Tionscadal Soláthair Uisce
Water Supply Project

Environmental Impact Assessment Report (EIAR)

Volume 6 of 6: Appendices

(Appendix 5.3) Methods of Working in Peat

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Uisce Éireann Irish Water

Jacobs

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Contents

Acronyms and Abbreviations

Acronym	Meaning
BH	Borehole
BPS	Booster Pumping Station
BPT	Break Pressure Tank
COD	Chemical Oxygen Demand
DOC	Dissolved Organic Carbon
DP	Dynamic Probe
EIAR	Environmental Impact Assessment Report
EPA	Environmental Protection Agency
GDA WRZ	Greater Dublin Area Water Resource Zone
GI	Ground Investigation
GIS	Gas Insulated Switchgear
GSI	Geological Survey Ireland
GWDTE	Groundwater Dependent Terrestrial Ecosystems
HLPS	High Lift Pumping Station
IPC	Integrated Pollution Control
Mld	Megalitres per day
NPWS	National Parks & Wildlife Servies
PCAS	Peatland Climate Action Scheme
PP	Peat Probe (to measure peat depths)
RWI&PS	Raw Water Intake and Pumping Station
RWRMs	Raw Water Rising Mains
SWMP	Surface Water Management Plan
TPR	Termination Point Reservoir
WTP	Water Treatment Plant

1. Introduction

1.1 Background

1. This Appendix (A5.3) to Chapter 5 (Construction & Commissioning) of this Environmental Impact Assessment Report (EIAR) provides a high-level outline of the construction of the pipeline through areas of peat as part of the Water Supply Project Eastern and Midlands Region (the 'Proposed Project').

2. The Proposed Project is a water supply project involving the abstraction and pumping of raw water from the Lower River Shannon at Parteen Basin, treatment of the water nearby at Birdhill, County Tipperary, and pumping of the treated water to a high point near Cloughjordan, County Tipperary. From this high point near Cloughjordan, the treated water would flow generally by gravity 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. A summary of the Proposed Project infrastructure is included in Table 1.1.

3. The Proposed Project has been developed to deliver a long-term sustainable water supply source for the Eastern and Midlands Region, to meet the water demand from residential and commercial development until the year 2050. The project infrastructure would deliver water to meet the projected peak deficit of 300Mld of treated water in 2050.

Table 1.1: Summary of Proposed 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.
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.

Proposed Project Infrastructure	Outline Description of Proposed Project Infrastructure*
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.
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.

Proposed Project Infrastructure	Outline Description of Proposed Project Infrastructure*
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.
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.

Proposed Project Infrastructure	Outline Description of Proposed Project Infrastructure*
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.
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.

1.2 Objective of this Document

4. This report examines the information available on the sections of peat that may be encountered along the route of the Treated Water Pipeline[1].

5. The objective is to set out the construction methods available for working in peat areas, and other soft ground such as alluvium in order to:
    - Determine that uncertainties such as peat depth and ground instability could be managed during the Construction Phase
    - Confirm that sufficient working width has been provided within the Planning Application Boundary
    - Allow an assessment to be made within the EIAR of the alternative construction techniques.

6. This Appendix is support by the following documents:
    - Annex A5.3: Assessment of peat depth

7. The locations of the methods of working in peat, based on peat depth are shown in in Figures 5.35 to 5.85.

1.3 Terminology

8. The following terminology is being adopted in this report
    - Reinstatement refers to the reinstatement of the Construction Working Width, by Uisce Éireann, following the completion of the relevant section of construction, to the conditions which existed on site prior to the construction of the Proposed Project
    - Rehabilitation refers to the measures being implemented by Bord Na Móna in accordance with the approved Rehabilitation Plans under an Integrated Pollution Control (IPC) Licence or an enhanced Rehabilitation Plan under a Peatlands Climate Action Schemes.

1.4 Calculations

9. All data has been presented to one decimal place. As a result some totals are affected by rounding.

[1] There would be no peat along the 2km length of the RWRMs.

2. Bord na Móna Bog Rehabilitation Scheme

10. Bord na Móna has undertaken a programme of peatland rehabilitation across many of its bogs previously harvested for peat extraction. Peatland rehabilitation enables environmental stabilisation of these bogs and will result in increased carbon storage and in time, increased carbon sequestration. Additional benefits include improved biodiversity, water quality and water storage attenuation. BnM are currently delivering an enhanced rehabilitation programme, over and above that required under their IPC licence, which will help deliver climate action and biodiversity objectives.

2.1 Peatland Rehabilitation

11. Rehabilitation involves slowing the movement of water across the bog and inhibiting the movement of mobile silt. Enhanced rehabilitation comprises the establishment of stable water levels of approximately 100mm (±50mm) across the bog and this process of rewetting the bogs promotes the development of wetlands, fens, bog habitats and the growth of peatland vegetation. To achieve these conditions the following activities are undertaken:

- Blocking and bunding of certain drains
- Reprofiling of surface levels.

2.2 Bord na Móna Lands

12. The proposed pipeline is routed through eight bogs within Bord na Móna lands:

- Ballydermot Bog
- Clonad Bog
- Cloncreen Bog
- Esker Bog
- Gilltown Bog
- Mount Lucas Bog
- Timahoe North Bog
- Timahoe South Bog.

13. For three of the bogs Ballydermot, Timahoe North and Gilltown, Bord na Móna are currently preparing Rehabilitation Plans.

14. For all of the remaining sites Bord na Móna have published Enhanced Rehabilitation Plans for each of these bogs in 2021[2] and 2022[3].

15. In each of the plans (both Rehabilitation Plans and Enhanced Rehabilitation Plans), Bord na Móna has accounted for the Proposed Project and has not included any rehabilitation works within the footprint of the Proposed Project, stating that:

> '*Bord na Móna do not propose to carry out any rehabilitation works within the footprint of the proposed Water Supply Project – Eastern and Midlands Region until a decision has been made by the relevant authorities in relation to the statutory consent applications for the project.'*

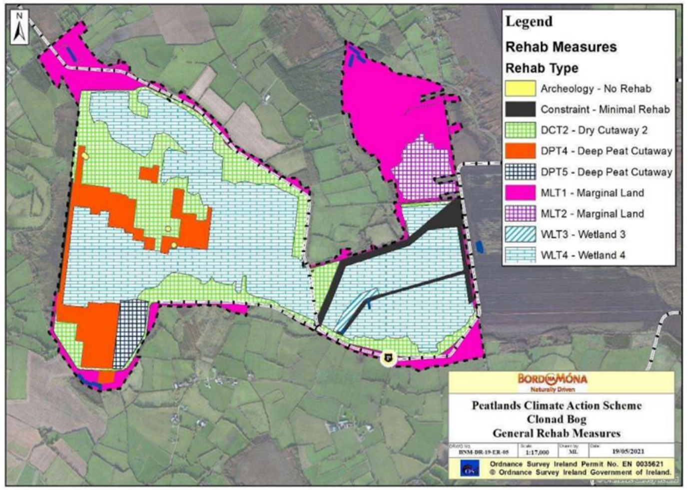
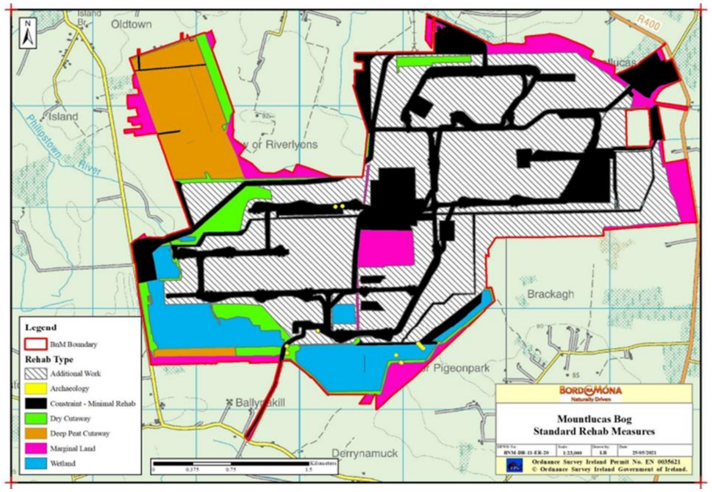
[2] https://www.bnmpcas.ie/bogs-peatlands-climate-action-scheme/
[3] https://www.bnmpcas.ie/2022bogsrehabilitation/

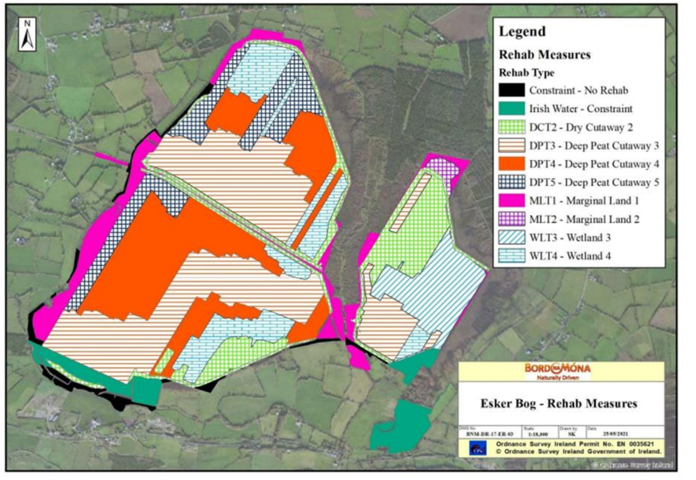
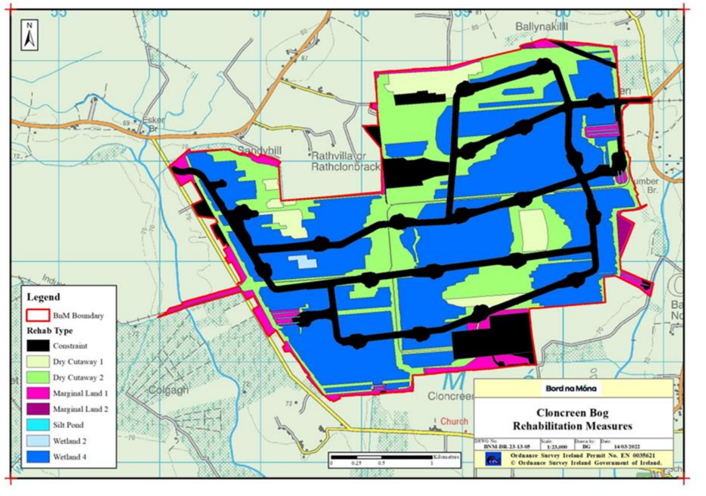
16. For Ballydermot, Timahoe North and Gilltown the Bord na Móna on site proposals will take account of the Proposed Project.

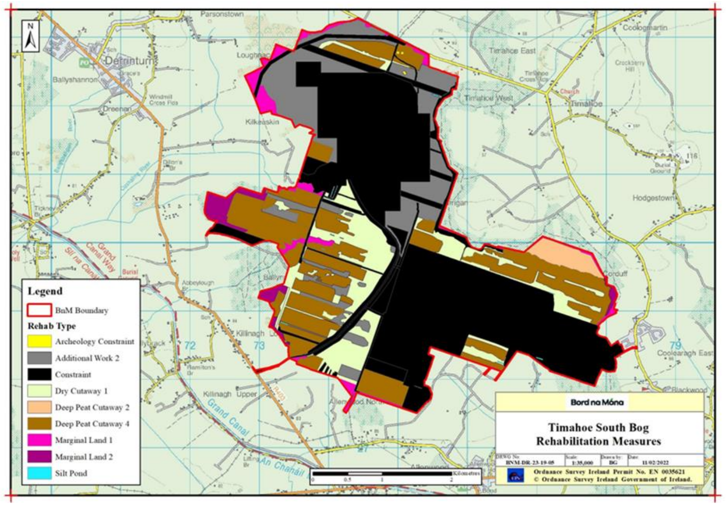
17. At Mount Lucas the proposed route of the Treated Water Pipeline has been refined since the Rehabilitation Plan was developed. This has been done in order to reduce the potential effects on raised cutover bogs north of the bog. This has arisen from the recommendations of the EIAR process. Bord na Móna's approval has been obtained to traverse Mount Lucas as set out in the Strategic Infrastructure Development Planning Application. The Environmental Protection Agency (EPA) are responsible for the IPC licence and rehabilitation plan for this site. The National Parks & Wildlife Service (NPWS) are responsible for the Enhanced Rehabilitation Plan for this site. Uisce Éireann will support Bord na Móna to rehabilitate the original proposed route including the implementation of additional water management measures and / or habitat creation. This would be subject to a separate consenting process and would be as agreed with Bord na Móna.

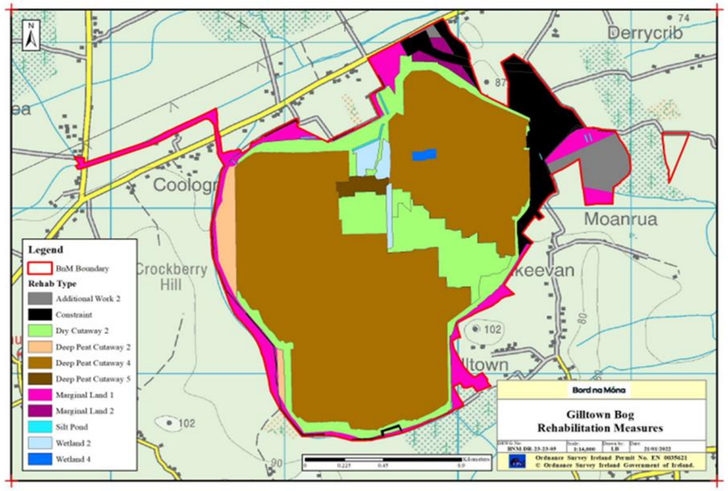
18. A summary of the rehabilitation for each Bord na Móna bog is provided in Table 2.1.

Table 2.1: Summary of Bord na Móna Rehabilitation Plans

<table>
<tr><th>Bog</th><th>Rehabilitation Plan Status</th><th>Enhanced Rehabilitation Plan in Place?</th><th>Works started on site?</th><th>Works completed on site?</th><th>Plan</th></tr>
<tr><td>Clonad Bog</td><td>Finalised</td><td>Yes</td><td>Yes</td><td>Yes – All complete</td><td>
</td></tr>
<tr><td>Mount Lucas Bog</td><td>Finalised</td><td>Yes</td><td>Yes</td><td>Yes – All complete</td><td>
</td></tr>
</table>

Bog	Rehabilitation Plan Status	Enhanced Rehabilitation Plan in Place?	Works started on site?	Works completed on site?	Plan
Esker Bog	Finalised	Yes	Yes	Yes – All complete	
Cloncreen Bog	Finalised	Yes	Yes	Yes – All complete	
Ballydermot Bog	Draft	No	Yes	No	Rehabilitation plan will be finalised alongside windfarm proposals

Bog	Rehabilitation Plan Status	Enhanced Rehabilitation Plan in Place?	Works started on site?	Works completed on site?	Plan
Timahoe North Bog	On-going	Yes	No	No	The Rehabilitation Plan was updated in 2025 and work is on-going on the Enhanced Rehabilitation Plan
Timahoe South Bog	Finalised	Yes	Yes	Completed	

Bog	Rehabilitation Plan Status	Enhanced Rehabilitation Plan in Place?	Works started on site?	Works completed on site?	Plan
Gilltown Bog	Draft	No	No	No	

3. Baseline Data

3.1 Data Available

19. To inform the development of construction techniques in peat areas, peat depth information from several sources have been considered including Teagasc Subsoil Classification Map, 2017 ground investigation and 2022 ground investigation. In addition, Bord Na Móna provided some peat probe information for sections of the pipeline within its ownership.

3.1.1 Teagasc Subsoil Classification Map

20. The Teagasc Subsoils Map produced by Teagasc, the EPA and Geological Survey Ireland (GSI) classifies the subsoils of Ireland. This map has been obtained in digital form and is included in Figures 5.35 – 5.85 to identify the location of land with peaty subsoils. The Teagasc baseline data is summarised in Table 3.1 and this indicates that approximately 29% of the pipeline route would be within peaty soil. This has then been validated using additional ground investigation and the overall length in peat is summarised in Table 5.1.

Table 3.1: Pipeline Routed Through Peat Subsoils based on Teagasc data

Proposed Project Pipeline	Length (km)	Proportion (%)
Pipeline length (km) (the Raw Water Rising Mains and Treated Water pipeline)	172.0	-
Pipeline length identified as potentially within peat soils using Teagasc dataset (km)	49.0 (Note: This is not the final length in peat see Table 5.1 for the combined GI and Teagasc data)	29%

3.1.2 Ground Surveys - 2017

21. Ground surveys were carried out during May to December 2017 along the entire pipeline route to provide geotechnical information of the underlying ground conditions, and to enable characterisation of the soil. Table 3.2 summarises the survey locations in peat areas.

