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Royal Canal Urban Greenway

Feasibility and constraint study

at Coolmine Train Station

Comhairle Contae Fhine Gall
Fingal County Council

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Executive summary

This document discusses the feasibility and constraints associated with the proposal to construct the Royal Canal Urban Greenway route along the southern bank of the canal between Coolmine Train Station and Castleknock Train Station. The proposal is, in our opinion, feasible but subject to significant constraints in relation to constructability.

We would not recommend constructing the proposed greenway path from the existing southern towpath due to the lack of access for typical construction plant. It is also impractical to work from the existing railway track due to the frequency of railway traffic along this commuter line and the disturbance that would be caused to the public transportation network.

The most feasible option for construction is to work from a lower level within the canal channel. In order to accommodate this option, a platform will have to be constructed within the canal channel using pipes overlain by granular fill allowing water to flow through the platform embankment throughout the works. Canal traffic may have to be restricted during the construction works due to the presence of this platform. The construction of the platform will likely be a rolling operation which is likely to generate siltation of the canal bed, which may require control measures to be implemented.

This report does not consider wayleave permissions, ecological and environmental constraints or pollution controls. These considerations will likely require stakeholder engagement and consent before progressing to the construction phase of the works.

1 Introduction

1.1 Description of the Project

Gavin and Doherty Geosolutions Ltd. (GDG) was requested by Fingal County Council (FCC) to carry out the feasibility study of constructing the proposed greenway along the Royal Canal adjacent to the Irish Rail (IR) Dublin-Sligo railway line. The subject section of greenway is located along the southern bank of the Royal Canal between the Coolmine Train Station and Castleknock Train Station, over a length of approximately 1050m extending eastwards from the Kirkpatrick Bridge. FCC intends to deliver a pedestrian and cycle route which is to be constructed along the Royal Canal from the Kildare County boundary to the Old Navan Road (near 12th lock) to connect with a previously constructed section of the Ashtown Greenway.

On the 20th February 2020, GDG carried out a site walkover with the purpose to identify the condition of the Royal Canal and the potential design issues. GDG identified locations along the Royal Canal existing towpath where the path is relatively narrow, typically 2.0m to 2.5m wide with local pinch points as low as 1.3m. The presence of the narrow path restricts the choice of appropriate equipment for the construction of the works.

The proposals for the upgrade of the new path was prepared by DBFL Consulting Engineers (DBFL). DBFL designed three preliminary options for the greenway upgrade as per the sketches produced by Áit Urbanism and Landscape Ltd (Áit) in document no. "*18FG01_Cantilever-Sketches rev.*" as follows:

- Option A – Cantilever Boardwalk with planted strip between the boardwalk and retaining wall;
- Option B – Cantilever Boardwalk with retaining wall adjacent;
- Option C – Cantilever Boardwalk elevated on precast anchored wall.

DBFL also progressed the Option A proposal for the greenway as detailed in Sections 5.2 and 6.4 of this report.

Murphy Surveys Ltd. previously carried out a LIDAR survey of the canal and a traditional topographic survey of the southern towpath and embankment. Irish Rail issued additional survey information of the railway line adjacent to the southern towpath. This survey information was used to supplement this feasibility study report.

1.2 Geotechnical category

The scheme has been identified to be Geotechnical Category 2 according to I.S. EN 1997-1:2005, in that it includes only conventional types of structure with no exceptional risk or difficult ground or loading conditions. It should be noted that the site includes glacial till used within the original path.

1.3 Scope of report

The scope of this report comprises of the following:

1. Review all general and background geological information related to the proposed scheme;
2. Site walkover of site area;
3. Discussion of the Ground Investigations Ireland (2020) ground investigation;
4. Foundation design and construction challenges associated with the option of routing the Greenway on the south side of Royal Canal;
5. Discussion of the feasibility of the initial DBFL greenway proposal;
6. Discussion of the feasibility of the progressed DBFL greenway proposal;
7. Constraints associated with the greenway upgrade proposals.

Any consultancy services outside this scope are not covered by this report and GDG should be informed so that a new assessment can be advised if required.

2 The site

2.1 General description

The subject section of the Royal Canal Urban Greenway is located to the northwest of Dublin city centre, Ireland, as shown in Figure 2-1. The approximate long/lat coordinates for the project are 53°22'46.9"N 6°22'57.8"W. Figure 2-2 present an aerial image showing the subject section of the Royal Canal Urban Greenway location.

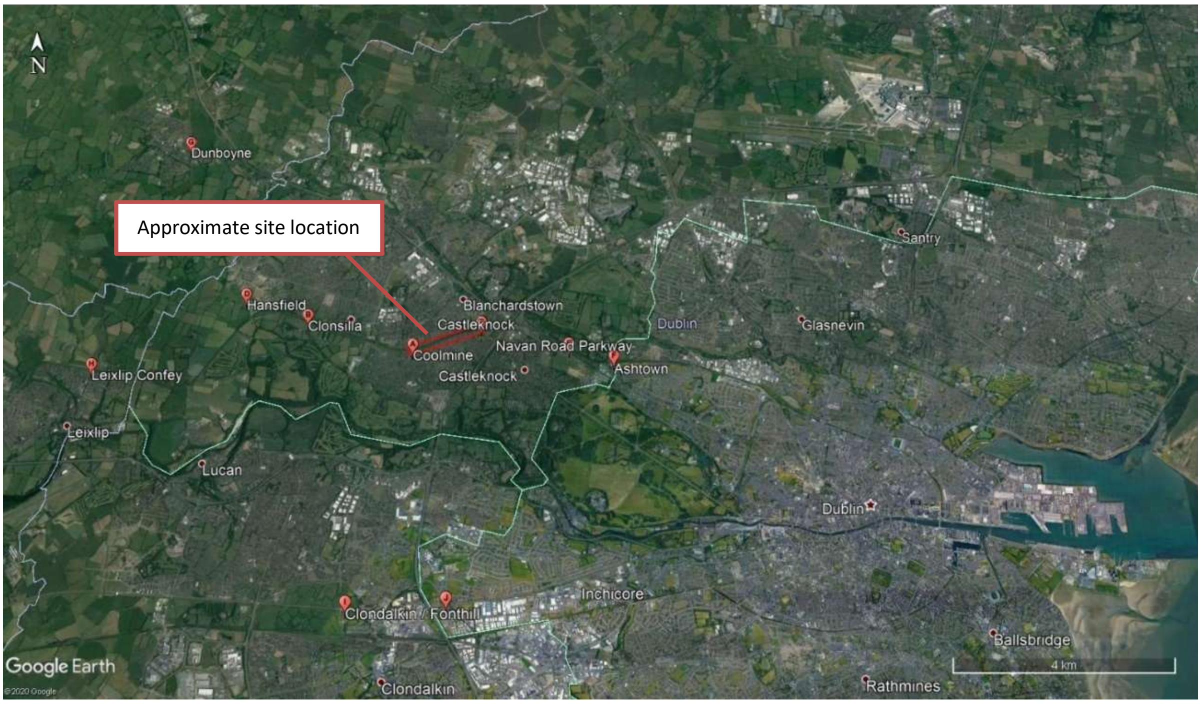

Figure 2-1: General site location, Dublin, Ireland. (Google Maps. 2020)

Figure 2-2: Aerial image showing subject section of the Royal Canal Urban Greenway location (Google Maps. 2020)

The Royal Canal is located along the northern boundary of the site is covered by trees. There are residential properties along the northern bank of the canal. The Dublin-Sligo railway line is located on the southern boundary of the site. Trains run on this route every 20-40 minutes with the frequency of trains illustrated in Figure 2-3 and Figure 2-4. The Kirkpatrick Bridge and the pedestrian bridge are located at the western end of the proposed greenway. The Coolmine Train Station is located off the Coolmine Road immediately south of the proposed greenway. A mooring quay is located on the eastern end of the subject section immediately north of the Castleknock Train Station which may be used for access to the canal by construction plant.

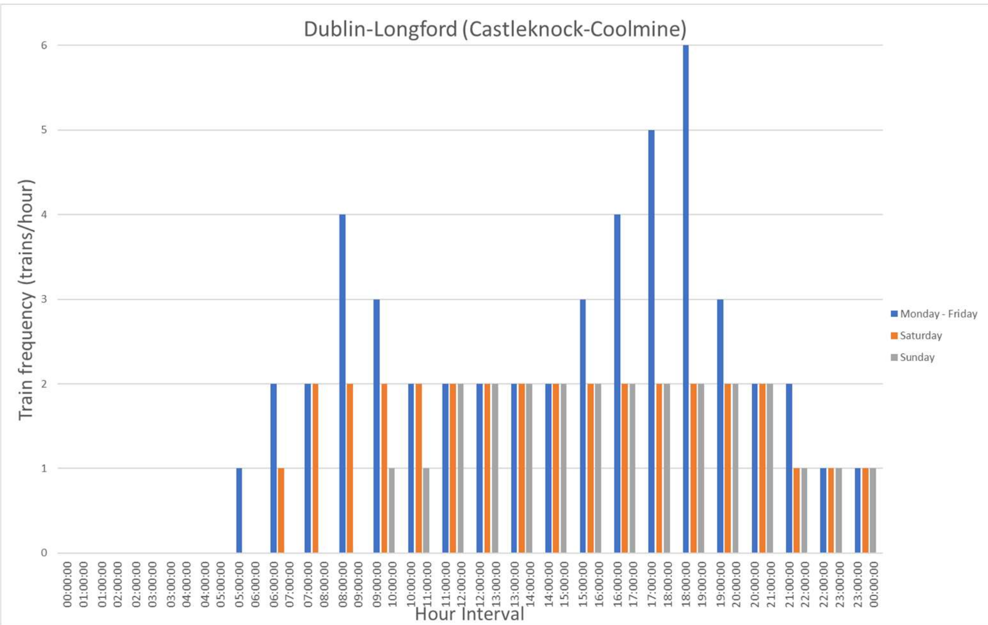

Figure 2-3 Frequency of trains between Castleknock and Coolmine Train Stations

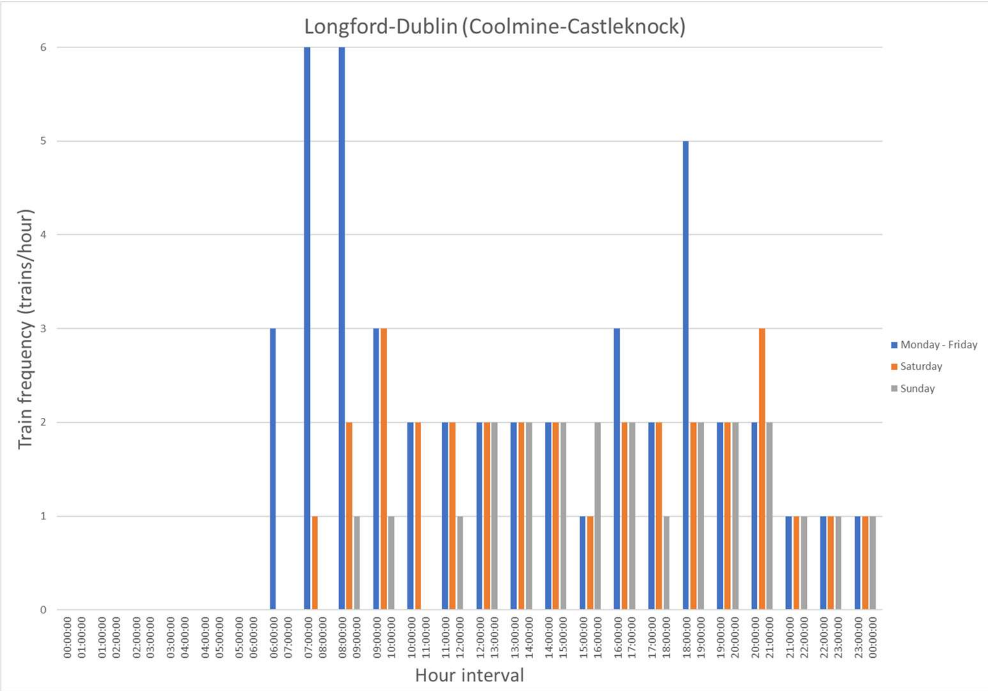

Figure 2-4 Frequency of trains between Coolmine and Castleknock Train Stations

2.2 Desktop study – Geology

The details of the superficial deposits and bedrock geology are summarised in Table 2-1. The quaternary deposits and bedrock geology of the site obtained from the GSI (2020) online mapping database are shown on 1:100,000 geological maps illustrated in Figure 2-5 and Figure 2-6 respectively.

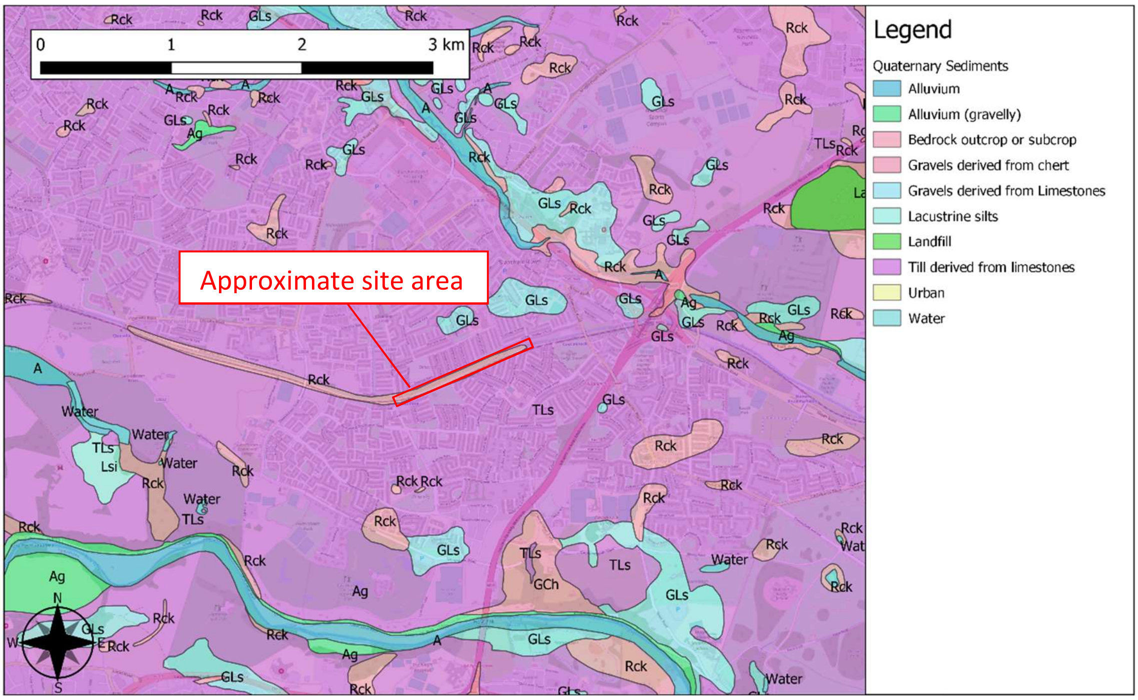

Figure 2-5: Quaternary deposits 1:100,000 (GSI data, 2020)

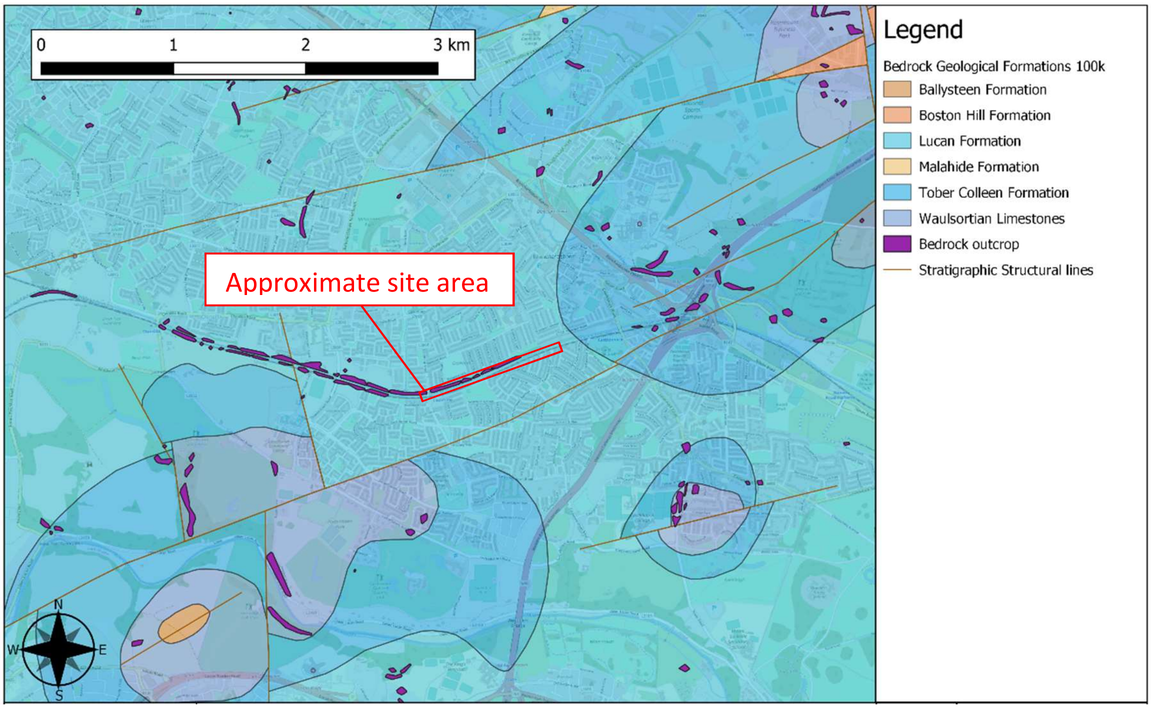

Figure 2-6: Bedrock geology 1:100,000 (GSI data, 2020)

The site is underlain by Till and Gravel derived from limestone. The bedrock in the area is typically dark limestone & shale of the Lucan formation and calcareous shale & limestone conglomerate of the Tober Collen Formation. There is a structural line feature described as a fault in the GSI (2020) online mapping database, near the Coolmine Train Station.

