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Project Ireland
2040

N19 SHANNON AIRPORT ACCESS ROAD IMPROVEMENT SCHEME

PRELIMINARY SOURCES STUDY REPORT



Comhairle Contae an Chláir
Clare County Council

April 2020

Rev 03



An Roinn Iompair,
Turasóireachta agus Spóirt
Department of Transport,
Tourism and Sport



REVISION CONTROL SHEET

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1 INTRODUCTION

1.1 Scope and Objectives of Report

This report presents the findings of the preliminary Sources Study, undertaken to establish the geotechnical and geo-environmental constraints and potential risks associated with the proposed scheme. It provides the geotechnical and geo-environmental evidence that supports the decision making in selection of a preferred corridor and then a preferred route. The scope of the study was necessarily constrained by the scheme design under development by the project team and was carried out in accordance with the Statement of Intent (ref N19SAAR-RP-EW-0001) previously issued.

This report has been prepared in accordance with the guidance of DN-ERW-03083, Managing Geotechnical Risk (TII, 2019).

1.2 Project Overview

Clare County Council (CCC) (the “Client”) in partnership with Transport Infrastructure Ireland (TII) proposes to carry out the planning and design for the N19 Shannon Airport Access Road Improvement Scheme (the “Project”). The Project shall provide a high-quality road improvement scheme on the N19 National Primary Road between Drumgeely Roundabout and Knockbeagh Point Roundabout on approach to Shannon International Airport.

Clare County Council appointed Fehily Timoney and Company and Clandillon Civil Consulting, FTC on the 14th October 2019 to provide Technical Consultancy Services which will provide the Engineering, Environmental, Economic and Appraisal services required to successfully deliver the project through the planning and design phases (TII Project Management Guidelines Phases 1 to 4 inclusive).

1.3 Geotechnical Category

The scheme involves the construction of a new road across an area where a significant depth of soft ground is likely to be encountered. As such, the scheme is classified as a Geotechnical Category 3, involving unusual or complex earthworks. This classification will be reviewed during Phase 2 and Phase 3 works and amended if required.

2 SOURCES OF INFORMATION AND DESK STUDY

2.1 Sources of Information

The sources of information and documents that have been used to compile this report are provided below.

- Historic OSI mapping
- OSI mapping
- GSI mapping
- EPA mapping

2.2 Consultation with Statutory Bodies and Agencies

The following utilities are known to be present within the Study Area.

Table 2-1 Statutory Undertakers (Utilities)

Authority	Relevance to Scheme
Bord Gais	Gas Service Locations
ESB	Electricity service locations
Irish Water	Water service locations
Eir	Telecommunication service locations
Shannon Airport	Water, Foul Sewer

2.3 Previous Ground Investigation Data

2.3.1 N18/N19 Ballycasey to Dromoland

Ground investigations were undertaken as part of the advance works for the N18/N19 Ballycasey to Dromoland Road Scheme, located to the north of the existing N19 Shannon Airport access road. Limited information is currently available on these ground investigations; however, it appears that one phase was undertaken in 1996 by Westmeath County Council, with another phase of ground investigation undertaken by Geotech Ltd in 1999. Several boreholes were drilled to the north of the existing Drumgeely Roundabout, indicating the presence of soft ground to depths of 6m bgl.

2.3.2 Shannon Flood Embankments

As part of the proposed upgrades to the existing Shannon flood defences, a ground investigation was undertaken during 2018 by IGSL under the supervision of Malachy Walsh and Partners. This investigation covered several sections of existing flood embankments. A number of cable percussive and rotary cored boreholes were drilled along a section of the flood embankment adjacent to the existing N19 Shannon Airport access road.

The ground conditions from the relevant boreholes are summarised in Table 2.2.

Table 2-2 Ground Conditions from historical boreholes

Stratum	Description	Depth (m bgl)
Made Ground	Granular fill, soft sandy Silt/Clay	0 to 1.0 - 2.0
Estuarine Silt/Clay	Very soft to soft grey sandy Silt	0.5 – 2.0 to 4.3 - 15
Glacial Till	Firm to very stiff sandy gravelly Clay with cobbles	4.3 – 15 to 17
Bedrock	Strong to very strong, thinly laminated to medium bedded, grey fine to medium grained Limestone	14.6 to 17

3 FIELD STUDIES

3.1 Walkover Survey

Not yet carried out.

3.2 Geomorphological/Geological Mapping

Not yet carried out.

3.3 Probing, Pitting and Testing Work

Not yet carried out.

3.4 Drainage and Hydrological Studies

Not yet carried out.

3.5 Geophysical Studies

A geophysical survey was undertaken along the existing N19 Shannon Airport access road during May 2018 by Minerex. The survey comprised a series of seismic refraction profiles undertaken along the southern/eastern side of the existing N19 Airport access road between the Drumgeely and Knockbeagh Point Roundabouts.

The interpretation of the results of the seismic refraction survey indicate the presence of five layers with the ground profile. These comprised:

- A shallow near surface layer of possible Topsoil or Made ground, described as soft or loose (generally 1m in thickness)
- A firm or dense layer of overburden (up to 5m in thickness)
- A stiff to very stiff or very dense layer of overburden (up to 12m in thickness)
- Two layers of bedrock, one described as 'fair', or slight weathered, the other described as good. The depth to bedrock ranged from 3m to approximately 20m.

It should be noted that no intrusive investigation has been undertaken to confirm the descriptions in the geophysical report.

4 SITE DESCRIPTION

The current route of the N19 Shannon Airport access road crosses generally flat ground between Drumgeely Roundabout and Knockbeagh Point Roundabout. The existing road appears to pass through a shallow cutting approximately 500m south of the Drumgeely Roundabout, adjacent to an area known as Drumgeely Hill. Approximately 650m south of the Drumgeely Roundabout the existing road crosses both a back drain from the adjacent flood bund and a drainage outfall from the Shannon Free Zone (SFZ).

To the east and southeast of the existing road is a flood bund on the banks of the River Shannon. A back drain is present behind the flood bund.

4.1 Topographical Maps

Historical Ordnance Survey of Ireland (OSI) online mapping was reviewed. The 6-inch mapping sheets (1837-1842) show no development in the area around the existing N19 Shannon Airport access road. A flood embankment is present to the southeast of the existing road, with numerous ditches in the area. The embankment is shown in the same location as the current flood relief embankment, along the edge of the Shannon Estuary. The shoreline appears to be the same as the present-day shoreline, except for the area to the west of Knockbeagh Point, where the shoreline runs to the northwest as far as the current position of the airport buildings, before turning to the west.

The historic 25-inch mapping (1888-1913) shows a network of watercourses across the current airport footprint, which appear to lead to a pump located on what is now Drumgeely Hill. A well is also noted to the north of the pump. A back drain also appears to be present behind the flood embankment, with a well noted to the northeast of Knockbeagh Point. As with the earlier mapping, no development is shown in the area currently occupied by the airport.

The more recent 6-inch mapping (Cassini) is shown in Figure 4.1 and shows the original airport development, plus the drainage culverts that cross the study area to the south of Drumgeely. At this stage the access to the Airport was from the west side of the airport, and only a couple of structures are recorded within the study area, along with an access road that runs from the airport as far as the culverts.

4.2 Aerial Photographs

Recent aerial photography has been reviewed to assess the current land use across the Study Area.

Housing is present to the east of the existing N19 route at Drumgeely. The Shannon Free Zone is present to the west of the existing N19.

A large vehicle parking area is present opposite a small roundabout that provides access to the southern end of the SFZ. A small car park is present closer to Knockbeagh Point Roundabout, opposite a series of buildings housing companies that provide support services to Shannon Airport.

4.3 Geological Maps and Memoirs

The available Geological Survey of Ireland (GSI) quaternary and bedrock geology mapping was reviewed, as well as the GSI memoir 'Geology of the Shannon Estuary' (GSI, 1999).

4.3.1 Superficial Geology

The superficial geology is characterised as both 'Urban' and 'Airport' with no further information provided. To the east of the existing N19 areas of Estuarine Silts and Clays, and Till derived from Limestone are noted. See Figure 4.2 for details.

4.3.2 Bedrock Geology

The study area is underlain by the Ballysteen Formation, which is described as a fossiliferous dark-grey muddy Limestone. To the northeast of Shannon Airport three other formations are present: the Ballymartin Formation, a Limestone and dark grey calcareous Shale, the Lower Limestone Shale, which comprises Sandstone, mudstone and thin limestone and the Old Red Sandstone, a red conglomerate, sandstone and mudstone which comprises red mudstones, siltstones and sandstones, and poorly sorted, polymict pebble conglomerates and breccias. To the west of the Airport the Walsortian Limestone is present, described as a massive, unbedded, lime-mudstone. See Figure 4.3 for details.

A single geological heritage site is noted at Rineanna Point, located approximately 3km to the west of the airport. This is described as an exposure of the base of the Carboniferous Walsortian limestone along strike on a shore section on the southern shore of Rineanna Point, comparable to the Deel River section on the opposite side of the Shannon in Limerick.