Table 3.2: Geotechnical Investigations (GI) Undertaken Along Pipeline

2017 GI Data	Result (Number)	Proportion (%)
Number of boreholes (BH)	135	-
Number of BH in peat areas	14	10%
Number of BH recording peat	13	10%
Number of BH in peat areas according to Teagasc data, but no peat recorded	5	36% (of BH in peat areas)
Number of dynamic probes (DP)	39	-
Number of DP in peat areas	28	72%

22. Information from the fieldwork investigative techniques is considered in this document:

- Cable Percussive Boreholes (BH) were bored to refusal and disturbed bulk and jar samples were taken at each change in strata. This has enabled the identification of peat subsoils in 55 locations along the proposed pipeline route
- Dynamic Probes (DP) data were used to ascertain the penetration resistance of the ground in peat areas, i.e. the depth at which the probe refuses to penetrate the ground (refusal). The dynamic probe measurements do not distinguish types of material and consequently are a measurement of depth to firm ground. The soft ground identified by the probes is therefore, assumed to all be peat for the purpose of this assessment.

3.1.3 Bord na Móna Peat Depth Data

23. Bord na Móna provided Uisce Éireann with peat depth data which had been collected in 2020. This peat depth information is limited to areas that are managed by Bord na Móna and covers many of the sections where the Treated Water Pipeline is routed through lands under Bord na Móna ownership in counties Offaly and Kildare. The total length of pipeline, for which depth of peat data from Bord na Móna is available, is 3.9km as set out in Table 3.3.

24. This depth of peat has been provided at 1m intervals. The variation in the depth for adjacent data points is relatively minor. To make the analysis of this data manageable – for each 25m long section of pipeline in peat – the maximum and average depth of peat has been taken.

25. The data includes peat depths only and does not include sub-strata such as marl.

Table 3.3: Pipeline in Bord na Móna Land

Pipeline Length versus Data Source	Result	Proportion (%)
Pipeline length (km)	172.0	-
Pipeline length in peat (km)	52.9 (see Table 5.1)	31% (of total pipeline length)
Pipeline length in peat, owned by Bord na Móna (km)	18.6	36% (of pipeline in peat)
Pipeline length in peat, for which peat depth provided by Bord na Móna (km)	3.9	21% (of pipeline in peat owned by Bord na Móna)

3.1.4 Ground Surveys - 2022

26. A further ground investigation survey was commissioned by Uisce Éireann commencing in February 2022.

27. This covered the whole of the Proposed Project and consisted of 246 boreholes, and 1,489 peat probes.

28. The 2022 Ground Investigation data is set out in Table 3.4.

Table 3.4: Geotechnical Investigations (GI) Undertaken Along Pipeline

2022 GI Data	Result (Number)	Proportion (%)
Number of boreholes (BH)	505	-
Number of BH in peat areas	175	35%
Number of BH recording peat	112	22%
Number of BH in peat areas according to Teagasc data, but no peat recorded	36	21% (of BH in peat areas)
Number of dynamic probes (DP)	49	-
Number of DP in peat areas	12	24%
Number of Peat Probes (PP)	1,489	-
Number of PP recording peat	1,436	96%

4. Analysis of Peat Depth Information

29. Analysis of the peat depth information was undertaken as described below in steps a) to h). The results of this analysis are recorded in Annex A5.3, (Assessment of peat depth) which contains the peat depth information, which have assigned confidence grades based on the source of the information/data provided, and recommended construction techniques.

a) The total length of pipeline through peat, as indicated from the Ground Investigation informed by Teagasc Subsoil Map layers and Ground Investigation Data, was determined using Geographic Information System as 52.9km.

b) Discrete sections where the pipeline would be routed through peat subsoils were established. Where these sections are located through Bord na Móna lands (18.6km), the name of the bog was assigned where a name for the bog exists.

c) The depth of peat has been subdivided into discrete sections for the purposes of the construction methodology set out in Section 6, as follows:

i. The length of pipeline where the peat depth is less than 0.5m

ii. The length of pipeline where the peat depth is greater than 0.5m but less than 1m

iii. The length of pipeline where the peat depth is greater than 1m but less than 2.5m

iv. The length of pipeline where the peat depth is greater than 2.5m but less than 4.5m

v. The length of pipeline where the peat depth is greater 4.5m.

d) The total length of the pipeline through peat subsoils (52.9km) was consolidated, for ease of data handling given the volume of information, into 25m increments, as follows:

i. Each data point was first rounded to the nearest 25m chainage

ii. In many instances, several data points from the same data source were within the same 25m section of the pipeline. The data point with the closest horizontal distance to the pipeline was selected. The principles described are summarised in Image 4.1.

e) Up to three different data sources were available for many of the 25m chainage increments. The process for inferring the peat depth within a section of peat subsoil is summarised in Image 4.2. The 2022 GI data was the preferred data set as it was the most widespread and recent, unless 2017 GI data had a smaller horizontal distance from the pipeline. Following this, the 2017 data was used in preference to the Bord na Móna data, as the latter does not account for the depth of marl layers.

f) Steps d) and e) provided a framework for analysing the data.

g) As the geotechnical survey did not cover every 25m length of the proposed pipeline the peat depth at certain chainages had to be estimated. Therefore, where there was no exact Ground Investigation undertaken geotechnical judgement was used to establish the 'Inferred Depth (m)' of the peat from the nearest appropriate ground investigation. The Inferred Depth could be up to 150m from the nearest ground investigation location.

h) Where there was no Ground Investigation within 150m the Teagasc data was relied on as the basis that the ground contains peat soils. The Teagasc data does not include the depth of peat and therefore, a general assumption has been applied that the peat in these areas would be greater than 0.5m and less than 1m.

Image 4.1: Data Point Selection Process

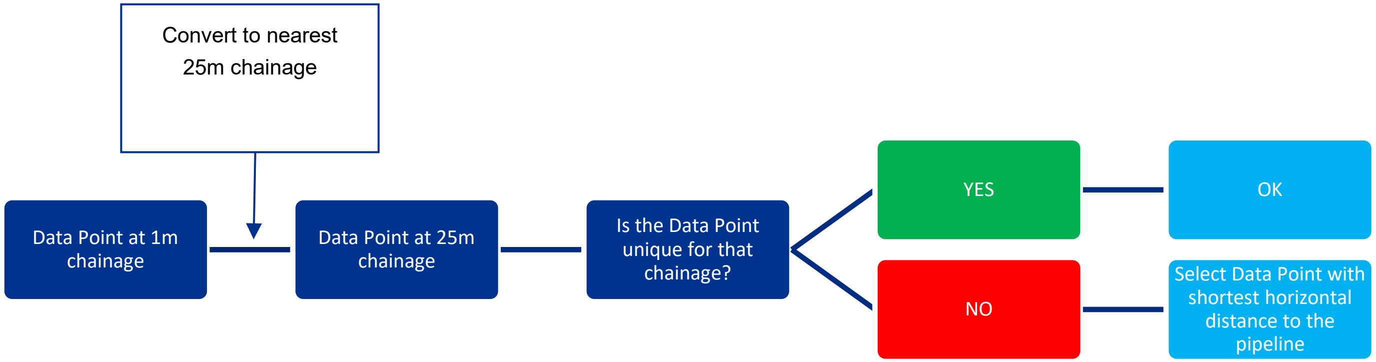
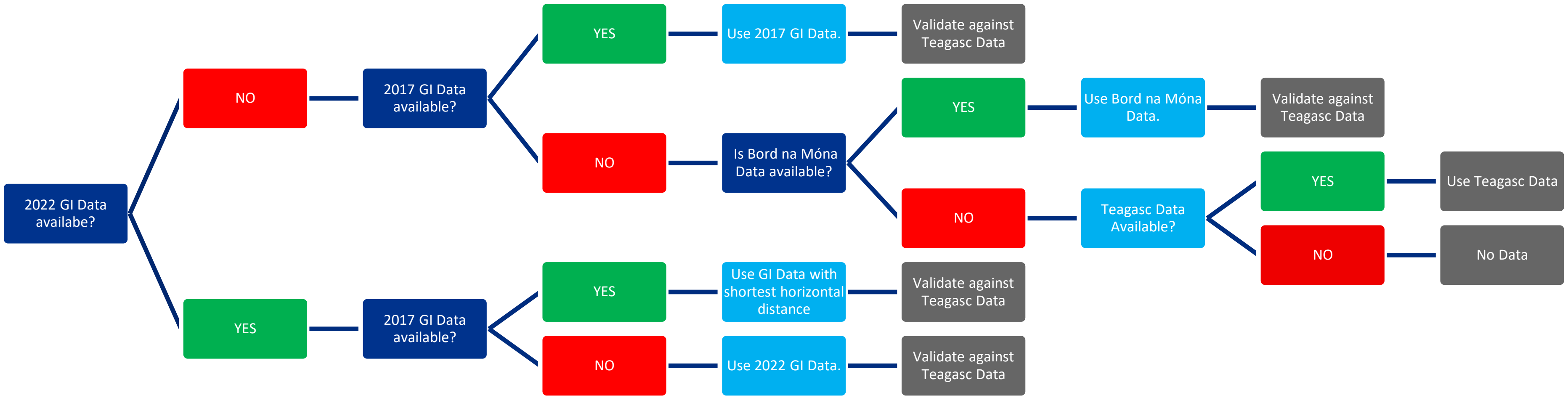


Image 4.2: Inference of Peat Depth Information



5. Summary of the Length of Peat

5.1 Length of pipeline in peat

30. The data set out in Section 3.1 has been used to determine the length of the proposed pipeline that would be within peat soils, based on the analysis process set out in Section 4. The most reliance has been placed on the 2022 data and the peat probes.

31. Based on this combined data the length of the pipeline in peats is as set out in Table 5.1.

32. Table 5.1 focuses on the length of pipeline in peat. There are sections of the pipeline where peat is over or underlain by alluvium. Therefore, the lengths included in Table 5.1 include areas where there would be overlapping soft ground, this is summarised in Table 5.3. Table 5.4 identifies sections of additional soft ground that would also need to be constructed using Methods 1-4, as described in Section 6.6 to be used, in addition to the lengths set out in Table 5.1.

Table 5.1: Summary of the Length of the Pipeline in Peat Soils

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

*Sub-total affected by rounding

** In addition to the lengths of peat set out in this table there would be a further 2.2km of alluvium / soft ground where Methods 1 – 4 would be used for the construction of the pipeline. These are set out in Table 5.4.

[4] This length of pipeline includes alluvium sections that either overlay or underlay peat but exclude sections containing just alluvium and not peat.

5.2 Uncertainties - Gaps in data

33. The boreholes were at 500m intervals and there are peat probes along the route. However, interpolation as described in Section 4 has been used to determine the indicative depth of peat across each of the 48 bog areas identified in the Teagasc baseline data covering 49.0km. In particular:

- Where there was no exact Ground Investigation undertaken geotechnical judgement was used to establish the 'Inferred Depth (m)' of the peat from the nearest appropriate ground investigation. The Inferred Depth could be up to 150m from the nearest ground investigation location.
- Where there was no Ground Investigation within 150m the Teagasc data was relied on as the basis that the ground contains peat soils. The Teagasc data does not include the depth of peat and therefore, a general assumption has been applied that the peat in these areas would be greater than 0.5m and less than 1m.

34. Table 5.2 sets out a summary of the basis of the peat depth.

Table 5.2: Basis of the Depths of Peat along the Length of the Pipeline

Data Source	Description of peat depth information	Result (km of pipeline in peat)[5]	Proportion (%)
Ground Investigation (either 2022 / 2017) supported by Teagasc Data	Depth measured within the relevant 25m length of pipeline	28.2	53.3
Inferred from Ground Investigation supported by Teagasc Data	Depth inferred up to 150m from the nearest Ground Investigation within the Teagasc baseline Data	17.9	33.8
Inferred from Ground Investigation not supported by Teagasc Data	Depth inferred up to 150m from the nearest Ground Investigation outside of the Teagasc baseline Data	5.7	10.8
Teagasc Data only	No peat depth available as depth assumed to be between 0.5 – 1.0m	1.1	2.2

5.3 Other Soft Ground

35. As part of the review of peat it has been determined, using the Ground Investigation set out in Section 3 that there are other areas of soft ground / alluvium which could require the use of construction methods similar to those described in Section 6 for peat. A summary of this is provided in Table 5.3.

36. As explained in Section 5.1 there will be overlapping sections of peat and other soft ground / alluvium captured in Table 5.1. As summarised in Table 5.3 and is 3.3km.

37. There is a further 2.2km of soft ground / alluvium which does not overlap with lengths of peat but which would potentially require Methods 1-4 to be used for the purpose of construction. Therefore, there would be an additional length of Methods 1-4, over and above that reported in Table 5.1. This is summarised in Tables 5.3 and 5.4.

[5] The total pipeline length through peat areas is 49.1km. During analysis of peat depth information, pipeline increments of 25m are considered. Rounding up of analysis results leads to slight differences in total pipeline length through peat.

Table 5.3: Summary of the Length of the Pipeline in Soft Ground / Alluvium

Description	Alluvium Overlapping with Peat (included in Table 5.1)		Alluvium not Overlapping with Peat (in addition to the lengths in Table 5.1)	
	Length (km)	Proportion of whole pipeline (172km) (%)	Length (km)	Proportion of whole pipeline (172km) (%)
The length of pipeline where soft ground / alluvium is less than 0.5m	0.0	0.0	0.0	0.0
The length of pipeline where soft ground / alluvium is greater than 0.5m but less than 1m	0.1	0.1	0.0	0.0
The length of pipeline where the where soft ground / alluvium is greater than 1m but less than 2.5m	2.5	1.5	1.8	1.0
The length of pipeline where the depth of where soft ground / alluvium is greater than 2.5m but less than 4.5m	0.5	0.3	0.3	0.2
The length of pipeline where the depth of the where soft ground / alluvium is greater than 4.5m.	0.2	0.1	0.1	0.1
Total	3.3	2.0	2.2	1.3

5.4 Total lengths of Constructions Methods in Peat and Other Soft Ground

38. Table 5.4 provides the total length of the different construction techniques based on the lengths in peat soils and the length in other soft ground. This is effectively a combination of the lengths provided in Tables 5.1 and 5.3.

Table 5.4: Summary of the Combined Length of the Proposed Pipeline in Peat and Soft Ground / Alluvium

Description	Length in peat (km) (including areas of alluvium where overlapping)	Length in soft ground / alluvium in addition to length of peat(km)	Total (km)
Pipeline length identified as potentially within peat soils using Teagasc dataset (km)	49.0	0.0	0
Length in pipeline route within Teagasc dataset not considered to be peat based on the results of Ground Investigation	1.8	0.0	0.0
Overall length of pipeline route within Teagasc dataset that is verified as peat by the Ground Investigation	47.2	0.1	47.3
Length of route not identified as potentially peat by Teagasc dataset but is identified as such based on Ground Investigation	5.7	2.1	7.8
The length of pipeline where the peat / soft ground depth is less than 0.5m	16.3*	0.0	16.3
The length of pipeline where the peat / soft ground depth is greater than 0.5m but less than 1m	14.0*	0.0	14.0
The length of pipeline where the peat / soft ground depth is greater than 1m but less than 2.5m	15.7	1.8	17.5
The length of pipeline where the peat / soft ground depth is greater than 2.5m but less than 4.5m	5.7	0.3	6.0
The length of pipeline where the peat depth is greater 4.5m.	1.1	0.1	1.2
Total	52.9*	2.2*	55.0*

*Sub-total affected by rounding

6. Construction Methods

39. This section of the report sets out the alternative methods of construction that may be adopted by the Contractor. This was informed by a site visit in 2021, as described in Section 6.1 and on-going engagement with Bord na Móna through 2023-2025 including a 'bog by bog review' of the proposed construction approach in each Bord na Móna bog at the beginning of 2024. This section of the report has been structured around the broad phases of construction within in peat:

- Pipeline design
- Site set-up
- Construction of the Pipeline
- Site reinstatement (to the conditions on site pre-construction of the Proposed Project).

6.1 Site Visit to Bord na Móna - 2021

40. On 30 November 2021, Bord na Móna facilitated a site visit attended by Bord na Móna, JacobsTobin and Uisce Éireann personnel to two bogs in County Offaly – Esker Bog and Mount Lucas.

41. During this site visit, Bord na Móna personnel provided information and advice based on their extensive experience of working the bogs, including:

- Harvesting of peat and excavation for land drains
- Bog rehabilitation, including blocking drains
- Construction of the Mount Lucas Windfarm.

42. Key findings from this site visit are described in Section 6.1.1 to Section 6.1.3 inclusive.

6.1.1 Surface Water Management

43. Surface water management on site during construction would be an important consideration and pre-drainage works would likely be necessary. Bord na Móna personnel advised that excavations in peaty soil can rapidly flood following excavations. This would be managed through over-pumping and the mitigation measures set out the Surface Water Management Plan in Appendix 5.1 (CEMP) where a variety of mitigation measures are proposed to reduce effects on waterbodies during construction of the pipeline in peat areas including (but not limited to):

- Monitoring of water quality
- Daily visual inspections of waterbodies
- Halting of work during heavy rainfall / storm events
- Silt management using settlement ponds and silt fences
- Appropriate handling of excavated material
- Appropriate peat storage
- Managing surface water through peat areas.

