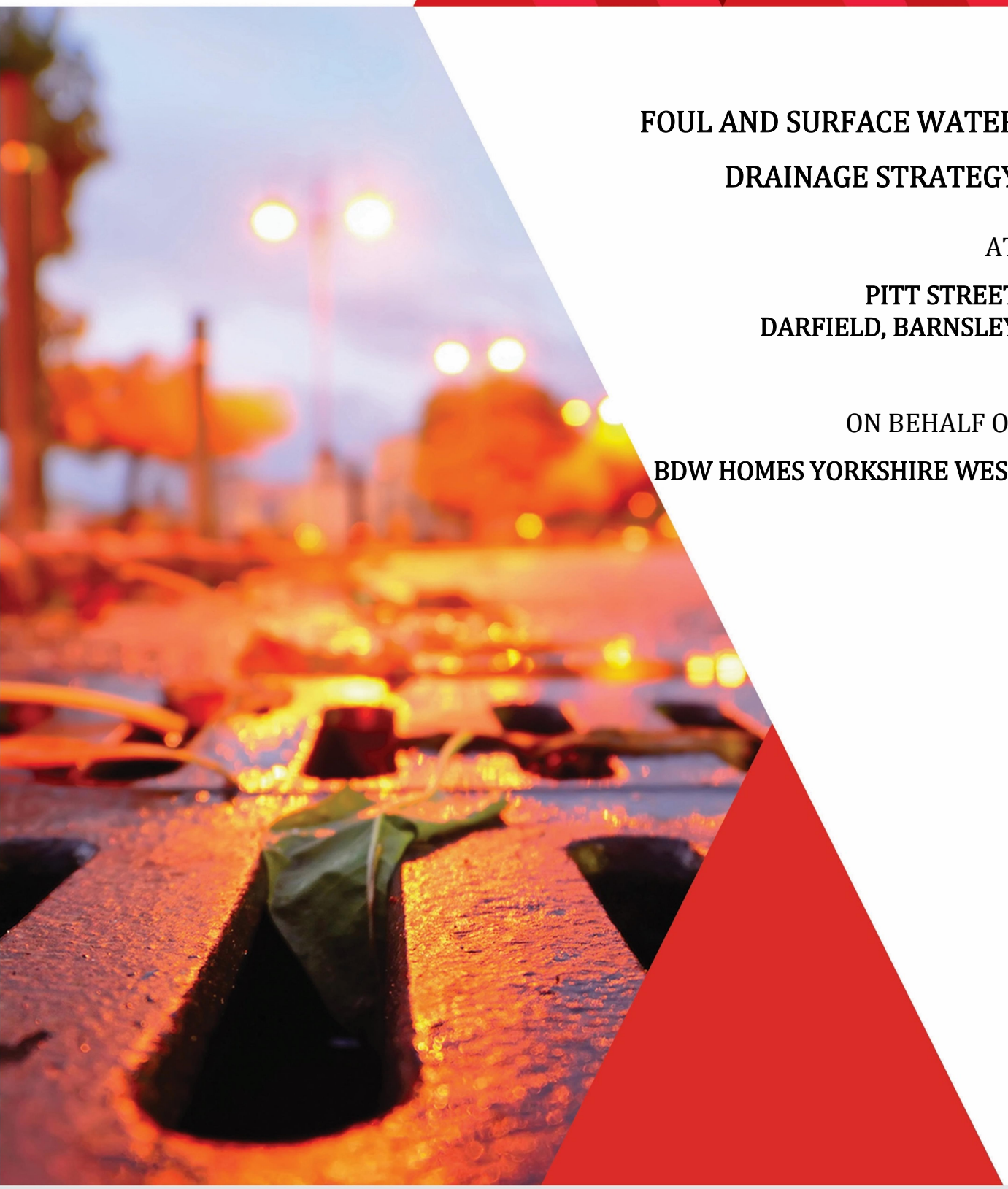


# FOUL AND SURFACE WATER DRAINAGE STRATEGY

AT

**PITT STREET**
**DARFIELD, BARNSLEY**

ON BEHALF OF

**BDW HOMES YORKSHIRE WEST**

**ARP ASSOCIATES**
CHARTERED CONSULTING ENGINEERS
Northwest House 5/6 Northwest Business Park Servia Hill Leeds LS6 2QH
c 0113 245 8498 m leeds@arpassociates.co.uk w www.arpconsultingengineers.co.uk

| Foul and Surface Water Drainage Strategy at Pitt Street, Barnsley<br>1048/141 R1 | | | |
|---|---|---|---|
| **Revision/Date** | **Initial Issue**<br>**10 Aug. 2021** | | |
| **Prepared By:** | A Tills<br>MEng (Hons) MICE | | |
| **Signature** |  | | |
| **Reviewed By:** | Paul Carter | | |
| **Signature** | | | |
| **Authorised By:** | Martin Ingram | | |
| **Signature** | | | |

## CONTENTS


| | | Page |
|---|---|---|
| 1.0 | Introduction | 4 |
| 2.0 | Site Details | 4-5 |
| 3.0 | Existing Drainage | 5 |
| 4.0 | Consultations | 5-6 |
| 5.0 | Surface Water Drainage | 6 |
| 6.0 | Foul Water Drainage | 6-7 |
| 7.0 | Flood Risk | 7 |


## APPENDICES


| | |
|---|---|
| Appendix A | Utilities Survey |
| Appendix B | Utilities Records |
| Appendix C | Proposed Site Plan |
| Appendix D | Topographical Survey |
| Appendix E | ARP Drawings |
| Appendix F | Yorkshire Water |
| Appendix G | Indicative Drainage Calculations |

# 1 INTRODUCTION

1.1 ARP Associates has been commissioned by BDW Homes Yorkshire West to undertake a report on the drainage feasibility principles, strategy and overland flood routes for the proposed residential development of a parcel of land located at Pitt Street, Darfield, Barnsley. This land will hereafter be referred to as the 'Site'.

1.2 The consultations and site appraisal have been carried out between September 2020 and August 2021.

1.3 The report has been initially prepared for the use and reliance of the Client only. The report shall not be relied upon or transferred to any other parties without the written agreement of ARP Associates. For the avoidance of any doubt, where ARP Associates enters into a letter of reliance for the benefit of a third party, that third party will be permitted to rely on the report. No responsibility will be accepted where this report is used, either in its entirety or in part, by any other party without ARP Associates consent.

1.4 Attention is drawn to the requirements of the Construction Design and Management Regulations 2015, and in particular, the duties and obligations of the Client.

# 2 SITE DETAILS

2.1 The site is formed of a rectangular Greenfield site of 3.4 hectares accessed from Pitt Street. The site is surrounded by fields/ allotments to the East and West. And by houses to the North and South.

2.2 There is a footpath through the site from the housing to the North

2.3 The site falls at a uniform gradient of approximately 1 in 40 to Pit Street.

2.4 A site location plan is presented in Appendix C and a Topographic Survey is presented in Appendix D.

2.5 The site is bounded by shallow field ditches to the South and West. The ditches are not connected to a piped system or watercourse.

2.6 The site has a boundary with 42&44 Pitt Street.

2.7 The site is mainly grass with areas of dense vegetation around the boundaries. There are several mature trees in the North-West corner.

2.8 An area designated for the SUDS basin is taken from the adjacent field to the South-West.

2.9 We have considered a future phase in the additional area to the east of the main site, area above the allotments. The ground levels in this area fall away from the site towards separate sewers in Hampton Court. This area is best considered independently for drainage and flood risk.

## 3 EXISTING DRAINAGE

3.1 Yorkshire water records indicate 150 & 225 diameter foul and combined sewers in the roads surrounding the site. the nearest surface water sewer is at the junction with George Street approximately 220m East.

3.2 No live foul drainage on-site has been surveyed. Yorkshire Water records do not show any sewers crossing the site.

3.3 Yorkshire Water sewer records are presented in Appendix F.

## 4 CONSULTATIONS

4.1 A consultation was requested from Yorkshire Water, who is the Water Authority for this area, and a copy of their response is presented in Appendix F.

4.2 The drainage strategy is based on the Enzygo FRA (CRM.1122.003.HY.R.001.A) and Phase 2 SI report (CRM.1122.002.GE.R.002.A). These reports established the surface water attenuation rate, ruled out infiltration as not feasible and found no watercourses in the vicinity of the site available to connect into.

4.3 Yorkshire Water advise that due to recent change in legislation, there could be sewers which have transferred over to the Water Authority that are not shown on the statutory sewer records, but are located on the Developer's land. The comments reflect the Water Authority's view, with regard to the public sewer network only, based on a 'desk top' study of the site and are valid for a maximum period of 12 months. The arrangement of existing sewers shown on ARP drawings is our interpretation based on the sewer plans and the utilities survey.

4.4 Yorkshire Water requires development of the site to take place with separate systems for foul and surface water drainage. The separate systems would need to extend to the agreed points of discharge.

4.5 Yorkshire Water has agreed the foul water domestic waste should discharge to the 150mm diameter sewer located in Pitt Street at the site entrance. This manhole was unable to be surveyed as it was partially buried, the invert level assumed in the drainage design is taken from sewer records and should be verified.

4.6 Yorkshire water have agreed surface water from the site can discharge to the surface water sewer at the junction with George street at a limit of 5l/s. Subject to other methods of disposal being proved unfeasible.

## 5 SURFACE WATER DRAINAGE

5.1 It is understood that Barnsley Council flood risk requirements for managing on/off-site flood risk from fluvial flooding is to assess the development using a 30% allowance for climate change for the 1 in 100 year event. No urban creep is applied and default CV values are 0.75/0.84

5.2 The offsite surface water drainage is shown on the drawings in Appendix E. There route has been designed to avoid the existing main sewers and services as far as possible, however the route is through an established residential road and there may be clashes with other services and private drains.

5.3 The development has been designed to drain via a piped surface water system and an attenuation basin prior to being discharged into the existing sewer. The basin has been designed to store and release surface water at a restricted discharge rate of 5l/s for all storm events up to and including the 1 in 100 year + 30% climate change return period. To achieve this, the attenuation basin has been sized to provide 1140m$^3$ of storage at a maximum 1m water depth (based on the current masterplan).

5.4 Refer to ARP drawing 1048/141/SK06 in Appendix E for the Proposed Surface Water Drainage Strategy. Calculations are in Appendix G. The detailed calculations and proposals will need to submitted for section 104 approval and to the Planning Authority for approval prior to construction.

## 6 FOUL WATER DRAINAGE

6.1 The drainage strategy layout 1048-141-sk06 is presented in Appendix E for reference purposes.

6.2 Yorkshire Water has indicated that they would accept discharge of foul water domestic waste into the 150mm diameter foul sewer located in Pitt Street. The sewer in Pitt Street is approximately 2.0m deep, therefore no pumping is required.

## 7 FLOOD ROUTING

7.1 Surface water flow routes for flood exceedance have informed the design progression of the site layout, site levels and drainage system. Details of the flow routes are shown in drawings 1048/141/SK07.

7.2 Site levels have been designed to allow any flow exceedance from within or outside the Site to pass through the site, mainly down the roads towards Pitt Street. Flood exceedance from some side roads will follow the existing flow paths southwards through gardens and fields. The basin has been designed with freeboard for flood exceedance; any overtopping would be in the south near the control chamber and flow towards Pitt Street.

7.3 The Plot levels have been set higher than the adjacent roads and higher than surrounding ground levels. There is one exception of plot 50 which has tanking to the driveway.

# Appendix A
# Utilities Survey




## Detection Grades

| Method Type | Quality Grade | Horizontal Accuracy | Vertical Accuracy | Detection Clarification |
|---|---|---|---|---|
| Desktop Records Search | D | N/A | N/A | Service shown on records only not found on site. |
| Site Reconnaissance | C | N/A | N/A | Site Evidence of service i.e evac but not able to locate with equipment. |
| Detection | B4 | N/A | N/A | Records and Site Evidence agree but not confirmed with site equipment due to Topography or equipment limitations. |
| Detection | B3 | +- 500mm | +- 500mm | Service Located with one surveying technique. Confidence level of surveyor low due to a poor trace and/or inconclusive signal. |
| Detection | B2 | +- 250mm | +- 40% Detected Depth | Service Located with one surveying technique. Confidence level of surveyor high due to a clear trace. |
| Detection | B1 | +- 150mm | +- 15% Detected Depth | Service Located with two detection techniques which agree to 150 mm of each other. |
| Verification | A | +- 50mm | +- 25mm | Top of the service visually identified and measured accurately, either in slit trench or thrie pit or chamber. |


## Copyright

This drawing and the information contained therein is issued in confidence and is the copyright of Terra Measurement Ltd. Disclosure of this information to Third Parties and unauthorised copying or replication of this data without approval is forbidden.


## Terra Measurement Survey Key

AIR VALVE, BEACON, SCHEDULE, BUILDING HEIGHT (AT), BUILDING LEVEL, BENCH MARK, BOLLARD, BOUNDARY POST, BUS STOP, BOUNDARY STONE, BRITISH TELECOM, CAMERA, CONTROL BOX, CCTV, CABLE TV SUPPLY, DOWN PIPE (AT), EAVES HEIGHT (AT), ELECTRIC BOX, ELECTRIC POST, EARTH ROD, FIRE HYDRANT, FLOODLIGHT, FLAT ROOF (AT), FLAG STAFF, GAS MARKER POST, LAMP POST, LAMP COLUMN (GULLY), GATE POST (AT), GAS VALVE, HOSE, HOSE HEIGHT (AT), HALLY, ILLUMINATED BOLLARD, INSPEC COVER ROUND, INSPEC COVER SQUARE, INSPEC COVER UNDER, KP FLOOR LEVEL (AT), MARKET LEVEL (AT), KERB OUTLET, LETTERBOX, MANHOLE ROUND, MANHOLE SQUARE, MANHOLE TRIANGLE, MARKER POST, MARKER, PIPE RISER, PARKING METER, UNIDENTIFIED POST, RUBBER DRUM, ROADSIGN, RADIUS HEIGHT (AT), SPEED CAMERA, SOFFIT LEVEL (AT), SIGN POST, STOP TAP, STILE, TOP OF WALL (AT), VALVE, VIDEO CAMERA, VENT PIPE, WATER LEVEL (AT), WATER METER, WASH OUT, POLE, STUMP, STOP VALVE, STAY, TAP, TELEPHONE, TOP OF KERB, TRAFFIC LIGHT, TELEGRAPH POST, TRAFFIC SIGNAL, Cable TV Cover, Electric Cover, Water Service Cover, Telecomms Cover, BT Cover, Gas Cover

## Utilities Survey Key

| | |
|---|---|
| BT | BT Cable |
| CATV | CATV Cable |
| COM | Coms Cable |
| COM/PWR | Coms/Power |
| TS | Traffic Signal Cable |
| E | Electric Cable |
| LV | Electric LV Cable |
| HV | Electric HV Cable |
| GAS | Gas Pipe |
| U | Unidentified Service |
| W | Water Main |
| FW | Foul Sewer |
| CW | Combined Sewer |
| PRIV | Private Sewer |
| PUMP | Pumped Sewer |
| SW | Surface Sewer |
| RM | Rising Main |
| TE | Trade Effluent |
| GPR | GPR Anomaly |
| D | Service Duct |
| XS | Survey Extents |
| XC | Chamber Extents |
| FO | Fibre Optic |
| CCTV | CCTV Cables |

| | | | |
|---|---|---|---|
| 1.00 | Depth (m) | DOC | Depth Of Slab Cover |
| UTT | Unable To Trace | P.T | Poor Trace |
| EOT | End of Trace / Signal Lost | N.V.P | No Visible Pipe |
| EOS | End of Sonde | N.V.V | No Visible Valve |
| AR | Assumed Route | E.D | Empty Duct |
| TFR | Taken From Records | RWP | Rain Water Pipe |
| UTL | Unable To Lift | BLKD | Blocked |
| UTM | Unable To Measure | M.U.D | Multiple Ducts |
| M.A.R | Man Access Required | M.U.C | Multiple Cables |
| CL | Cover Level | CR | Cable Rise |
| IL | Invert Level | AG | Above Ground |
| U/S | Underside/Soffit | DC | Drainage Channel |


TERRA MEASUREMENT

Utilities

Telephone 01773 790080 Fax 01773 790080
Email info@terrameasurement.com
Website www.terrameasurement.com


Survey, Utilities, Measurement and Specialist Solutions for:
Design - Construction - Refurbishment - Urban & Rural Development
Transport Infrastructure - Mine and Quarry - Retail - Intelligent Data

## Disclaimer.

All underground services have been located using GPR and Electro-Magnetic location techniques. All locating equipment used on site has accuracy limitations, these limitations can be found by consulting the manufacturers guidelines. Please see the Terra Measurement Utility survey limitations documents for further explanation on the limitations of the survey data.
The accuracy of each detection is given a confidence grade based on the on site evidence available to the survey team at the time of survey. These detection grades are not a guide to the depth of the service, further intrusive evidence (i.e. slit trenches) can confirm the position of the surveyed service.
Terra Measurement accept no responsibility for utility drawings older than 90 days from the original survey date stated below.
Utility survey equipment is reliable up to 2.5m in depth anything deeper than 2.5m may not be as accurately positioned.
Terra Measurement cannot give any indication to whether services shown on the survey drawing are live or dead, as such all service shown should be treated as live and proven otherwise by a competent person.
Terra Measurement cannot determine the size of services unless they can be physically measured on site i.e. in a manhole chamber or open excavation.
Service records will be consulted and checked against both on site during the survey and in the office as part of the QA procedure. In instances where services are shown on service records but cannot be located on site Terra Measurement will show indicative positions on the survey.
Terra Measurement cannot guarantee the accuracy of any service records supplied or obtained in the process of completing the utility survey.

The following exclusions may be made on the survey:-

1. Pot ended cables.
2. Cables with no current i.e. DC Pilot cables or de-commissioned cables.
3. Small plastic pipes below 75mm in size.
4. Private service connections where access to properties was not available during the survey.
5. Non-conductive pipes, foundations and/or below ground obstructions which are not specifically targeted with pre-existing knowledge of whereabouts from plans provided whilst on site.

Direction of North

GRID

OS NATIONAL GRID
Using the OS GPS Network, applying an OSTN15 transformation and removing the scale factor for true distances.

DATUM

OS LEVEL DATUM
Using the OS GPS Network and applying OSGM15 National Geoid Model to obtain local area corrections.

| REV | DATE | DRAWN | DESCRIPTION | CHECKED |
|---|---|---|---|---|
| B | 25.05.21 | DR | Additional CCTV information added. | KS |
| A | 21.03.21 | KP | Drainage on Pitt Street Amended after clarification from CCTV survey. | DR |

Layout

A1-L1

A1-L2

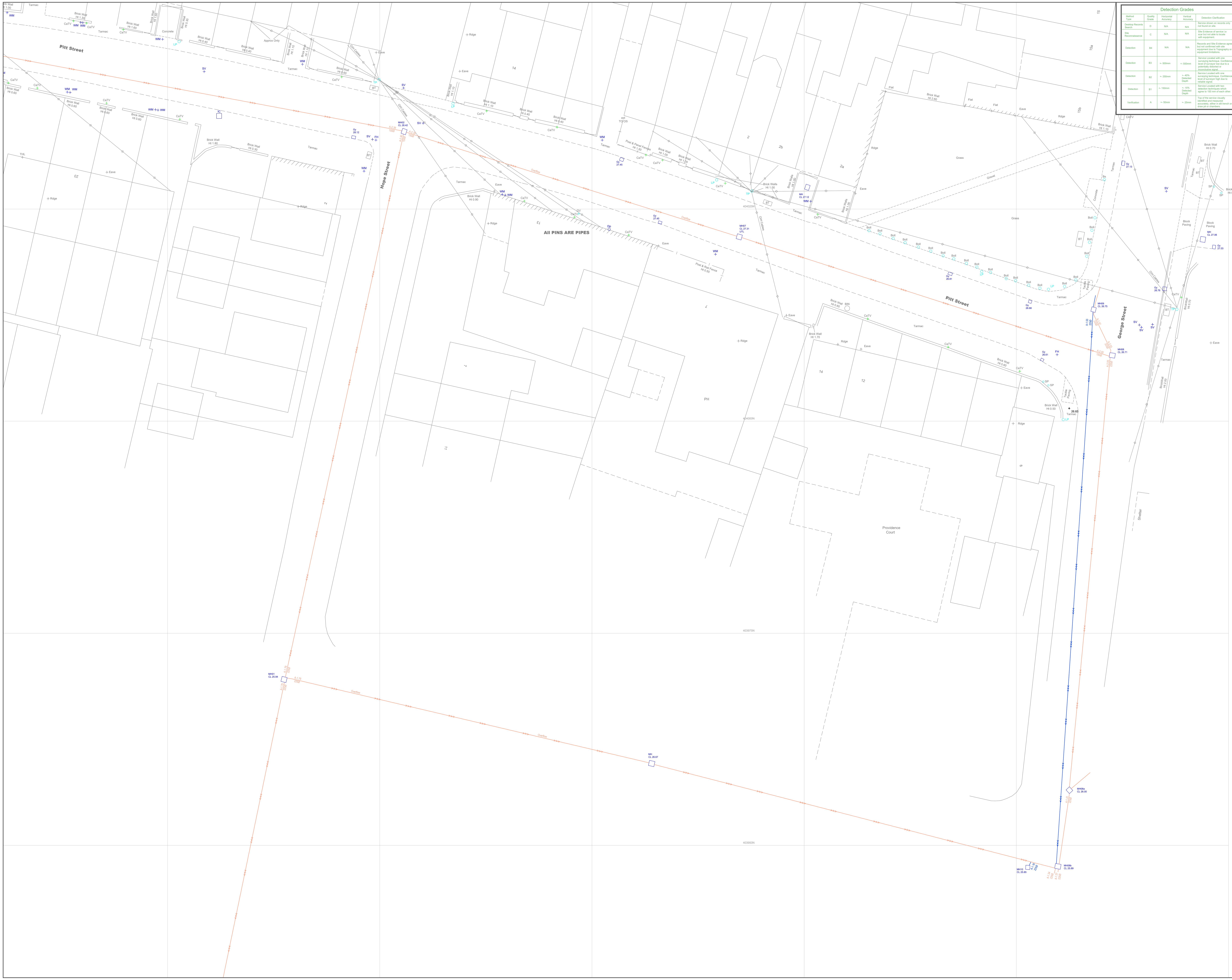
CLIENT
BARRAT & DAVID WILSON HOMES, YORKSHIRE WEST

SITE
PITT STREET
DARFIELD
S73 8AS

DRAWING TITLE
UNDERGROUND UTILITIES SURVEY

| DRAWING REF (LAYOUT TAB) | SCALE@A1 |
|---|---|
| 3315_PITT STREET (A1-L1) | 1/200 |
| PROJECT REF: 3315 | REV: B |

| SURVEYED | KP | DRAWN | KP |
|---|---|---|---|
| CHECKED | DR | DATE | 04/03/2021 |




## Detection Grades

| Method Type | Quality Grade | Horizontal Accuracy | Vertical Accuracy | Detection Clarification |
|---|---|---|---|---|
| Desktop Records Search | D | N/A | N/A | Service shown on records only not found on site. |
| Site Reconnaissance | C | N/A | N/A | Site Evidence of service i.e scar but not able to locate with equipment. |
| Detection | B4 | N/A | N/A | Records and Site Evidence agree but not confirmed with site equipment due to Topography or equipment limitations. |
| Detection | B3 | +- 500mm | +- 500mm | Service Located with one surveying technique. Confidence level of surveyor low due to a potentially distorted or inconclusive signal. |
| Detection | B2 | +- 250mm | +- 40% Detected Depth | Service Located with one surveying technique. Confidence level of surveyor high due to reliable signal. |
| Detection | B1 | +- 150mm | +- 15% Detected Depth | Service Located with two detection techniques which agree to 150 mm of each other. |
| Verification | A | +- 50mm | +- 25mm | Top of the service visually identified and measured accurately, either in slit trench or draw pit or chambers. |

## Copyright

This drawing and the information contained therein is issued in confidence and is the copyright of Terra Measurement Ltd. Disclosure of this information to Third Parties and unauthorised copying or replication of this data without approval is forbidden.

