Tionscadal Soláthair Uisce
Water Supply Project

Environmental Impact Assessment Report (EIAR)

Volume 2 of 6: EIAR Main Report

(Chapter 3) Consideration of Reasonable Alternatives

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Uisce Éireann
Irish Water

Jacobs

TOBIN

Contents

Acronyms and Abbreviations

Acronym	Meaning
AA	Appropriate Assessment
BPS	Booster Pumping Station
BPT	Break Pressure Tank
CAPEX	Capital Expenditure
DI	Ductile Iron
DYCP	Dry Year Critical Period
EIA	Environmental Impact Assessment
EIAR	Environmental Impact Assessment Report
ESB	Electricity Supply Board
ESBN	ESB Networks
FCV	Flow Control Valve
FOAR	Final Options Appraisal Report
GAC	Granular Activated Carbon
GDA WRZ	Greater Dublin Area Water Resource Zone
GIS	Geographic Information System
GRS	Glass Reinforced Plastic
HGV	Heavy Goods Vehicle
HLPS	High Lift Pumping Station
km	Kilometre
m	Metre
m^3/s	Cubic metres per second
mAOD	Metres Above Ordnance Datum
MCA	Multi-Criteria Analysis
Ml	Million litres
Mld	Million litres per day
NPV	Net Present Value
NWRP	National Water Resources Plan
NYAA	Normal Year Annual Average
OPEX	Operational Expenditure
OWP	Options Working Paper
PE	Polyethylene
PNR	Project Need Report
POAR	Preliminary Options Appraisal Report
PCC	Prestressed Concrete Cylinder
RWA-E	Raw Water Abstraction – Eastern
RWA-N	Raw Water Abstraction – Northern
RWA-W	Raw Water Abstraction – western

Acronym	Meaning
RWI&PS	Raw Water Intake and Pumping Station
RWRM	Raw Water Rising Main
SAC	Special Area of Conservation
SEA	Strategic Environmental Assessment
THM	Trihalomethane
TOTEX	Total Expenditure
TPR	Termination Point Reservoir
WRZ	Water Resource Zone
WTP	Water Treatment Plant

3 Consideration of Reasonable Alternatives

3.1 Introduction

1. Article 5(1)(d) and Annex IV of the EIA Directive[1] require an Environmental Impact Assessment Report (EIAR) to provide a description of the reasonable alternatives (for example in terms of project design, technology, location, size and scale) studied by the developer, which are relevant to the proposed project and its specific characteristics, and an indication of the main reasons for selecting the chosen option, including a comparison of the environmental effects. To comply with this requirement this chapter sets out the reasonable alternatives considered in respect of the Proposed Project and outlines the main reasons for decisions made in respect of the Proposed Project as described in Chapter 4 (Proposed Project Description), and Chapter 5 (Construction & Commissioning).

2. The Guidelines on the Information to be contained in Environmental Impact Assessment Reports (Environmental Protection Agency 2022) notes the following in respect of alternatives:

> *'The objective is for the developer to present a representative range of the practicable alternatives considered. The alternatives should be described with an indication of the main reasons for selecting the chosen option. It is generally sufficient to provide a broad description of each main alternative and the key issues associated with each, showing how environmental considerations were taken into account in deciding on the selected option. A detailed assessment (or 'mini-EIA') of each alternative is not required.'*

3. This chapter fulfils the requirements of Article 5(1)(d) and Annex IV. It has been separated into the following sections:
   - Overview of the Proposed Project to provide an understanding of the overall project in respect of which alternatives were considered
   - A summary of the previous iterations of the project prior to the development of the National Water Resources Plan (Ireland's first such plan) (Irish Water 2021 and 2022)
   - Overview of the recommendations of the National Water Resources Plan
   - Sections dealing with design decisions regarding:
     - Siting of infrastructure including the pipeline
     - The design of the pipeline
     - Power supply to the pipeline
     - Construction compounds.

4. This chapter is supported by the following documents:
   - Appendix A3.1 Pipeline Routing Report.

5. Figures which are referenced in the text are provided in Volume 5 of this EIAR.

[1] Directive 2014/52/EC amending Directive 2011/92/EU on the Assessment of the Effects of Certain Public and Private Projects on the Environment transposed through S.I. No. 296 of 2018 EU (Planning and Development) (Environmental Impact Assessment) Regulations 2018.

3.1.1 Terminology

6. This chapter distinguishes between different stages of the development of alternatives by adopting the following terminology: 'Previous iterations of the 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 Regional Water Resources Plan – Eastern and Midlands (the Eastern and Midlands Plan) (Irish Water 2022). The 'Proposed Project' refers to the project that planning permission is being sought for as described in Chapter 4 (Proposed Project Description) in this EIAR 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).

3.2 Overview of the Proposed Project

7. The Proposed Project, for which alternatives have been considered, would comprise a water supply pipeline with the abstraction and pumping of raw water from the Lower River Shannon at the Parteen Basin; treatment of the water nearby at Birdhill, County Tipperary; and pumping of the treated water to a high point near Cloughjordan, County Tipperary and on through the Midlands to a termination point at Peamount, in County Dublin (within the administrative area of South Dublin County Council), where it would connect into the existing Greater Dublin Area Water Resource Zone (GDA WRZ) network.

8. 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) 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.

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
- The TPR would have a capacity of 75 megalitres (Ml) and would provide the location for the Proposed Project to connect into the existing drinking water network
- Pipeline infrastructure including a Break Pressure Tank (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 Sites 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 Area 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 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. Once completed, the Proposed Project would provide the capacity to meet the drinking water need for a Water Supply Area consisting of 36 Water Resource Zones (WRZs) across the Eastern and Midlands Region. This aligns with the Eastern and Midlands Plan[2] (Irish Water 2022).

12. It would do this by providing the capacity to supply up to 280 megalitres of water per day (Mld) which would:
    - 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 WRZ into four new WRZ, when future projects are brought forward by Uisce Éireann.

13. The Proposed Project would also provide the capacity for a further supply of 20Mld to meet future reductions in existing supplies.

14. Therefore, the maximum daily peak volume demand of water to be supplied by the Proposed Project would be 300Mld.

15. A graphical overview of the Proposed Project, including the locations of the water supply infrastructure and routing of the pipeline, is shown in Image 3.1.

[2] 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 Barndarrig 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.

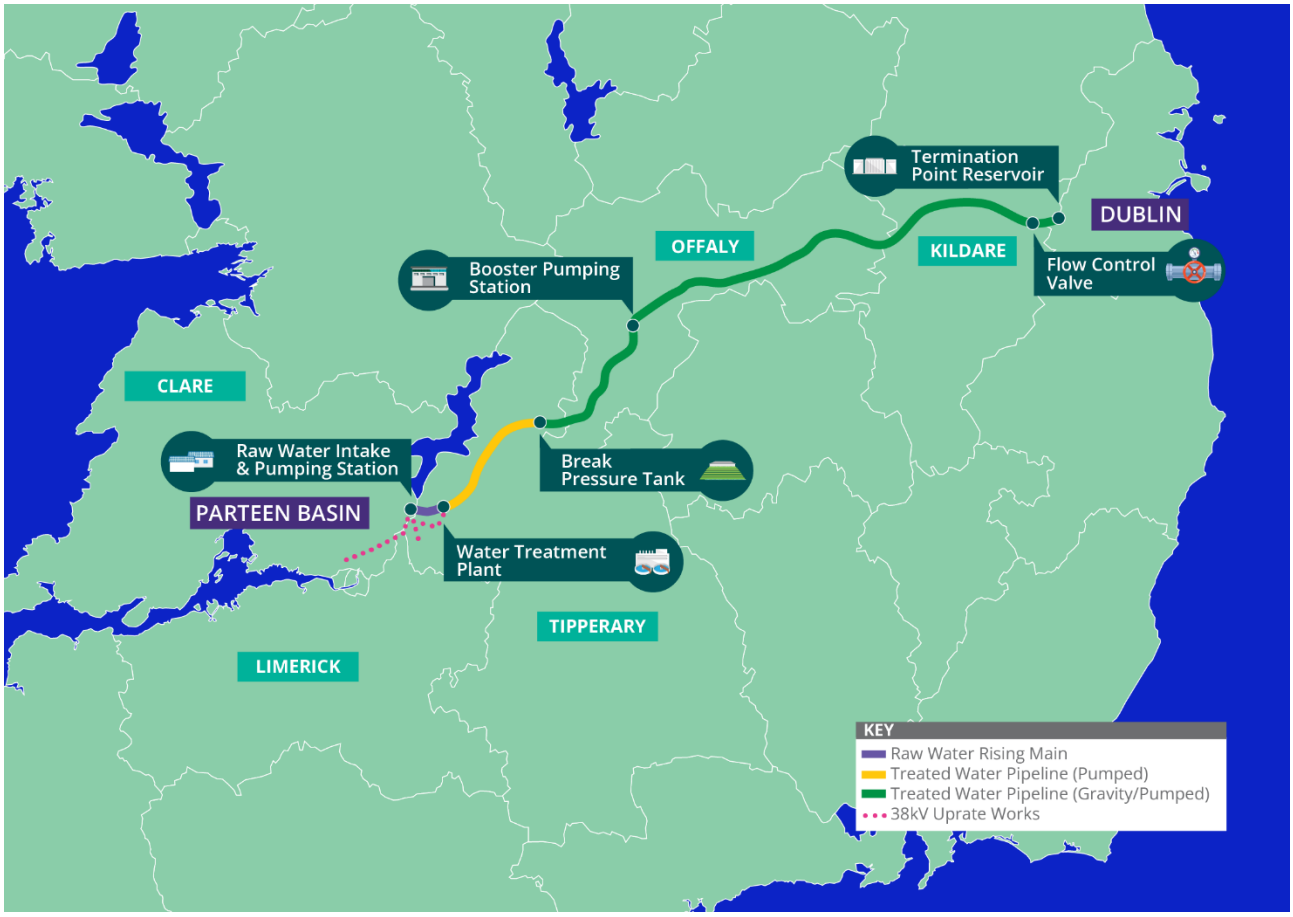


Image 3.1: Graphical Overview of the Proposed Water Supply Infrastructure

16. Table 3.1 provides a summary the principal project infrastructure.

Table 3.1: 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	• 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.

Proposed Project Infrastructure	Outline Description of Proposed Project Infrastructure*
Raw Water Rising Mains (RWRMs) (Pipeline) County Tipperary	• 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	• 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.
Treated Water Pipeline from the WTP to the BPT (Pipeline) County Tipperary	• 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.

Proposed Project Infrastructure	Outline Description of Proposed Project Infrastructure*
Break Pressure Tank (BPT) (Infrastructure Site) County Tipperary	• 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.
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)	• 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.
Booster Pumping Station (BPS) (Infrastructure Site) County Offaly	• 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	• 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)	• 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	• 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 modular 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)	• 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)	• 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 Lisgarriff (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	• 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.

3.3 Previous Iterations of the Project

17. The emergence of a long term solution to the water supply needs of Dublin and surrounding areas has been underway since the mid-1990s, originally under Dublin City Council acting on behalf of the four Dublin local authorities along with Kildare and Wicklow County Councils. The development of previous iterations of the project to deliver water to Dublin from the River Shannon were the result of a design process, over an extended period, which examined the options that existed at the time to deliver a long-term sustainable water supply source, initially for the Dublin Region and latterly for the Dublin Region and an additional Benefiting Corridor.

18. An initial Strategic Environmental Assessment (SEA) (Phase 1) was published in 2006, (Dublin City Council 2006) following a Feasibility Study of three water supply options which commenced in 2004, as part of 'The Plan – Water Supply Project Dublin Region' (Dublin City Council 2008). Feasibility Studies on 10 options were completed in 2007/08, in conjunction with the Plan ('The Plan – Water Supply Project Dublin Region') (Dublin City Council 2008) and SEA (Phase 2) process.

19. On taking responsibility for the Proposed Project, but prior to the development of the NWRP, Uisce Éireann carried out four key stages of assessment and four non-statutory public consultation processes between 2015 and 2017. In addition to the consultations, the technical and environmental assessments, ground investigations and computer modelling simulations, were also used to identify a preferred scheme for a new water supply for the Eastern and Midlands Region.

20. The consultations were undertaken on the Project Need Report – February 2015 (PNR) (Irish Water 2015a), Options Working Paper – June 2015 (OWP) (Irish Water 2015b), Preliminary Options Appraisal Report – November 2015 (POAR) (Irish Water 2015c), and Final Options Appraisal Report – November 2016 (FOAR) / Environmental Impact Statement – Scoping Report (Irish Water 2016).

21. Table 3.2 summarises the timeline in the development of previous iterations of the project.

22. The final preferred option, prior to the Eastern and Midlands Plan (Irish Water 2022) was set out in the FOAR.

Table 3.2: Timeline for Previous Iterations of the Project

Stage	Date	Description
'The Plan – Water Supply Project Dublin Region' Draft (Dublin City Council 2006)	2006	An initial SEA (Phase 1) was published in 2006, following a Feasibility Study of three water supply options which commenced in 2004. The three options comprised: • Liffey / Barrow Conjunctive Use • Lough Ree on the River Shannon • Desalination in North County Dublin.
'The Plan – Water Supply Project Dublin Region' Final (Dublin City Council 2008)	2008	Feasibility Studies on the 10 options were completed in 2007/08, in conjunction with the Plan ('The Plan – Water Supply Project Dublin Region') and SEA (Phase 2) process which commenced in early 2008. The SEA (Phase 2) and Appropriate Assessment (AA) processes were carried out in respect of The Plan, thus ensuring that consultation and the environmental significance of the 10 options were considered and informed certain changes to the Plan.
Project Need Report (PNR) (Irish Water 2015a)	February 2015	The PNR confirmed the need for a new water supply source for the Dublin Water Supply Zone and a Benefiting Corridor[3], based on demographic projections, economic assessment of water supply in the regional and national economy, water demand projections and on considerations of resilience of supply.
Options Working Paper (OWP) (Irish Water 2015b)	June 2015	The 10 water supply options, initially considered in The Plan, and subject to SEA and AA, were subsequently reviewed in the OWP. It determined that four of the options identified in The Plan, were technically viable and therefore appropriate to be brought forward for further consideration.
Preliminary Options Appraisal Report (POAR) (Irish Water 2015c)	November 2015	The POAR set out the detail of the assessment process for the four technically viable options and considered and evaluated them, taking into account preliminary results of investigative surveys and modelling at the time, which had been continuing over the interim period. This consultative assessment was done to identify an Emerging Preferred Option from the four water supply options determined as technically viable in the OWP. The consultative assessment incorporated: • A review of the submissions from the public consultation on the OWP • Investigative studies recommended by the SEA, including a water quality survey and model of Lough Derg and a full geophysical survey of the soil and bedrock conditions at the potential raw water storage site at Garryhinch, County Offaly • A multi-criteria analysis (MCA) of each of the options, based on published criteria reviewed following consultation. The POAR determined that, following investigative surveys, options involving abstraction from the north-east quadrant of Lough Derg, (Option B and F2) did not meet environmental and technical requirements.
Final Options Appraisal Report (FOAR) (Irish Water 2016)	November 2016	The FOAR examined the two remaining options, (abstraction from the River Shannon at the Parteen Basin, and desalination of seawater at the coast in Fingal), providing more detailed assessment of the distribution of impact on residence times under a range of scenarios, and Cost Benefit Analysis of both options.

3.4 The National Water Resources Plan

23. Since the FOAR (Irish Water 2016) Uisce Éireann has adopted Ireland's first National Water Resources Plan for public water supply. The National Water Resources Plan, composed of the Framework Plan (Irish Water 2021) and the four Regional Water Resource Plans (RWRPs), is one of Uisce Éireann's Tier 2 Implementation Plans and its formulation and adoption is an objective outlined within Uisce Éireann's Tier 1 Water Services Strategic Plan 2050 (WSSP) (Uisce Éireann 2025). The National Water Resources Plan focusses on water supply, set out within the objectives of the WSSP 2050 (Uisce Éireann 2025).

24. These WSSP 2050 (Uisce Éireann 2025) objectives are:

    - Safe and Reliable Drinking Water

[3] The Benefiting Corridor was an area defined by the infrastructure and transfer pipeline, where the proximity of treated water supplies from the in-flight project offered opportunities for future consolidation of existing smaller and more vulnerable public water supply schemes, in a resilient, well-supported configuration. Future connecting infrastructure would be subject to separate consenting processes. This has subsequently been replaced by the Water Supply Area as set out in Section 3.4.

- Support our Customers, Communities & the Economy
- Protect and Restore our Environment
- Sustainable Services fit for the future.

25. The National Water Resources Plan (Irish Water 2021 and 2022), being Uisce Éireann's strategic framework for the delivery of water services will guide the company in the planning of projects and programmes to address water supply issues nationally in a manner consistent with relevant national policies. These projects and programmes will then be prioritised and brought forward through regulated 5-year investment cycles.

26. The objective of the National Water Resources Plan (Irish Water 2021 and 2022) is to implement a strategic plan to meet Ireland's water requirements over the short, medium and long term by ensuring a safe, secure, sustainable and reliable water supply for all consumers.

27. The National Water Resources Plan (Irish Water 2021 and 2022) was delivered in two phases.
    - Phase 1, the National Water Resources Plan Framework Plan (the 'Framework Plan') (Irish Water 2021) set out the approach to identifying water supply needs and quantifies those needs up to the year 2044. It also described the approach to identifying solutions to address the water supply needs across all of Uisce Éireann's water supplies. The Framework Plan (Irish Water 2021), following public consultation, was finalised and adopted in spring 2021
    - Phase 2 comprised the development of four Regional Water Resources Plans to identify the optimal technical solutions (the 'Preferred Approaches') required to address the needs outlined in the Framework Plan (Irish Water 2021). The Regional Water Resources Plan – Eastern and Midlands Region (the 'Eastern and Midlands Plan') (Irish Water 2022), was adopted in autumn 2022, following public consultation.

28. Both phases of the National Water Resources Plan (Irish Water 2021 and 2022) were subject to SEA processes, which considered alternatives.

29. The key outcome from the Framework Plan (Irish Water 2021) and the Eastern and Midlands Plan (Irish Water 2022), relevant for consideration of the In-flight Water Supply Project was that a New Shannon Source with transfers, comprising an abstraction from Parteen Basin and a transfer of treated water to a termination point reservoir in Dublin, is the Preferred Approach to address Supply Demand Balance deficits in 37[4] Water Resource Zones in the Eastern and Midlands Region.

30. The New Shannon Source serves as the Preferred Approach for 37 WRZs in the Eastern and Midlands Region (at the time of the adoption of the plan it was 37 WRZs but two have been subsequently combined), comprising:
    - Direct supply from the New Shannon Source transfer pipeline connecting to the GDA WRZ at Peamount
    - Offtakes from the New Shannon Source transfer pipeline to WRZs in the Midlands
    - Supply from the GDA WRZ to other WRZs in the East facilitated by the additional supply available from the New Shannon Source to the GDA.

[4] 37 Water Resource Zones were identified in the Eastern and Midlands Plan consisting of the GDA WRZ and 36 other WRZs. Subsequently Barndarrig 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.

31. The National Water Resources Plan (Irish Water 2021 and 2022) noted that understandably planning for many projects had been and continued to be underway at the time the plan was being developed and that certain projects had been initiated prior to the development of the Framework Plan (Irish Water 2021). These projects are called 'in-flight' projects and the Water Supply Project was one such 'in-flight' project This is referred to as the In-Flight Water Supply Project.

32. Following the adoption of the Framework Plan (Irish Water 2021) and the applicable Eastern and Midlands Plan (Irish Water 2022), Uisce Éireann undertook an exercise where all 'in-flight' projects were compared against the relevant Preferred Approaches identified in the Framework Plan (Irish Water 2021). Uisce Éireann then considered to what extent an in-flight project could or should be adapted in light of the Preferred Approaches, on a 'case by case' basis. This exercise was undertaken in respect of the previous iteration of the project, the In-Flight Water Supply Project.

33. The examination of the In-Flight Water Supply Project in light of the Preferred Approaches contained within the Eastern and Midlands Plan (Irish Water 2022) is set out in Sections 3.4.1 – 3.4.3.

34. For the avoidance of doubt, all references below to the 'In-Flight Water Supply Project' refer to the previous iteration of the project, which preceded the adoption of the Framework Plan (Irish Water 2021) and the Eastern and Midlands Plan (Irish Water 2022). Section 3.5 explains how the conclusions of the review that was undertaken relate to the current, Proposed Project which is the subject of the Strategic Infrastructure Development Planning Application.

3.4.1 Examination of the In-Flight Water Supply Project in Light of the Eastern and Midlands Plan Preferred Approach

3.4.1.1 Summary of the In-Flight Water Supply Project

35. The In-Flight Water Supply Project, as set out in the FOAR, published in 2016, was an abstraction of water from the Lower River Shannon at Parteen Basin in County Tipperary with water treatment nearby at Birdhill. Treated water would then be piped 170km to a termination point reservoir at Peamount in south County Dublin, with provision being made for supplies to communities along the route of the pipeline, and ultimately connecting into the Greater Dublin network at Peamount.

3.4.1.2 Summary of the Framework Plan and Eastern and Midlands Plan Outcomes

36. In the Eastern and Midlands Plan (Irish Water 2022) the options appraisal process was initially applied locally to each WRZ within an individual Study Area in the region. After that, a wider assessment area was considered to determine whether there were larger scale options that might resolve deficits across multiple WRZs within the same Study Area. Consequently, the assessment area size was further increased, and the methodologies were applied at a regional level.

37. In the National Water Resources Plan (Irish Water 2021 and 2022), the GDA is defined as a single WRZ and a single Study Area (Study Area 9, 'SA9').

38. For the GDA Water Resource Zone the Preferred Approach identified in the Eastern and Midlands Plan (Irish Water 2022) was a new supply from the Lower Shannon. The plan stated the following for Study Area 9 (the GDA):

> *'As a single WRZ, the Preferred Approach for SA9 is both the WRZ Level Approach and the SA Preferred Approach.'*

39. In addition, the Preferred Approach identified for the GDA (SA9) in the Eastern and Midlands Plan (Irish Water 2022) was a New Shannon Source which had the potential to supply multiple WRZs within the Region and was the only Regional Option outlined.

40. Therefore, the Eastern and Midlands Plan (Irish Water 2022) identified a new source from the River Shannon as the Preferred Approach at Regional Level for supplying the GDA WRZ and 36[5] further WRZs in the Midlands and East, with those 36 WRZs supplied through the GDA water network and through offtakes from the transfer pipeline from the River Shannon to the GDA.

3.4.1.3 Conclusion

41. Having examined the outcomes of the Framework Plan (Irish Water 2021) 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 the 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.

3.4.2 Examination of Water Supply Area for the In-Flight Water Supply Project in Light of the Eastern and Midlands Plan Preferred Approach

3.4.2.1 Summary of the Water Supply Area for the In-Flight Water Supply Project

42. The FOAR, identified a number of locations in the Eastern and Midlands region that, in addition to the GDA, would benefit from a new supply from a treated water pipeline from the River Shannon. These areas, where water supply deficits exist, were collectively referred to in the FOAR as the 'Benefiting Corridor'. The FOAR recognised that potential future connections from a transfer pipeline from the Shannon to these areas supported Uisce Éireann's objective of reducing the overall number of individual supplies in the State to a smaller number of interconnected supplies that would be more reliable and environmentally and economically sustainable.

3.4.2.2 Summary of the Framework Plan and Eastern and Midlands Plan Outcomes

43. The Framework Plan (Irish Water 2021) provides a consistent methodology for establishing Supply Demand Balance deficits in every WRZ in the State and for identifying Preferred Approaches to address those deficits. This methodology has been applied in the Eastern and Midlands Plan (Irish Water 2022) and formed part of the assessment process for identifying appropriate solutions to address deficits where they arise in each WRZ in the Region. There were 134 WRZs in the nine Study Areas in the Eastern and Midlands Region.

44. One of the key benefits of preparing the National Water Resources Plan (Irish Water 2021 and 2022) is the ability to look holistically at existing and potential new supplies and within that context to consider the best options for particular areas. The Eastern and Midlands Plan (Irish Water 2022) was progressed first (out of four Regional Plans) given the Region's ageing infrastructure, dense population and criticality of need. The GDA was the first WRZ (and study area) in the Eastern and Midlands Plan (Irish Water 2022) to have its Preferred Approach identified because it had the highest population and the greatest Supply Demand Balance Deficit.

45. The Preferred Approach identified for the GDA in the Eastern and Midlands Plan (Irish Water 2022) was a New Shannon Source and the Eastern and Midlands Plan (Irish Water 2022) identified that the sustainable yield available from the Lower River Shannon at Parteen Basin has the potential to supply more water than is required to address the Supply Demand Balance Deficit in the GDA. Consequently, when developing the Preferred Approach for other WRZs and Study Areas for the Eastern and Midlands Region, cross study area transfers were considered both from the GDA in the context of a New Shannon

[5] 37 Water Resource Zones were identified in the Eastern and Midlands Plan consisting of the GDA WRZ and 36 other WRZs. Subsequently Barndarrig 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.

Source having been delivered, and also from any pipeline transferring the water from the Shannon as part of the proposed New Shannon Source.

46. Through the options development process in the Eastern and Midlands Plan (Irish Water 2022), transfers from the New Shannon Source were identified in seven Study Areas. In many of these study areas it was apparent that there would be an opportunity to decommission certain WTPs and discontinue certain unsustainable abstractions if the New Shannon Source and connections were delivered. Again, this was assessed through the options development process where the option to upgrade an existing plant was compared against the option to tap into an alternative supply, such as the pipeline for the New Shannon Source.

47. In total, the Eastern and Midlands Plan (Irish Water 2022) identified the New Shannon Source being the Preferred Approach to supply water to 37[6] WRZs as follows:
    - The GDA and 18[7] additional WRZs, which collectively would become the GDA Regional WRZ
    - 18 WRZs via four transfers from the pipeline connecting the New Shannon Source to the GDA.

48. The intention is that the 37 WRZs would ultimately form five new/consolidated WRZs: Tullamore/ Mountbolus WRZ, Mullingar Regional WRZ, Dunkerrin/Moneygall/ Borrisokane WRZ, Newport / Killaloe WRZ and a Regional GDA WRZ.

49. The Preferred Approach would enable Uisce Éireann to decommission 33 groundwater abstractions and 14 surface water abstractions resulting in a more efficient, interconnected and resilient supply system.

50. The 36 WRZs that were identified in the plan, in addition to the GDA, as benefiting from a New Shannon Source Regional transfer are listed in Table 3.3. Barndarrig WRZ and Redcross WRZ have subsequently been rationalised and combined leaving 36 WRZs. The Proposed Project would meet the water supply requirement for 35 WRZs and the GDA WRZ, a combined total of 36 WRZs. This does not affect the volume of water to be supplied.

