A30 Chiverton to Carland Cross
Environmental Statement

Volume 6 Document Ref 6.4 ES Appendix 9.1
WSP Preliminary Sources Study Report

HA551502-WSP-EGT-SW-RP-LE-000001

August 2018

Planning Act 2008
Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009 (as amended)
APFP Regulation 5(2)(a)

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EXECUTIVE SUMMARY

The section of the A30 in Cornwall between Chiverton Cross and Carland Cross, to the north of Truro, experiences congestion and delays throughout the year, with poor journey time reliability. The route is in need of improvement to meet Highways England's objectives of supporting economic growth, maintaining the smooth flow of traffic with a view of making the network safer.

The scope of the scheme is to upgrade 7.9 miles of existing single carriageway to dual carriageway on the A30 between Chiverton Cross roundabout and Carland Cross roundabout. The scope includes addressing the junctions at Chiverton Cross, Carland Cross and the key intermediate junctions which provide connections to the local highway network.

The specific transport objectives identified at the stage 0 value management workshop are to:

- contribute to regeneration and sustainable economic growth;
    - support employment and residential development opportunities;
- improve the safety, operation and efficiency of the transport network;
- improve network reliability and reduce journey times;
    - deliver capacity enhancements to the strategic road network;
- support the use of sustainable modes of transport;
- deliver better environmental outcomes; and
- improve local and strategic connectivity.

This report provides geotechnical and geoenvironmental assessments for the proposed scheme and a proposed preliminary ground investigation for determining the ground conditions and engineering properties, along with the groundwater regime, these focus upon any gaps in the existing information as well as areas not covered by existing ground investigation data.

The assessment of the desk study data implies the ground conditions are dominated by well fractured Mid Devonian interbedded mudstones, slates, siltstones and sandstones with a prevailing dip to the south, however, due strong deformation and folding dips can deviate.

Historically the area has been heavily mined for the mineral seams. Only one recorded ground working is likely to intercept the route. However, due to no obligations to keep mining records prior to 1872, it may be assumed that where workable deposits are present, unrecorded mining may have taken place and this may present a risk of localised subsidence in the immediate vicinity.

A walkover survey was undertaken as part of this report. Results from this survey identified no major issues with ground conditions in the areas surveyed at this time. The areas surveyed indicated that the route is mainly located in agricultural fields and appears easily accessible from minor roads off the A30; however, small-scale traffic management may be necessary for some locations.

This report proposes a series of 119 trial pits, 81 boreholes and 11 cone penetration tests for the ground investigation. The majority of the exploratory holes target the new route alignment and the associated structures.

1 PROJECT BACKGROUND

The scope of the scheme is to upgrade 7.9 miles of existing single carriageway to dual carriageway on the A30 between Chiverton Cross roundabout and Carland Cross roundabout. The scope includes addressing the junctions at Chiverton Cross, Carland Cross and the key intermediate junctions which provide connections to the local highway network. (See Figure 1.1)

The upgrade includes a mainly off-line design with the majority of the alignment of the road located on agricultural fields. The road trace occasionally crosses over the existing A30 and smaller B roads. The design includes 8 structures associated with the road including 5 under-bridges, 2 over-bridges and 1 accommodation bridge.

WSP | Parsons Brinckerhoff, on behalf of Highways England, is carrying out an initial study of the area which will include;

- Preliminary sources study Report (PSSR);
- PSSR walkover;
- Preparation of the scope of the Ground investigation (GI) works;
- Tender the GI;
- Manage the GI process; and
- Prepare a Ground Investigation Report (GIR);

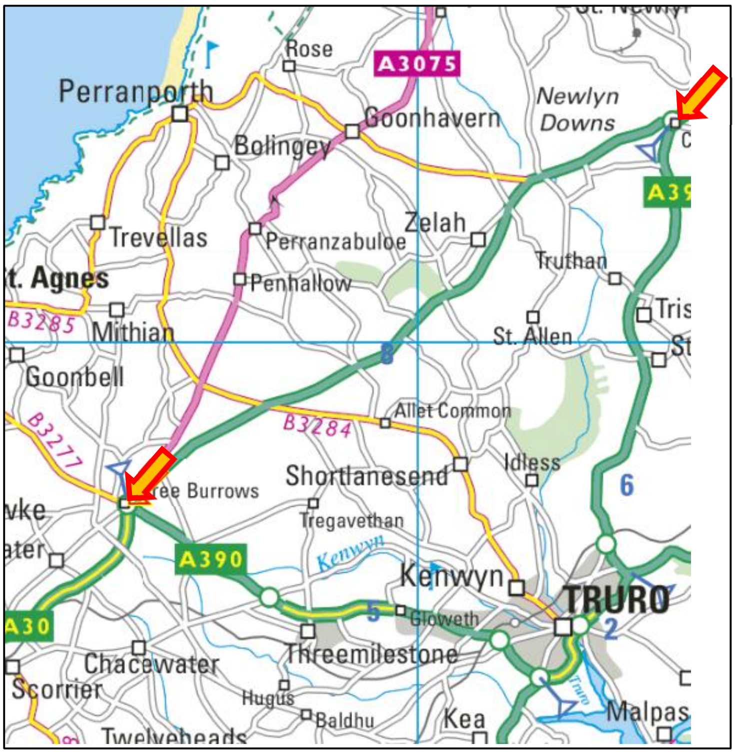


Figure 1.1: Section of A30 proposed for improvement (streetmap.co.uk) [Ref 1]

1.1 SCOPE AND OBJECTIVES OF THE REPORT

This PSSR shall define the key findings of a desktop study, including topography, geology and current ground conditions where known.

An outline design for an initial GI will be recommended with consideration given to safety, logistical and economical limitations of the site.

1.2 OTHER RELEVANT INFORMATION

This PSSR has been written in accordance with HD22/08, Managing Geotechnical Risk (Highways England, 2008) [Ref 2].

The project has been classified provisionally as a Geotechnical Category 2 in accordance with HD22/08 (Highways England, 2008) [Ref 2]. A category 2 project includes conventional types of geotechnical structures, earthworks and activities, with no exceptional geotechnical risks, unusual or difficult ground conditions or loading condition.

Category 2 is also where there is no excavation below the water table or where comparable local experience indicates that a proposed excavation below the water table will be straightforward.

This classification will be revisited at further design stages.

2 SOURCES OF INFORMATION

2.1 MAPPING

Ordnance Survey (OS) mapping has been utilised from the internet and is shown in Figure 2.1.

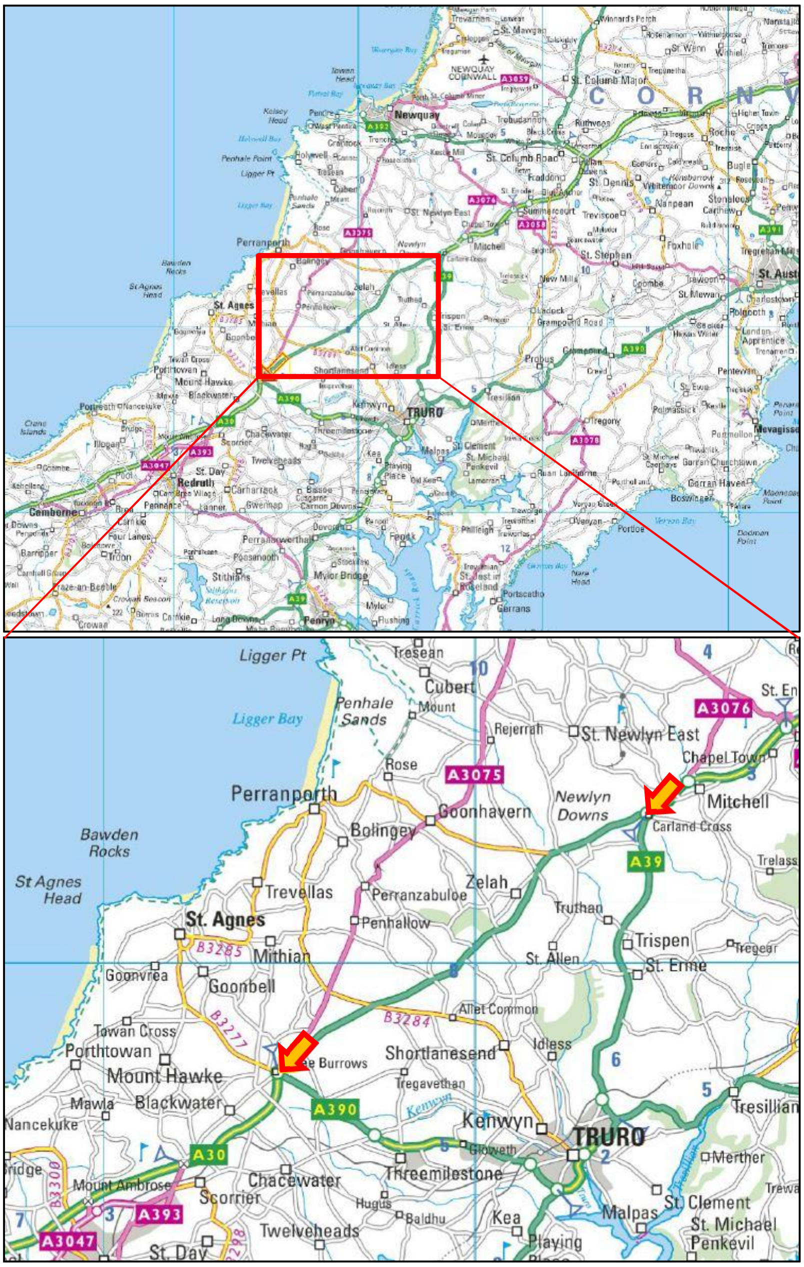


Figure 2.1: Ordnance Survey mapping of the study area at scales: (a) 1:200k and (b) 1:100k (www.streetmap.co.uk) [Ref 1].

OS survey data for mapping purposes was also obtained under licence from Highways England, 10030649, 2016 [Ref 3].

2.2 GROUNDSURE REPORT

A 2016 Groundsure Report [Ref 4] has been commissioned for the study area. The full Report is located with WSP|PB and the summary data sheets are presented in the PSSR Appendix B-1.

2.3 GEOLOGICAL MAPS AND RECORDS

Geological maps and records obtained from the British Geological Survey (BGS) include:

- BGS Geological map viewer of Britain, GeoIndex [Ref 5] ;
- Falmouth, Solid & Drift, Sheet 352, Scale 1:50,000 (1990) [Ref 6]; and
- Newquay , Bedrock & Superficial, Sheet 346, Scale 1:50,000 (2011) [Ref 7].

2.4 BOREHOLES

Studies of the BGS Geoindex [Ref 5] and HADGMS databases [Ref 8] have identified a number of varying depth boreholes in the study area. A map of the borehole locations and commentary is included in Section 5.9 of this Report.

2.5 ENVIROCHECK

Information from a historic Envriocheck Report from a previous study was obtained from the following source:

- Hyder Consulting, A30 Chiverton to Carland Cross Preliminary Sources Study, Feb 2003.[Ref 9]

2.6 HADGMS INFORMATION

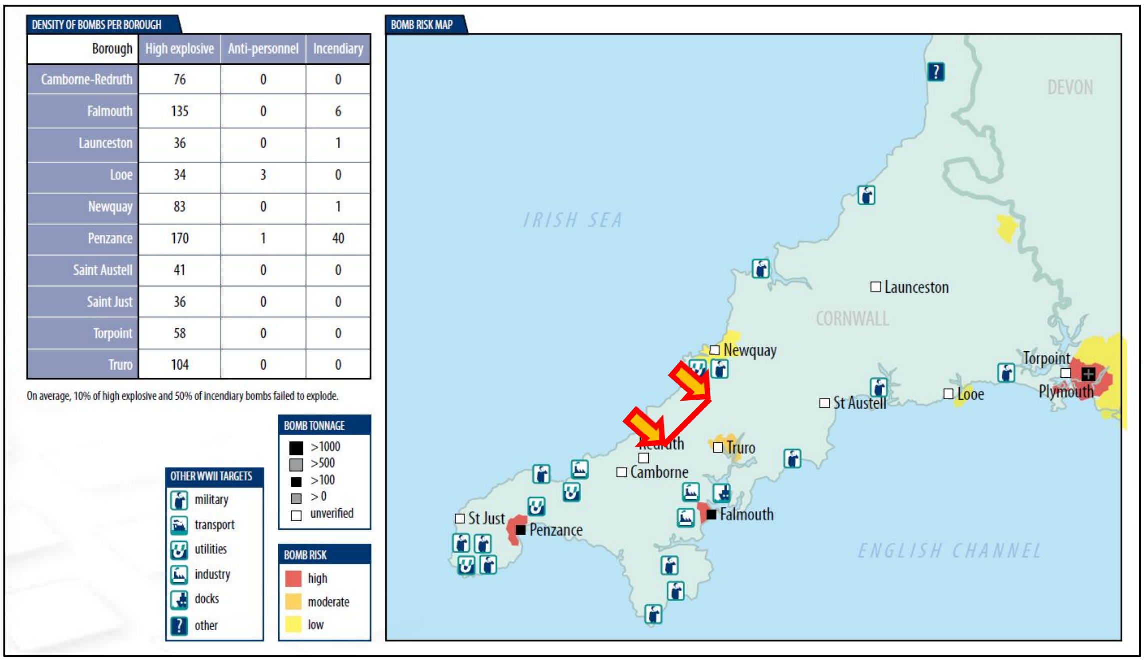
Additional information on the project has been obtained from previous studies using the Highways England (Agency) Geotechnical Data Management System (HAGDMS) database (www.hadgms.co.uk) [Ref 8].

2.7 HISTORICAL MAPPING

The historical mapping was obtained as part as a 2016 Groundsure Report [Ref 4] for the study area. Observations and commentary on the historical development of the area are included in Section 4.3 of this Report.

2.8 UNEXPLODED ORDNANCE

Figure 2.2 is taken from the Zetica Ltd. [Ref 10] website and gives a preliminary indication that the Chiverton to Carland Cross area has a low risk.


DENSITY OF BOMBS PER BOROUGH

Borough	High explosive	Anti-personnel	Incendiary
Camborne-Redruth	76	0	0
Falmouth	135	0	6
Launceston	36	0	1
Looe	34	3	0
Newquay	83	0	1
Penzance	170	1	40
Saint Austell	41	0	0
Saint Just	36	0	0
Torpoint	58	0	0
Truro	104	0	0

On average, 10% of high explosive and 50% of incendiary bombs failed to explode.

Figure 2.2: UXO risk map, Zetica Ltd. [Ref 10]

2.9 HYDROGEOLOGY

Information on the hydrogeology of the area was obtained from the following sources:

- Climate and weather data, Met Office (metoffice.gov.uk) [Ref 11];
- Highways England (Agency) Geotechnical Data Management System (hagdms.co.uk) [Ref 8];
- Environment Agency (environment-agency.gov.uk) [Ref 12]; and
- 2016 Groundsure Report [Ref 4].

2.10 GEOTECHNICAL DESK STUDY AND GROUND INVESTIGATION REPORTS

Information from third party Reports was obtained from the following sources:

- Hyder Consulting, A30 Carland Cross to Chiverton Cross Preliminary Ground Investigation – Factual Report on ground investigation, July 2004 [Ref 13];
- Parsons Brinckerhoff, A30 Chiverton Cross Roundabout Improvement Geotechnical Report, August 2005 [Ref 14];
- Accord, A38 Chiverton Roundabout CCTV Geotechnical Report, June 2008 [Ref 15].
- Engineering Services Laboratory (Cornwall Council) - A30 Chiverton Cross Roundabout Improvement Preliminary Sources Study Report 2009 [Ref 16];
- Soil Mechanics, A30 Carland Cross to Chiverton Cross Preliminary Ground Investigation, June 2006 [Ref 17];

- Hyder Consulting, A30 Chiverton Cross to Garland Cross Statement of Intent, January 2003 [Ref 18]; and

- The Department of Transport, Exeter, A30 Penhale to Carland Cross Improvement Site Investigation Report, 1988 [Ref 19].

2.11 UTILITIES SERVICES

Statutory Undertakers have been approached to supply utility plans as part of the C2 process. A composite utility summary can be found along with mapping in Appendix C-1

2.12 TOPOGRAPHY

The topography along the proposed route has been generated from OS survey 2m 3D contour data obtained under licence from Highways England, 10030649, 2016

2.13 ENVIRONMENT

Information on the environmental issues of the study area was obtained from the following sources:

- MAGIC (magic.defra.gov.uk) [Ref 20]; and

- Environment Agency (environment-agency.gov.uk) [Ref 12].

2.14 MINING

- Highways England (Agency) Geotechnical Data Management System (hagdms.co.uk)[Ref 8];

- 2016 Groundsure Report [Ref 4];

- 2002 Mining Activity Search, Cornwall Consultants [Ref 21]; and

- 2003 DEFRA non-coal mining database search for the Chiverton cross to Carland Cross stretch of the A30. [Ref 22].

3 FIELD STUDIES

3.1 WALKOVER SURVEY

A preliminary site walkover survey was undertaken on the 4th of August 2016 by Simon Maynard (Principal Materials and Geotechnical Engineer) and Zoe Horrell (Graduate Geotechnical Engineer), both of WSP|PB.

3.2 SITE WALKOVER SURVEY RESULTS

A preliminary site walkover was carried out by representatives of WSP | PB on the 4th of August 2016. No access onto private land was permitted during the walkover. The walkover was undertaken on public footpaths and roads. It is proposed that access to the site during the ground investigation stages will be through private land access gates leading onto side roads. Photograph locations are shown in red and location of proposed access points and shown in blue. Specific observations and findings from the walkover are detailed below:

Chainage 0m – 700m:

At the time of undertaking the PSSR walkover, this section is live carriageway and inaccessible. However, there are no GI exploratory hole locations in this area.

Chainage 700m – 1500m:

The current general arrangement drawings for this 800m section of the proposed route consist of the carriageway running northeast passing over an under bridge structure which connects two roundabouts. These roundabouts connect the existing A30 and A3075 to the proposed route. An attenuation pond sits the north-west of the bridge.

This area comprises large open grass fields. Access to these fields is via large open gaps in the hedge running alongside the A3075.

Figure 3.1: Walkover photograph set A- Field through which route alignment passes, looking south-east (LEFT) and looking north-west (RIGHT).Taken from open access to the field.

Figure 3.2: Walkover photograph set A- Location of Walkover photograph set A.

Chainage 1500m – 2000m:

The current general arrangement drawings for this 500m section of the proposed route consist of the carriageway running northeast. The carriageway passes over a small side road off the A3075 at 1800m. An attenuation pond is located at 2000m just west of the carriageway alignment.