## Terra Measurement Survey Key

AIR VALVE, BEACON, BOREHOLE, BUILDING HEIGHT (NT), BUILDING LEVEL, BENCH MARK, BOLLARD, BOUNDARY POST, BUS STOP, BOUNDARY STONE, BRITISH TELECOM, CAMERA, CONTROL BOX, CCTV, CABLE TV SUPPLY, DOWN PIPE (NT), EAVES HEIGHT (NT), ELECTRIC BOX, ELECTRIC POST, EARTH ROD, FIRE HYDRANT, FLOODLIGHT, FLAT ROOF (NT), FLAG STAFF, GAS MARKER POST, CIRCULAR GULLY, GATE POST (NT), GAS VALVE, GULLY, ILLUMINATED BOLLARD, INSPEC COVER ROUND, INSPEC COVER SQUARE, INSPEC COVER UNDEF, INT FLOOR LEVEL (NT), INVERT LEVEL (NT), KERB OUTLET, LETTERBOX, LAMP POST, MANHOLE ROUND, MANHOLE SQUARE, MANHOLE TRIANGLE, MARKER POST, MARKER, PIPE INVERT, PARKING METER, UNDEFINED POST, RUBBISH BIN, RODDING EYE, RIDGE HEIGHT (NT), SPEED CAMERA, SOFFIT LEVEL (NT), SIGN POST, STOP TAP, STILE, TOP OF WALL (NT), VALVE, VIDEO CAMERA, VENT PIPE, WATER LEVEL (NT), WATER METER, WASH OUT, PEG, STUMP, STOP VALVE, STAY, TAP, TELEPHONE, TOP OF KERB, TRAFFIC LIGHT, TELEGRAPH POST, TRAFFIC SIGNAL, Cable TV Cover, Electric Cover, Water Service Cover, Telecomms Cover, BT Cover, Gas Cover

## Utilities Survey Key

- BT Cable
- CATV Cable
- Coms Cable
- Coms/Power
- Traffic Signal Cable
- Electric Cable
- Electric LVCable
- Electric HVCable
- Gas Pipe
- Unidentified Service
- Water Main
- Foul Sewer
- Combined Sewer
- Private Sewer
- Pumped Sewer
- Surface Sewer
- Rising Main
- Trade Effluent
- GPR Anomaly
- Service Duct
- Survey Extents
- Chamber Extents
- Fibre Optic
- CCTV Cables

| | | | |
|---|---|---|---|
| 1.00 | Depth (m) | DOC | Depth Of Slab Cover |
| UTT | Unable To Trace | P.T | Poor Trace |
| EOT | End of Trace / Signal Lost | N.V.P | No Visible Pipe |
| EOS | End of Sonde | N.V.V | No Visible Valve |
| AR | Assumed Route | E.D | Empty Duct |
| TFR | Taken From Records | RWP | Rain Water Pipe |
| UTL | Unable To Lift | BLKD | Blocked |
| UTM | Unable To Measure | M.U.D | Multiple Ducts |
| M.A.R | Man Access Required | M.U.C | Multiple Cables |
| CL | Cover Level | CR | Cable Rise |
| IL | Invert Level | AG | Above Ground |
| U/S | Underside/Soffit | DC | Drainage Channel |

TERRA MEASUREMENT
Utilities

Telephone 01773 790080 Fax 01773 790080
Email info@terrameasurement.com
Website www.terrameasurement.com

Survey, Utilities, Measurement and Specialist Solutions for:
Design - Construction - Refurbishment - Urban & Rural Development
Transport Infrastructure - Mine and Quarry - Retail - Intelligent Data

## Disclaimer.

All underground services have been located using GPR and Electro-Magnetic location techniques. All locating equipment used on site has accuracy limitations, these limitations can be found by consulting the manufacturers guidelines. Please see the Terra Measurement Utility survey limitations documents for further explanation on the limitations of the survey data.
The accuracy of each detection is given a confidence grade based on the on site evidence available to the survey team at the time of survey. These detection grades should only be used as a guide until further intrusive evidence (i.e. slit trenches) can confirm the position of the surveys.
Terra Measurement accept no responsibility for utility drawings older than 90 days from the original survey date stated below.
Utility survey equipment is reliable up to 2.5m in depth anything deeper then 2.5m may not be as accurately positioned.
Terra Measurement cannot give any indication to whether services shown on the survey drawing are live or dead, as such all service shown should be treated as live until proven otherwise by a certified operative.
Terra Measurement cannot indicate the size of services unless they can be physically measured on site i.e. in a manhole chamber or open excavation.
Service records will be consulted and checked against both on site during the survey and in the office as part of the QA procedure. In instances where services are shown on service records but cannot be located on site Terra Measurement will show indicative positions on the survey.
Terra Measurement cannot guarantee the accuracy of any service records supplied or obtained in the process of completing the utility survey.

The following exclusions may be made on the survey:-

1. Pot ended cables.
2. Cables with no current i.e. DC Pilot cables or de-commisioned cables.
3. Small plastic pipes below 75mm in size.
4. Private service connections where access to properties was not available during the survey.
5. Location of voids, foundations and/or below ground obstructions which are not specifically targeted with pre-existing knowledge of whereabouts from plans provided whilst on site.

Direction of North

N / E / S / W

## GRID

OS NATIONAL GRID
Using the OS GPS Network, applying an OSTN15 transformation and removing the scale factor for true distances.

## DATUM

OS LEVEL DATUM
Using the OS GPS Network and applying OSGM15 National Geoid Model to obtain local area corrections.

| REV | DATE | DRAWN | DESCRIPTION | CHECKED |
|---|---|---|---|---|
| B | 25.05.21 | DR | Additonal CCTV information added. | KS |
| A | 21.03.21 | KP | Drainage on Pitt Street Amended after clarification from CCTV survey. | DR |

Layout

A1-L1 A1-L2

| | |
|---|---|
| CLIENT | BARRAT & DAVID WILSON HOMES, YORKSHIRE WEST |
| SITE | PITT STREET DARFIELD S73 8AS |
| DRAWING TITLE | UNDERGROUND UTILITIES SURVEY |
| DRAWING REF (LAYOUT TAB) | 3315_PITT STREET (A1-L2) |
| SCALE@A1 | 1/200 |
| PROJECT REF | 3315 |
| REV | B |
| SURVEYED | KP |
| DRAWN | KP |
| CHECKED | DR |
| DATE | 04/03/2021 |

# Appendix B
# Utilities Records

CORNERSTONE PROJECTS LTD

# Utilities Search Report



**Monday, 01 Mar 2021**

**Terra Measurement**

**3315**

**Pitt Street Darfield**

91 Market Street Hoylake Wirral CH47 5AA
Tel. 0151 632 5142
enquiries@cornerstoneprojects.co.uk
www.cornerstoneprojects.co.uk
VAT Reg. No. 851 4941 19
Company No. 5132353

Registered in England. Registered Address : Cornerstone Projects Ltd, 91 Market Street, Hoylake, Wirral CH47 5AA

CORNERSTONE PROJECTS LTD

# Table of contents:

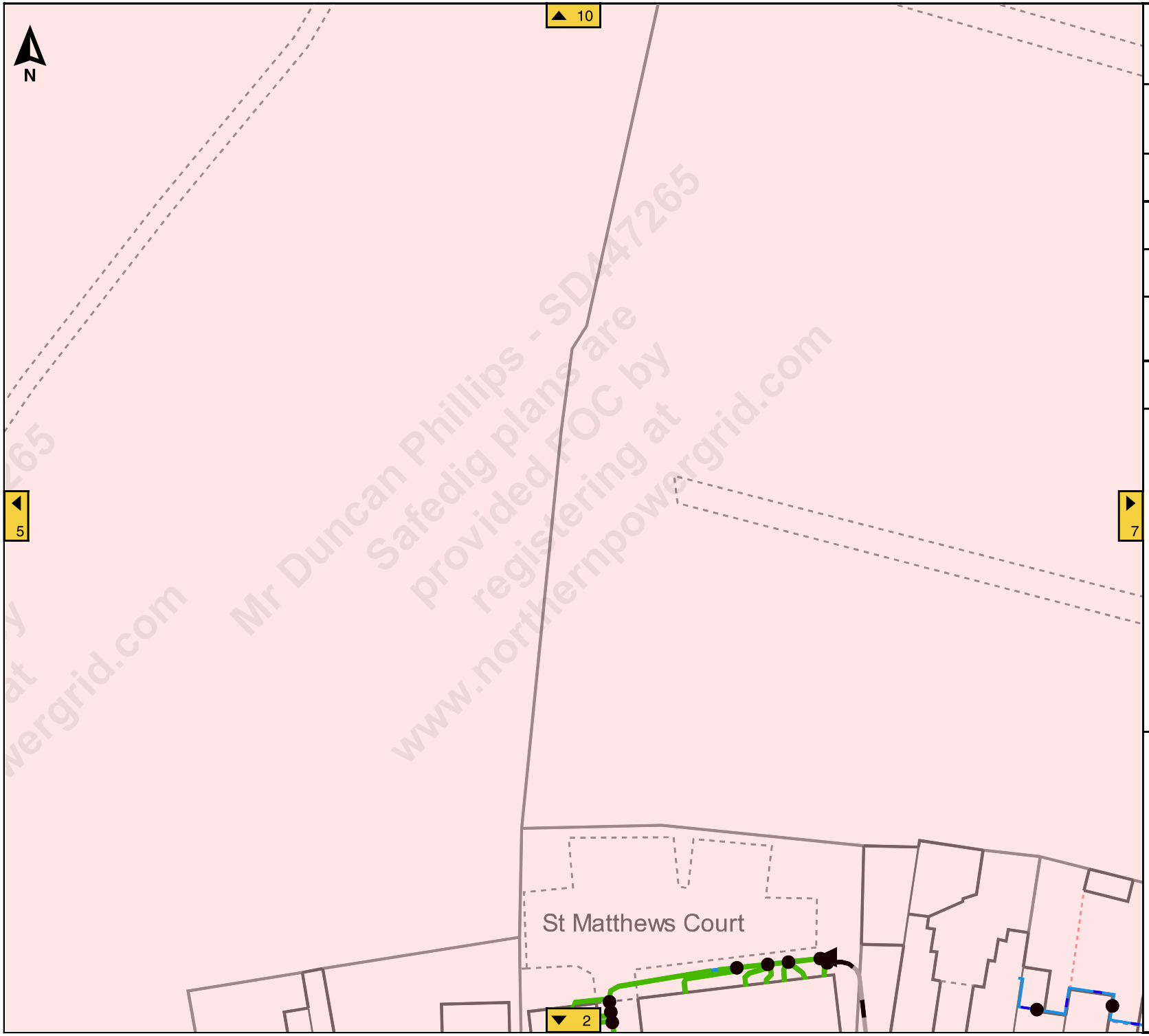
| Utility / Service | Included | | Utility / Service | Included |
|---|---|---|---|---|
| **Basic Search** | | | **Independent Utilities** | |
| Gas | **Yes** | | GTC | **Not Requested** |
| Water | **Yes** | | Last Mile | **Not Requested** |
| Sewers | **Yes** | | SSE | **Not Requested** |
| BT | **Yes** | | Harlaxton | **Not Requested** |
| Electricity | **Yes** | | Utility Assets | **Not Requested** |
| 3rd Party Searches* | **Yes** | | UK Power Distribution | **Not Requested** |
| | | | Albion Water | **Not Requested** |
| **Cable Search** | | | ESP | **Not Requested** |
| Vodafone | **Yes** | | Fulcrum Pipelines | **Not Requested** |
| Virgin Media | **Yes** | | Energy Assets | **Not Requested** |
| BSkyB | **Yes** | | ENGIE | **Not Requested** |
| GTT | **Not Affected** | | Leep Utilities | **Not Requested** |
| Colt | **Yes** | | | |
| KPN | **Not Affected** | | | |
| Sota | **Not Affected** | | | |
| CGI Logica | **Not Affected** | | **Others** | |
| SSE Telecom | **Not Affected** | | CAD Pack | **Not Requested** |
| City Fibre | **Yes** | | Smart pdf | **Not Requested** |
| Telia Sonera | **Not Affected** | | Coal Authority Report | **Not Requested** |
| Instalcom** | **Yes** | | | |
| KCom | **Not Affected** | | | |
| Verizon | **Yes** | | | |
| Trafficmaster | **Not Affected** | | | |
| Zayo Group | **Yes** | | | |
| Tata Communications | **Not Affected** | | | |
| Gamma | **Not Affected** | | | |
| Gigaclear Plc | **Not Affected** | | | |
| | | | | |
| | | | | |

*Includes Utilibilly and Linesearch

**Includes Level3, GC(UK) Ltd, GC PEC, Fibrenet UK and Fibrespan

**NB: All plans / responses are valid for a maximum of three months unless noted otherwise**

91 Market Street Hoylake Wirral CH47 5AA
Tel. 0151 632 5142
enquiries@cornerstoneprojects.co.uk
www.cornerstoneprojects.co.uk
VAT Reg. No. 851 4941 19
Company No. 5132353




Mr Duncan Phillips - SD447265
Safedig plans are provided FOC by registering at www.northernpowergrid.com

NORTHERN POWERGRID

Job Reference : SD447265

3315

Scale : 1:500

Grid Coordinates : 440583 404108

Date : 24/02/2021

Produced For :
Mr Duncan Phillips



Terms and Conditions

Electric cables and/or overhead line information shown on the record plans are to be used in accordance with the Health & Safety Executive's Booklet HS(G)47, "Avoiding Danger from Underground Services" and Guidance Note GS 6, "Avoidance of Danger from Overhead Electric Lines".
Record plans do not always show out of commission cables or service cables from Northern Powergrid\'s mains to adjoining or cross road properties.
Plans do not show local authority owned public lighting or sign cables. The information is provided as a service by NorthernPowergrid and does not impart any legal obligation on their part.
Persons using it are reminded of their responsibility to execute works safely to avoid damaging Northern Powergrid\'s apparatus.

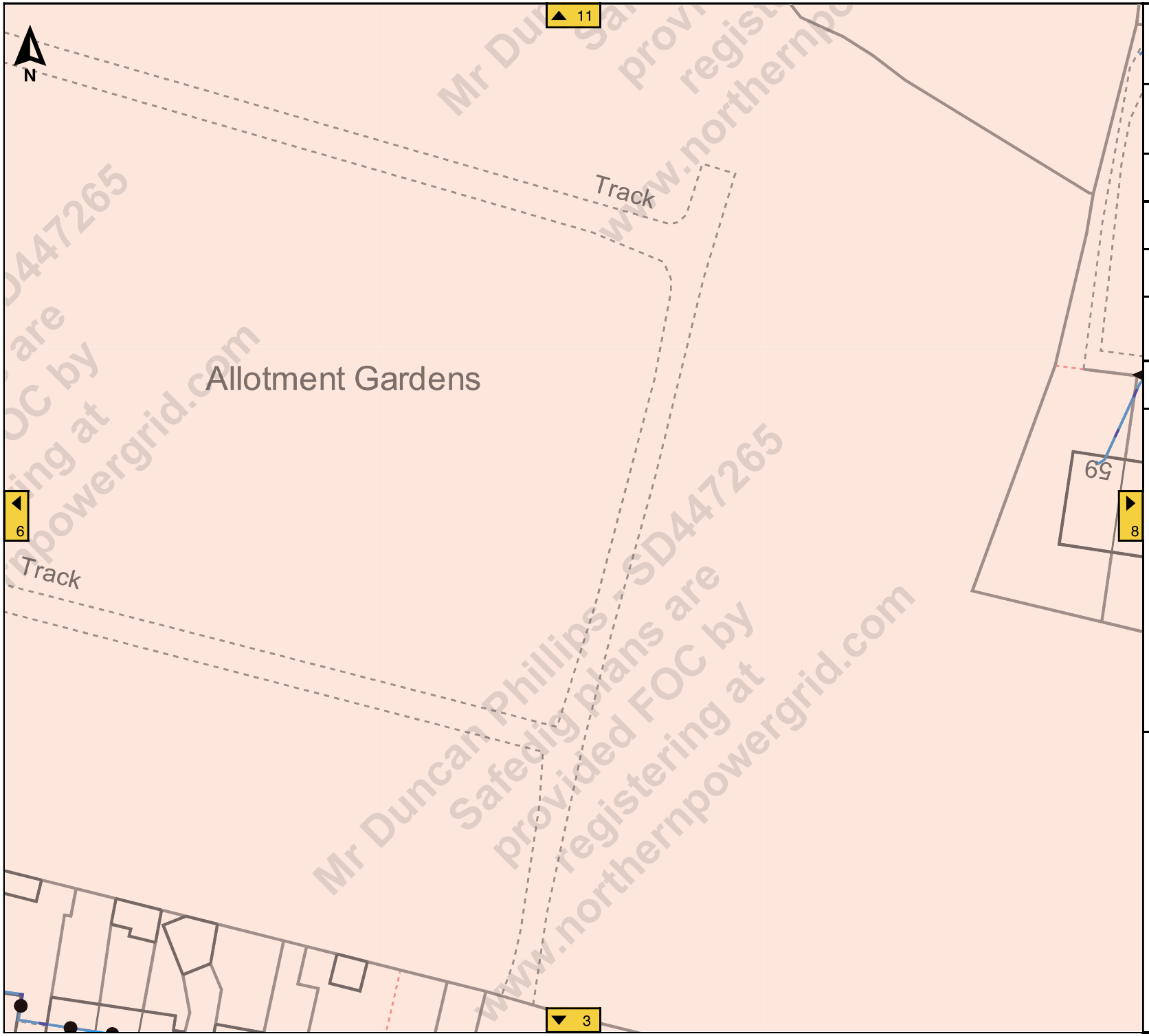
Further advice or assistance is available from the Records Information Centre on 0191 2294296
In an emergency or outside normal working hours contact our customer information centre on 0800 668877
Cable depths shown were correct at the time cables were laid however alterations to ground levels or cable disposition may have taken place.

Legend:

Underground Cables:
- 132kV
- 66kV
- 33kV
- 25kV
- Left In Situ
- LV Mains
- LV Service Assumed Route
- LV Service Logical Connection
- Duct Route
- 20kV
- 11kV
- 6kV
- 3kV
- Aux
- LV Service

Overhead Conductors:
- 132kV
- 66kV
- 33kV
- 25kV
- LV Mains
- LV Service
- 20kV
- 11kV
- 6kV
- 3kV
- Aux

0 5 10 15 20m




NORTHERN POWERGRID

Job Reference : SD447265

3315

Scale : 1:500

Grid Coordinates : 440688 404108

Date : 24/02/2021

Produced For :
Mr Duncan Phillips



Terms and Conditions

Electric cables and/or overhead line information shown on the record plans are to be used in accordance with the Health & Safety Executive's Booklet HS(G)47, "Avoiding Danger from Underground Services" and Guidance Note GS 6, "Avoidance of Danger from Overhead Electric Lines".
Record plans do not always show out of commission cables or service cables from Northern Powergrid\'s mains to adjoining or cross road properties.
Plans do not show local authority owned public lighting or sign cables. The information is provided as a service by NorthernPowergrid and does not impart any legal obligation on their part.
Persons using it are reminded of their responsibility to execute works safely to avoid damaging Northern Powergrid\'s apparatus.

Further advice or assistance is available from the Records Information Centre on 0191 2294296
In an emergency or outside normal working hours contact our customer information centre on 0800 668877
Cable depths shown were correct at the time cables were laid however alterations to ground levels or cable disposition may have taken place.

Legend:

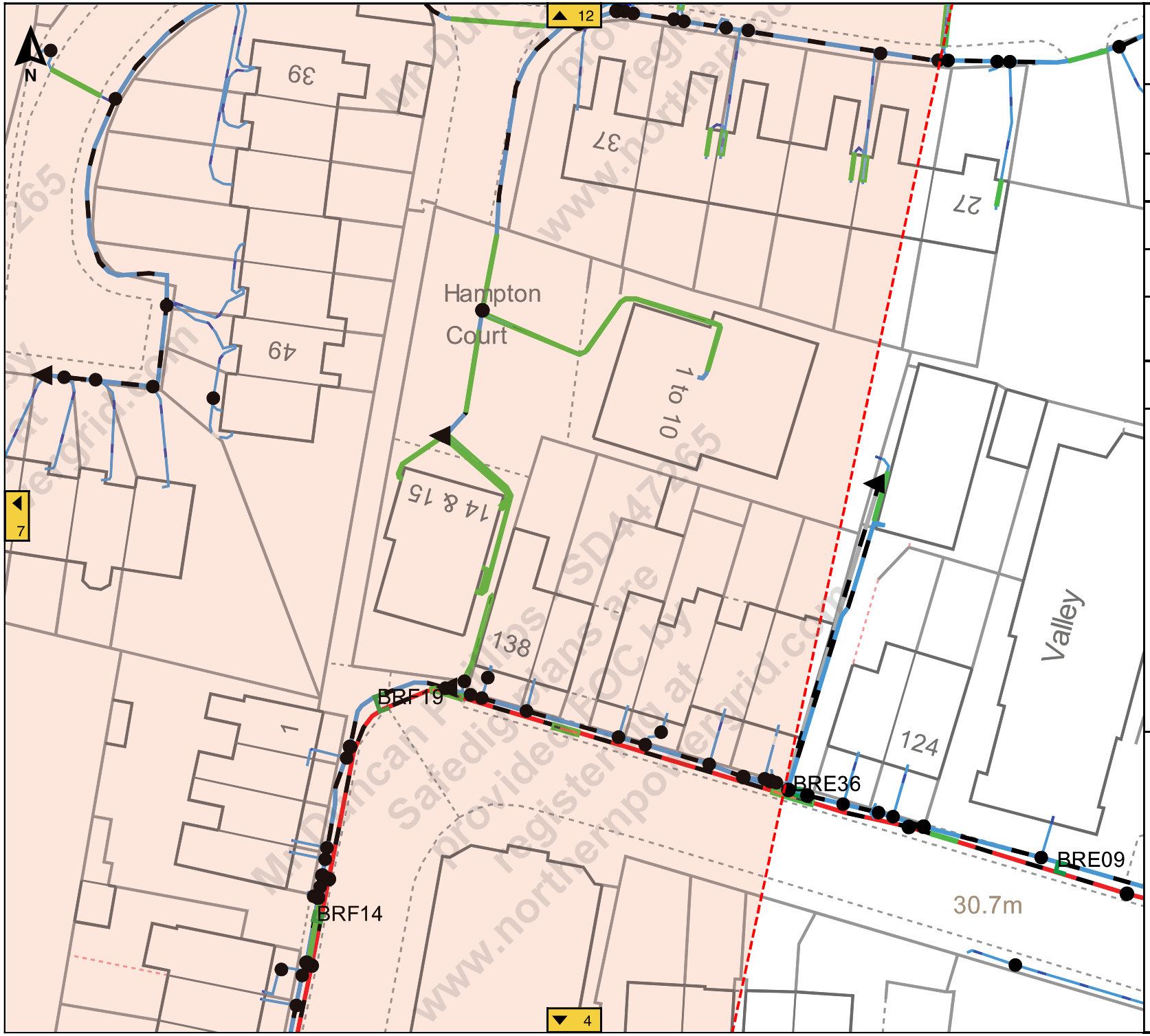
Underground Cables:

- 132kV
- 66kV
- 33kV
- 25kV
- Left In Situ
- LV Mains
- LV Service Assumed Route
- LV Service Logical Connection
- Duct Route
- 20kV
- 11kV
- 6kV
- 3kV
- Aux
- LV Service

Overhead Conductors:

- 132kV
- 66kV
- 33kV
- 25kV
- LV Mains
- LV Service
- 20kV
- 11kV
- 6kV
- 3kV
- Aux

0 5 10 15 20m




NORTHERN POWERGRID

Job Reference : SD447265

3315

Scale : 1:500

Grid Coordinates : 440794 404108

Date : 24/02/2021

Produced For :
Mr Duncan Phillips



Terms and Conditions

Electric cables and/or overhead line information shown on the record plans are to be used in accordance with the Health & Safety Executive's Booklet HS(G)47, "Avoiding Danger from Underground Services" and Guidance Note GS 6, "Avoidance of Danger from Overhead Electric Lines".
Record plans do not always show out of commission cables or service cables from Northern Powergrid\'s mains to adjoining or cross road properties.
Plans do not show local authority owned public lighting or sign cables. The information is provided as a service by NorthernPowergrid and does not impart any legal obligation on their part.
Persons using it are reminded of their responsibility to execute works safely to avoid damaging Northern Powergrid\'s apparatus.