6.1.2 Other Subsoil Features

44. In nearly all instances there is a soft marl layer beneath the peat subsoil in the Bord na Móna lands. Marl is a sedimentary material consisting of carbonates, clay, and silt. Marl layers of up to 1m can be experienced beneath the bogs in the Irish midlands. Marl generally has poor cohesion and permeability and is hazardous for construction and for pipe laying. It was recommended by Bord na Móna personnel that any excavation in the bogs extend beneath the depth of the marl layer. This would be done within the vertical design flexibility as defined in Chapter 4 (Proposed Project Description). Where the Marl layer would be removed then impermeable material such as clay, would be used to re-instate a layer of similar geological properties.

6.1.3 Construction Vehicles

45. Bord na Móna typically use specially adapted low-bearing pressure excavators for work in the bogs. Standard construction vehicles have narrower tyre widths and are not generally suited to bog ground conditions. Machines on Esker Bog were limited to 13 tonnes, while at other bogs limits of 6 tonnes are in place. Examples of this are shown in Image 6.1.

Image 6.1: Bord na Móna Vehicles at Esker Bog

6.2 General Construction Method

46. Some of the general working arrangements such as only undertaking earthworks in suitable weather conditions and keeping the pipeline excavation open for the shortest period practicable would be important for the sections of the pipeline in peat soils.

47. Similarly, consistent with the general construction approach a surface water filter drain would be used to intercept land drainage and direct it away from the trench towards the settlement. Filter drains would be sited depending on the adjacent topography and may be located either side of the Construction Working Width. It would be temporary and removed on completion of the Proposed Project.

48. However, in addition there are a number of key differences compared with the installation for non-peat areas. These are:

- Use of a ‘floating road’ for access to avoid removing peat for the purpose of the Temporary Construction Road. The ‘floating road’ would be removed after construction

- Some areas of peat would not require topsoil stripping and so construction working areas that would usually be used for topsoil storage could be used for storage of layers of peat material, widened excavation and additional drainage, where required. Note that some areas of peatland do have topsoil, notably where grassland overlies peat in agricultural areas. Where this would be the case topsoil or other overlaying material that has to be excavated would be stored separately
- During the construction of the pipeline the excavated peat would be stored separately to any acrotelm layer or amorphous layer / vegetated fibrous layer, kept wetted (if appropriate) and the different layers, where they exist reinstated in the same order that it was extracted
- Additional temporary surface water measures / land required due to the saturated nature of the ground
- De-watering only for deep sections >2.5m depth of peat
- De-watered water would be treated through temporary treatment facilities such as a ‘silt buster’ prior to discharge through the existing on-site drainage
- Greater use of side-boom cranes or gantry cranes to lift the pipe into place rather than using standard excavators
- Side slope angles would be made shallower to allow for safe construction in less stable ground conditions
- Retaining measures, such as temporary piles or a trench box may be adopted if slacker side slopes were not sufficient
- The cover over the permanent concrete collars would be a minimum of 0.8m and 1.2m over the top of the pipe itself
- Piling may also be installed under the pipe for areas where Method 4 as described in Section 6.7, is adopted. As an alternative to piling there could be additional excavation for the stone piles to be placed under sections of the pipe in deeper peat; this is Method 3, as described in Section 6.7
- The pipeline is not anticipated to create new preferential flow paths; however, as a precautionary measure drain ‘plugs’ would be installed to prevent this.

6.3 Construction Method Assumptions

49. Assumptions have been used when proposing construction methods for the pipeline in sections of peat:

- De-watering only for deep sections >2.5m depth of peat
- No activities on peat bogs during inclement weather
- Floating roads would be used for all bogs where the peat depth is greater than circa 1m. Bog mats would be used in other circumstances
- Soil stripping would not generally be required in bogs
- Excavated peat would only be used for reinstatement or additional use within the same bog that it was excavated from
- Air Valves would be situated along the pipeline centreline and would share the same invert level as the pipeline. The construction method for these features would be same as the adjacent pipeline
- Washout Valves (including those situated at Line Valves) would be offset from the pipeline, though they would share the same invert level as the pipeline. The construction method for Washout Valves would be same as the adjacent pipeline. Additional design considerations for Washout Valves In areas of deep peat (>4.5m depth), are discussed in Section 6.9.

6.4 Pipeline design

6.4.1 Permanent Pipeline Structural Support and Floatation Management

50. Constructing the proposed pipeline within poor ground means there would be a risk that the pipe could ‘sink’ when it is full of water as it is denser than the surrounding peat which does not have the shear strength to prevent it from sinking (this is only true where the invert of the pipe is still within the peat layer and not able to rest on solid ground beneath the peat).

51. Conversely, when the pipe is empty, there is a substantial flotation force that may cause the pipe to rise to the surface.

52. A pipe that sinks or floats from its installed position would alter the designed gradient of the pipe and could cause unplanned high and low spots that prevent air removal during operation or drain down during maintenance. Both can be serious problems. The sinking or floating may also lead to unacceptable displacement of the washouts beyond the design capacity of the rocker pipe and cause pipe failures on the washout branches.

6.4.1.1 Structural Support

53. The four techniques, detailed in Section 6.6.4 all relate to different mechanisms by which the potential for ‘sinking’ is prevented by the construction method. In summary this relies on either:

- Use of ‘good ground’ with sufficient structural support (Method 1 and 2 in Sections 6.6.4.1 and 6.6.4.2)
- Use of stone pillars (Method 3 in Section 6.6.4.3)
- Use of concrete piles (Method 4 in Section 6.6.4.4).

6.4.1.2 Floatation Management

54. The flotation of the pipe would be resisted in the same way regardless of the construction techniques set out in Section 6.6.4.1 to 6.6.4.4. This would be by means of either saddle-bags filled with rocks, or concrete collars with a density and mass sufficient to counter-act the buoyancy, as illustrated in Image 6.2.

Image 6.2: Saddle-Bags and Concrete Collars to Oppose Buoyancy

55. For ease of placement, it is recommended that in most circumstances pre-cast concrete half collars are used that simply sit over the pipe. Although the density of concrete is around 2.4 tonnes per cubic metre, it also experiences a buoyance force of 1 tonne per m^3 when submerged below the water table giving a net down force of only 1.4 tonnes per cubic metre. Thus, a collar weight of 20 to 32 tonnes (dependant on ground conditions and pipe depths) is required for each 13.5m long pipe section. An indicative sketch of a pipe collar is illustrated in Image 6.3. Indicative dimensions if a collar is placed either side of each joint are provided in Table 6.1.

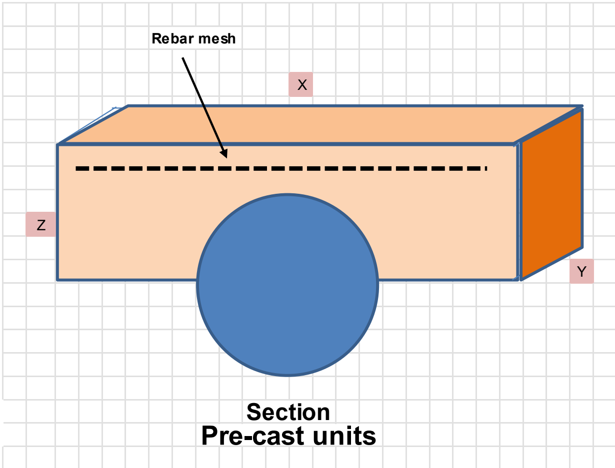


Image 6.3: Indicative Pipeline Collar

Table 6.1: Indicative Collar Dimensions and Weights

Number of Planks in Each Collar	Width X (m)	Length Y (m)	Height Z (m)	Weight unsubmerged (tonnes)
Single “plank”	4.8	1.4	1.2	16
Two “planks”	4.8	0.7	1.2	8
Three “planks”	4.8	0.35	1.2	4

56. The use of narrower planks would facilitate easier casting, transportation, handling and placement and could be ‘tied’ together after placement if necessary.

57. A minimum depth of cover of 1.2m has been chosen to ensure that there is still typically 0.8m of cover above the collar to ground level after reinstatement. This is because 0.8m of the 1.2m collar would be over the top half of the pipe only around 0.4m would be above the crown of the pipe and this would leave 0.8m of the minimum depth of cover of 1.2m.

6.5 Site set up

6.5.1 Suitable Working Conditions

58. There is a general construction commitment that earthworks including excavating the trench for the pipeline and topsoil stripping would only be undertaken in suitable weather conditions, which is generally taken to be outside of the winter period. This would apply to working in peat soils / alluvium and as far as possible works would be taken during driest periods over summer months when water levels would be a low as reasonably practicable.

6.5.2 Drainage: Temporary drainage arrangements

59. In sections of peat soils / alluvium that are either of the following, there is the potential for the ground to be saturated and therefore temporary drainage ditches would be constructed on the boundary of the Construction Working Width, to intercept some ground water. This would be diverted, and if appropriate, in order to maintain drainage flows across the peat bog, over-pumped.

   - subject to peat rehabilitation plans (where the design aim is to have water level within approximately 100mm of ground level); or
   - that are not subject to land drainage.

60. This would be supplemented with temporary de-watering of the excavation during the construction of the pipeline itself.

61. The approach to the management of surface water during the construction of the pipeline in peat areas is broadly similar to that described in Annex B of Appendix A5.1 (Construction Environmental Management Plan), the Surface Water Management Plan (SWMP) for silty water control. However, the potential water quality issues associated with the construction of the pipeline through peat areas are slightly different to those along the rest of the route, therefore additional measures are required to reduce environment effects on the water quality of receiving waters.

62. Water quality issues associated with peat include elevated levels of suspended solids, ammonia, phosphorus and dissolved organic carbon (DOC). In water bodies draining excavated peat areas, these elevations have been observed and been compared to lowered levels following the rewetting of peatlands (An Fóram Uisce, 2021).

63. Bord na Móna uses a series of silt ponds across its bogs to manage drainage flows and water quality to meet its Integrated Pollution Control licence requirements. The licence requirements stipulate flows and water quality as follows:

   - Maximum flow velocity: <10 cm/s
   - Silt pond design capacity: minimum 50m^3 per net ha of bog serviced
   - Emission limits for water:
     - Suspended Solids: 35mg/l
     - Trigger level values for water:
     - Total ammonia: 3mg/l
     - COD (chemical oxygen demand): 100mg/l.

64. To achieve these requirements, Bord na Móna's silt ponds are generally constructed to a depth of 1.5m below invert level and would be up to 8m wide (or wider where it is possible to clean/de-sludge from both sides). The length varies depending on the volume of water being controlled.

65. All de-watered water would be subject to treatment via a BioBuster or equivalent and settlement ponds would be used to manage suspended solids.

66. In areas where there is a significant volume of marl, which is a very fine clay-type soil, it may be more difficult to settle suspended solids within the silt ponds. Slower settling solids may require:

   - Additional silt ponds, in series; or
   - The addition of a coagulant, and possibly flocculant, to ensure successful settlement.

67. Coagulants and flocculants are usually metal or polymer based chemicals and these have been shown to be harmful to aquatic organisms. More recently however, non-toxic bio-coagulants and bio-flocculants have been developed. Therefore, if additional treatment is required to treat the marl, biological based treatment approaches only would be used, where practicable. Flocculant treatment would be used, where necessary to achieve the required management of suspended solids.

68. Weekly sampling of the effluent silt ponds would be undertaken to ensure compliance with any emission limits set. The water quality of any discharge from the Construction Working Width would be monitored and further monitoring would be undertaken on the perimeter of Bord na Móna land.

69. The approach outlined above does not differ for Methods 1 to 4 set out in Sections 6.6.4.1 – 6.6.4.4. The volumes of peat, marl and water involved with greater depths of peat being excavated, would dictate the level of treatment required.

6.5.3 Access: Use of temporary Floating Road

70. Each technique would require the construction of a suitable stable access road for heavy plant across the peat. For Methods 2, 3 and 4, as set out in Section 6.6.4.2 – 6.6.4.4 this would involve the construction of a Floating Road. This approach has been informed by experience of working in peat areas including input from Bord na Móna, and by the report about “Floating Roads on Peat” (Forestry Commission Scotland and Scottish Natural Heritage, 2010) which provides excellent guidance and construction principles.

71. A ‘floating road’ was an engineering solution developed in Scotland during the construction of several kilometres of roads in very poor, organic materials such as peat, and it is used where it is impracticable to remove the underlying soft material. Peat is a very compressible and decaying material which is the worst possible subgrade for a road and is too unstable to support the movement of plant and machinery. The ‘floating road’ is a raised stone platform, or embankment, where stability is provided by interlocking geogrids and provides a stable surface for the trafficking of construction plant and machinery.

72. The ‘floating road’ does not require any excavation of the poor ground material and is laid directly on top of it at ground level. This limits the impact on the underlying vegetation. It is standard practice to use at least two layers of geogrid: a lower one directly on the existing surface and an upper one to support the embankment created. Whilst the precise make-up of the floating road would depend on the ground conditions at a particular location, a typical representation is shown Image 6.4 and Image 6.5. This would involve a base geotextile membrane, overlain with stone. On top of this is another geotextile membrane and layer of stone.

73. The peat would be loaded slowly to avoid breaking the shear strength in the peat. Careful design is needed to assess how close the trench can be excavated next to such a floating road without causing it to become unstable and lose the compressive support to the road. Image 6.6 shows a Construction Road being constructed in poor ground (peat).

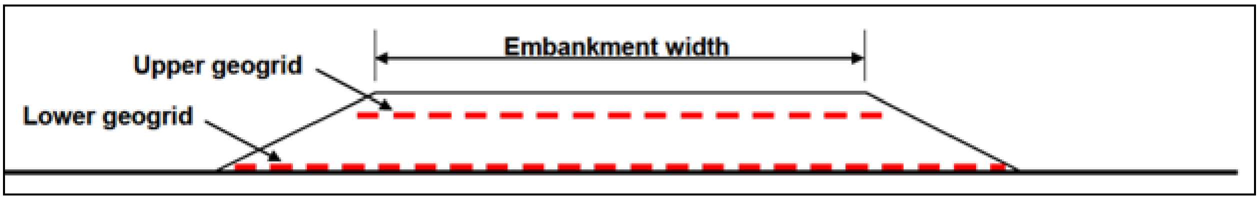


Image 6.4: Typical Stabilised ‘Floating Road’ Cross Section with Geogrids

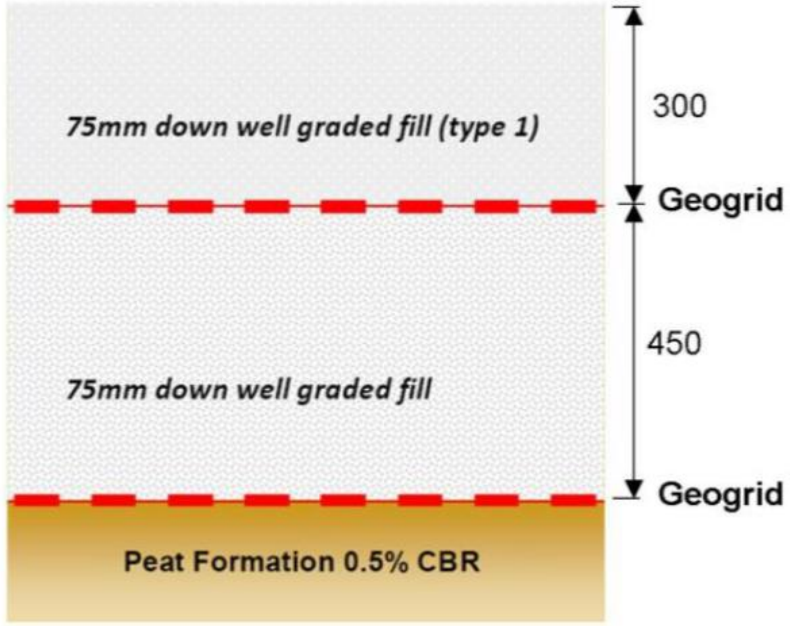


Image 6.5: 'Floating Road' – Potential Make-up[6]

Image 6.6: Typical Construction Road in Poor Ground

74. The 'floating road' is temporary and would be removed when a section of works is completed, and it is no longer required. It is estimated that at least 25km of the total pipeline length (allowing for lengths of both peat and alluvium as set out in Table 5.4) would be subject to a floating road' which requires significant depths of imported stone. It is proposed that on completion of sections of the works in a given area it would be lifted and removed to the next required location to limit the amount of imported stone required for the works. The stone would be moved via the Construction Working Width or along the Haul Roads.

[6] CBR is the California Bearing Ratio and is a measure of the *in situ* stiffness of the peat.

6.6 Construction of the pipeline

6.6.1 Peat Instability

75. Peat has low shear strength and fluid-like properties. Peat instability as a result of excavation of a pipe trench is a major health and safety risk.