This area consists of large open grass fields. Access to these fields is via of large open gaps in the hedge running alongside a small side road off from the A3075. Access out of this side road onto the A3075 includes a blind dip in the A3075 cutting off view to oncoming traffic.

Figure 3.3: Walkover photograph set B- Fields through which route alignment passes, looking south-east (LEFT) and looking north-west (RIGHT).Taken from open access to fields.

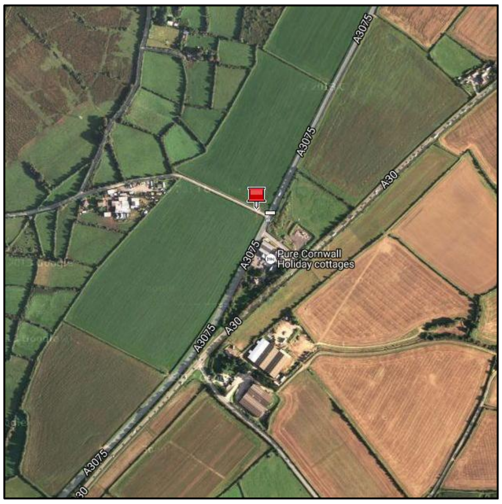


Figure 3.4: Walkover photograph set B - Location of Walkover photograph set B.

Chainage 2000m – 2300m:

At the time of undertaking the PSSR walkover, this section was on private land and so was inaccessible. However, through investigation of Google Maps and Streetview and notes taken during the walkover, it seems likely that access for GI Contractor's plant and equipment will be possible to via a wide gap in the hedge off the A3075. This will be confirmed during subsequent site visits with the GI tenderers.

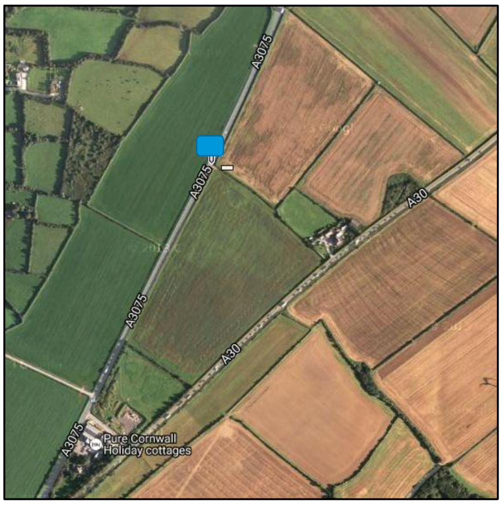


Figure 3.5: Possible access location for chainage 2000m – 2300m.

Chainage 2300m – 2700m:

The current general arrangement drawings for this 400m section of the proposed route consist consists of the continuation of the dual carriageway between Trevissome Park and Pendown Farm running northeast.

This area consists of large open crop fields. Access to these fields is via an open gap in the hedge running adjacent to the A3075.

Figure 3.6: Walkover photograph set C- Fields through which route alignment passes, looking south-east (LEFT) and looking south (RIGHT).

Figure 3.7: Walkover photograph set C- Open access to fields (LEFT) Location of Walkover photograph set C (RIGHT).

Chainage 2700m – 3100m:

At the time of undertaking the PSSR walkover, this section was on private land and so was inaccessible. However, through investigation of Google Maps and Streetview, it seems likely that access for GI Contractor's plant and equipment will be possible to via interconnecting field gates from the field accessed for chainage 2300m – 2700m. This will be confirmed during subsequent site visits with the GI tenderers.

Figure 3.8: Possible access locations with interconnecting fields accessed for chainage 2700m – 3100m.

Chainage 3100m – 3400m:

At the time of undertaking the PSSR walkover, this section was on private land and so was inaccessible. However, through investigation of Google Maps and Streetview, it seems likely that access for GI Contractor's plant and equipment will be possible to via an interconnecting field gate from the field accessed for chainage 3400m – 3800m. This will be confirmed during subsequent site visits with the GI tenderers.

Figure 3.9: Possible access locations for chainage 3100m – 3400m from an interconnecting field accessed for chainage 3400m – 3900m.

Chainage 3400m – 3900m:

The current general arrangement drawings for this 500m section of the proposed route consist consists of the continuation of the dual carriageway between Truro Saw Mills and Callestick Vean running east.

This area consists of large open crop fields. Access to these fields is via an open gap in the hedge and a private farm gate off the B3284.

Figure 3.10: Walkover photograph set D- Fields through which route alignment passes, looking south-west (LEFT) and looking north-east (RIGHT).

Figure 3.11: Walkover photograph set D- Access to the right field through private farm gate (LEFT); Location of Walkover photograph set D (RIGHT).

Chainage 3900m – 4200m:

The current general arrangement drawing for this 300m section of the proposed route consists of the continuation of the dual carriageway in fields around Callestick Vean, running east.

This area consists of large open grass fields, one field contained hard standing and the fields are separated by a structure and hedges, Access to these fields is via private farm gates down a hummocky gravel track off of the B3284.

Figure 3.12: Walkover photograph set E- Fields through which route alignment passes, looking south-east (LEFT) and looking north (RIGHT).

Figure 3.13: Walkover photograph set E- Access to the right field through private farm gate (LEFT); Location of Walkover photograph set E (RIGHT).

Chainage 4200m – 4700m:

At the time of undertaking the PSSR walkover, this section was on private land and so was inaccessible. However, through investigation of Google Maps and Streetview, it seems likely that access for GI Contractor's plant and equipment will be possible to via interconnecting field gates from the field accessed for chainage 3900m – 4200m. This will be confirmed during subsequent site visits with the GI tenderers.

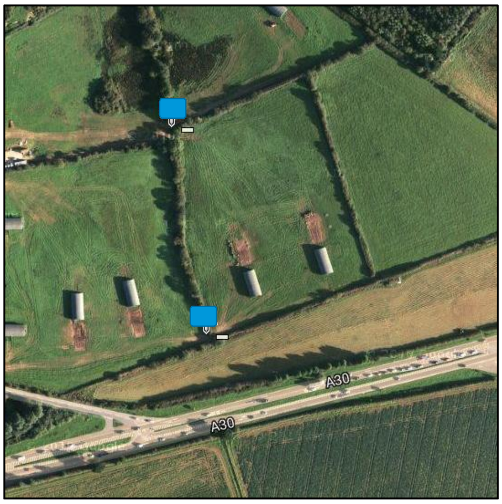


Figure 3.14: Possible access locations for chainage 4200m – 4700m from interconnecting fields accessed from chainage 3900m – 4200m.

Chainage 4700m – 4900m:

At the time of undertaking the PSSR walkover, this section was adjacent to live carriageway with no obvious safe public layby and therefore was inaccessible. However, through investigation of Google Maps and Streetview, it seems likely there may be access via the A30. This will be confirmed during subsequent site visits with the GI tenderers.

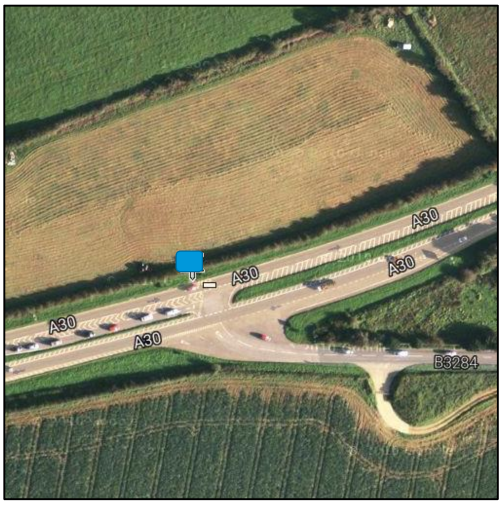


Figure 3.15: Possible access location for chainage 4700m – 4900m.

Chainage 4700m – 5100m:

The current general arrangement drawings for this 300m section of the proposed route consist of the route passing through the existing A30. The A30 is then re-joined to the road network using an overbridge and two roundabouts. These roundabouts connect to the B3284 top the south of the alignment and the existing A30 to the north of the alignment. The dual carriageway then continues northeast parallel to the A30.

This area consists of a large open crop field; Access to these fields is via an open gap in the hedge running along the B3284.

Figure 3.16: Walkover photograph set F- Field through which route alignment passes, looking north (LEFT); Location of Photo Set F (RIGHT).

Chainage 5100m – 5800m:

At the time of undertaking the PSSR walkover, this section was on private land and so was inaccessible. However, it was noted on the walkover that it seems likely there may be access via a farm track off the B3284. This will be confirmed during subsequent site visits with the GI tenderers.

Figure 3.17: Possible access location for chainage 5100m – 5800m via farm track.

Chainage 5800m –5900m:

The current general arrangement drawings for this 100m section of the proposed route consist of the continuation of the dual carriageway leading up to an underbridge structure. The dual carriageway then continues northeast parallel to the A30.

This area consists of a large open crop field. Access to these fields is via an open gap in the hedge running along a side road off the A30

Figure 3.18: Walkover photograph set G- Field through which route alignment passes, looking west (LEFT); Location of Photo Set G (RIGHT).

Chainage 5900m – 7000m:

The current general arrangement drawings for this 400m section of the proposed route consist of the continuation of the dual carriageway from Nanteague Farm to Nanteague Solar Farm running northeast.

This area comprises of large open interconnecting grass fields with a small wooded area. An electricity substation and a small breeze-block structure containing a tank are located within this wooded area. Access to these fields is via a concrete entrance with double metal gates and a cattle grid.

Figure 3.19: Walkover photograph set H- Fields through which route alignment passes, looking south-east (LEFT) and looking West (RIGHT).

Figure 3.20: Walkover photograph set H- Access to right field through private farm gate (LEFT); Location of Walkover photograph set H (RIGHT).

Chainage 7000m – 7200m:

The current general arrangement drawings for this 100m section of the proposed route consist of the continuation of the dual carriageway over a small side road near the Marazan Farm campsite running northeast.

This area consists of a large open grass field. Access to these fields is via a private farm gate.

Figure 3.21: Walkover photograph set I- Field through which route alignment passes, ` looking east (LEFT) and access to the field (RIGHT).

Figure 3.22: Walkover photograph set I- Location of Walkover photograph set I

Chainage 7200m – 8100m:

At the time of undertaking the PSSR walkover, this section was on private land and so was inaccessible. However, it was noted on the walkover that there may be access via a single track lane leading to Nancarrow Farm off the A30. This will be confirmed during subsequent site visits with the GI tenderers.

Figure 3.23: Possible access location for chainage 7200m – 8100m.

Chainage 8100m – 8600m:

The current general arrangement drawings for this 200m section of the proposed route consist of the carriageway running over an existing side road from the A30. It is proposed to construct an underbridge structure keeping the existing road layouts as they are. The dual carriageway then continues northeast parallel to the existing A30.

This area consists of interconnecting large open crop fields. Access to these fields is via private farm gates.

Figure 3.24: Walkover photograph set J- Field through which route alignment passes, looking north-west (LEFT) and looking north showing private farm gate (RIGHT).

Figure 3.25: Walkover photograph set J- Access to the east field through private farm gate looking East (LEFT); Location of Walkover photograph set J (RIGHT).

Chainage 8600m – 9000m:

The current general arrangement drawings for this 400m section of the proposed route consist of the carriageway running parallel to the existing A30 and the extension of an existing bridge over the proposed route and the A30. The area also is proposed to contain an attenuation pond to the east of the alignment at 9000m

This area consists of large open grass fields. Access to these fields is via private farm gates on small side roads.

Figure 3.26: Walkover photograph set K- Fields through which route alignment passes, looking northeast from existing accommodation bridge over the A30 (LEFT) and looking north from further down the road showing private farm gate to access fields seen in the left photo (RIGHT).

Figure 3.27: Walkover photograph set K- Fields through which route alignment passes, looking south (LEFT); Access to left field via private farm gate (RIGHT).

Figure 3.28: Walkover photograph set K– Existing bridge over A30 looking north-west (LEFT) and south-east (RIGHT).

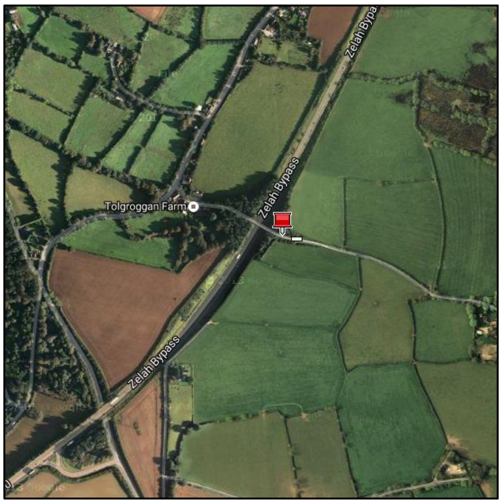


Figure 3.29: Walkover photograph set K- Location of Walkover photograph set K.

Chainage 9000m – 9800m:

At the time of undertaking the PSSR walkover, this section was not accessed. However, through investigation of Google Maps and Streetview, it seems likely there may be access via a single track lane leading to the A30 crossing to Zelah and then via interconnecting fields. This will be confirmed during subsequent site visits with the GI tenderers.

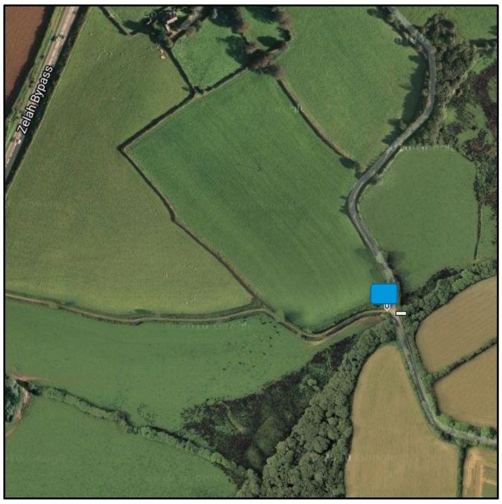


Figure 3.30: Possible access location for chainage 9000m – 9800m.

Chainage 9800m – 10000m:

The current general arrangement drawings for this 100m section of the proposed route consist of the continuation of the dual carriageway over a small side road from Trevalso cottage to Trevalso Farm running northeast.

This area consists of a grass field. Access to these fields is via private farm gates on a small side road off the A30.

Figure 3.31: Walkover photograph set L– Access to fields through which route alignment passes, looking north-east (LEFT); Location of Walkover photograph set L (RIGHT).

Chainage 10000m – 10200m:

At the time of undertaking the PSSR walkover, this section was on private land and so was inaccessible. However, through investigation of Google Maps and Streetview, it seems likely there may be access via a single track lane. This will be confirmed during subsequent site visits with the GI tenderers

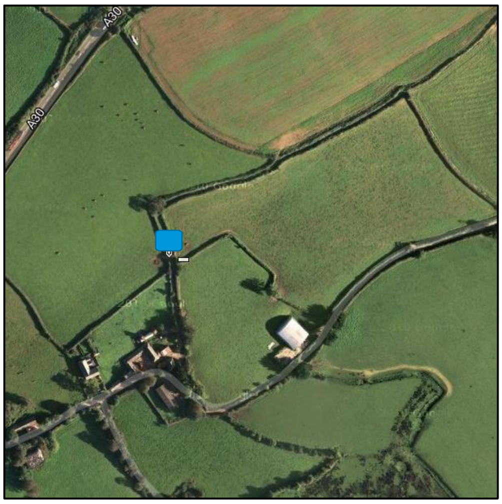


Figure 3.32: Possible access location for chainage 10000m – 10200m.

Chainage 10200m – 10500m:

At the time of undertaking the PSSR walkover, this section was on private land and so was inaccessible. However, through investigation of Google Maps and Streetview, it seems likely there may be access via a single track lane. This will be confirmed during subsequent site visits with the GI tenderers

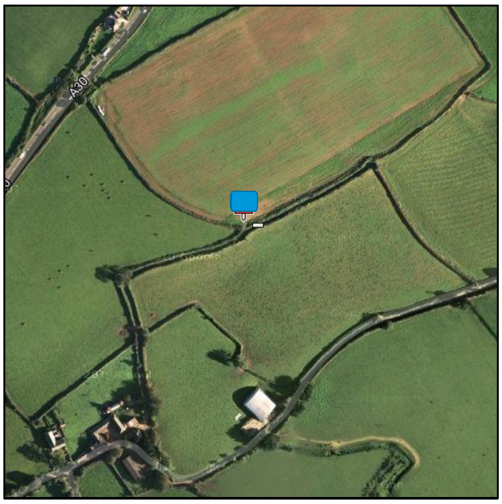


Figure 3.33: Possible access location for chainage 10200m – 10500m.

Chainage 10500m – 10700m:

The current general arrangement drawings for this 200m section of the proposed route consist of the continuation of the dual carriageway over a small side road near Tregoriand running northeast away from the A30.

This area consists of a large open grass field. Access to this field is via a private farm gate but also a small track leading to fields further behind.

Figure 3.34: Walkover photograph set N- Field which may provide access to the route alignment looking south (LEFT) and track which may access fields further behind (RIGHT).

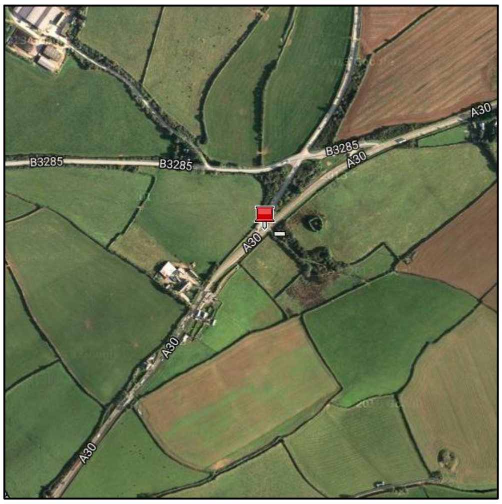


Figure 3.35: Walkover photograph set N- Location of Walkover photograph set N.

Chainage 10700m – 11200m:

The current general arrangement drawings for this 200m section of the proposed route consist of the carriageway running over an existing side road from the A30. It is proposed to construct an underbridge structure keeping the existing road layouts as they are. The dual carriageway then continues northeast converging towards the existing A30.

This area consists of large open crop fields. Access to these fields is via private farm gates.

Figure 3.36: Walkover photograph set O- Field through which route alignment passes, looking west (LEFT) and looking east showing private farm gate (RIGHT).