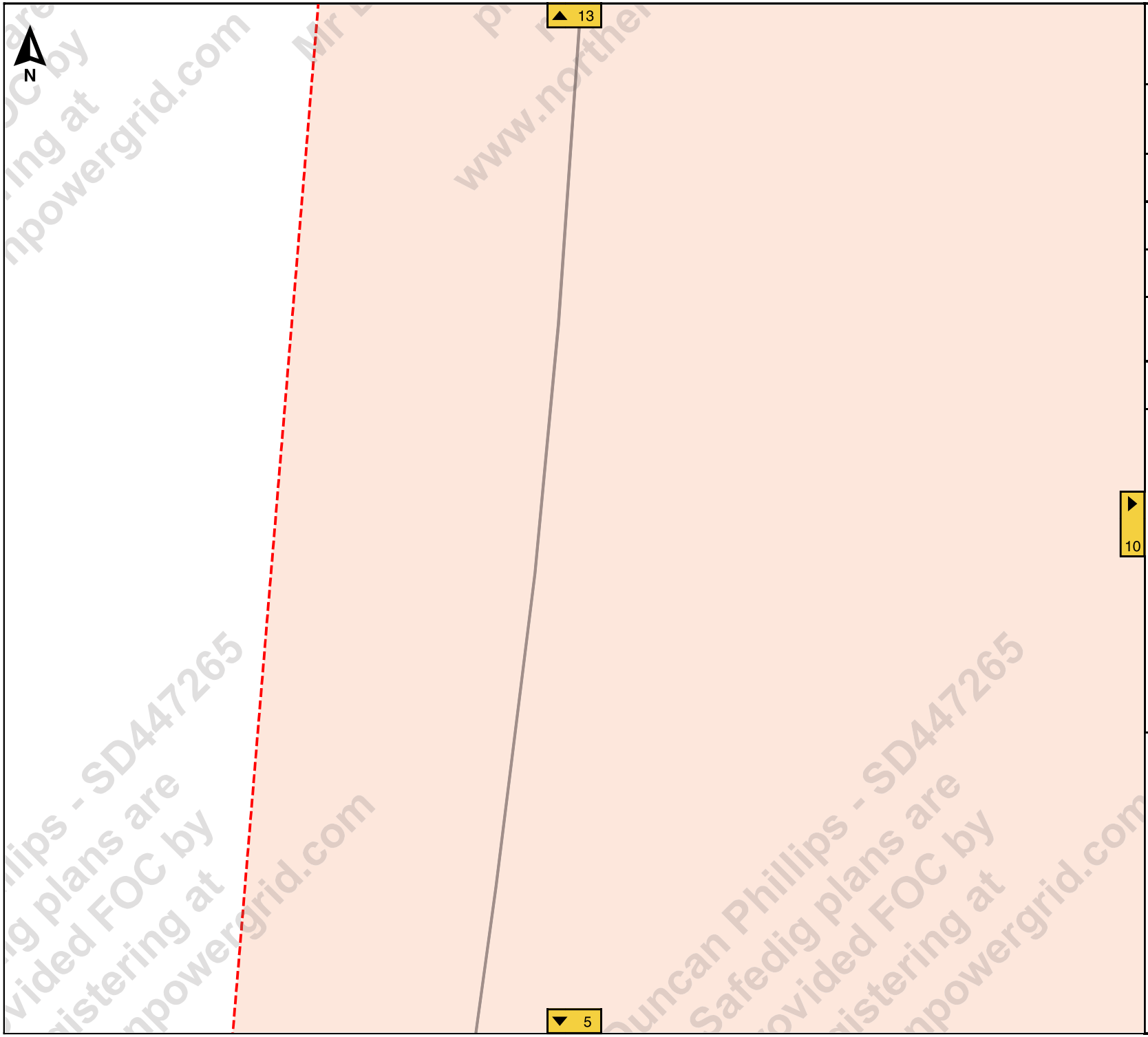
Further advice or assistance is available from the Records Information Centre on 0191 2294296
In an emergency or outside normal working hours contact our customer information centre on 0800 668877
Cable depths shown were correct at the time cables were laid however alterations to ground levels or cable disposition may have taken place.

Legend:

Underground Cables:
- 132kV
- 66kV
- 33kV
- 25kV
- Left In Situ
- LV Mains
- LV Service Assumed Route
- LV Service Logical Connection
- Duct Route
- 20kV
- 11kV
- 6kV
- 3kV
- Aux
- LV Service

Overhead Conductors:
- 132kV
- 66kV
- 33kV
- 25kV
- LV Mains
- LV Service
- 20kV
- 11kV
- 6kV
- 3kV
- Aux

0 5 10 15 20m




NORTHERN POWERGRID

Job Reference : SD447265

3315

Scale : 1:500

Grid Coordinates : 440477 404203

Date : 24/02/2021

Produced For :
Mr Duncan Phillips



Terms and Conditions

Electric cables and/or overhead line information shown on the record plans are to be used in accordance with the Health & Safety Executive's Booklet HS(G)47, "Avoiding Danger from Underground Services" and Guidance Note GS 6, "Avoidance of Danger from Overhead Electric Lines".
Record plans do not always show out of commission cables or service cables from Northern Powergrid\'s mains to adjoining or cross road properties.
Plans do not show local authority owned public lighting or sign cables. The information is provided as a service by NorthernPowergrid and does not impart any legal obligation on their part.
Persons using it are reminded of their responsibility to execute works safely to avoid damaging Northern Powergrid\'s apparatus.

Further advice or assistance is available from the Records Information Centre on 0191 2294296
In an emergency or outside normal working hours contact our customer information centre on 0800 668877
Cable depths shown were correct at the time cables were laid however alterations to ground levels or cable disposition may have taken place.

Legend:

Underground Cables:

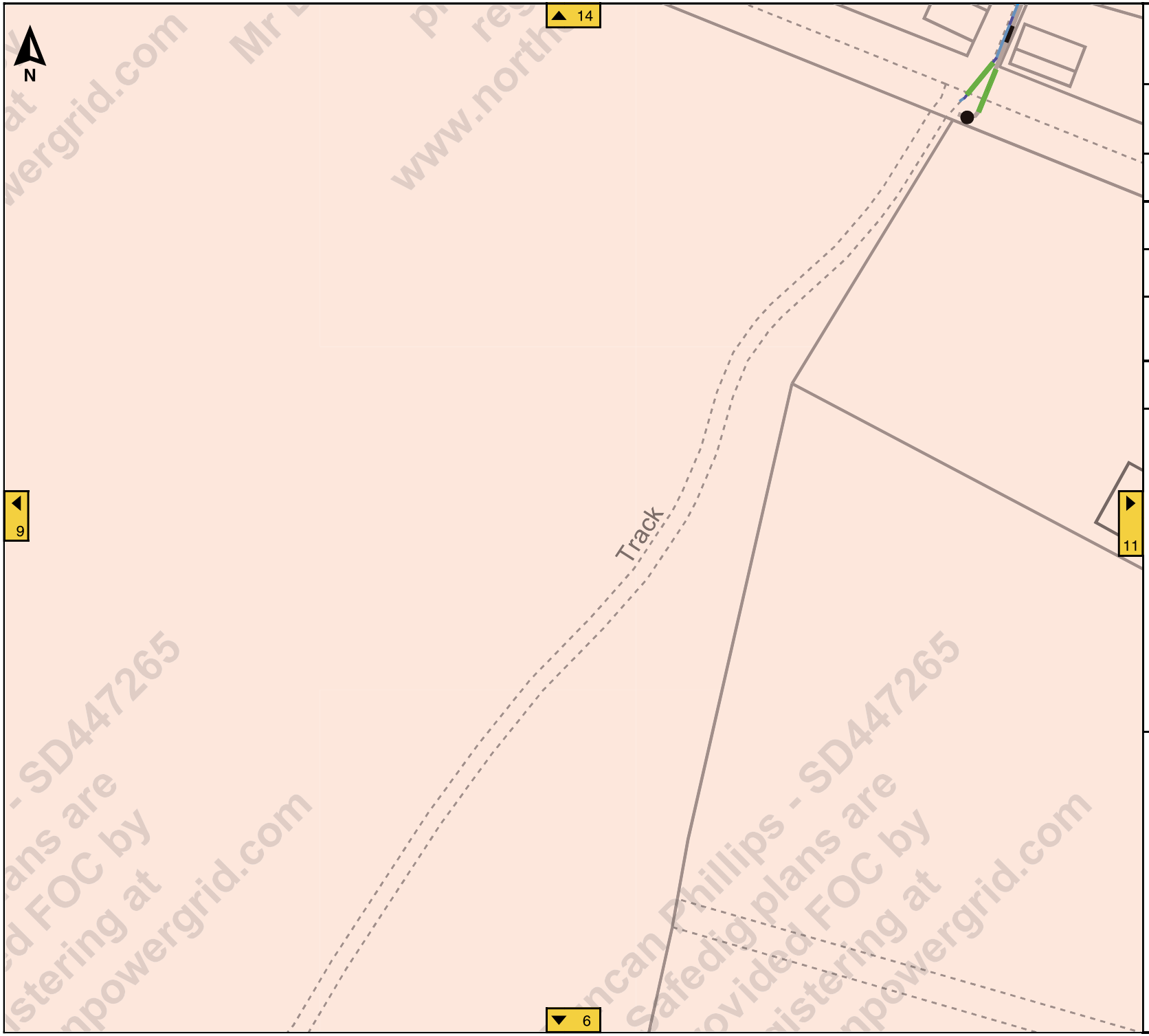
- 132kV
- 66kV
- 33kV
- 25kV
- Left In Situ
- LV Mains
- LV Service Assumed Route
- LV Service Logical Connection
- Duct Route
- 20kV
- 11kV
- 6kV
- 3kV
- Aux
- LV Service

Overhead Conductors:

- 132kV
- 66kV
- 33kV
- 25kV
- LV Mains
- LV Service
- 20kV
- 11kV
- 6kV
- 3kV
- Aux

0 5 10 15 20m

Mr Duncan Phillips - SD447265 Safedig plans are provided FOC by registering at www.northernpowergrid.com




NORTHERN POWERGRID

Job Reference : SD447265

3315

Scale : 1:500

Grid Coordinates : 440583 404203

Date : 24/02/2021

Produced For :
Mr Duncan Phillips



Terms and Conditions

Electric cables and/or overhead line information shown on the record plans are to be used in accordance with the Health & Safety Executive's Booklet HS(G)47, "Avoiding Danger from Underground Services" and Guidance Note GS 6, "Avoidance of Danger from Overhead Electric Lines".
Record plans do not always show out of commission cables or service cables from Northern Powergrid\'s mains to adjoining or cross road properties.
Plans do not show local authority owned public lighting or sign cables. The information is provided as a service by NorthernPowergrid and does not impart any legal obligation on their part.
Persons using it are reminded of their responsibility to execute works safely to avoid damaging Northern Powergrid\'s apparatus.

Further advice or assistance is available from the Records Information Centre on 0191 2294296
In an emergency or outside normal working hours contact our customer information centre on 0800 668877
Cable depths shown were correct at the time cables were laid however alterations to ground levels or cable disposition may have taken place.

Legend:

Underground Cables:

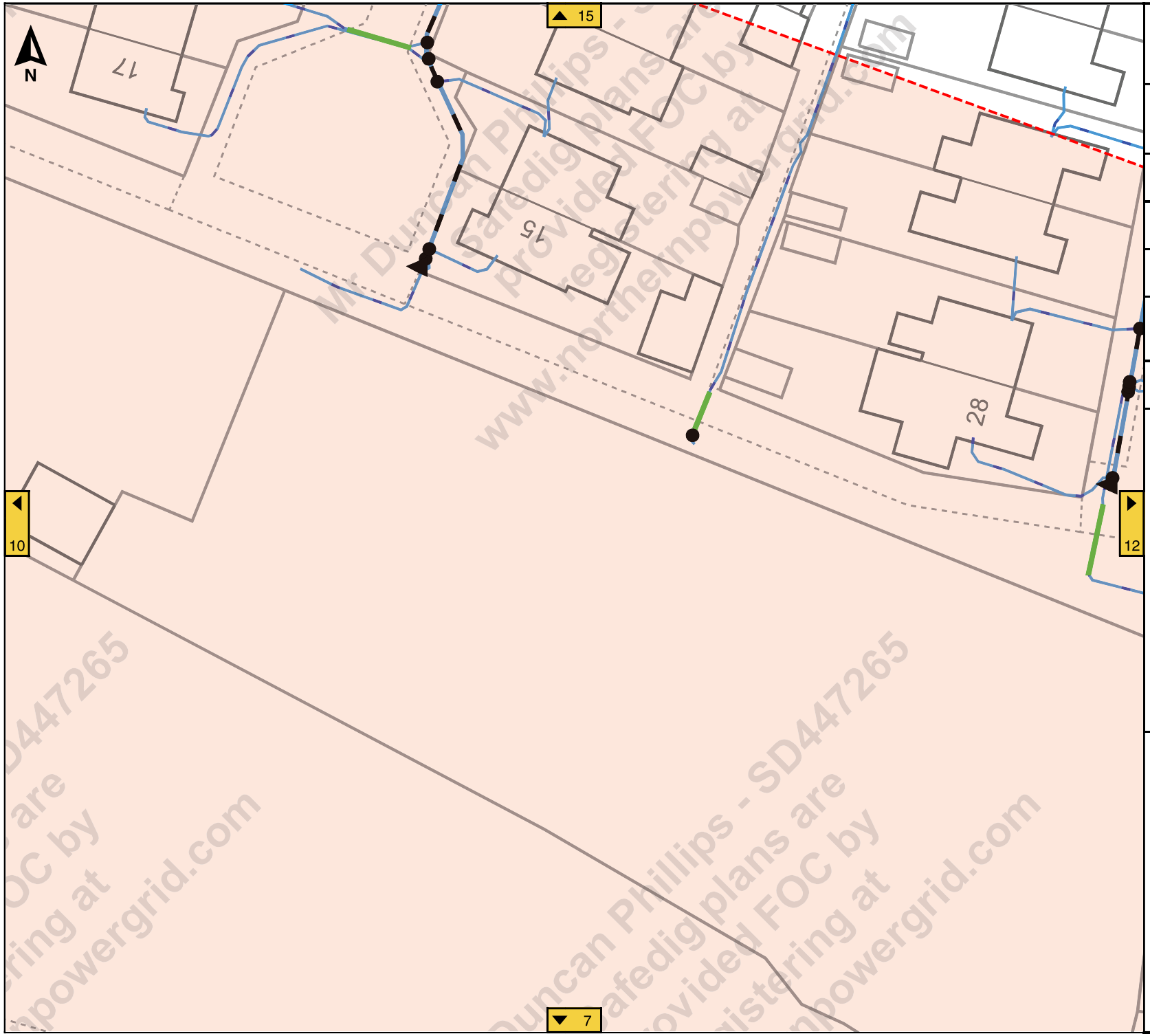
- 132kV
- 66kV
- 33kV
- 25kV
- Left In Situ
- LV Mains
- LV Service Assumed Route
- LV Service Logical Connection
- Duct Route
- 20kV
- 11kV
- 6kV
- 3kV
- Aux
- LV Service

Overhead Conductors:

- 132kV
- 66kV
- 33kV
- 25kV
- LV Mains
- LV Service
- 20kV
- 11kV
- 6kV
- 3kV
- Aux

0 5 10 15 20m

www.northernpowergrid.com - SD447265 - Mr Duncan Phillips - Safedig plans are provided FOC by registering at www.northernpowergrid.com




NORTHERN POWERGRID

Job Reference : SD447265

3315

Scale : 1:500

Grid Coordinates : 440688 404203

Date : 24/02/2021

Produced For :
Mr Duncan Phillips



Terms and Conditions

Electric cables and/or overhead line information shown on the record plans are to be used in accordance with the Health & Safety Executive's Booklet HS(G)47, "Avoiding Danger from Underground Services" and Guidance Note GS 6, "Avoidance of Danger from Overhead Electric Lines".
Record plans do not always show out of commission cables or service cables from Northern Powergrid\'s mains to adjoining or cross road properties.
Plans do not show local authority owned public lighting or sign cables. The information is provided as a service by NorthernPowergrid and does not impart any legal obligation on their part.
Persons using it are reminded of their responsibility to execute works safely to avoid damaging Northern Powergrid\'s apparatus.

Further advice or assistance is available from the Records Information Centre on 0191 2294296
In an emergency or outside normal working hours contact our customer information centre on 0800 668877
Cable depths shown were correct at the time cables were laid however alterations to ground levels or cable disposition may have taken place.

Legend:

Underground Cables:

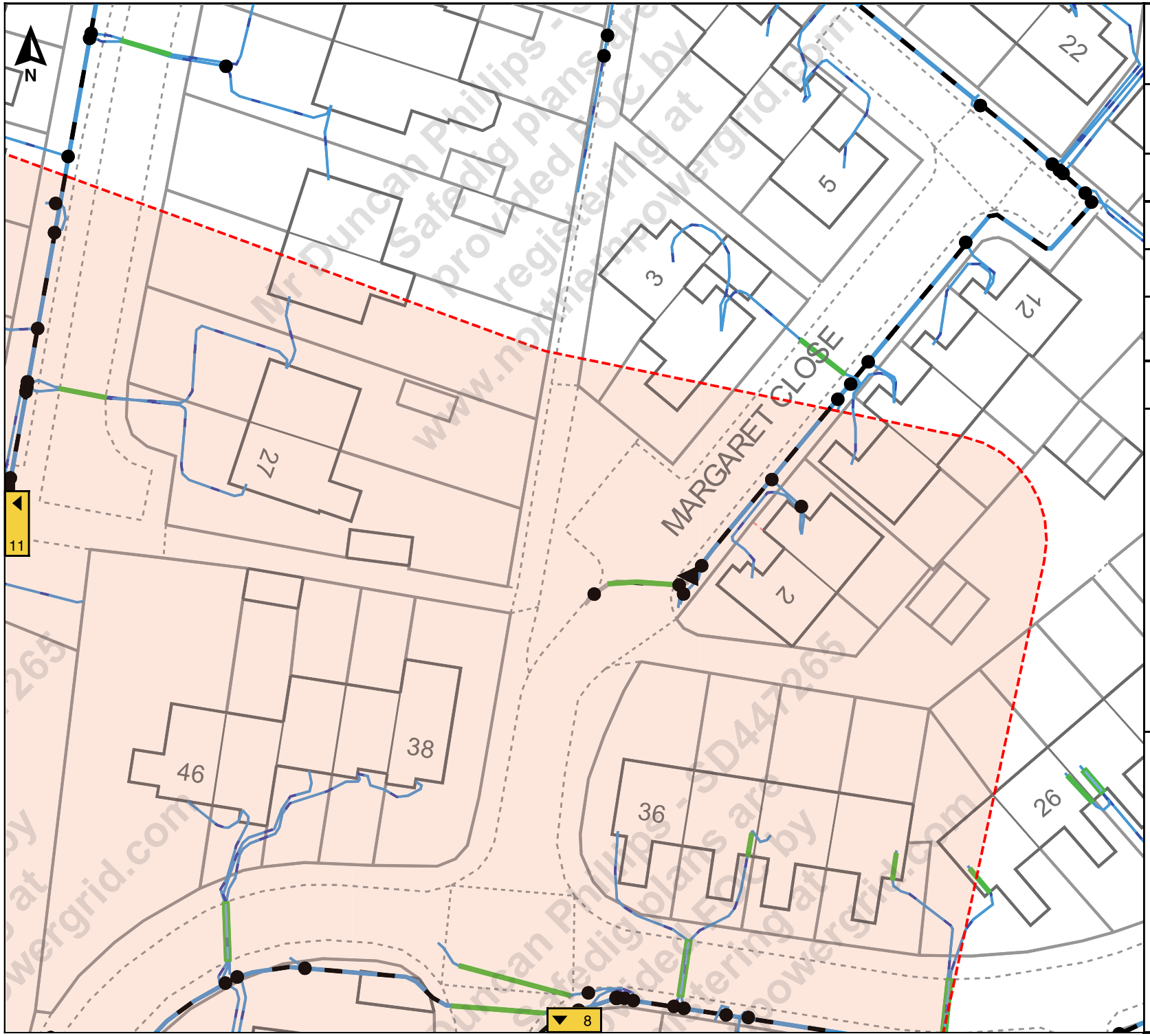
- 132kV
- 66kV
- 33kV
- 25kV
- Left In Situ
- LV Mains
- LV Service Assumed Route
- LV Service Logical Connection
- Duct Route
- 20kV
- 11kV
- 6kV
- 3kV
- Aux
- LV Service

Overhead Conductors:

- 132kV
- 66kV
- 33kV
- 25kV
- LV Mains
- LV Service
- 20kV
- 11kV
- 6kV
- 3kV
- Aux

0 5 10 15 20m

Mr Duncan Phillips - SD447265 Safedig plans are provided FOC by registering at www.northernpowergrid.com




NORTHERN POWERGRID

Job Reference : SD447265

3315

Scale : 1:500

Grid Coordinates : 440794 404203

Date : 24/02/2021

Produced For :
Mr Duncan Phillips



Terms and Conditions

Electric cables and/or overhead line information shown on the record plans are to be used in accordance with the Health & Safety Executive's Booklet HS(G)47, "Avoiding Danger from Underground Services" and Guidance Note GS 6, "Avoidance of Danger from Overhead Electric Lines".
Record plans do not always show out of commission cables or service cables from Northern Powergrid\'s mains to adjoining or cross road properties.
Plans do not show local authority owned public lighting or sign cables. The information is provided as a service by NorthernPowergrid and does not impart any legal obligation on their part.
Persons using it are reminded of their responsibility to execute works safely to avoid damaging Northern Powergrid\'s apparatus.

Further advice or assistance is available from the Records Information Centre on 0191 2294296
In an emergency or outside normal working hours contact our customer information centre on 0800 668877
Cable depths shown were correct at the time cables were laid however alterations to ground levels or cable disposition may have taken place.

Legend:

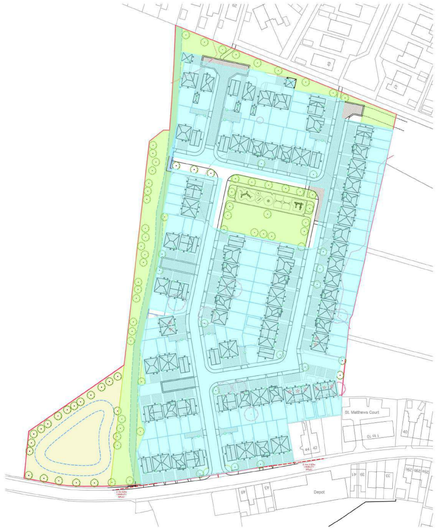
Underground Cables:
- 132kV
- 66kV
- 33kV
- 25kV
- Left In Situ
- LV Mains
- LV Service Assumed Route
- LV Service Logical Connection
- Duct Route
- 20kV
- 11kV
- 6kV
- 3kV
- Aux
- LV Service

Overhead Conductors:
- 132kV
- 66kV
- 33kV
- 25kV
- LV Mains
- LV Service
- 20kV
- 11kV
- 6kV
- 3kV
- Aux

0 5 10 15 20m

# Appendix C
# Proposed Site Plan

NET AREA




SALES AREA




DENBY = 16% FREE SALES UNIT
MAIDSTONE = 22% FREE SALES UNIT




SCHEDULE OF ACCOMMODATION

| AFFORDABLE | HOUSETYPE | AMOUNT |
|---|---|---|
| | TYPE 67<br>2 STOREY<br>2 BED/4 PERSON | 3 No. |
| | TYPE 69<br>2 STOREY<br>3 BED/5 PERSON | 7 No. |
| | AFFORDABLE TOTAL | 10 No |

| FREESALE | HOUSETYPE | AMOUNT |
|---|---|---|
| | MAIDSTONE<br>2 STOREY<br>3 BED/5 PERSON | 21 No. |
| | ELLERTON<br>2 STOREY<br>3 BED/5 PERSON | 19 No. |
| | MORESBY<br>2 STOREY<br>3 BED/5 PERSON<br>*EV CHARGE POINT PLOT SPECIFIC | 20 No. |
| | DENBY<br>2 STOREY<br>3 BED/5 PERSON | 15 No. |
| | WINDERMERE<br>2 STOREY<br>4 BED/8 PERSON | 10 No. |
| | HALTON<br>2 STOREY<br>4 BED/8 PERSON | 4 No. |
| | KINGSLEY<br>2 STOREY<br>4 BED/7 PERSON<br>*EV CHARGE POINT IN DETACHED GARAGE | 2 No. |
| | RADLEIGH<br>2 STOREY<br>4 BED/8 PERSON<br>*EV CHARGE POINT IN DETACHED GARAGE | 3 No. |
| | FREESALE TOTAL | 94 No |
| | **TOTAL** | **104 No** |

KEY

- SITE BOUNDARY
- 1.800m BRICK WALL
- 1.800m BRICK WALL & FENCE
- 1.800m TIMBER FENCE
- 900mm METAL RAILINGS
- 900mm FEATURE WALL
- ACCESS EASEMENT
- REAR ACCESS GATES (LOCKABLE)
- AFFORDABLE
- BIN COLLECTION POINTS
- BLOCK PAVING
- VISIBILITY SPLAYS
- REMOVED TREE
- ELECTRIC VEHICLE CHARGING POINT
- CYCLE STORAGE

# 01 / PROPOSED SITE LAYOUT

NORTH

1:500 SCALE
10m 50m

Do not scale off this drawing - Only figured dimensions to be taken from this drawing. Drawings based on Ordnance Survey and/or existing record drawings - Design and Drawing content subject to Site Survey, Structural Survey, Site Investigations, Planning and Statutory Requirements and Approvals.
Authorised reproduction from Ordnance Survey Map with permission of the Controller of Her Majesty's Stationery Office. Crown Copyright reserved.

jrp ARCHITECTURE | PLANNING | LANDSCAPE

14 MARINER COURT / CALDER PARK / WAKEFIELD / WF4 3FL
01924 383322 / www.jrpassoc.co.uk / info@jrpassoc.co.uk
jrpassociates is trading style of John R Parry Associates Limited

CLIENT: BARRATT LEEDS

PROJECT: PITT STREET, WOMBWELL BARNSLEY

DRAWING: PROPOSED SITE LAYOUT

DRAWING NUMBER: 20:5429:01

SCALE @ A0: 1:500

DRAWN: THS DATE: 13.04.21

CHECKED: LM/SD DATE: 13.04.21

# Appendix D
# Topographic Survey


| Station | Easting | Northing | Level |
|---|---|---|---|
| RT01 | 440453.125 | 404024.712 | 32.293 |
| RT03 | 440576.409 | 404265.255 | 36.656 |
| S1 | 440456.463 | 404016.033 | 30.096 |
| S2 | 440557.837 | 404040.971 | 29.247 |
| S3 | 440629.826 | 404047.842 | 29.043 |
| S4 | 440741.594 | 404010.434 | 26.903 |
| S5 | 440332.216 | 404031.566 | 31.344 |
| S6 | 440225.012 | 404054.799 | 33.019 |
| S7 | 440112.828 | 404096.470 | 33.755 |
| S8 | 440163.071 | 404092.012 | 34.058 |
| S10 | 440589.822 | 404259.212 | 34.944 |
| S11 | 440515.703 | 404287.727 | 35.315 |
| S12 | 440671.493 | 404224.740 | 33.931 |
| S4A | 440770.244 | 404018.612 | 26.989 |

| REV. NO. | DESCRIPTION TO REVISION | REV. BY | DATE |
|---|---|---|---|
| A | | | |
| B | | | |
| C | | | |
| D | | | |

