Flood Risk Screening and Surface Water Management Plan

Holmston Farm BESS

Ref	04874-4875441

Revision History

Issue	Date	Name	Latest changes
01	22.02.22	Daniel Cole	First issue

Contents

1 Overview

1.1 Introduction

Holmston Farm is a proposed battery-based energy storage system located just east of the town of Ayr, South Ayrshire, Scotland.

This report sets out the flood risk screening and surface water management plan for the proposed Holmston Farm battery energy storage system, which will house battery enclosures along with associated infrastructure and electrical equipment.

The battery storage system comprises battery enclosures with associated power conversion systems, transformers, a switchhouse and grid compliance equipment. All electrical equipment will be set on concrete foundations.

Drawing 04874-RES-LAY-DR-PT-001 included in Appendix A shows the proposed project layout. The compound area within the fence measures 0.70 hectares, the total area enclosed by the red line boundary measures 2.19 hectares.

2 Relevant guidance and legislation requirements

All drainage relating to the proposed energy storage facility will be constructed using best practice and in conformance with the requirements of the relevant regulatory authorities. The key legislation and guidance that will be adhered to are as follows:

- The EU Water Framework Directive (2000/60/EC).
- Scottish Planning Policy.
- The Water Environment (Controlled Activities) (Scotland) Regulations 2011.
- SEPA Pollution Prevention Guidance Notes (PPGs).
- Engineering in the Water Environment, Good Practice Guide, Temporary Construction Methods, First Edition, March 2009.
- Sewers for Scotland 3rd Edition.
- South Ayrshire Council Sustainable Design Guide
- CD 15 Environmental Report of Strategic Environmental Assessment Appendix H Strategic Flood Risk Assessment
- The Sustainable Urban Drainage Scottish Working Party (SUDSWP) Water Assessment and Drainage Assessment Guide.
- The SuDS Manual 2015. CIRIA C753.
- Soakaway Design BRE Digest 365.
- British Geological Survey (BGS) mapping.

3 Existing Information

3.1 Site Location

Site can be located by National Grid Reference (NGR) N:236316, E:621202. A location plan is included in Appendix A.

The site sits within the east of a field adjacent to Holmston Roundabout, which lies on the eastern edge of Ayr. The field is bound to the west and south by the A77 and A70 respectively. A garden centre sits adjacent to the south of the site, abutting the southeast corner of the field. To the east of the site lies a substation and associated access track. The River Ayr passes a short distance north of the site.

3.2 Existing Land Use and Topography

A walkover survey of the site has been undertaken, and a topographical survey of the site extents carried out to confirm the existing land use and topography. Land on the site is partially used to grow conifer trees commercially, other areas on the site remain roughland with no apparent use.

Levels on the site slope down from east to west at a typical gradient of approx. 1:20. The substation access track abutting to the east is elevated approx. 5m above the site. This level difference is accommodated by a bank against the field's eastern boundary, sloping at an average of approx. 1:2.5.

Several shallow open drainage channels run across the site, approx. 1m wide and 0.5m deep, converging to an open-top inspection chamber in the west of the site.

A copy of the site topography survey plan is included in Appendix D.

3.3 Ground Conditions

BGS mapping indicates that the site is underlain with a bedrock of Coal Measures Formation, described as sandstone, siltstone and mudstone with common coal seams. Superficial deposits on site are shown to comprise till, described as a mixture of clay, sand and gravel.

A Coal Mining Risk Assessment undertaken found the site was unlikely to be impacted by shallow mine workings.

3.4 Existing Hydrology / Drainage

Understanding of the site's existing hydrology / drainage is based on observations made during site visits, review of topographical survey information, and discussions with the landowner.

Stormwater is currently intercepted by the on-site shallow open drainage channels and conveyed into the open-top inspection chamber located in the west of site. A 150mm dia outlet pipe then conveys flows northwest, running underneath the wider field with approx. 100 – 200mm of cover. The outlet pipe discharges into a ditch, approx. 1.5m wide and 1m deep, that abuts the outer edge of the wider field's north-western boundary. The ditch terminates a short distance before the wider field's northern corner; flows then continue northwards in a buried pipe, ultimately discharging into the River Ayr.

The River Ayr is classified by SEPA as a ‘moderate’ quality watercourse. Annual monitoring data shows good status on all parameters except for aquatic plant ‘Phyto benthos’, which has ‘moderate’ status.

The site is located within the Ayr groundwater catchment, which is classified by SEPA as ‘Poor’ quality.

4 Flood Risk Screening

4.1 Overview

A review of flood risk from various sources has been undertaken, and concludes that the site is at no risk of flooding. The proposed development will not increase flood risk anywhere on or off site due to the proposed measures outlined in Sections 5 and 6 of this report.

4.2 Fluvial Flood Risk

The SEPA fluvial flood risk map shows there is no specific fluvial flood risk on or near to the site. The nearest area of fluvial flood risk to the site is approximately 100m to north, local to the River Ayr.

OS contouring indicates the area of fluvial flood risk local to the River Ayr lies at least 5m below site. The site is therefore considered to be at no risk of flooding from fluvial sources.

Figure 1 below shows a map of fluvial flood risk produced by SEPA covering the vicinity of site, overlaid with the proposed development application boundary.

Figure 1 - Excerpt from SEPA fluvial flood risk map, with proposed site boundary overlaid.

4.3 Coastal Flood Risk

The SEPA coastal flood risk map shows there is no coastal flood risk on or near to the site.

4.4 Surface Water Flood Risk

The SEPA surface water flood risk map shows there is no specific surface water flood risk on the site. A strip of surface water flood risk is shown along the east of the garden centre, which sits adjacent to the south of site. The garden centre is situated at a lower level than the site. The site is therefore currently considered to be at no risk of surface water flooding.

Figure 2 below shows a map of surface water flood risk produced by SEPA covering the vicinity of site, overlaid with the proposed development application boundary.

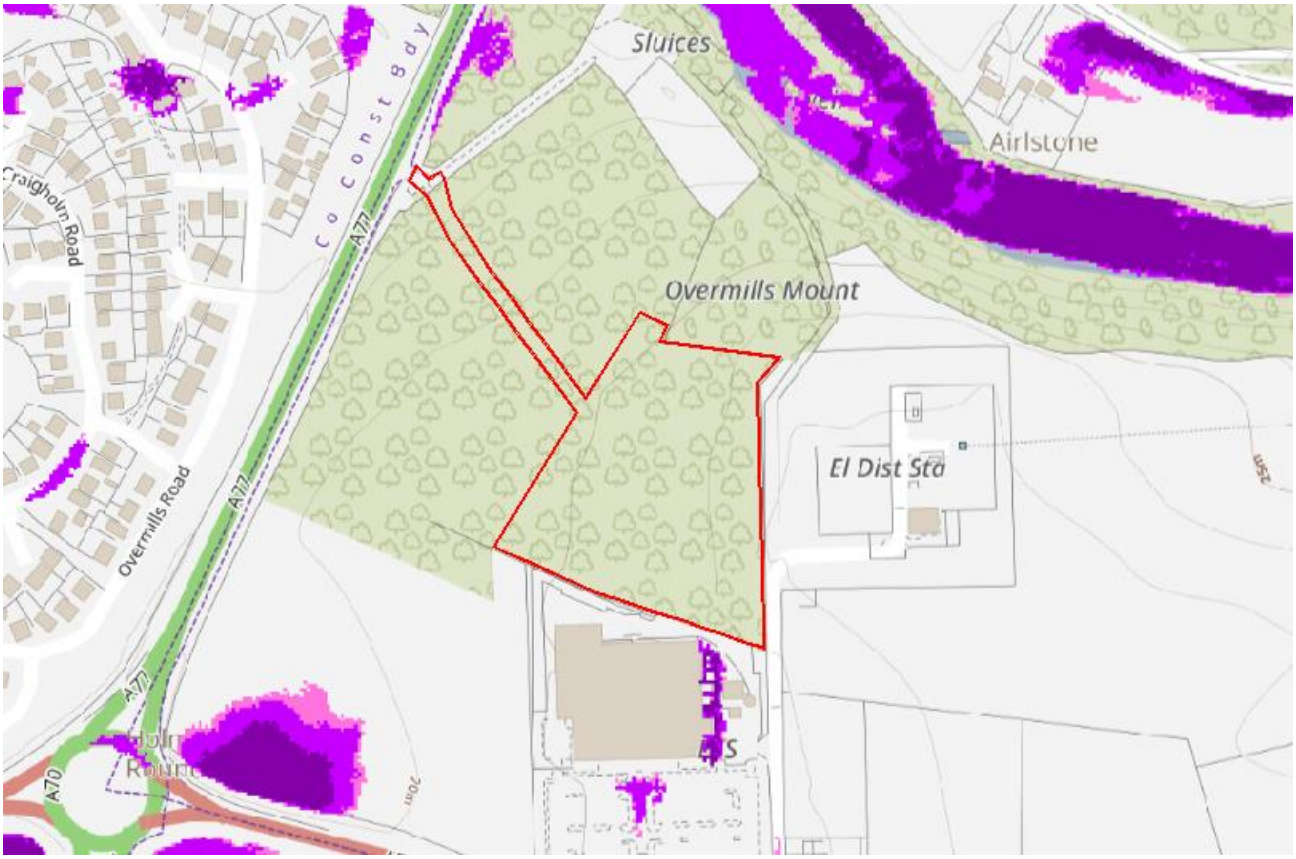


Figure 2 - Excerpt from SEPA surface water flood risk map, with proposed site boundary overlaid.

4.5 Flooding from Sewers

Scottish Water asset location plans show no sewers to exist within the vicinity of site. There is therefore considered to be no specific flood risk resulting from sewers.

4.6 Flooding as a Result of the Development

Whilst the proposed development will increase the total impermeable area on site, the measures set out in Sections 5 and 6 of this report will ensure there would be no increase in flood risk as a result of this development.

5 Drainage Design

5.1 Site Preparation

Topsoil on the site will be scraped off and set aside. The existing shallow open drainage channels on the site will be filled in with unbound granular material.

Proposed hardstanding areas and tracks will be graded with a minimum 300mm layer of unbound granular material. Depending on earthing requirements at detail design stage, the compound area may require a surface course of asphalt. To be conservative, an asphalt surface is assumed for the purposes of all calculations in this report.

The finished ground level of the proposed facility will be approximately 28.3m AOD. Finished levels across the compound will slope down to the west, in keeping with existing topography, at a gradient of approx. 1:50.

5.2 SuDS Hierarchy

In line with Scottish planning policy, a drainage solution for this proposed development shall be selected based on the principles of the SuDS Hierarchy as disclosed in the CIRIA C753 'The SuDS Manual'.

5.2.1 Rainwater Harvesting

Rainwater harvesting is not applicable to this project; there are no facilities within the proposed development that have a demand for water.

5.2.2 Infiltration

Prior to the detailed design of a drainage solution for the proposed development, infiltration testing will be undertaken on the site, performed to BRE 365 Digest.

It is anticipated that the ground underlying the site will not support an infiltration drainage solution, due to the following:

- Existing site drainage, as described in Section 3.4, demonstrates that surface water is not currently infiltrated into the ground, and must be conveyed off the site via constructed drains.
- BGS ground data indicates the site is underlain by superficial deposits of predominantly clay.

A drainage solution for the site is proposed in this report on the conservative assumption that an infiltration solution is not possible.

5.2.3 Attenuate Rainwater in Ponds for Gradual Release

If infiltration to ground proves to be unfeasible, the next preference in the drainage hierarchy is to attenuate flows in a detention basin with a restricted discharge.

5.3 Proposed Surface Water Drainage Solution

The drainage strategy and indicative details of the proposed drainage infrastructure are included in Appendix B.

The drainage strategy proposed for the site will aim to maintain the existing hydrological pathway outlined in Section 3.4.

In the proposed drainage solution, all stormwater falling into the compound will run overground to the west and be intercepted by a filter drain along the compound's western boundary. From the filter drain, water will be conveyed to an attenuation basin situated adjacent to the west of the site. Water will then discharge from the basin into the ditch abutting the field's north-western boundary via a new 150mm dia. outfall pipe. The new outfall pipe will run alongside the site access track, following the route of the existing outfall pipe currently serving site (see Section 3.4). The existing outfall pipe runs underneath the site access track; as such it will need be removed as part of the access construction works due to its shallow depth.

Water will discharge at a maximum flow rate equivalent to the pre-development greenfield rate 'Qbar'. This restriction in discharge flow rate will be achieved by a new outfall manhole with a flow control unit within, installed immediately downstream of the basin.

Stormwater uphill on the bank adjacent to the east of the site will be intercepted by a second filter drain along the compound's eastern boundary. From this filter drain, water will be conveyed to the new outfall manhole. No change in ground permeability is proposed on the bank; no increase in storm flows is therefore expected so water intercepted by this eastern filter drain can discharge into the north-western ditch without restriction imposed by flow control.

5.4 Foul Drainage

There will be no permanent foul drainage from the proposed development.

Any foul drainage from the temporary welfare facilities will be self-contained and disposed off-site appropriately.

5.5 Water Quality and Treatment

A Simple Index Approach is adopted as per CIRIA SuDS Manual to determine the suitability of the proposed development's SuDS components in mitigating water quality risks, as per Section 26.7.1 of the SuDS Manual 2015 (CIRIA C753).

1. Filtration of water through filter drain along western edge of compound; mitigation indices for filter drain: TSS = 0.4, metals = 0.4, hydrocarbons = 0.4.

