Furners Lane, Henfield

Drainage Strategy Report

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Created By	Martin Howell	MEng (Hons)	[redacted]	24/09/24
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P01	First Issue	MH	MRW	13/09/24
P02	Site plan updated	MH	MH	20/09/24
P03	Rainwater harvesting added	MH	MRW	24/09/24

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1. Introduction

ABSTRUCT Consulting have been appointed by Elivia Homes Eastern to prepare a surface and foul water drainage strategy to support a planning application for a new development of 29 dwellings.

1.1. Site Address / Location

Furners Lane, Henfield, West Sussex, BN5 9HS

Ordnance Survey Grid TQ 217 161

Figure 1 – Site Location Plan

1.2. Description of Site

1.2.1. Site

The site extends to 2.90ha and is located within the administrative boundary of Horsham District Council. The site comprises a greenfield with a track running through it which serves several dwellings on the eastern side of the site.

1.2.2. Surrounding Area

The site is immediately south of Furners Lane

To the west is the village of Henfield, whilst to the south is Henfield Bowling Club. There are further fields and small areas of woodland to the north and east.

1.2.3. Access

The site is accessed via an existing track, accessed off Furners Lane (public highway), beyond the existing track access Furners Lane changes to private. The existing access onto the development will be upgraded and formalised into a junction whilst the development is built out.

1.3. Description of Development

The development will comprise 29 dwellings along with associated access roads, parking areas, driveways, and landscaping. A proposed site layout can be found in Appendix A.

2. Existing Foul Water Drainage

Being a greenfield site there is no existing foul drainage on site. This is supported by the topographic survey found in Appendix B which shows no drainage onsite. There is a foul chamber within Furners Lane to the northwest of the site.

The Southern Water sewer records (found in Appendix C) shows that this is a public sewer.

3. Proposed Foul Drainage

A new private foul drainage system will be developed to discharge all foul water to the Southern Water public sewer manhole identified to the northwest of the site entrance.

All foul drainage is proposed to discharge under gravity via the new foul drainage system.

All new foul drainage will be designed and constructed in accordance with Approved Document Part H of the Building Regulations. A layout showing the drainage strategy can be found in Appendix F.

4. Existing Surface Water Drainage

Being a greenfield site there is no existing surface water drainage on site, however there will be greenfield runoff due to the impermeable nature of the soils beneath the site.

Appendix D contains calculations showing the greenfield runoff rates for various storms. These are summarised in Table 1 below.

Return Period	Greenfield Runoff Rate (ls^{-1})
1:1 year	12.7
QBar	15.0
1:30 year	34.0
1:100 year	47.8

Table 1 – Greenfield Runoff Rates

5. SUDS Assessment

Sustainable Urban Drainage Systems (SUDS) is the philosophy of trying to replicate, as closely as possible, the natural drainage from a site before development.

There are a number of SUDS features that should be considered for any development and these are set out in a hierarchy. These are summarised along with their suitability for the site in Table 2 below.

The British Geological Survey mapping for the area shows that the site is underlain by the Lower Greensand Group – Sandstone, silty. This, combined with the on site evidence of poor drainage through the upper layers of the soils shows that infiltration features would not be suitable for this site.

SUDS Feature	Site Specific Notes	Proposed Use
1) Store Rainwater for Later Use		
Rainwater Harvesting	The site has a requirement to consider water neutrality. Rainwater harvesting will assist with this.	Proposed for use.
2) Use Infiltration Techniques		
Green Roofs	Sloped roofs generally offer poor results with green roofs.	Not proposed for use.
Soakaways	Site underlain by unsuitable soils.	Not proposed for use.
Permeable Paving	Site underlain by unsuitable soils. However, a tanked (lined) permeable paving system, discharging to the main drainage system would be possible and provides water quality improvement.	Proposed for use as a tanked system discharging to the sewer for water quality benefits.
3) Attenuate Rainwater in Ponds / Open Features for Gradual Release		
Swales / Detention Basins / Ponds	There are large open areas suitable for the use of these features.	Swales and a pond are proposed for use on site.
4) Attenuate Rainwater in Tanks for Gradual Release		
Reduced Discharge and Storage	Infiltration is expected to be very poor, offering no practical infiltration solution. Therefore, , surface water will be discharged to a local sewer. A combination of below ground attenuation tanks, tanked (lined) permeable paving, and a pond will be used to temporarily store the surface water prior to discharge.	Proposed for use.

Table 2 – SUDS Features Summary

6. Proposed Surface Water Drainage

Pre development, the site is classified as a greenfield site and therefore West Sussex's requirements for surface water drainage is to manage and control discharge rates to QBar, Greenfield runoff rates for the developed area.

Surface water runoff will be collected via a mix of tanked (lined) permeable paving, road gullies, swales, and gutters and rainwater downpipes. Surface water from the roofs will be collected and stored for reuse via rainwater harvesting units.

The remaining surface water will be conveyed via a new gravity surface water drainage network to a combined pond and below ground tank storage system located to the northeastern corner of the site.

Due to the topography of the site the surface water held in the pond / below ground attenuation tank will need to be pumped to a surface water sewer located further along Furners Lane to the west of the new site entrance.

The final, offsite flow rate will be restricted through the use of a surface water pump. Vortex flow controls will be utilised within the development in key areas (parking courts) to help control and manage the surface water run-off / discharge into the wider site drainage network.

A layout showing the drainage strategy can be found in Appendix E.

The above changes are summarised in table 3 below, and calculations supporting this summary can be found in Appendices D and F.

Return Period	Developed Area Greenfield Runoff Rate (ls^{-1})	Post Development Runoff Rate (ls^{-1})
1:1 year	2.7	3.3
QBar	3.2	3.3
1:30 year	7.3	3.3
1:100 year	10.3	3.3

Table 3 – Pre / Post Development Offsite Flow Rate Comparison

Temporary storage will be provided within a combination of a below ground attenuation tank and a pond to balance the volumes prior to discharge to the offsite sewer network up to and including the 1:100 year event with a 45% allowance for climate change which is in accordance with the Environment Agencies recent changes (May 2022), to how Climate Change Allowance is assessed and incorporated within developments.

The tank will be sufficient to store all storms up to and including the 1:30 year event, with the pond providing additional storage for the 1:100 year event.

Using the Environment Agencies Climate Change Allowances web page the 1% annual exceedance rainfall event for the 2070's Epoch * (upper end allowance) is 45%.

** Environment Agency guidelines state:-*

Use '2050s' for development with a lifetime up 2060 and use the 2070s epoch for development with a lifetime between 2061 and 2125. Design life of building is 100 years, therefore the 2070s number has been used.

Causeway Flow Calculations supporting the above strategy can be found in Appendix F.

In the event of surface water drainage system exceedance / failure, surface water will discharge over ground towards the north and west, as per the existing condition.

It is therefore shown that post development offsite surface water flows will be suitably managed and controlled in accordance with West Sussex Councils requirements.

7. Water Quality, Ecology, and Amenity

As demonstrated in Figure 2 below the site is not within any Source Protection Zones.

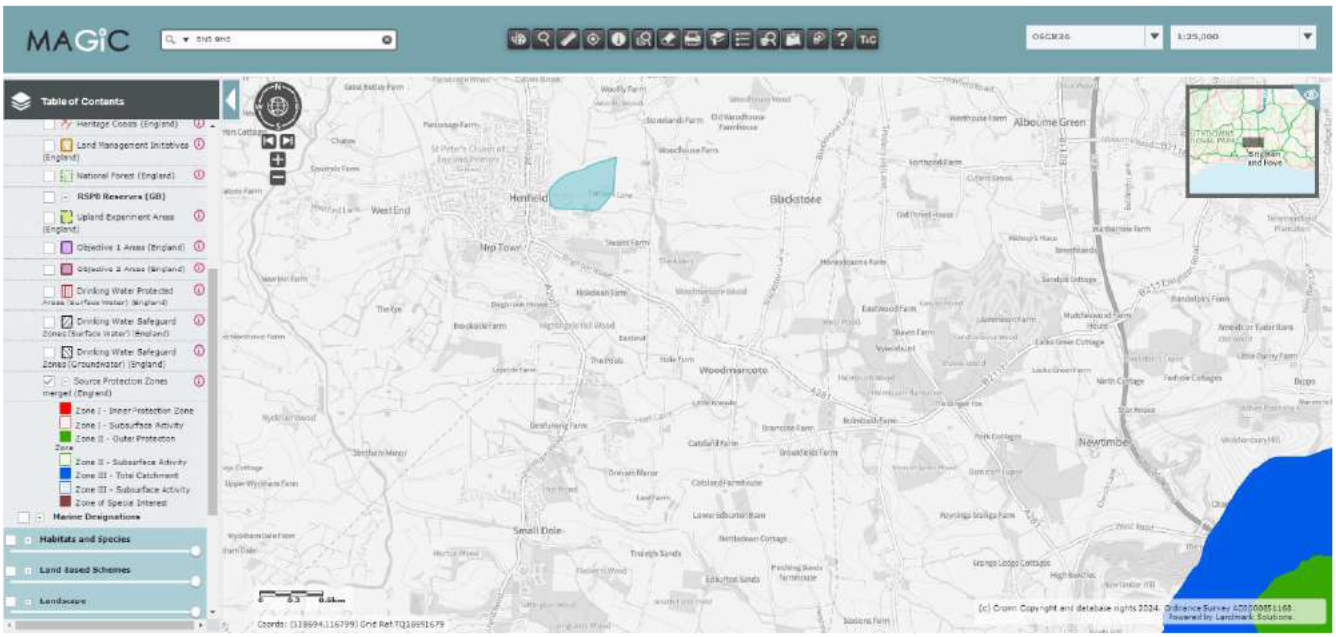

Figure 2 – Magic Map Showing Source Protection Zone

Surface water should be treated prior to discharge to the public sewer. Table 4.3 from CIRIA C753 (The SuDS Manual, 2015) sets out water quality management requirements for discharging surface water.

For Residential Roofs, removal of gross solids only is considered appropriate.

For Residential Parking, and Streets, a Simple Index Approach is considered appropriate. Therefore the site can be assessed using the simple index approach.

Table 26.2 of CIRIA C753 sets out the Hazard Indices for the areas of the site as identified in the previous paragraph. These need to be equalled or better by the Mitigation Indices of the SUDS components proposed to satisfy the requirements of the Simple Index Approach.

Table 4 below sets out the hazard indices.

Land Use	Total Suspended Solids	Metals	Hydrocarbons
Individual Driveways and low traffic roads	0.3	0.2	0.05

Table 4 – Pollution Hazard Indices

Table 26.3 of CIRIA C753 sets out the Mitigation Indices for various common SUDS features.

The surface water from the site will pass through various SUDS features, all of which will provide sufficient cleansing to the surface water.

Table 5 below compares the mitigation indices in the various treatment types to the pollution hazard indices and demonstrates compliance.

