in Chapter 6 (Noise and Vibration).

- If required, additional site investigations inclusive of in situ testing and laboratory testing in specific risk areas on the site
- Client's Geotechnical Engineer/Site Geotechnical Supervisor to approve the method statement
- Approved Contractor to provide toolbox talks and on-site supervision prior to and during the works
- Daily sign-off by supervising staff on completed works
- Implementation of emergency plan and unforeseen event plan by the approved Contractor.

759. An assessment of peat stability has been undertaken as is summarised in Appendix A5.3 (Methods of Working in Peat). This concluded that with the proposed construction management measures including specifically the measures to reduce water levels and try to create as 'dry' conditions as possible there was not a risk of side slope collapse within the excavation. This was based on an excavation with a 1:2 side slope up to 4.5m in depth, with an overall peat depth of 5m and allowing for a temporary stockpile of 1m high (with a side slope of 1:3 and an offset of 1m from the top of the excavation). This analysis relied on the benching of the side slope of the trench excavation using 0.5m wide benches at approximately 1.5m height intervals. This is consistent with the proposed construction approach as shown in Image 10.3. Further, the current vertical alignment does not go below 4.5m deep in areas of peat based on the data available.

760. In the event that the excavation in peat was deeper than 4.5m, the peat depth was deeper than 5m or conditions on-site were wetter, then either, the side slope angles would have to be reduced, stockpiling moved further from the excavation and / or temporary retaining measures such as temporary sheet piles would have to be adopted.

761. It is expected that temporary sheet piling would be required to retain the earthworks for sections of very deep peat (deeper than 4.5m), at the bell pits and if there are prolonged periods of wet weather after excavation has commenced or if dewatering proves not to be effective.

762. Following completion of the construction works the general principle is that the areas of peat would be reinstated in a manner consistent with the Bord na Móna's rehabilitation plans where such plans exist. This would be on the basis of the conditions which existed on site prior to the construction of the Proposed Project including the material, habitat, on-site features and surface water management measures that were on site before the works commenced. The aim of the reinstatement of the Construction Working Width is

- To get the post-construction conditions back to the pre-construction conditions in terms of the material, surface water management measures and water level
- Not to inhibit the longer term delivery of the Rehabilitation Plans / Enhanced Rehabilitation Plans.

763. This would mean that the excavated peat material would be used to backfill the excavation around the pipeline in approximately the same layers and depths that it was excavated. The reinstatement would include material being reinstated over the top of the pipeline. Hydraulic connectivity would be reinstated over the top of the pipe, where it existed prior to construction and this would include reinstating permanent drainage and drain blocks over the top of the pipe in order to reinstate the surface water management and water levels back to the condition that existed pre-construction.

764. In many areas the peat has already been worked and so is already degraded or 'cut-over'. However, there would be sections of raised peat bog that will be affected by the works. Excavating the peat, storing it and reinstating it would affect the integrity of the peat and result in some degradation and therefore, as part of the reinstatement additional measures would be employed including:

- Ditch/Gully blocking

- Ditch reprofiling
- Removing any scrubs/trees and/or ground smoothing
- Habitat creation
- Surface bunding.

765. This work would be undertaken as soon as reasonably practicable following the placement and connection of the pipes within the trench.

766. Suitable surplus excavated peat materials would be used as part of Bord na Móna rehabilitation plans. Agreement has been reached, in principle with Bord na Móna that surplus material can be re-used within their lands. Material would only be re-used within the bog that it was excavated from.

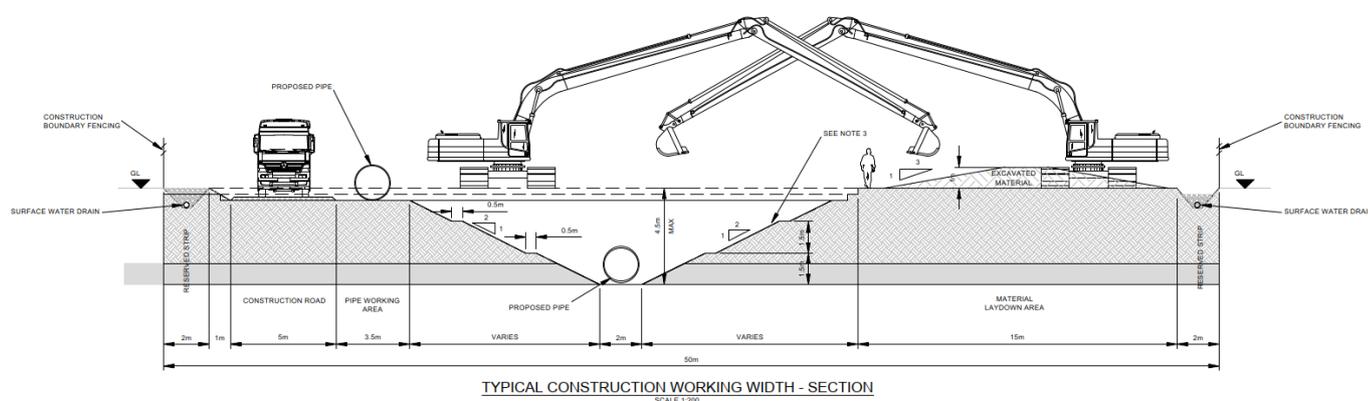


Image 10.3: Indicative Construction Working Width Cross Section in Peat Areas

10.7 Testing and Commissioning

767. During the construction of the Proposed Project, testing and commissioning of individual elements of the works would be carried out at suitable stages of progression. Upon works completion, final commissioning of the whole works would be undertaken to confirm that the system responds in accordance with its specified requirements.

768. In general, the sequence of commissioning is dictated by the following interdependencies:

- The microfiltration pipe units at the RWI&PS site must be commissioned fully before water is introduced into the RWRM
- The RWRM must be tested before the RWI&PS pumps can be fully commissioned
- Both the RWI&PS and the RWRM must be commissioned and ready before commissioning of the WTP begins
- WTP Module 1, at least, and the Pipeline from the WTP to the BPT must be commissioned and ready before the HLPS can be commissioned
- The BPT must be ready before water is fed to it from the WTP
- The TPR must be tested and ready before water is fed to it from the Treated Water Pipeline.

769. The sequence for pipeline testing and commissioning is as follows:

- a) Initial clean and internal inspection

- b) Low pressure 'air test' – using compressed air
- c) Hydrostatic pressure testing with filtered raw water
- d) Final swabbing and cleaning
- e) Disinfection
- f) Filling with potable water
- g) Water quality sampling.

770. Items a) to d) would be undertaken as each sub-section of up to approximately 7km of pipeline is completed.

771. Items e) to g) would be undertaken once the entire pipeline is complete and the HLPS, BPT and TPR are also ready for 'wet' commissioning.

10.8 Operation and Maintenance

10.8.1 Operational Management of Water Levels at Parteen Basin

772. ESB manages water levels on Lough Derg and controls the water levels on Parteen Basin by diverting water to Ardnacrusha power station for the production of zero carbon electricity, and by opening gates at Parteen Weir to release water down the old course of the River Shannon.

773. Parteen Basin is a small reservoir, built with earthen Embankment Dams along the south-western and south-eastern perimeter. It is fed from Lough Derg through the narrow river channel at Killaloe. ESB controls the water levels in Parteen Basin by closely matching the amount of water taken by Ardnacrusha and the Old River Shannon with the amount of water flowing into Parteen Basin each day.

774. The water levels on Lough Derg are managed within a Normal Operating Band 460mm (18 inches approximately) in depth, across a wide range of flows. It should be noted that 100mm of this operating band is usually reserved for emergency electricity generation and therefore, ESB seek to keep the water level within a 360mm range, above 30.50mAOD Malin Head (33.20mAOD Poolbeg).

775. At present, the normal water level on Lough Derg and on Parteen Basin is managed to be between the following limits:

- Parteen Basin: Upper level 30.86mOD Malin Head (33.56mAOD Poolbeg). Lower level: 30.00mAOD Malin Head (32.70mAOD Poolbeg)
- Lough Derg: Upper level 30.86mAOD Malin Head (33.56mOD Poolbeg). Lower level: 30.40mAOD Malin Head (33.10mAOD Poolbeg).

776. Parteen Weir acts as the downstream control structure for water levels in the system. Water levels in Parteen Basin are maintained within the upper and lower levels at all times. During low flow conditions, the lower water level at Parteen Basin (30.0mAOD Malin), must be maintained for dam safety purposes and in doing this ESB ensures that water levels in Lough Derg are within the Normal Operating Band as the waterbodies broadly operate as a combined system, in these conditions.

777. ESB also continually discharges a statutory flow of 10m³/s down the Old River Shannon. By selecting how many turbines are in operation each day, ESB can set how much water is diverted from Parteen

Basin to the station daily. To generate its full electrical output, each hydro turbine at Ardnacrusha takes approximately 100m³/s (100 cubic metres per second or tonnes of water per second). With its four turbines at full output, Ardnacrusha can take a flow of up to 400m³/s.

778. When the inflow from Lough Derg into Parteen Basin is higher than 400m³/s, ESB must ensure that the extra water is discharged down the Old River Shannon to prevent the water level in Parteen Basin exceeding 30.86mAOD Malin Head (33.56mAOD Poolbeg). Gates at Parteen Weir are opened gradually to release the excess water to the old course of the River Shannon, to safely pass the excess inflow and return water levels to within the Normal Operating Band.
779. When the inflow from Lough Derg into Parteen Basin is less than 400m³/s, ESB keeps the water level within its Normal Operating Band by controlling how much water passes through the turbines. Using this control of water levels ESB's general practice is to maintain levels at the lower end of the Normal Operating Band in late autumn, in anticipation of higher inflow conditions across autumn and winter.
780. As winter comes to an end, ESB monitors the falling inflows along the length of the River Shannon before cutting back electricity generation in late spring with the general aim to retain water towards the upper end of the Normal Operating Band and to keep it in the upper end of the band through the summer. This is to enable sufficient water for the continual release, (if there is a dry summer), of the statutory flow of 10m³/s down the Old River Shannon alongside further electricity generation, if the inflows rise due to summer rainfall.
781. There are often periods of wet weather in the summer when inflows into Lough Derg will rise and increase the level at Lough Derg. As the inflows from Lough Derg arrives at Parteen Basin, ESB takes that additional water to increase generation at Ardnacrusha (up to 400m³/s). Once the flood flows in the river have passed and the more typical summer flows resume, ESB will normally return to managing water levels in Lough Derg towards the upper end of its Normal Operating Band.
782. In broad scale terms, approximately 90%–95% of the long-term average annual flow in the River Shannon at Parteen Weir (which is approximately 180m³/s), is directed through Ardnacrusha, with the minimum statutory compensation water flow of 10m³/s directed to the lower Shannon at Parteen Weir.
783. The proposed abstraction from the River Shannon would be located on the eastern shore of Parteen Basin, in the townland of Garrynatineel, approximately 3.3km north-east of the Parteen Weir. It is proposed to abstract up to a maximum of 3.47m³/s from Parteen Basin. This represents the projected peak deficit in a drought period, in 2050. Abstraction rates would vary during normal operation up to this maximum; however, more typical abstraction rates would be represented by the average deficit which is projected to be equivalent to 1.78m³/s in 2050.
784. At the maximum rate of abstraction the proposed abstraction of water would equate to a small fraction (approximately 2%) of the long term annual average flow through Parteen Basin.
785. The proposed abstraction of water is in essence, an abstraction from water normally used in the hydro-power plant, using the same existing water level controls, and therefore avoiding having to construct a new impoundment.
786. ESB will continue to maintain water levels as it does today, within its Normal Operating Band and therefore, ESB will facilitate the proposed abstraction of water by the Proposed Project within its current operating practices. As part of an overall agreement with ESB, water will be diverted to the Proposed Project abstraction from the flow that would otherwise have been used for electricity generation on a continuous year round basis. At a practical level, this will mean that ESB, in keeping the water level within

the Normal Operating Band on Lough Derg and within the upper and lower water level on Parteen Basin, will take account of, and respond to, the volume of water abstracted for the Proposed Project, alongside other relevant considerations such as, maintaining statutory compensation flow of 10m³/s down the Old Shannon channel, predicted rainfall, the demand for power and operating practices. ESB will maintain the water levels within the Normal Operating Band on Lough Derg and within the upper and lower water levels on Parteen Basin, as it does currently. Over longer periods there would be a generalised adjustment of the flow going to Ardnacrusha by ESB to respond to the volume of water used by the Proposed Project. However, the operation of Lough Derg, post works, will feel and look very similar to the way it currently operates, and there will not be a visible day to day difference.

787. The minimum statutory compensation water of 10m³/s passed through Parteen Weir into the 'Old Shannon River' will remain unchanged and undiminished under this proposal. Navigation and beneficial uses focused on tourism will experience the same operating water level range as normal.

10.8.2 Operation – Control Philosophy

788. The Control Philosophy refers to how the flow of water through the pipeline would be controlled. This would effectively be done using a SPF which determines the volume of water moving through the pipeline.

789. Uisce Éireann would predict the required daily output from the Proposed Project based on a forecast up to a week in advance. Relatively minor adjustments or refinements to the forecast would be made 12 hours in advance. The required output of water determines the SPF for a given day.

790. The Proposed Project output would then be controlled from the WTP however, the level in the BPT would be the active control level for the entire pipeline. The control systems main task would be to keep this level constant.

791. Between the RWI&PS and the WTP, the WTP would control the rate of abstraction and pumping at the RWI&PS and the treatment process at the WTP in order to provide the required SPF into the CWSTs at the WTP.

792. The flow between the WTP to the BPT, and then further east would be controlled by the rate of pumping at the HLPS which would also operate at the given SPF, (although independently from the WTP, i.e. not trying to match the WTP usual minor fluctuations and with this would pump the SPF to the BPT. minor variations accommodated within the operating range of the CWSTs). Therefore, the HLPS would pump the SPF to the BPT.

793. From the BPT to the TPR the flow in the pipeline and the level in the BPT would still be influenced by the rate of pumping from the HLPS but would be controlled by very fine adjustments to the opening of the FCV.

794. The BPS, when required at higher SPF rates, merely acts as an input of energy to allow flows greater than the maximum gravity flow to be achieved. The BPS pumps would not be able to control flow as precisely as the FCV. Therefore, the BPS would simply be set at the most efficient rate of pumping for the SPF within a given flow control band.

795. There would be no level control on the TPR, (other than automatic shut down of the flows from the BPT in the event of a high-high level alarm), it merely receives water at the SPF rate. It is expected that the TPR level would follow a typical diurnal pattern of dropping during the day and recovering at night.

796. The SPF can be altered at any time but the following would need to happen:

- The WTP needs to adjust the abstraction, RWI&PS and WTP output to match the new set point
- While this is happening the HLPS can be made to match the new SPF
- The FCV would then notice the change in level in the BPT and adjust to match.

797. In the event of a shutdown of the high lift pumps at the HLPS, the flow to the TPR and would have to be stopped to prevent the pipeline from draining. The communications to each of the valves to achieve this would be via the telemetry system.

798. An actuated isolation valve would provide an emergency back-up in the event of a problem with any of the associated FCVs on the connection point pipelines.

10.8.3 System Control

799. The system control refers to how the system would be operated.

800. The overall pipeline system control would be from the central SCADA control. This would be located within the Control Building at the WTP and monitored at Uisce Éireann's National Operations Management Centre.

801. The system control philosophy is to default to 'shut down' in the event of a high-water level or overflow at the BPT or TPR, or in the event of a comms failure between the Infrastructure Sites. Similarly, if the RWI&PS or WTP experience difficulties a signal would be sent to the BPT, TPR and BPS (as necessary) to shut down, to ensure the system remains primed.

802. A controlled shut down of the pipeline from full gravity flow would take around 15 minutes after which the control system would prevent a restart attempt for up to 30 minutes to allow transient pressures to settle in the pipelines.

803. The shut down sequence from full pumped flow would take around 18.5 minutes after which the control system would prevent a restart attempt for up to 30 minutes to allow transient pressures to settle in the pipelines.

804. All critical systems would be provided with an uninterruptible power supply, with a battery back-up, to allow safe control, monitoring and shut-down in the event of power failure.

805. The SCADA system would monitor and/or control all critical system activities, including the following elements:

- RWI&PS – Parteen Basin levels, valve opening status, and pump voltages, currents, flow rates, suction and delivery pressures
- HLPS – valve opening status, and pump voltages, currents, flow rates, suction and delivery pressures, surge system status
- BPT – water levels and position status of inlet and outlet valves for each cell, and flow measurement
- BPS – valve opening status, and pump voltages, currents, flow rates, suction and delivery pressures
- FCV – valve opening status, flow rate and pressures
- TPR – water levels, status of inlet and outlet valves for each cell, and flow measurement
- Line Valves – valve position status

- Pressure monitoring – in-line pressure monitoring at regular intervals along the Treated Water Pipeline from the WTP to the BPT and Treated Water Pipeline from the BPT to the TPR at Line Valve locations
- Impressed-current Cathodic Protection system – voltage, current, status
- Closed-circuit television cameras – security at critical locations, such as RWI&PS, WTP, BPT, BPS, FCV, and TPR entrance gate and boundaries
- Tamper alarms on all Line Valve kiosks – to alert the operators at the WTP of unauthorised access
- Uninterruptible power supply status on all critical systems.

10.8.4 Telemetry

806. Communications between the various Infrastructure Sites and the Line Valve sites would be via a telemetry system. This would be a combination of the following:

- Digital radio (point to multipoint) – This is the preferred method of communications selected for the Infrastructure Sites and the actuated Line Valves, where the location is within the reach of the nearest digital radio backhaul site
- If digital radio is not suitable then 4G cellular would be used, provided that a signal strength of ‘good’ or better is available at the location with a 4G provider (suitable to Uisce Éireann)
- If digital radio is unavailable and there is not a suitable 4G signal strength, then a satellite connection would be provided.

10.8.4.1 Infrastructure Sites

807. Within the Proposed Project, the first-choice telemetry network communications method selected for the above ground infrastructure sites (RWI&PS, WTP, BPT, BPS, FCV and TPR) is for dual redundant connections of digital radio and fixed line broadband.

808. If digital radio is not suitable then 4G cellular should be utilised provided that a signal strength of ‘good’ or better is available at the location with a 4G provider (suitable to Uisce Éireann).

809. If broadband services are not available at any site then either a 4G cellular should be utilised, provided that a signal strength of ‘good’ or better is available at the location with a 4G provider (suitable to Uisce Éireann), or a satellite connection should be provided.

10.8.4.2 Line Valve Sites

810. Within the Proposed Project the first-choice telemetry network communications method selected for the actuated Line Valves is 4G cellular provided that a signal strength of ‘good’ or better is available at the location with a 4G provider (suitable to Uisce Éireann).

811. For sites that fall out with the above qualifications then a satellite connection should be provided.

812. This telemetry communication equipment would be housed inside one of the kiosks located at the Line Valve site.

10.8.5 Cathodic Protection

813. Steel has been selected as the pipeline material as part of the design development of the Proposed Project. One of the features of steel, however, is the requirement for adequate protection against external corrosion attack.

814. As well as the internal and external protective coatings, the steel pipeline would be protected against corrosion by means of a remotely monitored, impressed-current Cathodic Protection system. An impressed-current Cathodic Protection system involves placing a very low continuous voltage (1 or 2 volts) on to the pipeline which can be continuously monitored by the SCADA system. This alerts the operators of changes in system current which may indicate possible damage to the pipe coatings and that may, in the long run, cause localised corrosion. The system would work silently and continuously. The impressed-current Cathodic Protection system requires grounded beds and rectifiers which would be located at Line Valve sites. The grounded beds would be installed in a vertical alignment below ground level and the rectifiers would share the same kiosks and share the same power and SCADA system.
815. Marker posts containing monitoring terminals which are connected directly to the pipeline would be located directly over the pipeline at Line Valve locations and at road crossings along the pipeline length. Periodic routine visits to these marker/monitoring posts can also check that the impressed-current Cathodic Protection system is running as it should.

10.8.6 Maintenance

816. A pipeline conveying treated water, such as the Proposed Project would operate for many years with little maintenance and there is not expected to be frequent maintenance required. Further, there is no requirement for regular cleaning as the pipeline would be transferring clean water.
817. If maintenance on the pipeline is required, then it is probable that at least partial draindown would be required. As this would be a planned event it would be scheduled to suit landowner constraints and appropriate weather conditions with adequate advance notice provided to the landowner.
818. The need to drain a section of the pipeline in operation would be a very rare event, at a typical frequency of perhaps once in every 20 to 30 years, but the design has carefully considered and provided for the circumstances where this could arise. This is set out in the following paragraphs.
819. Line Valves along the pipelines allow sections ranging from 1km to 7km to be isolated such that they can be drained without the need to drain the entire pipeline.
820. Furthermore, the design of the Line Valves is such that up to 60% of the water from one pipeline section can be pumped forward or backward via the bypass pipework to the adjacent sections thus saving water and reducing discharges to the environment. This reduces the volume of water that needs to be managed to draindown a section of the pipeline.
821. Once the pumps at the Line Valve have drained as much as they are able, one or more of the several washouts within the section may be used to drain the water now 'standing' in the pipe. Each washout would discharge either to a watercourse (which may have a permanent outfall but may also be connected by a temporary flexible pipe) or discharge to land.
822. Which washouts are used and the rate of discharge would depend largely on the prevailing conditions, such as:
- Which sub-sections of the isolated section are required to be drained
 - The environmental sensitivity of the watercourse and environs
 - The ease of access to the particular washout
 - The proximity to a watercourse
 - The size of the watercourse and the existing water levels.

823. A discharge to a receiving watercourse would be restricted based on the following:

- Discharge volume limited to <20% Q_{med}
- No discharge if watercourse is in flood (Flow >Q₃₀).

824. The use of a discharge to land would be discussed with the landowner in advance. To control the discharge to land a temporary pond/earthwork would be created which would be used to direct the use of the water and to reduce the velocity of water.

10.8.7 Operational Maintenance Access

825. Operational access for Uisce Éireann, for routine maintenance purposes, would be conferred under the 20m Permanent Wayleave along the length of the pipeline, as described in Section 10.3.

826. In areas of Bord na Móna land which have been subject to peat extraction and rehabilitation, alternative access routes into the line valves and air valves have been discussed and agreed in principle. This has been done to avoid Uisce Éireann needing to use the permanent wayleave and avoid either:

- The need to drain areas of peat / rehabilitated peat to gain route maintenance access
- The need for a permanent floating road.

11. Pipeline Features

827. The RWRMs and Treated Water Pipeline would incorporate a number of key pipeline features, namely:

- Line Valves to allow elements of the pipeline to be isolated for operation and maintenance purposes (Section 11.3)
- Chambers around the Line Valves to protect the valve and enable access for maintenance purposes (Section 11.3)
- Lay-bys at Line Valves to allow safe access to the valves (Section 11.3)
- Cathodic Protection beds at the Line Valves to monitor the pipeline (Section 11.3)
- Washout Valves to allow sections of the pipeline to be drained down, if required (Section 11.4)
- Air Valves to facilitate removing air from the pipeline (Section 11.5)
- Manways to provide access to the pipe once operational (albeit it would be necessary to excavate down to them) (Section 11.6)
- Potential future connection points to the pipeline within the Water Supply Area (Section 11.7).

828. The pipeline features would be required for the entire length of the pipeline and the number of valves is summarised in Table 11.1. Image 11.1 provides an overview of pipeline features along the length of the pipeline.

Table 11.1: Valve Types and Number

Valve Type	Treated Water Pipeline (WTP to TPR)	Raw Water Rising Mains	Total
Line Valves (including Washout, Air Valves and Manways)	49	2	51
Washout Valves:			
• Discharge to a watercourse with permanent outfall	39	-	39
• Discharge to a watercourse without a permanent outfall	57	-	57
• Localised discharge to ditch / land	91	-	91
• Incorporated within Line Valve installation (no discharge during operation).	49	-	49
Air Valves			
• Dedicated	287	2	289
• Incorporated within Line Valves installation.	30	2	32
Potential future connection points	3	1 (at the WTP)	4
Manways:			
• Dedicated	64	4	68
• Incorporated within Air Valves and Line Valves	389	-	389
• Co-incident with Washouts.	110	-	110

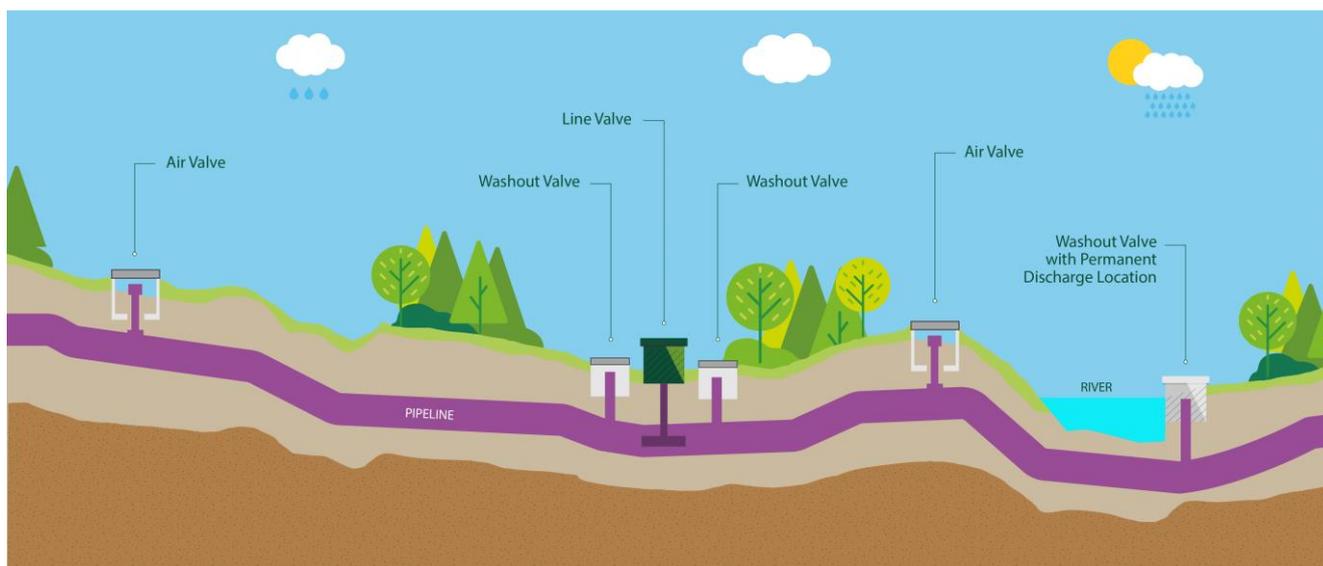


Image 11.1: Overview of a Pipeline Section Showing Pipeline Features

11.1 Construction Flexibility

11.1.1 Pipeline Features

829. In relation to the positioning of pipeline features, the design process has identified suitable locations for these features. However, if there were a change in the vertical or horizontal profile as a result of the Construction Flexibility defined in Section 10.4, this could affect the precise location of some of the valves, which have to be above the pipe itself.

830. Consequently, the pipeline features, specifically, Valves, Manways and Chambers, have the flexibility to move within the same 20m Pipeline Corridor as the horizontal alignment of the pipeline. However, this is subject to the following constraint:

- Those features must remain within the same parcel/folio of land in which they are currently proposed.

831. The location of the Lay-Bys would not vary because they are constrained by the Planning Application Boundary.

11.1.2 Outfall Connections

832. Some of the Washout Valves along the length of the pipeline would have a permanent outfall to a watercourse. To get the water from the Washout to the outfall there would be a connecting pipe. To provide construction flexibility to overcome onsite obstacles or constraints a 10m wide corridor has been defined within which the pipe would be located. This corridor has been defined by a 5m width either side of the centre of the connecting pipe alignment as current proposed i.e. 10m in total.

11.1.3 Outfall Headwalls and Discharge

833. For the Washouts with a permanent outfall, the outfall headwalls and discharge point would have to have the construction flexibility to move with the alignment of the outfall pipe. Therefore, the discharge point would have the flexibility to move within the same 10m corridor as the pipe, as defined in Section 10.1.2. The headwalls would need the flexibility to move further because they step out from the pipe. To allow for

appropriate construction flexibility, the headwalls could move 10m either side of the current pipeline alignment. Therefore, a total construction flexibility width of 20m has been defined.

11.2 Valve Location Optimisation

834. The number and spacing of the various valves have been optimised based on the time taken to drain, repair and recharge the pipeline at any location along its length. An approximate 36-hour outage time has been applied for the pipeline design.

835. In order to minimise the drain down time, the vertical alignment of the pipe has been designed to maximise the volume of water that drains to Line Valves. This would allow the water to be pumped round the closed valves at Line Valves which would avoid wasting water and has the highest flow rate to drain the pipe.

836. Where draining around a Line Valve is not achievable, the design then prioritises Washouts to larger watercourses where high discharge rates would be acceptable, followed by Washouts to smaller watercourses and finally local Washouts to land.

11.3 Line Valves

837. There would be 51 Line Valves located along the pipeline. (This does not include valves at the Infrastructure Sites which are not defined as Line Valves). Line Valves would be installed on the RWRMs and Treated Water Pipeline to enable all sections of the pipeline to be isolated, drained and recharged during the Commissioning Phase and for maintenance purposes during the Operational Phase.

838. The spacing of Line Valves is a function of the topography and the capacity and suitability of the nearby watercourses to receive water from washouts. The average spacing between the Line Valves is 3.3km. The Line Valves have been sited adjacent to public roads, where reasonably practicable, to facilitate operational inspection and maintenance. Access to the Line Valves would be facilitated, in most instances, by a permanent Lay-Bys at the road edge.

839. A power supply would be required for the Line Valves, and a mains power supply connection to the nearest LV/MV overhead power line would be facilitated by ESB Networks.

840. Each Line Valve installation would incorporate a bypass pipework arrangement and washout facility designed to maximise the potential to pump treated water around the Line Valves to sections not undergoing maintenance works. This would reduce the quantity of water to be discharged to the environment during draindown of any pipeline sub-section.

841. Generally, pipe sections would be drained partially around the Line Valve bypass pipework under gravity and then by the use of temporary, mobile pumps which would need to be brought to site. A permanent installation of the pump in each location would not be necessary given how infrequently it would be required. However, this means that sufficient space would be required at the Line Valves to allow safe placement and removal of the temporary pumps. This has been accounted for in the design of Lay-Bys and accommodated within the increased width of the Permanent Wayleave at each Line Valve.

842. The Line Valves would be actuated 'butterfly valves' which rotate to open and close within the pipe. These are considered to be the most effective valve type for the needs of the Proposed Project and have a proven track record for robustness and reliability. The butterfly valves would be in the Line Valve Chamber along with the actuator.

843. For four of the Line Valves it is proposed that the surrounding land would need to be raised slightly, using suitably graded embankments to match the ground levels of the adjacent road for future access during

the Operational Phase. A fence would be required at the top of these embankments for safety. These are the valves at the following locations:

- TWA-14100
- TWC-9000
- TWD-8100
- TWE-100.

11.3.1 Line Valve Chambers

844. Each of the Line Valves would be housed in a below-ground concrete chamber. The chamber would contain the principal valve and associated powered actuator along with pressure instruments, flood detection and control equipment. The chamber allows this equipment to be protected and to be more easily accessed during the operation of the pipeline.

845. The chamber would be 5.8m wide by 5.8m long. The depth of each of the chambers would vary depending on the pipe depth of the pipeline at the location of the Line Valve.

11.3.2 Kiosks

846. In addition to the chamber a pair of kiosks (or a single co-joined kiosk with separate secure access, see Image 11.2) would be installed close by each Line Valve but offset at a sufficient distance to permit safe work on the pipeline if needed. One kiosk would house the ESB connection, isolator and meter. The other would house the PLC, telemetry and SCADA systems.



Image 11.2: Photograph of a Typical Kiosk Arrangement

11.3.3 Lay-Bys

847. At Line Valve locations adjacent to roads, Lay-Bys would be constructed to facilitate safe working during planned periodic maintenance of the Line Valves and associated electricity supply kiosks. Lay-Bys would allow sufficient space for a delivery vehicle to park beside the installation and place/remove the temporary pumps required to facilitate the bypass required during a draindown. The kiosks would be located adjacent to the Lay-Bys.

848. There would be 43 Lay-bys.

849. The majority of the lay-bys would be adjacent to public roads however four of the lay-bys would be accessed from a private road and a Right of Way is being acquired as part of the Proposed Project in order to allow Uisce Éireann to get to these locations.