2. Settlement in attenuation / infiltration basin; mitigation indices for detention basin: TSS = 0.5, metals = 0.5, hydrocarbons = 0.6.

3. Filtration of water through vegetation within ditch abutting north-western edge of field: TSS = 0.5, metals = 0.6, hydrocarbons = 0.6.

Table 1 below demonstrates how the pollution hazard index for each contaminant is satisfied by the three stages of water treatment provided as part of the proposed drainage strategy.

Table 1 – Simple Index calculation

Contaminant Type	Stage 1	Stage 2	Stage 3	Total SUDS Mitigation Index	Pollution Hazard Index	Utilisation
TSS	0.4	0.5(0.5)=0.25	0.5(0.5)=0.25	0.90	0.8	1.13
Metals	0.4	0.5(0.5)=0.25	0.5(0.6)=0.3	0.95	0.8	1.19
Hydrocarbons	0.4	0.5(0.6)=0.3	0.5(0.6)=0.3	1.00	0.9	1.11

During the construction phase, temporary silts fences will be installed, providing an additional treatment stage of water filtration.

Refer to Appendix B for indicative drainage details and proposed drainage strategy plan.

6 Hydraulic Assessment

A preliminary runoff and attenuation calculation for compound and temporary hardstanding has been undertaken using a HR Wallingford online design tool available from:

https://www.uksuds.com/tools/greenfield-runoff-rate-estimation

The inputs taken have been assumed as "worst case" and as such has determined the maximum drainage component extents required for the project. This includes assuming all permanent infrastructure (other than the access track) has an asphalt surface, and that drainage by infiltration is not possible.

A detailed drainage design will be performed following the ground investigation and compound earthing design (to determine surface finishes).

All methods and inputs are taken in accordance with the relevant guidance documents provided in Section 2.

6.1 Greenfield Peak Runoff Rates from Site

Current and future greenfield runoff rates for the development have been estimated using the IH124 Method. Using the mapping software within HR Wallingford Design Tool, the site-specific parameters have been established:

- Standard average annual rainfall between 1941 – 1970 (SAAR): 979mm.
- Standard percentage run-off: 47%.
- Total drained area: 0.70 ha.
- M5-60 rainfall depth: 14mm.
- Ratio M5-60 / M5-2day: 0.3.

Total drained area is defined as the catchment area for the attenuation basin, which comprises the area inside the compound (0.70 ha). The extents of this area are defined by a hatch labelled *'surface finish typically comprising stone or asphalt'* on the Infrastructure Layout in Appendix A.

Refer to Appendix C for the Qbar design tool calculation summary.

The peak runoff rate calculated for a Qbar (1 in 2.3) rainfall event is 5.0 l/s. It is proposed to match this discharge rate through use of a flow control device installed in a manhole positioned immediately downstream of the basin.

6.2 Attenuation Storage Required Post Development

The surface water storage volume estimation tool uses a storage assessment method developed by HR Wallingford based on correlations between storage requirements and hydrological characteristics of sites.

Attenuation storage will be provided to accommodate the peak runoff rate calculated up to the critical 1 in 200 storm plus a 40% allowance for climate change. This attenuation requirement was confirmed via email during early liaison with the South Ayrshire Council. A record of this email is included in Appendix E.

As per the calculation described in Section 6.1, allowable discharge from the basin is set to the calculated greenfield runoff rate of 5.0 l/s.

The attention volume calculated based on the above criteria is approximately 430m^3. 3D modelling has been carried out to prove this volume can be accommodated within the site boundary. The attenuation volume should be considered a maximum volume, this assumes that all surface finishes (other than of the access track) are of asphalt and that drainage by infiltration methods is not possible.

Refer to Appendix C for the storage volume calculation and greenfield runoff estimation summary.

7 Operation and Maintenance Requirements

All surface water drainage and pollution control features associated with the site will remain private and will be maintained by the site operator.

The following section outlines the proposed maintenance for the various aspects of the drainage system. If necessary, these outline maintenance proposals will be refined when the site is operational to suit specific conditions.

7.1 Filter Drain / Discharge Pipe

The anticipated maintenance plan for the filter drains and attenuation basin discharge pipe is outlined in Table 2.

Table 2 – Typical filter drain and discharge pipe operation and maintenance requirements

Filter Drain / Discharge Pipe Maintenance Schedule	
Maintenance Action	**Minimum Frequency**
Inspect filter drain / manhole / pipe. Where stone or pipe has become clogged with silt, it will be cleared out	Half yearly
Remove litter and debris	Half yearly
Inspect inlets and outlets for blockages, and clear (if required)	Half yearly

7.2 Basin

The anticipated maintenance plan for the basin at the site is outlined in Table 3.

Table 3 – Typical basin operation and maintenance requirements

Basin Maintenance Schedule	
Maintenance Action	**Minimum Frequency**
Remove litter and debris	Half yearly
Inspect inlets and outlets for blockages, and clear (if required).	Half yearly
Inspect inlets and outlets for noticeable effects of erosion, suitable erosion protection measures such as reno-mattress or placement of large stones (>150mm) to dissipate water energy levels will be installed at the area affected.	Half yearly
Inspect silt accumulation rates in any forebay and in main body of the pond and establish appropriate removal frequencies	Half yearly
Reseed areas of poor vegetation growth, alter plant types to better suit conditions (if required).	As required, or if bare soil is exposed over 10% or more of the basin treatment area

8 Conclusion

A flood risk assessment has been undertaken across the site. The site has been deemed at no specific risk of flooding.

An assessment of the drainage options has also been undertaken, and it has been concluded that drainage by infiltration is unlikely to be a viable option. As such, the current proposal is to drain the site via an attenuation basin, with a restricted discharge rate into the River Ayr.

The required attenuation volume has been calculated as approximately 430m^3. This should be considered a maximum volume, based on the assumption that all permanent infrastructure (other than the access track) has an asphalt surface and that drainage by infiltration methods is not possible.

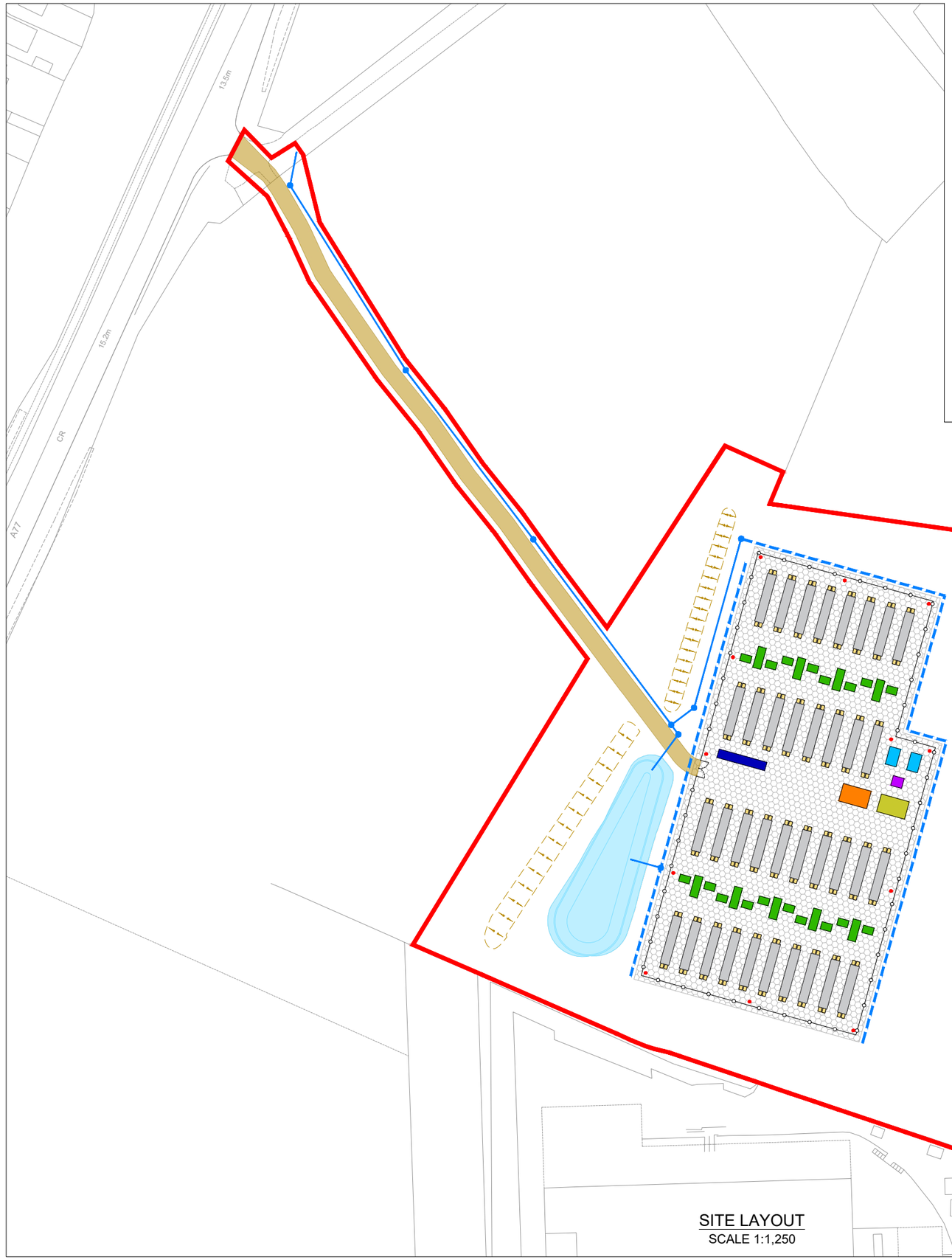
A site investigation, 3D earthworks design, earthing design, and a further assessment of the proposed discharge route will be undertaken to inform the detailed design of the site drainage.

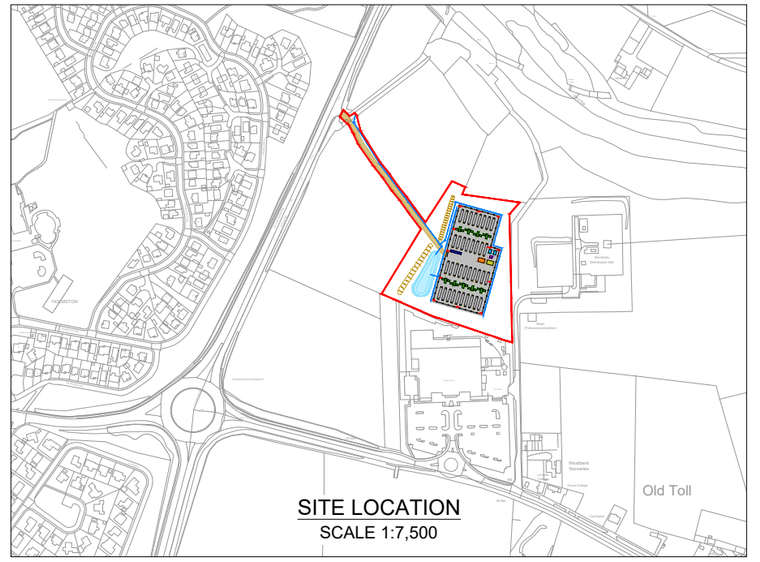
The drainage strategy proposed will provide sufficient water quality treatment as demonstrated using the Simple Index Approach.

Appendix A Project Drawings

A.1 Infrastructure Layout – 04874-RES-LAY-DR-PT-001

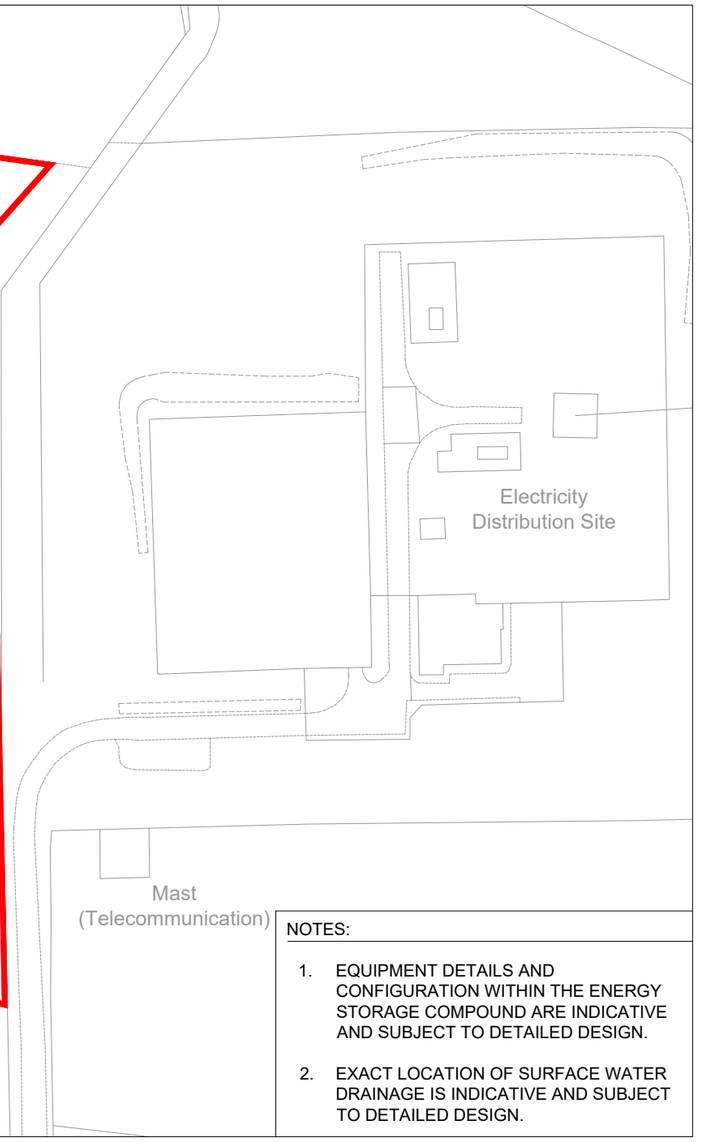
A.2 Location Plan – 04874-RES-MAP-DR-XX-001





SITE LOCATION
SCALE 1:7,500

SITE LAYOUT
SCALE 1:1,250



NOTES:

1. EQUIPMENT DETAILS AND CONFIGURATION WITHIN THE ENERGY STORAGE COMPOUND ARE INDICATIVE AND SUBJECT TO DETAILED DESIGN.
2. EXACT LOCATION OF SURFACE WATER DRAINAGE IS INDICATIVE AND SUBJECT TO DETAILED DESIGN.