Table 3.3: WRZs, Outside the GDA WRZ, Potentially Benefiting From a Supply From the New Shannon Source

Study Area	Water Resource Zone Code	Water Resource Zone Name	Water Resource Zone Name Post-Rationalisation
SA1	3400SC0007	Avoca Ballinaclash Public Supply	GDA Regional
SA1	3400SC0012	Redcross Conary Public Supply (subsequently combined with the Barndarrig)	GDA Regional
SA1	3400SC0017	Barndarrig (subsequently combined with the Redcross)	GDA Regional
SA1	3400SC0025	Ballinteskin Public Supply	GDA Regional
SA1	3400SC0027	Ballinapark Public Supply	GDA Regional
SA1	3400SC0046	Rathdrum Public Supply	GDA Regional
SA1	3400SC0047	Laragh Annamoe Public Supply	GDA Regional
SA2	0100SC0005	Hacketstown	GDA Regional

[6] 37 Water Resource Zones were identified in the Eastern and Midlands Plan consisting of the GDA WRZ and 36 other WRZs. Subsequently Barndarrig 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.

[7] 18 Water Resource Zones were to be incorporated into the GDA Regional WRZ. Subsequently Barndarrig WRZ and Redcross WRZ have been rationalised and combined and so there are 17 WRZ to be incorporated into the GDA Regional WRZ. This does not affect the volume of water to be supplied.

Study Area	Water Resource Zone Code	Water Resource Zone Name	Water Resource Zone Name Post-Rationalisation
SA2	3400SC0004	Dunlavin Public Supply	GDA Regional
SA2	3400SC0005	Hollywood Donard Public Supply	GDA Regional
SA3	2300SC0055	Navan-Mid Meath	GDA Regional
SA3	2100SC0001	South Louth East Meath	GDA Regional
SA3	2300SC0005	Kells Oldcastle	GDA Regional
SA3	2300SC0014	Trim	GDA Regional
SA3	2300SC0006	Athboy	GDA Regional
SA3	2300SC0007	Ballivor	GDA Regional
SA3	2300SC0011	Kilmessan	GDA Regional
SA6	0100SC0001	Carlow North	GDA Regional
SA6	2500SC0002	Tullamore	Tullamore/ Mountbolus
SA6	2500SC0013	Mountbolus PWS	Tullamore/ Mountbolus
SA4	3200SC0003	Ballany	Mullingar Regional
SA4	3200SC0001	Mullingar Regional	Mullingar Regional
SA4	2300SC0012	Clonard/Abbeysfields Housing Estate	Mullingar Regional
SA4	2300SC0016	Longwood WS	Mullingar Regional
SA4	1400SC0004	Ardcarraig Clogherinkoe	Mullingar Regional
SA4	2500SC0005	Edenderry & Rhode	Mullingar Regional
SA4	2500SC0014	Daingean	Mullingar Regional
SA4	2500SC0006	Walsh Island	Mullingar Regional
SA4	2000SC0003	Ballymahon	Mullingar Regional
SA4	2300SC0018	Enfield	Mullingar Regional
SA4	2500SC0004	Geashill	Mullingar Regional
SA7	2500SC0010	Dunkerrin /Moneygall	Dunkerrin/Moneygall/ Borrisokane
SA7	2900SC0045	Borrisokane (Greyford source to Crotta)	Dunkerrin/Moneygall/ Borrisokane
SA7	2900SC0046	Cloughjordan	Dunkerrin/Moneygall/ Borrisokane
SA8	2900SC0066	Newport	Newport / Killaloe
SA8	0300SC0024	Killaloe	Newport / Killaloe

3.4.2.3 Conclusion

51. For the In-Flight Water Supply Project, areas in the Eastern and Midlands Region outside of the GDA, where water supply needs exist, and that have the potential to have their needs addressed through future connections from a transfer pipeline from the Lower Shannon, were collectively referred to in the FOAR as the Benefiting Corridor. The FOAR recognised the potential future connections from a transfer pipeline from the Shannon to these areas. The Eastern and Midlands Plan (Irish Water 2022) provides a Preferred Approach to address each identified water supply need in the region. The Eastern and Midlands Plan (Irish Water 2022) provides the most up to date position on WRZs that could potentially be supplied from a New Shannon Source. All locations that were included in the Benefiting Corridor in the FOAR have been considered within the Eastern and Midlands Plan (Irish Water 2022) or within one of the other three Regional Water Resources Plans, and solutions have been identified for these locations. It was therefore considered appropriate to amend the In-Flight Water Supply Project by substituting the Benefiting Corridor previously identified in the FOAR with the WRZs identified in the Eastern and Midlands Plan (Irish Water 2022) which is then, collectively to be referred to as the 'Water Supply Area' for the Proposed Project.

3.4.3 Summary of Comparison Conclusions

52. The In-Flight Water Supply Project was compared against the relevant outcomes of the Framework Plan (Irish Water 2021) and Eastern and Midlands Plan (Irish Water 2022) to see if any changes should be made to the In-Flight Water Supply Project in light of them, where necessary and feasible to do so. This is summarised in Table 3.4.

Table 3.4: Comparison of the Eastern and Midlands Plan and the In-Flight Water Supply Project

Category	In-Flight Water Supply Project	Framework Plan and Eastern and Midlands Plan Outcomes	Comparison of the In-Flight Water Supply Project with the Framework Plan and Eastern and Midlands Plan Outcomes	Conclusion
Preferred Solution	A new abstraction from Parteen Basin and treated water transfer pipeline to the GDA, with offtake locations for potential future connecting pipelines	A New Shannon Source consisting of an abstraction from Parteen Basin and treated water transfer pipeline to the GDA and with offtakes to other WRZs in the Region is identified as the Preferred Approach to address supply deficits in the GDA and 36 other WRZs in the Region	The In-Flight Water Supply Project is substantially consistent with the relevant outcomes of the Framework Plan and Eastern and Midlands Plan in its recommended solution to address Need in the GDA and other locations in the Eastern and Midlands Region	The In-Flight Water Supply Project does not need to be modified.
Water Supply Area	The In-Flight Water Supply Project includes the GDA and a Benefiting Corridor based on an interim assessment of potential benefiting communities from a new supply from the River Shannon	The Framework Plan and the Eastern and Midlands Plan, when looking at the region holistically, identified the potential for a New Shannon Source to address supply deficits in 36 WRZs in the Region, in addition to supplying the GDA WRZ.	The In-Flight Water Supply Project and the Plans both identify water supplies outside of the current GDA WRZ that have water supply needs that could be addressed by a new supply from the Lower River Shannon. There are some differences in the composition of the Benefiting Corridor of the In-Flight Water Supply Project compared with the list of benefiting WRZs identified in the Eastern and Midlands Plan.	Recommend updating the Benefiting Corridor to align with the WRZs identified in the Eastern and Midlands Plan as listed in Table 3.3.

53. The In-Flight Water Supply Project was identified as an abstraction from Parteen Basin on the Lower River Shannon and a treated water distribution pipeline to the GDA with capability to supply communities in the Midlands. The Framework Plan (Irish Water 2021) and Eastern and Midlands Plan (Irish Water 2022) identify an abstraction from Parteen Basin (the New Shannon Source), treated water pipeline to the GDA and transfers to other WRZs in the region as the Preferred Approach. The In-Flight Water Supply Project was therefore substantially consistent with the relevant outcomes of the Framework Plan (Irish Water 2021) and Eastern and Midlands Plan (Irish Water 2022) other than in respect of the list of WRZs to be served by the pipeline from the New Shannon Source.

54. On this basis it was concluded that the Benefiting Corridor proposed for the In-Flight Water Supply Project should be replaced with a Water Supply Area for the Proposed Project which aligns with the 36 WRZs that are identified in the Eastern and Midlands Plan (Irish Water 2022) to be supplied from a New Shannon Source with transfers. To achieve this outcome the Proposed Project infrastructure will therefore:

- Have the capacity to deliver the volume of water needed to meet the peak demand in the Water Supply Area
- Include take-off points to allow for potential future connections into the Water Supply Area.

3.5 Implementing the Recommendations of the National Water Resources Plan

55. The update of the previous iteration of the project, the In-Flight Water Supply Project, to account for the Water Supply Area, means that the Proposed Project aligns with the National Water Resources Plan (Irish Water 2021 and 2022) including the Eastern and Midlands Plan (Irish Water 2022).

56. This comparison of the Eastern and Midlands Plan (Irish Water 2022) and the In-Flight Water Supply Project has also determined the objectives for the Proposed Project, taking account of the National Water Resources Plan (Irish Water 2021 and 2022). These objectives are to:

- Provide a sustainable water supply from a New Shannon Source
- Address critical supply issues in the GDA with provision for future supplies to multiple WRZs in the Region
- Increase resilience of supplies and Levels of Service
- Deliver a flexible, future-proofed solution that is responsive to change.

57. Therefore, the assessment of reasonable alternatives in respect of the Proposed Project, as addressed below, did not re-consider strategic alternatives that had been considered by the National Water Resources Plan (Irish Water 2021 and 2022) and was carried out within the defined Proposed Project objectives. Therefore, the reasonable alternatives in respect of the Proposed Project which have been assessed include for example, alternatives in terms of project design, technology, location, size and scale.

3.6 Alternatives for the Proposed Project

58. The alternatives assessed within this chapter are the design options that implement the New Shannon Source with transfers. These are summarised in Table 3.5. Potential environmental constraints have been considered throughout the alternatives appraisal process.

Table 3.5: Summary of the Reasonable Alternatives Considered

Alternative	Description	Section of this Chapter
Alternative Locations – Pipeline Route Corridor	This section describes the methodology that enabled the development of the selected route corridor, from the initial constraints mapping, through the Least Constrained Route Corridor to the final Proposed Project Pipeline route.	Section 3.7.3
Alternative Locations – Infrastructure Sites	Alternative locations which were explored for the following infrastructure: Raw Water Intake & Pumping Station (RWI&PS) Termination Point Reservoir (TPR) Water Treatment Plant (WTP) Break Pressure Tank (BPT) Booster Pumping Station (BPS) Flow Control Valve (FCV)	 Section 3.7.1 Section 3.7.2 Section 3.7.4.1 Section 3.7.4.2 Section 3.7.4.3 Section 3.7.4.4
Alternative Design	Alternative designs which have been considered: Alternative Water Treatment Technology Process Waters Management Alternative Pipeline Design	 Section 3.7.4.1.2 Section 3.7.4.1.2 Section 3.8
Power Supply to Line Valves	Describes the options reviewed for Power to Line Valves	Section 3.9
Construction	Describes the options reviewed in relation to Construction Compounds and Pipe Storage Depots	Section 3.10

3.7 Alternative Siting and Routing

59. This section outlines the site selection, and where applicable alternative technologies, relating to each of the key infrastructural elements of the Proposed Project.

60. The site selection for each of the infrastructure sites is set out in the following order:

- Raw Water Intake and Pumping Station: the abstraction point forms a fixed initial point for the development of the pipeline routing. The identification of the preferred abstraction point followed the assessment of options in the development of the In-Flight Water Supply project
- Termination Point Reservoir: the termination point forms the fixed nodal point for the pipeline to connect to in order to allow for the connection into the existing distribution network within Dublin
- Pipeline: the routing of the pipeline was developed from the selected abstraction point to the termination point at Peamount, Co. Dublin
- Water Treatment Plant: the site selected is derived from within a 3km search radius from the RWI&PS
- Break Pressure Tank: for hydraulic design reasons, a BPT would be required to be located at, or near, the highest elevation along the transmission pipeline to provide the transition between the pumped section of the Treated Water Pipeline and the section that will usually be gravity fed. Its site selection options are influenced by the preferred pipeline route corridor
- Booster Pumping Station: an on-line infrastructure element whose site selection options are set by the pipeline routing
- Flow Control Valve: an on-line infrastructure element whose site selection options are set by the pipeline routing.

61. The evaluation process for the selection of sites for the permanent infrastructure necessarily involved consideration of whether infrastructure site options were capable of achieving the required level of technical parameters and considerations to meet the required drinking water output. A pipeline of this size, length and complexity must be designed, built and operated within established technical boundaries to enable the efficient and safe operation of the asset. Factors such as vertical alignment (topography was a key determinant in whether pumping was required to maintain flow within sections of pipeline) and

horizontal alignment were key technical determinants influencing the flow characteristics and optimisation of the design and thereby enabling energy efficiencies. In turn, the selection of site locations for permanent infrastructure such as the BPT and BPS were highly constrained by the optimised vertical and horizontal alignment of the pipeline route. However, environmental factors, including the effect of the infrastructure sites on communities, people and places, remained a key element of the evaluation process.

3.7.1 Raw Water Intake & Pumping Station

3.7.1.1 Raw Water Intake & Pumping Station Site Selection

62. The optimum location for the RWI&PS was considered when planning the previous iteration of the project. As originally set out in the POAR (Irish Water, 2015c) five broad locations along Lough Derg and Parteen Basin were considered. These areas are shown in Image 3.2.

63. An MCA analysis was undertaken using the classification shown in Table 3.6.

Table 3.6: MCA Impact Classifications

Impact	Colour Coding
Very High	
High	
Moderate	
Low	
Very Low	

64. The outcome of the assessment is shown in Table 3.7.

Table 3.7 MCA Outcomes for Alternative Water Abstraction Locations

Impact	Slevoir	Mota	Dromineer	Youghal	Parteen
Ecology					
Aquatic Ecology					
Surface Water					
Air Quality					
Noise					
Cultural Heritage					
Landscape and Visual					
Agronomy					
People					
Soils, Geology & Hydrogeology					
Planning Policy					
Traffic, Engineering & Design					
Risk					
Overall	2	4	5	3	1

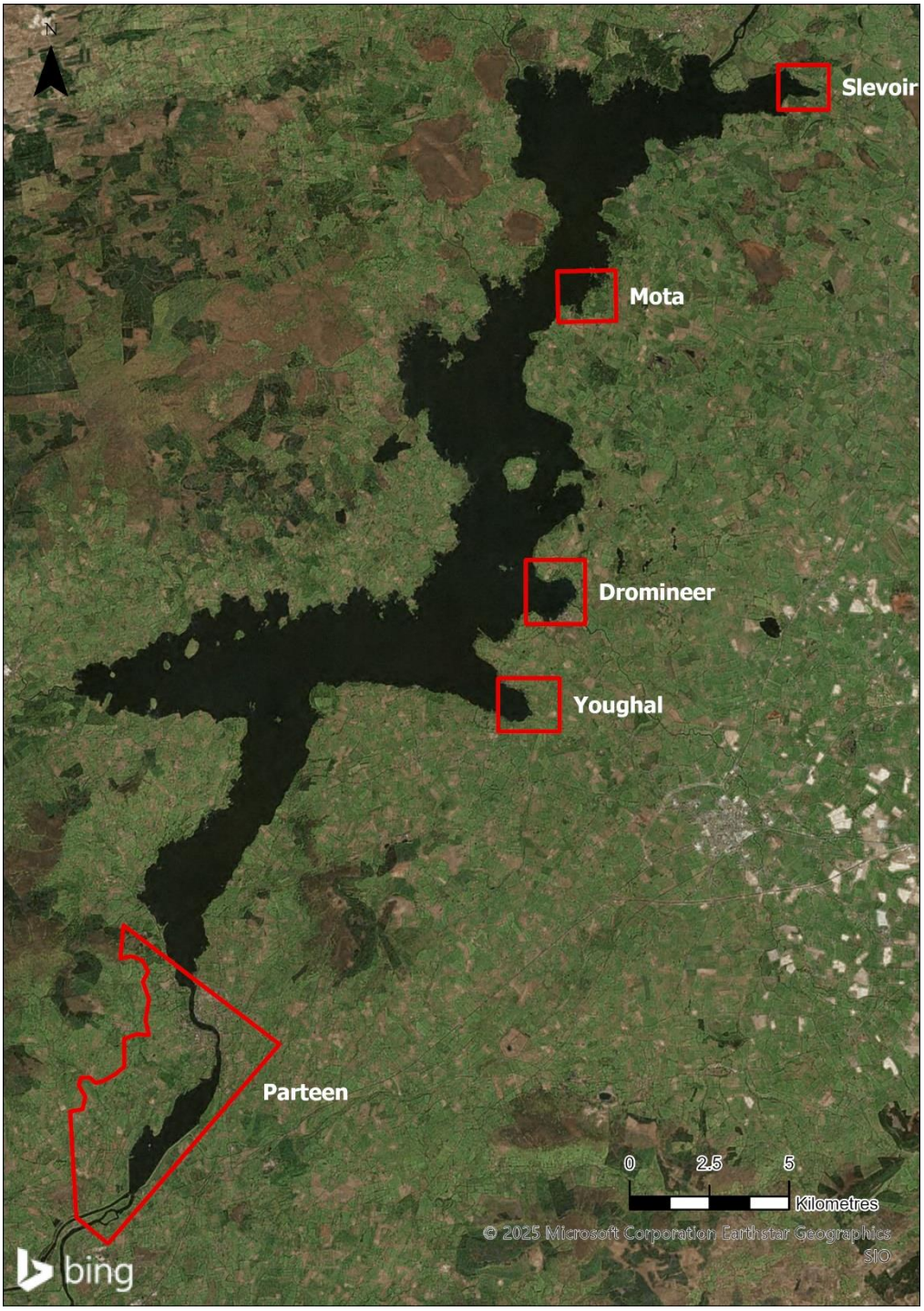


Image 3.2: Alternative abstraction locations on Lough Derg and Parteen Basin

65. Although a number of potentially significant constraints were identified in relation to the Parteen Basin Reservoir option, it was highlighted that the study area for this water body was much larger than the relatively confined sites considered in Lough Derg and therefore was not a direct 'like-for-like' comparison.

66. The Parteen Basin Reservoir location was considered, overall, to be the least constrained of the Shannon abstraction options for the following reasons:

    - Modelling studies of the Lough Derg abstraction locations showed a measurable impact on flushing time in the lake and this would be likely to have a negative impact on the conservation objectives of Lough Derg SAC and of the entire lake aquatic ecosystem. The level of impact

predicted [at the time of the assessment] at Parteen Basin Reservoir was considered too low to affect its ecological status

- Parteen Basin Reservoir is a reservoir formed by the creation of Ardnacrusha dam, hence it was not as sensitive a lake habitat as Lough Derg, with low fisheries value, less developed wetlands habitat and with areas of more modified (non-qualifying habitat) occurring on the eastern shore
- The limited relative impact on flushing times (generated at the time of the assessment) in Parteen Basin Reservoir supported the consideration of a lower potential impact on the objectives of the Water Framework Directive relative to abstraction from Lough Derg
- It is likely that due to the scale of the location of the Parteen Basin Reservoir there would be a possibility of finding a suitable site for the location of the necessary infrastructure which would significantly mitigate impact on known Planning, cultural heritage, landscape and visual constraints.

67. As a result, Parteen Basin was selected for the abstraction point for the previous iteration of the project.

68. The Eastern and Midlands Plan (Irish Water 2022) confirmed that the Preferred Approach was a New Shannon Source from the Parteen Basin and the Parteen Basin remained the preferred option for the location of the RWI&PS site for the Proposed Project.

69. Based on the preferred abstraction location at Parteen Basin, County Tipperary, three potential areas for the RWI&PS in the vicinity of Parteen Basin were identified during the previous iteration of the project. This was previously presented in the FOAR (Irish Water, 2016). Collectively these areas cover the available perimeter on both sides of the Basin located within the Lower River Shannon Special Area of Conservation (SAC) and also a small area downstream of Lough Derg on the eastern bank, not part of any European Site. The raw water abstraction locations that were considered are as follows:
    - Western shore of Parteen Basin (RWA-W) shown as RWA1 on Image 3.3
    - Eastern shore of Parteen Basin (RWA-E) shown as RWA2 on Image 3.3
    - Eastern bank of River Shannon, immediately downstream of Lough Derg (RWA-N) shown as RWA3 on Image 3.3.

70. While RWA-N was not within a European Site, it was heavily constrained in its ability to act as a potential raw water abstraction point. This was because its proximity to the existing urban area of Ballina meant there would be disturbance of the population during the construction period and, further, the steep terrain made it technically less suited from a construction perspective. In addition, a pipe route transfer would only be feasible if existing properties were acquired and demolished to accommodate construction. It was therefore discounted from further consideration.

71. In areas RWA-W and RWA-E, the availability of potential raw water abstraction sites was constrained by the presence of Electricity Supply Board (ESB) embankments. These embankments form part of the engineering infrastructure facilitating the impoundment of water that serves the hydroelectric power generation at Ardnacrusha. As a result, it was necessary to minimise or avoid potential adverse effects on these structures as part of the site selection process.

72. A detailed assessment (by MCA) was undertaken for areas RWA-W and RWA-E to assess potential site locations for the RWI&PS and to allow an environmental comparison of the alternatives. Table 3.8 shows the colour coding used for each of the MCA impact assessment classifications.

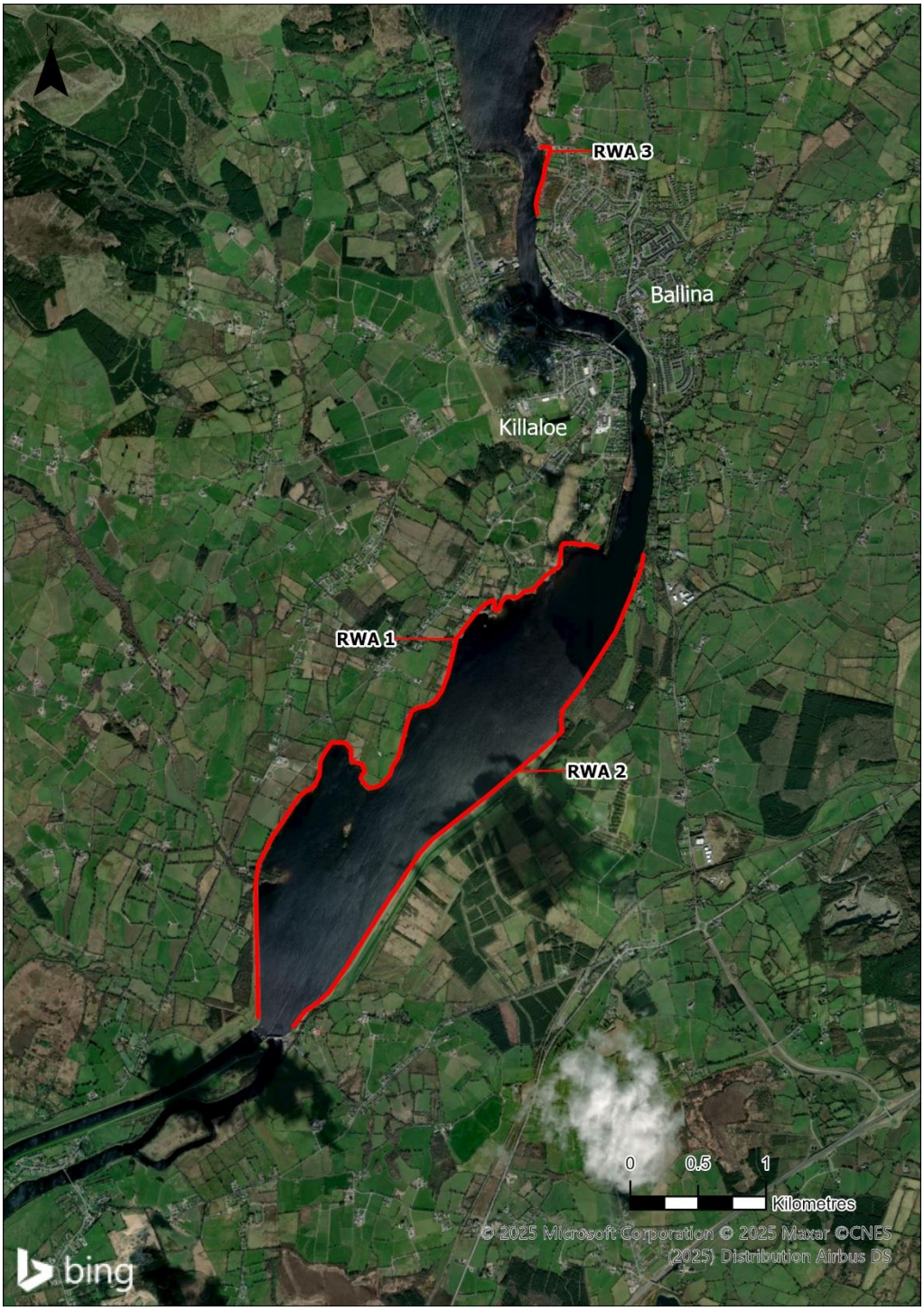


Image 3.3: Potential Raw Water Abstraction Areas in Parteen Basin

Table 3.8: MCA Impact Classifications

Impact	Colour Coding
Very High	
High	
Moderate	
Low	
Very Low	

3.7.1.2 Evaluation of Alternative Sites for the Raw Water Intake & Pumping Station

73. Four sub-options were identified, two on the western shore of Parteen Basin (RWA Site 1W and RWA Site 2W) and a further two sites on the eastern shore (RWA Site 3E and RWA Site 4E)[8], see Figure 3.1. The summary of the MCA process for the four sites and the level of impact being indicated through the colour coding is presented in Table 3.9.

Table 3.9: MCA Outcomes for Alternative Water Abstraction Sites

Constraint	RWA Site 1W	RWA Site 2W	RWA Site 3E	RWA Site 4E
Terrestrial Ecology				
Aquatic Ecology				
Surface Water				
Air Quality				
Noise				
Cultural Heritage				
Landscape and Visual				
Agronomy				
People				
Soils, Geology & Hydrology				
Planning Policy				
Traffic				
Engineering & Design				
Overall Ranking	4	3	1	2

74. The site selection process, as reported in the FOAR (Irish Water 2016that sites RWA Sites 1W and 2W would require the construction of a raw water pipeline, tunnelled under Parteen Basin, resulting in additional works within the SAC. For this reason, the sites on the western shore of the lake were considered to be more constrained than those on the eastern shore for ecology, aquatic ecology and surface water. The potential for significant effects on the Lower River Shannon SAC were evaluated as broadly equal between RWA Site 3E and RWA Site 4E. Overall, the RWA Site 3E was considered least constrained from an ecology perspective as it would be located within, and connected to, lower value terrestrial habitats.

75. RWA Site 3E was also least constrained in terms of human receptors and potential effects upon them, such as noise, due to the distance from residential receptors and the land use surrounding the proposed site.

76. On completion of the MCA process, RWA Site 3E became the preferred location for the site of a raw water abstraction for the following reasons:

- RWA Sites 1W and 2W would require additional pipeline construction through Parteen Basin which would have a higher potential for ecological, archaeological and technical risks. Furthermore, construction phase haul routes to the M7 Dublin-Limerick Road would be required to route through residential, commercial and industrial areas in Limerick City
- RWA Site 4E would be located within a woodland of higher value than RWA Site 3E
- RWA Site 3E would be well screened, south of the Fort Henry demesne lands and provides no obstruction to views of Parteen Basin from the western bank.

[8] Further details are provided in Appendix F of the FOAR.