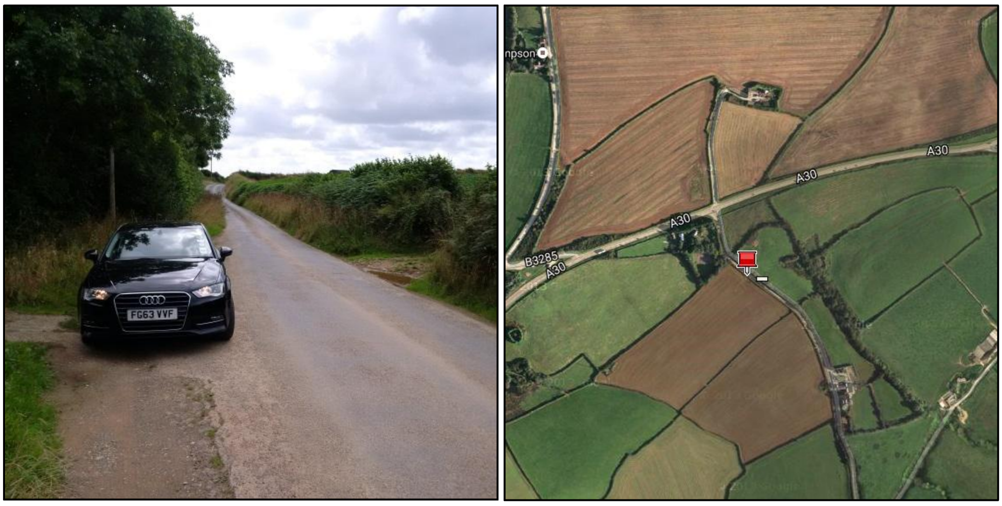


Figure 3.37: Walkover photograph set O- Access to field through private farm gate looking south (LEFT); Location of Walkover photograph set O (RIGHT).

Chainage 11200m – 11600m:

The current general arrangement drawings for this 100m section of the proposed route consist of the continuation of the dual carriageway over a small side road north Ventanteauge running northeast parallel to the existing A30.

This area consists of large open crop fields. Access to these fields is via private farm gates. Fields are interconnected via smaller farm gates.

Figure 3.38: Walkover photograph set P- Field through which route alignment passes, looking west (LEFT) and showing the access to the field (RIGHT).

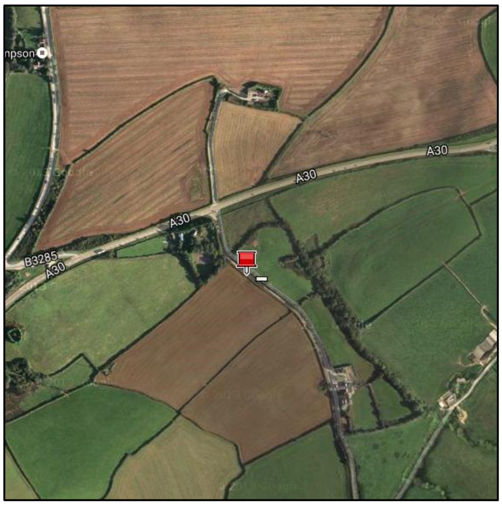


Figure 3.39: Walkover photograph set P- Location of Walkover photograph set P

Chainage 11600m – 12100m:

At the time of undertaking the PSSR walkover, this section was adjacent to live carriageway with no safe area for stopping and therefore was inaccessible. However, through investigation of Google Maps and Streetview, it seems likely there may be access via a farm gate on a minor road off the A30. This will be confirmed during subsequent site visits with the GI tenderers

Figure 3.40: Possible access location for chainage 11600m – 12100m.

Chainage 12100m – 12800m:

The current general arrangement drawings for this 700m section of the proposed route consist of the continuation of the dual carriageway over a large field opposite Rocland house. The route runs northeast parallel to the existing A30.

This area comprises of large open crop fields. Access to these fields comprises a large double private farm gate. The area has a gas pipeline running through it; its location is identified by signs in the area and by fenced off area for monitoring.

Figure 3.41: Walkover photograph set Q- Field through which route alignment passes, looking west, this photo also shows the location of a gas (red circle) (LEFT) and showing private farm gate access (RIGHT).

Figure 3.42: Walkover photograph set Q- Access to field through private farm gate looking east (LEFT); Location of Walkover photograph set Q (RIGHT).

Chainage 12800m – 13000m:

At the time of undertaking the PSSR walkover, the access to this is unclear and further investigation will need to be undertaken.

Chainage 13000m – 14400m:

The current general arrangement drawings for this 1400m section of the proposed route consist of the carriageway running northeast passing over two under bridge structures on which connects to the existing A30 at 13000m and the other which connects at Carland roundabout at 14000m. The route alignment runs through the Newlyn downs and through the Scottish Power wind farm at Carland cross.

This area consists of large open grass fields with wind turbines. Access to these fields is via the entrance to the wind farm owned by Scottish Power. The area has a gas pipeline running through it; its location is identified by signs in the area and by fenced off area for monitoring.

Figure 3.43: Walkover photograph set R- Field through which route alignment passes, looking west (LEFT) and northeast, this photo also shows the location of a gas pipeline running through (RIGHT).

Figure 3.44: Walkover photograph set R- Access to wind farm field through the private gate (LEFT); Location of Walkover photograph set R (RIGHT).

3.3 PREVIOUS GROUND INVESTIGATIONS

3.3.1 LONDON – PENZANCE TRUNK ROAD A30 PENHALE TO CARLAND CROSS IMPROVEMENT SITE INVESTIGATION REPORT, THE DEPARTMENT FOR TRANSPORT 1988

INTRODUCTION

A ground investigation was requested by Cornwall County Council Surveyors Department, for the construction of a new dual from Carland Cross to Penhale. The ground investigation was undertaken by the Soil and Materials Laboratory of Cornwall County Council County Surveyors Department, and included the identification of strata, the groundwater regime and the existing pavement design, as well as an assessment of the engineering properties of the strata.

SUMMARY OF GROUND INVESTIGATION

A total of 29 No. trial pits and 37 No. boreholes were carried out during the ground investigation. All the boreholes were completed using both percussive and rotary follow on drilling techniques. Insitu standard and cone penetration testing was undertaken at regular intervals within the boreholes, and the ground water levels were measured and sampled where appropriate.

SUMMARY OF GROUND CONDITIONS

The information obtained during the ground investigation indicates that the ground conditions are relatively consistent across the site. The general geological sequence at the site comprises Topsoil overlying composite Residual Soils that are underlain by a gradational weathering profile into the underlying bedrock. More rounded material was also encountered at some locations suggesting Head Deposits.

The Residual Soils were identified from 0.10-2.10m bgl to 0.85-4.00m bgl. Generally the Residual Soils consisted of clayey or silty sandy gravels and very clayey or silty very sandy gravels that contained occasional cobbles. The SPT N value ranged from 6 to 19, and near the rock head the SPT N values were in excess of 50.

Bedrock was encountered from 0.30 – 0.40m bgl to an unproven depth, and varied between the western and eastern ends of the site.

Within the western half of the site the predominant lithology was slaty siltstone with subordinate thin beds of laminae of mudstone. There were predominantely dark bluish and greenish grey, and frequently iron stained resulting in orange and pink/black mottling. Immediately beneath the Residual Soil the siltstone was completely to highly weathered with the grade decreasing to moderately to slightly weathered with depth. Where the rock was more highly fractured towards rock head, clayey material was deposited along discontinuities. In addition quartz veins were occasionally recorded.

The SPT N value for the siltstone was initially 50, and did not exceed 50 until depth was increased.

In the eastern end of the site the exploratory holes contained finer slaty mudstone, with slaty siltstone present as thinly bedded horizons. The mudstone was a light greyish brown which was frequently iron stained orange and pink/black. It was thinly laminated with very close, well developed cleavage causing it to be friable.

The bedding of both bedrock lithologies frequently contorted towards rockhead, with dips ranging from 30° to 90°. The cleavage developed tended to coincide with the bedding, parting along the laminae, with a second set recorded in some of the cores at 0-10° and 40-70°. The jointing predominated at approximately 90°, with further sets at 20-40°.

Groundwater encountered from 2.70m bgl to 2.75m bgl during the ground investigation.

3.3.2 A30 CARLAND CROSS TO CHIVERTON CROSS PRELIMINARY GROUND INVESTIGATION FACTUAL REPORT, SOIL MECHANICS 2004

INTRODUCTION

In March 2004 Soil Mechanics were commissioned by Hyder Consulting Limited on behalf of the Highways Agency to undertake a ground investigation on the A30, between Carland

Cross and Chiverton Cross. The ground investigation was required to obtain geotechnical and geoenvironmental information for the proposed dualling of the A30 carriageway.

SUMMARY OF GROUND INVESTIGATION

The ground investigation comprised; tarmac coring, trial pitting, window sampling and cable percussion and rotary drilled boreholes along the highway verge of in adjacent fields. The types of exploratory holes undertaken during the ground investigation are listed below:

TYPE	QUANTITY	MAXIMUM DEPTH (M BGL)
Tarmac Cores	4	-
Trial Pits (machine excavated)	14	3.60
Window Sampling	2	5.10
Cable Percussion Boring	4	8.40
Cable Percussion Boring extended by Rotary Core/Rotary Open Hole Drilling	14	14.00
Rotary Open Hole extended by Rotary Core Drilling	2	6.00
Rotary Open Hole Drilling Only	2	15.00

SUMMARY OF GROUND CONDITIONS

The ground investigation indicates the ground conditions were relatively consistent across the site, comprising in general; Topsoil underlain by Gravel and/or Clay overlying a gradational weathering profile of the Weathered Porthtowan Formation. The bedrock was identified as the Weathered Meadfoot Beds at 2 No. exploratory hole locations.

Gravel was encountered from 0.25-3.70m bgl to a depth of 1.20-4.15m bgl. The Gravel comprised red/ orange/ brown/ pink very clayey to slightly clayey slightly sandy to very sandy gravel, which was subrounded to angular fine to coarse of slate, quartz, quartzite and mudstone. Occasional to frequent cobbles of slate and quartzite were also identified at some exploratory hole locations.

The Clay is described as red/ orange/ brown/ pink slightly sandy to sandy slightly gravely to gravelly clay. The sand was described as fine to coarse, and the gravel as subrounded to angular fine to coarse slate, quartz and mudstone. The Clay was encountered from a depth of 0.20-1.20m bgl to a depth of 0.70-8.40m bgl.

The Weathered Porthtowan Formation was encountered from a depth of 0.70-4.70m bgl to an unproven depth. It comprised slate, slate/ mudstone and sandstone with quartz veins, which was occasionally interbedded. The slate was described as blue/ grey brown and red brown thinly to thickly laminated, whilst the slate/ mudstone comprised red/ orange/ grey brown thinly to thickly laminated slate/ mudstone. The sandstone is described as red/ orange/ grey brown thinly laminated to thinly bedded fine to medium grained.

Open to tight folding was occasionally identified in the laminations. Fractures were identified subhorizontal to subvertical dipping 20 to 70° very closely to medium spaced planar to undulating and smooth and rough in the Weathered Porthtowan Formation.

The Weathered Meadfoot Beds were encountered from 2.20 to 2.80m bgl to an unproven depth. They are described as grey brown and green mudstone, thinly laminated red brown and grey slate, and thickly laminated green grey fine sandstone with moderately strong and thinly laminated grey foliated slate. Quartz veins were also recorded.

Immediately beneath the Gravel and/or Clay the Meadfoot Beds are completely to highly weathered with the grade decreasing to moderately to slightly weathered with depth.

Fractured were identified dipping 15 to 60° subhorizontal and subvertical very close to medium spaced planar to stepped smooth and rough, with occasional red brown staining.

During the ground investigation groundwater was encountered at 3 No. exploratory hole locations between 2.70 and 10.20m bgl. Groundwater installations were emplaced at 20 No. exploratory hole locations. The groundwater level recorded ranged between dry and 9.74m bgl at 15 No. locations, with 5 No. locations recorded as dry during every groundwater monitoring visit.

3.3.3 A30 CHIVERTON CROSS ROUNDABOUT GEOTECH REPORT, PARSONS BRINCKERHOFF 2005

INTRODUCTION

A ground investigation was commissioned by Parsons Brinckerhoff to obtain geotechnical information for the proposed Chiverton Cross Roundabout improvements. The improvements involved the construction of a new roundabout to the west, connecting to the existing Chiverton Cross Roundabout, and the widening of the existing A30 and A390.

SUMMARY OF GROUND INVESTIGATION

The ground investigation comprised 8 No. trial pits, with insitu CBR testing and soakaway testing. The insitu CBR testing was performed in 7 No. trial pits and the soakaway testing was carried out in 1 No. trial pit.

SUMMARY OF GROUND CONDITIONS

The ground conditions generally comprise Topsoil underlain by either Residual Soils or Completely Weathered – Grade V bedrock, with exception to 2 No. trial pits where Made Ground was underlying the Topsoil.

The Made Ground was encountered between ground level and 0.20m bgl, and had an unproven thickness. It was described as reddish brown clayey silty gravel underlain by sandy gravel and black hard road pavement, and silty clay with gravel of mudstone or slate with some wood, plastic bags and paper. The CBR value for the Made Ground was 1.4%.

The Residual Soil comprised reddish brown silty clayey gravel with occasional boulders of mudstone/slate and reddish brown silty to very silty clay with angular fine to coarse gravel of mudstone and slate. It was encountered from 0.40 to 0.50m bgl, but with an unproven thickness.

The CBR tests indicate a CBR value of between 2.7 and 6.5%. The results of the soakaway testing indicate a soil infiltration rate of 4.37E-04 m/s in the silty clay of the Residual Soils.

The Completely Weathered – Grade V bedrock was encountered between 0.30 and 0.50m bgl, and had an unproven thickness. It was described reddish brown silty slightly sandy to sandy very gravelly clay with angular fine to coarse gravel of mudstone, siltstone and/or slate. The CBR value ranged from 1.4% to 4.4%.

No groundwater was encountered in any of the trial pits during the ground investigation.

3.3.4 A38 CHIVERTON ROUNDABOUT CCTV GEOTECHNICAL REPORT, ACCORD 2008

INTRODUCTION

The proposed scheme involved the erection of a CCTV mast to monitor traffic flows on the Chiverton Cross Roundabout, between the A390 and the westbound carriageway of the A30. A ground investigation was therefore undertaken by Geotechnics to provide sufficient information and parameters to allow the design of the foundation for the mast structure.

SUMMARY OF GROUND INVESTIGATION

The ground investigation comprised 1 No. machine dig trial pit which was excavated within the verge, close to the intended location of the CCTV mast.

SUMMARY OF GROUND CONDITIONS

The trial pit comprised 0.15m of Topsoil described as light to dark brown fissured slightly sandy silty clay, underlain by 1.3m of Made Ground described as dark orange red silty gravelly clay, light yellow beige brown slightly silty gravel, dark orange red silty clayey gravel, and dark brown clayey gravel to gravelly clay. The trail pit refused at 1.45m bgl on boulders.

Groundwater was encountered during the excavation of the trial pit at 1.20m bgl.

4 SITE DESCRIPTION

The area surrounding the existing A30 carriageway is rural agricultural land with renewable energy generators and some disused quarries. The scheme is in the proximity of the Cornwall West Devon Mining Landscape World Heritage Site located 75m to the south west of the Chiverton roundabout; however the current proposed route should not interfere with this area. The scheme also is adjacent to the Chiverton Park registered park and garden, and the Newlyn Downs Special Area of Conservation and Cornwall Area of Outstanding Natural Beauty (AONB) in addition to numerous scheduled heritage features.

4.1 GEOGRAPHY

The site and surrounding geography are shown in Figure 4.1. It is situated along the existing A30, between Chiverton and Carland Cross, Cornwall.

Highways England groups the scheme within the Managing Agent area 1. The scheme starts with marker post ID 53/0 and finishes around marker post ID 66/8.

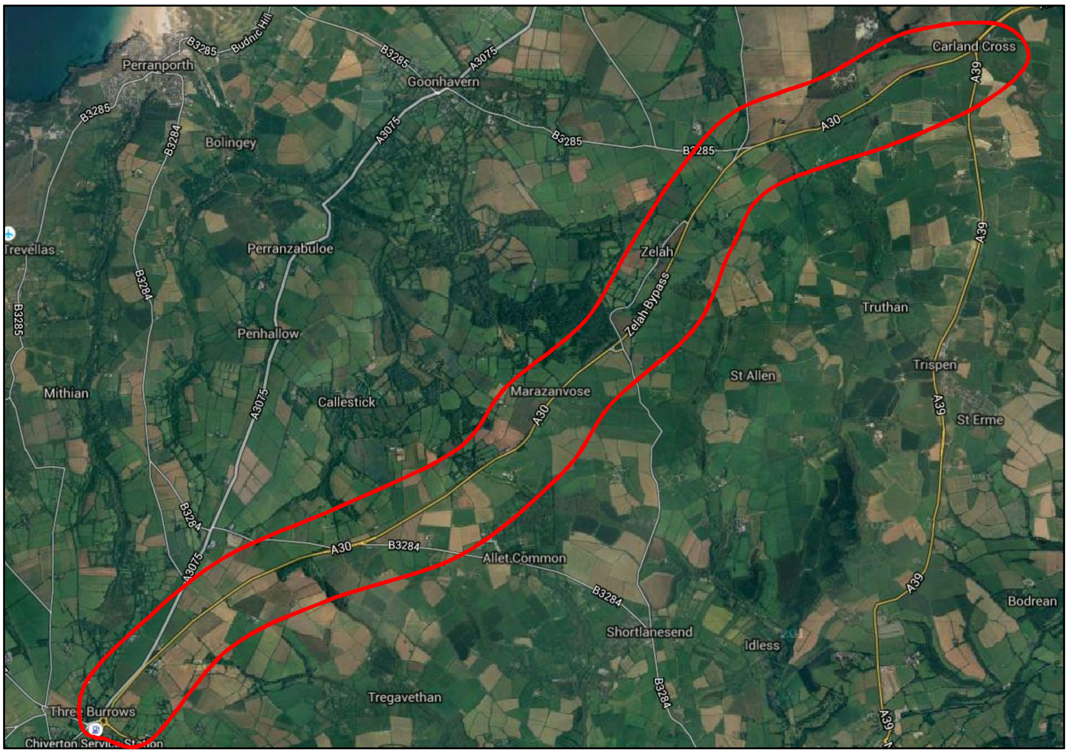


Figure 4.1: Scheme Location (googlemaps.co.uk) [Ref 23]

4.2 TOPOGRAPHY

The topography for the proposed route is summarised in Table 4-1. Detailed topography can be found on drawings in Appendix C-2.

Table 4-1 : Summarised Topography

CHAINAGE (m)	HEIGHTS (mAOD)	GENERAL DESCRIPTION
0 - 900	122.23 – 147.17	Gradual uphill slope with minor gentle undulations.