11.3.4 Cathodic Protection

850. The impressed-current Cathodic Protection system would require grounded beds and rectifiers which would be located at Line Valve sites. The grounded beds would be installed in a vertical alignment below ground level and the rectifiers would share the same kiosks and share the same power and SCADA system.

851. Marker posts containing monitoring terminals which are connected directly to the pipeline would be located directly over the pipeline at Line Valve locations and at road crossings along the pipeline length. Periodic routine visits would be undertaken to check these marker/monitoring posts and that the impressed-current Cathodic Protection system is running as it should.

11.4 Washout Valves

852. Washout Valves would be located at low points along the pipeline. These valves would be used during testing and commissioning when sub-sections of the pipeline are undergoing hydraulic testing prior to commissioning to empty sections of the pipeline of test water which cannot be pumped to adjoining test sections.

853. During pipeline operation, it is very rare that these valves would be used, as sections would only infrequently need to be drained down. They would generally only be required for emptying sections of the pipeline where necessary for emergency repairs or possibly for cleaning programmes every 20 to 30 years. Even then, the Washout Valves would only be used to drain short sections of pipeline, which cannot otherwise be drained to either end of the pipeline section due to the topography.

854. The number of Washouts is a function of the topography and the capacity of the receiving streams to accept the discharge. This has been based on a commitment to restrict any single discharge to 20% of the associated stream's median annual flood flow rate (Q_{med}). This has been achieved through a combination of the strategic location of Line Valves to isolate sections of pipeline and by limiting the draindown in any given section.

855. Washout Valves would include a secondary guard valve to ensure reliable operation under a range of conditions including emergencies. This also permits the Washout Valves to be regularly 'exercised' to ensure they are fully operational without the need to discharge water; since one or other of the valves can remain closed at all times.

856. Washout Valves would be directly buried below the surface and can be re-excavated in the very rare event of a problem that requires the valve to be replaced. The valves would incorporate extended telescopic spindles accessed via surface boxes at ground level.

857. Washout Valves do not require a power supply, as operation is by a standard 'valve key and bar' which can be operated manually.

858. Discharges from the pipeline would require dechlorination prior to discharge to the environment. This would be achieved by using dechlorination tablets at the Washout locations. Tablets would be placed within a perforated basket allowing water to pass through. Dechlorination would be achieved almost immediately on contact with the tablets. This method provides the most flexible approach for the removal

of low chlorine residual and is suited to the infrequent operation of the Washouts. The level of residual chlorine reduced to <0.005mg/l as required by the Salmonid Regulations.

859. There would be 236 Washout Valves in total. Of these, 49 would be Washout Valves incorporated in the bypass pipework at each Line Valve installation. (The two Line Valves on the RWRMs do not have washouts). These would be used during operation to move the water from one section of the pipeline to the next as part of the drain down strategy. However, the 49 Washouts at Line Valves would not be used to discharge water from the pipe during operation. (Some of them would be used to discharge water during commissioning and some would only be used to move water from one section of the pipe to another).

860. Therefore, excluding the 49 Washout Valves incorporated in the bypass pipework at each Line Valve installation, there would be a further 187 Washout Valves along the length of the pipeline. These would be used during the Commissioning Phase (as described in Chapter 5 (Construction and Commissioning)) and could be used in the event of a drain down of the pipeline during its operation. The Washouts are divided into three types which are described in Section 11.4.1 to Section 11.4.3.

11.4.1 Washouts – Permanent Discharge Locations with Permanent Outfall (39 no.)

861. Where possible, the pipeline design has strategically located Washout Valves close to watercourses, so that water can be discharged into the watercourse at a controlled rate when the pipeline is drained. For the Permanent Discharge Locations with permanent outfalls, a buried pipeline would connect the water supply pipeline to a fixed permanent outfall structure on the bankside of the watercourse. The connecting pipeline would be a maximum of 600mm nominal diameter. The outfall structure would contain a stilling basin that would be used both for dechlorination and for decelerating the discharge velocity to avoid any scour in the watercourse.

11.4.2 Washouts – Temporary Discharge Locations (57 no.)

862. Temporary Discharge Locations are washouts where water can be discharged into a nearby watercourse at a controlled rate through temporary pipework such as a flexible hose. In most instances the washout is close to the watercourse, typically within 100m. However, in some cases the temporary pipework would be laid across adjacent fields to the watercourse. There would be 57 Temporary Discharge Locations along the length of the pipeline. Water from these Temporary Discharge Locations would be discharged responsibly at rates of up to 25l/s.

11.4.3 Washouts – Local Discharges (91 no.)

863. Where no sufficiently sized watercourse would be available within 100m of the Washout, the water would be discharged to the adjacent land and would be allowed to soak away responsibly, taking into account local conditions at that time. There would be 91 Washout locations where no sufficiently sized watercourse is available within 100m of the Washout for a permanent discharge. For 51 of these locations, the discharge would be to small ditches and field drains which would ultimately discharge to larger watercourses. For the remaining 40 locations, the water would be discharged to the adjacent land and would be allowed to soak away responsibly, taking into account local conditions at that time, including use of a temporary bund/pond where necessary, at rates of up to 15l/s. There would be no direct discharges to groundwater and water would only be discharged to land where it is appropriate to do so.

11.5 Air Valves

864. There would be a total of 321 Air Valves along the pipeline. 32 of these would be incorporated with a number of the Line Valve installations. There would be 289 stand-alone Air Valves.

865. The control of air in the pipeline is critical for initial filling and priming, efficient operation and for draindown and recharge. Air Valves of a 'double orifice' type would be provided for the following purposes:

- To permit air to be vented in or out of the pipeline when filling or emptying
- To release accumulated air during normal operation, which may be entrapped in the water from pumping or which comes out of solution from the water at lower pressures
- To prevent vacuum pressures from forming by admitting air into the pipeline, when emptying sections for maintenance.

866. Where possible, within the constraints of topography and draindown times, Air Valves would be located in verges and near field boundaries to limit the impact on landowners and to permit easy access for maintenance.

867. Air Valve chambers for the RWRMs and Treated Water Pipeline would be elevated relative to pre-existing ground levels. This would reduce the potential for drainage into the chamber itself and also mitigate against contamination of the Treated Water Pipeline should it be necessary to drain the pipeline down. The Air Valve chamber would protrude 1m above the existing ground level.

11.6 Manways

868. Manways would be used during commissioning to facilitate the disinfection of the pipeline during the initial filling. After this they are used only in very rare circumstances to facilitate access to the pipe.

869. The Manways consist of a tee pieces inserted into the pipeline, closed with a blank flange and buried with the pipeline. To access the pipeline, it would be necessary to excavate down to the blank flange.

870. Manways are located on either side of every Line Valve if there is not an Air Valve already there and are also spaced throughout the pipeline route to ensure access is provided at least every 550m. In total there would be

- 68 dedicated Manways
- 321 Manways provided as part of an Air Valves
- 68 Manways at Line Valves
- 110 Manways at Washout locations.

11.7 Potential Future Connections – Take Off Point Locations

871. In line with the Project Objectives and the Preferred Approach set out in the Eastern and Midlands Plan (Irish Water 2022), provision has been made for potential future connections along the route of the pipeline. There would be four potential future connections.

872. One of these, at the WTP, would be unique and would involve a pipeline from the Clear Water Balancing Tank and routed along the access road to the WTP, terminating with a blank flange at the junction of the access road and the R445 (in the townland of Kilmastulla).

873. The other three would be on the pipeline itself and include a tee piece to allow another pipeline to be connected to the Proposed Project, at a later stage, with no disruption to the operation of the Proposed Project. The potential future connections are summarised in Table 11.2.

Table 11.2: Summary of Future Potential Connections

Chainage	Road Name/No.	Name	Townland	County
From WTP	WTP access road	1a Newport/Killaloe	Greenhills	Tipperary
TWA – 1990	R491	2a Newtown/North Tipperary	Newtown (Guest)	Tipperary
TWB – 17340	L6052	3a Tullamore/Mountbolus	Killananny	Offaly
TWC – 19770	R400	4a Mullingar Regional	Ballyhugh Springfield	or Offaly

874. The Take-Off Points on the Treated Water Pipeline from the BPT to the TPR would each comprise an 800mm tee off the Pipeline and initially would be terminated at twin isolation valves and a blank flange. The valves would isolate the main line from the future connecting branch and permit the blank flange (essentially a plate bolted to the free connection end) to be safely removed when making the new connection.

875. When demand requires the new connection at these locations, the blank flange can be removed and the local trunk main can be connected to the valves and brought into operation without affecting the operation of the main pipeline.

876. The first potential future connection point listed in Table 11.2 would be directly from the WTP and has been included as part of the Proposed Project. A pipeline would be provided from the CWSTs and routed along the access road to the WTP, terminating with a blank flange at the junction of the access road and the R445.

877. The pipelines which would be required to connect to these potential future connection points to the local mains network would be the subject of a stand-alone project with its own development consent process.

11.8 Operation and Maintenance of Pipeline Features

878. The Valves have been included in the design in order to facilitate the operation and maintenance of the pipeline.

879. The operation of the valves would vary based on their purpose. Although the Line Valves and Washouts would be critical to draining down the pipeline this would only be an exceptional circumstance. They would generally only be required for emptying sections of the pipeline where necessary for emergency repairs or possibly for cleaning programmes every 20 to 30 years. However, given the importance of the valves, if required to be used, and the infrequency of their use regular inspections and exercising would be undertaken to ensure that the valves remain operational.

880. Similarly, although a large number of Manways have been included in the design it would only be in very rare situations that these would be used.

881. In contrast the air valves would be used more regularly to manage air within the pipeline.

882. As a result, all valves would be exercised regularly to check satisfactory operation. A permanent dedicated team would maintain the Treated Water Pipeline checking all valves at least every six months.

883. Suitable Line, Bypass, Washout and Air Valves and other ancillary items would be kept in the strategic stock at suitable locations in case of emergencies.

884. The Cathodic Protection would operate continuously and this is described in Section 10.8.7.

12. 38 kV Uprating Works – Power Supply to RWI&PS and WTP

12.1 Purpose of the 38 kV Uprate Works

885. The purpose of the 38 kV Uprate Works is to provide the new power supply needed for the RWI&PS and WTP.
886. The works needed would entail uprating the existing Ardnacrusha – Birdhill (38 kV overhead) Line running from poleset 6B north of Ardnacrusha Substation, in County Clare, in a north-easterly direction and terminating at the Birdhill 38 kV Substation in County Tipperary. The works would also include the removal of polesets on the Ardnacrusha – Birdhill – Nenagh Line and replacement with a double-circuit underground cable and works at the Birdhill 38 kV Substation.
887. The existing single-circuit overhead line carries one set of three conductors, which comprises one complete distribution circuit. The Ardnacrusha – Birdhill Line (northern line) forms one part of a loop circuit between the substations of Ardnacrusha and Birdhill, with the second main element being the Ardnacrusha – Birdhill – Nenagh Line (southern line).
888. With the exception of the area around Ardnacrusha, the line largely travels through areas of agricultural farmland and avoids any major settlements. The Ardnacrusha – Birdhill Line leaves Ardnacrusha Substation in a northerly direction, travelling through a predominantly residential area before turning in a north-easterly direction. The line then travels in a general easterly direction through predominantly rural, agricultural land. The line crosses the Headrace and the Lower River Shannon to the west of O'Briensbridge. This part of the River Shannon forms part of the Lower River Shannon SAC. The line then continues in an easterly direction until it terminates at Birdhill 38 kV Substation.
889. The initial section of the Ardnacrusha – Birdhill Line is currently an overhead line carried on six structures from Ardnacrusha Substation to poleset 6B. However, this is due to be converted to an underground cable, as part of works planned by the ESB. This line runs alongside the initial part of the Ardnacrusha – Tulla Line as it leaves Ardnacrusha Substation and comprises a double-circuit 38 kV line. There are no works proposed on the Ardnacrusha – Tulla Line as part of the Proposed Project. The remainder of the line is an existing overhead line and it is this section that would be subject to upgrade works including line replacement and replacement of polesets as part of the Proposed Project.
890. The existing Ardnacrusha – Birdhill Line passes through three counties: Clare, Limerick and Tipperary.
891. The existing Ardnacrusha – Birdhill – Nenagh Line, which links Ardnacrusha Substation with Birdhill Substation and Nenagh Substation, consists of similar polesets and structures to the Ardnacrusha – Birdhill Line. As part of the Proposed Project, the section of this overhead line from the Birdhill Substation passing over the R445 and running proximal/adjacent to the east of the R494 would be removed and replaced with a 38 kV double-circuit underground cable. This work would be within County Tipperary.

12.2 Design

892. The Ardnacrusha – Birdhill (northern line) 38 kV overhead line comprises 110 structures (polesets/steel towers), where works would be carried out, including replacement/uprating of 15 of the structures.
893. The existing lines have been in place for approximately 70 years and are primarily constructed on double wooden polesets with a number of portal towers and steel lattice towers where the lines terminate. Image 12.1, Image 12.2 and Image 12.3 provide an overview of typical structures on both lines.

894. Wooden polesets are embedded in the soil at a depth of 2.3m, while lattice towers have concrete foundations under each leg extending to 2.5m x 2.5m x 2m. Polesets and towers range in height from 12m to 18m. Currently, the span lengths on both 38 kV lines vary from 57m to 180m, with mid-span ground clearance ranging from 6.4m to 16.7m.

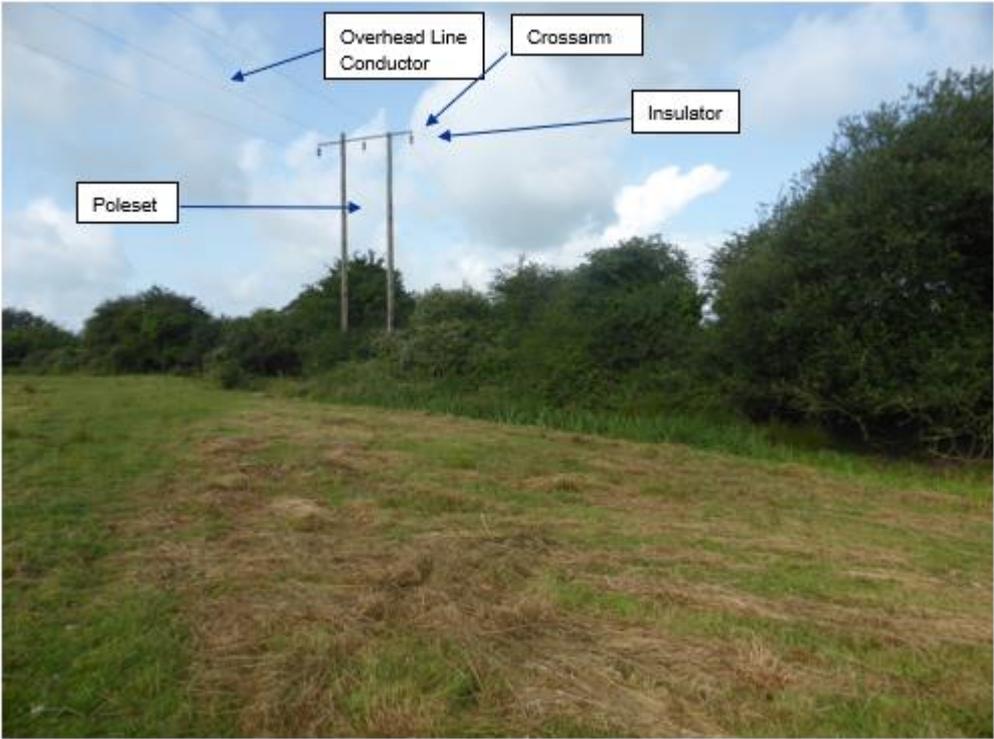


Image 12.1: Existing 38 kV Single-Circuit Overhead Line and Intermediate Wooden Poleset Structure

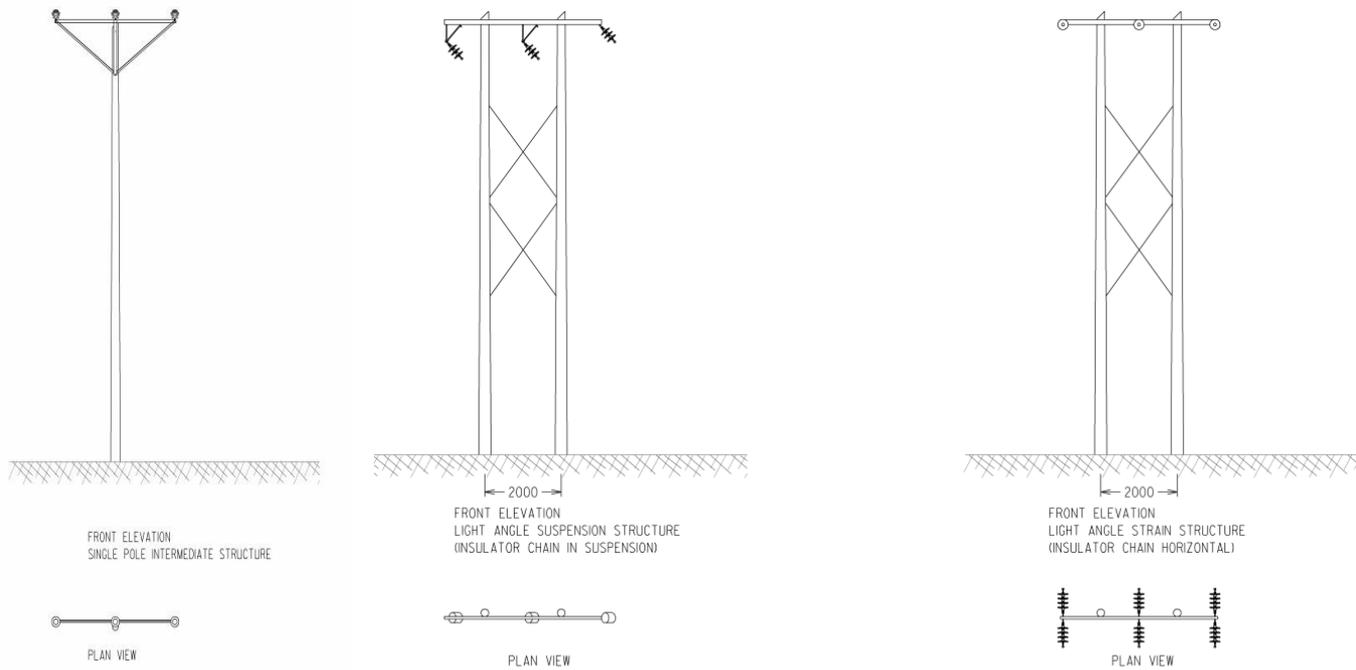


Image 12.2: Typical 38 kV Structures

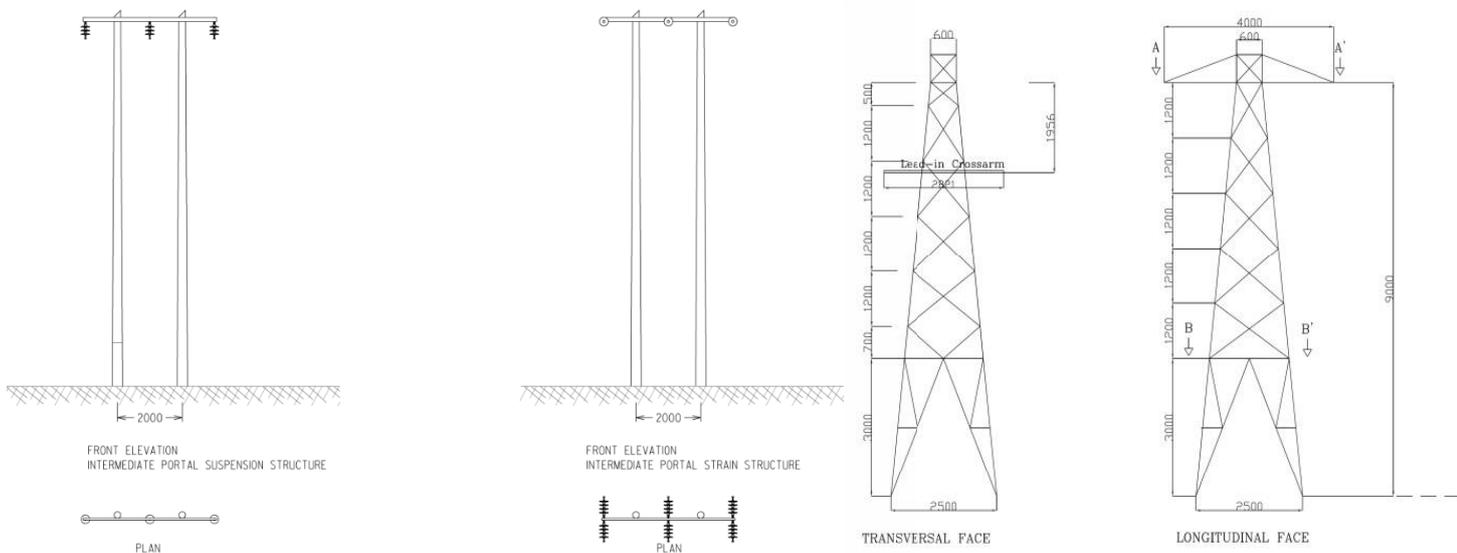


Image 12.3: Typical 38 kV Structures (contd.)

895. The current Ardnacrusha – Birdhill Line is strung with 50mm² copper conductor while the Ardnacrusha – Birdhill – Nenagh Line is strung with a 92mm² Aluminium Conductor Steel Reinforced (ACSR) conductor. It is proposed that both these overhead conductor types would be replaced by new 150mm² All Aluminium Alloy Conductors (AAAC). The equivalent AAAC have approximately the same ampacity and strength as their ACSR counterparts with a much-improved strength-to-weight ratio and also exhibit substantially

better electrical loss characteristics than their equivalent ACSR constructions. The thermal coefficient of expansion is also greater for AAAC than that of ACSR.

896. In order to meet the power requirements of the RWI&PS and WTP, certain structures, conductors and fittings need to be replaced, together with the installation of a double-circuit underground cable running from Birdhill Substation to the existing poleset 242.

12.2.1 Categorisation of the Proposed 38 kV Uprate Works

12.2.1.1 Extension of Existing 38 kV Substation at Birdhill

897. Works internal to the existing Birdhill 38 kV Substation would include the following:

- Site clearance and removal of existing poles and a portion of fencing
- One new 38 kV Gas Insulated Switchgear modular building, maximum 4.8m high and floor area of 28m²
- Provision of electrical plant and equipment, new poles and three 4m lighting poles
- All site works, including internal access road and new 2.6m high palisade fence
- Provision of all site services including drainage.

12.2.1.2 Ardnacrusha – Birdhill 38 kV Line Uprate

898. The Proposed 38 kV Uprate Works on the Ardnacrusha – Birdhill 38 kV Line would commence at existing poleset 6B and terminate at Birdhill Substation.

899. The categories of works involved in the uprating of the line are summarised below:

- Fittings replacement – this would involve removing existing fittings and then installing new fittings. These include smaller-scale items such as brackets, insulators and clamps. This would generally be required at all polesets as the existing fittings are not suitable to carry the new 150mm² AAAC conductor
- Replace crossarm and fittings – this would involve removing crossarm and fittings and then installing new crossarm and fittings. This would generally be required at all polesets as the existing fittings are not suitable to carry the new 150mm² AAAC conductor
- Replace intermediate poleset structures – this would involve removing all associated fittings and stays, and cutting and removing the poles, then installing new poles, stays, crossarm and fittings. The replacement polesets would be located immediately adjacent to the existing polesets
- Replace angle structures – this would involve removing the structure and all associated fittings, then constructing the new structure and installing fittings. The replacement angle structures would be located immediately adjacent to the existing angle structures
- Replacing the conductor – this would involve re-stringing by pulling the conductor between the angle masts across the entire line
- Mid-span conductor joint installation at the stringing location.

900. Currently, there are a total of 110 structures on the Ardnacrusha – Birdhill Line. For this line, 14 replacement polesets would be required together with one new replacement tower. Replacement polesets would be located immediately adjacent to existing polesets. Once a new poleset is installed, the existing poleset would be removed.

12.2.1.3 Ardnacrusha – Birdhill – Nenagh 38 kV Line Cabling Works

901. For the Ardnacrusha – Birdhill – Nenagh Line, a section of the line currently located on the eastern side of the R494 would be undergrounded. This would involve the retirement and removal of 10 existing polesets and one tower and the provision of a twin 38 kV underground cable running from Birdhill Substation to the existing poleset 242.

902. The work would result in a minor reconfiguration of the current Ardnacrusha – Birdhill – Nenagh Line. Due to the retirement of the existing polesets along the R494 and the provision of a twin 38 kV underground cable, a second Ardnacrusha – Birdhill circuit would be created. The twin 38 kV underground cable would also form a new Birdhill – Nenagh circuit.

12.2.2 Summary of the 38 kV Uprate Works

903. Table 12.1 provides a summary of the Proposed 38 kV Uprate Works.

Table 12.1 Summary of Proposed 38 kV Uprate Works

Proposed Uprate Works	Number of Structures
Ardnacrusha – Birdhill Line (Northern Line)	
Polesets/structures to be replaced/uprated	15
Replacement of fittings and conductor	110
Polesets located in SAC (number to be replaced)	3(0)
Ardnacrusha – Birdhill – Nenagh Line (Southern Line)	
Structures to be removed and replaced with underground section	11

12.3 Operation and Maintenance

904. The Proposed 38kV Uprate works are works to the existing electricity network and so would become part of the main network operated and maintained by ESB Networks in accordance with its standard operational practices.

905. There would be no permanent access routes constructed for the 38 kV Uprate Works. Future access would be under ESB Network’s existing wayleaves.

13. Energy

906. Uisce Éireann is committed to designing, building and operating assets to ensure energy efficiency. The plant, equipment, building and systems associated with the Proposed Project would be designed, equipped, operated and maintained in such a manner as to ensure a high level of energy performance and that energy is used efficiently.

907. The Proposed Project would be designed following the requirements set out in IS 399 Energy Efficient Design Management (Sustainable Energy Authority of Ireland (SEAI) and National Standards Authority of Ireland 2014) and IW-TEC-600-04 Energy Efficient Design Standard (Uisce Éireann 2024). In addition, the Proposed Project will align with AMS-SI-POL-007 Energy Policy (Uisce Éireann 2025) and the requirements of ISO 50001:2018 Energy Management Systems. These standards require that any design features or methods that may reduce energy consumption are considered, and the process of their consideration is clearly documented.

908. Directive EU/2024/1275 of the European Parliament and of the Council on the energy performance of buildings (Energy Performance of Buildings Directive) requires a reduction in greenhouse gas (GHG) emissions by at least 60% in the building sector by 2030 compared to 2015, achieving a decarbonised, zero-emission building stock by 2050 and significant increases in the amount of on-site renewable energy used in buildings. This aligns with the requirements of EU/2023/1791 (the revised Energy Efficiency Directive). A lifecycle assessment and embodied carbon calculation is included in Chapter 13 (Climate) of the EIAR and a PAS 2080 (British Standards Institution (BSI) 2023) process would be followed during detailed design and into construction.

909. The detailed design would account for this and would also follow SEAI guidelines, including:

- Development of energy balances
- Determination of the minimum achievable energy performance indicator for the design
- Energy benchmarks
- Preparation of Measurement and Verification Plans to detail how the energy performance of the design would be measured and verified as per ISO 50015:2014 Energy management systems — Measurement and verification of energy performance of organizations — General principles and guidance (International Organization for Standardization (ISO) 2014).

910. Where possible, the Proposed Project would procure equipment and vehicles classified as Triple E or equivalent.

13.1 Energy Efficient Design

13.1.1 Pumping

911. The need for pumping cannot be avoided due to the topography between the River Shannon and Dublin. However, by specifying high-efficiency pumps and motors, and the use of variable speed drives for both the HLPS and BPS, energy use would be optimised for the required water demand.

13.1.2 Treatment Process

912. The proposed design of the treatment process is a conventional process of coagulation/flocculation followed by clarification, filtration and disinfection. Each element of the process has been sized in accordance with Uisce Éireann's WTP design guidelines (IW-TEC-900 series).

13.1.3 Process Wastewater

913. The WTP has been designed to allow for the recirculation of appropriately treated process water to the head of the works, as it would reduce the volumes of raw water that would otherwise need to be delivered to the WTP and reduce the energy consumption of the RWI&PS, by approximately 5%.

13.1.4 Pipeline Sizing

914. In designing the Treated Water Pipeline that would convey the treated water from the WTP to the GDA WRZ, several different options were considered, using a variety of pipe and pump configurations. This had to consider that the smaller the pipeline the more pumping would be required to move the peak flows through the pipeline. The larger the pipeline diameter the more use could be made of gravity but the larger the amount of material and embodied carbon in the pipeline itself. The option chosen for this Proposed Project was made on the basis of the lowest TOTEX. As such, the OPEX (and thus the energy requirements of any pumps) were considered and incorporated into the decision-making process.

13.2 Energy Demand

915. An energy demand assessment has been performed with consideration for the local ESB electricity distribution network in the areas relating to supply to the proposed RWI&PS, WTP, BPT, BPS, FCV and TPR.

916. The assessment has also been carried out with consideration for the wider electricity network and the ability of the system operator to ensure that supply meets demand. The baseline environment considered is based on the latest figures available in the All-Island Generation Capacity Statement 2023–2032 (EirGrid 2024).

13.2.1 Raw Water Intake and Pumping Station (RWI&PS)

917. The main energy users of the RWI&PS would be the raw water pumps. It is expected that for an output of 154Mld and, 300Mld, the total energy consumption of the RWI&PS would be 26,946kWh/day and 52,401kWh/day respectively in 2050.

918. The total annual electricity demand for the proposed RWI&PS in 2050 would be approximately 9.8GWh.

13.2.1.1 Water Treatment Plant (WTP)

919. The WTP is designed to allow water to flow as far as possible by gravity through the plant; however, there is a requirement for inter-stage pumping. The treated water would be stored in the CWSTs and would be pumped onwards by the HLPS. The HLPS would deliver treated water to the 1,600mm nominal diameter Treated Water Pipeline from the WTP to the BPT which would convey the water to the BPT. The HLPS would consume the majority of energy associated with the WTP. For an output of 300Mld, the expected total energy consumption of the HLPS would be 123,120kWh/day and for an output of 154Mld, the expected total energy consumption would be 82,080kWh/day.

920. The proposed WTP (excluding the HLPS) would have a total energy consumption of 50,895kWh/day for an output of 154Mld and a consumption of 68,481kWh/day for an output of 300Mld in 2050. The combined power requirements of the WTP and HLPS, would be approximately 132,975kWh/day for an output of 154Mld and 191,601kWh/day for an output of 300Mld.

921. The total annual average electricity demand for the proposed WTP and HLPS in 2050 would be approximately 48.5GWh.

13.2.1.2 Break Pressure Tank (BPT)

922. It is expected that the total energy consumption of the BPT would be approximately 2,757kWh/day at an output of 300Mld and 1,496kWh/day at an output of 154Mld. The OSEC would account for the largest proportion of this demand.

13.2.1.3 Booster Pumping Station (BPS)

923. It is expected that the total energy consumption of the BPS would be low most of the time since it would be in standby mode, perhaps averaging 463kWh/day across the year including the maintenance runs on the pumps.

924. When pumping at peak output, 300Mld the power requirement would be around 4.6MW, which would consume about 111,144kWh/day for the two to three-week duration.

13.2.1.4 Termination Point Reservoir (TPR)

925. It is expected that the total energy consumption of the TPR would be 2,757Wh/day at an output of 300Mld and 1,232kWh/day at an output of 154Mld. The OSEC would account for the largest proportion of this demand.

13.2.2 Energy Demand Summary

926. The total annual average power consumption for an output of 154Mld is summarised in Table 13.1.

Table 13.1 Annual Average Power Consumption in 2050 at a Typical Operational Flow of 154Mld

Site	Approximate Average Daily Consumption in 2050 (kWh/day)	Approximate Annual Average Consumption in 2050 (MWh/annum)
RWI&PS	26,946	9,835
WTP	50,895	18,577
HLPS	82,080	29,959
BPT	1,496	546
BPS	463	169
TPR	1,232	450
FCV	188	69
Total	163,300	59,605

14. Route-Wide Construction Matters

14.1 Basis of Construction

927. Sections 4–12 set out construction information relevant to specific infrastructure elements of the Proposed Project. This section provides additional information on route-wide construction matters. A full description of the construction of the Proposed Project is provided in Chapter 5 (Construction and Commissioning) in the EIAR.