3.7.1.3 Alternative Access Options for the Raw Water Intake & Pumping Station

77. On identification of the preferred RWI&PS location as RWA Site 3E, three potential access roads to the site were also evaluated. Options 1 and 2 were via the R494. A third option, Option 3, which would involve routing along the existing ESB-owned track, was considered for feasibility at the initial stage. The track stops approximately 450m south of the proposed site and access to it is controlled by ESB via locked gates at their Parteen Weir site. Entrance to the site, via a narrow bridge spanning the Kilmastulla River channel, can be accessed only with the permission of ESB. This road passes through the Lower River Shannon SAC and was therefore, considered to be less favourable.

78. Both of the remaining potential access roads from the R494 to the proposed RWI&PS site crossed open farmland and areas of forestry. The level of environmental constraints within this area was generally low as shown in Image 3.4.

Image 3.4: Environmental Constraints Map at RWI&PS Site Access Roads

79. It was identified that the alignment of Access Option 1 would conflict with the proposed surface water attenuation ponds at the side of the proposed Killaloe bypass works on the R494. The alignment of Option 2 would be unaffected by the proposed bypass works.

80. Ground levels for both Option 1 and 2 did not vary greatly and the options differed little in terms of length. Option 1 would connect with the R494 at a point where safe sight lines would be available on the existing R494 alignment, albeit with some clearance of existing roadside hedges/trees being needed to achieve this. Option 2 would follow the route of the proposed raw water rising mains. The junction that would be created with the R494 by this access road would not, however, have safe sight lines on the existing R494 alignment, due to a crest in the road to the south of such a junction.

81. It was concluded, therefore, that access to the selected raw water abstraction site should be made by way of Option 1 which was the shortest and most direct connection to the regional road network. This

route offered the required safe visibility splays at its junction with the R494 and reduced the impact on landowners along its route.

3.7.1.4 Conclusion of the Site Selection for the Abstraction Location and Access to the Raw Water Intake and Pumping Station

82. In summary, the Parteen Basin was identified as the preferred abstraction point on the River Shannon and then the RWA Site 3E was identified as the preferred option among the reasonable alternatives considered for the location of the RWI&PS. This was because it would give rise to fewer adverse environmental effects and its design, construction and operation would pose fewer technical challenges. The site is notably of lower ecological value than RWA Site 4E, and it is well screened south of the Fort Henry demesne lands and provides no obstruction to views of Parteen Basin from the eastern bank. As a result, the RWA Site 3E site was selected as the location for the RWI&PS for the Proposed Project and safe access could be achieved using Access Option 1.

83. The design decisions for the RWI&PS and the options evaluation undertaken in respect of them were made before 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 aligns with the Eastern and Midlands Plan (Irish Water 2022) and the preferred options for the intake remain valid and continue to be the preferred options for the design of the Proposed Project.

3.7.1.5 Intake Options for the Raw Water Intake

84. Once the preferred location for the RWI&PS had been determined there was further consideration of how the abstraction of raw water would take place. Two approaches were considered:

- A bankside raw water intake. In this model, the intake would occur at the bank of the watercourse, via intake chambers excavated below ground level, from which the raw water would then be pumped via a suction pipe and the raw water pumping station to the WTP
- An alternative approach was to develop an intake structure extending into Parteen Basin (an in-basin configuration). This would comprise a series of passive screens and intake pipes located at the bankside of Parteen Basin itself connecting to land side structures that pump the raw water to the WTP.

85. The technological approach would be the same in each case, comprising a fine mesh screening to prevent the intake of additional material or species, cleansed by a backwashing ‘airburst’ approach.

3.7.1.6 Evaluation of the Alternative Intake Options

86. The in-basin configuration was not selected for the following safety and environmental reasons:

- The bankside configuration would have a reduced environmental impact on Parteen Basin, (located within the Lower River Shannon SAC), compared with the alternative option due to the extent and nature of the construction and operation required. At the construction stage a greater extent of in-stream works would be required to accommodate in-basin structures. During the operational phase, the pipework and intake screens would be located within Parteen Basin and therefore have greater potential to affect the SAC
- The bankside configuration would also provide easier control and containment of cleaning operations for the intake and rising mains, which may arise in the management of invasive species in raw water assets. This is because the structures could be accessed from the land and thus reduce the risk of activity in the SAC
- The bankside configuration provides easier access to the fine mesh screen units in the event they need to be withdrawn for maintenance.

3.7.1.7 Conclusion of the Selection for the Raw Water Intake Option

87. The bankside alternative would have a lower environmental impact than the in-basin alternative, as it would involve less works within the SAC and have fewer interactions with the habitats and species therein. As a result, the bankside alternative was selected as the preferred intake option and was included in the design.

88. This design decision for the RWI&PS and the options evaluation undertaken in respect of it was undertaken before 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 aligns with the Eastern and Midlands Plan (Irish Water 2022) and the preferred option for the intake remain valid and continue to be the preferred option for the design of the Proposed Project.

3.7.2 Termination Point Reservoir

3.7.2.1 Determination of Peamount as the Termination Point Reservoir

89. The existing Peamount Reservoir in County Dublin is a key nodal point for water distribution within Dublin, particularly to Leixlip and Saggart, both of which are very important elements of the water supply infrastructure.

90. During previous iterations of the project there had been consideration of an alternative termination point that would allow for a different connection into the existing water distribution network. The potential sites were:

- Peamount, County Dublin
- Clonaghlis, County Kildare
- Lyons, County Kildare
- Athgoe, County Dublin
- Baldonnel, County Dublin.

91. It was quickly determined that because of the existing infrastructure, including the existing 40Ml reservoir, at Peamount which facilitates a connection between the supply from Ballymore Eustace, and Leixlip supply the Peamount location was the key nodal point for the end of the pipeline and the only site that would provide the required technical and strategic connection point and further site selection was not undertaken.

92. An MCA was undertaken to confirm that the site was suitable and this was reported in the FOAR (Irish Water, 2016). This is replicated in Table 3.5. The conclusion of the MCA assessment was that the proposed TPR site was a suitable location. The colour coding used for each of the MCA impact assessment classifications is as defined in Table 3.8.

Table 3.10: MCA Impact Classifications

Constraint	Colour Coding
Ecology	
Surface Water	
Air Quality	
Noise	
Cultural Heritage	
Landscape and Visual	
Agronomy	
People	
Soils, Geology & Hydrogeology	
Planning Policy	
Traffic	
Engineering & Design	
Overall Ranking	**N/A**

93. This process also identified the following additional benefits of this site being selected for the TPR:

- A supply to Peamount maximises the natural topography to bring water from the WTP; limiting the requirement for boosting of flows through other means, i.e. pumping plant
- The topography of Peamount allows a TPR site at this location to be readily integrated into its environs
- A site at Peamount facilitates integration with both the existing water distribution system, and future proposals within the Dublin Water Supply Area.

94. Therefore, the termination point at Peamount had already been identified as an essential element of previous iterations of the project for technical and operational reasons prior to the work on the routing of the pipeline which is described in Section 3.7.3.

3.7.2.2 Alternative Access to the Termination Point Reservoir

95. Two alternative access points to the TPR site were considered, namely the existing access to the east and a proposed new access from the western side, as shown in Image 3.5. While the level of operational traffic would be relatively low following construction, the following considerations were relevant:

- Suitability of access road to accommodate construction traffic
- The management of traffic through an existing, and operational, storage facility.

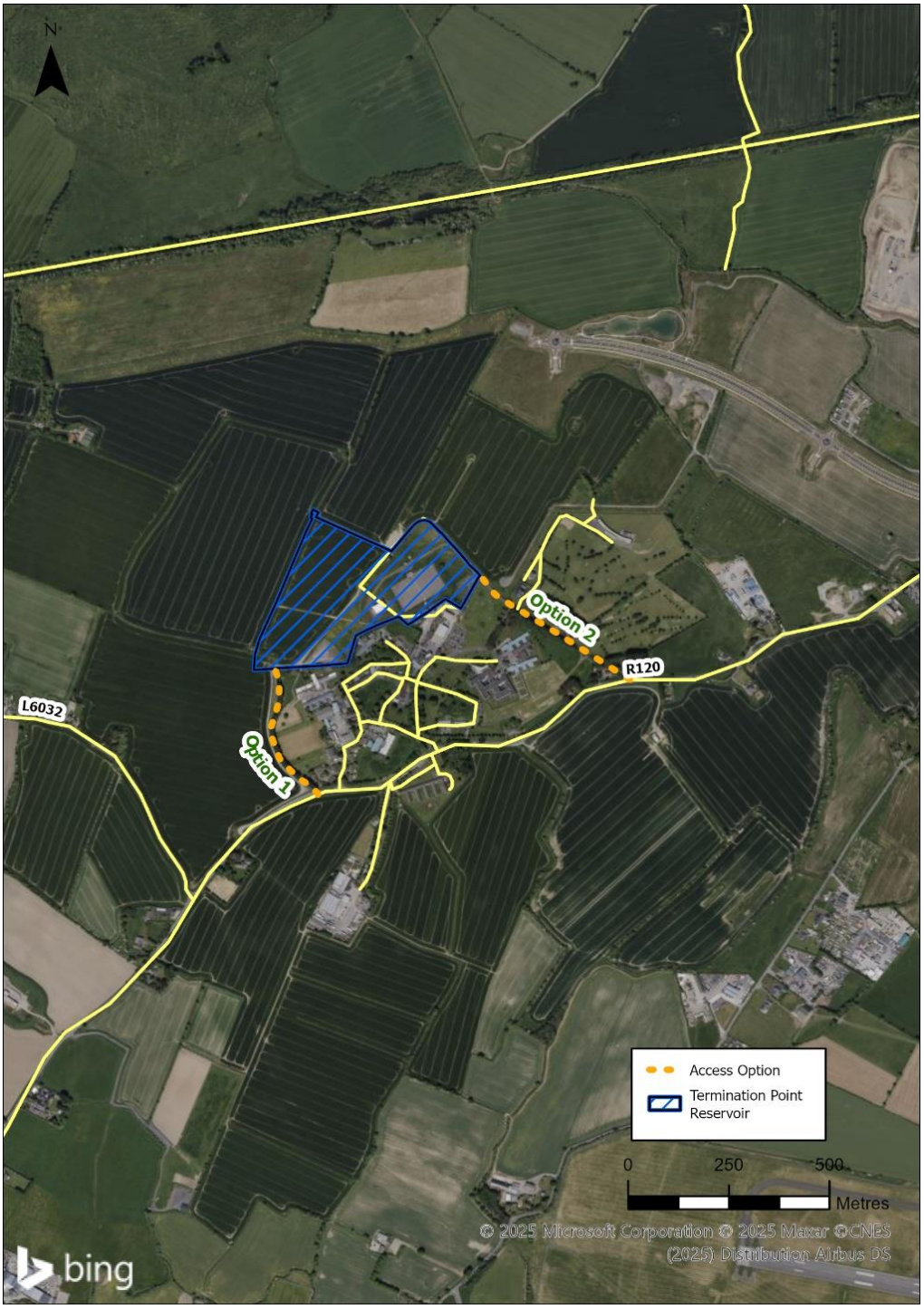


Image 3.5: TPR Location Local Road Network Options

96. Option 1 would provide a new and permanent access from the R120 regional road following the western perimeter of Peamount Hospital to enter the TPR site from the south-west. Option 2 was the access used for the existing Uisce Éireann storage facility, which is accessed from the R120 via the L60322 local road. This is a narrow road, approximately 3m in width.

97. Option 1 had the following advantages:

    - Interaction with residential, amenity and other local traffic would be segregated from traffic to the TPR

- The route included an existing wayleave maintained by Uisce Éireann from the R120, as far as Uisce Éireann's existing storage facility
- It permitted a single-purpose access for the sole use of Uisce Éireann to an important nodal point on the Dublin water supply network.

98. Option 2 had the additional disadvantage that during construction, there would be the potential conflict between construction traffic and residential vehicle movements. This would be compounded by traffic turning onto the L60322 from the R120 as there would be potentially consequential delays along the Regional Road. Inevitably, this would disrupt residents and commercial premises along this road as there would be no alternative means of access to their properties for a period of up to 18 months, together with the associated construction related environmental effects of air and noise emissions.

99. For these reasons Option 1 was selected as the access route to the TPR.

3.7.2.3 Conclusion of the Site Selection for the Termination Point Reservoir Location and Access

100. To facilitate integration with the existing network, and maintain system performance and operational flexibility, a TPR at Peamount would be integrated with the existing adjacent reservoir. Facilities adjacent to each other, or in close proximity, would benefit from less complex control systems in operation, and minimise the extent of the likely construction impacts.

101. On this basis the TPR site adjacent to the existing reservoir at Peamount was the optimum site identified for the connection point of the Proposed Project into the existing distribution network.

102. The design decisions for the TPR and the options evaluation undertaken in respect of them were made before 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 aligns with the Eastern and Midlands Plan (Irish Water 2022) and the preferred options for the TPR remain valid and continue to be the preferred options for the design of the Proposed Project.

3.7.3 Pipeline

3.7.3.1 Pipeline Routing Five Step Approach

103. As part of the development of previous iterations of the project, the methodology for the initial development of pipeline route corridors was published for public consultation in the OWP in June 2015 (Irish Water 2015b). It was subsequently confirmed in the FOAR (Irish Water 2016) and is summarised in Image 3.6. This illustrates a five step approach which sought to progressively refine the pipeline route corridor from an initial, unconstrained broad search area between the abstraction point at Parteen Basin and the termination point at Peamount (Step 1), through the identification of route based on 2km wide corridors which were the least constrained (Steps 2 and 3), selection of a 200m wide preferred corridor (Step 4) to an indicative 50m pipeline corridor (Step 5). Since the completion of stage 5 further route refinement has been undertaken through direct engagement with landowners and as part of the design development. Since the completion of stage 5 further route refinement has been undertaken through direct engagement with landowners and as part of the design development.

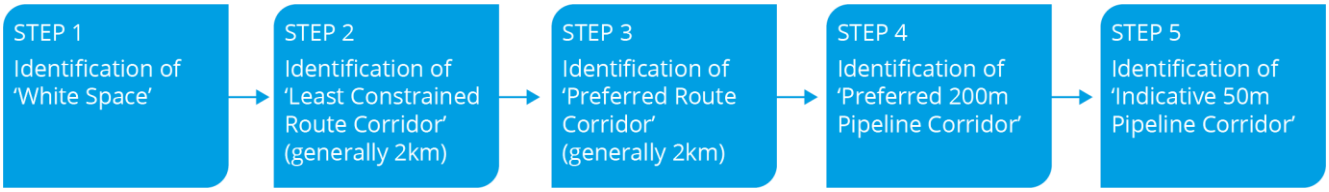


Image 3.6: Pipeline Route Selection Methodology

104. As development of each step of the Pipeline Corridor – Route Selection Methodology proceeded, they were presented for non-statutory consultation on previous iterations of the project:

- Step 1, OWP (June 2015), (Irish Water 2015b) was a desktop-based assessment and involved a high-level screening and mapping exercise of initial constraints which were categorised as having a high impact. The 'White Space' represented those areas which avoided these high impact constraints
- Step 1 also included the evaluation of the Strategic Environmental Assessment (SEA) water supply options, considered alternatives and provided recommendations
- Step 2, POAR (November 2015), (Irish Water 2015c) was a desktop-based assessment to identify 'Preliminary Route Corridors' (approximately 2km wide) and a 'Least Constrained Route Corridor' from those identified. The Preliminary Route Corridors were determined from within the 'White Space' identified in Step 1
- Step 3, FOAR (November 2016), (Irish Water 2016) was primarily a desktop assessment which followed the POAR non-statutory consultation. In conjunction with feedback from the POAR non-statutory consultation and supported with limited/focused windscreen surveys (i.e. from the public road), the 'Least Constrained Route Corridor' (approximately 2km wide) was confirmed from the 'Preliminary Route Corridors' identified in Step 2
- Step 4, FOAR (November 2016), (Irish Water 2016) involved further desktop assessment supported by localised windscreen surveys, and site visits, to identify a 'Preliminary Pipeline Corridor' (200m wide) from within the 'Least Constrained Route Corridor' confirmed in Step 3. Subsequently the 'Preferred 200m Pipeline Corridor,' was identified
- Step 5, FOAR (November 2016), (Irish Water 2016) was a further refinement of Step 4 and involved further constraint mapping and field surveys to determine an 'Indicative 50m Pipeline Corridor'.

105. Further information is provided on each of these steps in Appendix A3.1 (Pipeline Routing Report). Each of these steps are described in further detail in Sections 3.7.3.4 – 3.7.3.8.

106. From the outset the methodology was based on constraint mapping, a process that relied on consideration of predetermined 'constraints' that directly influenced the pipeline corridor. The constraints for consideration were originally presented in the OWP (Irish Water 2015b).

107. The siting of a potential pipeline corridor mitigated the impact of these constraints and represented the least constrained route. The methodology for siting the pipeline corridor was outlined in Volume 2 of the POAR, Appendix B.

108. Steps 1 and 2 were presented in the POAR (Irish Water 2015c) non-statutory consultation process while Steps 3, 4 and 5 were presented in the FOAR (Irish Water 2016) non-statutory consultation process in November 2016.

109. All published documents can be located on the main website: https://www.water.ie/projects/national-projects/water-supply-project-east-1. This report, which includes the alternative route options considered, sets out in detail, with reasons, the development of the route selection process and the determination of this '50m Pipeline Corridor' final route.

3.7.3.2 Post Step 5 Route Development

110. Subsequent to feedback from the FOAR (Irish Water 2016) non-statutory consultation process, further surveys, a review and update to datasets informing the constraint mapping, geotechnical investigation, and extensive landowner engagement the 'Indicative 50m Pipeline Corridor' has been confirmed.

111. Following Step 5/post FOAR (Irish Water 2016), further design development has taken place, namely:

- Consolidation of a preferred 50m pipeline corridor, in consultation with landowners.

112. This has resulted in the pipeline route contained within the Strategic Infrastructure Development planning application and Compulsory Purchase Order application.

113. This step is described in further detail in Section 3.7.3.9.

3.7.3.3 Route Corridor start and finish points

114. The following defined the size and extent of the proposed pipeline infrastructure:

- The peak deficit of water to be met by the Proposed Project, (as defined by the Eastern and Midlands Plan (Irish Water 2022) and set out in the Engineering Report, (Jacobs Tobin 2025))
- The abstraction location
- The location of the termination point.

115. The Infrastructure Sites at either end of the pipeline, (the RWI&PS and TPR) form fixed nodal points. The abstraction point location, as described in Section 3.7.1, forms a fixed initial point for the development of the pipeline routing. In addition, as described in Section 3.7.2 Peamount is a key nodal point for water distribution within Dublin, and connection at that specific location had therefore, already been identified as an essential element of previous iterations of the project for technical and operational reasons. From these two points, the corridor for the development of pipeline routing was established.

3.7.3.4 Step 1: Water Supply Options Working Paper: White Space Mapping

116. The initial stage of the routing process was to identify constraints within which infrastructure/proposed assets should not (as far as reasonably practicable) be located due to an excessive impact on human beings and/or the environment, or present excessive engineering challenges. The identified area endeavours to avoid such constrained areas where alternative siting and routing options are both available and reasonable.

117. The accumulation of the constraints identified a ‘White Space’, within which the siting and routing of infrastructure would, where possible, be best positioned with respect to remaining constraints and would help mitigate the impact of this project, both technically and on human beings and the environment.

118. Details of the white space assessment are presented in Appendix A3.1 (Pipeline Routing Report).

3.7.3.5 Step 2: Preliminary Option Appraisal Report: Preliminary Route Corridors and Least Constrained Route Corridor

119. The methodology employed in siting the pipeline involved the application of Geographic Information System (GIS) sifting and evaluation techniques. The GIS enabled map-based analysis of environmental constraints, such as environmental or geological designations or protected habitats, settlements, material assets such as quarries, archaeological features, residential properties, zoned land, protected structures, protected views and floodplains[9]. Several 2km wide potential pipeline corridor alternatives (Preliminary Route Corridors) were identified and assessed in the POAR in November 2015 (Irish Water 2015c). An MCA was completed on each route corridor option to identify the least constrained option among them.

120. This methodology enabled the production of a series of Preliminary Route Corridor options shown in yellow in Image 3.7 and Figure 3.2. From these a Least Constrained Route Corridor was developed (shown in red in Image 3.7). The Preliminary Corridor Alternatives were developed to broadly meet many environmental and technical objectives, which included ground conditions, obstructions, accessibility,

[9] The full list of criteria is in the POAR (Appendices B and F).

idealistic elevation and landowner impact. MCA techniques were applied to each of these Preliminary Corridor Alternatives by technical and environmental specialists. Through consensus between the specialists the Least Constrained Route Corridor[10] was selected.

121. For the purposes of reporting the consideration of alternatives, the Pipeline Route Corridor has been divided into four sections:
    - Birdhill to Birr
    - Birr to Tullamore
    - Tullamore to Carbury
    - Carbury to Peamount.

122. Figure 3.3 gives an overview of the Preliminary Route Corridor alternatives, together with the sub-options loops across the Proposed Project. Figure 3.4 to Figure 3.7 show these alternatives with more detail. A full breakdown of the development of the route corridor is set out in Appendix A3.1 (Pipeline Routing Report).

3.7.3.5.1 Route Section Birdhill to Birr

123. Between Birdhill, County Tipperary and Birr, County Offaly, three Preliminary Route Corridors were identified, shown as A1, A2 and A3 in Figure 3.4. The Preliminary Route Corridor alternatives, together with the sub-options, met the primary environmental and technical objectives and as such provided reasonable route options in principle.

124. The MCA, reported in the POAR (Irish Water 2015c), determined that Preliminary Route Corridor alternatives A2 and A3 were, more constrained compared with the alternative Preliminary Route Corridor A1 and therefore, did not perform as well as it for the following reasons:
    - They are longer route alternatives and would involve a higher degree of hedgerow clearance and associated disturbance on flora and fauna
    - Greater impact potential on local, secondary and tertiary roads, and potentially poorer construction access from the national, regional road and local primary road network
    - Higher potential for encountering ground with peat and alluvium
    - Greater impact potential for watercourse crossings and WFD as they both will require crossing of River Ollatrim whereas A1 does not.

125. Preliminary Route Corridor alternative A1 encountered a divergence point at Lough Eorna, County Tipperary. At this location the corridor could be routed either in a more northerly or southerly direction. These ‘sub-options’ or ‘loops’, as shown on Figure 3.4, were evaluated, and it was concluded that the potential environmental impacts, including ecology were similar for both routes and that the routing decision relied on engineering/technical considerations. On the basis of these technical factors, the northerly sub-option was preferred because it had the least potential for encountering poor ground conditions and was more favourably accessed from secondary roads. Therefore, the northerly Lough Eorna Loop was the least constrained of the two sub-options.

126. Overall, for the route section between Birdhill to Birr, Preliminary Route Corridor alternative A1, with the northerly sub-option alignment of the Lough Eorna Loop, was selected as the least constrained alternative for a combination of environmental and technical reasons.

[10] Full details are contained in Appendix F of the POAR.

3.7.3.5.2 Route Section Birr to Tullamore

127. Between Birr and Tullamore, County Offaly, two Preliminary Route Corridor alternatives were identified. These were referred to as B1 and B2 and are shown in Figure 3.5.The Preliminary Route Corridors, together with the sub-options, met broad environmental and technical objectives and as such provided reasonable route options in principle.

128. The MCA, reported in the POAR (Irish Water 2015c), determined that Preliminary Route Corridor B1 was more constrained compared with the alternative Preliminary Route Corridor B2, and therefore, did not perform as well as it, for the following reasons:

- It is a longer route and would involve a higher degree of hedgerow clearance and associated disturbance on flora and fauna
- Higher potential for encountering conditions where construction would be difficult, more crossings of major obstructions and has a less acceptable elevation profile
- It encounters a higher number of cultural heritage constraints
- A higher presence of extensive areas of peat, and the potential to sterilise mineral resources make it less suitable.

129. Preliminary Route Corridor B2 encountered a divergence point at Castletown, County Offaly. At this location the corridor could be routed either in a more north-easterly or south-easterly alignment. These were referred to as the Birr Loops ‘North’ and ‘South’ and they are shown on Figure 3.5. Following appraisal of these sub-options, it was established that the South loop performed better on technical grounds. The environmental effects of both options were broadly similar, with low effects on the environment generally for either. However, the northern loop would have potential moderate impacts on cultural heritage, and soils, geology and hydrogeology. Therefore, the southern Birr Loop was the least constrained of the two sub-options.

130. Overall, for the route section between Birr to Tullamore, Preliminary Route Corridor alternative B2 with the southern sub-option alignment of the Birr Loop was selected as the least constrained alternative for a combination of environmental and technical reasons. This is shown in Figure 3.5.

3.7.3.5.3 Route Section Tullamore to Carbury

131. Between Tullamore, County Offaly and Carbury, County Kildare, four Preliminary Route Corridor alternatives were identified. These were referred to as C1, C2, C3 and C4. The Preliminary Route Corridors, together with the sub-options, met the primary environmental and technical objectives and as such provided reasonable route options in principle.

132. The MCA, reported in the POAR (Irish Water 2015c), determined that Preliminary Route Corridor alternatives C1, C2, and C4 were more environmentally constrained compared with the alternative Preliminary Route Corridor C3, and therefore, did not perform as well as it, for the following reasons:

- C1 and C2 would be longer than C3
- C1 and C2 would impact more locally important habitats than C3
- These routes presented a higher risk to sensitive salmonid spawning areas in the River Boyne and Blackwater River SAC catchment
- These routes had a greater number of local secondary and tertiary road crossings and less beneficial construction access via the regional road network.

133. Preliminary Route Corridor C3 encountered a divergence point at two locations and so four sub-options were considered.

134. The first of these was at Edenderry, County Offaly and was referred to as the Edenderry loop. At this location the corridor could be routed either in a more northerly or southerly direction. It was established, following an appraisal of these sub-options, that the northern alignment passed through areas of high ecological value, including an area of remnant raised bog, the Long Derries SAC and the Grand Canal proposed Natural Heritage Area. The southern alignment was therefore selected as the least constrained option for the Edenderry Loop.

135. A second divergence point was identified further east, with the option of a more northerly or southerly alignment at Killinagh. The Killinagh Loop sub-options displayed comparable environmental characteristics but the northern alignment had lower biodiversity impacts. As a result, the northern alignment of the Killinagh Loop was selected as the least constrained of the two sub-options.

136. Overall, for the route section between Tullamore to Carbury, Preliminary Route Corridor alternative C3, with the southern alignment of the Edenderry Loop and the northern alignment of the Killinagh Loop was selected as the least constrained alternative for a combination of both environmental and technical reasons. This is shown in Figure 3.6.

3.7.3.5.4 Route Section Carbury to Peamount

137. Between Carbury, County Kildare and Peamount, County Dublin, two Preliminary Route Corridor alternatives were identified, shown as D1 and D2 in the Routing Report. The Preliminary Route Corridors, together with the sub-options, met the primary environmental and technical constraints and as such provided reasonable alternative route options.

