

Growing Baldock

Environmental Statement Volume 2: Figures & Appendices

Chapter 12: Ground Conditions and Soils

Appendix 12.8 Technical Documentation Roads 2 and 3 and Pedestrian Bridge



SHADBOLT
ENVIRONMENTAL

Baldock North
Roads and Bridges

CD 622 Technical Documentation
Pedestrian Bridge and Vehicular Road and Bridge – Options 2/3

Urban & Civic

Issue V1
February 2024



SHADBOLT
GROUP

Baldock North

Roads and Bridges

CD 622 Technical Documentation

Pedestrian Bridge and Vehicular Road and Bridge –
Options 2/3

Client	Urban and Civic
Our Reference	Baldock North - Roads and Bridges
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Urban&Civic



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PREAMBLE

Shadbolt Group (SG) were commissioned by the Client, **Urban & Civic (Corby) Ltd.** to prepare documents in accordance with the Design Manual for Roads and Bridges document CD 622 Managing Geotechnical Risk, relating to a proposed road including a vehicular bridge and a proposed pedestrian bridge over the existing railway at the proposed development on the site, referred to as Baldock North, located in Hertfordshire.

It is understood that there is a single planned pedestrian bridge and five options for the run of the road and vehicular bridge under consideration. The current report considers the Pedestrian Bridge and Options 2 and 3 for the vehicular road and bridge with the Pedestrian bridge currently considered the most likely option to be located in this area. The other vehicular crossing options (Options 1, 4 and 5) are each considered within an independent CD 622 report.

This report is intended to form a single document covering the pre-construction technical reporting requirements of CD 622 from Statement of Intent through to the Geotechnical Design Report. The current version of the report (V1) incorporates all elements up to and including the Ground Investigation Report. The report will be updated to include the Geotechnical Design Report upon receipt of relevant design information and to incorporate the Special Geotechnical Measures Form elements if deemed to be required.

The proposed options for the proposed road and bridge railway crossing are shown on Royal Haskoning DHV Drawing Ref. PC3381-XXX-XX-XX-XX-X-0100 rev P01, "Location Plan". The route for the proposed pedestrian railway crossing are shown on David Lock Associates Drawing Ref. UAC080-079, "Baldock Sustainable Extension N-S Active Travel Rail Crossing - Conceptual Exploration Sketch (03-08-23)". Copies of both drawings are presented in **Appendix B** for reference.

1.0 STATEMENT OF INTENT (SOI)

1.1 Details of the Project

Urban & Civic (U&C) are currently in the planning stages for a proposed mixed residential and commercial development to the east of the town of Baldock, North Hertfordshire.

At the time of writing, the proposed developments are still in the planning stages and the site is comprised predominantly of agricultural land for cropping or grazing.

A vehicular road and bridge crossing the existing railway and a pedestrian crossing are both proposed as part of the wider development to provide access between the new proposed development areas to the north and south of the railway line. There are currently five options being considered for the route of the vehicular road. The current report considers Options 2 and 3 for the road and vehicular crossing and the pedestrian crossing all of which follow a similar route, the approximate location of which is indicated on Figures 1A to 1C below.



Figure 1A – Approximate Location of Proposed New Road and Bridge Crossing – Option 2



Figure 1B – Approximate Location of Proposed New Road and Bridge Crossing – Option 3