No karst features are noted in the area around Shannon Airport. The nearest known karst features are found in Ennis, approximately 16km to the north. However, the Ballysteen Formation is known to be karstified in areas, and as such the presence of unidentified karst features cannot be excluded.

4.4 Hydrogeology

The bedrock in the study area is classified as a Dinantian Pure Unbedded Limestones (Walsortian Limestone) and Dinantian Lower Impure Limestones (Ballysteen Formation). These rock units are classified as Locally Important aquifers, that are moderately productive in local zones.

The GSI has not identified any gravel aquifers within or in the vicinity of the study area. The GSI only designates a sand and gravel aquifer as being locally important if the area of aerial extent is greater than 1km² and the saturated thickness is greater than 5m (or if the saturated thickness is unknown a full thickness of <10m).

The GSI has produced a vulnerability map for the Shannon region. The Study Area includes areas of variable vulnerability from extreme (rock near surface) to low vulnerability (Figure 4.4).

The most vulnerable sections of underlying aquifers are identified to the west of Shannon Airport where shallow bedrock is present.

4.5 Hydrology

There do not appear to be any natural watercourses within the study area. Two man-made drainage channels cross the study area to the west of Drumgeely, draining in the River Shannon to the southeast. A back drain is present behind the River Shannon flood bunds to the south of the study area.

4.6 Contaminated Land

No definite areas of contaminated land are currently known, although the likelihood of such cases in proximity to a town is historically very high. Existing industrial sites may be the source of locally contaminated land due to site activities. However, these sites operate within the EPA Integrated Pollution Control (IPC) licence framework and due to the regulated nature of their activities, the risk of contamination is low.

Land contamination is highly related to site history and previous land use which can leave contaminants in the ground depending on historic site activities. The OSI historic maps were assessed to determine land uses within the scheme study such as factories, railway works, etc. that may provide a potential source of historic contamination. Most of the development around the airport has occurred in the past 60 years.

Sites which have been granted a wastewater discharge licence may be a source of contamination. However, there are no wastewater discharge licensed sites within the study area.

5 GROUND CONDITIONS

5.1 Historical Ground Investigation Data

The ground conditions discussed in this section are based on the findings of ground investigations undertaken on sites adjacent to the proposed Scheme and will be confirmed following the detailed ground investigation.

5.2 Made Ground

Made Ground was recorded in several boreholes drilled along the existing River Shannon flood bunds. The Made ground is described as coarse granular fill, cobble fill, concrete, brick and rubble, and also as sandy Silt/Clay.

No laboratory testing was undertaken on samples of the Made Ground.

A single SPT was carried out with a result of 4 at a depth of 1m, indicating a soft material.

5.3 Estuarine Silt/Clay

Estuarine Silt/Clay was recorded in three boreholes adjacent to the existing N19 (EE01, EE02 and EE03). The material is described as very soft to soft grey sandy Silt and was encountered at between 0.5 and 2.0m bgl, with a thickness of between 2.3 – 14m.

Moisture content results ranged from 32 to 48%. Atterberg limit results indicate that the material is non-plastic.

SPT N values recorded ranged between 1 and 4, indicating a very soft to soft material. Two undrained triaxial tests recorded results of 4 and 11kPa.

5.4 Peat

A thin layer of buried peat was recorded below Estuarine Silt/Clay deposits to the north of Drumgeely Roundabout. The material was described as peat and wood and was between 0.4 and 0.5m in thickness.

No in-situ or laboratory testing was undertaken on this material.

5.5 Glacial Till

Glacial Till was recorded below the Estuarine Silt/Clay in two of the historical boreholes. The glacial till is described as firm to very stiff sandy gravelly Clay with occasional to frequent cobbles.

Moisture content results ranged from 19 to 30%. Atterberg limit results indicate that the material is either of low plasticity or non-plastic.

SPT N values recorded ranged between 16 and 38, indicating a stiff to very stiff material.

5.6 Bedrock

Bedrock was recorded in two rotary cored boreholes at the existing flood bund at depths of between 14.7 and 16.5m bgl. The boreholes drilled to the north of Drumgeely roundabout recorded refusal on possible bedrock at between 2.5 and 7m bgl.

Bedrock was described as a strong to very strong, thickly to medium bedded, locally thinly laminated, fine to medium grained Limestone. Rock strength testing undertaken on core samples recorded UCS (Uniaxial Compressive Strength) values of 58 and 60MPa, indicating a strength of strong. Point load testing recorded strength values ranging from 4 to 133MPa.

5.7 Groundwater

Groundwater strikes were recorded in two of the rotary cored boreholes drilled at the existing flood bund, ranging from 2.8 to 12m bgl. Inflow was recorded as slow. None of the cable percussive boreholes recorded groundwater strikes.

6 PRELIMINARY ENGINEERING ASSESMENT

Specialist consultation with a number of bodies may be expected to take place due to the location of the proposed scheme.

- Shannon Airport Authority DAC (SAA), part of Shannon Group
- Shannon Commercial Properties, operators of Shannon Free Zone, part of Shannon Group
- Office of Public Works
- Utilities providers

Workshops were undertaken in Q4 2019, as part of Phase 1, with stakeholders such as Shannon Airport, Shannon Commercial Properties, Clare County Council CFRAMS Team and Utilities Providers covering various geotechnical issues.

6.1 Cuttings

No significant cuttings are proposed along the proposed route of the N19 SAAR.

6.2 Embankments

Embankments will be constructed from imported fill materials, either cohesive (Class 2) or granular (Class 1). No significant embankment heights are anticipated. Side slopes of 1(v):2(h) would be expected to be stable.

Where embankments cross areas of estuarine deposits, considerable settlement should be anticipated due to the presence of compressible alluvial and estuarine soils. There are a number of potential solutions in order to minimise consolidation times, including load transfer platforms, ground improvement with band drains and staged construction to avoid failure of soft and compressible ground.

6.3 Subgrade

Where at grade sections are constructed across soft ground, low CBR values (<2.5%) may be expected. These sections may require the use of ground improvement or geogrid reinforcement to the capping layer in order to minimise differential settlement. The formation in these sections may also be frost susceptible.

Embankment fill material can be specified such that a minimum CBR value is achieved; CBR values in the range 2.5% to 5% should be assumed at this stage. If granular fill is used, then a higher CBR value (10%) would be achievable.

Subgrade drainage in the form of a combined filter drain will likely be required along the scheme, however the exact drainage requirements will depend on the final design level of the scheme.

6.4 Structure Foundations

The replacement of two existing culverts is anticipated as part of the proposed scheme.

While no ground investigation has been carried out at the location of the culverts, it is likely that a piled foundation will be required due to the likely presence of soft compressible estuarine deposits.

The likely presence of soft ground at the proposed structure location and the proximity of the Shannon Estuary SAC will create potential limitations on the use of standard construction techniques at this location.

The presence of areas of deep soft compressible deposits along the proposed scheme will likely require non-standard construction techniques, leading to a longer than normal construction period and increasing the overall cost of the scheme when compared to a similarly sized scheme without such soft deposits.

6.5 Contaminated Land

No definite areas of contaminated land are currently known, although the likelihood of such cases in proximity to a town is historically very high. Existing industrial sites may be the source of locally contaminated land due to site activities. However, these sites operate within the EPA Integrated Pollution Control (IPC) licence framework and due to the regulated nature of their activities, the risk of contamination is low.

Land contamination is highly related to site history and previous land use which can leave contaminants in the ground depending on historic site activities. The OSI historic maps were assessed to determine land uses within the scheme study such as factories, railway works, etc. that may provide a potential source of historic contamination. Most of the development around the airport has occurred in the past 60 years.

Sites which have been granted a wastewater discharge licence may be a source of contamination. However, there are no wastewater discharge licensed sites within the study area.

When undertaking the main ground investigation, it is recommended that the determinants selected for chemical testing at each site are associated with the former land use.

As no intrusive ground investigation has been undertaken for the proposed scheme, it is not currently possible to comment on the potential for the reuse of marginal/recycled material within the scheme. It is possible that the existing road make up (capping, subbase, pavement) may be recycled into the proposed scheme.

7 COMPARISON OF PROJECT OPTIONS AND RISKS

7.1 Comparison of Project Options

Project Options have been considered in detail in the Project Brief (N19SAAR-MP-AL-0005), which concluded that the following options should undergo more detailed appraisal:

- a road improvement within the existing corridor
- a set of measures to improve non-car journeys (a package of footway/cycleway measures and bus infrastructure)

From a geotechnical standpoint, the following factors have been identified as having the potential to impact on the route, alignment and buildability of the proposed scheme.

Table 7-1 Potential Geotechnical Risks

	Risk
Geotechnical/Ground Conditions	Presence of soft/compressible alluvial soils affecting settlement and stability of the proposed Scheme
	Uncertain pavement foundation conditions
	Unknown foundation conditions for proposed structures
	Access/space constraints in areas of soft ground
Groundwater	Effect of high groundwater table on pavement performance
	Stability of cutting slopes
Contaminated Land	Fuel installations
	Unknown landfill/industrial areas

7.2 Approach to Geotechnical Risk

A review of the potential geotechnical risks associated with the scheme has been undertaken following guidance in DN-ERW-03083 (TII, 2019). The degree of risk is determined as the product of probability (P) and impact (I), which gives the Risk Rating (R) as follows:

$$\text{Risk rating (R)} = \text{Probability (P)} \times \text{Impact (I)}$$

The scoring system used in the geotechnical risk register is as follows:

	Impact	Probability
1	Very Low	Highly Unlikely
2	Low	Unlikely
3	Medium	Possible
4	High	Likely
5	Very High	Highly Likely

Due to the 5-point scales used to assess Probability and Impact, the Risk Rating can range from 1 to 25 as shown below.

