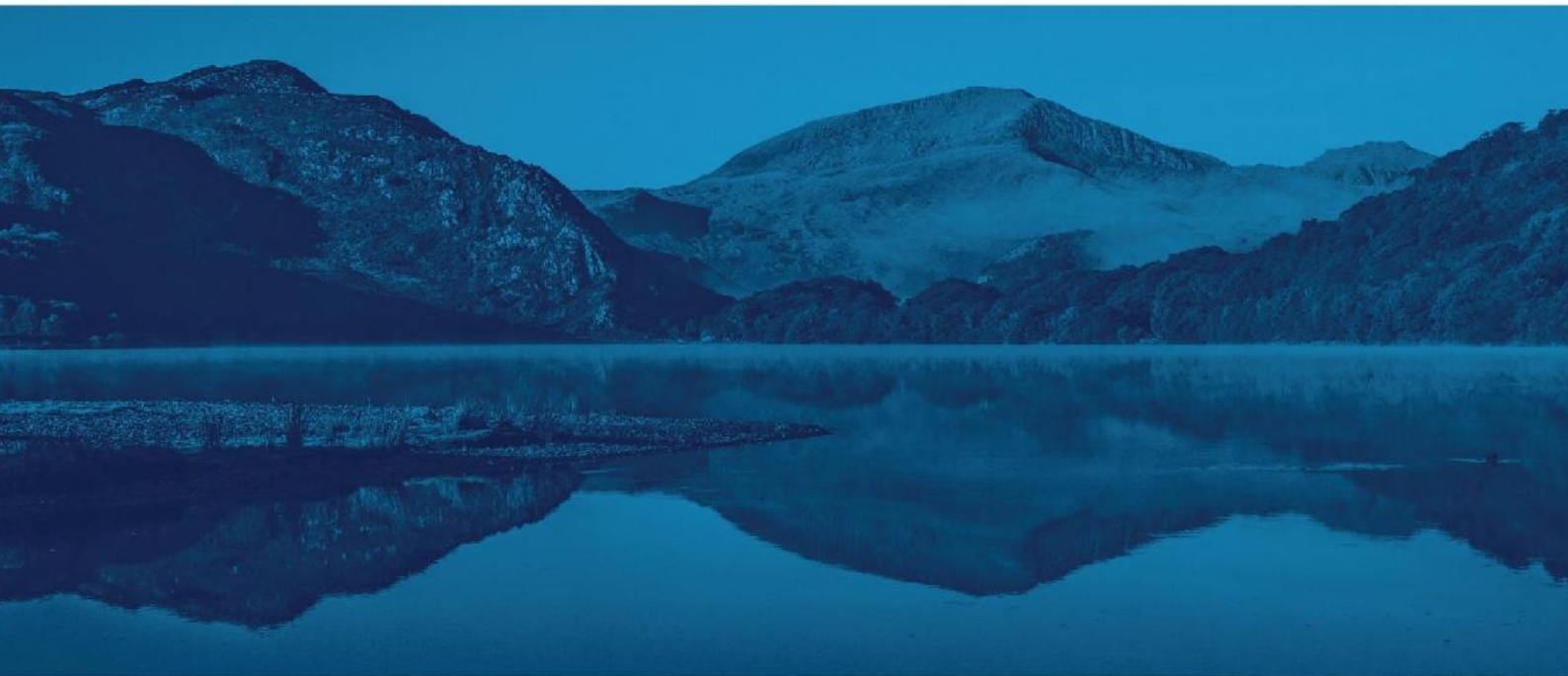




Harts Farm Way, Havant

Drainage Strategy

September 2018



Assessment / Modelling / Design

waterco.co.uk

DOCUMENT VERIFICATION RECORD

CLIENT:	Green Frog Power (GFP11) LTD
SCHEME:	Proposed Generation Compound at Harts Farm Way, Havant – Drainage Strategy
INSTRUCTION:	The instruction to carry out this Drainage Strategy was received from Simon Iyob Toclu of GFP11 LTD.

DOCUMENT REVIEW & APPROVAL

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Introduction

Waterco Consultants have been commissioned to undertake a Drainage Strategy in relation to a proposed power generation compound at Harts Farm Way, Havant, PO9 1HS.

The aim of this Drainage Strategy is to identify water management measures, including Sustainable Drainage Systems (SuDS), to provide surface water runoff reduction and treatment. This Drainage Strategy will inform detailed drainage design.

Existing Conditions

The 3,225m² development site is located at National Grid reference (NGR): 470616, 105836. A location plan and an aerial image are included in Appendix A.

Online imagery (accessed August 2018) and historical aerial imagery (Google Earth Pro) shows that the site comprises the remains of a former car park associated with nearby industrial land uses.

The site is bordered by previously developed industrial land to the north and east, Harts Farm Way (road) to the south with industrial units beyond, and an unnamed watercourse, an access road and industrial units to the west.

Local Topography

Topographical data is included on the 'Proposed Site Plan – Drainage Layout (Survey)' provided by Green Frog Power Ltd in June 2018 (included in Appendix B). The 'Proposed Site Plan – Drainage Layout (Survey)' shows that site levels are relatively flat with levels varying from approximately 3.57 metres Above Ordnance Datum (m AOD) to 3.94m AOD.

Topographic levels have also been derived from a 1m resolution Environment Agency (EA) composite 'Light Detecting and Ranging' (LiDAR) Digital Terrain Model (DTM). A review of LiDAR data shows that site levels corroborate with levels on the proposed development plan. A LiDAR extract is included in Appendix B.

Ground Conditions

Reference to the British Geological Survey online mapping (1:50,000 scale) indicates that the site is underlain by superficial deposits of Alluvium generally comprising clay, silt, sand and gravel. The

superficial deposits are identified as being underlain by chalk. Given the resolution of the BGS mapping, the actual underlying conditions may vary.

A review of BGS online borehole scans shows that there is a borehole (ref: SU70NW99) located immediately south-east of the site. The borehole was advanced to 4.57m below ground level (m.bgl) and identified medium shingle and flint found to a depth of 1.5m. bgl. The shingle and flint are shown to be underlain by chalk and flint to the base of the borehole at 4.57m. bgl. No groundwater was recorded. A borehole scan is included in Appendix C.

According to the EA's online Groundwater Vulnerability data, accessed via MAGIC's online mapping, the superficial Alluvium is classified as a Secondary A Aquifer. These are permeable layers capable of supporting water supplies at a local rather than strategic scale and in some cases form an important source of base flow to rivers. The underlying bedrock is classified as a Principal Aquifer. These are layers of rock or drift deposits that have high intergranular and/or fracture permeability - meaning they usually provide a high level of water storage. They may support water supply and/or river base flow on a strategic scale.

The Environment Agency's designated 'Groundwater Source Protection Zones', accessed via MAGIC's online mapping, indicates that the site is not located within a Groundwater Source Protection Zone.

The Cranfield University 'Soilscapes' map indicates that the site is underlain by clayey floodplain soils with naturally high groundwater.

Local Drainage

Public sewer records have been obtained from Southern Water and are included in Appendix D. The Southern Water sewer records show that there is a public foul sewer (of an undefined diameter) flowing south-east through the centre of the site. Public foul manhole 6802, located in the centre of the site, has an identified cover level of approximately 3.65m AOD and an invert level of -0.02m AOD. There are no other public sewers in the immediate vicinity of the site. The 'Proposed Site Plan – Drainage Layout (Survey)' indicates that the foul sewer crossing the site is approximately 600mm in diameter.

The 'Proposed Site Plan – Drainage Layout (Survey)' indicates that the existing (disused) car park is served by a surface water drainage system. Surface water gullies and manholes on site are identified as being silted. Drainage gullies in the eastern extent of the site are shown to drain to a 600mm sewer immediately south of the site and north of Harts Farm Way. The 600mm sewer is not identified on

Southern Water sewer plans and is orientated south-west. It is likely that the sewer discharges into a watercourse immediately west of the site.

An existing manhole on the 600mm sewer south of the site is identified on the 'Proposed Site Plan – Drainage Layout (Survey)'. The manhole, where surface water from the site is discharged, has an identified cover level of 3.71m AOD and an invert level of 2.23m AOD.

Existing gullies in the western extent of the site are shown to drain to a manhole located near the western site boundary. The manhole is described as 'badly silted' and onward drainage from the manhole is not identified. Based on the location of the manhole and orientation of the drains on site, it is likely that surface water from the western extent of the site is discharged directly to the watercourse immediately west of the site.