CHAINAGE (m)	HEIGHTS (mAOD)	GENERAL DESCRIPTION
900 – 1800	147.17 – 131.22	Very gentle downhill slope with minor gentle undulations.
1800 – 2700	131.22 – 142.99	Gentle uphill slope with minor gentle undulations.
2700 – 4200	142.99 – 96.33	Gradual downhill slope with minor gentle undulations
4200 – 5200	96.33 – 121.30	Gentle uphill slope with minor undulations
5200 – 6100	121.30 – 79.38	Gradual becoming steep downhill slope with minor gentle undulations.
6100 – 6600	79.38 – 100.80	Gradual uphill slope with very minor gentle undulations
6600 – 7200	100.80 – 78.48	Steep becoming gradual downhill slope with slight gentle undulations.
7200 – 7800	78.48 – 100.66	Gradual uphill slope with gentle minor undulations.
7800 – 8500	100.66 – 107.01	Flat becoming steep uphill slope with moderate undulations.
8500 - 9000	107.01 – 68.60	Steep downhill slope with minor undulations.
9000 - 13400	68.60 – 143.82	Steep becoming gentle uphill slope with minor stepped undulations becoming minor gentle undulations.
13400 - 14400	143.82 – 118.20	Gentle becoming steep uphill slope with minor gentle undulations.

4.3 HISTORICAL DEVELOPMENT

The history of development in the area is summarised in Table 4-2. Historical Maps are included in Appendix D-1.

The grid index refers the area of the study site the historical maps cover (See Figure 4.2).

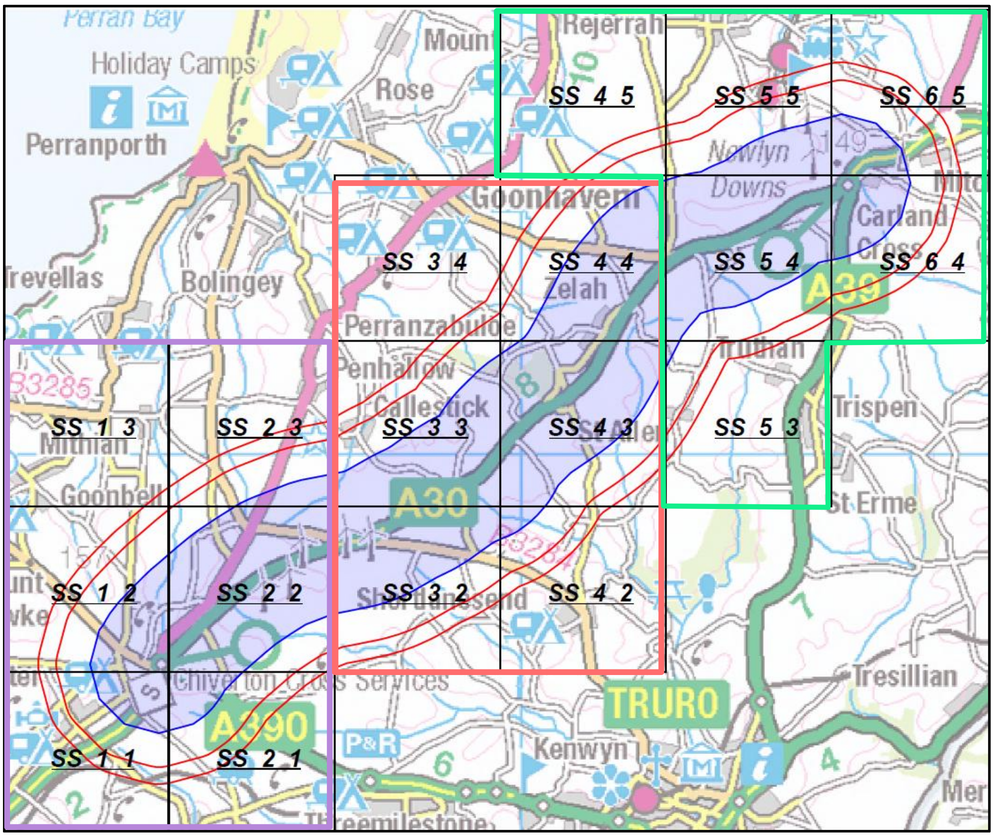


Figure 4.2: Historical Mapping Grid Index

Table 4-2: Summarised Historical Development

MAP	YEAR	DESCRIPTION	CHANGES FROM PREVIOUS
Chiverton – Grid Index SS 1.1, SS 2.1 , SS 1.2, SS 2.2, SS 1.3 , SS 2.3			
1: 10,000 (Small Scale)			
1 : 10,560	1879 - 1886	A road runs parallel through the middle of the study section area with other roads branching off to connect small settlements in the area. The current land use of this section of the study area is mostly open agricultural fields and plantations with occasional single or multiple dwellings in groups. Occasional old shafts and quarries labelled within this section of the study area. Ancient burial ground referred to as Tumuli (plural: Tumulus) or Barrows, are labelled inside and around the boundaries of this section of the study area.	N/A
1 : 10,560	1958	As 1908	No significant changes.
1: 10,000	1980	As 1975	Large roundabout constructed at Chiverton Cross with new entrances

MAP	YEAR	DESCRIPTION	CHANGES FROM PREVIOUS
			and exits to existing roads. Construction of occasional single dwellings within this section of the study area. Unlabelled water feature constructed in the south of this section of the study area (Section SS 2.2).
1 : 10,00	1988	As 1980	Construction of the A30 carriageway outside study site. No development to road running parallel through the middle of this section of the study area. Widening of the A390 leading south-east off the Chiverton roundabout. Construction of occasional single dwellings within this section of the study area.
1 : 10,000	2002	As 1988	Construction of occasional single dwellings and extensions to buildings within this section of the study area Construction of Four Burrows Wind Farm in the south of this section of the study area.
1 : 10,000	2014	As 2002	Occasional construction and extension of buildings within this section of the study area.
Zelah – Grid Index SS 3.2, SS 4.2, SS 3.3 , SS4.3 , SS3.4, SS 4.4			
1: 10,000			
1 : 10,560	1879 - 1886	A road runs parallel through the middle of this section of the study area with other roads branching off to connect small settlements in the area. The current land use of this section of the study area is mostly open agricultural fields and plantations with occasional single or multiple dwellings in groups. A small village labelled as Zelah is located towards the north-east of this section of the study area, with a small quarry to the north of that. Three Lead and Blende (Zinc) mines are labelled in the north-west (SS 3.3) of the study site; two of these mines are labelled as disused. West Chiverton mine has a large reservoir just north-west of the mine. It also has other associated reservoirs and engineering works and appears to still be in use. Other quarries and shaft in the area	N/A

MAP	YEAR	DESCRIPTION	CHANGES FROM PREVIOUS
		as labelled as “disused” or “old”. One disused lead mine is labelled outside this section of the study area to the north. Numerous old shafts and disused quarries are labelled outside this section of the study area. Ancient burial ground referred to as Tumuli (plural: Tumulus) or Barrows, are labelled inside and around the boundaries to the south and south-west.	
1 ; 10,560	1908	As 1886	West Chiverton Mine is now labelled as disused. Construction of the Truro & Newquay Branch of the Great Western Railway network trending east the north of this section of the study area. Construction of occasional single dwellings within this section of the study area and its boundaries.
1 : 10,560	1958	As 1908	The large reservoir associated with West Chiverton Mine is no long shown on the map. Construction of occasional single dwellings within this section of the study area and its boundaries.
1 : 10,000	1971 - 1976	As 1958	The large reservoir associated with West Chiverton Mine is now labelled as a tip, The Great Western Railway line is labelled as dismantled. Two barrows hill labelled in the middle of this section of the study area (Section SS 4.3). Site of tumulus is labelled to the south-east outside the study site Many of the old shafts and quarries in the area are now labelled as tips. Development of single dwellings and extensions to buildings in and around this section of the study area.
1: 10,000	1982	As 1971-1976	Prominent “earthwork” labelled in the middle of the study site (Section SS 3.3). Large development of structures in Shortlanesend.
1 : 10,00	1990 -1993	As 1982	Zelah Bypass road constructed.
1 : 10,000	2014	As 1990 - 1993	No significant changes noted.
Carland Cross – Grid Index SS 5.3, SS 5.4, SS 6.4, SS 4.5, SS 5.5, SS 6.5			

MAP	YEAR	DESCRIPTION	CHANGES FROM PREVIOUS
1: 10,000			
1 : 10,560	1879 - 1886	Cornwall's Mineral railway is located to the north-west of this section of the study area. A Lead , Blende (Zinc) and Copper mine with associated ponds are labelled as disused to the north of this section of the study area (Section SS 5.5). There are further disused lead and silvers mines to the north outside this section of the study site. The current land use of this section of the study area is mostly open agricultural fields with some plantations. The area also has a large expanse of moor area labelled the Newlyn Downs. The area also has occasional single or multiple dwellings in groups and wooded areas. Ancient burial ground referred to as Tumuli (plural: Tumulus) or Barrows, are labelled inside and around the boundaries of this sections of the study area.	
1 ; 10,560	1908	As 1886	The Cornwall's Mineral Railway is now repurposed as the Great Westerns Railway's Treamble Branch and is connected to the newly built Truro and Newquay branch just north-west of the section of the study area. The ponds associated with the disused mine inside this section of the study area are no longer shown on the map.
1 : 10,560	1958	As 1908	Possibility of a moated area known as a "killigrew" labelled In the south of this section of the study area (Section SS 5.4).
1 : 10,000	1976	As 1958	Warrens Barrow (Burial Mound) labelled west of Carland Cross intersection. Occasional construction and extension of buildings within this section of the study area. Disused Cargoll mine now labelled as a tip. Many old/disused shafts in this section of the study area now labelled as tips.
1 : 10,00	1990 -1993	As 1971-1976	Large development of buildings to the south-east of this section of the study area in Trispen to the south-east of this section of the study

MAP	YEAR	DESCRIPTION	CHANGES FROM PREVIOUS
			area. A depot is constructed to the north of this section of the study area.
1 : 10,000	2002	As 1990 - 1993	Construction of the A30 carriageway and roundabout interchange extending north-east from Carland Cross. Widening of the A39 (T) as it approaches the new Carland Cross roundabout. A bypass road has been constructed around Trispen to the south outside this section of the study area.
1 : 10,000	2014	As 2002	No significant changes noted.

During the past 130 years, the area surrounding the site has remained largely open agricultural fields, plantations, wooded areas and moor with the occasional village, town, hamlet or singular dwelling. The area historically has been heavily involved in the mining industry and there are many mines, shafts and quarries, most of which are old/disused.

However, over time the mining industry decreased and all workings around the study area are disused, and many of which are now filled in and labelled tips. The area also is scattered with ancient burial mounds labelled as Tumuli (plural: Tumulus) or Barrows. Some barrows have been later named burrows, some of which are used as place names, i.e. Two Burrows just south-east of the study area.

The major development in the area in the last 130 years is the construction of the A30 and the larger roundabout interchanges that accompanied them, along with bypasses built around Zelah to relieve traffic going through the village.

5 GROUND CONDITIONS

5.1 REGIONAL GEOLOGY

The region comprises of a varied geology but is mainly underlain by Upper Palaeozoic rocks of Devonian age. During the Variscan Orogeny, a mountain building event which commenced in the Devonian, deformed and variably folded and faulted these rocks. Minor granite intrusions of latest Carboniferous to early Permian age occur near the coast and Cenozoic deposits are present locally around St Agnes, in the west. The regional strikes are generally east–west to northeast-southwest. Many of the mineral veins and mines in this region follow parallel to these strikes (British Geological Society. (1990) Falmouth, solid & drift, sheet 352, scale 1:50,000. [Ref 6])(British Geological Society. (2011) Newquay , bedrock & superficial, sheet 346, scale 1:50,000 [Ref 7])

5.2 LOCAL GEOLOGY

The geology of the area is dominated by well fractured Mid Devonian interbedded mudstones, slates, siltstones and sandstones locally known as “Killas”. The strata in the region have a prevailing dip to the south, but the rocks have been strongly deformed and folded. There are numerous intrusive dykes crossing this area. Mineralisation in the area occurs in planar structures known as lodes which occupy former fissures in the Killas bedrock.

5.3 DRIFT GEOLOGY

Reference to BGS map sheets [Ref 6] and [Ref 7] and the BGS Geology of Britain viewer [Ref 5] indicates the following superficial deposits for the local area (See Figure 5.1):

- Alluvial Deposits - comprising of coarse silty gravels with an abundance of cobbles mainly in the river valley areas. Local environment previously dominated by rivers. These deposits were formed from deposition mainly sand and gravel detrital material in channels to form river terrace deposits, with fine silt and clay from overbank floods forming floodplain Alluvium.

- Head Deposits - comprising of gravelly sand that’s original structure may be disrupted in some areas with associated open cracks (cryoturbation structures). Local environment previously dominated by sub-aerial slopes. These deposits were formed from the material accumulated by downslope movements including landslide, debris flow, solifluction, soil creep and hill wash.

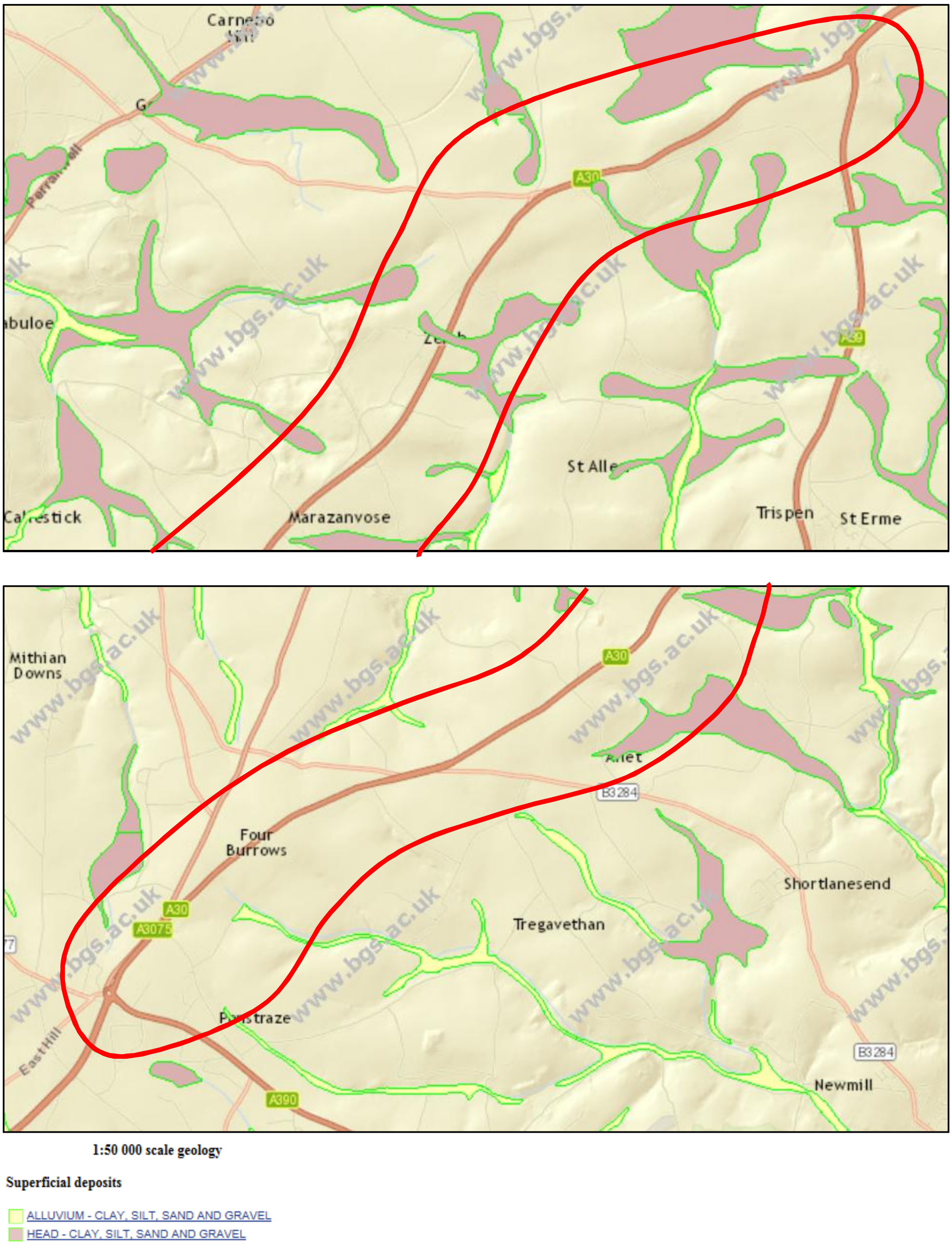


Figure 5.1: Superficial Deposits (BGS geology viewer)

5.4 SOLID GEOLOGY

Reference to BGS map sheets and the BGS Geology of Britain viewer indicate the following bedrock geology for the local area (See Figure 5.2):

- Porthtowan Formation - Mid Devonian interbedded slates and turbidite sandstones. Local environment previously dominated by deep seas. These rocks were formed from infrequent slurries of shallow water sediments which were then redeposited as graded beds. This underlies most of the area from Chiverton to Marazanvose.

- Grampound Formation – Mid Devonian interbedded sandstone and sun-ordinate siltstones, including thick to very thick beds of the Treworgans Sandstone Member. Local environment previously dominated by open seas with pelagite deposits. These rocks were formed on a deep ocean floor beyond the influence of land. They often consist of fine material from microscopic pelagic organisms. The area is fractured at the boundaries of the Grampound formation. This underlies most of the area from Marazanvose to Carland Cross.

- Meadfoot Beds (Trendrean Formation)- Devonian grey mudstone with siltstone laminations and occasional sandstone beds. Local environment previously dominated by shallow seas. These rocks were formed with mainly siliciclastic sediments (comprising of fragments or clasts of silicate minerals) deposited as mud, silt, sand and gravel. This is just to the north-east of Carland Cross.

- Intrusive Dykes - quartz –porphyry, (known locally as Elvans) cross the Meadfoot beds trending east-west. Local environment previously dominated by intrusions of silica-rich magma. These rocks were formed from silica-rich magma intruding into the Earth's crust. It cooled to form intrusions.

- A number of metalliferous rich mineral seams cross the area. Minerals include; Lead, Silver, Copper, Zinc, Iron and Tin. The seams tend to follow the strike of the bedrock geology.