14.1.1 Delivery of Construction

928. The delivery of the construction of the Proposed Project is based on the division of the works into geographic sections as outline in Table 14.1. This is necessary to allow a linear project to be delivered efficiently.

Table 14.1: Construction Sections for the Proposed Project – Water Supply Infrastructure

Geographic Section	Key Project Elements Included in geographical section of the Proposed Project	Associated Construction Compounds (CC) and Pipe Storage Depots (PSD)	Pipeline Features and Ancillary Pipe Infrastructure								
			Line Valves	Washout Valves	Air Valves	Flow Control Valve	Connection Points	System Control	Kiosks	Lay-Bys	Cathodic Protection
1	RWI&PS, RWRMs and WTP. Section includes approximately 2km of twin pipeline,	CC0 RWI&PS CC1 WTP	✓	-	✓	-	✓	✓	✓	✓	✓
2	Treated Water Pipeline between TW – 0 and TWA – 2000, including the BPT. Section includes approximately 39km of pipeline,	PSD1 Carrigatogher CC2 Lisgarrieff CC3 BPT	✓	✓	✓	-	-	✓	✓	✓	✓
3	Treated Water Pipeline between TWA – 2000 and TWC – 7860 (R420), including the BPS Section includes approximately 62km of pipeline	PSD2 Toora PSD3 Boveen PSD4 Fortel CC4 BPS PSD5 Derrinboy CC5 Killananny PSD6 Derryweelan	✓	✓	✓	-	✓	✓	✓	✓	✓
4	Treated Water Pipeline between TWC – 7860 (R420) and TWE – 17870 (TPR) including the TPR Section includes approximately 69km of pipeline)	PSD8 Rathlumber CC6 Drummond PSD9 Graiguepottle PSD10 Barberstown Upper CC7 TPR	✓	✓	✓	✓	✓	✓	✓	✓	✓

929. There may be additional packages of work required including, for example works:

- The Proposed 38 kV Uprate Works
- Power connections to Line Valves and the BPS
- Commissioning the pipeline.

930. Each of the individual sections or phases of works would be scheduled so that substantial construction completion is achieved in good time to allow commissioning of the whole pipeline in the final year of the Construction Phase.

14.1.2 Sequential Delivery of Construction Works

931. It is anticipated that each section of works would broadly be delivered in a west to east sequence and that further, a Contractor would aim to complete a length of pipeline construction between two access points in a single year.

932. There would be exceptions to the general west to east delivery due to matters, such as, suitable access points and the requirements for trenchless crossing construction techniques. and Table 14.2 provides a summary of the direction of the construction of these crossings.

Table 14.2: Direction of Trenchless Crossing Construction

Construction Matter	Direction of Construction
Trenchless crossing drives	<p>There would be 44 trenchless crossings along the length the pipeline (noting that there would be flexibility in the construction methodology for the MV/LV power line crossings as described in Section 5.3.3). Of these trenchless crossings, 11 would primarily be water crossings, 9 would primarily be road crossings, 18 would be overhead powerline crossings, 2 would be rail crossings, 3 would primarily avoid a steep slope and 1 would be due to existing land use. These crossings would typically be constructed from west to east unless otherwise specified:</p> <p>RDX001: This crossing would be for a road crossing and steep slopes and occurs between RW –800 to RW – 1100 and would extend in a north-easterly direction for approximately 300m to avoid very deep excavation.</p> <p>RDX003: This road crossing occurs at TW –1900 and would extend in a south-easterly direction for approximately 50m.</p> <p>WBX008/WBX009: This crossing would be for steep slopes and occurs between TW – 3600 to TW – 3900 and would extend in an east by north-easterly direction for approximately 300m.</p> <p>RDX007: This road crossing occurs at TW – 5500 and would extend in a south-easterly direction for approximately 200m. This trenchless section would be constructed broadly from east to west in a north-westerly direction.</p> <p>OHX001: This overhead powerline crossing occurs at TW – 7400 and would extend in an east by north-easterly direction for approximately 50m.</p> <p>OHX002: This overhead powerline crossing occurs at TW – 10500 and would extend in a north-easterly direction for approximately 60m.</p> <p>RDX013: This road crossing occurs at TW – 12700 and would extend in a north by north-westerly direction for approximately 40m.</p> <p>RDX015: This road crossing occurs at TW – 13100 and would extend in a northerly direction for approximately 70m.</p> <p>WCX016: This water crossing occurs at TW – 19500 and would extend in a north-easterly direction for approximately 60m.</p> <p>OHX003: This overhead powerline crossing occurs at TW – 24800 and would extend in a north-westerly direction for approximately 50m.</p> <p>OHX004: This overhead powerline crossing occurs between TW – 26200 and would extend in a north by north-easterly direction for approximately 50m. This trenchless section would be constructed broadly from east to west in a west by south-westerly direction.</p> <p>RDX026 and RDX 128: This road crossing occurs at TW – 28900 and would extend in a north by north-easterly direction for approximately 100m.</p>

Construction Matter	Direction of Construction
	<p>BPT: This tunnelled crossing is due to steep slopes and occurs between TWA – 0 to TWA – 200 and would extend in a north-easterly direction for approximately 200m. This trenchless section would be constructed broadly from east to west in a west by south-westerly direction.</p> <p>WCX026: This water crossing occurs at TWA – 13000 and would extend in a north-easterly direction for approximately 60m.</p> <p>RDX044: This road crossing occurs at TWA – 14200 and would extend in a north-easterly direction for approximately 50m.</p> <p>OHX005: This overhead powerline crossing occurs at TWA – 21700 and would extend in a north-easterly direction for approximately 40m.</p> <p>WCX031: This water crossing occurs at TWA – 26000 and would extend in an east by north-easterly direction for approximately 80m.</p> <p>WCX032 / RDX053: This water and road crossing occurs between TWA – 27600 to TWA – 27950 and would extend in a north by north-easterly direction for approximately 350m. This trenchless section would be constructed broadly from east to west in a south-westerly direction.</p> <p>OHX006: This overhead powerline crossing occurs at TWB – 1700 and would extend in an easterly direction for approximately 50m.</p> <p>OHX007: This overhead powerline crossing occurs at TWB – 11700 and would extend in a north by north-easterly direction for approximately 50m.</p> <p>WCX036: This water crossing occurs at TWB – 12600 and would extend in a north-easterly direction for approximately 60m.</p> <p>WCX039: This water crossing occurs at TWB – 24900 and would extend in an east by north-easterly direction for approximately 70m.</p> <p>OHX008: This overhead powerline crossing occurs at TWB – 27800 and would extend in a north-easterly direction for approximately 50m.</p> <p>RDX071: This road crossing occurs at TWC – 100 and would extend in a north by north-easterly direction for approximately 40m.</p> <p>RYX005: This rail crossing occurs at TWC – 4800 and would extend in a north-easterly direction for approximately 50m.</p> <p>RDX077: This road crossing occurs between TWC – 8900 and TWC-9000 would extend in a north-easterly direction for approximately 90m. This trenchless section would be constructed broadly from east to west in a west by south-westerly direction.</p> <p>OHX024: This overhead powerline crossing occurs at TWC – 11800 and would extend in a north-easterly direction for approximately 50m.</p> <p>WCX056: This water crossing occurs at TWD – 4100 and would extend in an east by south-easterly direction for approximately 50m. This trenchless section would be constructed broadly from east to west in a west by north-westerly direction.</p> <p>WCX057: This water crossing occurs at TWD – 6400 and would extend in a south-easterly direction for approximately 80m. This trenchless section would be constructed broadly from east to west in a north by north-westerly direction.</p> <p>WBX078: This water crossing occurs at TWD – 15100 and would extend in a north by north-easterly direction for approximately 50m. This trenchless section would be constructed broadly from east to west in a south-westerly direction.</p> <p>OHX009: This overhead powerline crossing occurs at TWD – 15500 and would extend in a north by north-easterly direction for approximately 50m.</p> <p>OHX010: This overhead powerline crossing occurs at TWD – 15700 and would extend in a north-easterly direction for approximately 50m.</p> <p>OHX011: This overhead powerline crossing occurs at TWD – 22300 and would extend in an east by north-easterly direction for approximately 50m.</p> <p>OHX012: This overhead powerline crossing occurs at TWD – 25800 and would extend in a south by south-easterly direction for approximately 70m.</p> <p>OHX013: This overhead powerline crossing occurs at TWD – 29500 and would extend in a north-easterly direction for approximately 50m.</p> <p>OHX014 and OHX015: This overhead powerline crossing occurs at TWE – 2800 and would extend in a south by south-easterly direction for approximately 80m.</p>

Construction Matter	Direction of Construction
	<p>OHX016: This overhead powerline crossing occurs at TWE – 5200 and would extend in an east by south-easterly direction for approximately 60m.</p> <p>OHX017: This overhead powerline crossing occurs at TWE – 6300 and would extend in a southerly direction for approximately 60m.</p> <p>RDX107: This road crossing occurs at TWE – 8500 and would extend in a southerly direction for approximately 70m.</p> <p>RDX108 / OHX018 / WCX076 / WCX073: This crossing occurs between TWE – 9600 to TWE – 9800 and would extend in a south-easterly direction for approximately 250m. This trenchless section would be constructed broadly from east to west in a west by north-westerly direction.</p> <p>OHX019: This overhead powerline crossing occurs at TWE – 10200 and would extend in an east by south-easterly direction for approximately 50m.</p> <p>RYX006: This rail crossing occurs at TWE – 12400 and would extend in a south by south-easterly direction for approximately 60m.</p> <p>WBX088: This water crossing occurs at TWE – 14200 and would extend in a south-easterly direction for approximately 80m. This trenchless section would be constructed broadly from east to west in a north-westerly direction.</p> <p>RDX113 / RDX114: This crossing is due to the existing land use and occurs between TWE – 15400 to TWE – 15600 and would extend in an east by south-easterly direction for approximately 300m. This trenchless section would be constructed broadly from east to west in a west by north-westerly direction.</p>

14.2 Working Hours

933. The typical working hours during the Construction Phase are outlined in Table 14.3.

Table 14.3: Typical Working Hours During the Construction Phase

Start	Finish	Day
07:00	19:00	Monday to Friday
08:00	16:30	Saturday

934. However, certain construction activities would need to be undertaken outside typical working hours. This includes works associated with each trenchless crossing which would take place 24 hours a day and works to complete open-cut crossings of roads to minimise the length of time for temporary road closures or other traffic management measures.

935. Working outside of typical working hours may also be required to carry out, or attend to, an emergency on the works.

936. There would be no abnormal loads required for the construction of the Proposed Project. However, occasionally, certain loads would need to be moved outside of typical working hours or at night, such as prefabricated tanks, and large, non-standard equipment (specials), or precast concrete. This would be done in conjunction with Gardaí, TII and Local Authorities. In addition, it has been requested by Kildare County Council that construction traffic movement through Celbridge be undertaken at night to avoid impacting traffic levels during the day.

14.3 Number of Workers

937. Throughout the Construction Phase, different skillsets would be required at different stages for each of the Infrastructure Sites (RWI&PS, WTP, BPT, BPS, FCV and TPR); the RWRMs, Treated Water Pipeline; and the Proposed 38 kV Uprate Works. Table 14.4 presents the anticipated number of workers that would be deployed across the works at the peak of the Construction Phase.

Table 14.4: Number of Workers Deployed On-Site – Construction Phase (Peak)

Works Area	No. of Workers
RWI&PS	50
WTP	150
BPT	60
BPS	60
FCV	20
TPR	60
RWRMs	50
Treated Water Pipeline from the WTP to the BPT	200
Treated Water Pipeline from the BPT to the TPR	400
38 kV Uprate Works	15

938. Workers would include general operatives; plant operators; concrete and steel workers; pipe technicians and welders; Mechanical, Electrical, Instrumentation, Control and Automation (MEICA) engineers and technicians, project management staff and supporting staff.

939. Temporary welfare facilities and office accommodation would be installed on each of the Infrastructure Sites for the Construction Phase.

14.4 Construction Access

14.4.1 Construction Vehicle Access

940. Access to the works areas will be via designated Haul Roads only.

14.4.2 Haul Roads

941. Access routes have been identified and agreed with Local Authorities. Only these routes can be used by construction vehicles. The Traffic Management Plan within the EIAR (Appendix 7.2) makes commitments on monitoring of traffic coming to and from site.

14.4.3 Worker Access

942. Workers would start their working day at one of the Construction Compounds/Infrastructure Sites. Workers required on the pipelines would be bussed to the various pipeline works.

943. No parking would be available at the pipeline works areas. The only vehicles expected to be arriving at the access points for the construction of the pipeline would be:

- Mini-buses dropping off / picking up workers
- Delivery vehicles including Light Goods Vehicles., Ordinary Goods Vehicle Type 1 and Type 2
- Intermittent car journeys for site not based full time at the construction site e.g foreman, environmental clerk of works etc.

944. Workers would travel from home or use local accommodation, e.g. hotels/bed and breakfast/rental properties. There would be no provision for worker accommodation anywhere within the works areas. All accommodation would be off site. Travel to Construction Compounds would be from these locations.

14.4.4 Temporary Construction Road

945. An internal Temporary Construction Road would be constructed within the Construction Working Width to facilitate the movement of plant, workers and materials.
946. These roads would be formed by stripping the topsoil and upper level of subsoil across the Temporary Construction Road to its full depth, as determined by the Agronomist engaged by Uisce Éireann. Records would be kept of the depths stripped in each of the parcels of land that the Construction Working Width passes through.
947. Where the ground conditions are suitable the construction vehicles would run directly on the formation layer i.e. directly on top of the lower level of subsoil. This would be the approach for the majority of the length of Temporary Construction Road that would be required for the pipeline.
948. However, where the ground conditions would not be suitable for direct running on the lower level of subsoil, then a geogrid mattress and stone would be laid to form the Temporary Construction Road for vehicles to run on.
949. Based on the length of pipeline to be constructed each year it would be expected that a maximum of approximately 10km of Temporary Construction Road would be used in each section of the pipeline at any one time. This is based on the three geographical sections 2-4 as set out in Table 14.1.
950. Once the relevant section of the Temporary Construction Road is no longer required then the material within the road would be removed and re-used on the next section along the route.

14.5 Construction Vehicles

951. A range of vehicle types would be used during the construction of the works. This includes vehicles which would travel on the public road network via Haul Roads, and construction traffic. Vehicles on the public road network would include cars, passenger vehicles such as minibuses, Light Goods Vehicles such as transit and delivery vans; Ordinary Goods Vehicle Type 1 such as rigid vehicles with two or three axles including tractors, box vans, backhoe diggers and trucks which have double rear wheels; and Ordinary Goods Vehicle Type 2 such as rigid vehicles with four or more axles.
952. Where a vehicle is unsuitable on the public road, e.g. crawler cranes and front loaders, these would be transported by Ordinary Goods Vehicle Type 2 to designated access/egress points which are gateways to the working areas.

14.6 Vehicle Numbers

953. For the purpose of the EIAR a profile of HGV deliveries and staff vehicles has been developed using the estimated quantities of materials to be delivered to site and the volume of surplus excavated material to be removed. These vehicles have then been assigned to the haul routes to be used to get to each of the identified access points along the route. This profile would set a limit for the contractor(s) regarding daily HGV movements.

14.7 Sequencing of Deliveries

954. The HGV profile makes assumptions on which sections of pipeline would be built in which year and the timing of deliveries to site. These include:
- Earthworks activities would not take place during the winter period defined as December – February

- The contractors would generally work from west to east (unless there is a constraint preventing this, e.g. a trenchless crossing)
- The contractors would plan works so that a section of pipe between two access points would typically be constructed in a single year
- The pipeline construction in any given year would substantively commence in March with delivery of the stone for the internal haul road (and delivery of additional material for floating roads for sections of the pipeline in peat). Prior to March during the winter there would be mobilisation activities including vegetation clearance, fencing, drainage and landowner access
- Pipe delivery to site from a Pipe Storage Depot would also commence in March of a given year
- Pipeline construction would continue through the summer with allowance made for working in peat and trenchless crossings where applicable. This would include removal of surplus material
- Removal of the Temporary Construction Road would occur at the end of the summer
- Site reinstatement would take place over the winter.

14.8 Suitable Working Conditions

955. The earthworks associated with the construction of the pipeline, including topsoil stripping and excavation would only be undertaken in suitable weather conditions. This means they would not be undertaken during periods of heavy rainfall where the ground would be water-logged and/or frozen. For the purpose of planning the works this has meant that the earthworks associated with the pipeline, and therefore, the construction of the pipeline generally would be completed outside of the winter period. The 'winter' has been defined as the period from December to February inclusive.

956. In addition, land would not be handed back during this time, as the Proposed Project would still be considered to be 'in construction' until a time when it can be reinstated appropriately and sufficient time has passed for the land to recover.

957. However, preparatory works such as pre-construction surveys, the removal of sections of hedgerow for pipeline crossings, demarcation of the Construction Working Width with wayleave fencing, establishing construction access to the Construction Working Width, installing pre-construction drainage, and other advanced works such as pipeline installation by trenchless construction techniques at major crossings may take place during the winter to allow the pipelines to be constructed efficiently. Installation and fit out of valves, washouts and outfalls, power connections and the welding of pipeline could also take place during the winter period provided earthworks were not needed, during that period, to facilitate such works.

14.9 Disturbance Above Trenchless Crossings

958. In developing the construction information an assessment has been made of which trenchless crossings break the internal site haul road (e.g. a river crossing) and which trenchless crossing would still have access above ground from one side of the tunnel to the other. If there is no access over the top of a trenchless crossing this dictates that access to build the pipeline must be from either side of the trenchless section.

14.10 Construction Compounds and Pipe Storage Depots

14.10.1 Introduction

959. Construction Compounds and Pipe Storage Depots are temporary elements required by appointed Contractors to facilitate construction of the Proposed Project. There would be a Construction Compound

for each of the geographical sections defined in Table 14.1 and several Pipe Storage Depots associated with the construction of the pipeline between the WTP and the TPR.

14.10.2 Construction Compounds

960. The Principal Construction Compounds, would act as the appointed Contractor's central strategic (operational) hub for plant/material/worker movement, general storage, administration, logistical support, technical (design) staff, etc. It has been determined, from experience and from consideration of the space requirements for management and welfare facilities, plant storage, vehicle parking and traffic circulation, that approximately 12ha of land-take would be needed for each Principal Construction Compound.

961. The four Principal Construction Compounds are proposed at the following locations:

- In the townland of Incha Beg, County Tipperary, within the WTP Site. This is the proposed Principal Construction Compound (CC1) for the RWI&PS, RWRMs and WTP
- In the townland of Lisgarriff, County Tipperary. This is the proposed Principal Construction Compound (CC2) for the Treated Water Pipeline from the WTP to the BPT, the BPT itself and the section of trenchless construction to the east of the BPT including approximately 39km of the pipeline
- In the townland of Killananny, County Offaly. This is the proposed Principal Construction Compound (CC5) for the section of Treated Water Pipeline from the trenchless section east of the BPT, the BPS including approximately 62km of the pipeline
- In the townland of Drummond, County Kildare. This is the proposed Principal Construction Compound (CC6) for approximately 69km of the Treated Water Pipeline to the TPR, and the TPR itself.

962. In addition to these four Principal Construction Compounds, there would be four secondary Satellite Construction Compounds. These would be needed to build the other Infrastructure Sites and so have been located at the RWI&PS, BPT, BPS and TPR. (The WTP is a Principal Construction Compound). These Satellite Construction Compounds would provide materials storage and support plant and workers along the route to allow for an efficient construction programme. This would, for example, help to reduce traffic to and from Principal Construction Compounds. The proposed Principal and Satellite Construction Compounds are presented in Table 14.5. Indicative layouts have been prepared for each of the proposed Principal and Satellite Construction.

Table 14.5: Proposed Construction Compounds

ID Reference and Compound Type	Description and Location	Access
CC0 Satellite	CC0 is a Satellite Construction Compound located at the RWI&PS site at Garrynatineel, County Tipperary. This Compound and works would be supported from the Principal Construction Compound (CC1), which would be located at the WTP.	Access would be provided via the proposed RWI&PS access road from the R494 Regional Road.
CC1 Principal	CC1 is a Principal Construction Compound within the proposed land acquisition at Incha Beg which is located north-east of Birdhill, County Tipperary for the WTP. The site is located immediately north of dense woodland but is itself made up of open fields.	It is proposed to construct a new permanent access road from the R445 Regional Road.
CC2 Principal	CC2 is a Principal Construction Compound located on a greenfield site which is currently used for agriculture at Lisgarriff, County Tipperary, between the N52 National Secondary Road and the Construction Working Width.	Access would be provided via a new site entrance off the N52 National Secondary Road.

ID Reference and Compound Type	Description and Location	Access
CC3 Satellite	CC3 is a Satellite Construction Compound located at the BPT site at Knockanacree, County Tipperary. This Compound and works would be supported from Principal Construction Compound CC2.	Access would be provided via the proposed BPT access road off the L1064.
CC4 Satellite	CC4 is a Satellite Construction Compound located at the BPS site. This Compound and works would be supported from Principal Construction Compound CC5.	Access would be provided via the proposed BPS access road off the L3003.
CC5 Principal	CC5 is a Principal Construction Compound located in an area of farmland south-west of Killurin at Killananny, County Offaly, which is bisected by the R421 Regional Road.	Access to CC5 would be provided via new site entrances off both sides of the R421 Regional Road.
CC6 Principal	CC6 is a Principal Construction Compound located at Drummond, County Kildare, in an area of farmland directly accessed from the R403 Regional Road between Allenwood and Derrinturn.	Access to CC6 would be provided via a new site entrance off the R403 Regional Road
CC7 Satellite	CC7 is a Satellite Construction Compound located at the TPR site at Peamount, County Dublin. This Compound and works would be supported from Principal Construction Compound CC6.	Access would be provided via the proposed TPR access road off the R120 Regional Road.

14.10.3 Pipe Storage Depots

963. In addition to the Construction Compounds, Pipe Storage Depots would be used to manage the storage and transportation of the pipe itself, which would be in 13.5m lengths. The Pipe Storage Depots would take direct delivery of the pipe for storage before onward journey to the required location along the pipeline. Given the volume of pipe material to be delivered and the logistical scale of the Proposed Project, it is not considered feasible to deliver pipe material directly to the point of installation. The pipe would be transported from the Pipe Storage Depot to its point of installation via either the Haul Road network or directly along the Construction Working Width.

964. It has been determined that approximately 2ha of land-take would be needed for each Pipe Storage Depot site. Indicative layouts of the Pipe Storage Depots have been prepared.

965. There would be capacity for pipe storage within the Construction Compounds; specific Pipe Storage Depots are only proposed where necessary to support construction between the compounds. Construction Compound CC1 (WTP) would provide sufficient storage of pipe for the RWRMs. Pipe Storage Depots are required to augment those Principal Construction Compounds, namely CC2 (Lisgarriff), CC5 (Killananny) and CC6 (Drummond), which would serve the installation of pipe between the WTP and the TPR.

966. The locations of the proposed Pipe Storage Depots are set out in Table 14.6.

Table 14.6: Proposed Pipe Storage Depot Locations

ID Reference	Associated Construction Compound	Description and Location	Access
PSD1	Principal Construction Compound CC2, Lisgarraff, County Tipperary	Pipe Storage Depot (PSD1) at Carrigatogher, County Tipperary, would be located in an area of farmland accessed directly off the R445 Regional Road.	Access to PSD1 would be via new site entrances off the R445 Regional Road. As PSD1 straddles the R445 Regional Road, access would be required on both sides of the road.
PSD2	Principal Construction Compound CC5, Killananny, County Offaly	Pipe Storage Depot (PSD2) at Toora, County Offaly, would be located in an area of farmland, which would be accessed directly off the L4022 Local Road.	Access to PSD2 would be via a new site entrance off the L4022 Local Road.
PSD3		Pipe Storage Depot (PSD3) at Boveen, County Offaly, would be located in an area of farmland accessed directly off the N62 National Secondary Road.	Access to PSD3 would be via new site entrances off the N62 National Secondary Road.
PSD4		Pipe Storage Depot (PSD4) at Fortel, County Offaly, would be located in an area of farmland off L4004 Local Road between the R421 Regional Road and the R440 Regional Road.	Access to PSD4 would be via a new site entrance off the L4004 Local Road.
PSD5		Pipe Storage Depot (PSD5) at Derrinboy, County Offaly, would be located on agricultural land adjoining the Construction Working Width.	Access to PSD5 would be via a new site entrance off an unnamed local road which links the N52 National Secondary Road at Kilcormac with the R421 Regional Road.
PSD6		Pipe Storage Depot (PSD6) at Derryweelan, County Offaly, would be located in an area of forestry with relatively flat topography.	Access to PSD6 would be via a new site entrance off the R420 Regional Road between Geashill and Tullamore. This new site entrance would also provide access to the Construction Working Width.
PSD8		Principal Construction Compound CC6, Drummond, County Kildare	Pipe Storage Depot (PSD8) at Rathlumber, County Offaly, would be located in an area of relatively flat agricultural land south-west of Edenderry.
PSD9	Pipe Storage Depot (PSD9) at Graiguepottle, County Kildare, would be located in an area of agricultural land south of Kilcock.		Access to PSD9 would be via a new site entrance off the R407 Regional Road.
PSD10	Pipe Storage Depot (PSD10) at Barberstown Upper, County Kildare, would be located in an area of agricultural land north of Straffan.		Access to PSD10 would be via a new site entrance off the R406 Regional Road.

14.10.4 Construction Compounds and Pipe Storage Depot Facilities

967. Table 14.7 provides an overview of the typical facilities required at the Construction Compounds and Pipe Storage Depots.

Table 14.7: Overview of Facilities at Construction Compounds and Pipe Storage Depots

Facilities	Principal Construction Compound		Satellite Construction Compound		Pipe Storage Depots	
		Notes		Notes		Notes
Offices	✓	Significant multi-storey prefab offices including space for the appointed Contractors, design teams, administration staff, etc.	✓	Small number of single-storey prefab offices to accommodate the appointed Contractors, design teams, administration staff, etc.	✓	Single-storey prefab building to accommodate site and delivery staff.
Canteen	✓	Prefab buildings to accommodate site staff, visitors, construction staff and delivery staff.	✓	Single-storey prefab building to accommodate site and delivery staff.	✓	Single-storey prefab building to accommodate site and delivery staff.
Welfare facilities	✓	Prefab buildings to accommodate site staff, visitors, construction staff and delivery staff.	✓	Single-storey prefab buildings to accommodate site staff, visitors and delivery staff.	✓	Single-storey prefab building to accommodate site and delivery staff.
Security hut	✓	Controlled access at all times. Full-time security provided at common site entrance/exit. Closed-Circuit Television (CCTV) would also be in place. Gates closed when not in use.	✓	Controlled access at all times. Full-time security provided at common site entrance/exit. CCTV would also be in place. Gates closed when not in use.		Controlled access during working hours. Access gate locked outside of working hours. No full-time security provided. CCTV would be in place. Gates closed when not in use.
Access and internal roads/ vehicle turning areas/ coach pick-up and drop-off point	✓	Internal roads to allow circulation where possible. Road layout enabling vehicle turning. Includes coach pick-up and drop-off areas.	✓	Internal roads to allow circulation where possible. Road layout enabling vehicle turning.	✓	Internal circulation roads provided to maintain one-way traffic flow, wherever possible.
Material storage areas	✓	Multiple storage areas provided.	✓	General storage areas provided.	✓	General storage areas provided.
Pipe storage areas	✓	Capacity varies according to site extents. Multiple defined areas allocated within each site. Site layouts accommodate loading/unloading pipe within individual sites.		There is no specific provision for pipe storage. Capacity for storage of materials, generally, on-site has been provided. This is suitable for storing pipes and fittings which are to be incorporated into the works at this location only.	✓	Capacity varies according to site extents. Multiple defined areas allocated within each site. Site layouts accommodate loading/unloading pipe within individual sites.
Segregated waste management areas	✓	Defined areas within each site. Segregated waste skips provided.	✓	Defined areas within each site. Segregated waste skips provided.	✓	Defined areas within each site. Segregated waste skips provided.
Parking spaces staff	✓	Typically allow for 250 car parking spaces.	✓	Staff parking allocated for typically up to 60 parking spaces.	✓	Staff parking allocated for typically up to 25 parking spaces.
Parking spaces visitors	✓	Typically allow for 50 car parking spaces.	✓	Included within staff parking.		No visitor spaces. Parking provided for off road delivery vehicles.
Septic tank	✓	Storage tank provided with no drain outlet. Contents emptied by suction tanker.	✓	Storage tank provided with no drain outlet. Contents emptied by suction tanker.	✓	Storage tank provided with no drain outlet. Contents emptied by suction tanker.

Facilities	Principal Construction Compound		Satellite Construction Compound		Pipe Storage Depots	
		Notes		Notes		Notes
Bunded refuelling areas	✓	Two provided in each site.	✓	Provided	✓	Provided adjacent to designated parking areas
Plant cleaning area	✓	Two provided in each site.		Not applicable		Not applicable
Plant service area	✓	Two provided in each site.		Not applicable		Not applicable
Wheel wash area	✓	Provided adjacent to the common site entrance/exit	✓	Provided adjacent to the common site entrance/exit	✓	Provided adjacent to the common site entrance/exit
Topsoil and subsoil stockpile area	✓	Separate stockpile areas provided – limited to maximum 2m high	✓	Separate stockpile areas provided – limited to maximum 2m high	✓	Separate stockpile areas provided – limited to maximum 2m high

14.11 Construction Programme

968. It has been assumed that construction would commence in Q1 Year 2028 based on the likely timing of consenting processes and procurement completing at the end of 2027.

969. This means that pre-commencement activities including additional ground investigation and site surveys as well as pre-commencement landowner engagement can be undertaken in 2028. For the majority of the Proposed Project the first year of substantive construction work would be 2029 and this would include the first 'dry period' for construction of the pipeline.

970. Substantial completion would be achieved at the of 2032.

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Water Supply Project Eastern and Midlands Region - SID Engineering Report

Appendix A - Infrastructure Sites Architectural Statement

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Infrastructure Sites Architectural Statement

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1. Introduction

1. McAdam Design, Belfast were appointed in April 2021 as sub consultants to JacobsTOBIN to develop architectural treatments of key buildings on the Water Supply Project's five of the six Infrastructure Sites, namely
 - Raw Water Intake & Pumping Station (RWI&PS) superstructure at the proposed raw water intake site on Parteen Basin
 - Control / Administration and Visitor Centre Building at the proposed Water Treatment Plant (WTP) Site
 - Control Building at the proposed Break Pressure Tank (BPT) Site
 - Superstructure of the proposed Booster Pumping Station (BPS) and
 - Control Building at the proposed Termination Point Reservoir (TPR) site
2. The brief for the McAdam architects was to develop architectural concept designs for the above sites that would imbue a corporate image and incorporate a wider common architectural approach across the Water Supply Project whilst also respecting each site's particular context.

2. Raw Water Intake and Pumping Station

2.1 RWI&PS Site Location

3. Figure 2.1 below shows the locations of the proposed Figure 3.1 below shows the locations of the proposed RWI&PS (at 1) and WTP (at 2) relative to one another.



Figure 2.1 Raw Water Intake & Pumping Station (1) and Water Treatment Plant (2) Site Locations

2.2 RWI&PS Site Context

4. The RWI&PS site occupies a prominent riverside location on the eastern bank of Parteen Basin, approximately 4ha in size. It is located in a rural setting and bordered by mature woodland and mixed species forestry to the north and east (Figure 2.2 below).
5. It is noted that the bank approaching the site from the south is a man-made edge known as the Fort Henry Embankment.