76. A peat stability assessment has been undertaken to consider the combined effect of the excavation of the trench and the storage of material at ground level. This assessed the slope stability of the excavation with a 1 in 2 side slope. The assessment relied on engineering judgement and literature findings due to the limited geotechnical testing from the ground investigation. The assessment has been undertaken in accordance with BS8006 (BSI, 2010). Due to the anticipated properties of the peat and the short duration of the proposed works, it is expected that undrained conditions will prevail in the peat, therefore undrained analysis has been undertaken. The minimum necessary side slope Ls (offset of stockpile from crest of the excavation) was determined using the formula in Image 6.7.

$$L_s \geq \frac{(f_{fs}\gamma_{emb}H + f_q w_s - \frac{4c_u}{f_{ms}})z_c}{\frac{(1 + a'_{bc})c_u}{f_{ms}}}$$

Image 6.7: Peat Instability Calculation

77. The formula is based on the following:

- ffs is the partial factor for soil unit weight (see Image 6.8)
- fq is the partial load factor for external applied loads (see Image 6.8)
- γemb is the unit weight of the embankment fill
- H is the maximum height of the embankment
- ws is the surcharge intensity on top of the embankment
- cu is the undrained shear strength of the soft foundation layer
- fms is the partial material factor applied to cu (see Image 6.8)
- a'bc is the interaction coefficient relating the soil/reinforcement adherence to cu
- zc is the depth of the soft foundation layer when the foundation is of limited depth with constant undrained shear strength with depth.

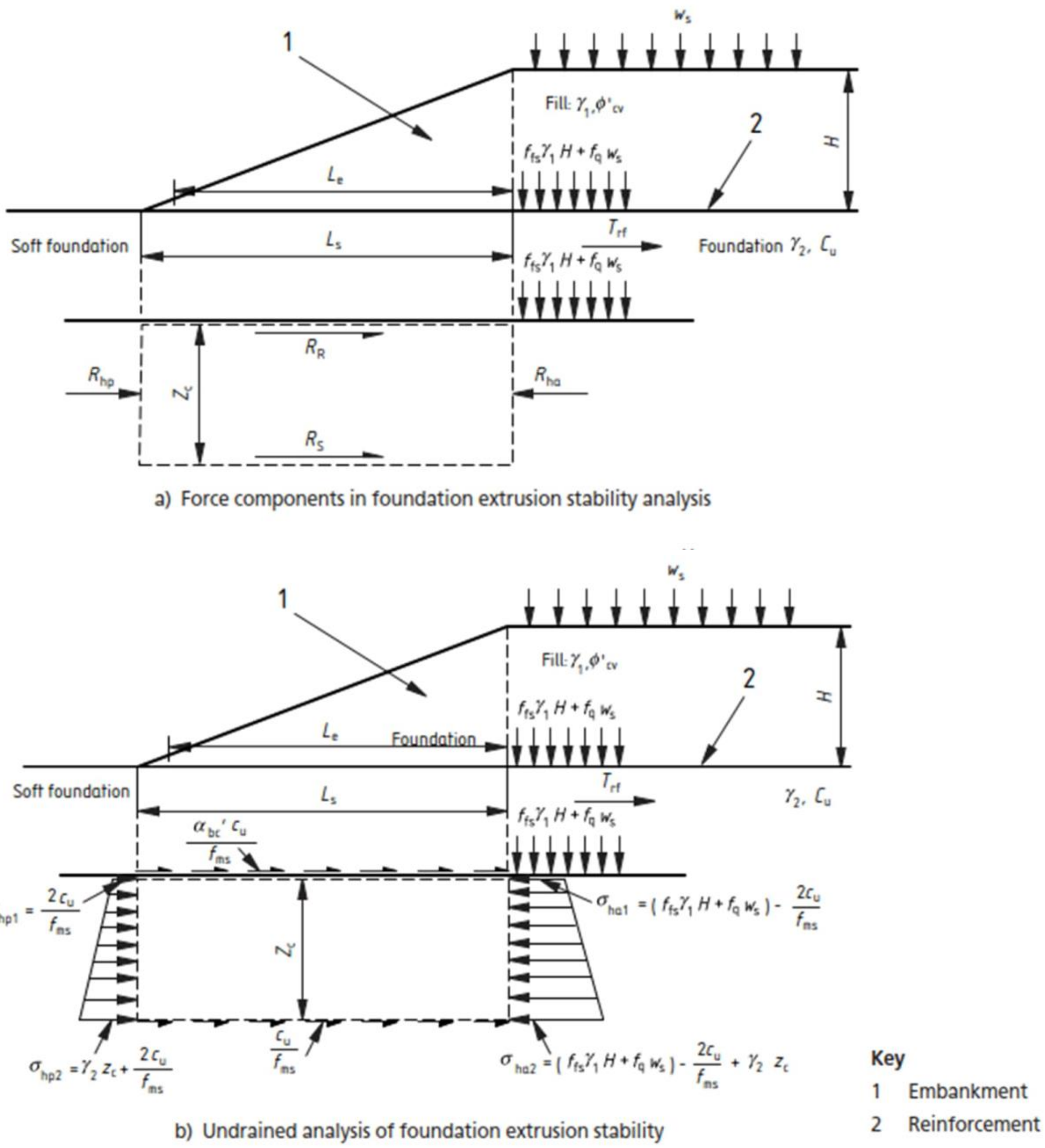


Image 6.8: Analysis of foundation extrusion stability

78. As per the British Standard S8006 (BSI, 2010) a sensitivity analysis using different values of zc should be performed to determine the minimum side slope length Ls needed to prevent foundation extrusion. This sensitivity analysis was undertaken with different side slope angles on the stockpiles being considered.

79. The assessment took account of the construction method that would reduce the level of ground saturation. The guidance states ‘wet’ means submerged or widespread seepage, whereas ‘dry’ means minor or no seepage. In both cases, pore water pressures could be present, therefore the peat could be in an undrained case for both ‘wet’ and ‘dry’ conditions. For the purpose of the assessment it was considered that the dewatering / drainage system developed by the contractor for the temporary works would be sufficient to provide a ‘dry’ trench, with minimal seepage from the batters and with drains to intercept groundwater recharge. Therefore, in those circumstances the “dry” case (CIRIA 2001) was appropriate.

80. Due to the anticipated properties of the peat and the short duration of the proposed works, it is expected that undrained conditions will prevail in the peat, therefore, the assessment was based on an undrained analysis.'

Stockpile Design Option	Factor Applied	Minimum offset required (m)	FoS	Verification
1m Height, 1m Width	Unfactored	1	1.32	**OK**
1m Height, 2m Width	Unfactored	2	1.37	**OK**
1m Height, 3m Width	Unfactored	3	1.42	**OK**
2m Height, 1m Width	Unfactored	+1	1.10	**NO**
2m Height, 2m Width	Unfactored	+2	1.10	**NO**
2m Height, 3m Width	Unfactored	+3	1.15	**NO**
Note: The '+' indicates a great offset would be required to achieve a FoS of 1.3.				

Table 6.2: Factor of Safety for 2:1 side slope stability taking account of stockpile loading

81. Using the parameters shown in Image 6.8, the assessment reported in Table 6.2 demonstrates that with a depth of excavation of 4.5m and a side slope angle of 1:2 on the trench excavation a stock pile of 1m and a 1-3m crest (with a side slope of 1:2 and an offset from the excavation of at least 1m) would not create a risk of side slope collapse. This analysis relied on the benching of the side slope of the trench excavation using 0.5m wide benches at approximately 1.5m height intervals as shown in Image 6.9. It also relies on the depth of the peat underneath the excavation being 0.5m.

82. However, in the event of the following, additional retainment measures (such as temporary sheet piling) or a slacker side slopes would be used on the trench:

- The trench needs to be deeper than 4.5m (Note: the current vertical alignment does not go below 4.5 deep in areas of peat based on the data available and as described in Section 5)
- The peat underneath the trench is deeper than 0.5m (i.e. total depth of peat is greater than 5m)
- Conditions are not consistent with 'dry' scenario
- Stockpiles of excavated peat material to be higher than 1m
- Side slope angles or offset distances different to those assessed.

83. Image 6.9 contains an indicative cross section and plan view of the construction activities to be considered while constructing the pipeline in areas of peat. Two long-reach excavators are utilised to excavate wide trenches that incorporate benching.

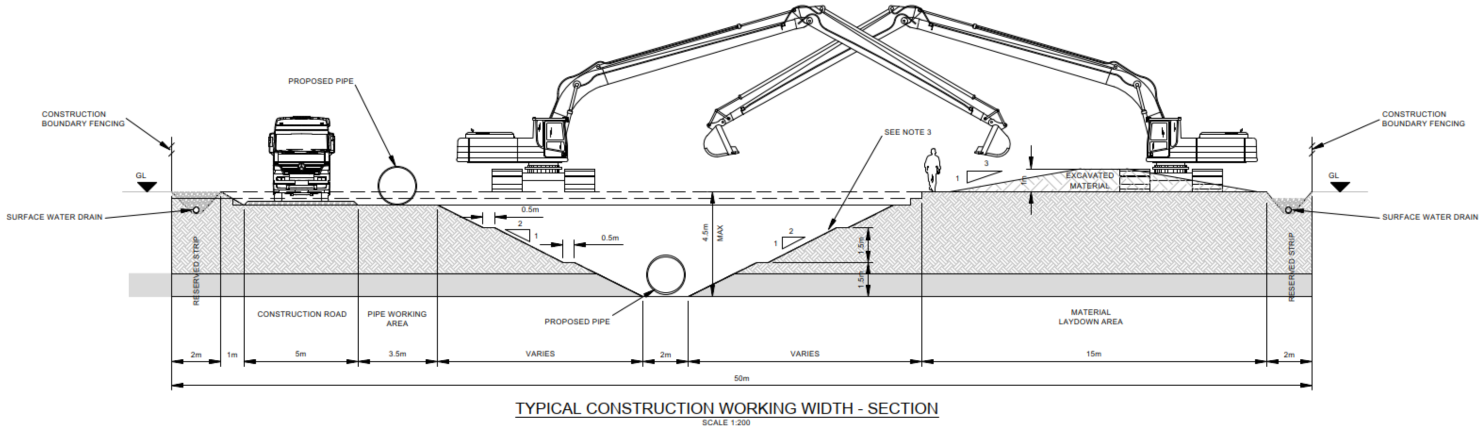


Image 6.9: Indicative Construction Working Width Cross Section in Peat Areas

6.6.2 Management of peat instability

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

- Work in dry weather conditions as far as reasonably practicable with earthworks planned for summer months and movement of machinery to be suspended during heavy rainfall / high water levels (other than as required to respond to a potential incident).
- Interceptor drains on the perimeter of the Construction Working Width and dewatering of the excavation for the pipeline, will be used as part of the temporary drainage plan in areas of peat and / or land with high ground water table to create 'dry' conditions as far as reasonably practicable, (definition of 'dry' as per (CIRIA 2001))
- Slacken side slopes on the batter of the trench excavation as informed by peat probes / further Ground Investigation undertaken as part of the preparation of the construction phase. This is to be as determined through a detailed slope stability assessment by a competent temporary works designer and is to be set out in construction Method Statement for each section of pipeline construction within peat soils
- Utilise land within the Construction Working Width upstream and downstream of the section of pipeline being constructed for activities which there is flexibility over their location such as the temporary stock piling of material and drainage ponds. This would be done to maximise the land available at the section of pipeline being built that could be utilised in slackening side slopes
- For sections of construction where there would be deep peat and/or dewatering proves not to be effective, or slacker side slopes cannot be adopted the contractor would adopt a trench box / temporary sheet piled coffer dam (this would be installed using a vibratory plate method / press piling[7]) in order to retain the side slopes
- Each section of excavation is to be left open for as short a period of time as reasonably practicable.

85. In addition the following would be adopted:

- Limiting stockpiling of materials in any specific areas
- No stockpiling in areas of degraded raised bog

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

- Excavated material to be removed to designated deposition areas
- Implementation of monitoring regime for peat movement
- Frequent monitoring and inspection during construction and operation of access roads and temporary peat storage areas
- If required, additional site investigations inclusive of in situ testing and laboratory testing in specific risk areas on the site
- Client's Geotechnical Engineer/Site Geotechnical Supervisor to approve the method statement
- Approved Contractor to provide toolbox talks and on-site supervision prior to and during the works
- Daily sign-off by supervising staff on completed works
- Implementation of emergency plan and unforeseen event plan by the approved Contractor.

86. It is expected that temporary sheet piling would be required to retain the earthworks for sections of very deep peat (deeper than 4.5m), at the bell pits and if there are prolonged periods of wet weather after excavation has commenced or if dewatering proves not to be effective. This is shown indicatively in Image 6.10.

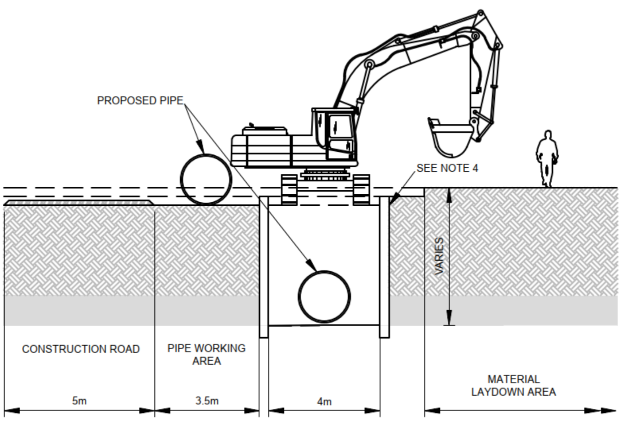


Image 6.10: Use of trench box / sheet piling

6.6.3 Use of Side-Boom

87. In areas of soft ground, such as peat, there would be the risk that during the excavating of a trench and the lifting in of a pipe string, by the nature of it being to one side of the road, would cause an uneven load distribution on the road. For this reason, using 'side-boom' cranes with suitable counter-balance weights may be preferable to standard excavators since the over-turning moments on such vehicles are much lower and the likelihood of causing the road to become unstable far less. Alternatively, safe handling and lifting in of a pipe string could be performed using gantry cranes. These gantry cranes could consist of multi-wheeled or tracked lifting gantries, to eliminate cranes over-turning and soil compaction. Indicative illustrations of such gantry cranes are shown in Image 6.11 and Image 6.12.

88. Weight restrictions on floating road may be required and would be identified during the detailed design stage, in consultation with a geotextile manufacturer.