Land Use	SUDS Component	Total Suspended Solids	Metals	Hydrocarbons
Individual Driveways and low traffic roads.		0.3	0.2	0.05
	Pond	0.7	0.7	0.5
	Permeable Pavement	0.7	0.6	0.7
	Swale	0.5	0.6	0.6

Table 5 – Pollution Hazard Indices and Mitigation Indices

It can therefore be seen that the Mitigation Indices equal or better the Hazard Indices as required by the Simple Index Approach.

As well as providing water quality benefits the Swales and pond will also provide Ecology and Amenity benefits and will help soften the boundary with the housing to the southeast.

8. Adoption

It is not proposed to offer the new below ground surface and foul water drainage systems for Adoption.

9. Drainage Maintenance

The surface water drainage system serving the development will be managed and maintained by the residents own appointed management and maintenance team once the development has been officially handed over.

The pipework within the site will be designed to be self-cleansing in accordance with Part H of the Building Regulations and as such should have no specific maintenance requirements other than general clearance of silts and debris as and when required.

The use of manholes and inspection chambers will allow future access to maintain the system.

Standard typical maintenance associated with any property will be required for the roof water, typically consisting of ensuring that the system is clear of any leaves or other debris. This should be carried out as required.

Table 6 sets out the various elements of the drainage system and suggested maintenance requirements.

Drainage Element	Inspection Requirements	Maintenance Requirements	Inspection Schedule
Gutters & Rainwater Downpipes	Visual inspection to check for blockages.	Clear and blockages / debris found.	Yearly
Pipework	Designed to be self-cleansing, only required if flooding issue occurs, then by specialist CCTV company.	As recommended by specialist CCTV survey company.	When required.
Catchpits / Hydrobrake Chambers	Visual inspection for silt / debris.	Clear silt / debris.	Initially after 3 months, then every 6 months.
Permeable Paving	Visual check for debris and weeds.	Remove debris and weeds with powered brush to sweep the surface.	Initially after 3 months, then every 6 months.
Attenuation Tanks	CCTV survey to check distributor pipe is clear of debris, visual inspection of surface to check for deformation indicating an issue with the tank below.	Clear silt / debris. Excavation and replacement if required.	Yearly
Swales and Pond	Check for litter, debris, and weeds. Check grass length. Check for areas of poor vegetation growth.	Clear litter, debris, and weeds. Mow grass. Reseed areas to assist with growth.	Initially after 3 months, then every 6 months. Monthly during growing season.
Pump	As required by the manufacturer	As required by the manufacturer	Yearly
Below ground drainage system MUST only be worked on / entered by suitably trained and qualified people using appropriate Health and Safety equipment			

Table 6 – SUDS Maintenance Summary

10. Construction Phase Drainage System

Once appointed, the main contractor as part of their overall responsibilities will prepare the necessary documentation and methodology regarding how they intend to manage the surface water run-off during the main construction works.

11. Conclusions

The site is currently a greenfield site. There is a public foul water sewer network to the northwest of the site entrance in Furners Lane. A public surface water sewer network is also located to the northwest of the site entrance in Furners Lane.

The new development will comprise 29 new dwellings, alongside associated access roads, parking area, and driveways.

The proposed development will discharge foul water to the Southern Water public foul sewer to the northwest of the site in Furners Lane, via a new connection.

Surface water will be discharged to a surface water sewer identified to the northwest of the site along Furners Lane. Surface water flow rates will be restricted to the Greenfield Runoff QBar rate in accordance with the requirements of West Sussex County Council's surface water drainage requirements. Surface water will be temporarily stored on site through the use of a combined below ground attenuation tank and pond prior to discharge. This will be sized for the 1:100 year event with a 45% allowance for climate change.

All surface water runoff shall also be treated prior to discharge to the sewer to help prevent contaminated surface water from leaving the site.

Appendix A – Proposed Site Layout

CDM 2015 Health & Safety Information

This information relates only to 'Significant Hazards' identified on this drawing and is to be read in conjunction with the Designer's Hazard Register.

N

SITE PLAN

Accommodation Schedule

Affordable Rented Dwellings [10no. - 34.5%]

2no.	1-Bedroom M4(3) Flats	AFF Type 1	Block	607sqft
2no.	2-Bedroom Flats	AFF Type 2	Block	716sqft
2no.	2-Bedroom Houses	AFF Type 3	Terraced	874sqft
4no.	3-Bedroom Houses	AFF Type 4	Terraced	1003sqft

Open Market Dwellings [19no. - 65.5%]

3no.	2-Bedroom w/ Study Chalet Bungalows	Farleigh	Detached	1142sqft
5no.	3-Bedroom Chalet Bungalows	Birtley	Detached	1231sqft
2no.	4-Bedroom Houses	Ashcombe II	Detached	1428sqft
2no.	3-Bedroom w/ Study Chalet Bungalows	Priestwood	Detached	1517sqft
4no.	4-Bedroom Houses	Barnham	Detached	1628sqft
1no.	4-Bedroom Chalet Bungalow	Bramblelon	Detached	1727sqft
2no.	4-Bedroom w/ Study Houses	Goring	Detached	1889sqft

Total; 29 Dwellings

Parking

Allocated Spaces:	59 spaces
Visitor Parking:	13 spaces
Total Parking Spaces:	**72 spaces**

Rev	Date	Revision Details	Dr	Ch
P11	19.09.24	Updated Red line boundary.	NK	TW
P10	17.09.24	Updated Site Layout	NK	TW
P9	05.09.24	Footpath on western boundary widened to 2m	TW	AK
P8	22.08.24	Indicative planting removed.	EW	TW
P7	14.08.24	Parking added to schedule - annotations added.	NK	KE
P6	12.08.24	Updated Site Layout - drainage info added.	NK	KE
P5	29.07.24	Updated Site Layout	TW	AK
P4	22.07.24	Updated Site Layout	JY	AK
P3	16.07.24	Updated Site Layout	AK	KE
P2	30.08.23	Updated Site Layout to Pre-App Comments	LD	AK
P1	05.07.23	Updated to Client Comments	LD	AK

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T 0117 214 1101 E bristol@ecewestworks.com
ECE Architecture
www.ecearchitecture.com

Client's Name
Elivia Homes

Job Title
Land West of Backsettown, Furners Lane, Henfield

Drawing Title
Proposed Site Plan

Scale
1:500 @ A1 / 1:1000 @ A3
metres 10 20 30 40 50

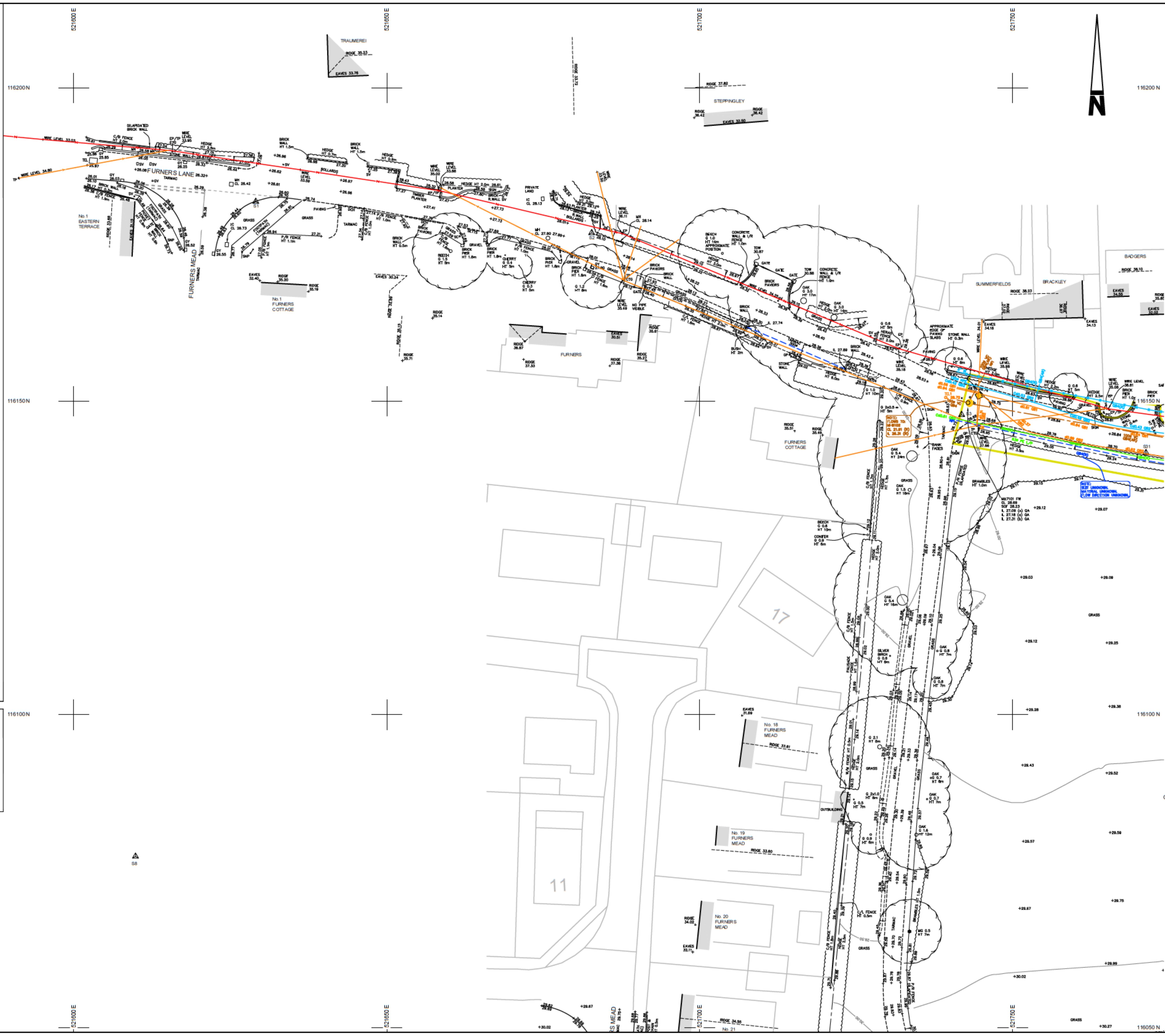
Drawn	Checked	Date
AK	KE	02.03.23

Job No	Drawing No	Rev
7227	PL-10	P11

Status
PRELIMINARY

CAD Plot date: 19/09/2024 - 14:54:57 7227m henfield site plan - new scheme.dwg

Appendix B – Topographic and Utility Survey



Notes :

1. GRID AND LEVELS BASED ON ORDNANCE DATUM, DERIVED FROM THE NATIONAL GNSS NETWORK. LOCAL SCALE FACTOR 0.99978 APPLIED.
2. TREE AND HEDGE SPECIES HAVE BEEN IDENTIFIED AS ACCURATELY AS POSSIBLE BUT SHOULD BE CROSS CHECKED IN CRITICAL AREAS.
3. THIS SURVEY SHOULD ALWAYS BE READ IN CONJUNCTION WITH THE DESKTOP UTILITY REPORT, THAT WAS CARRIED OUT AS A PREREQUISITE TO THIS DETECTION SURVEY.
4. BACKGROUND INFORMATION (SHOWN GREY) PROVIDED BY THE CLIENT.