Table 2-1: Geological succession

Soil or Rock Deposit Name	Brief description
Drift Geology	
Glacial Till	The structure of glacial till varies in composition from granular to cohesive material. Granular glacial till is often found in areas of glacial outwash and lateral moraine features. These tend to be in the form of loose to dense material. Cohesive glacial till varies in forms from poorly to well-graded till. Cobbles and boulders may be present. Consistency varies from firm to hard.
Solid Geology	
Lucan formation	The formation comprises dark-grey to black, fine-grained, occasionally cherty, micritic limestones that weather paler, usually to pale grey.
Tober Colleen Formation	Dark-grey, calcareous, commonly bioturbated mudstones and subordinate thin micritic limestones.

A ground investigation (GI) was carried out by Ground Investigations Ireland Ltd. in July 2020 covering the full length of the proposed Royal Canal Urban Greenway. The GI information relevant to the subject section along the southern bank of the Royal Canal between the Coolmine Train Station and Castleknock Train Station has been reviewed in Section 4 of this report.

According to the GSI online mapping, there are previous projects near the Coolmine Greenway with freely available borehole log data. Borehole logs were analysed to understand the geological succession of the site. The historical boreholes map is shown in Figure 2-7 with the relevant borehole logs downloaded from the GSI (2020) online mapping database and reviewed. The subsurface in the areas surrounding the site is typically described as consisting of soft to stiff, brown, slightly sandy, slightly gravelly clay with occasional cobbles. Approximately 3 m below ground level, boulders are encountered as described in the borehole logs. This is probably weathered bedrock from Lucan Formation or Tober Collen Formation.

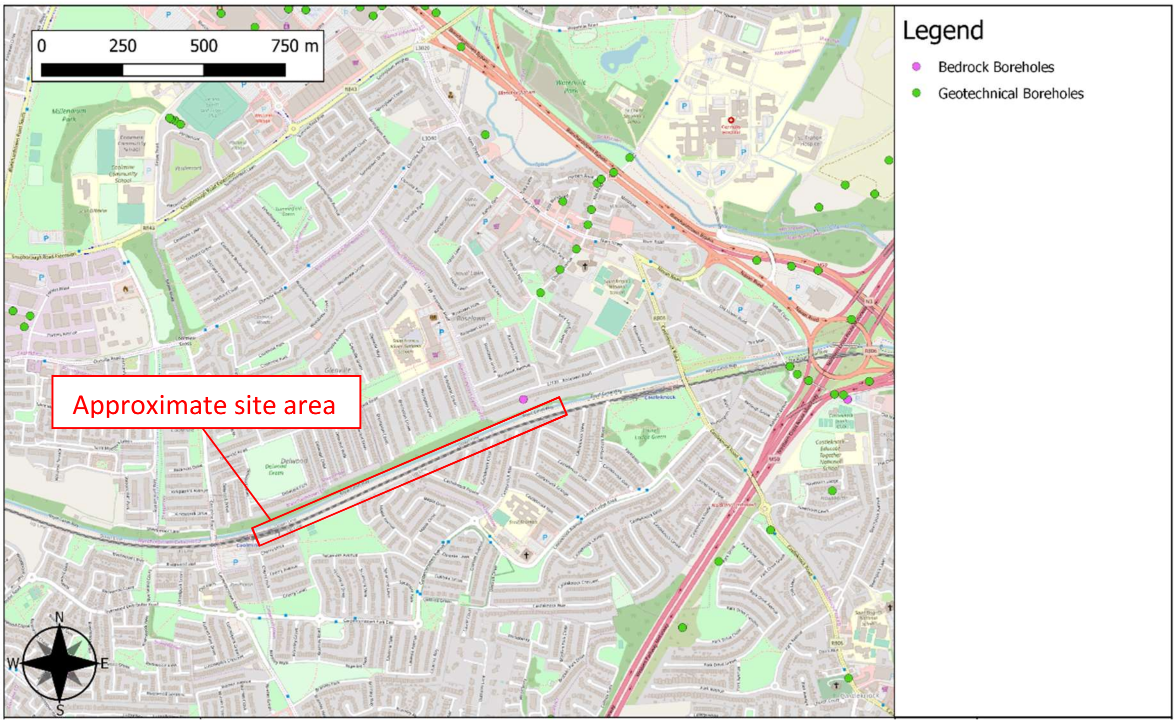

Figure 2-7: Historical boreholes (GSI data, 2020)

2.3 Desktop study – Hydrogeology/hydrology

According to the GSI online mapping database (2020), the bedrock along the western end site is noted as moderately productivity aquifers only in local zones (LI), with a small area of poor aquifer near Castleknock Train Station. The bedrock beneath the eastern side of the site is generally unproductive except for local zones (PI). A map of the bedrock aquifers is shown in Figure 2-8.

The groundwater vulnerability map produced in Figure 2-9 presents the risk of groundwater contamination. Rock near-surface or karst (X) is located along with the western end site of the canal. Extremely (E) vulnerable aquifers were identified at the eastern end of the proposed site.

The normal water level within the canal is taken to be 56.5 m OD in accordance with the topographical and bed level surveys received. It is noteworthy that the River Tolka is located 500m at its nearest point from the proposed works.

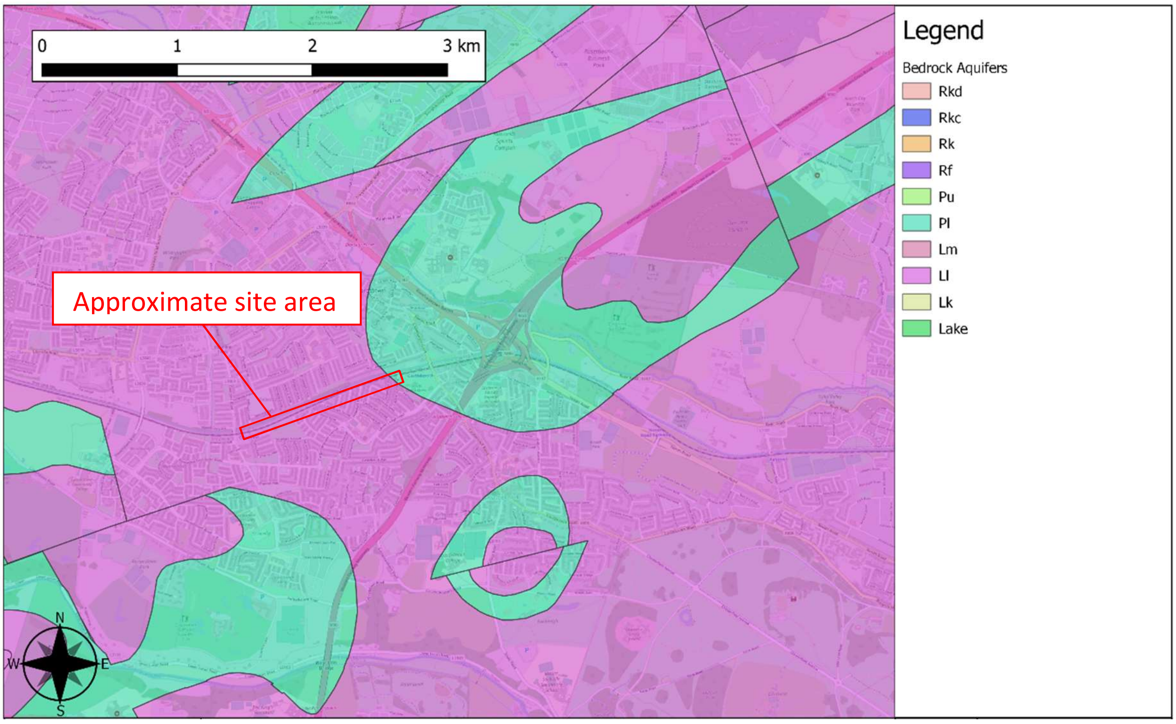

Figure 2-8: Bedrock aquifers (GSI data, 2020)

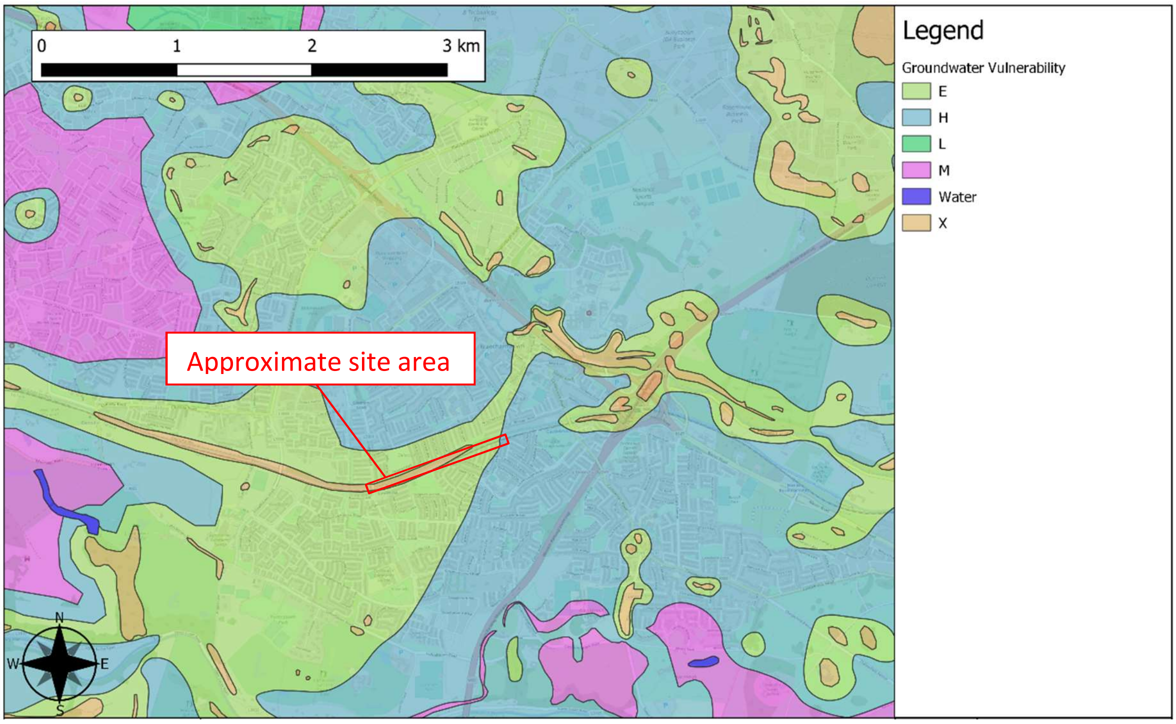

Figure 2-9 Groundwater vulnerability (GSI data, 2020)

3 GDG site walkover

3.1 Walkover details

A site visit was carried out by two geotechnical engineers from GDG on the morning of Thursday 20th February 2020. The duration of the site walkover was approximately two hours. On the day of the site visit, the weather conditions consisted of clear skies, with low winds and no precipitation throughout the walkover. It had been raining the previous day (19th February 2020) with much of the ground surface and rock faces noted to be wet, including puddles along the existing towpath.

The purpose of the site walkover was to gain an appreciation for the condition of the existing towpath corridor including:

- The path width,
- The slope gradient between the towpath and the canal,
- The ground conditions,
- The proximity to the railway line, and
- Any retaining structures supporting the railway line.

The site walkover started from the Coolmine Train Station and proceeded eastwards along the existing towpath on the southern bank of the Royal Canal. The walkover along the southern bank traversed the full length of the subject section of the greenway as shown in Figure 2-2. In addition, the walkover was progressed along the northern bank of the canal for approximately 200m starting from Coolmine Road. All chainages quoted in the following sections are distance eastwards from the centreline of the Kirkpatrick Bridge.

3.2 Towpath corridor

The existing towpath is located along the southern bank of the Royal Canal and along the northern boundary to the Dublin-Sligo railway line. The width of the towpath at path level is typically 2.0m to 2.5m wide with local pinch points as low as 1.3m. The towpath widens out to 9.5m between chainage Ch.900 and Ch.1100 and maintains this width as it approaches the Castleknock Train Station.

The towpath was observed to be approximately 1.3m wide with evidence of an unbound gravel surfacing along the initial 800m starting from the Kirkpatrick bridge as shown in Figure 3-1 and Figure 3-2. The remainder of the path was observed as a well-worn mud path of varying widths as illustrated by Figure 3-3 and Figure 3-4.

Figure 3-1: Existing track condition at the Kirkpatrick bridge (looking eastwards)

Figure 3-2: Existing track condition at an approximate chainage of Ch.150 (looking eastwards)

Figure 3-3: Existing track condition at an approximate chainage of Ch.850 (looking eastwards)

Figure 3-4: Existing track condition at an approximate chainage of Ch.1200 (looking westwards)

Vegetated verges were noted to be present along the full length of the site. The flora varied in size from grassy areas to mature trees. Mature tree roots were observed along the canal banks occasionally crossing the towpath as shown in Figure 3-5. Along a particularly narrow stretch of the towpath, measured to be 1.3m, a steel rail covered in vegetation (Figure 3-6) was noted with the apex of the rail approximately 0.1m above the path. The original purpose of this rail was unknown at the time of the site walkover. It was assumed that this rail was installed to either act as an edge warning system, or to retain the edge of the path as the ground appeared to be eroding beneath the rail.

Figure 3-5: Mature tree roots crossing the towpath

Figure 3-6: Metal rail along a narrow stretch of towpath (<1.3m wide)

Cross-sections were developed from the topographic information received to date as shown in Figure 3-7, Figure 3-8 and Figure 3-9. A steep slope with an inclination of 50° to 70° was observed between the towpath and the canal along the initial 600m from the Kirkpatrick bridge as illustrated in Figure 3-7. This steep slope was estimated to be between 2.5m and 6.0m in height. The slope between the towpath and canal was noted to have an inclination of less than 45° and height less than 2.0m along the remainder of the site as illustrated Figure 3-8 and Figure 3-9.

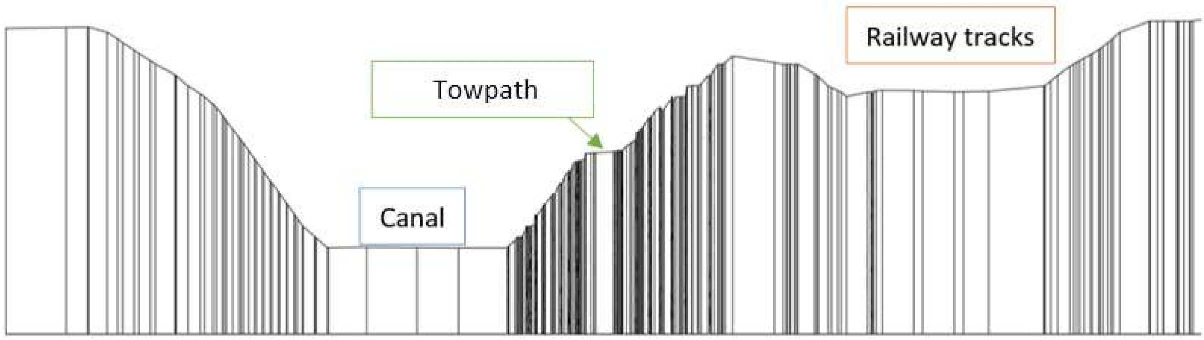

Figure 3-7: Existing cross-section at Ch.325

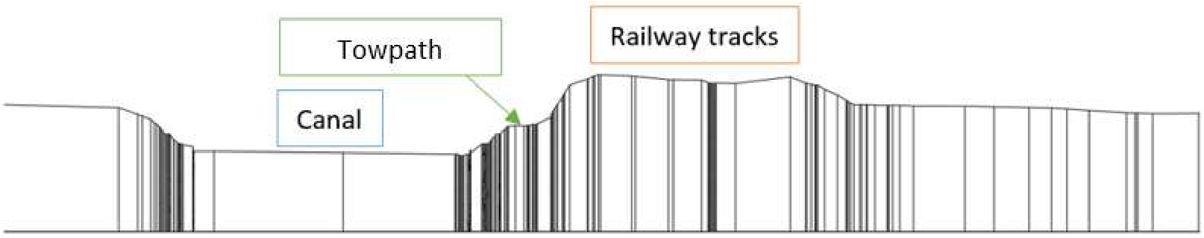

Figure 3-8: Existing cross-section at Ch.825

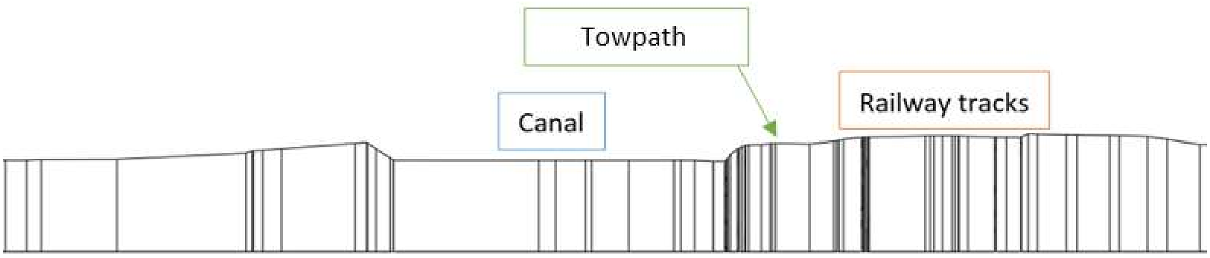

Figure 3-9: Existing cross-section at Ch.1250

3.3 Ground conditions

The ground conditions beneath the existing towpath appeared to vary across the site. Between the approximate chainages Ch.0 and Ch.600, the towpath appeared to be founded on a shallow depth of glacial till overlying competent rock. Rock outcrops were observed along the northern bank (Figure 3-10) between these chainages. The southern bank was also observed to have an exposed rock face typically at the base of the canal slope beneath the towpath (Figure 3-11 and Figure 3-12). The exposed rock face was observed to be higher along the southern bank than the adjacent northern bank, suggesting that the rock dips in a northerly direction.