KEY:

- RED LINE BOUNDARY (DENOTED BY OUTSIDE EDGE OF THE LINE)
- BATTERY CONTAINERS
- HVAC UNIT
- DNO SUBSTATION
- CLIENT SUBSTATION
- AUXILIARY TRANSFORMER
- GRID COMPLIANCE EQUIPMENT
- PCS / TRANSFORMER
- SPARES CONTAINER
- ACOUSTIC FENCING UP TO 3m IN HEIGHT
- ACCESS TRACK
- SURFACE FINISH TYPICALLY COMPRISING STONE OR ASPHALT
- CCTV & LIGHTING
- FILTER DRAIN
- SURFACE WATER DRAINAGE
- DRAINAGE BASIN
- PROPOSED BUND

ISSUE	DRAWN	CHKD	APPD	DATE	REVISION NOTES
2	BM	DC	JF	2023-02-24	UPDATED NOTES
1	BM	DC	JF	2023-02-24	FIRST ISSUE

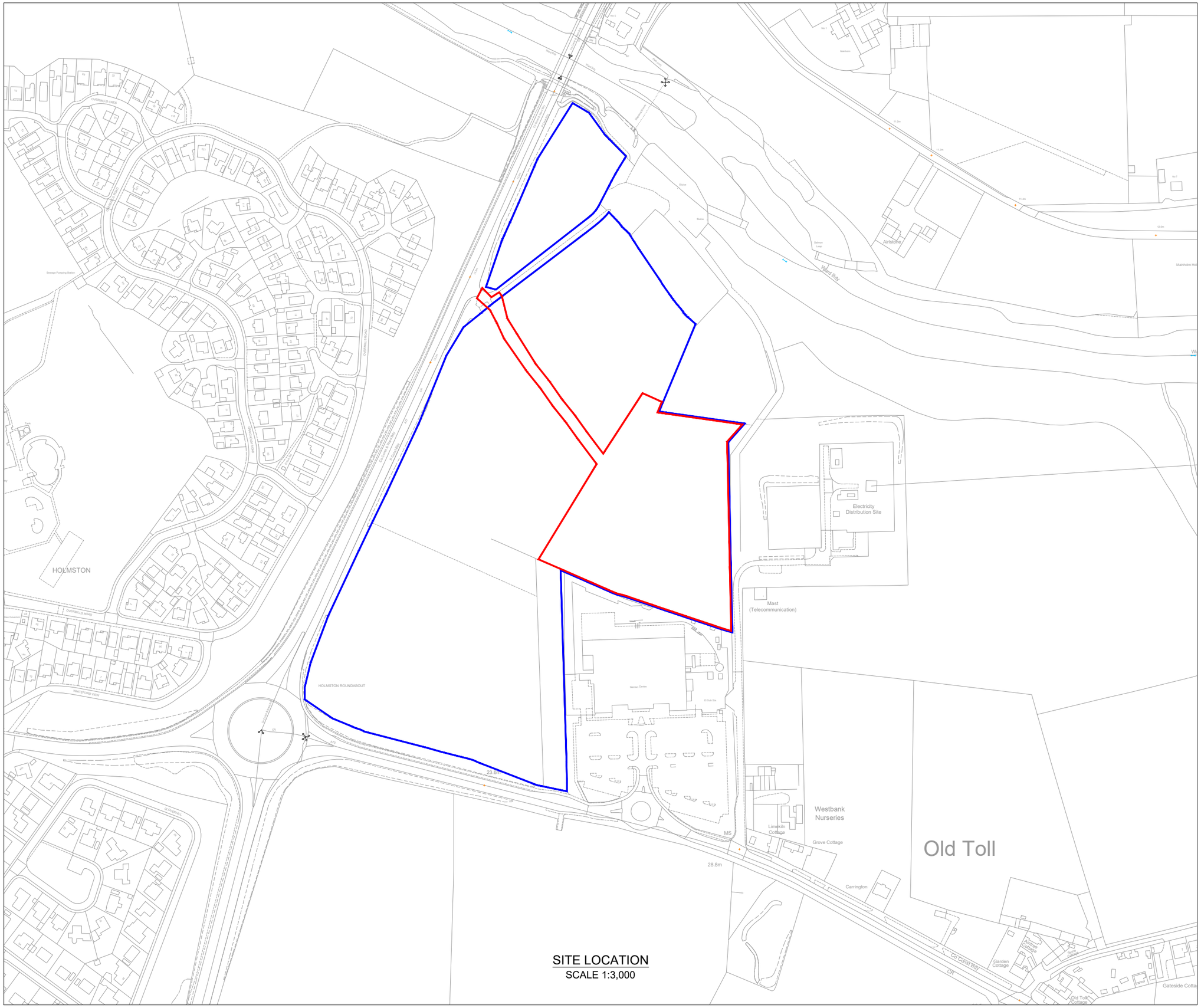
PURPOSE: PLANNING	COORDINATES: OSGB 1936
SCALE: AS SHOWN @A3	DATUM: N/A
LAYOUT DRAWING: N/A	T-LAYOUT NO: N/A

PROJECT TITLE: HOLMSTON FARM

DRAWING TITLE: INFRASTRUCTURE LAYOUT

RES DRAWING NUMBER: 04874-RES-LAY-DR-PT-001 | REV: 2

BEAUFORT COURT,
EGG FARM LANE,
KINGS LANGLEY,
HERTS WD4 8LR. UK
TEL +44 (0) 1923 299200
WWW.RES-GROUP.COM



SITE LOCATION
SCALE 1:3,000

KEY:

LANDOWNER BOUNDARY
(INSIDE EDGE OF LINE DENOTES BOUNDARY)

DEVELOPMENT BOUNDARY
(OUTSIDE OF LINE DENOTES BOUNDARY)

KEY PLAN

0 20 40 60 80 100m

SCALE 1:3,000

ISSUE	DRAWN	CHKD	APPD	DATE	REVISION NOTES
3	BM	DC	JF	2023-02-27	ADDED SCALE BAR
2	BM	DC	JF	2023-02-22	UPDATED DEVELOPMENT BOUNDARY
1	BM	DC	JF	2022-08-18	FIRST ISSUE

PURPOSE: PLANNING	COORDINATES: OSGB 1936
SCALE: 1:3,000 @A3	DATUM: N/A
LAYOUT DRAWING: N/A	T-LAYOUT NO: N/A

PROJECT TITLE
HOLMSTON FARM

DRAWING TITLE
LOCATION PLAN

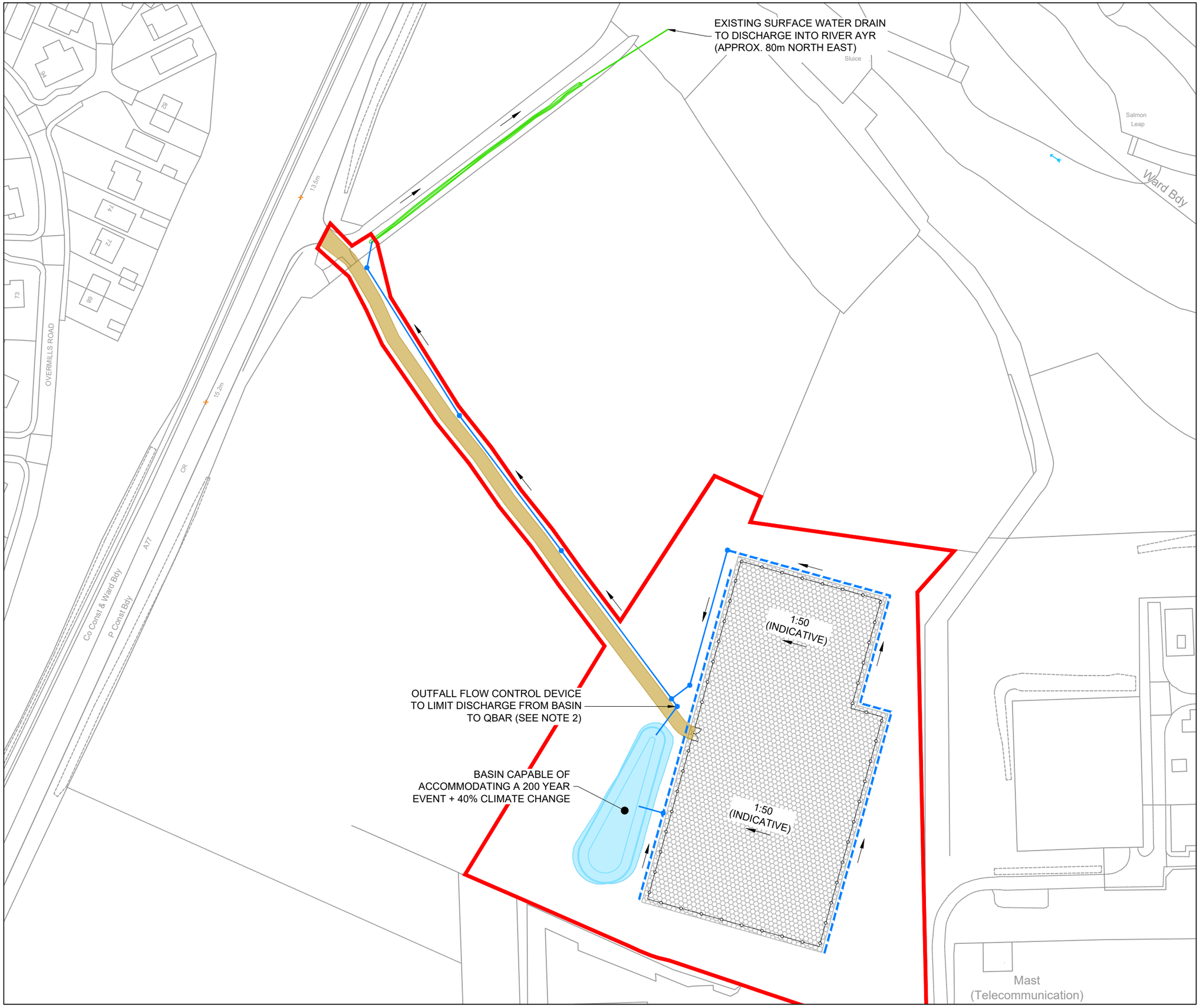
RES DRAWING NUMBER	REV
04874-RES-MAP-DR-XX-001	3

BEAUFORT COURT,
EGG FARM LANE,
KINGS LANGLEY,
HERTS WD4 8LR. UK
TEL +44 (0) 1923 299200
WWW.RES-GROUP.COM

Appendix B Drainage Drawings

B.1 Proposed Drainage Strategy - 04874-RES-DRN-DR-PT-001

B.2 Typical Drainage Details – 04874-RES-DRN-DR-PT-002



KEY:

- RED LINE BOUNDARY (DENOTED BY OUTSIDE EDGE OF THE LINE)

PROPOSED DRAINAGE

- FILTER DRAIN
- DRAINAGE PIPE
- MANHOLE/INSPECTION CHAMBER
- BASIN (SEE NOTE 2)

EXISTING DRAINAGE

- DRAINAGE DITCH
- DRAINAGE PIPE

PROPOSED INFRASTRUCTURE

- ACCESS TRACK
- SURFACE FINISH TYPICALLY COMPRISING STONE OR ASPHALT
- FENCING

NOTES:

1. ELECTRICAL EQUIPMENT OMITTED FOR CLARITY.
2. DRAINAGE LAYOUT SHOWN IS INDICATIVE AND IS BASED ON EXPECTATION THAT AN INFILTRATION SOLUTION IS NOT POSSIBLE. IF AN INFILTRATION SOLUTION IS FOUND TO BE POSSIBLE, NO BASIN OUTFALL PIPE OR FLOW CONTROL WILL BE REQUIRED.

ISSUE	DRAWN	CHKD	APPD	DATE	REVISION NOTES
1	BM	DC	JF	2023-02-24	FIRST ISSUE

PURPOSE: PLANNING	COORDINATES: OSGB 1936
SCALE: 1:1,250 @A3	DATUM: N/A
LAYOUT DRAWING: N/A	T-LAYOUT NO: N/A

PROJECT TITLE
HOLMSTON FARM

DRAWING TITLE
PROPOSED DRAINAGE STRATEGY

RES DRAWING NUMBER	REV
04874-RES-DRN-DR-PT-001	1

BEAUFORT COURT,
EGG FARM LANE,
KINGS LANGLEY,
HERTS WD4 8LR. UK
TEL +44 (0) 1923 299200
WWW.RES-GROUP.COM

Appendix C Calculations

C.1 Greenfield Runoff Estimate (HR Wallingford)

C.2 Storage Volume Calculation

Print | Close Report

Greenfield runoff rate estimation for sites

www.uksuds.com | Greenfield runoff tool

Calculated by:	Dan Cole
Site name:	Holmston Farm BESS
Site location:	South Ayrshire

This is an estimation of the greenfield runoff rates that are used to meet normal best practice criteria in line with Environment Agency guidance "Rainfall runoff management for developments", SC030219 (2013) , the SuDS Manual C753 (Ciria, 2015) and the non-statutory standards for SuDS (Defra, 2015). This information on greenfield runoff rates may be the basis for setting consents for the drainage of surface water runoff from sites.