Coordinate Table

Station	Description	Easting	Northing	Level
S1	ROAD NAIL	521629.085	116181.868	26.633
S2	ROAD NAIL	521682.736	116176.876	28.082
S3	ROAD NAIL	521741.829	116147.849	28.712
S31	ROAD NAIL	521771.278	116141.770	28.815
S32	ROAD NAIL	521845.803	116136.759	27.762
S33	ROAD NAIL	521902.803	116162.273	27.368
S4	PEG	521775.036	116083.947	29.641
S5	PEG	521775.547	116004.393	30.514
S51	PEG	521826.232	115955.317	30.432
S6	ROAD NAIL	521730.851	116039.591	30.274
S61	PEG	521827.959	116018.801	29.417
S7	ROAD NAIL	521680.337	116044.756	30.272
S8	ROAD NAIL	521609.859	116077.368	28.910

Equipment Information

Equipment	Manufacturer	Model	Serial Number	MKS Ref	Date of Calibration
EML Tx Transmitter	SPX Radiodetection	RD8100	10696	RD16	27/09/2021
EML Rx Receiver	SPX Radiodetection	RD8100	2707	RD16	27/09/2021
GPR	IDS Georadar	Opera	8991A	GPR7	29/08/2022

DETECTION SURVEY REPORT

GENERAL
This survey was carried out in accordance with PAS 128:2014 (Publicly Available Specification from BSI). After a pre-survey consultation with the client it was agreed to carry out the detection survey using methodology M1 as per Table 2 of the PAS 128:2014. The survey boundary has been shown on the drawing; please see linestyle section of the key for reference.

DESKTOP UTILITY REPORT
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DETECTION SURVEY
DRAINAGE
Drainage was lifted with pipe sizes and invert levels recorded. Wherever possible the chamber sizes have been recorded and positioned on the drawing. All connections from gullies, external rainwater pipes and external soil stacks have been proven wherever possible into manholes and sewer runs by radio sonde location and/or GPR. Where a saddle connection is present the position is assumed only until proven to QB2 or above. In instances where other detection methods were unsuccessful connections between manholes have been assumed to be straight and labelled as QB4. All drainage should be cross checked in critical areas by CCTV survey or verification survey type A. Supplied information from our client suggests some drainage to be present in the field. These utilities do not feature in the Thames Water records and therefore have limited information regarding these.

WATER
Water utilities have been located using GPR with depths recorded to the crown of the pipe. Undetected routes have been added from the supplied record information. Trial excavations are recommended to confirm location and depth of pipes in critical areas.

GAS
Gas utilities have been located using GPR with depths recorded to the crown of the pipe. Undetected routes have been added from the supplied record information. Trial excavations are recommended to confirm location and depth of pipes in critical areas.

ELECTRICITY
Electricity utilities have been located using GPR and EML methods with depths recorded electronically and to the crown of the duct. Trial excavations are recommended to confirm location and depth of pipes in critical areas.

TELECOM
Telecom ducts have been traced with depths recorded. Due to laws protecting British Telecom apparatus all ducts have been located using remote detection techniques only and compared with record information. Chamber sizes have been recorded using GPR techniques wherever possible. For further information regarding BT apparatus please contact Openreach directly.

CATV
There were no CATV utilities detected on site which matches with the supplied record information.

UNKNOWNS
Some unknown targets identified on the drawing using GPR are classified as "non-linear targets". These are not consistent with what we expect to see when identifying a buried utility, and appear on the drawing as single targets with depths (i.e. not linking two or more depth readings). This does not mean they are not utilities, we are just unable to positively identify them as a utility. We would strongly recommend that further verification surveys (PAS 128:2014 survey type A) are carried out to identify these targets in critical areas. Unknown anomalies located using EML or GPR techniques with electronically derived depths recorded where possible. Recommend trial excavations to confirm identity position and depths in critical areas.

SEE CAUTIONARY NOTES WITHIN THE UTILITY KEY

PAS 128:2014 Quality Level Guide

Quality Level	Description	Accuracy
QB4	A utility is expected to exist but cannot be detected - (AR), (R), (M)	Undefined
QB3 QB3P	Horizontal location only using one geophysical technique. No depth information - ND.	+/- 500mm Horizontal Undefined Vertical
QB2 QB2P	Horizontal and vertical location only using one geophysical technique.	+/- 250mm or +/- 40% of depth whichever is greater
QB1 QB1P	Horizontal and vertical location only using two geophysical techniques.	+/- 150mm or +/- 15% of depth whichever is greater
QA	Service verified in an open excavation, inside an inspection chamber / draw pit, or at the point the service enters / exits the ground	+/- 50mm Horizontal +/- 25mm Vertical

Desktop Utility Records

Utility Type	Provider Details	Date Acquired
Drainage	Southern Water	08/03/2022
Water	Southern Water	08/03/2022
Gas	SGN	09/03/2022
Electricity	UK Power Networks	09/03/2022
Telecom	Openreach	08/03/2022
CATV	Virgin Media	08/03/2022
Tunnels & Pipelines	Linesearchbeforeudig	09/03/2022

0m 2 4 6 8 10 12 14 16 18 20 22

Topographical and PAS 128:2014 Utility Survey

MILLWOOD

Furners Lane
Henfield
West Sussex

Scale:	Sheet Size:	Sheet Number:	Date:
1:200	A0	1	March 2022
Project Number:	Rev:	Surveyed by:	Checked by:	Approved by:
31022	-	JL/LW	AJ/TW	CP/NF

mksurveys

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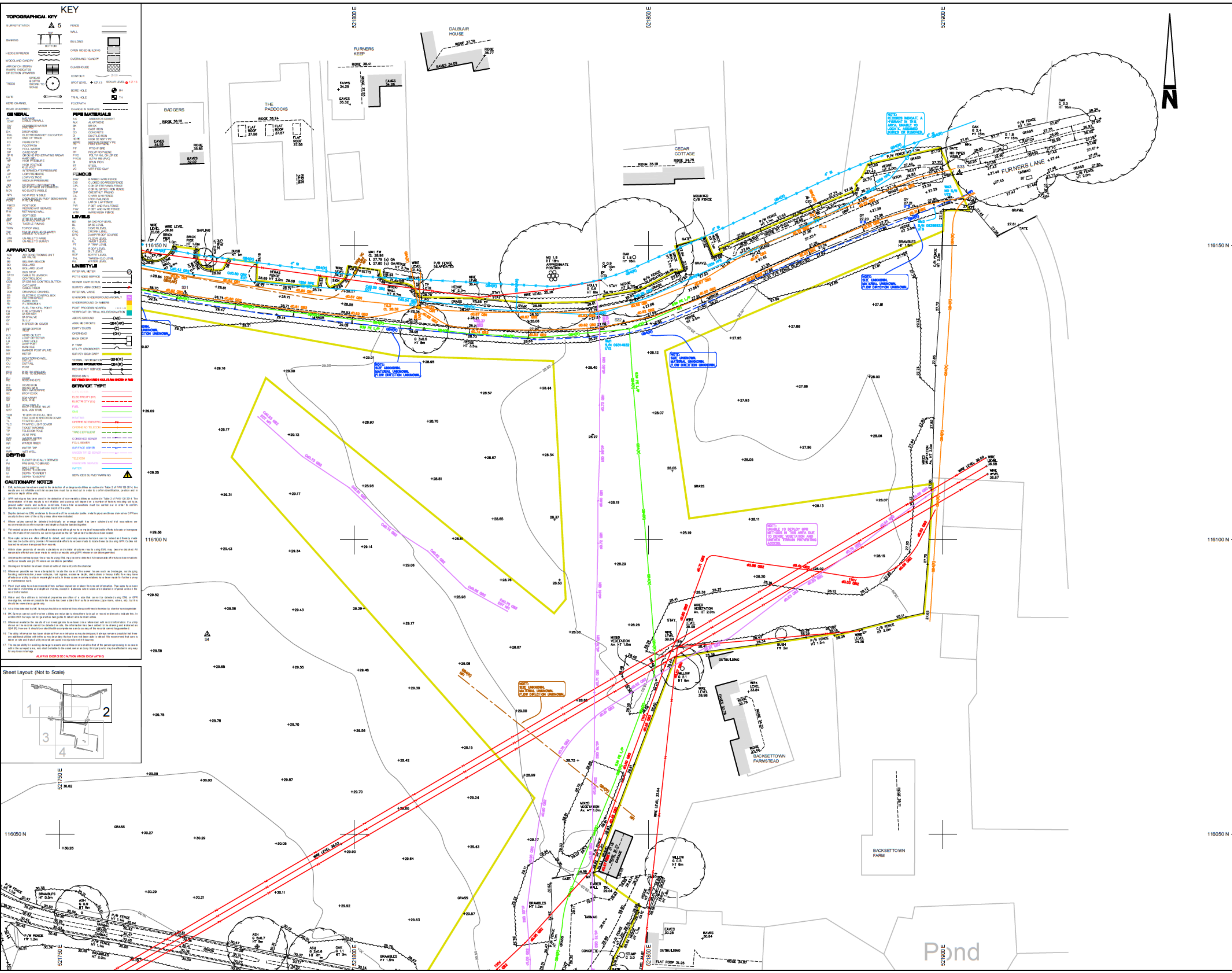

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SEE CAUTIONARY NOTES WITHIN THE UTILITY KEY

PAS 128:2014 Quality Level Guide

Quality Level	Description	Accuracy
QB4	A utility is expected to exist but cannot be detected - (AR), (R), (M)	Undefined
QB3 QB3P	Horizontal location only using one geophysical technique. No depth information - ND.	+/- 500mm Horizontal Undefined Vertical
QB2 QB2P	Horizontal and vertical location only using one geophysical technique.	+/- 250mm or +/- 40% of depth whichever is greater
QB1 QB1P	Horizontal and vertical location only using two geophysical techniques.	+/- 150mm or +/- 15% of depth whichever is greater
QA	Service verified in an open excavation, inside an inspection chamber / draw pit, or at the point the service enters/exits the ground	+/- 50mm Horizontal +/- 25mm Vertical

Desktop Utility Records

Utility Type	Provider Details	Date Acquired
Drainage	Southern Water	08/03/2022
Water	Southern Water	08/03/2022
Gas	SGN	09/03/2022
Electricity	UK Power Networks	09/03/2022
Telecom	Openreach	08/03/2022
CATV	Virgin Media	08/03/2022
Tunnels & Pipelines	Linesearchbeforeudig	09/03/2022

Revision	Description	Surv. by	Check. by	Appr. by	Date

0m 2 4 6 8 10 12 14 16 18 20 22

Topographical and PAS 128:2014 Utility Survey

MILLWOOD

Furners Lane
Henfield
West Sussex

Scale:	Sheet Size:	Sheet Number:	Date:
1:200	A0	2	March 2022

Project Number:	Rev:	Surveyed by:	Checked by:	Approved by:
31022	-	JL/LW	AJ/TW	CP/NF