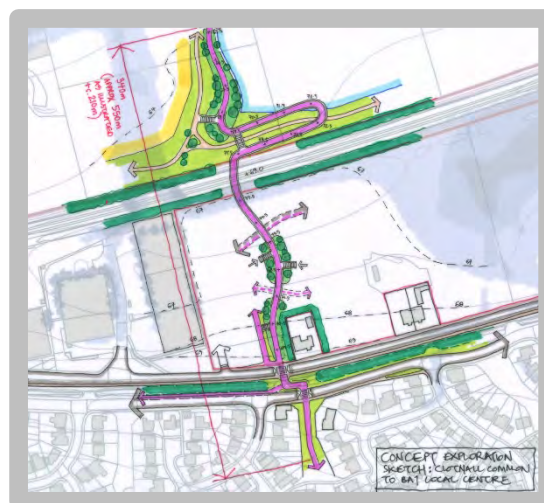


Figure 1C – Approximate Location of Proposed New Pedestrian Bridge Crossing

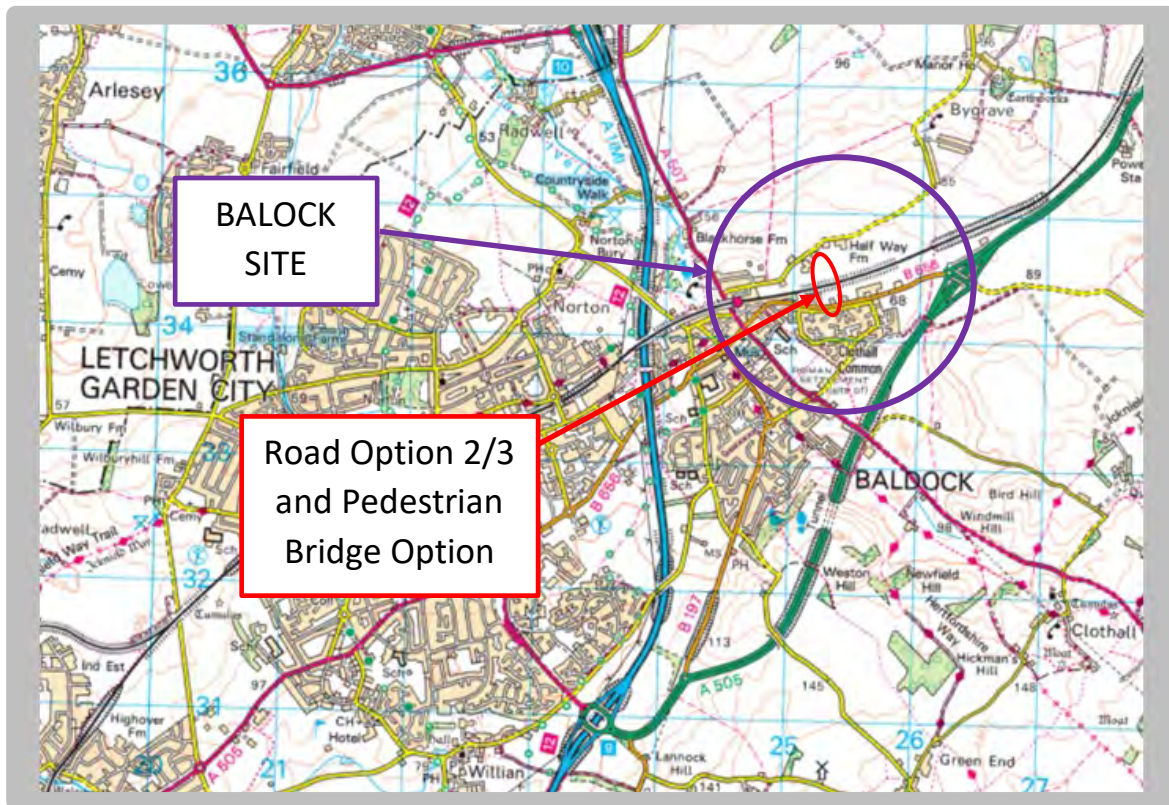


Figure 2 – Site Location in Regional Context

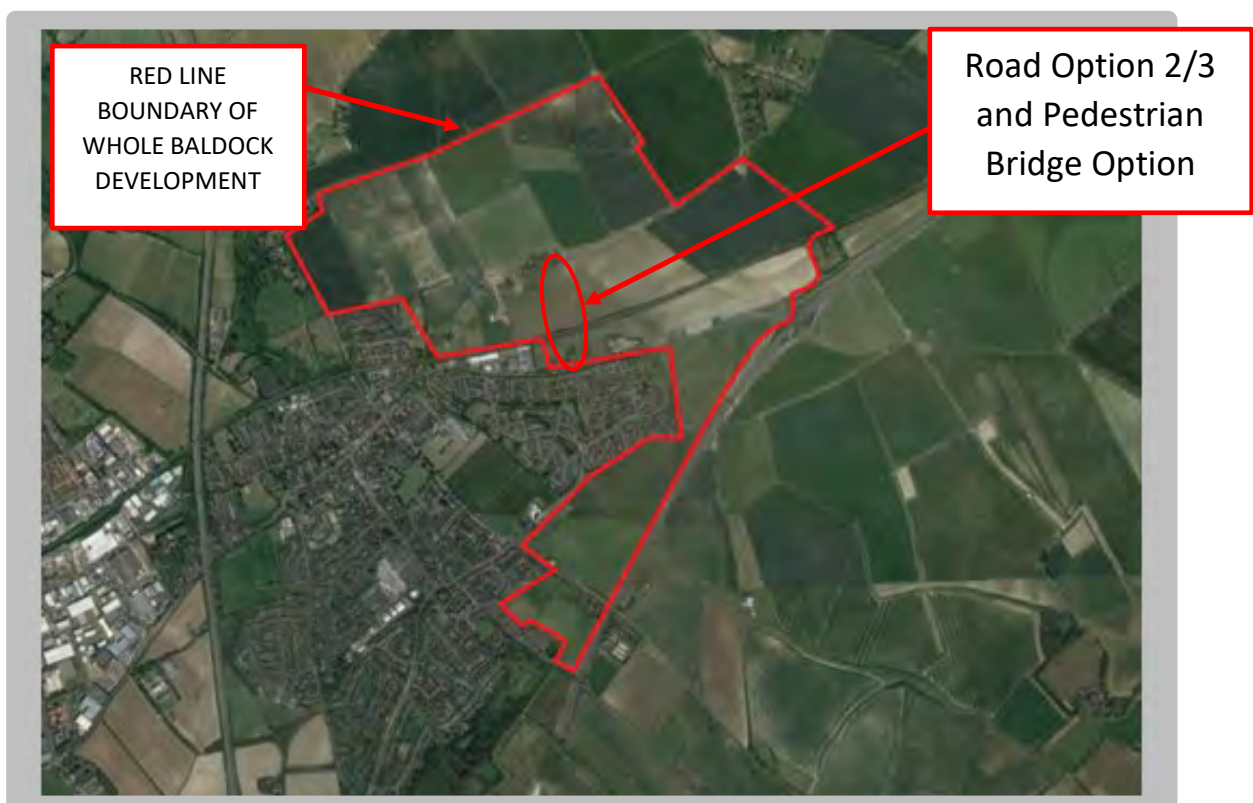


Figure 3 – Aerial Photo Showing Approximate Location of Proposed Pedestrian Bridge and Road Options 2/3 within Baldock Development

1.2 Objectives

SG have been commissioned by U&C to produce documents in accordance with CD 622.

The objectives of the development proposals are to create either a permanent pedestrian access across the railway line linking Clothall Common to the south and the new local centre and Bygrave Common to the north of the railway, or a permanent vehicular access linking developments north and south of the railway line and provide improved access to the proposed development via the A505.

SG's commission is to review previous relevant reports and site investigation works undertaken and provide standalone documents in relation to the construction of the Pedestrian Crossing and Road and Bridge – Options 2/3 as proposed.

1.3 Existing Information

Previous reports outside of the current CD 622 standard relating to the current Pedestrian/Vehicular crossing include:

- 77000739-DS – Baldock North Infrastructure, Vehicle and Pedestrian Bridge Desk Study, September 2020, WSP
- 2899 – Baldock, North Hertfordshire, Preliminary Risk Assessment, Issue V1, July 2022, Shadbolt Group

Previous intrusive investigations were also carried out by WSP following on from the above mentioned desk study, however, the previous investigation areas were over 250m to the east and are not considered relevant to the current investigation.

1.4 Geotechnical Risk

1.4.1 Key Geotechnical Risks

The site is not located within a coal field and from preliminary searches there are 6 No records relating to non-coal mining areas recorded by the BGS or the Coal Authority (CA) within 1000m of the site. 4 No. of these non-coal mining areas are recorded as encroaching onto site and refer to potential Chalk mining. The likelihood is noted as:

"Sporadic underground mining of restricted extent may have occurred. Potential for difficult ground conditions are unlikely and localised and are at a level where they need not be considered."

In addition, none of the former workings, such as ponds or chalk pits are shown to be located within the proposed run of the Pedestrian Crossing or Road Options 2/3 area of the site.

There are no records relating to underground working, mining cavities, JPB mining areas, brine areas, gypsum areas, tin mining, clay mining, natural cavities recorded by the BGS or the Coal Authority (CA) within 1000m of the site.

Surface ground workings are shown along the route of the existing railway line to the northwest identified as "cuttings". A pond is also shown just to the southwest of the site boundary mapped from 1981, which now appears to have been infilled.

The BGS consider the risk to the site from natural ground subsidence due to shrink/swell clays, running sand, compressible deposits, collapsible deposits, landslides, and ground dissolution of soluble rocks all to be at the maximum “very low” on the area of the site in the vicinity of the Pedestrian Crossing / Road Options 2/3 and for several hundred meters surrounding the proposed road route.

The BGS and EA have also identified the site to lie within an area with a risk of soluble rock. Their assessment notes that:

“Significant soluble rocks are likely to be present. Problems are unlikely except with considerable surface or sub-surface water flow”.

Two faults are noted within the Groundsure report for the wider Baldock development site; however, these are located over 500m north from the subject area of this report.

The primary geotechnical risk at this stage is considered to be potential slope instability of the proposed embankment and interaction with the existing railway line embankment. Although considered to be very low risk the potential for soluble rocks exists below the site which given the potential sensitivity of the bridge may be significantly impacted by management of drainage from the new development and road/bridge.

The key geotechnical risks are presented in the Geotechnical Risk Register, presented in Section 7.

The Geotechnical Risk Register is a live document and will be updated at each stage of the reporting process and may be reviewed at any stage if required.

1.4.2 Geotechnical Category

The proposed works are for the formation of a new embankment and bridge to allow construction of the crossing for either pedestrian or vehicular access across the existing railway line and at this stage are classified as Geotechnical Category 2.

This will be reviewed as the project progresses and further information and assessments become available.

1.5 Proposed Studies and Investigations

A general site investigation has been undertaken across part of the proposed development. A series of targeted site investigations along the possible proposed routes of the new road were carried out concurrently as part of the more general site investigation. Some areas were not accessible during the initial site investigation and further works are planned. The planned route of Pedestrian Crossing / Road and Bridge – Options 2/3 which is the focus of the current report was fully accessible based upon the currently planned route.

In accordance with CD622 the following report elements will be combined within this report for the Pedestrian Crossing / Road and Bridge Options 2/3.

- Statement of Intent (SOI)
- Preliminary Sources Study Report (PSSR)
- Ground Investigation Report (GIR)
- Geotechnical Design Report (GDR)*
- Special Geotechnical Measures Form (SGM)**

* The GDR is outstanding in the current version (V1) of the report. Should the proposed crossing options outlined in this report still be under consideration and the design progressed to the next stage, the report will be updated upon receipt of the design documents.

** Subject to OOGA requirements, not expected to be requested at this stage.

1.6 Specialist Consultation

Discussions are ongoing with Network Rail with regards necessary clearances and design requirements.

The bridge design is to be undertaken by others to the approval of Network Rail and the OO (Overseeing Organisation).