Development Proposals

The proposed development is for a power generation compound comprising 14no containerised generators, a switch room, workshop, welfare office, transformers, meter kiosk and Distribution Network Operator (DNO) substation. A new tarmac access road will be formed, and a gravel surface is proposed for the remainder of the site. A proposed development plan is included in Appendix E.

The development has an estimated design life of 25 years.

Planning Policy

The Havant Borough Council Core Strategy (adopted March 2011) contains the following policy relating to drainage.

Policy CS15 Flood and Coastal Erosion Risk

...All development will be required to ensure that there is no net increase in surface water run off. Priority should be given to incorporating Sustainable Drainage Systems (SuDS) to manage surface water drainage, unless it is proven that SuDS are not appropriate. Where SuDs are provided arrangements must be put in place for their whole life management and maintenance.

The Hampshire County Council 'Surface Water and Sustainable Drainage Guidance for Developers, Designers and Planners' has been reviewed and informs this Drainage Strategy.

Surface Water Management

The site is currently occupied by hardstanding from the previous use as a car park. Surface water runoff currently drains at an unrestricted rate to a 600mm sewer south of the site and to watercourse west of the site. It is assumed that the 600mm sewer discharges to the watercourse located immediately west of the site.

In accordance with the DEFRA 'Non-statutory technical standards for sustainable drainage systems' (March 2015), 'for developments which were previously developed, the peak runoff rate from the development to any drain, sewer or surface water body for the 1 in 1 year rainfall event and the 1 in 100 year rainfall event must be as close as reasonably practicable to the greenfield runoff rate from the development for the same rainfall event, but should never exceed the rate of discharge from the development prior to redevelopment for that event'.

Greenfield and brownfield runoff rates have been estimated using the Revitalised Flood Hydrograph Model (ReFH2) method with a summary of the runoff rates included in Appendix F. The 1 in 1 year greenfield runoff rate for the 3,225m² development site is 0.5 l/s. The existing 1 in 100 year greenfield runoff rate is 1.6 l/s. The existing 1 in 1 year brownfield runoff rate is 4.7 l/s.

A discharge rate of 2 l/s is proposed to ensure that the drainage system is self-cleansing. A discharge rate of 2 l/s provides 57.4% betterment over the existing 1 in 1 year brownfield runoff rate.

Attenuation Storage

In order to achieve a discharge rate of 2 l/s, attenuation storage will be required. A storage estimate is included in Appendix G.

In accordance with the EA 'Flood risk assessments: climate change allowances' guidance (February 2016), for developments with a design life of up to 25 years, a 20% climate change (CC) allowance should be considered.

An estimated storage volume of 172m³ will be required to accommodate the 1 in 100 year plus 20% CC event. The storage estimate is based on storage within a tank or pond structure, an impermeable drainage area of 3,225m² (the whole site area), a design head of 0.3m and hydro-brake flow control.

The attenuation volume is provided for indicative purposes only and should be verified at the detailed design stage.

Discharge Method

Paragraph 080 of the NPPG: Flood Risk and Coastal Change sets out the following hierarchy of drainage options: into the ground (infiltration); to a surface water body; to a surface water sewer, highway drain or another drainage system; to a combined sewer.

Infiltration

The first consideration for the disposal of surface water is infiltration (permeable surfaces). As described above, the site is underlain by superficial deposits of Alluvium which is underlain by chalk. It can be concluded that infiltration techniques may be suitable for the discharge of surface water runoff.

Infiltration tests should be undertaken to determine the suitability of infiltration techniques.

Watercourse

Where infiltration techniques are not suitable, a connection to watercourse is the next consideration.

The nearest watercourse is an unnamed watercourse which is located immediately west of the site. A connection to the watercourse could be made via the 600mm sewer located immediately south of the site as per the existing situation. A manhole on the 600mm sewer immediately south of the site, where surface water is currently discharged, has an identified cover level of 3.71m AOD and an invert level of 2.23m AOD. A gravity connection therefore appears achievable. Discharge would be made at a limited rate of 2 l/s.

Sewer

As described above, a connection to the 600mm sewer south of the site is proposed to facilitate a connection to watercourse.

Sustainable Drainage Systems

Attenuation storage should be provided in the form of Sustainable Drainage Systems (SuDS) where practical.

Permeable gravel surfacing will be used throughout with the exception of the tarmac access road. It is proposed to accommodate attenuation storage within the gravel surfacing. Runoff from the tarmac access road and all buildings / containers will be directed onto adjacent gravel surfaces.

Gravel surfacing will cover approximately 2,420m². Based on a gravel surfacing depth of 300mm, a surface area of 2,420m² and a void ratio of 30%, the gravel surfacing could provide up to 217.8m³ of attenuation storage.

A perforated pipe will be laid within the gravel material to direct surface water towards a flow control chamber.

Concept Surface Water Drainage Scheme

Surface water runoff will be directed to the 600mm sewer immediately south of the site as per the existing scenario. Surface water discharge will be limited to a rate of 2 l/s. Surface water runoff up to the 1 in 100 year plus 20% climate change allowance event will be attenuated on site. A total attenuation volume of 172m³ will be required to achieve the discharge rate and will be provided within the gravel surfacing. A gravel surfacing depth of 300mm over a surface area of 2,420m² (at a level gradient) will provide up to 217.8m³ of attenuation storage.

A concept drainage sketch is included in Appendix H.

Exceedance Event

Storage will be provided below ground for the 1 in 100 year plus 20% climate change event. A minimum sub-grade depth of 300mm provides additional storage, above that required for the 1 in 100 year plus 20% climate change event and would minimise the likelihood of an exceedance event. It is recommended that all buildings / containers / inverters etc. are set on plinths raised a minimum of 150mm above surrounding ground levels.

Surface Water Treatment

In accordance with the CIRIA C753 publication 'The SuDS Manual' (2015), low traffic roads (applicable to the access road) have a 'low' pollution hazard level. Table 1 shows the pollution hazard indices for low traffic roads.

Table 1 – Pollution Hazard Indices

Land Use	Pollution Hazard Level	Total Suspended Solids (TSS)	Metals	Hydrocarbons
Low Traffic Roads	Low	0.5	0.4	4

Table extract taken from the CIRIA C753 publication 'The SuDS Manual' – Table 26.2

* Indices values range from 0-1.

Runoff will be directed to the gravel surface. Table 2 below demonstrates that permeable paving (applicable to the gravel surface) provides sufficient treatment.

Table 2 – SuDS Mitigation Indices

Type of SuDS	Mitigation Indices		
	Total Suspended Solids (TSS)	Metals	Hydrocarbons
Permeable paving	0.7	0.6	0.7

Table extract taken from the CIRIA C753 publication 'The SuDS Manual' – Table 26.3

Maintenance

Maintenance of on-site private drainage features such as the gravel surface and flow control chamber will be the responsibility of the site owner. Maintenance will be arranged by the site owner with a maintenance schedule adopted.

A maintenance schedule for permeable paving (applicable to the gravel surfacing) is included in Appendix I.

Foul Drainage

A public foul sewer is shown to cross through the site from north-west to south-east. A minimum 3m stand-off (from buildings / containers) will be required either side of the sewer. The developer could consider diverting the sewer to achieve the 3m stand-off. A sewer diversion scheme would need to be agreed with Southern Water.

A build over agreement could also be considered, however guidance on the Southern Water website states that, *"Although we will consider every case sympathetically, it is probable that permission to build over a sewer which is greater than 225mm diameter and/or three metres deep will not be given."* It is understood that the foul sewer crossing the site is approximately 600mm in diameter. The invert level of the sewer is 3.67m below ground level.

Foul flows from the on-site welfare facilities (small canteen and WC) will be discharged to the public foul sewer. Public foul manhole 6802, located in the centre of the site has an identified cover level of 3.65m AOD and an invert level of -0.02m AOD. A gravity connection is therefore feasible.

Conclusions

The proposed development is for approximately 14No. containerised generators, a switch room, workshop, welfare office, transformers, meter kiosk and Distribution Network Operator substation. A new tarmac access road will be formed, and a gravel surface is proposed for the remainder of the site.

In order to comply with local and national guidance, surface water runoff from the development will be controlled and attenuation storage provided to accommodate the 1 in 100 year plus 20% climate change allowance event.

All methods of surface water discharge have been assessed. Where infiltration is not possible, surface water will be discharged to the watercourse immediately west of the site via an existing 600mm sewer located immediately south of the site. A discharge rate of 2 l/s is proposed. A gravity connection can be achieved. Flow control will be provided in the form of a hydro-brake or an orifice plate.

Attenuation will be provided within the gravel surfacing. Runoff from the tarmac access road and all buildings / containers will be directed to adjacent gravel surfacing. A gravel surface area of 2,420m² with a depth of 0.3m and a void ratio of 30% will provide up to 217.8m³ of storage. Approximately 172m³ of storage is required to accommodate the 1 in 100 year plus 20% climate change event.