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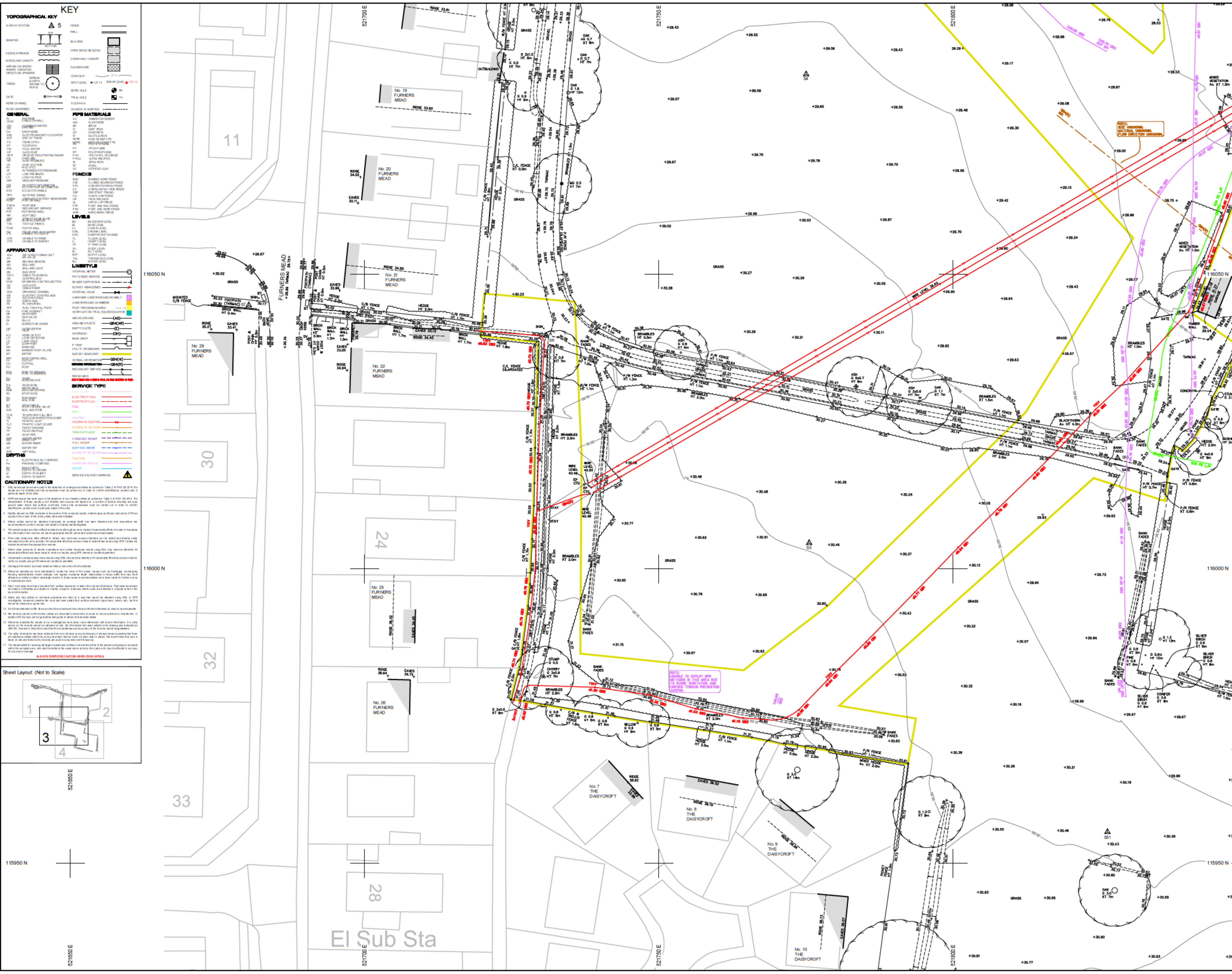

Notes :

1. GRID AND LEVELS BASED ON ORDNANCE DATUM, DERIVED FROM THE NATIONAL GNSS NETWORK. LOCAL SCALE FACTOR 0.99978 APPLIED.
2. TREE AND HEDGE SPECIES HAVE BEEN IDENTIFIED AS ACCURATELY AS POSSIBLE BUT SHOULD BE CROSS CHECKED IN CRITICAL AREAS.
3. THIS SURVEY SHOULD ALWAYS BE READ IN CONJUNCTION WITH THE DESKTOP UTILITY REPORT, THAT WAS CARRIED OUT AS A PREREQUISITE TO THIS DETECTION SURVEY.
4. BACKGROUND INFORMATION (SHOWN GREY) PROVIDED BY THE CLIENT.

Coordinate Table

Station	Description	Easting	Northing	Level
S1	ROAD NAIL	521629.085	116181.868	26.633
S2	ROAD NAIL	521682.736	116176.876	28.082
S3	ROAD NAIL	521741.829	116147.849	28.712
S31	ROAD NAIL	521771.278	116141.770	28.815
S32	ROAD NAIL	521845.803	116136.759	27.762
S33	ROAD NAIL	521902.803	116162.273	27.368
S4	PEG	521775.036	116083.947	29.641
S5	PEG	521775.547	116004.393	30.514
S51	PEG	521826.232	115955.317	30.432
S6	ROAD NAIL	521730.851	116039.591	30.274
S61	PEG	521827.959	116018.801	29.417
S7	ROAD NAIL	521680.337	116044.756	30.272
S8	ROAD NAIL	521609.859	116077.368	28.910

Equipment Information

Equipment	Manufacturer	Model	Serial Number	MKS REF	Date of Calibration
EML Tx Transmitter	SPX Radiodetection	RD8100	10696	RD16	27/09/2021
EML Rx Receiver	SPX Radiodetection	RD8100	2707	RD16	27/09/2021
GPR	IDS Georadar	Opera	8991A	GPR7	29/08/2022

DETECTION SURVEY REPORT

GENERAL

This survey was carried out in accordance with PAS 128:2014 (Publicly Available Specification from BSI). After a pre-survey consultation with the client it was agreed to carry out the detection survey using methodology M1 as per Table 2 of the PAS 128:2014. The survey boundary has been shown on the drawing; please see linestyle section of the key for reference.

DESKTOP UTILITY REPORT

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Drainage was lifted with pipe sizes and invert levels recorded. Wherever possible the chamber sizes have been recorded and positioned on the drawing. All connections from gullies, external rainwater pipes and external soil stacks have been proven wherever possible into manholes and sewer runs by radio sonde location and/or GPR. Where a saddle connection is present the position is assumed only until proven to QB2 or above. In instances where other detection methods were unsuccessful connections between manholes have been assumed to be straight and labelled as QB4. All drainage should be cross checked in critical areas by CCTV survey or verification survey type A. Supplied information from our client suggests some drainage to be present in the field. These utilities do not feature in the Thames Water records and therefore have limited information regarding these.

WATER

Water utilities have been located using GPR with depths recorded to the crown of the pipe. Undetected routes have been added from the supplied record information. Trial excavations are recommended to confirm location and depth of pipes in critical areas.

GAS

Gas utilities have been located using GPR with depths recorded to the crown of the pipe. Undetected routes have been added from the supplied record information. Trial excavations are recommended to confirm location and depth of pipes in critical areas.

ELECTRICITY

Electricity utilities have been located using GPR and EML methods with depths recorded electronically and to the crown of the duct. Trial excavations are recommended to confirm location and depth of pipes in critical areas.

TELECOM

Telecom ducts have been traced with depths recorded. Due to laws protecting British Telecom apparatus all ducts have been located using remote detection techniques only and compared with record information. Chamber sizes have been recorded using GPR techniques wherever possible. For further information regarding BT apparatus please contact Openreach directly.

CATV

There were no CATV utilities detected on site which matches with the supplied record information.

UNKNOWNS

Some unknown targets identified on the drawing using GPR are classified as "non-linear targets". These are not consistent with what we expect to see when identifying a buried utility, and appear on the drawing as single targets with depths (i.e. not linking two or more depth readings). This does not mean they are not utilities, we are just unable to positively identify them as a utility. We would strongly recommend that further verification surveys (PAS 128:2014 survey type A) are carried out to identify these targets in critical areas. Unknown anomalies located using EML or GPR techniques with electronically derived depths recorded where possible. Recommend trial excavations to confirm identity position and depths in critical areas.

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N

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Topographical and PAS 128:2014 Utility Survey

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Furners Lane
Henfield
West Sussex

Scale:	Sheet Size:	Sheet Number:	Date:
1:200	A0	3	March 2022

Project Number:	Rev:	Surveyed by:	Checked by:	Approved by:
31022	-	JL/LW	AJ/TW	CP/NF

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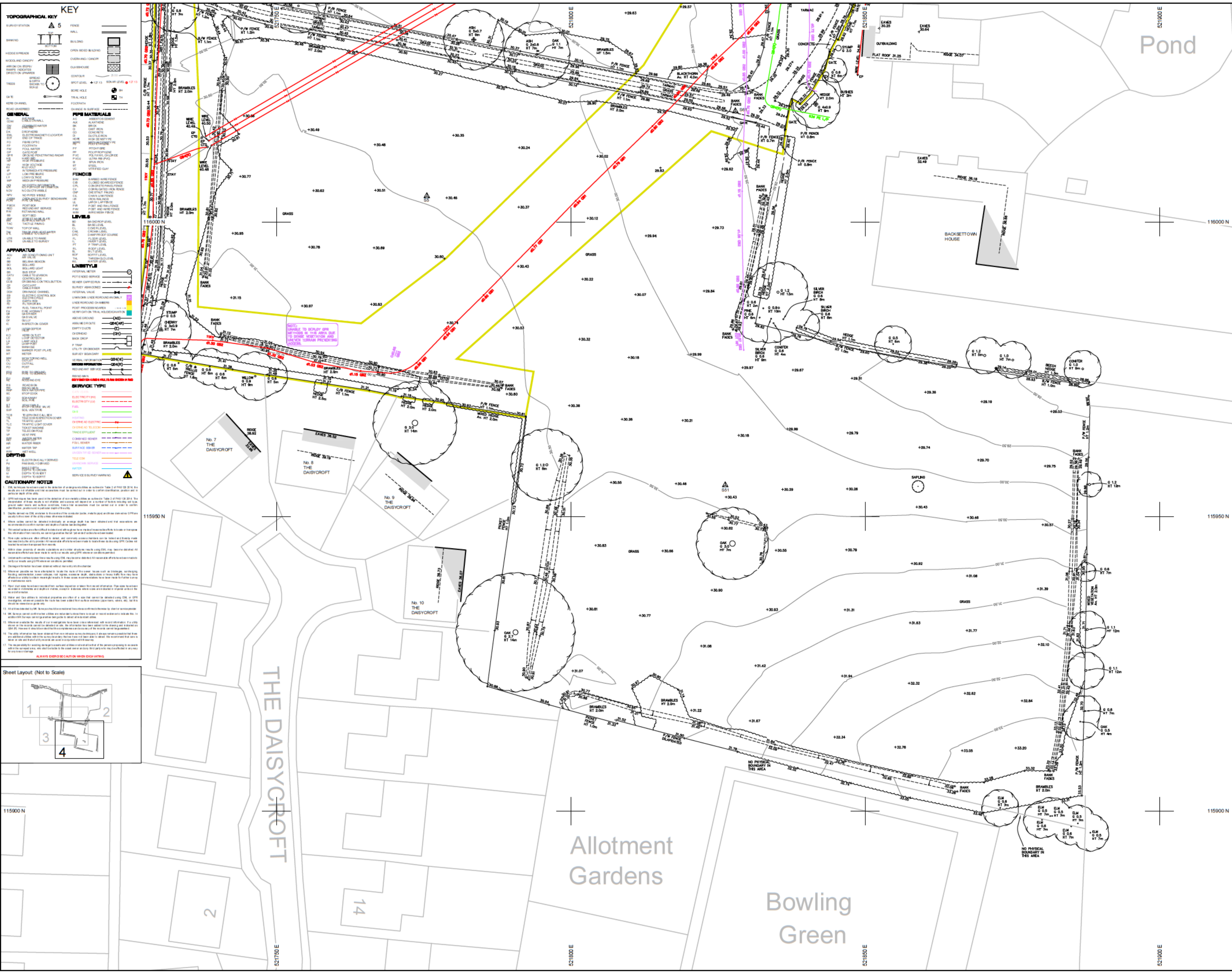