Consultation in relation to archaeology is ongoing as part of the planning process and it is expected that further consultation in relation to ecology and landscaping of the proposed public open spaces planned as part of the whole development will be required.

As these consultations are being undertaken across the development site as a whole it is possible that findings may impact on the construction of the proposed pedestrian/vehicular crossings and further consideration of the proposed crossing options may be required.

1.7 Programme

The SOI PSSR, and GIR elements are presented within this combined report for review in February 2024.

The GDR and SGM (if required) elements will be included within the future revised report upon receipt of design documents for the proposed pedestrian bridge / vehicular road and bridge.

The proposed development is currently in the planning and design stages and the project timeline has not yet been finalised. The GDR and SGM (if required) elements of this report will be updated upon receipt of the relevant data. A Geotechnical Feedback report will be produced on completion of the construction phase.

2.0 PRELIMINARY SOURCES STUDY REPORT (PSSR)

2.1 Introduction

Following on from the above Statement of Intent (SOI) the following sections present a summary of existing Desk Study data in relation to potential geotechnical risks in the development of Pedestrian Crossing / Road Options 2/3.

Option 2

The proposed highways link is to comprise a single carriageway road with an embankment either side to elevate the carriageway and associated abutments for the proposed bridge to cross the existing railway line. The carriageway is currently on the order of 478m in length. We understand that detailed design of the road route, carriageway and embankments is underway. This report will be updated upon receipt of the detailed design.

Option 3

The proposed highways link is to comprise a single carriageway road with an embankment to the east only to elevate the carriageway and associated abutments for the proposed bridge to cross the existing railway line. It is considered likely that retaining structures will be required to the western side of the carriageway as no embankment is shown. The carriageway is currently on the order of 482m in length. We understand that detailed design of the road route, carriageway and embankments is underway. This report will be updated upon receipt of the detailed design.

Pedestrian Crossing

The proposed pedestrian link is to comprise a pedestrian access way with an embankment either side to elevate the carriageway and associated abutments for the proposed bridge to cross the existing railway line. The embankment will also serve as a green corridor providing additional public amenity green space.

The pedestrian route currently covers a distance in the order of 340m but is meandering along its length and intersects with several additional current and proposed footpaths for the development. We understand that detailed design of the footpath, bridge and embankments is underway. This report will be updated upon receipt of the detailed design.

The proposed options for the proposed road and bridge railway crossing are shown on Royal Haskoning DHV Drawing Ref. PC3381-XXX-XX-XX-XX-X-0100 rev P01, "Location Plan". The route for the proposed pedestrian railway crossing are shown on David Lock Associates Drawing Ref. UAC080-079, "Baldock Sustainable Extension N-S Active Travel Rail Crossing - Conceptual Exploration Sketch (03-08-23)". Copies of both drawings are presented in **Appendix B** for reference.

2.2 Sources of information, desk study, site reconnaissance, site description and review of findings

Data has been obtained from the following sources:

Review of previous Desk Study and Ground Investigation carried out by WSP on behalf of Hertfordshire County Council for the previously proposed crossings;

- 77000739-DS – Baldock North Infrastructure, Vehicle and Pedestrian Bridge Desk Study, September 2020, WSP

A Preliminary Risk Assessment was also undertaken for the Baldock, North Hertfordshire development by Shadbolt on behalf of Urban&Civic. The area of the Pedestrian Crossing and Road Options 2/3 is located roughly centrally within the large Baldock development for which the PRA was commissioned.

- 2899 – Baldock, North Hertfordshire, Preliminary Risk Assessment, Issue V1, July 2022, Shadbolt Group

2.3 Summary of Previous Reports

The previous WSP Desk Study report was carried out for a proposed vehicular road bridge and pedestrian bridges with a separate Ground Investigation Report issued for each of the schemes.

Both the pedestrian and vehicular routes considered by the previous WSP reports were to the east of the current routes, the pedestrian c.250m to the east and the vehicular route c.950m to the east. Given the significant distance from the current areas under consideration the data has not been considered relevant for the current proposed routes.

The recent Preliminary Risk Assessment was carried out by Shadbolt and reported in July 2022 was carried out on the whole Baldock proposed development site of which the current area under investigation is located on the western edge but roughly centrally with respect to the northern-southern boundaries of the site. Review of the information within the desk study indicates that the area has remained as agricultural land throughout the recorded history apart from the construction of the railway line which was established prior 1881 which is the earliest historical map available.

2.4 Site Reconnaissance

A site reconnaissance visit was undertaken by Shadbolt Group in June 2022.

The proposed Baldock development site is an irregularly shaped plot of land located east of the town centre of Baldock, approximately 23km northwest of the county town of Hertford. It comprises agricultural land and was predominantly cropped with barley and potato at the time of the initial site visit.

The area in the vicinity of Pedestrian Crossing / Road Options 2/3 is located centrally north-south and on the eastern boundary of the site as a whole and straddles the existing railway line.

The area to the north of the railway line slopes moderately downwards to the south and is grazing land separated into several paddocks. Several farm buildings are located to the north (Freeland Farm) and to the northwest (Dairy Farm) with further areas of pasture to the east and west.

The railway line lies atop an embankment lined with timber fencing either side of the railway and with overhead power lines along the route.

The area to the south of the railway line is also arable land with the B656 (Royston Road) bounding the site to the south. Further agricultural land is present to the east with an industrial estate with several commercial/industrial units to the west. The general topography in this area is flat dipping slightly to the southwest.

An area of Local Authority owned public open space is present south/southeast of the B656 surfaced with rough densely vegetation and cross by several public footpaths.

No obvious olfactory or visual evidence of significant contamination was noted during site reconnaissance.

No significant changes were noted during the fieldwork in October – December 2023 except that arable areas of land were in differing stages of the cropping process that noted previously.

2.5 Ground Conditions

2.5.1 Geology

Published BGS maps (at 1:10,000 and 1:50,000 scales) have been reviewed via the BGS Maps Portal. Sheet explanation of the British Geological Survey. 1:50 000 sheet 221 Hitchin (England and Wales) and 1:10,000 sheet TL23SE (Weston) are obtained as part of the Groundsure Geo-Insight report for the Baldock, North Hertfordshire development.

The mapping indicates Made Ground to be present along the railway line, likely to be the presence of the embankment.

Both the 1:10,000 and 1:50,000 scale map sheets indicated that there is no significant superficial deposits across the majority of the site however bands of superficial deposits does cross the site in an east-west direction on the northern end of the proposed routes.

The superficial geology underlying the site is indicated to comprise Head Deposits (clay, silt, sand and gravel). On the 1:10,000 scale sheet these deposits are described more specifically as Dry Valley Deposits: Brown sandy silt or clay with chalk and flint pebble.

The solid geology underlying the site comprise CHALK, specifically that of the Holywell Nodular Chalk Formation and New Pit Chalk Formation (Undifferentiated).

2.6 Preliminary Engineering Assessment

The existing railway embankment is likely to have been constructed utilising locally sourced material and may comprise variable Made Ground. Due to the age of the railway line this is not likely to have been carried out to an engineering standard comparable to current methods or standards, however, also given the age of the embankment, long term settlement is likely to have ceased. It is likely that regular inspection/maintenance is carried out by Network Rail who may have records with respect to such inspection/maintenance and any remedial action previously carried out. It is recommended that the existence or absence of such data is sought during consultation with Network Rail.

No visual evidence of significant slope instability was noted in the existing embankments. The embankment are vegetated on both the northern and southern sides with some large shrubs and former trees also present on the embankments. It was noted the some trees had been recently felled prior to the fieldwork as part of continuing maintenance. Drainage culverts are present at the base of the embankments to allow surface runs off, one of which is visible to the east of the investigation area.