A public foul sewer is shown to cross through the site from north-west to south-east. A minimum 3m stand-off (from buildings / containers) will be required either side of the sewer. The developer could consider diverting the sewer to achieve the 3m stand-off.

Foul flows from the on-site welfare facilities (small canteen and WC) will be discharged to the public foul sewer.

Recommendations

1. Verify the attenuation volumes included in this report when undertaking detailed drainage design and upon receipt of ground investigations.
2. Provide a minimum 3m stand-off to the public foul sewer crossing the site. The sewer could be diverted (in agreement with Southern Water) to achieve the 3m stand-off

Appendix A – Location Plan & Aerial Image



NOTES:
1) ALL DIMENSIONS ARE IN METRES AND ALL LEVELS IN METRES ABOVE ORDNANCE DATUM UNLESS STATED OTHERWISE

LEGEND

- Site Boundary
- Watercourses / Water Bodies



CLIENT:

GFP11 LTD

waterco
consultants
www.waterco.co.uk

SCHEME:

HARTS FARM WAY, HAVANT

PLOT TITLE:

LOCATION PLAN

PLOT STATUS:			DATE:
FINAL			13/09/2018
DRAWN:	CHECKED:	APPROVED:	PLOT SCALE @ A3:
HW	AW	VG	1:2,000 (UNLESS STATED OTHERWISE)
PLOT NAME:			REV:
w10748-Location_Plan			-



NOTES:
1) ALL DIMENSIONS ARE IN METRES AND ALL LEVELS IN METRES ABOVE ORDNANCE DATUM UNLESS STATED OTHERWISE

LEGEND

Site Boundary



CLIENT:

GFP11 LTD



www.waterco.co.uk

SCHEME:

HARTS FARM WAY, HAVANT

PLOT TITLE:

AERIAL PLAN

PLOT STATUS:

FINAL

DATE:

13/08/2018

DRAWN:

HW

CHECKED:

AW

APPROVED:

VG

PLOT SCALE @ A3:

1:2,000

(UNLESS STATED OTHERWISE)

PLOT NAME:

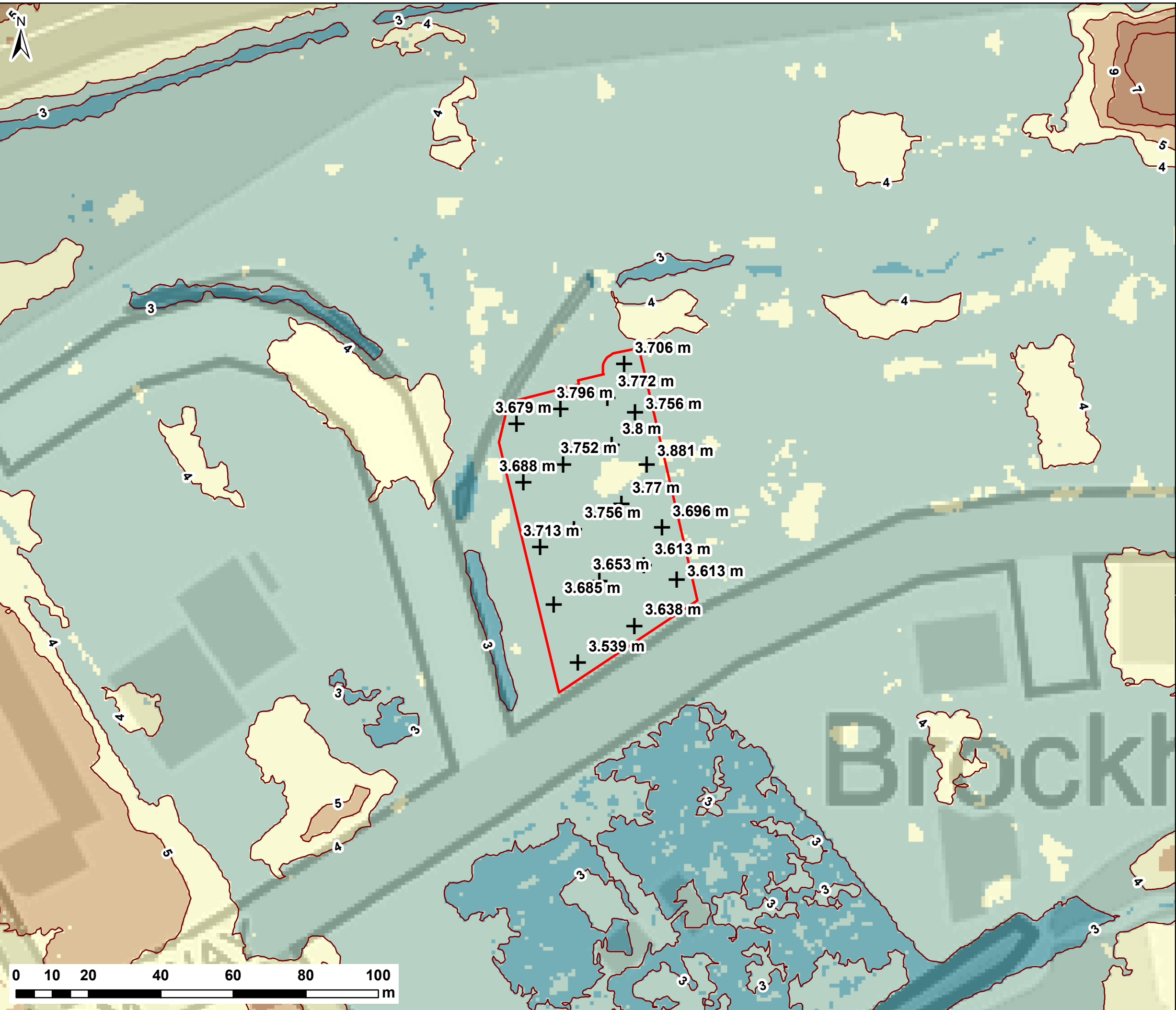
w10748-Aerial_Plan

REV:

-

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Appendix B – Drainage Survey & LiDAR Extract



NOTES:
1) ALL DIMENSIONS ARE IN METRES AND ALL LEVELS IN METRES ABOVE ORDNANCE DATUM UNLESS STATED OTHERWISE

LEGEND

Site Boundary

+ Site Levels

Ground Elevations (m AOD)

	< 3
	3 - 4
	4 - 5
	5 - 6
	> 6

CLIENT:

GFP11 LTD

www.waterco.co.uk

SCHEME:

HARTS FARM WAY, HAVANT

PLOT TITLE:

LIDAR ELEVATIONS
1m RESOLUTION

PLOT STATUS:			DATE:
FINAL			13/08/2018

DRAWN:	CHECKED:	APPROVED:	PLOT SCALE @ A3:
HW	AW	VG	1:1,000
			(UNLESS STATED OTHERWISE)

PLOT NAME:	REV:
w10748-LIDAR	-

Appendix C – BGS Borehole Scan

50 70 NW/99
70680582

SHEET NO. 10 OF 17
CONTRACT No. 4195

BOREHOLE RECORD

British Geological Survey

British Geological Survey

CONTRACT Havant DATE STARTED 14/9 FINISHED 14/9/67
BOREHOLE No. 86 OPERATOR D. Smith
ORDNANCE DATUM LEVEL 11.8 3.60m TYPE OF PENETRATION TEST SPT
TYPE OF BORING Shell & Auger WEIGHT 140 lbs DROP 2.6
DIAMETER OF BORING 6" STANDING WATER LEVEL NIL
REMARKS

British Geological Survey

British Geological Survey

British Geological Survey

Depth Feet	O.D. Level	Type & No. of Sample	Boring Details			Legend	Description of Material and Observations
			Penetration	Lining	Water		
5		D					Medium shingle & flint
10		D					Chalk & flint
15		D					Chalk & flint
			Borehole terminated				

British Geological Survey

British Geological Survey

British Geological Survey

British Geological Survey

British Geological Survey

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British Geological Survey

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Appendix D – Southern Water Sewer Plan



Centara Bureau Services Ltd
Office 9 and 10 Normanton Business Park
Ripley Drive
Normanton
West Yorkshire
WF6 1QT

Your ref Harts Farm way
Our ref 248677
Date 14 June 2017
Contact searches@southernwater.co.uk
Tel 0845 272 0845
 0330 303 0276
Fax 01634 844514

Attention: Gillian Paterson

Dear Customer

Re: Provision of public sewer record extract

Location: Harts Farm Way, PO9 1HS

Thank you for your order regarding the provision of extracts of our sewer and/or water main records. Please find enclosed the extracts from Southern Water's records for the above location.