		Probability (P)				
		1	2	3	4	5
Impact (I)	1	1	2	3	4	5
	2	2	4	6	8	10
	3	3	6	9	12	15
	4	4	8	12	16	20
	5	5	10	15	20	25

The geotechnical risk register is detailed in Table 7-2. The register lists the anticipated geotechnical and environmental hazards associated with the works and the potential consequences of those hazards. The risk before control of the hazard has been assessed quantitatively as has the anticipated risk following the proposed response to each hazard.

The Risk Register is currently as per the Stage 1 assessment, as no further information is available to further develop the register. Once the utilities survey and ground investigation have been completed further updates to the Risk register will be produced and included in the GIR.

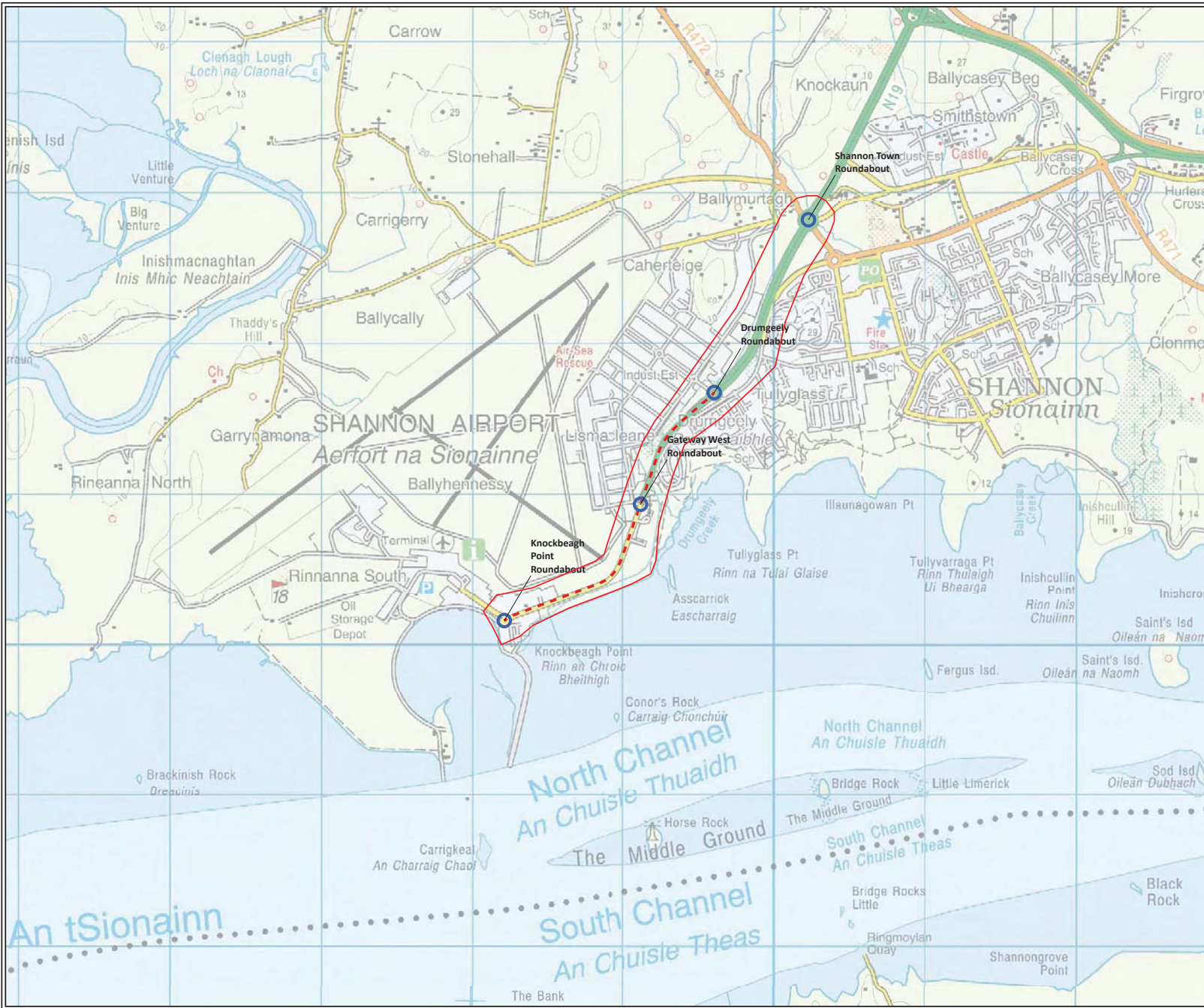
Table 7-2 Geotechnical Risk Register

Date/ Initials	Risk/Hazard	Consequence	Risk before Control			Mitigation Control Measure	Residual Risk		
			P	I	R		P	I	R
12/2019	Unforeseen ground conditions	Collapse of highways, programme delays and additional costs. Overconservative design solutions selected.	4	4	16	Review existing information and undertake further ground investigation.	2	4	8
12/2019	Weak and compressible strata	Ground improvement/stabilisation works required.	4	4	16	Undertake ground investigation and design suitable earthworks.	2	3	6
12/2019	Earthworks failure during/immediately after construction	Risk to construction workers and the public. Closure of the carriageway.	2	4	8	Detailed understanding of soil properties and construct earthworks in accordance with approved specification and geotechnical design criteria.	1	4	4
12/2019	Groundwater levels	Effects on surface water drainage, Effects on stability of deep excavations, due to water ingress. Effects on earthworks stability and effects on foundation designs and construction.	3	4	12	Ensure groundwater regime is unaltered by works. Ensure appropriate temporary works. Plan for appropriate temporary works using GI data. Consult GI and monitor installations.	2	4	8
12/2019	Construction on weak/soft ground	Deformation of pavement	3	3	6	Undertake detailed ground investigation and use appropriate soil properties in design.	1	3	3
12/2019	Shallow foundations for structures	Collapse / excessive deformation, programme delays, additional costs incurred and damage to highway.	3	4	12	Review existing ground investigation information and undertake further ground investigation if required. Design appropriate foundations based on the findings of the ground investigation.	1	4	4
12/2019	Damage to services	Disruption to programme, damage to highway, additional costs incurred and potential for injury to workers	3	5	15	Obtain and review up to date services information before undertaking any intrusive works.	1	5	5

8 DRAWINGS AND PHOTOGRAPHS

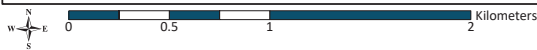
The following drawings/figures are included as part of this report:

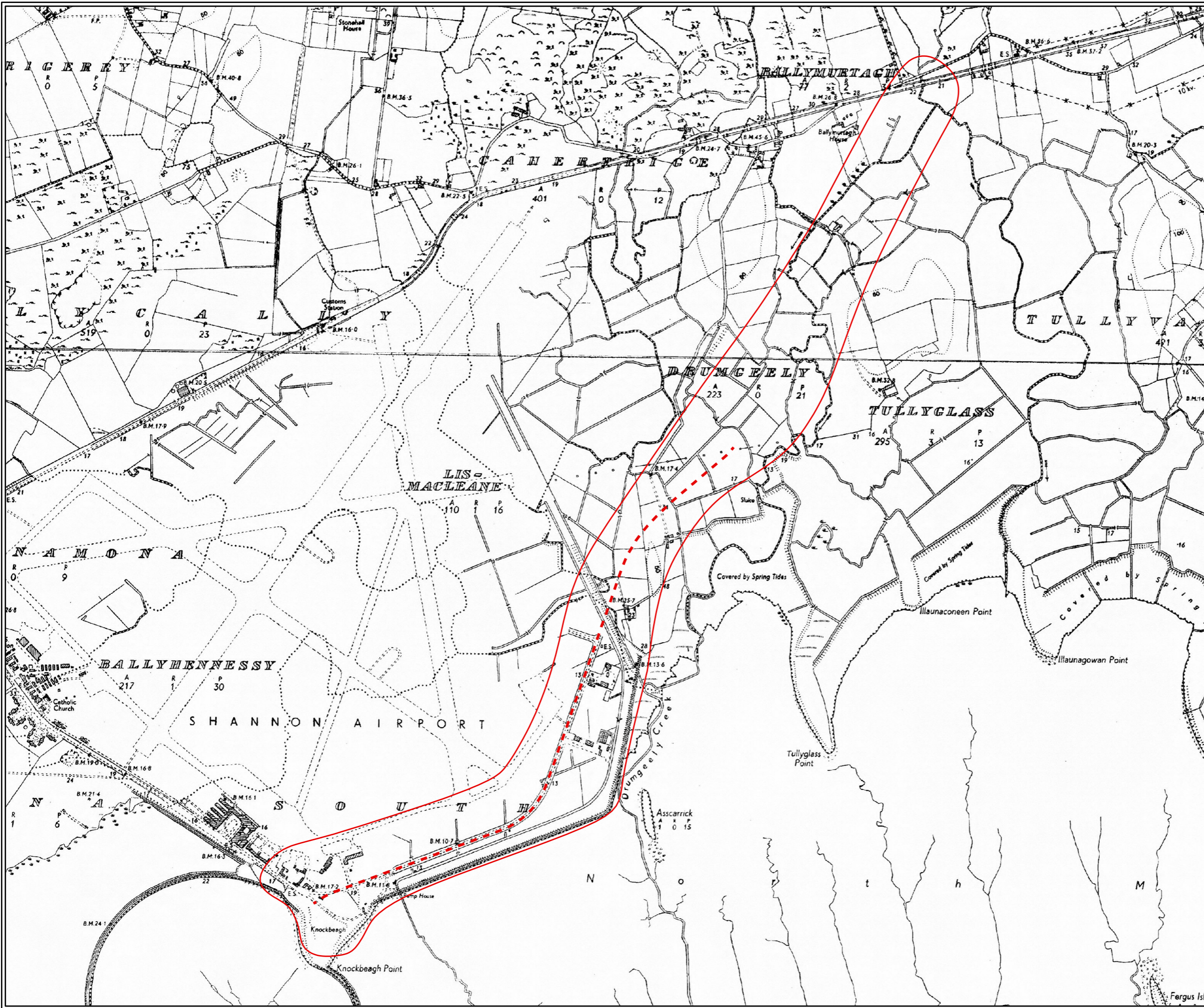
- Figure 1.1: Site Location
- Figure 4.1: Historical Mapping
- Figure 4.2: Quaternary Geology
- Figure 4.3: Bedrock Geology
- Figure 4.4: Groundwater Vulnerability