Evidence of burrows (possible rabbit warrens) were noted at several points along the railway embankment that could potentially contribute to slope instability. Inspection of the burrows and arisings adjacent to the burrows showed grey brown silty sand which could be indicative of the existing embankment make up. Such burrowing may migrate to the new bridge embankment and consideration should be given to possible impacts upon stability with mitigation (e.g. netting) to prevent this in the proposed embankment design if deemed to pose a significant risk.

The underlying bedrock geology is expected to comprise Chalk strata which is potential soluble. Increased run off and drainage from the new road/bridge and surrounding developments could result in formation or propagation of solution features.

Minor cut and fill works are anticipated to be required in order to improve / prepare the sub grade with larger scale earthworks for formation of the embankment and bridge abutments.

2.7 Comparison of Project Options and Risks

Of the potential vehicular crossings currently under consideration, Options 2/3 outlined in this report are considered unlikely to be progressed and Option 1 located some 900m to the east (and considered in a separate report) is considered likely to be most favourable due to the reduced height of embankments required at that point and lowest cost and foreseeable geotechnical risk.

Of the potential pedestrian crossings currently under consideration the route outlined in this report is considered likely to be most favourable due to the central location providing most convenient access links between the existing and proposed developments and thus providing the greatest public amenity.

2.8 Drawings and Photographs

The proposed options for the proposed road and bridge railway crossing are shown on Royal Haskoning DHV Drawing Ref. PC3381-XXX-XX-XX-XX-X-0100 rev P01, "Location Plan". The route for the proposed pedestrian railway crossing are shown on David Lock Associates Drawing Ref. UAC080-079, "Baldock Sustainable Extension N-S Active Travel Rail Crossing - Conceptual Exploration Sketch (03-08-23)". Copies of both drawings are presented in **Appendix B** for reference.

3.0 GROUND INVESTIGATION REPORT (GIR)

3.1 Existing Information

The following section carries on from the preceding sections and presents the Ground Investigation Report, discussing the findings and interpretation of Ground Investigation works undertaken in relation to the proposed permanent highway construction covered by this report.

3.2 Existing Information and Field and Laboratory Studies (Undertaken)

Site works undertaken by RSK Environment Limited and reported by WSP in 2020 however given the distance (>250m west) these works are not considered relevant to the current pedestrian crossing/road options.

Shadbolt have recently undertaken targeted works in November / December 2023 along the route of a proposed road and bridge in order to confirm the ground conditions and to obtain appropriate samples for geotechnical analysis.

The fieldworks completed during the recent November / December 2023 ground investigation comprised;

- *Excavation of 14 No. machine excavated trial pits to depths of between 2.50m and 3.50m bgl.*
- *The drilling of 7 No. window sample boreholes to depths of between 2.45m to 3.45m bgl.*
- *The drilling of 4 No. rotary boreholes to depths of 15.50m bgl.*
- *Monitoring of standpipes installed within selected boreholes.*
- *Associated in-situ testing and laboratory testing undertaken on sample retrieved during the fieldworks*

The strata encountered is discussed below and the logs are presented in **Appendix C**.

3.2.1 Topsoil

Topsoil was encountered within all of the exploratory holes undertaken and was generally describes as grey/brown slightly sandy slightly gravelly CLAY with the gravel fraction comprising chalk and locally flint. Such Topsoil type material was typically encountered in thicknesses between 0.15m and 0.30m bgl.

3.2.2 Superficial Geology

Superficial deposits were typically shallower to the north of the railway line and increased in depth and thickness moving south. Typically these deposits were very soft to firm friable variably sandy / gravelly CLAY. This material was noted in some cases to be borderline clayey SAND. Locally this was identified as orangish brown, yellowish brown and light brown mottled white gravelly silty SAND.

Such soils are considered likely to be Head deposits are extended to between 0.60m and 2.10m depth.

Within trial pits TP-R2/R3-08, TP-R2/R3-09 and TP-R2/R3-10 the sandy, gravelly CLAY/clayey SAND was underlain by brown very sandy GRAVEL of coarse chalk and flint, first encountered from depth of between 0.40m and 2.10m depth and extending to the base of the trial pits at between 2.50m and 2.60m depth. Similar material of gravelly SAND was encountered within the boreholes WS-R3-03 and WS-R3-04 to the base of the boreholes at 3.45m and 2.45m respectively.

No superficial deposits were identified within trial pits TP-R3-01 and TP-R3-04.

Within the rotary boreholes poor recovery was noted within the shallow superficial deposits, likely due to the sandy nature even where predominantly cohesive resulting in blow out of sample from the flush medium.

3.2.1 Made Ground

No Made Ground soils were encountered within the exploratory points. Given that the area is arable land and is likely ploughed then all soils down to a depth of approximately 0.60m could be considered to be Made Ground Type Topsoil/subsoil as they have been disturbed by human activity at some point however given the lack of anthropogenic inclusions it is difficult to accurately distinguish between such slight anthropogenic disturbance and natural weathering of shallow soils.

3.2.3 Solid Geology

Solid geology of the White Chalk Subgroup was encountered across the site directly beneath the Topsoil and Superficial deposits except to the south of the area within trial pits TP-R2/R3-08, TP-R2/R3-09 and TP-R2/R3-10 and boreholes WS-R3-03 and WS-R3-04.

The chalk strata were typically initially encountered as structureless white/off white mottle orange brown silty GRAVEL to depth of between 3.50m and 5.00.

At depth the chalk typically comprised white locally mottled orange brown and speckled black weak low to medium, locally high-density CHALK with very closely to medium spaced horizontal (bedding) and steeply inclined / vertical fractures. The fractures were typically undulating rough tight clean with grey, brown and orange brown staining and black speckling.

At depth of between 11.35m and 14.66m cream sandy (gritty) weak low to medium density CHALK with wispy marl seams locally with a shaley texture and typically more closely spacing bedding fractures with orange brown staining and black speckling was encountered and extended to the base of the boreholes.

The fractures, particularly those that are steeply inclined resulted in a heavy degree of disturbance along the fracture line resulting in some of the core lengths to disintegrate into fine to coarse gravel sized fragments. Such shattering of the core result can in some lengths of competent rock being recovered as non-intact core and can result in low SCR and RQD quotients, potentially not representative of the true rock mass properties. In addition, such fracturing can obscure other fractures or stratigraphic features.

The base of the Chalk strata was not encountered within any of the exploratory holes the maximum depth of which was 15.50m bgl.

3.2.4 Groundwater

No groundwater was encountered during the drilling works carried out by Shadbolt Group, however given the method of drilling (rotary coring with air/mists flush) this can sometimes mask minor seepages.

Groundwater monitoring of the standpipe installed within the rotary boreholes indicated standing water levels of between 5.78m and 9.35m depth bgl. The results of the monitoring are presented in full in **Appendix F**. It should be noted that groundwater conditions will vary seasonally and with changes in weather conditions along with several other factors including local discharges consents, abstraction licences permeability of the underlying deposits.

Exploratory Point	Ground Level (m AOD)	Depth to Groundwater Level on Stated Monitoring Date (m bgl)					
		07/12/23	09/01/24	25/01/24	07/02/24	20/02/24	To Follow
RO-R2/3-01	64.22	7.88	6.50	6.18	6.08	5.78	To Follow
RO-R2/3-02	64.46	8.15	7.32	5.95	6.29	5.98	To Follow
RO-R2/3-03	65.37	8.92	6.97	7.06	7.11	6.90	To Follow
RO-R2/3-04	65.86	9.35	7.28	7.42	7.55	7.26	To Follow

3.2.5 Ground Obstructions

No significant ground obstructions were observed during the works. The chalk strata typically increased in strength and density at between circa 3-5m depth bgl with structured chalk encountered within the deeper rotary boreholes only.