We confirm payment of your fee in the sum of £49.92 and enclose a VAT receipt for your records.

Customers should be aware that there are areas within our region in which there are neither sewers nor water mains. Similarly, whilst the enclosed extract may indicate the approximate location of our apparatus in the area of interest, it should not be relied upon as showing that further infrastructure does not exist and may subsequently be found following site investigation. Actual positions of the disclosed (and any undisclosed) infrastructure should therefore be determined on site, because Southern Water does not accept any responsibility for inaccuracy or omission regarding the enclosed plan. Accordingly it should not be considered to be a definitive document.

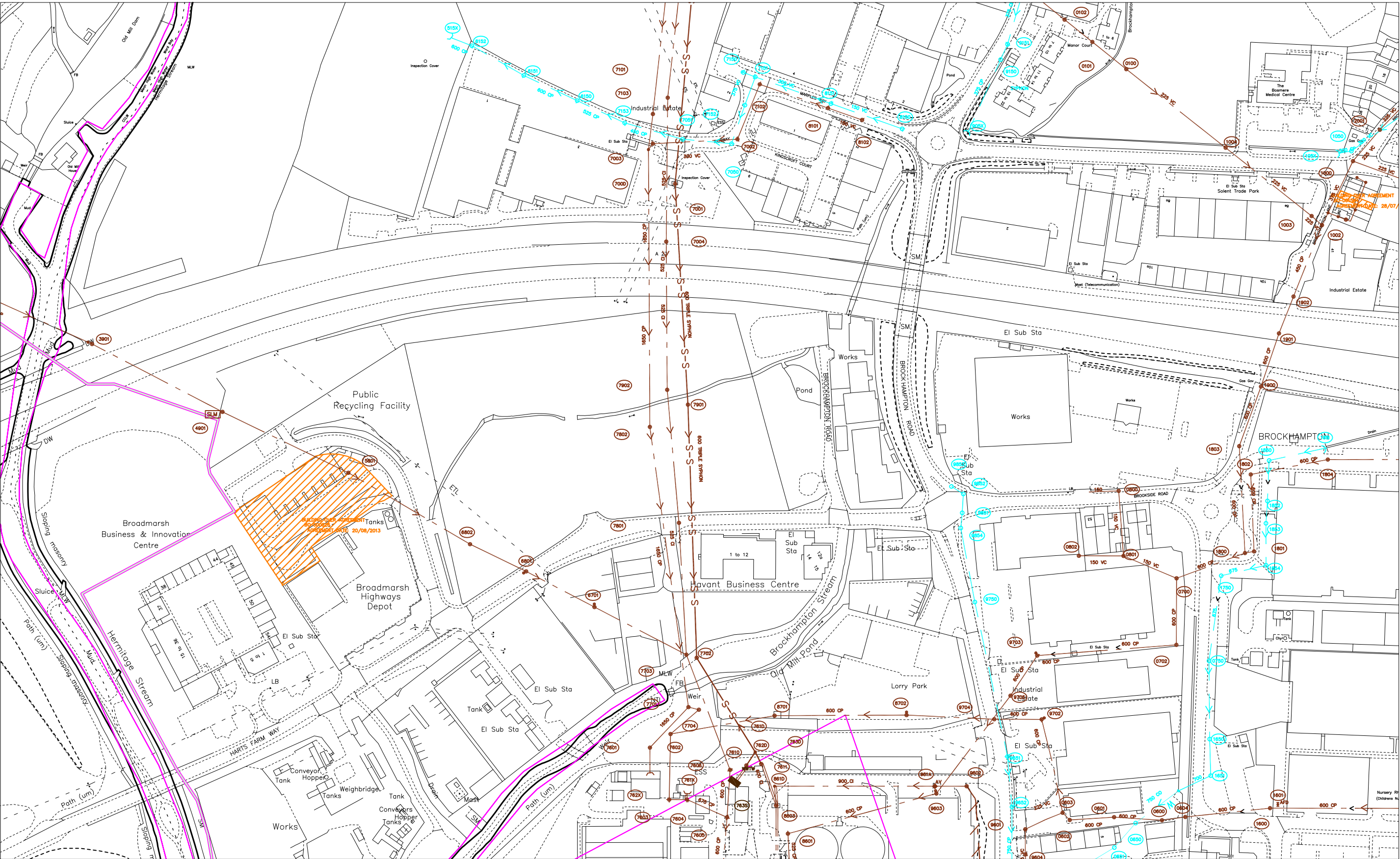
Should you require any further assistance regarding this matter, please contact the LandSearch team.

Yours faithfully

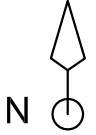
LandSearch

SEWER RECORDS PAGE 1 OF 2

106185



105608

O.S. REF. SU7005NE	Drawn by: kumaria	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. WARNING: BAC pipes are constructed of Bonded Asbestos Cement WARNING: Unknown (UNK) materials may include Bonded Asbestos Cement	 
	Scale: 1:2500		
Title: 248677_Harts Farm Way, PO9 1HS	Date: 14/06/2017	Based upon Ordnance Survey Digital Data with the permission of the controller of H.M.S.O. Crown Copyright Reserved Licence No. WU 298530.	