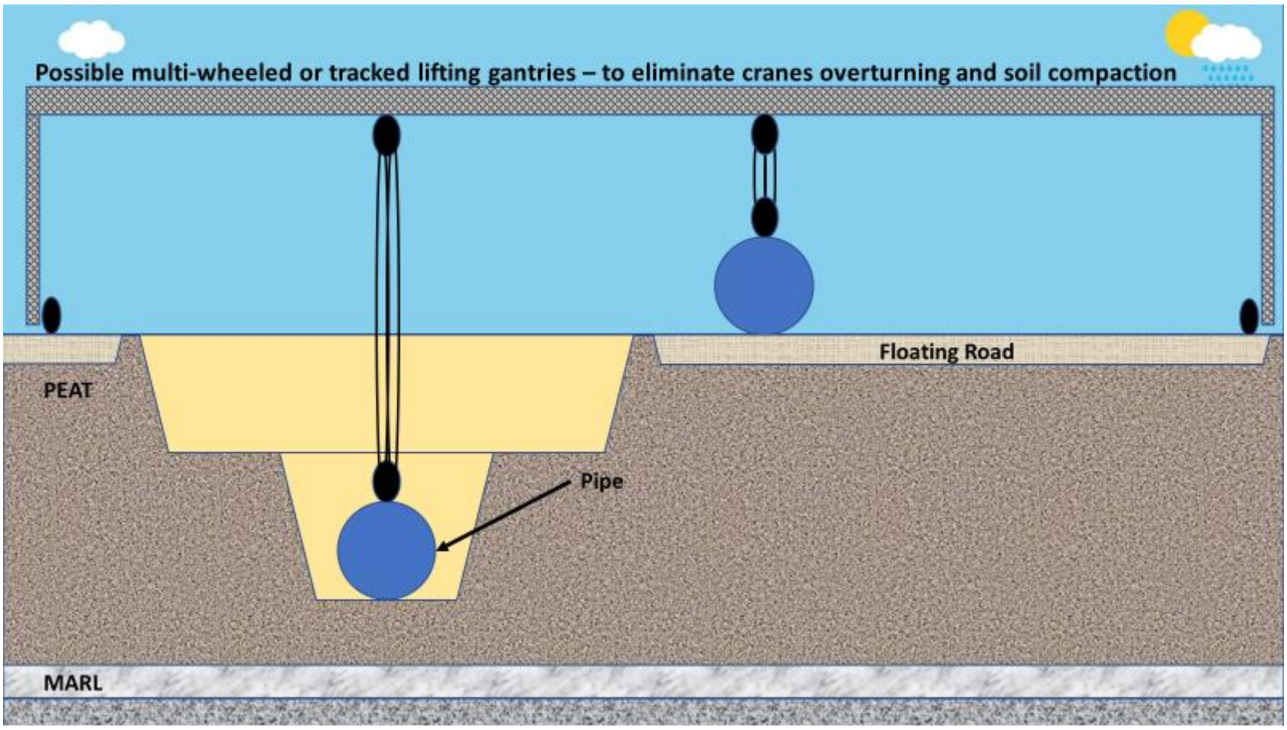


Image 6.11 Cross Section Illustration of Gantry Crane

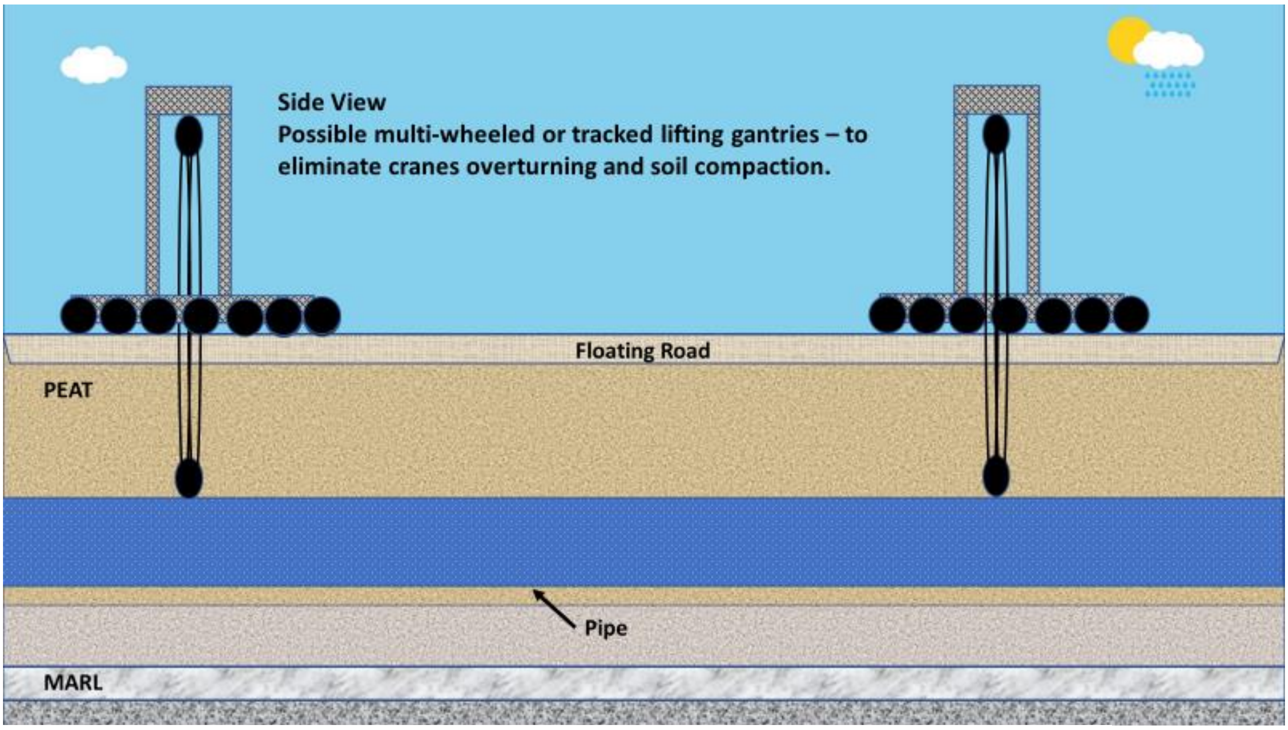


Image 6.12: Side View Illustration of Gantry Crane

6.6.4 Alternative construction methods

89. There are four methods of construction in the peat sections that have been identified. They are referred to as Method 1-4. This section summarises each. These are suggested construction methods that need to be amended by the appointed contractor, based on soil and weather conditions information and plant availability at the time of construction however, for the purposes of the EIAR these methods enable the identification of the likely environmental effects of working in peat.

90. Method 0 is a reference to the construction approach in areas of peat that would be less than 0.5m. This would not be a construction method specific to peat rather the construction approach for the pipeline within these sections would be the same general pipeline construction approach as described in Chapter 5 (Construction and Commissioning). The reference to Method 0 is necessary to explain the difference between the total length of the pipeline proposed to be constructed using Methods 1-4 compared with the total length of pipeline within areas of peat soils as set out in Table 6.3.

6.6.4.1 Method 1

91. This method is to be employed where the extent of the peat (and any underlying marl) is less than circa 1m below the starting ground level. The peat would be removed down to firm ground which would then form the base for both the construction road and the pipe trench. Two or three 13.5m long steel pipes are welded together at ground level beside the trench. An external coating covering the exposed metal at the joint would then be made with an epoxy paint and a heat shrink wrap. This results in a pipe ‘string’ of either 27m or 40.5m long.

92. Only when the pipe string is ready, would a trench be dug just long enough to receive it with the aim being to dig the minimum amount of peat for the shortest feasible time.

93. The substrata below the peat would be exposed with the peat being temporarily placed beside the excavation. The substrata would then be excavated and graded as necessary to achieve the correct rise or fall of the pipeline as per the long section gradient requirements.

94. Where possible the substrate material would be recycled by being crushed and/or passed through a riddle bucket to remove unwanted cobbles and used as bedding for the pipeline.

95. The pipe would then placed in the trench and the string immediately welded in a ‘bell pit’ to the previous string that is already in the ground. A ‘bell pit’ is a short length of trench that is dug deeper to allow the welders access to the underside of the pipe joint in the trench. Once the weld had been completed the external joint coating would be applied as described previously and the bell pit filled in. A wider excavation would be required at the location of bell pits and the width of such excavations would be dependent on the trench depth and can be determined at detailed design. The Construction Working Width would be adequately wide to accommodate the additional excavation width for bell pits. Temporary stabilisation measures may be necessary to provide additional protection to welders while working in a bell pit as described in Section 6.5.2.

96. Concrete collars, if required, (based on the groundwater level) would then be placed over the pipeline adjacent to the joint, sufficient to prevent flotation. The processed recycled substrate material would then be placed and compacted as side fill and surround up to the original level of the substrata. Finally, the excavated peat would be replaced around and over the pipe up to the original ground level.

97. Only the end of the newly installed pipe would be left exposed awaiting connection to the next pipe string. The end would be capped at all times up to the moment of being connected to prevent contamination of the inside of the pipe. Pipe and joint inspection would be undertaken in the same way as other open-cut construction along the pipeline, as all trenches associated with Method 1 would be reinstated in same working day, where practicable.

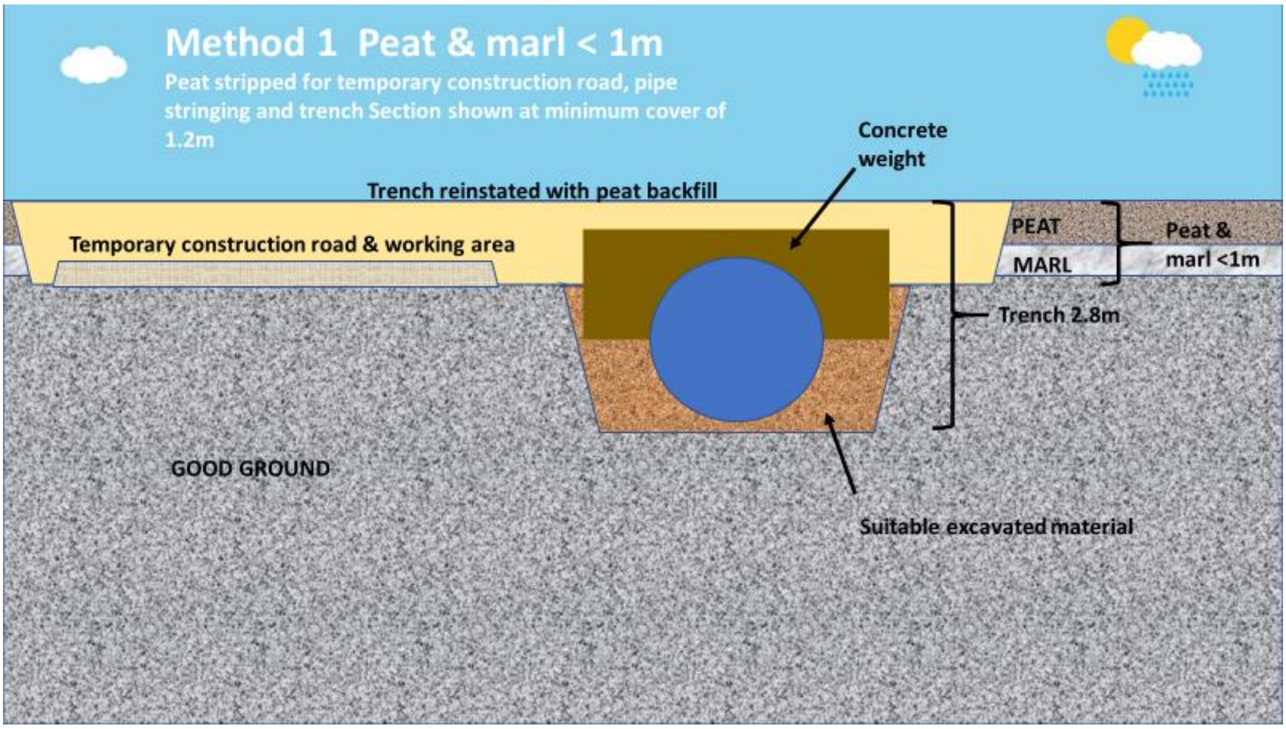


Image 6.13: Method 1 Pipeline with Maximum Depth of 1m

98. In peat areas, the minimum cover over the pipe would be set at 1.2m and therefore the minimum depth of the trench for a 1.6m diameter pipe would be not less than 2.8m (Image 6.13). The maximum depth is limited to what is 'safe' from a construction perspective and depends on the stability of the soil and the reach of the excavators. In areas of deeper peat or soft ground the pipeline would not be deeper than 4.5m (it may be up to 6m deep where the peat layer is shallower) (Image 6.14).

99. A Construction Working Width of 50m is considered for most of the pipeline length and in good ground conditions (not containing peat), a significant portion of the construction working width would accommodate the storage of top soil and sub soil. Soil stripping would not be undertaken through sections of peat, unless an acrotelm [8] layer of peat exists. If there is it would be stripped and temporarily stored separately to other excavated peat. In these circumstances the Construction Working Width either side of the section of pipeline being constructed or the additional allowance for material storage described for Method 3 / 4 would be utilised. Therefore, there is no requirement to increase the construction working width to accommodate Method 1.

[8] The acrotelm is the uppermost layer in bogs where fresh plant material, such as sphagnum mosses, and decaying plant material exist.

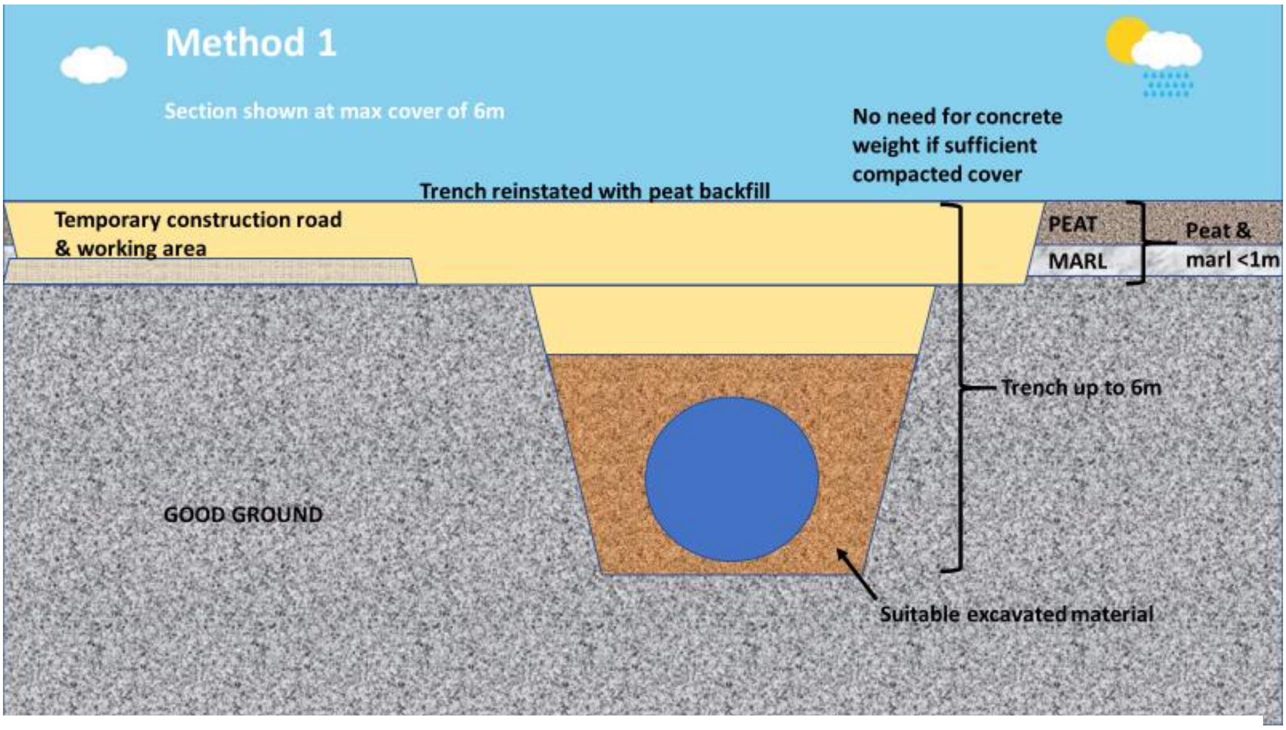


Image 6.14: Method 1 Pipeline with Maximum Depth of 6m

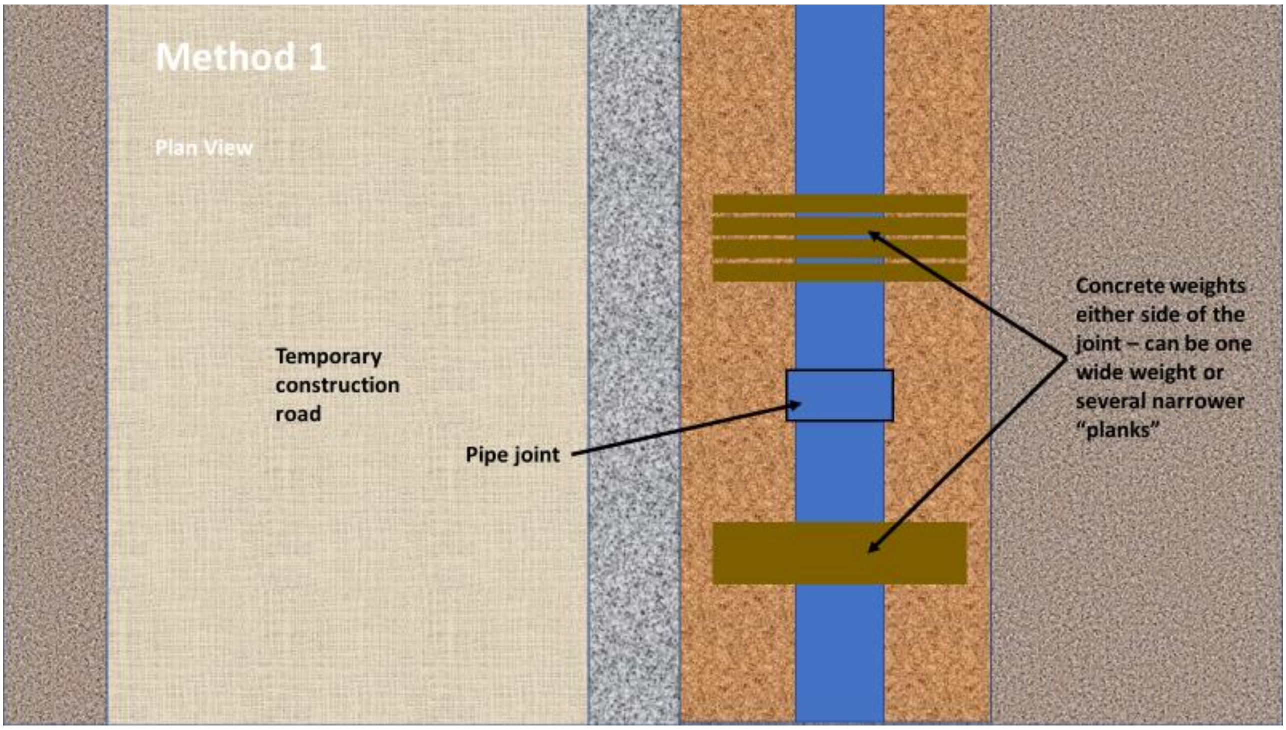


Image 6.15 Method 1 Distribution of Weights

6.6.4.2 Method 2

100. This method is to be employed where the extent of the peat (and any underlying marl) is less than circa 2.5m but greater than circa 1m. The only difference here is that the construction road would be constructed as a floating road on top of the peat (see Section 6.4.5.3). As for Method 1, the substrata would be exposed and the pipe laid in or on the substrate bedded on recycled material.

101. As per Method 1, collars would be placed at the joints to prevent flotation, where required. Image 6.16, Image 6.17 and Image 6.18 provide indicative illustrations of Method 2.

102. As with Method 1 there is no general requirement to increase the construction working width to accommodate Method 2. The same principles apply to any acrotelm layer within the peat and proposed material storage as described for Method 1.