Site Details

Latitude:	55.45730° N
Longitude:	4.59048° W
Reference:	673559337
Date:	Nov 28 2022 16:34

Runoff estimation approach IH124

Site characteristics

Total site area (ha): 0.702

Methodology

Q_{BAR} estimation method:	Calculate from SPR and SAAR
SPR estimation method:	Calculate from SOIL type

Soil characteristics	Default	Edited
SOIL type:	4	4
HOST class:	N/A	N/A
SPR/SPRHOST:	0.47	0.47

Hydrological characteristics	Default	Edited
SAAR (mm):	979	979
Hydrological region:	2	2
Growth curve factor 1 year:	0.87	0.87
Growth curve factor 30 years:	1.95	1.95
Growth curve factor 100 years:	2.63	2.63
Growth curve factor 200 years:	2.99	2.99

Notes

(1) Is Q_{BAR} < 2.0 l/s/ha?

When Q_{BAR} is < 2.0 l/s/ha then limiting discharge rates are set at 2.0 l/s/ha.

(2) Are flow rates < 5.0 l/s?

Where flow rates are less than 5.0 l/s consent for discharge is usually set at 5.0 l/s if blockage from vegetation and other materials is possible. Lower consent flow rates may be set where the blockage risk is addressed by using appropriate drainage elements.

(3) Is SPR/SPRHOST ≤ 0.3?

Where groundwater levels are low enough the use of soakaways to avoid discharge offsite would normally be preferred for disposal of surface water runoff.

Greenfield runoff rates	Default	Edited
Q_{BAR} (l/s):	5.02	5.02
1 in 1 year (l/s):	4.37	4.37
1 in 30 years (l/s):	9.79	9.79
1 in 100 year (l/s):	13.2	13.2
1 in 200 years (l/s):	15	15

Holmston Farm - Storage Volume Calculation

PROJECT:	Holmston Farm BESS
PROJECT NO:	4874
REFERENCE NO:	04874-5011522

Issue	Date	Author	Nature and Location of Change
1	14.12.22	Daniel Cole	First issue

Note: revision history should include design stage, revision of load and other relevant information.

Attenuation Storage

1. INPUT PARAMETERS AND ASSUMPTIONS
1.1 First category of inputs - Hydrological Characteristics

m5-60	14.00	mm	*Five Year - 60 Minute Rainfall Depth (see "Data" Tab)*
r	0.30		*Ratio M5-60/M5-2day (see "Data" Tab)*
Location	S/NI		*E/W (England and Wales) or S/NI (Scotland and Northern Irela*
Fc	1.40		*Climate Change Factor (refer to the hyperlink for what to choos*

1.2 Second category of inputs - Catchment Area Characteristics

Ap	0.00	ha	*Permeable Area*
Cp	0		*Permeable area runoff coefficient (see "Data" Tab)*
Ai	0.70	ha	*Impermeable Area (C= 1 assumed) (ha)*
Qa	0.00502	m³/s	*Allowable Discharge*

2. CALCULATIONS
2.1 First calculation section - effective catchment area calculation

Ae	0.70	ha	*Effective area (see "Data" Tab)*

2.2 Second calculation section - calculation to dermine the m5 rainfall for various durations

D (min)	Z1	m5 - D (mm)
15.00	0.59	8.26
30.00	0.77	10.78
60.00	1.00	14.00
120.00	1.25	17.50
240.00	1.57	21.98
360.00	1.78	24.92
600.00	2.12	29.68
1440.00	2.84	39.76

m5-D calculation

Note: z1 is calculation in the "Att Data" Tab

2.3 Third calculation section - attenuation volume calculations for various durations and return periods

D (min)	Z2	MT-10 (mm)	Inflow Vol m^3	Outflow vol (m^3)	Att Volume
15.00	0.68	8	55	5	50
30.00	0.68	10	72	9	63
60.00	0.69	13	95	18	77
120.00	0.70	17	120	36	83
240.00	0.70	22	152	72	80
360.00	0.71	25	174	108	65
600.00	0.72	30	210	181	29
1440.00	0.74	41	289	434	-145

1 year return period calculation

Note: z2 is calculation in the "Att Data" Tab

D (min)	Z2	MT-10 (mm)	Inflow Vol m^3	Outflow vol (m^3)	Att Volume
15.00	1.03	12	83	5	79
30.00	1.03	16	109	9	100
60.00	1.02	20	141	18	123
120.00	1.02	25	175	36	139
240.00	1.02	31	220	72	148
360.00	1.02	36	250	108	141
600.00	1.02	42	298	181	117
1440.00	1.02	57	399	434	-35

5 year return period calculation

Note: z2 is calculation in the "Att Data" Tab

D (min)	Z2	MT-10 (mm)	Inflow Vol m^3	Outflow vol (m^3)	Att Volume	
15.00	1.18	14	96	5	92	
30.00	1.19	18	126	9	117	
60.00	1.20	23	165	18	147	
120.00	1.20	29	206	36	169	*10 year return period calculation*
240.00	1.19	36	256	72	184	
360.00	1.18	41	289	108	181	
600.00	1.18	49	344	181	163	
1440.00	1.17	65	457	434	24	*Note: z2 is calculation in the "Att Data" Tab*

D (min)	Z2	MT-10 (mm)	Inflow Vol m^3	Outflow vol (m^3)	Att Volume	
15.00	1.47	17	120	5	115	
30.00	1.49	22	158	9	149	
60.00	1.49	29	205	18	187	
120.00	1.48	36	255	36	219	*30 year return period calculation*
240.00	1.47	45	317	72	245	
360.00	1.46	51	358	108	249	
600.00	1.44	60	421	181	241	
1440.00	1.41	79	553	434	119	*Note: z2 is calculation in the "Att Data" Tab*

D (min)	Z2	MT-10 (mm)	Inflow Vol m^3	Outflow vol (m^3)	Att Volume	
15.00	1.93	22	157	5	152	
30.00	1.97	30	209	9	200	
60.00	1.98	39	272	18	254	
120.00	1.96	48	336	36	300	*100 year return period calculation*
240.00	1.91	59	413	72	341	
360.00	1.89	66	463	108	355	
600.00	1.85	77	540	181	360	
1440.00	1.77	99	692	434	259	*Note: z2 is calculation in the "Att Data" Tab*

D (min)	Z2	MT-10 (mm)	Inflow Vol m^3	Outflow vol (m^3)	Att Volume	
15.00	2.20	25	178	5	174	
30.00	2.25	34	239	9	230	
60.00	2.26	44	311	18	293	
120.00	2.23	55	384	36	347	*200 year return period calculation*
240.00	2.18	67	470	72	398	
360.00	2.14	75	524	108	416	
600.00	2.09	87	611	181	430	
1440.00	1.98	110	775	434	341	*Note: z2 is calculation in the "Att Data" Tab*

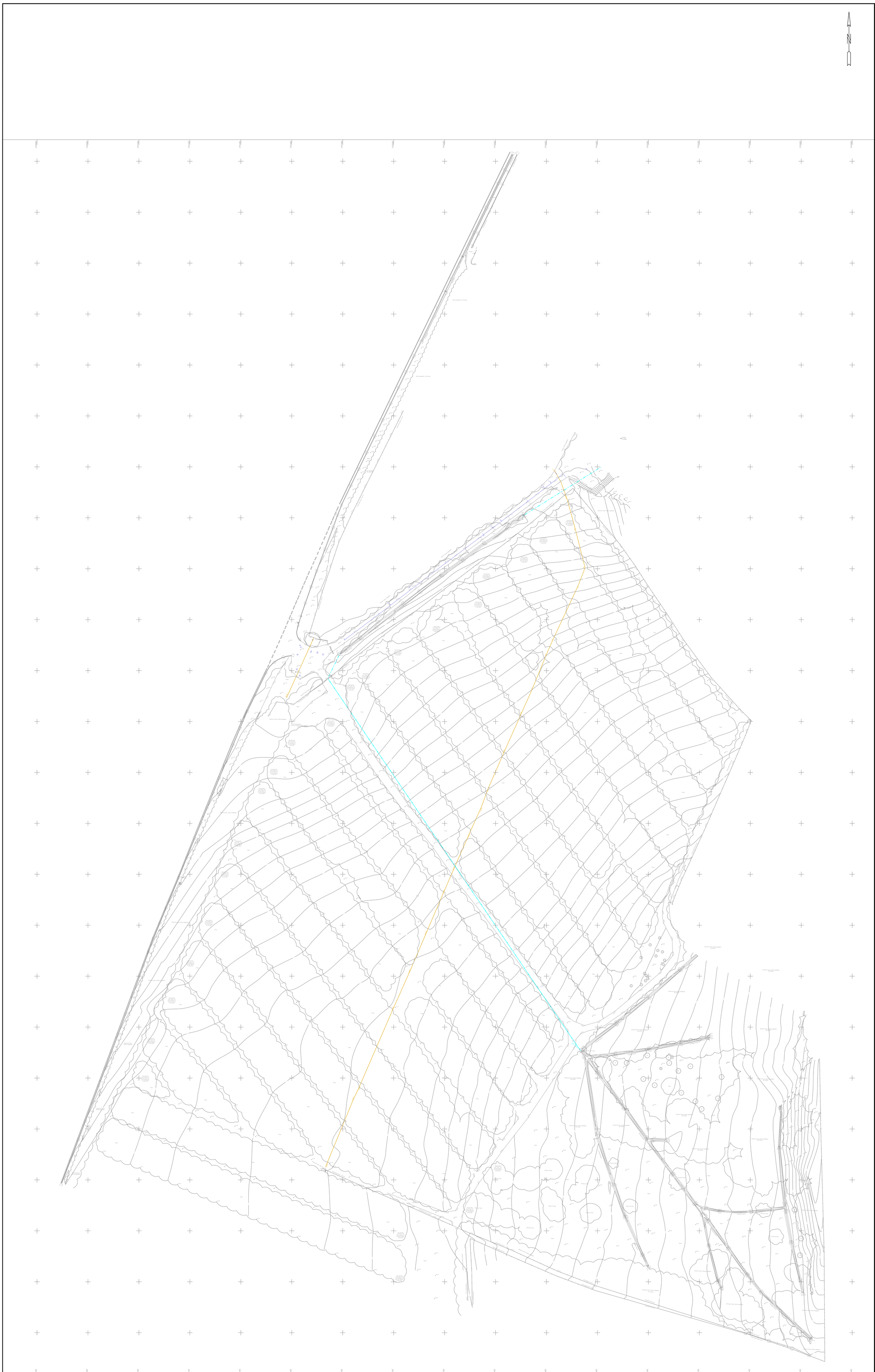
3. RESULTS

Att 1	83	m³	*Attenuation volume required in a 1 in 1 year event*
Att 5	148	m³	*Attenuation volume required in a 1 in 5 year event*
Att 10	184	m³	*Attenuation volume required in a 1 in 10 year event*
Att 30	249	m³	*Attenuation volume required in a 1 in 30 year event*
Att 100	360	m³	*Attenuation volume required in a 1 in 100 year event*
Att 200	430	m³	*Attenuation volume required in a 1 in 200 year event*

Appendix D Topographic Surveys

D.1 Below Ground Survey

D.2 Topographic Survey



LEGEND

- Electricity Cable
- BT Cable
- Gas Pipe
- Mains Water Pipe
- Combined Water Pipe
- Surface Water Pipe
- Foul Water Pipe
- Fibre Optic Cable
- CTV Cable
- Unknown Service
- Earth Tape
- Oxygen Pipe
- Assumed Electricty Cable
- Assumed BT Cable
- Assumed Gas Pipe
- Assumed Mains Water Pipe
- Assumed Combined Water Pipe
- Assumed Surface Water Pipe
- Assumed Foul Water Pipe
- Assumed Fibre Optic Cable
- Assumed General Comms. Cable
- GPR Route
- Historic Excavation Scar Line

999	Depth Unknown
BD	Back Drop
ED	Empty Duct
EOT	End of Trace (Proceed with caution)
EOR	End of Record
FOW	Full Of Water
MAR	Man Access Req
MPPR	Multi Point Radio Signal
MPPS	Multi Point Power Signal
NPV	No Pipe Visible
SOR	Start Of Run
TFR	Taken From Records
UTL	Unable To Lift
UTS	Unable to Sonde
UTM	Unable to Measure
UTT	Unable To Trace

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Control Stations

STN1	236161.542	621379.452	13.948
STN2	236289.288	621471.174	10.698

Notes:

1. All dimensions are in metres unless otherwise stated.
2. All survey co-ordinates are related to a site-centred pseudo OS National Grid (OSTN15) with a scale factor of 1
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Rev	Amendments	Date	Dwn	Chk

Drawn by: TK	Scale: 1:500	Original Size A0
Checked by: JM	Date: 22/08/2022	Drg File Name: 34JJ100550_02