471227

SEWER RECORDS PAGE 2 OF 2

Node	Cover	Invert	Size	Material	Shape	Node	Cover	Invert	Size	Material	Shape	Node	Cover	Invert	Size	Material	Shape	Node	Cover	Invert	Size	Material	Shape
0100X	4.92	3.98	225	VC	CIRC	7150X	6.42	4.76	300	VC	CIRC												
0101X			225	VC	CIRC	7151X	6.36	4.75	375	VC	CIRC												
0102X			225	VC	CIRC	7152X	6.2	4.66	375	VC	CIRC												
0600X	4.04	1.19	600	CP	CIRC	7153X	5.54	3.69	525	CP	CIRC												
0601X	3.95		600	CP	CIRC	7601X	3.68	0.28	1650	CP	CIRC												
0602X	3.9	0.94	600	CP	CIRC	7602X	3.64	-1.23	OTHER	CP	CIRC												
0603X	3.89		600	CP	CIRC	7603X	3.37	-1.37	OTHER	CP	CIRC												
0604X			UNK	UNK	CIRC	7604X	3.71	-1.44	675	CP	CIRC												
0650X			750	CO	CIRC	7605Y	3.76	-1.11	600	CP	CIRC												
0651X			750	CO	CIRC	7606X	3.48	-0.95	600	CP	CIRC												
0652X		4.346	750	CO	CIRC	7610X	4.04		600	CI	CIRC	*											
0700X	4.64		600	CP	CIRC	7610Y	4.04		600	CI	CIRC	*											
0702X	4.41	1.26	600	CP	CIRC	7610Y	4.04		600	UNK	CIRC	*											
0750X	5.1	3.7	UNK	UNK	CIRC	7611Y	4.06		600	CI	CIRC	*											
0800X	4.51		150	VC	CIRC	7611X	4.06		600	CI	CIRC	*											
0801X	4.8		150	VC	CIRC	7611Y	4.06		600	CI	CIRC	*											
0802X	4.75	3.44	150	VC	CIRC	7611Y	4.06		600	UNK	CIRC	*											
1000X	5.55	3.48	375	VC	CIRC	761XX	3.65		600	CI	CIRC	*											
1002X	5.59		450	CP	CIRC	761XY	3.65		600	CI	CIRC	*											
1003X	5.79	3.24	225	VC	CIRC	762DX			600	CI	CIRC	*											
1004X	5.05	3.6	225	VC	CIRC	762DY			600	CI	CIRC	*											
1005X			UNK	UNK	CIRC	762DY			600	UNK	CIRC	*											
100DX			UNK	UNK	CIRC	763SY			600	CI	CIRC	*											
101DX			UNK	UNK	CIRC	763SX			600	CI	CIRC	*											
102DX			UNK	UNK	CIRC	7701Y	3.48	0.33	525	CP	CIRC	*											
103DX			375	VC	CIRC	7701X	3.48	0.33	1650	CP	CIRC	*											
1050X	5.36	4.6	300	CP	CIRC	7702X	3.37		600	CI	CIRC												
1600X	5.09	1.14	600	CP	CIRC	7703X	3.36		UNK	UNK	CIRC												
1650X	5.416	3.516	UNK	UNK	CIRC	7704X	3.87	0.2	525	CP	CIRC												
1651X	5.426		700	UNK	CIRC	7801X	3.59		525	CI	CIRC												
1750X			675	UNK	CIRC	7802X	4.09	0.55	1650	CP	CIRC												
1800X	5.54	1.61	600	CP	CIRC	7901X			600	UNK	CIRC												
1801X	5.35	1.45	600	CP	CIRC	7902X	3.63	1.85	525	CI	CIRC												
1802X	5.3	1.7	600	CP	CIRC	8101X	6.34	4.46	150	VC	CIRC												
1803X	4.96	2.1	600	CP	CIRC	8102X	6.51	4.57	150	VC	CIRC												
1804X	5.39	1.79	600	CP	CIRC	8150X	7.04	5.28	150	VC	CIRC												
1850X			UNK	UNK	CIRC	8151X	6.42	4.93	300	VC	CIRC												
1852X	5.528	3.958	UNK	UNK	CIRC	8601X	4.46	0.08	525	CP	CIRC												
1853X	5.415	3.975	UNK	UNK	CIRC	8603X	4.39		450	CI	CIRC	*											
1854X	6.59	3.905	675	UNK	CIRC	8603Y	4.39		450	CI	CIRC	*											
185IX	-1		UNK	UNK	CIRC	861DX			450	CI	CIRC	*											
1900X	5.35	2.31	600	CP	CIRC	861DY			450	CI	CIRC	*											
1901X	5.89	2.64	600	CP	CIRC	8701X			UNK	UNK	CIRC												
1902X			UNK	UNK	CIRC	8702X	4.51	0.36	600	CP	CIRC												
2001X	5.59	3.65	225	VC	CIRC	9150X	4.98		375	CP	CIRC												
201DX			UNK	UNK	CIRC	9151X	4.92		375	CP	CIRC												
3901X	3.25		OTHER	CP	CIRC	9601X	3.81		225	VC	CIRC												
4901X	2.84		UNK	UNK	CIRC	9602X			UNK	UNK	CIRC												
5801X	3.01	0.11	OTHER	CP	CIRC	9603X	4.42	0.64	600	CP	CIRC												
6150X	5.45	3.48	600	CP	CIRC	9604X	3.49	1.54	225	VC	CIRC												
6151X	5.29	3.29	600	CP	CIRC	961AX	3.99	1.56	900	CI	CIRC												
6152X	5.2	3.2	600	CP	CIRC	9651X	3.95	2.26	750	CP	CIRC												
6701X	3.98		OTHER	CP	CIRC	9652X	3.76	2.11	750	CP	CIRC												
6801X	3.64	-0.14	OTHER	CP	CIRC	9702X	4.14	0.57	600	CP	CIRC												
6802X	3.69	-0.02	OTHER	CP	CIRC	9703X	4.73	0.85	600	CP	CIRC												
7001X	5.8		600	UNK	CIRC	9704X	3.96	0.52	600	CP	CIRC												
7002X	6.05	3.89	300	VC	CIRC	9705X	4.54	0.87	600	CP	CIRC												
7003X	5.67	3.44	300	VC	CIRC	9750X	4.59		750	CP	CIRC												
7004X	4.74	2.13	525	CI	CIRC	9851X			600	CP	CIRC												
700DX			1650	CP	CIRC	9852X			600	CP	CIRC												
7050X	6.02	4.55	375	VC	CIRC	9853X			675	CP	CIRC												
7051X	5.74	3.95	450	CP	CIRC	9854X			750	CP	CIRC												
7101X	6.42	2.42	525	CI	CIRC																		
7102X	6.33	4.16	225	VC	CIRC																		
7103X	5.98	1.01	1650	CP	CIRC																		

LINE STYLES / COLOURS

Brown

Red

Orange

Dark Blue

Purple

Light Blue

Yellow

Green

Foul

Foul Syphon Sewer

Foul Vacuum Main

Foul Rising Main

Combined

Combined Syphon Sewer

Combined Rising Main

Lateral Drain

Building Over Agreement Area

Treated Effluent

Sludge

Sewer Catchment

Section 104 Area

Surface Water

Surface Water Rising Main

Private

Access Shaft

Decommissioned

MATERIALS

AK

BAC

BRC

BRE

CC

CI

CO

CP

CSB

CSU

DI

GRC

GRP

MAC

MAR

PE

PF

PP

PVC

RPM

SI

ST

VC

XXX

ZZZ

Alkathene

Bonded Asbestos Cement

Brick (Common)

Brick (Engineering)

Concrete Box Culvert

Cast Iron

Concrete (In-Situ)

Concrete (Pre-Cast)

Concrete Segments (bolted)

Concrete Segments (unbolted)

Ductile Iron

Glass Reinforced Concrete

Glass Reinforced Plastic

Masonry in regular Courses

Masonry in random Courses

Polyethylene

Pitch Fibre

Polypropylene

Polyvinyl Chloride

Reinforced Plastic Matrix

Spun Iron

Steel

Unfilled Clay

Other

Unknown

LEGEND - SEWERS

Manhole (SW)

Manhole (F&C)

Lamp hole (SW)

Lamp hole (F&C)

Pumping Station (SW)

Pumping Station (F&C)

Side entry manhole (SW)

Side entry manhole (F&C)

Blind shaft (SW)

Blind shaft (F&C)

Ejector station (SW)

Ejector station (F&C)

Watertight door (SW)

Watertight door (F&C)

Flushing ch. Min-e (SW)

Flushing ch. Min-e (F&C)

Flushing ch. No-e (SW)

Flushing ch. No-e (F&C)

Demarcation Chamber

Washout (SW)

Washout (F&C)

Rodding Eye (SW)

Rodding Eye (F&C)

Gauging point (SW)

Gauging point (F&C)

Intercept chamber (SW)

Intercept chamber (F&C)

Storm Tank (SW)

Storm Tank (F&C)

Vortex chamber (SW)

Vortex chamber (F&C)

Label ellipse

Dummy/S24 manhole

Outfall

Penstock chamber

Damboards

Storm Overflow

Backdrop manhole

Other (s)

Other

Change in sewer (s)

Change in sewer

Reflex valve

Flap valve

Cascade

Anode

Valve

Closed Valve

Air Valve

Hatch box (SW)

Hatch box (F&C)

Direction arrow

Emptying valve

Catchpit

Soakaway

Inlet

Balancing Pond

Wastewater treatment works

Marine treatment works

Outfall headworks

Vent

Vent column

Tidal storage tank

Blank end

Head of Public Sewer

Micro Pumping Station

SHAPES (S)

A

B

C

E

H

Arched

Barrel

Circular

Egg

Horseshoe

R

S

T

U

X

Rectangular

Square

Trapezoidal

U Shape

Other

NODE REFERENCING SYSTEM

1st digit:

2nd digit:

3rd digit:

4th digit:

hundred metre easting identifier

hundred metre northing identifier

sewer type identifier

0-4 = Foul/Combined

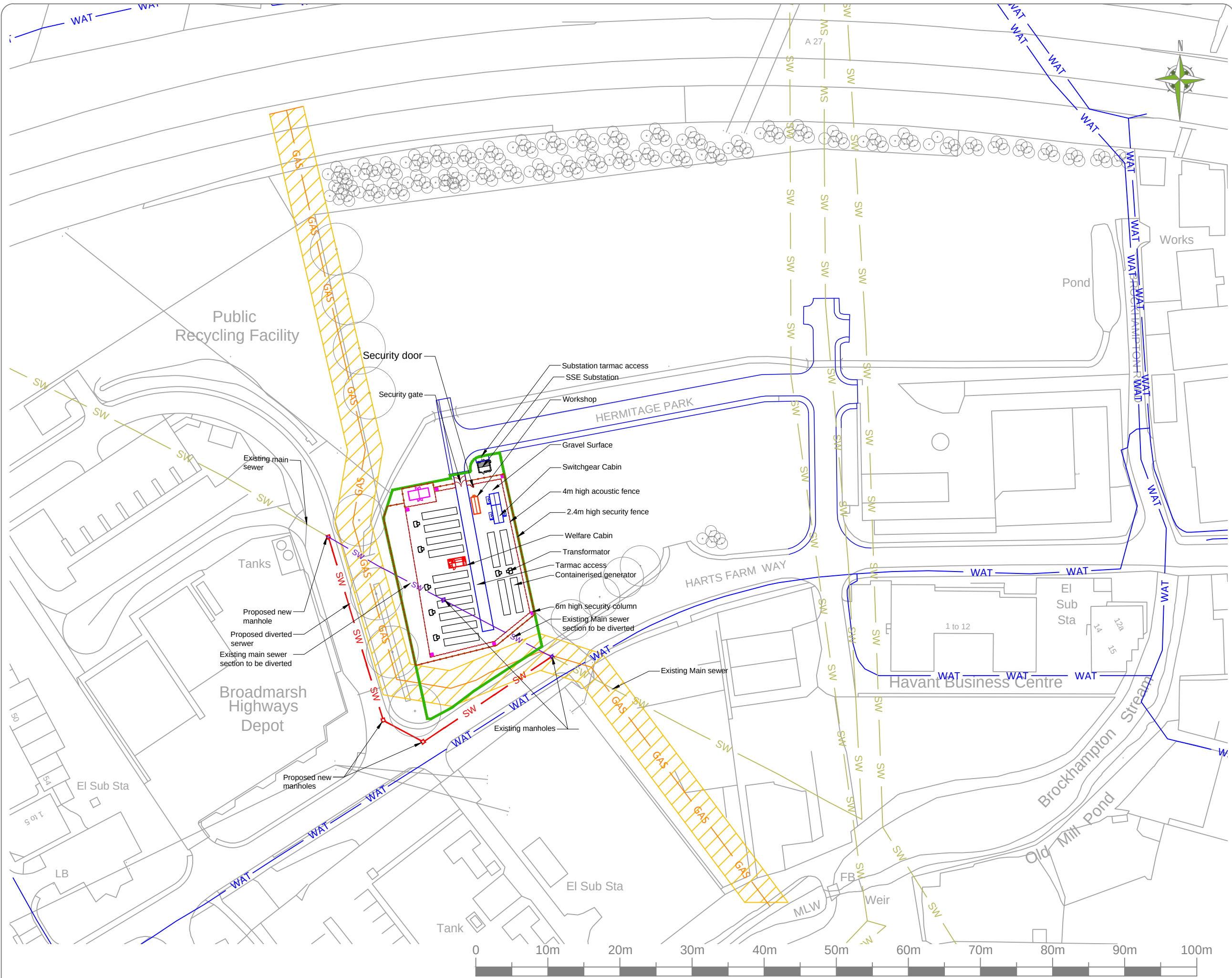
5-9 = Surface Water

next sequential node

Drawn by:	kumaria
Title:	248677_Harts Farm Way, PO9 1HS
Date:	14/06/2017



Appendix E – Proposed Development Plan



PLANNING PLAN

LEGEND:

LANDLORDS PROPERTY
DEVELOPMENT BOUNDARY

DNO SUBSTATION

SECURITY COLUMN

GAS GOVERNORS

TRANSFORMER

SWITCHGEAR

SECURITY GATE

WELFARE CABIN

GENERATOR

DRIVE ACCESS

2.4M HIGH SECURITY FENCE

4M HIGH ACOUSTIC FENCE

HIGH PRESSURE GAS EASEMENT

WAT WAT EXISTING WATER MAIN

SW SW EXISTING MAIN SEWER

SW SW EXISTING MAIN SEWER SECTION TO BE DIVERTED

SW SW PROPOSED DIVERTED SEWER

rev revision notes date

REVISIONS

Planning

ALL DIMENSIONS TO BE CHECKED ON SITE
WORK TO FIGURED DIMENSIONS ONLY
REPORT DISCREPANCIES TO THE GFP
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Tel: 01675 437777

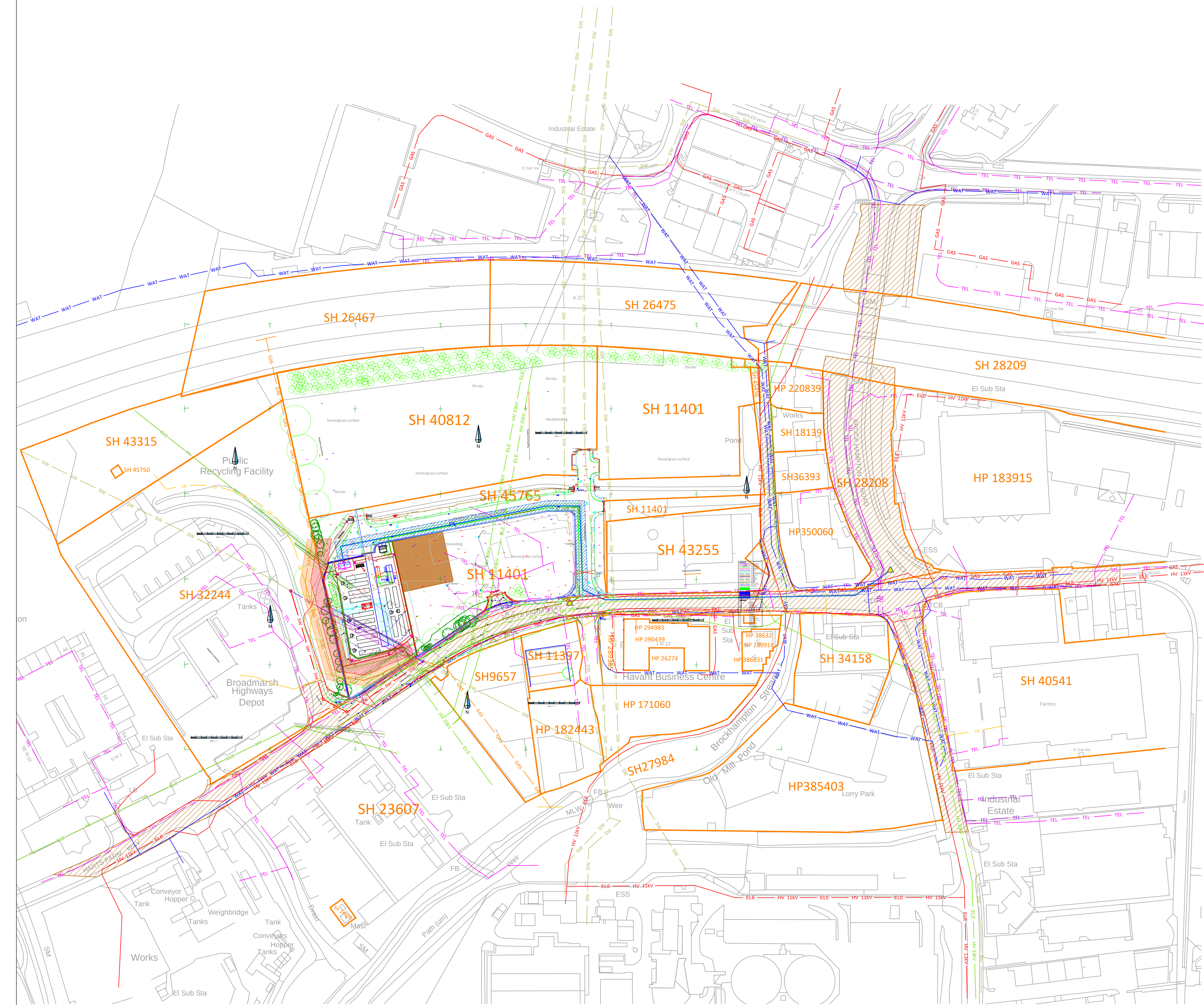
Project Title:
GENERATION COMPOUND
HARTS FARM WAY
PO9 1HS

Drawing Title:
DEVELOPMENT PLAN
(SOUTHERN WATER)