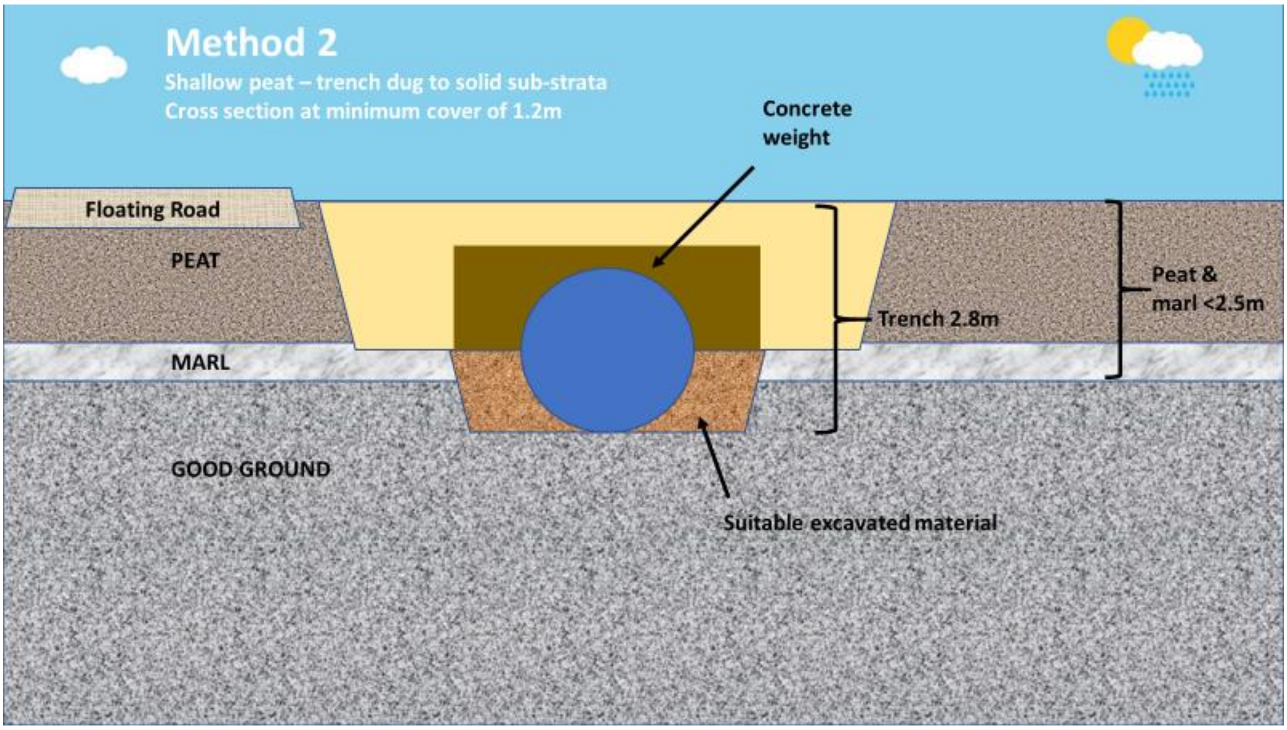


Image 6.16: Method 2 Pipeline with Minimum Cover of 1.2m

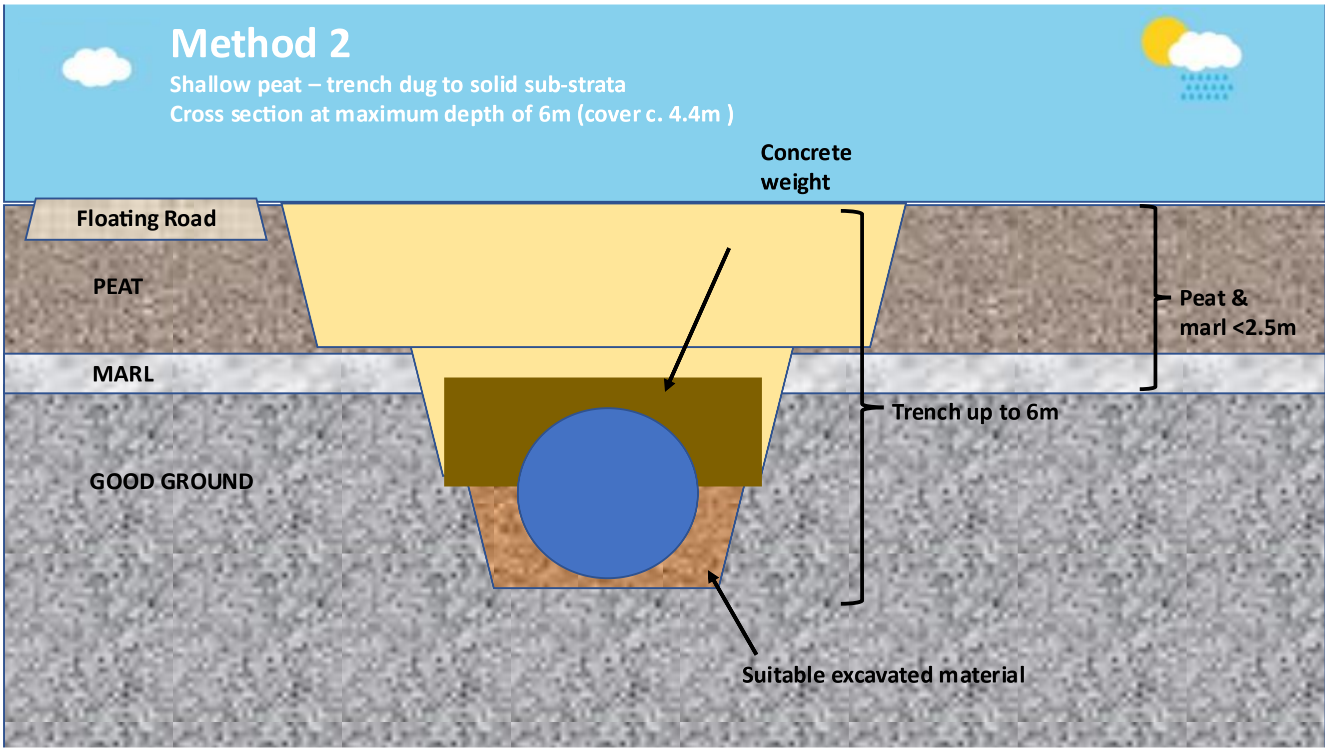


Image 6.17: Method 2 Pipeline with Maximum Depth of 6m

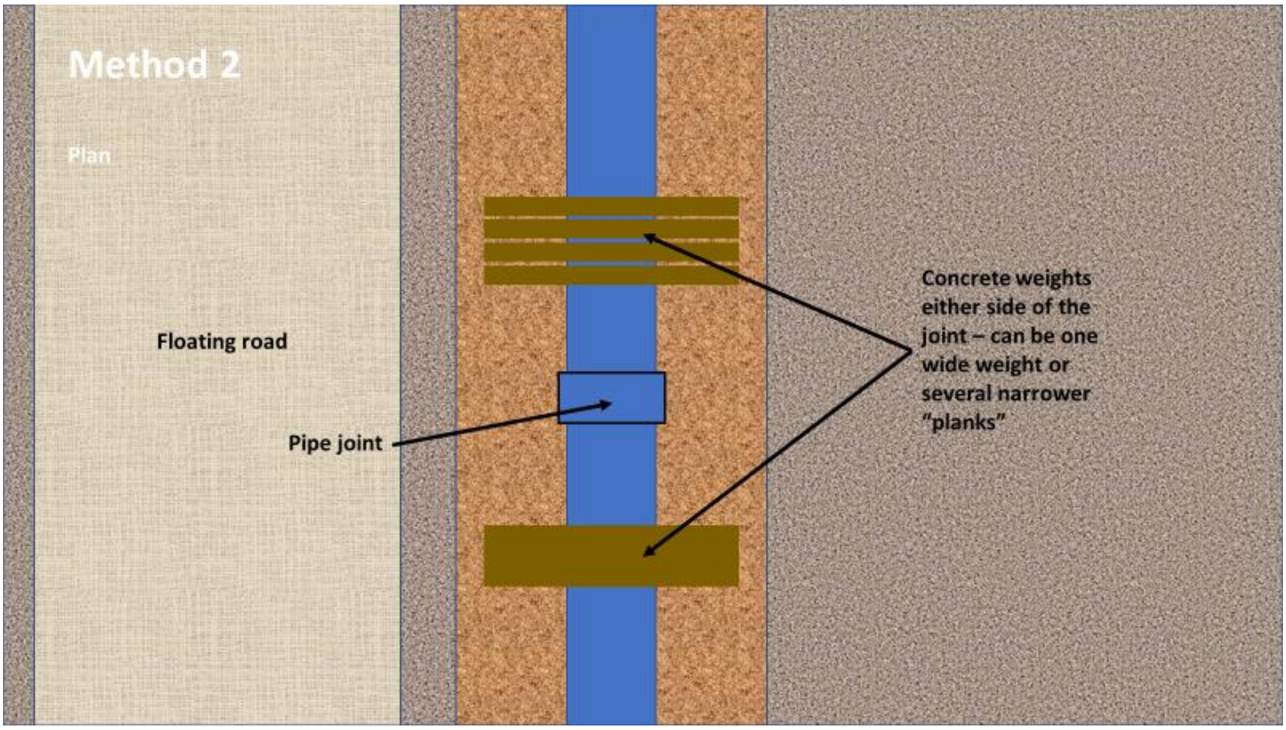


Image 6.18: Method 2 Distribution of Weights

6.6.4.3 Method 3

103. This method is to be employed where the extent of the peat (and any underlying marl) is greater than circa 2.5m below the starting ground level but less than circa 4.5m. The access road would be by way of a floating road.

104. The trench would be dug to receive a single pipe string (either two or three lengths of 13.5m long steel pipes). The substrata below the peat would be exposed only at the pipe ends where a column of stone would be placed on the firm ground and levelled off to support the pipe and ensure it is at the correct grade. The majority of the pipeline would be laid in the peat and the peat would be immediately replaced as bedding, surround and backfill. The excavation would be made slightly deeper at the pipe ends and the stone placed in the deeper excavation. The stone would be a maximum of 1.2m deep (based on a maximum peat depth of 4.5m, a pipe diameter of 1.6m and a minimum cover of 1.2m) and so this would be the depth of the additional excavation. De-watering would be needed, for a short temporary period to keep the excavated area sufficiently dry to place the stone but this would be within the general level of dewatering that would be required for construction in peat of this depth, The gradient of the pipe would be maintained solely by the stone columns at each joint.

105. Bell pits would be required at every second or third joint and this would dictate the placement of the stone in two phases to facilitate support for the pipe while allowing access underneath for welding and coating. The stone would also provide the means by which the collars are prevented from rotating and slipping to the side of the pipe. Images 6.19 – 6.22 provide indicative illustrations of Method 3.

106. The depth of the excavation combined with the depth of the peat means that there could be a need to slacken the side slopes on the excavation, as described in Section 6.6.2 and as a result additional land may be required for storage of materials and / surface water management. Therefore, in certain locations the Construction Working Width has been widened to allow for this. In other locations the Construction Working Width either side of the section of pipeline under construction, would have to be used.