- - - 2.2km Proposed Improvement Scheme
- Roundabout
- Constraints Area

TITLE:	
Site Location	
PROJECT:	
N19 Shannon Airport Road Improvement Scheme	
FIGURE NO: 1.1	
CLIENT: Clare County Council	
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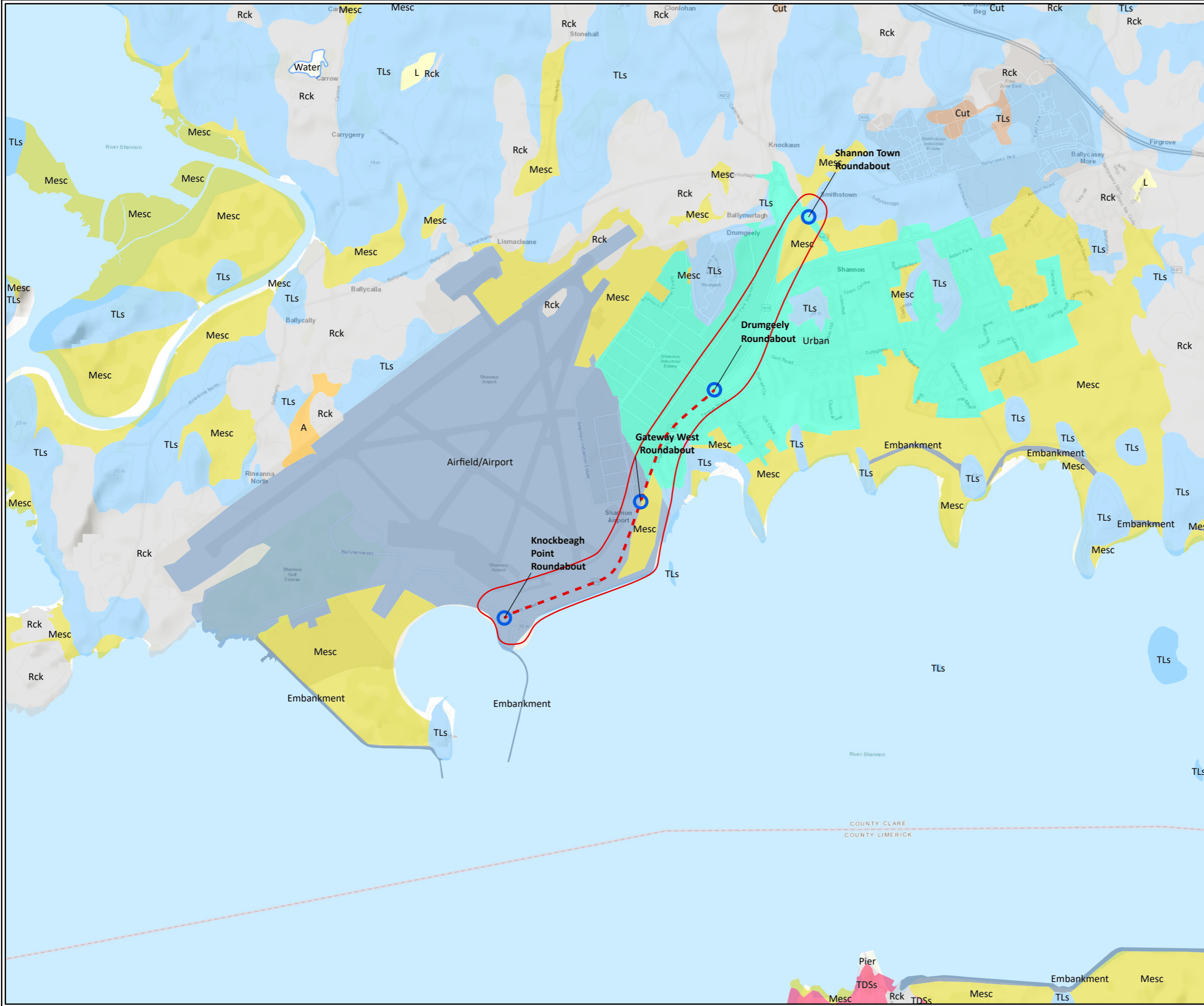




- Constraints Area
- 2.2km Proposed Improvement Scheme

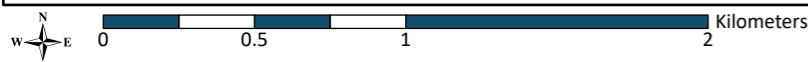
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PROJECT: N19 Shannon Airport Road Improvement Scheme	
FIGURE NO.: 4.1	
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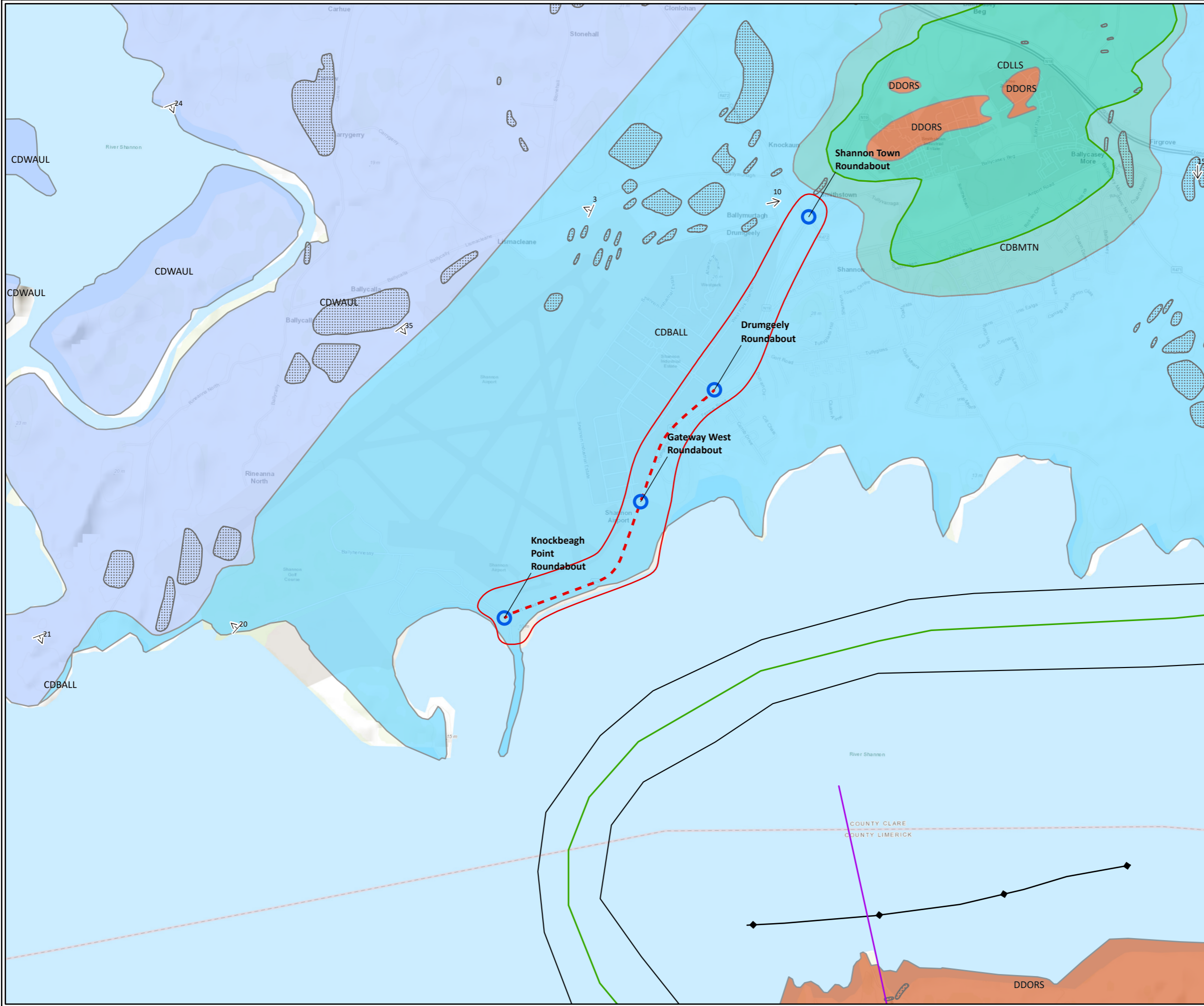