138. The MCA, reported in the POAR (Irish Water 2015c), determined that Preliminary Route Corridor D2 was a more environmentally constrained option, compared with the alternative Preliminary Route Corridor D1 and therefore, did not perform as well, for the following reasons:

- A significant portion of the D2 corridor would affect the sensitivity of the existing landscape character
- A significant portion of the D2 corridor is occupied by the K Club; a highly sensitive receptor as it an important source of local employment
- Higher potential for encountering poor ground conditions
- A higher number of crossings posing greater technical constraints
- Less acceptable elevation profile
- It encountered a higher number of cultural heritage constraints.

139. Preliminary Route Corridor D1 encountered a divergence point at Barreen, County Kildare. At this location the corridor could be routed either in a more northerly or southerly direction. While the potential environmental impacts were similar for both routes, the northerly sub-option was preferred for landscape character reasons. There were some technical advantages to the southern loop including a more preferrable elevation profile. However, overall the north loop was considered the least constrained.

140. Overall, for the route section between Carbury to Peamount Preliminary Route Corridor alternative D1, with the northern Barreen Loop was selected as the least constrained alternative for a combination of environmental and technical reasons. This is shown in Figure 3.7.

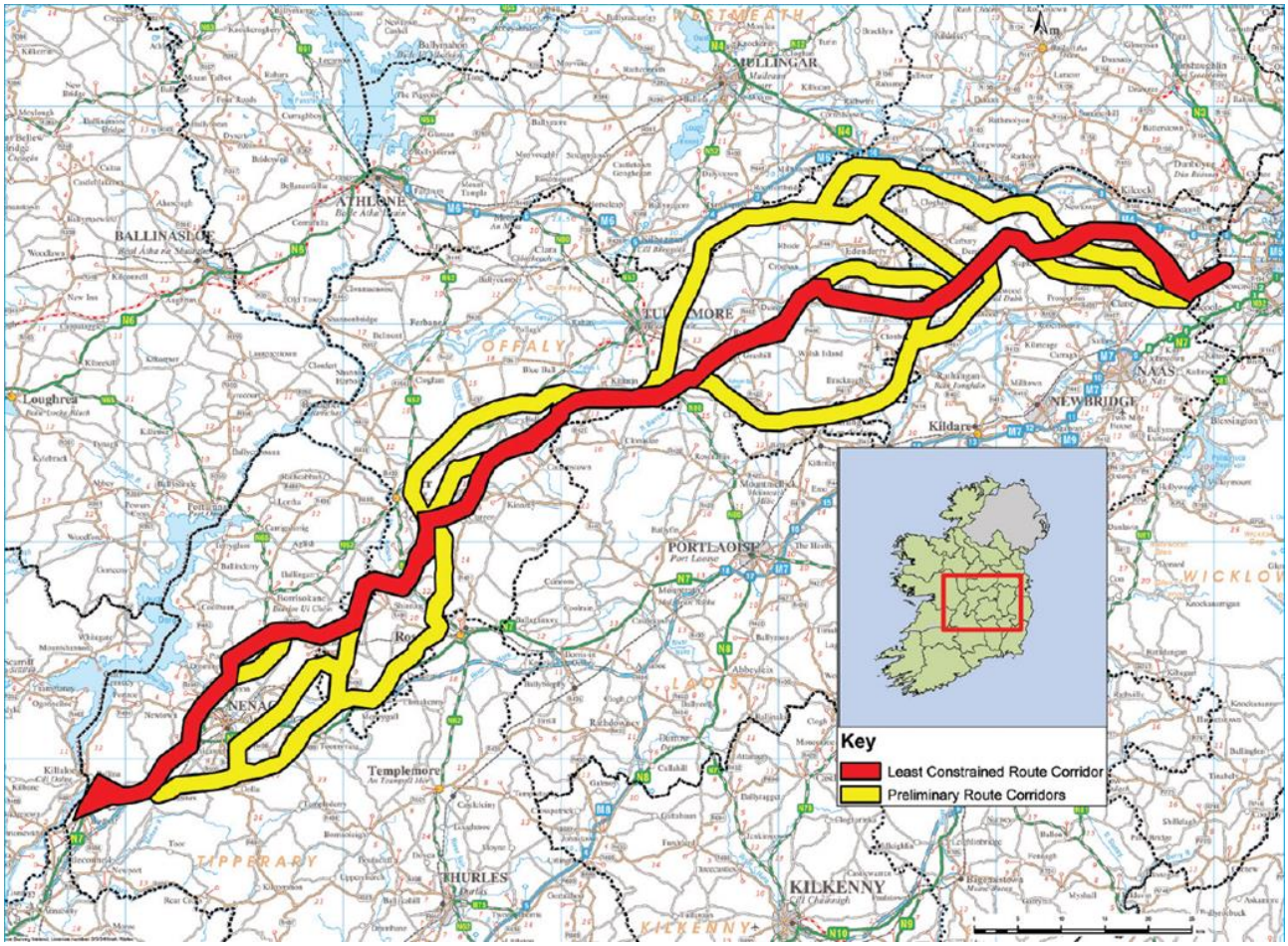


Image 3.7: Preliminary Route Corridors and Least Constrained Route Corridor

3.7.3.6 Step 3: Preferred Route Corridor[11]

141. The objective of Step 3 was as follows:

- Consider amendments to the 'Least Constrained Route Corridor' (Section 3.7.3.5) based upon feedback from the POAR (Irish Water 2015c) consultation process
- Confirmation of the 'Preferred Route Corridor' (generally 2km)
- Identification of pipeline / infrastructure assets.

142. Feedback was received from several stakeholders on the 'Least Constrained Route Corridor' for the emerging preferred option; Option C: Parteen Basin Reservoir (Direct).

143. A review of this feedback was undertaken by the project team. The review resulted in several refinements to the 'Least Constrained Route Corridor,' at the following locations:

- Lower Lake (Parteen Basin)
- Annaghmore, south of Tullamore (County Offaly)
- Esker Bog, south-west of Edenderry (County Offaly)
- Timahoe North Bog, south of Enfield (County Kildare)
- North Kildare, south of Maynooth.

[11] FOAR, Appendix I for full details on Route Selection Methodology. FOAR available on https://www.water.ie/projects/national-projects/water-supply-project-east-1

144. Further details on these changes are provided in Appendix A3.1 (Pipeline Routing Report).

145. Upon completion of Step 3, which included taking cognisance of the public consultation process, the 'Preliminary Route Corridor' (generally 2km wide) was re-defined as the 'Preferred Pipeline Corridor'.

3.7.3.7 Step 4: 200 Metre Corridor

146. The following process was adopted in defining the 'Preliminary 200m Pipeline Corridor':

- The environmental and technical constraints from Step 3 were carried forward and refined within the constraints database
- Data from Ordnance Survey Ireland was also mapped to take account of additional buildings e.g. farmhouses, sheds, etc. not previously identified
- Areas were excluded where a constraint, or combination of constraints, (classified as either 'High' or 'Medium') were of sufficient extent to influence the routing of the 200m corridor
- Field visits of the 'Preferred Pipeline Corridor (generally 2km),' identified in Step 3; and initiating landowner engagement in order to assist with refining the corridor to 200m.

147. Reroute corridor amendments were implemented and thereafter, alternative 200m wide corridor options within it were identified and assessed. This was based on environmental and technical constraints / requirements, in a refinement of the approach to the identification of the 2km corridors. This included factors such as:

- Maintaining a pipeline elevation to optimise the system
- Avoiding areas of poor ground, where possible
- Minimising the number of obstructions such as road, rail and river crossings
- Minimising landowner impact
- Ease of access, both during construction and operation, to the existing road infrastructure.

148. To validate the Preferred 200m Pipeline Corridor, further field investigation was carried out in 2016, where specialists surveyed the Preferred 200m Pipeline Corridor. This was supported by landowner liaison and consultation with local stakeholders and community groups which had begun earlier that year. This work resulted in adjustments to the Preferred 200m Pipeline Corridor.

3.7.3.8 Step 5: 50 Metre Corridor

149. The objective of Step 5 was to:

- Validate the 'Preferred 200m Pipeline Corridor', identified in Step 4
- Identify an 'Indicative 50m Pipeline Corridor,' from the 'Preferred 200m Pipeline Corridor' in Step 4
- Obtain feedback from landowners as part of investigative surveys.

150. This 'Indicative 50m Pipeline Corridor' was identified in consideration of known technical and environmental constraints, as well as feedback from landowners as part of the investigative surveys. The final corridor was subject to the following:

- Feedback from the FOAR public consultation on the 'Preferred 200m Pipeline Corridor', and actions arising
- Further constraints/requirements mapping exercise with the inclusion of an extended constraints/requirements dataset, augmented by additional information upon completion of the environmental surveys, as required
- Ongoing hydraulic design

- Ongoing consultation with landowners/stakeholders. The 'Indicative 50m Pipeline Corridor' will be refined for further positional adjustments accordingly.

151. Further information on the decision making process is contained in Appendix A3.1 (Pipeline Routing Report). This includes details of the Indicative 50m Pipeline Corridor.

3.7.3.9 Post Step 5: Route Refinement

152. The final selection of the preferred 50m Pipeline Corridor was an iterative one and involved extensive consultation with landowners directly and indirectly affected, including re-route requests from affected landowners.

153. Uisce Éireann engaged directly with landowners along the route of the proposed pipeline, a process that began in advance of the conclusion of the non-statutory consultation process on the FOAR (Irish Water 2016). The constraints database was kept under constant review, updated and augmented as required. Field surveys and intrusive and non-intrusive geotechnical investigations were carried out.

154. This process has continued between 2018 and 2025 with on-going engagement with landowners and re-routes proposed by landowners throughout this period. These are set out in Appendix A.

155. At the same time as part of the on-going preliminary design process, a number of technical routing adjustments have been proposed. These adjustments result from minor improvements in the design and have been subjected to the same robust approach to pipeline route evaluation.

156. All adjustments to the pipeline corridor were subject to a robust evaluation using MCA techniques. In addition, the process of decision-making made by the design team took account of the potential impact on neighbouring land holdings, i.e. adjacent lands could not be unduly disadvantaged by reaching agreement elsewhere. The decision-making process for this step comprised three evaluation categories:

- Technical
- Environmental
- Landowner issues.

157. Technical considerations assessed the design and constructability of proposed changes, and included:

- Adequate working area to construct the pipeline
- Proximity to buildings and infrastructure
- Impact of any correction to the pipeline length, and the number of fittings required, which may have affected its hydraulic operation
- The 'shape' of the landholding, consideration of severance of agricultural land, and relative alignment of the pipeline
- Topography (which exerts a strong influence on the design of any pipeline project), as it will determine the horizontal/ vertical alignment, the flow characteristics through the transported medium, and whether the pipeline is gravity fed or needs a pumping station(s). The topography was utilised to optimise the pipeline design to minimise the diameter of the pipeline and pumping costs, limit the impact on the environment and mitigate energy consumption
- Watercourse crossings which introduce greater complexity in construction.

158. The environmental evaluation of proposed changes included:

- Ecology – impact on flora and fauna, particularly with respect to Annex 1 and Annex 2 of the Habitats Directive (Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora)

- Traffic – the maintenance of access to property and safe sight lines
- Cultural heritage – proximity to architectural, cultural and archaeological heritage assets
- Impact on watercourses
- Watercourse crossing alignments (optimal design would dictate that the pipeline crossing would be perpendicular to the watercourse)
- Community, people, land uses including agriculture and economic enterprises.

159. With respect to the community, land use and people category, the following factors were considered:

- Whether agreement was required from neighbouring landowner(s) to facilitate a proposed realignment of the pipeline
- The level of additional impact on neighbouring landowner(s) whose land already fell within curtilage of the pipeline corridor
- Whether suggested changes may affect landowners whose land was not previously directly impacted by the proposals.

160. Ongoing consultation, and design development, has continued to influence the route of the '50m Pipeline Corridor' with dialogue with landowners and other affected parties used to explore options to make minor amendments to the pipeline corridor. This has resulted in minor changes to the indicative planning application boundary but the boundary of the indicative 50m pipeline corridor identified through the routing process in 2016 remains broadly the same.

3.7.3.9.1 Route Selection Conclusion

161. The pipeline routing decisions for the preferred route corridor and the options evaluation undertaken in respect of it were made before the adoption of the National Water Resources Plan (Irish Water 2021 and 2022) including the Eastern and Midlands Plan (Irish Water 2022). The detailed alignment has continued to be refined through reroute requests from affected landowners and stakeholders and other technical refinements to derive the alignment of the Proposed Project. The Proposed Project aligns with the Eastern and Midlands Plan (Irish Water 2022) and this preferred route remains valid and continues to be the preferred option for the design of the Proposed Project.

162. A full breakdown of the development of the final routing of the Proposed Project is set out in Appendix A3.1 (Pipeline Routing Report).

3.7.4 Other Permanent Infrastructure Sites

163. The following section considers the reasonable alternative locations, access and general arrangements for the other permanent infrastructure sites.

3.7.4.1 Water Treatment Plant

3.7.4.1.1 Site Selection for the Water Treatment Plant

Site Selection for the Water Treatment Plant – Land Take Requirements

164. During the previous iterations of the project, the design of the proposed WTP evolved in response to changing engineering, construction and operational requirements that arose from ongoing engineering design, ground investigations and supply / demand balance considerations. Initially, a site requirement of 15 hectares (ha) was anticipated when identifying potential appropriate sites in the FOAR (Irish Water, 2016) for previous iterations of the project. Subsequently, there was a need to review the proposed land take requirement for the WTP site in light of several factors including specifically:

- Achieving the required water standards taking account of the water quality from the New Shannon Source and known invasive species
- Allowing safe and efficient working space clearances for operational maintenance and construction activities
- Accommodating a proposal to store water treatment sludge on the WTP site for periods of up to six months to make the sludge available for beneficial re-use (National Water Resources Plan Draft Plan Technical Appendices, Appendix K – Residuals; (Irish Water 2020), and subsequently incorporated into the adopted Framework Plan (Irish Water 2021)
- Allowing for landscaping of the site in a rural area.

165. Previous iterations of the design for the proposed water treatment plant were prepared prior to the collation of a large body of raw water quality data from the source at Parteen Basin. When such data was collated over an extended period, the design development took account of specific water quality challenges in the raw water, thereby increasing the required footprint of the plant. Examples of this include the incorporation of Granular Activated Carbon (GAC) filters to remove organic matter in order to limit the potential for trihalomethane (THM) generation in the treated water pipeline following disinfection, the incorporation of manganese filters to deal with occasional spikes in manganese in the raw water, and the inclusion of both On-Site Electrochlorination and sodium hypochlorite dosing options for final water disinfection to provide operational flexibility in limiting the potential for biofilm growth in the treated water pipeline. All of these additional treatment process resulted in an increase in the volume of used washwater settlement facilities, and in the scale of sludge management facilities. In previous iterations of the project the original design layout at the FOAR stage included sludge management facilities incorporating thermal drying of the treatment process sludge to minimise the volume of dried sludge that would need disposal from the site rather than temporary retention on site to enable beneficial reuse.

166. Uisce Éireann has opted for a treatment solution to support a circular economy model, and help mitigate climate change, whilst also having available stockpiles to meet supply and demand for sustainable recovery/recycling opportunities.

167. Uisce Éireann's proposal for sludge management at the proposed WTP is therefore not to thermally dry the sludge to 80–90% dry solids, but instead to produce sludge cake of 25% dry solids and to seek beneficial re-use of this cake. It would therefore be necessary to make provision for the storage of sludge cake on the WTP site, as outlets for beneficial re-use may not be available at all times throughout the year. Uisce Éireann has determined that storage would be provided for up to six months of dewatered sludge from the treatment process at the WTP site. It has been estimated that, with three treatment modules in operation producing up to 154Mld in normal operation, the proposed treatment process could produce up to approximately 9,280m³ of dewatered sludge cake over a six-month period.

168. Separately, during construction of tankage and deep structures to the levels defined in the developed design, there is a requirement to maintain space to stockpile safely and later move excavated material, to construct interconnecting pipework, and to keep plant and equipment stored away from the immediate work areas and construction traffic circulation areas. This would be facilitated on space which would later be used during the Operational Phase for storage of spare pipes and fittings and on space being preserved to maintain clearance for cranage during maintenance and for positioning external plant such as silos and surge vessels.

169. Furthermore, preliminary discussions with Tipperary County Council on previous iterations of the project in general, but on the proposed RWI&PS and WTP sites in particular, emphasised the importance of landscaping proposals to reduce the impact of the proposed WTP buildings on the surrounding area.

170. It was therefore concluded that the WTP and ancillary features would require a site of between 26ha to 28ha. The consideration of the alternative sites for the WTP was therefore based on this larger site requirement. This occurred 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 Eastern and Midlands Plan (Irish Water 2022) did not consider this level of detail and therefore, the adoption of the Plan does not affect the decision on the size of the WTP site. The Preferred Approach in the Eastern and Midlands Plan (Irish Water 2022) would require a WTP and to this extent the Proposed Project aligns with it.

Evaluation of Alternative Sites for the Water Treatment Plant

171. Arising from this, potential locations sufficiently large to accommodate this greater requirement of a 26ha to 28ha development were identified within approximately a 3km proximity to the proposed RWI&PS. This was achieved by excluding sites with significant environmental constraints, such as an identified flood risk, areas of higher biodiversity potential, existing residential development and areas of archaeological interest.

172. The 3km search radius from the RWI&PS was adopted to limit the length of raw water pipeline, as longer raw water pipelines would pose a higher invasive non-native species risk during the operational phase and would increase general maintenance requirements. The further the WTP is from the RWI&PS the longer the length of twin pipeline that would be required which would increase cost and pumping. This would reduce the energy requirement from the operation of the project and, as a result, help to optimise the energy efficiency and reduce carbon emissions.

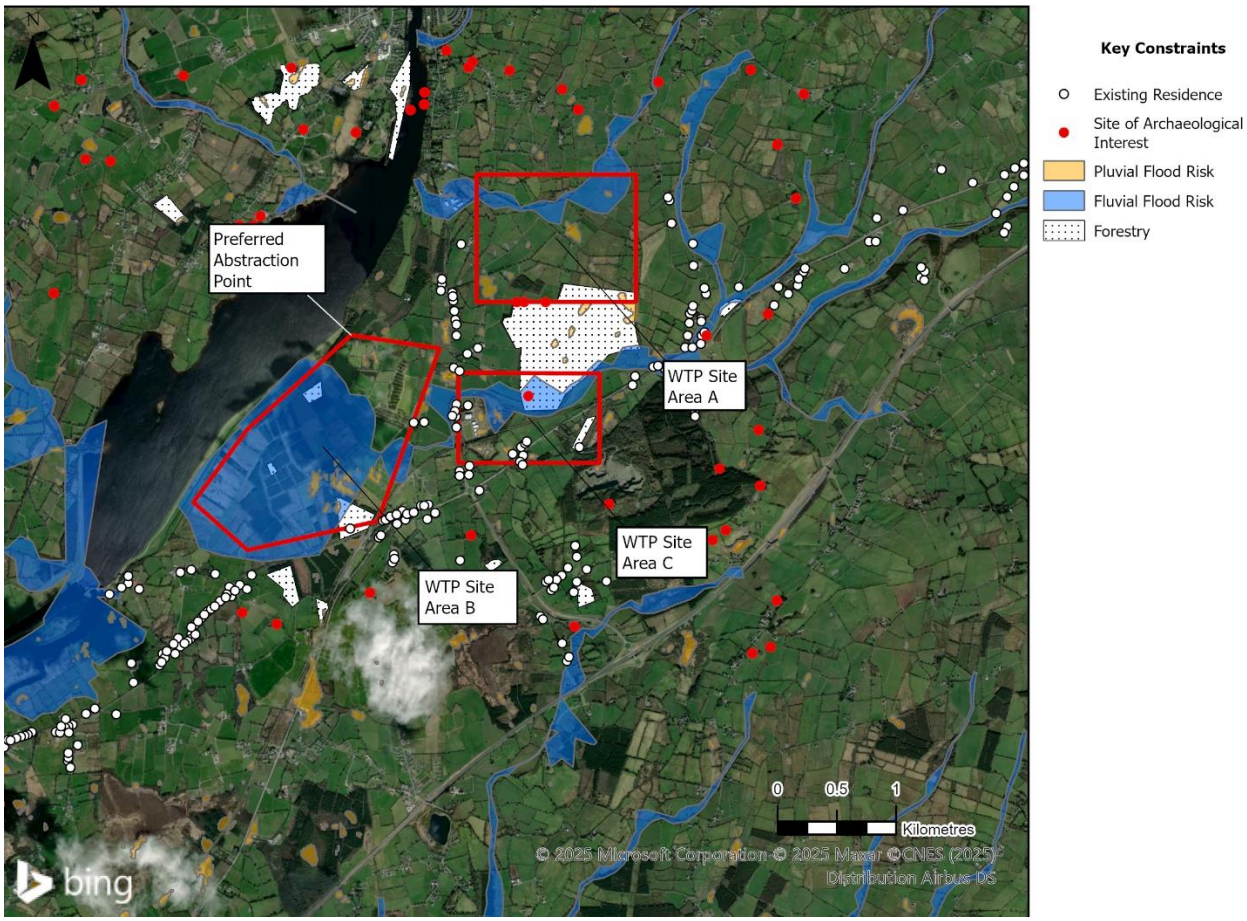


Image 3.8: Potential WTP Site Location Areas

173. Three general areas were identified as shown in Image 3.8 and Figure 3.8 that met the broad environmental and technical objectives and as such provided reasonable options in principle. Area A covered approximately 194ha and was 1.5km – 2.5km north-east of the RWI&PS and the R494 road. Area B was south of the RWI&PS and covers an area of approximately 230ha. It extended north of the

Kilmastulla River and was bounded along the west by Parteen Basin and to the south-east by the R466 road between Birdhill and O'Briensbridge. Area C covered an area of approximately 87ha and incorporated considerable existing development, including residential properties.

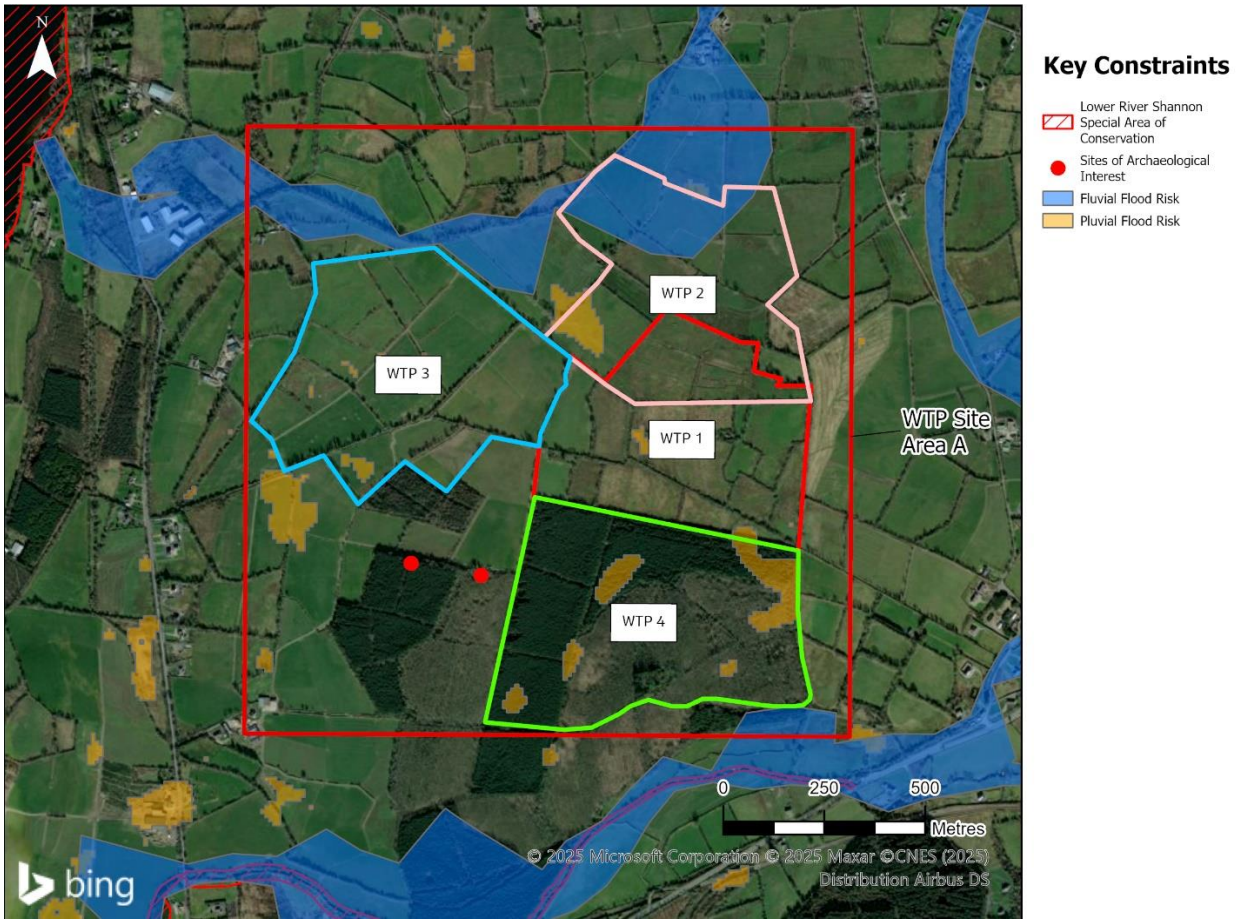


Image 3.9: Potential WTP Sites Within WTP Area A

174. Area A was identified as the least constrained area for siting a WTP as it was largely composed of open farmland, with no direct impact on properties or priority habitats. Area B was environmentally constrained by the Lower Shannon SAC, including the Kilmastulla River. The area also lies within the flood plain of the Kilmastulla River. Area C encompassed considerable existing development, including residential properties and the Shannonside Business Park. It was considered as having an established use upon which a large WTP would have a less significant impact than in the more rural settings of Areas A and B.

175. Overall, Area A was identified as the preferred general location for the WTP as a result of this sifting exercise. This was because sites within this area would not be highly visible from the public roads, were generally not in close proximity to a large number of houses and would not impact directly on priority habitats.