**NOTES:**

TERRA MEASUREMENT

3D SURVEY AND MEASUREMENT SPECIALISTS


Telephone +44 (0)1773 790080
Email info@terrameasurement.com
Website www.terrameasurement.com


Survey, Measurement and Specialist Solutions for:
Design - Construction - Refurbishment - Urban & Rural Development
Rail & Highway Infrastructure - Minerals Industry - Civil Engineering
Commercial & Retail - Maritime - Large Scale Fabrication - Heritage
Please follow us on: Twitter, Instagram, Facebook and LinkedIn

**CLIENT:** BARRATT & DAVID WILSON HOMES, YORKSHIRE WEST

**PROJECT:** PITT STREET, DARFIELD, BARNSLEY, S73 8AS

**TITLE:** TOPOGRAPHICAL SURVEY SHEET 1 OF 6

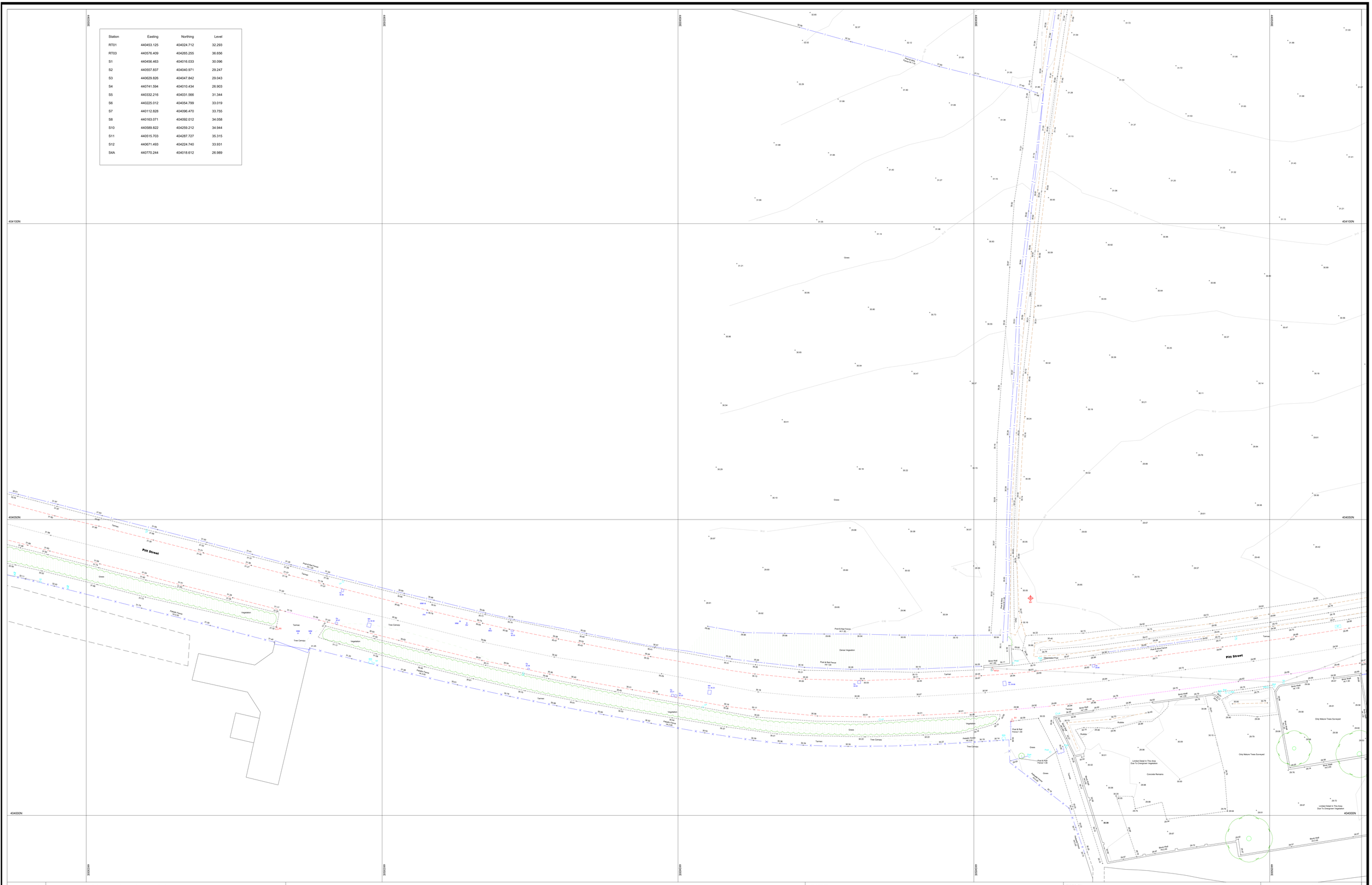
**DATE:** 01.03.2021

| GRID: | LEVEL: | DATA TYPE: | OTHER DATA AVAILABLE: |
|---|---|---|---|
| ORDNANCE SURVEY | ORDNANCE SURVEY | 2D | 3D ACAD - YES<br>3D GROUND MODEL - YES<br>POINT CLOUD - NO<br>SECTIONS - YES<br>CUT & FILL ANALYSIS - YES |
| **DRAWN BY:** TB | **SCALE @ AO:** 1:200 | **PROJECT NO.:** 3315 | **DRAWING NAME:** 3315_PITT STREET TOPOGRAPHICAL SURVEY |

**REV.**

N
W
E
S

| Station | Easting | Northing | Level |
|---|---|---|---|
| RT01 | 440453.125 | 404024.712 | 32.293 |
| RT03 | 440576.409 | 404265.255 | 36.656 |
| S1 | 440456.463 | 404016.033 | 30.096 |
| S2 | 440557.837 | 404040.971 | 29.247 |
| S3 | 440629.826 | 404047.842 | 29.043 |
| S4 | 440741.594 | 404010.434 | 26.903 |
| S5 | 440332.216 | 404031.566 | 31.344 |
| S6 | 440225.012 | 404054.799 | 33.019 |
| S7 | 440112.828 | 404096.470 | 33.755 |
| S8 | 440163.071 | 404092.012 | 34.058 |
| S10 | 440589.822 | 404259.212 | 34.944 |
| S11 | 440515.703 | 404287.727 | 35.315 |
| S12 | 440671.493 | 404224.740 | 33.931 |
| S4A | 440770.244 | 404018.612 | 26.989 |




| REV. NO. | DESCRIPTION TO REVISION | REV. BY | DATE |
|---|---|---|---|
| A | | | |
| B | | | |
| C | | | |
| D | | | |

NOTES:

TERRA MEASUREMENT

3D SURVEY AND MEASUREMENT SPECIALISTS


Telephone +44 (0)1773 790080
Email info@terrameasurement.com
Website www.terrameasurement.com


Survey, Measurement and Specialist Solutions for:
Design - Construction - Refurbishment - Urban & Rural Development
Rail & Highway Infrastructure - Minerals Industry - Civil Engineering
Commercial & Retail - Maritime - Large Scale Fabrication - Heritage
Please follow us on: Twitter, Instagram, Facebook and LinkedIn

**CLIENT:** BARRATT & DAVID WILSON HOMES, YORKSHIRE WEST

**PROJECT:** PITT STREET, DARFIELD, BARNSLEY, S73 8AS

**TITLE:** TOPOGRAPHICAL SURVEY SHEET 2 OF 6

**DATE:** 01.03.2021

N W E S

| | | | |
|---|---|---|---|
| GRID: ORDNANCE SURVEY | LEVEL: ORDNANCE SURVEY | DATA TYPE: 2D | OTHER DATA AVAILABLE: 3D GROUND MODEL - YES POINT CLOUD - NO SECTIONS - YES CUT & FILL ANALYSIS - YES |
| DRAWN BY: TB | SCALE @ A0: 1:200 | PROJECT NO.: 3315 | DRAWING NAME: 3315_PITT STREET TOPOGRAPHICAL SURVEY |

REV.

| Station | Easting | Northing | Level |
|---|---|---|---|
| RT01 | 440453.125 | 404024.712 | 32.293 |
| RT03 | 440576.409 | 404265.255 | 36.656 |
| S1 | 440456.463 | 404016.033 | 30.096 |
| S2 | 440557.837 | 404040.971 | 29.247 |
| S3 | 440629.826 | 404047.842 | 29.043 |
| S4 | 440741.594 | 404010.434 | 26.903 |
| S5 | 440332.216 | 404031.566 | 31.344 |
| S6 | 440225.012 | 404054.799 | 33.019 |
| S7 | 440112.828 | 404096.470 | 33.755 |
| S8 | 440163.071 | 404092.012 | 34.058 |
| S10 | 440589.822 | 404259.212 | 34.944 |
| S11 | 440515.703 | 404287.727 | 35.315 |
| S12 | 440671.493 | 404224.740 | 33.931 |
| S4A | 440770.244 | 404018.612 | 26.989 |

| REV. NO. | DESCRIPTION TO REVISION | REV. BY | DATE |
|---|---|---|---|
| A | | | |
| B | | | |
| C | | | |
| D | | | |

NOTES:

TERRA MEASUREMENT

3D SURVEY AND MEASUREMENT SPECIALISTS


Telephone +44 (0)1773 790080
Email info@terrameasurement.com
Website www.terrameasurement.com


Survey, Measurement and Specialist Solutions for:
Design - Construction - Refurbishment - Urban & Rural Development
Rail & Highway Infrastructure - Minerals Industry - Civil Engineering
Commercial & Retail - Maritime - Large Scale Fabrication - Heritage
Please follow us on: Twitter, Instagram, Facebook and LinkedIn

CLIENT:
**BARRATT & DAVID WILSON HOMES, YORKSHIRE WEST**

PROJECT:
**PITT STREET**
**DARFIELD**
**BARNSLEY**
**S73 8AS**

TITLE:
**TOPOGRAPHICAL SURVEY**
**SHEET 3 OF 6**

DATE:
**01.03.2021**

| | | | |
|---|---|---|---|
| GRID: ORDNANCE SURVEY | LEVEL: ORDNANCE SURVEY | DATA TYPE: 2D | OTHER DATA AVAILABLE: 3D ACAD - YES 3D GROUND MODEL - YES POINT CLOUD - NO SECTIONS - YES CUT & FILL ANALYSIS - YES |
| DRAWN BY: TB | SCALE @ AO: 1:200 | PROJECT NO.: 3315 | DRAWING NAME: 3315_PITT STREET TOPOGRAPHICAL SURVEY |

REV.

N
W E
S

| Station | Easting | Northing | Level |
|---|---|---|---|
| RT01 | 440453.135 | 406024.712 | 32.293 |
| RT03 | 440579.409 | 406065.265 | 36.656 |
| S1 | 440456.483 | 406016.033 | 30.096 |
| S2 | 440557.837 | 406045.971 | 29.247 |
| S3 | 440609.826 | 406047.842 | 29.043 |
| S4 | 440741.094 | 406016.434 | 26.903 |
| S5 | 440332.316 | 406013.566 | 31.944 |
| S6 | 440226.072 | 406054.799 | 33.079 |
| S7 | 440117.828 | 406054.799 | 33.755 |
| S8 | 440109.071 | 406050.072 | 34.056 |
| S10 | 440509.822 | 406239.272 | 34.944 |
| S11 | 440515.703 | 406287.727 | 35.315 |
| S12 | 440971.493 | 406226.740 | 33.931 |
| SAA | 440770.244 | 406016.612 | 26.889 |

| REV. NO. | DESCRIPTION TO REVISION | REV. BY | DATE |
|---|---|---|---|
| A | | | |
| B | | | |
| C | | | |
| D | | | |

NOTES:

TERRA MEASUREMENT

3D SURVEY AND MEASUREMENT SPECIALISTS


Telephone +44 (0)1773 790080
Email info@terrameasurement.com
Website www.terrameasurement.com


Survey, Measurement and Specialist Solutions for:
Design - Construction - Refurbishment - Urban & Rural Development
Rail & Highway Infrastructure - Minerals Industry - Civil Engineering
Commercial & Retail - Maritime - Large Scale Fabrication - Heritage
Please Follow us on: Twitter, Instagram, Facebook and LinkedIn

CLIENT:
**BARRATT & DAVID WILSON HOMES, YORKSHIRE WEST**

PROJECT:
**PITT STREET**
**DARFIELD**
**BARNSLEY**
**S73 8AS**

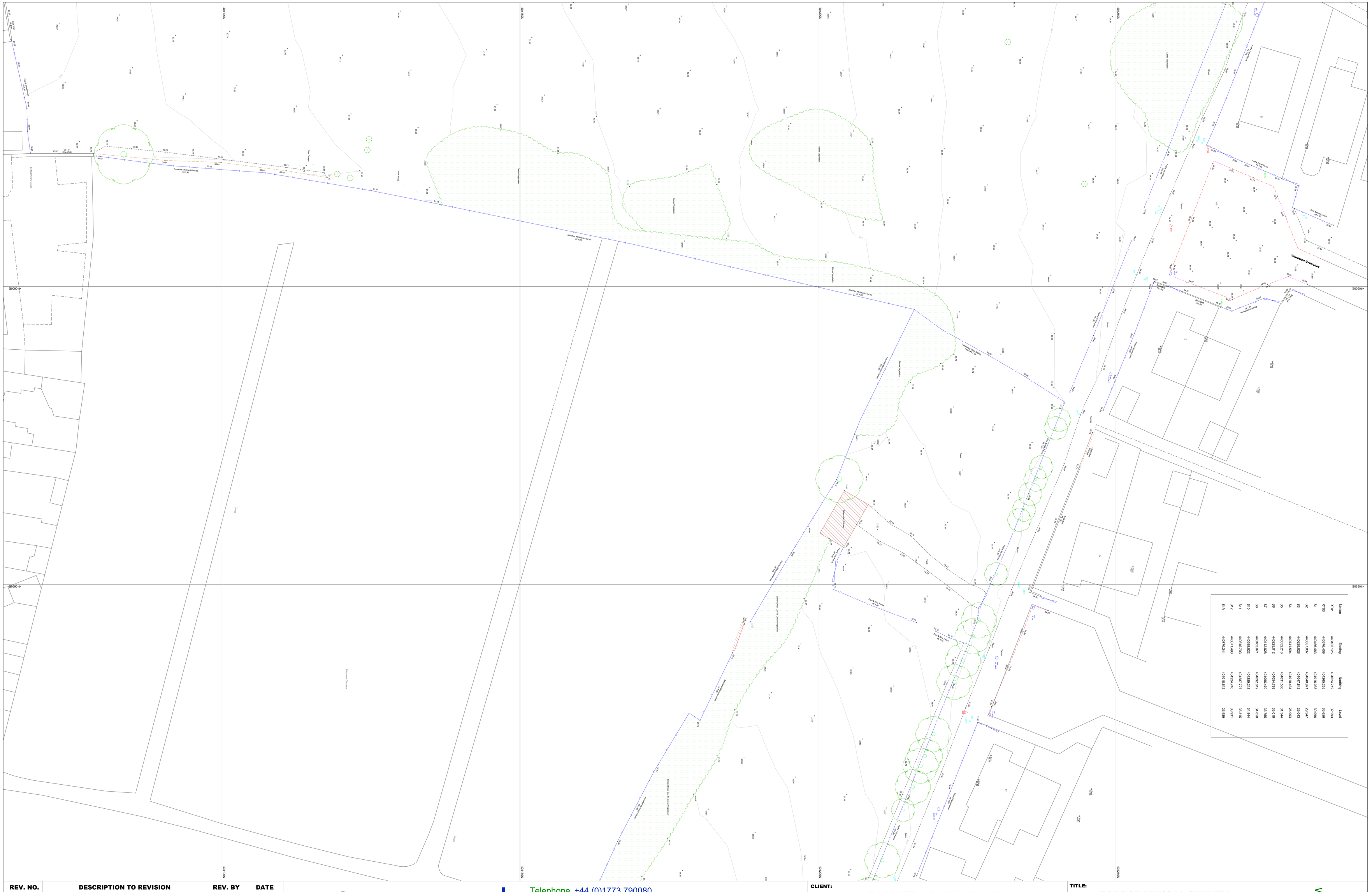
TITLE:
# TOPOGRAPHICAL SURVEY SHEET 4 OF 6

DATE: **01.03.21**

| | | | |
|---|---|---|---|
| GRID: ORDNANCE SURVEY | LEVEL: ORDNANCE SURVEY | DATA TYPE: 2D | OTHER DATA AVAILABLE: 3D AECAD - YES 3D GROUND MODEL - YES POINT CLOUD - NO SECTIONS - YES CUT & FILL ANALYSIS - YES |
| DRAWN BY: TB | SCALE @ AO: 1:200 | PROJECT NO.: 3325 | DRAWING NAME: 3315_PITT STREET_TOPOGRAPHICAL SURVEY |

REV.

N W S E




| REV. NO. | DESCRIPTION TO REVISION | REV. BY | DATE |
|---|---|---|---|
| A | | | |
| B | | | |
| C | | | |
| D | | | |

NOTES:


TERRA MEASUREMENT

3D SURVEY AND MEASUREMENT SPECIALISTS

Telephone +44 (0)1773 790080
Email info@terrameasurement.com
Website www.terrameasurement.com

Survey, Measurement and Specialist Solutions for:
Design - Construction - Refurbishment - Urban & Rural Development
Rail & Highway Infrastructure - Minerals Industry - Civil Engineering
Commercial & Retail - Maritime - Large Scale Fabrication - Heritage
Please Follow us on: Twitter, Instagram, Facebook and LinkedIn


**CLIENT:** BARRATT & DAVID WILSON HOMES, YORKSHIRE WEST

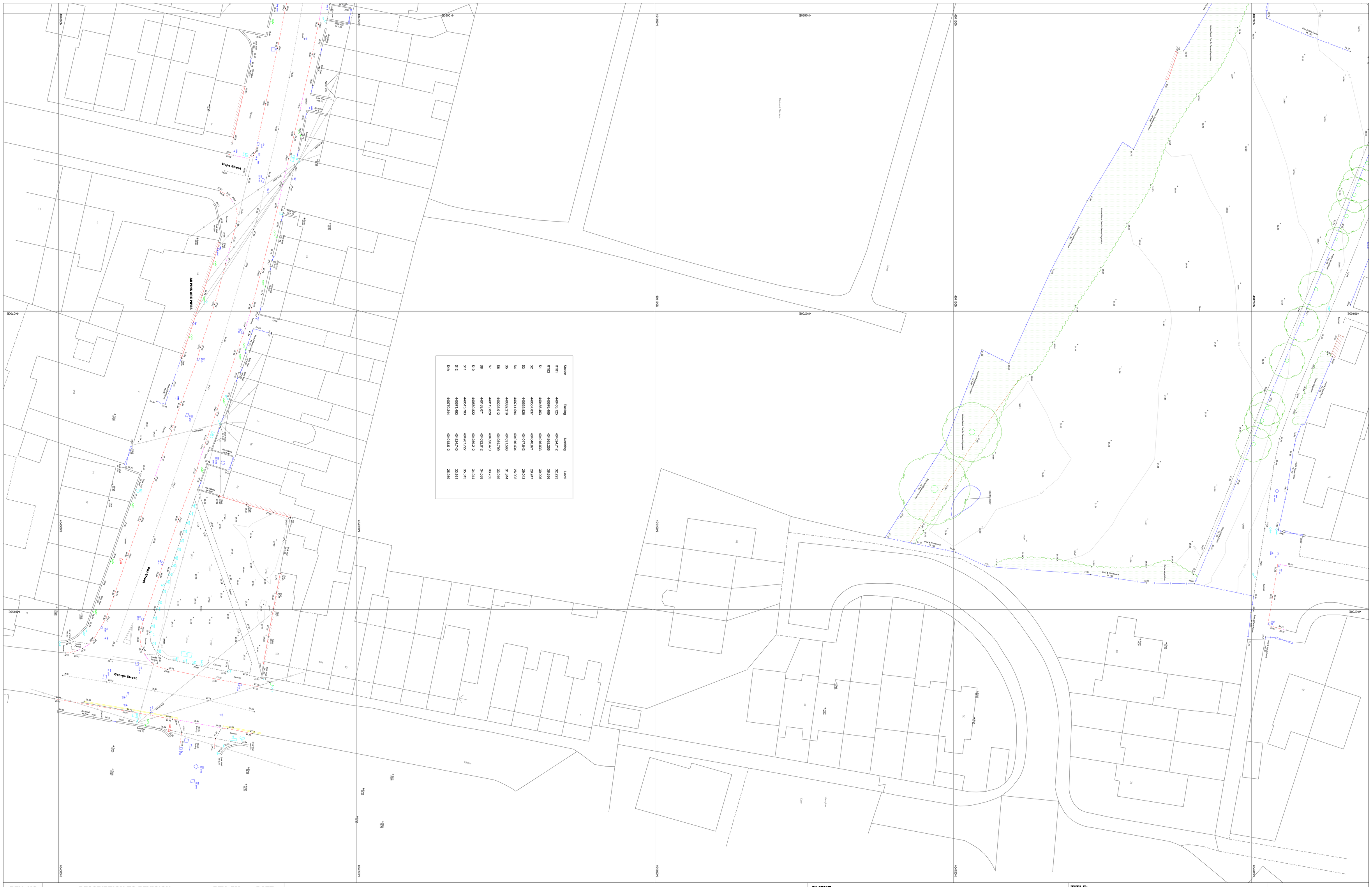
**PROJECT:** PITT STREET, DARFIELD, BARNSLEY, S73 8AS

**TITLE:** TOPOGRAPHICAL SURVEY SHEET 5 OF 6

**DATE:** 01.03.2021

| GRID: | LEVEL: | DATA TYPE: | OTHER DATA AVAILABLE: |
|---|---|---|---|
| ORDNANCE SURVEY | ORDNANCE SURVEY | 2D | 3D AGAD - YES<br>3D TERRAIN MODEL - YES<br>POINT CLOUD - NO<br>SECTIONS - YES<br>CUT & FILL ANALYSIS - YES |
| DRAWN BY: TB | SCALE @ A0: 1:200 | PROJECT NO.: 3325 | DRAWING NAME: 3315_PITT STREET_TOPOGRAPHICAL SURVEY |

REV.




| Station | Easting | Northing | Level |
|---|---|---|---|
| RT01 | 440453.125 | 404024.712 | 32.293 |
| RT03 | 440576.409 | 404285.255 | 36.656 |
| S1 | 440456.463 | 404016.033 | 30.096 |
| S2 | 440557.837 | 404040.971 | 29.247 |
| S3 | 440629.826 | 404047.842 | 29.043 |
| S4 | 440741.594 | 404010.434 | 26.903 |
| S5 | 440332.216 | 404031.566 | 31.344 |
| S6 | 440225.012 | 404054.799 | 33.019 |
| S7 | 440112.828 | 404096.470 | 33.755 |
| S8 | 440163.071 | 404092.012 | 34.058 |
| S10 | 440589.822 | 404259.212 | 34.944 |
| S11 | 440515.703 | 404287.727 | 35.315 |
| S12 | 440671.493 | 404224.740 | 33.931 |
| S4A | 440770.244 | 404018.612 | 26.989 |

| REV. NO. | DESCRIPTION TO REVISION | REV. BY | DATE |
|---|---|---|---|
| A | | | |
| B | | | |
| C | | | |
| D | | | |

NOTES:

TERRA MEASUREMENT

3D SURVEY AND MEASUREMENT SPECIALISTS


Telephone +44 (0)1773 790080
Email info@terrameasurement.com
Website www.terrameasurement.com


Survey, Measurement and Specialist Solutions for:
Design - Construction - Refurbishment - Urban & Rural Development
Rail & Highway Infrastructure - Minerals Industry - Civil Engineering
Commercial & Retail - Maritime - Large Scale Fabrication - Heritage
Please Follow us on: Twitter, Instagram, Facebook and LinkedIn

CLIENT: BARRATT & DAVID WILSON HOMES, YORKSHIRE WEST

PROJECT: PITT STREET DARFIELD BARNSLEY S73 8AS

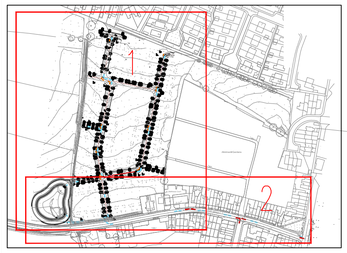
TITLE: TOPOGRAPHICAL SURVEY SHEET 6 OF 6