Figure 3-10: Northern bank adjacent to Kirkpatrick bridge

Figure 3-11: Southern bank adjacent to Kirkpatrick bridge (Ch.0)

Figure 3-12: Exposed rock face along the southern bank (approximately Ch.200)

A stone masonry wall was exposed intermittently between vegetation along Ch.50 to Ch.150 as shown in Figure 3-13. At the time of writing, it was unknown when this wall was constructed, how far rock is located to the rear of this wall, or whether similar walls exist further down chainage as access along the northern bank was limited. This wall appears to support overburden material beneath the existing towpath.

Figure 3-13: Stone masonry wall facing along the southern bank between Ch.50 and Ch.150

Above the rock and stone wall, a shallow depth of heavily vegetated glacial till was noted along both the northern and southern banks of the canal. The inclination of the glacial till slopes appeared to be in excess of 45°. Mature trees were observed along both banks of the canal as shown in Figure 3-14.

Figure 3-14: Presence of heavily vegetated overburden along the southern embankment

An apparent overburden slip failure was observed along the northern bank at an approximate chainage of Ch.265 as shown in Figure 3-15. Vegetation was observed to be growing over the face of the slip plane and no material was noted to be accumulated at the base of the slip. These indicators suggest the slip did not occur recently. There was no evidence of large slip failures along the southern embankment from the towpath. However, small natural drainage trenches, 0.3m wide by 0.2m deep, had eroded into the bank (Figure 3-16) where rainwater would flow from the railway line and/or towpath into the canal.

Figure 3-15: Apparent slip failure in the northern embankment

Figure 3-16: Natural drainage trench in the canal bank

3.4 Dublin-Sligo railway line

Irish Rail owns and operates Dublin-Sligo railway line which is present along the full extent of the southern boundary to the site. Coolmine Station is located immediately south of the access track adjacent to the Kirkpatrick Bridge. A pedestrian over-bridge is located between the two Coolmine Station platforms, with the northern support column (Figure 3-17) constructed within 1m of the station boundary fence. At the time of writing, the foundation details of the pedestrian bridge were unknown.

The railway track level is between 0.5m and 3.75m higher than the towpath, with the greatest level difference observed along the western half of the study area. The increase in level between the towpath and the railway track is due to an apparent man-made embankment. Evidence of a historic stone masonry wall in the lower half of the embankment was observed at various locations along the initial 200m extending from the Kirkpatrick bridge as shown in Figure 3-18 and Figure 3-19. This wall was inclined at approximately 60° to the horizontal. The stone wall was in a poor condition, as the blocks appeared to be loosened with soil between the blocks in place of mortar. The wall was also heavily overgrown by vegetation, and the roots from this vegetation were observed to intrude the gaps between stone blocks. From the site observations, it is likely that this wall is acting less like a retaining wall and is more likely contributing dead weight at the base of the slope to maintain the stability of the slope alongside the mature vegetation.

Further down chainage, another stone masonry wall (Figure 3-20) was noted to retain the railway track embankment, however, this wall had a near vertical orientation. The stone retaining wall was noted to be in better condition than the wall adjacent to the Coolmine Train Station. The mortar between rock blocks was present and the facing was relatively even. However, the wall was observed to be overturning in the direction of the towpath and previous efforts including retrofitted concrete buttresses to rectify this instability were evident in the area. At the time of writing, it was unknown when these remediation works were implemented. The foundation of this wall and/or the buttresses was not exposed during the site walkover and, as such, no commentary could be made in relation to the wall foundations.

Figure 3-17: Pedestrian bridge traversing Dublin-Sligo railway line at Coolmine Train Station

Figure 3-18: Apparent masonry retaining wall supporting Coolmine Train Station Platform 1

Figure 3-19: Apparent masonry retaining wall supporting Dublin-Sligo railway line

Figure 3-20: Retrofitted buttresses to support stone masonry retaining wall support railway line

4 Ground Investigation

A ground investigation was undertaken by Ground Investigations Ireland Ltd between February and June, 2020. The works comprised of the following:

- 79 No. total exploratory holes including:
    - 47 No. Slit trenches with seven (ST42 to ST48) completed along the subject section of greenway,
    - 11 No. hand diamond drilled cores with seven (RC01, RC03, RC04, RC07, RC09, RC11, RC13, RC15, RC17, RC20 and RC22) all completed along the subject section of greenway,
    - 3 No. rotary cored boreholes (RC18, RC24 and RC28) all completed along the subject section of greenway, and
    - 18 No angled rotary core boreholes (RC02, RC05, RC06, RC08, RC08A, RC12, RC14, RC16, RC19 and RCH01 to RCH09) all completed along the subject section of greenway from a barge on the Canal.
- Plate load testing and TRL probe testing,
- A geophysical survey completed by Apex Geophysics along the subject section of greenway and
- A suite of geotechnical and environmental laboratory testing carried out on selected disturbed and undisturbed samples from the exploratory holes.

Full details of the procedures implemented, as well as results of the field and laboratory work, are contained within the relevant GIR ''*GI Report – Royal Canal Urban Greenway 31-07-20 Rev B*".

4.1 Soil and rock descriptions

Soils at the site location can generally be described as Topsoil/Surfacing overlying Made Ground overlying Cohesive Glacial Till. Granular deposits were encountered underlying the Cohesive Glacial Till in rotary core RC24. Bedrock was encountered during rotary coring between Coolmine and Castleknock Station on the northern and southern banks of the canal. The bedrock was recovered from the angled rotary cored boreholes typically as weak to strong LIMESTONE.

4.1.1 Topsoil/Surfacing

The ground conditions at the existing ground level along the subject section of greenway consisted of either Topsoil, Tarmacadam or Gavel Surfacing. Topsoil was generally described as dark brown/brown slightly sandy gravelly CLAY with the depth varying from 0.1m to 0.2m BGL. Tarmacadam was encountered in ST42, on the existing paved sections to a depth of 0.06m and 0.12m BGL. Gravel surfacing was described as angular to subangular fine to course sandy Gravel with depths between 0.1m and 0.19m BGL placed on top of a geotextile separator layer.

4.1.2 Made Ground

Made Ground deposits were encountered beneath the Topsoil/Surfacing in the majority of the slit trenches. Made Ground was typically present between 0.2m BGL and 0.6m BGL with a maximum depth of 1.4 m BGL. These deposits were described as dark brown/brown slightly sandy gravelly CLAY or occasionally as a grey sandy angular fine to coarse GRAVEL. Occasional cobble and boulder content was noted on the exploratory hole logs. In several slit trenches, the made ground contained waste materials including fragments of concrete, red brick, glass, ceramic, wood and plastic.

According to geophysical investigation prepared by Apex Geophysics in 2020, the Made Ground has low to medium strength. These deposits might require reinforcement to install a working platform where required.

4.1.3 Cohesive Glacial Till

Cohesive Glacial Tills were encountered beneath Made Ground and were generally described as brown/greyish slightly sandy gravelly CLAY. The gravel was described as angular to subrounded fine to coarse. Deposits occasionally contain angular to subrounded cobbles and boulders. The Cohesive Glacial Tills were present at depths ranging between 1.5m and 17.2 m BGL. Based on SPT N values which vary from 8 to 29 and a maximum 50, the Cohesive Glacial Tills are anticipated to have medium strength increasing to high strength with depth. The strength of the deposit should be sufficient for a working platform installation.

4.1.4 Granular deposits

Granular deposits were encountered within rotary borehole RC24 only underlying the Cohesive Glacial Tills and were described as grey brown clayey gravelly fine to coarse SAND or sandy fine to coarse GRAVEL. There was limited recovery of these materials from the rotary cored holes between depths of 8.2m and 23.2m BGL. Based on the SPT N values from RC24 which various from 25 to 50 the deposits are typically dense to very dense.

4.1.5 Rock

Rock was generally recovered in the angled rotary cored boreholes as weak to strong grey/dark grey fine to medium grained LIMESTONE with calcite veins. According to a geophysical survey, along the Coolmine and Castleknock Stations the depth to rock is generally shallow but varies at depths of between 0.5 and 3.5m BGL with an average of 1.0m BGL.

It was noted that rotary coring towards Castleknock Station at the eastern end of the subject section (RC16, RCH09 and RC19) did not encounter rock nor was rock recovered from RC06 and RCH04.This was confirmed in RC24 and RC28 that drilled vertically from the towpath to depths of 23.20m and 17.20 BGL respectively without encountering rock. At the location of RCH04 and RC06 rock was also not encountered and this has been interpreted as being a possible fault zone.

4.2 Stratigraphic models

Long-sections of the exploratory hole logs along the subject section of greenway are presented in Figure 4-2 to Figure 4-6 inclusive, showing the elevations and thicknesses of the strata encountered. The sequence and type of geological strata identified in the GII ground investigation is summarised in Table 4-1 and Table 4-2 below, starting with the most recent deposits

Table 4-1: Stratigraphic summary eastern side of subject section

Material Name	Typical Description	Thickness (m)*		Depth to top (m BGL)
		Min.	Max.	
Topsoil	dark brown/brown slightly sandy gravelly	0.1	1.3	0
Made Ground				
Clay	dark brown/brown slightly sandy gravelly CLAY	0.12	1.2	0.2
Gravel	grey sandy angular fine to coarse GRAVEL	0.15	1	
Glacial Deposits				
Cohesive Glacial Till	brown/greyish slightly sandy gravelly CLAY	0.0	15	0.6
Granular Deposits	Grey brown clayey gravelly fine to coarse SAND or sandy fine to coarse GRAVEL	0.3	15	8.2
BEDROCK	N/A	N/A		

Table 4-2: Stratigraphic summary western side (near Kirkpatrick bridge) of subject section

Material Name	Typical Description	Thickness (m)*		Depth to top (m BGL)
		Min.	Max.	
Topsoil	dark brown/brown slightly sandy gravelly	0.1	1.3	0
Made Ground				
Clay	dark brown/brown slightly sandy gravelly CLAY	0.12	1.2	0.2
Gravel	grey sandy angular fine to coarse GRAVEL	0.15	1	
Glacial Deposits				
Cohesive Glacial Till	brown/greyish slightly sandy gravelly CLAY	0.1	1.3	0.6
BEDROCK	Weak to strong grey/dark grey fine to medium grained LIMESTONE with calcite veins	Unproven		1.5

4.3 Groundwater conditions

Groundwater strikes were recorded where encountered during slit trenching operations, typically as a slow seepage. Water strikes were encountered along the subject section in holes ST45, ST46, ST48 and ST49 generally between 0.9m to 1.5m BGL. A minimum groundwater level of 1.0m BGL is recommended for the detailed design.

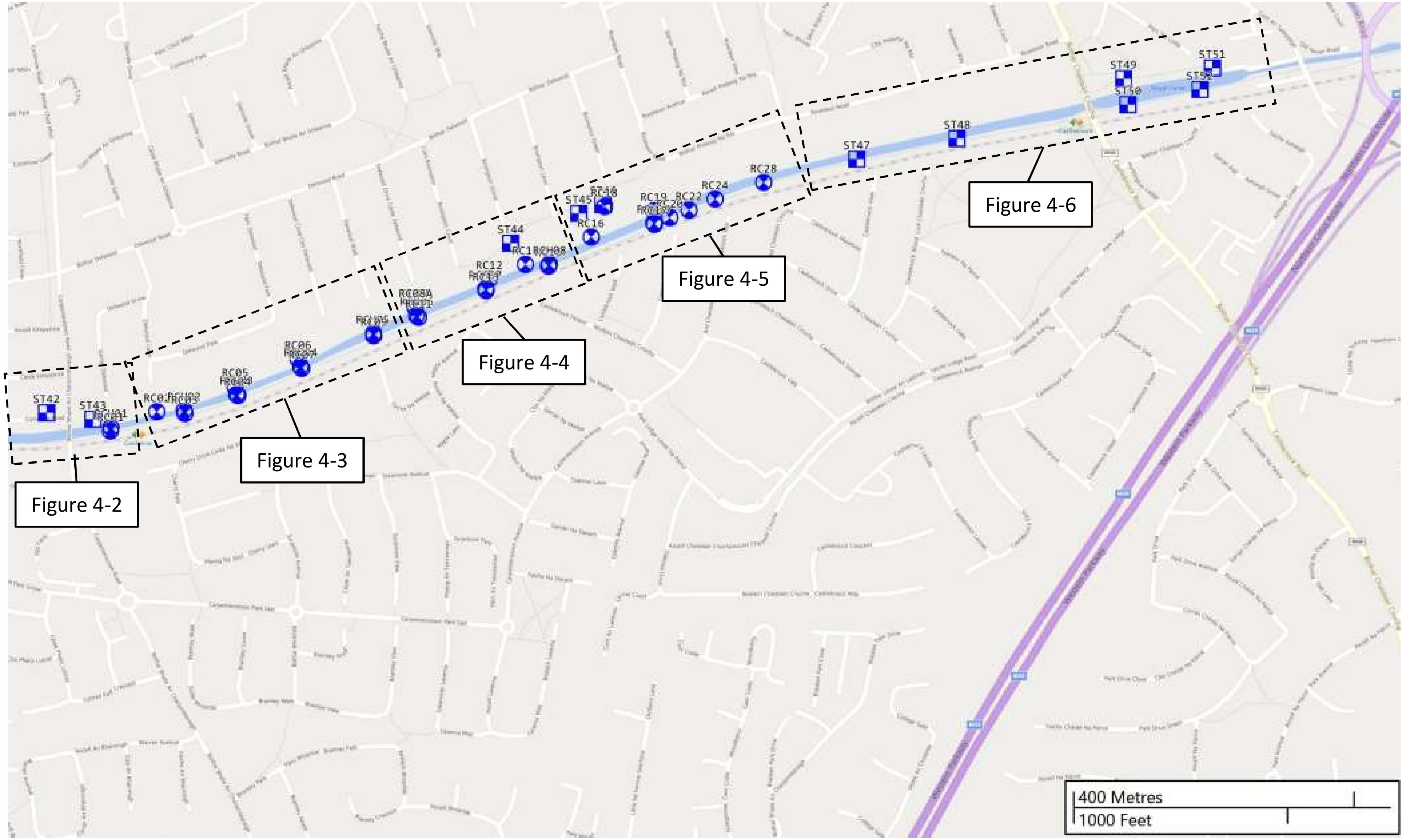

Figure 4-1: Plan of exploratory holes completed by Ground Investigations Ireland (2020)