176. Once Site Area A had been determined to be the preferred area, four potential land parcels were identified for the WTP and compared using MCA. These sites are shown in Image 3.9 and Figure 3.9 and comprised the following:

- WTP Site 1 was located in the townland of Incha Beg, contained within a sparsely populated rural area that is enclosed within a broad triangle formed by the R496, R445 and R494 regional roads. It was located immediately north of dense woodland, but consists of open fields, covering an area of 27.5ha. The boundary was defined by existing field boundaries and the site was relatively

square in shape and with the ground level falling west to east. This provided a desirable hydraulic profile for the treatment process units

- WTP Site 2 was located to the north of WTP Site 1 (and indeed overlapped WTP Site 1 in part) and east of WTP Site 3. The site covered an area of 28.3ha and was contained within a sparsely populated rural area that is enclosed within a broad triangle formed by the R496, R445 and R494 regional roads. The boundary of the site was defined by existing field boundaries and the site was relatively square in shape and with the ground level falling west to east. This provided a desirable hydraulic profile for the treatment process units
- WTP Site 3 was located to the west of WTP Site 1 and WTP Site 2 and was contained within a sparsely populated rural area that is enclosed within a broad triangle formed by the R496, R445 and R494 regional roads. The area of the site was 31.4ha. The boundary of the site was defined by existing field boundaries and is relatively square in shape
- WTP Site 4 was located immediately south of WTP Site 1, within an overgrown forested area. The boundary of the site was defined by existing field boundaries and the site was relatively square in shape and with the ground level falling west to east. This provided a desirable hydraulic profile for the treatment process units.

177. The summary of the MCA process for the site assessment is shown in Table 3.11. The rankings are colour coded to assessed impact levels as set out previously in Table 3.8.

Table 3.11: Evaluation of Alternative Sites Within Area A

Constraint	WTP Site 1	WTP Site 2	WTP Site 3	WTP Site 4
Ecology				
Surface Water				
Air Quality				
Noise				
Cultural Heritage				
Landscape and Visual				
Agronomy and land-based enterprise				
People				
Soils, Geology & Hydrology				
Planning Policy				
Traffic, Engineering & Design				
Overall Ranking	1	2	4	3

178. The site selection assessment identified that, although the sites had similar characteristics and constraints and therefore, performed similarly in many environmental respects, WTP Site 1 was furthest from neighbouring residential receptors. Therefore, it was marginally less constrained than the other sites for noise, air quality and population and tourism. Similarly, it was marginally less constrained, (along with WTP Site 4) from a landscape and visual perspective because it was well screened (by a combination of vegetation and the terrain) and would not be readily visible from surrounding roads, dwellings and settlements.

179. All sites were broadly similar from an ecological perspective, although for aquatic ecology WTP Site 1 was considered to be slightly less constrained than the other sites based on ecological receptors within and directly adjacent to the site. No surface water constraints were identified at WTP Site 1. However, it was noted that potential access requirements to all sites could give rise to watercourse crossings with connectivity to the Lower River Shannon SAC downstream.

180. WTP Site 1 was also favoured on the basis of potential traffic connections to the R445 and therefore, avoided effects that could have arisen from the use of smaller local roads. This was also a benefit in terms of construction and longer term operational access.

181. For Cultural Heritage, WTP Site 1 had higher potential for historic remains and so was slightly more constrained than the other sites in that regard.

182. The assessment concluded that WTP Site 1 was the preferred location for the WTP for the following reasons:

- WTP Site 1 was the site that is furthermost from neighbouring residential receptors, and that could be accessed easily by construction and operational traffic using the most direct access from the R445
- WTP Sites 2 and 3 were more constrained than WTP Site 1 by residential and commercial receptors, and through proximity to the Roolagh watercourse
- WTP Site 4 shared the same access road off the R445 as that proposed for WTP Site 1 and consequently shared the associated advantages relating to traffic. However, WTP Site 4 would impact on a greater number of sensitive receptors than the other sites, having a greater number of residences within 500m of the site boundaries.

<u>Alternative Access Option for the Water Treatment Plant</u>

183. Four potential access roads were considered to connect the preferred WTP site to the public road. These are shown in Image 3.10.

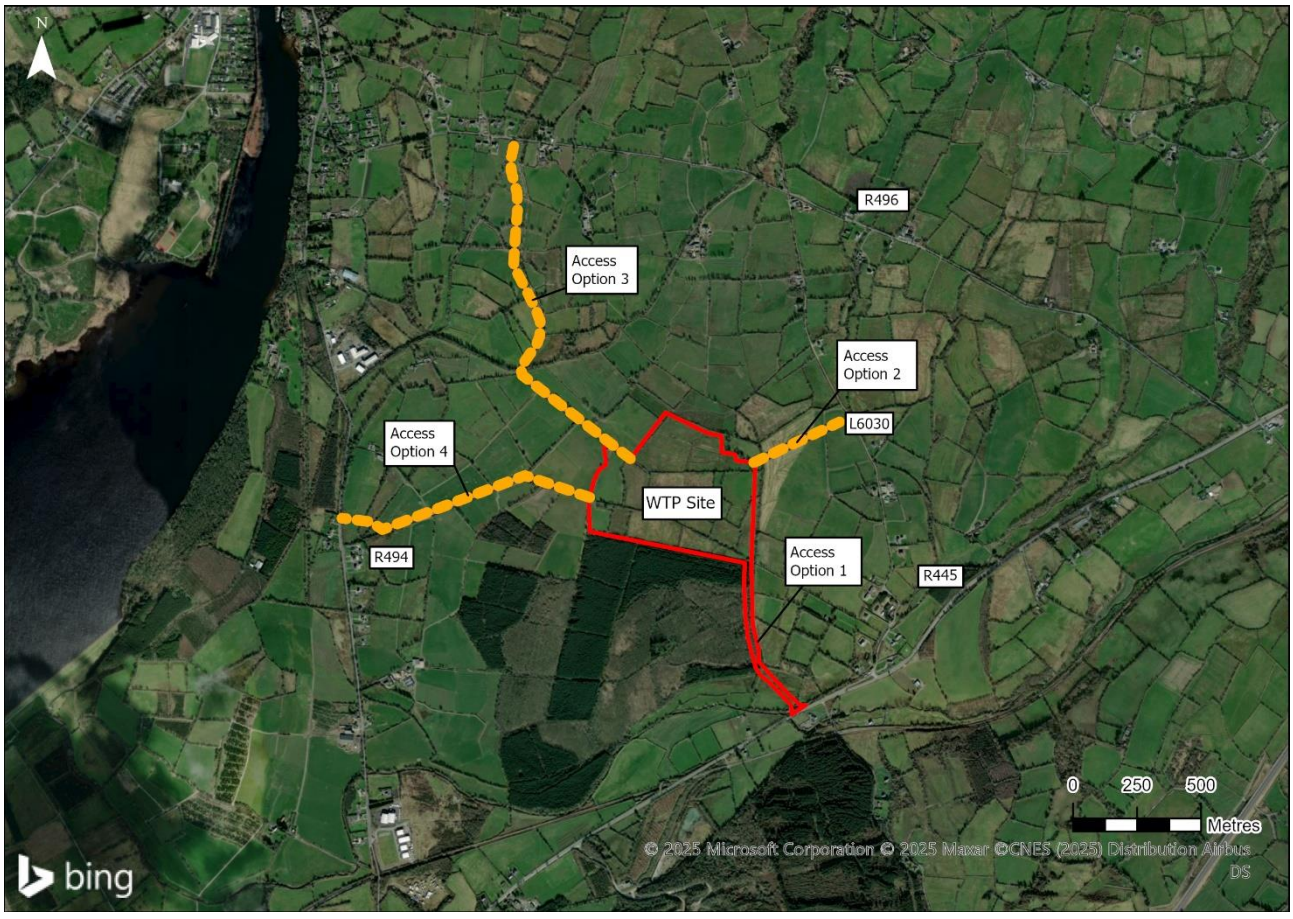


Image 3.10: Potential Access Roads from Proposed WTP Site to Public Roads Network

184. Option 1 approached the WTP site from the south, connecting the site with the R445 (formerly the N7 main Limerick to Dublin road). Option 2 connected the WTP site to a local road, L6030, to the east of the site. Option 3 considered making use of an existing unsurfaced track from the R496 to the north of the WTP site, while Option 4 connected the WTP site to the R494 to the west.

185. Option 1 crossed open farmland and forested land while Options 2, 3 and 4 cross open farmland along their respective routes.

186. There were technical considerations relating to the operation of the WTP which influenced the access road selection. The site topography is such that Raw Water would enter at a relatively high elevation from the western side, and the treatment process would be hydraulically stepped down so that Clear Water Tanks and the HLPS sit at the lowermost (eastern) end. It is preferable, therefore that the access road should enter the WTP Site at the clear water side of the treatment process since the hydraulic gradient for that process is from the Raw Water Balancing Tanks on the western side, to the HLPS on the eastern side. This is for a number of reasons:

    - The requirement for independent ESB access to the WTP site substation is better provided for by an access road entering at the south-east corner of the site, since the substation itself is best located near the high lift pumping power requirement. This is the preferable location when cable ducts for ESB power supply are designed to enter via an access road
    - The Control Building is properly positioned at the down-gradient Clear Water side of the site, with short runs, routed away from the working area of the site, and from the entrance gate for staff vehicles and for visitors. It is preferable to bring construction traffic and excavated material imports onto the WTP site on a construction traffic route with a road base that would form the eventual access road, and which does not unnecessarily impact the Intake RWRM–WTP axis of early construction work. It is also preferable that WTP construction traffic would not cross or cause interference with the separate RWRMs and Intake works traffic. The requirement to provide a watermain within the access road to provide for a potential future connection to align with the Eastern and Midlands Plan (Irish Water 2022), is best positioned from an access road entering the site in the quadrant near the Clear Water tanks. It is also preferable to route attenuated surface water drainage from the WTP site within the access roads. Therefore, operationally there was a clear preference for an access on the eastern side of the WTP site.

187. Option 1 was selected as the preferred access road for the following reasons:

    - Option 2 would connect to the local road to the east which is a narrow road constrained by ribbon development with poor alignment. This would limit the suitable construction and other traffic and further the required sight lines could not be delivered at the L6030. Option 3 connecting to the north would be constrained by road geometry at Ballina and adequate sightlines could not be delivered on the regional road. This road access would direct traffic movements through Ballina village, which would affect the amenity of the village, particularly at construction stage. The route would also affect a large number of landholdings. Option 4 connection to the west would be to a regional road heavily constrained by ribbon development and could not deliver adequate sight lines with the regional road
    - The first 200m to 250m of the route of Option 1 from the R494 would have to be raised above the flood plain of the Kilmastulla River and culverts incorporated into the raised section to allow flood waters to pass under the road in order to avoid an effect on flood risk. In addition it would sever an existing open field and, given that this section of the road would be raised above existing ground levels, it would have a high impact on the land. However, Option 1 to the south was the shortest route (640m in length) with direct access to a high-quality regional road, the R445. Therefore, although it would have some environmental and landowner effects Option 1 was preferred for this reason.

Conclusion of the Site Selection for the WTP Location and Access

188. WTP Site 1 had the least environmental impact of the reasonable alternatives available. It benefitted from more favourable traffic connections to the R445 (the former N7) and would, through avoidance, help to mitigate potential construction related impacts on human beings from haulage traffic employing local roads in the area. As a result, WTP Site 1 was selected for the Proposed Project.

189. Option 1 was selected for the access route as safe access to this site could be achieved and it was the least constrained alternative. Technical and environmental factors were taken into account in the selection for the access route, with no archaeological features nearby, no special protected flora species in evidence and no suitable areas for breeding or wintering birds. It was noted that the route is partially within the Kilmastulla River flood plain and there is some risk of contaminated soil at the former petrol station at the entrance to the public road, however, these could be managed / mitigated through the design process.

190. These design decisions and the options evaluation undertaken in respect of them were made before 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 aligns with the Eastern and Midlands Plan (Irish Water 2022) and the preferred options for the WTP remain valid and continue to be the preferred options for the design of the Proposed Project.

3.7.4.1.2 WTP – Design Alternatives

191. There were two design decisions made in respect of the WTP for which alternatives were considered. This was the Water Treatment Technology and the Wastewater Management.

Alternative Water Treatment Technology – Removal of Organic Compounds

192. The purpose of the WTP would be to treat the raw water abstracted from Parteen Basin to a drinking water standard. For the purpose of the design and the EIAR the Proposed Project includes GAC filtration as the preferred treatment option for removal of dissolved organic compounds and reduction of THM formation.

Granular Activated Carbon

193. GAC is commonly used to adsorb natural organic compounds, taste and odour compounds, and synthetic organic chemicals in drinking water treatment. GAC offers particularly strong adsorbent properties. Its high surface area to volume ratio facilitates the ability to tackle a large number of contaminants and it can be used in static beds or part of a mobile filter system. The activated carbon removes certain chemicals that are dissolved in water passing through a filter containing GAC by adsorbing the chemical in the GAC.

Evaluation of Alternative Water Treatment – Ion Exchange Technology

194. The use of Ion Exchange Technology was considered as an alternative process. With this technology, an Ion Exchange process stage is provided upstream of the coagulation, clarification, and filtration process. Incoming raw water is mixed with a proprietary magnetic ion exchange ‘resin’. When the resin comes into contact with the raw water, organic material is magnetically attracted to the surface of the resin particles, thus preventing it from being carried forward to the main treatment process. In this way, there is less organic material available in the treated water to react with the chlorine which is added at the disinfection stage. While the technology works well the resulting waste stream must be discharged to a sewer, as opposed to GAC which has no discharge.

195. There is no precedent to date for an ion exchange plant of the scale required for the Proposed Project. Research into the process has included site visits to two working WTPs in Australia and the United

Kingdom which are currently using the Ion Exchange Process. One of these is the largest such plant in the world, but at 112Mld is significantly smaller than the proposed WTP.

196. While there have been developments in reducing the quantity of waste generated from the Ion Exchange Process, there is no evidence that the goal of zero discharge has yet been attained, and as a result, the likely effect on this aspect of the environment is reduced with GAC. With discharge to a public sewer, this would require a connection to the main drainage system at Castleconnell, given capacity constraints at other potential sites.

Alternative Water Treatment Technology – pH Treatment

197. The proposed Water Treatment Process includes for dosing of caustic soda at the Water Treatment Plant in order to achieve the required pH level in the water as it leaves the site.

198. Two alternative options were considered for achieving the required pH. These were:

- CO_2 stripping
- Lime treatment.

199. A high-level assessment was undertaken to consider the viability of these alternatives and they were both discounted. The CO_2 stripping was not taken forward because of the requirement for additional pumping and the potential for additional carbon emissions. Lime treatment was discounted because it would have required additional lime silos to be included within the design.

Conclusion of the Selection for the Water Treatment Technology

200. GAC technology is proven at the required scale of production and can be operated in a way that could guarantee zero discharge from the treatment process on a site situated in proximity to the Lower River Shannon SAC.

201. Therefore, GAC has been selected as the preferred treatment option for the Proposed Project. This design decision for the WTP and the options evaluation undertaken in respect of it was made before 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 aligns with the Eastern and Midlands Plan (Irish Water 2022) and this preferred option remains valid and continues to be the preferred option for the design of the Proposed Project.

Alternative Wastewater Management

202. During the water treatment process wastewaters would be generated at the WTP. Two broad alternative options were previously considered for the management of these process wastewaters:

- Treatment of the process wastewaters with recirculation to the head of the WTP
- Treatment of the process wastewaters with discharge back to the source water body, i.e. Parteen Basin.

203. During the evaluation of the options, it was identified that the volume of water abstracted from Parteen Basin under normal conditions could be reduced by re-circulating the wastewater in a continuous loop through the treatment process. This alternative had the additional advantages of reduced energy, reduced energy costs and avoiding any discharge of process wastewaters back into Parteen Basin.

204. The alternative, where treatment of the process wastewaters results would be discharged back to Parteen Basin, would result in approximately 0.2m^3/s of treated wastewaters being returned with potential to introduce trace chemicals, potentially impacting on the Lower River Shannon SAC. Additional construction

works would also be required within the Lower River Shannon SAC to reduce the risk of the process wastewaters affecting the proposed intake of raw water.

Evaluation of Process Waters Management

205. The recirculation of process wastewaters to the head of the WTP would ensure that discharge of water back to the Lower River Shannon SAC is prevented. This would eliminate potential impacts to the Lower River Shannon SAC as there would be no discharge to the Parteen Basin. In addition, energy costs are optimised through reducing the quantity of abstracted water overall and allowing flexibility in the extent of water abstracted from Parteen Basin during a daily cycle.

Conclusion of the Selection for the Process Waters Management

206. Recirculation of process wastewaters to the head of the WTP would have the least environmental impact of the reasonable alternatives considered. As a result, this management approach was selected for inclusion in the design. This design decision for the WTP, and the options evaluation undertaken in respect of it, was made before 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 aligns with the Eastern and Midlands Plan (Irish Water 2022) and this preferred option remains valid and continues to be the preferred option for the design for the Proposed Project.

3.7.4.2 Break Pressure Tank

3.7.4.2.1 Break Pressure Tank Site Selection

207. In the previous iteration of the project, it was identified that for hydraulic design reasons, a BPT would be required to be located at, or near, the highest elevation along the transmission pipeline. The BPT would provide the transition between the pumped section of the Treated Water Pipeline and the section that will usually be gravity fed (with additional pumping required for higher flows). Therefore, putting the BPT at the highest point along the pipeline route would provide the greatest opportunity use of gravity, harnessing the natural topography to convey water by gravity to the TPR. Higher elevations are preferable in principle as this would generate higher energy potential in the Treated Water Pipeline which would make the delivery of water to the TPR more efficient. This would reduce the energy requirement from the operation of the project and, as a result, help to optimise the energy efficiency and reduce carbon emission.

3.7.4.2.2 Evaluation of Alternative Sites for the Break Pressure Tank

208. The site selection process for the BPT followed a two-stage approach. Initially, strategic locations (necessarily high points along the pipeline route) were identified within the Preferred 200m Pipeline Corridor. Following the identification of an optimal strategic location, specific sites were examined to identify a preferred site for the BPT that met technical requirements and minimised adverse environmental effects. This was previously presented in the FOAR (Irish Water, 2016).

209. The initial hydraulic analysis determined that land with an elevation in excess of 125 metres above Ordnance Datum (mAOD) presented the opportunity to maximise gravity flows during operation. Therefore, areas in excess of 125mAOD on the route of the proposed pipeline were mapped.

210. Environmental constraints mapping was applied to the potential sites (noting that impacts on forestry plantations represented a key constraint), and as a result three alternative locations were identified as potential sites for the BPT. Location 1 at Knockanacree, Cloughjordan, County Tipperary was deemed preferable to the other two locations as it is at a higher elevation than the alternatives (147mAOD). As noted, higher elevations are preferable in principle as this would generate higher energy potential in the Treated Water Pipeline which would make the delivery of water to the TPR more efficient. In addition,

Location 1 offered the greatest flexibility for siting the BPT, as the elevated area is relatively extensive, (over 2,200m wide), compared with the available area and elevation at the other locations.

211. Within Location 1 three alternative options for the site of the BPT were developed, as shown in Image 3.11 and Figure 3.10[12].

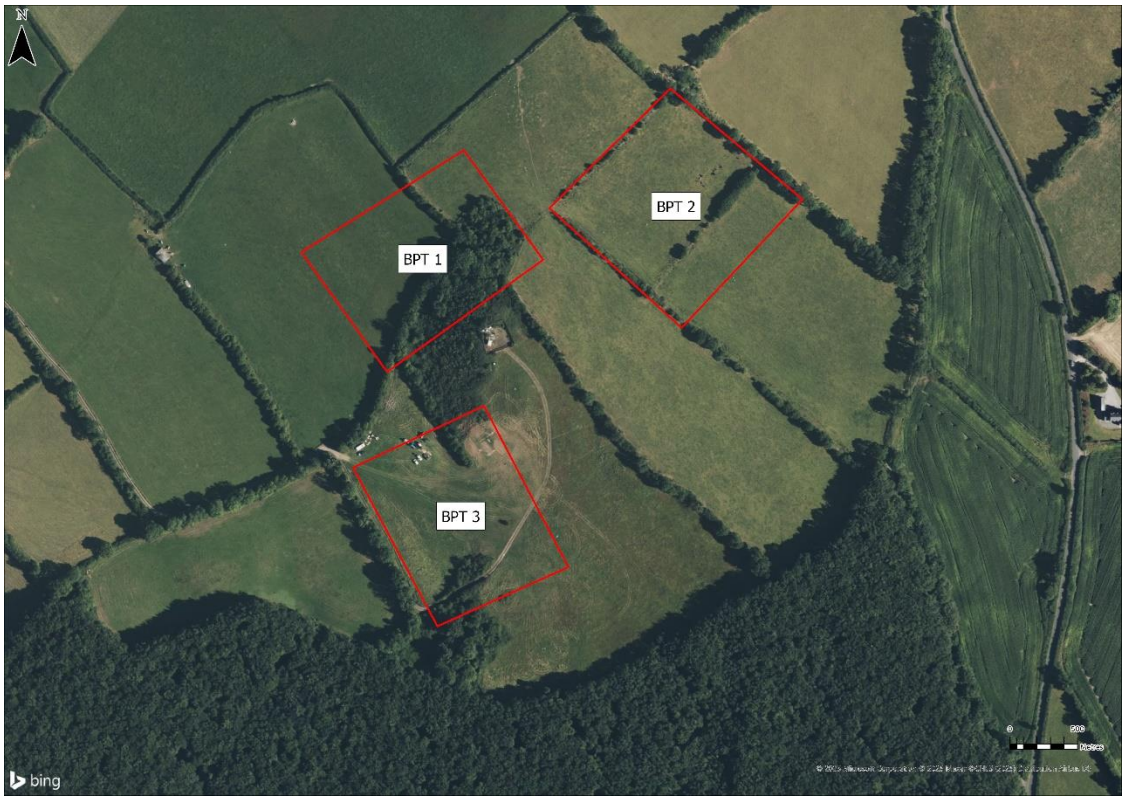


Image 3.11: Potential Break Pressure Tank Sites

212. The three potential sites were all located in the townland of Knockanacree, north of the Knockanacree Woods and trails. The Eco Village of Cloughjordan is located approximately 1.7km south east.

213. The summary of the MCA process for the sites is shown in Table 3.12. The rankings are colour coded to assessed impact levels as set out in Table 3.8.

214. The site selection assessment identified that, environmentally, the sites were similar. BPT Site 3 was identified as less favourable from the landscape and visual perspective and had the potential for archaeological remains. However, it was less constrained than BPT Site 2 across a range of environmental topics and was favoured compared with BPT Site 1 on technical grounds. Therefore, overall, BPT Site 3 was less constrained than the other sites.

[12] FOAR, Appendix G

Table 3.12: Evaluation of Alternative BPT Sites at Knockanacree

Constraint	BPT Site 1	BPT Site 2	BPT Site 3
Ecology			
Surface Water			
Air Quality			
Noise			
Cultural Heritage			
Landscape and Visual			
Agronomy			
People			
Soils, Geology & Hydrology			
Planning Policy			
Traffic			
Engineering & Design			
Overall Ranking	3	2	1

215. The MCA process concluded that BPT Site 3 represented the preferred location for the siting of a BPT for the following reasons:

- It maintained the maximum elevation relative to the termination point thereby giving greater flexibility for routing a pipeline whilst still retaining delivery under gravity
- It would be on the side of the ridge that has less of an incline compared with the other two sites, thus facilitating integration of the works into the existing landscape. It would also be screened by the forestry adjacent to the site
- While each of the alternative sites had similar environmental characteristics, BPT Site 3 was less constrained by existing housing receptors and as a result, would have reduced noise and air impacts on sensitive receptors during the construction stage.

3.7.4.2.3 Alternative Access Options for the Break Pressure Tank

216. In examining access to the preferred BPT site, six options were considered as shown in Image 3.12 and included access alignments to the site from the north, south, east and west.

217. As the BPT site was to be at an elevated position it was important to establish the viability of an access road geometric profile. Primarily, this involved an assessment of the topography and whether suitable gradients in the road vertical alignment could be achieved.

218. Route Option 1 was identified from the L1064, close to field boundaries and directed to a point where it then skirted the forested area en route to the BPT site. Route Option 2 was identified from the L1064 primarily following the existing farm access track close to field boundaries en route to the BPT site. For both options the gradient along the alignment did not generally exceed 10% until its final approach to the BPT site.

219. In respect of the L5020, routing Options 3, 4 and 5 were considered. In all three options on the approach from the L5020 (Option 3, Option 4 and Option 5), the topography rose sharply in the middle third of the alignment with gradients in excess of 15%. To overcome this would require a cutting in the road alignment, necessitating additional land-take. Consequently, it was determined that the land-take for these options could be up to two or three times wider than would otherwise be necessary.

220. Option 6 was considered for an approach from the L1060. On the approach from the L1060, the topography rose sharply in the middle third of the alignment with a gradient in excess of 11.5%. To

overcome the excessive gradient would require a cutting in the road alignment, which would necessitate additional land-take. Consequently, it was determined that the land-take could be up to two to three times wider than would otherwise be necessary.

221. In addition, the routes from both the L5020 (which Options 3, 4 and 5 connected into) and L1060 (which Option 6 accessed) had potentially adverse ground conditions and groundwater vulnerability.

222. For Options 3, 4 and 5 there were additional constraints in the form of National Monuments near to the site affecting access from the east.

223. Option 6, involving an access from the L1060 to the south would have required either passing through Knockanacree Woods, or an alignment to the west and outside of the wooded area. In Knockanacree Woods there was an existing, well developed internal track, which would require a relatively short extension in order to create an access to the BPT site. However, use of this track would affect the local amenity use of the woods and was likely to experience disruption from construction traffic for an extended period.

224. It was concluded, therefore, that access to the BPT site should be from the L1064 local road (Option 1 or Option 2), for the following reasons:

- The environmental and technical assessment determined that these were the least constrained routes
- Given the BPT's elevated position, the vertical alignment of the access road could be graded to the existing ground profile
- The access road approach from the west could be readily integrated with the proposed orientation of the BPT
- The access road profile could be readily incorporated into the BPT's works construction
- The route from the L1060 would be through an amenity area
- The route(s) from the L1060 and L5020 would require significant reprofiling of ground levels to effect a suitable gradient for the movement of vehicles, and would include increased land-take.

225. Option 2 was ultimately selected as the preferred option for the following reasons:

- Alternative routes posed greater environmental constraints, including archaeology, the Beara Breifne Way trail and woodlands. There were also more significant constructability issues on narrow local roads, unsuitable for operational access and particularly construction access, due to their constrained width and inadequate alignment for construction traffic
- Option 2 was aligned along land boundaries and has been selected to stay outside the boundaries of the archaeological features in the vicinity. Traffic management measures would maintain the local road network's ability to accommodate construction traffic at that stage.