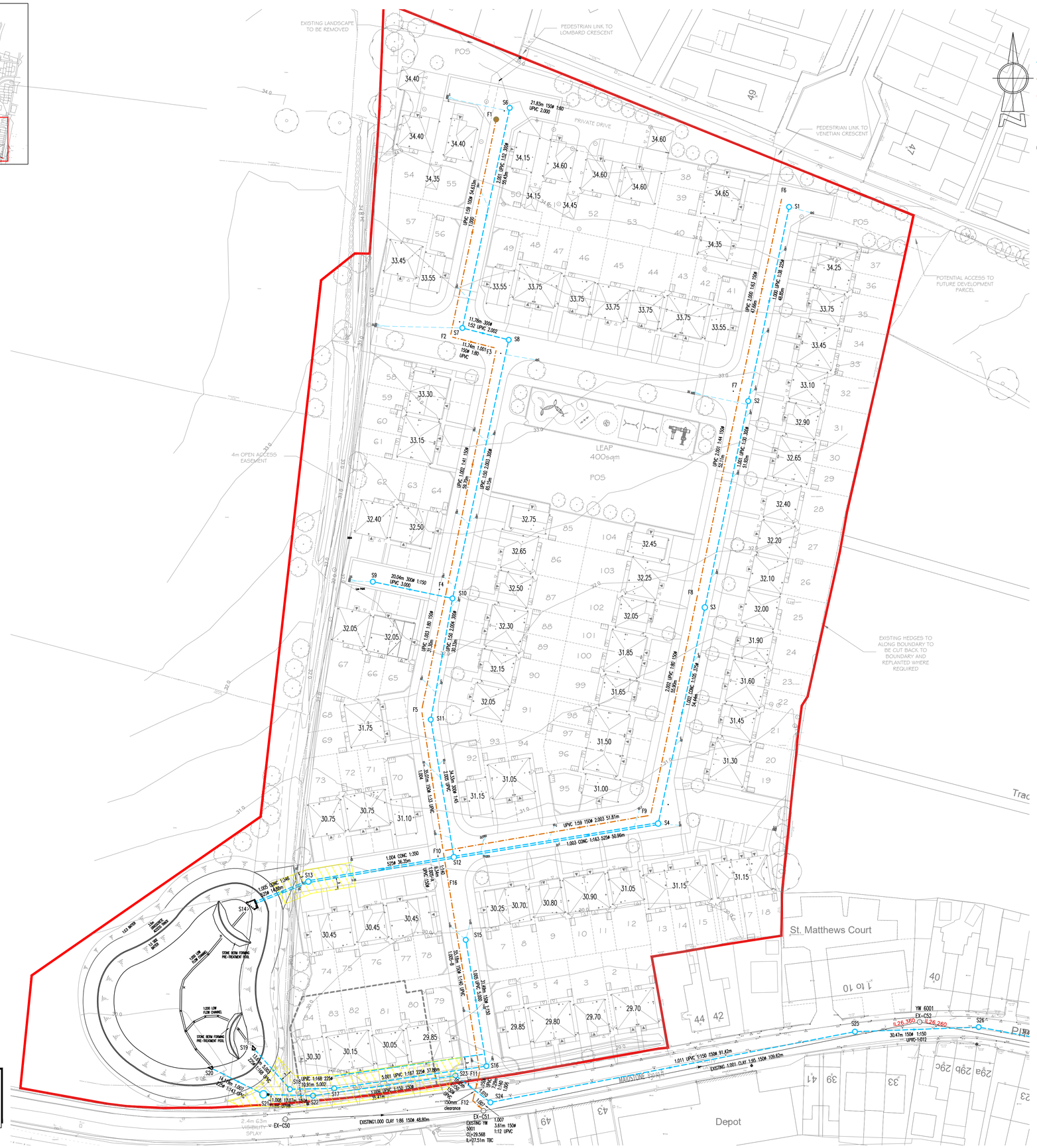
DATE: 01.03.2021

| GRID: ORDNANCE SURVEY | LEVEL: ORDNANCE SURVEY | DATA TYPE: 2D | OTHER DATA AVAILABLE: 3D ACAD - YES 3D GROUND MODEL - YES POINT CLOUD - NO SECTIONS - YES CUT & FILL ANALYSIS - YES |
|---|---|---|---|
| DRAWN BY: TB | SCALE @ AO: 1:200 | PROJECT NO.: 3325 | DRAWING NAME: 3315_PITT STREET_TOPOGRAPHICAL SURVEY |

REV.

# Appendix E
# ARP Drawings
# Drainage Strategy
# Flood Routing




## K E Y

- Storm water manhole
- Foul water manhole
- Storm water sewer
- Foul water sewer
- Combined sewer
- G — Gully
- YG — Yard gully
- CD — Channel Drain (min B125 grade cover)
- Easement

## N O T E S

ATTENTION IS DRAWN TO THE REQUIREMENTS OF THE CONSTRUCTION DESIGN AND MANAGEMENT REGULATIONS 2015 AND THE DUTIES AND RESPONSIBILITIES CONTAINED THEREIN

1. For longitudinal sections refer to drawing 1048/141/06.
2. No services are to be sited directly over, or within 1m of, an adoptable sewer or manhole.
3. Private drainage connections to adoptable sewers to be via 45° junction.
4. Off site manholes already built must have invert levels checked prior to connection to the off site drainage.
5. Any connections to existing sewers/manholes are to be supervised by Yorkshire Water.
6. All connections to proposed public sewers to be minimum 150mmø.
7. Any land drain or water course on site to be diverted as not to pass under proposed buildings. Diversion to be approved and inspected on site by the Local Authority.

Yorkshire Water General Notes

1. All adoptable sewer works and material to be in accordance with the Code for Adoptions 2020 design and construction guidance, the relevant British/European and Yorkshire Water's Standards/Requirements/Addendum to the Mechanical and Electrical Specification and Kitemarked.
2. Manhole covers shall/must have a clear opening of 600mm and shall be Class D400 to BS EN 124 with 150mm deep frames in highways.
3. Filled ground must be filled and consolidated under the supervision, and to the satisfaction, of Yorkshire Water before any sewer works are carried out.
4. Cover slabs must carry the BSI Kitemark or will be rejected by the Yorkshire Water inspector. Where the clear opening of the Kitemarked product is different to that of the cover and frame, a loading bearing slab should be fitted above the cover slab to bring the size down to 600x600mm for the Yorkshire Water specified cover size. Please refer to the Concrete Pipe Systems Association (CPSA), 'Technical Bulletin' issued autumn 2004 for kitemarked cover slab opening sizes.
5. The adoptable sewers should be a minimum of 1m and manholes 0.5m from kerb faces and service margins.
6. Sewers must have 5 metres clearance from trees and hedges, (please also refer to 5.1.10 in Code for Adoption 2020 for restrictions on tree planting adjacent to Sewers).
7. Sewers to be laid in Class "S" bedding (150mm granular bed and surround). Where depth of cover to top of the sewer is less than 1.2m in highways and verges (or less than 900mm in none vehicular access areas) then a concrete slab should be provided above the granular bed and surround.
8. Adoptable plastic sewer pipes to be BSI Kitemarked (Certified to WIS 4-35-01 and BS/EN13476). Adoptable sewer pipes to be laid in maximum 3 metre lengths unless there is a specific operational need to lay longer.
9. Plastic channel sections in manholes are not acceptable and clayware is preferable. Plastic channels are difficult to set in concrete and a satisfactory finish cannot be obtained on the benching.
10. The chamber size of manholes with more than one connection in them may need to be increased an increment to accommodate the connections and bends.
11. Yorkshire Water policy is not to accept Type "C" brick manhole and 1050mm dia manhole rings. Instead it is preferred that you use a type "B" manhole with 1200mm dia or 1500mm dia. rings, with the opening sited over the channel where depth of cover to pipe soffit is 1-1.5m.
12. Surface water and foul rising mains to be provided with marker tape above the rising mains.
13. If plastic pipes are to be used then the following should apply:-
    a. All adoptable sewers to be BSI Kitemark (certified to WIS 4-35-01).
    b. Bedding and backfill material to conform to the requirements of Water industry Specification 4-08-02 (Table A2)
14. Where plastic pipes are proposed for adoptable sewers, structural calculations for the plastic pipes and a site investigation report to prove that the ground condition is suitable for the plastic pipes are to be produced.
15. Where plastic pipes are installed into the ground prior to getting full technical approval, the developer must provide a CCTV survey of the prospectively adoptable sewers and a deformation test (Light-Line test) of the plastic pipes.
16. Demarcation chambers to be a min. 450mmø chamber for 100mmø foul & 150mmø surface water pipes up to 1.2m deep. For depths greater than 1.2m, restricted access opening to 350mm is required for safety reasons.
17. Maximum depth of demarcation chamber to be 2m, where depth exceeds 2m, manhole to be constructed as type B manhole.
18. Where a B125 cover and frame has been approved, this must not be coated in plastic and must have lifting eyes suitably sizes to accommodate standard lifting keys. Screw down covers are not acceptable.
19. Yorkshire Water is not obliged to accept filter drain/land drainage runoff into the public sewer network or adoptable drainage system (directly or in-directly). An alternative method of disposal of the land drainage runoff will therefore be required and you will have to liaise with the Land Drainage Authority/Land Drainage Section with regard to the disposal of the filter drain/land drainage runoff is required.
20. Sulphate resisting cement (C20-DC2) and precast concrete products must be used or a laboratory report provided proving that such precautions are not necessary.
21. Strength of vitrified clay pipes (if used) to be 40KN/m for 100ø, 40KN/m for 150ø, 45KN/m for 225ø and 72KN/m for 300ø. All concrete pipes to be Class 120 concrete to EN 1916/BS 5911-1:2002.
22. All levels of existing drainage to be confirmed prior to work commencing on site.
23. The contractor must allow for any fee's required for road and sewer opening permits, sewer connections and make the appropriate applications.
24. There should be enough clearance to accommodate the bedding for both pipes, approx 300mm: If crossover is near rocker then the clearance needed may be increased.

| Rev | By | Date | Revision | Chk | Apvd |
|---|---|---|---|---|---|
| / | MB | 08.07.21 | Issued for approval | AT | AT |

ARP ASSOCIATES
Chartered Consulting Engineers
Northwest House ● 5 & 6 Northwest Business Park ● Servia Hill, Leeds ● LS6 2QH
☎ 0113 245 8498 OR 0113 244 3864 ✉ leeds@arpassociates.co.uk ⊕ www.arpassociates.co.uk
ARP Associates is a trading division of ARP Geotechnical Ltd, a company registered in England and Wales with company number 3771811, whose registered office is at 5/6 Northwest Business Park, Servia Hill, Leeds LS6 2QH

NOTE
Lateral sewers to be Plastidrain (110 & 160 O.D.) in UPVC and manufactured by Hepworth or similar approved by Yorkshire Water. Demarcation chamber to be polypropylene Non-Entry Inspection Chamber up to 2.0m depth manufactured by Wavin or similar approved by Yorkshire Water to BS EN 13598-1:2003.

SUBJECT TO THE APPROVAL OF ALL RELEVANT AUTHORITIES

TITLE
# DRAINAGE STRATEGY LAYOUT SHEET (1 OF 2)

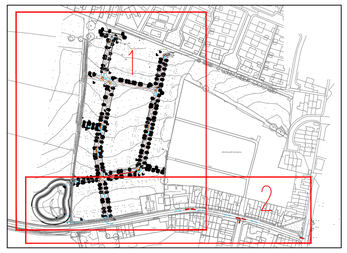
PROJECT
PITT STREET
DARFIELD

CLIENT
BDW YORKSHIRE WEST

DRAWING STATUS
PRELIMINARY

| Scale | Date | Drawn |
|---|---|---|
| 1:500 @ A1 | JULY 21 | MB |
| | | Chk. AT |

Drg. No. 1048/141/SK06.01 Rev /




NOTE
Lateral sewers to be Plastidrain (110 & 160 O.D.) in UPVC and manufactured by Hepworth or similar approved by Yorkshire Water. Demarcation chamber to be polypropylene Non-Entry Inspection Chamber up to 2.0m depth manufactured by Wavin or similar approved by Yorkshire Water to BS EN 13598-1:2003.

- Storm water manhole
- Foul water manhole
- Storm water sewer
- Foul water sewer
- Combined sewer
- Gully (G)
- Yard gully (YG)
- Channel Drain (min B125 grade cover) (CD)
- Easement




SUBJECT TO THE APPROVAL OF ALL RELEVANT AUTHORITIES

# N O T E S

ATTENTION IS DRAWN TO THE REQUIREMENTS OF THE CONSTRUCTION DESIGN AND MANAGEMENT REGULATIONS 2015 AND THE DUTIES AND RESPONSIBILITIES CONTAINED THEREIN

1. For longitudinal sections refer to drawing 1048/141/06.
2. No services are to be sited directly over, or within 1m of, an adoptable sewer or manhole.
3. Private drainage connections to adoptable sewers to be via 45° junction.
4. Off site manholes already built must have invert levels checked prior to connection to the off site drainage.
5. Any connections to existing sewers/manholes are to be supervised by Yorkshire Water.
6. All connections to proposed public sewers to be minimum 150mmø.
7. Any land drain or water course on site to be diverted as not to pass under proposed buildings. Diversion to be approved and inspected on site by the Local Authority.

Yorkshire Water General Notes

1. All adoptable sewer works and material to be in accordance with the Code for Adoptions 2020 design and construction guidance, the relevant British/European and Yorkshire Water's Standards/Requirements/Addendum to the Mechanical and Electrical Specification and Kitemarked.
2. Manhole covers shall/must have a clear opening of 600mm and shall be Class D400 to BS EN 124 with 150mm deep frames in highways.
3. Filled ground must be filled and consolidated under the supervision, and to the satisfaction, of Yorkshire Water before any sewer works are carried out.
4. Cover slabs must carry the BSI Kitemark or will be rejected by the Yorkshire Water inspector. Where the clear opening of the Kitemarked product is different to that of the cover and frame, a loading bearing slab should be fitted above the cover slab to bring the size down to 600x600mm for the Yorkshire Water specified cover size. Please refer to the Concrete Pipe Systems Association (CPSA), 'Technical Bulletin' issued autumn 2004 for kitemarked cover slab opening sizes.
5. The adoptable sewers should be a minimum of 1m and manholes 0.5m from kerb faces and service margins.
6. Sewers must have 5 metres clearance from trees and hedges, (please also refer to 5.1.10 in Code for Adoption 2020 for restrictions on tree planting adjacent to Sewers).
7. Sewers to be laid in Class "S" bedding (150mm granular bed and surround). Where depth of cover to top of the sewer is less than 1.2m in highways and verges (or less than 900mm in none vehicular access areas) then a concrete slab should be provided above the granular bed and surround.
8. Adoptable plastic sewer pipes to be BSI Kitemarked (Certified to WIS 4-35-01 and BS/EN13476). Adoptable sewer pipes to be laid in maximum 3 metre lengths unless there is a specific operational need to lay longer.
9. Plastic channel sections in manholes are not acceptable and clayware is preferable. Plastic channels are difficult to set in concrete and a satisfactory finish cannot be obtained on the benching.
10. The chamber size of manholes with more than one connection in them may need to be increased an increment to accommodate the connections and bends.
11. Yorkshire Water policy is not to accept Type "C" brick manhole and 1050mm dia manhole rings. Instead it is preferred that you use a type "B" manhole with 1200mm dia or 1500mm dia. rings, with the opening sited over the channel where depth of cover to pipe soffit is 1-1.5m.
12. Surface water and foul rising mains to be provided with marker tape above the rising mains.
13. If plastic pipes are to be used then the following should apply:-
    a. All adoptable sewers to be BSI Kitemark (certified to WIS 4-35-01).
    b. Bedding and backfill material to conform to the requirements of Water industry Specification 4-08-02 (Table A2)
14. Where plastic pipes are proposed for adoptable sewers, structural calculations for the plastic pipes and a site investigation report to prove that the ground condition is suitable for the plastic pipes are to be produced.
15. Where plastic pipes are installed into the ground prior to getting full technical approval, the developer must provide a CCTV survey of the prospectively adoptable sewers and a deformation test (Light-Line test) of the plastic pipes.
16. Demarcation chambers to be a min. 450mmø chamber for 100mmø foul & 150mmø surface water pipes up to 1.2m deep. For depths greater than 1.2m, restricted access opening to 350mm is required for safety reasons.
17. Maximum depth of demarcation chamber to be 2m, where depth exceeds 2m, manhole to be constructed as type B manhole.
18. Where a B125 cover and frame has been approved, this must not be coated in plastic and must have lifting eyes suitably sizes to accommodate standard lifting keys. Screw down covers are not acceptable.
19. Yorkshire Water is not obliged to accept filter drain/land drainage runoff into the public sewer network or adoptable drainage system (directly or in-directly). An alternative method of disposal of the land drainage runoff will therefore be required and you will have to liaise with the Land Drainage Authority/Land Drainage Section with regard to the disposal of the filter drain/land drainage runoff is required.
20. Sulphate resisting cement (C20-DC2) and precast concrete products must be used or a laboratory report provided proving that such precautions are not necessary.
21. Strength of vitrified clay pipes (if used) to be 40KN/m for 100ø, 40KN/m for 150ø, 45KN/m for 225ø and 72KN/m for 300ø. All concrete pipes to be Class 120 concrete to EN 1916/BS 5911-1:2002.
22. All levels of existing drainage to be confirmed prior to work commencing on site.
23. The contractor must allow for any fee's required for road and sewer opening permits, sewer connections and make the appropriate applications.
24. There should be enough clearance to accommodate the bedding for both pipes, approx 300mm: If crossover is near rocker then the clearance needed may be increased.

| Rev | By | Date | Revision | Chk | Apvd |
|---|---|---|---|---|---|
| / | MB | 08.07.21 | Issued for approval | AT | AT |

ARP ASSOCIATES
Chartered Consulting Engineers
Northwest House ● 5 & 6 Northwest Business Park ● Servia Hill, Leeds ● LS6 2QH
☎ 0113 245 8498 🖷 0113 244 3864 ✉ leeds@arpassociates.co.uk 🌐 www.arpassociates.co.uk
ARP Associates is a trading division of ARP Geotechnical Ltd, a company registered in England and Wales with company number 3771811, whose registered office is at 5/6 Northwest Business Park, Servia Hill, Leeds LS6 2QH

TITLE
# DRAINAGE STRATEGY LAYOUT (SHEET 2 OF 2)

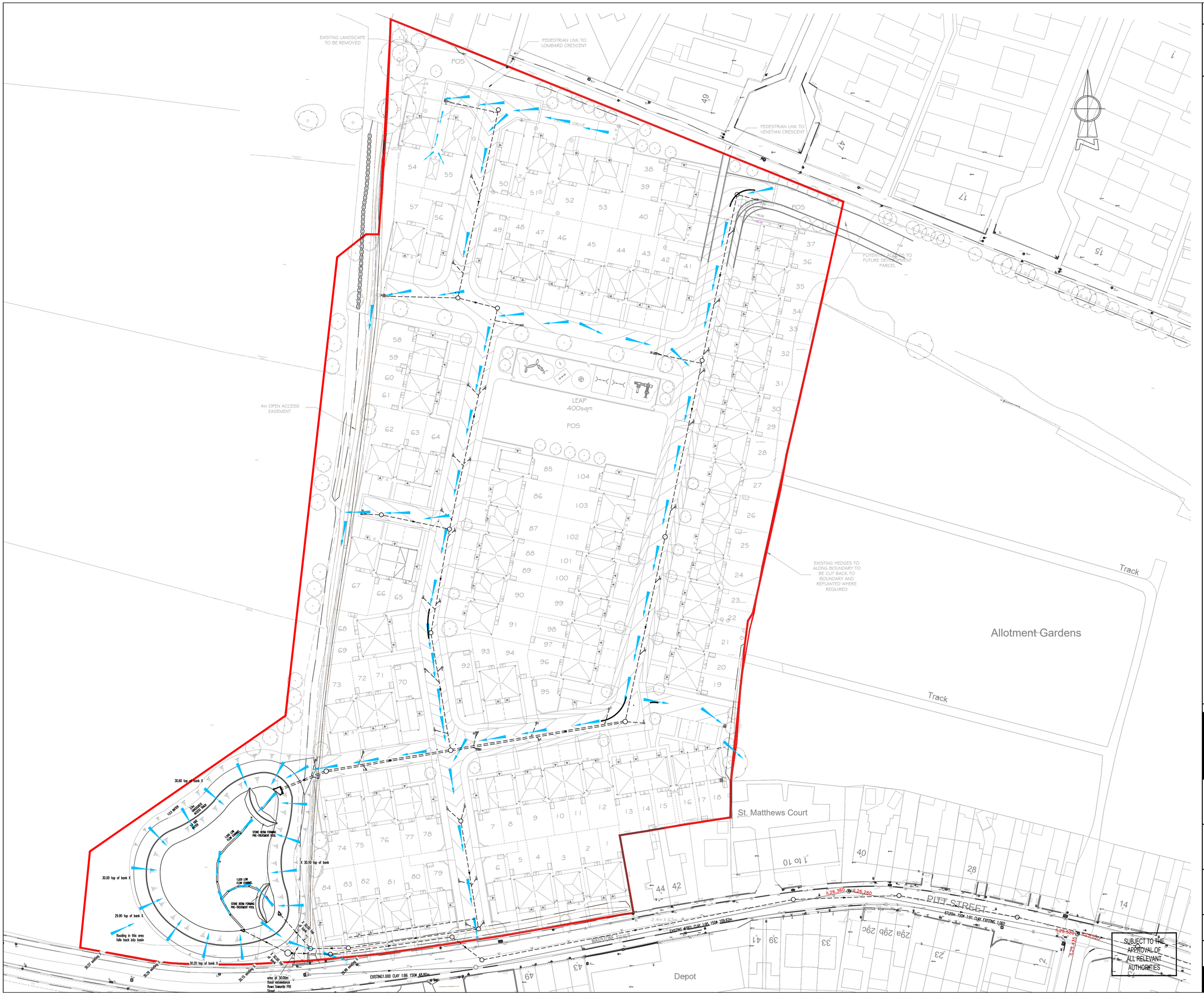
PROJECT
PITT STREET
DARFIELD

CLIENT
BDW YORKSHIRE WEST

DRAWING STATUS
PRELIMINARY

| Scale | Date | Drawn | Chk. |
|---|---|---|---|
| 1:500 @ A1 | JULY 21 | MB | AT |

| Drg. No. | Rev |
|---|---|
| 1048/141/SK06-2 | / |




# N O T E S

ATTENTION IS DRAWN TO THE REQUIREMENTS OF THE CONSTRUCTION DESIGN AND MANAGEMENT REGULATIONS 2015 AND THE DUTIES AND RESPONSIBILITIES CONTAINED THEREIN

## K E Y

Exceedance Route

| Rev | By | Date | Revision | Chk | Apvd |
|---|---|---|---|---|---|
| / | MB | 27.07.21 | Issued for approval | AT | MI |


ARP ASSOCIATES
Chartered Consulting Engineers
Northwest House ● 5 & 6 Northwest Business Park ● Servia Hill, Leeds ● LS6 2QH
☎ 0113 245 8498 ✆ 0113 244 3864 ✉ leeds@arpassociates.co.uk ● www.arpassociates.co.uk
ARP Associates is a trading division of ARP Geotechnical Ltd, a company registered in England and Wales with company number 3771811, whose registered office is at 5/6 Northwest Business Park, Servia Hill, Leeds LS6 2QH


TITLE FLOOD EXCEEDANCE LAYOUT

PROJECT
PITT STREET
DARFIELD

CLIENT
BDW YORKSHIRE WEST

DRAWING STATUS
PITT STREET

| Scale | Date | Drawn | Chk. |
|---|---|---|---|
| 1:500 @ A1 | JULY 21 | MB | AT |

Drg. No. 1048/141/SK07 Rev /

# Appendix F
# Yorkshire Water

YorkshireWater

**Yorkshire Water Services**
**Developer Services**
**Pre-Development Team**
**PO BOX 52**
**Bradford**
**BD3 7AY**

**Tel: 0345 120 8482**
**Fax:**

**Email:**
**technical.sewerage@yorkshirewater.co.uk**

**For telephone enquiries ring:**
**George Mullaney on 0345 120 8482**

**13th July 2021**

**Alastair Tills**
**Arp Associates**
**Unit 5/6 Northwest Business Pk; 1ST FLR**
**Servia Hill**
**Woodhouse**
**Leeds**
**LS6 2QH**
**alastairtills@arpassociates.co.uk**

**Your Ref: 1048-141**
**Our Ref: X012453**

Dear Mr Tills,

**Pitt Street, Darfield, Barnsley, S73 8AS - Pre Planning Sewerage Enquiry - Residential - U301615**

Thank you for your recent enquiry. Our charge of £165.00 plus VAT will be added to your account with us, reference ARP013. You will receive an invoice for your account in due course.

Please find enclosed a complimentary extract from the Statutory Sewer Map which indicates the recorded position of the public sewers. Please note that as of October 2011 and the private to public sewer transfer, there are many uncharted Yorkshire Water assets currently not shown on our records. The following comments reflect our view, with regard to the public sewer network only, based on a 'desk top' study of the site and are valid for a maximum period of twelve months:

Foul Water

Development of the site should take place with separate systems for foul and surface water drainage. The separate systems should extend to the points of discharge to be agreed.

Foul water domestic waste can discharge to the 225 mm diameter public combined sewer recorded in Hope Street, at a point to the south east of the site.

Surface Water



INVESTING IN VOLUNTEERS FOR EMPLOYERS
CUSTOMER SERVICE EXCELLENCE CSE

The developer's attention is drawn to Requirement H3 of the Building Regulations 2000. This establishes a preferred hierarchy for surface water disposal. Consideration should firstly be given to discharge to soakaway, infiltration system and watercourse in that priority order.