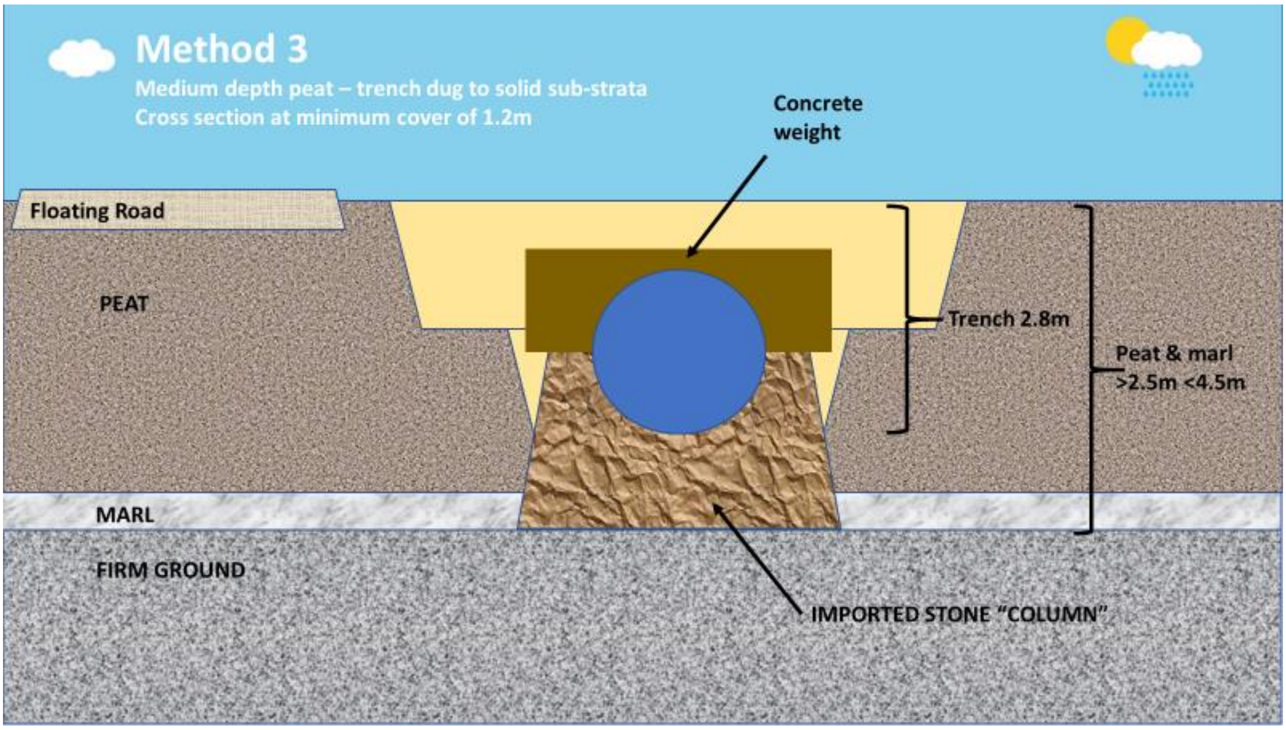


Image 6.19: Cross Section at Minimum Peat Cover of 1.2m

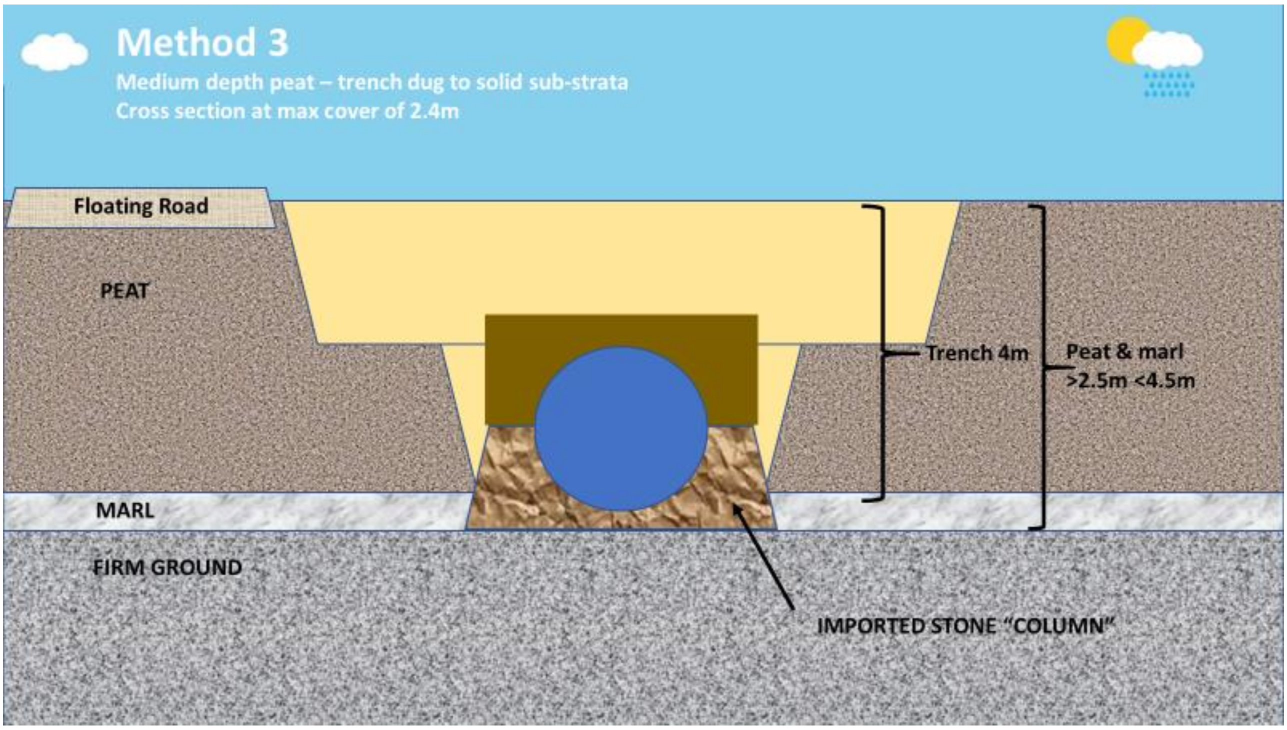


Image 6.20: Method 3 Cross Section of Peat at Maximum Cover of 2.4m

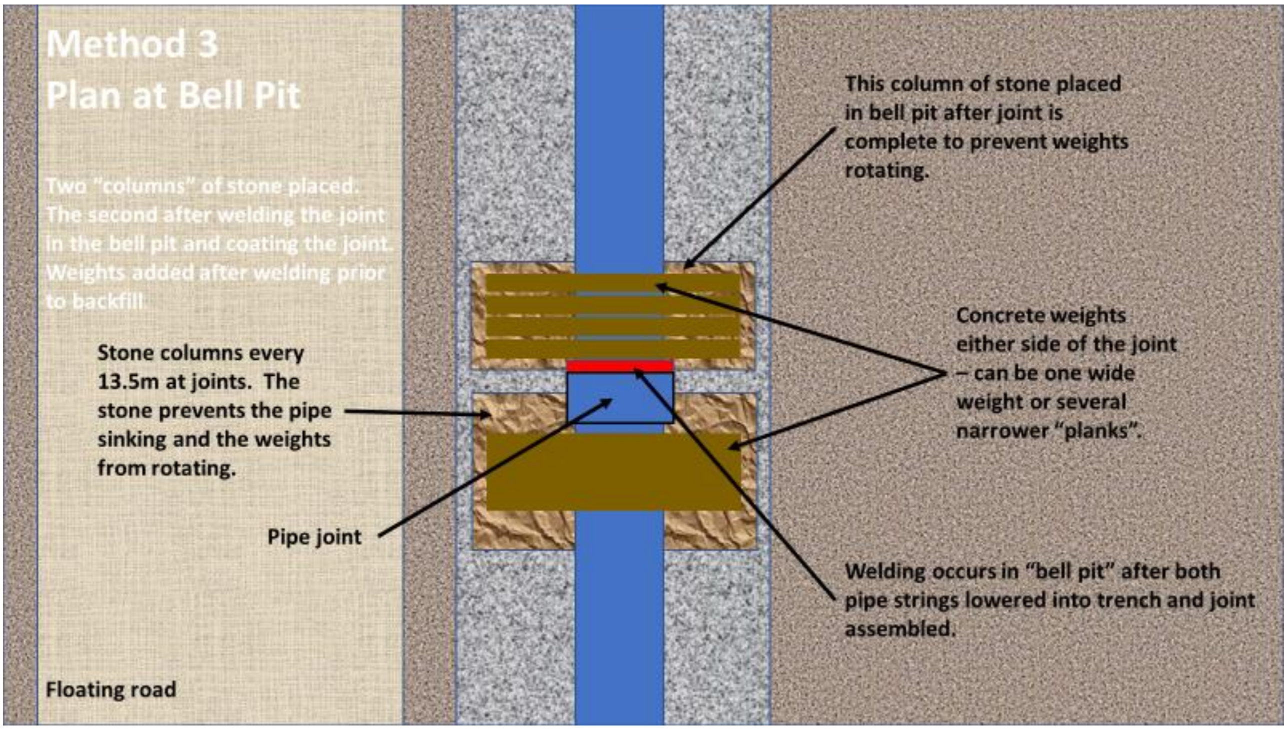


Image 6.21: Method 3 Plan View of Joint at Bell Pit

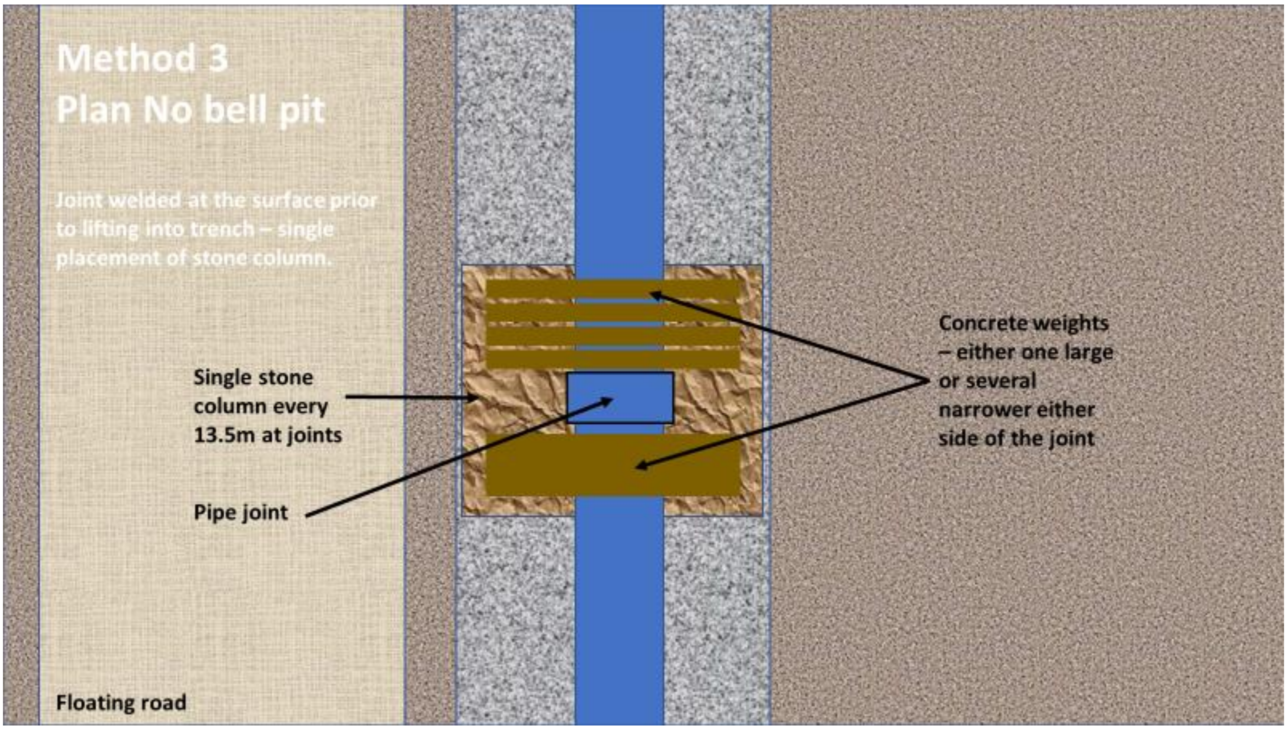


Image 6.22: Method 3 Plan View of Joint without Bell Pit

6.6.4.4 Method 4

107. This method is to be employed where the peat (and any underlying marl) is deep (>circa 4.5m) or particularly unstable. Images 6.25 – 6.27 provide indicative illustrations of Method 4.

108. Twin concrete piles would be driven at 13.5m intervals along the pipe centreline from equipment on the floating road. An excavation would then be made around the piles and the piles would be cut off at the correct height to achieve the desired gradients and levels on the pipe and a pre-cast pipe saddle would be affixed to the top of the pile.

109. There are different piling methods that can create a firm base on which to lay the pipes described in Chapter 5 (Construction and Commissioning). The concrete piles for Method 4 would be installed using a steel pile (such as those in Image 6.23) or pre-cast piles (such as those shown in Images 6.24) and installed by vibratory method or, where close to residential receptors by pushing the piles into the peat.

Image 6.23: Steel H Pile

Image 6.24: Precast Square Pile

110. Pipe welding would take place at surface level and when the pipe string is ready, the remainder of the trench would be excavated between the piles and the pipe lifted into place on to the saddles with the sockets of the pipe rest near to the saddle. The piles would prevent the pipe from sinking and resist lateral movement arising from un-even ground pressure caused by construction activity.

111. Pre-cast concrete collars would then be fixed around the pipe and attached to the saddles such that the combined weight of the saddle and collar is sufficient to prevent flotation. Typically, the pipe string would contain three pipes at 40.5m in length, though it is noted that the string length is dependent on installation equipment and techniques used by the appointed contractor. It may be necessary to reduce the length of the pipe section to account for propping of the trench box / sheet piling where this is required. A bell pit would be situated at every 2nd or 3rd pipe to accommodate safe conditions for pipe welding. The excavated peat would then be replaced around the pipe.

112. Washout Valves would be offset from the pipeline, though they would share the same invert level as the pipeline. Additional piles would be required to support the Washout Valve and any outfall, where these features are also located in areas of deep peat. The type and length of the piles would be dependent on the depth of peat and the nature of the substrata and would be decided during detail design.

113. There is no general requirement to increase the construction working width to accommodate Method 4 however, as described for Method 3 allowance has been made for widening the construction working width to allow for surface water management and temporary stock piling of materials.

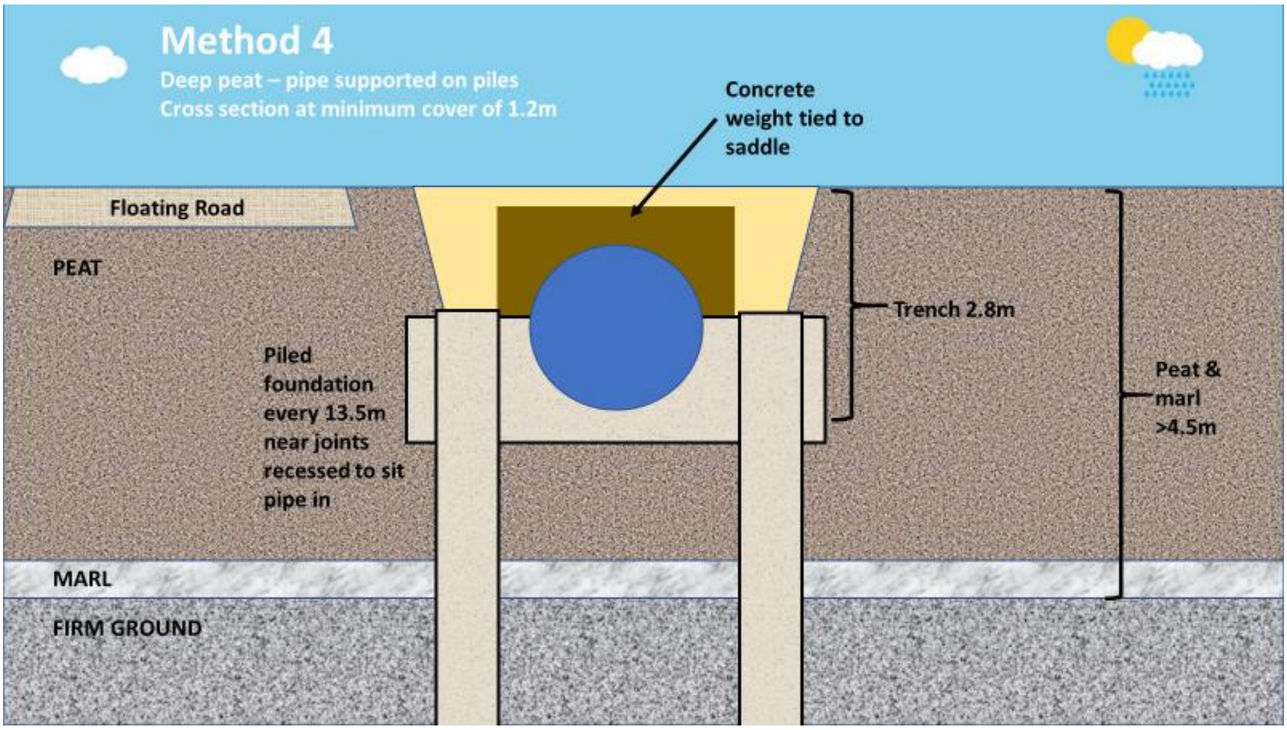


Image 6.25: Cross Section at Minimum Depth of 1.2m

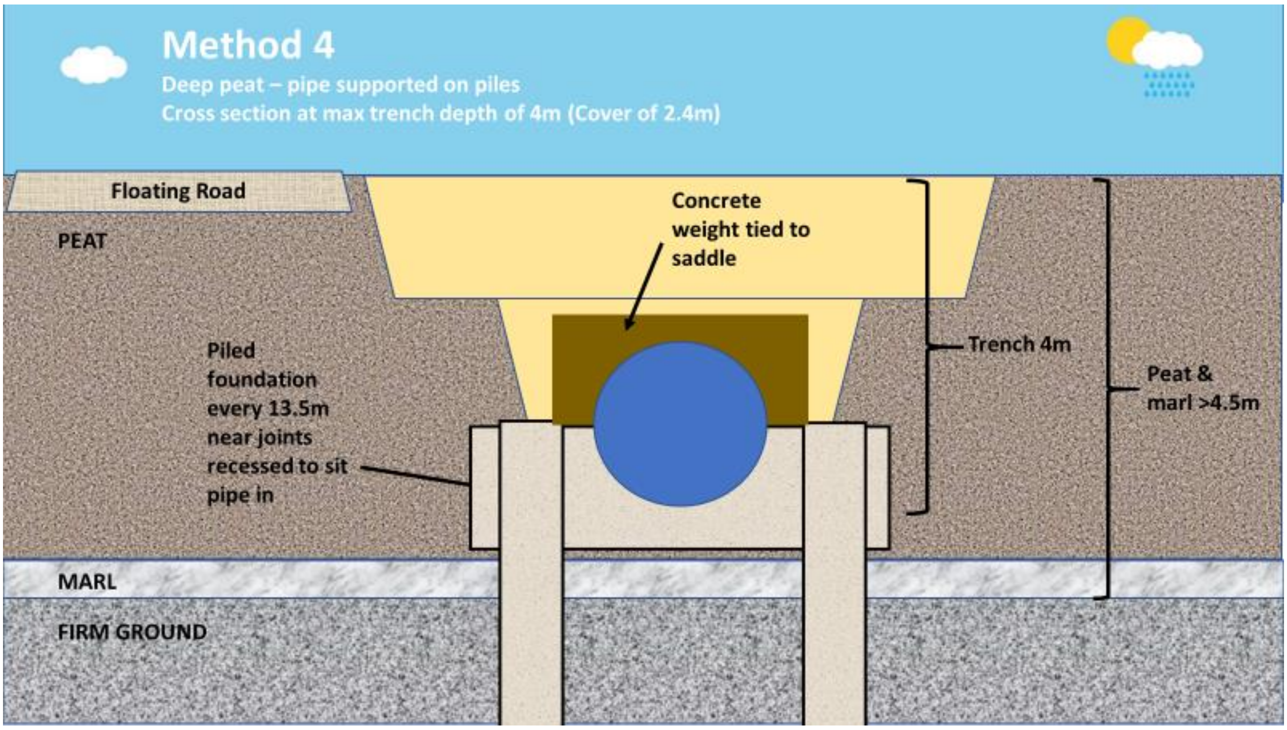


Image 6.26: Cross Section at Maximum Depth of 4m

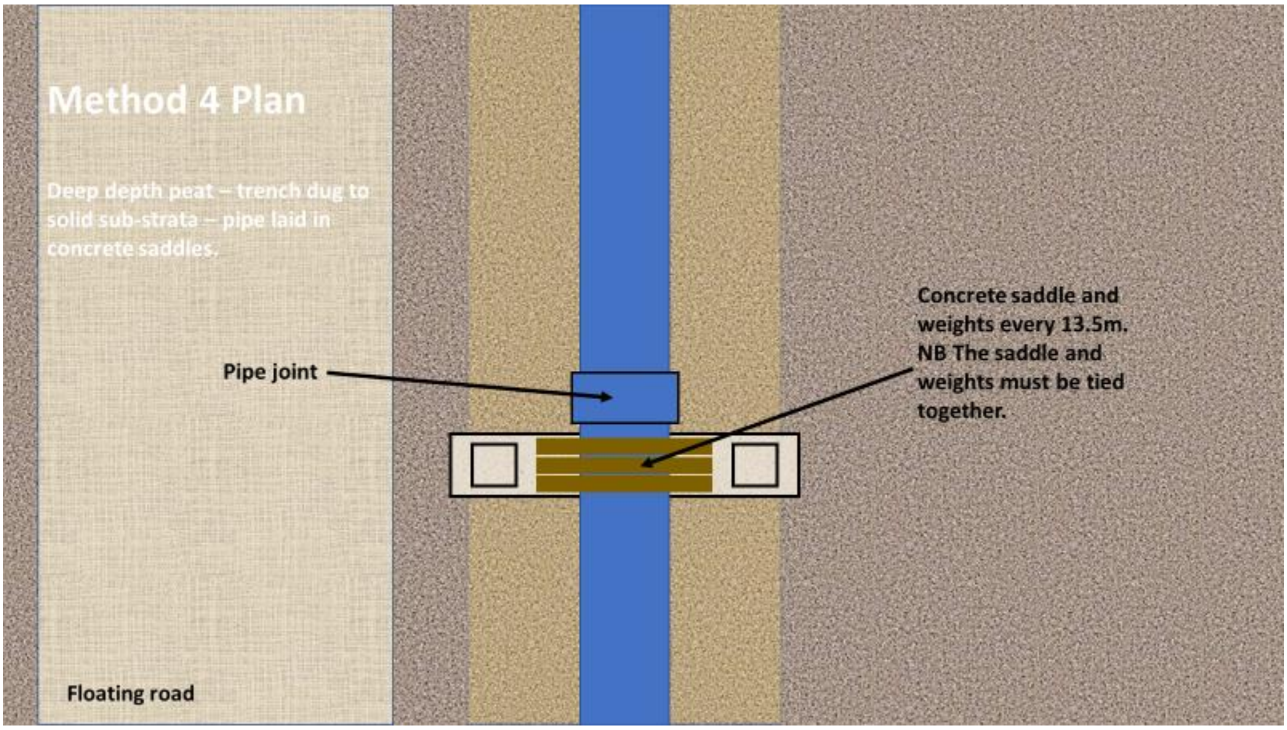


Image 16.27: Plan view of Method 4 Joint

6.7 Summary of Construction Methods Proposed

114. The depth of peat has been inferred following assessment of peat depth data, as described in Section 3 - 5. The construction methods described in Section 6.6 have been assigned to pipeline sections through peat, dependent on the depth of peat. Table 6.3 summarises the length of each proposed construction method, as per Table 5.1. Table 6.4 provides the same information but with the inclusion of the soft ground / alluvium as well as the lengths of peat soils, as per Table 5.4.