3.2.6 Ground Conditions Summary

The new pedestrian crossing if selected to be developed in this area is to be constructed to provide a link between the local centre to the north of the railway and the new development south of the railway and existing public access to the south of the B656 / Royston Road. The crossing will also be a green corridor to provide additional green space and public amenity.

The new road and bridge (if Option 2/3 are selected) are to be constructed to provide a link between the B656 / Royston Road in the south to Ashwell Road to the north and provide the proposed and existing developments with efficient access to the A505 and A1.

The strata underlying the proposed route comprises generally Topsoil over localised soft sandy, gravelly Clay/clayey Sand to a maximum of 2.10m depth with localised Sand/Gravel to greater depths of >3.45m in the south. Where the base of the superficial strata was proven this overlies natural Chalk bedrock. The chalk stratum is initially recovered as structureless silty GRAVEL to depth of between 3-5m overlying structured white weak low to medium density Chalk becoming cream with a localised shaley texture from between 11.35-14.66m and extending to the base of the exploratory hole undertaken at 15.50m depth bgl.

3.2.9 Site Investigation In-situ and Laboratory Testing

The following in-situ and laboratory geotechnical testing was undertaken as part of the site investigation, the results of which are summarised in Table 3.2.9 (below) and presented on logs and laboratory reports in full in **Appendices C and E** respectively.

Method	Strata	Parameter	Comments
Atterberg Limits (3 No.)	Superficial (Head) 0.65m-1.40m	Liquid Limit 17 - 22% Modified Plasticity Index 4.9 to 7.0%	Near surface borderline clayey SAND/ sandy CLAY soils are confirmed as Non Shrinkable.
Particle Size Distribution (3 No.)	Superficial (Head) 0.65m-1.40m	Cobbles: 0% Gravel: 6-16% Sand: 39-49% Clay/Silt: 37-46%	Materials are typically a 2C (Stony Cohesive) material (SHW Series 600) and will be detrimentally affected by elevated moisture.
Compaction (Dry Density - Moisture Content Relationship) (5 No.)	Head (2 samples) 1.0m to 1.40m	Moisture Content as received was 14-15% Optimum Moisture Content is 9-9.6%	Materials ranged from 4.4% dry to 6% wet of optimum moisture content for earthworks (Average 5.2% Wet)
	Chalk (3 samples) 1.40m to 2.50m	Moisture Content as received was 20-22% Optimum Moisture Content is 16-17%	Materials ranged from 4% dry to 6% wet of optimum moisture content for earthworks (Average 4.3% Wet)
Standard Penetration Test (SPT) (15 No.)	Chalk 1.00m to 3.00m	SPT 'N-Values' in range N=9 to N=50+	No correlations relating SPTs to chalk parameters or classifications.
CBR (Lab Remoulded) (4 No.)	Head 0.40m to 1.00m	Indicated CBR value of Chalk is <1%.	Lab remoulded CBR tests indicate CBR of <1% The laboratory results do not match well with SPTs values and in-situ description this is considered to be a significant underestimate of the in-situ CBR value, possibly due to disturbance of the soils during sampling.

Chalk Crush Value (3 No.)	Chalk 1.00m to 2.50m	Material Greater than 10mm = 12% to 47% (Average 31.7%) Moisture Content = 17% to 19% (Average 18.3%) Saturated Moisture Content = 20% to 20% (Average 20%) Chalk Crushing Value = 1.8 to 2.5 (Average 2.16)	Materials classified as Chalk Class A to C according to TRL LR806
Saturation Moisture Content and Intact Dry Density (10 No.)	Chalk 1.40m to 13.88m	Saturation Moisture Content = 11% to 27% (Average = 19.2%) Intact Dry Density = 1.56Mg/m ³ to 2.06Mg/m ³ (Average = 1.79 Mg/m ³)	Chalk is typically classified as Medium to High locally Very High density.
Point Load Tests	Chalk	Is(50) ranged between 0.15 to 1.24	Chalk strata is to typically classified as "extremely weak" to "very weak"

Table 3.2.9 – Summary of In-Situ and Laboratory Geotechnical Testing undertaken.

3.2.12 Contamination Testing

Shadbolt Group undertook an initial screen of the laboratory results using Shadbolt Group Tier One Screening Values Version (TSVs). This screening was undertaken using TSVs derived for the current and proposed Public Open Spaces (Residential) end use, which is considered to be appropriate / conservative for the grass verges of the embankment.

Contaminant concentrations below the TSVs are considered not to warrant further risk assessment. Concentrations of potential contaminants above the TSVs require further consideration of the potential pollutant linkages.

In total 5 No. soil samples were submitted for testing for a suite of common contaminants during the Shadbolt Group ground investigation. The laboratory chemical results have reported concentrations of potential contaminants to be within SE TSVs for 'Public Open Space' end use.

The water-soluble sulphate test results generally recorded concentrations between 7.7mg/l and 77.9mg/l. The soil pH was generally between 8.0 and 9.1 indicating slightly alkaline condition.

Sulphate levels and soil pH have been assessed and DS-1 and ACEC class 1 concrete is suitable for use at the site.

Copies of the laboratory reports are presented in **Appendix D**.

3.4 Ground Summary

Ground investigations undertaken along the length of the proposed route of the proposed Pedestrian Crossing / Road Option 2/3 has confirmed a reasonably consistent geological profile, of Topsoil over Superficial soils typically increasing in depth to the south over weathered structureless Chalk over structured fractured Chalk at depth. Groundwater was not identified during the field work with standing groundwater levels recorded at depth of between 5.78m and 9.35m bgl during subsequent monitoring. No significantly elevated concentrations of contaminants have been reported from soils retrieved from the site.

3.5 Geotechnical Risk Register

See Section 7

3.6 Engineering Assessment

To follow upon receipt of design documents.

4.0 GEOTECHNICAL DESIGN REPORT (GDR)

The GDR element of this report will be completed upon receipt of design documents for the proposed pedestrian crossing and/or road and bridge.

5.0 CONCLUSIONS

6.0 REFERENCES

- Site walkover survey.
- Historical and Recent Ordnance Survey maps and plans.
- Geological Survey Sheets.
- The Environment Agency.
- Groundsure Report.
- British Geological Survey.
- Coal Authority Mining Report.
- BRE Report BR211; Radon: Protective measures for new buildings.
- NRPB-W26 'Radon Atlas of England and Wales,' NRPB, 2002.
- CIRIA 132 'A guide for safe working on contaminated sites,' CIRIA, 1996.
- CIRIA C552 'Contaminated Land Risk assessment. A guide to good practice,' CIRIA, 2001.
- BS10175 'Investigation of potentially contaminated sites – code of practice,' BS, 2011.
- CLR 11 'Model Procedures for the management of land contamination' EA, 2004
- Environmental Protection Act 1990: Part IIA
- Environmental Protection Act 1990: Part 2A Contaminated Land Statutory Guidance April 2012.
- Ciria C733 Asbestos in soil and made ground: a guide to understanding and managing risks, March 2014.
- BRE Special Digest 1, 2005 (Third Edition). Concrete in aggressive ground. Construction Research Communications Ltd, Watford.
- BS 5930: 1999. Code of practice for site investigations. BSI, UK.
- BS 10175: 2011. Investigation of potentially contaminated sites – Code of Practice. BSI, UK.
- CIRIA C665: 2006. Assessing risks posed by hazardous ground gases to buildings. London UK.
- DD ENV, 1997. Eurocode 7: Geotechnical Design. Parts 1 to 3. BSI, UK.
- Environment Agency, 2008 - onwards, Science Reports SC050021 (SGVs)
- TOMLINSON, M.J., 2001 Foundation design and construction. Prentice Hall, London.
- The LQM/CIEH S4ULs for Human Health Risk Assessment (S4UL3251), November 2014
- The Water Environment (Water Framework Directive) (England and Wales) (Amendment) Regulations, September 2015.
- Rocscience Slide Software
- Rocscience Settle 3D Software