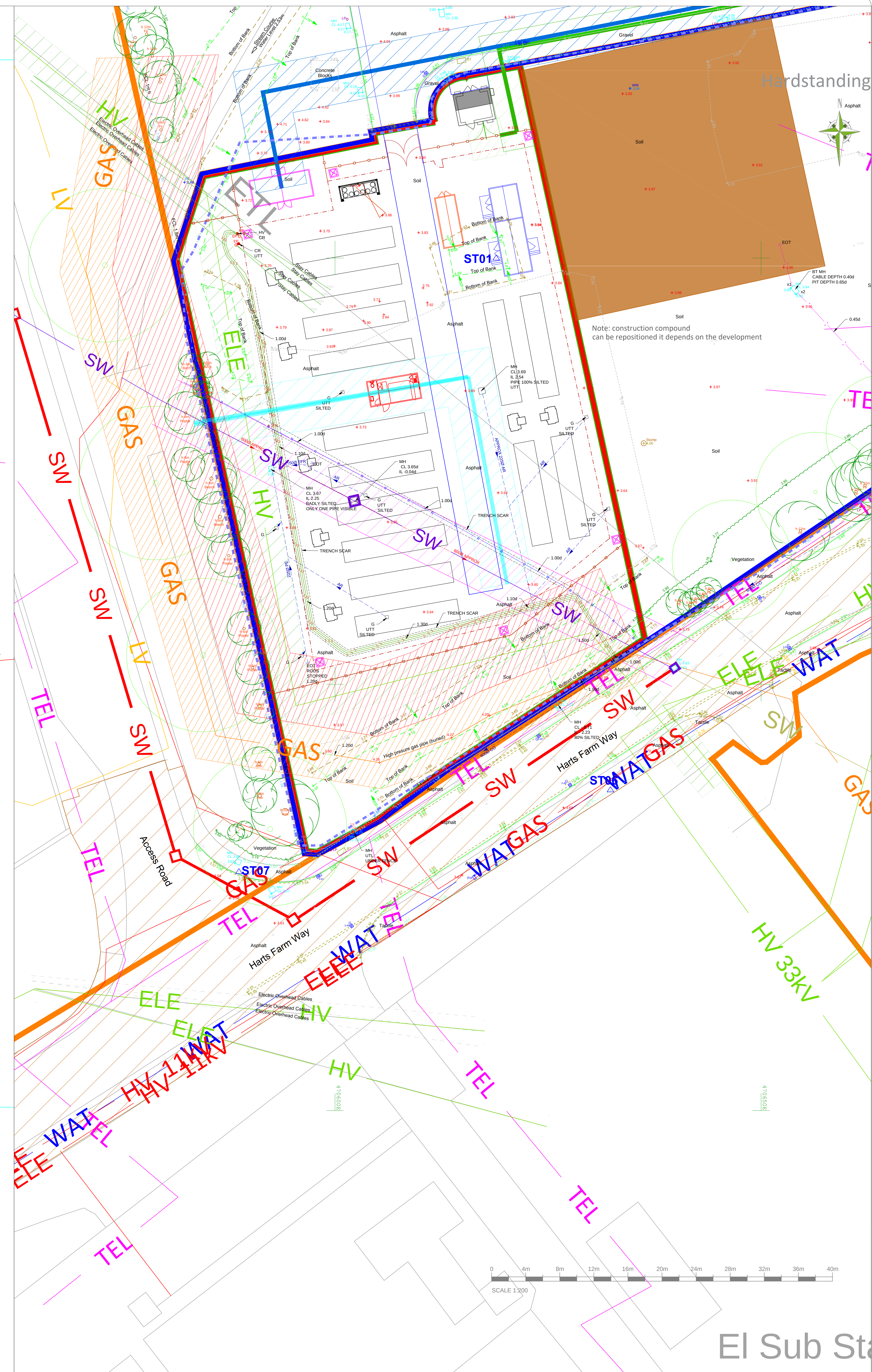
Scale @A3: 1:1250 Date: June 2018
Drawn: SI Checked: DS
Drawing No: Rev:

4000_GF_DR_DP_106 -

MASTER DRAWING



0 50m 100m 150m 200m 250m
SCALE 1:1250



0 4m 8m 12m 16m 20m 24m 28m 32m 36m 40m
SCALE 1:200

MASTER PLAN

LEGEND

SITE INFRASTRUCTURE

- RETAINED PROPERTY
- PROPOSED SITE
- MAINTENANCE ACCESS
- PERIMETER FENCELINE
- INNER FENCELINE
- DNG SUBSTATION
- SECURITY COLUMN
- GAS COLUMNS
- TRANSFORMER
- SWITCHGEAR
- SECURITY GATE
- WELFARE CABIN
- GENERATOR

LR TITLES

PROPOSED SERVICES

- GAS CONNECTION
- ELECTRIC CONNECTION
- GAS EASEMENT
- ELECTRIC EASEMENT
- POINT OF CONNECTION

EXISTING SERVICES

- GAS - LOW PRESSURE
- GAS - MEDIUM PRESSURE
- GAS - INTERMEDIATE PRESSURE
- GAS - HIGH PRESSURE
- ELECTRIC - 11kV
- ELECTRIC - 33kV
- ELECTRIC 132kV
- WATER MAIN
- TELECOMS
- EXISTING SEWER ROUTE
- SEWER DIVERSION ROUTE
- HIGH PRESSURE GAS PIPE
- ELECTRIC OVERHEAD CABLE DIVERSION ROUTE

- EXISTING SEWER EASEMENT 6m
- DIVERTED SEWER EASEMENT 6m
- HIGH PRESSURE GAS PIPE EASEMENT 12m
- SGN HP PROTECTION ZONE
- DIVERTED OVERHEAD CABLE EASEMENT 4m
- CONSTRUCTION COMPOUND

B	Added SGN protection zone easement	10/08/2018
A	Adopted highways added	22/06/2017
rev	revision notes	date
REVISIONS		

Design

ALL DIMENSIONS TO BE CHECKED ON SITE
WORK TO BE FINISHED DIMENSIONS ONLY
REPORT DISCREPANCIES TO THE GFP
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Project Title:
GENERATION COMPOUND
HARTS FARM WAY
HAVANT
POB 3HS

Drawing Title:
HARTS FARM WAY
MASTER PLAN

Scale @A0: 1:200, 1:1250 Date: May 2017
Drawn: TB Checked: DS
Drawing No: 4000_GF_DR_MP_100 Rev: B

Appendix F – ReFH2 Runoff Estimates

Job number: w10748	Author: HW
Scheme name: Harts Farm, Havant	Checked: AW
ReFH2 Runoff Rates	Date: 10/09/2018

Return period (yrs)	Urbanised peak flow (m ³ /s)	Urbanised peak flow (l/s)	As-rural peak flow (m ³ /s)	As-rural peak flow (l/s)
1	0.00471975	4.719750432	0.000533987	0.53398658
2	0.005367753	5.367753166	0.000605617	0.605617101
5	0.007470954	7.470953858	0.000846418	0.846417733
10	0.008900049	8.900048727	0.00101729	1.017289578
30	0.011162471	11.16247081	0.001299796	1.299796444
50	0.012252755	12.25275526	0.00144119	1.441190263
75	0.013139367	13.13936722	0.001558689	1.55868851
100	0.013788353	13.78835271	0.001646127	1.646126863
200	0.015479387	15.47938663	0.001879645	1.879645426
1000	0.020841205	20.84120531	0.002674392	2.674392163