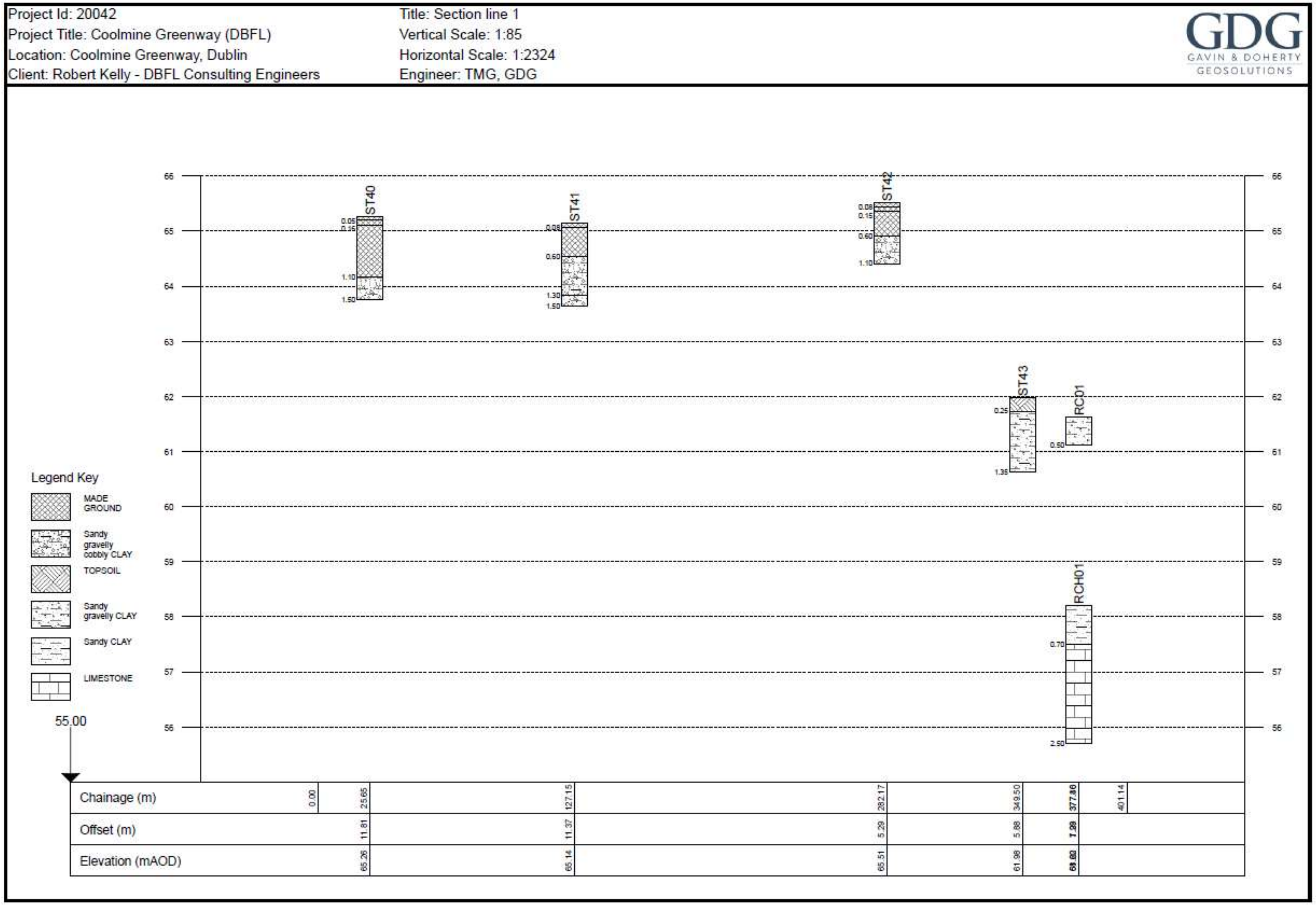

Figure 4-2: GI long-section 1 – ST40 to ST43, RC01 and RCH01

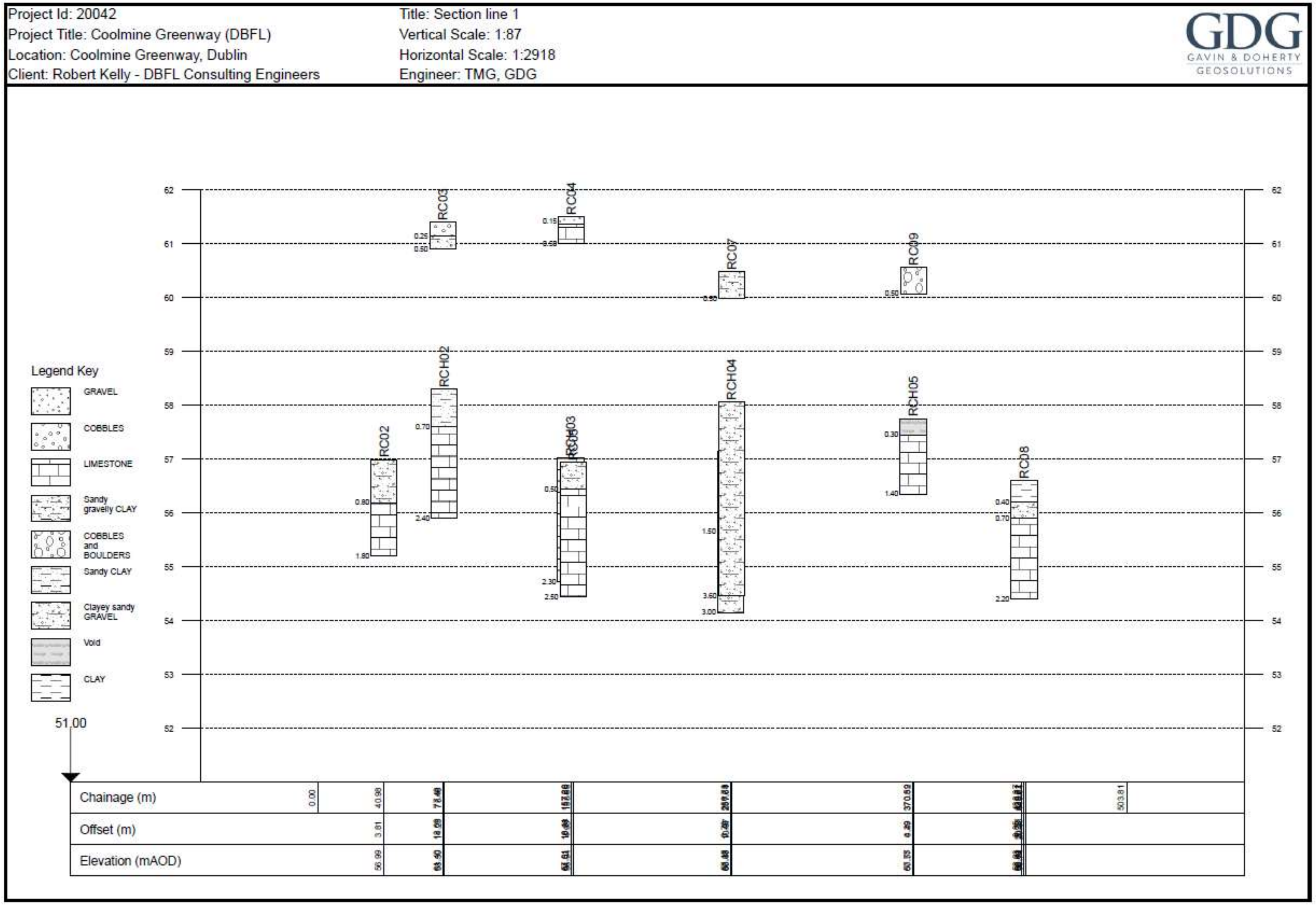

Figure 4-3: GI long-section 2 – RC2 to RC5, RC6, RC7, RC9 and RCH02 to RCH05

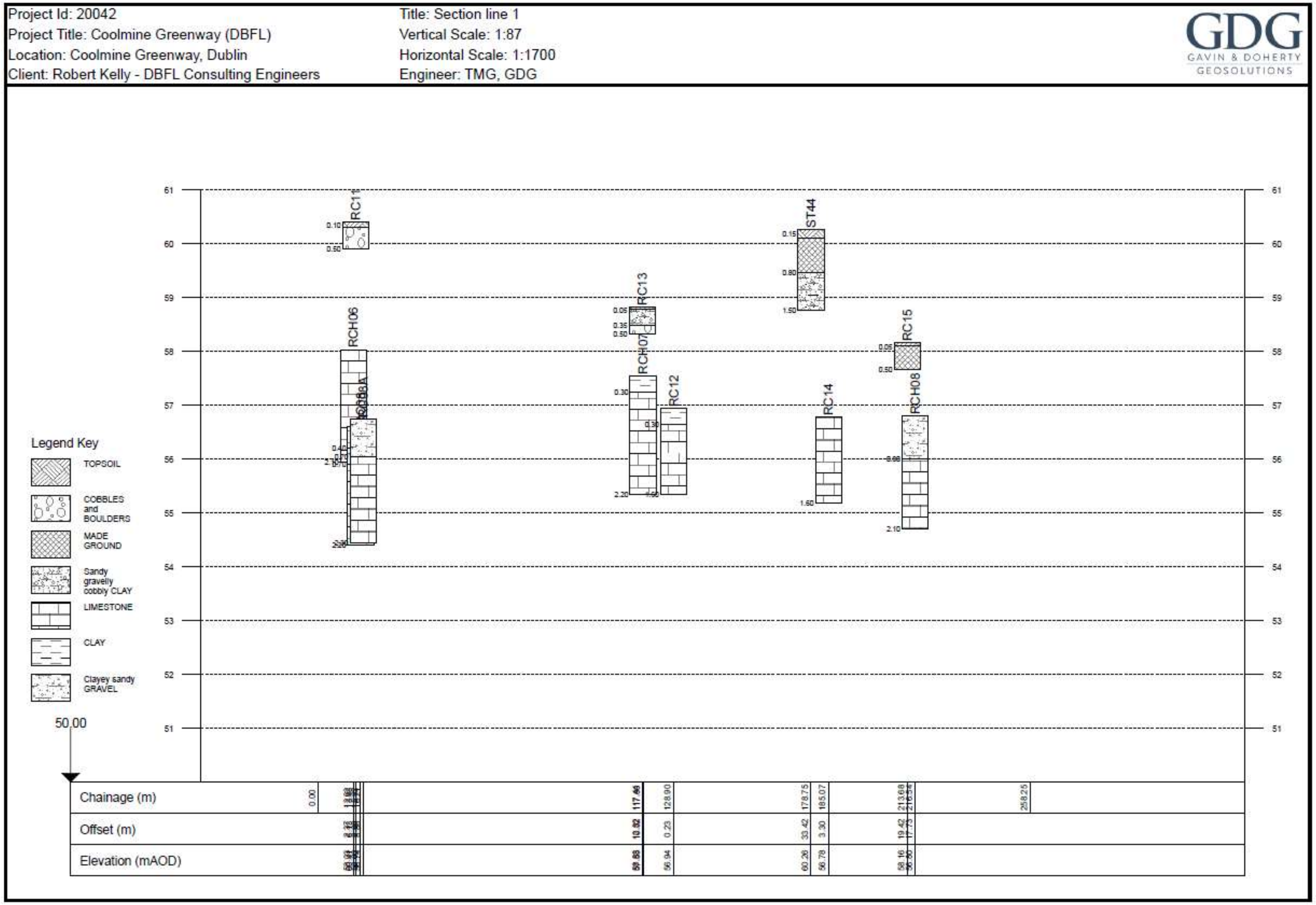

Figure 4-4: GI long-section 3 – ST44, RC08, RC08a, RC11 to RC15 and RCH06 to RCH08

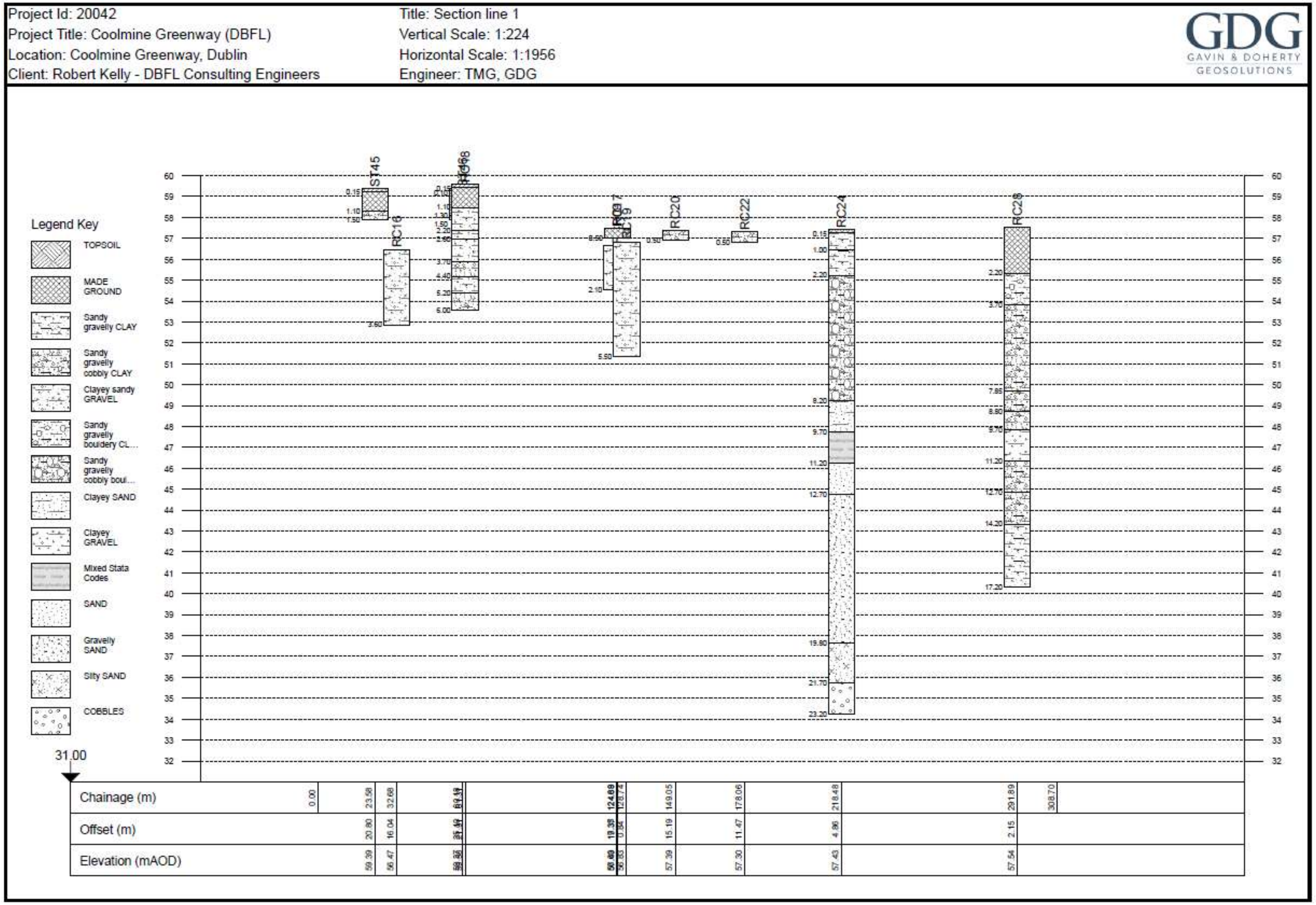

Figure 4-5: GI long-section 4 – ST45, ST46, RC16 to RC20, RC22, RC24, RC28 and RCH09

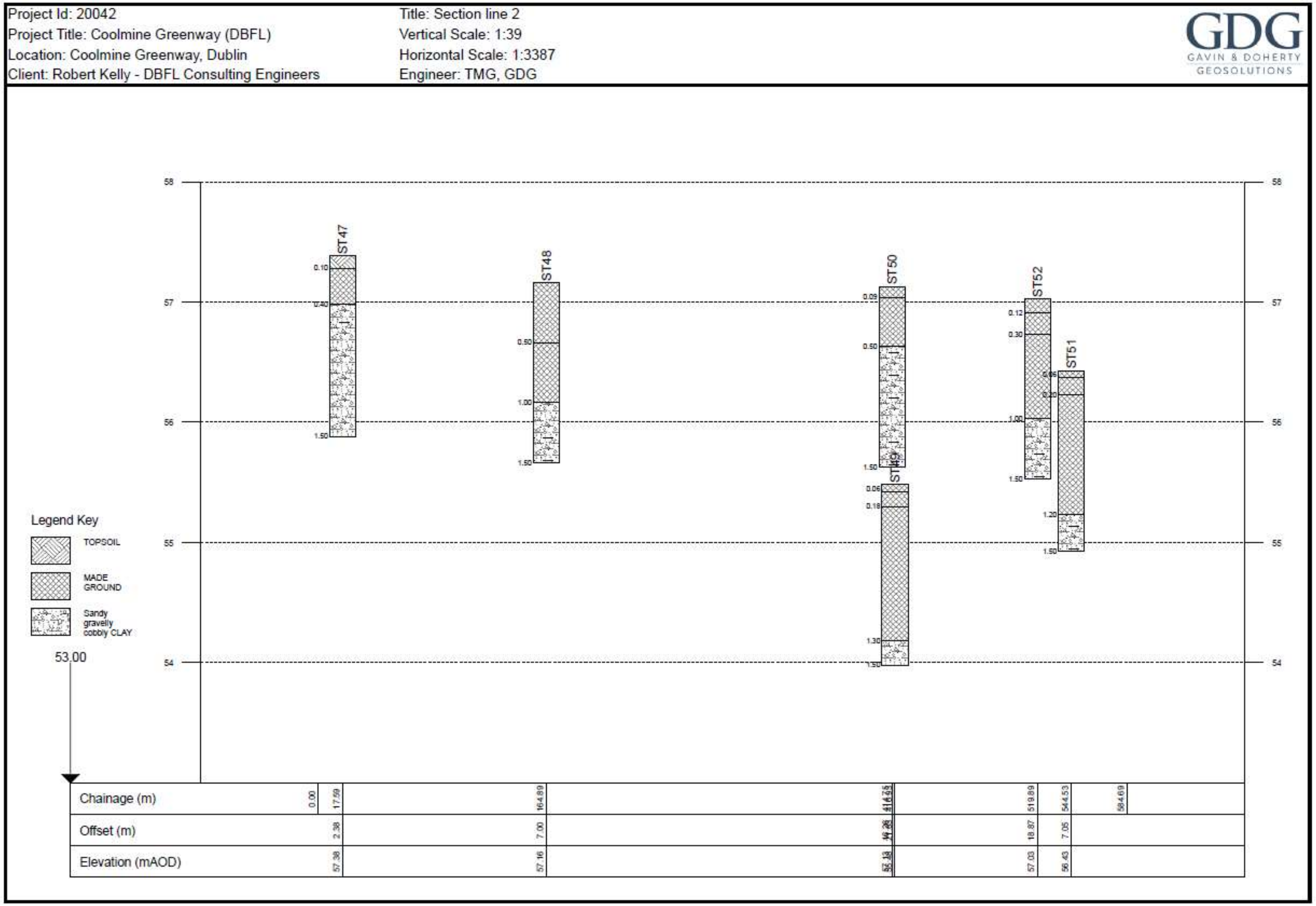

Figure 4-6: GI long-section 5 – ST47 to ST52

5 Proposed construction

5.1 Initial DBFL proposal

DBFL has proposed three separate solutions to upgrade the Royal Canal Urban Greenway along the Royal Canal's southern bank between the Coolmine Train Station and the Castleknock Train Station. The three solutions were termed Option A, Option B and Option C and have been reproduced from DBFL's 18FG01_Cantilever-Sketches rev. document in Figure 5-1, Figure 5-2 and Figure 5-3 respectively. The three options are described as follows:

- Option A – Cantilever boardwalk with planted strip between the boardwalk and retaining wall;
- Option B – Cantilever boardwalk with retaining wall adjacent; and
- Option C – Cantilever boardwalk elevated on precast anchored wall.

All three of the DBFL solutions proposed widening the greenway path to a width of 4.0m using structural concrete units that extend over the Canal, with concrete propping beneath the overhanging section of the new path. It was proposed to include a suitable balustrade as edge protection along the path edge adjacent to the canal.

Both Option A and Option B included an embedded retaining wall installed between the proposed boardwalk and the existing Dublin-Sligo railway line. The retaining wall was to be embedded within the underlying rock with no lateral support proposed along the retained height and an IR approved safety fence installed at the top of the retaining wall. Option A proposed installing the retaining wall tight to the boundary with the boundary of the railway line, with the material in front of the wall to be excavated and planted with native trees as shown in Figure 5-1. Option B proposed installing the retaining wall near the southern edge of the existing towpath, with the retained ground to be backfilled and planted with native trees as shown in Figure 5-2.