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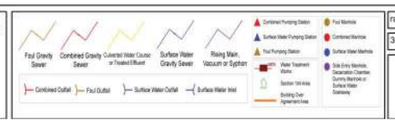
Appendix C – Southern Water Sewer Records

(c) Crown copyright and database rights 2022 Ordnance Survey 100031673 | Date: 08/02/22 | Scale: 1:1250 | Map Centre: 521804,116094 | Data updated: 17/01/22 | Our Ref: 776904 - 3 | Wastewater Plan A1

The positions of pipes shown on this plan are believed to be correct, but Southern Water Services Ltd accept no responsibility in the event of inaccuracy. The actual positions should be determined on site. This plan is produced by Southern Water Services Ltd (c) Crown copyright and database rights 2022 Ordnance Survey 100031673 .This map is to be used for the purposes of viewing the location of Southern Water plant only. Any other uses of the map data or further copies is not permitted.

WARNING: BAC pipes are constructed of Bonded Asbestos Cement.

WARNING: Unknown (UNK) materials may include Bonded Asbestos Cement.



rachel.dyson@mksurveys.co.uk

31022

WATER for LIFE from Southern Water.

Appendix D – Greenfield Runoff Calculations

abstruct consulting Structural & Civil Engineers	File Name: AC23068-ABS-XX-XX-CA-C-5502	Project: Furners Lane, Henfield	Job No: AC23068
Title: Greenfield Runoff Rates		By: MH	Date: 11/09/2024	Sheet No: 1 of 1

Pre Development Offsite Flows

Site Area = 28,964 m² Developed Area = 6,220 m²

Greenfield Runoff Rates

IH 124 gives greenfield runoff rates for a 50ha site, guidance for sites smaller than this is to linearly interpolate down to the site size, greenfield rates calculated using Micro Drainage.

	1:1 year		1:30 year		1:100 year		Qbar	
IH 124 (50ha)	219.9	ls-1	586.2	ls-1	825.2	ls-1	258.7	ls-1
Site Area	12.7	ls-1	34.0	ls-1	47.8	ls-1	15.0	ls-1
Developed Area	2.7	ls-1	7.3	ls-1	10.3	ls-1	3.2	ls-1

IH 124 Mean Annual Flood

Input

Return Period (years)	1	Soil	0.450
Area (ha)	50.000	Urban	0.000
SAAR (mm)	805	Region Number	Region 7

Results	**l/s**
QBAR Rural	258.7
QBAR Urban	258.7
Q1 year	219.9
Q1 year	219.9
Q2 years	227.9
Q5 years	331.1
Q10 years	419.1
Q20 years	518.2
Q25 years	555.6
Q30 years	586.2
Q50 years	677.7
Q100 years	825.2
Q200 years	970.0
Q250 years	1016.6
Q1000 years	1334.8

Appendix E – Drainage Strategy Drawing

APPROXIMATE LOCATION OF SOUTHERN WATER PUBLIC FOUL WATER SEWER, CHAMBER REF. 6151.
CL=26.21
IL=24.70
DP=1.51m
INFORMATION TAKEN FROM SEWER RECORDS, NOT VISIBLE ON SURVEY OR FROM WALK OVER.
FURTHER INVESTIGATION REQUIRED

5m SECTION OF GRAVITY PIPEWORK BETWEEN RECEIVING CHAMBER OF RISING MAIN AND PUBLIC SEWER.

PROPOSED NEW CONNECTION TO EXISTING PUBLIC SEWER SUBJECT TO APPROPRIATE SECTION 105 CONNECTION APPLICATION WITH SOUTHERN WATER.

BREAK CHAMBER FOR PUMPED RISING MAIN.

EXISTING MANHOLE ASSUMED TO BE SOUTHERN WATER PUBLIC FOUL WATER SEWER, CHAMBER REF. 6101.
CL=26.43
IL=UNKNOWN
DP=UNKNOWN
INFORMATION TAKEN FROM SEWER RECORDS. POSITION TAKEN FROM TOPOGRAPHICAL SURVEY.

EXISTING MANHOLE ASSUMED TO BE SOUTHERN WATER PUBLIC FOUL WATER SEWER, CHAMBER REF. 6102.
CL=27.91
IL=26.31
DP=1.60m
INFORMATION TAKEN FROM SEWER RECORDS. POSITION TAKEN FROM TOPOGRAPHICAL SURVEY.

EXISTING MANHOLE ASSUMED TO BE SOUTHERN WATER PUBLIC FOUL WATER SEWER, CHAMBER REF. 7101.
CL=28.70
IL=27.09
DP=1.61m
INFORMATION TAKEN FROM SEWER RECORDS. POSITION TAKEN FROM TOPOGRAPHICAL SURVEY.

PROPOSED NEW CONNECTION TO EXISTING PUBLIC SEWER SUBJECT TO APPROPRIATE SECTION 106 CONNECTION APPLICATION WITH SOUTHERN WATER.

DITCH OUTFALL AND DOWN STREAM NETWORK TO BE INVESTIGATED TO DETERMINE IF SURFACE WATER FROM SITE COULD DISCHARGE TO THIS POINT TO REDUCE LENGTH OF RISING MAIN / WORKS TO FURNERS LANE.

SURFACE WATER PUMP LIMITS OFFSITE FLOW RATE TO GREENFIELD QBAR RUNOFF RATE OF 3.2l/s

BALANCING POND WITH GEOCELULLUAR ATTENUATION TANK BENEATH.

TANK TO BE 14m x 14m x 1m AND SIZED TO STORE THE 1:30 YEAR EVENT.

POND ABOVE PROVIDES THE ADDITIONAL STORAGE UP TO AND INCLUDING THE 1:100 YEAR EVENT WITH A 45% ALLOWANCE FOR CLIMATE CHANGE.

500mm DEEP SWALE.

HYDROBRAKE LIMITS FLOW RATE TO 1l/s

PERMEABLE PAVING WITH 400mm LAYER OF GEOCELLULAR ATTENUATION CRATES BENEATH FOR STORAGE.

HYDROBRAKE LIMITS FLOW RATE TO 1l/s

KEY:

PRIVATE DRAINAGE

ALL BELOW GROUND PIPEWORK TO BE 100Ø UNLESS NOTED OTHERWISE

- 150Ø, 1:80 — -SURFACE WATER DRAIN.
- S1 — -SURFACE WATER CHAMBER.
- CP1 — -SURFACE WATER CATCHPIT CHAMBER.
- SPS — -SURFACE WATER PUMPING STATION.
- -PUMPED SURFACE WATER RISING MAIN.
- HB — -HYDRO-BRAKE FLOW CONTROL MANHOLE.
- -PERMEABLE PAVING (TANKED).
- -HEADWALL (INLET / OUTLET)
- -BELOW GROUND GEOLIGHT SURFACE WATER ATTENUATION STORAGE SYSTEM BY SDS (TEL: 01934 751 303).
- -EXCEEDANCE FLOOD ROUTING.
- 150Ø, 1:80 — F1 — -FOUL WATER DRAIN.
- -FOUL WATER CHAMBER.
- FPS — -FOUL WATER PUMPING STATION.
- -PUMPED FOUL WATER RISING MAIN.

EXISTING DRAINAGE

- 150Ø — Ex — -SURFACE WATER DRAIN TO REMAIN.
- Ex — -SURFACE WATER CHAMBER.
- 150Ø — -FOUL WATER DRAIN TO REMAIN.
- Ex — -FOUL WATER CHAMBER.

0m 5 10 15 20 25m 30 35 40 45 50m
1:500 SCALE

1. DO NOT SCALE THIS DRAWING.
2. THIS DRAWING TO BE READ IN CONJUNCTION WITH ALL OTHER RELEVANT ENGINEER'S AND ARCHITECT'S DRAWINGS AND SPECIFICATIONS.

FOR INFORMATION ONLY

Rev	Drwn	Chkd	D.M.Y	Revision notes
P02	MH	MRW	20.09.24	SITE PLAN UPDATED TO LATEST.
P01	MH	MRW	13.09.24	PRELIMINARY ISSUE

Revisions

abstruct consulting
Structural & Civil Engineers
T: 01732 838000 E: info@abstruct-consult.com www.abstruct-consult.com