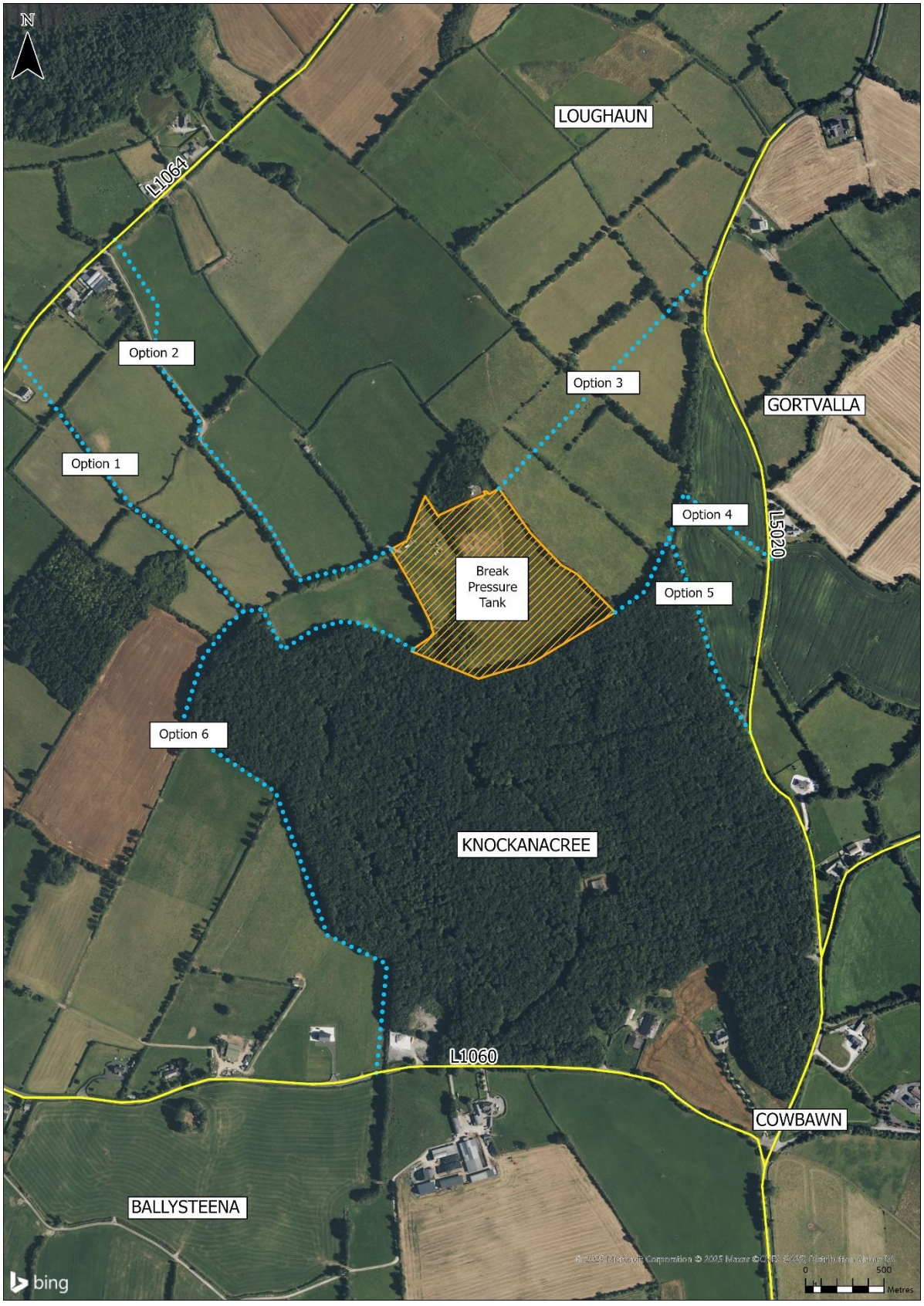


Image 3.12: BPT Location – Access Route Options

3.7.4.2.4 Conclusion of the Site Selection for the Break Pressure Tank Location and Access

226. Of the three sites, BPT Site 3 would have the least impact when taking account of environmental, design and construction parameters. This remains the case when the access road is included. BPT Site 3 also benefits from more favourable topography than the other sites considered in relation to reducing potential landscape and visual impacts, general vegetation screening, and distance from residential property.

227. These design decisions for the BTP and the options evaluation undertaken in respect of them were made before 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 aligns with the Eastern and Midlands Plan (Irish Water 2022) and the preferred options for the BPT remain valid and continue to be the preferred options for the design of the Proposed Project.

3.7.4.3 Booster Pumping Station

3.7.4.3.1 Introduction

228. The need for a BPS was confirmed during previous iterations of the project when the decision was taken to reduce the diameter of the pipeline to 1.6m (as described in Section 3.8.2). This would be necessary because a smaller pipeline requires more pressure to move the peak flows through it.

229. The location of a BPS determines the level of pumping pressure required, which in turn dictates the power demand of the pumps. All BPS site location alternatives would require a connection to the 38 kV supply network. Sites located further away from a suitable connection point would require additional infrastructure to deliver a supply to site, contributing to an overall increase in the cost of building the BPS.

3.7.4.3.2 Booster Pumping Station Site Selection Exercise

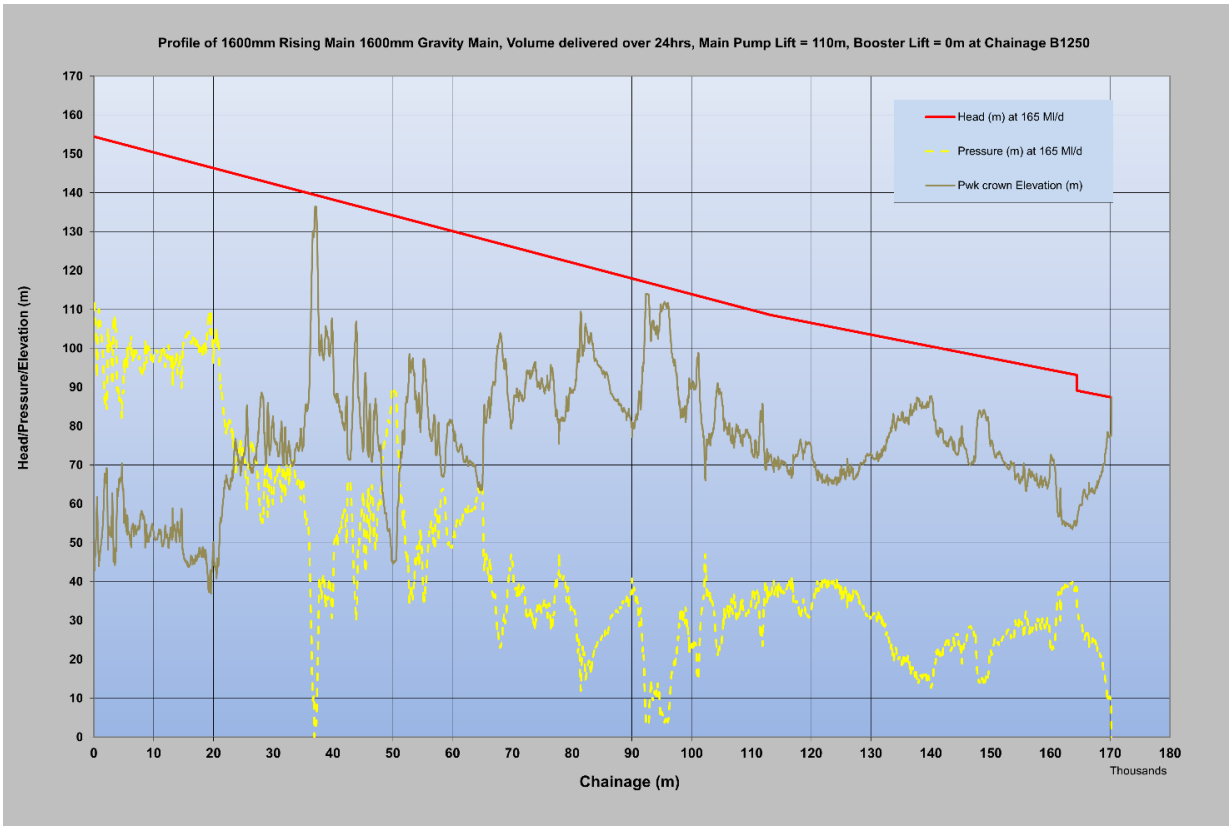
230. The RWI&PS, WTP, BPT and TPR comprise core elements of the Proposed Project with significant technical, environmental and operational requirements that required a site selection process prior to or alongside the pipeline routing decisions. The pipeline routing identifies the preferred route between these determined points. Therefore, the preferred locations for these sites and the routing of the pipeline were activities undertaken in parallel. As a result, a large spatial area could be considered for the location of these sites. The need for the BPS (and FCV) was established as the project design developed, at a date after the determination of the pipeline routing and the selection of the RWI&PS, WTP, BPT and TPR sites. As online elements of the pipeline, the site selection for the BPS (and FCV) was limited to locations along the pipeline, in areas that had already been examined for likely environmental constraints and technical considerations. As a result, a slightly different methodology was required to reflect that the engineering and environmental considerations were within site constraints including environmental considerations had been taken account of in the routing of the pipeline. This is reflected in the slightly different evaluation criteria in Table 3.13 (compared with the MCA for the other sites).

3.7.4.3.3 BPS Site Selection Hydraulic Requirements

231. As water flows along a pipeline it loses energy due the frictional losses arising from contact with the walls of the pipe. For a given pipeline diameter, the higher the flow rate, the higher the losses.

232. The energy in the pipe is known as the ‘total head’ (often abbreviated to just ‘head’). If plotted on a graph, the line joining the dots representing all the energies at different points along the pipe is known as the hydraulic gradient or hydraulic grade line. The higher the flow rate, the greater the energy losses, and therefore the steeper the hydraulic gradient.

233. Graph 3.1 below shows the hydraulic gradient for a flow rate of 170Mld in a 1,600mm diameter pipe along the length of the Treated Water Pipeline (shown in red). The darker line represents the pipework elevation and the yellow line shows the pressure in the pipe.



Graph 3.1: Hydraulic Profile of 1600mm Diameter Steel Pipe at 170Mld Flow

234. In Graph 3.1 the highest elevation is at the BPT at chainage 37km approximately. This is the only place where pressures are allowed to drop to zero at the free surface of the tank.

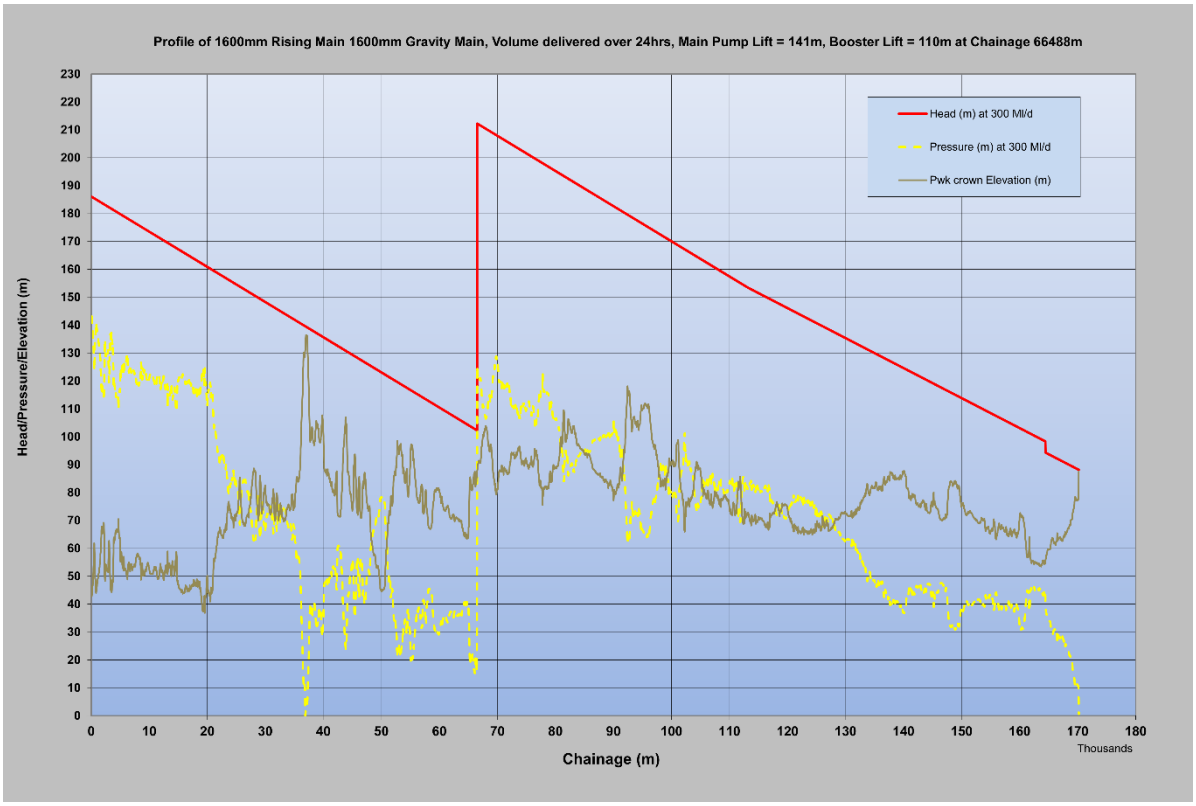
235. To function efficiently and to avoid any ingress that might contaminate the potable water, the pipelines must run full of water, with a positive pressure and with no air in the pipe. Graphically, this means the yellow line, representing pressure in the pipeline, must stay above a minimum level, commonly taken as 5m.

236. As the flow rate increases above 170Mld, the hydraulic gradient will get steeper and a BPS is required, to ensure that the water can reach the TPR (i.e. the head exceeds the elevation at the TPR). This is demonstrated in the following sections describing the parameters for identifying the appropriate eastern and western limits along the Gravity Pipeline for potential BPS site locations.

3.7.4.3.4 Eastern Limit for the Location of the BPS

237. The hydraulic gradient is steeper for higher flow rates and the most easterly location suitable for the BPS was dictated by the point along the pipeline where the hydraulic gradient intersects the notional line 5m above the ground profile.

238. Graph 3.2 shows the hydraulic profile of the Gravity Pipeline, for the highest flow design case, namely the year 2050 'Dry Year Critical Period (DYCP)+Head Room (HR)' demand profile, which requires a daily flow rate of 300Mld. In this graph the location of the BPS is represented by the sudden jump up in the hydraulic gradient at chainage TWB – 2600m where the suction pressure (the upstream side of the pumps) reaches the 5m limit. This was the most easterly potential BPS location.



Graph 3.2: Hydraulic Profile for 1,600mm Diameter Pipework at 300Mld – BPS 67.5km east of WTP

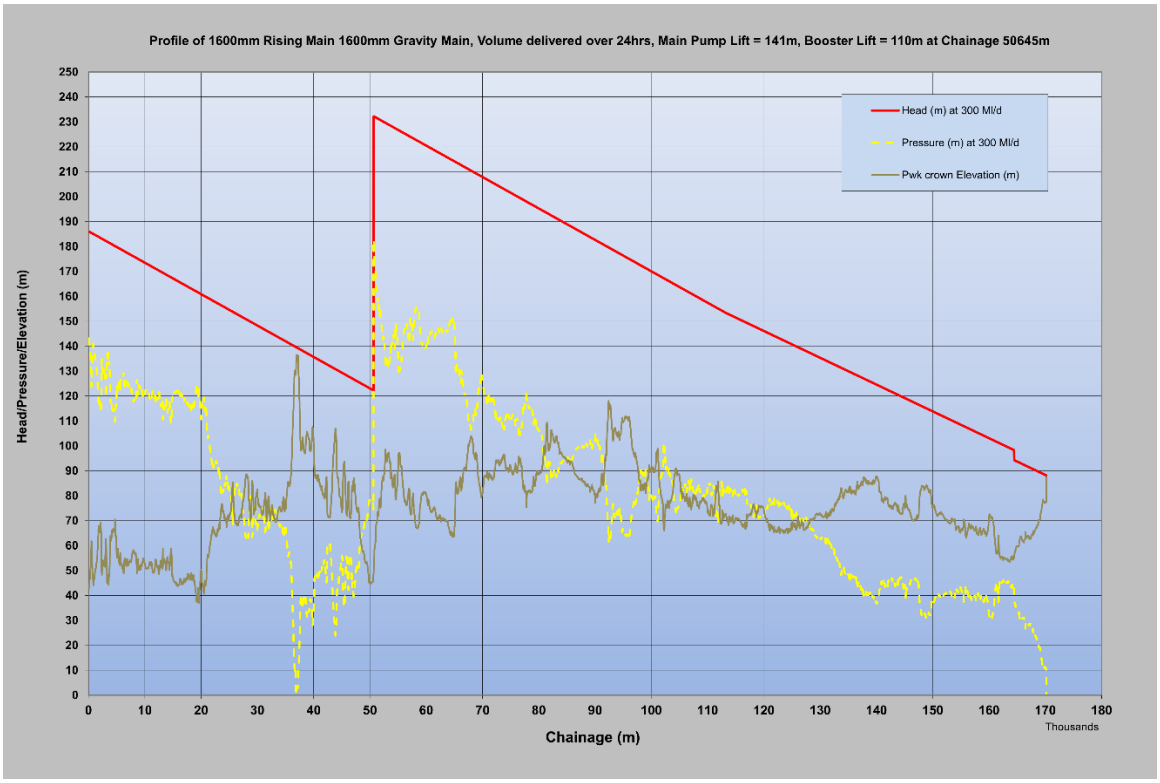
3.7.4.3.5 Western Limit for the Location of the BPS

239. To determine the most westerly location it was necessary to consider the maximum pressure in the downstream pipework. This increases as the BPS is moved to the west along the Treated Water Pipeline.

240. The most common and cost-effective pressure rating placed on the pipework is 16bar. Using this parameter it was possible to determine the western limit for a potential BPS, by identifying where this 16bar pressure would be exceeded. Graph 3.3 shows this point as around chainage TWA – 13900 (at the time of the assessment) where the yellow line is touching 160m (which is approximately 16bar).

3.7.4.3.6 Extents of the BPS location

241. Using the two hydraulic constraint criteria to define the eastern most and western most location for the BPS a site location area was identified between chainages TWA - 13900 and TWB - 2650. Within this study area it was apparent that the further east the location, the higher the potential to cater for additional flows whilst still meeting the two requirements for positive suction pressures and avoiding delivery pressures above 16bar.



Graph 3.3: Hydraulic Profile for 1,600mm Diameter at 300Mld – BPS 50.6km east of the WTP

3.7.4.3.7 Booster Pumping Station Site Selection Exercise – Long List

242. An initial desktop assessment of the Treated Water Pipeline route within the extents defined in Section 3.7.4.6 was undertaken to create a long list of sites at which the BPS could potentially be located (Sites 1 – 13). This was informed by the technical requirements for the BPS including the need for a relatively flat site of, at minimum, 2 hectares with suitable access and a viable power supply for peak pumping requirements. 13 sites were included on the long list, all located at road crossings along the length of the pipeline within the hydraulic envelope. These are shown on Image 3.13 and in Figure 3.11 to Figure 3.14.

243. Locations 3 and 4 were discounted on the basis that the roads where they were located were too small and therefore unsuitable for permanent access. Therefore, only 11 locations were taken forward.

244. Three of the eleven had an option to be either side of the road and therefore, effectively had two sub-options. On this basis the long list was refined to 14 sites.

245. Table 3.13 summarises the reasons that sites were discounted and which sites were taken forward.

Table 3.13: Shortlisted Sites for the BPS

Alternative Site	Discounted / Short Listed
1	Discounted – less hydraulically preferred compared with other options
2	Discounted – less hydraulically preferred compared with other options
5	Discounted - Proximity to SAC
6	Discounted – less hydraulically preferred compared with other options
7	Short listed
8	Discounted – very similar to site 7 however site 7 preferred and so site 8 not taken forward.
9A	Discounted - East of site within PFRA identified flood zone. Reasonably close proximity to Kilmaine 25 water body
9B	Short listed
10	Discounted – adjacent to to Kilmaine 25 water body
11	Discounted – minor road and proximity of properties
12A	Discounted – due to potential landscape impact and proximity of properties
12B	Discounted – due to potential landscape impact and proximity of properties
13A	Discounted – 13B preferred compared with 13A as it was further east and due to proximity of existing property.
13B	Short listed

3.7.4.3.8 Booster Pumping Station Site Selection Exercise – Short List

246. As a result of the process described in Section 6.3.3, three sites were shortlisted based on the hydraulic envelope and access requirements, site 7, 9B and 13B. These were then assessed against the methodology for site selection, technical evaluation criteria, proximity to pipeline haul road and potential environmental constraints. All three options met the broad environmental and technical objectives and as such provided reasonable options in principle.

247. Location 7 was located approximately 6km to the south of Birr. The site was adjacent to a single-lane road, which connects to the R440 approximately 3.7km away, towards Birr. There were no watercourses in the vicinity of the site and it had a low risk of flooding. The site was used as a mixed livestock enterprise. The nearest property to the Location 7 boundary was 50m to the south.

248. Location 9B was approximately 7km to the east of Birr. The site was adjacent to a single-lane road, which connects to the R440 approximately 5.2km away, towards Birr. The site was approximately 130m away from the Kilmaine water body and was located in agricultural land used for mixed livestock. The nearest property was a newly built domestic dwelling approximately 150m to the west.

249. Location 13B was approximately 12km to the east of Birr on the L3003. The L3003 is a single-lane public road, which connects to the R440 and the N52. Location 13B is the closest to the R440 regional road which is of higher standard, and this would aid the transport of materials and equipment during construction and operation. The Upper Coagh River runs 180m to the east of the site, along the field boundary. The site was approximately 160m away from this river's flood zone. The site was located in agricultural land defined as mixed livestock/grassland. The nearest property to the site was approximately 250m to the north-west.

250. As noted above, the route of the pipeline corridor had been established prior to the BPS site selection. The pipeline routing had taken account of, and avoided, major environmental constraints and therefore, the environmental considerations for all potential BPS sites were broadly similar. Therefore, the technical requirements for the operation of the BPS were materially more influential in the decision on its location. An environmental comparison was carried on a site-specific basis, as set out in Table 3.14.

Image 3.13: Long Listed Site Locations (Previous Iteration of the Project Boundary Shown in Red)

251. All three locations could meet the hydraulic requirements however, Location 13B provided the optimum location for hydraulic performance. The electricity supply would be provided by ESB. All three locations would potentially require an upgrade of Ikerrin 110 kV substation and would contribute to the drivers for the already planned up-rating of the Ikerrin to Roscrea and Dallow to Birr 38 kV overhead lines. However, the difference in the distances meant there was a difference in the cost associated with each option with Location 7 being cheaper than the other options. The evaluation of each location against the assessment criteria has been summarised into Table 3.14. A RAG (Red, Amber, Green) system has been used to convey preferred (green), feasible but with potential constraints (orange), and least preferred (red) locations.

Table 3.14: Summary of Evaluation

Assessment Parameter	Location 7	Location 9B	Location 13B
Delivery pressure of pipework	14.6bar	14.6bar	12.3bar
Maximum achievable flow at 16bar delivery pressure	310Mld	310Mld	340Mld
Power supply			
Site topography			
Site Access			
Geotechnical Info			
Biodiversity			
Water/Flooding			
Land and Soils			
Agriculture			
Air Quality			
Noise and Vibration			
Traffic and Transport			
The Landscape			
Cultural Heritage			
Material Assets			
Waste			

252. On completion of the evaluation process, Location 13B represented the preferred location for siting the BPS for the following reasons:

- Technically it was the optimum location for hydraulic delivery thereby enabling the greatest energy efficiencies in plant selection.
- Access to all of the sites would be via minor public roads; however, Location 13B was the closest to the R440 regional road which is of a higher standard and so would aid the transport of materials and equipment during construction and operation
- The ground conditions at Location 13B were more suitable for the construction of the BPS compared to Locations 7 and 9B
- Location 13B is the least environmentally constrained of the three options. It is noted in particular that Location 7 was less preferred due to its proximity and setting close to a number of residences. Location 9B required a higher loss of hedgerows and is not preferred.

3.7.4.3.9 Alternative Access to the Booster Pumping Station

253. The BPS site that was included into the design is immediately adjacent to the L3003 and therefore, there would be no dedicated access route, as access would be directly from the road.

3.7.4.3.10 Conclusion of the Site Selection for the Booster Pumping Station Location

254. Location 13B was the preferred site for the BPS as it has the most favourable hydraulics and ability to handle surge pressures. It comprised a relatively level site requiring minimal earthworks, has a low visual impact giving less disturbance during construction and operation, has favourable ground conditions for construction and was least environmentally constrained. Whilst the power supply would represent a more significant cost compared to the other locations this is outweighed by the benefits.

255. The design decision for the BPS and the options evaluation undertaken in respect of it was made before 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 aligns with the Eastern and Midlands Plan (Irish Water 2022) and this preferred option remains valid and continues to be the preferred option for the design of the Proposed Project.

3.7.4.4 Flow Control Valve

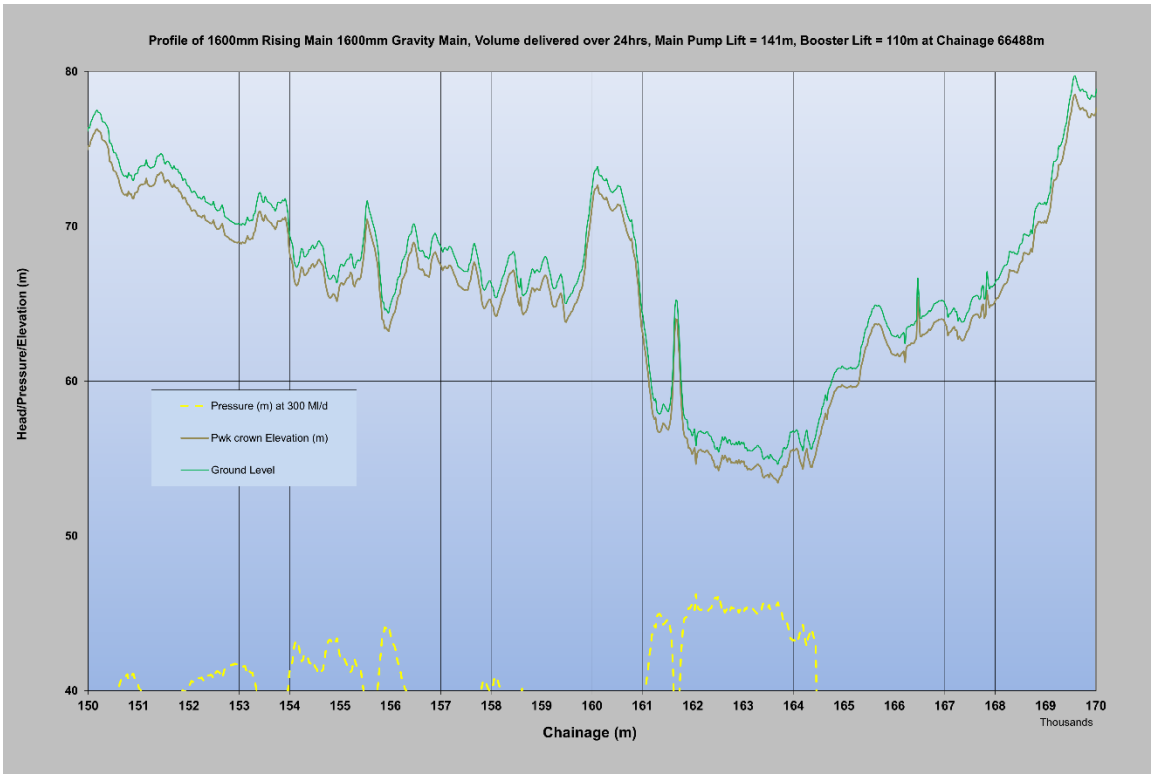
3.7.4.4.1 Introduction

256. To manage and refine the flow in the pipeline between the BPT and the TPR a Flow Control Valve (FCV) would be required. The FCV would provide the control to ensure the BPT would not overflow or empty. It facilitates the means to control or if necessary, shut-off the water arriving at the TPR and ensure, that the capacity of the storage at the TPR is not exceeded. The spatial requirements needed to operate the FCV were used to identify that a permanent site of approximately 0.3ha would be needed for the FCV.