Table 6.3: Summary of Proposed Construction Methods along the Length of the Pipeline in Peat Soils

Proposed Pipeline Construction Method	Length (km) of Construction Method in Peat	Description from Table 5.1	Length in Peat from Table 5.1
Method 0	16.3	The length of pipeline where the peat depth is less than 0.5m	16.3
Method 1	14.0	The length of pipeline where the peat depth is greater than 0.5m but less than 1m	14.0
Method 2	15.7	The length of pipeline where the peat depth is greater than 1m but less than 2.5m	15.7
Method 3	5.7	The length of pipeline where the peat depth is greater than 2.5m but less than 4.5m	5.7
Method 4	1.1	The length of pipeline where the peat depth is greater than 4.5m.	1.1

Table 6.4: Summary of Proposed Construction Methods along the Length of the Pipeline in Peat and Soft Ground / Alluvium

Proposed Pipeline Construction Method	Length (km) of Construction Method in Peat	Description from Table 5.4	Length in Peat from Table 5.4
Method 0	16.3	The length of pipeline where the peat depth is less than 0.5m	16.3
Method 1	14.0	The length of pipeline where the peat depth is greater than 0.5m but less than 1m	14.0
Method 2	17.5	The length of pipeline where the peat depth is greater than 1m but less than 2.5m	17.5
Method 3	6.0	The length of pipeline where the peat depth is greater than 2.5m but less than 4.5m	6.0
Method 4	1.2	The length of pipeline where the peat depth is greater than 4.5m.	1.2

6.8 Storage of material

115. Excavated peat would be temporarily stored within the Construction Working Width, as discussed in Section h). Where an acrotelm[9] layer of peat exists, it would be stripped and temporarily stored separate to other excavated peat.

116. Temporary storage of excavated peat would be accommodated parallel to the trench and within the Construction Working Width. The length of these storage mounds would exceed the length of the open trench and a maximum height of 1m and side slope gradients in the range of 1:2 to 1:3 would be used.

117. As far as reasonably practicable the trench for the pipeline would be ‘open’ as short a period as possible. This would reduce the period of time that excavated material needs to be stored.

6.9 Reinstatement of pre-construction conditions

118. Following completion of the construction works the general principle is that the Construction Working Width would be reinstated in a manner consistent with conditions that existed on site prior to construction commencing and in accordance with the Rehabilitation Plans / Enhanced Rehabilitation Plans, where such plans are in place (and noting the exception for the Mount Lucas Bog as described in Section 1). This would be on the basis of the conditions which existed on site prior to the construction of the Proposed Project including the material, habitat, on-site features and surface water management measures that were on site before the works commenced. The aim of the reinstatement of the Construction Working Width is

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

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

[9] The acrotelm is the uppermost layer in bogs where fresh plant material, such as sphagnum mosses, and decaying plant material exist.

120. The principles of the reinstatement approach are:

- Material cannot be moved between bogs must be used in same bog
- The material would be backfilled using an excavator
- Compaction would be reduced as far as practicable
- Drainage channels / drain blocks would be reinstated post construction
- For PCAS Enhanced Rehabilitation: Facilitate Bord Na Móna to achieve target of water level within 100mm of ground level (where possible based on existing topography)
- For PCAS Enhanced Rehabilitation: reinstate drain blocks
- Operational access would not require the permanent draining of the 20m Permanent Wayleave.

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

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

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

123. The acrotelm layer of peat, where present, would be returned to the surface and seeding may be undertaken to aid revegetation, which in turn would contribute to stabilisation of the reinstated material.

124. Where marl is present, it would be excavated and reused on site for habitat creation in accordance with the recommendations of Bord Na Móna and the approach it has adopted on wind farm developments.

6.10 Use of Surplus Material

125. Suitable surplus excavated peat materials would be used in partnership with Bord Na Móna to supplement the approved Rehabilitation Plans / Enhanced Rehabilitation Plans.

126. Agreement has been reached, in principle with Bord na Móna that surplus material can be re-used within their lands. Material would only be re-used within the bog that it was excavated from. In general the material would be used to reduce the depth of water within areas subject to rehabilitation or to change the ground profile to support the long term plans for that relevant bog.

127. This would include for the beneficial reuse of the material including Marl within the rehabilitation plans.

7. References

An Fóram Uisce, March 2021. Optimising Water Quality Returns from Peatland Management while Delivering Co-Benefits for Climate and Biodiversity.

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Annex A – Assessment of Peat Depth

Table 1: Assessment of Peat Depth

Name of bog	Chainage	Total Length of Peat(m)	Inferred Peat Depth (m)		Confidence Grading (average scoring)	Proposed Construction Method	Comments	Mapbook Sheet Reference
			Average	Maximum				
Peat subsoil in private land #1	TW-4000 to TW-4175	200	1.2	1.2	3	Method 2	GI suggests short segment of Alluvium	Figure 5.37
Peat subsoil in private land #2	TW-10025 to TW-10500	500	0.4	0.8	1	Method 0 / 1	-	Figure 5.38
Peat subsoil in private land #3	TW-11500 to TW-11825	350	0.25	0.25	3	Method 0		Figure 5.39
Peat subsoil in private land #4	TW-13450 to TW-13675	250	0.5	0.5	3	Method 0		Figure 5.39
Peat subsoil in private land #5	TW-32825 to TW-33550	725	No Peat	No Peat	1	No Peat Method Required	GI for this extent indicates no Peat.	Figure 5.45
Peat subsoil in private land #6	TWA-3500 to TWA-3750	275	0.2	0.6	1	Method 1	-	Figure 5.47
Peat subsoil in private land #7	TWA-3775 to TWA-4900	925	0.5	2.5	2	Method 0 / 1 / 2	-	Figure 5.47 – 5.48
Peat subsoil in private land #8	TWA-5325 to TWA-5950	650	0.9	2.1	2	Method 0 / 1 / 2	2022 GI data suggests shallow peat depths below 1m, up to TWA-5500, with depths between 1-2m further to the east. A deep peat patch can be observed at TWA-5625, where construction using Method 3 is proposed.	Figure 5.48
Peat subsoil in private land #9	TWA-9275 to TWA-9500	250	0.5	0.9	1	Method 1	-	Figure 5.49
Peat subsoil in private land #10	TWA-12625 to TWA-13550	950	1.6	3.2	2	Method 0 /2 / 3 / 4	2022 GI data suggests peat depths of greater than 1.5m for much of this section, where construction using Method 2 and 3 is proposed. On the fringes of this section, peat depths are more shallow and Method 2 is recommended. The section between TWA–12800 and TWA-13000 includes deep Alluvium, where construction Method 4 is suggested.	Figure 5.50
Peat subsoil in private land #11	TWA-15300 to TWA-15450	175	0.5	0.5	3	Method 0		Figure 5.51

Name of bog	Chainage	Total Length of Peat(m)	Inferred Peat Depth (m)		Confidence Grading (average scoring)	Proposed Construction Method	Comments	Mapbook Sheet Reference
			Average	Maximum				
Peat subsoil in private land #12	TWA-15850 to TWA-16025	200	2.9	3.5	3	Method 2 / 3	GI suggests segment of Alluvium	Figure 5.51
Peat subsoil in private land #13	TWA-16675 to TWA-16750	100	2.0	2.0	3	Method 2	GI suggests segment of Alluvium	Figure 5.51
Peat subsoil in private land #14	TWA-17475 to TWA-17625	175	0.4	1	3	Method 1		Figure 5.51
Peat subsoil in private land #15	TWA-19175 to TWA-20300	600	0.3	0.8	1	Method 1	-	Figure 5.52
Peat subsoil in private land #16	TWA-20975 to TWA-21600	650	0.4	0.6	2	Method 0 / 1	-	Figure 5.52
Peat subsoil in private land #17	TWA-22800 to TWA-24025	800	0.4	0.8	1	Method 0 / 1	-	Figure 5.53
Peat subsoil in private land #18	TWA-25500 to TWA-27675	1,375	No Data	No Data	4	Tunnelled	Initial fringe includes medium section of Alluvium, where construction Method 2 is recommended. Tunnelling has previously been proposed for this section.	Figure 5.54
Peat subsoil in private land #19	TWB-4575 to TWB-4650	100	1.2	1.2	3	Method 2	GI suggests segment of Alluvium	Figure 5.56
Peat subsoil in private land #20	TWB-6075 to TWB-6875	825	1.0	2.0	2	Method 1 / 2	-	Figure 5.56 – 5.57
Peat subsoil in private land #21	TWB-8925 to TWB-9500	425	0.4	0.7	2	Method 0 / 1	-	Figure 5.57
Peat subsoil in private land #22	TWB-10825 to TWB-10975	175	0.5	0.7	1	Method 0	-	Figure 5.58
Peat subsoil in private land #23	TWB-12700 to TWB-12750	75	0.2	0.7	1	Method 1	-	Figure 5.58
Peat subsoil in private land #24	TWB-13225 to TWB-13700	500	0.5	1.1	2	Method 0 / 1 / 2	-	Figure 5.58
Peat subsoil in private land #25	TWB-13950 to TWB-14275	350	0.4	0.9	2	Method 0 / 1	-	Figure 5.58 - 5.59
Peat subsoil in private land #26	TWB-14750 to TWB-15425	700	0.5	0.9	2	Method 0 / 1	-	Figure 5.59
Peat subsoil in private land #27	TWB-18475 to TWB-19925	1,475	0.3	0.4	2	Method 0		Figure 5.60

Name of bog	Chainage	Total Length of Peat(m)	Inferred Peat Depth (m)		Confidence Grading (average scoring)	Proposed Construction Method	Comments	Mapbook Sheet Reference
			Average	Maximum				
Peat subsoil in private land #28	TWB-20250 to TWB-23350	2,800	0.2	1.0	2	Method 0 / 1	-	Figure 5.60 – 5.61
Peat subsoil in private land #29	TWB-24700 to TWB-25675	925	0.3	0.9	1	Method 0 / 1 / 2	-	Figure 5.62
Peat subsoil in private land #30	TWB-26225 to TWB-26325	125	0.2	0.4	3	Method 0		Figure 5.62
Peat subsoil in private land #31	TWC-975 to TWC-1125	175	0.2	1.5	3	Method 2		Figure 5.63
Peat subsoil in private land #32	TWC-8700 to TWC-9125	450	0.8	1.4	3	Method 1 / 2 / Tunnel	Tunnelling has previously been proposed for the western portion of this section.	Figure 5.65
Peat subsoil in private land #33	TWC-9550 to TWC-10425	900	0.3	0.7	1	Method 0 / 1 / 2 / 3	This section has Alluvium deposits between TWC-10000 and TWC-10400, where construction Method 1 / 2 / 3 are recommended.	Figure 5.65 – 5.66
Peat subsoil in private land #34	TWC-11025 to TWC-11500	500	0.2	0.8	1	Method 0 / 1	-	Figure 5.66
Clonad Bog	TWC-11850 to TWC-13400	1,475	1.5	4.6	1	Method 1 / 2 / 3 / 4	The observed peat depth varies in Clonad Bog. The proposed construction technique consists of Method 1 and 2 for the majority of the section, with Method 3 in localised areas of deeper peat. The deepest area of peat was 4.6m deep which was observed approximately 5m from the pipeline.	Figure 5.66
Mount Lucas Bog	TWC-13425 to TWC-17100	3,700	1.0	2.8	2	Method 0 / 1 / 2 / 3	The observed peat depth varies in Mount Lucas Bog. Construction Methods 0, 1 and 2 are proposed for the majority of the section, with Method 3 in localised areas of deeper peat.	Figure 5.66 – 5.67
Peat subsoil in private land #35	TWC-17125 to TWC-17975	875	2.9	6.2	2	Method 0 / 2 / 4	-	Figure 5.67 – 5.68

Name of bog	Chainage	Total Length of Peat(m)	Inferred Peat Depth (m)		Confidence Grading (average scoring)	Proposed Construction Method	Comments	Mapbook Sheet Reference
			Average	Maximum				
Peat subsoil in private land #36	TWC-18825 to TWC-19100	300	0.4	0.9	1	Method 0 / 1	-	Figure 5.68
Peat subsoil in private land #37	TWC-19125 to TWC-20250	1,150	0.2	1.0	2	Method 0 / 1	-	Figure 5.68
Esker Bog	TWC-20275 to TWC-21300	1,050	2.4	3.5	1	Method 1 / 2 / 3 / 4	-	Figure 5.68
Peat subsoil in private land #38	TWC-21325 to TWC-23175	1,875	0.8	3.0	3	Method 0 / 1 / 2 / 3	-	Figure 5.69
Esker Bog	TWC-23200 to TWC-23475	300	1.2	2.4	1	Method 2 / 3	-	Figure 5.69
Peat subsoil in private land #X	TWC-23500 to TWC-23875	400	1.8	4.9	2	Method 1 / 2 / 3 / 4		Figure 5.69
Peat subsoil in private land #39	TWC-24300 to TWC-24450	175	1.0	1.0	4	Method 1	Segment of Peat inferred from Teagasc GI	Figure 5.69
Peat subsoil in private land #40	TWD-150 to TWD-425	300	0.2	0.2	2	Method 0	-	Figure 5.70
Peat subsoil in private land #41	TWD-1900 to TWD-2175	300	0.4	0.8	2	Method 0 / 1	-	Figure 5.70
Cloncreen Bog	TWD-2200 to TWD-2900	725	2.2	4.5	2	Method 0 / 2 / 3	Peat depths above 2.5m were observed in the east of this section and construction using Method 3 is proposed. Observed peat depths were below 2.5m in the west and Method 2 is proposed in this area.	Figure 5.70 – 5.71
Peat subsoil in private land #42	TWD-2925 to TWD-6375	3,475	1.0	4.5	2	Method 1 / 2 / 3	The observed peat depth varies in this section. The proposed construction technique consists of Methods 1 and 2 for a majority of the section, with Method 3 in localised areas of deeper peat.	Figure 5.71

Name of bog	Chainage	Total Length of Peat(m)	Inferred Peat Depth (m)		Confidence Grading (average scoring)	Proposed Construction Method	Comments	Mapbook Sheet Reference
			Average	Maximum				
Ballydermot Bog	TWD-6400 to TWD-14375	8,000	1.6	4.0	1	Method 1 / 2 / 3	Peat depth information through this section of Ballydermot Bog indicate deep peat in many areas. Method 3 is proposed across approximately 1.4km of this section and Methods 1 and 2 are proposed for the remainder.	Figure 5.71 – 5.74
Peat subsoil in private land #43	TWD-14400	25	2.5	2.5	3	Method 2		Figure 5.74
Peat subsoil in private land #44	TWD-16825 to TWD-17850	1,050	0.3	1.0	2	Method 0 / 1	-	Figure 5.75
Peat subsoil in private land #45	TWD-18450 to TWD-18900	475	0.3	0.4	2	Method 0	-	Figure 5.76
Timahoe South Bog	TWD-18925 to TWD-21500	2,600	1.0	4.5	2	Method 0 / 1 / 2 / 3	-	Figure 5.76
Timahoe North Bog	TWD-21525 to TWD-23900	2,400	2.0	5.5	2	Method 1 / 2 / 3 / 4	-	Figure 5.76 – 5.77
Peat subsoil in private land #46	TWD-23925 to TWD-25400	1,500	0.6	2.5	2	Method 0 / 1 / 2	-	Figure 5.77
Peat subsoil in private land #47	TWD-25425 to TWD-26475	1,075	1.6	4.1	2	Method 1 / 2 / 3	-	Figure 5.77 – 5.78
Gilltown Bog	TWD-26500 to TWD-26975	500	3.0	5.6	2	Method 1 / 2 / 4	-	Figure 5.78
Gilltown Bog	TWD-27000 to TWD-27300	350	1.7	3.0	1	Method 1 / 2 / 3	-	Figure 5.78
Peat subsoil in private land #48	TWD-27325 to TWD-29350	2,025	1.5	4.4	2	Method 0 / 1 / 2 / 3	-	Figure 5.78 – 5.79