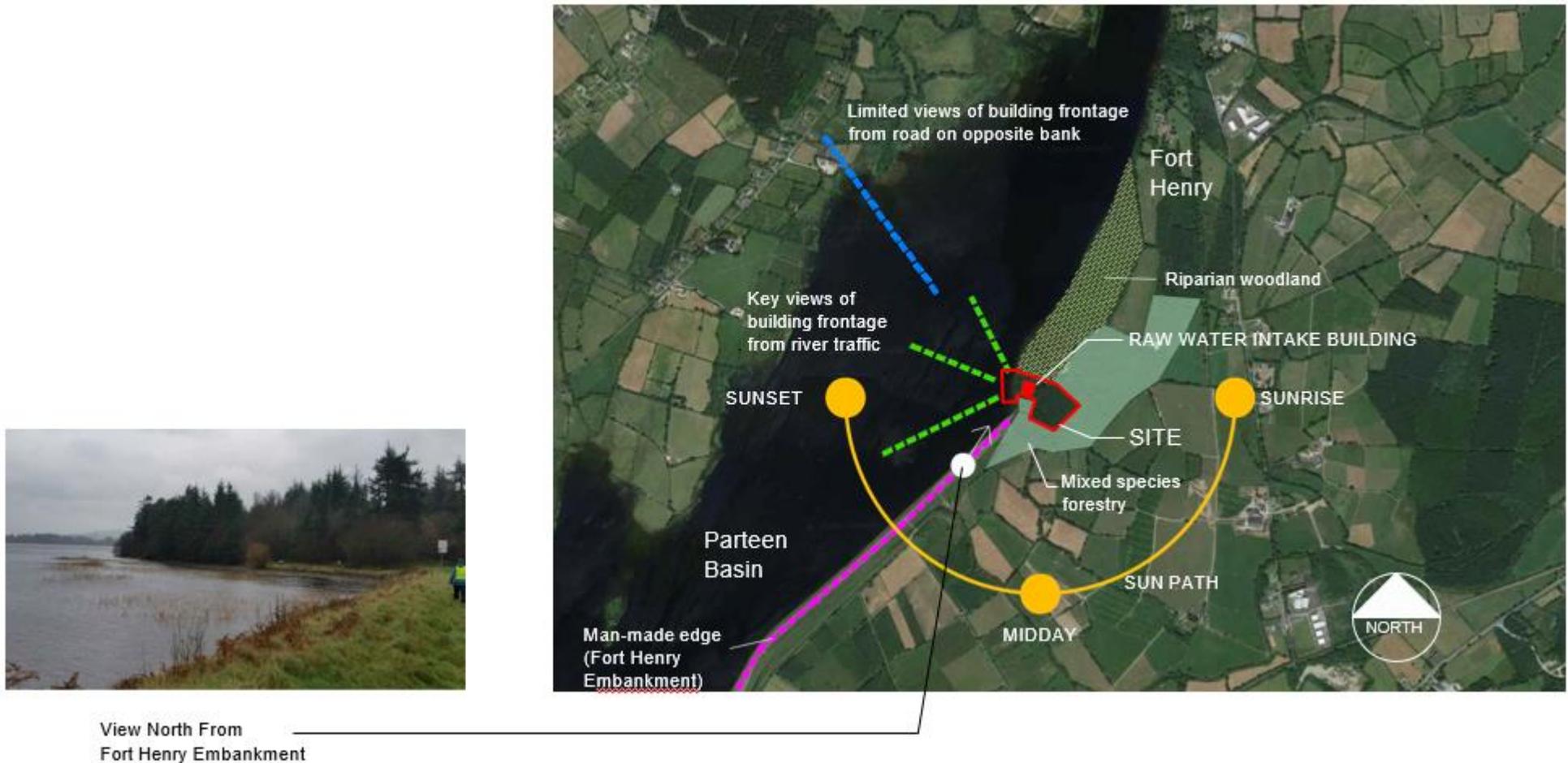


Figure 2.2 RWI&PS Site Context

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6. Archaeology & Historic Monuments - The Historic Environment Viewer indicates no evidence of any historic sites, monuments or Architectural Heritage within or adjacent to the subject site. The closest historic monuments are on the western bank of the river as shown on Figure 2.3 below.

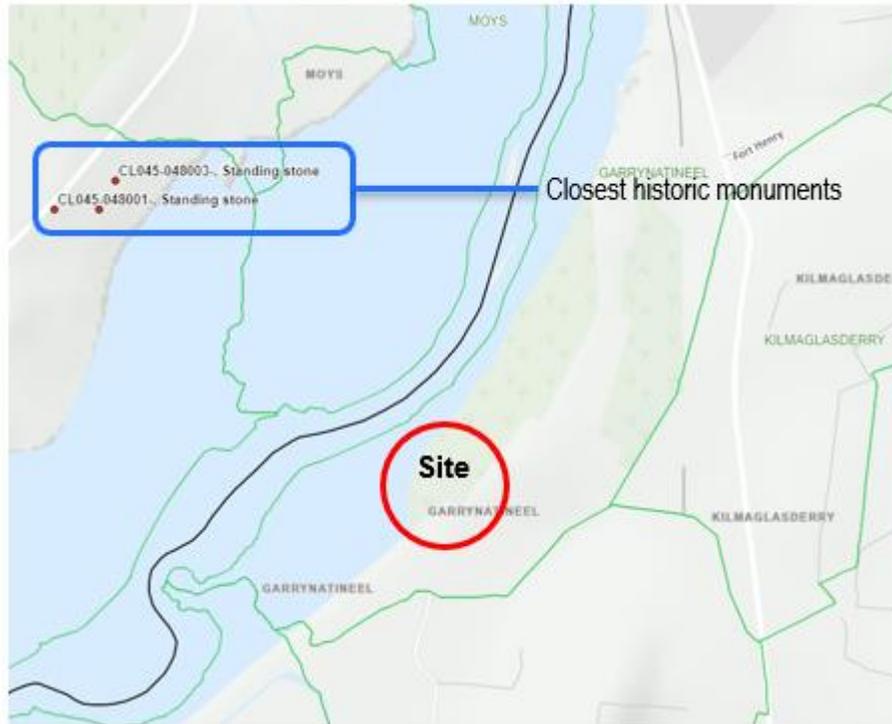


Figure 2.3 Extract from Historic Environment Viewer

2.3 Planning Policy

7. **Planning Policy** – Refer to the Planning Report
8. **Landscape Character Areas (LCA)** - The subject site is situated in **LCA 12 River Shannon – Newport LCA** - part of the ‘The Lakelands’ landscape category, sub-class ‘B2 Lakeland Enclosures’.

9. **Landscape Characteristics:**

- Diverse landforms with rolling hills, broad valley, river plain and raised bogs creating a varied landscape.
- Strong westwards orientation towards County Limerick and the River Shannon.
- Undulating hills create an intimate landscape with occasional views from elevated points afforded eastwards to the Silvermines and Arra Mountains.
- Lower boggy areas create remote landscape offering contrast with more heavily settled hilly areas.



Figure 2.4 Typical Landscape Characteristics

10. **Landscape Condition** - This is largely a flat open landscape at the southern and western end which has, as natural resources, a range of valuable and scenic landscape habitats. These range from the floodplain and associated meadows at the Lough Derg shores to the raised bogs at Newport. The presence of these resources raises the scenic quality of this area. Factors that impact on the landscape condition include buildings that are not appropriately incorporated in to the landscape, fly tipping on the bogs and the removal of acid scrub to facilitate turf harvesting. The northerly part of this LCA comprises an undulating hilly landscape with well-maintained pasture in overall good condition. This northerly part is less sensitive owing to the absence of the particular habitats noted in other areas. The scenic quality is good and such a landscape is deserving of good guidance in terms of design for future development.

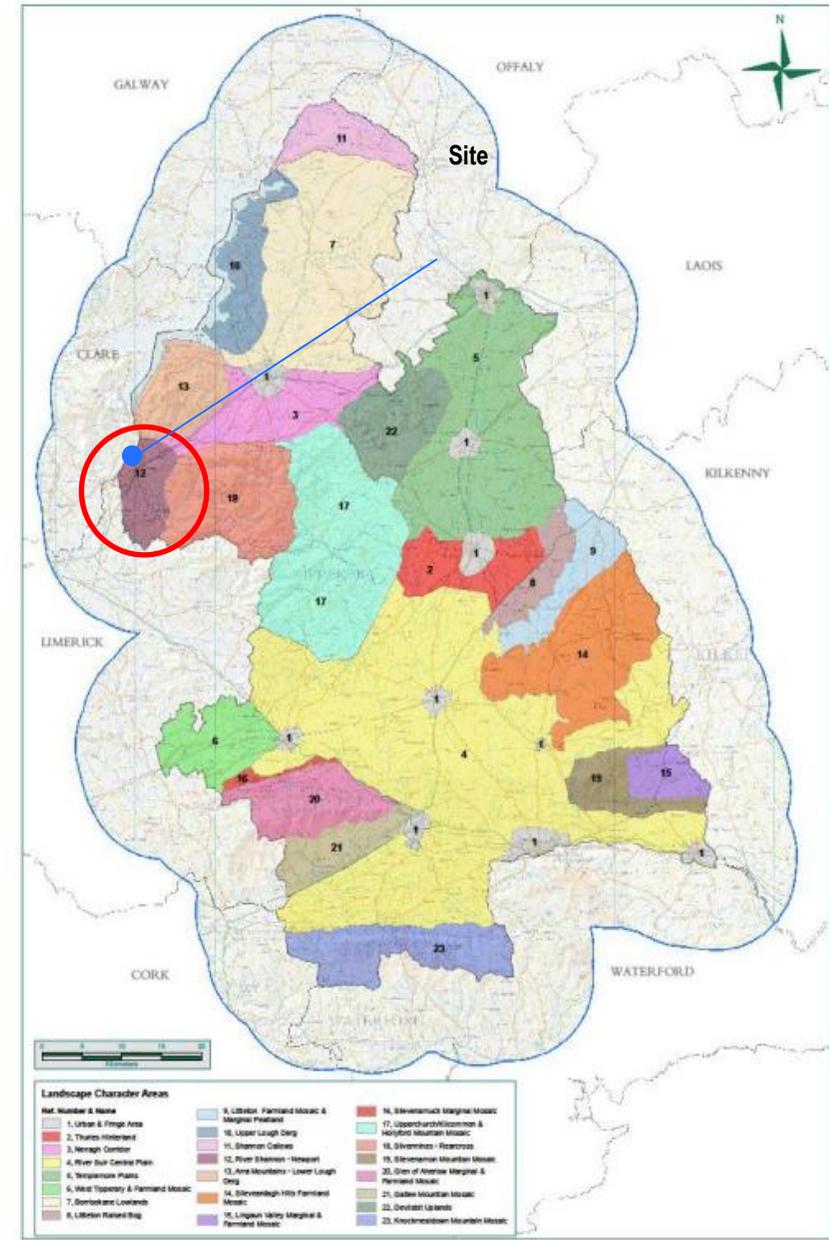


Figure 2.5 Map of Landscape Character Areas of Tipperary

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11. **Landscape Sensitivity** - In the context of the County Landscape Capacity classes, this is a **Transitional Vulnerability Class 4: Sensitive Landscape** – with very low capacity for change without detriment. Such landscapes require significant additional care during design and assessment of alternatives to determine how established patterns of use and settlement can be accommodated.
12. Among the 'Forces for Change' listed for LCA 12 in the development Plan are:
“Sensitive siting and design of individual buildings and groups of buildings as well as site treatment appropriate to the area will be of importance in this landscape. Specific design guidance should be provided to facilitate these outcomes”

2.4 Factors Considered in RWI & PS Design

13. The development of an appropriate design response entails a consideration of a multitude of different factors including a rigorous review and analysis of
 - the extant site and context
 - project brief
 - all available survey information
 - planning policy pertaining to the site
 - environmental and sustainable legislation relevant to the site; and
 - other relevant design related information.
14. The design is developed via an iterative process to reach a solution that satisfies these numerous parameters. For the RWI & PS the following have been identified as key design considerations:
 - Landscape Sensitivity - Adherence to principles set out in TCDP-A3 in relation to Landscape Sensitivity. The site is situated in an area classed as Transitional Vulnerability Class 4: Special Landscape – **with very low capacity for change without detriment**. The County Council will seek to “control unavoidable new developments or uses unless it **can conclusively demonstrate capacity to conform to existing appearance and character**.”
 - Visual impact of proposed - Blend the design with the natural environment, using organic forms and natural colours eg. consider use of stone and timber, consider use of organic curved roof form, consider use of matt grey pre-patented zinc cladding to blend with the natural environment; Incorporate landscaping with native plants to enhance ecological balance and visual appeal – the site is enveloped by an extant riparian wood which could be augmented with additional native species tree planting.
 - Key Views – limited long distant view from West bank of Parteen Basin; views from recreational and commercial river traffic; site shielded from landward views by existing nature deciduous woodland. Design should respond appropriately to views from the water and opposite shore – consideration should be given to a well-proportioned design solution with bold use of form and materials to enhance the visual appeal
 - Form, Scale and Massing - appropriate form, massing and scale of development within its context. The site is identified as having very low capacity for change without detriment – building should be well articulated and avoid an overly monolithic appearance – consider breaking form and mass into smaller elements and use articulated roof form

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- Materiality – use of eco-friendly, locally sourced materials to reduce the carbon footprint and connect the development to its location eg. locally sourced stone, use of structural glulam timber to reduce embodied carbon.
- Hydrology and Flood Risk - Understand seasonal water levels, floodplain boundaries, and flow patterns; Incorporate flood-resistant designs, such as raised structures or floodable ground levels.
- Ecosystem Sensitivity - Assess the impact on local flora, fauna, and aquatic ecosystems; Maintain riparian buffer zones and avoid disrupting habitats
- Energy Efficiency - Incorporate renewable energy systems (e.g., solar panels, micro-hydro turbines); Maximize natural lighting and ventilation to reduce energy consumption eg. clerestory windows will reduce electrical demand for lighting and operational carbon.
- Community and Cultural Considerations - Design the building to harmonize with the cultural and aesthetic aspects of the area – By using a building typology that would be appropriate in a riverine context eg. in recreational, commercial or industrial sectors that are in evidence along the banks of the River Shannon including boat clubs, boat houses, boat yards, warehousing etc.
- Resilience and Adaptability - Plan for long-term environmental changes, such as climate change-induced flooding or shifts in river behaviour; Use materials and techniques that allow for future modifications or dismantling.

2.5 RWI&PS Site Design Response

15. The choice of building form and massing is a direct response to the site's sensitive environmental setting. Breaking up the building mass into three smaller components will reduce the overall visual impact of the structure. Curved mono-pitch roofscape forms are utilised for each of the individual components to visually soften the building forms. Wall panels in a contrasting material are used to separate the three components to further lessen the impact visually.

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Design Approach

Massing



Option 3 +

Roofscape



Option 4 +

Figure 2.6 RWI&PS Site Design Response

16. Simple forms repeated can produce a strong design approach, especially when viewed from a distance. This is successfully achieved with the massing (Option 3) and roofscape (Option 4) selected in the Design Response

2.6 RWI&PS Design Precedents

17. Use of natural materials - stone rubble walls, zinc standing seam cladding and timber is attractive, robust, and appropriate for the building's function and context (See Figure 2. to Figure 2. below for Precedents).
18. Establishment of a strong yet harmonious visual identity with the articulated elevation facing the waterfront, while remaining carefully integrated within its riparian woodland setting
19. Evoking imagery of a boathouse or quayside warehouse structure provides a pleasing and appropriate design solution (see Figure 2. for Precedent)
20. The use of translucent clerestory panels is effective. This is achievable through the repetitive massing and roofline created in the Design Response.
21. Visible structural bracing can be striking a functional design feature (Figure 2.7 and Figure 2.8).



Figure 2.7 Building Scale, Form & Material Precedent Commercial Quayside Development, Bantry, Co. Cork

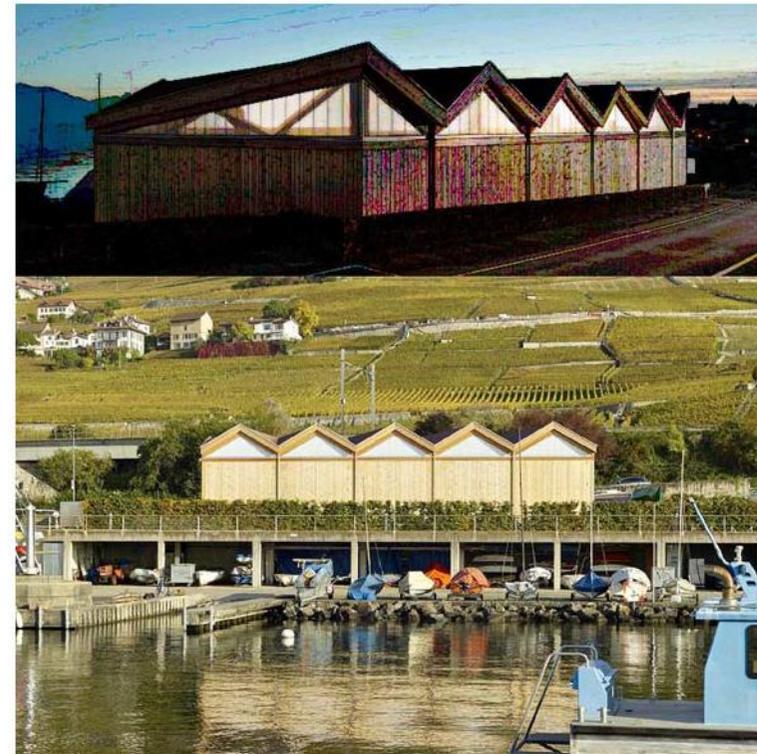


Figure 2.8 Building Form & Material Precedent – Boatyard, Lake Geneva

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Figure 2.9 Shannon Waterside Development Precedents- Lough Key Forest Park (an example of development adjacent to the Shannon in a similar riparian context)



Figure 2.10 Shannon Waterside Development Precedents – Lough Derg Sailing Club

2.7 RWI&PS Design Development

22. The orientation & massing of the proposed design addresses the waterfront to establish a strong yet harmonious visual identity with the articulated elevation facing the waterfront, while remaining carefully integrated within its riparian woodland setting
23. A functional hard standing area for gantry access to the passive intake screens is required
24. 3 no. Massing elements relate directly to the three passive intake screens

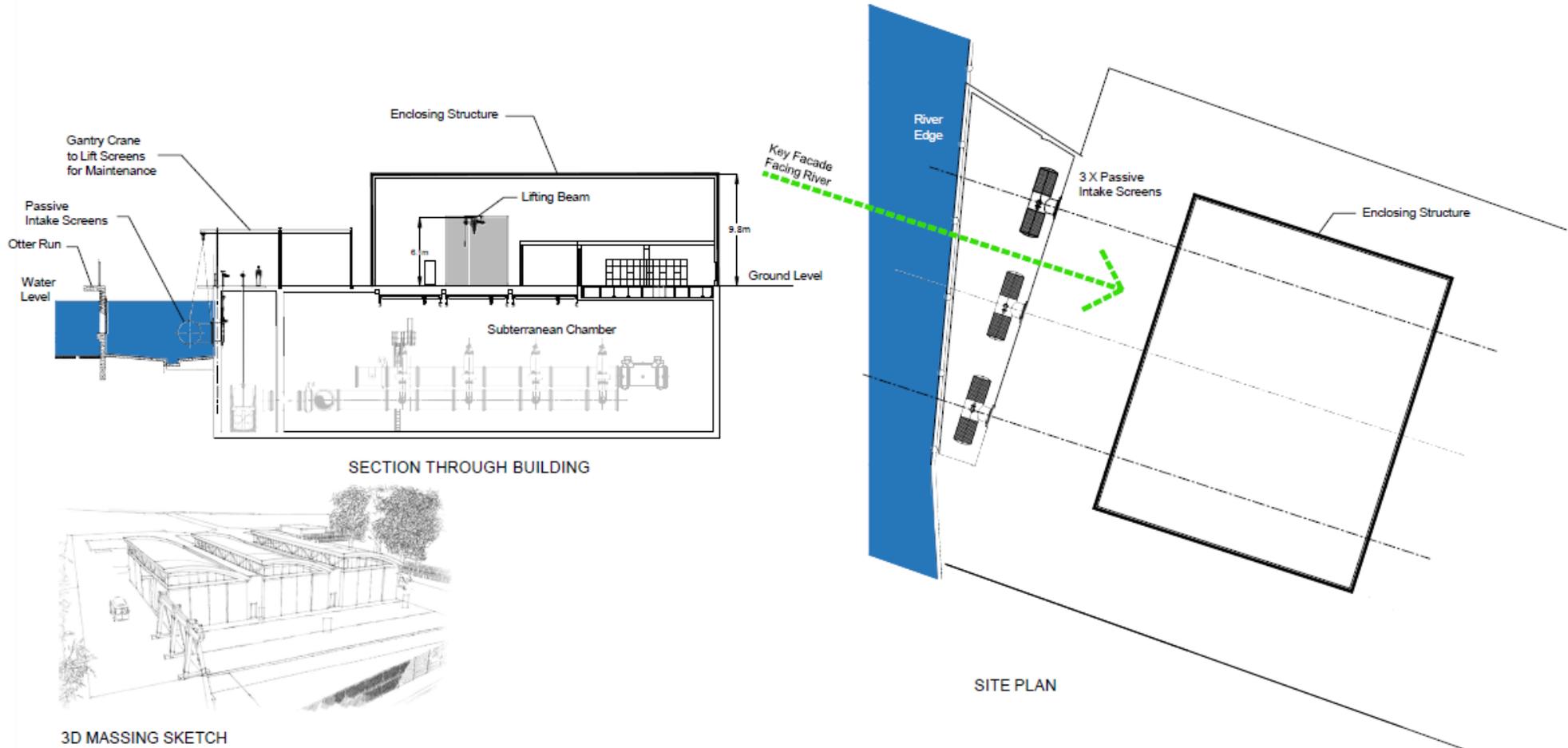


Figure 2.11 RWI&PS Design Development Sketches

2.8 Design Materiality RWI&PS Superstructure

25. The design materiality of the proposed pumping station superstructure is set out and described in Figure 2.12 below

High Quality, Durable and Robust Natural Materials Appropriate to Natural Environment Context



1. Local Stone Random Rubble Walling



2. Pre-Patented Standing Seam Cladding



3. Exposed Glulam Timber Structure



4. Translucent Panelling

Figure 2.12 Design Materiality RWI&PS Superstructure

2.9 Pros & Cons of Proposed Design Solution

26. The advantages of the proposed design solution are:

- Visual Impact – Positive visual appearance from the water and opposite bank – the use of natural, non-reflective materials will help the building to blend into the natural environment setting.
- Materiality – Use of high quality well detailed materials will enhance the quality, resilience, maintenance requirements and longevity of the structure.
- Community & Culture – Proposed design to invoke a boatyard or warehouse building typology which are evidenced along the banks of the River Shannon in order that the building should not appear 'out of place' within its highly sensitive landscape context.
- Sustainability – Mitigation of embodied carbon by using locally sourced materials and use of glulam timber structural elements, clerestory windows will reduce operational energy requirements.

27. The proposed design has the following disadvantages

- Cost – proposed solution with articulated roof form, clerestory windows, glulam roof structure and high quality materials would more costly than a portal frame industrial shed structure clad in composite aluminium cladding panels with standardised components and systems and higher speed of construction
- Adaptability – proposed solution may have more limited ability for future modifications or dismantling over a conventionally panel clad structure.

2.10 Reasons for Selection

28. The designed form of the RWI&PS superstructure and the materials selected for its construction are proposed in order to:

- blend with its natural surroundings to mitigate detriment to highly sensitive setting
- demonstrate capacity to conform to existing appearance and character eg. a building typology that would not look out of place in its context.
- provide an attractive and appealing building to enhance its setting and positively influence the Uisce Eireann brand.
- provide a robust and resilient structure that will have longevity, optimal resilience and low maintenance demands.
- minimise embodied and operational carbon emissions.

2.11 RWI&PS Superstructure Rendered Images

29. The design approach at the RWI&PS site has been to address the Parteen Basin in a purposeful manner and to account for the waterside setting.
30. A 'boathouse' architectural form of regular and repeated elements is emphasised by the curved roofline sections.
31. The gantry element to the front of the building, through a distinctly industrial form, is used to supplement the 'boathouse' design theme, whilst identifying the utilitarian nature of the development in an up-front manner.



Figure 2.13 Rendered image of proposed RWI&PS viewed from south west

Infrastructure Sites Architectural Statement



Figure 2.14 Rendered image of proposed RWI&PS viewed from Parteen Basin



Figure 2.15 Rendered Image of proposed RWI&PS viewed from north western corner of site

3. Water Treatment Plant – Control Building & Visitor Centre

3.1 Water Treatment Plant Site Location

32. Figure 3.1 below shows the locations of the proposed RWI&PS (at 1) and WTP (at 2) relative to one another.



Figure 3.1 Raw Water Intake & Pumping Station (1) and Water Treatment Plant (2) Site Locations

3.2 Water Treatment Plant Site Context

33. The permanent WTP site is the largest of the infrastructure sites, approximately 31ha in size, located in a predominately rural setting of farmland and forestry.
34. The proposed Control/Administration and Interpretative Visitor Centre building is located to the south east corner of the site, with dedicated vehicular access.
35. There are potential views of extensive woodland and forest to the southern boundary.
36. There is significant distance (300m to 600m) between proposed development and main arterial roads / residential properties.

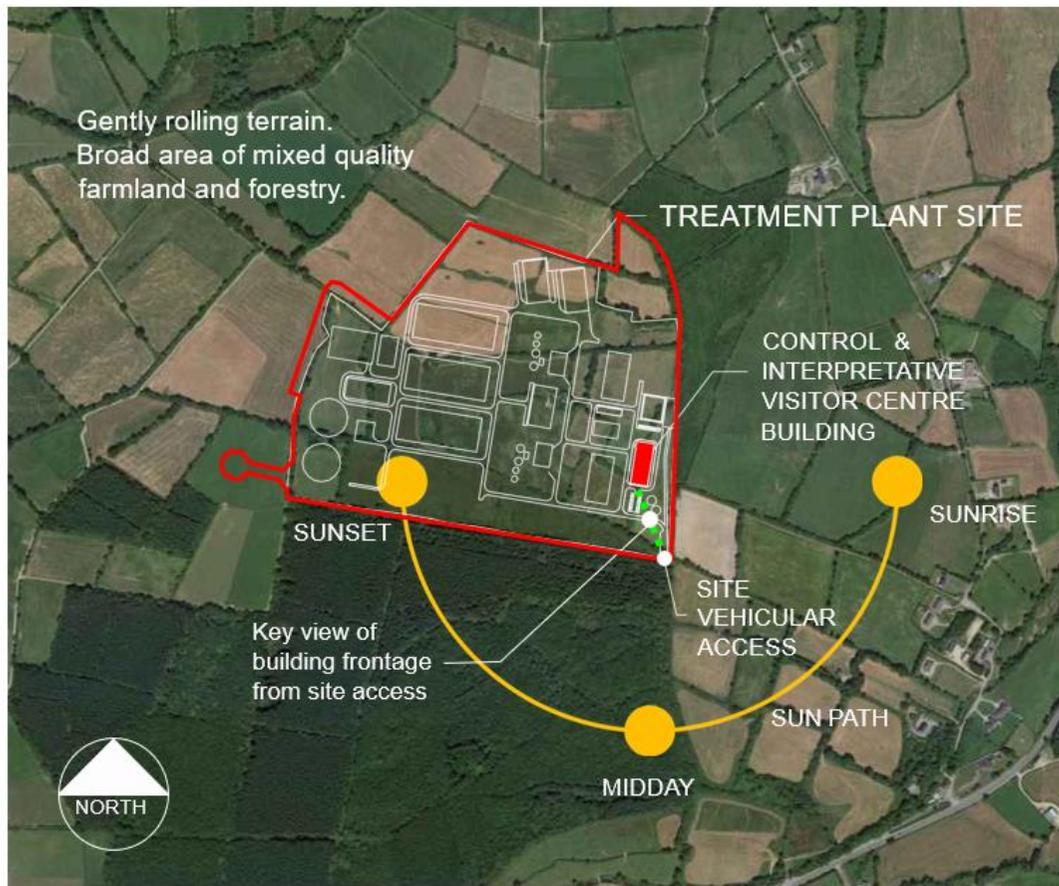


Figure 3.2 Water Treatment Plant Site Context

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37. Archaeology & Historic Monuments - The Historic Environment Viewer indicates evidence of seven RMP sites located within a 250m radius of this section of the proposed development. The required actions in relation to these monuments are described in the Cultural Heritage chapter (Ch. 17) of the project Environmental Impact Assessment Report

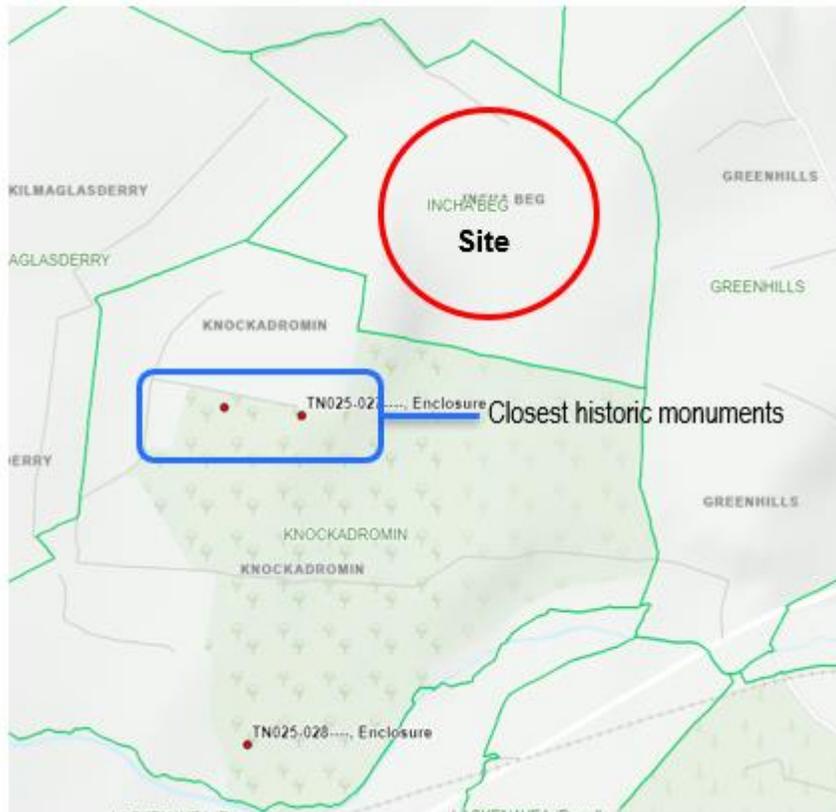


Figure 3.3 Extract from Historic Environment Viewer

3.3 Planning Policy

38. **Planning Policy** – Planning policy in respect of this site is outlined in the Planning Report that accompanies the application.
39. **Landscape Character Areas (LCA)** - As with the RWI&PS site, the subject site is situated in **LCA 12 River Shannon – Newport LCA** - part of 'The Lakelands' landscape category, sub-class 'B2 Lakeland Enclosures'. As such the Landscape Characteristics, Landcover & Ecology, Landscape Condition, and Landscape Sensitivity criteria quoted from the Tipperary County Development Plan in Section 2.3 in relation to the RWI&PS site above are the same for the WTP site.

3.4 Factors Considered in Water Treatment Plant Control Building and Visitor Centre Design

40. The development of an appropriate design response entails a consideration of a multitude of different factors including a rigorous review and analysis of:
- the extant site and context;
 - project brief;
 - all available survey information;
 - planning policy pertaining to the site;
 - environmental and sustainable legislation relevant to the site; and
 - other relevant design related information.
41. The design is developed via an iterative process to reach a solution that satisfies these numerous parameters. For the WTP Control Building and Visitor Centre the following have been identified as key design considerations:
- Landscape Sensitivity - Adherence to principles set out in TCDP-A3 in relation to Landscape Sensitivity. The site is situated in an area classed as Transitional Vulnerability Class 4: Special Landscape – ***with very low capacity for change without detriment***. The County Council will seek to “control unavoidable new developments or uses unless it ***can conclusively demonstrate capacity to conform to existing appearance and character***.”
 - Visual impact of proposed - Orient the building to maximize views of the woodland while minimizing visibility from key viewpoints. Use landscaping to blend the structure into its natural environment.
 - Look & Feel – The Control Building and Visitor Centre are part of a proposed water treatment complex, extending over 22Ha, comprising industrial sheds, tanks, lagoons, silos and other structures and equipment associated with a WTP site. The subject building will be located close to the site access and will act as the ‘front door’ to the site and will very much be the public face representing Uisce Eireann and this nationally strategic infrastructure project. Consideration should be given to the design to reflect these facts.
 - Form, Scale and Massing - the building scale needs to meet the requirements of the brief – a large 2 storey industrial building. The effective use of semi-mature perimeter tree and hedge planting will be a key consideration to mitigate the impact to the highly sensitive extant landscape

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- **Materiality** – use of eco-friendly, locally sourced materials to reduce the carbon footprint and connect development to its location. Design the building to harmonize with the rural and woodland setting, using natural colours and textures
- **Biodiversity and Wildlife** - Assess the presence of protected species or sensitive habitats in the woodland and surrounding areas. Avoid disrupting wildlife corridors and nesting sites; incorporate measures like bat boxes, birdhouses, or hedgehog passes. Consideration should be given to continuous band of native species tree and shrub planting to surround the site perimeter to provide foraging routes to link with the extant woodland and mitigate habitat loss.
- **Woodland Enhancement** - Consider rewilding or woodland expansion projects as part of the design. Use native plants in landscaping to support local biodiversity
- **Energy Efficiency** - Use passive design strategies, such as orientation for solar gain, shading from woodland, and natural ventilation. Incorporate renewable energy systems like solar panels or ground/air-source heat pumps.
- **Sustainability** - Source materials locally and prioritize those with a low environmental impact, such as timber from sustainable forests. Minimize the use of heavy machinery to reduce soil compaction and ecosystem disturbance. Use modular or prefabricated components when possible.
- **Lighting and Noise** - Use dark-sky-compliant lighting to reduce light pollution and its impact on nocturnal wildlife. Design for quiet operations to avoid disturbing wildlife and the rural tranquillity.
- **Long-term Maintenance** - Ensure the design allows for easy maintenance without harming the adjacent woodland.