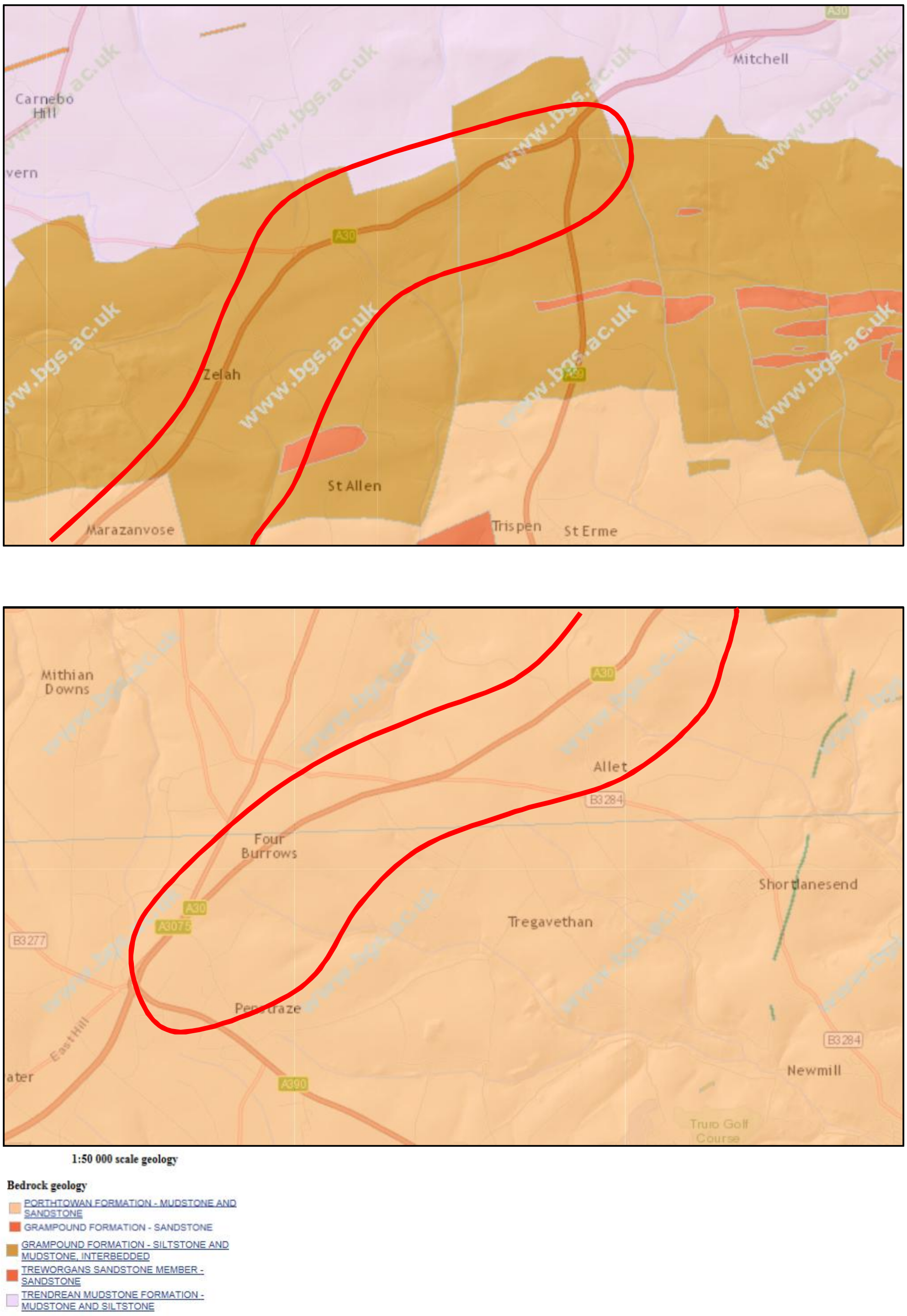


Figure 5.2: Bedrock Geology (BGS geology viewer)

5.5 HYDROLOGY

5.5.1 REGIONAL

The Meteorological Office website (Met Office, 2016) [Ref 11] provides weather data averages for various weather stations around the UK. The nearest weather station to the study area is the Camborne weather station which is approximately 13 km south-east from Chiverton.

Data contained in illustrates the weather averages for Camborne over a period of 12 months, based on averages from data collected between 1979 and 2015.

Table 5-1: Weather Averages from Camborne Weather Station

MONTH	MAX. TEMP (ºC)	MIN. TEMP (ºC)	DAYS OF AIR FROST (DAYS)	RAINFALL (mm)	SUNSHINE (HOURS)
Jan	8.9	4.5	3.2	123.4	60.0
Feb	8.7	4.2	3.0	91.5	80.9
Mar	10.0	5.3	1.2	78.6	118.4
Apr	11.7	6.2	0.1	70.5	183.5
May	14.2	8.5	0.0	64.2	210.5
Jun	16.6	10.9	0.0	60.6	207.2
Jul	18.6	13.0	0.0	65.0	197.0
Aug	18.8	13.1	0.0	73.6	187.4
Sep	17.3	11.8	0.0	72.4	154.8
Oct	14.4	9.8	0.0	115.4	105.7
Nov	11.6	7.2	0.4	120.8	72.1
Dec	9.8	5.4	1.9	132.7	55.1

The data collected at Camborne, although not immediately adjacent to the site, provides a good indication of the weather patterns for the site; there are no major geographical features between the site and the weather station that would result in significantly different weather patterns.

Of particular note are the rainfall patterns indicating, as elsewhere in the UK, higher autumn and early winter rainfall can be seen. The rainfall forms the base flow for both surface water features and shallow ground water flows. A number of springs in the area are used for both domestic and agricultural use.

5.5.2 LOCAL

Information on the local hydrology was gathered from the Groundsure Report [Ref 4]:

SURFACE WATER FEATURES

Generally, the existing road alignment runs along a surface water divide. The River Gannel and its tributaries flow to the north and the Rivers Kenwyn, Tresillian and Allen and tributaries flow to the south.

WATER ABSTRACTIONS

While Groundsure indicates that there is no current groundwater or potable water abstraction points in the vicinity of the study area, it is known that a number of springs are exploited for botrh domestic and agricultural uses. Records indicate that there are numerous historical abstraction licences relating to the farms within the study area.

HYDROGEOLOGY

Reference to the Environment Agency (EA) [Ref 12] data maps indicates site classification for the following hydrogeological categories, summarised in Table 5-2:

Table 5-2: Summary of Hydrogeology data (Environment Agency, 2016) [Ref 12].

CATEGORY	SITE CLASSIFICATION
Flood Zone & Risk	Flood Zone 3 around streams and rivers (Figure 5.3).
Groundwater Source Protection Zone	Zones 1 – 3 at Carland Cross (Figure 5.4).
Superficial Aquifer Mapping	Secondary A (Alluvium) (Figure 5.5).
Bedrock Aquifer Mapping	Secondary A (Figure 5.6).
Groundwater Vulnerability Zone	Major Aquifer Low – Minor Aquifer High (Figure 5.7).

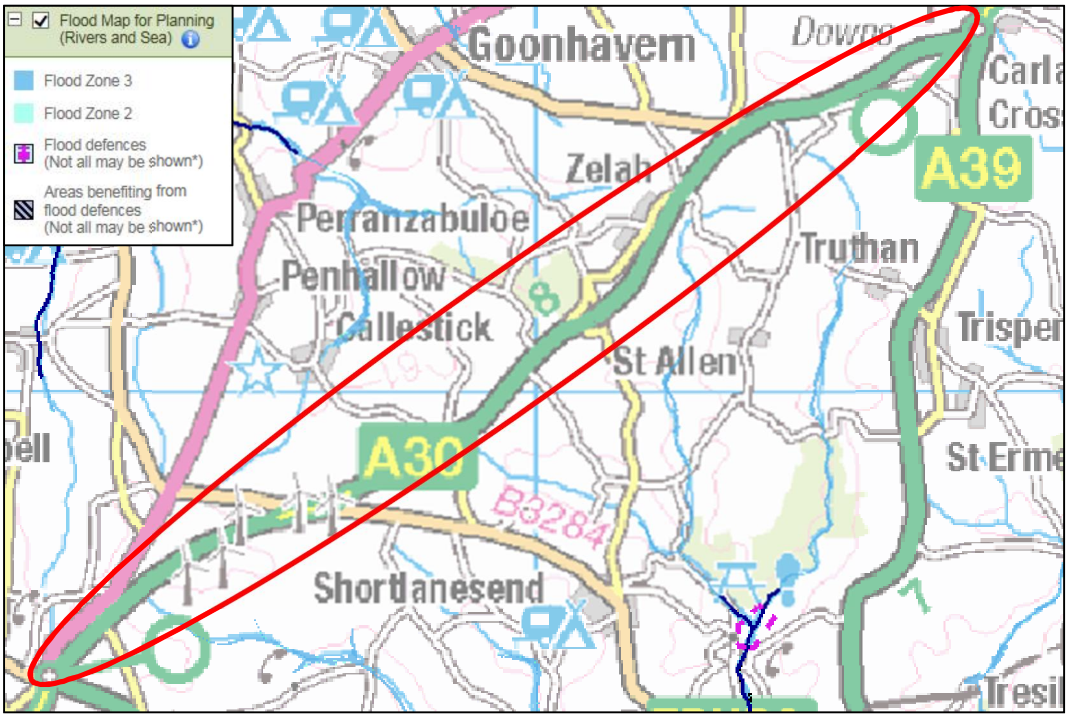


Figure 5.3: Flood Zone and Risk, (Environment Agency, 2016) [Ref 12].

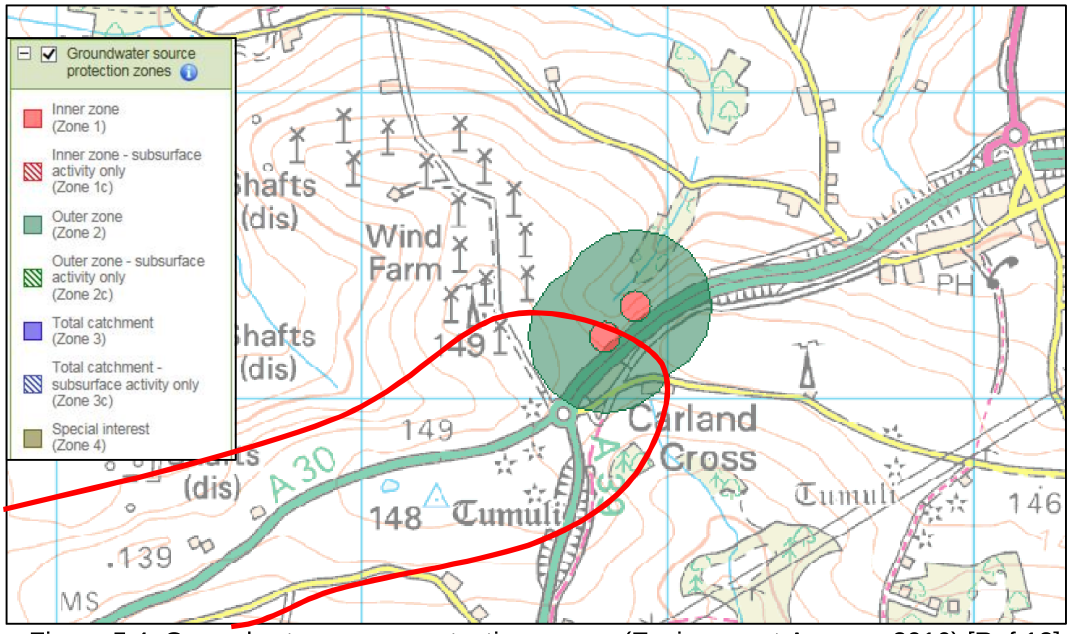


Figure 5.4: Groundwater source protection zones, (Environment Agency, 2016) [Ref 12].

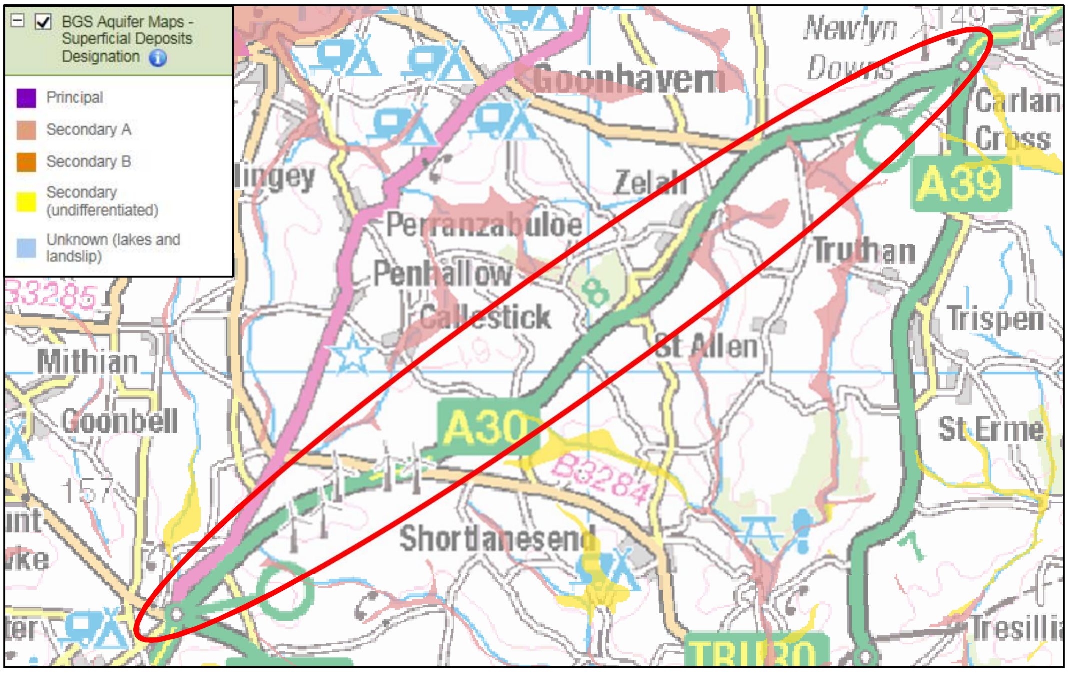


Figure 5.5: Superficial aquifer mapping, (Environment Agency, 2016) [Ref 12].

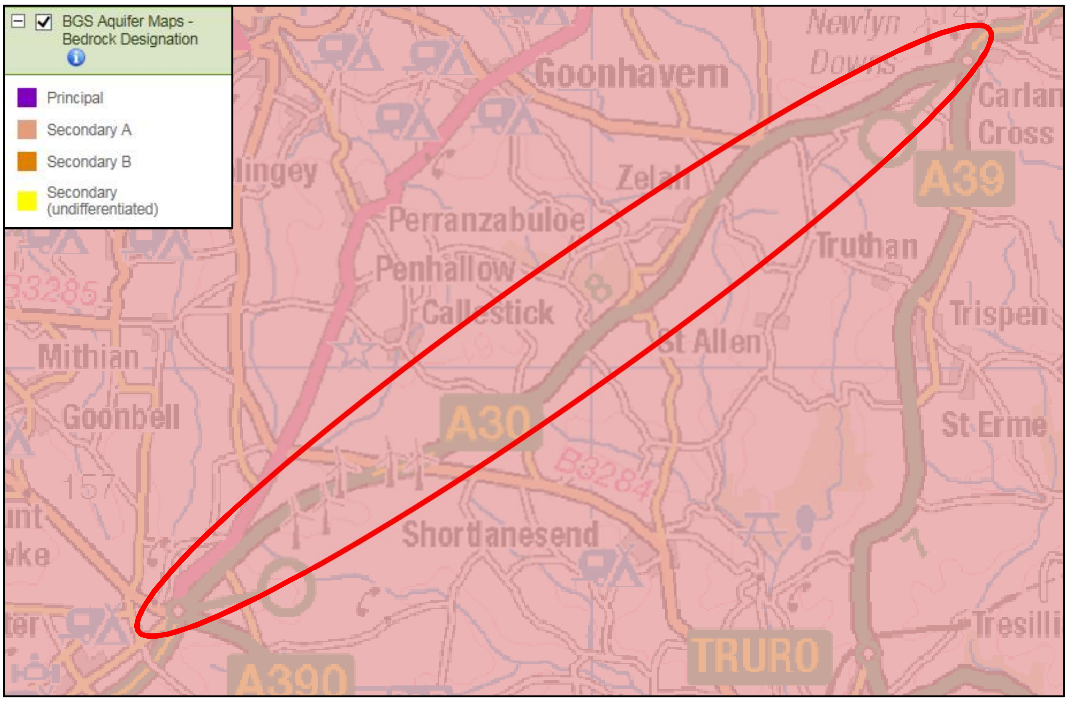


Figure 5.6: Bedrock aquifer mapping, (Environment Agency, 2016) [Ref 12].

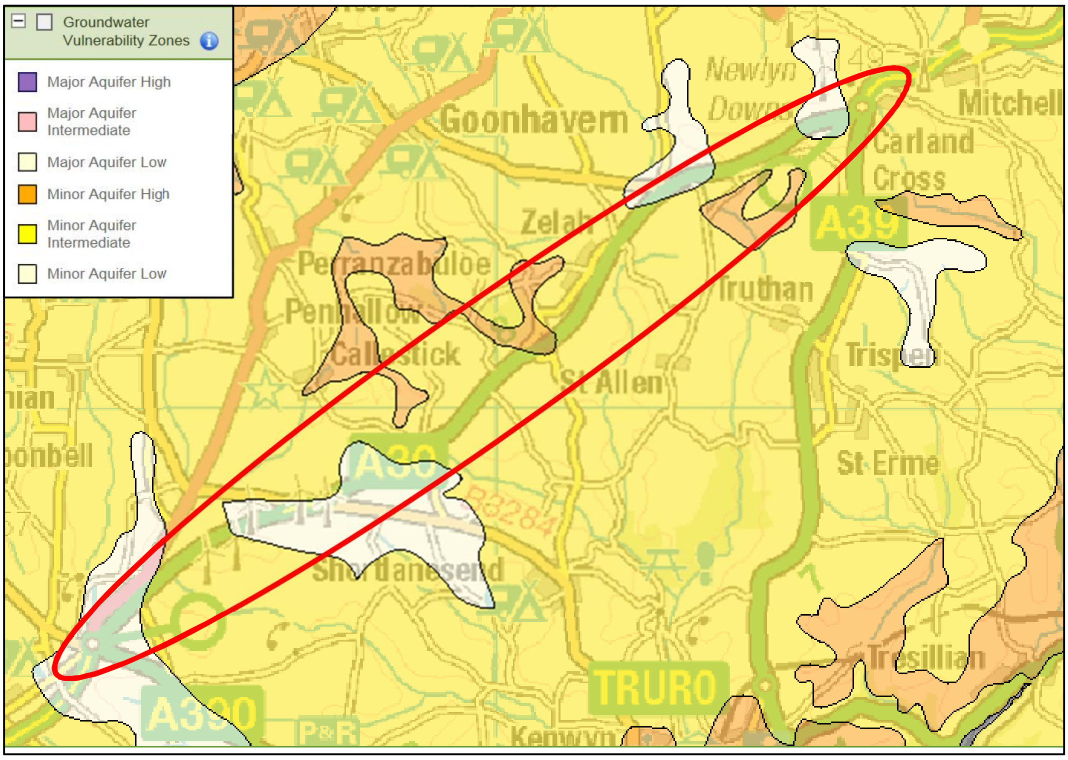


Figure 5.7: Groundwater vulnerability zones, (Environment Agency, 2016) [Ref 12].