RES

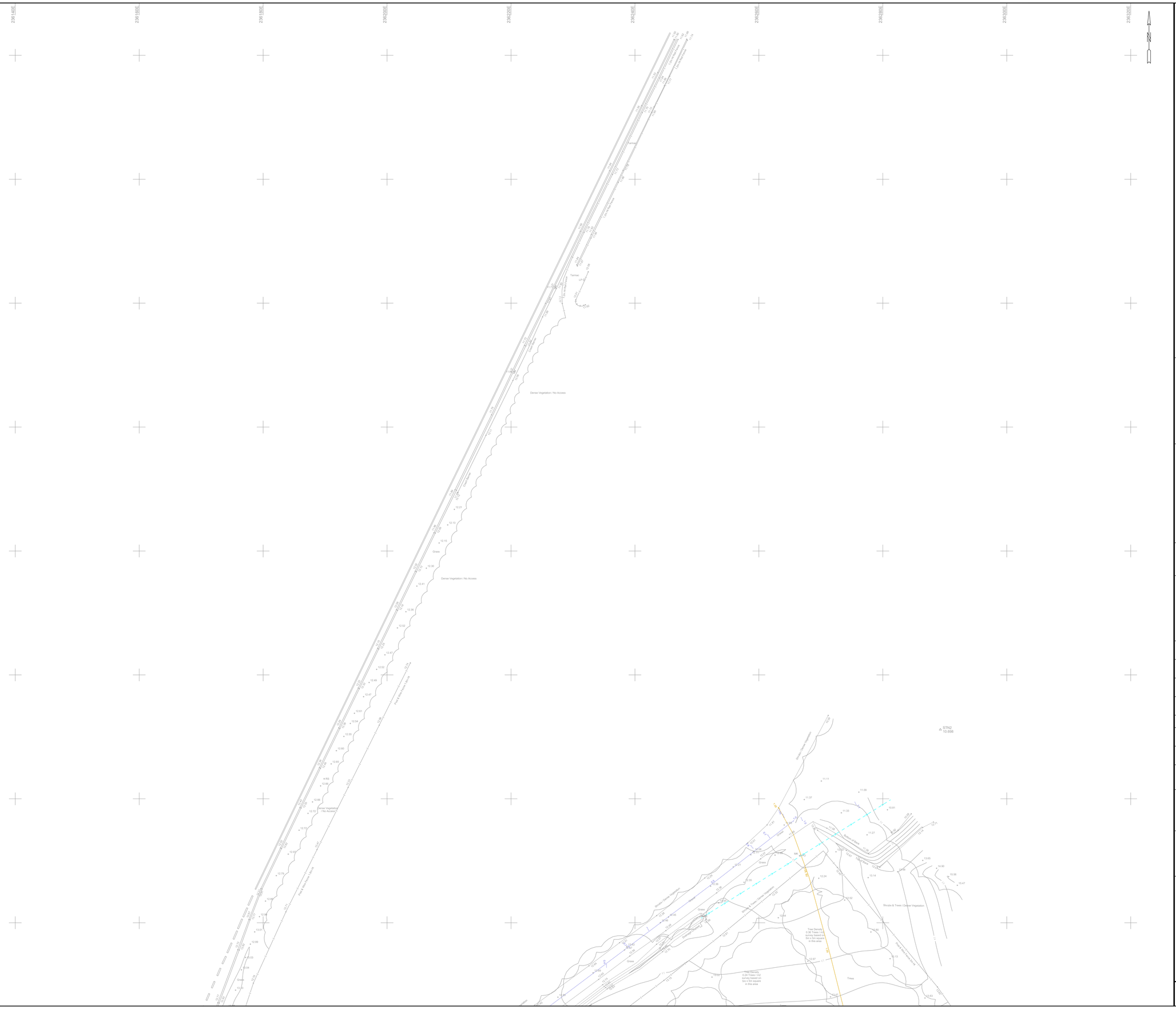
Holmston Farm
2D Utility Survey
August 2022

UTEC

Unit 2B, Alba Business Pavilions,
Alba Business Park, Livingston, EH54 7HG
Tel: 01506 447 460

DRAWING No. 34JJ100550_02

REV. -



LEGEND

- Electricity Cable
- BT Cable
- Gas Pipe
- Mains Water Pipe
- Combined Water Pipe
- Surface Water Pipe
- Foul Water Pipe
- Fibre Optic Cable
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- Unknown Service
- Earth Tape
- Oxygen Pipe
- Assumed Electricity Cable
- Assumed BT Cable
- Assumed Gas Pipe
- Assumed Mains Water Pipe
- Assumed Combined Water Pipe
- Assumed Surface Water Pipe
- Assumed Foul Water Pipe
- Assumed Fibre Optic Cable
- Assumed General Comms. Cable
- GPR Route
- Historic Excavation Scar Line

999	Depth Unknown	MPPS	Multi Point Power Signal
BD	Back Drop	NPV	No Pipe Visible
ED	Empty Duct	SOR	Start Of Run
EOT	End of Trace (Proceed with caution)	TFR	Taken From Records
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MAR	Man Access Req	UTM	Unable to Measure
MPPR	Multi Point Radio Signal	UTT	Unable To Trace

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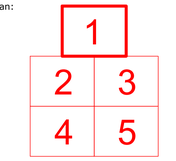
Key Plan:



Control Stations

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STN2	236289.288	621471.174	10.698

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Rev	Amendments	Date	Dwn	Chk

Drawn by: TK	Scale: 1:200	Original Size A0
Checked by: JM	Date: 22/08/2022	Drg File Name: 34JJ100550_02

RES

Holmston Farm
2D Utility Survey

UTEC

Unit 2B, Alba Business Pavilions,
Alba Business Park, Livingston, EH54 7HG
Tel: 01506 447 460

DRAWING No.	REV.
34JJ100550_02_01	-

LEGEND

- Electricity Cable
- BT Cable
- Gas Pipe
- Mains Water Pipe
- Combined Water Pipe
- Surface Water Pipe
- Foul Water Pipe
- Fibre Optic Cable
- CTV Cable
- Unknown Service
- Earth Tape
- Oxygen Pipe
- Assumed Electricity Cable
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- Assumed Mains Water Pipe
- Assumed Combined Water Pipe
- Assumed Surface Water Pipe
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- Assumed Fibre Optic Cable
- Assumed General Comms. Cable
- GPR Route
- Historic Excavation Scar Line

999	Depth Unknown	MPPS	Multi Point Power Signal
BD	Back Drop	NPV	No Pipe Visible
ED	Empty Duct	SOR	Start Of Run
EOT	End of Trace (Proceed with caution)	TFR	Taken From Records
EOR	End of Record	UTL	Unable To Lift
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MAR	Man Access Req	UTM	Unable to Measure
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Key Plan:

1
2 3
4 5

Control Stations

STN1	236161.542	621379.452	13.948
STN2	236289.288	621471.174	10.698

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Drawn by TK	Scale 1:200	Original Size A0
Checked by JM	Date 22/08/2022	Drg File Name 34JJ100550_02

RES

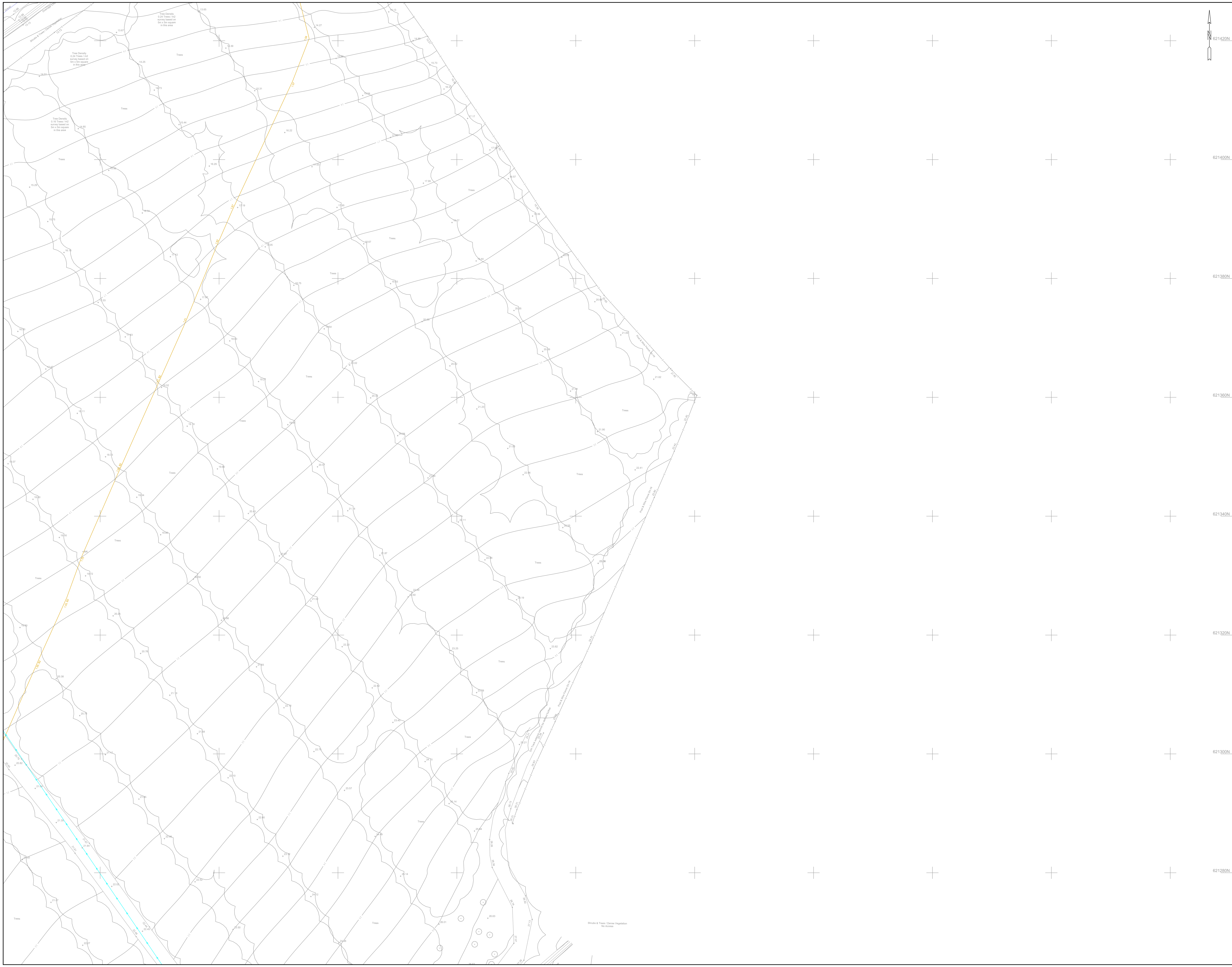
Holmston Farm
2D Utility Survey
Page 02 of 05

UTEC

Unit 2B, Alba Business Pavilions,
Alba Business Park, Livingston, EH54 7HG
Tel: 01506 447 460

DRAWING No. 34JJ100550_02_02

REV. -



LEGEND

Electricity Cable	
BT Cable	
Gas Pipe	
Mains Water Pipe	
Combined Water Pipe	
Surface Water Pipe	
Foul Water Pipe	
Fibre Optic Cable	
CTV Cable	
Unknown Service	
Earth Tape	
Oxygen Pipe	
Assumed Electricty Cable	
Assumed BT Cable	
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Assumed Combined Water Pipe	
Assumed Surface Water Pipe	
Assumed Foul Water Pipe	
Assumed Fibre Optic Cable	
Assumed General Comms. Cable	
GPR Route	
Historic Excavation Scar Line	

999	Depth Unknown	MPPS	Multi Point Power Signal
BD	Back Drop	NPV	No Pipe Visible
ED	Empty Duct	SOR	Start Of Run
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Key Plan:

	1	
2	**3**	
4	5	

Control Stations

STN1	236161.542	621379.452	13.948
STN2	236289.288	621471.174	10.698

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Drawn by TK	Scale 1:200	Original Size A0
Checked by JM	Date 22/08/2022	Drg File Name 34JJ100550_02