3.5 Water Treatment Plant Control Building and Visitor Centre Design Development

- 42. Main Facade - 'Shopfront' / 'Front Door' of the Visitor Centre should directly address the WTP Site entrance point, as shown in Figure 3.4.

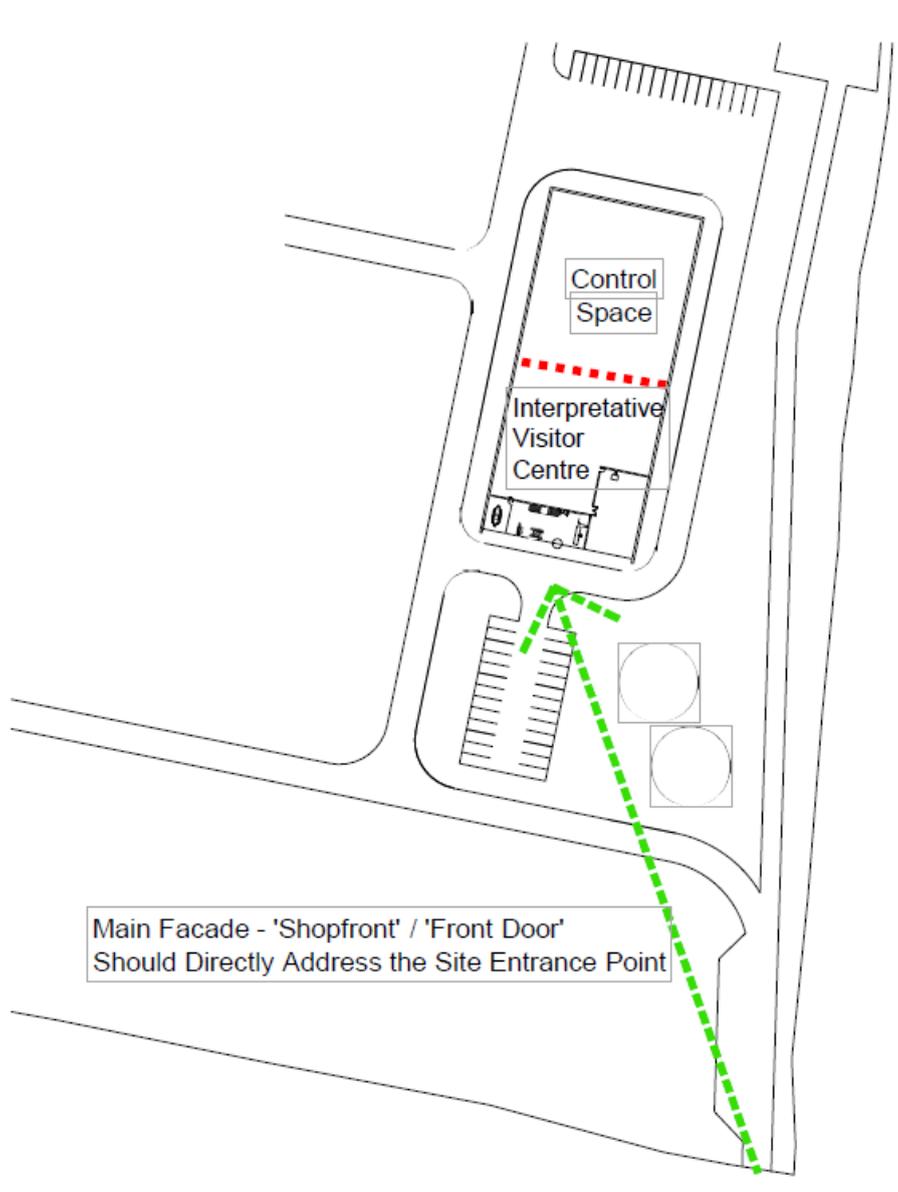


Figure 3.4 Site Layout at Control Building and Visitor Centre

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43. The WTP Visitor Centre, located at the southern end of the Control Building, has been designed with high quality architectural form and finish to present as the public face of the WTP and indeed, the overall Water Supply Project.
44. The large, glazed façade indicates the public face of the building for visitors / interpretative function.
45. The main entrance opens into double height spaces and leads onto a Visitor Centre in the front part of the building. The larger, northern part of the building is dedicated to the Control / Administration Space. There will be no access for the public from the Visitor Centre to the Control / Admin part of the building.



Figure 3.5 Proposed Façade of Visitor Centre

46. Key Facade of fully glazed curtain wall provides a clean, minimalist, modern, corporate look and feel.
47. Angled wing walls at sides are introduced to provide striking visual aesthetic, shelter, and solar shading



Figure 3.6 Section through proposed WTP Visitor Centre

3.6 Design Materiality Water Treatment Plant Control Building & Visitor Centre

48. High quality, durable and robust natural materials appropriate to the natural environment context are proposed for the building., as illustrated in Figure 3.7. This materiality will also provide a tie in with the Raw Water Intake Pumping Station superstructure described in Section 2 above.



Light / Mid-Grey Composite Cladding Panels
Main Entrance to Non Public Area
Grey Brickwork Base
Entrance to Non Public Area

Subtle Change in Materials, Tones and Texture

Materiality Tie In With Raw Water Intake Building

Key Facade Fully Glazed Curtain Wall Providing a Clean, Minimalist, Modern, Corporate Look and Feel. A Clearly Identifiable 'Front Door' / 'Shop Front' for the Water Treatment Works

Angles Introduced to Provide Striking Visual Aesthetic, Shelter and Solar Sading



1. Grey Facing Brick



2. Composite Panels



3. Pre-patented Standing Seam Cladding



4. Curtain Wall Glazing

Figure 3.7 Design Materiality WTP Control Building and Visitor Centre

3.7 Pros & Cons of Proposed Design Solution

49. The advantages of the proposed design solution for the Control/Administration & Visitor Centre Building are:

- Visual Impact – The striking, modern, minimalist entrance façade will provide a suitable ‘front door’ to the WTP site and an appropriate public face representing Uisce Eireann and this nationally strategic infrastructure project.
- Materiality – Use of high quality well detailed materials will enhance the quality, resilience, maintenance requirements and longevity of the structure. Materials specifically selected for their colour and texture to harmonise with the surrounding natural environment.
- Sustainability – The design will help mitigate the levels of embodied carbon by using locally sourced materials and use of glulam timber structural elements where possible. It will also optimise operational energy usage by projecting the eaves of the building, providing effective solar shading in summer to reduce cooling requirements and allowing natural light to penetrate deep into the space in winter which will reduce energy use for lighting.

50. The proposed design has the following disadvantages

- Cost – the proposed solution with higher quality materials and extensive usage of high-performance curtain wall system would be more costly than the use of composite aluminium cladding panels with standardised components and systems and higher speed of construction.
- Landscape Sensitivity – the requirements of the brief entail that the development will have a detrimental impact on the extant sensitive landscape. This is a strategically important project and therefore this impact will be unavoidable. However, the use of extensive semi mature native species perimeter planting will mitigate this impact as well as consequential biodiversity impacts.

3.8 Reasons for Selection

51. The proposed design described above and illustrated in Figure 3.9 above, and in Figures 3.10 to 3.12 on the following pages, is put forward to:

- To provide a visually dynamic and striking façade to provide a suitable ‘front door’ to the WTP site and an appropriate public face for a high profile, nationally strategic infrastructure project.
- To provide a robust and resilient structure that will have longevity, optimal resilience and low maintenance demands.
- To minimise embodied and operational carbon emissions.

3.9 Rendered Images of Water Treatment Plant Control Building & Visitor Centre

52. The approach to landscaping for the WTP will be a juxtaposition of formal and aesthetic to the 'front-of-house' and naturalistic and functional for the industrial aspects of the site.
53. Landscaping in the vicinity of the Control & Interpretative Visitor Centre building has been designed in combination with surrounding landscaping to present as a discrete entrance enclave within the WTP, whilst also integrating and connecting seamlessly with the utilitarian elements of the wider site.
54. The formal planting will consist of low ornamental shrubs and clear stemmed specimen trees to complement the architecture of the visitors centre / control building, whereas native woodland and hedgerow planting will serve to screen industrial elements.



Figure 3.8 Rendered Image of façade of Proposed Visitor Centre showing landscape proposals

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Figure 3.9 Rendered Image of proposed Visitor Centre viewed from south west

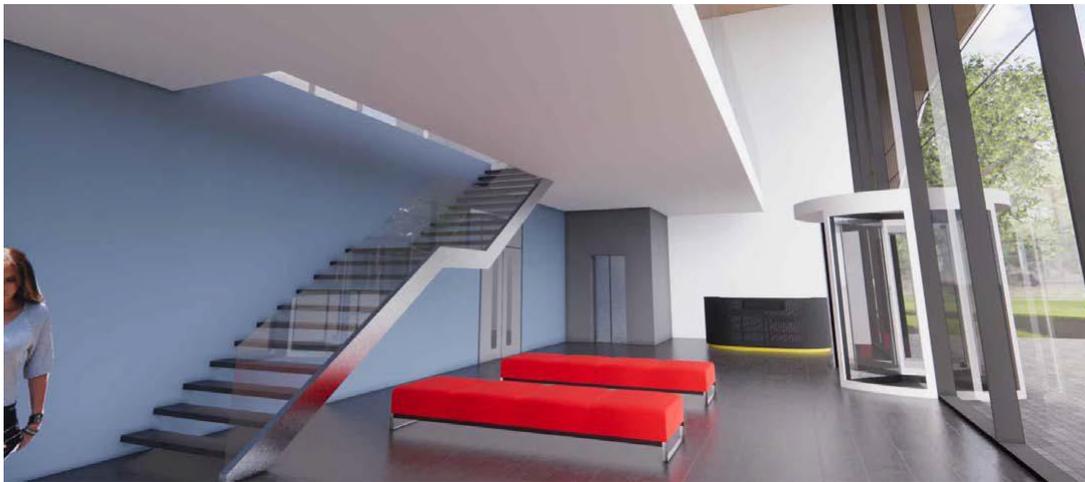


Figure 3.10 Rendered Image of ground floor interior of Visitor Centre

4. Break Pressure Tank Site

4.1 Break Pressure Tank Site Location

55. Figure 4.1 below shows the location of the proposed BPT near Cloughjordan, Co. Tipperary.

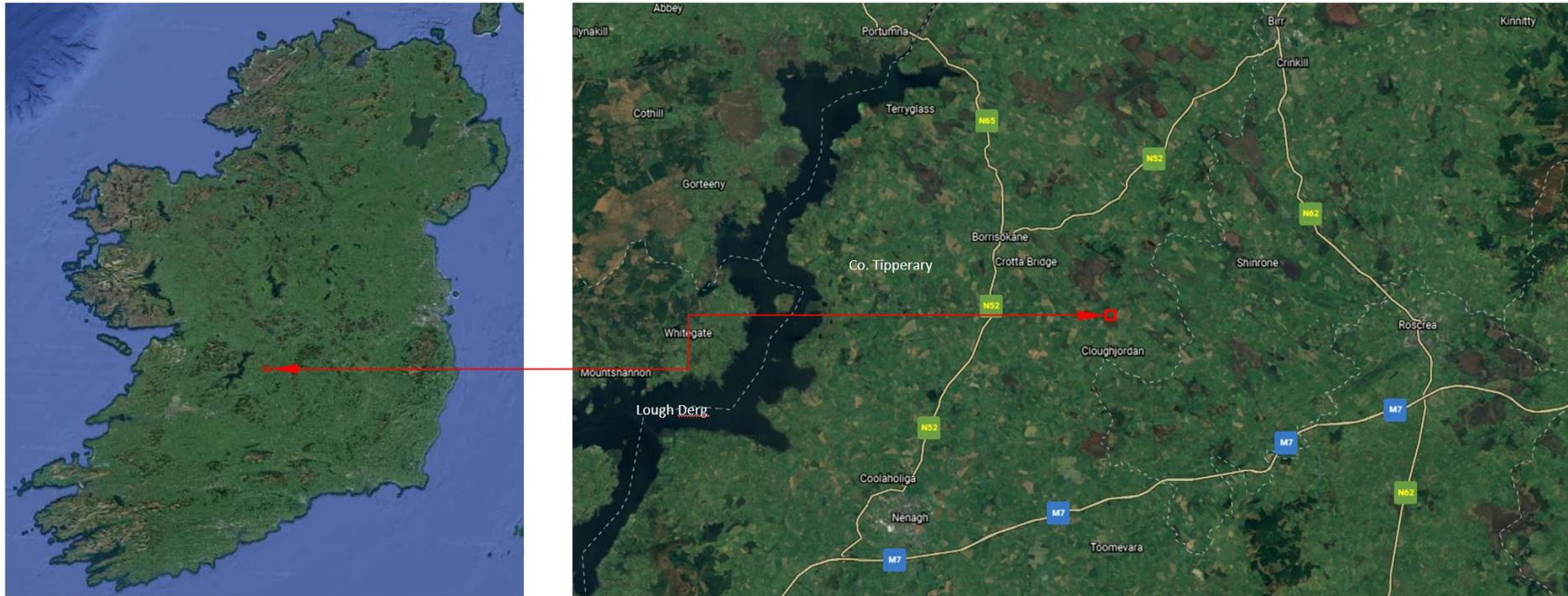


Figure 4.1 BPT Site Location

4.2 Break Pressure Tank Site Context

56. The permanent BPT site is approximately 7Ha in area and is located in a predominately rural setting of farmland and forestry.
57. The proposed control building is located to the south of the site.
58. There are potential views of extensive woodland and forest to the southern boundary.
59. There is significant distance (over 600m) between the proposed development and the local road network.

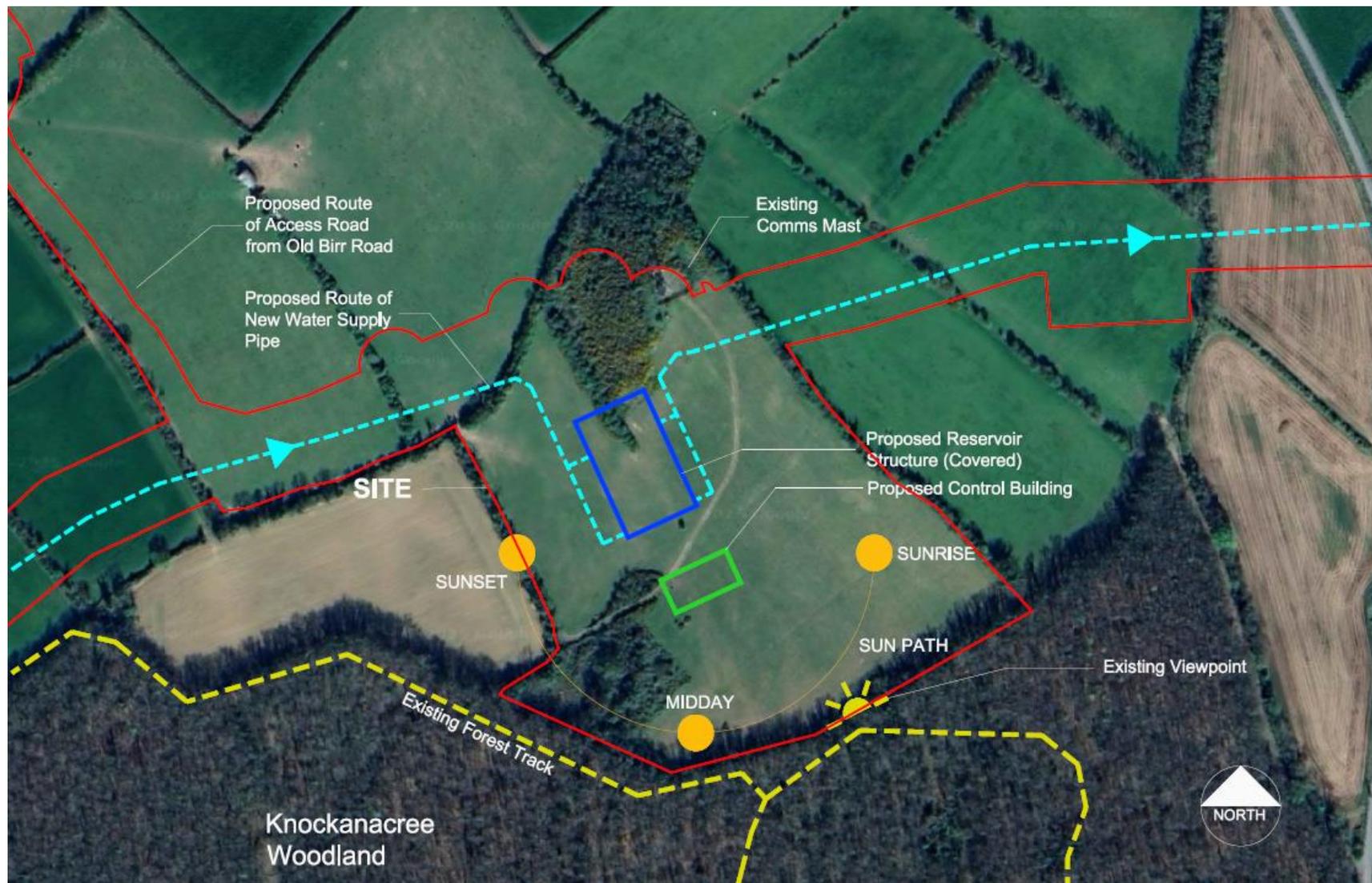


Figure 4.2 BPT Site Context

Infrastructure Sites Architectural Statement

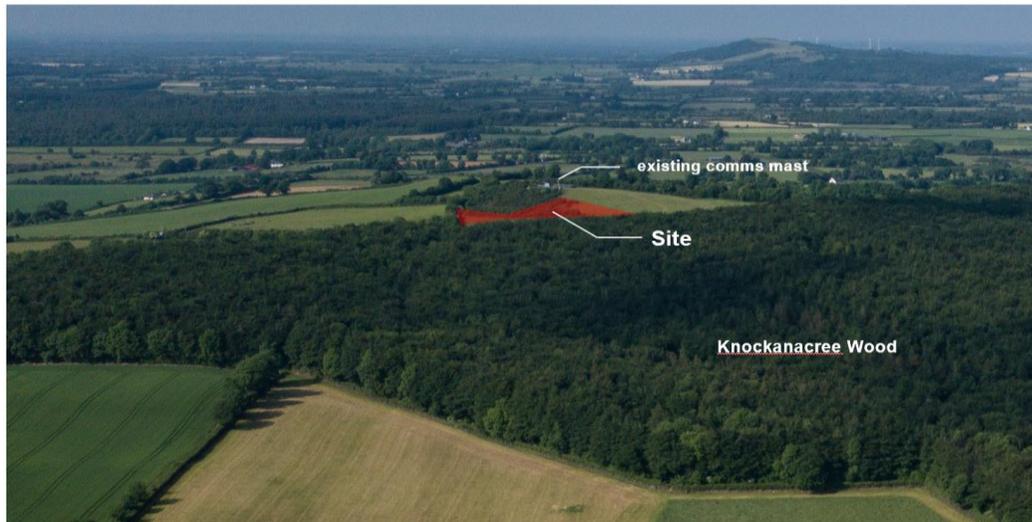


Figure 4.3 Aerial View of BPT Site, looking north

60. Archaeology & Historic Monuments - The Historic Environment Viewer indicates evidence of a Ringfort and several earthworks adjacent to the subject site. There are also a number of other ringforts noted in the locality. Any protective actions required in relation to these monuments are described in the Cultural Heritage chapter of the project Environmental Impact Assessment Report.

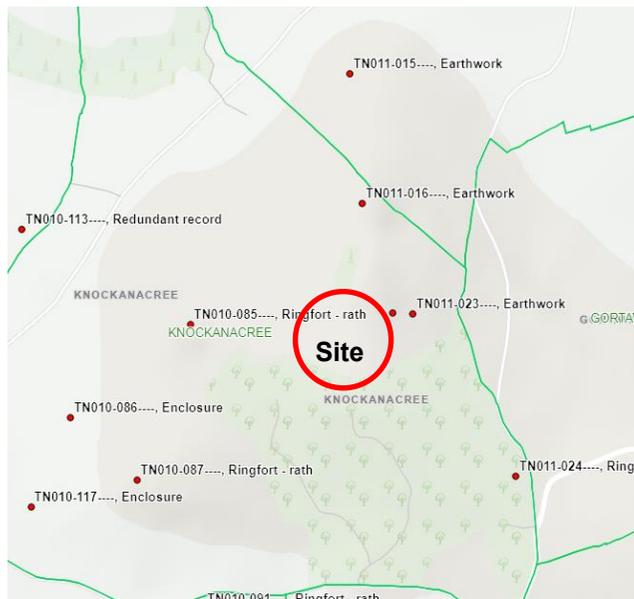


Figure 4.4 Extract from Historic Environment Viewer

4.3 Planning Policy

61. **Planning Policy** – Planning policy in respect of this site is outlined in the Planning Report that accompanies the application.
62. **Landscape Character Areas (LCA)** - Tipperary is sub-divided into 23 LCA arranged into 4 generalised landscape categories: The Plains; The Lakelands; The Foothills and: The Uplands. A3 defines the purpose of the LCA as “to develop a tool for identifying the landscape features of the County and establishing a basis for policies for the protection, management and planning of the landscapes having regard to those landscape features that give Tipperary its unique ‘sense of place’”. The subject site is situated in **LCA 7 Borrisokane LCA** - part of the ‘The Plains’ landscape category, sub-class ‘A2 Peatlands & Wet Mixed Farmland.
63. **Landscape Characteristics:**
- Farmed landscape dominated by limestone pasture interspersed with major communication routes to Portumna and Birr in adjoining Counties.
 - Occasional farmed ridges and gently undulating areas add landscape diversity to this large area.
 - Very high density of ‘Big Houses’ with tree lined avenues and cut stone outbuildings
 - Scattered settlement with principal nucleated settlement of Borrisokane located at junctions of major and regional roads.
 - Due to generally low-lying landform, long views are afforded from occasional ridges across to Offaly, the western drumlin belt and the Silvermines.



Figure 4.5 Typical Landscape Characteristics

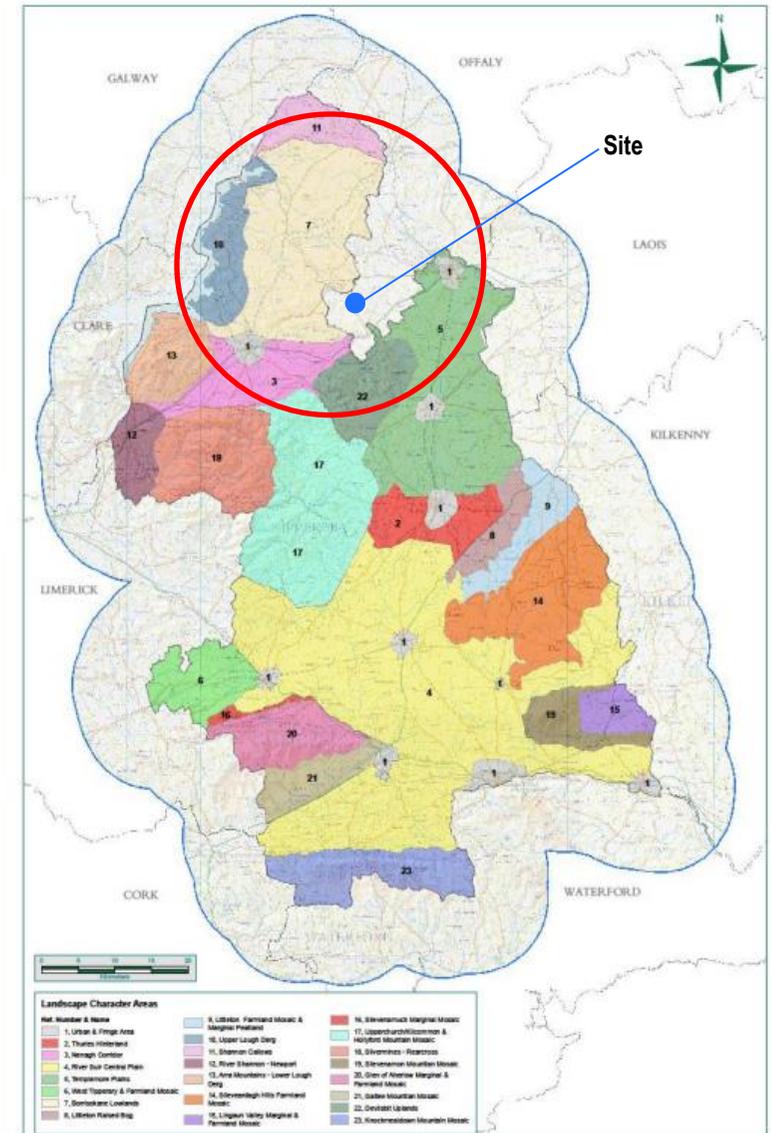


Figure 4.6 Map of Landscape Character Areas of Tipperary

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64. **Landscape Condition** - This is a flat open landscape which, in particular locations commands long range views to adjacent mountainous areas namely the Arra mountains and Borrisnoe. It does not have a sense of remoteness, being a working landscape given over to both pastoral and tillage uses. It is not a striking landscape in terms of scenic quality. This is largely due to the flat planar topography and the intensity of use as indicated by the larger field sizes (created by hedgerow removal). Characteristics which enhance the scenic quality of this landscape are the presence of ridgelines comprised of chains of small hills (Knockshigowna and Screggaun complexes) on the western side. These present as a distinct and visually attractive landscape feature in the overall flat terrain. Other enhancing features relate to the presence of pockets of mature deciduous woodland and tree lined routes and avenues to dwellings. Traditional settlement (e.g. the village of Lorrha), larger houses and farmsteads and the presence of ruined castles and churches confer a strong sense of architectural vernacular in localised parts of this landscape. In general, this is not a sensitive landscape albeit that its capacity to accommodate future development is a function of good design as this is a flat and really quite visually exposed landscape. The sensitivity of this landscape increases in locations where the enhancing landscape elements already outlined are present.
65. **Landscape Sensitivity** - In the context of the County Landscape Capacity classes, this is a landscape of **high capacity/low Sensitivity, Class 2 i.e. Transitional Sensitivity**, having a moderate sensitivity to change. These areas have reduced capacity to accommodate change without detriment. Such landscapes require additional care during design and assessment to continue established patterns of use and settlement.
66. **Principles for Landscape Management** - Sensitive siting and design of individual buildings and groups of buildings as well as site treatment appropriate to the area will be of importance in this landscape. Specific design guidance should be provided to facilitate these outcomes. Agricultural and forest cropping practices should be such to not impact on the integrity and visual setting of the raised bog areas or indeed the water quality of the Rivers Nenagh and Ballinfinboy.

4.4 Factors Considered in Break Pressure Tank Building Design

67. The development of an appropriate design response entails a consideration of a multitude of different factors including a rigorous review and analysis of: the extant site and context; project brief; all available survey information; planning policy pertaining to the site; environmental and sustainable legislation relevant to the site; and other relevant design related information. The design is developed via an iterative process to reach a solution that satisfies these numerous parameters. For the Break Pressure Tank building the following have been identified as key design considerations:

- Landscape Sensitivity - Adherence to principles set out in TCDP-A3 in relation to Landscape Sensitivity. The site is situated in an area classed as Transitional Sensitivity Class 2:– **moderate sensitivity to change**. The County Council will seek to **“facilitate development that with capacity to continue and enhance established patterns of use and settlement without significant change to appearance or character.”**
- Visual impact of proposed – The use of materials and colours that blend with the rural environment, such as earth tones or natural textures. The building is designed as a low-profile building to reduce visual impact, especially in open or scenic landscapes, with consideration given to the use of a vernacular roof form e.g. curved barrel vaulted
- Community and Stakeholders - Designing the building to align with local cultural or historical significance e.g. consider curved barrel-vaulted roof form which would replicate traditional agricultural barn structures prevalent throughout the Irish countryside.
- Materiality – use of eco-friendly, locally sourced materials to reduce the carbon footprint and connect the development to its location e.g. consider use of timber cladding to help the building blend in with the natural environment surroundings.
- Biodiversity and Wildlife - Assess the presence of protected species or sensitive habitats in the woodland and surrounding areas. Avoid disrupting wildlife corridors and nesting sites; incorporate measures like bat boxes, birdhouses, or hedgehog passes. Consideration should be given to native species tree and shrub planting within the site to provide foraging routes to link with the extant woodland and mitigate habitat loss.
- Climate and Geographic Factors - Design the building to withstand local weather conditions, such as wind, snow, or extreme heat. Use insulation, ventilation, and passive solar strategies to improve energy efficiency
- Sustainability - Source materials locally and prioritize those with a low environmental impact, such as timber from sustainable forests. Minimize the use of heavy machinery to reduce soil compaction and ecosystem disturbance. Use modular or prefabricated components when possible.
- Lighting and Noise - Use dark-sky-compliant lighting to reduce light pollution and its impact on nocturnal wildlife. Design for quiet operations to avoid disturbing wildlife and the rural tranquillity. Implement noise-reduction measures, such as acoustic barriers, to minimize disturbance to nearby wildlife.
- Long-term Maintenance - Ensure the design allows for easy maintenance without harming the adjacent woodland

4.5 Break Pressure Tank Control Building Design Approach

68. Figure 4.7 below illustrates the approach to the design of the Break Pressure Tank control building



Figure 4.7 Design Approach to proposed BPT Control Building

4.6 Pros & Cons of Proposed Design Solution

69. The proposed design has the following advantages:

- Visual Impact – A low profile building with curved barrel-vaulted roof providing an organic form to blend in with its natural environment setting assisted by the selection of natural materials, and earth tones and textures.
- Community and Cultural Considerations – The design of the building to harmonize with the cultural and aesthetic aspects of the area, using a building typology that would be appropriate in a rural context. The proposed design invokes a traditional agricultural barn structure prevalent throughout the Irish countryside.
- Materiality – The use of high quality well detailed materials will enhance the quality, resilience, maintenance requirements and longevity of the structure. The materials are specifically selected for their colour and texture to harmonise with the natural environment setting.
- Sustainability – The mitigation of embodied carbon by using locally sourced materials where possible, and the mitigation of operational carbon by optimising insulating performance of the thermal envelope.

70. Disadvantages of the design include:

- Cost – proposed solution with higher quality materials would be more costly than the use of composite aluminium cladding panels with standardised components and systems and higher speed of construction
- Landscape Sensitivity – The design of a low profile, organic form building, and use of extensive semi mature native species perimeter planting will mitigate the impact of this development as well as consequential biodiversity impacts.

4.7 Reasons for Selection

71. The selected design solution was developed to

- To provide a low impact, high quality structure that blends into its setting and enhances established patterns of use and settlement without significant change to appearance or character.
- To provide a robust and resilient structure that will have longevity, optimal resilience and low maintenance demands.
- To optimise embodied and operational carbon emissions.