- - - 2.2km Proposed Improvement Scheme
- Constraints Area
- Roundabout
- Quaternary Sediments**
- A, Alluvium
- Airfield/Airport
- Cut, Cut over raised peat
- Embankment
- L, Lacustrine sediments
- Mesc, Estuarine silts and clays
- Pier
- Rck, Bedrock outcrop or subcrop
- TDSs, Till derived from Devonian sandstones
- TLs, Till derived from limestones
- Urban
- Water

TITLE:	Quaternary Geology	
PROJECT:	N19 Shannon Airport Road Improvement Scheme	
FIGURE NO:	4.2	
CLIENT:	Clare County Council	
SCALE:	1:25,000	REVISION: 0
DATE:	01/04/2020	PAGE SIZE: A3

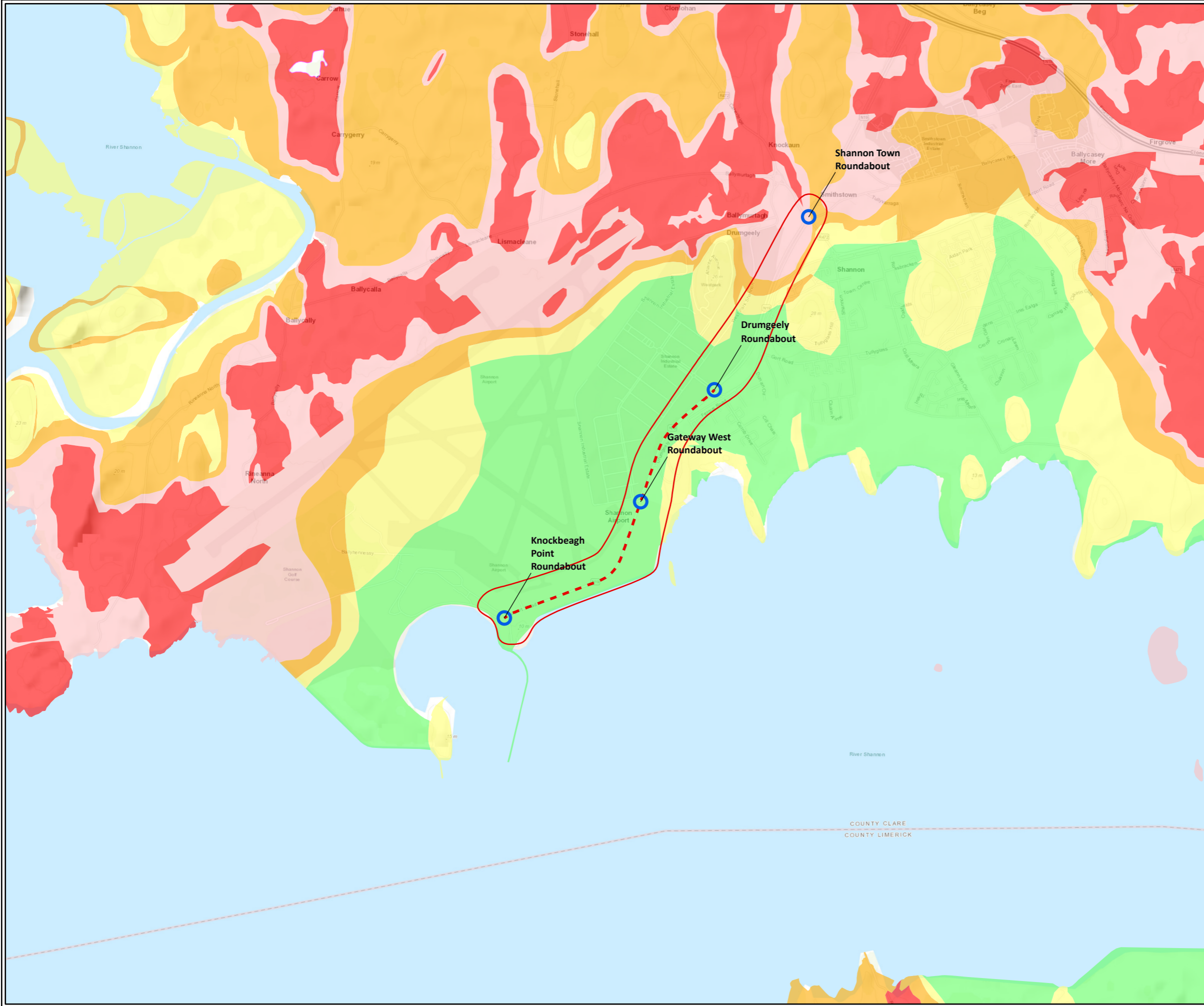




- - - 2.2km Proposed Improvement Scheme
- Constraints Area
- Roundabout
- Bedrock Outcrop
- Bedrock Structural Symbols**
- ↑ Dip of bedding or main foliation, old GSI data
- ↖ Strike and dip of bedding, right way up
- Stratigraphic and Structural Linework**
- ◆ Anticlinal Axis
- Fault
- Lithological boundary offshore
- Thin stratigraphical unit, diagrammatic
- Bedrock Geology**
- Ballysteen Formation
- Ballymartin Formation
- Lower Limestone Shale
- Waulsortian Limestones
- Old Red Sandstone (undifferentiated)

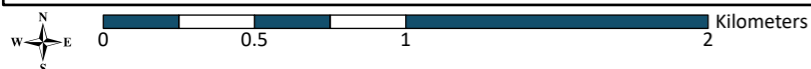
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Bedrock Geology	
PROJECT:	
N19 Shannon Airport Road Improvement Scheme	
FIGURE NO: 4.3	
CLIENT: Clare County Council	
SCALE: 1:25,000	REVISION: 0
DATE: 01/04/2020	PAGE SIZE: A3





- Constraints Area
- 2.2km Proposed Improvement Scheme
- Roundabout
- Groundwater Vulnerability**
- E - Extreme
- H - High
- M - Moderate
- L - Low
- Water
- X - Rock Near Surface or Karst

TITLE:	
Groundwater Vulnerability	
PROJECT:	
N19 Shannon Airport Road Improvement Scheme	
FIGURE NO:	
4.4	
CLIENT:	
Clare County Council	
SCALE:	REVISION:
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DATE:	PAGE SIZE:
02/04/2020	A3



9 REFERENCES

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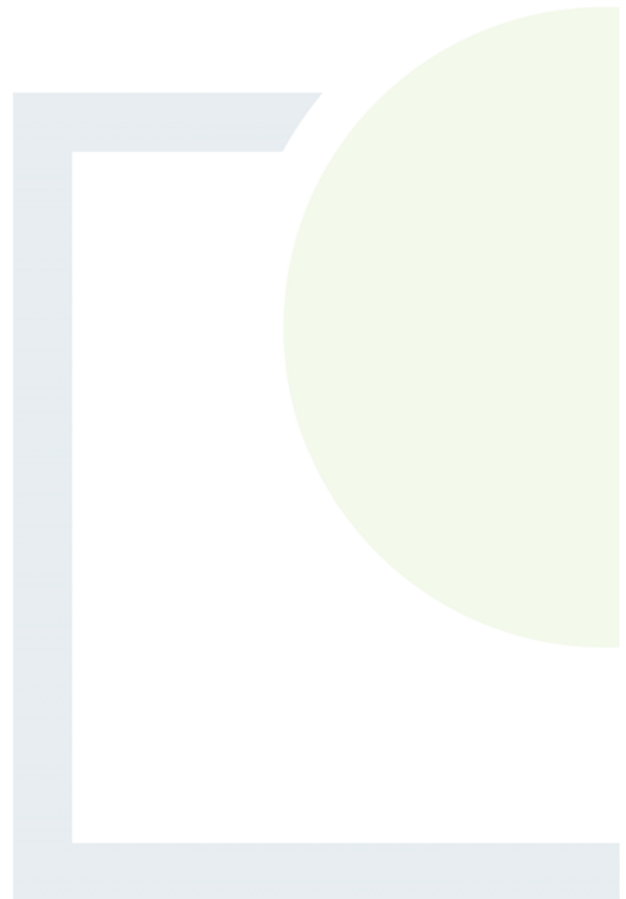
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CONSULTANTS IN ENGINEERING,
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APPENDIX A

Annex A to the Preliminary
Sources Study



ANNEX A TO PRELIMINARY SOURCES STUDY

A summary of the proposed ground investigation for the proposed Scheme is provided below.