HIGHWAYS AGENCY STANDARDS AND INFORMATION

- DMRB CD622 Rev 1 – Managing Geotechnical Risk, Highways England.
- Manual of Contract Documents for Highway Works – Series 600 Earthworks

BRITISH AND EUROCODE STANDARDS

- BS 8002:2015, 'Code of practice for earth retaining structures', British Standards Institution.
- BS 6031:2009 Incorporating Corrigendum No. 1, 'Code of practice for earthworks', British Standards Institution.
- BSEN 1997-1:2004+A1:2013 Incorporating corrigendum February 2009, 'Eurocode 7: Geotechnical design – Part 1: General rules', British Standards Institution.
- BS EN 1997-2:2007 Incorporating corrigendum June 2010, 'Eurocode 7 – Geotechnical design – Part 2: Ground investigation and testing', British Standards Institution.
- NA+A1:2014 to BS EN 1997-1:2004+A1:2013 Incorporating Corrigendum No. 1, 'UK National Annex to Eurocode 7: Geotechnical Design – Part1: General rules', British Standards Institution.

7.0 GEOTECHNICAL RISK REGISTER

No	Hazard	Consequence	Phase of project affected	Risk Management Measures	Comments or further recommended actions	Risk
1	Soft and compressible ground	High differential and total settlements. Increased costs to dig out and replace soft / very soft soils or undertake ground improvement techniques.	Construction, design life	Ground investigations carried out and confirmed geological profile of Topsoil over localised soft CLAY over Chalk at typically <1m bgl. Near surface Topsoil/soft CLAY shall be removed. Earthworks to be undertaken to construct embankment to appropriate engineering design with confirmatory validation testing conducted during/post construction.	From Ground Investigations to date significant depths of compressible materials are not anticipated. Near surface Topsoil/Sub-soil shall be removed. Construction of the proposed embankment will require placement of suitable site won/imported material to a suitable specification with appropriate validation testing. Base-Ex level is to be proof rolled to identify any soft spots and materials excavated and replaced as required. The works will be supervised by a suitably qualified geo-environmental engineer.	Low
2	Flooding	Increased construction costs. Damage to structures, foundations and earthworks, including erosion of embankment slopes. Maintenance liability.	Excavations, earthworks, design life	Design will consider flood levels and fluctuations, including rapid drawdown. Ensure adequate temporary and permanent drainage for earthworks.	The site is located within a Flood Zone 1 – low risk. The underlying strata comprises chalk and is likely to be permeable with typically good drainage noted during the fieldworks. Flooding is not expected to present a risk to the highway construction; however, care should be taken during excavation works to ensure excessively wet materials are not incorporated into the engineered fill. During wet weather pumping or drainage cuts may be required to prevent pooling of surface water. The works will be supervised by a suitably qualified geo-environmental engineer.	Low
3	Aggressive ground conditions	Long term degradation of concrete components leading to reduced design life and increased maintenance costs.	Design life	Laboratory tests to determine aggressiveness of the ground. Design sulphate classifications for buried concrete to be assessed. Depending on sulphate concentration, avoid calcium-based additives to treat soils (i.e. lime, cement) or blend in non- plastic soils. Increase specification of concrete to higher class.	The results have been assessed in accordance with the guidance given in BRE Special Digest 1:2005. Assuming a brownfield site with mobile groundwater the concrete Design Sulphate Class for the site is DS-1, ACEC Class AC-1. Chemical testing will be undertaken during the works on the fill to be placed and the works will be supervised by a suitably qualified geo-environmental engineer.	Low
4	Shrinking / Swelling Potential	Changes in groundwater conditions as a result of the construction may cause shrinking or swelling of any high plasticity clays which may result in excessive movement of structures.	Design life	Geotechnical sampling and testing to assess plasticity of the strata below the site. Treatment with hydrated lime / cement, however this is dependent on sulphate concentration.	Limited cohesive soils are present on site. Laboratory analysis on the shallow cohesive materials has indicated soils to be of Low Plasticity and None Shrinkable. The natural underlying bedrock comprises of Chalk which is predominantly clast supported (Grade Dc) at shallow depth and structure chalk at depth, neither of which are expected to exhibit plastic behaviour.	Very low
5	Unexpected Ground Conditions	Unsuitable earthwork proposals if parameters assumed in the design are significantly different to those encountered on site during construction.	Design and construction works	GI has been undertaken and has confirmed soils are consistent and also consistent with those carried out by other previously.	Ground investigation have been undertaken at the site and a detailed ground model has been produced. However, should unexpected ground conditions be encountered NHC will be contacted immediately for comment. The works will be supervised by a suitably qualified geo-environmental engineer	Low
6	Instability of slopes on or adjacent to the proposed scheme	Failure of existing slopes and proposed embankment profile during construction.	Earthworks, Design life	Embankment and proposed slopes to be designed by appropriately qualified engineer. Validation testing of embankment fill to be carried out during construction to confirm placed material meets appropriate criteria / specifications. Possible ground investigation to confirm stability of existing railway embankment.	A ground investigation had been carried out along the current proposed pedestrian crossing or road/bridge route. Should the route be altered further confirmatory investigations may be required. Confirmation of the composition and stability of the existing railway embankment may be prudent dependent upon the expected interaction between it and the proposed road embankment. The ground investigation data should be utilised to design an appropriate earthworks specification and validation strategy for the proposed embankment and road design. Geotechnical validation testing will be undertaken during the works as described within the strategy in order to ensure that the works are undertaken appropriately, and these works will be supervised by a suitably qualified geo-environmental engineer.	Low
7	Hard ground or obstructions	Delay site works, Increased construction costs.	Excavations, foundations	GI has been undertaken to confirm ground conditions along currently proposed route. Bedrock strata increased in density around 2-3m depth. No works have yet been carried out to confirm the make up of the railway embankment. This may be required should interaction between the existing railway embankment and the new road embankment be anticipated.	Obstructions may be associated with Made Ground and natural solid geology. Ground conditions of the existing railway embankment not yet confirmed. The works will be supervised by a suitably qualified geo-environmental engineer	Low
8	UXO	Delay site works, Increased construction costs.	Excavations, foundations	UXO bomb mapping indicates LOW Risk with no UXO identified within the area.	The works will be supervised by a suitably qualified geo-environmental engineer. Should UXO be encountered (unlikely) a suitably qualified UXO engineer will be contacted for further assessment.	Very Low

APPENDIX A

REPORT CONDITIONS

REPORT CONDITIONS

This report is produced for the benefit of **Urban and Civic** in accordance with the terms of the appointment.

This report has been prepared in accordance with the terms and conditions of the appointment and relates to the condition of the site at the time of ground investigations. No warranty is provided as to the possibility of future changes in the condition of the site.

Shadbolt Group takes no responsibility for conditions which occur between the individual exploratory holes. Whilst every effort has been made to interpret the conditions between investigation locations, such information is only indicative.

Whilst the contamination assessment detailed within this report reflects our view, because there are no exact UK definitions of these matters, being subject to risk analysis, Shadbolt Environmental are unable to give categoric assurances that they will be accepted by authorities or funds without question. This report is prepared and written for the purposed uses stated in the report and should not be used in a different context without reference to Shadbolt Environmental. In time, improved practices or amended legislation may necessitate a re-assessment.

The report is limited to the geotechnical and environmental aspects detailed within the report, and is necessarily restricted and no liability is accepted for any other aspect especially concerning gradual or sudden pollution incidents.