5. Booster Pumping Station Site

5.1 Booster Pumping Station Site Location

72. Figure 5.1 below shows the location of the proposed BPS, east of Birr Co. Offaly.

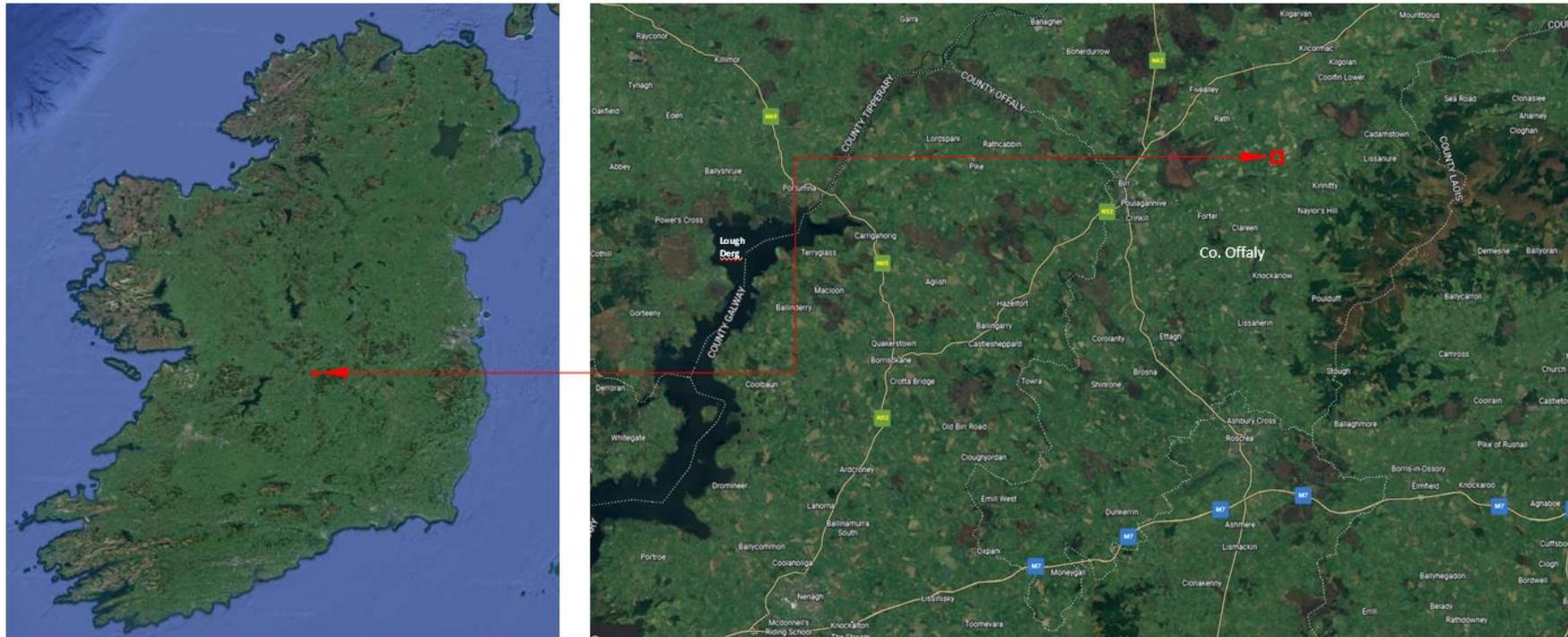


Figure 5.1 Booster Pumping Station Site Location

5.2 Booster Pumping Station Site Context

73. The permanent BPS site is approximately 2.6ha in area, located approximately 9.5km east of Birr, on the local L3003.
74. The site is in a rural greenfield environment amongst a patchwork of agricultural fields with mature hedge boundaries (see Figures 5.3 & 5.4).
75. In terms of topography the site is set in a generally level area of rolling countryside with levels fall gently towards the L3003 road.
76. An existing watercourse (tributary of Camcor River) winds around the site to the east.

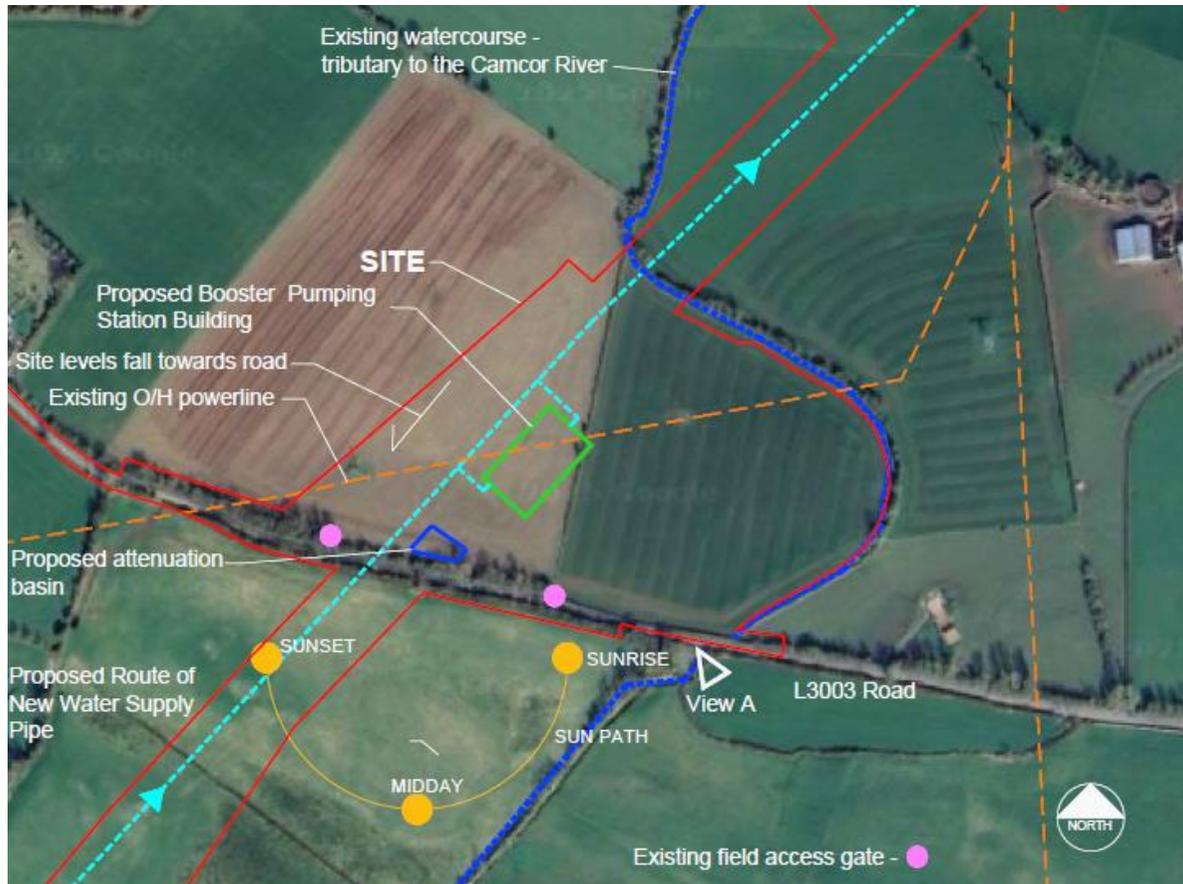


Figure 5.2 BPS Site Context

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77. Farm buildings adjacent to the site have barrel vaulted building form cojoined with 'lean-to' form



Figure 5.3 Adjacent Farm Buildings



Figure 5.4 View of BPS site from south east

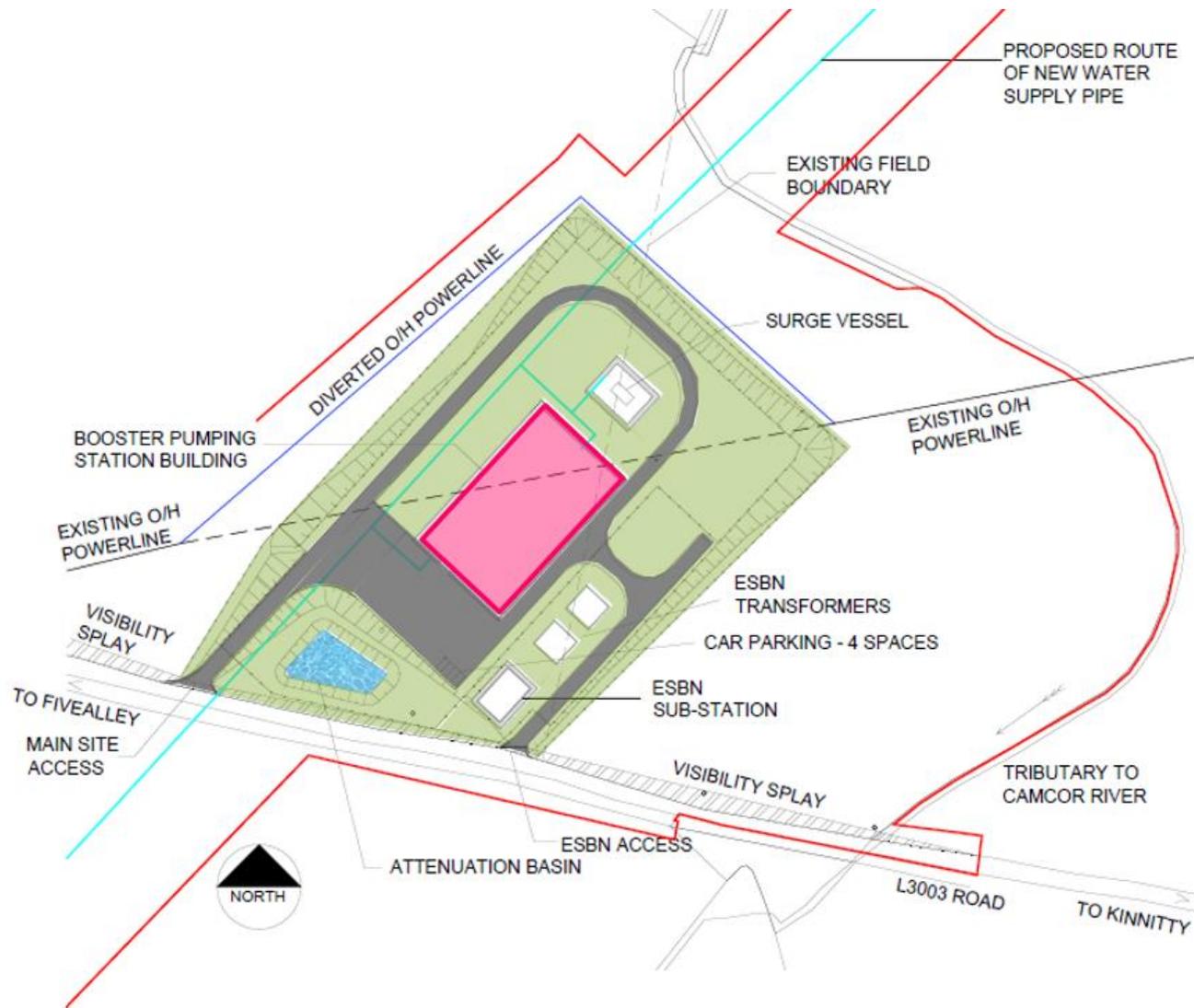


Figure 5.5 Proposed Booster Pumping Station Site Layout

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78. Archaeology & Historic Monuments - The Historic Environment Viewer indicates evidence of a Ringfort adjacent to the subject site. There are also a number of other ringforts noted in the locality.

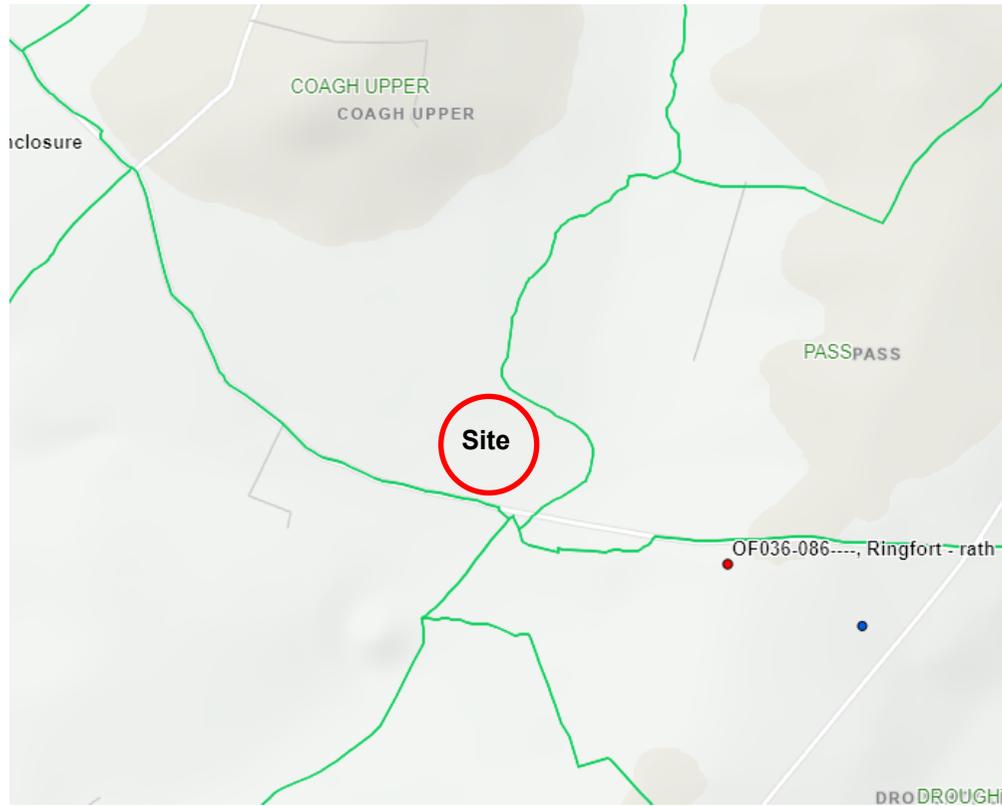


Figure 5.6 Extract from Historic Environment Viewer

5.3 Planning Policy

79. **Planning Policy** – Planning policy in respect of this site is outlined in the Planning Report that accompanies the application.
80. There is an extensive network of hedgerows throughout County Offaly. **There will be a firm presumption against the removal of hedgerows to facilitate development** unless an equivalent compensatory length of native hedgerow is proposed. In general, trees and hedgerows should be included in design plans for development proposals.
81. **Landscape Sensitivity** - The sensitivity of a landscape is the measure of its ability to accommodate change or intervention without suffering unacceptable effects to its character and values. The sensitivity of the landscapes of County Offaly varies and is thereby classified within the following sensitivity classes: Low, Moderate and High Sensitivity. The capacity of each landscape character type to absorb new development will largely depend on the sensitivity of the landscape type. Developments which are likely to create a significant environmental and particularly visual impact will best be absorbed into areas where the landscape is most robust, i.e. has the capacity to absorb development without significantly changing its character. **All developments should be assessed on a site by site basis to avoid, minimise or mitigate any potential environmental or visual impact.**

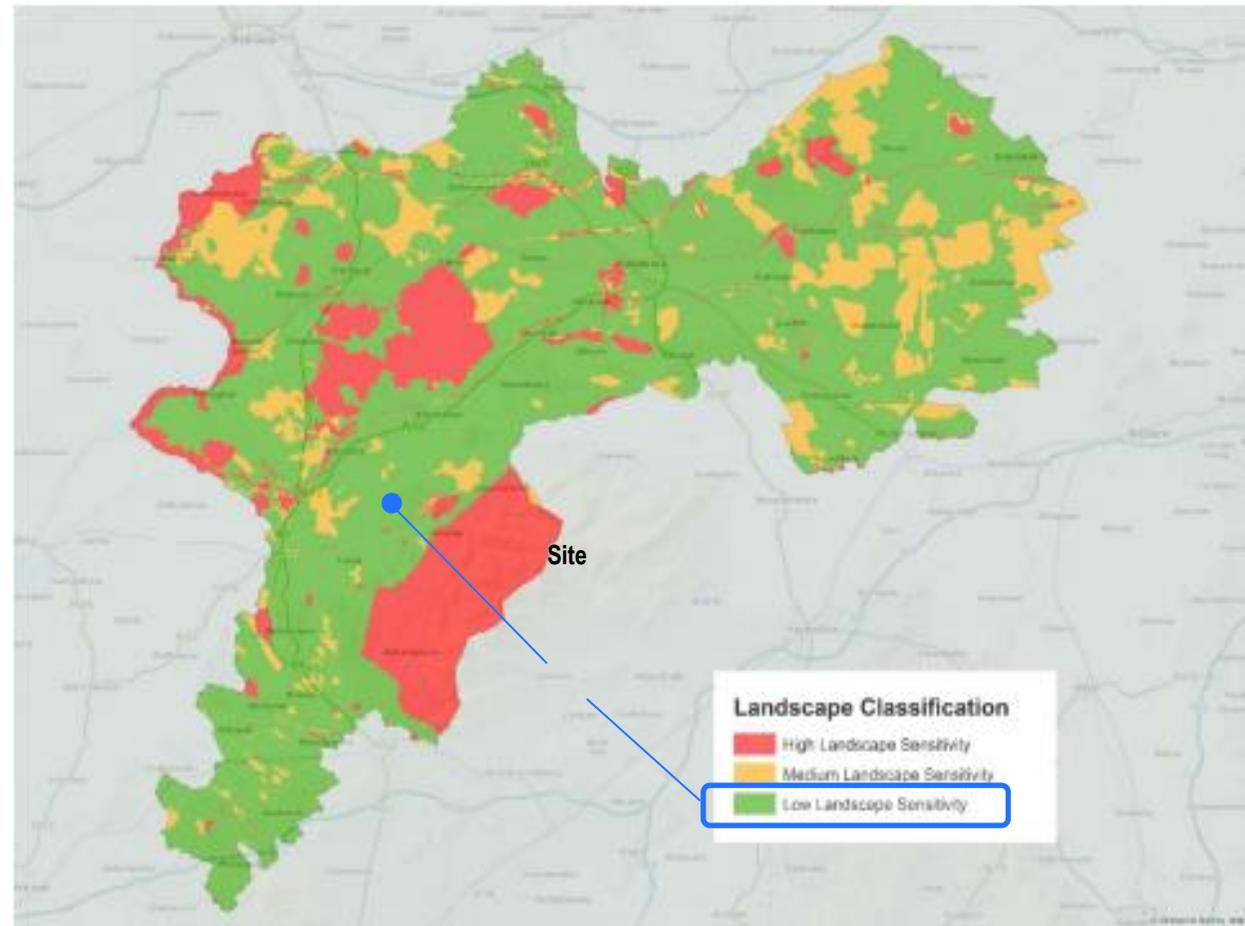


Figure 5.7 Landscape Classification Areas in County Offaly

LOW SENSITIVITY AREAS

Low sensitivity areas are robust landscapes which are tolerant to change, such as the county's main urban and farming areas, which have the ability to accommodate development.

Characteristics:

County Offaly is largely a rural county which comprises of a predominantly flat and undulating agricultural landscape coupled with a peatland landscape. Field boundaries, particularly along roadside verges which are primarily composed of mature hedgerows typify the county's rural landscape.

Sensitivities:

- These areas in general can absorb quite effectively, appropriately designed and located development in all categories (including: telecommunication masts and wind energy installations, afforestation and agricultural structures).
- Within the rural areas, development shall be screened by appropriate natural boundaries that are sympathetic to the landscape generally, where possible.
- New housing proposed in rural areas should respect Offaly County Councils Rural Housing Design Guidelines, together with conformity with development standards.

Acceptability of Development for consideration: A wide range of development subject to appropriateness / conditions

Need for Landscaping and Appropriate Design: High.

Figure 5.8 Low Sensitivity Areas in County Offaly

5.4 Factors Considered in Booster Pumping Station Building Design

82. For the Booster Pumping Station building the following have been identified as key design considerations:

- Landscape Sensitivity - Adherence to principles set out in DOCDP-V1/C4 in relation to Landscape Sensitivity. The site is situated in an area classed as **low landscape sensitivity**. The DOCDP-V1/C4 states that low sensitivity areas as having “robust landscapes which are tolerant to change” and “in general can absorb quite effectively, appropriately designed and located development (including agricultural structures)”.
- Visual impact of proposed – Consider use of materials and colours that blend with the rural environment, such as earth tones or natural textures. Design low-profile buildings to reduce visual impact, especially in open or scenic landscapes – consider use of more organic roof form eg. curved barrel vaulted
- Community and Stakeholders - Design the building to align with local cultural or historical significance eg. consider curved barrel vaulted roof form which would replicate traditional agricultural barn structures prevalent throughout the Irish countryside.
- Materiality – use of eco-friendly, locally sourced materials to reduce the carbon footprint and connect the development to its location eg. consider use of structural glulam timber for the entire building structure to reduce embodied carbon. Consider use of timber cladding to help the building blend in with the natural environment surroundings.
- Biodiversity and Wildlife - Assess the presence of protected species or sensitive habitats in the woodland and surrounding areas. Avoid disrupting wildlife corridors and nesting sites; incorporate measures like bat boxes, birdhouses, or hedgehog passes. Consideration should be given to continuous band of native species tree and shrub planting to surround the site perimeter to provide foraging routes to link with the extant woodland and mitigate habitat loss.
- Climate and Geographic Factors - Design the building to withstand local weather conditions, such as wind, snow, or extreme heat. Use insulation, ventilation, and passive solar strategies to improve energy efficiency
- Sustainability - Source materials locally and prioritize those with a low environmental impact, such as timber from sustainable forests. Minimize the use of heavy machinery to reduce soil compaction and ecosystem disturbance. Use modular or prefabricated components when possible.
- Lighting and Noise - Use dark-sky-compliant lighting to reduce light pollution and its impact on nocturnal wildlife. Design for quiet operations to avoid disturbing wildlife and the rural tranquillity. Implement noise-reduction measures, such as acoustic barriers, to minimize disturbance to nearby wildlife.
- Long-term Maintenance - Ensure the design allows for easy maintenance without harming the adjacent woodland

5.5 Booster Pumping Station Superstructure Design Approach

83. As with the BPT Control Building, a barrel vaulted steel portal framed building is proposed, to invoke an agricultural building aesthetic, as shown in Figure 5.9, below. A lean-to roof at the side of the main barrel-vaulted roofed building will harmonise with agricultural buildings in the area (refer to Figure 5.3).
84. A muted colour palette proposed in this sensitive rural context.
85. Façades are to be overclad using robust thermally treated timber battens, fitted vertically, and spaced to give a three dimensional effect and soften the visual appearance.
86. Panels of exposed dark grey painted render break up the building form.



Figure 5.9 Booster Pumping Station Superstructure Design Approach

5.6 Pros & Cons of Proposed Design Solution

87. The proposed design has the following advantages:

- Visual Impact – Low profile building with curved barrel-vaulted roof providing an organic form to blend in with its natural environment setting assisted by the selection of natural materials, and earth tones and textures.
- Community and Cultural Considerations - Design the building to harmonize with the cultural and aesthetic aspects of the area – By using a building typology that would be appropriate in a rural context. Proposed design invokes a traditional agricultural barn structure prevalent throughout the Irish countryside.
- Materiality – Use of high quality well detailed materials will enhance the quality, resilience, maintenance requirements and longevity of the structure. Materials specifically selected for their colour and texture to harmonise with the natural environment setting.
- Sustainability – Mitigation of embodied carbon by using locally sourced materials and use of glulam timber structural elements where possible. Mitigation of operational carbon by optimising insulating performance of the thermal envelope.

88. The following disadvantages are created by this proposed design:

- Cost – proposed solution with higher quality materials would be more costly than the use of composite aluminium cladding panels with standardised components and systems and higher speed of construction
- Landscape Sensitivity – the requirements of the brief entail that the development will have a detrimental impact on the extant sensitive landscape. This is a strategically important project and therefore this impact will be unavoidable however the design of a low profile, organic form building, and use of extensive semi mature native species perimeter planting will mitigate this impact as well as consequential biodiversity impacts.

5.7 Reasons for Selection

89. The design illustrated in Figure 5.9 above has been selected to

- To provide a low impact, high quality structure that blends into its setting and enhances established patterns of use and settlement without significant change to appearance or character.
- To provide a robust and resilient structure that will have longevity, optimal resilience and low maintenance demands.
- To minimise embodied and operational carbon emissions.

6. Termination Point Reservoir Site

6.1 Termination Point Reservoir Site Location

90. Figure 6.1 below shows the location of the proposed TPR in south Co. Dublin.

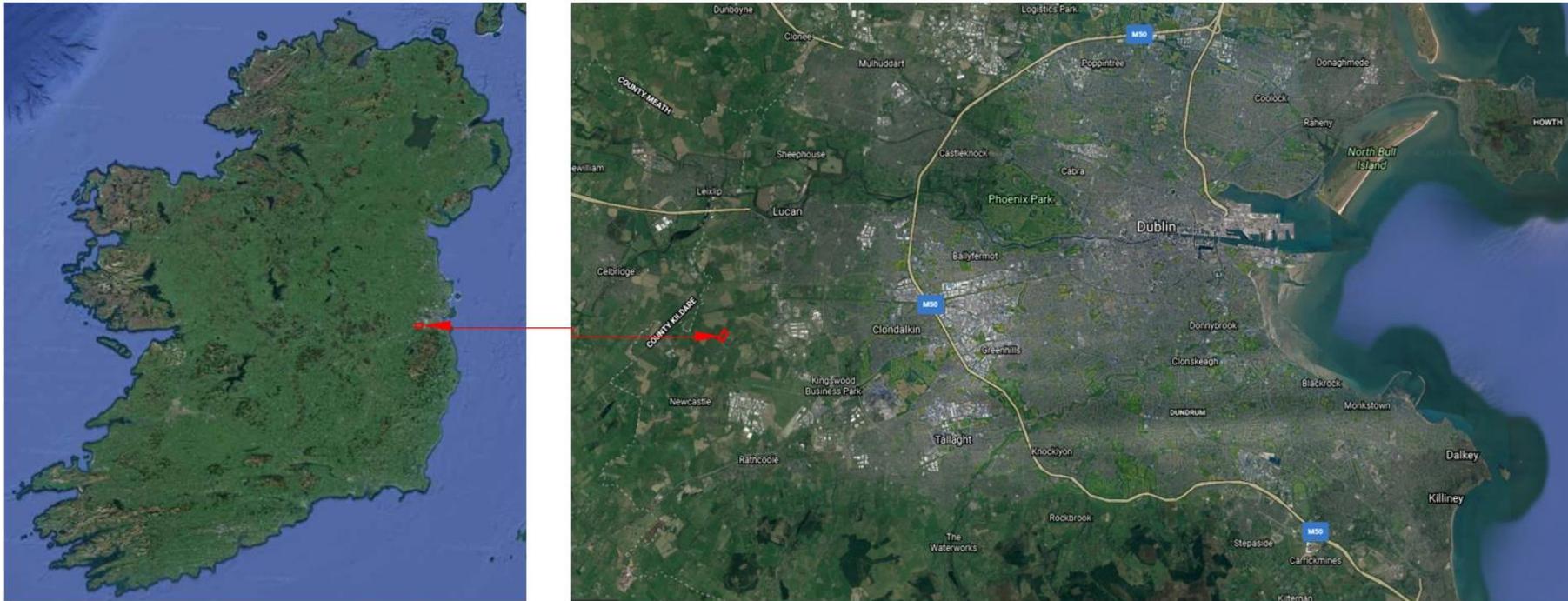


Figure 6.1 Termination Point Reservoir Site Location

6.2 Termination Point Reservoir Site Context

91. The TPR site is a greenfield site, but adjacent to an existing large reservoir and the Peamount Hospital estate. The site is approximately 2.3km north of the town of Newcastle, approximately 15.2km to the west of Dublin city centre, and 7km to the west of the M50 motorway. The permanent site is approximately 8ha excluding the existing Uisce Éireann reservoir and associated facility. The TPR will be integrated with the existing Uisce Éireann infrastructure.
92. In terms of topography the site gradient falls south-east to north-west at approximately 1 in 50.
93. Views are generally limited to local access roads and isolated dwellings and farm buildings across rolling agricultural topography from the west and north.



Figure 6.2 TPR Site Context

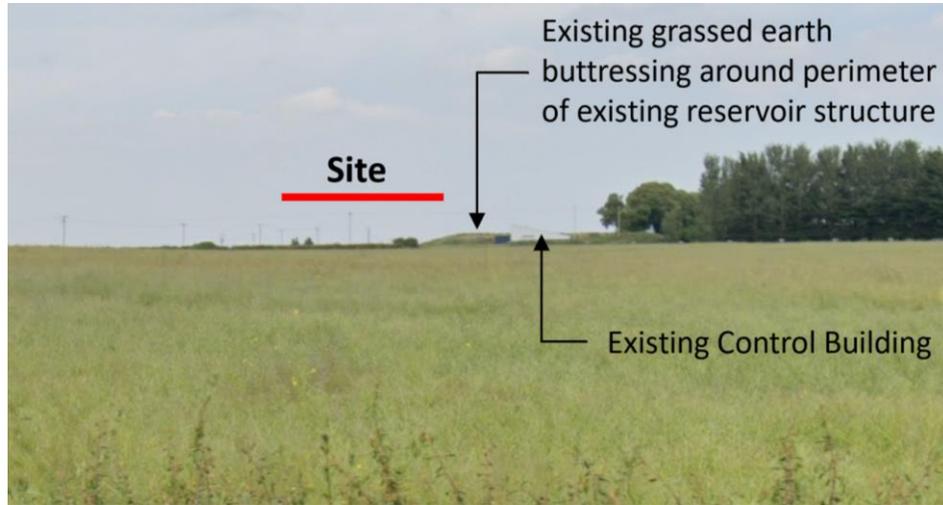


Figure 6.3 View of TB Site from the south

6.3 Planning Policy

94. **Planning Policy** – Planning policy in respect of this site is outlined in the Planning Report that accompanies the application.

6.4 Factors Considered in Termination Point Reservoir Building Design

95. The design is developed through an iterative process to reach a solution that satisfies the numerous parameters described in Section 2.4 (paragraph 13). For the Termination Point Reservoir control building the following have been identified as key design considerations:
- Landscape Sensitivity - The SDCCDP zoning designation for the site is 'EE' - "To provide for enterprise and employment related uses". This zoning recognises that the type of development envisaged for the Termination Point Reservoir would likely be 'permitted in principle'. The site is located in an existing agricultural field, and any development would have biodiversity impacts and as such cognisance must be taken of Section 3 of the SDCCDP, in particular "Protection of Habitats and Species Outside of Designated Areas".
 - Visual impact of proposed – Consideration is given to incorporating low-profile designs to reduce visual intrusion into the green belt. Use natural vegetation or earth mounds to screen the building from key viewpoints
 - Look & Feel – The Termination Point Reservoir & Control Building mark the end of this nationally significant infrastructure project. Cognisance should be taken of the potential for an iconic structure to celebrate this huge achievement and investment.
 - Materiality & Sustainability – Consideration is given to the use of ultra-durable materials suitable for a structure intended to be in use for a significant period of time e.g. in-situ concrete could fulfil this role and although it has higher embodied carbon element, due to its cement content, reduced maintenance requirements and longevity of this type of structure would mitigate this fact over the potential lengthened lifespan of the structure. Embodied carbon can be further mitigated by the use of supplementary cementitious materials (SCMs) to reduce the amount of cement used in the manufacture of concrete.
 - Biodiversity and Wildlife – consideration is given to mitigate loss of habitat e.g. integrate features like green roofs, living walls, or wildlife habitats to enhance biodiversity. Use native plants in landscaping to support local flora and fauna.
 - Cost & Maintenance - Plan for cost-effective construction and operation while ensuring high durability and resilience. Design for easy maintenance with accessible systems and long-lasting materials.
 - Climate and Geographic Factors - Design the building to withstand local weather conditions, such as wind, snow, or extreme heat. Use insulation, ventilation, and passive solar strategies to improve energy efficiency
 - Lighting and Noise - Use dark-sky-compliant lighting to reduce light pollution and its impact on nocturnal wildlife. Design for quiet operations to avoid disturbing wildlife and the rural tranquillity. Implement noise-reduction measures, such as acoustic barriers, to minimize disturbance to nearby wildlife.