5.6 LAND DESIGNATIONS

Reference to the DEFRA MAGIC map application online [Ref 20] demonstrates:

- To the south of the A30 the land is designated into the following categories:
    - Site of Special Scientific Interest (SASSY) Impact Risk Zone;
    - Nitrate Vulnerable Zone – Eutrophic; and
    - To the south-east of Carland cross the area is designated as a nitrate vulnerable zone – Groundwater.
- Many items of cultural heritage significance are recorded within the study area including:
    - Twenty-four scheduled monuments;
    - One world heritage site to the south;
    - Thirty-one listed buildings; and
    - One registered park or gardens in the north of the study site (National Grid Reference SW7951) near Cost-is-lost.
- The study area is classed as an Objective 1 area, which aims to help grow and reshape the economy of Cornwall.

5.7 MINING

The study area lies on the boundary of two mining districts, the Chacewater mining district to the south-west and the St Agnes mining district to the northeast. The resources mined are generally metalliferous. In the early days of mining, this district was prospected by means of pits excavated to bedrock to uncover lodes that weren't already visible at the surface. Then in order to continue exploration at depth, shafts were sunk and horizontal tunnels were driven away from the shafts along the lodes. See Figure 5.8 for a typical historical cross-section of local mining practice.

Historic maps show a number of disused Lead, Silver, and Copper, Zinc, Iron and Tin mining sites throughout the study area.

Information provided by HADGMS [Ref 8] show:

- Conclusive metalliferous mining is present throughout most of the study area.
- There are a number of potential areas being mined for a variety of minerals and materials within the study area (Figure 5.9); and
- A number of man-made mining cavities are identified, mostly the resource is unknown but with occasional lead and copper mines.

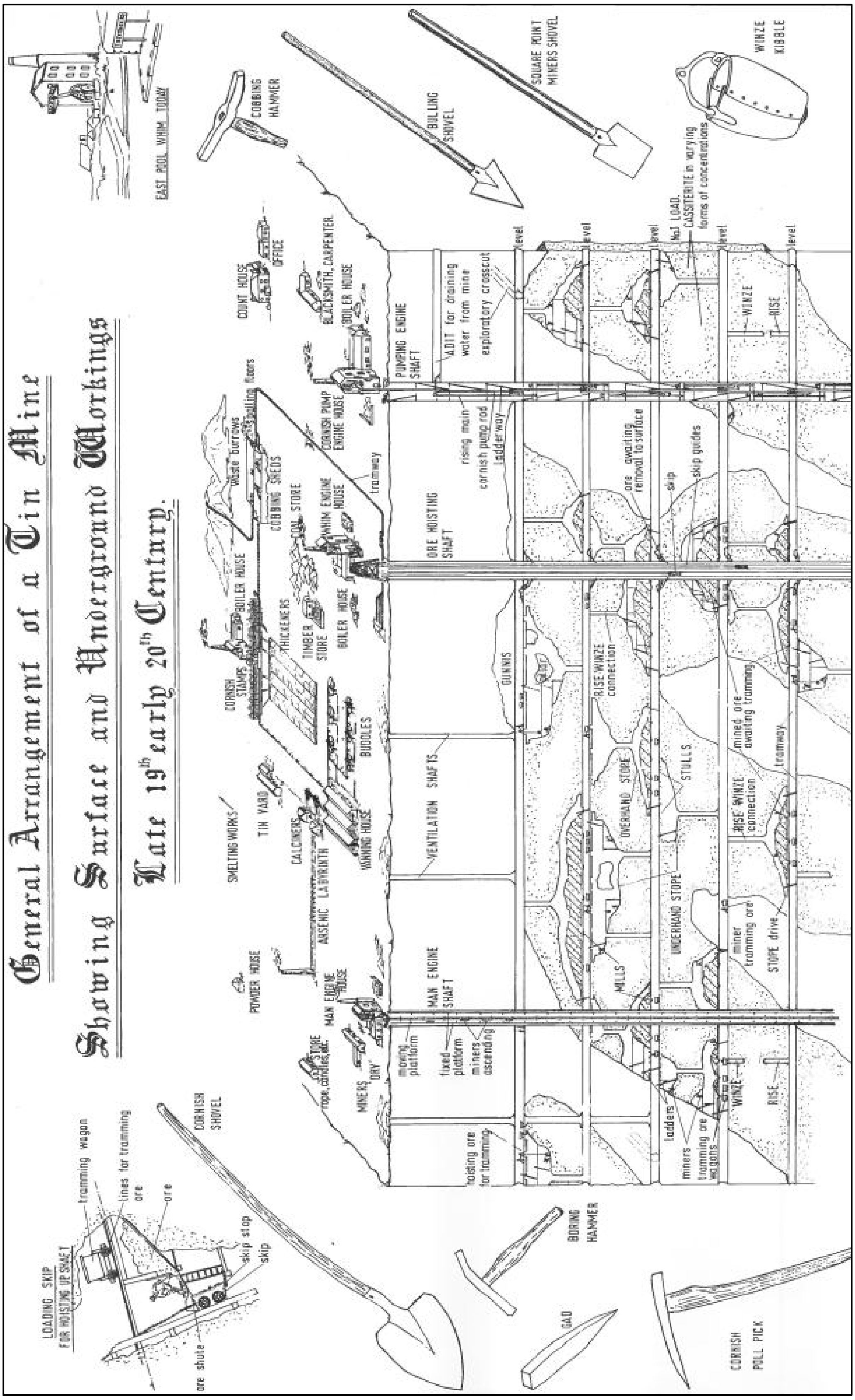


Figure 5.8: General Arrangement of Mine Workings - (Royalcollection.org.uk) [Ref 24].

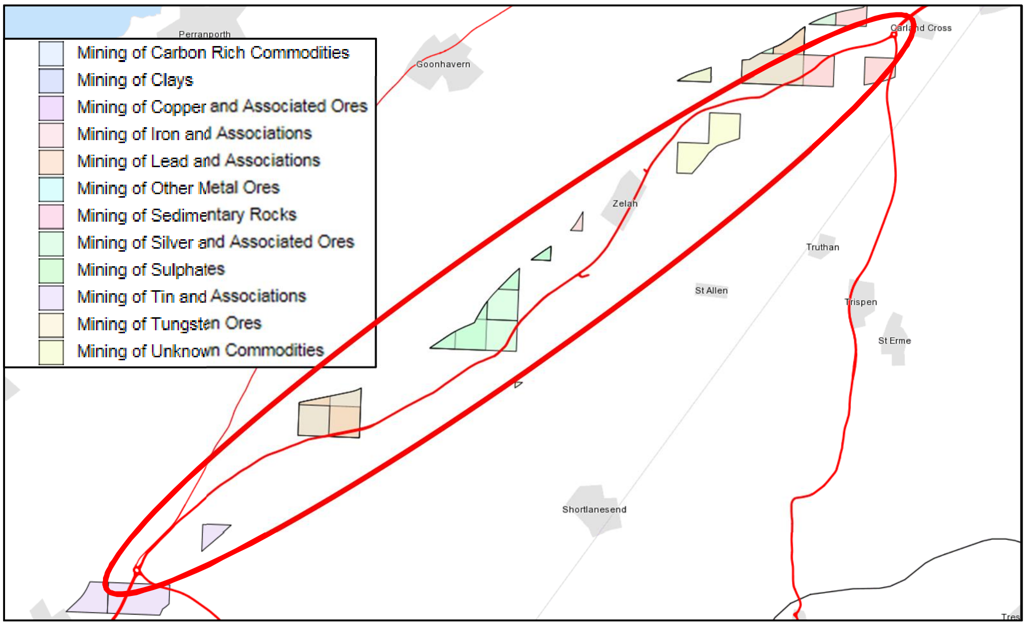


Figure 5.9: Potential mining areas (hadgms.co.uk) [Ref 8].

Cornwall Consultants Ltd conducted a Mining Activity Report in 2002 [Ref 21] and Hyder Consulting Ltd contracted Peter Brett Associates to undertake a DEFRA non-coal mining database search for the Chiverton Cross to Carland Cross stretch of the A30 in 2003 [Ref 22].

Both Reports concurred with one another and indicated that there was 33 recorded Copper (C) and Lead (L) mining locations within a 300m radius of the existing A30 and that a number of them may extend beneath the road alignment.

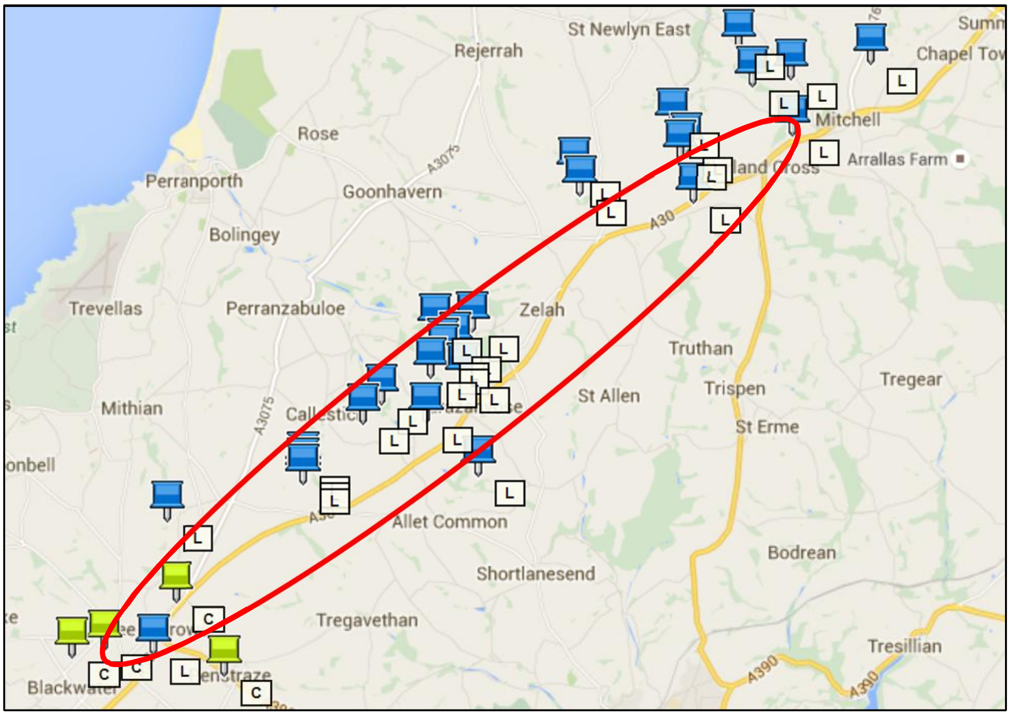


Figure 5.10: Recorded Copper (C) and Lead (L) mining locations

Prior to 1872, there was no requirement for metalliferous mines in Cornwall to keep accurate records and abandonment plans of mines and so the extent of mining in the area prior to this date is largely unrecorded. It may be assumed that where workable deposits are present, unrecorded mining may have taken place within the study area and this may present a risk of localised subsidence in the immediate vicinity.

Historical maps (Appendix D-1) indicate that a number of quarrying and mining activities have taken place in the study area. Many of the pits and shafts identified on the historical maps are now in-filled and all of them are now disused. The 2016 Groundsure Report [Ref 4] identifies most of these features and the lodes they worked as potentially in-filled land.

5.8 CONTAMINATION

5.8.1 SUMMARY

The 2016 Groundsure Report [Ref 4] identified a number of land-uses as potentially contaminative. Many of the land-uses are associated with the historic mining in the area including:

- Refuse Heaps;
- Disused tips;
- Old quarries;
- Unspecified pits ;
- Mines;
- Chimneys; and
- Unspecified ground workings.

Other potential sources of contamination within the study are:

- Nurseries; and
- Smithies.

5.8.2 GROUND CHARACTERISATION

A Groundsure Report [Ref 4] (Appendix B-1) of the study area shows that the entirety of the site indicates a level of contamination. The estimated levels of contamination are summarised in Table 5-3.

Table 5-3: Estimated levels of contamination

CONTAMINATE	CONCENTRATION (mg/kg)
Arsenic	45 - >120
Cadmium	< 1.8 – 2.2
Chromium	60-120
Lead	<100 - 300
Nickel	15-30

5.9 GROUND CONDITIONS

5.9.1 EXISTING BOREHOLE DATA

Excluding the previous ground investigation detailed at 3.3 above, existing borehole information was obtained from the BGS Geoindex [Ref 5]. There were a number of existing boreholes within the study area, however, due to the age and uncertainty of some of the records they were omitted for use in this PSSR. The information regarding geology is summarised below:

Generally the level of at which bedrock occurs mirrors the topography and a thin weathering profile extends upwards towards the surface. The unweathered bedrock is generally expected to be moderately strong to very strong, and the weathered bedrock has being described as very weak – weak.

In-situ Standard Penetration Tests (SPT) reported in the borehole logs indicated N values relating to the characteristic strength of the underlying strata have been identified. An N value of >5 is poor ground; an N value of 50 or greater in strong ground.

Made ground in the area is expected to be of variable depths. Residual soils vary from clay to gravel and experience the same variety in the N values. Where residual soils were underlain by the Grampound formation, Clayey residual soils were predominantly found with N values ranging from 11 – 37. In the area where Porthtowan beds are expected to underlay the residual soils, these soils ranged from gravels to sands giving N values of 21 – 41.

Table 5-4: Existing Boreholes Summary

REF	BGS REF	NORTHING	EASTING	SUMMARY		
EX-01	SW74NW38	174760	046880	145.7mOD – 145.55mOD	-	TOPSOIL
				145.55mOD – 144.25mOD (End of Hole)	-	MADE GROUND
EX-02	SW74NW39	174664	046679	137.02mOD – 135.37mOD	-	TOPSOIL
				135.37mOD - 134.22mOD	-	RESIDUAL SOIL
				134.22mOD – 131.02mOD (End of Hole)	-	PORTHTOWAN FORMATION
EX-03	SW74NW40	174701	046875	144.24mOD – 144.02mOD	-	TOPSOIL
				144.02mOD – 141.52mOD	-	MADE GROUND
				141.52mOD – 138.22mOD (End of Hole)	-	PORTHTOWAN FORMATION
EX-04	SW74NE1	175230	047520	136.00mOD – 135.50mOD	-	TOPSOIL
				135.50mOD – 128.00mOD (End of Hole)	-	PORTHTOWAN FORMATION
EX-05	SW85SW2	182930	052570	85.00.mOD – 84.70mOD	-	TOPSOIL
				84.70mOD – 75.50mOD	-	RESIDUAL SOIL

REF	BGS REF	NORTHING	EASTING	SUMMARY		
				75.50mOD – 73.50mOD (End of Hole)	-	GRAMPOUND FORMATION
EX-06	SW85SW1	182040	052000	70.50mOD – 70.01mOD	-	TOPSOIL
				70.01mOD- 68.40mOD	-	RESIDUAL SOIL
				68.40mOD – 65.60mOD (End of Hole)	-	GRAMPOUND FORMATION
EX-07	SW85SW3	184800	054060	134.00mOD – 133.50mOD	-	TOPSOIL
				133.50mOD – 131.00mOD	-	RESIDUAL SOIL
				131.00mOD – 124.70mOD (End of Hole)	-	GRAMPOUND FORMATION

Figure 5.11 shows the locations of the existing holes used in this summary.

Water strike recorded in boreholes ranged from 1.25mbgl (144.45mOD) to 3.4mbgl (132.6mOD). The water table in the area is likely to reflect the topography and will be subject to seasonal change as the result of rainfall.

Figure 5.11: Existing Exploratory Hole Location Plan

5.9.2 IDENTIFIED GEOLOGICAL RISKS

The national ground subsidence rating is obtained through the 6 natural ground stability hazard datasets, which are supplied by the BGS for the 2016 Groundsure Report [Ref 4]]. The potential geological risks to the area are identified and classified below, it should be noted that this listing does not include manmade hazards such as mining related voids, which are described above:

- Potential for collapsible ground stability hazards (Very Low);
- Potential for compressible ground stability hazards (Moderate (Alluvium) – Negligible);
- Potential for ground dissolution stability hazards (Negligible);
- Potential for landslide ground stability hazards (Low (Meadfoot beds & Porthtowan Formation) - Negligible);
- Potential for running sand ground stability hazards (Low (Alluvium) ,Very Low (Head) Negligible (bedrock);
- Potential for shrinking or swelling clay ground stability hazards (Very Low - Negligible) ; and
- Potential for Karstic features (Negligible).

6 PRELIMINARY ENGINEERING ASSESSMENT

6.1 OVERVIEW

Excavations and foundations are likely in Made Ground, Alluvium, Head Deposits, weathered rock and un-weathered rock.

6.2 EXCAVATABILITY – MADE GROUND, ALLUVIUM AND HEAD DEPOSITS

Excavation through the Made Ground and/or Alluvium/Head deposits using conventional hydraulic excavators is unlikely to present issues.

Within areas of made ground large obstructions may be present. Allowance for breaking out and removal of such obstructions should be made and any over digging should be backfilled with suitable engineered fill.

6.3 EXCAVATABILITY – WEATHER AND UN-WEATHERED BEDROCK

It is likely that this project will require excavation into the Shale, Sandstone and Mudstone; however excavation in such material may be achieved by either conventional excavator methods likely to involve hard digging or easy ripping with bull dozers.

6.4 PILING

It is unlikely that this project will require piling.

6.5 EARTHWORKS

Materials arising should be suitable for reuse in earthworks

Any vertically sided excavations will require support to ensure stability and to provide safe man access. Supports should be installed as the excavation proceeds. For service excavations overlapping trench sheets could be used as close support in the unconsolidated deposits to minimise ground loss or alternatively consideration could be given to the use of trench boxes, provided excavations take place within the boxes.

While the weather data indicates high levels of rainfall during the winter months, the nature of the ground suggests that trafficability should not be an issue.

6.6 CUTTINGS

The excavation of cuttings is unlikely to offer any significant engineering difficulties, although easy ripping may be required. No blasting is envisaged to be required. It is likely that side slopes of cuttings may be formed at slopes between 1:2 and 1:3. In un-weathered bedrock steeper side slopes may be achievable.

6.7 EMBANKMENTS

The construction of embankments is unlikely to offer any significant engineering difficulties. It is likely that side slopes of cuttings may be formed at slopes between 1:2 and 1:3.

6.8 SUBGRADE

CBR values will vary, they are likely to be low in areas of alluvium and head deposits potentially less than 2.5%, whereas in areas of weathered rock they are likely to higher and may well be in excess of 5%.