Sustainable Drainage Systems (SuDS), for example the use of soakaways and/or permeable hardstanding etc, may be a suitable solution for surface water disposal appropriate in this situation. You are advised to seek comments on the suitability of SuDS in this instance from the appropriate authorities.

As a last resort and subject to providing satisfactory evidence as to why the other methods of surface water disposal have been discounted, curtilage surface water may discharge to the 300 mm diameter public surface water sewer recorded in George Street, at a point to the east of the site, at a maximum rate of 5 (five) litres per second.

Please note further restrictions on surface water disposal from the site may be imposed by other parties. You are strongly advised to seek advice/comments from the Environment Agency/Land Drainage Authority/Internal Drainage Board, with regard to surface water disposal from the site.

Other Observations

Any new connection to an existing public sewer will require the prior approval of Yorkshire Water. You may apply on line or obtain an application form from our website (www.yorkshirewater.com) or by telephoning 0345 120 84 82.

Under the provisions of section 111 of the Water Industry Act 1991 it is unlawful to pass into any public sewer (or into any drain or private sewer communicating with the public sewer network) any items likely to cause damage to the public sewer network interfere with the free flow of its contents or affect the treatment and disposal of its contents. Amongst other things this includes fat, oil, nappies, bandages, syringes, medicines, sanitary towels and incontinence pants. Contravention of the provisions of section 111 is a criminal offence.

An off-site foul and surface water sewer may be required which may be provided by the developer and considered for adoption under Section 104 of the Water Industry Act 1991. Please telephone 0345 120 84 82 for advice on sewer adoptions. Alternatively, the developer may in certain circumstances be able to requisition off-site sewers under Section 98 of the Water Industry Act 1991 for which an application must be made in writing. For further information, please telephone 0345 120 84 82.

Prospectively adoptable sewers and pumping stations must be designed and constructed in accordance with the Codes for Adoption as supplemented by Yorkshire Water's requirements, pursuant to an agreement under Section 104 of the Water Industry Act 1991. An application to enter into a Section 104 agreement must be made in writing prior to any works commencing on site. Please contact our Developer Services Team

(telephone 0345 120 84 82) for further information.

All the above comments are based upon the information and records available at the present time and is subject to formal planning approval agreement. The information contained in this letter together with that shown on any extract from the Statutory Sewer Map that may be enclosed is believed to be correct and is supplied in good faith. Please note that capacity in the public sewer network is not reserved for specific future development. It is used up on a 'first come, first served' basis. You should visit the site and establish the line and level of any public sewers affecting your proposals before the commencement of any design work.

Yours sincerely

**George Mullaney**
**Development Services Technician**

## Alastair Tills

**From:** George.Mullaney@yorkshirewater.co.uk on behalf of technical.sewerage@yorkshirewater.co.uk
**Sent:** Tuesday 27 July, 2021 4:47 pm
**To:** Alastair Tills
**Subject:** RE: U301615 - Pitt Street, Darfield, Barnsley, S73 8AS - Pre Planning Sewerage Enquiry
**Attachments:** pic00778.gif

Good afternoon Alastair,

My apologies, I made a mistake directng you to the 225mm sewer in Hope Street, I can confirm that the sites foul water domestic waste can discharge to the 150mm diameter public combined sewer recorded in Pitt Street.

Kind Regards

(Embedded image moved to file: pic00778.gif)

|---------->
| From: |
|---------->
>----------|
|Alastair Tills <AlastairTills@arpassociates.co.uk> |
>----------|
|---------->
| To: |
|---------->
>----------|
|Technical Sewerage@NotesMail |
>----------|
|---------->
| Date: |
|---------->
>----------|
|13/07/2021 18:01 |
>----------|
|---------->
| Subject: |
|---------->
>----------|
|RE: U301615 - Pitt Street, Darfield, Barnsley, S73 8AS - Pre Planning Sewerage Enquiry
|
>----------|

VR 514447944010000

DATED 13/7/2021

Good Afternoon,

Thank you for the pre-planning response.

We thought that in this case, as the site has planning approval, the developer has a right to connect foul drainage to the sewer available at the normal connection point on the site frontage. If there is not sufficient capacity in the existing sewer, it would then be Yorkshire Waters responsibility to upgrade the 150mm combined sewer in Pitt Street up to the proposed connection point at the 225mm diameter sewer in Hope Street.

Please can you have another look at if it is possible to connect the foul drainage nearer the site.

Kind Regards,

Alastair Tills
Senior Civil Engineer
0113 244 3238
0777 0999 829
AlastairTills@arpassociates.co.uk

ARP ASSOCIATES &
ARP GEOTECHNICAL LTD

www.arpassociates.co.uk

5 & 6 Northwest Business Park, Servia Hill, Leeds LS6 2QH Pre-planning Geotechnical Civil Engineering Structural Engineering

P Please consider the environment before printing this e-mail.
This e-mail is intended for the exclusive use of the individual(s) or entity to which it is addressed and contains confidential and/or privileged information. Any form of distribution, copying or use of this communication by anyone else is strictly prohibited. If you have received this communication in error please delete from your system and notify us immediately so that we can arrange for its return. Viruses: Although this e-mail and it's attachments are believed to be free from any virus, it is the responsibility of the recipient(s) to conduct their own virus checks on all parts of this communication. ARP Associates and ARP Geotechnical Ltd accept no liability for loss or damage arising from their presence. ARP Associates is a trading division of ARP Geotechnical Ltd, a company registered in England and Wales with company number 3771811, whose registered office is at 5/6 Northwest Business Park, Servia Hill, Leeds LS6 2QH.

-----Original Message-----
From: George.Mullaney@yorkshirewater.co.uk [ mailto:George.Mullaney@yorkshirewater.co.uk] On Behalf Of technical.sewerage@yorkshirewater.co.uk
Sent: Tuesday 13 July, 2021 2:33pm
To: Alastair Tills
Subject: U301615 - Pitt Street, Darfield, Barnsley, S73 8AS - Pre Planning Sewerage Enquiry

Good Afternoon,

Please see the attached consultation and map extract for application reference U301615 - Pitt Street, Darfield, Barnsley, S73 8AS.

(See attached file: Pitt Street, Darfield, Barnsley, S73 8AS - Pre Planning Sewerage Enquiry - Residential - U301615.pdf)(See attached file:
MULLANEG_radA8F31.PDF)

Kind Regards

(Embedded image moved to file: pic32391.gif)

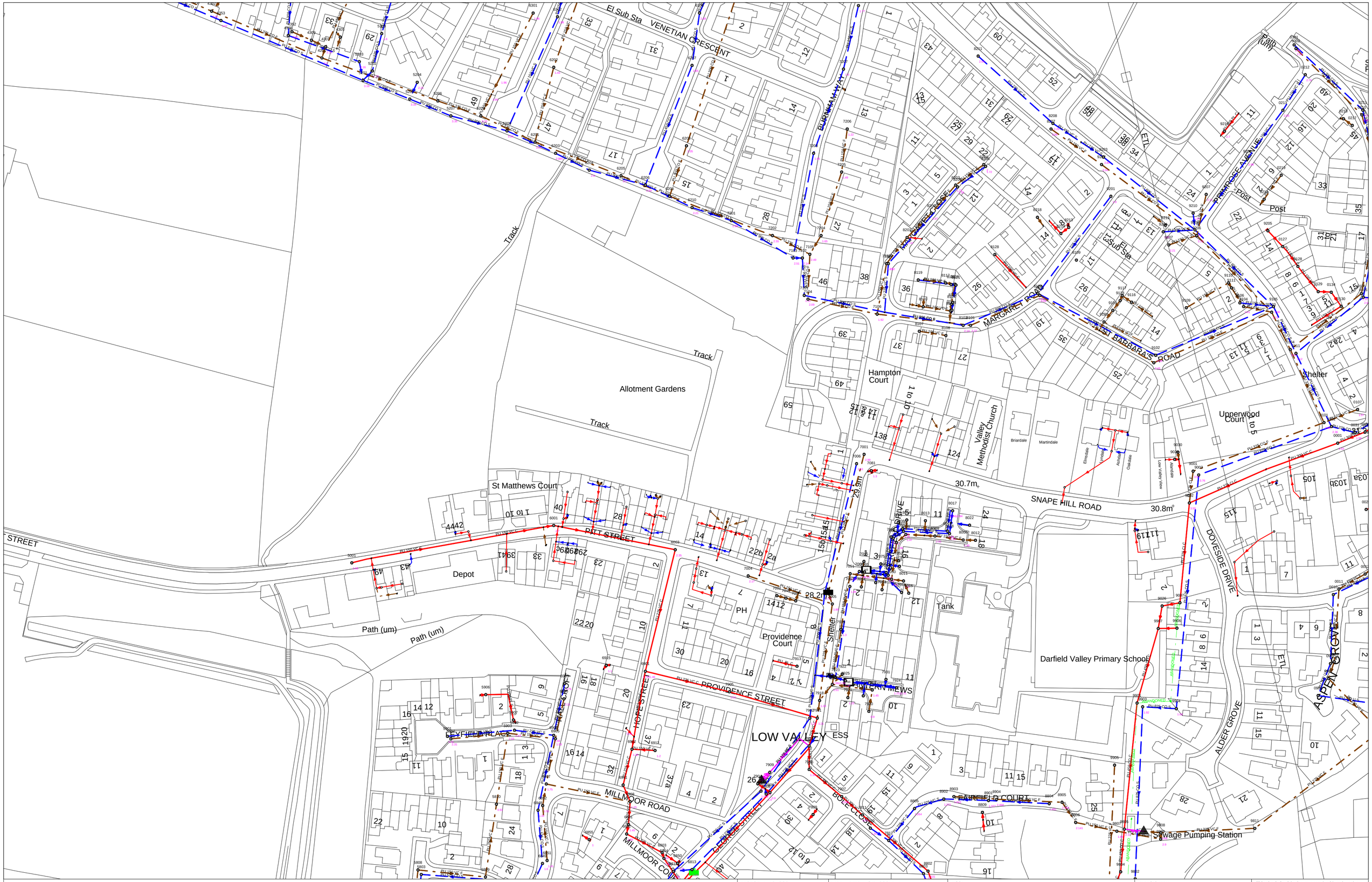
---

Yorkshire Water customers can get in touch for free with us via live chat or by requesting a free call back at https://www.yorkshirewater.com

Save money on your utility bills and help conserve water by requesting a free water saving pack https://www.yorkshirewater.com/savewater

The information in this e-mail, and any files transmitted with it, is confidential and may also be legally privileged. The contents are intended solely for the addressee only and are subject to the legal notice available at http://www.keldagroup.com/email.htm. This email does not constitute a binding offer, acceptance, amendment, waiver or other agreement, or create any obligation whatsoever, unless such intention is clearly stated in the body of the email. If you are not the intended recipient, please return the message by replying to it and then delete the message from your computer.
Any disclosure, copying, distribution or action taken in reliance on its contents is prohibited and may be unlawful.

Yorkshire Water Services Limited
Registered Office Western House, Halifax Road, Bradford, BD6 2SZ Registered in England and Wales No 2366682




| | | | |
|---|---|---|---|
| 440585 : 404030 | Map Name : SE4003NW | Title | Partial Key |
| | Yorkshire Water,<br>PO Box 500,<br>Halifax Road,<br>Bradford BD6 2LZ<br>Contact Name :<br>YorMap Advisor C ROBERTS<br>Contact Tel : 87 2582 | Notes | Foul Sewer = F<br>Combined Sewer = C<br>Surface Water Sewer = SW<br>Trade Sewer = TD<br>Partially Separate = PS |
| | | (Ody) COPYRIGHT STATEMENTS: Reproduced by permission of Ordnance Survey on behalf of HMSO © Crown copyright and database 2014. All rights reserved Ordnance Survey Licence number 100022432 | This plan is furnished as a general guide only and no warranty as to its correctness is given or implied. This plan must not be relied upon in the event of excavations or other works made in the vicinity of public sewers. No house or property connections are shown. |
| | | | Date Req : 02/06/2021, 10:29:21 |
| | | | Date Gen : 02/06/2021, 10:38:52 |
| | | | Source : Sewer Network Enquiry |

UPN: Undefined Originator: C ROBERTS, YorMap, 87 2582

# Appendix G
# Drainage Calculations

## Design Settings

| | | | |
|---|---|---|---|
| Frequency of use (kDU) | 1.00 | Minimum Velocity (m/s) | 0.75 |
| Flow per dwelling per day (l/day) | 4000 | Connection Type | Level Soffits |
| Domestic Flow (l/s/ha) | 0.0 | Minimum Backdrop Height (m) | 1.000 |
| Industrial Flow (l/s/ha) | 0.0 | Preferred Cover Depth (m) | 1.650 |
| Additional Flow (%) | 0 | Include Intermediate Ground | ✓ |

## Nodes

| Name | Dwellings | Cover Level (m) | Manhole Type | Easting (m) | Northing (m) | Depth (m) |
|---|---|---|---|---|---|---|
| 1 | 6 | 34.289 | Adoptable | 440507.658 | 404268.924 | 2.218 |
| 2 | 5 | 33.127 | Adoptable | 440496.314 | 404215.159 | 1.800 |
| 3 | 11 | 33.234 | Adoptable | 440507.692 | 404212.274 | 2.054 |
| 4 | 8 | 32.146 | Adoptable | 440495.637 | 404153.806 | 2.436 |
| 5 | 6 | 31.622 | Adoptable | 440489.259 | 404123.161 | 2.303 |
| 7 | 8 | 33.006 | Adoptable | 440567.888 | 404202.998 | 1.957 |
| 8 | 14 | 31.806 | Adoptable | 440557.267 | 404151.984 | 1.954 |
| 9 | 16 | 30.953 | Adoptable | 440545.601 | 404097.313 | 1.800 |
| 10 | | 30.614 | Adoptable | 440494.540 | 404088.547 | 2.343 |
| 16 | | 30.306 | Adoptable | 440496.040 | 404079.312 | 2.113 |
| 11 | 0 | 29.591 | Adoptable | 440503.559 | 404034.109 | 1.780 |
| C51 | | 29.568 | Adoptable | 440504.481 | 404024.511 | 2.058 |
| 12 | | 29.621 | Adoptable | 440501.861 | 404027.015 | 1.871 |

## Links (Input)

| Name | US Node | DS Node | Length (m) | ks (mm) / n | US IL (m) | DS IL (m) | Fall (m) | Slope (1:X) | Dia (mm) |
|---|---|---|---|---|---|---|---|---|---|
| 1.000 | 1 | 2 | 54.949 | 1.500 | 32.071 | 31.377 | 0.694 | 79.2 | 100 |
| 1.001 | 2 | 3 | 11.738 | 1.500 | 31.327 | 31.180 | 0.147 | 79.9 | 150 |
| 1.002 | 3 | 4 | 59.698 | 1.500 | 31.180 | 29.710 | 1.470 | 40.6 | 150 |
| 1.003 | 4 | 5 | 31.302 | 1.500 | 29.710 | 29.319 | 0.391 | 80.1 | 150 |
| 1.004 | 5 | 10 | 35.015 | 1.500 | 29.319 | 28.271 | 1.048 | 33.4 | 150 |
| 2.001 | 7 | 8 | 52.108 | 1.500 | 31.049 | 29.852 | 1.197 | 43.5 | 150 |
| 2.002 | 8 | 9 | 55.902 | 1.500 | 29.852 | 29.153 | 0.699 | 80.0 | 150 |
| 2.003 | 9 | 10 | 51.808 | 1.500 | 29.153 | 28.271 | 0.882 | 58.7 | 150 |
| 1.005 | 10 | 16 | 9.356 | 1.500 | 28.271 | 28.193 | 0.078 | 119.9 | 150 |
| 1.006 | 16 | 11 | 45.824 | 1.500 | 28.193 | 27.811 | 0.382 | 120.0 | 150 |
| 1.007 | 11 | 12 | 7.294 | 1.500 | 27.811 | 27.750 | 0.061 | 119.6 | 150 |
| 1.008 | 12 | C51 | 3.624 | 1.500 | 27.750 | 27.510 | 0.240 | 15.1 | 150 |

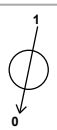
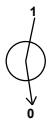
Flow+ v10.2 Copyright © 1988-2021 Causeway Technologies Ltd

## Pipeline Schedule

| Link | Length (m) | Slope (1:X) | Dia (mm) | Link Type | US CL (m) | US IL (m) | US Depth (m) | DS CL (m) | DS IL (m) | DS Depth (m) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1.000 | 54.949 | 79.2 | 100 | Circular_Default Sewer Type | 34.289 | 32.071 | 2.118 | 33.127 | 31.377 | 1.650 |
| 1.001 | 11.738 | 79.9 | 150 | Circular_Default Sewer Type | 33.127 | 31.327 | 1.650 | 33.234 | 31.180 | 1.904 |
| 1.002 | 59.698 | 40.6 | 150 | Circular_Default Sewer Type | 33.234 | 31.180 | 1.904 | 32.146 | 29.710 | 2.286 |
| 1.003 | 31.302 | 80.1 | 150 | Circular_Default Sewer Type | 32.146 | 29.710 | 2.286 | 31.622 | 29.319 | 2.153 |
| 1.004 | 35.015 | 33.4 | 150 | Circular_Default Sewer Type | 31.622 | 29.319 | 2.153 | 30.614 | 28.271 | 2.193 |
| 2.001 | 52.108 | 43.5 | 150 | Circular_Default Sewer Type | 33.006 | 31.049 | 1.807 | 31.806 | 29.852 | 1.804 |
| 2.002 | 55.902 | 80.0 | 150 | Circular_Default Sewer Type | 31.806 | 29.852 | 1.804 | 30.953 | 29.153 | 1.650 |
| 2.003 | 51.808 | 58.7 | 150 | Circular_Default Sewer Type | 30.953 | 29.153 | 1.650 | 30.614 | 28.271 | 2.193 |
| 1.005 | 9.356 | 119.9 | 150 | Circular_Default Sewer Type | 30.614 | 28.271 | 2.193 | 30.306 | 28.193 | 1.963 |
| 1.006 | 45.824 | 120.0 | 150 | Circular_Default Sewer Type | 30.306 | 28.193 | 1.963 | 29.591 | 27.811 | 1.630 |
| 1.007 | 7.294 | 119.6 | 150 | Circular_Default Sewer Type | 29.591 | 27.811 | 1.630 | 29.621 | 27.750 | 1.721 |
| 1.008 | 3.624 | 15.1 | 150 | Circular_Default Sewer Type | 29.621 | 27.750 | 1.721 | 29.568 | 27.510 | 1.908 |

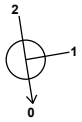
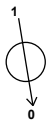
| Link | US Node | Dia (mm) | Node Type | MH Type | DS Node | Dia (mm) | Node Type | MH Type |
|---|---|---|---|---|---|---|---|---|
| 1.000 | 1 | 1200 | Manhole | Adoptable | 2 | 1200 | Manhole | Adoptable |
| 1.001 | 2 | 1200 | Manhole | Adoptable | 3 | 1200 | Manhole | Adoptable |
| 1.002 | 3 | 1200 | Manhole | Adoptable | 4 | 1200 | Manhole | Adoptable |
| 1.003 | 4 | 1200 | Manhole | Adoptable | 5 | 1200 | Manhole | Adoptable |
| 1.004 | 5 | 1200 | Manhole | Adoptable | 10 | 1200 | Manhole | Adoptable |
| 2.001 | 7 | 1200 | Manhole | Adoptable | 8 | 1200 | Manhole | Adoptable |
| 2.002 | 8 | 1200 | Manhole | Adoptable | 9 | 1200 | Manhole | Adoptable |
| 2.003 | 9 | 1200 | Manhole | Adoptable | 10 | 1200 | Manhole | Adoptable |
| 1.005 | 10 | 1200 | Manhole | Adoptable | 16 | 1200 | Manhole | Adoptable |
| 1.006 | 16 | 1200 | Manhole | Adoptable | 11 | 1200 | Manhole | Adoptable |
| 1.007 | 11 | 1200 | Manhole | Adoptable | 12 | 1200 | Manhole | Adoptable |
| 1.008 | 12 | 1200 | Manhole | Adoptable | C51 | 1200 | Manhole | Adoptable |

## Manhole Schedule

| Node | Easting (m) | Northing (m) | CL (m) | Depth (m) | Dia (mm) | Connections | Link | IL (m) | Dia (mm) |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 440507.658 | 404268.924 | 34.289 | 2.218 | 1200 |  0 | 1.000 | 32.071 | 100 |
| 2 | 440496.314 | 404215.159 | 33.127 | 1.800 | 1200 |  1 | 1.000 | 31.377 | 100 |
| | | | | | | 0 | 1.001 | 31.327 | 150 |
| 3 | 440507.692 | 404212.274 | 33.234 | 2.054 | 1200 | 1 | 1.001 | 31.180 | 150 |
| | | | | | |  0 | 1.002 | 31.180 | 150 |
| 4 | 440495.637 | 404153.806 | 32.146 | 2.436 | 1200 |  1 | 1.002 | 29.710 | 150 |
| | | | | | | 0 | 1.003 | 29.710 | 150 |
| 5 | 440489.259 | 404123.161 | 31.622 | 2.303 | 1200 |  1 | 1.003 | 29.319 | 150 |
| | | | | | | 0 | 1.004 | 29.319 | 150 |

Flow+ v10.2 Copyright © 1988-2021 Causeway Technologies Ltd

## Manhole Schedule

| Node | Easting (m) | Northing (m) | CL (m) | Depth (m) | Dia (mm) | Connections | Link | IL (m) | Dia (mm) |
|---|---|---|---|---|---|---|---|---|---|
| 7 | 440567.888 | 404202.998 | 33.006 | 1.957 | 1200 |  | 0 2.001 | 31.049 | 150 |
| 8 | 440557.267 | 404151.984 | 31.806 | 1.954 | 1200 |  | 1 2.001<br>0 2.002 | 29.852<br>29.852 | 150<br>150 |
| 9 | 440545.601 | 404097.313 | 30.953 | 1.800 | 1200 |  | 1 2.002<br>0 2.003 | 29.153<br>29.153 | 150<br>150 |
| 10 | 440494.540 | 404088.547 | 30.614 | 2.343 | 1200 |  | 1 2.003<br>2 1.004<br>0 1.005 | 28.271<br>28.271<br>28.271 | 150<br>150<br>150 |
| 16 | 440496.040 | 404079.312 | 30.306 | 2.113 | 1200 |  | 1 1.005<br>0 1.006 | 28.193<br>28.193 | 150<br>150 |
| 11 | 440503.559 | 404034.109 | 29.591 | 1.780 | 1200 |  | 1 1.006<br>0 1.007 | 27.811<br>27.811 | 150<br>150 |
| C51 | 440504.481 | 404024.511 | 29.568 | 2.058 | 1200 |  | 1 1.008 | 27.510 | 150 |
| 12 | 440501.861 | 404027.015 | 29.621 | 1.871 | 1200 |  | 1 1.007<br>0 1.008 | 27.750<br>27.750 | 150<br>150 |

Flow+ v10.2 Copyright © 1988-2021 Causeway Technologies Ltd

## Design Settings

| | | | |
|---|---|---|---|
| Rainfall Methodology | FSR | Maximum Time of Concentration (mins) | 30.00 |
| Return Period (years) | 1 | Maximum Rainfall (mm/hr) | 50.0 |
| Additional Flow (%) | 0 | Minimum Velocity (m/s) | 1.00 |
| FSR Region | England and Wales | Connection Type | Level Soffits |
| M5-60 (mm) | 20.000 | Minimum Backdrop Height (m) | 1.000 |
| Ratio-R | 0.400 | Preferred Cover Depth (m) | 1.200 |
| CV | 0.750 | Include Intermediate Ground | ✓ |
| Time of Entry (mins) | 5.00 | Enforce best practice design rules | x |