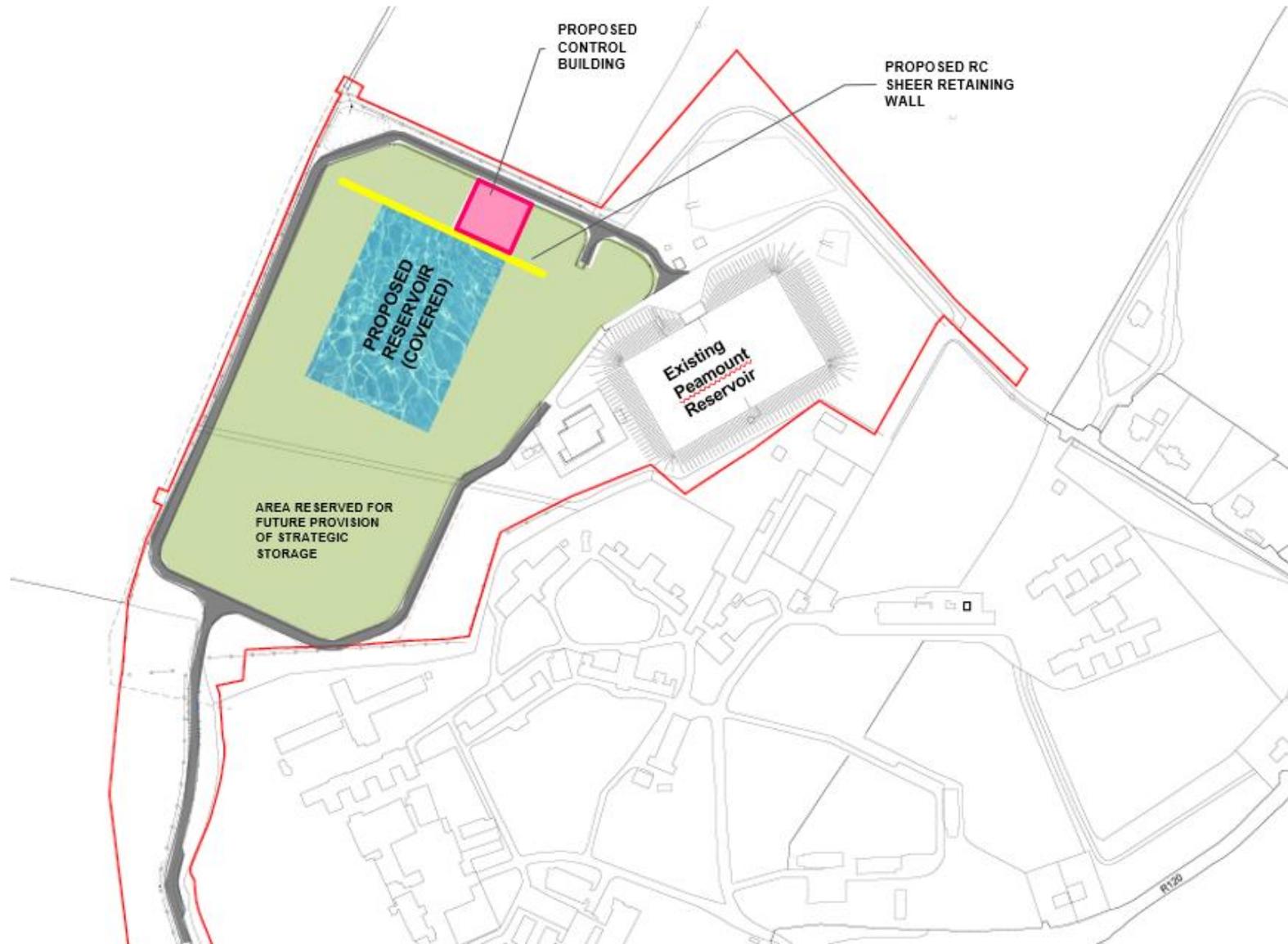


Figure 6.4 Proposed TPR Site Layout



Figure 6.5 Proposed Aerial View of TPR Site

6.5 Termination Point Reservoir Control Building Design Approach

96. If we consider the RWI&PS Site, at Parteen Basin, as the start of this historic project, then the TPR site could be considered the finish and perhaps worthy of some celebration in terms of architectural expression.
97. Inspiration is drawn from the proposed sheer concrete retaining wall to make the control building homogeneous with it – the angle of the retaining wall buttressing is inverted in the building by removing a ‘wedge’ underneath. The concrete form extends, dramatically, at eaves level, projecting past the curtain wall façade
98. The lower wedge is clad with curtain walling, glazed with ceramic backed spandrel panels which gives the effect of glass (light versus the heaviness of the monolithic concrete) but is non-transparent.
99. The homogeneous concrete form set atop the ‘light’ glazed curtain wall could provide a dramatic and suitable end point for the Water Supply Project.



Figure 6.6 Proposed TPR Control Building

Infrastructure Sites Architectural Statement

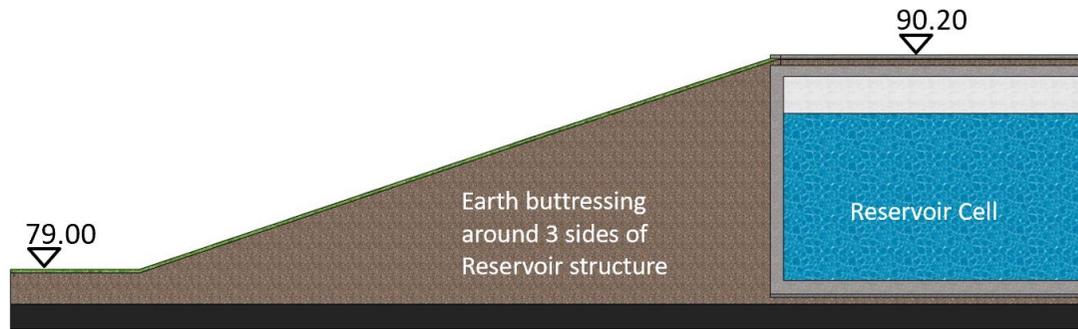
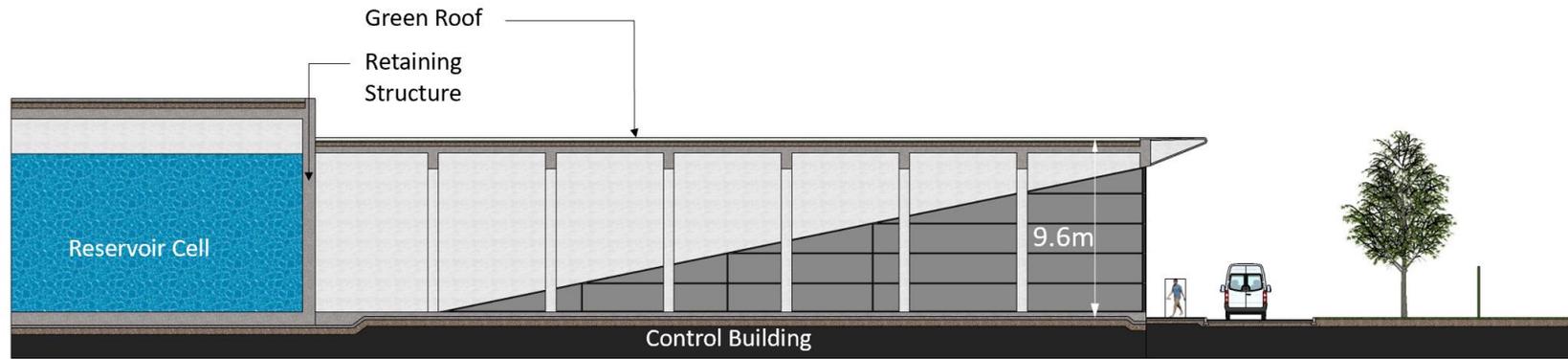


Figure 6.7 Proposed Sections of TPR and Control Building

6.6 Pros & Cons of Proposed Design Solution

100. The following advantages are derived from the proposed design solution:

- Visual Impact – Striking, modern, minimalist control building, homogenous with the concrete buttress walls of the reservoir structure would provide an ‘structural statement to celebrate the end point iconic’ nationally significant multibillion euro infrastructure project.
- Materiality – Use of high quality well detailed in-situ concrete will enhance the quality, resilience, maintenance requirements and longevity of the structure.
- Sustainability – Mitigation of embodied carbon by using SCMs to reduce the amount of cement used in the manufacture of concrete and by the inherent durability and longevity of concrete as a structural material
- Biodiversity – Potential to integrate green roofs, living walls, or wildlife habitats to enhance biodiversity

101. The main disadvantage of the proposed design is:

- Cost – proposed solution with in-situ concrete construction curtain wall system would be more costly than the use of composite aluminium cladding panels with standardised components and systems and higher speed of construction

6.7 Reasons for Selection

102. The design as illustrated in Figure 6.6 and 6.7 above has been selected in order to:

- provide a visually dynamic and an ‘iconic’ structure to celebrate the termination point of the Water Supply Project -Eastern and Midlands Region, a historically significant multibillion euro infrastructure project.
- provide a robust and resilient structure that will have longevity, optimal resilience and low maintenance demands.
- minimise embodied and operational carbon emissions.

7. Infrastructure Sites Overview of Architectural Treatment of Buildings



Proposed Control & Interpretative Visitor Centre Building
Treatment Plant Site (WTP), Co. Tipperary



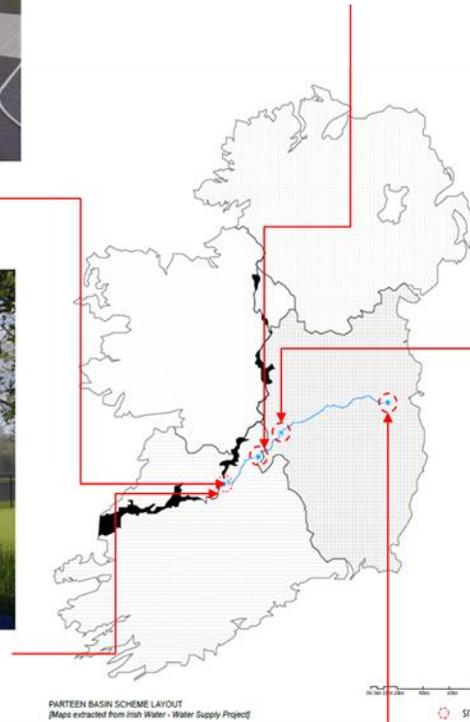
Proposed Control Building Break Pressure Tank Site (BPT)
Co. Tipperary



Proposed Booster Pumping Station Building, Booster Pumping Station Site
(BPS), Co. Offaly



Proposed Raw Water Intake Building, Raw Water Intake Site
(RWI&PS) Parteen Basin, Co. Tipperary



Proposed Control Building - Termination Point Reservoir Site (TPR)
Peamount Hospital, Co. Dublin

Water Supply Project Eastern and Midlands Region - SID Engineering Report

Appendix B - Standard Specification for ESB 38kV Networks

Document no: 32105801/SIDEngineeringReport/AppendixB
Version: Final

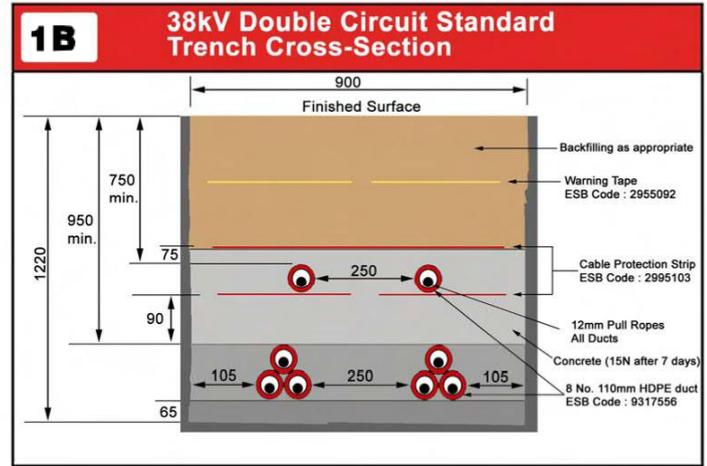
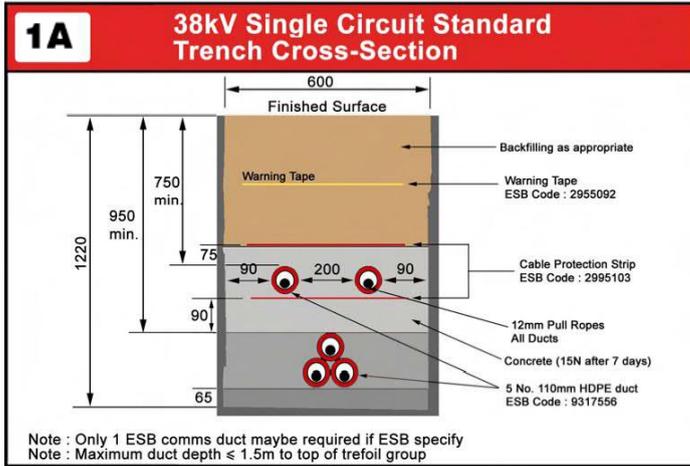
December 2025

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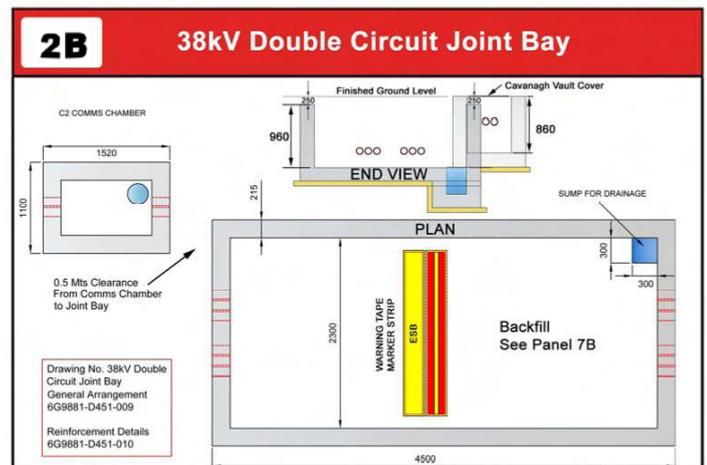
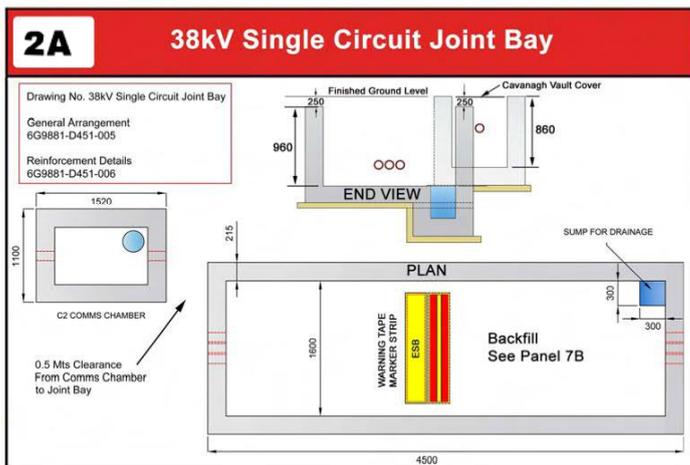
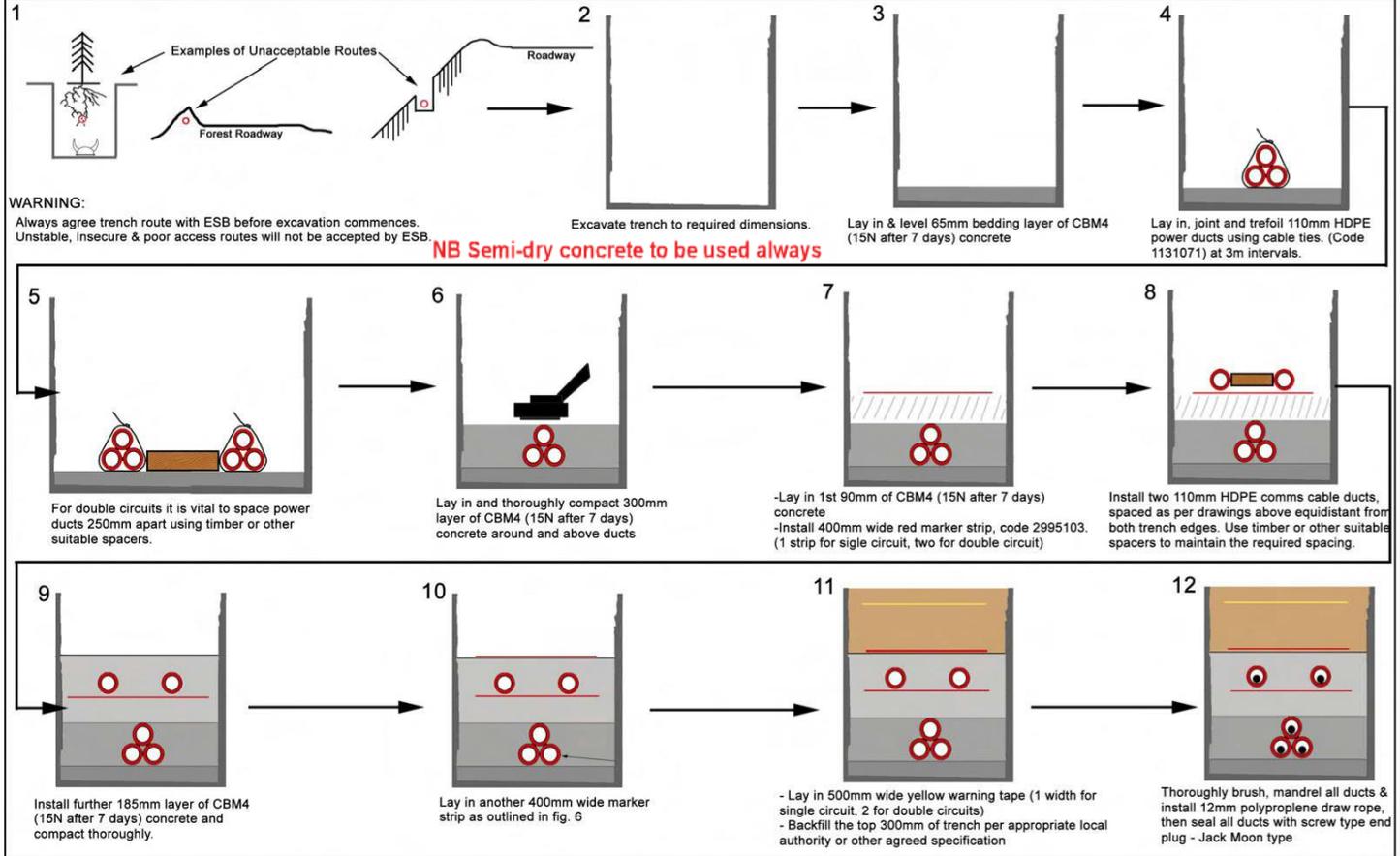
Standard Specification for ESB 38kV Networks Ducting/Cabling (Minimum Standards)

Note 1 : ESB Networks reserves the right not to accept ducting which does not conform to these standards and dimensions
 Note 2 : Refer to ESB Networks for Specific job Specification. These instructions do not apply to LV/MV/110kV/220kV cable
 Note 3 : All materials (ducts, marker tapes/strips, duct surrounds, mandrels and brushes) must be ESB approved materials

ESB Networks
 Rev 0: Date 08-09
 Approved:

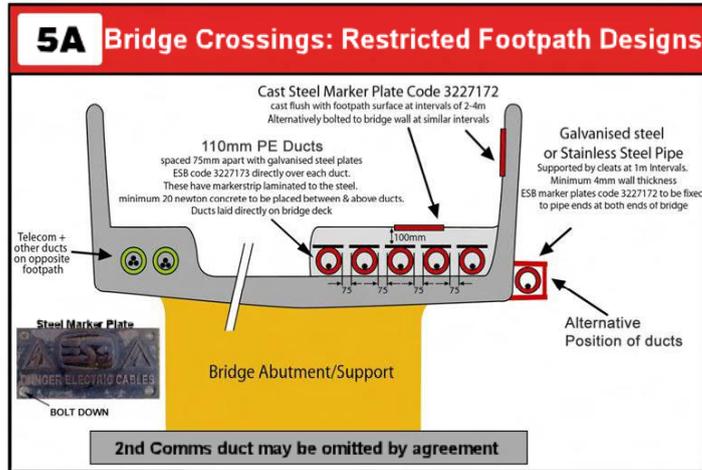


1C Trench Installation Sequence

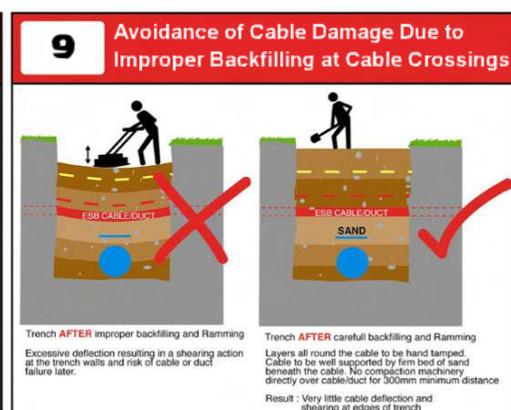
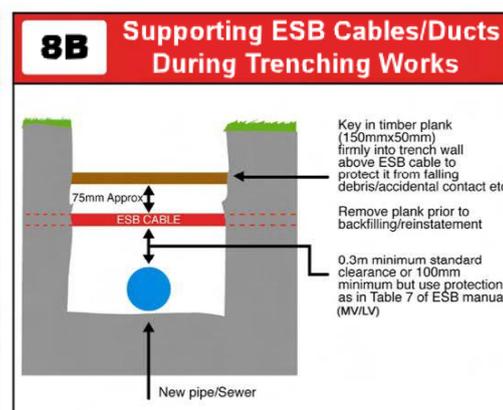
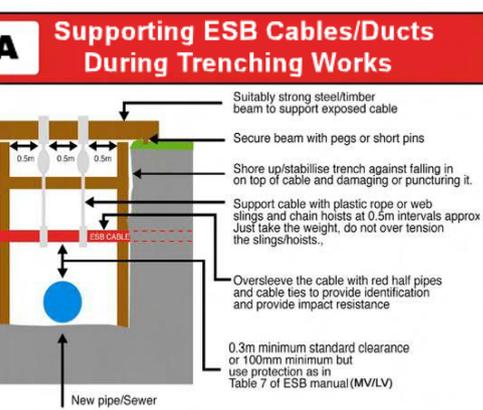
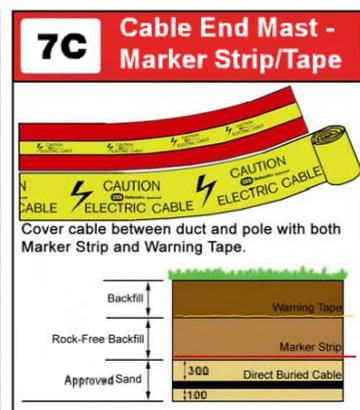
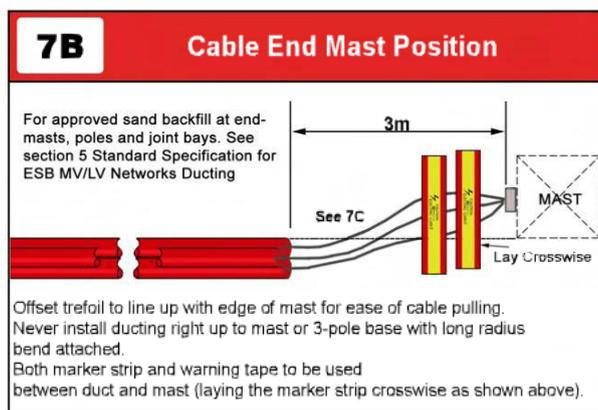
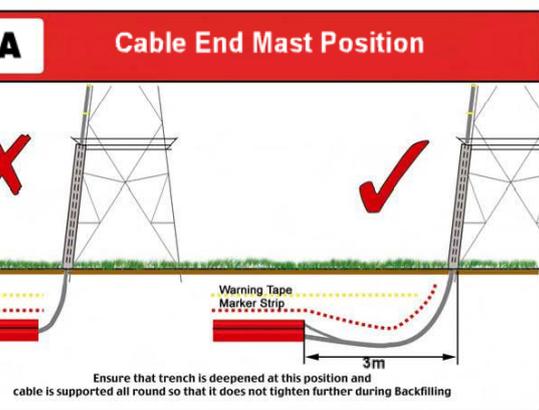
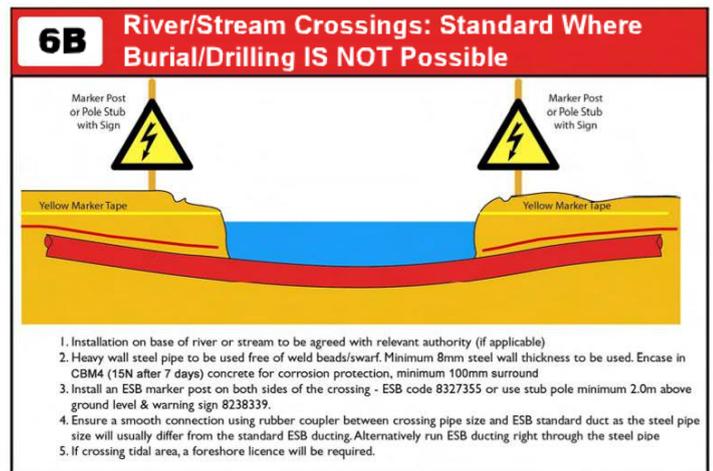
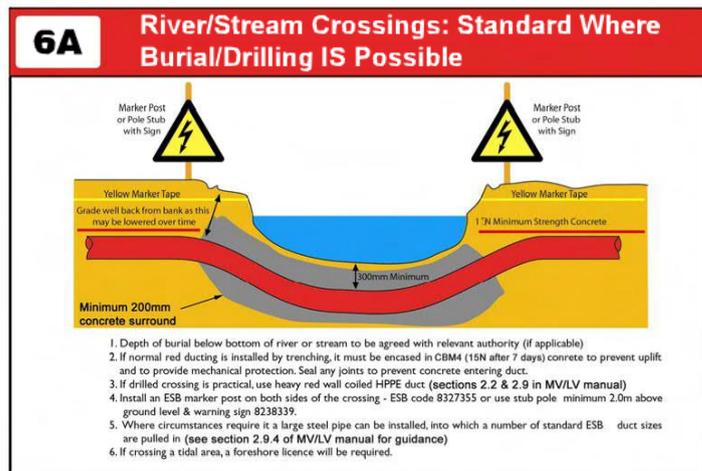


Networks Ducting/Cabling (Minimum Standards)

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 Note 2 : Refer to ESB Networks for Specific job Specification. These instructions do not apply to LV/MV/110kV/220kV cable
 Note 3 : All materials (ducts, marker tapes/strips, duct surrounds, mandrels and brushes) must be ESB approved materials



- ### 5B Bridge Crossings: Restricted Footpath Designs
1. The design must be agreed with the bridge authority. Position in footpath is preferred.
 2. Minimum cover over ducts on footpath 100mm.
 3. Where duct cover is > 300mm, marker strip & surface marker plates can be used.
 4. Red ducting is not suitable for cable run external to bridges.
 5. Where possible galvanised steel/stainless steel piping should be used, all joints must be free of weld burrs on inside. Alternatively heavy duty 10mm wall thickness black HDPE material with cast steel marker plates attached must be used to permanently warn of presence of electric cable.



Networks Ducting/Cabling (Minimum Standards)

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Note 3 : All materials (ducts, marker tapes/strips, duct surrounds, mandrels and brushes) must be ESB approved materials



3A End Mast Termination

For existing 9m masts increase steel work height by 1.3m at mast top

12m Mast (For all new works)

Anti-Climbing Guard

EARTH GRID

Cable Assembly Drawing Number : D205778

3B Triple Pole Structure

Cable Steel Work Code: 1286697

Made up anti-climbing guard

7m Min Dimension to Bare Metal Use 12m Pole

3C Station Termination

To Cubicle

If Cable run <50m install lightning arrestors.

Assess need for mesh screen guard (Code: 3175003)

Drg. No A3205856

Clearances : Phase to:
- Phase 500mm outdoor
- Earth 500mm outdoor

3D Earth Grids

10m PLAN

10m

3m approx.

1.5m

1.5m

12 Rod Earth Grid For 3-Pole Structure

12 Rod Earth Grid For Mast Structure

Warning Tape

500

300

Earth Grid resistances <10 Ohms. If ground is known to be high resistance, plan ahead and put additional earthwire into cable trench.

Drg. No. A4D 205343
PE424-D901-911-001-000

4A Obligation of Duct Installer to minimise the number and severity of duct bends

The duct installer must minimise the number and severity of preformed bends in ground with obstructions and other utility service crossings by opening ground 15m ahead of backfilled duct, wherever practical to do so. This safety obligation, which may require use of steel plating, allows the duct installer to pick the least bendy duct route through utility crossings and obstructions. Otherwise, numerous sharp unrecorded duct route deviations will be present making cable installation considerably more difficult and less safe for the cable installer.

Backfilled Duct

Obstructions

Digger

Dig 15m Ahead of duct to uncover obstructions

4B Standard for Brushing, Mandrelling, Roping and End-Capping of 38kV ducts

All Ducts must be:

- Thoroughly brushed and mandrelled to prove ducts against debris /excessive deflection
- Roped using 12mm polypropylene rope with certified safe breaking load of 1.5 tons -- all rope joints to be properly spliced and PVC taped over. Approved Supplier Silver Strand Bunclana Donegal, ph (074) 9382503 - 500m drum lengths available to minimise splicing/coil handling
- Sealed using endcaps against grit and water getting into them

NB: Replace mandrels once mandrel wear indicators or grooves are worn down
Replace brushes once brush diameter falls 5mm below dimensions in table below

- Approved endcaps, both disposable and reusable types, are available from suppliers of approved ESB ducting
- Approved ESB Mandrel and brush suppliers :

Brandon Agencies, Rathnew, Co Wicklow: Phone 0404 20500 (Brushes & Mandrels)
IS Varian, Greenhills Industrial Estate, Walkinstown, Dublin 12 Phone: 01-4501150 (Brushes Only)
Clydesdale UK Phone 086 172 6665 (Brushes & Mandrels)
Tynagh Network Systems, Loughrea, Co Galway, Phone: 091 842206 (Brushes & Mandrels)

110mm HDPE Duct Size

Mandrel Code: 9317546

Brush Code: 8783255

Sponge Code: 8783252

4C Approved ESB Ducting for 38kV Cables

- Use only solid wall high impact resistance ESB approved HDPE red ducting to IS 370 colour standard and ESB specification 16113 (6.3mm minimum wall thickness) Discoloured or unidentified ducting not acceptable. All duct material must be approved by ESB Networks.
- Lightweight flexible corrugated twinwall ducting is not acceptable to ESB irrespective of manufacturer
- Current approved HDPE Duct and duct bend manufacturers are: Lynplast (bend fittings only), Uponor-Radius Systems, Wavin, Quality Plastics

4D Specification for Duct Jointing for 38kV Cables

Mallet or Hammer

Timber block to protect end of duct from damage

Long Coupler

Fully jointed Duct Marks

All ducts to be securely jointed by tapping against timber board on each duct until the black depth insertion mark is reached

Always smear duct lubricant on coupler rubber ring

4E Repair of Existing Ducts

Use only approved slip couplers from approved manufacturers in section 4C

Damaged Duct Section

Slip Coupler

Slip Coupler

Repair length

- Cut out damaged section of duct and ensure all cut surfaces are square and free from sharp edges
- Slide, position and centre the repair couplers on the centering marks

4F Sealing of Ducts

All ducts to be permanently sealed at both ends of duct run
Ducts to be temporarily sealed during installation using endcaps provided with each bale

Endcap Plain End

ESB Code 110mm: 9317569

10A 38kV Railway Crossing Details

ESB Signpost

3m

ESB Signpost

Drilling pits outside CIE property line

Formal licence for crossing and approval required from CIE. Accurately record crossing location & erect marker posts.

10B Directional Drill/Thrust Bore Duct Bore Details

DESIGN 1

Minimum internal bore size = 325mm for 5 ducts

=290mm for 4 ducts where approved by ESB

Spacer

5 no. 110mm diameter HDPE ducts

Alternatively use 2 x 37mm HDPE ducts for comms cables with C2 chamber on each side of the crossing to permit pulling along entire route. (See 10C)

Completed interstitial space to be bentonited thoroughly to maintain cable rating. Accurately record crossing location & erect marker posts.

10C Directional Drill/Thrust Bore Duct Bore Details

ALTERNATIVE DESIGN

ESB Signpost

3m

ESB Signpost

Cable joint pit

Cable joint pit

37

37

Install 1 no. 200mm SDR 17.6 duct with 3 no. short length cables pulled into this pipe along with 2 x 37mm comms ducts. Full cable joint bays are required on either side of crossing along with C2 chambers for this design. This method is used where it is not practical to install large diameter pipe -eg. risk of ground upheaval or presence of obstructions. Completed interstitial space to be thoroughly bentonited to maintain cable rating. Accurately record crossing location & erect marker posts.