RES

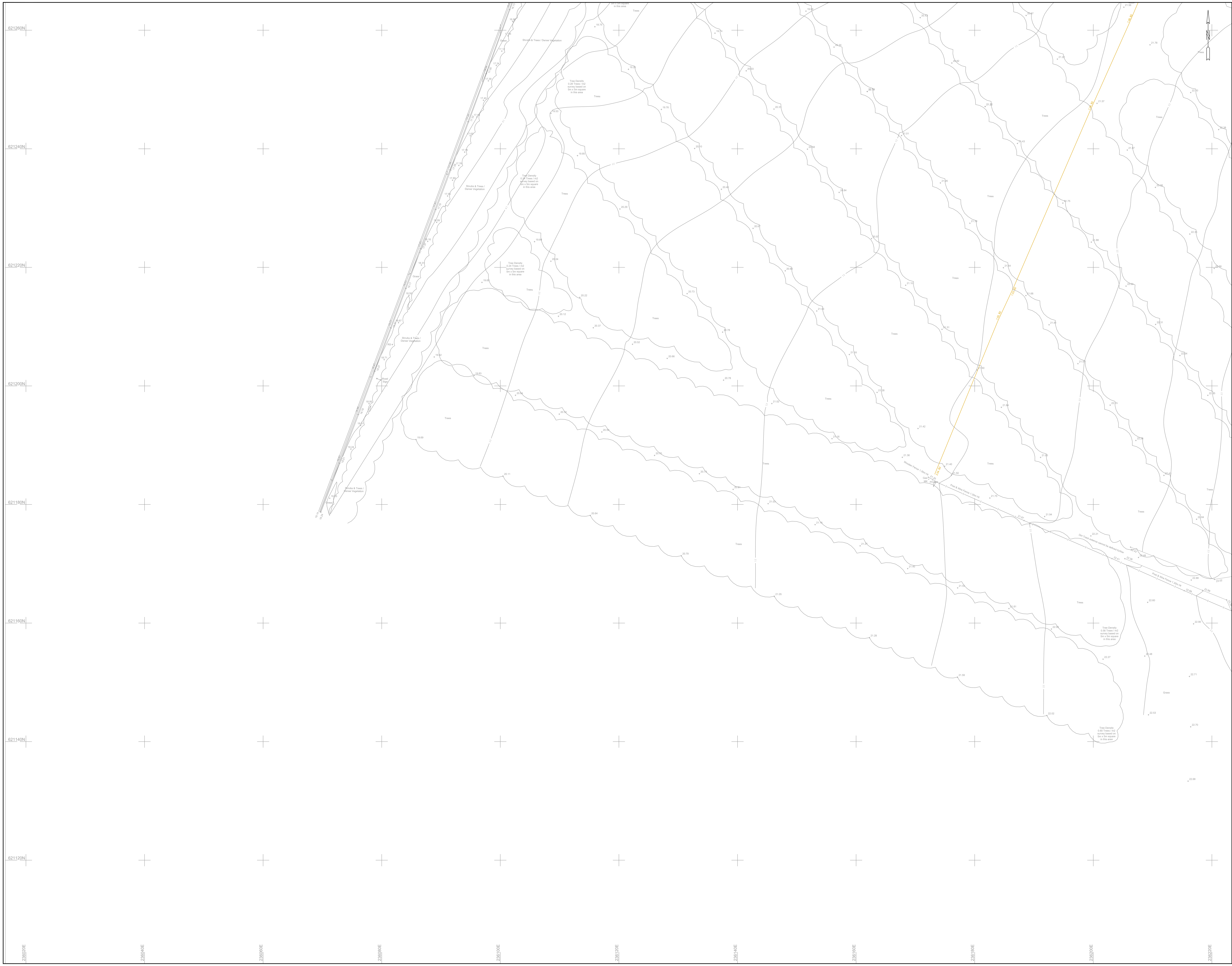
Holmston Farm
2D Utility Survey
Page 03 of 05

UTEC

Unit 2B, Alba Business Pavilions,
Alba Business Park, Livingston, EH54 7HG
Tel: 01506 447 460

DRAWING No. 34JJ100550_02_03

REV. -



LEGEND

Electricity Cable	
BT Cable	
Gas Pipe	
Mains Water Pipe	
Combined Water Pipe	
Surface Water Pipe	
Foul Water Pipe	
Fibre Optic Cable	
CTV Cable	
Unknown Service	
Earth Tape	
Oxygen Pipe	
Assumed Electricty Cable	
Assumed BT Cable	
Assumed Gas Pipe	
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Assumed General Comms. Cable	
GPR Route	
Historic Excavation Scar Line	

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Key Plan:

	1	
2	3	
4	5	

Control Stations

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STN2	236289.288	621471.174	10.698

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Rev	Amendments	Date	Dwn	Chk

Drawn by	Scale	
TK	1:200	Original Size A0
Checked by	Date	Drg File Name
JM	22/08/2022	34JJ100550_02

RES

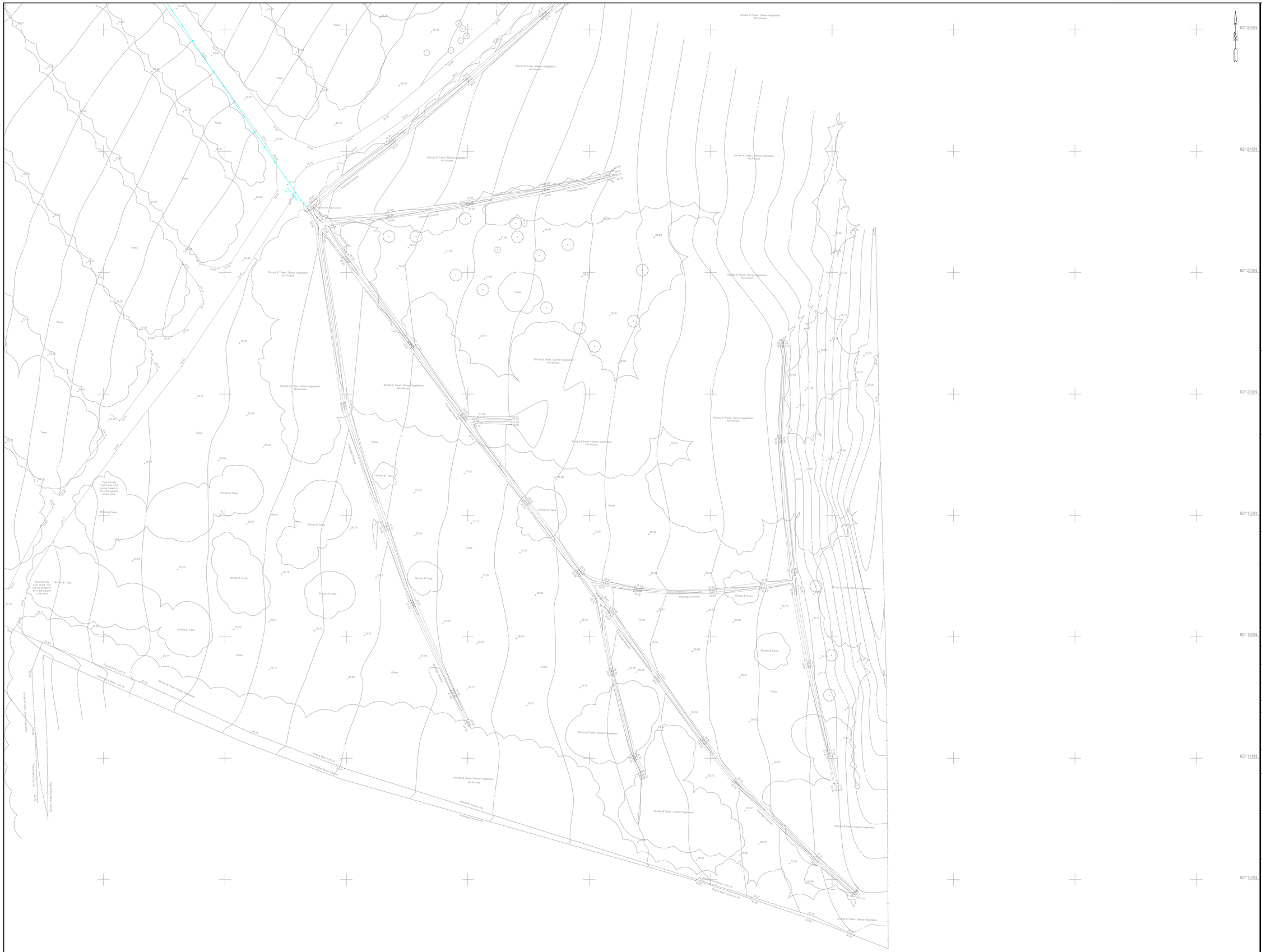
Holmston Farm
2D Utility Survey

Page 04 of 05

UTEC

Unit 2B, Alba Business Pavilions,
Alba Business Park, Livingston, EH54 7HG
Tel: 01506 447 460

DRAWING No.	REV.
34JJ100550_02_04	-



LEGEND

- Electricity Cable
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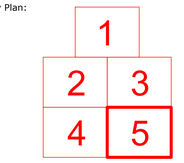

Control Stations

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Drawn by: TK	Scale: 1:200	Original Size A0
Checked by: JM	Date: 22/08/2022	Drg File Name: 34JJ100550_02

RES

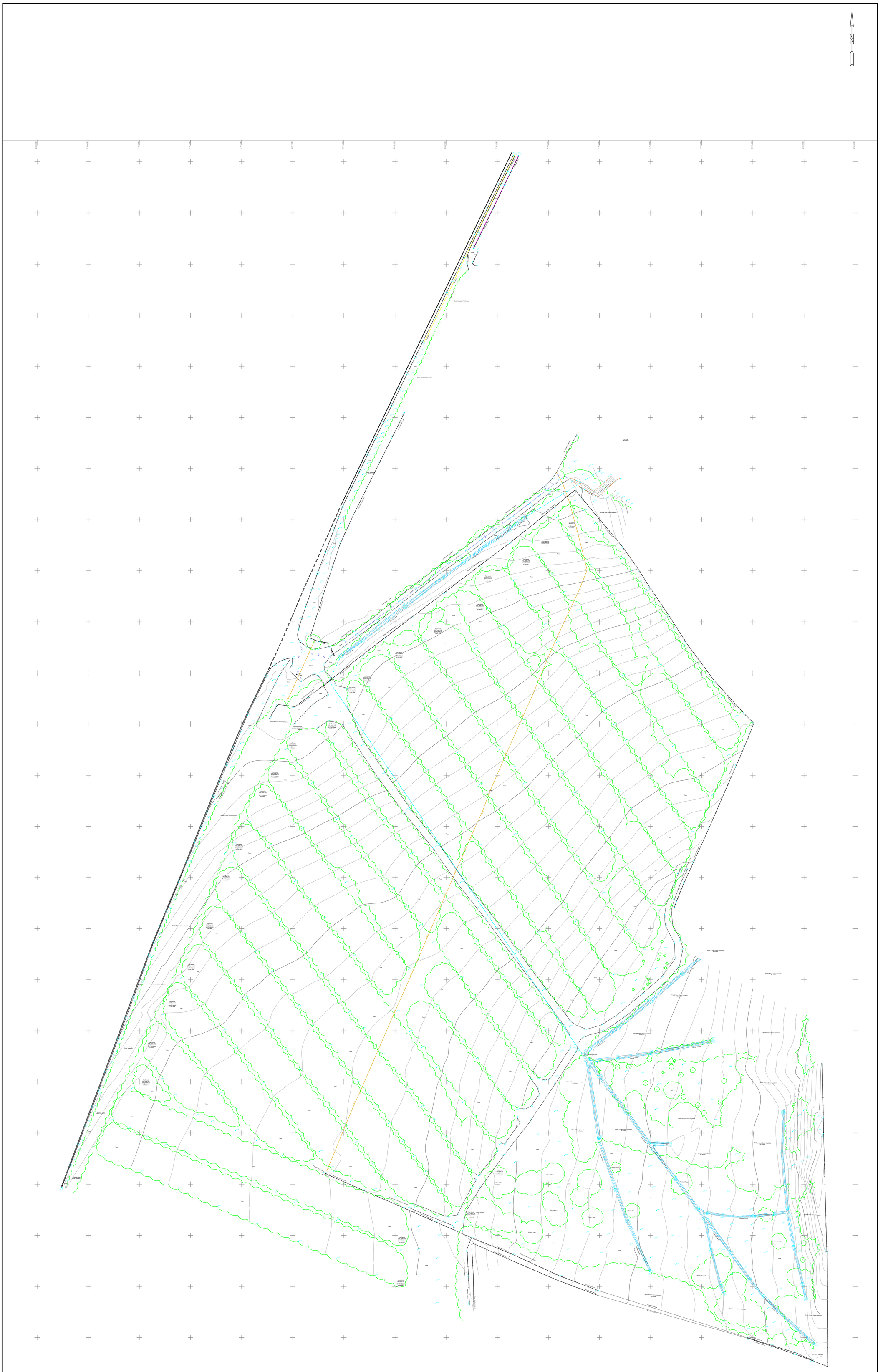
Holmston Farm
2D Utility Survey
Page 05 of 05

UTEC

Unit 2B, Alba Business Pavilions,
Alba Business Park, Livingston, EH54 7HG
Tel: 01506 447 460

DRAWING No. 34JJ100550_02_05

REV. -



Legend:

AP	Anchor Point		Bottom of Bank
BH	Borehole		Building
BO	Bollard		Building (Open)
BT	Telecoms		Building (Overhang)
COL	Column		Bush
CTV	Cable TV		Change of Surface
DP	Down Pipe		Crash Barrier
EL	Eaves Level		Cross Section
EP	Electric Pylon		Drainage
ER	Earthing Rod		Drop Kerb
FH	Fire Hydrant		Fence
FL	Floor Level		Foliage
G	Gully		Gate
GA	Gas Valve		Hedge
IC	Inspection Cover		Kerbline
IL	Invert Level		Overhead Elec.
JB	Junction Box		Overhead Line
KO	Kerb Outlet		Overhead Tele.
LP	Lamp Post		Pipe
MH	Manhole		Railway Line
MK	Marker Post		Road Centreline
PO	Post		Road Edge
RE	Rodding Eye		Rock Outcrop
RL	Ridge Level		Sapling
RP	Reflector Post	+10.00	Spot Height
RS	Road Sign		Steps
SC	Water Stop Cock		Street Furniture
SL	Soffit Level		Top of Bank
TBM	Temp. Benchmark		Tree
TFE	Top of Feature		Utility Cover
TFL	Top of Fence Lev.		Verge
TFOL	Top of Foliage Lev.		Wall
TL	Threshold Level		Waterline

Control Stations

STN1	236161.542	621379.452	13.948
STN2	236289.288	621471.174	10.698

Notes:

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Rev	Amendments	Date	Dwn	Chk

Drawn by: TK	Scale: 1:500	Original Size A0
Checked by: JM	Date: 22/08/2022	Drg File Name: 34JJ100550_01

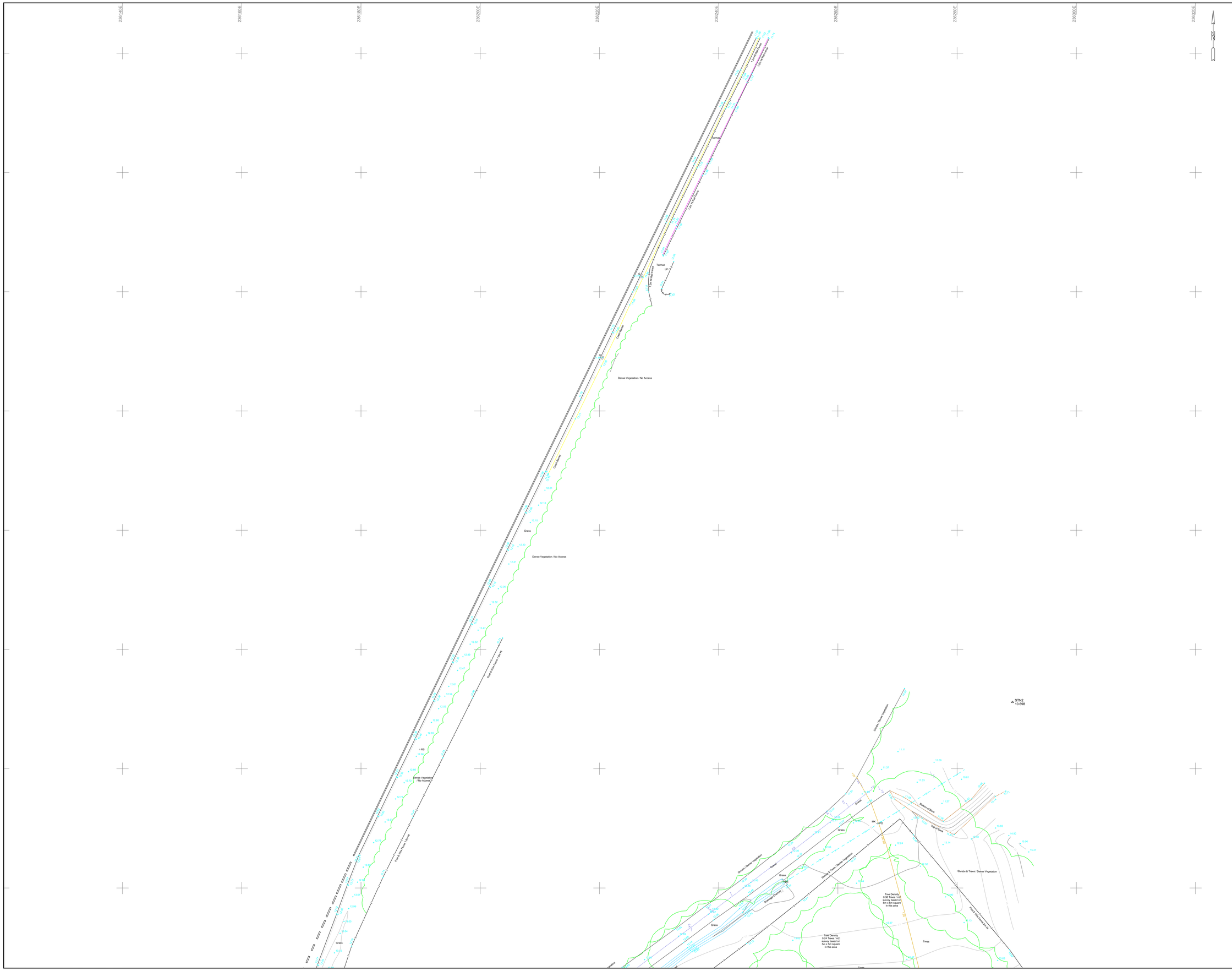
RES

Holmston Farm
2D Topographical Survey
August 2022

UTEC

Unit 2B, Alba Business Pavilions,
Alba Business Park, Livingston, EH54 7HG
Tel: 01506 447 460

DRAWING No.	REV.
34JJ100550_01	-



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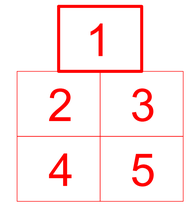
GA	Gas Valve		Hedge
IC	Inspection Cover		Kerbline
IL	Invert Level		Overhead Elec.
JB	Junction Box		Overhead Line
KO	Kerb Outlet		Overhead Tele.
LP	Lamp Post		Pipe
MH	Manhole		Railway Line
MK	Marker Post		Road Centreline
PO	Post		Road Edge
RE	Rodding Eye		Rock Outcrop
RL	Ridge Level		Sapling
RP	Reflector Post	+10.00	Spot Height
RS	Road Sign		Steps
SC	Water Stop Cock		Street Furniture
SL	Soffit Level		Top of Bank
TBM	Temp. Benchmark		Tree
TFE	Top of Feature		Utility Cover
TFL	Top of Fence Lev.		Verge
TFOL	Top of Foliage Lev.		Wall
TL	Threshold Level		Waterline

Key Plan:



Control Stations

STN1	236161.542	621379.452	13.948
STN2	236289.288	621471.174	10.698

Notes:

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2. All survey co-ordinates are related to a site-centred pseudo OS National Grid (OSTN15) with a scale factor of 1
3. All survey levels are related to OS Datum - Geoid model: OSGM15.
4. For further details with regards to the above information please contact UTEC StarNet.

Rev	Amendments	Date	Dwn	Chk

Drawn by: TK	Scale: 1:200	Original Size A0
Checked by: JM	Date: 22/08/2022	Drg File Name: 34JJ100550_01

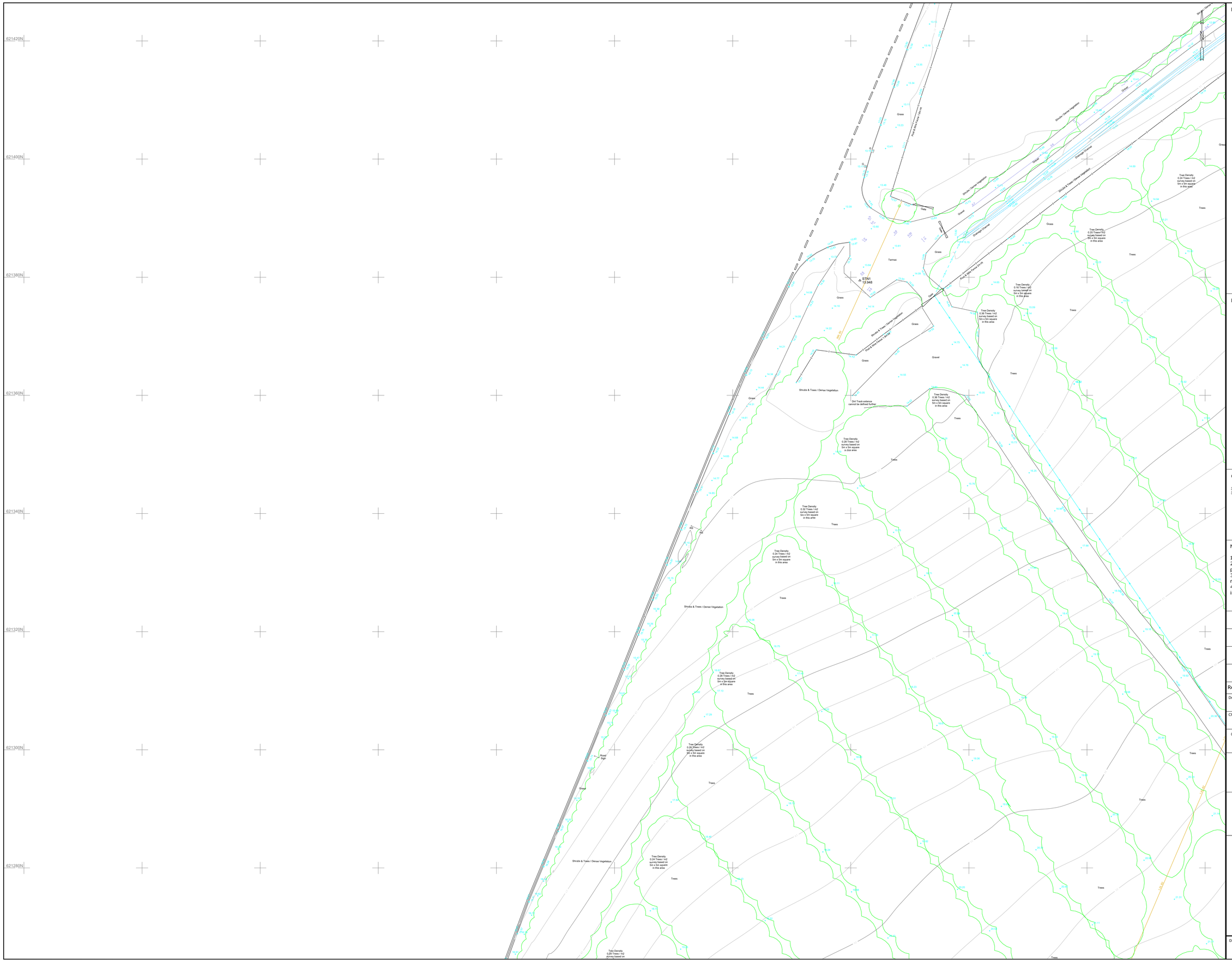
RES

Holmston Farm
2D Topographical Survey

UTEC

Unit 2B, Alba Business Pavilions,
Alba Business Park, Livingston, EH54 7HG
Tel: 01506 447 460

DRAWING No.	REV.
34JJ100550_01_01	-



Legend:

AP	Anchor Point		Bottom of Bank
BH	Borehole		Building
BO	Bollard		Building (Open)
BT	Telecoms		Building (Overhang)
COL	Column		Bush
CTV	Cable TV		Change of Surface
DP	Down Pipe		Crash Barrier
EL	Eaves Level		Cross Section
EP	Electric Pylon		Drainage
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TFOL	Top of Foliage Lev.		Wall
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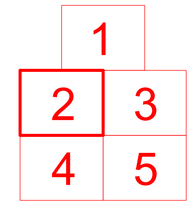
Key Plan:



Control Stations

STN1	236161.542	621379.452	13.948
STN2	236289.288	621471.174	10.698

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Checked by: JM	Date: 22/08/2022	Drg File Name: 34JJ100550_01

RES

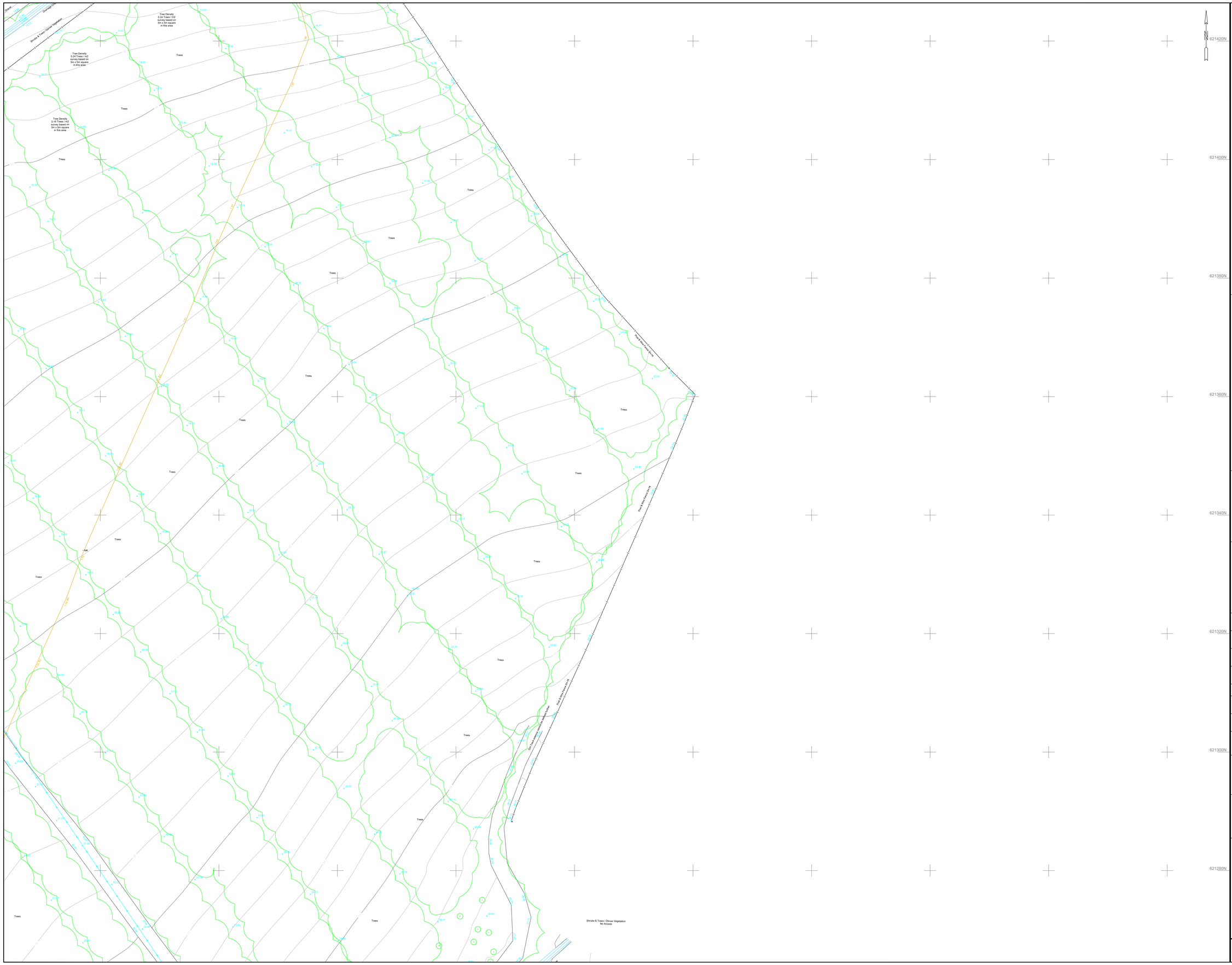
Holmston Farm
2D Topographical Survey
Page 02 of 05