A1.1 Objectives and Format of any Investigation

The historical ground investigation information reviewed for the Preliminary Sources Study Report indicates that none of the previously undertaken investigations have been carried out in close enough proximity to the proposed scheme to allow the collated data to be used to undertake the necessary design works.

Proposed ground investigations are to provide information to clarify geotechnical, geomorphological and geo-environmental findings of the Preliminary Sources Study, as reported separately. Investigations are designed as such to obtain detailed knowledge of the soils, solid geology, land contamination groundwater regime encountered and their likely behaviour and acceptability.

A1.2 Special Problems to be Investigated

The available historical ground investigation information indicates that the Scheme is likely to be underlain by variable depths of soft estuarine silt/clay. Construction on this material will likely lead to excessive settlement or the risk of bearing failure of embankments or structures. Detailed investigation of this material will be required in order to produce an economic design for the proposed Scheme.

The majority of the existing N19 is contained on low height embankment or is at-grade. In areas where the embankment fill has not been previously investigated, or where substantial lengths of parallel widening are proposed, exploratory holes will be required through the existing earthworks to determine the nature and geotechnical properties of the embankment fill material.

Information to be gathered will allow for an assessment of the potential impact of the proposed scheme on adjacent properties, such as the Shannon Free Zone, as well as an assessment of the potential for contaminated ground along the proposed scheme.

A1.3 Proposed Investigation

The proposed ground investigation has been designed as per the guidelines set out within IS EN1997 for a linear structure to provide information on the ground conditions across the proposed scheme. Furthermore, proposed ground investigations have been designed to target areas where specific and detailed information is required; such as areas associated with proposed structures, cuttings and embankments along the proposed scheme. Proposed ground investigation locations are shown on the drawings N19-SAAR-DR-GI-0001 to 0003, enclosed at the end of this report.

The proposed investigation is likely to comprise the following:

- 12 number cable percussive boreholes to refusal to provide information on the in-situ strength and to recover disturbed and undisturbed soil samples for laboratory testing
- 6 number rotary cored boreholes as follow-in from the cable percussive boreholes, to recover rock core for classification purposes
- 24 number trial pits to 4.5m bgl to recover bulk soil samples for laboratory testing

- 18 number CPT's to refusal with dissipation testing in each CPT, to provide detailed information on the strength of the soft soil deposits along the proposed route
- 20 number Dynamic probes to refusal to provide information on the depth and strength of the soft soil deposits along the proposed route
- 6 number soakaway tests to provide information on the permeability of the near surface materials
- 7 number slit trenches in the existing carriageway to confirm the location of any utilities within the existing road
- In-situ shear vane testing in cable percussive boreholes at 2m intervals in soft compressible deposits to provide strength values for the soft soil deposits
- SPT's in cable percussive boreholes at 1m intervals to provide strength values for the soft soil deposits
- 12 number standpipe piezometers to allow for groundwater monitoring
- Disturbed and undisturbed samples from trial pits and boreholes
- Appropriate soil/rock and chemical testing:
 - Moisture content, Atterberg Limit, PSD, Undrained shear strength, Consolidation, pH and Sulphates, Contamination testing
 - Point load tests, Uniaxial Compressive Strength testing of rock

Appropriate laboratory testing to be scheduled to provide appropriate design parameters for the soil and rock types encountered during the investigation for use at detailed design stage.

The exploratory hole records together with results of the in situ and laboratory testing will be presented in a factual report prepared by the ground investigation contractor. All factual data to be supplied in digital form to AGS4 format.

A1.4 Site & Working Restrictions

Works on site, during the ground investigation, will be restricted to the working hours as set by the Contract Information. Access to private land will be agreed in advance.

The works will be undertaken along both sides of the current single carriageway N19 Shannon Airport access road. The precise details of the traffic management and site working arrangements shall be discussed and agreed with MMaRC, Clare County Council, Shannon Airport and the chosen ground investigation contractor.

It will be necessary to obtain up to date information with respect to Statutory Undertakers services before any intrusive ground investigation works are undertaken. If a service exists in the locality of a proposed exploratory hole then it is to be expected that the company will impose a minimum safe working distance from protection of the equipment. A Utilities survey will be undertaken in advance of the intrusive investigation works, and exploratory hole locations may be altered following this to avoid utilities.

Workshops were held with MMaRC, Clare County Council, Shannon Airport & Commercial properties and Utility Providers to discuss Site and Working Restrictions in Q4 2019.

A1.5 Specialist Consultation

No specialist consultation is currently planned to be undertaken. The need for such provision will be kept under review for the duration of the scheme and should a reason arise that indicates the need for specialist advice, this will be sought.

A1.6 Programme, Cost and Contract Arrangements

The proposed Ground Investigation will be procured by the Clare County Council, and FT will be responsible for the programme and management of the ground investigation.

A period of approximately 4 weeks will be required to adequately design the ground investigation works and to prepare the contract documentation. The procurement period for the proposed ground investigation (including tender period and assessment) is anticipated to be approximately 6 weeks. Subsequent to the contract award the appointed ground investigation contractor is likely to require 4 - 8 weeks mobilisation including preparing all Health, Safety and Environmental management plans and site documentation (including traffic management plans etc.).

The timescales listed above do not include for any application periods for consents from local authorities or any affected parties. They also assume that the implementation of the traffic management and the access to the proposed positions will be relatively straightforward.

The ground investigation (site operations) as envisaged should be completed within a 6 to 7-week period assuming that investigations are run concurrently, although a start date is yet to be established. Consideration is required when planning for the completion of the scheme specific schedules and bill of quantities, planning of traffic management requirements, any procurement or tendering process and the likely lead in time required by the appointed ground investigation contractor.

The soils and chemical laboratory testing is expected to take some 6 weeks to complete after the completion of the ground investigation site operations. A further 3 weeks would then be expected to be required for preparation and review of the ground investigation contractor's factual report and its final issue. This gives an overall period for the ground investigation works (from planning to the submission of a final report) of about 36 weeks.

Monitoring of the installed instrumentation will be considered based on the proposed programme of works and any phasing of the scheme. To account for seasonal factors and due to the likely relatively high groundwater tables it is considered that monthly monitoring over a calendar year would be appropriate.

Based on recent ground investigation contracts the proposed ground investigation works are estimated at approximately €180,000 excluding VAT but inclusive of contractors supervisory and reporting costs.

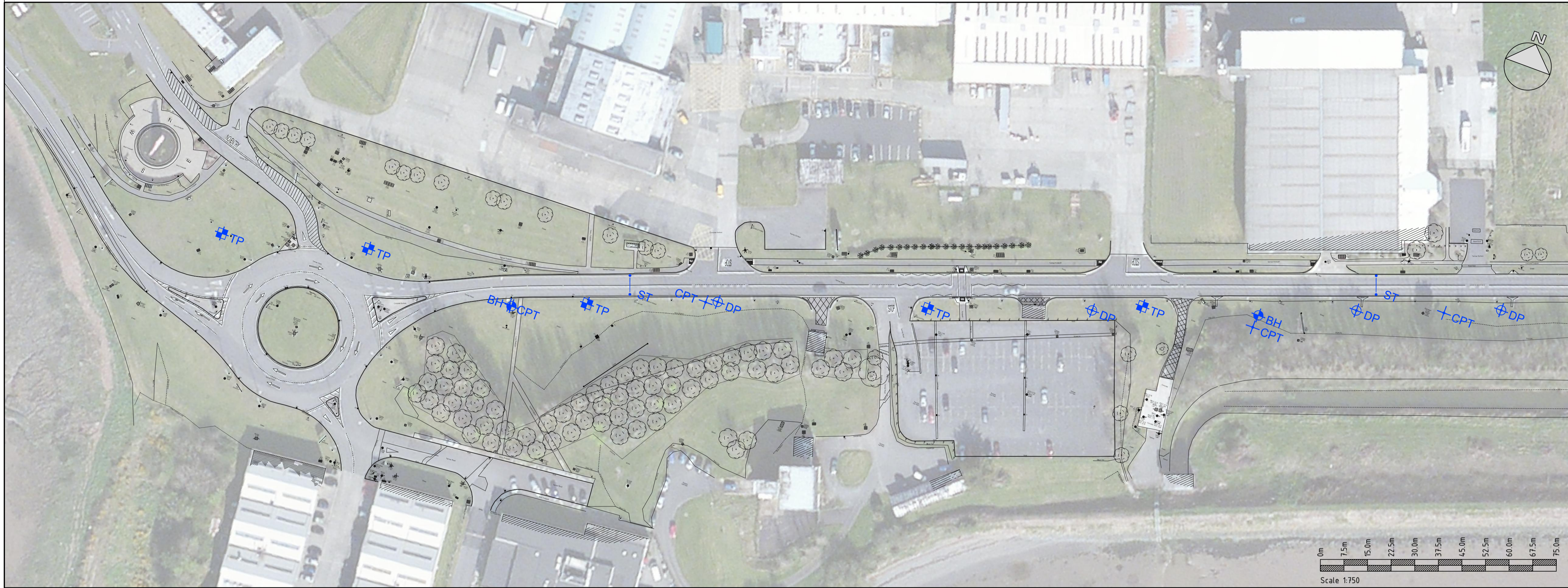
FT will fulfil the role of Employer's Representative and shall manage, administer and provide full time site supervision for the duration of the Ground Investigation Contract. FT will provide one no. Resident Engineer to provide full time supervision for the duration of the Ground Investigation Contract.