257. The RWI&PS, WTP, BPT and TPR comprise core elements of the Proposed Project with significant technical, environmental and operational requirements that required a site selection process prior to or alongside the pipeline routing decisions. The pipeline routing identifies the preferred route between these determined points. Therefore, the preferred locations for these sites and the routing of the pipeline were activities undertaken in parallel. As a result, a large spatial area could be considered for the location of these sites. The need for the FCV (and BPS) was established as the project design developed, at a date after the determination of the pipeline routing and the selection of the RWI&PS, WTP, BPT and TPR sites. As online elements of the pipeline, the site selection for the FCV (and BPS) was limited to locations along the pipeline, in areas that had already been examined for likely environmental constraints and technical considerations. As a result, a slightly different methodology was required to reflect that the engineering and environmental considerations were within site constraints including environmental considerations had been taken account of in the routing of the pipeline. This is reflected in the slightly different evaluation criteria in Table 3.15 (compared with the MCA for the other sites).

3.7.4.4.2 Flow Control Valve Site Selection Hydraulic Requirements

258. For hydraulic design reasons the FCV is required to be placed around the lowest point along the pipeline. This gives the highest downstream pressure which mitigates the risk of the formation of cavitation bubbles that could lead to a risk of damage to the infrastructure. Based on this, and as shown in Graph 3.4, the FCV needed to be located between approximately TWE-8000 (Chainage 160) and TWE-15000 (Chainage 167). This technical requirement identified the study area for the location of the FCV along the pipeline.



Graph 3.4 Ground profile at the end of the Treated Water Pipeline

3.7.4.4.3 Flow Control Valve Site Selection

259. An initial desktop assessment of the Treated Water Pipeline within the study area defined in Section 3.7.4.9.2 was undertaken to create a list of potential sites for the FCV. The sites were identified based on an examination of the availability of land within the construction wayleave of the Proposed Project adjacent to the public road and limited to those roads that act as haul roads for the Proposed Project. This process identified six potential road crossings along the pipeline route within the identified hydraulic envelope, all of which are within the Kildare County Council or South Dublin County Council areas shown in Image 3.14 and Figures 3.15 to Figure 3.21.

Image 3.14: Location of Road Crossings within the Search Area

260. The evaluation criteria included systems hydraulics, engineering, environment and the availability of power. Both sides of the road were then examined, and this identified sub-options on either side of the road for locations 1,2,4 and 5. This increased the number of locations to 10. All 10 options met the broad environmental and technical objectives and as such provided reasonable options in principle. The 10 identified sites were assessed against the methodology for site selection.

261. Table 3.15 provides a summary of the review of the sites.

Table 3.15: Summary of analysis of FCV sites

Alternative Site	Analysis
1A and 1B	No environmental constraints, site has suitable access but is least favourable for hydraulic performance due to elevation.
2	Potential landscape effect, site has suitable access but is less favourable for hydraulic performance due to elevation.
3	No environmental constraints and close to optimal location for hydraulic performance. Access road is narrow and has some construction constraints.
4A and 4B	Site has suitable access and close to optimal location for hydraulic performance. Location 4B has no environmental constraints. Location 4B would sever part of a field.
5A and 5B	Acceptable hydraulic performance, but on a narrow road and adjacent of railway line.
6	Acceptable hydraulic performance, but would impact on equine land use.

262. As noted above, the route of the pipeline corridor had been established prior to the FCV site selection. The pipeline routing had taken account of, and avoided, major environmental constraints and therefore, the environmental considerations for all potential FCV sites were broadly similar. Therefore, the technical requirements for the operation of the FCV were materially more influential in the decision on its location. An environmental comparison was, therefore, carried out on a broad, site-specific basis.

263. The assessment of each location against the criteria identified has been summarised into Table 3.6 to identify the preferred location. A RAG (Red, Amber, Green) system has been used to convey preferred (green), feasible but with potential constraints (orange), and least preferred (red) locations.

264. Orange and Red ranking for environmental matters across the sites came from potential effects on scenic views, loss of hedgerows and mature trees, and potential disturbance of sensitive land use.

Table 3.16: Summary of Evaluation

Site	Road Name	Side of Road	Hydraulics	Engineering and Access	Environmental
1A	R406	West			
1B	R406	East			
2A	R403	North			
2B	R403	South			
3	Ardrass Road	North			
4A	Temple Mills Road	North-west			
4B	Temple Mills Road	South-east			
5A	Lyons Road	West			
5C	Lyons Road	East			
6	Hazelhatch Road	West			

265. On completion of the evaluation process, location 4B represented the preferred location for the FCV as it had been rated green in all categories. Therefore, the FCV was included in the design at this location.

3.7.4.4.4 Alternative Access to the Flow Control Valve

266. The FCV site that was included into the design is immediately adjacent to a minor road (L1016) and therefore, there is no need for a dedicated access route, as access would be directly from the road.

3.7.4.4.5 Conclusion of the Site Selection for the Flow Control Valve Location

267. Location 4B is the preferred site for the FCV. It has good road access and is close to the optimal hydraulic location. It has no additional constraints.

3.7.5 Summary

268. In identifying the locations for each of the infrastructure sites in the Proposed Project, a comprehensive site selection process was followed that examined technical, environmental and operational criteria. Table 3.17 sets out the preferred design option for each element.

Table 3.17: Summary of Evaluation

Design Element	Alternatives	Preferred Design
RWI&PS Site	3 options considered	Preferred Option: RWA Site 3E
WTP Site	4 options considered	Preferred Option WTP Site 1
BPT Site	3 options considered	Preferred Option ‘Option 3’
BPS Site	3 options considered	Preferred Option ‘Location 13B’
FCV Site	10 options considered	Preferred Option ‘Location 4B’
TPR Site	1 location considered	Peamount

3.8 Pipeline Design

3.8.1 Alternative Pipeline Design

269. During the previous iterations of the project, consideration was given to whether multiple pipelines were needed to supply drinking water to the region or whether a single pipeline was the preferred design solution.

270. The choice between one or more pipelines is driven primarily by a consideration of:

- Strategic need
- Water age
- Operational flexibility
- Asset optimisation.

271. Multiple pipelines opened the possibility of reducing pipe sizes and increasing the possibility of more vendors being able to supply pipeline products as at larger diameters the number of suppliers, and suitably appropriate materials would be reduced.

272. A preliminary hydraulic analysis was carried out on a number of alternative approaches to the pipeline design from the BPT to the TPR, including an assessment of phasing, and single/multiple pipe configurations, based on the following demand scenarios (which were applicable at the time and preceded the National Water Resources Plan (Irish Water 2021 and 2022) which represented Ireland's first co-ordinated assessment of demand at national and regional levels):

- 150Mld (day 1 of WTP operations)
- 245Mld, as demand grows
- 314Mld, being the assumed ultimate output of the WTP (as of the time of analysis).

273. A summary of the options considered is set out in Table 3.18.

Table 3.18: Pipeline Design Alternatives

Alternative	Description
Option A – Single pipe / phased Booster Pumping Station solution optimised for 314Mld	This option assumed a solution which would be gravitational for a number of years in a pipeline which could deliver 150Mld and 245Mld, but could be upgraded to a higher output (to be delivered in a future planning application) by the installation of a booster pumping station at a time of the growing demand. The supply main infrastructure is phased accordingly.
Option B – Twin pipes / phased Booster Pumping Station solution optimised for 314Mld.	This option assumed a solution which would be gravitational for a number of years in twin pipes which could deliver 150Mld and 245Mld, but could be upgraded to a higher output (to be delivered in a future planning application) by the installation of a booster pumping station at a time of the growing demand. The supply main infrastructure is phased accordingly.
Option C – Single pipe solution optimised for 314Mld.	This option assumed a solution which would be entirely gravitational. Whilst the supply main infrastructure for the ultimate demand would be constructed at the outset, the operation of the WTP would be phased according to demand.
Option D – Twin pipe solution optimised for 314Mld (No Phasing of Pipeline Capital Expenditure (CAPEX))	This option assumed a solution which would be entirely gravitational. Whilst the supply main infrastructure for the ultimate demand would be constructed at the outset, the operation would be phased according to growing demand.
Option E – Two pipe solution optimised for 245Mld (single pipe) and 69Ml/d (single pipe)	This option assumed a solution which would be gravitational for a number of years in a smaller pipeline diameter which could deliver 150Mld and 245Mld, but could be upgraded with the construction of a second pipe at a time of growing demand. This second pipe would have a capacity of 69Mld to balance the ultimate demand of 314Mld. The supply main infrastructure is phased accordingly.

Alternative	Description
Option F – Twin pipe solution optimised for 314Mld (Phasing of Pipeline CAPEX).	This option assumes a solution which would be gravitational for a number of years in a pipeline diameter which can deliver 157Mld, but could be upgraded with the construction of a second pipe (capacity 157Mld) at a time of growing demand. This second pipe would balance the ultimate demand of 314Mld. The supply main infrastructure would be phased accordingly.
Option G – Single pipe / Booster Pumping Station (constructed at the outset) solution optimised for 314Mld.	This option assumes a solution which would use a combination of smaller diameter pipes/ booster station capable of delivering the ultimate demand of 314Mld. Whilst the supply main infrastructure for the ultimate demand would be constructed at the outset, the operation would be phased accordingly.

3.8.1.1 Evaluation of the Pipeline Design

274. Hydraulic analysis indicated that a single pipe configuration was the optimum solution, irrespective of diameter and flow capacity. This was significantly more cost effective than two pipe equivalents. The analysis was as follows:

- Option G was marginally the most cost-effective solution. However, Option A (consistent with the Proposed Project) was the most cost-effective solution when potential fluctuations in energy tariffs and inflationary pressures were taken into account.

275. The twin pipe alternative was likely to have greater impacts on the environment for a number of reasons, including:

- A higher volume of material construction needed to construct the same length of pipeline, with higher levels of resulting traffic movements, air and noise emissions and impacts on local communities from this source
- A potentially wider construction wayleave, as the laying of the pipelines would require a separation distance. This would increase the land take at construction stage, and resulting higher levels of impact on landowners, extent of soil and vegetation removed, and higher resulting waste
- Higher carbon usage from the larger volume of construction material needed for twin pipeline construction
- Approximately double the number of line valves, air valves and wash out valves for a twin pipeline, with higher project land take.

276. It is noted that one advantage of twin pipes was that they would present fewer challenges in relation to draindown repairs and environmental discharges. Pumping from one pipe, across to the other would reduce the risk of a discharge anywhere to the environment.

3.8.1.2 Conclusion of the Selection for the Pipeline Design

277. The single pipeline approach represented the preferred option in terms of cost effectiveness and lesser impacts on the environment. This design decision and the options evaluation undertaken in respect of it was made before 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 aligns with the Eastern and Midlands Plan (Irish Water 2022) and this preferred option remains valid and continues to be the preferred option for the design of the Proposed Project.

3.8.2 Pipeline Sizing

278. During previous iterations of the project an assessment was made of the optimum pipeline diameter which included the options for using an in-line BPS part way along the Treated Water Pipeline. This permitted the consideration of pipe diameters that would otherwise be too small to facilitate the peak flows required. The cost saving and risk reduction of using a smaller diameter pipe had to be offset by the capital expenditure (CAPEX) and operational expenditure (OPEX) costs of the BPS.

279. The Eastern and Midlands Plan (Irish Water 2022) identified a small reduction in peak demand to be conveyed by the pipeline and updated information on flows during normal operation of the pipeline. As a result, an optimisation assessment was undertaken to consider whether alternative pipe diameters could achieve the required design flows at a lower project delivery cost, whilst taking account of the operational flexibility to achieve alternative flows.

280. This assessment used the Normal Year Annual Average (NYAA) flows and Dry Year Critical Period (DYCP) profiles from the National Water Resources Plan (Irish Water 2021 and 2022) including an allowance for Head Room (HR), which caters for outages elsewhere in the supply system. The following demand profiles, derived from information provided by Uisce Éireann, have been used:

- NYAA
- NYAA+HR
- DYCP+HR.

281. The principle of the optimisation was to find the lowest Total Expenditure (TOTEX) solution. Whilst a smaller pipe diameter would result in lower CAPEX costs for the pipeline, it would result in higher CAPEX and OPEX costs for both the HLPS and the BPS since larger pumps would be required. For the larger pipe diameters, no BPS would be required at all as the elevation difference between the BPT and the TPR is sufficient to drive the full peak flows.

3.8.2.1 Evaluation of Pipeline Sizing

282. As part of the assessment an analysis was undertaken for the Treated Water Pipeline between the WTP and the BPT and a second analysis for the BPT to the TPR. The conclusions for each are set out in the following sections.

3.8.2.1.1 Treated Water Pipeline Between the WTP and BPT

283. Between the WTP and BPT the water would always be pumped and a range of pipeline sizes were considered for this section of the pipeline given this specification. These included pipe diameters between 1,400mm and 2,000mm. The summary conclusions were:

- Diameters of 1,400mm and below were technically unsuitable due to the high operating pressures
- Whilst 1,500mm was marginally cheaper it was very close to the 16bar threshold at the peak design flows (300Ml/d) and had no capacity beyond that if 16bar rated
- The 1,600mm diameter pipe was well within the 16bar threshold and the Net Present Value (NPV) of costs is only very marginally more than for 1,500mm yet offers considerably more capacity (up to c.345Ml/d) and less risk of exceeding pressure ratings
- A 1,700mm whilst giving greater capacity, this was beyond what is required by the Proposed Project and the lower velocities for the vast majority of the operation life would add to the residence time (the amount of time the water spends in the system) increasing the risk of reduced water quality. Any degree of over-sizing results in greater drain down volumes resulting in more line valves, more landowner disruption and higher on-going maintenance costs.

284. On this basis, a 1,600mm 16bar pipeline was recommended for the Treated Water Pipeline between the WTP and BPT.

3.8.2.1.2 Treated Water Pipeline Between the BPT and TPR

285. Between the BPT and TPR, the water would usually be gravity driven but for higher flows this would be supplemented with pumping from the BPS. A range of pipeline sizes was considered for this section of the pipeline given this specification. These included pipe diameters between 1,400mm and 2,000mm. The summary conclusions were:

- The lowest TOTEX cost in the assessment model, between the BPT and the TPR, by a fraction, was for a 1,400mm diameter pipe. However, the limitations of the model under-estimated the costs of multiple boosters which would increase costs by several million euro. This premium would not apply to larger diameters
- A 1,400mm diameter pipe was also not recommended based on operational restrictions, with multiple boosters required to accommodate 300Ml/d peak flows, and restrictions in the flow under gravity
- The 1,500mm pipe diameter was technically feasible, however it was barely able to accommodate 2050 NYAA+HR flows under gravity. In addition, the 1,500mm diameter limited the flexibility in selecting the BPS location, which would be required in order for the 1,500mm diameter pipeline to achieve maximum NYAA+HR flows and above. Diameters above this size were capable of achieving this flow under gravity and permit much greater scope in selecting the location of the BPS
- The 1,600mm diameter pipeline reduced the power requirements for pumping (by circa 3MW), but still allowed for significant flexibility in the future if the flows were required to increase to accommodate an extreme event
- 1,600mm diameter was able to supply all 'normal' flow (NYAA+HR) under gravity and up to circa 345Ml/d with a single booster under 16bar
- Whilst 1,700mm diameter would allow additional flows beyond 345Ml/d to be transferred without the need for an additional booster or increases in pipe pressure ratings, the additional cost when compared with 1,600mm diameter is estimated to be in the region of €15m. Additionally age of water and minimum velocities should not be overlooked and can become problematic in over-sized pipes
- 1,600mm pipe is far more common than 1,700mm (there are nearly 50 times the length of 1,600mm pipe than 1,700mm pipe in the UK) and prospective contractors reviewing the Proposed Project are likely to associate less risk with a 1,600mm pipeline than a 1,700mm and are typically more comfortable handling the smaller of the two. In addition, the availability of valves is likely to be much better and cost effective for this size of pipe.

286. On this basis, a 1,600mm 16bar pipeline was considered optimal for the Treated Water Pipeline between the BPT and TPR.

3.8.2.2 Conclusion on the Alternatives for the Size of the Pipeline

287. Based on cost, projected flow scenarios and technical feasibility a 1,600mm pipeline with an in-line booster for peak events provides the right balance of cost versus flexibility and was the recommendation for the size of the Treated Water Pipeline and was included in the design. This design decision and the options evaluation undertaken in respect of it was made before 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 aligns with the Eastern and Midlands Plan (Irish Water 2022) and this preferred option remains valid and continues to be the preferred option for the design of the Proposed Project.

3.8.3 Pipeline Material

288. The assessment process for the preferred pipeline material included a comparative assessment of the various materials in terms of:

- Suitability for this application
- Constructability
- Condition monitoring and maintenance
- Carbon footprints
- Environmental impact.

289. The comparative assessment is equally applicable to the Raw Water Rising Mains and the treated water pipelines.

290. As stated above, the optimum internal diameter for both pipelines would be 1,600mm. To cater for flows up to the projected 300Ml/d a pressure rating of 16bar would be required for both pipelines. The required diameter for the Raw Water Rising Mains would be 1,500mm nominal diameter. The Raw Water Rising Mains would be required to cater for flows up to 310Ml/d. The pressure rating required is 5bar.

291. For the transmission of bulk water supplies there are a number of material types commercially available for this purpose including:

- Prestressed Concrete Cylinder (PCC) Pipe
- Steel
- Glass Reinforced Plastic (GRP)
- Ductile Iron (DI)
- High Density Polyethylene (PE).

3.8.3.1 Prestressed Concrete Cylinder Pipe (PCC)

292. PCC pipe is a composite pipe which essentially consists of a concrete core, a thin steel cylinder, high tensile stressing wires and a mortar coating. Various forms of concrete pipe, often without the steel cylinder, have been used in the water industry for 70 years. PCC pipe is available in a large range of sizes from 500mm to more than 4,000mm nominal diameter; and pipe lengths are between 4.5m and 7m depending on the manufacturer.

293. PCC pipe is limited by the following:

- Catastrophic ruptures – once deterioration sets in the material, particularly where protection to the prestressing wires is compromised, the structural integrity of the pipe core can be lost rapidly. Where catastrophic failure of large diameter pipe occurs, there can be substantial collateral flood damage and material can be thrown from the burst area
- Loss of service – to affect a repair of the pipe or a joint, the pipe has to be taken out of service. For larger diameter pipes this period of time can be significant (> 3 days) and the Client/ end user has to be mindful that there is adequate storage provision within their distribution system to manage the ‘downtime’. Specific couplings are required to connect the PCC to non-PCC repair pipework and would need to be stored so delivery would be quick in the event of a burst
- The material weight per metre is very high, e.g. for 1,600mm diameter it is 2,000kg/m. This makes it difficult to handle and is especially unsuitable in areas of poor ground such as peat and other soft ground
- Jointing – needs a 'diaper' wrapped around it, which is filled with mortar to provide corrosion protection at the joint. This is carried out in the trench. Consequently, this needs a high level of construction quality control to ensure the integrity of the joint in service and particularly with respect to leakage control. There are also significantly more joints required than in flexible pipe systems such as steel and polyethylene
- ‘Standard’ designs of PCC pipe go to 1,500mm diameter and 12bar. Larger diameters and higher-pressure ratings are feasible.

3.8.3.2 Steel Pipe

294. Steel pipes and fittings can be readily designed and manufactured in virtually any configuration and pressure rating. Pressure ratings exceeding 100bar are frequently used in the oil and gas sector. Thus, 16bar or even 25bar present no unusual challenges.

295. The limitations of steel pipes include:

- Corrosion: Steel pipes require adequate protection against external corrosion attack. It is a common practice to supplement the inert barrier pipe layer with a cathodic protection system. The adoption of cathodic protection entails a commitment to a continuing programme of performance monitoring, operation and maintenance. The positive side to this is that an 'impressed current' cathodic protection system provides continuous monitoring of the state of the external protection and gives early indication of coating damage and allows pinpointing of issues
- Need for welding: This requires skilled and accredited operatives. A high level of quality control and testing will therefore be required on-site. However, the use of E-joint spigots on the pipes is a significant step forward in the market and avoids the need for internal lining repair following site welding. This is hugely beneficial in avoiding issues of health and safety associated with man entry into confined spaces as well much improved lining quality.

3.8.3.3 Glass Reinforced Plastic (GRP)

296. GRP can be designed for pressures up to 32bar and is typically also specified with a 'stiffness class'. At 16bar, 1,600mm internal diameter and stiffness class SN10000 the wall thickness is over 50mm.

297. The limitations of GRP pipes include:

- The principal drawback of GRP is it is very vulnerable to impact damage and yet this damage is very hard to spot. Impact can cause star fractures on the bore that are not easily visible from the outside
- Another drawback is the potential for catastrophic failure and the subsequent third-party damage and extensive repair times
- A further drawback is the multiplicity of gasket type seals (2 per pipe joint) – each one being a weakness and potential leak and subsequent catastrophic failure.

298. GRP pipes are a flexible pipe and, as such, depend to a large extent on the correct selection and compaction of bedding, surround and backfill material to ensure adequate strength of the pipe system. Any installation defects can result in catastrophic failure of the pipe with substantial collateral flood damage.

299. Ireland does not have a track record of handling GRP pipe. It should be noted that UK water utilities companies are currently not laying or considering GRP pipelines. Thus, the skills and experience amongst contractors required to lay and supervise GRP mains installation are not readily available either in Ireland or the UK. Asia and the Middle East are understood to be the only regions that have recently installed GRP for potable water and GRP pipe is generally used for agricultural irrigation purposes in Australasia. There have been no recent installations in Ireland, UK or USA.

3.8.3.4 Ductile Iron (DI)

300. DI was first introduced to the Irish market in the 1960s and has been widely used in the water industry ever since. DI is available in sizes ranging from 80mm to 2,000mm nominal diameter, and lengths between 6m and 8.5m depending on the pipe diameters. The main limitations of DI pipes include:

- DI pipes require both external and internal corrosion protection. For given conditions DI will corrode significantly faster than steel or cast iron and consideration would have to be given for cathodic protection were this material to be selected. Sacrificial anodes are the most common form of cathodic protection only because impressed current systems are impracticable due to the rubber seals at each joint preventing electrical continuity
- Buried DI pipes can be subject to microbial influenced corrosion under certain soil conditions (e.g. soils rich in sulphates). DI pipes that are subject to these conditions will require special protection (e.g. Polyethylene encasement)

- As flexible joints are unrestrained, anchoring using thrust blocks is required at changes in direction and at blank ends. This presents a huge challenge for large diameter pipelines at pressure since these forces amount to many tonnes. For example, a 1,200mm pipeline at 10bar requires over 110 tonnes of restraint at a 90-degree bend. This also makes the material unsuitable in poor ground where ground movement may lead to seals in joints becoming dislodged, resulting in leaks. Restrained flexible joints incorporating anchor gaskets, can be used to avoid the need for thrust blocks where forces are within acceptable limits. However, the gaskets cannot be subsequently removed
- Potable water, particularly from soft water sources, is prone to leaching the lime from cement mortar linings. This can cause significant pH problems and necessitates the need for a seal coat of epoxy or similar over the cement. The weakness of all pipelines (along with many other similar systems) is the joints. The DI joint is significantly inferior to a welded steel joint, and this coupled with the much higher number required for a comparable length results in DI pipes being less favourable from a technical perspective. Pipes are typically delivered in up to 6m lengths.

3.8.3.5 High Density Polyethylene (PE)

301. PE pipes are classified by the type of material (PE80, PE100) from which the pipe has been extruded and the Standard Dimension Ratio (SDR) of the pipe, i.e. ratio of pipe outside diameter to pipe wall thickness. The most common PE materials used in Europe for pipe extrusion are PE80 and PE100, where the numbers refer to the long-term material strength according to European EN standards.

302. The main limitations of PE pipes would be:

- The issues of jointing where butt welding is not possible is a major obstacle
- The current standards for butt welding restrict this to a maximum pipe wall thickness of circa 65mm. Therefore, at 1,600mm internal diameter the 65mm limitation in wall thickness would result in an outside diameter of more than 1,700mm and a 5bar pressure limit (SDR 33)
- Should contaminated land, containing certain compounds such as benzene or phenol, have to be crossed PE pipes would require special external protection.

3.8.3.6 Evaluation of the Alternative Pipeline Materials

303. Following the initial assessment of the materials the PCC, Steel and DI options were taken forward.

304. The remaining pipe materials were compared relative to each other in relation to:

- Construction Working Width requirements
- Transportation
- Speed of pipe laying and safety considerations
- Type and number of joints
- Internal linings
- Bedding, surround and backfill
- Impact of ground conditions on material choice.

305. Table 3.19 shows comparisons between the pipe materials and Red, Amber, Green (RAG) highlighting to assist with visually seeing the significant differences. All pipe materials are theoretically feasible, but the technical merits differ significantly.

Table 3.19: A Summary Comparison of Pipe Materials

Criteria	Prestressed Concrete Cylinder Pipe	Steel	Ductile Iron
Pipe Lengths (m)	6	Up to 18	8.2
Weight (kg/m)	2,000	450	800
Pressure rating (bar)	12 typical 16 by special design	25 or greater as required	25
Joint type	Socket and Spigot Rubber gasket	Socket and Spigot Welded	Socket and Spigot Rubber gasket
Indicative estimated number of joints	28,000	13,000 (based on 13.5m length)	21,000
Internal Coating	Cement mortar Higher friction factor Potential for pH problem Zebra mussels	Epox Low friction factor	Cement mortar Higher friction factor Potential for pH problems Zebra mussels
External Coating	Cement mortar	3-layer PE	Zinc /Aluminium Epoxy
Failure mode	Can be catastrophic	Rare pin holing	Most likely at joints but can be catastrophic
Installation expertise available in Ireland	Virtually none	High. Frequently laid by Irish contractors in the UK	Limited at this diameter for cross country pipeline
Range of suppliers	2 in Europe and several in North America	At least 3 major suppliers in Europe	At least two but un-tested at this diameter Europe and Asia
Thrust restraint	Either thrust blocks or anchored joints	Not required	Either thrust blocks or anchored joints
Poor ground	Jointing system susceptible to leak / failure	Can accommodate considerable deflections	Jointing system susceptible to leak / failure
Speed of laying (meters/day)	40	>200	>100
Continual condition monitoring.	None yet	Impressed current cathodic protection	Cathodic protection difficult
Bedding	Imported granular materials recommended as bedding	Selected excavated materials can be used as bedding	Imported granular materials recommended as bedding
Repair Time (Typical)	More than 3 days	Less than 1 day	More than 1 day

306. A carbon footprint assessment was conducted on each of these three pipe material types. The carbon dioxide equivalent, or tCO_2e, were determined for each of the pipe materials for a range of services from manufacture to installation under four different stages:

- Pipe Manufacture
- Transportation from the manufacturing works to Ireland – there are currently no manufacturing facilities in Ireland that can produce these pipe materials
- Transportation to Site – from the port where the material is received to the pipe storage depot areas
- Construction – onward distribution from pipe storage depots to the works areas, installation and reinstatement.