Figure 5-1: DBFL Option A proposal

Figure 5-2: DBFL Option B proposal

Option C proposed installing vertical rock anchors with precast modular units with a “cut stone look front face” and the proposed boardwalk installed on top of these anchors, although it appeared that the modular blocks will apply bearing loads to the in-situ soil and rock materials. The slope to the rear of the modular units is to be backfilled with a suitable engineered fill. Concrete upstand walls were proposed along the southern edge of the boardwalk to retain a planting bed including native trees and various other vegetation. Between this planting bed and the railway, DBFL proposed a wall to support the IR approved safety fence and allow the ground between this wall and the railway line to be regraded as required.

Figure 5-3: DBFL Option C proposal

5.2 Progressed DBFL proposal

The DBFL progressed proposal appears to be a rationalisation of Option A. DBFL proposed to reduce the surcharge loads of the platform, use piled foundations in place of shallow foundations and replace the embedded retaining wall with either a stabilised soil slope or remediating the existing masonry retaining walls. DBFL has proposed three platform layouts to address the varying ground conditions across the study area. All of the platform layouts include a lightweight boardwalk consisting of a steel platform with a suitable balustrade as edge protection along the path edge adjacent to the canal. This lightweight platform is proposed to be the same width as the initial boardwalk proposal at 4.0m but would reduce the loads to be supported by the in-situ soil and rock materials. The difference in the layouts is the foundation details and the remediation of the slope and masonry retaining walls between the proposed greenway path and the Dublin-Sligo railway line.

The first layout proposal was to be installed where the towpath is underlain by competent rock typically encountered on the western end of the proposed greenway from chainage Ch.0 to Ch.725. For these sections, the boardwalk will be fixed to the slope by either steel anchors or reinforced concrete (RC) mini-piles with a lightweight steel prop to support the span extending beyond the existing towpath. The steel anchors/RC mini-piles are proposed to be embedded in competent rock, which would allow the loads from the platform to be transferred directly into the underlying rock. The platform could also be floated above the existing towpath. This would result in minimal alterations to the existing slope and thus any adverse effects to the stability of the slope would be negligible. On the land-side of the greenway path, it was proposed to install a non-structural greening fence whilst the slope may require localised devegetation and a geocell anti-erosion matt is to be laid and seeded, to support the assumed shallow overburden. The proposed layout for the rock sections is reproduced in Figure 5-4.

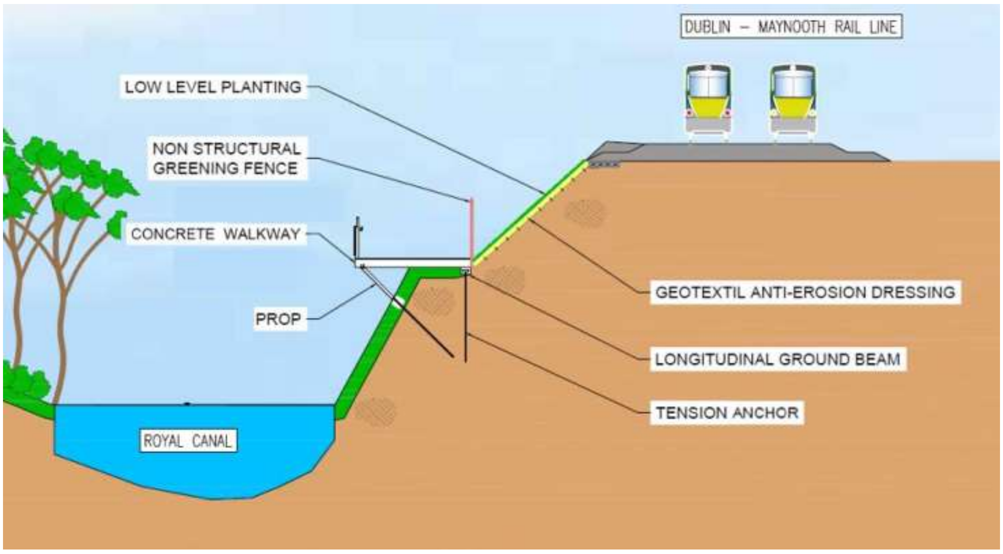

Figure 5-4: DBFL proposal for path founded on shallow rock

The second layout proposal was to be installed where the towpath is underlain by glacial till between chainages Ch.725 to Ch.925. For these sections, it was proposed to install two lines of ODEX piles or steel anchors through the overburden beneath the existing towpath or within the canal depending on the available towpath and embedded into the bedrock. The remainder of the boardwalk will cantilever above the canal water. As with the rock sections, the platform could be floated above the existing towpath resulting in minimal alterations to the existing slope and thus any adverse effects to the stability of the slope would be negligible. As part of this layout, it is proposed to remediate the existing masonry retaining wall located adjacent to the railway line where encountered. The remediation solution includes a structural facing with tie-back anchors installed beneath the railway line. The proposed layout for the glacial till sections is reproduced in Figure 5-5.

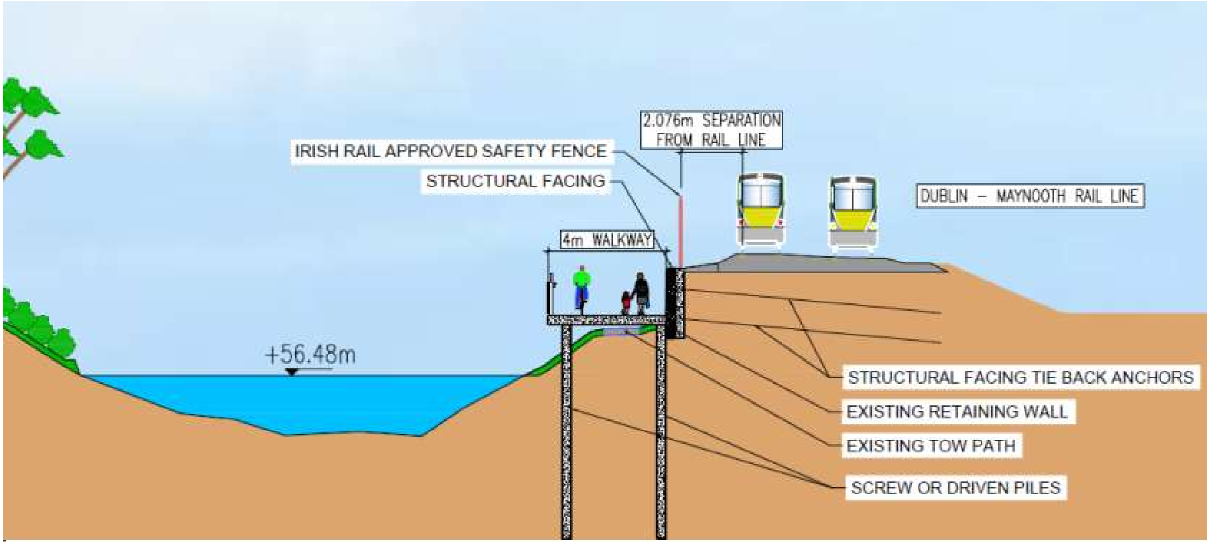

Figure 5-5: DBFL proposal for till section

6 Feasibility and constraints

6.1 General site constraints

Due to the proposed location of the site, there are several general constraints that would apply to any construction works to completed along the southern bank of the Royal Canal. The following sections detail the general constraints to construction on the site.

6.1.1 Access to site from land-side

The steep topographical nature of the site between an existing canal and live railway line will result in constraints to any proposed solution. The proximity to the railway line would pose significant challenges for the access and egress of suitable construction plant to the proposed works area from the land-side of the greenway.

For any proposed solution, construction plant would be directly adjacent to the Dublin-Sligo railway line if accessing the site from the land-side. As previously discussed in Section 2.1, trains travel along the route in both directions typically every 20mins to 40mins between 06:00hrs and 00:00hrs Monday to Saturday and between 09:00hrs to 00:00hrs on Sundays.

IR has produced guidance documentation in relation to works adjacent to live railway lines, including the "*CCE Departmental and Multidisciplinary Standard: I-DEP-0121 Third Party Works: Additional Details of Railway Safety Requirements*". Appendix C.7 of this document defines the requirements of "*Green Zone Working*" and "*Red Zone Working*". An extract of Appendix C.7 is provided in Figure 6-1.

C.7 Other Protection Arrangements: Green and Red Zones

C.7.1 IÉ distinguishes two types of worksites: green zone and red zone. Different arrangements apply in each case. These are determined by IÉ during the approvals process and set out in the method statement(s) prepared by the third party.

C.7.2 *Green Zone Working*

1. A Green Zone is where work is arranged to take place without any third party personnel going on or near any line or siding, including one in a Possession, on which trains (or movements) may pass.
2. A Green Zone exists where the worksite is safeguarded by:
   - stopping of trains on all lines, or
   - being separated from the nearest line open to trains, by a distance of at least 3 metres, or
   - being fenced from the nearest line open to trains where one or more lines remain open to trains.
3. Third party personnel present or working in the vicinity of the track must be accompanied by the RPR who is responsible for implementing the appropriate safe system of work regarding railway protection. No works should begin unless the RPR gives permission to proceed.

C.7.3 *Red Zone Working*

1. If any work cannot reasonably be carried out under Green Zone protection, it may be possible in certain circumstances to work within 3 metres of the nearest track open to rail operations. This is termed Red Zone working and is allowed only when:
   - absolutely necessary and it is not practical to arrange a Green Zone, and
   - protection can be provided to give sufficient warning of all trains approaching on the line(s) concerned.
2. Where this protection is in place, an RPR is responsible for implementing and maintaining the arrangements.
3. IÉ provides personnel to implement protection during the course of the works in a Red Zone.
4. No works should begin unless an RPR is present and gives permission to proceed.

Figure 6-1: Extract from Appendix C.7 of IR's *CCE Departmental and Multidisciplinary Standard: I-DEP-0121*

To qualify for a green zone working a minimum way leave of 3m is to be provided from the nearest track with suitable fencing installed at this location to separate the construction works from the live railway lines. This way leave would result in a proposed working platform extending beyond the slope edge or in rare cases up against the crest of the slope. A sketch illustrating a minimum 5.0m working platform beyond a 3.0m way leave adjacent to the railway line is provided in Appendix A to this document, an extract of this sketch is provided in Figure 6-2, with the red hatched section indicating the minimum way leave and the yellow area illustrating 5m wide working platform. The sketch demonstrates that a working platform is not feasible in this area.

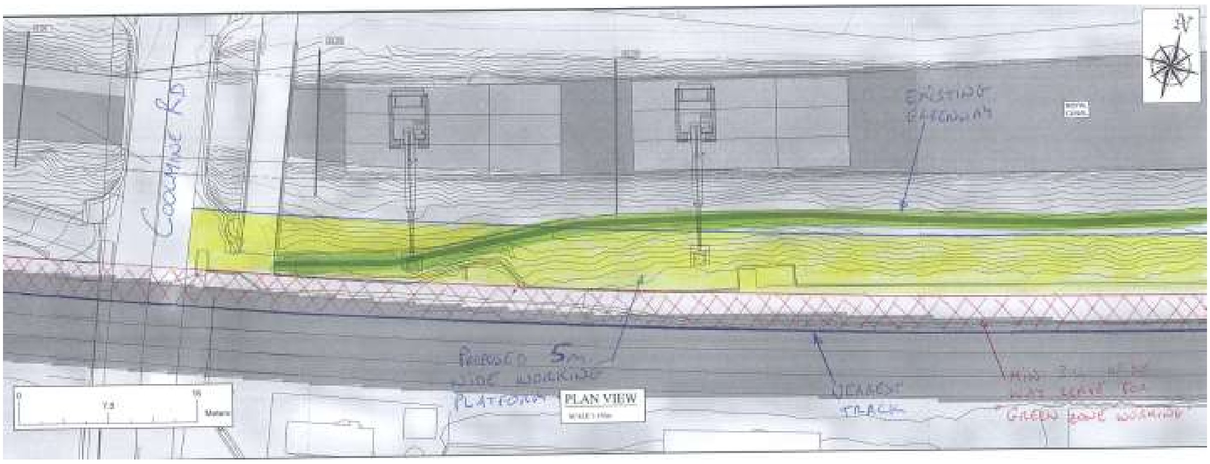

Figure 6-2: Extract from GDG sketch of 5m wide working platform in "green zone"

If the northern line of the Dublin-Sligo railway were to be closed between Coolmine Train Station and Castleknock Train Station, the working platform edge would move further south towards the slope crest. However, working space remains an issue at the western end of the site, where the Coolmine Train Station currently sits, and the risk of instability of the working platform would be a major concern. In addition, it is believed that IR would not permit the working platform to be constructed over the existing train platform at Coolmine Station or over the existing rail lines. In addition, the existing train platform is unlikely to have been designed to support the loads of larger construction plant, such as piling rigs, which can impose surcharge loads in excess of 150kPa. IR would object to plant traversing the platform as there would be a risk of damage to their infrastructure.

If working in the red zone, within 3m of the nearest track, a Railway Protection Representative (RPR) would have to be present at all times throughout the construction works. The RPR would dictate when works would be permitted alongside the live railway line. Based on the frequency of trains passing between Coolmine Train Station and Castleknock, it is unlikely that works would be able to progress as plant would have to mobilise to and set up at the required locations, before installation of piles or anchors. This would likely result in an extensive construction programme with a significant risk of delays.

IR may be willing to allow a contractor to take possession of the railway line for night works between 00:00hrs and 05:00hrs. It is understood that the Environmental Report for the project is under development, and it is our opinion that it is highly unlikely that percussive drilling into rock would be permitted outside normal working hours by the Planning Authority.

6.1.2 Access to site from the canal

For access from the canal side, construction plant would have to be situated within the canal channel and reach up to the proposed level of the greenway path. For the plant to work within the canal, we would anticipate two potential solutions:

1. Placing the construction plant on a barge from which to work; or
2. Create a safe working platform within the canal from which to work.

For the first of these solutions, there would be a constraint on the size of the barge. Floating pontoons are typically in excess of 7.5m wide and 1.2m deep, whilst jack-up barges are too large to be facilitated within the canal. There are a number of pinch points, particularly along the western half of the site along the canal, where the width is less than 8.5m wide which will likely not have sufficient draught depth to allow the barge to pass, as illustrated in Figure 6-3.

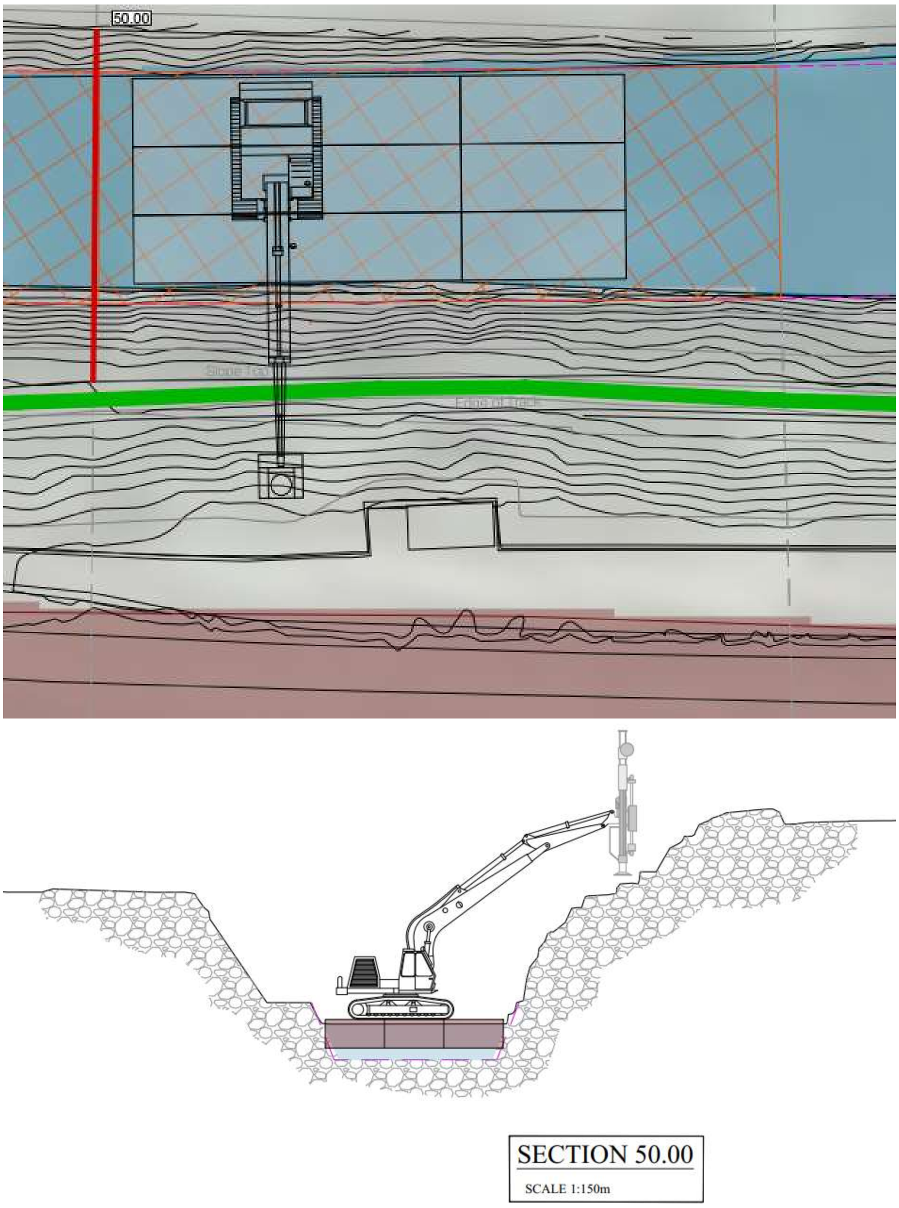

Figure 6-3: pinch point along the canal at Ch.50

A 7.5m wide barge could be used along the eastern half of the site and could ferry plant and materials to and from a granular platform if built up along the western end of the embankment. Alternatively, a bespoke barge with a narrower width could be used if available and a sufficient Risk Assessment and Method Statement were to be provided by the contractor.