A1.7 Reporting

The factual reporting will be the responsibility of the ground investigation contractor. The report shall be prepared in accordance with the requirements of BS EN 1997-2. The report will be required in paper and digital formats. Digital reporting is to be in AGS format and in portable document file format.

All reporting of the works will be in accordance with TII DN-ERW-03083 Managing Geotechnical Risk. The following will be produced:

- A single Ground Investigation Report (GIR) for the proposed alignment separated into appropriate sections, based on the information obtained from the proposed ground investigation.
- A single Geotechnical Design Report (GDR) will be produced for the alignment, earthworks and associated structures.







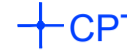
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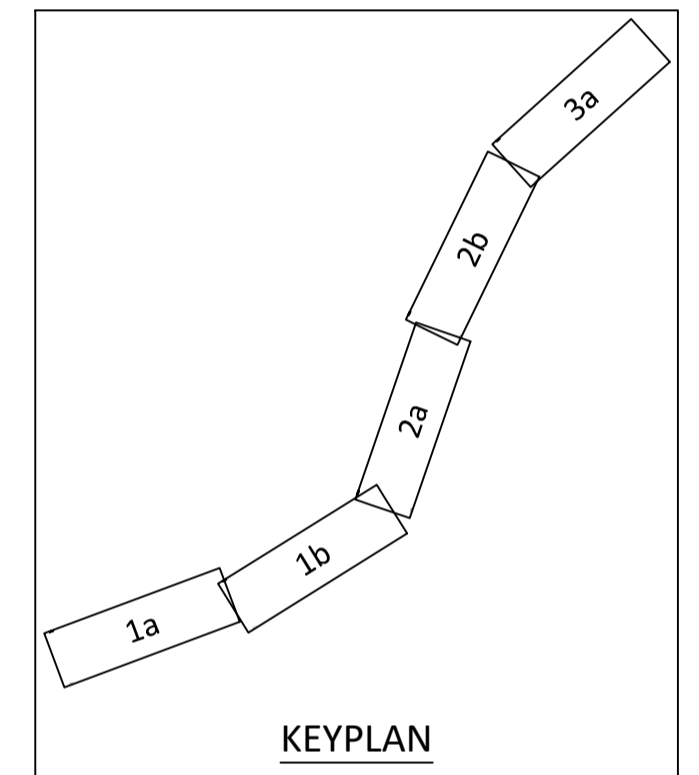
PLAN 1b
Scale 1:750

NOTES

GI Legend

-  Proposed Borehole
-  Proposed Trial Pit
-  Proposed Slit Trench
-  Proposed Dynamic Probe
-  Proposed Cone Penetration Probe

Note - ground investigation locations shown are preliminary and subject to client approval.



REV	DESCRIPTION	BY	CHK	APD	DATE
P02	PRELIMINARY ISSUE	IH	BB	BDH	03.03.20
P01	PRELIMINARY ISSUE	IH	BB	BDH	26.02.20

DESIGNER



CONTRACTOR - CLIENT



An Roinn Iompair,
Turastóireachta agus Spóirt
Department of Transport,
Tourism and Sport



Tionscadal Éireann
Project Ireland
2040

PROJECT



FEHILY
TIMONEY



CLANDILLON
CIVIL CONSULTING



Mid West
National Road Design Office



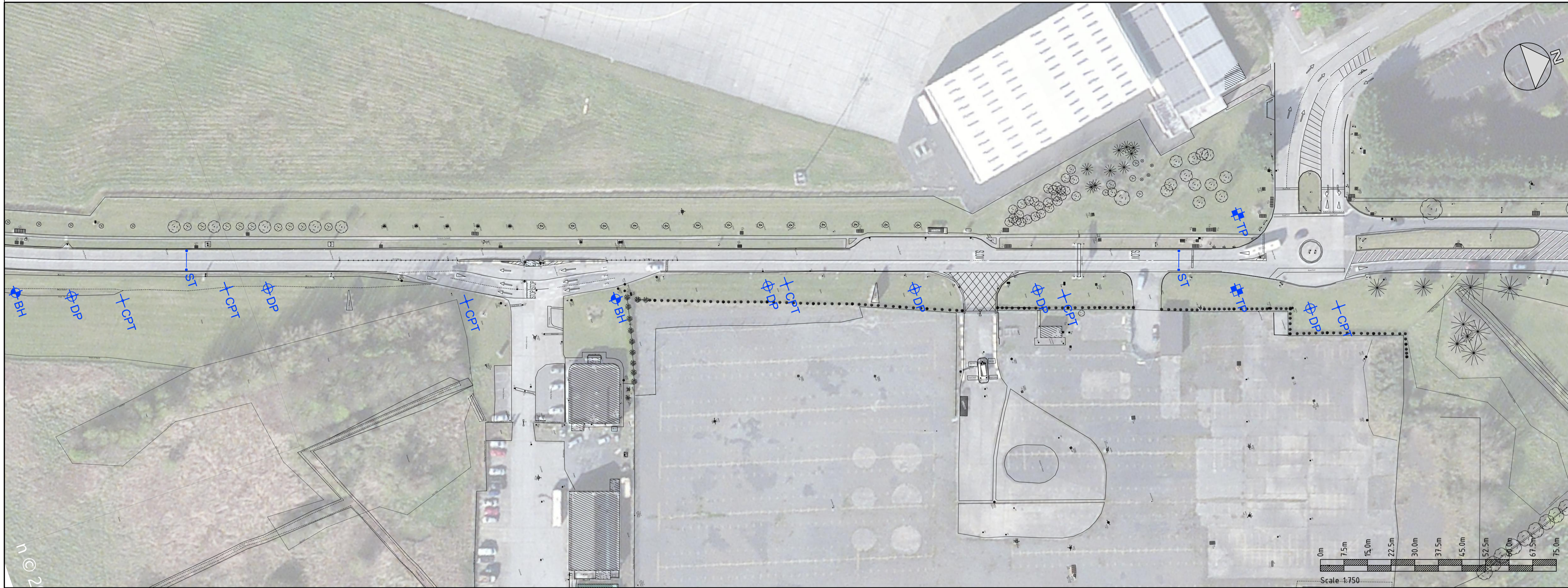
TII
Bonnagar Iompair Éireann
Transport Infrastructure Ireland

N19 SHANNON AIRPORT ACCESS ROAD IMPROVEMENT SCHEME

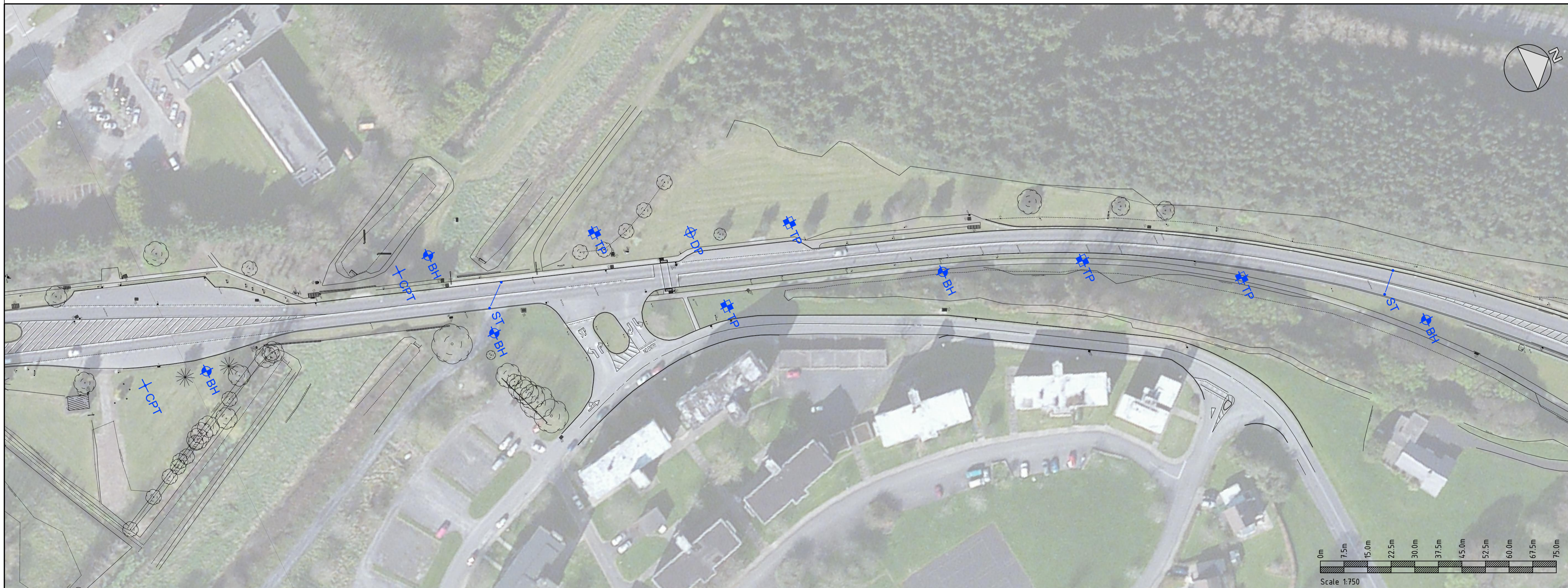
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GROUND INVESTIGATION PLAN - SHEET 1 OF 3