## Nodes

| Name | Area (ha) | T of E (mins) | Cover Level (m) | Diameter (mm) | Easting (m) | Northing (m) | Depth (m) |
|---|---|---|---|---|---|---|---|
| 1 | 0.139 | 5.00 | 34.246 | 1200 | 440579.737 | 404247.081 | 1.516 |
| 2 | 0.137 | 5.00 | 32.857 | 1200 | 440569.665 | 404199.278 | 1.500 |
| 3 | 0.184 | 5.00 | 31.697 | 1350 | 440558.992 | 404148.468 | 2.146 |
| 4 | 0.147 | 5.00 | 30.924 | 1350 | 440547.492 | 404095.253 | 2.039 |
| 6 | 0.151 | 5.00 | 34.412 | 1200 | 440510.955 | 404271.473 | 1.651 |
| 7 | 0.062 | 5.00 | 33.205 | 1200 | 440499.286 | 404217.281 | 1.500 |
| 8 | 0.145 | 5.00 | 33.312 | 1200 | 440510.700 | 404214.357 | 1.831 |
| 9 | 0.063 | 5.00 | 32.002 | 1200 | 440477.251 | 404154.807 | 1.702 |
| 10 | 0.054 | 5.00 | 32.101 | 1200 | 440496.861 | 404150.696 | 1.935 |
| 11 | 0.034 | 5.00 | 31.587 | 1200 | 440491.513 | 404120.840 | 2.028 |
| 12 | 0.083 | 5.00 | 30.552 | 1350 | 440497.208 | 404086.985 | 1.980 |
| 13 | 0.010 | 5.00 | 30.291 | 1350 | 440461.356 | 404080.972 | 1.823 |
| 14 | 0.000 | | 30.431 | 1500 | 440447.526 | 404075.485 | 2.006 |
| 15 | 0.047 | 5.00 | 30.005 | 1200 | 440500.130 | 404066.621 | 1.122 |
| 16 | 0.044 | 5.00 | 29.602 | 1200 | 440505.225 | 404035.548 | 1.004 |
| 17 | 0.044 | 5.00 | 29.950 | 1200 | 440467.748 | 404030.054 | 1.579 |
| 18 | 0.000 | | 30.131 | 1200 | 440456.843 | 404029.856 | 1.825 |
| 19 | 0.000 | | 30.011 | 1200 | 440447.811 | 404040.032 | 1.786 |
| 20 | 0.000 | 5.00 | 29.962 | 1200 | 440437.776 | 404035.246 | 1.862 |
| 21 | 0.000 | | 30.000 | 1500 | 440450.525 | 404029.150 | 1.999 |
| 22 | 0.000 | 5.00 | 30.033 | 1200 | 440462.539 | 404028.249 | 2.173 |
| 23 | 0.000 | | 29.800 | 1200 | 440497.598 | 404033.224 | 2.318 |
| 24 | 0.000 | | 29.581 | 1200 | 440506.192 | 404026.608 | 2.171 |
| 25 | 0.000 | | 29.356 | 1200 | 440595.934 | 404044.023 | 2.555 |
| 26 | 0.000 | | 29.023 | 1200 | 440626.388 | 404045.141 | 2.425 |
| 27 | 0.000 | | 28.392 | 1200 | 440660.471 | 404038.912 | 2.037 |
| 28 | 0.000 | | 27.700 | 1200 | 440695.151 | 404030.504 | 1.741 |
| 29 | | | 26.697 | 1200 | 440758.702 | 404009.299 | 1.627 |

## Links (Input)

| Name | US Node | DS Node | Length (m) | ks (mm) / n | US IL (m) | DS IL (m) | Fall (m) | Slope (1:X) | Dia (mm) | T of C (mins) | Rain (mm/hr) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1.000 | 1 | 2 | 48.853 | 0.600 | 32.730 | 31.432 | 1.298 | 37.6 | 225 | 5.38 | 50.0 |
| 1.001 | 2 | 3 | 51.919 | 0.600 | 31.357 | 29.626 | 1.731 | 30.0 | 300 | 5.68 | 50.0 |
| 1.002 | 3 | 4 | 54.443 | 0.600 | 29.551 | 29.035 | 0.516 | 105.5 | 375 | 6.20 | 49.6 |
| 1.003 | 4 | 12 | 50.959 | 0.600 | 28.885 | 28.572 | 0.313 | 162.8 | 525 | 6.68 | 47.8 |
| 2.001 | 6 | 7 | 55.434 | 0.600 | 32.761 | 31.705 | 1.056 | 52.5 | 300 | 5.64 | 50.0 |
| 2.002 | 7 | 8 | 11.783 | 0.600 | 31.705 | 31.481 | 0.224 | 52.6 | 300 | 5.73 | 50.0 |
| 2.003 | 8 | 10 | 65.148 | 0.600 | 31.481 | 30.166 | 1.315 | 49.5 | 300 | 6.22 | 49.5 |

Flow+ v10.2 Copyright © 1988-2021 Causeway Technologies Ltd

## Links (Input)

| Name | US Node | DS Node | Length (m) | ks (mm) / n | US IL (m) | DS IL (m) | Fall (m) | Slope (1:X) | Dia (mm) | T of C (mins) | Rain (mm/hr) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 3.000 | 9 | 10 | 20.036 | 0.600 | 30.300 | 30.166 | 0.134 | 149.5 | 300 | 5.26 | 50.0 |
| 2.004 | 10 | 11 | 30.331 | 0.600 | 30.166 | 29.559 | 0.607 | 50.0 | 300 | 6.44 | 48.7 |
| 2.005 | 11 | 12 | 34.331 | 0.600 | 29.559 | 28.797 | 0.762 | 45.1 | 300 | 6.69 | 47.8 |
| 1.004 | 12 | 13 | 36.353 | 0.600 | 28.572 | 28.468 | 0.104 | 349.5 | 525 | 7.83 | 44.1 |
| 1.005 | 13 | 14 | 14.879 | 0.600 | 28.468 | 28.425 | 0.043 | 346.0 | 525 | 8.06 | 43.5 |
| 4.000 | 15 | 16 | 31.488 | 0.600 | 28.883 | 28.673 | 0.210 | 149.9 | 150 | 5.46 | 50.0 |
| 4.001 | 16 | 17 | 37.878 | 0.600 | 28.598 | 28.371 | 0.227 | 166.9 | 225 | 6.09 | 50.0 |
| 4.002 | 17 | 18 | 10.907 | 0.600 | 28.371 | 28.306 | 0.065 | 167.8 | 225 | 6.27 | 49.3 |
| 4.003 | 18 | 19 | 13.606 | 0.600 | 28.306 | 28.225 | 0.081 | 168.0 | 225 | 6.50 | 48.5 |
| 1.007 | 20 | 21 | 14.132 | 0.600 | 28.100 | 28.001 | 0.099 | 142.7 | 225 | 5.24 | 50.0 |
| 1.008 | 21 | 22 | 12.047 | 0.600 | 28.001 | 27.860 | 0.141 | 85.4 | 150 | 5.44 | 50.0 |
| 1.009 | 22 | 23 | 35.410 | 0.600 | 27.860 | 27.482 | 0.378 | 93.7 | 150 | 6.01 | 50.0 |
| 1.010 | 23 | 24 | 10.846 | 0.600 | 27.482 | 27.410 | 0.072 | 150.0 | 150 | 6.23 | 49.5 |
| 1.011 | 24 | 25 | 91.416 | 0.600 | 27.410 | 26.801 | 0.609 | 150.0 | 150 | 8.09 | 43.4 |
| 1.012 | 25 | 26 | 30.475 | 0.600 | 26.801 | 26.598 | 0.203 | 150.1 | 150 | 8.71 | 41.7 |
| 1.013 | 26 | 27 | 34.648 | 0.600 | 26.598 | 26.355 | 0.243 | 142.6 | 150 | 9.41 | 40.1 |
| 1.014 | 27 | 28 | 35.685 | 0.600 | 26.355 | 25.959 | 0.396 | 90.1 | 150 | 9.97 | 38.9 |
| 1.015 | 28 | 29 | 66.995 | 0.600 | 25.959 | 25.070 | 0.889 | 75.4 | 150 | 10.94 | 37.0 |

## Pipeline Schedule

| Link | Length (m) | Slope (1:X) | Dia (mm) | Link Type | US CL (m) | US IL (m) | US Depth (m) | DS CL (m) | DS IL (m) | DS Depth (m) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1.000 | 48.853 | 37.6 | 225 | Circular_Default Sewer Type | 34.246 | 32.730 | 1.291 | 32.857 | 31.432 | 1.200 |
| 1.001 | 51.919 | 30.0 | 300 | Circular_Default Sewer Type | 32.857 | 31.357 | 1.200 | 31.697 | 29.626 | 1.771 |
| 1.002 | 54.443 | 105.5 | 375 | Circular_Default Sewer Type | 31.697 | 29.551 | 1.771 | 30.924 | 29.035 | 1.514 |
| 1.003 | 50.959 | 162.8 | 525 | Circular_Default Sewer Type | 30.924 | 28.885 | 1.514 | 30.552 | 28.572 | 1.455 |
| 2.001 | 55.434 | 52.5 | 300 | Circular_Default Sewer Type | 34.412 | 32.761 | 1.351 | 33.205 | 31.705 | 1.200 |
| 2.002 | 11.783 | 52.6 | 300 | Circular_Default Sewer Type | 33.205 | 31.705 | 1.200 | 33.312 | 31.481 | 1.531 |
| 2.003 | 65.148 | 49.5 | 300 | Circular_Default Sewer Type | 33.312 | 31.481 | 1.531 | 32.101 | 30.166 | 1.635 |
| 3.000 | 20.036 | 149.5 | 300 | Circular_Default Sewer Type | 32.002 | 30.300 | 1.402 | 32.101 | 30.166 | 1.635 |
| 2.004 | 30.331 | 50.0 | 300 | Circular_Default Sewer Type | 32.101 | 30.166 | 1.635 | 31.587 | 29.559 | 1.728 |
| 2.005 | 34.331 | 45.1 | 300 | Circular_Default Sewer Type | 31.587 | 29.559 | 1.728 | 30.552 | 28.797 | 1.455 |
| 1.004 | 36.353 | 349.5 | 525 | Circular_Default Sewer Type | 30.552 | 28.572 | 1.455 | 30.291 | 28.468 | 1.298 |
| 1.005 | 14.879 | 346.0 | 525 | Circular_Default Sewer Type | 30.291 | 28.468 | 1.298 | 30.431 | 28.425 | 1.481 |
| 4.000 | 31.488 | 149.9 | 150 | Circular_Default Sewer Type | 30.005 | 28.883 | 0.972 | 29.602 | 28.673 | 0.779 |

| Link | US Node | Dia (mm) | Node Type | MH Type | DS Node | Dia (mm) | Node Type | MH Type |
|---|---|---|---|---|---|---|---|---|
| 1.000 | 1 | 1200 | Manhole | Adoptable | 2 | 1200 | Manhole | Adoptable |
| 1.001 | 2 | 1200 | Manhole | Adoptable | 3 | 1350 | Manhole | Adoptable |
| 1.002 | 3 | 1350 | Manhole | Adoptable | 4 | 1350 | Manhole | Adoptable |
| 1.003 | 4 | 1350 | Manhole | Adoptable | 12 | 1350 | Manhole | Adoptable |
| 2.001 | 6 | 1200 | Manhole | Adoptable | 7 | 1200 | Manhole | Adoptable |
| 2.002 | 7 | 1200 | Manhole | Adoptable | 8 | 1200 | Manhole | Adoptable |
| 2.003 | 8 | 1200 | Manhole | Adoptable | 10 | 1200 | Manhole | Adoptable |
| 3.000 | 9 | 1200 | Manhole | Adoptable | 10 | 1200 | Manhole | Adoptable |
| 2.004 | 10 | 1200 | Manhole | Adoptable | 11 | 1200 | Manhole | Adoptable |
| 2.005 | 11 | 1200 | Manhole | Adoptable | 12 | 1350 | Manhole | Adoptable |
| 1.004 | 12 | 1350 | Manhole | Adoptable | 13 | 1350 | Manhole | Adoptable |
| 1.005 | 13 | 1350 | Manhole | Adoptable | 14 | 1500 | Manhole | Adoptable |
| 4.000 | 15 | 1200 | Manhole | Adoptable | 16 | 1200 | Manhole | Adoptable |

Flow+ v10.2 Copyright © 1988-2021 Causeway Technologies Ltd

## Pipeline Schedule

| Link | Length (m) | Slope (1:X) | Dia (mm) | Link Type | US CL (m) | US IL (m) | US Depth (m) | DS CL (m) | DS IL (m) | DS Depth (m) |
|---|---|---|---|---|---|---|---|---|---|---|
| 4.001 | 37.878 | 166.9 | 225 | Circular_Default Sewer Type | 29.602 | 28.598 | 0.779 | 29.950 | 28.371 | 1.354 |
| 4.002 | 10.907 | 167.8 | 225 | Circular_Default Sewer Type | 29.950 | 28.371 | 1.354 | 30.131 | 28.306 | 1.600 |
| 4.003 | 13.606 | 168.0 | 225 | Circular_Default Sewer Type | 30.131 | 28.306 | 1.600 | 30.011 | 28.225 | 1.561 |
| 1.007 | 14.132 | 142.7 | 225 | Circular_Default Sewer Type | 29.962 | 28.100 | 1.637 | 30.000 | 28.001 | 1.774 |
| 1.008 | 12.047 | 85.4 | 150 | Circular_Default Sewer Type | 30.000 | 28.001 | 1.849 | 30.033 | 27.860 | 2.023 |
| 1.009 | 35.410 | 93.7 | 150 | Circular_Default Sewer Type | 30.033 | 27.860 | 2.023 | 29.800 | 27.482 | 2.168 |
| 1.010 | 10.846 | 150.0 | 150 | Circular_Default Sewer Type | 29.800 | 27.482 | 2.168 | 29.581 | 27.410 | 2.021 |
| 1.011 | 91.416 | 150.0 | 150 | Circular_Default Sewer Type | 29.581 | 27.410 | 2.021 | 29.356 | 26.801 | 2.405 |
| 1.012 | 30.475 | 150.1 | 150 | Circular_Default Sewer Type | 29.356 | 26.801 | 2.405 | 29.023 | 26.598 | 2.275 |
| 1.013 | 34.648 | 142.6 | 150 | Circular_Default Sewer Type | 29.023 | 26.598 | 2.275 | 28.392 | 26.355 | 1.887 |
| 1.014 | 35.685 | 90.1 | 150 | Circular_Default Sewer Type | 28.392 | 26.355 | 1.887 | 27.700 | 25.959 | 1.591 |
| 1.015 | 66.995 | 75.4 | 150 | Circular_Default Sewer Type | 27.700 | 25.959 | 1.591 | 26.697 | 25.070 | 1.477 |

| Link | US Node | Dia (mm) | Node Type | MH Type | DS Node | Dia (mm) | Node Type | MH Type |
|---|---|---|---|---|---|---|---|---|
| 4.001 | 16 | 1200 | Manhole | Adoptable | 17 | 1200 | Manhole | Adoptable |
| 4.002 | 17 | 1200 | Manhole | Adoptable | 18 | 1200 | Manhole | Adoptable |
| 4.003 | 18 | 1200 | Manhole | Adoptable | 19 | 1200 | Manhole | Adoptable |
| 1.007 | 20 | 1200 | Manhole | Adoptable | 21 | 1500 | Manhole | Adoptable |
| 1.008 | 21 | 1500 | Manhole | Adoptable | 22 | 1200 | Manhole | Adoptable |
| 1.009 | 22 | 1200 | Manhole | Adoptable | 23 | 1200 | Manhole | Adoptable |
| 1.010 | 23 | 1200 | Manhole | Adoptable | 24 | 1200 | Manhole | Adoptable |
| 1.011 | 24 | 1200 | Manhole | Adoptable | 25 | 1200 | Manhole | Adoptable |
| 1.012 | 25 | 1200 | Manhole | Adoptable | 26 | 1200 | Manhole | Adoptable |
| 1.013 | 26 | 1200 | Manhole | Adoptable | 27 | 1200 | Manhole | Adoptable |
| 1.014 | 27 | 1200 | Manhole | Adoptable | 28 | 1200 | Manhole | Adoptable |
| 1.015 | 28 | 1200 | Manhole | Adoptable | 29 | 1200 | Manhole | Adoptable |

## Manhole Schedule

| Node | Easting (m) | Northing (m) | CL (m) | Depth (m) | Dia (mm) | Connections | Link | IL (m) | Dia (mm) |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 440579.737 | 404247.081 | 34.246 | 1.516 | 1200 |  0 | 1.000 | 32.730 | 225 |
| 2 | 440569.665 | 404199.278 | 32.857 | 1.500 | 1200 |  1<br>0 | 1.000<br>1.001 | 31.432<br>31.357 | 225<br>300 |
| 3 | 440558.992 | 404148.468 | 31.697 | 2.146 | 1350 |  1<br>0 | 1.001<br>1.002 | 29.626<br>29.551 | 300<br>375 |
| 4 | 440547.492 | 404095.253 | 30.924 | 2.039 | 1350 |  1<br>0 | 1.002<br>1.003 | 29.035<br>28.885 | 375<br>525 |
| 6 | 440510.955 | 404271.473 | 34.412 | 1.651 | 1200 |  0 | 2.001 | 32.761 | 300 |

Flow+ v10.2 Copyright © 1988-2021 Causeway Technologies Ltd

## Manhole Schedule

| Node | Easting (m) | Northing (m) | CL (m) | Depth (m) | Dia (mm) | Connections | Link | IL (m) | Dia (mm) |
|---|---|---|---|---|---|---|---|---|---|
| 7 | 440499.286 | 404217.281 | 33.205 | 1.500 | 1200 | 1 | 2.001 | 31.705 | 300 |
| | | | | | | 0 | 2.002 | 31.705 | 300 |
| 8 | 440510.700 | 404214.357 | 33.312 | 1.831 | 1200 | 1 | 2.002 | 31.481 | 300 |
| | | | | | | 0 | 2.003 | 31.481 | 300 |
| 9 | 440477.251 | 404154.807 | 32.002 | 1.702 | 1200 | 0 | 3.000 | 30.300 | 300 |
| 10 | 440496.861 | 404150.696 | 32.101 | 1.935 | 1200 | 1 | 3.000 | 30.166 | 300 |
| | | | | | | 2 | 2.003 | 30.166 | 300 |
| | | | | | | 0 | 2.004 | 30.166 | 300 |
| 11 | 440491.513 | 404120.840 | 31.587 | 2.028 | 1200 | 1 | 2.004 | 29.559 | 300 |
| | | | | | | 0 | 2.005 | 29.559 | 300 |
| 12 | 440497.208 | 404086.985 | 30.552 | 1.980 | 1350 | 1 | 2.005 | 28.797 | 300 |
| | | | | | | 2 | 1.003 | 28.572 | 525 |
| | | | | | | 0 | 1.004 | 28.572 | 525 |
| 13 | 440461.356 | 404080.972 | 30.291 | 1.823 | 1350 | 1 | 1.004 | 28.468 | 525 |
| | | | | | | 0 | 1.005 | 28.468 | 525 |
| 14 | 440447.526 | 404075.485 | 30.431 | 2.006 | 1500 | 1 | 1.005 | 28.425 | 525 |
| 15 | 440500.130 | 404066.621 | 30.005 | 1.122 | 1200 | 0 | 4.000 | 28.883 | 150 |
| 16 | 440505.225 | 404035.548 | 29.602 | 1.004 | 1200 | 1 | 4.000 | 28.673 | 150 |
| | | | | | | 0 | 4.001 | 28.598 | 225 |
| 17 | 440467.748 | 404030.054 | 29.950 | 1.579 | 1200 | 1 | 4.001 | 28.371 | 225 |
| | | | | | | 0 | 4.002 | 28.371 | 225 |
| 18 | 440456.843 | 404029.856 | 30.131 | 1.825 | 1200 | 1 | 4.002 | 28.306 | 225 |
| | | | | | | 0 | 4.003 | 28.306 | 225 |
| 19 | 440447.811 | 404040.032 | 30.011 | 1.786 | 1200 | 1 | 4.003 | 28.225 | 225 |

Flow+ v10.2 Copyright © 1988-2021 Causeway Technologies Ltd

## Manhole Schedule

| Node | Easting (m) | Northing (m) | CL (m) | Depth (m) | Dia (mm) | Connections | Link | IL (m) | Dia (mm) |
|---|---|---|---|---|---|---|---|---|---|
| 20 | 440437.776 | 404035.246 | 29.962 | 1.862 | 1200 | | 0 | 1.007 | 28.100 | 225 |
| 21 | 440450.525 | 404029.150 | 30.000 | 1.999 | 1500 | | 1 | 1.007 | 28.001 | 225 |
| | | | | | | | 0 | 1.008 | 28.001 | 150 |
| 22 | 440462.539 | 404028.249 | 30.033 | 2.173 | 1200 | | 1 | 1.008 | 27.860 | 150 |
| | | | | | | | 0 | 1.009 | 27.860 | 150 |
| 23 | 440497.598 | 404033.224 | 29.800 | 2.318 | 1200 | | 1 | 1.009 | 27.482 | 150 |
| | | | | | | | 0 | 1.010 | 27.482 | 150 |
| 24 | 440506.192 | 404026.608 | 29.581 | 2.171 | 1200 | | 1 | 1.010 | 27.410 | 150 |
| | | | | | | | 0 | 1.011 | 27.410 | 150 |
| 25 | 440595.934 | 404044.023 | 29.356 | 2.555 | 1200 | | 1 | 1.011 | 26.801 | 150 |
| | | | | | | | 0 | 1.012 | 26.801 | 150 |
| 26 | 440626.388 | 404045.141 | 29.023 | 2.425 | 1200 | | 1 | 1.012 | 26.598 | 150 |
| | | | | | | | 0 | 1.013 | 26.598 | 150 |
| 27 | 440660.471 | 404038.912 | 28.392 | 2.037 | 1200 | | 1 | 1.013 | 26.355 | 150 |
| | | | | | | | 0 | 1.014 | 26.355 | 150 |
| 28 | 440695.151 | 404030.504 | 27.700 | 1.741 | 1200 | | 1 | 1.014 | 25.959 | 150 |
| | | | | | | | 0 | 1.015 | 25.959 | 150 |
| 29 | 440758.702 | 404009.299 | 26.697 | 1.627 | 1200 | | 1 | 1.015 | 25.070 | 150 |

## Simulation Settings

| | | | |
|---|---|---|---|
| Rainfall Methodology | FSR | Skip Steady State | ✓ |
| FSR Region | England and Wales | Drain Down Time (mins) | 240 |
| M5-60 (mm) | 20.000 | Additional Storage (m³/ha) | 0.0 |
| Ratio-R | 0.400 | Check Discharge Rate(s) | ✓ |
| Summer CV | 0.750 | Check Discharge Volume | ✓ |
| Winter CV | 0.840 | 100 year 360 minute (m³) | |
| Analysis Speed | Normal | | |

### Storm Durations

| 15 | 30 | 60 | 120 | 180 | 240 | 360 | 480 | 600 | 720 | 960 | 1440 |
|---|---|---|---|---|---|---|---|---|---|---|---|

Flow+ v10.2 Copyright © 1988-2021 Causeway Technologies Ltd

| Return Period (years) | Climate Change (CC %) | Additional Area (A %) | Additional Flow (Q %) |
|---|---|---|---|
| 2 | 0 | 0 | 0 |
| 30 | 30 | 0 | 0 |
| 100 | 30 | 0 | 0 |

## Pre-development Discharge Rate

| | | | |
|---|---|---|---|
| Site Makeup | Greenfield | Growth Factor 30 year | 1.95 |
| Greenfield Method | IH124 | Growth Factor 100 year | 2.48 |
| Positively Drained Area (ha) | | Betterment (%) | 0 |
| SAAR (mm) | | QBar | |
| Soil Index | 1 | Q 1 year (l/s) | |
| SPR | 0.10 | Q 30 year (l/s) | |
| Region | 1 | Q 100 year (l/s) | |
| Growth Factor 1 year | 0.85 | | |

## Pre-development Discharge Volume

| | | | |
|---|---|---|---|
| Site Makeup | Greenfield | Return Period (years) | 100 |
| Greenfield Method | FSR/FEH | Climate Change (%) | 0 |
| Positively Drained Area (ha) | | Storm Duration (mins) | 360 |
| Soil Index | 1 | Betterment (%) | 0 |
| SPR | 0.10 | PR | |
| CWI | | Runoff Volume ($m^3$) | |

## Node 21 Online Hydro-Brake® Control

| | | | |
|---|---|---|---|
| Flap Valve | x | Objective | (HE) Minimise upstream storage |
| Replaces Downstream Link | ✓ | Sump Available | ✓ |
| Invert Level (m) | 28.001 | Product Number | CTL-SHE-0098-5000-1500-5000 |
| Design Depth (m) | 1.500 | Min Outlet Diameter (m) | 0.150 |
| Design Flow (l/s) | 5.0 | Min Node Diameter (mm) | 1200 |

## Node 20 Flow through Pond Storage Structure

| | | | | | |
|---|---|---|---|---|---|
| Base Inf Coefficient (m/hr) | 0.00000 | Porosity | 1.00 | Main Channel Length (m) | 65.000 |
| Side Inf Coefficient (m/hr) | 0.00000 | Invert Level (m) | 28.100 | Main Channel Slope (1:X) | 200.0 |
| Safety Factor | 2.0 | Time to half empty (mins) | 225 | Main Channel n | 1.500 |

**Inlets**

14 | 19

| Depth (m) | Area ($m^2$) | Inf Area ($m^2$) | Depth (m) | Area ($m^2$) | Inf Area ($m^2$) |
|---|---|---|---|---|---|
| 0.000 | 975.0 | 0.0 | 1.300 | 1380.0 | 0.0 |

## Approval Settings

| | | | |
|---|---|---|---|
| Node Size | ✓ | Crossings | ✓ |
| Node Losses | ✓ | Cover Depth | ✓ |
| Link Size | ✓ | Minimum Cover Depth (m) | |
| Minimum Diameter (mm) | 150 | Maximum Cover Depth (m) | 3.000 |
| Link Length | ✓ | Backdrops | ✓ |
| Maximum Length (m) | 100.000 | Minimum Backdrop Height (m) | |
| Coordinates | ✓ | Maximum Backdrop Height (m) | 1.500 |
| Accuracy (m) | 1.000 | Full Bore Velocity | ✓ |