For the second solution, suitably large concrete pipes would have to be laid along the canal floor to allow water flow beneath the platform. A Class 6A granular fill would then be placed around and over these pipes to create a working platform above water level from which to work. The width of the working platform would likely have to extend across the full width of the canal to allow sufficient working space. An illustration of the working platform is provided in Figure 6-4. The size of the pipes and the depth of the platform would be ruled by the cross-section profile of the canal.

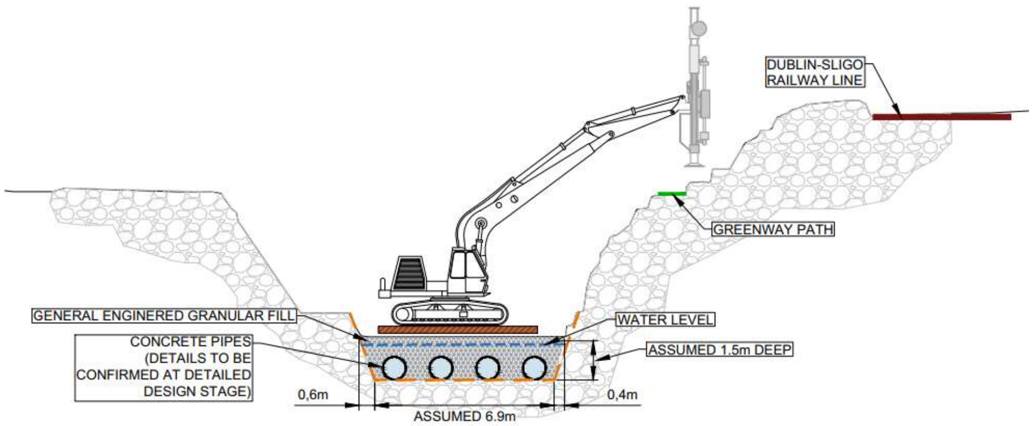

Figure 6-4: Proposal for the granular working platform within the canal

It should be noted that for either solution, the Royal Canal would have to remain closed to traffic within the canal throughout the works as the barge or working platform would likely extend across the full draught width of the canal. Liaison with Waterways Ireland will be required to obtain permission to close the canal for this prolonged period.

A risk associated with working from the canal would be the potential for debris to fall down onto the barge or the working platform. This risk could be mitigated by the implementation of a suitable safe system of works including:

- an exclusion zone beneath the slope,
- a debris capture netting, and/or
- steel cages around construction plant windows.

6.1.3 Bathymetric data

A bathymetric survey of the site was completed by Murphy Surveys Ltd (2018a) which suggests the base level of the canal is approximately 54.5m OD which results in a draught depth of approximately 2.0m. The banks of the canal beneath the water line before reaching the base level follow a similar gradient to the banks above the water line. The choice regarding the use of barges or a granular platform shall be made at the detailed design stage. Of particular concern is the loss of draught channel that would restrict the use of general canal traffic within the canal during the construction stage.

6.1.4 Vibrations and ground movements

Any works requiring the installation of piles or anchors will result in vibrations, noise and ground movements. Any structural elements are likely to be constructed upon piles or anchored foundations. By the nature of these works, vibration and noise will occur throughout the installation works.

It was assumed that the Dublin-Sligo railway line is founded on bedrock on the western end of the site, and on top of ballast underlain by overconsolidated glacial till along the eastern half of the site. These subsurface materials will likely dampen the vibrations for small to medium-sized construction plant. However, it is recommended that IR is contacted to agree suitable vibration limits and that vibration monitoring is carried out adjacent to the railway line to ensure no damage is caused to the IR infrastructure.

There is the potential for ground movements if piles and/or anchors are installed through overburden material. The movements are anticipated to be highly localised as the size of pile or anchor bores will be less than 300mm. In addition, no excavation is anticipated adjacent to any retaining walls constructed along the railway line. Thus, the magnitude of the movements beneath the railway line would be very minor (less than 1mm) as the works will likely be carried out in overconsolidated glacial tills or competent rock. As such, ground movements were anticipated to have a negligible impact on any adjacent structures, railway lines, pavements or services.

6.1.5 Buried services

Murphy Surveys Ltd. (2018b) completed a survey of the services within the site boundary and the surrounding area. The services along the subject section of the greenway included:

- Near Kirkpatrick Bridge (to the west of the subject section):
  - Underground electrical lines and overhead electrical cables.
  - Some lamps, including those along the Coolmine Station platforms, were supplied by the overhead cables.
  - Traffic lights.
  - Storm water manholes.
  - Water main pipes.
  - Telecommunication cables including Eircom lines based on records. No evidence of UPC and BT networks was found on site.
  - A gas pipeline was found going north - south within survey area.
- Between the Kirkpatrick and Granard bridges:
  - Utilities were not identified along the southern towpath between the Coolmine Station and Castleknock Station.
- Near Granard Bridge (to the east of the subject section):
  - Foul sewer and storm water networks.
  - Water pipes.
  - Underground electrical lines and overhead electrical cables.
  - Some lamps, including along the Castleknock Station platforms, were supplied by the overhead cables.

- Telecommunication cables were noted along and adjacent to the Granard bridge including Eircom lines and chambers, UPC lines and manholes and a BT line.
- Traffic lines were detected in the northern part of the survey area.
- A gas line in northern part of site.

For more details of the utility survey, reference should be made to the Murphy Surveys Ltd. (2018b) report.

6.2 DBFL initial Option A and Option B specific constraints

Figure 6-5: DBFL initial Option A (left) and Option B (right)

In addition to the general site constraints outlined in Section 6.1, there are a number of constraints specific to Option A:

A1. The proposed embedded retaining wall adjacent to the railway line would be difficult to construct in proximity to the existing railway line. For a retained height between 2m and 3m, it would be anticipated that a retaining wall between 450mm and 600mm thick would be required to support the lateral soil and groundwater pressures. A retaining wall of this size would require a medium-sized rotary bore or ODEX piling rig to embed the wall a sufficient depth (approx. 3m) into the underlying rock. A piling rig would need to be located either at the level of the proposed greenway or possibly above this level. As previously discussed in Section 6.1.1, construction plant cannot access the site from above the greenway slope. In our opinion, an embedded secant or contiguous pile retaining wall is not suitable for this site. A kingpost wall would require fewer drilling positions but would still have significant challenges to the construction of the temporary works required for the mobilisation of the required equipment. Health and safety, temporary works, cost, programme, potential for disruption to Irish Rail, noise and vibration would all be adversely affected by these options.

A2. A secondary issue related to the retaining wall is the erection of the retaining wall above ground level. If a suitable embedment could be achieved by some piling system, the wall above ground level could not be a continuation of the underlying piles. Instead, the wall above ground level would likely have to be raised by casting a new concrete wall in-situ or using precast concrete units. The use of a cast in-situ concrete wall may pose difficulties during construction but these could be overcome by suitable methodologies. Lifting and installation of precast concrete units would pose significant risks to health and safety if completed from a barge, and as such was deemed suitable only for areas where a suitable working platform can be provided.

A3. DBFL proposed the installation of engineered fill to the rear of the retaining walls in their initial Option A and Option B. Whilst the placing of fill may be possible from the canal, the compaction of fill would have to be carried out using small compaction plant such as a vibro-tamper or vibratory plate compactor. Using small compaction plant will result in shallower lift depths and a prolonged construction programme.

A4. The stability of the proposed boardwalks in DBFL's initial Option A and Option B would also be a concern when founded on shallow foundations as indicated in Figure 5-1 or Figure 5-2. The bearing resistance of the underlying glacial till the sliding resistance of the platform foundation and the global stability of the slope would have to be assessed at the detailed design stage to satisfy the relevant design codes. In particular, the global stability of the slope was a concern as natural slopes tend to approach a factor of safety of unity. Thus, adding a large surcharge load such as a concrete boardwalk may destabilise the slope.

In conclusion, it was deemed unlikely that Option A or Option B would be suitable for construction along the full extent of the proposed greenway.

6.3 DBFL initial Option C specific constraints

Figure 6-6: DBFL initial Option C

In addition to the general site constraints outlined in Section 6.1, there are a number of constraints associated with Option C:

C1. The foundation details are unclear from the sketches provided by Áit, as vertical anchors are included as shown in Figure 5-3, but the purpose of these anchors is likely to provide resistance to overturning moments from the retained soil. Similar to Option A and Option B, the stability of the proposed boardwalk in DBFL Option C would be a concern if founded on shallow foundations bearing onto glacial tills. The bearing resistance of the underlying glacial till, the sliding resistance of the platform foundation, the overturning resistance of the modular system and the global stability of the slope would have to be assessed at the detailed design stage to satisfy the relevant design codes. In particular, the global stability of the slope was a concern as the addition of precast concrete modular blocks and granular fill would add a significant surcharge load to the slope which may destabilise the slope. In addition, groundwater pressures may build up to the rear of the modular blocks which could result in additional bearing loads applied at the toe of the structure. The toe of the structure is located near the crest of the slope and as such the bearing capacity of the glacial till/rock at this location is likely to be lesser than that of the glacial till/rock at the heel of the structure.

C2. The level along the existing towpath varies across the site from 57.5m OD to 65.0m OD. The level at the top of the proposed greenway path is likely to vary in a similar manner to permit travel by both pedestrians and cyclists. To allow for this variance in both existing track level, multiple sizes of modular blocks will have to be precast and placed along the site. This could pose issues with delivery and installation of the correct block sizes across the site which may result in a prolonged construction programme.

C3. In addition, to a suitable top of greenway path gradient, a level formation would be required for the installation of modular blocks. To form the level formation some excavation would be required along the existing greenway path, although longitudinal benches could be implemented to reduce the volume of excavation. Excavation in close proximity to the railway line may pose a risk of destabilising the slope beneath the railway line. Any excavation works to create the formation for the modular blocks would have to be assessed by a suitably qualified temporary works designer.

In conclusion, it was deemed that Option C is feasible for construction. However, the installation of the anchors requires specialised access to the site, whilst the lifting and placement of the modular blocks would be challenging. In addition, the ground conditions beneath the structure would have to be reviewed particularly in relation to global stability of the slope beneath both the railway line and the proposed greenway structure.

6.4 DBFL progressed proposal specific constraints

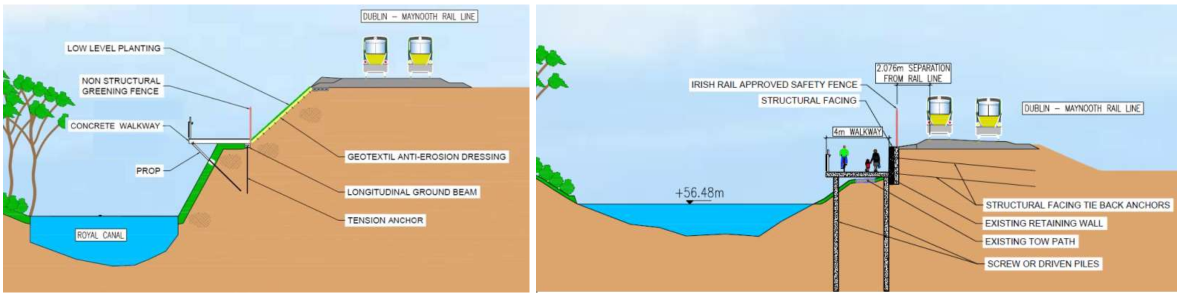

Figure 6-7: DBFL progressed proposal

In addition, to the general site constraints outlined in Section 6.1, there are constraints associated with the DBFL progressed proposal:

D1. To construct the platform, a long-reach with a rock anchor drilling head will have to be used on site. The long-reach will have to be placed within the canal on either a barge or a granular working platform as discussed in Section 6.1.2. It is recommended to use a bespoke barge between 6.5m to 7.5m where possible. The canal width is at a minimum adjacent to the Kirkpatrick bridge. It is recommended to place the long reach on the southern end of the bridge and to extend the arm over the slope to its maximum reach to install the mini-piles and anchors. The long reach should then be able to install the remaining anchors from the canal beyond this maximum reach.

D2. To install piles within the canal, as per the pinch point sections founded on glacial till the spoil from any piles will disperse into the canal water. Displacement piles are unlikely to be acceptable unless a significant depth of overburden exists above the rockhead. The piles are likely to be installed using rotary core or ODEX piling techniques, which will produce spoil. However, the pinch points were noted to be localised areas along the proposed greenway route and piling works within the canal should be minimised. Liaison with Waterways Ireland would be required to confirm that this minor volume of spoil entering the canal water channel is acceptable.

D3. The existing masonry gravity retaining wall along the eastern end of the site appears to be toppling. It was proposed by DBFL to install a structural facing to overlie the face of the existing wall without demolishing the existing wall. The structural facing would then be tied back by steel anchors beneath the railway track. Liaison with IR would be required for permission to install these anchors beneath the railway tracks. The anchors could be installed with the same rig as the steel anchors/RC mini-piles used in the rock sections and could be inclined by up to 45° to the horizontal to increase the depth of the anchors beneath the railway. It should be noted that the masonry retaining wall was observed to be toppling and as such this remediation would benefit IR if implemented.

D4. It is likely that the depth of overburden is relatively shallow, as the railway line is in close proximity to the slope crest and as such is anticipated to be constructed on competent rock. However, the shallow depth of soil along the slopes adjacent to the Coolmine Station are to be protected from erosion using a geocell anti-erosion net. Once the geocell anti-erosion mat is laid and seeded, it will act to stabilise the slope in the permanent condition and will bring the stability of the slope within the requirements of the current geotechnical design codes. To place the geocell anti-erosion net, the majority of the existing vegetation will have to be removed with the geocell to span between mature trees that are deemed to be in an acceptable condition. A tree survey was completed by Dr. Philip Blacklock, a Professional Member of the Arboricultural Association and a Registered Forestry Consultant with the Irish Forest Service, in July 2018. As part of the survey, the author commented on the condition of the mature trees designating them as one of either good, fair, poor or dead. It is recommended that trees in good condition are to be left in place and trees in fair condition can also remain but may require remediation in line with the Tree Survey Report’s recommendations. Trees in poor condition or dead are recommended to be removed from the slope. The existing mature tree roots are likely adding stability to the shallow soil, however, this benefit is difficult to quantify or to account for in geotechnical design. It is recommended that the tree roots are to remain within the slope and will thus aid the stability of the slope in the temporary condition. It is recommended that the slope is probed prior to devegetation to determine the depth to rock behind the slope face and permit an assessment of the slope stability.

In conclusion, it was deemed that the DBFL proposal is feasible, but will require some engagement with IR for permission to install anchors beneath the railway line. In addition, probing of the slope face above the greenway sections founded on rock is recommended to identify the depth to rock behind the slope face.

7 Conclusions and recommendations

Gavin and Doherty Geosolutions Ltd. (GDG) was requested by Fingal County Council (FCC) to carry out the feasibility study of constructing the proposed greenway along the Royal Canal adjacent to the Irish Rail Dublin-Sligo railway line. The subject section of greenway is located along the southern bank of the Royal Canal between the Coolmine Train Station and Castleknock Train Station, over a length of approximately 1050m extending eastwards from the Kirkpatrick Bridge. FCC intends to deliver a pedestrian and cycle route which is to be constructed along the Royal Canal from the Kildare County boundary to the Old Navan Road (near 12th lock) to connect with a previously constructed section of the Greenway.

GDG completed a desk study of the site and completed site walkover on 20th February 2020 as summarised in Section 2 and Section 3 of this document respectively. A ground investigation (GI) was carried out by Ground Investigations Ireland Ltd. in July 2020 covering the full length of the proposed Royal Canal Urban Greenway. The GI information relevant to the subject section along the southern bank of the Royal Canal between the Coolmine Train Station and Castleknock Train Station has been reviewed in Section 4 of this report.

GDG completed a review of DBFL's three initial greenway proposals and the DBFL Consulting Engineers progressed proposal. There are a number of constraints that will apply to any and all proposed construction works if the greenway is to be constructed along the southern bank as detailed in Section 6.1.

It should be noted that for any solution, the Royal Canal would likely have to remain closed to traffic within the canal throughout the works as the barge or working platform would likely extend across the full draught with of the canal. Liaison with Waterways Ireland will be required to obtain permission to close the canal for this prolonged period.

It was determined that DBFL's initial Option A and Option B are not suitable for construction as the installation of an embedded retaining wall. These options would adversely affect health and safety, temporary works construction, cost, programme, potential for disruption to Irish Rail, noise and vibration. DBFL Option C may be feasible but would require a robust geotechnical design for both the temporary works and permanent works and also a complex construction methodology which would result in a prolonged programme.

The DBFL progressed solution proposes to reduce the surcharge loads of the platform, use piled foundations in place of shallow foundations and replace the embedded retaining wall with either a stabilised soil slope or remediating the existing masonry retaining walls. There are some constraints specific to this solution as detailed in Section 6.4. Liaison with Irish Rail would be required to allow permission to install anchors beneath the railway line and to agree any restrictions on ground movements or vibrations adjacent to the railway line.