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Drawing Number N19-SAAR-DR-GI-0001		Rev P02








PLAN 2a
Scale 1:750



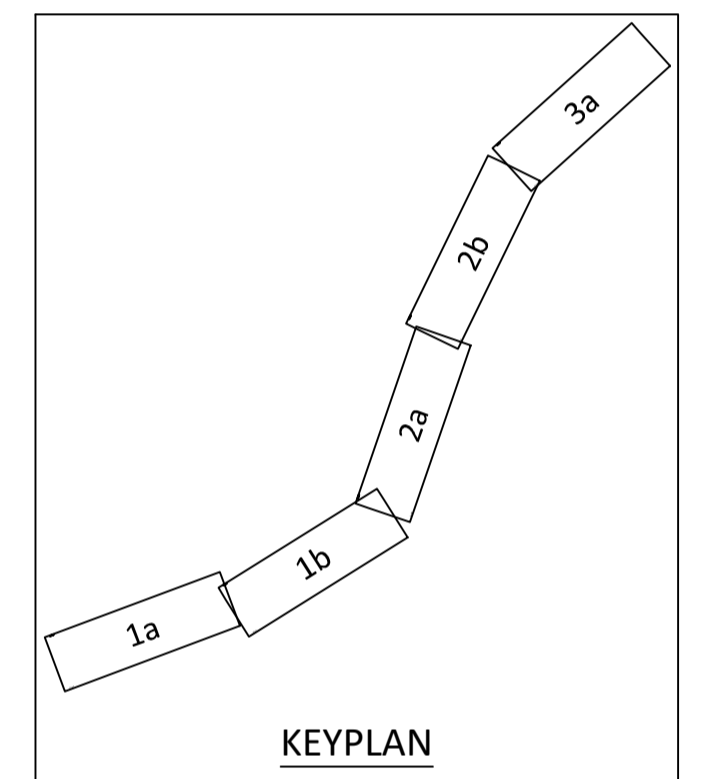
PLAN 2b
Scale 1:750

NOTES

GI Legend

-  Proposed Borehole
-  Proposed Trial Pit
-  Proposed Slit Trench
-  Proposed Dynamic Probe
-  Proposed Cone Penetration Probe

Note - ground investigation locations shown are preliminary and subject to client approval.



P02	PRELIMINARY ISSUE	IH	BB	BDH	03.03.20
P01	PRELIMINARY ISSUE	IH	BB	BDH	26.02.20
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2040

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Mid West
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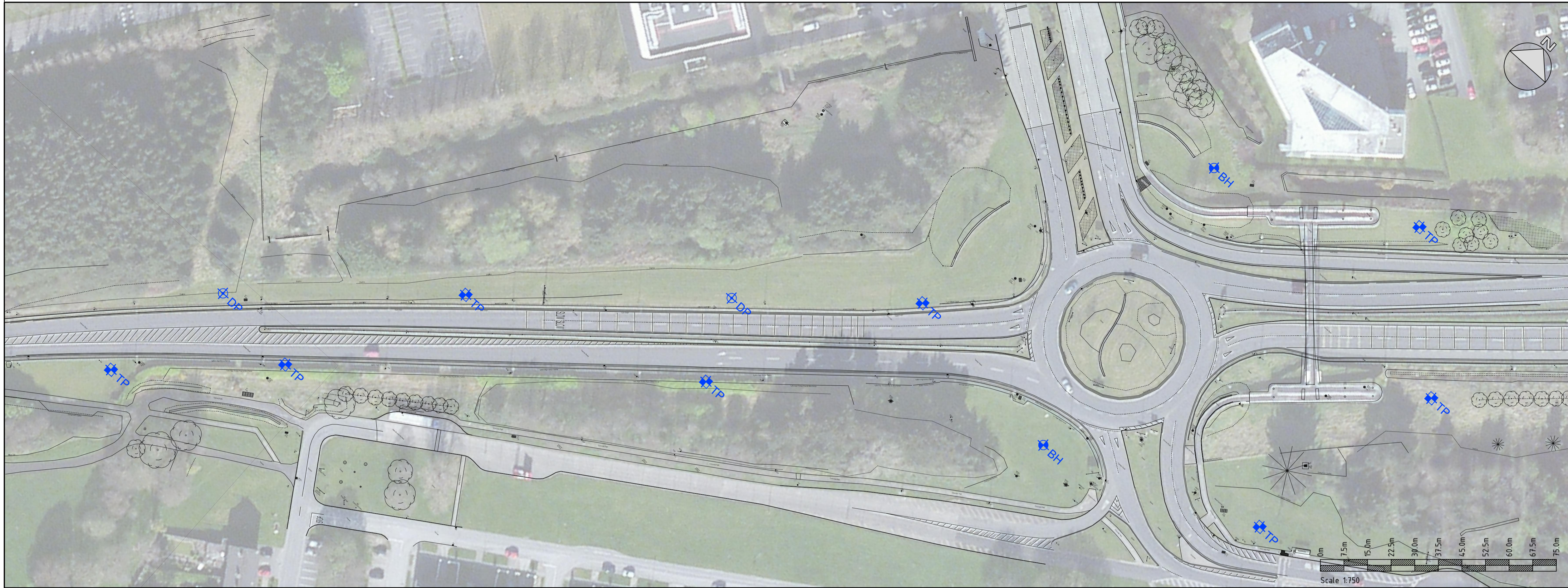
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N19 SHANNON AIRPORT ACCESS ROAD IMPROVEMENT SCHEME

DRAWING TITLE

GROUND INVESTIGATION PLAN - SHEET 2 OF 3

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Drawing Number N19-SAAR-DR-GI-0002		Rev P02



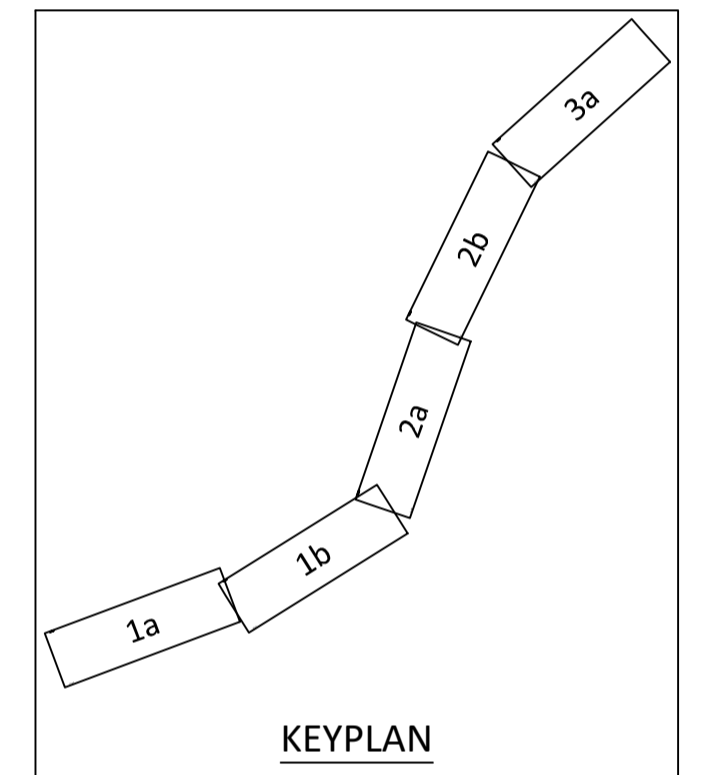
PLAN 3a
Scale 1:750

NOTES

GI Legend

- Proposed Borehole
- Proposed Trial Pit
- Proposed Slit Trench
- Proposed Dynamic Probe
- Proposed Cone Penetration Probe

Note - ground investigation locations shown are preliminary and subject to client approval.



P02	PRELIMINARY ISSUE	IH	BB	BDH	03.03.20
P01	PRELIMINARY ISSUE	IH	BB	BDH	26.02.20
REV	DESCRIPTION	BY	CHK	APD	DATE



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**N19 SHANNON AIRPORT ACCESS ROAD
IMPROVEMENT SCHEME**

DRAWING TITLE

**GROUND INVESTIGATION PLAN -
SHEET 3 OF 3**

Drawn by POR	Checked by BB	Approved by BB
Date 03.03.20	Project number P2057	Scale (@ A1) 1:750m
Drawing Number N19-SAAR-DR-GI-0003		Rev P02