UTEC

Unit 2B, Alba Business Pavilions,
Alba Business Park, Livingston, EH54 7HG
Tel: 01506 447 460

DRAWING No. 34JJ100550_01_02

REV. -



Legend:

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BH	Borehole		Building
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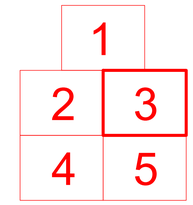
Key Plan:



Control Stations

STN1	236161.542	621379.452	13.948
STN2	236289.288	621471.174	10.698

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Drawn by: TK	Scale: 1:200	Original Size A0
Checked by: JM	Date: 22/08/2022	Drg File Name: 34JJ100550_01

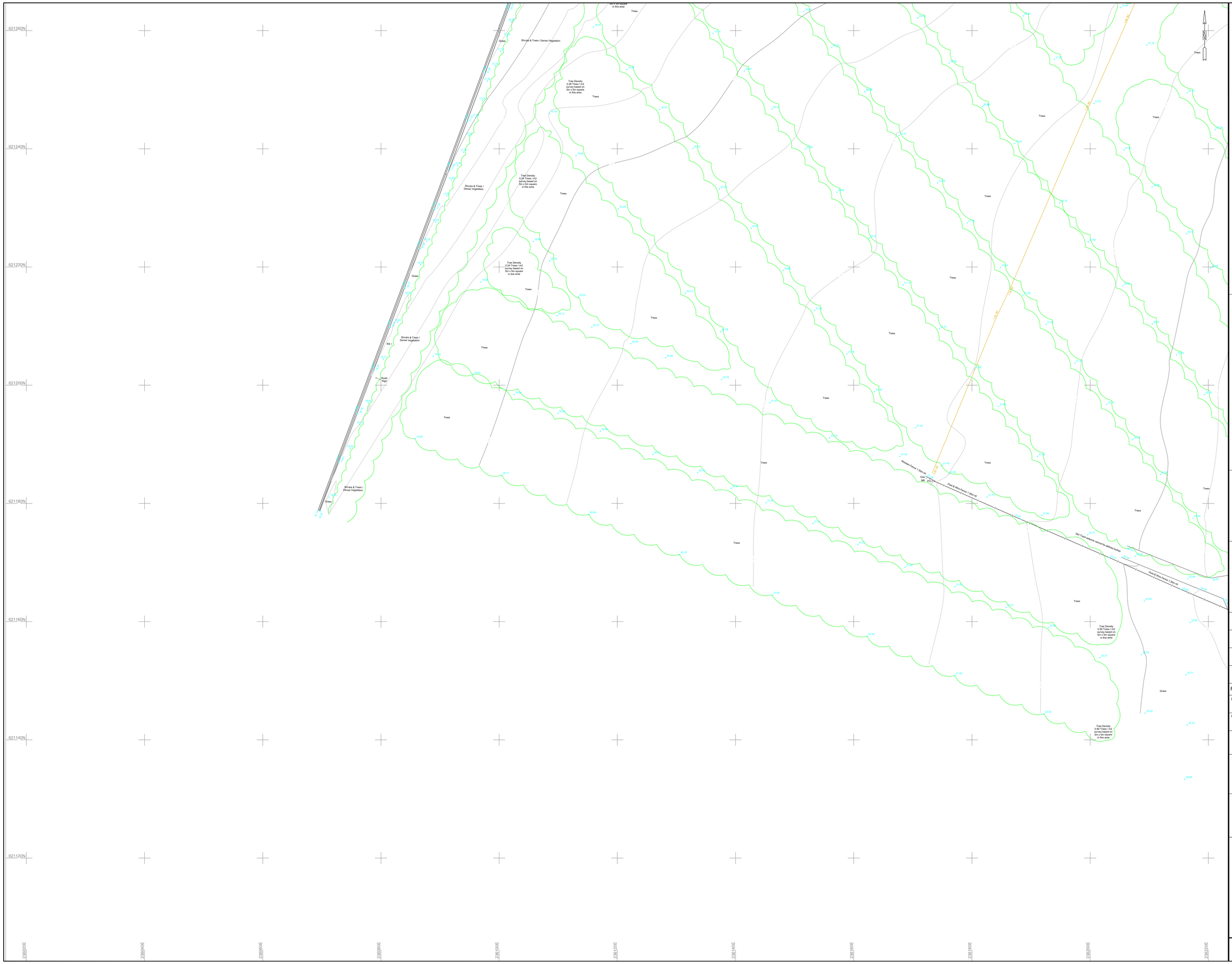
RES

Holmston Farm
2D Topographical Survey
Page 03 of 05

UTEC
Unit 2B, Alba Business Pavilions,
Alba Business Park, Livingston, EH54 7HG
Tel: 01506 447 460

DRAWING No. 34JJ100550_01_03

REV. -



Legend:

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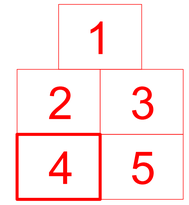
Key Plan:



Control Stations

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Drawn by: TK	Scale: 1:200	Original Size A0
Checked by: JM	Date: 22/08/2022	Drg File Name: 34JJ100550_01

RES

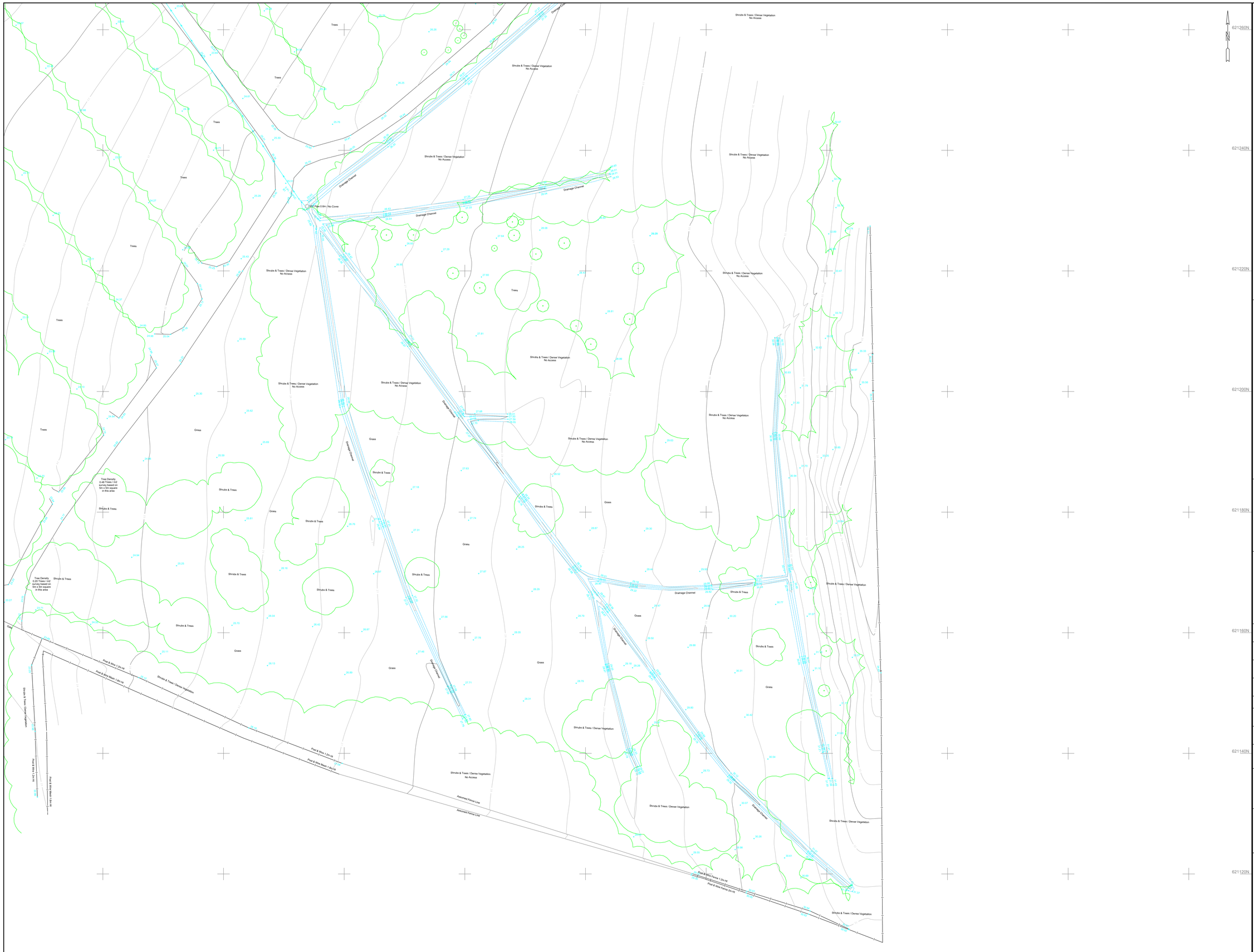
Holmston Farm
2D Topographical Survey
Page 04 of 05

UTEC

Unit 2B, Alba Business Pavilions,
Alba Business Park, Livingston, EH54 7HG
Tel: 01506 447 460

DRAWING No. 34JJ100550_01_04

REV. -



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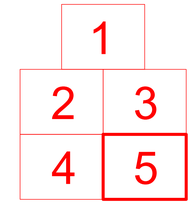
Key Plan:



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RES

Holmston Farm
2D Topographical Survey

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UTEC

Unit 2B, Alba Business Pavilions,
Alba Business Park, Livingston, EH54 7HG
Tel: 01506 447 460

DRAWING No.	REV.
34JJ100550_01_05	-

Appendix E Correspondence

E.1 South Ayrshire Council Drainage Response

Daniel Cole

From: Greig, Scott <Scott.Greig@ayrshireroadsalliance.org>
Sent: 01 November 2022 13:02
To: Daniel Cole
Subject: RE: South Ayrshire Council drainage / flood risk criteria for 22/00437/PREAPP - enquiry [OFFICIAL]

Follow Up Flag: Follow up
Flag Status: Flagged

CLASSIFICATION: **OFFICIAL**

Afternoon Daniel,

South Ayrshire Council have no specific Guidance Document online for the management of flood risk. However the aim is always to ensure that any proposed development is compliant with the principles of Scottish Planning Policy where you will find useful information.

Please see below comments on your various specific questions.

Scott,

Scott Greig B.Eng., C.Eng., M.I.C.E.
Supervisory Engineer, Bridges - Ayrshire Roads Alliance
Ayr Town Hall
21 Newbridge Street
Ayr
KA7 1JX.

Telephone ~~01563 576459~~ 07974 443010
Email scott.greig@ayrshireroadsalliance.org
Website www.ayrshireroadsalliance.org

AyrshireRoadsAlliance

A partnership between East Ayrshire Council and South Ayrshire Council

From: Daniel Cole <daniel.cole@res-group.com>
Sent: 27 October 2022 13:48
To: Greig, Scott <Scott.Greig@ayrshireroadsalliance.org>
Subject: South Ayrshire Council drainage / flood risk criteria for 22/00437/PREAPP - enquiry

Good afternoon Scott,

We are currently preparing a planning application for a battery energy storage facility at Holmston Farm, in Ayr – grid ref: N:236312, E:621202, pre-app advice ref: 22/00437/PREAPP.

I'm emailing regarding the criteria we should adhere to in our design / documentation around drainage / flood risk for a planning submission of this nature. I apologise if this information is denoted online, I have searched but have been unable to find it.
The type of criteria I'm seeking clarification on are:

- Criteria for surface water discharge rate limitation

Greenfield equivalent rate for the 1 in 200+cc event.

- Critical storm to be attenuated on site

1 in 200 + cc

- Plans / figures to include in documentation

Greenfield equivalent calculations and discharge rates. Outline drainage details including proposed attenuation measures and outfall.

- Checks and demonstrations to include in documentation

Evidence of your internal checking and quality control process.
Drainage system capacity checks for relevant storm events.
If public roads then details of the two levels of treatment for road drainage prior to discharge to the water environment.

Any guidance would be appreciated. I would be more than happy to discuss the proposal and any requirements on the phone if you would prefer.

Kind regards,

Daniel Cole
Civil Design Engineer

daniel.cole@res-group.com | www.res-group.com

Committed to a future where everyone has access to affordable zero carbon energy

MND Scotland is the leading charity in Scotland providing care and support to people affected by Motor Neurone Disease (MND), as well as funding vital research into finding a cure.
Please consider donating to the Provost's chosen charity for the next two years to help people living with Motor Neurone Disease.
https://eastayrshi.re/provostcharitydonation