Client
ELIVIA HOMES

Project
FURNERS LANE,
HENFIELD

Drawing Title
DRAINAGE STRATEGY LAYOUT

Status FOR INFORMATION

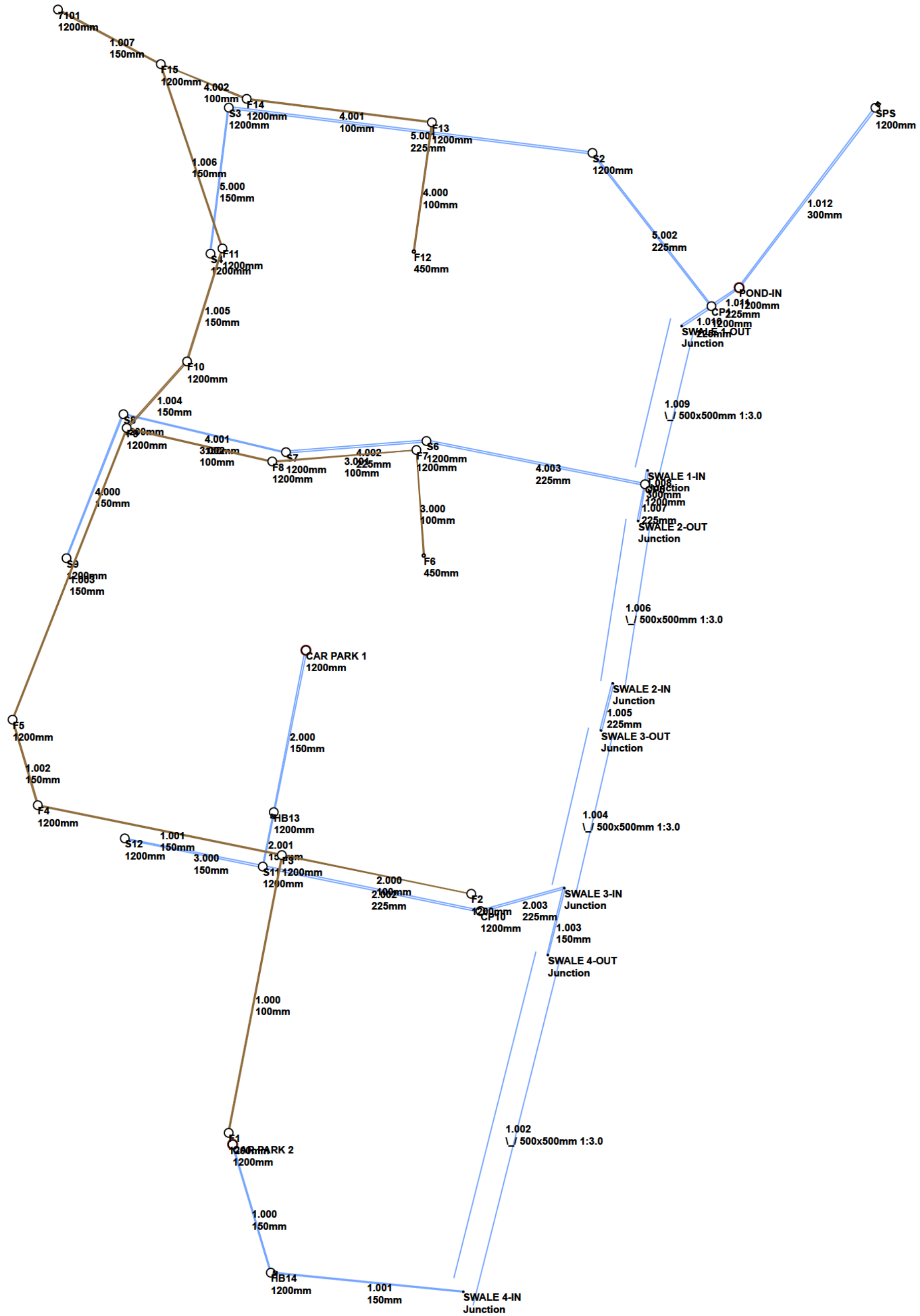
Scale 1 : 500 @A1 Proj. No. AC23068

Drawing Ref. AC23068-ABS-XX-ZZ-DR-C-5100 Revision P02

THIS DRAWING MUST BE READ AS A COLOUR PRINT

DWG FILE:AC23068-ABS-XX-ZZ-DR-C-5100-P02.dwg

Appendix F – Surface Water Drainage Calculations



Design Settings

Rainfall Methodology	FSR	M5-60 (mm)	20.000	Maximum Time of Concentration (mins)	30.00	Minimum Backdrop Height (m)	0.200
Return Period (years)	1	Ratio-R	0.350	Maximum Rainfall (mm/hr)	50.0	Preferred Cover Depth (m)	1.200
Additional Flow (%)	0	CV	0.750	Minimum Velocity (m/s)	1.00	Include Intermediate Ground	✓
FSR Region	England and Wales	Time of Entry (mins)	5.00	Connection Type	Level Soffits	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)
CAR PARK 2	0.085	5.00	30.700	1200	521767.150	115992.379	0.800
HB14			30.800	1200	521772.460	115974.582	1.020
SWALE 4-IN			30.100		521799.234	115971.942	0.500
SWALE 4-OUT			29.600		521810.994	116018.628	0.500
CAR PARK 1	0.076	5.00	30.200	1200	521777.341	116060.905	0.460
HB13			30.540	1200	521772.872	116038.455	0.960
S12	0.033	5.00	30.430	1200	521752.149	116034.821	0.880
S11	0.055	5.00	30.500	1200	521771.339	116030.910	1.200
CP10	0.041	5.00	30.050	1200	521801.619	116024.738	0.960
SWALE 3-IN			29.500		521813.275	116027.931	0.500
SWALE 3-OUT			29.200		521818.374	116049.764	0.500
SWALE 2-IN			29.100		521820.015	116056.335	0.500
SWALE 2-OUT			28.700		521823.552	116078.845	0.500
S9	0.020	5.00	29.810	1200	521744.044	116073.681	1.030
S8	0.028	5.00	29.540	1200	521751.963	116093.650	0.910
S7	0.043	5.00	29.680	1200	521774.568	116088.386	1.280
S6			29.440	1200	521794.103	116089.937	1.140
CP5	0.015	5.00	28.650	1200	521824.503	116083.936	0.500
SWALE 1-IN			28.600		521824.863	116085.860	0.500
SWALE 1-OUT			28.100		521829.602	116105.867	0.500
S4	0.042	5.00	29.220	1200	521764.068	116115.917	1.500
S3	0.039	5.00	29.140	1200	521766.615	116136.169	1.710
S2	0.031	5.00	28.750	1200	521817.196	116129.896	1.850
CP1			28.050	1200	521833.746	116108.634	1.950
POND-IN			28.000	1200	521837.596	116111.205	2.000
SPS			28.000	1200	521856.549	116136.156	2.100

Links

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)	Design Flow (l/s)
1.000	CAR PARK 2	HB14	18.572	0.600	29.900	29.780	0.120	154.8	150	5.38	49.6	
1.001	HB14	SWALE 4-IN	26.904	0.600	29.780	29.600	0.180	149.5	150	5.93	47.5	1.0
1.002	SWALE 4-IN	SWALE 4-OUT	48.144	0.240	29.600	29.100	0.500	96.3	500	10.42	36.0	
1.003	SWALE 4-OUT	SWALE 3-IN	9.579	0.600	29.100	29.000	0.100	95.8	150	10.58	35.7	

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
1.000	0.805	14.2	11.4	0.650	0.870	0.085	0.0	102	0.893
1.001	0.819	14.5	1.0	0.870	0.350	0.085	0.0	27	0.469
1.002	0.179	178.7	8.3	0.000	0.000	0.085	0.0	121	0.080
1.003	1.027	18.1	8.2	0.350	0.350	0.085	0.0	71	1.001

Links

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)	Design Flow (l/s)
2.000	CAR PARK 1	HB13	22.890	0.600	29.740	29.580	0.160	143.1	150	5.46	49.3	
2.001	HB13	S11	7.699	0.600	29.580	29.375	0.205	37.6	150	5.53	49.0	1.0
3.000	S12	S11	19.584	0.600	29.550	29.375	0.175	111.9	150	5.34	49.7	
2.002	S11	CP10	30.903	0.600	29.300	29.090	0.210	147.2	225	6.01	47.2	
2.003	CP10	SWALE 3-IN	12.085	0.600	29.090	29.000	0.090	134.3	225	6.19	46.6	
1.004	SWALE 3-IN	SWALE 3-OUT	22.421	0.240	29.000	28.700	0.300	74.7	500	12.42	32.9	
1.005	SWALE 3-OUT	SWALE 2-IN	6.773	0.600	28.700	28.600	0.100	67.7	225	12.49	32.8	
1.006	SWALE 2-IN	SWALE 2-OUT	22.786	0.240	28.600	28.200	0.400	57.0	500	14.12	30.6	
1.007	SWALE 2-OUT	CP5	5.179	0.600	28.200	28.150	0.050	103.6	225	14.19	30.6	
4.000	S9	S8	21.482	0.600	28.780	28.630	0.150	143.2	150	5.43	49.4	
4.001	S8	S7	23.210	0.600	28.630	28.475	0.155	149.7	150	5.90	47.6	
4.002	S7	S6	19.596	0.600	28.400	28.300	0.100	196.0	225	6.25	46.4	
4.003	S6	CP5	30.987	0.600	28.300	28.150	0.150	206.6	225	6.82	44.6	
1.008	CP5	SWALE 1-IN	1.957	0.600	28.150	28.100	0.050	39.1	300	14.20	30.6	
1.009	SWALE 1-IN	SWALE 1-OUT	20.561	0.240	28.100	27.600	0.500	41.1	500	15.46	29.2	
1.010	SWALE 1-OUT	CP1	4.983	0.600	27.600	26.100	1.500	3.3	225	15.47	29.1	
5.000	S4	S3	20.412	0.600	27.720	27.505	0.215	94.9	150	5.33	49.8	
5.001	S3	S2	50.969	0.600	27.430	26.900	0.530	96.2	225	5.97	47.4	
5.002	S2	CP1	26.944	0.600	26.900	26.100	0.800	33.7	225	6.17	46.7	
1.011	CP1	POND-IN	4.630	0.600	26.100	26.000	0.100	46.3	225	15.51	29.1	
1.012	POND-IN	SPS	31.333	0.600	26.000	25.900	0.100	313.3	300	16.10	28.5	

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
2.000	0.838	14.8	10.2	0.310	0.810	0.076	0.0	91	0.901
2.001	1.647	29.1	1.0	0.810	0.975	0.076	0.0	19	0.767
3.000	0.949	16.8	4.4	0.730	0.975	0.033	0.0	52	0.801
2.002	1.075	42.8	21.0	0.975	0.735	0.164	0.0	111	1.070
2.003	1.126	44.8	25.9	0.735	0.275	0.205	0.0	123	1.165
1.004	0.203	202.9	28.8	0.000	0.000	0.323	0.0	208	0.123
1.005	1.591	63.3	28.7	0.275	0.275	0.323	0.0	106	1.551
1.006	0.232	232.4	30.2	0.000	0.000	0.364	0.0	200	0.138
1.007	1.284	51.1	30.2	0.275	0.275	0.364	0.0	124	1.335
4.000	0.837	14.8	2.7	0.880	0.760	0.020	0.0	43	0.636
4.001	0.819	14.5	6.2	0.760	1.055	0.048	0.0	68	0.786
4.002	0.930	37.0	11.4	1.055	0.915	0.091	0.0	86	0.822
4.003	0.906	36.0	11.0	0.915	0.275	0.091	0.0	85	0.796
1.008	2.520	178.1	38.9	0.200	0.200	0.470	0.0	95	2.029
1.009	0.273	273.5	40.3	0.000	0.000	0.510	0.0	212	0.168
1.010	7.230	287.5	40.3	0.275	1.725	0.510	0.0	57	5.147
5.000	1.031	18.2	5.7	1.350	1.485	0.042	0.0	57	0.910
5.001	1.333	53.0	10.4	1.485	1.625	0.081	0.0	67	1.040
5.002	2.262	89.9	14.2	1.625	1.725	0.112	0.0	60	1.662
1.011	1.927	76.6	49.1	1.725	1.775	0.622	0.0	131	2.043
1.012	0.883	62.4	48.0	1.700	1.800	0.622	0.0	198	0.970