307. The assessment concluded:

- The overall carbon footprint for PCC pipe, allowing for pipe manufacture, transportation and construction is lowest

- Steel marginally worse than PCC by around 2.5%
- Ductile Iron has a much greater carbon footprint than either PCC pipe or Steel. 24.5% more than PCC
- PCC pipe has a significantly lower carbon footprint than Ductile Iron and Steel in the manufacturing stage. In all other stages the carbon footprint for Steel is lowest.

308. Prestressed Concrete Cylinder Pipe outperforms both Steel and Ductile Iron, attributable primarily to a much lower carbon footprint in manufacture; Steel and Ductile Iron are metal, or predominantly metal based, requiring intensive energy input in their manufacture. However, thereafter, other factors come to the fore:

- Length of pipeline – Steel can be manufactured to a length that is principally limited by the road haulage considerations. This means that fewer journeys are required than for Ductile Iron and Prestressed Concrete Cylinder Pipe. The material lengths taken for Steel, Ductile Iron and Prestressed Concrete Cylinder Pipe were 13.5m, 8.0m and 6.1m respectively
- Tonnage – a primary consideration in transport by sea. Prestressed Concrete Cylinder Pipe is significantly heavier per m length than the other materials, and more journeys would be required for delivery
- Materials of Construction – Prestressed Concrete Cylinder Pipe and Ductile Iron require significant quantities of imported material for bedding the pipeline and PCC generates greater surplus excavated material for disposal. Both PCC and Ductile Iron will require large concrete thrust blocks. Steel will require less transport movements, and generate a smaller carbon footprint, for the movement of materials in comparison with the alternatives given its method of construction.

3.8.3.7 Conclusion of the Alternative Pipeline Materials

309. Steel was selected as the preferred material for the pipeline as it was a more reliable technical solution. The assessment when comparing Steel to PCC and DI concludes that it:

- Has less environmental impact
- Is less likely to fail and catastrophic failure is virtually unheard of
- Is well within the pressure and diameter range required for this project
- Is significantly lighter
- For cross country pipelines is quicker to install
- Comes in longer pipe lengths and has significantly fewer joints. Minimising joints is advantageous since they are the weakest part of any pipeline
- Joints are welded and significantly less likely to leak than the rubber gasket of the other materials
- Being flexible and welded it is more suited to poor ground
- Is significantly easier and quicker to repair
- Has an excellent track record
- Is already familiar material to a good number of experienced Irish contractors
- Is well known and understood by the UK and Irish supply chain.

3.9 Power and Water Supply to Sites

3.9.1 Power to Line Valves

310. The total load when the main valve and bypass valve are being operated is around 5 to 10kW – which is considerably smaller than a standard domestic connection. However, this load is only needed for a very

short period (less than half an hour) to operate the valve. The rest of the time the load is considerably less.

311. Thus, the ***average*** demand, relevant particularly for non ESBN options where the high short-term load is provided by a large battery, is around 60 to 70W in winter.

312. Options reviewed for Power to Line Valve complexes were:

- ESBN connection to the grid
- Solar power with battery storage
- Wind turbine with battery storage
- Inline turbine within the pipe with battery storage
- Battery only – replaced every few months.

313. With repair and maintenance logistics, land take requirements, cost, location of dwellings and the reliability of the power supply, the preferred option to supply the Line Valves is that it be provided by ESBN overhead line connection to the grid.

314. Since ESBN have already indicated that a permanent power supply is feasible in every location, the higher costs associated with the other options examined, both for OPEX and, in most cases CAPEX, along with reduced reliability and additional maintenance make solar, wind and battery systems unsuitable for this project.

3.10 Construction

315. The consideration of alternatives for Construction Compounds and Pipe Storage Depots are inter-related because the delivery of the pipe to site would be to both compounds and depots. As a result the location of a Construction Compound could influence the decision on the location of a Pipe Storage Depot because it would change the potential distance between that compound and the next depot along the route of the pipeline. Therefore, the consideration of alternatives was a combined decision making process.

3.10.1 Number and Extent of Construction Compounds

316. The number of Construction Compounds and Pipe Storage Depots proposed in the design, was influenced by several factors including:

- The overall length of the Proposed Project
- Distance between Construction Compound and/or Pipe Storage Depots to ensure a good spatial distribution, if possible.

317. It was assumed that based on the length of the Proposed Project four Principal Construction Compounds would be required. One Principal Construction Compound would be required in each of the following sections:

- RWI&PS, RWRM and WTP
- Approximately 37km of the Treated Water Pipeline between the WTP and BPT
- Approximately 64km of the Treated Water Pipeline between the BPT and approximately TWC-8000
- Approximately 69km Treated Water Pipeline between approximately TWC-8000 and the TPR.

318. A Principal Construction Compound acts as a central hub for plant/materials/labour movement, general storage and temporary contractor offices. In consultation with the reference contracts/contractors a Construction Compound requirement for a minimum site area of the order of 12ha was estimated. Apart

from the WTP none of the other four permanent infrastructure sites were big enough to act as a Principal Construction Compound.

319. In addition to Principal Construction Compounds, Satellite Construction Compounds would need to be located at proposed infrastructure sites for basic requirements, such as office and welfare facilities and space for plant and equipment.

320. Therefore, when considering alternatives it was determined that there would need to be:

- Four Principal Construction Compounds
- Satellite Compounds at any of the Infrastructure Sites not proposed as a Principal Construction Compound (This excluded the FCV because it was so small).

3.10.2 Number and Extent of Pipe Storage Depots

321. To support delivery of the pipe to site the need for pipe storage depots, in addition to the construction compounds was identified. The initial determination was that a requirement for up to 11 sites for Pipe Storage Depots and Construction Compounds at approximately 16km intervals, would be appropriate.

322. At a Pipe Storage Depot, a number of vehicles is likely to arrive at a given location simultaneously, and therefore space is required to remove them from the public road as quickly and safely as possible for off-loading pipes, limiting any potential disruption to other road users and facilitating turning movements; a Pipe Storage Depot requirement for a minimum site area of the order of 2ha was estimated.

323. The Principal and Satellite Construction Compound would also act as a Pipe Storage Depot.

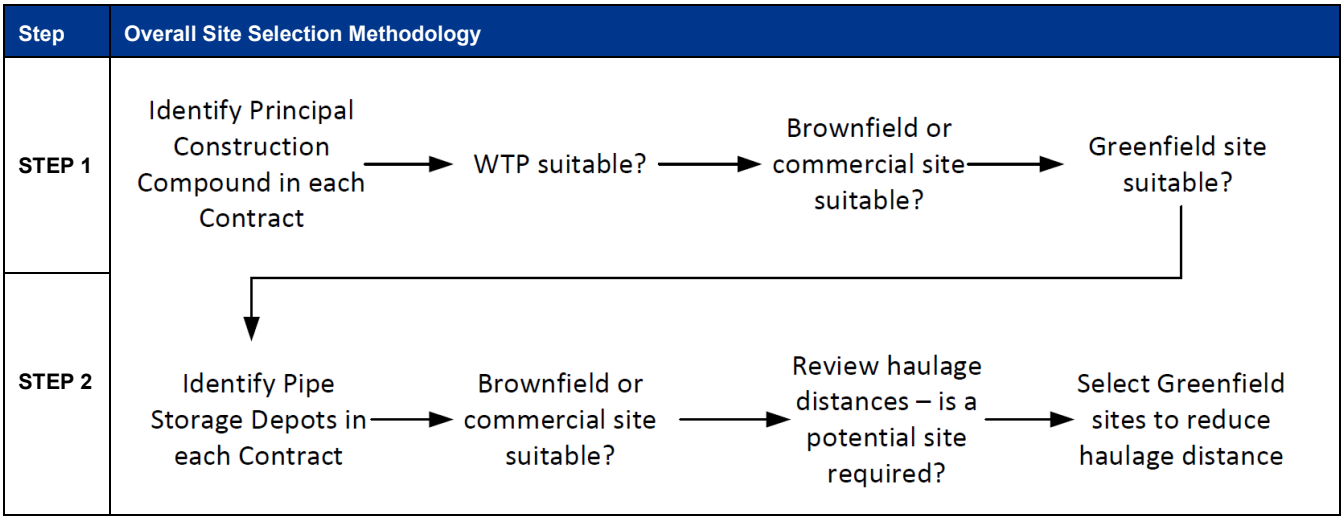
3.10.3 Site Selection Process

324. For each section of the pipeline, as described in Section 3.10.1, the following steps were undertaken:

1) Identify a Principal Construction Compound in each section of the pipeline. Key site identification criteria include:
    a. Site selection in order of land type hierarchy - Proposed Infrastructure Site, Brownfield / Commercial and then greenfield
    b. Site is to be connected directly to a Haul Road and preferably to a national road
    c. Site area is to be a minimum of 12ha.
2) Identify Pipe Storage Depots along the Proposed Project. Key site identification criteria include:
    a. Site selection in order of land type hierarchy - Proposed Infrastructure Site, Brownfield / Commercial and then greenfield
    b. Sites to be a maximum haulage distance of 16km between sites along the Construction Working Width and 8km haulage distance from end of contract works.

325. The site selection methodology is shown in Image 3.15.

Image 3.15: Overall Site Selection Methodology



3.10.4 Site Identification

3.10.4.1 Step 1 – Identify Construction Compounds

326. A site for a Principal Construction Compound was selected in each section of the pipeline route, (as defined in Section 3.10.1). These site locations are summarised in Table 3.22.

327. The initial step was to consider if any of the permanent Infrastructure Sites could also act as the temporary Principal Construction Compound. Only the WTP was of sufficient size to do this and it was determined that it could act as an operational compound for plant / material / labour movement and has sufficient capacity to store the approximate 4km (two pipes x 2km) of RWRM required for construction. Therefore, the WTP was selected as the Principal Construction Compound for the first section of the Proposed Project (as defined in Section 3.10.1).

328. None of the other Infrastructure Sites were suitable as Principal Construction Compound and so an exercise was undertaken to identify potential sites. This focused initially on brownfield sites and then in the absence of sufficient suitable sites was extended to greenfield sites.

3.10.4.2 Type 1 Sites – Brownfield and Commercial Sites

329. Ten type 1 (brownfield and commercial) sites were identified within 2km of the Construction Working Width as potential sites for Construction Compounds and Pipe Storage Depots. In addition, to identifying sites in accordance with the methodology three further potential Type 1 sites were identified via on-ground investigations.

330. A summary of potential brownfield and commercial sites for Construction Compounds and Pipe Storage Depots is found in Table 3.20. The status ('rejected' or 'potential') was determined in accordance with the site identification criteria and methodology outlined in this section.

Table 3.20: Brownfield and Commercial Sites Identified as Potential Sites

No.	Site location	Chainage	Pipeline Section	Status	Key reason for status
1	Kilmaglasderry, County Tipperary (B1)	RW-1500	1	Rejected	This site is within 8km of the WTP and therefore no longer required.
2	Glasderry More, County Offaly (B2)	TWA - 15000	3	Rejected	Access to Haul Road not suitable for daily HGV traffic.

No.	Site location	Chainage	Pipeline Section	Status	Key reason for status
3	Cloghanmore, County Offaly (B3)	TWA - 28000	3	Rejected	Multiple land drains and ecologically sensitive area.
4	Derrinboy, County Offaly (B4)	TWB - 6500	3	Rejected	Significant depth of peat remaining.
5	Annaghbrack Glebe, County Offaly (B5)	TWB - 20000	3	Rejected	Access to Haul Road not suitable for daily HGV traffic.
6	Ballinvally, County Offaly & County Laois (B6)	TWB - 26000	3	Rejected	Access to Haul Road not suitable for daily HGV traffic.
7	Derryweelan, County Offaly (B7)	TWC - 7500	3	Potential	Complies with site identification criteria and methodology.
8	Clonad, County Offaly (B8)	TWC - 13500	4	Rejected	Access to Haul Road not suitable for daily HGV traffic.
9	Ballykilleen Townland, County Offaly (B9)	TWD - 3500	4	Rejected	Access to Haul Road not suitable for daily HGV traffic.
10	Timahoe West, County Kildare (B10)	TWD - 21500	4	Rejected	Access to Haul Road not suitable for daily HGV traffic.
11	Derrylahen, County Kildare - Site 1 (B11)	TWD - 25500	4	Rejected	This site is over 500m from a Haul Road. Access to Haul Road not suitable for daily HGV traffic.
12	Derrylahen, County Kildare – Site 2 (B12)	TWD - 26500	4	Rejected	Access to Haul Road not suitable for daily HGV traffic.
13	Barberstown Upper, County Kildare (B13)	TWE - 7500	4	Rejected	Subject to planning enforcement.

331. In the absence of a sufficient number of brownfield and commercial sites available that meet the site selection criteria, greenfield sites were considered as potential sites for Construction Compounds and Pipe Storage Depots.

3.10.4.3 Type 2 Sites – Greenfield sites

332. Greenfield sites were identified on the Construction Working Width and assessed according to the methodology outlined in Image 3.15.

333. Thirty greenfield sites were identified and a summary of these are listed in Table 3.21. The status ('rejected' or 'potential') was determined in accordance with the site identification criteria and methodology outlined in Image 3.15, followed by the site-specific review of potential technical or environmental constraints.

Table 3.21: Greenfield Sites Identified as Potential Sites

No.	Site Location	Chainage	Pipeline Section	Status	Key Reason for Status
1	Kilmastulla (G1), Co. Tipperary	TW - 2000	2	Potential	Complies with site identification criteria
2	Carrigatogher (G2), Co. Tipperary	TW - 12500	2	Potential	Complies with site identification criteria
3	Belleen Lower (G3), Co. Tipperary	TW - 16500	2	Potential	Complies with site identification criteria
4	Boolagelagh (G4), Co. Tipperary	TW - 18500	2	Potential	Complies with site identification criteria
5	Knigh/Ballyanny (G5), Co. Tipperary	TW - 21500	2	Potential	Complies with site identification criteria
6	Lisgarriff (G6), Co. Tipperary	TW - 29500	2	Potential	Complies with site identification criteria
7	Eminiska (G7), Co. Tipperary	TW - 34500	2	Potential	Complies with site identification criteria

No.	Site Location	Chainage	Pipeline Section	Status	Key Reason for Status
8	Newtown (G8), Co. Tipperary	TWA - 2000	3	Potential	Complies with site identification criteria
9	Toora (G9), Co. Offaly – Site 1	TWA - 5000	3	Potential	Complies with site identification criteria
10	Toora (G10), Co. Offaly – Site 2	TWA - 5500	3	Rejected	Haul Road not suitable for daily HGV traffic
11	Toora (G11), Co. Offaly – Site 3	TWA - 6000	3	Potential	Complies with site identification criteria
12	Curralanty (G12), Co. Offaly	TWA - 11500	3	Potential	Complies with site identification criteria
13	Boveen (G13), Co. Offaly	TWA - 14500	3	Potential	Complies with site identification criteria
14	Fortel (G14), Co. Offaly	TWA - 23500	3	Potential	Complies with site identification criteria
15	Derrinboy (G15), Co. Offaly	TWB - 7500	3	Potential	Complies with site identification criteria
16	Killananny (G16), Co. Offaly	TWB - 19000	3	Potential	Complies with site identification criteria
17	Killeigh (G17), Co. Offaly	TWB - 28000	3	Potential	Site approximately 7km from potential commercial forestry site. This site is suitable if no other potential sites are identified in the area.
18	Curragh (G18), Co. Offaly	TWC - 8000	3	Rejected	Site circa 0.5km of potential commercial forestry site.
19	Esker Beg (G19), Co. Offaly	TWC - 19000	4	Rejected	Site is in the flood plain. Equipment and materials cannot be stored in the flood plain without risk of damage.
20	Rathlumber/Rathvilla (G21), Co. Offaly	TWC - 24500	4	Potential	Complies with site identification criteria
21	Shean (G22), Co. Offaly	TWD - 3500	4	Rejected	Site is in the flood plain. Equipment and materials cannot be stored in the flood plain without risk of damage.
22	Drummond (G23), Co. Kildare	TWD - 16500	4	Potential	Complies with site identification criteria
23	Derryvarroge (G24), Co. Kildare	TWD - 26500	4	Rejected	Haul Road not suitable for daily HGV traffic
24	Derrycrib (G25), Co. Kildare	TWD - 29000	4	Rejected	Line of mature trees restricts area available to less than 2Ha
25	Graiguepottle (G26), Co. Kildare	TWD - 34000	4	Potential	Complies with site identification criteria
26	Graiguesallagh (G27), Co. Kildare	TWE - 4000	4	Potential	Complies with site identification criteria
27	Barberstown Lower (G28), Co. Kildare	TWE - 8500	4	Potential	Complies with site identification criteria
28	Commons Upper (G29), Co. Kildare	TWE - 12000	4	Rejected	Site within 16km haulage distance of potential brownfield site. Haul Road not suitable for daily HGV traffic.
29	Kearneystown Upper (G30), Co. Kildare	TWE - 13000	4	Rejected	Site within 16km haulage distance of potential brownfield site. Haul Road not suitable for daily HGV traffic
30	Commons (G31), Co. Kildare	TWE - 15000	4	Rejected	Site within 16km haulage distance of potential brownfield site. Haul Road not suitable for daily HGV traffic

334. All ‘potential’ and ‘rejected’ sites are illustrated in Figure 3.22. All of the ‘potential sites’ were then reviewed to determine which were required from a construction and logistics perspective.

3.10.5 Site Selection Assessment

3.10.5.1 Principal Construction Compounds

335. No brownfield or commercial sites, of sufficient size for a Principal Construction Compound were connected directly to a Haul Road and therefore, no brownfield or commercial site was selected as a potential site for a Principal Construction Compound. As a result, Principal Construction Compounds for the other three sections of the pipeline, as defined in Section 3.10.1, were proposed to be located on greenfield sites. These are listed in Table 3.22.

336. Between the WTP and the BPT, (section 2 for the purpose of the consideration of alternatives for compounds and depots) all potential greenfield sites complied with the site identification criteria. However, only one greenfield site would connect directly to a national secondary road. To reduce traffic congestion on local and regional roads, reduce vehicle distances and associated air and noise emissions, Lisgarriff was selected as the preferred site for a Principal Construction Compound in this section.

337. Between the BPT and the TPR, (both sections 3 and 4 as defined in Section 3.10.1) a greenfield site that complied with the site identification criteria and located approximately halfway along the pipeline alignment in each contract was selected as the preferred site for a Principal Construction Compound.

Table 3.22: Principal Construction Compounds

Site Location	Chainage (m)	Pipeline Section	Land Type
WTP	TW - 0	1	Proposed infrastructure site
Lisgarriff (G6), County Tipperary	TW - 29500	2	Greenfield
Killananny (G16), County Offaly	TWB - 19000	3	Greenfield
Drummond (G23), County Kildare	TWD - 16500	4	Greenfield

3.10.5.2 Satellite Construction Compounds

338. The support satellite compounds were pre-determined based on the location of the Infrastructure Sites as set out in Table 3.23.

339. No alternatives were considered. The FCV was too small to act as a Satellite Construction Compound

Table 3.23: Satellite Construction Compounds

Site Location	Chainage (m)	Pipeline Section	Land Type
RWI&PS	RW - 0	1	Commercial forestry
BPT	TWA - 0	2	Greenfield
BPS	TWB - 1200	3	Greenfield
TPR	TWE - 17500	4	Greenfield

3.10.5.3 Pipe Storage Depots

340. Brownfield and commercial sites that comply with the site identification criteria and methodology are listed in Table 3.24.

Table 3.24: Pipe Storage Depots on Brownfield or Commercial Sites

Site Location	Chainage (m)	Pipeline Section	Land Type
Derryweelan (B7), County Offaly	TWC - 7500	3	Commercial forestry

341. For the first section of the pipeline, as defined in Section 3.4.1 a Pipe Storage Depot is not required to facilitate works as the WTP has capacity to store approximately 4km (two pipes x 2km) of RWRM.

342. Between the WTP and BPT, a Pipe Storage Depot is required to reduce the haulage distance of approximately 29km between the start of the contract and the potential Principal Construction Compound in Lisgarriff. Two potential greenfield sites, Carrigatogher and Belleen Lower, comply with the site identification criteria and are located halfway between the start of the contract and the potential Principal Construction Compound. The site in Carrigatogher is connected to a national motorway, M7 and the site in Belleen Lower is connected to a regional road, R494. Carrigatogher was selected as a potential site for a Pipe Storage Depot to reduce the traffic congestion and number of HGVs on regional roads.

343. While the haulage distance from the start of the contract to the site in Carrigatogher is approximately 12km, slightly above the initial screening criteria of 5-10km, an additional Pipe Storage Depot was not deemed required.

344. The selected sites between the WTP and BPT are summarised in Table 3.25.

Table 3.25: Proposed compounds and depots between WTP and BPT

Site Location	PSD or PCC	Chainage	Land Type
Carrigatogher (G2), County Tipperary	Pipe Storage Depot	TW - 12500	Greenfield
Lisgarriff (G6), County Tipperary	Principal Construction Compound	TW - 29500	Greenfield

345. Between the BPT and TWC-8000, Pipe Storage Depots are required to reduce the haulage distance of 46km between the BPT and the selected Principal Construction Compound G16 at Kilananny. A greenfield site in the townland of Boveen was selected as it is directly connected to a national secondary road, N62. An alternative greenfield site in Curralanty was not selected as the connecting Haul Road is a regional road.

346. A Pipe Storage Depot is required in both directions from the potential site in Boveen as the haulage distances are approximately 14km and 32km respectively. Potential greenfield sites in the townland of Toora, Fortel and Derrinboy were selected as Pipe Storage Depots. These sites comply with the site identification criteria and provide similar haulage distances between each site.

347. The selected sites are summarised in Table 3.26.

Table 3.26: Proposed compounds and depots between BPT and TWC-8000

Site Location	PSD or CC	Chainage	Land Type
Toora (G11), County Offaly	Pipe Storage Depot	TWA - 6000	Greenfield
Boveen (G13), County Offaly	Pipe Storage Depot	TWA - 14500	Greenfield
Fortel (G14), County Offaly	Pipe Storage Depot	TWA - 23500	Greenfield
Derrinboy (G15), County Offaly	Pipe Storage Depot	TWB - 7500	Greenfield
Killananny (G16), County Offaly	Principal Construction Compound	TWB - 19000	Greenfield
Derryweelan (B7), County Offaly	Pipe Storage Depot	TWC - 7500	Commercial forestry

348. Between TWC-8000 and the TPR, a Pipe Storage Depot is required to reduce the haulage distance of approximately 34km between the TWC-8000 and the Principal Construction Compound in Drummond. The site in Rathlumber was selected as it complies with the site identification criteria and is located halfway along the haulage distance.

349. There is a haulage distance of approximately 14km from the potential site in Rathlumber to the start of the contract. There are no other potential sites between Rathlumber and the start of the contract that

comply with the site identification criteria and therefore no additional Pipe Storage Depot has been selected.

350. Pipe Storage Depots are required to reduce the haulage distance of approximately 34km from the potential site in Drummond (Principal Construction Compound on a greenfield site) and the TPR. The site at Graiguepottle was selected as it is the closest available site to Drummond. The haulage distance from Graiguepottle to Drummond is approximately 18km. While this is slightly above the initial screening criteria of 16km it is deemed acceptable. The site at Barberstown Lower was selected as it is approximately half way between Graiguepottle and the TPR.

351. The selected sites are summarised in Table 3.3.27.

Table 3.27: Proposed compounds and depots between TWC-8000 and the TPR

Site Location	PSD or CC	Chainage	Land Type
Rathlumber (G21), County Offaly	Pipe Storage Depot	TWC - 24500	Greenfield
Drummond (G23), County Offaly	Principal Construction Compound	TWD - 16500	Greenfield
Graiguepottle (G26), County Kildare	Pipe Storage Depot	TWD - 34000	Greenfield
Barberstown Lower (G28), County Kildare	Pipe Storage Depot	TWE - 8500	Greenfield

3.10.5.4 Summary of the Compounds and Depots Site Selection

352. A summary of selected sites for Principal Construction Compounds, Satellite Construction Compounds and Pipe Storage Depots is set out in Table 3.28.

Table 3.28: Overall Site Selection for Construction Compounds and Pipe Storage Depots

ID Reference	Site Location	Land Type	Chainage	Construction Compound or Pipe Storage Depot	Pipeline Section
CC0	RWI&PS	Infrastructure Site	RW - 0	Satellite Construction Compound	1
CC1	WTP	Infrastructure Site	TW - 0	Principal Construction Compound	1
PSD1	Carrigatogher (G2)	Greenfield	TW - 12500	Pipe Storage Depot	2
CC2	Lisgarriff (G6)	Greenfield	TW - 29500	Principal Construction Compound	2
CC3	BPT	Infrastructure Site	TWA - 0	Satellite Construction Compound	2
PSD2	Toora (G11)	Greenfield	TWA - 6000	Pipe Storage Depot	3
PSD3	Boveen (G13)	Greenfield	TWA - 14500	Pipe Storage Depot	3
PSD4	Fortel (G14)	Greenfield	TWA - 23500	Pipe Storage Depot	3
CC4	BPS	Greenfield	TWB - 1200	Satellite Construction Compound	3
PSD5	Derrinboy (G15)	Greenfield	TWB - 7500	Pipe Storage Depot	3
CC5	Killananny (G16)	Greenfield	TWB - 19000	Principal Construction Compound	3
PSD6	Derryweelan (B7)	Commercial forestry	TWC - 7500	Pipe Storage Depot	3
PSD8	Rathlumber (G21)	Greenfield	TWC - 24500	Pipe Storage Depot	4
CC6	Drummond (G23)	Greenfield	TWD - 16500	Principal Construction Compound	4
PSD9	Graiguepottle (G26)	Greenfield	TWD - 34000	Pipe Storage Depot	4
PSD10	Barberstown Lower (G28)	Greenfield	TWE - 8500	Pipe Storage Depot	4

ID Reference	Site Location	Land Type	Chainage	Construction Compound or Pipe Storage Depot	Pipeline Section
CC7	TPR	Infrastructure Site	TWE - 17500	Satellite Construction Compound	4

3.11 References

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