10D Double Circuit Bore Crossing

Standard Design

3m min

-Both Bentonited

Separate drilling for each circuit crossing

Alternative

HDPE or steel thrust bore pipe Diameter ID= 400mm

Bentonite

6 no. 110mm Power ducts + 2 no. 110mm comms ducts

2 no. sets of 110mm HDPE ducts - 8 ducts in total. All crossings to be accurately recorded and signposts erected given impracticality of marker tape. If both circuits = 40MVA then use 630 Cu cable

12 Minimum Standard Clearances to Other Services

Normal Services

300

600

Large Pipelines High Pressure Pipes

Clearances less than the above at pinch points and crossings requires placement of additional mechanical protection (concrete slab/brick) and agreement of ESB

ESB ducts must never be laid over other services on parallel runs, except with the written prior agreement of the other utilities and ESB

Other services must never be laid directly over ESB ducts on parallel runs

13 Combined MV & 38kV Cable Runs

38kV Trench

1.1m to 1.25m Depending on Location

Yellow Marker Tape

Pilot Cables

Concrete Surround

MV/LV Cables

Yellow Marker Tape

Red Marker Strip

150mm

150mm

Additional MV/LV Ducts as Required

300mm Strict Minimum Separation

Where it is impractical to avoid such trench runs, the separation of 300mm should be strictly controlled and monitored to minimise derating (See MV/LV manual page 180)

14 Sealing and Protection of 38kV Cables Once They Exit Ducts

Duct

Sandbags or other durable support for cable as it exits ducts to prevent damage to cable sheath

Ducts to be thoroughly using ESB approved water sealant and 4hr fire rating approved for firestop. NB - All joint bay duct entries to be thoroughly sealed to prevent sand washout and subsidence.

15 Duct Crossovers Are Not Allowed

1, 2, 3

Be especially careful when going from flat to trefoil formation in vicinity of services

Eliminate this possibility by marking ducts 1, 2, 3 etc before & after flattening to avoid an obstruction.

NB. If using double circuit, tape mark power ducts 1 to 6

16 Crossing Dumps/Contaminated Ground

Thoroughly seal all joints with adhesive water-tight duct jointing compound and pressure test for airtightness. Gasketed couplers alone are inadequate. Fusion welded couplers are also acceptable but require red over-taping.

NB. Avoid whenever possible due to: Subsidence, methane gas & severe thermal derating risks. Seek advice from ug networks section to ensure rating of cable is adequate (derating of 50% can occur) NB. Waste oils and chemicals can also seriously damage cables

Seal all duct joints with duct adhesive compound or use continuous duct lengths & seal all duct ends in joint bays. Alternatively weld pipes.

Concrete is continued up to 300mm of final surface to offset derating (CBM4 - 15N after 7 days)

Standard Specification for ESB MV/LV Networks Ducting (Minimum Standards)

Note 1: ESB Networks reserves the right not to accept ducting which does not conform to these standards and dimensions
 Note 2: Refer to ESB Networks for Specific job Specification. These instructions do not apply to 38kV/110kV/220kV cable
 Note 3: All materials (ducts, marker tapes/strips, duct surrounds, mandrels and brushes) must be ESB approved materials

ESB Networks
 Drg. No. NW-014
 Rev 0: Date 09-08
 Approved:

1 MINIMUM depths below finished ground level

DEPTH

- 450mm in established footways
- 600mm in new housing estate carriageways & footways and all grassed areas
- 750mm All Non-Housing Estate carriageways, forestry, farmland & bogland

Depth is measured to top of duct
 Max depth is 1m except at:

- service crossings where 1.5m is allowed
- short rail and road crossings where up to 2.5m is allowed

2A Minimum Standard Clearances to Other Services

- To achieve these clearances see sections 3D and 3E below
- Clearances less than the above at pinch points and crossings requires placement of additional mechanical protection (concrete slab/brick) and agreement of ESB
- ESB ducts must never be laid over other services on parallel runs, except with the written prior agreement of the other utilities and ESB
- Other Services must never be laid directly over ESB ducts on parallel runs

2B Trench Installation Sequence

Warning:
 Always agree trench route with ESB before excavation commences. Unstable, insecure & poor access routes will not be accepted by ESB.

1. Examples of Unacceptable Routes: Roadway, Forest Roadway

2. Excavate trench to required dimensions. Ensure loose material and protruding stones are removed

3. Lay in & compact a bedding layer of approved material to a min thickness of 50mm or as otherwise specified

4. Lay ducts and horizontal spacer on 50mm bedding layer maintaining specified clearances

5. For multiple circuits ensure ducts are spaced as per Section 3 below with a min of 150mm duct spacing

6. Lay in and compact a layer of approved backfill to a depth of 200/275mm above bedding layer

7. Install ESB approved red marker strip on top of approved compacted backfill

8. Lay in and compact a layer of approved backfill maintaining a max depth of 300mm to the surface

9. Install ESB approved yellow marker tape. The max depth for the marker tape is 300mm from finished ground level

10. Reinstate final layer of backfill as per agreed L&L and Owner Specification

3A Minimum Duct Spacings for ESB Ducts

75mm minimum duct spacing for up to two ducts in any layer

Duct crossovers not allowed at any point along route.

3B Minimum Duct Spacings for ESB Ducts

150mm duct spacing required for more than 2 ducts in any layer

Duct crossovers not allowed at any point along route.

3C Minimum Duct Spacings for ESB Ducts

Minimum duct to trench wall clearances and minimum bedding depths

Minimum duct to trench edge clearance is 100mm and minimum bedding depth is 50mm

NB: 50mm minimum depth of compacted approved backfill above duct top

3D Minimum Duct Spacings for ESB Ducts

Achievement of Horizontal Duct Spacing

Use 75mm or 150mm temporary timber/brick or plastic spacers as appropriate to establish horizontal duct spacing during construction

NB Use 300mm or 600mm horizontal spacers to achieve horizontal spacing from other utilities as appropriate

Always keep a stock of 300mm, 150mm & 75mm spacers for ESB Trenching

3E Minimum Duct Spacings for ESB Ducts

Achievement of Vertical Duct Spacing

STEP 1 Lay in Ducts and horizontal spacer Lay in 50mm bedding Layer

Step 2 Lay in and compact approved backfill to 200/275mm depth depending on spacing in 3A/3B above

Step 3 Check depth of approved backfill above 1st duct layer and lay in 2nd layer of ducts and spacers on top of sand layer

NB. Vertical Duct Spacers are not allowed anywhere as they create point loading of ducts. Refer to 3A/3B for spacings in specific situations

4A Installation of: Special ESB marked Yellow Marker Tape and Special ESB marked Red Marker Strip in Carriageways

ESB yellow marker tape and red marker strip is to be used on all carriageways and on grassed areas for both LV & MV cables

300mm Maximum for ESB yellow marker tape

75mm minimum above duct for ESB red marker strip.

ESB yellow marker tape and red marker strip widths must always be wider than ducts beneath

ESB yellow marker tape and ESB red marker strip must never be laid directly on top of ducts

Never lay other utility marker tape or strip over ESB ducts

Never lay ESB marker tape or strip over other utility pipes

4B Installation of Special ESB marked Yellow Marker Tape in all Footways

ESB approved yellow marker tape to be used on all Footways

300mm Maximum for ESB yellow marker tape

ESB yellow marker tape width must always be wider than width of ducts beneath

ESB Yellow marker tape must never be laid directly on top of ducts

Never lay other utility marker tape or strip over ESB ducts

Never lay ESB marker tape or strip over other utility pipes

CAUTION
ELECTRIC CABLE

5 Specification for duct surround material

The thermal resistivity of the duct surround material must be maximum 1.0km/watt @0% moisture content. Only ESB approved unwashed sand graded to BS882 standard or equivalent ESB approved material is acceptable.

Duct surround material must be well compacted around ducts without damaging the ducts

NB: Pea gravel and foam concrete are unacceptable ESB duct surround materials

6A Specification for Installation of Ducts at sharp route bends

ESB Approved Long Radius Bend (minimum Duct Bend Radius 1.2 Metres) Bends less than 1.2m radius are unacceptable

400mm 10N Minimum strength concrete on inside of bend to withstand cable pulling forces

Cross Section at bend Showing concrete support all around the duct and increased trench width

Wider trench to accommodate 400mm of concrete on inside of bend

Normal Trench Width

6B Specification for Installation of Ducts at Gentle sweep bend positions

6m length straight pipe

Always use a series of 11, 22 or 45° bends to provide a smooth joint interface where the trench route curves around in a large sweep. Never bend ducts around a large sweep trench

Concrete support as for item 6A

7 Obligation of Duct Installer to minimise the number and severity of duct bends

The duct installer must minimise the number and severity of preformed bends in ground with obstructions and other utility service crossings by opening ground 12m ahead of backfilled duct, wherever practical to do so. This safety obligation, which may require use of steel plating, allows the duct installer to pick the least bendy duct route through utility crossings and obstructions. Otherwise, numerous sharp unrecorded duct route deviations will be present making cable installation considerably more difficult and less safe for the cable installer.

Backfilled Duct

Obstructions

Digger

Dig 12m Ahead of duct to uncover obstructions

8 Standard for Brushing, Mandrelling Roping and End-capping of MV/LV Ducts

All Ducts must be:

- Thoroughly brushed and mandrelled to prove ducts against debris/excessive deflection
- Roped using 12mm polypropylene rope with certified safe breaking load of 1.5 tons – all rope joints to be properly spliced and PVC taped over. Approved Supplier Silver Strand Bundana Donegal, ph (074) 9382503 - 500m drum lengths available to minimise splicing/handling
- Sealed using endcaps against grit and water getting into them
- Replace mandrels once mandrel wear indicators or grooves are worn down
- Replace brushes once brush diameter falls 5mm below dimensions in table below
- Approved endcaps, both disposable and reusable types, are available from suppliers of approved ESB ducting
- Approved ESB Mandrel and brush suppliers:

Brandon Agencies, Rathnew, Co Wicklow. Phone 0464 20500 (Brushes & Mandrels)
 IS Varian, Greenhills Industrial Estate, Walkinstown, Dublin 12. Phone: 01-4501150 (Brushes Only)
 Clydesdale UK Phone 085 172 6665 (Brushes & Mandrels)
 Tynagh Network Systems, Loughrea, Co Galway. Phone: 091 842206 (Brushes & Mandrels)

125mm uPVC Duct Size		160mm uPVC Duct Size	
Mandrel	Brush	Mandrel	Brush
155mm	250mm	135mm	250mm
Code: 9317547	Code: 8783254	Code: 9317548	Code: 8783251

9 Guidance on Correct Direction to Lay Spigot and Socket Ducting

Case 1 Duct run with all bends at one end

Correct direction as cable drum will be located at bendy end

Case 2 (a) Bendy no matter which side route is looked at
No best direction to lay ducts

Case 2 (b) More bends at one end than the other
Correct direction

Case 3 Trenching routes longer than 500m

Treat any route as a series of lengths between joint bays at say 500m intervals and lay ducting as for Case 1 & 2 above

If on large sloping route lay as shown

10 Approved ESB Ducting for MV/LV Cables

- Use only solid wall high impact resistance ESB approved PVC red ducting to IS 370 colour standard and ESB specification 16113 (3.8mm minimum wall thickness) Discoloured or unidentified ducting not acceptable. All duct material must be approved by ESB Networks.
- Lightweight flexible corrugated twinwall ducting is not acceptable to ESB irrespective of manufacturer
- Current approved Duct and duct bend manufacturers are: Lynplast (bend fittings only) Radius Systems, Wavin, Quality Plastics, MFP Plastics, Cork Plastics, Emtelle

11 Specification for Duct Jointing for MV/LV Cables

All ducts to be securely jointed by tapping against timber board on each duct until the black depth insertion mark is reached

12 Repair of Existing Ducts

Use only approved slip couplers from approved manufacturers in section 9

- Cut out damaged section of duct and ensure all cut surfaces are square and free from sharp edges
- Slide, position and centre the repair couplers on the centering marks

13 Sealing of Ducts

All ducts to be permanently sealed at both ends of duct run
Ducts to be temporarily sealed during installation using endcaps provided with each bale

ESB Code 125mm: 9317583 ESB Code 160mm: 9317566

14A Cross-Sectional Drawing of Backfilling in Front of MV Sub

SAFETY WARNING!!
Earths are an essential safety system. Connection will not be made available until they are installed.

See pg. 213 of MV/LV Manual

14B Plan View of Ducting in Front of Substation

300mm Minimum
75mm - 1-3 ducts
150mm - 3+ ducts
2.5m Minimum Pit Opening Length
1.0m Minimum

See pg. 212 of MV/LV Manual

17A Supporting ESB Cables/Ducts During Trenching Works

Suitably strong steel/timber beam to support exposed cable
Secure beam with pegs or short pins
Shore up/stabilise trench against falling in on top of cable and damaging or puncturing it.
Support cable with plastic rope or web slings and chain hoists at 0.5m intervals approx. Just take the weight, do not over tension the slings/hoists.
Oversleeve the cable with red half pipes and cable ties to provide identification and provide impact resistance
0.3m minimum standard clearance or 100mm minimum but use protection as in relevant section of ESB manual

New pipe/Sewer

See pg. 42 of MV/LV Manual

17B Supporting ESB Cables/Ducts During Trenching Works

Key in timber plank (150mmx50mm) firmly into trench wall above ESB cable to protect it from falling debris/accidental contact etc
Remove plank prior to backfilling/reinstatement
0.3m minimum standard clearance or 100mm minimum but use protection as in Table 7 of ESB manual

New pipe/Sewer

See pg. 42 of MV/LV Manual

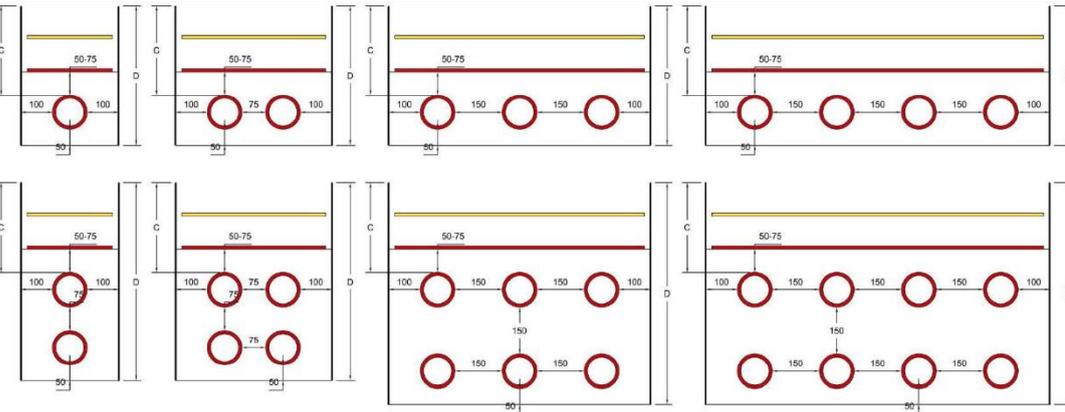
18 Avoidance of Cable Damage Due to Improper Backfilling at Cable Crossings

Trench AFTER improper backfilling and Ramming
Excessive deflection resulting in a shearing action at the trench walls and risk of cable or duct failure later.

Trench AFTER careful backfilling and Ramming
Layers all round the cable to be hand tamped. Cable to be well supported by firm bed of sand beneath the cable. No compaction machinery directly over cable/duct for 300mm minimum distance
Result: Very little cable deflection and shearing at edges of trench

See pg. 44 of LV/MV Manual

19 MV/LV Trench Dimensions & Duct Clearances for 125mm Ducting Layouts



Minimum Trench Widths for 1 & 2 Rows of Ducts

No. Of Ducts in Row	1	2	3	4	5	6
Minimum Trench Width	325	525	875	1150	1425	1700

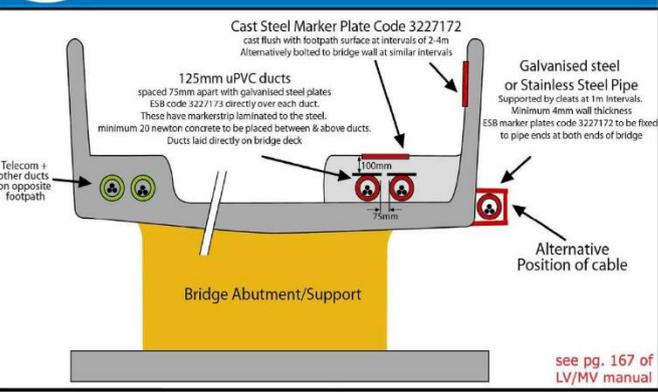
Minimum Trench & Duct Depths for 1 Horizontal Row of Ducts

Location of Trench	New Housing Scheme Footpath, road & Grass Areas in Vicinity	Existing Footpaths	Existing or New Roads Other Than New Housing Scheme	Farmland, Forestry tracks & Bogland
Minimum Trench Depth (D)	775	625	925	925
Minimum Depth to top of Duct (C)	600	450	750	750

Minimum Trench & Duct Depths for 2 Horizontal Row of Ducts

Location of Trench	New Housing Scheme Footpath, road & Grass Areas in Vicinity	Existing Footpaths	Existing or New Roads Other Than New Housing Scheme	Farmland, Forestry tracks & Bogland
Minimum Trench Depth (D)	975	825	1125	1125
Minimum Depth to top of Duct (C)	1050	900	1200	1200
Minimum Depth to top of Duct (C)	600	450	750	750

20A Bridge Crossings: Restricted Footpath Designs



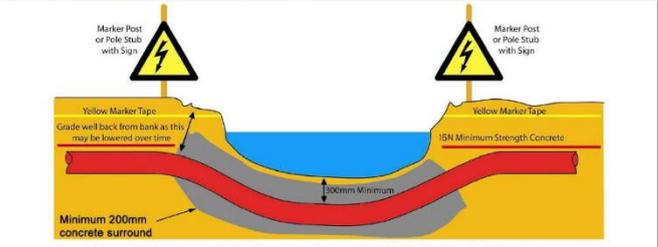
see pg. 167 of LV/MV manual

20B Bridge Crossings: Restricted Footpath Designs

1. The design must be agreed with the bridge authority. Position in footpath is preferred.
2. Minimum cover over ducts on footpath 100mm.
3. Where duct cover is > 300mm, marker strip & surface marker plates can be used.
4. Red uPVC ducting is not suitable for cable run external to bridges.
5. Where possible galvanised steel/stainless steel piping should be used, all joints must be free of weld burrs on inside. Alternatively heavy duty 10mm wall thickness black HDPE material with cast steel marker plates attached must be used to permanently warn of presence of electric cable.

see pg. 167 of LV/MV manual

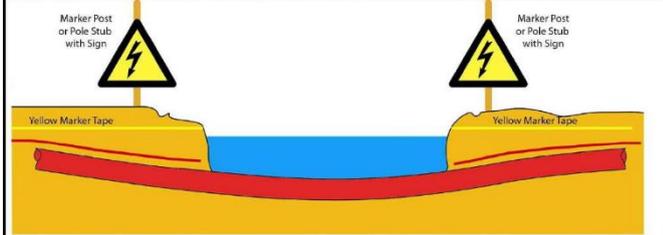
21A River/Stream Crossings: Standard Where Burial/Drilling is possible



1. Depth of burial below bottom of river or stream to be agreed with relevant authority (if applicable)
2. If normal red ducting is installed by trenching, it must be encased in CBM4 (15N after 7 days) concrete to prevent uplift and to provide mechanical protection. Seal any joints to prevent concrete entering duct.
3. If drilled crossing is practical, use heavy red wall coated HDPE duct (sections 2.2 & 2.9 in MV/LV manual)
4. Install an ESB marker post on both sides of the crossing - ESB code 8327355 or use stub pole minimum 2.0m above ground level & warning sign 8238339.
5. Where circumstances require it a large steel pipe can be installed, into which a number of standard ESB duct sizes are pulled in (see section 2.9.4 of MV/LV manual for guidance)
6. If crossing a tidal area, a foreshore licence will be required.

See pg. 168 of LV/MV manual

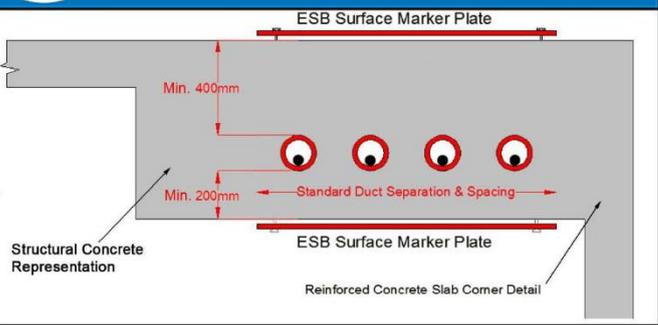
21B River/Stream Crossings: Standard Where Burial/Drilling is not possible



1. Installation on base of river or stream to be agreed with relevant authority (if applicable)
2. Heavy wall steel pipe to be used free of weld beads/swarf. Minimum 8mm steel wall thickness to be used. Encase in CBM4 (15N after 7 days) concrete for corrosion protection, minimum 100mm surround
3. Install an ESB marker post on both sides of the crossing - ESB code 8327355 or use stub pole minimum 2.0m above ground level & warning sign 8238339.
4. Ensure a smooth connection using rubber coupler between crossing pipe size and ESB standard duct as the steel pipe size will usually differ from the standard ESB ducting. Alternatively run ESB ducting right through the steel pipe.
5. If crossing tidal area, a foreshore licence will be required.

See pg. 168 of LV/MV manual

22A Minimum Standard Over Basements/Carparks



22B Minimum Standard Over Basements/Carparks

Minimum depth of duct is 400mm.

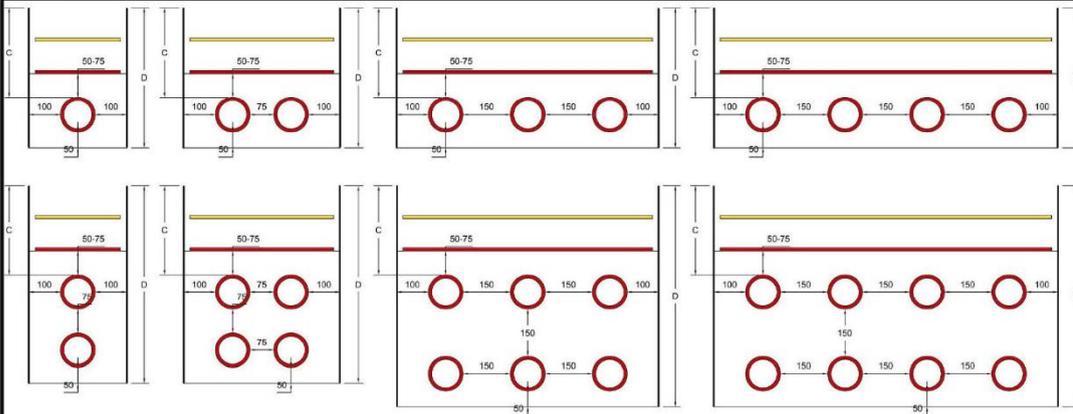
Minimum thickness from bottom of duct to underside of slab is 200mm.

ESB surface marker plates are to be placed at approximate intervals of 3 metres on the top and bottom surfaces of the slab.

Marker plates are to be cast level with the surface and screwed down to avoid lift off (ESB code: 3227172)

For ESB Ducts concrete surround - same strength for entire slab

23 MV/LV Trench Dimensions & Duct Clearances for 160mm Ducting



Minimum Trench Widths for 1 & 2 Rows of Ducts

No. Of Ducts in Row	1	2	3	4	5	6
Minimum Trench Width	360	595	980	1290	1600	1910

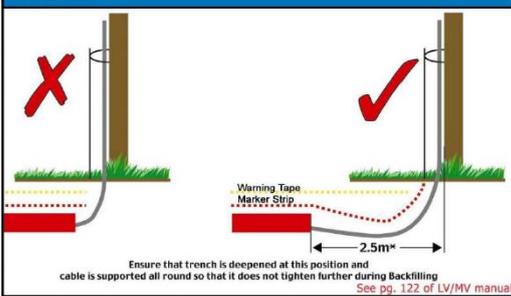
Minimum Trench & Duct Depths for 1 Horizontal Row of Ducts

Location of Trench	New Housing Scheme Footpath, road & Grass Areas in Vicinity	Existing Footpaths	Existing or New Roads Other Than New Housing Scheme	Farmland, Forestry tracks & Bogland
Minimum Trench Depth (D)	810	660	960	960
Minimum Depth to top of Duct (C)	600	450	750	750

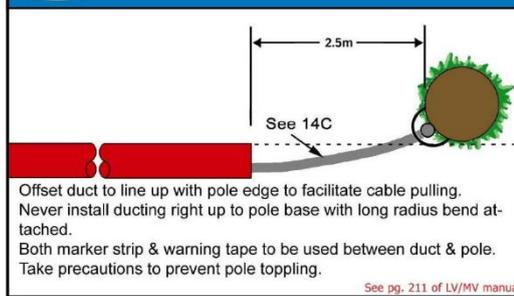
Minimum Trench & Duct Depths for 2 Horizontal Row of Ducts

Location of Trench	New Housing Scheme Footpath, road & Grass Areas in Vicinity	Existing Footpaths	Existing or New Roads Other Than New Housing Scheme	Farmland, Forestry tracks & Bogland
Minimum Trench Depth (D)	1045	895	1195	1195
Minimum Depth to top of Duct (C)	1120	970	1270	1270
Minimum Depth to top of Duct (C)	600	450	750	750

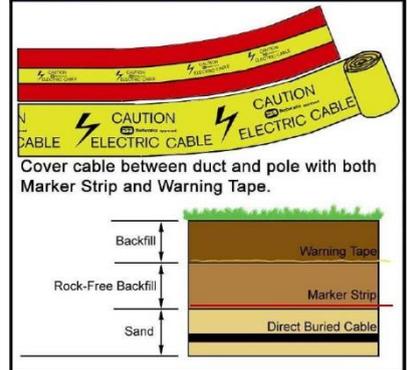
24A MV Cable End Pole Position - Elevation



24B MV Cable End Pole Position - Plan View

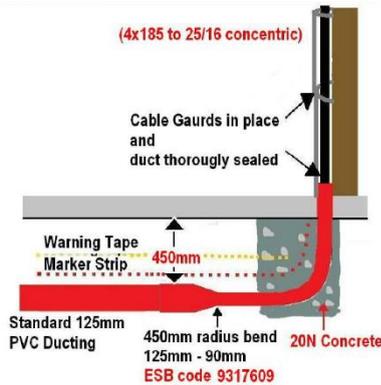


24C MV Cable End Pole - Marker Strip/Tape



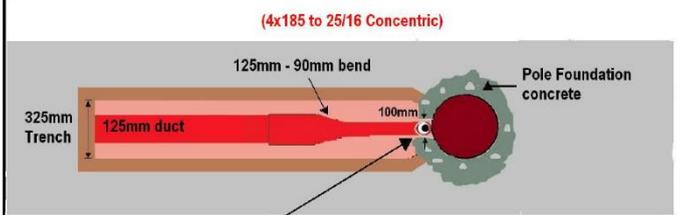
24D LV Cable End Pole Position - Elevation

Ducting For LV Mains and LV Service Cable



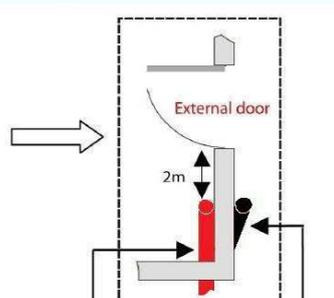
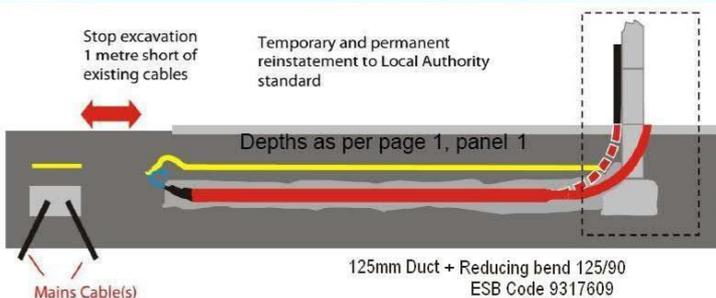
24E LV Cable End Pole Position - Plan View

Ducting for LV Mains and LV Service Cable



1. Cut channel into pole concrete foundation to allow for the vertical section of the duct bend to lie against the pole
2. Place duct bend into position
3. Backfill and support bend with 20N concrete mix as per elevation view

25 A LV Ducting for Non Domestic Connections Duct laid to Mains Cable



General Note for all Cases:

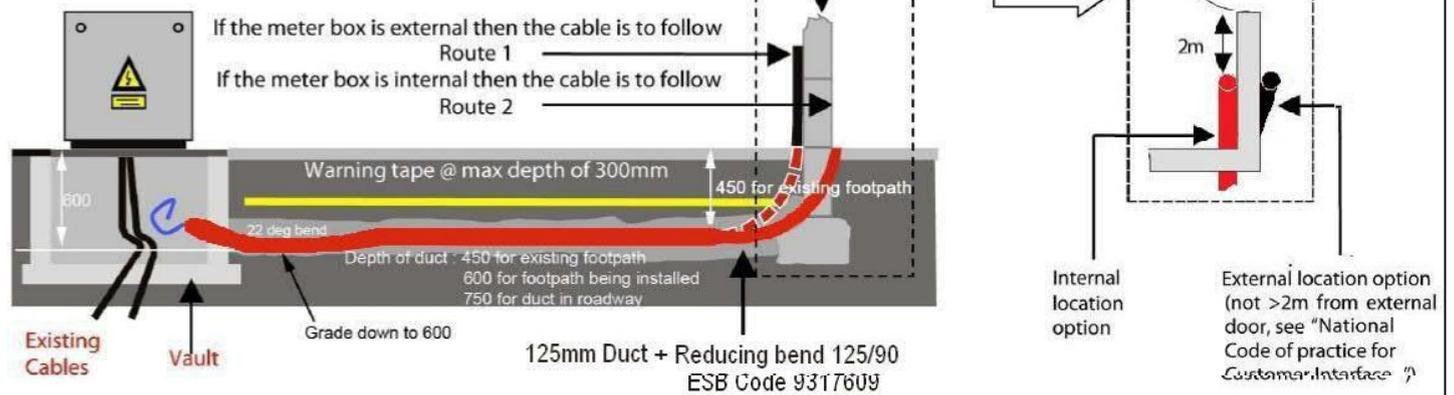
- 1: Excavation within 1 metre of existing cables must only be carried out by hand and with agreement of the local ESB Networks office. This is to prevent damage to existing cables and consequent safety risk for workers.
 - 2: Liaise with ESB Networks to confirm location of all cables.
- All Excavation work to be in accordance with HSA Code of Practice

25B

LV Ducting for Non Domestic Connections Duct laid to Mini Pillar Location

The new duct must only be put into the vault with an ESB Networks person present

If no vault in front of minipillar, the limit of excavation must be agreed with ESB Networks personnel locally.
Temporary and permanent reinstatement to Local Authority Standard.



26

Specification for Standard Non-Scheme Domestic Underground Service to an Outdoor Meter Cabinet (low-voltage service not exceeding 50m) from an Overhead Network



The Customer must ensure that:

- The service pole and the complete run of the duct are both within the site boundary. ESB's Engineering Officer will confirm the service pole position and the ducting route on-site.
- An outdoor meter cabinet, to ESI Standard 12-3 (1986), is installed in a suitable location, see overleaf.
- An ESB approved "hockey stick" is installed at the meter cabinet position.
- Red ESB approved 50mm service ducting is installed at a minimum depth of 600mm between the hockey stick position and the service pole. Yellow ESB cable warning tape must be installed at a maximum depth of 300mm below ground level along the full length of the duct.
- Corrugated Ducting of any colour is not permitted.
- The duct shall be as straight as possible and free of sharp bends.
- A continuous and strong 10mm polypropylene draw rope is installed in the duct. It must be free of knots and secured at both ends of the duct.

Notes:

- It is essential that the ESB cable does not come into contact with the cavity insulation. Allow a projection of 25mm of the hockey stick into the base of the cabinet.
- There must be a minimum clearance of 100mm between the service duct and other services on the house-holder's property.
- ESB will provide black UV light-resistant ducting from below the finished ground level to the top of the service pole.
- For poles more than 50m away from the cabinet, 125mm red ESB approved ducting shall be used with an ESB approved service vault at the junction of the duct and the hockey stick.

Connection will only be made after all above requirements are met.