Simulation Settings

Rainfall Methodology	FSR	M5-60 (mm)	20.000	Winter CV	0.840	Drain Down Time (mins)	240	Check Discharge Rate(s)	x
Rainfall Events	Singular	Ratio-R	0.350	Analysis Speed	Normal	Additional Storage (m³/ha)	20.0	Check Discharge Volume	x
FSR Region	England and Wales	Summer CV	0.750	Skip Steady State	x	Starting Level (m)			

Storm Durations

15 | 30 | 60 | 120 | 180 | 240 | 360 | 480 | 600 | 720 | 960 | 1440 | 2160

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)	Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)	Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
1	0	0	0	30	0	0	0	100	45	0	0

Node HB14 Online Hydro-Brake® Control

Flap Valve	x	Design Depth (m)	0.520	Sump Available	✓	Min Node Diameter (mm)	1200
Replaces Downstream Link	✓	Design Flow (l/s)	1.0	Product Number	CTL-SHE-0053-1000-0520-1000		
Invert Level (m)	29.780	Objective	(HE) Minimise upstream storage	Min Outlet Diameter (m)	0.075		

Node HB13 Online Hydro-Brake® Control

Flap Valve	x	Design Depth (m)	0.590	Sump Available	✓	Min Node Diameter (mm)	1200
Replaces Downstream Link	✓	Design Flow (l/s)	1.0	Product Number	CTL-SHE-0052-1000-0590-1000		
Invert Level (m)	29.580	Objective	(HE) Minimise upstream storage	Min Outlet Diameter (m)	0.075		

Node SPS Online Pump Control

Flap Valve x | Replaces Downstream Link ✓ | Invert Level (m) 25.900 | Switch on depth (m) 0.001 | Switch off depth (m) 0.000

Depth (m)	Flow (l/s)
0.001	3.200

Node CAR PARK 1 Depth/Area Storage Structure

Base Inf Coefficient (m/hr) 0.00000 | Side Inf Coefficient (m/hr) 0.00000 | Safety Factor 2.0 | Porosity 0.95 | Invert Level (m) 29.740 | Time to half empty (mins)

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	150.0	0.0	0.400	150.0	0.0	0.401	0.0	0.0

Node CAR PARK 2 Depth/Area Storage Structure

Base Inf Coefficient (m/hr) 0.00000 | Side Inf Coefficient (m/hr) 0.00000 | Safety Factor 2.0 | Porosity 0.95 | Invert Level (m) 29.900 | Time to half empty (mins)

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	133.0	0.0	0.400	133.0	0.0	0.401	0.0	0.0

Node POND-IN Depth/Area Storage Structure

Base Inf Coefficient (m/hr) 0.00000 | Side Inf Coefficient (m/hr) 0.00000 | Safety Factor 2.0 | Porosity 1.00 | Invert Level (m) 27.400 | Time to half empty (mins)

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	615.0	0.0	0.600	844.0	0.0

Node POND-IN Depth/Area Storage Structure

Base Inf Coefficient (m/hr) 0.00000 | Side Inf Coefficient (m/hr) 0.00000 | Safety Factor 2.0 | Porosity 0.95 | Invert Level (m) 26.000 | Time to half empty (mins)

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	196.0	0.0	1.000	196.0	0.0	1.001	0.0	0.0

Results for 1 year Critical Storm Duration. Lowest mass balance: 98.25%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
180 minute winter	CAR PARK 2	132	29.957	0.057	3.1	7.4228	0.0000	OK
180 minute winter	HB14	132	29.957	0.177	1.4	0.1999	0.0000	SURCHARGED
600 minute summer	SWALE 4-IN	390	29.651	0.051	1.0	0.0000	0.0000	OK
15 minute winter	SWALE 4-OUT	14	29.141	0.041	2.9	0.0000	0.0000	OK
180 minute winter	CAR PARK 1	132	29.784	0.044	2.8	6.4191	0.0000	OK
60 minute winter	HB13	42	29.784	0.204	1.9	0.2306	0.0000	SURCHARGED
15 minute winter	S12	10	29.603	0.053	4.5	0.1004	0.0000	OK
15 minute winter	S11	10	29.380	0.080	11.8	0.1637	0.0000	OK
15 minute winter	CP10	11	29.190	0.100	17.0	0.1991	0.0000	OK
15 minute winter	SWALE 3-IN	12	29.145	0.145	17.0	0.0000	0.0000	OK
15 minute winter	1.004:50%	13	29.042	0.192	17.6	0.0000	0.0000	OK
15 minute winter	SWALE 3-OUT	13	28.779	0.079	15.7	0.0000	0.0000	OK
15 minute winter	SWALE 2-IN	14	28.744	0.144	15.9	0.0000	0.0000	OK
15 minute winter	1.006:50%	15	28.577	0.177	17.6	0.0000	0.0000	OK
30 minute winter	SWALE 2-OUT	23	28.301	0.101	16.5	0.0000	0.0000	OK
15 minute winter	S9	10	28.822	0.042	2.7	0.0645	0.0000	OK
15 minute winter	S8	11	28.701	0.071	6.4	0.1233	0.0000	OK
15 minute winter	S7	11	28.491	0.091	11.7	0.1633	0.0000	OK
15 minute winter	S6	11	28.390	0.090	11.8	0.1022	0.0000	OK
30 minute winter	CP5	22	28.266	0.116	24.8	0.2012	0.0000	OK
30 minute winter	SWALE 1-IN	22	28.267	0.167	24.6	0.0000	0.0000	OK
30 minute winter	1.009:50%	23	28.104	0.254	27.2	0.0000	0.0000	OK
30 minute winter	SWALE 1-OUT	23	27.645	0.045	26.3	0.0000	0.0000	OK
15 minute winter	S4	10	27.778	0.058	5.7	0.0985	0.0000	OK
15 minute winter	S3	11	27.500	0.070	10.8	0.1114	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)
180 minute winter	CAR PARK 2	1.000	HB14	1.4	0.221	0.101	0.2208	
180 minute winter	HB14	Hydro-Brake®	SWALE 4-IN	1.0				
600 minute summer	SWALE 4-IN	1.002	SWALE 4-OUT	1.0	0.043	0.006	1.1394	
15 minute winter	SWALE 4-OUT	1.003	SWALE 3-IN	-2.9	0.317	-0.161	0.1007	
180 minute winter	CAR PARK 1	2.000	HB13	1.5	0.222	0.102	0.2502	
60 minute winter	HB13	Hydro-Brake®	S11	1.0				
15 minute winter	S12	3.000	S11	4.3	0.789	0.258	0.1077	
15 minute winter	S11	2.002	CP10	11.6	0.786	0.272	0.4582	
15 minute winter	CP10	2.003	SWALE 3-IN	17.0	0.781	0.381	0.2650	
15 minute winter	SWALE 3-IN	1.004	1.004:50%	13.6	0.091	0.067	1.8914	
15 minute winter	SWALE 3-IN	1.004	SWALE 3-OUT	15.7	0.128	0.077	1.4820	
15 minute winter	SWALE 3-OUT	1.005	SWALE 2-IN	15.9	0.985	0.251	0.1303	
15 minute winter	SWALE 2-IN	1.006	1.006:50%	15.4	0.099	0.066	1.7897	
15 minute winter	SWALE 2-IN	1.006	SWALE 2-OUT	16.8	0.132	0.072	1.5002	
30 minute winter	SWALE 2-OUT	1.007	CP5	16.6	0.938	0.325	0.0979	
15 minute winter	S9	4.000	S8	2.6	0.438	0.176	0.1310	
15 minute winter	S8	4.001	S7	6.2	0.780	0.431	0.1854	
15 minute winter	S7	4.002	S6	11.8	0.791	0.319	0.2924	
15 minute winter	S6	4.003	CP5	11.7	0.802	0.326	0.4851	
30 minute winter	CP5	1.008	SWALE 1-IN	24.6	0.761	0.138	0.0641	
30 minute winter	SWALE 1-IN	1.009	1.009:50%	24.6	0.105	0.090	2.4947	
30 minute winter	SWALE 1-IN	1.009	SWALE 1-OUT	26.3	0.186	0.096	1.7919	
30 minute winter	SWALE 1-OUT	1.010	CP1	26.3	1.961	0.092	0.0727	
15 minute winter	S4	5.000	S3	5.5	0.892	0.302	0.1262	
15 minute winter	S3	5.001	S2	10.7	1.107	0.201	0.4912	

Results for 1 year Critical Storm Duration. Lowest mass balance: 98.25%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	S2	11	26.961	0.061	14.7	0.0897	0.0000	OK
15 minute summer	CP1	10	26.477	0.377	28.1	0.4261	0.0000	SURCHARGED
600 minute winter	POND-IN	480	26.360	0.360	21.0	67.3710	0.0000	SURCHARGED
600 minute winter	SPS	480	26.359	0.459	11.4	0.5195	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	S2	5.002	CP1	14.7	0.867	0.163	0.6532	
15 minute summer	CP1	1.011	POND-IN	33.7	2.204	0.440	0.0946	
600 minute winter	POND-IN	1.012	SPS	11.4	0.515	0.182	2.2064	
600 minute winter	SPS	Pump		3.2				120.4