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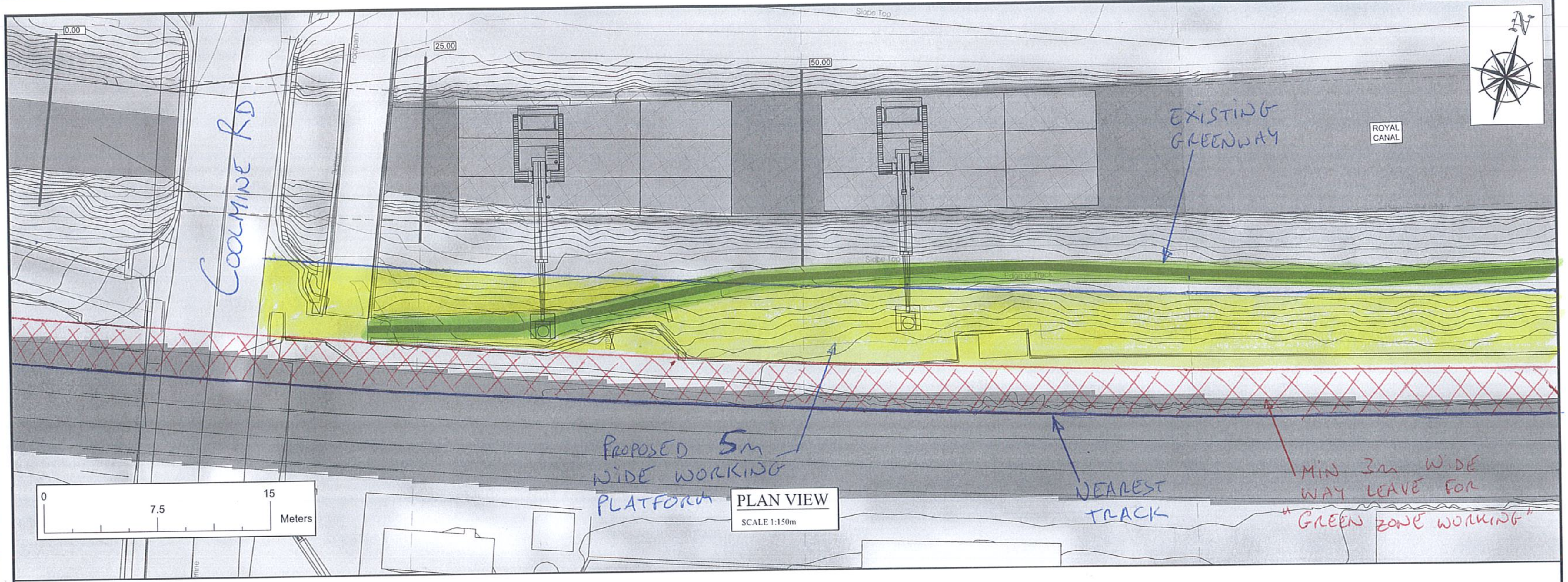
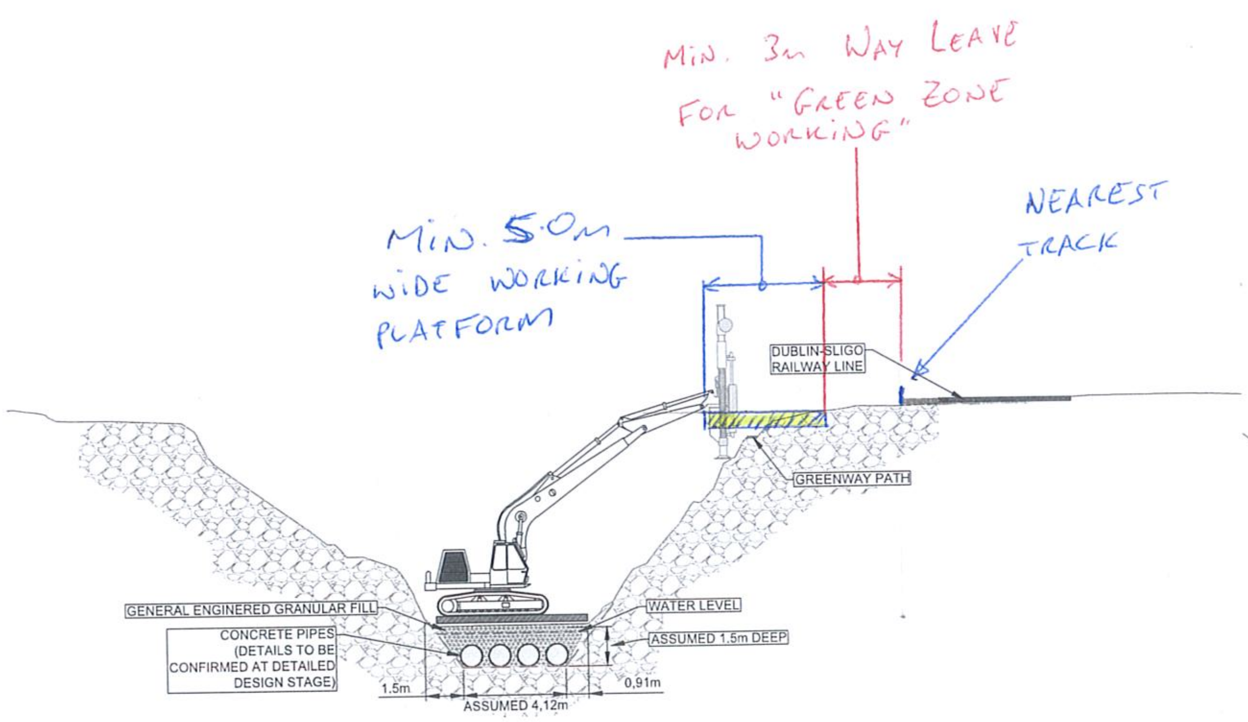
Appendix A – Land-side working platform sketch



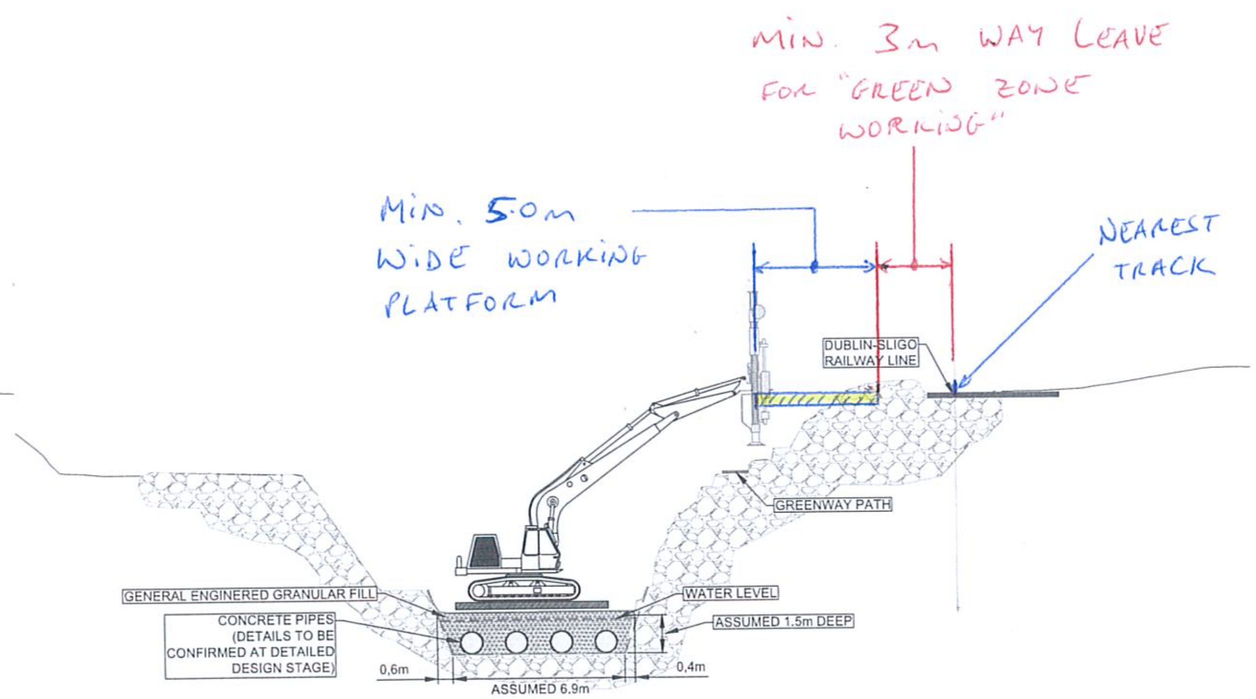
PLAN VIEW

SCALE 1:150m



SECTION 25.00

SCALE 1:150m



SECTION 50.00

SCALE 1:150m

NOTES:

1. ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE STATED
2. USE DIMENSIONS ON DRAWINGS (DO NOT SCALE FROM DRAWINGS).
3. IRISH TRANSVERSE MERCATOR 1995 WITH ETRS89 DATUM; IRELAND COORDINATE SYSTEM
4. SURVEY FILES RECEIVED FROM MURPHY SURVEYS.

LEGEND:

- BOUNDARY FOR BARGE WORKING SPACE (8.5m WIDE)
- RAILWAY LINE
- ASSUMED CANAL PROFILE
- GREENWAY PATH
- RAILROAD TRACKS
- ROYAL CANAL
- EXTENT OF PIPES AND FILL

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ISSUED AS: FOR INFORMATION

CLIENT:

DBFL CONSULTING ENGINEERS

Comhairle Contae Fhine Gall
Fingal County Council

PROJECT TITLE: COOLMINE GREEN WAY

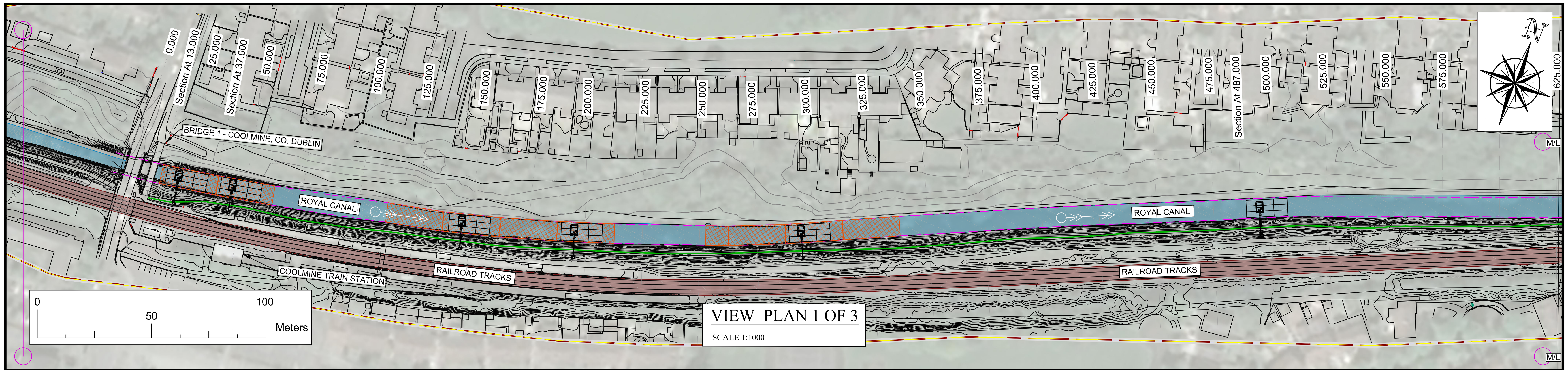
DRAWING No: 20042-GDG-XX-XX-DR-C-0002

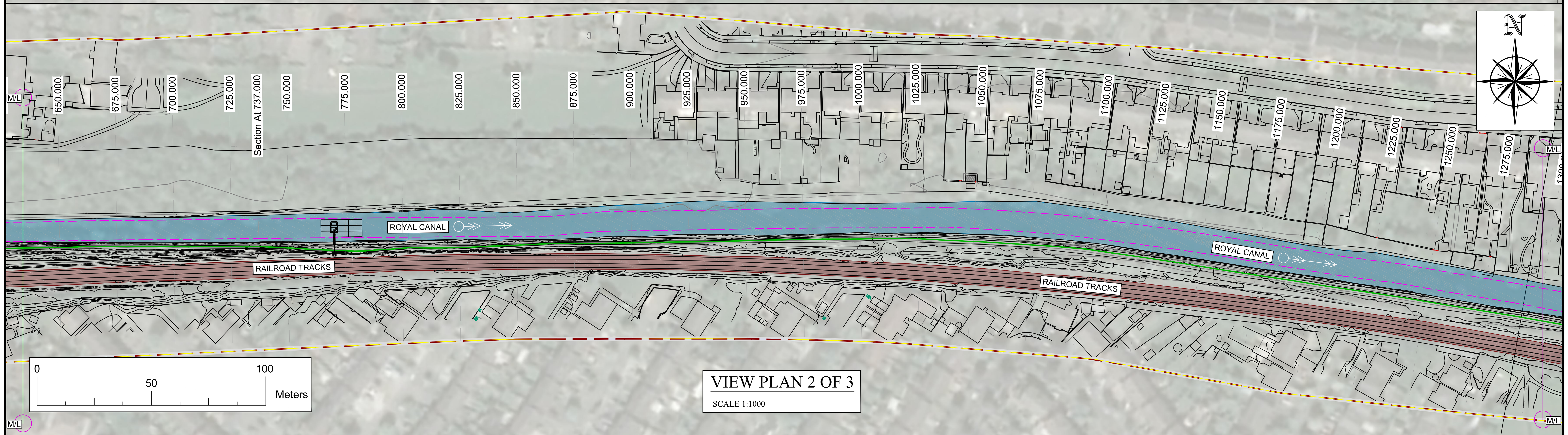
Revision: -FI -00

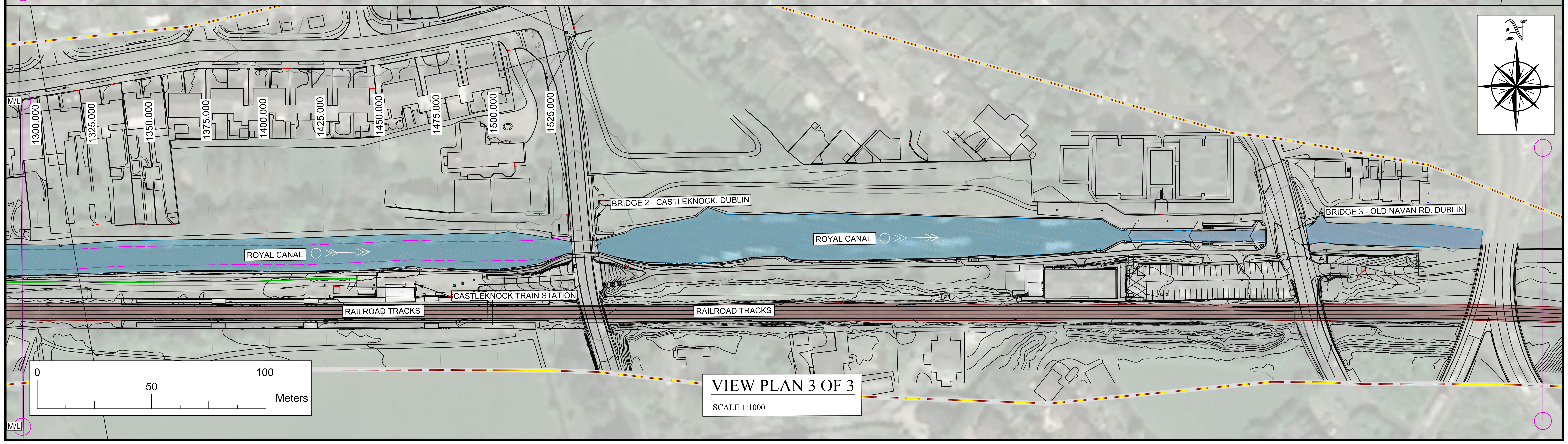
DRAWING TITLE: SECTION FROM 25.00 TO 50.00

SCALE: 1:150m	SHEET SIZE: A1	DATE: 09/03/2020
DRAWN BY: R.R	CHECKED BY: T.MG	APPROVED BY: P.Q.

Appendix B – Canal-side access drawings







NOTES:

1. ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE STATED
2. USE DIMENSIONS ON DRAWINGS (DO NOT SCALE FROM DRAWINGS).
3. IRISH TRANSVERSE MERCATOR 1995 WITH ETRS89 DATUM; IRELAND COORDINATE SYSTEM
4. SURVEY FILES RECEIVED FROM MURPHY SURVEYS.