APPENDIX B

DRAWINGS

Project Id: 2899 - Pedestrian Bridge and Bridge Options 2/3

Project Title: Baldock - Pedestrian Bridge and Bridge Option 2/3

Location:

Client:

Title: Site Plan

Scale: 1:1500

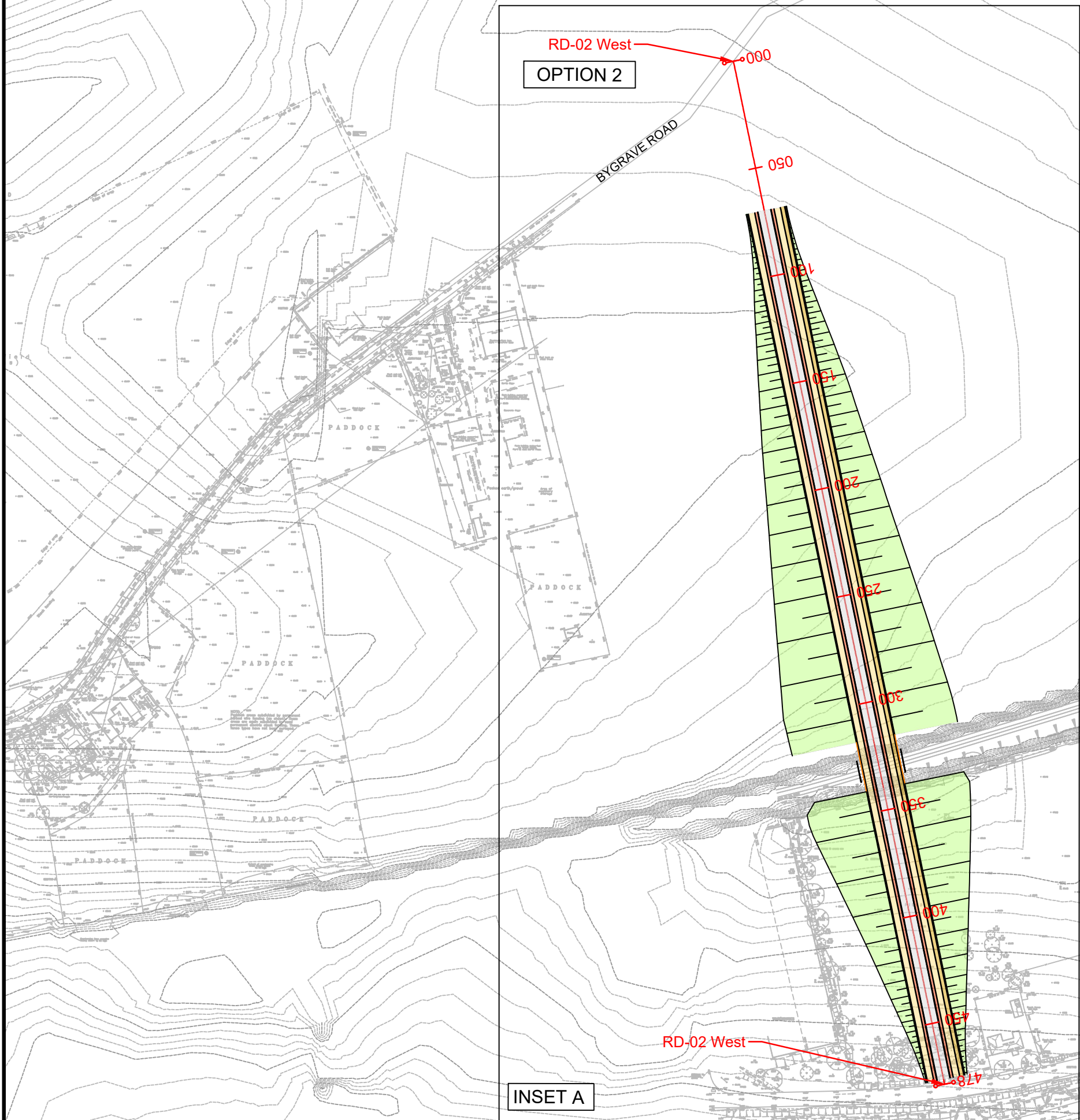
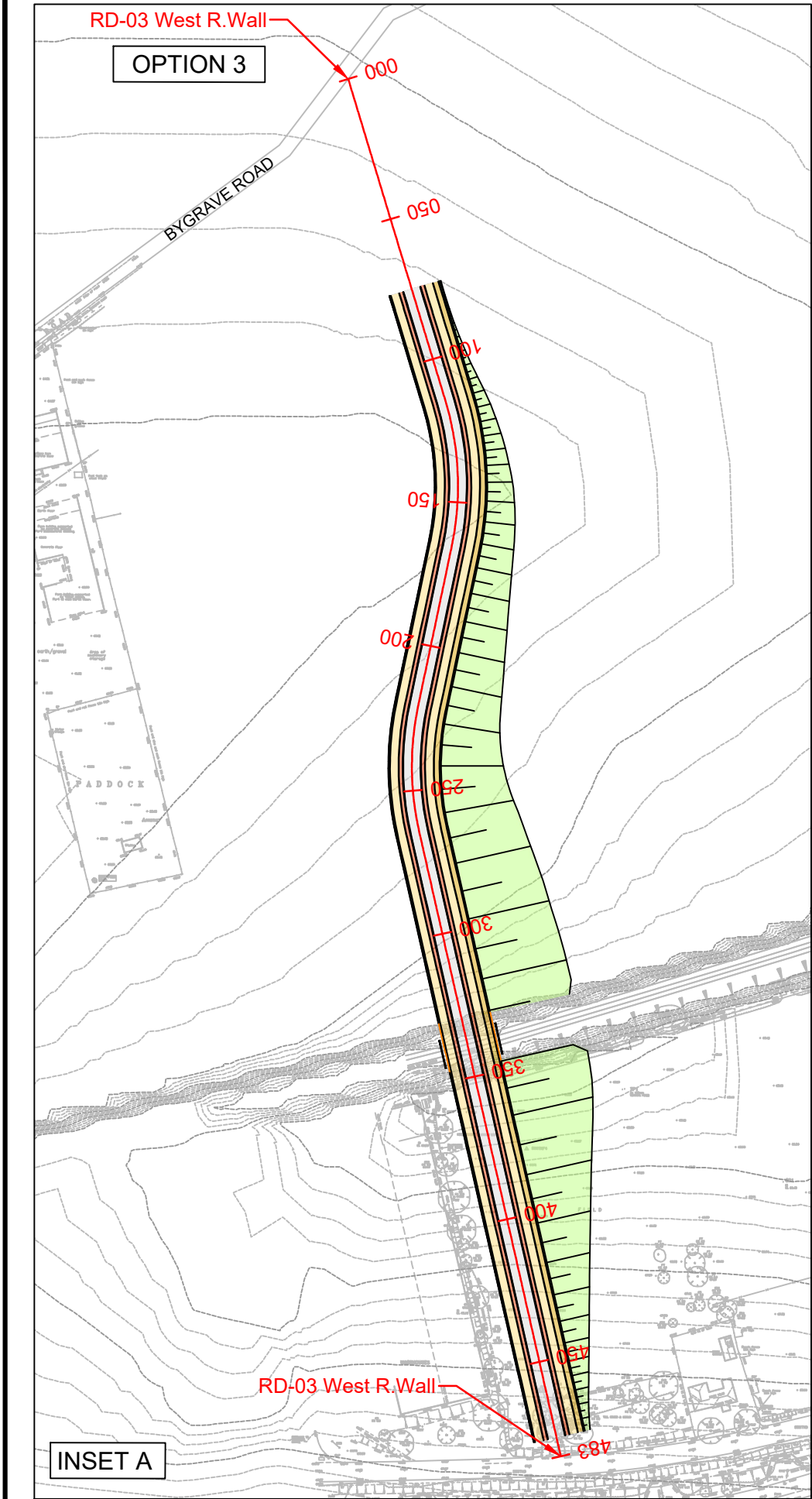
Engineer:

Contractor:



- Legend Key
- Locations By Type - Empty
 - Locations By Type - RC
 - Locations By Type - TP
 - Locations By Type - WLS





NOTES

KEY:

ALIGNMENT POSITION

ROAD

CYCLEWAY

FOOTWAY

BRIDLEWAY

VERGE

EMBANKMENT

P01	12/10/23	FIRST ISSUE	KZ	LZ	DJ
REV	DATE	DESCRIPTION	BY	CHK	APP

REVISIONS

DRAWING STATUS

CLIENT

PROJECT

BALDOCK RAILWAY CROSSING

TITLE

LOCATION PLAN



Portland Street,
Manchester One, 9th Floor
Manchester, M1 3LP
Tel +44(0)161 2361018
Email info.manchester@uk.rdhv.com
Website www.royalhaskoning.com

DRAWN	KZ	CHECKED	LZ	APPROVED	DJ
DATE	SEP 23	SCALE AT A1	1:2000	PROJECT NUMBER	PC3381
DRAWING No.	PC3381-XXX-XX-XX-XX-X-0100			SUITABILITY	REVISION
					P01

340m
550m
(approx
K9 illustrated
+ c. 210m)

CONCEPT EXPLORATION
SKETCH: CLOTHALL COMMON
TO BA1 LOCAL CENTRE

**BALDOCK SUSTAINABLE EXTENSION
N-S ACTIVE TRAVEL RAIL XING**

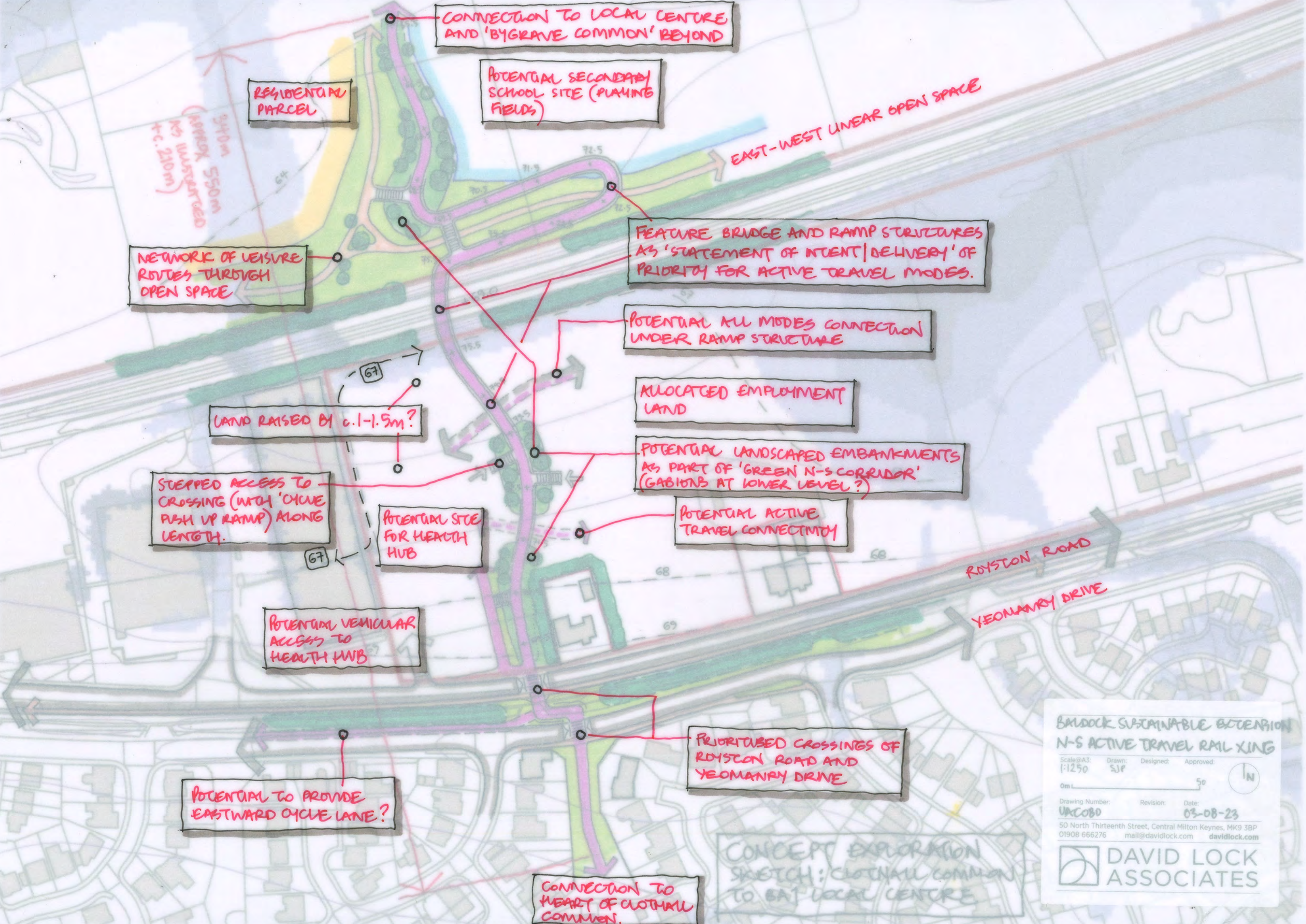
Scale@A3: 1:1250 Drawn: SJP Designed: Approved: 

0m 50

Drawing Number: **VACOB0** Revision: Date: **03-08-23**

50 North Thirteenth Street, Central Milton Keynes, MK9 3BP
01908 666276 mail@davidlock.com davidlock.com

 **DAVID LOCK
ASSOCIATES**



CONNECTION TO LOCAL CENTRE AND 'BYGRAVE COMMON' BEYOND

RESIDENTIAL PARCEL

POTENTIAL SECONDARY SCHOOL SITE (PLAYING FIELDS)

EAST-WEST LINEAR OPEN SPACE

NETWORK OF LEISURE ROUTES THROUGH OPEN SPACE

FEATURE BRIDGE AND RAMP STRUCTURES AS 'STATEMENT OF INTENT/DELIVERY' OF PRIORITY FOR ACTIVE TRAVEL MODES.

POTENTIAL ALL MODES CONNECTION UNDER RAMP STRUCTURE

ALLOCATED EMPLOYMENT LAND

POTENTIAL LANDSCAPED EMBANKMENTS AS PART OF 'GREEN N-S CORRIDOR' (GABIONS AT LOWER LEVEL?)

POTENTIAL ACTIVE TRAVEL CONNECTIVITY

LAND RAISED BY c.1-1.5m?

STEPPED ACCESS TO CROSSING (WITH 'CHIVE PUSH UP RAMP') ALONG LENGTH.

POTENTIAL SITE FOR HEALTH HUB

POTENTIAL VEHICULAR ACCESS TO HEALTH HUB

ROYSTON ROAD
YEOMANRY DRIVE

POTENTIAL TO PROVIDE EASTWARD CYCLE LANE?

PRIORITISED CROSSINGS OF ROYSTON ROAD AND YEOMANRY DRIVE

CONNECTION TO HEART OF CLOTHALL COMMON.

CONCEPT EXPLORATION SKETCH: CLOTHALL COMMON TO BAT LOCAL CENTRE

BALDOCK SUSTAINABLE EXTENSION
N-S ACTIVE TRAVEL RAIL LINK

Scale: A3 1:1250 Drawn: SJF Designed: Approved: [N]

0m 50m

Drawing Number: VAC080 Revision: Date: 03-08-23

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DAVID LOCK ASSOCIATES