Results for 30 year Critical Storm Duration. Lowest mass balance: 98.25%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
180 minute winter	CAR PARK 2	176	30.069	0.169	7.0	21.9148	0.0000	SURCHARGED
180 minute winter	HB14	176	30.068	0.288	1.4	0.3263	0.0000	SURCHARGED
2160 minute winter	SWALE 4-IN	1200	29.651	0.051	1.0	0.0000	0.0000	OK
15 minute winter	SWALE 4-OUT	13	29.219	0.119	8.5	0.0000	0.0000	OK
180 minute winter	CAR PARK 1	172	29.868	0.128	6.3	18.7682	0.0000	OK
180 minute winter	HB13	172	29.867	0.287	1.6	0.3247	0.0000	SURCHARGED
15 minute winter	S12	10	29.641	0.091	10.9	0.1707	0.0000	OK
15 minute winter	S11	10	29.434	0.134	29.5	0.2754	0.0000	OK
15 minute winter	CP10	11	29.295	0.205	42.6	0.4066	0.0000	OK
15 minute winter	SWALE 3-IN	12	29.220	0.220	41.6	0.0000	0.0000	OK
15 minute winter	1.004:50%	12	29.128	0.278	42.6	0.0000	0.0000	OK
15 minute winter	SWALE 3-OUT	13	28.851	0.151	41.0	0.0000	0.0000	OK
15 minute winter	SWALE 2-IN	13	28.828	0.228	40.4	0.0000	0.0000	OK
15 minute winter	1.006:50%	13	28.653	0.253	47.7	0.0000	0.0000	OK
15 minute winter	SWALE 2-OUT	14	28.448	0.248	48.2	0.0000	0.0000	FLOOD RISK
15 minute winter	S9	10	28.849	0.069	6.6	0.1049	0.0000	OK
15 minute winter	S8	11	28.770	0.140	15.8	0.2445	0.0000	OK
15 minute winter	S7	11	28.560	0.160	28.6	0.2880	0.0000	OK
15 minute winter	S6	11	28.456	0.156	28.5	0.1762	0.0000	OK
15 minute winter	CP5	14	28.384	0.234	69.5	0.4051	0.0000	OK
15 minute winter	SWALE 1-IN	14	28.372	0.272	69.1	0.0000	0.0000	OK
15 minute winter	1.009:50%	14	28.240	0.390	75.3	0.0000	0.0000	OK
15 minute winter	SWALE 1-OUT	14	27.676	0.076	73.3	0.0000	0.0000	OK
15 minute winter	S4	10	27.822	0.102	13.9	0.1720	0.0000	OK
15 minute winter	S3	10	27.546	0.116	26.4	0.1838	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)
180 minute winter	CAR PARK 2	1.000	HB14	1.4	0.222	0.097	0.3270	
180 minute winter	HB14	Hydro-Brake®	SWALE 4-IN	1.0				
2160 minute winter	SWALE 4-IN	1.002	SWALE 4-OUT	1.0	0.043	0.006	1.1394	
15 minute winter	SWALE 4-OUT	1.003	SWALE 3-IN	-8.5	-0.569	-0.466	0.1559	
180 minute winter	CAR PARK 1	2.000	HB13	1.6	0.222	0.109	0.3844	
180 minute winter	HB13	Hydro-Brake®	S11	1.0				
15 minute winter	S12	3.000	S11	10.6	0.984	0.632	0.2116	
15 minute winter	S11	2.002	CP10	29.0	0.932	0.679	0.9675	
15 minute winter	CP10	2.003	SWALE 3-IN	41.6	1.079	0.930	0.4681	
15 minute winter	SWALE 3-IN	1.004	1.004:50%	32.5	0.106	0.160	3.5124	
15 minute winter	SWALE 3-IN	1.004	SWALE 3-OUT	41.0	0.169	0.202	2.8574	
15 minute winter	SWALE 3-OUT	1.005	SWALE 2-IN	40.4	1.144	0.639	0.2302	
15 minute winter	SWALE 2-IN	1.006	1.006:50%	39.9	0.137	0.172	3.3516	
15 minute winter	SWALE 2-IN	1.006	SWALE 2-OUT	48.2	0.163	0.208	3.5148	
15 minute winter	SWALE 2-OUT	1.007	CP5	48.2	1.212	0.944	0.2060	
15 minute winter	S9	4.000	S8	6.5	0.531	0.437	0.2673	
15 minute winter	S8	4.001	S7	14.9	0.947	1.033	0.3644	
15 minute winter	S7	4.002	S6	28.5	0.960	0.770	0.5827	
15 minute winter	S6	4.003	CP5	28.6	0.918	0.794	1.0507	
15 minute winter	CP5	1.008	SWALE 1-IN	69.1	1.097	0.388	0.1235	
15 minute winter	SWALE 1-IN	1.009	1.009:50%	69.1	0.140	0.253	5.1974	
15 minute winter	SWALE 1-IN	1.009	SWALE 1-OUT	73.3	0.262	0.268	3.6391	
15 minute winter	SWALE 1-OUT	1.010	CP1	73.2	2.389	0.254	0.1286	
15 minute winter	S4	5.000	S3	13.5	1.104	0.743	0.2511	
15 minute winter	S3	5.001	S2	26.0	1.403	0.490	0.9444	

Results for 30 year Critical Storm Duration. Lowest mass balance: 98.25%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	S2	11	26.998	0.098	36.2	0.1441	0.0000	OK
960 minute winter	CP1	915	26.982	0.882	13.1	0.9970	0.0000	SURCHARGED
960 minute winter	POND-IN	915	26.981	0.981	14.7	183.7982	0.0000	SURCHARGED
960 minute winter	SPS	915	26.981	1.081	10.0	1.2224	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	S2	5.002	CP1	35.9	1.096	0.400	0.7602	
960 minute winter	CP1	1.011	POND-IN	14.7	1.039	0.191	0.1841	
960 minute winter	POND-IN	1.012	SPS	10.0	0.673	0.160	2.2064	
960 minute winter	SPS	Pump		3.2				181.9

Results for 100 year +45% CC Critical Storm Duration. Lowest mass balance: 98.25%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
360 minute winter	CAR PARK 2	344	30.283	0.383	8.0	49.6936	0.0000	SURCHARGED
360 minute winter	HB14	344	30.283	0.503	1.2	0.5686	0.0000	SURCHARGED
2160 minute winter	SWALE 4-IN	900	29.651	0.051	1.0	0.0000	0.0000	OK
15 minute winter	SWALE 4-OUT	14	29.286	0.186	13.1	0.0000	0.0000	SURCHARGED
360 minute winter	CAR PARK 1	344	30.036	0.296	7.1	43.5489	0.0000	FLOOD RISK
360 minute winter	HB13	344	30.036	0.456	1.4	0.5154	0.0000	SURCHARGED
15 minute winter	S12	11	30.100	0.550	20.5	1.0340	0.0000	SURCHARGED
15 minute winter	S11	11	29.877	0.577	49.3	1.1820	0.0000	SURCHARGED
15 minute winter	CP10	11	29.566	0.476	71.7	0.9457	0.0000	SURCHARGED
15 minute winter	SWALE 3-IN	12	29.292	0.292	71.2	0.0000	0.0000	OK
15 minute winter	1.004:50%	11	29.184	0.334	76.2	0.0000	0.0000	OK
15 minute winter	SWALE 3-OUT	13	29.036	0.336	78.3	0.0000	0.0000	FLOOD RISK
15 minute winter	SWALE 2-IN	14	28.899	0.299	72.6	0.0000	0.0000	OK
15 minute winter	1.006:50%	14	28.733	0.333	85.9	0.0000	0.0000	OK
15 minute winter	SWALE 2-OUT	15	28.672	0.472	80.3	0.0000	0.0000	FLOOD RISK
15 minute winter	S9	12	29.419	0.639	12.4	0.9704	0.0000	SURCHARGED
15 minute winter	S8	12	29.350	0.720	24.7	1.2579	0.0000	FLOOD RISK
15 minute winter	S7	12	28.918	0.518	46.0	0.9343	0.0000	SURCHARGED
15 minute winter	S6	12	28.746	0.446	43.9	0.5043	0.0000	SURCHARGED
15 minute winter	CP5	13	28.503	0.353	117.6	0.6113	0.0000	FLOOD RISK
15 minute winter	SWALE 1-IN	14	28.445	0.345	117.5	0.0000	0.0000	OK
30 minute winter	1.009:50%	19	28.309	0.459	128.5	0.0000	0.0000	OK
30 minute winter	SWALE 1-OUT	22	27.784	0.184	133.6	0.0000	0.0000	OK
15 minute winter	S4	12	28.155	0.435	26.1	0.7363	0.0000	SURCHARGED
15 minute winter	S3	12	27.836	0.406	47.6	0.6450	0.0000	SURCHARGED

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	CAR PARK 2	1.000	HB14	1.2	0.216	0.087	0.3270	
360 minute winter	HB14	Hydro-Brake®	SWALE 4-IN	1.0				
2160 minute winter	SWALE 4-IN	1.002	SWALE 4-OUT	1.0	0.043	0.006	1.1394	
15 minute winter	SWALE 4-OUT	1.003	SWALE 3-IN	-13.0	-0.754	-0.717	0.1686	
360 minute winter	CAR PARK 1	2.000	HB13	1.4	0.214	0.092	0.4030	
360 minute winter	HB13	Hydro-Brake®	S11	1.0				
15 minute winter	S12	3.000	S11	18.1	1.031	1.082	0.3448	
15 minute winter	S11	2.002	CP10	47.7	1.200	1.116	1.2290	
15 minute winter	CP10	2.003	SWALE 3-IN	71.2	1.791	1.590	0.4806	
15 minute winter	SWALE 3-IN	1.004	1.004:50%	59.4	0.133	0.293	5.0149	
15 minute winter	SWALE 3-IN	1.004	SWALE 3-OUT	78.3	0.190	0.386	5.4918	
15 minute winter	SWALE 3-OUT	1.005	SWALE 2-IN	72.6	1.826	1.148	0.2694	
15 minute winter	SWALE 2-IN	1.006	1.006:50%	72.0	0.160	0.310	5.2271	
15 minute winter	SWALE 2-IN	1.006	SWALE 2-OUT	80.3	0.168	0.345	8.0049	
15 minute winter	SWALE 2-OUT	1.007	CP5	80.1	2.014	1.569	0.2060	
15 minute winter	S9	4.000	S8	9.5	0.570	0.645	0.3782	
15 minute winter	S8	4.001	S7	22.4	1.273	1.549	0.4086	
15 minute winter	S7	4.002	S6	43.9	1.105	1.188	0.7794	
15 minute winter	S6	4.003	CP5	43.4	1.090	1.204	1.2324	
15 minute winter	CP5	1.008	SWALE 1-IN	117.5	1.669	0.660	0.1378	
15 minute winter	SWALE 1-IN	1.009	1.009:50%	117.0	0.176	0.428	7.0720	
15 minute winter	SWALE 1-IN	1.009	SWALE 1-OUT	135.5	0.302	0.496	5.2525	
30 minute winter	SWALE 1-OUT	1.010	CP1	130.7	3.370	0.455	0.1857	
15 minute winter	S4	5.000	S3	23.4	1.328	1.282	0.3593	
15 minute winter	S3	5.001	S2	44.4	1.352	0.837	2.0271	

Results for 100 year +45% CC Critical Storm Duration. Lowest mass balance: 98.25%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
960 minute winter	S2	930	27.714	0.814	4.9	1.1927	0.0000	SURCHARGED
1440 minute winter	CP1	1440	27.695	1.594	16.6	1.8034	0.0000	SURCHARGED
1440 minute winter	POND-IN	1410	27.693	1.693	16.6	384.7497	0.0000	SURCHARGED
1440 minute winter	SPS	1410	27.692	1.792	3.5	2.0270	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)
960 minute winter	S2	5.002	CP1	5.0	0.391	0.055	1.0716	
1440 minute winter	CP1	1.011	POND-IN	16.6	1.084	0.217	0.1841	
1440 minute winter	POND-IN	1.012	SPS	3.5	0.650	0.057	2.2064	
1440 minute winter	SPS	Pump		3.2				275.2

Water Quality

Area (ha)	Intended Land Use	Entering via Node or Link	Name	SuDS Component	Pollution hazard indices TSS	Metals	Hydrocarbons	Pollution mitigation indices TSS	Metals	Hydrocarbons	Cumulative pollution hazard indices TSS	Metals	Hydrocarbons
		Link	1.002	Swale				0.5	0.6	0.6			
		Link	1.004	Swale				0.25	0.3	0.3			
		Link	1.006	Swale				0.25	0.3	0.3			
		Link	1.009	Swale				0.25	0.3	0.3			
		Node	SPS								Sufficient	Sufficient	Sufficient