6.9 MATERIAL CLASSIFICATION AND RE-USE

Unless large volumes of made or contaminated ground are encountered all arisings should be suitable for re-use within the works. Some material may require processing, this may include the crushing and screen of rock.

6.10 STRUCTURE FOUNDATIONS

It is likely that all foundations for structures on the scheme will comprise spread footings; no piling or unusual or novel foundations are expected to be required.

6.11 IMPLICATIONS AND FEASIBILITY OF THE SCHEME

Nothing identified in the production of this PSSR iwill impact upon the viability of the scheme. Findings indicate that no special or unusual engineering solutions will be required.

7 COMPARISON OF PROJECT AND RISKS

7.1 PRELIMINARY GEOTECHNICAL RISK REGISTER

7.1.1 GEOTECHNICAL RISK ASSESSMENT

In this section, a risk register has been prepared to allow a comparison of the risks, issues and benefits associated with the proposed construction. Table 7-1 and Table 7-2 show the Impact Index and Likelihood Index respectively. Table 7-3 is the Risk Matrix, which shows the actual risk level, rated from ‘Intolerable’ (maximum risk level) to ‘Negligible’ (minimum risk level). The actual Risk Register (Table 7-4) shows the potential hazards, consequences, risk level and the associated control measures and action.

Table 7-1: Impact Index

Impact			Cost	Time	Reputation	H&S	Environment
1	Very low	Negligible	Negligible	Negligible effect on programme	Negligible	Negligible	Negligible
2	Low	Significant	> 1% budget	> 5% effect on programme	Minor effect on local company image/ business relationship mildly affected	Minor injury	Minor environmental incident
3	Medium	Serious	> 10% budget	> 12% effect on programme	Local media exposure/ business relationship affected	Major injury	Environmental incident requiring management input
4	High	Threat to future work and client relations	> 20% budget	> 25% effect on programme	Nationwide media exposure / business relationship greatly affected	Fatality	Environmental incident leading to prosecution or protestor action
5	Very high	Threat to business survival and credibility	> 50% budget	> 50% effect on programme	Permanent nationwide effect on company image/ significant impact on business relationship	Multiple fatalities	Major environmental incident with irreversible effects and threat to public health or protected natural resource

Table 7-2: Likelihood index

Likelihood		Probability
1	Negligible/improbable	<1%
2	Unlikely/remote	>1%
3	Likely/possible	>10%
4	Probable	>50%
5	Very likely/almost certain	>90%

Table 7-3: Risk Matrix

		Impact				
		1	2	3	4	5
Likelihood	1	N	N	N	N	T
	2	N	N	T	T	S
	3	N	T	T	S	I
	4	N	T	S	I	I
	5	T	S	I	I	I

Note:

Intolerable	I
Significant	S
Tolerable	T
Negligible / Trivial	N

Risk type key:

HS	Health and Safety
T	Time
C	Cost
R	Reputation
E	Environment
M	Maintenance

Risk stage key:

GI	Ground Investigation
CON	Construction
PW	Permanent Works

Table 7-4: Geotechnical Risk Register

Ref	Hazard/aspect	Risk Stage	Consequences	Impact	Likelihood	Risk	Risk Type	Potential Risk Control Measures / Action	Impact	Likelihood	Residual Risk	Owner	Action	Current Risk Ranking
1	Locally variable ground conditions.	GI	The variable strength of ground leads instability and potential GI equipment toppling.	4	3	S	HS, T, C, R	Choose appropriate exploratory hole locations and investigation techniques, follow PSSR recommendations.	4	2	T	Designer and Contractor	Designer and Contractor	Tolerable
2	Condition/quality or consistency of superficial deposits is worse than expected and/or extend to a greater depth.	GI	Affecting cut slope angles and soil stabilisation/modification/ re-use ethos and design.	4	3	S	HS, T, C, R	Undertaking of detailed desk study/PSSR to include all historic geological/geotechnical data, to ensure that best assessment of materials competence is enabled and route alignment options formulated accordingly. Use the information gained to inform the production of a targeted detailed ground investigation during the detailed design phase.	4	2	T	Designer and Contractor	Designer and Contractor	Tolerable
3	Depth to the competent bedrock is greater than expected or the condition of bedrock is worse than expected.	GI	Affecting cut slope angles and stabilisation/modification/ re-use ethos and design.	4	2	T	HS, T, C, R	Undertaking of detailed desk study/PSSR to include all historic geological/geotechnical data, to ensure that best assessment of materials competence is enabled and route alignment options formulated accordingly. Use the above to inform the production of a targeted detailed ground investigation during the detailed design phase.	3	2	T	Designer and Contractor	Designer and Contractor	Tolerable

4	Encountering of historic, uncharted, backfilled mine workings on the route alignment.	GI	Drilling through voids/soft materials. The collapse of workings, potential GI equipment toppling. Delays to contract.	4	3	S	T, C, HS, E	Choose appropriate exploratory hole locations and investigation techniques, following PSSR recommendations. Obtain permit if necessary.	4	2	T	Designer and Contractor	Designer and Contractor	Tolerable
			Treatment of mine workings. Increased costs. Delays to contract	4	3	S	T, C, HS, E		4	2	T	Designer and Contractor	Designer and Contractor	Tolerable
5	Working adjacent to live roadway.	GI	Road accident. Death.	5	2	S	HS, R	Choose appropriate safe working methods, traffic management and PPE.	4	1	N	Designer and Contractor	Designer and Contractor	Negligible / Trivial
6	Working adjacent to live roadway.	GI	Road accident. Death.	5	2	S	HS, R	Choose appropriate safe working methods, traffic management and PPE.	4	1	N	Designer and Contractor	Designer and Contractor	Negligible / Trivial
7	Inoperable Wind Farm	GI/ CON/ PW	Damage/conflict with/downtime for Wind Farm. Compensation event.	4	3	S	HS, T, C, R, E	Choose appropriate exploratory hole locations. Safe Digging practices. Choose appropriate safe working methods. Open dialogue with Wind Farm owners/operators.	4	1	N	Designer	Designer and Contractor	Negligible / Trivial
8	Instability of cuttings – (e.g. tension crack, rabbit burrows).	GI	Unstable ground. GI work impacts the earthworks e.g. surcharge by GI plant.	4	1	N	HS, T, C	Safe method statement to be presented by the GI Contractor for working on/adjacent to live road.	4	1	N	Designer	Designer and Contractor	Negligible / Trivial
9	Ground obstructions associated with existing A30 and Junctions.	GI	Drilling through/Removing obstructions leads to delays to contract, Increased Costs.	4	2	T	T, C	Consider PSSR to indicate potential areas of obstructions and allowance for safe working practices according to HSG47 [Ref 26]. Obtain Permit to dig and implement "safe digging practices" at all times. Also, time for slow progress to be made in GI contract.	4	1	N	Designer and Contractor	Designer and Contractor	Negligible / Trivial

10	The quality of excavated material is lesser than expected.	GI	Cannot reuse material, ground improvements testing required. Earthworks Imbalance. Delays to contract.	3	3	T	T,C	The undertaking of detailed desk study/PSSR to include all geological/geotechnical data and provide information on ground conditions from the GI to the Contractor, so that adequate fill is available for the works.	2	2	N	Designer and Contractor	Designer and Contractor	Negligible / Trivial
11	Encountering of an unknown shallow groundwater table.	GI	Water ingress during works resulting in unstable ground conditions. Harm to ground investigation Contractor and equipment, delays to contract.	3	3	T	HS, T, C	The undertaking of detailed desk study/PSSR to include all hydrogeological data.	3	2	T	Designer and Contractor	Designer and Contractor	Tolerable
12	Adverse Weather conditions.	GI	Unsuitable working conditions. Harm to ground investigation Contractor and equipment, delays to contract.	4	3	S	HS, T, C	Keep up to date with daily weather report as to plan ahead with GI. Have correct weather gear.	2	3	T	Designer and Contractor	Designer and Contractor	Tolerable
13	Overhead Powerlines.	GI	Damaged Utilities. Harm to ground investigation Contractor and equipment. Delays to contract.	4	3	S	HS, T, C	If work beneath live overhead lines cannot be avoided, barriers, goal posts and warning notices should be provided.	2	2	N	Designer and Contractor	Designer and Contractor	Negligible / Trivial
14	Access issues and landowner activities.	GI	Harm to ground investigation Contractor and equipment, delays to contract.	3	3	T	T, C	Keep landowners aware of the GI schedule in their areas. Plan GI to be undertaken outside of farming periods.	3	2	T	Designer and Contractor	Designer and Contractor	Tolerable
15	Delays in lab testing.	GI	Delays to contract.	2	3	T	T, C	Take all measures to ensure samples reach the lab on schedule.	2	2	N	Designer and Contractor	Designer and Contractor	Negligible / Trivial

16	GI Contractor causes delays through lack of resources.	GI	Delays to contract.	3	3	T	T, C	Have a clear and concise bill of quantities so the Contractor is aware of the resources needed. Have meetings with the Contractor to discuss any additional resources needed ahead of time.	3	2	T	Designer	Designer and Contractor	Tolerable
17	Ecological delays. (E.g. finding protected species, bird nesting season).	GI	Delays to contract.	3	3	T	T, C, E	Undertake GI outside of bird nesting season. Be aware of protected species in the area.	3	2	T	Designer and Contractor	Designer and Contractor	Tolerable
18	Encountering of UXO.	GI	Disturbance of UXO. Harm to ground investigation Contractor and equipment, delays to contract.	4	3	S	HS, T, C	Undertake a UXO risk report for the area. CAT and Genny scan before undertaking exploratory holes and have a 1.2m hand dug inspection pit before undertaking any machine excavation or drilling. Where risk is considered high a watching brief to be present during any excavations.	4	2	T	Designer and Contractor	Designer and Contractor	Tolerable
19	Encountering Buried Services.	GI	Unidentified services causing delays/ obstructions during any Ground Investigation (GI) and construction works.	4	3	S	HS, T, C	Early contact with utility providers and MOD, undertake service trace and confirmatory holes prior to construction.	4	2	T	Designer and Contractor	Designer	Tolerable
			Damage to existing services.	4	3	S	HS, T, C	Early contact with utility providers and MOD, appropriate design measures.	4	2	T	Designer and Contractor	Designer and Contractor	Tolerable
20	The collapse of any excavations during works.	GI	Harm to ground investigation Contractor and equipment, delays to contract	3	3	T	HS, T, C	Set dimensions for pitting. No personnel to stand near the edge of the pit.	2	3	T	Designer and Contractor	Designer	Tolerable

21	Groundwater protection zones (E.g. at Carland Cross).	GI	Cross contamination from the drilling process to groundwater sources.	3	3	T	HS, T, C, E	Specify measures reduce cross contamination during drilling (e.g. telescoped borehole casing and bentonite seals between each reduction in the casing to prevent vertical migration of contaminants). Use of clean drilling techniques.	3	2	T	Designer and Contractor	Designer and Contractor	Tolerable
22	Contamination is present within land adjacent to the alignment which is to be acquired.	GI	Inhalation, ingestion and dermal contact of possible contaminated materials leading to Harm of ground investigation Contractor/engineer.	3	3	T	HS, T, C, E	A qualitative contaminated land risk assessment to be completed as part of the PSSR.	3	2	T	Designer and Contractor	Designer and Contractor	Tolerable
23	Encountering unexpected highly compressible and low strength drift deposits (Alluvium).	GI	Ground investigation works disturbs the soft deposits resulting in unstable ground conditions, Harm to the ground investigation Contractor and equipment.	3	4	S	HS, T, C	Choose appropriate exploratory intrusive locations and investigation techniques including low ground bearing pressure equipment.	3	3	T	Designer	Designer and Contractor	Tolerable
			Undesirable working ground conditions, difficulties of setting up drilling plant and carry out work, Harm to the ground investigation Contractor and equipment.	3	4	S	HS, T, C		3	3	T	Designer and Contractor	Designer and Contractor	Tolerable
24	Encountering of unexpected Made Ground.	GI	The variable strength of ground leads to equipment instability. Harm to ground investigation Contractor and equipment.	3	3	T	T, C	Choose appropriate exploratory hole locations and investigation techniques, following PSSR and walkover	3	2	T	Designer and Contractor	Designer and Contractor	Tolerable

25	Accessibility of GI locations.	GI	GI locations cannot be accessed or difficulty traversing open land. Harm to ground investigation Contractor, equipment and natural habitats. Delays and increased costs.	4	3	S	T, C	Choose appropriate and accessible exploratory intrusive locations and investigation techniques, following PSSR and walkover. Contractor to ensure the appropriate plant is utilised during the GI.	3	2	T	Designer and Contractor	Designer and Contractor	Tolerable
26	Geological anomalies / faults.	GI	Unstable ground. Delays to contract.	4	3	S	T, C	Identify potential areas of for faulting within the PSSR. Choose appropriate investigation techniques and safe working methods.	3	3	T	Designer and Contractor	Designer and Contractor	Tolerable
27	Site of Specific Scientific Interest (SSSI)	GI	Creation of contamination pathway or cross contamination during drilling	3	3	T	HS, T, C, E	Specify measures reduce cross contamination during drilling (e.g. telescoped borehole casing and bentonite seals between each reduction in the casing to prevent vertical migration of contaminants). Use of clean drilling techniques.	3	2	T	Designer and Contractor	Designer and Contractor	Tolerable
28	Nitrate Vulnerable Zones (NVZ)	GI	Increased pollution of waters by nitrates caused from excessive runoff over fields.	3	3	T	HS, T, C, E	Specify measures to reduce the runoff produced while drilling in NVZ.	2	2	N	Designer and Contractor	Designer and Contractor	Negligible / Trivial
29	ANOB and Heritage Features	GI	Decreasing the aesthetics of the Cornish landscape.	3	4	S	T, C, HS, E	Prior to backfilling or disposal, all arisings shall be kept on an impermeable membrane.. Where exploratory holes are on fields, turf shall be retained for placement once the hole has been backfilled to the original level. Any excess spoil shall be disposed of in compliance with all relevant waste.	3	2	T	Designer and Contractor	Designer and Contractor	Tolerable
			Disturbance of heritage	3	4	S	T,	The undertaking of detailed	3	2	T	Designer	Designer	Tolerable

			features / archaeological features in the ground.				C, HS, E	desk study/PSSR to include all historic/heritage data to ensure the best assessment of the locations of areas containing heritage features and the appropriate choice of exploratory hole locations and investigation techniques, following PSSR recommendations. Obtain permit if necessary.				and Contractor	and Contractor	

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Appendix A

APPENDIX A-1

RECOMMENDED GROUND INVESTIGATION

OBJECTIVES AND FORMAT OF ANY INVESTIGATION

To determine an appropriate and concise ground model for the purposes of design a GI is proposed within the site boundaries. It is likely that the scheme will require deep excavations. Formation level samples will be required to accurately assess pavement, embankment, foundations and slope stability at detailed design stage.

SPECIAL PROBLEMS TO BE INVESTIGATED

None.

PROPOSED INVESTIGATION

At the time of writing of this PSSR, a preferential engineering option is available. Any GI would likely consist of, but not limited to the following:

- Inspection pits at each borehole excavated to 1.2m depth;
- Boreholes;
- Track mounted window sampling;
- CBR testing for new road construction;
- Ground permeability tests (i.e. soakaway);
- Soil samples with associated geotechnical and chemical laboratory testing;

Furthermore, all the options shall require:

- Topographic Survey; and
- Ground Penetrating Radar survey to determine precise locations of services.

Access for the purposes of a GI has been considered at walkover stage and albeit restrictions apply, it is not considered preclusive.

All GI works will be undertaken in strict accordance with BS5930 Code of Practice for Ground Investigations, BS1377 Methods for Test for Soils for Civil Engineering Purposes and BS EN 1997 (Eurocode 7).

EXPLORATORY HOLES

A drawing showing the locations of the recommended location for trial holes can be found in Appendix C-1.

Preliminary recommendations for the depth and spacing of exploratory holes are in accordance with Eurocode 7 (EC7) part 2 [Ref 25] can be found in Annex A-1.