Flow+ v10.2 Copyright © 1988-2021 Causeway Technologies Ltd

## Approval Settings

| | | | |
|---|---|---|---|
| Minimum Full Bore Velocity (m/s) | | Maximum Surcharged Depth (m) | 0.100 |
| Maximum Full Bore Velocity (m/s) | 3.000 | Flooding | ✓ |
| Proportional Velocity | ✓ | Return Period (years) | 30 |
| Return Period (years) | | Time to Half Empty | x |
| Minimum Proportional Velocity (m/s) | 0.750 | Discharge Rates | ✓ |
| Maximum Proportional Velocity (m/s) | 3.000 | Discharge Volume | ✓ |
| Surcharged Depth | ✓ | 100 year 360 minute ($m^3$) | |
| Return Period (years) | | | |

Flow+ v10.2 Copyright © 1988-2021 Causeway Technologies Ltd

**Results for 2 year Critical Storm Duration. Lowest mass balance: 98.00%**

| Node Event | US Node | Peak (mins) | Level (m) | Depth (m) | Inflow (l/s) | Node Vol (m³) | Flood (m³) | Status |
|---|---|---|---|---|---|---|---|---|
| 15 minute winter | 1 | 10 | 32.815 | 0.085 | 25.3 | 0.0958 | 0.0000 | OK |
| 15 minute winter | 2 | 10 | 31.459 | 0.102 | 49.7 | 0.1155 | 0.0000 | OK |
| 15 minute winter | 3 | 11 | 29.725 | 0.174 | 82.2 | 0.2491 | 0.0000 | OK |
| 15 minute winter | 4 | 11 | 29.072 | 0.187 | 107.0 | 0.2677 | 0.0000 | OK |
| 15 minute winter | 6 | 10 | 32.846 | 0.085 | 27.5 | 0.0958 | 0.0000 | OK |
| 15 minute winter | 7 | 10 | 31.815 | 0.110 | 38.4 | 0.1242 | 0.0000 | OK |
| 15 minute winter | 8 | 10 | 31.611 | 0.130 | 64.1 | 0.1475 | 0.0000 | OK |
| 15 minute winter | 9 | 10 | 30.371 | 0.071 | 11.5 | 0.0804 | 0.0000 | OK |
| 15 minute winter | 10 | 11 | 30.331 | 0.165 | 84.2 | 0.1862 | 0.0000 | OK |
| 15 minute winter | 11 | 11 | 29.723 | 0.164 | 90.1 | 0.1849 | 0.0000 | OK |
| 15 minute winter | 12 | 12 | 28.988 | 0.416 | 212.9 | 0.5959 | 0.0000 | OK |
| 15 minute winter | 13 | 12 | 28.910 | 0.442 | 204.5 | 0.6325 | 0.0000 | OK |
| 15 minute winter | 14 | 12 | 28.855 | 0.430 | 204.2 | 0.7601 | 0.0000 | OK |
| 15 minute winter | 15 | 10 | 28.966 | 0.083 | 8.6 | 0.0944 | 0.0000 | OK |
| 15 minute winter | 16 | 11 | 28.696 | 0.098 | 16.2 | 0.1106 | 0.0000 | OK |
| 60 minute winter | 17 | 47 | 28.677 | 0.306 | 12.6 | 0.3460 | 0.0000 | SURCHARGED |
| 60 minute winter | 18 | 48 | 28.676 | 0.370 | 11.8 | 0.4182 | 0.0000 | SURCHARGED |
| 60 minute winter | 19 | 47 | 28.681 | 0.456 | 11.5 | 0.5154 | 0.0000 | OK |
| 360 minute winter | 20 | 352 | 28.492 | 0.392 | 37.1 | 0.4430 | 0.0000 | SURCHARGED |
| 360 minute winter | 21 | 352 | 28.490 | 0.489 | 5.0 | 0.8641 | 0.0000 | SURCHARGED |
| 180 minute winter | 22 | 184 | 27.913 | 0.053 | 4.9 | 0.0597 | 0.0000 | OK |
| 180 minute winter | 23 | 184 | 27.545 | 0.063 | 4.9 | 0.0712 | 0.0000 | OK |
| 180 minute winter | 24 | 184 | 27.470 | 0.060 | 4.9 | 0.0680 | 0.0000 | OK |
| 360 minute winter | 25 | 272 | 26.862 | 0.061 | 4.9 | 0.0690 | 0.0000 | OK |

| Link Event (Upstream Depth) | US Node | Link | DS Node | Outflow (l/s) | Velocity (m/s) | Flow/Cap | Link Vol (m³) | Discharge Vol (m³) |
|---|---|---|---|---|---|---|---|---|
| 15 minute winter | 1 | 1.000 | 2 | 24.7 | 1.842 | 0.291 | 0.6562 | |
| 15 minute winter | 2 | 1.001 | 3 | 48.8 | 2.354 | 0.240 | 1.0757 | |
| 15 minute winter | 3 | 1.002 | 4 | 81.8 | 1.680 | 0.420 | 2.6520 | |
| 15 minute winter | 4 | 1.003 | 12 | 107.5 | 0.901 | 0.283 | 6.3868 | |
| 15 minute winter | 6 | 2.001 | 7 | 27.1 | 1.374 | 0.177 | 1.0985 | |
| 15 minute winter | 7 | 2.002 | 8 | 37.7 | 1.434 | 0.245 | 0.3106 | |
| 15 minute winter | 8 | 2.003 | 10 | 63.1 | 1.847 | 0.399 | 2.2456 | |
| 15 minute winter | 9 | 3.000 | 10 | 11.4 | 0.456 | 0.125 | 0.5203 | |
| 15 minute winter | 10 | 2.004 | 11 | 84.3 | 2.139 | 0.535 | 1.1954 | |
| 15 minute winter | 11 | 2.005 | 12 | 91.2 | 2.289 | 0.550 | 1.4654 | |
| 15 minute winter | 12 | 1.004 | 13 | 202.8 | 1.103 | 0.786 | 6.8664 | |
| 15 minute winter | 13 | 1.005 | 14 | 204.2 | 1.067 | 0.787 | 2.8525 | |
| 15 minute winter | 14 | Flow through pond | 20 | 20.5 | 0.013 | 0.009 | 104.9066 | |
| 15 minute winter | 15 | 4.000 | 16 | 8.3 | 0.842 | 0.576 | 0.3115 | |
| 15 minute winter | 16 | 4.001 | 17 | 16.0 | 0.708 | 0.399 | 1.0348 | |
| 60 minute winter | 17 | 4.002 | 18 | 11.8 | 0.492 | 0.294 | 0.4338 | |
| 60 minute winter | 18 | 4.003 | 19 | 11.5 | 0.407 | 0.288 | 0.5411 | |
| 60 minute winter | 19 | Flow through pond | 20 | 42.0 | 0.017 | 0.019 | 169.1390 | |
| 360 minute winter | 20 | 1.007 | 21 | 5.0 | 0.323 | 0.116 | 0.5620 | |
| 360 minute winter | 21 | Hydro-Brake® | 22 | 4.9 | | | | |
| 180 minute winter | 22 | 1.009 | 23 | 4.9 | 0.781 | 0.266 | 0.2219 | |
| 180 minute winter | 23 | 1.010 | 24 | 4.9 | 0.719 | 0.338 | 0.0738 | |
| 180 minute winter | 24 | 1.011 | 25 | 4.9 | 0.734 | 0.338 | 0.6087 | |
| 360 minute winter | 25 | 1.012 | 26 | 4.9 | 0.728 | 0.338 | 0.2048 | |

Flow+ v10.2 Copyright © 1988-2021 Causeway Technologies Ltd

**Results for 2 year Critical Storm Duration. Lowest mass balance: 98.00%**

| Node Event | US Node | Peak (mins) | Level (m) | Depth (m) | Inflow (l/s) | Node Vol (m³) | Flood (m³) | Status |
|---|---|---|---|---|---|---|---|---|
| 360 minute winter | 26 | 272 | 26.659 | 0.061 | 4.9 | 0.0689 | 0.0000 | OK |
| 360 minute winter | 27 | 272 | 26.408 | 0.053 | 4.9 | 0.0604 | 0.0000 | OK |
| 240 minute winter | 28 | 216 | 26.009 | 0.050 | 4.9 | 0.0568 | 0.0000 | OK |
| 240 minute winter | 29 | 216 | 25.120 | 0.050 | 4.9 | 0.0000 | 0.0000 | OK |

| Link Event (Upstream Depth) | US Node | Link | DS Node | Outflow (l/s) | Velocity (m/s) | Flow/Cap | Link Vol (m³) | Discharge Vol (m³) |
|---|---|---|---|---|---|---|---|---|
| 360 minute winter | 26 | 1.013 | 27 | 4.9 | 0.794 | 0.330 | 0.2136 | |
| 360 minute winter | 27 | 1.014 | 28 | 4.9 | 0.907 | 0.261 | 0.1924 | |
| 240 minute winter | 28 | 1.015 | 29 | 4.9 | 0.952 | 0.239 | 0.3442 | 104.6 |

Flow+ v10.2 Copyright © 1988-2021 Causeway Technologies Ltd

**Results for 30 year +30% CC Critical Storm Duration. Lowest mass balance: 98.00%**

| Node Event | US Node | Peak (mins) | Level (m) | Depth (m) | Inflow (l/s) | Node Vol (m³) | Flood (m³) | Status |
|---|---|---|---|---|---|---|---|---|
| 15 minute winter | 1 | 10 | 32.877 | 0.147 | 62.4 | 0.1664 | 0.0000 | OK |
| 15 minute winter | 2 | 11 | 31.551 | 0.194 | 122.8 | 0.2198 | 0.0000 | OK |
| 15 minute winter | 3 | 11 | 30.710 | 1.159 | 200.3 | 1.6586 | 0.0000 | SURCHARGED |
| 15 minute winter | 4 | 11 | 30.147 | 1.262 | 248.5 | 1.8054 | 0.0000 | SURCHARGED |
| 15 minute winter | 6 | 10 | 32.898 | 0.137 | 67.8 | 0.1555 | 0.0000 | OK |
| 15 minute winter | 7 | 12 | 32.725 | 1.020 | 95.1 | 1.1536 | 0.0000 | SURCHARGED |
| 15 minute winter | 8 | 12 | 32.649 | 1.168 | 144.3 | 1.3210 | 0.0000 | SURCHARGED |
| 15 minute winter | 9 | 12 | 31.795 | 1.495 | 32.4 | 1.6906 | 0.0000 | FLOOD RISK |
| 15 minute winter | 10 | 12 | 31.784 | 1.618 | 160.0 | 1.8303 | 0.0000 | SURCHARGED |
| 15 minute winter | 11 | 12 | 30.996 | 1.437 | 171.5 | 1.6257 | 0.0000 | SURCHARGED |
| 15 minute winter | 12 | 12 | 29.982 | 1.410 | 444.1 | 2.0176 | 0.0000 | SURCHARGED |
| 15 minute winter | 13 | 12 | 29.578 | 1.110 | 445.8 | 1.5878 | 0.0000 | SURCHARGED |
| 15 minute winter | 14 | 12 | 29.344 | 0.919 | 446.8 | 1.6240 | 0.0000 | OK |
| 15 minute winter | 15 | 12 | 29.655 | 0.772 | 21.1 | 0.8728 | 0.0000 | SURCHARGED |
| 15 minute winter | 16 | 12 | 29.288 | 0.690 | 36.3 | 0.7799 | 0.0000 | SURCHARGED |
| 15 minute winter | 17 | 12 | 29.101 | 0.730 | 53.3 | 0.8260 | 0.0000 | SURCHARGED |
| 15 minute winter | 18 | 12 | 28.958 | 0.652 | 52.0 | 0.7379 | 0.0000 | SURCHARGED |
| 60 minute winter | 19 | 43 | 28.927 | 0.702 | 28.4 | 0.7943 | 0.0000 | OK |
| 720 minute winter | 20 | 705 | 28.872 | 0.772 | 43.3 | 0.8735 | 0.0000 | SURCHARGED |
| 720 minute winter | 21 | 705 | 28.871 | 0.870 | 8.6 | 1.5378 | 0.0000 | SURCHARGED |
| 30 minute summer | 22 | 49 | 27.913 | 0.053 | 4.9 | 0.0597 | 0.0000 | OK |
| 600 minute winter | 23 | 285 | 27.545 | 0.063 | 4.9 | 0.0712 | 0.0000 | OK |
| 30 minute winter | 24 | 44 | 27.470 | 0.060 | 4.9 | 0.0680 | 0.0000 | OK |
| 1440 minute winter | 25 | 660 | 26.862 | 0.061 | 4.9 | 0.0690 | 0.0000 | OK |

| Link Event (Upstream Depth) | US Node | Link | DS Node | Outflow (l/s) | Velocity (m/s) | Flow/Cap | Link Vol (m³) | Discharge Vol (m³) |
|---|---|---|---|---|---|---|---|---|
| 15 minute winter | 1 | 1.000 | 2 | 61.3 | 2.291 | 0.721 | 1.3075 | |
| 15 minute winter | 2 | 1.001 | 3 | 117.6 | 2.471 | 0.578 | 3.0814 | |
| 15 minute winter | 3 | 1.002 | 4 | 186.4 | 1.818 | 0.957 | 6.0049 | |
| 15 minute winter | 4 | 1.003 | 12 | 246.1 | 1.139 | 0.649 | 11.0088 | |
| 15 minute winter | 6 | 2.001 | 7 | 67.2 | 1.619 | 0.437 | 2.7958 | |
| 15 minute winter | 7 | 2.002 | 8 | 83.0 | 1.616 | 0.541 | 0.8298 | |
| 15 minute winter | 8 | 2.003 | 10 | 136.4 | 2.061 | 0.862 | 4.5877 | |
| 15 minute winter | 9 | 3.000 | 10 | 26.5 | 0.515 | 0.293 | 1.4109 | |
| 15 minute winter | 10 | 2.004 | 11 | 161.0 | 2.287 | 1.022 | 2.1359 | |
| 15 minute winter | 11 | 2.005 | 12 | 174.3 | 2.475 | 1.050 | 2.4176 | |
| 15 minute winter | 12 | 1.004 | 13 | 442.0 | 2.046 | 1.713 | 7.8534 | |
| 15 minute winter | 13 | 1.005 | 14 | 446.8 | 2.068 | 1.722 | 3.2144 | |
| 15 minute winter | 14 | Flow through pond | 20 | 104.5 | 0.027 | 0.049 | 261.8387 | |
| 15 minute winter | 15 | 4.000 | 16 | 17.9 | 1.016 | 1.237 | 0.5543 | |
| 15 minute winter | 16 | 4.001 | 17 | 34.8 | 0.874 | 0.866 | 1.5064 | |
| 15 minute winter | 17 | 4.002 | 18 | 52.0 | 1.307 | 1.299 | 0.4338 | |
| 15 minute winter | 18 | 4.003 | 19 | 50.7 | 1.274 | 1.267 | 0.5411 | |
| 60 minute winter | 19 | Flow through pond | 20 | 171.1 | 0.031 | 0.079 | 431.6528 | |
| 720 minute winter | 20 | 1.007 | 21 | 8.6 | 0.328 | 0.197 | 0.5620 | |
| 720 minute winter | 21 | Hydro-Brake® | 22 | 4.9 | | | | |
| 30 minute summer | 22 | 1.009 | 23 | 4.9 | 0.781 | 0.266 | 0.2219 | |
| 600 minute winter | 23 | 1.010 | 24 | 4.9 | 0.719 | 0.338 | 0.0738 | |
| 30 minute winter | 24 | 1.011 | 25 | 4.9 | 0.825 | 0.338 | 0.6086 | |
| 1440 minute winter | 25 | 1.012 | 26 | 4.9 | 0.728 | 0.338 | 0.2048 | |

Flow+ v10.2 Copyright © 1988-2021 Causeway Technologies Ltd

**Results for 30 year +30% CC Critical Storm Duration. Lowest mass balance: 98.00%**

| Node Event | US Node | Peak (mins) | Level (m) | Depth (m) | Inflow (l/s) | Node Vol (m³) | Flood (m³) | Status |
|---|---|---|---|---|---|---|---|---|
| 1440 minute winter | 26 | 660 | 26.659 | 0.061 | 4.9 | 0.0689 | 0.0000 | OK |
| 1440 minute winter | 27 | 660 | 26.408 | 0.053 | 4.9 | 0.0604 | 0.0000 | OK |
| 1440 minute winter | 28 | 660 | 26.009 | 0.050 | 4.9 | 0.0568 | 0.0000 | OK |
| 1440 minute winter | 29 | 660 | 25.120 | 0.050 | 4.9 | 0.0000 | 0.0000 | OK |

| Link Event (Upstream Depth) | US Node | Link | DS Node | Outflow (l/s) | Velocity (m/s) | Flow/Cap | Link Vol (m³) | Discharge Vol (m³) |
|---|---|---|---|---|---|---|---|---|
| 1440 minute winter | 26 | 1.013 | 27 | 4.9 | 0.794 | 0.330 | 0.2136 | |
| 1440 minute winter | 27 | 1.014 | 28 | 4.9 | 0.907 | 0.261 | 0.1924 | |
| 1440 minute winter | 28 | 1.015 | 29 | 4.9 | 0.952 | 0.239 | 0.3442 | 371.5 |

Flow+ v10.2 Copyright © 1988-2021 Causeway Technologies Ltd

**Results for 100 year +30% CC Critical Storm Duration. Lowest mass balance: 98.00%**

| Node Event | US Node | Peak (mins) | Level (m) | Depth (m) | Inflow (l/s) | Node Vol (m³) | Flood (m³) | Status |
|---|---|---|---|---|---|---|---|---|
| 15 minute winter | 1 | 11 | 33.721 | 0.991 | 80.9 | 1.1205 | 0.0000 | SURCHARGED |
| 15 minute winter | 2 | 11 | 32.707 | 1.350 | 147.0 | 1.5265 | 0.0000 | FLOOD RISK |
| 15 minute winter | 3 | 11 | 31.697 | 2.146 | 242.9 | 3.0709 | 0.2993 | FLOOD |
| 15 minute winter | 4 | 11 | 30.792 | 1.907 | 318.5 | 2.7289 | 0.0000 | FLOOD RISK |
| 15 minute summer | 6 | 11 | 33.621 | 0.860 | 83.8 | 0.9724 | 0.0000 | SURCHARGED |
| 15 minute winter | 7 | 11 | 33.205 | 1.500 | 119.1 | 1.6965 | 5.4202 | FLOOD |
| 15 minute winter | 8 | 11 | 33.152 | 1.671 | 151.3 | 1.8899 | 0.0000 | FLOOD RISK |
| 15 minute winter | 9 | 10 | 32.002 | 1.702 | 59.6 | 1.9250 | 9.9403 | FLOOD |
| 15 minute winter | 10 | 10 | 32.055 | 1.889 | 172.1 | 2.1365 | 0.0000 | FLOOD RISK |
| 15 minute winter | 11 | 11 | 31.397 | 1.838 | 173.1 | 2.0792 | 0.0000 | FLOOD RISK |
| 15 minute winter | 12 | 11 | 30.516 | 1.944 | 524.9 | 2.7819 | 0.0000 | FLOOD RISK |
| 15 minute winter | 13 | 11 | 29.939 | 1.471 | 530.0 | 2.1056 | 0.0000 | SURCHARGED |
| 15 minute winter | 14 | 12 | 29.614 | 1.189 | 529.3 | 2.1001 | 0.0000 | OK |
| 15 minute winter | 15 | 11 | 30.005 | 1.122 | 27.3 | 1.2690 | 1.0260 | FLOOD |
| 15 minute winter | 16 | 11 | 29.602 | 1.004 | 45.6 | 1.1355 | 0.2192 | FLOOD |
| 15 minute winter | 17 | 11 | 29.356 | 0.985 | 66.3 | 1.1137 | 0.0000 | SURCHARGED |
| 30 minute winter | 18 | 21 | 29.178 | 0.872 | 55.1 | 0.9861 | 0.0000 | SURCHARGED |
| 960 minute winter | 19 | 960 | 29.073 | 0.848 | 5.0 | 0.9595 | 0.0000 | OK |
| 960 minute winter | 20 | 945 | 29.063 | 0.963 | 37.7 | 1.0886 | 0.0000 | SURCHARGED |
| 960 minute winter | 21 | 945 | 29.061 | 1.060 | 8.7 | 1.8734 | 0.0000 | SURCHARGED |
| 480 minute summer | 22 | 232 | 27.913 | 0.053 | 4.9 | 0.0597 | 0.0000 | OK |
| 1440 minute winter | 23 | 600 | 27.545 | 0.063 | 4.9 | 0.0712 | 0.0000 | OK |
| 30 minute summer | 24 | 39 | 27.470 | 0.060 | 4.9 | 0.0680 | 0.0000 | OK |
| 1440 minute winter | 25 | 600 | 26.862 | 0.061 | 4.9 | 0.0690 | 0.0000 | OK |

| Link Event (Upstream Depth) | US Node | Link | DS Node | Outflow (l/s) | Velocity (m/s) | Flow/Cap | Link Vol (m³) | Discharge Vol (m³) |
|---|---|---|---|---|---|---|---|---|
| 15 minute winter | 1 | 1.000 | 2 | 72.3 | 2.340 | 0.850 | 1.9429 | |
| 15 minute winter | 2 | 1.001 | 3 | 142.9 | 2.477 | 0.702 | 3.6561 | |
| 15 minute winter | 3 | 1.002 | 4 | 237.9 | 2.157 | 1.221 | 6.0049 | |
| 15 minute winter | 4 | 1.003 | 12 | 318.6 | 1.475 | 0.840 | 11.0088 | |
| 15 minute summer | 6 | 2.001 | 7 | 87.4 | 1.650 | 0.569 | 3.9036 | |
| 15 minute winter | 7 | 2.002 | 8 | 88.4 | 1.602 | 0.576 | 0.8298 | |
| 15 minute winter | 8 | 2.003 | 10 | 140.7 | 2.058 | 0.889 | 4.5877 | |
| 15 minute winter | 9 | 3.000 | 10 | -25.1 | 0.533 | -0.277 | 1.4109 | |
| 15 minute winter | 10 | 2.004 | 11 | 160.8 | 2.283 | 1.020 | 2.1359 | |
| 15 minute winter | 11 | 2.005 | 12 | 174.1 | 2.473 | 1.049 | 2.4176 | |
| 15 minute winter | 12 | 1.004 | 13 | 524.5 | 2.428 | 2.033 | 7.8534 | |
| 15 minute winter | 13 | 1.005 | 14 | 529.3 | 2.450 | 2.041 | 3.2144 | |
| 15 minute winter | 14 | Flow through pond | 20 | 152.7 | 0.031 | 0.071 | 324.7982 | |
| 15 minute winter | 15 | 4.000 | 16 | 20.0 | 1.135 | 1.382 | 0.5543 | |
| 15 minute winter | 16 | 4.001 | 17 | 40.7 | 1.024 | 1.015 | 1.5064 | |
| 15 minute winter | 17 | 4.002 | 18 | 63.1 | 1.586 | 1.576 | 0.4338 | |
| 30 minute winter | 18 | 4.003 | 19 | 54.2 | 1.362 | 1.355 | 0.5411 | |
| 960 minute winter | 19 | Flow through pond | 20 | 37.7 | 0.009 | 0.017 | 884.5023 | |
| 960 minute winter | 20 | 1.007 | 21 | 8.7 | 0.420 | 0.199 | 0.5620 | |
| 960 minute winter | 21 | Hydro-Brake® | 22 | 4.9 | | | | |
| 480 minute summer | 22 | 1.009 | 23 | 4.9 | 0.781 | 0.266 | 0.2219 | |
| 1440 minute winter | 23 | 1.010 | 24 | 4.9 | 0.719 | 0.338 | 0.0738 | |
| 30 minute summer | 24 | 1.011 | 25 | 4.9 | 0.839 | 0.338 | 0.6085 | |
| 1440 minute winter | 25 | 1.012 | 26 | 4.9 | 0.728 | 0.338 | 0.2048 | |

Flow+ v10.2 Copyright © 1988-2021 Causeway Technologies Ltd

**Results for 100 year +30% CC Critical Storm Duration. Lowest mass balance: 98.00%**

| Node Event | US Node | Peak (mins) | Level (m) | Depth (m) | Inflow (l/s) | Node Vol (m³) | Flood (m³) | Status |
|---|---|---|---|---|---|---|---|---|
| 1440 minute winter | 26 | 600 | 26.659 | 0.061 | 4.9 | 0.0689 | 0.0000 | OK |
| 1440 minute winter | 27 | 600 | 26.408 | 0.053 | 4.9 | 0.0604 | 0.0000 | OK |
| 960 minute winter | 28 | 405 | 26.009 | 0.050 | 4.9 | 0.0568 | 0.0000 | OK |
| 960 minute winter | 29 | 405 | 25.120 | 0.050 | 4.9 | 0.0000 | 0.0000 | OK |

| Link Event (Upstream Depth) | US Node | Link | DS Node | Outflow (l/s) | Velocity (m/s) | Flow/Cap | Link Vol (m³) | Discharge Vol (m³) |
|---|---|---|---|---|---|---|---|---|
| 1440 minute winter | 26 | 1.013 | 27 | 4.9 | 0.794 | 0.330 | 0.2136 | |
| 1440 minute winter | 27 | 1.014 | 28 | 4.9 | 0.907 | 0.261 | 0.1924 | |
| 960 minute winter | 28 | 1.015 | 29 | 4.9 | 0.952 | 0.239 | 0.3442 | 267.1 |

Flow+ v10.2 Copyright © 1988-2021 Causeway Technologies Ltd