LEGEND:

- BOUNDARY FOR BARGE WORKING SPACE (8.5m WIDE)
- GREENWAY PATH
- EXTENTS OF SURVEY
- RAILROAD TRACKS
- ROYAL CANAL
- EXTENT OF PIPES AND FILL

REV: FI -01	DATE: 30/03/21	DRAWN BY: CM	CHECKED BY: TMG
DESCRIPTION:	CHAINAGE ZERO AT BRIDGE C/L		

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Fingal County Council

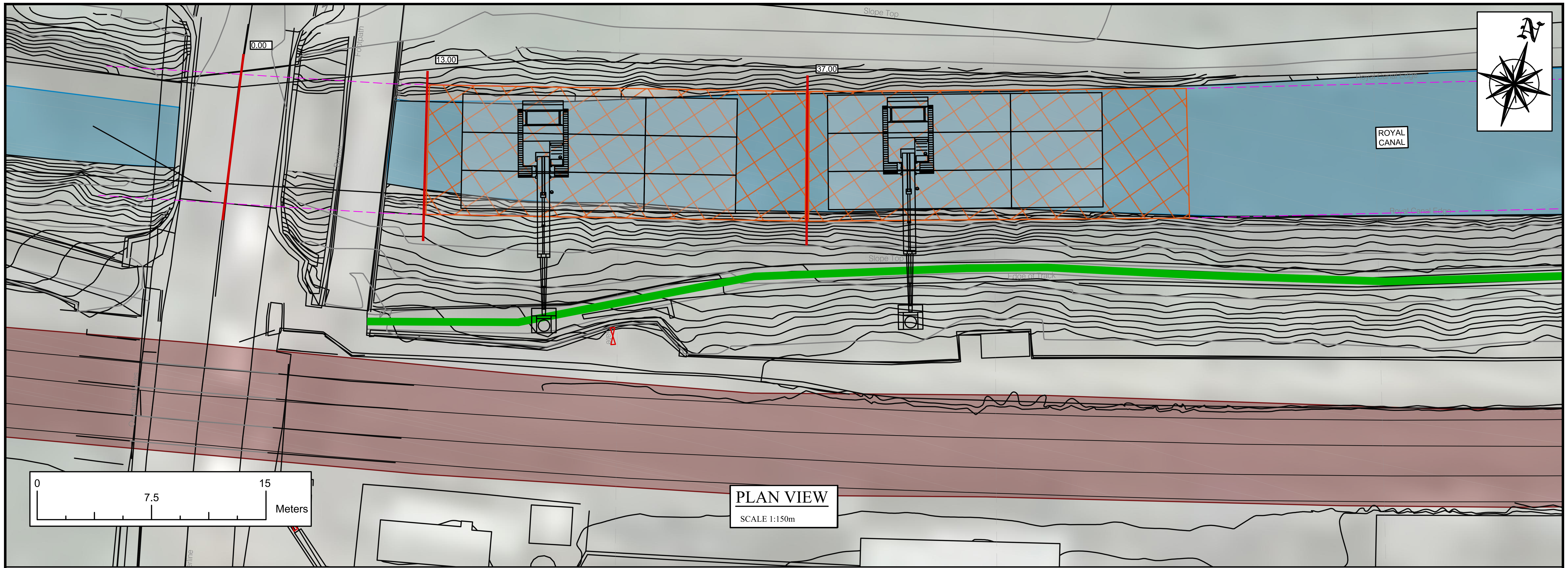
PROJECT TITLE: COOLMINE GREEN WAY

DRAWING No: 20042-GDG-XX-XX-DR-C-0001

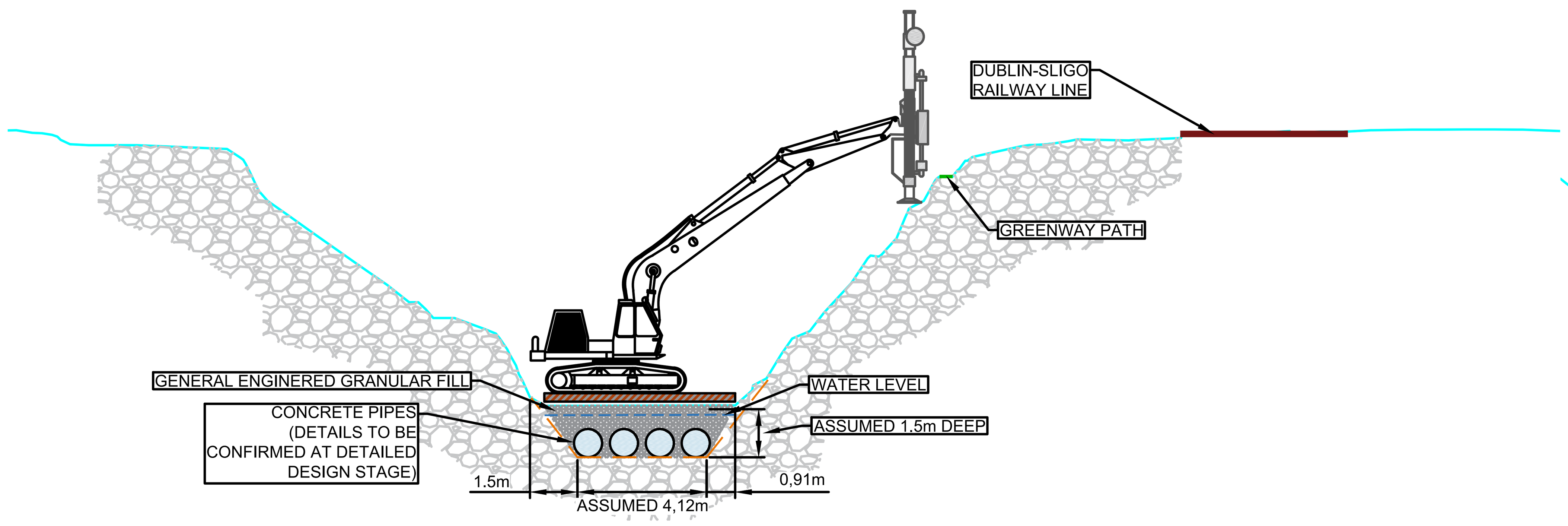
Revision: -FI -01

DRAWING TITLE: PLAN LAYOUT

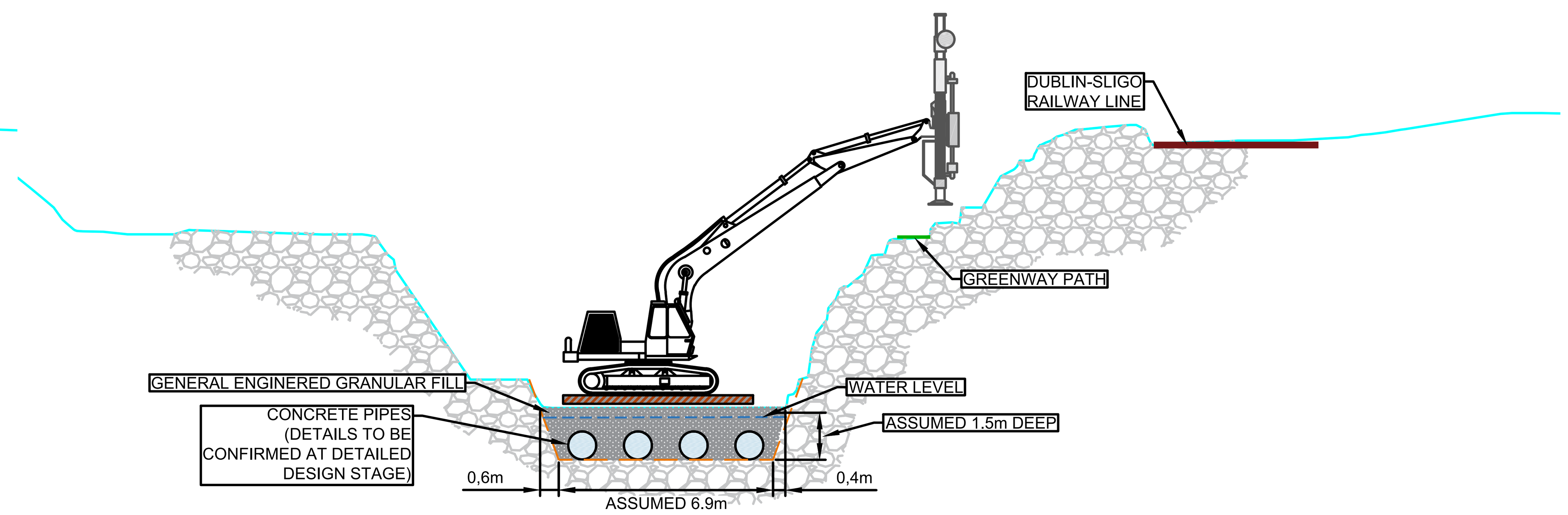
SCALE: 1:1000	SHEET SIZE: A1	DATE: 30/03/2021
DRAWN BY: R.R	CHECKED BY: T.MG	APPROVED BY: P.Q.



PLAN VIEW
SCALE 1:150m



SECTION 13.00M
SCALE 1:150m



SECTION 37.00M
SCALE 1:150m

NOTES:

1. ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE STATED
2. USE DIMENSIONS ON DRAWINGS (DO NOT SCALE FROM DRAWINGS).
3. IRISH TRANSVERSE MERCATOR 1995 WITH ETRS89 DATUM; IRELAND COORDINATE SYSTEM
4. SURVEY FILES RECEIVED FROM MURPHY SURVEYS.

LEGEND:

- BOUNDARY FOR BARGE WORKING SPACE (8.5m WIDE)
- RAILWAY LINE
- ASSUMED CANAL PROFILE
- GREENWAY PATH
- RAILROAD TRACKS
- ROYAL CANAL
- EXTENT OF PIPES AND FILL

REV: FI - 01	DATE: 30/03/21	DRAWN BY: CM	CHECKED BY: TMG
DESCRIPTION:	CHAINAGE ZERO AT BRIDGE C/L		

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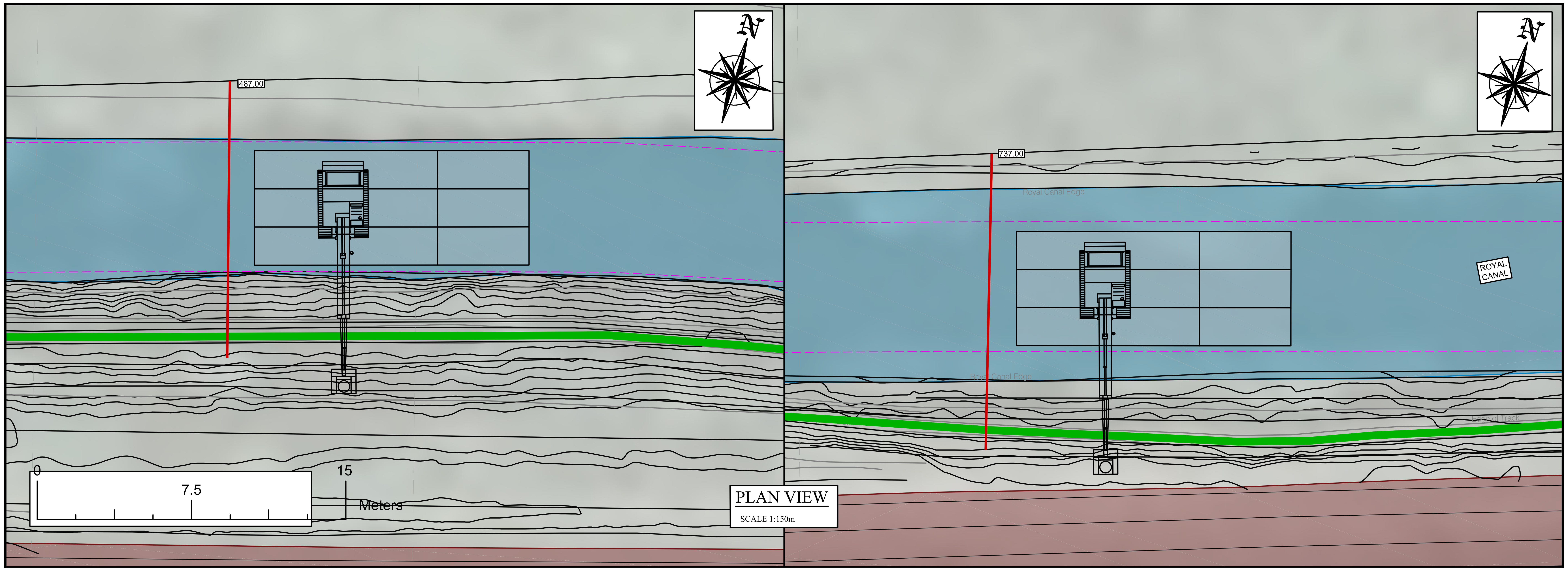
PROJECT TITLE: COOLMINE GREEN WAY

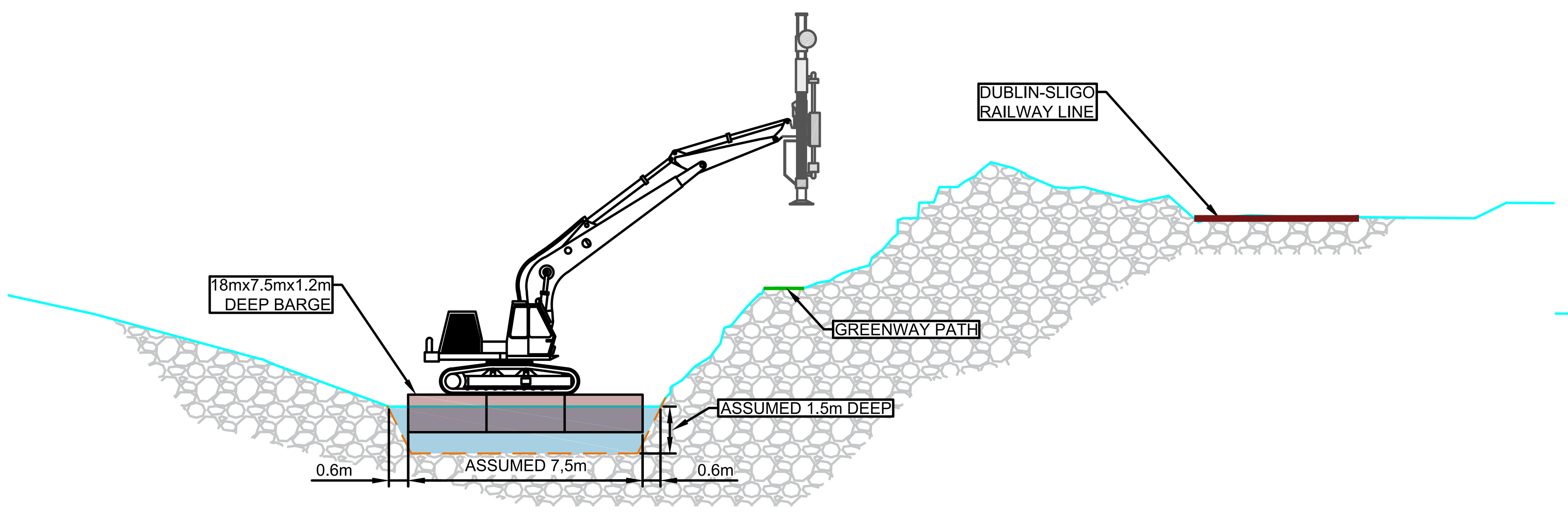
DRAWING No: 20042-GDG-XX-XX-DR-C-0002

Revision: -FI -01

DRAWING TITLE: SECTIONS AT CHAINAGES 13.00M AND 37.00M

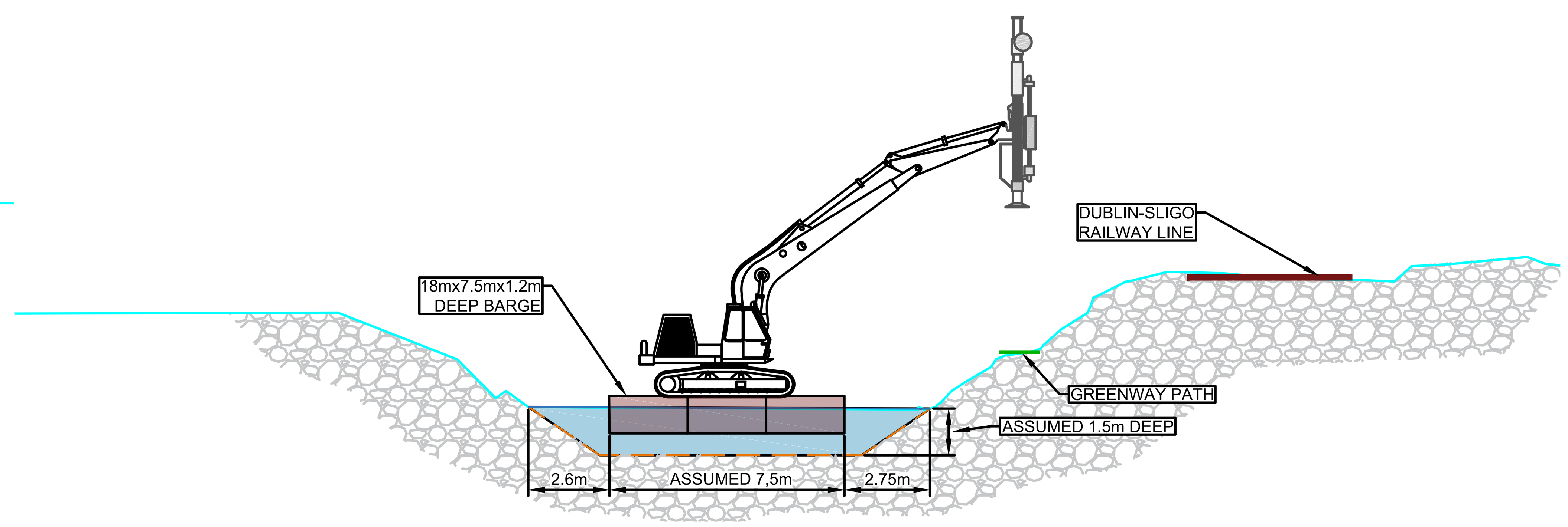
SCALE: 1:150m	SHEET SIZE: A1	DATE: 30/03/2021
DRAWN BY: R.R	CHECKED BY: T.MG	APPROVED BY: P.Q.





SECTION 487.00M

SCALE 1:150m



SECTION 737.00M

SCALE 1:150m

NOTES:

1. ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE STATED
2. USE DIMENSIONS ON DRAWINGS (DO NOT SCALE FROM DRAWINGS).
3. IRISH TRANSVERSE MERCATOR 1995 WITH ETRS89 DATUM; IRELAND COORDINATE SYSTEM
4. SURVEY FILES RECEIVED FROM MURPHY SURVEYS.

LEGEND:

- BOUNDARY FOR BARGE WORKING SPACE (8.5m WIDE)
- RAILWAY LINE
- GREENWAY PATH
- ASSUMED CANAL PROFILE
- RAILROAD TRACKS
- ROYAL CANAL

REV: FI -01	DATE: 30/03/21	DRAWN BY: CM	CHECKED BY: TMG
DESCRIPTION:	CHAINAGE ZERO AT BRIDGE C/L		

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PROJECT TITLE: COOLMINE GREEN WAY

DRAWING No: 20042-GDG-XX-XX-DR-C-0003

Revision: -FI -01

DRAWING TITLE: SECTIONS AT CHAINAGES 487.00M AND 737.00M

SCALE: 1:150m	SHEET SIZE: A1	DATE: 30/03/2021
DRAWN BY: R.R	CHECKED BY: T.MG	APPROVED BY: P.Q.

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