Annex A-1: Details of Proposed Exploratory Holes

Type	Exploratory Hole Reference No.	Location Easting	Location Northing	Provisional minimum excavation depth as required by EC7 (mbgl)	In Situ Testing	Instrumentation
Trial Pit	TP-P-001	174580.5471	46431.0313	3	Infiltration test (BRE365)	
	TP-P-002	174593.9268	46459.3175	3		
	TP-S-001	174923.3776	47112.5906	4.5		
	TP-R-001	174844.0817	47090.7133	3.5	Plate load test for CBR @ 0.5m	
	TP-S-002	174903.7568	47017.2302	4.5	Plate load test for CBR @ 0.5m	
	TP-S-003	174797.5491	47160.1239	4.5	Plate load test for CBR @ 0.5m	
	TP-R-002	174878.4881	47172.0829	2.5		
	TP-R-003	174904.3069	47263.7739	2.5		
	TP-R-004	174997.3457	47434.9543	2.5		
	TP-P-003	174926.6021	47427.0631	3	Infiltration test (BRE365)	
	TP-P-004	174936.6194	47453.0738	3		
	TP-R-004A	175168.6251	47684.7303	2.5		
	TP-R-005	174878.4881	47172.0829	2.5		
	TP-R-006	174904.3069	47263.7739	2.5		
	TP-R-007	175234.1045	47761.2950	2.5		
	TP-R-008	175304.9810	47836.2436	2.5		
	TP-R-009	175375.7216	47904.0189	2.5		
	TP-P-005	175482.5460	47935.1552	3	Infiltration test (BRE365)	
	TP-R-010	175450.9049	47969.3731	2.5		
	TP-P-006	175535.5857	47987.1326	3		
	TP-R-011	175529.0605	48030.8831	3		
	TP-R-012	175606.3468	48093.0822	3.5	Plate load	

Type	Exploratory Hole Reference No.	Location		Provisional minimum excavation depth as required by EC7 (mbgl)	In Situ Testing	Instrumentation
		Easting	Northing			
					test for CBR @ 0.5m	
	TP-R-013	175692.3745	48141.2004	2.5		
	TP-R-014	175776.9239	48189.8238	2.5	Plate load test for CBR @ 0.5m	
	TP-R-015	175863.7602	48234.6947	2.5		
	TP-R-016	175952.6261	48279.2458	3	Plate load test for CBR @ 0.5m	
	TP-R-017	176041.7696	48323.9360	4		
	TP-R-018	176396.7459	48488.3121	3.5	Plate load test for CBR @ 0.5m	
	TP-R-019	176486.4822	48523.6997	2.5		
	TP-R-020	176576.5512	48556.7154	2.5		
	TP-R-021	176666.8997	48587.0804	3	Plate load test for CBR @ 0.5m	
	TP-R-022	177328.2400	48734.6893	4		
	TP-R-023	177328.2400	48734.6893	2.5	Plate load test for CBR @ 0.5m	
	TP-R-024	177417.2993	48750.8380	2.5		
	TP-R-025A	177515.4099	48769.8137	2.5	Plate load test for CBR @ 0.5m	
	TP-R-026	177711.2058	48811.4300	4		
	TP-R-027	177809.0107	48834.4836	2.5		
	TP-R-028	177910.9101	48862.1432	3	Plate load test for CBR @ 0.5m	
	TP-R-029	177994.7448	48887.9561	2.5		
	TP-S-004	178057.3626	48778.6615	4.5	Plate load test for CBR @ 0.5m	
	TP-S-005	178076.9084	48991.4285	4.5		
	TP-R-030	178177.7555	48954.2719	3.5		
	TP-R-031	178267.4472	48992.0283	3.5		
	TP-R-032	178355.8244	49032.7964	3.5		

Type	Exploratory Hole Reference No.	Location Easting	Location Northing	Provisional minimum excavation depth as required by EC7 (mbgl)	In Situ Testing	Instrumentation
	TP-R-033	178442.3991	49077.7217	3		
	TP-R-034	178528.3835	49123.0558	3.5		
	TP-R-035	178612.1287	49172.7450	3.5		
	TP-R-036	178694.2426	49225.0710	2.5		
	TP-R-037	178774.5859	49280.1951	4		
	TP-R-084	179013.2743	49459.5384	2.5	Plate load test for CBR @ 0.5m	
	TP-P-009	179202.2175	49437.5342	3	Infiltration test (BRE365)	
	TP-S-006	179126.5335	49457.0882	4.5		
	TP-S-007	179085.3009	49536.4435	4.5		
	TP-P-010	179228.2263	49473.8848	3		
	TP-R-038	179181.1635	49570.4636	2.5		
	TP-R-039	179267.3072	49621.1192	3	Plate load test for CBR @ 0.5m	
	TP-R-040	179354.0130	49669.9102	2.5		
	TP-R-041	179440.0155	49725.2211	2.5	Plate load test for CBR @ 0.5m	
	TP-R-042	179516.5785	49785.6964	3		
	TP-R-043	179590.5072	49856.8649	3	Plate load test for CBR @ 0.5m	
	TP-R-044	179653.6660	49930.8774	2.5		
	TP-R-045	179712.7992	50011.5490	2.5	Plate load test for CBR @ 0.5m	
	TP-R-055	181077.5841	51389.9476	2.5		
	TP-P-013	181215.4399	51406.0369	3	Infiltration test (BRE365)	
	TP-P-014	181176.9567	51453.8582	3		
	TP-R-056	181126.6651	51477.0856	2.5		
	TP-R-057	181183.3473	51560.0354	2.5	Plate load test for CBR @ 0.5m	
	TP-R-058	181227.2661	51650.7842	3		
	TP-R-059	181278.7732	51737.4289	2.5	Plate load test for CBR @ 0.5m	

Type	Exploratory Hole Reference No.	Location Easting	Location Northing	Provisional minimum excavation depth as required by EC7 (mbgl)	In Situ Testing	Instrumentation
	TP-R-060	181322.2147	51828.2122	2.5		
	TP-R-061	181362.7157	51920.1646	2.5	Plate load test for CBR @ 0.5m	
	TP-R-062	181400.2395	52013.0081	4		
	TP-R-063	181438.5050	52104.8592	2.5	Plate load test for CBR @ 0.5m	
	TP-R-064	181484.1986	52193.1661	2.5		
	TP-R-065	181538.3252	52276.6839	2.5	Plate load test for CBR @ 0.5m	
	TP-R-066	181600.4064	52354.6115	2.5		
	TP-R-067	181669.8233	52426.1358	3.5	Plate load test for CBR @ 0.5m	
	TP-R-068	182004.8288	52640.7081	3.5		
	TP-R-069	182095.1426	52683.6402	2.5	Plate load test for CBR @ 0.5m	
	TP-R-070	182186.1881	52724.9980	2.5	Plate load test for CBR @ 0.5m	
	TP-R-071	182277.9378	52764.7690	2.5		
	TP-R-072	182370.3642	52802.9412	2.5		
	TP-R-073	182463.4081	52839.5836	3		
	TP-S-008	182506.0180	52933.1685	4.5		
	TP-S-009	182595.8859	52849.4070	4.5		
	TP-P-015	182746.2711	52917.0347	3	Infiltration test (BRE365)	
	TP-R-075	182735.4348	52979.3176	2.5		
	TP-P-016	182831.3840	52965.6334	3		
	TP-R-076	182820.9183	53030.5434	3.5	Plate load test for CBR @ 0.5m	
	TP-R-077	183166.7503	53232.3948	2.5	Plate load test for CBR @ 0.5m	

Type	Exploratory Hole Reference No.	Location Easting	Northing	Provisional minimum excavation depth as required by EC7 (mbgl)	In Situ Testing	Instrumentation
	TP-R-078	183257.1588	53274.7147	2.5		
	TP-R-079	183347.8718	53316.0942	2.5	Plate load test for CBR @ 0.5m	
	TP-R-080	183439.1734	53357.3334	2.5		
	TP-R-081	183796.5063	53522.7788	2.5		
	TP-R-082	183888.4083	53562.1962	2.5	Plate load test for CBR @ 0.5m	
	TP-R-083	183978.8350	53604.8325	3		
	TP-S-010	184252.7484	53822.0271	4.5		
	TP-R-085	184298.0631	53844.0040	2.5		
	TP-R-085A	184279.6821	53873.3272	2.5		
	TP-R-086	184380.8851	53899.9729	2.5		
	TP-R-086A	184362.5040	53929.2961	2.5		
	TP-R-087	184467.4684	53950.0005	2.5		
	TP-R-087A	184449.0873	53979.3237	2.5		
	TP-R-088	184552.9096	54001.9504	2.5		
	TP-R-088A	184534.5286	54031.2736	2.5		
	TP-S-011	184634.3663	54161.7900	4.5		
	TP-R-089	184718.1265	54114.5883	2.5		
	TP-R-090	184797.7032	54175.1404	2.5		
	TP-R-091	184877.8387	54234.9185	2.5		
	TP-R-092	184963.1476	54287.0184	2.5		
	TP-R-093	185135.2831	54386.6814	4.5		
	TP-R-094	185042.0977	54351.1224	3	Plate load test for CBR @ 0.5m	
	TP-P-017	185065.8419	54383.2528	3	Infiltration test (BRE365)	
	TP-P-018	185102.9824	54397.853	3		

Type	Exploratory Hole Reference No.	Location Easting	Location Northing	Provisional minimum excavation depth as required by EC7 (mbgl)	In Situ Testing	Instrumentation
			5			
	TP-R-095	185231.8561	54422.722 9	3	Plate load test for CBR @ 0.5m	
	BH-R-001	174773.0894	46888.1966	7	DS/RC Follow on	Piezometer / Standpipe
	BH-R-002	174798.3502	46984.5355	7	DS/RC Follow on	
	BH-S-001	174808.6008	47057.4657	15	DS/RC Follow on	
	BH-S-002	174811.5582	47077.5360	7	DS/RC Follow on	
	BH-S-003	174735.2979	47105.9678	7	DS/RC Follow on	
	BH-S-004	174847.1782	47157.9811	15	DS/RC Follow on	Piezometer / Standpipe
	BH-S-005	174855.3161	47156.7550	7	DS/RC Follow on	
	BH-S-006	174861.6024	47170.5942	15	DS/RC Follow on	
	BH-S-007	174867.7592	47168.9313	7	DS/RC Follow on	
	BH-R-101	174928.3243	47313.2509	7	DS/RC Follow on	
	BH-R-102	175205.0047	47728.2196	7	DS/RC Follow on	
	BH-S-008	175393.2373	47899.2619	15	DS/RC Follow on	
	BH-S-009	175410.9771	47917.1135	7	DS/RC Follow on	
	BH-S-010	175404.1750	47945.5202	15	DS/RC Follow on	
	BH-S-011	175420.1341	47958.9048	7	DS/RC Follow on	
	BH-R-003	176149.7893	48377.7780	7	DS/RC Follow on	
	BH-R-004	176240.0423	48420.4843	7	DS/RC Follow on	
	BH-R-005	176331.4248	48460.9789	7	DS/RC Follow on	Piezometer / Standpipe
	BH-R-006	176763.4215	48616.5162	7	DS/RC Follow on	
	BH-R-007	176890.2080	48650.6821	7	DS/RC Follow on	
	BH-R-008	177010.0326	48678.3269	7	DS/RC Follow on	

Type	Exploratory Hole Reference No.	Location Easting	Northing	Provisional minimum excavation depth as required by EC7 (mbgl)	In Situ Testing	Instrumentation
	BH-R-009	177114.3091	48698.7934	7	DS/RC Follow on	
	BH-R-010	177223.3743	48716.9781	7	DS/RC Follow on	
	BH-R-011	177613.3737	48790.0081	7	DS/RC Follow on	Piezometer / Standpipe
	BH-S-012	178086.5155	48903.1272	7	DS/RC Follow on	
	BH-S-013	178090.1051	48931.9691	15	DS/RC Follow on	
	BH-S-014	178093.8859	48945.5983	7	DS/RC Follow on	
	BH-S-015	178071.3219	48889.8544	7	DS/RC Follow on	
	BH-S-016	178077.3957	48914.4897	15	DS/RC Follow on	Piezometer / Standpipe
	BH-S-017	178076.6009	48938.2240	7	DS/RC Follow on	
	BH-R-103	178217.9410	48970.7215	7	DS/RC Follow on	
	BH-R-104	178398.9248	49054.0896	7	DS/RC Follow on	
	BH-R-105	178483.0754	49098.0143	7	DS/RC Follow on	
	BH-R-106	178587.2192	49157.6269	7	DS/RC Follow on	
	BH-R-107	178746.7411	49260.6353	7	DS/RC Follow on	
	BH-R-012	178853.4135	49338.2845	7	DS/RC Follow on	
	BH-R-013	178931.5201	49399.0586	7	DS/RC Follow on	
	BH-S-018	179062.1972	49510.7362	7	DS/RC Follow on	
	BH-S-019	179070.7734	49499.3511	15	DS/RC Follow on	Piezometer / Standpipe
	BH-S-020	179092.7295	49487.6589	7	DS/RC Follow on	
	BH-S-021	179037.0647	49505.1877	7	DS/RC Follow on	
	BH-S-022	179058.3289	49490.9112	15	DS/RC Follow on	
	BH-S-023	179075.0829	49477.8680	7	DS/RC Follow on	
	BH-R-108	179558.3707	49824.1292	7	DS/RC Follow on	
	BH-R-015	179771.7616	50092.3324	7	DS/RC Follow on	
	BH-R-016	179827.2601	50175.6780	7	DS/RC Follow on	

Type	Exploratory Hole Reference No.	Location Easting	Northing	Provisional minimum excavation depth as required by EC7 (mbgl)	In Situ Testing	Instrumentation
	BH-S-030	181002.3850	51234.5545	15	DS/RC Follow on	
	BH-S-031	180987.9247	51207.9606	7	DS/RC Follow on	
	BH-S-032	180942.4460	51276.9264	15	DS/RC Follow on	Piezometer / Standpipe
	BH-S-033	180926.2837	51252.2416	7	DS/RC Follow on	
	BH-R-023	181022.5206	51309.9414	7	DS/RC Follow on	
	BH-R-024	181745.8390	52490.4401	7	DS/RC Follow on	
	BH-R-025	181828.0950	52547.3516	7	DS/RC Follow on	
	BH-R-026	181915.2816	52596.1995	7	DS/RC Follow on	
	BH-R-109	182432.1031	52828.4210	7	DS/RC Follow on	
	BH-S-034	182546.3076	52872.8779	15	DS/RC Follow on	
	BH-S-035	182556.1971	52865.2241	7	DS/RC Follow on	
	BH-S-036	182571.4034	52871.6554	7	DS/RC Follow on	
	BH-S-037	182561.5140	52879.3093	15	DS/RC Follow on	Piezometer / Standpipe
	BH-S-038	182542.7518	52898.9641	7	DS/RC Follow on	
	BH-S-039	182528.9040	52889.6531	7	DS/RC Follow on	
	BH-R-074	182648.3254	52932.3401	7	DS/RC Follow on	Piezometer / Standpipe
	BH-R-027	182905.5901	53084.3657	7	DS/RC Follow on	Piezometer / Standpipe
	BH-R-028	182991.2702	53135.4152	7	DS/RC Follow on	
	BH-R-029	183078.4205	53184.9790	7	DS/RC Follow on	
	BH-R-030	183529.0742	53387.1345	7	DS/RC Follow on	
	BH-R-031	183616.6297	53435.4359	7	DS/RC Follow on	
	BH-R-032	183705.8092	53480.6687	7	DS/RC Follow on	
	BH-R-014	184064.9053	53655.6624	7	DS/RC Follow on	
	BH-S-041	184190.1363	53801.9045	7	DS/RC Follow on	
	BH-S-042	184229.1767	53803.2078	15	DS/RC Follow on	

Type	Exploratory Hole Reference No.	Location Easting	Location Northing	Provisional minimum excavation depth as required by EC7 (mbgl)	In Situ Testing	Instrumentation
	BH-S-043	184288.4950	53788.7347	15	DS/RC Follow on	Piezometer / Standpipe
	BH-S-044	184272.5443	53821.1250	15	DS/RC Follow on	
	BH-S-045	184297.9918	53818.6669	7	DS/RC Follow on	
	BH-S-046	184603.6184	54071.5709	7	DS/RC Follow on	
	BH-S-047	184624.0569	54053.9904	15	DS/RC Follow on	
	BH-S-048	184631.7348	54047.4835	7	DS/RC Follow on	
	BH-S-049	184591.0668	54062.3377	7	DS/RC Follow on	
	BH-S-050	184610.8193	54045.6082	15	DS/RC Follow on	Piezometer / Standpipe
	BH-S-051	184618.0353	54039.1568	7	DS/RC Follow on	
	BH-S-052	184563.0615	54108.0439	7	DS/RC Follow on	
	BH-R-040	184179.3712	53774.2072	7	DS/RC Follow on	
	BH-R041	185214.7548	54350.1172	7	DS/RC Follow on	Piezometer / Standpipe

A full detailed GI scope will be determined by WSP | Parsons Brinckerhoff at a later project stage.

RECOMMENDATION FOR SAMPLING/TESTING

In all trial pits, bulk and jar samples should be taken. The first sample is recommended be taken at 0.5mbgl within the inspection pit and thereafter at 1m intervals or on a change in strata, or as directed by the Engineer. Small disturbed samples are recommended also be taken from the topsoil. The requirements of EN ISO 22475-1 [Ref 29] are recommended be followed.

In boreholes where cores are extracted, bulk and jar samples should be taken. The first sample is recommended be taken at 0.5mbgl within the inspection pit and thereafter every run or on changes in strata, or as directed by the Engineer. In Cohesive soils undisturbed thin-wall (UT) samples are recommended be taken where possible and appropriate. In selected holes along the trace of the scheme, Standpipes for groundwater sampling are recommended be installed. Standpipes are recommended to be HDPE 50mm diameter (inc. stocking) 19mm diameter piezometers. Prior to sampling all standpipes and standpipe piezometers are recommended be purged of 5 times well volumes of groundwater. A single groundwater sample is recommended from all standpipe and standpipe piezometers.

Soakaway testing is recommended to be done in all trial pits relating to attenuation ponds but also in select trial pits along the trace of the scheme.

Suitable sampling shall be undertaken to provide samples for geo-environmental testing.

WAC testing is required in all areas where material from a cutting is proposed to be reused for a further earthwork. It is recommended that this material is also involved in lime/cement stabilisation testing.

Recommended laboratory testing includes:

- Odometer tests;
- Ring shear box test;
- Triaxial tests;
- Translations shear box tests;
- Bulk density determination;
- Permeability constant head test in the triaxial cell (or flexible wall permeameter); and
- Particle size analysis.

If the soils are cohesive additional testing is recommended:

- Direct simple shear test;
- Triaxial Test;
- Strength index tests; and
- Permeability tests in the falling head permeameter.

If the soil has organic content a loss on ignition test is recommended to be included on the testing schedule.

Geo-environmental screening laboratory tests will be required.

SITE & WORKING RESTRICTIONS

This detail is unknown at the time of writing this PSSR.

SPECIALIST CONSULTATION

In developing the project and enabling the GI to progress it is envisaged that the following consultations will be required:

- Highways England;
- Environment Agency;
- Natural England: permissions for access into, Sites of Special Scientific Interest (SSSI), Ancient Woodland areas and nature reserves; and
- Local Authority/Council.

PROGRAMME, COST AND CONTRACT ARRANGEMENTS

Likely GI estimated costs are presented as follows;

- Intrusive Investigation £740k.

REPORTING

Following the GI a Ground Investigation Report (GIR) will be delivered as part of Key Stage 2 in accordance with guidance provided in HD22/08 [Ref 2] and the requirements of BS EN 1997.

OTHER CONSIDERATIONS

There is a possibility that historic quarries and shafts exist along the route that may have been backfilled with material that could pose a significant risk of contamination. In such instances, the composition of the backfill will need to be determined.

Appendix B

APPENDIX B-1

GROUNDSURE REPORT

Available on request from Highways England.

Highways England can be contacted:

by email:

A30chivertontoCarlandCross@highwaysengland.co.uk

in writing:

Highways England,
Temple Quay House,
2 The Square,
Temple Quay,
Bristol, BS1 6HA

By telephone:

0300 123 5000

Appendix C

DRAWINGS

APPENDIX C-1

PRELIMINARY PROPOSED EXPLORATORY HOLE LOCATION PLAN ROUTE 6(B) WITH SERVICES LOCATIONS

Available on request from Highways England.

Highways England can be contacted:

by email:

A30chivertontoCarlandCross@highwaysengland.co.uk

in writing:

Highways England,
Temple Quay House,
2 The Square,
Temple Quay,
Bristol, BS1 6HA

By telephone:

0300 123 5000

APPENDIX C-2

GENERAL ARRANGEMENT OPTION 6(B) DRAWINGS

Available on request from Highways England.

Highways England can be contacted:

by email:

A30chivertontoCarlandCross@highwaysengland.co.uk

in writing:

Highways England,
Temple Quay House,
2 The Square,
Temple Quay,
Bristol, BS1 6HA

By telephone:

0300 123 5000

Appendix D

HISTORICAL MAPS

APPENDIX D-1

HISTORICAL MAPS

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Temple Quay,
Bristol, BS1 6HA

By telephone:
0300 123 5000

If you need help accessing this or any other Highways England information, please call **0300 123 5000** and we will help you.

Creative M170036