Appendix G – MicroDrainage Storage Estimates

Waterco Ltd				Page 1	
Eden Court		W10748			
Lon Parcwr Business Park		Harts Farm Way, Havant			
Denbighshire LL15 1NJ		1 in100 + 20% CC			
Date 10/09/2018		Designed by HW			
File W10748-1 IN100+20% - CO...		Checked by AW			
XP Solutions		Source Control 2018.1			
<u>Summary of Results for 100 year Return Period (+20%)</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	9.821	0.121	2.0	70.1	Flood Risk
30 min Summer	9.859	0.159	2.0	92.4	Flood Risk
60 min Summer	9.900	0.200	2.0	115.7	Flood Risk
120 min Summer	9.927	0.227	2.0	131.6	Flood Risk
180 min Summer	9.942	0.242	2.0	140.1	Flood Risk
240 min Summer	9.950	0.250	2.0	145.1	Flood Risk
360 min Summer	9.958	0.258	2.0	149.8	Flood Risk
480 min Summer	9.960	0.260	2.0	150.6	Flood Risk
600 min Summer	9.958	0.258	2.0	149.4	Flood Risk
720 min Summer	9.955	0.255	2.0	147.8	Flood Risk
960 min Summer	9.949	0.249	2.0	144.4	Flood Risk
1440 min Summer	9.936	0.236	2.0	136.7	Flood Risk
2160 min Summer	9.914	0.214	2.0	124.0	Flood Risk
2880 min Summer	9.893	0.193	2.0	112.2	Flood Risk
4320 min Summer	9.860	0.160	2.0	93.0	Flood Risk
5760 min Summer	9.835	0.135	2.0	78.6	Flood Risk
7200 min Summer	9.818	0.118	2.0	68.3	Flood Risk
8640 min Summer	9.805	0.105	2.0	61.0	Flood Risk
10080 min Summer	9.796	0.096	2.0	55.6	Flood Risk
15 min Winter	9.836	0.136	2.0	78.6	Flood Risk
30 min Winter	9.879	0.179	2.0	103.7	Flood Risk
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
15 min Summer	117.516	0.0	65.3	16	
30 min Summer	78.139	0.0	87.2	31	
60 min Summer	49.659	0.0	118.2	62	
120 min Summer	29.025	0.0	138.0	122	
180 min Summer	21.158	0.0	150.8	182	
240 min Summer	16.883	0.0	160.3	240	
360 min Summer	12.244	0.0	174.1	360	
480 min Summer	9.724	0.0	184.0	480	
600 min Summer	8.123	0.0	191.8	572	
720 min Summer	7.008	0.0	198.2	620	
960 min Summer	5.545	0.0	208.2	740	
1440 min Summer	3.984	0.0	221.8	1008	
2160 min Summer	2.870	0.0	249.8	1408	
2880 min Summer	2.287	0.0	265.0	1812	
4320 min Summer	1.683	0.0	290.6	2552	
5760 min Summer	1.371	0.0	318.6	3288	
7200 min Summer	1.185	0.0	344.3	4032	
8640 min Summer	1.061	0.0	370.0	4672	
10080 min Summer	0.974	0.0	394.3	5352	
15 min Winter	117.516	0.0	73.3	16	
30 min Winter	78.139	0.0	97.6	31	
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Waterco Ltd				Page 2	
Eden Court		W10748			
Lon Parcwr Business Park		Harts Farm Way, Havant			
Denbighshire LL15 1NJ		1 in100 + 20% CC			
Date 10/09/2018		Designed by HW			
File W10748-1 IN100+20% - CO...		Checked by AW			
XP Solutions		Source Control 2018.1			
<u>Summary of Results for 100 year Return Period (+20%)</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	9.924	0.224	2.0	130.0	Flood Risk
120 min Winter	9.955	0.255	2.0	148.1	Flood Risk
180 min Winter	9.972	0.272	2.0	157.8	Flood Risk
240 min Winter	9.982	0.282	2.0	163.7	Flood Risk
360 min Winter	9.993	0.293	2.0	169.7	Flood Risk
480 min Winter	9.995	0.295	2.0	171.3	Flood Risk
600 min Winter	9.994	0.294	2.0	170.7	Flood Risk
720 min Winter	9.991	0.291	2.0	168.8	Flood Risk
960 min Winter	9.982	0.282	2.0	163.5	Flood Risk
1440 min Winter	9.964	0.264	2.0	153.4	Flood Risk
2160 min Winter	9.935	0.235	2.0	136.1	Flood Risk
2880 min Winter	9.903	0.203	2.0	117.5	Flood Risk
4320 min Winter	9.850	0.150	2.0	87.0	Flood Risk
5760 min Winter	9.813	0.113	2.0	65.6	Flood Risk
7200 min Winter	9.791	0.091	2.0	52.7	Flood Risk
8640 min Winter	9.781	0.081	1.9	46.8	Flood Risk
10080 min Winter	9.775	0.075	1.8	43.3	Flood Risk
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
60 min Winter	49.659	0.0	132.3	62	
120 min Winter	29.025	0.0	154.5	120	
180 min Winter	21.158	0.0	168.8	178	
240 min Winter	16.883	0.0	179.3	236	
360 min Winter	12.244	0.0	194.7	352	
480 min Winter	9.724	0.0	205.7	464	
600 min Winter	8.123	0.0	214.4	572	
720 min Winter	7.008	0.0	221.4	678	
960 min Winter	5.545	0.0	232.4	778	
1440 min Winter	3.984	0.0	246.7	1080	
2160 min Winter	2.870	0.0	279.7	1536	
2880 min Winter	2.287	0.0	296.7	1960	
4320 min Winter	1.683	0.0	325.8	2724	
5760 min Winter	1.371	0.0	356.9	3400	
7200 min Winter	1.185	0.0	385.6	4032	
8640 min Winter	1.061	0.0	414.4	4672	
10080 min Winter	0.974	0.0	442.1	5352	
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Waterco Ltd		Page 3
Eden Court	W10748	
Lon Parcwr Business Park	Harts Farm Way, Havant	
Denbighshire LL15 1NJ	1 in100 + 20% CC	
Date 10/09/2018	Designed by HW	
File W10748-1 IN100+20% - CO...	Checked by AW	
XP Solutions	Source Control 2018.1	

Rainfall Details

Rainfall Model	FEH	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
FEH Rainfall Version	2013	Cv (Winter)	0.840
Site Location	GB 470646 105861	Shortest Storm (mins)	15
Data Type	Point	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+20

Time Area Diagram

Total Area (ha) 0.323

Time (mins)	Area
From:	To: (ha)

0	1 0.323
---	---------

Waterco Ltd		Page 4
Eden Court	W10748	
Lon Parcwr Business Park	Harts Farm Way, Havant	
Denbighshire LL15 1NJ	1 in100 + 20% CC	
Date 10/09/2018	Designed by HW	
File W10748-1 IN100+20% - CO...	Checked by AW	
XP Solutions	Source Control 2018.1	

Model Details

Storage is Online Cover Level (m) 10.000

Tank or Pond Structure

Invert Level (m) 9.700

Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
0.000	580.0	0.300	580.0

Hydro-Brake® Optimum Outflow Control

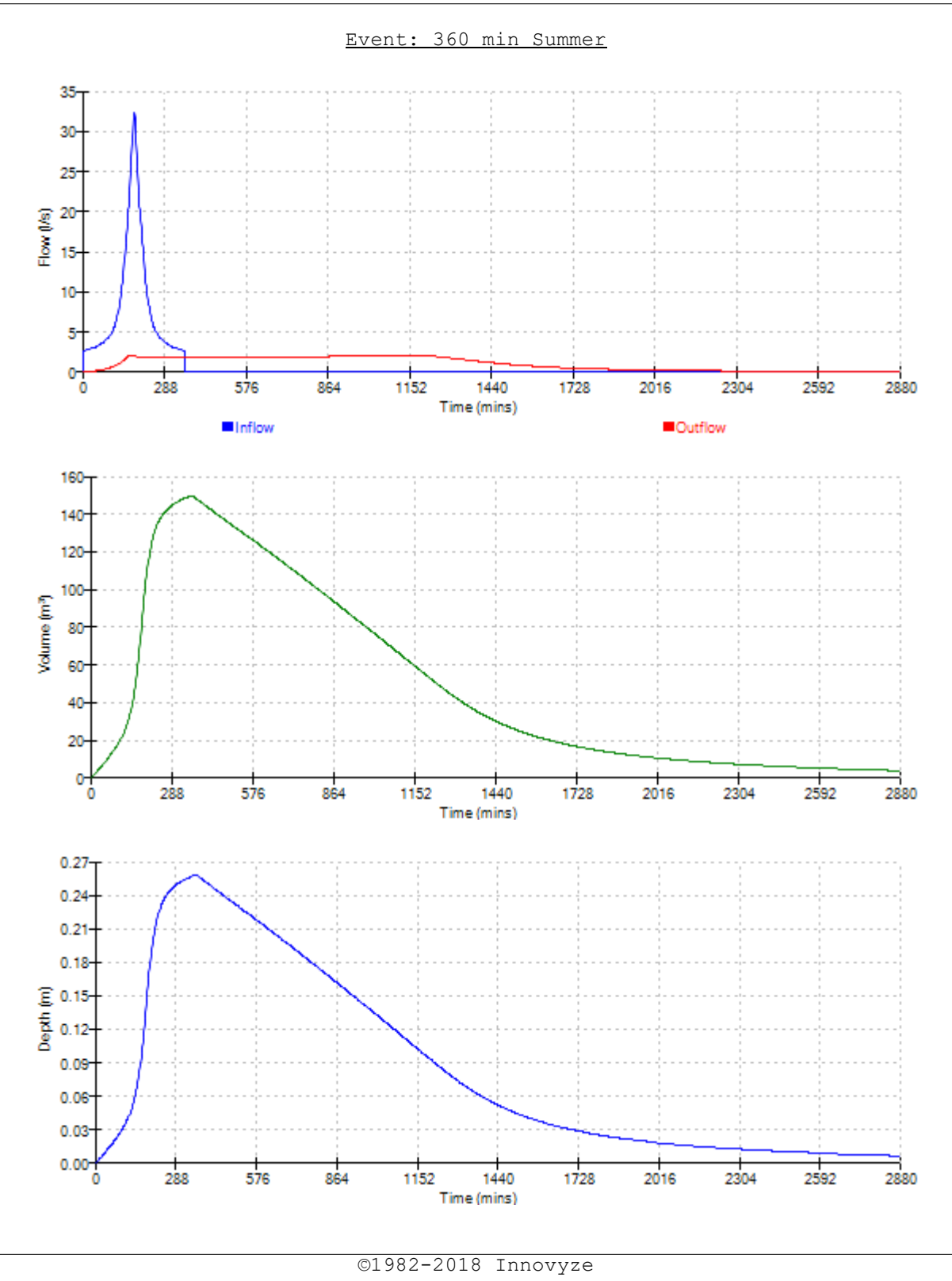
Unit Reference	MD-SHE-0077-2000-0300-2000
Design Head (m)	0.300
Design Flow (l/s)	2.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	77
Invert Level (m)	9.695
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.300	2.0
Flush-Flo™	0.113	2.0
Kick-Flo®	0.228	1.8
Mean Flow over Head Range	-	1.6

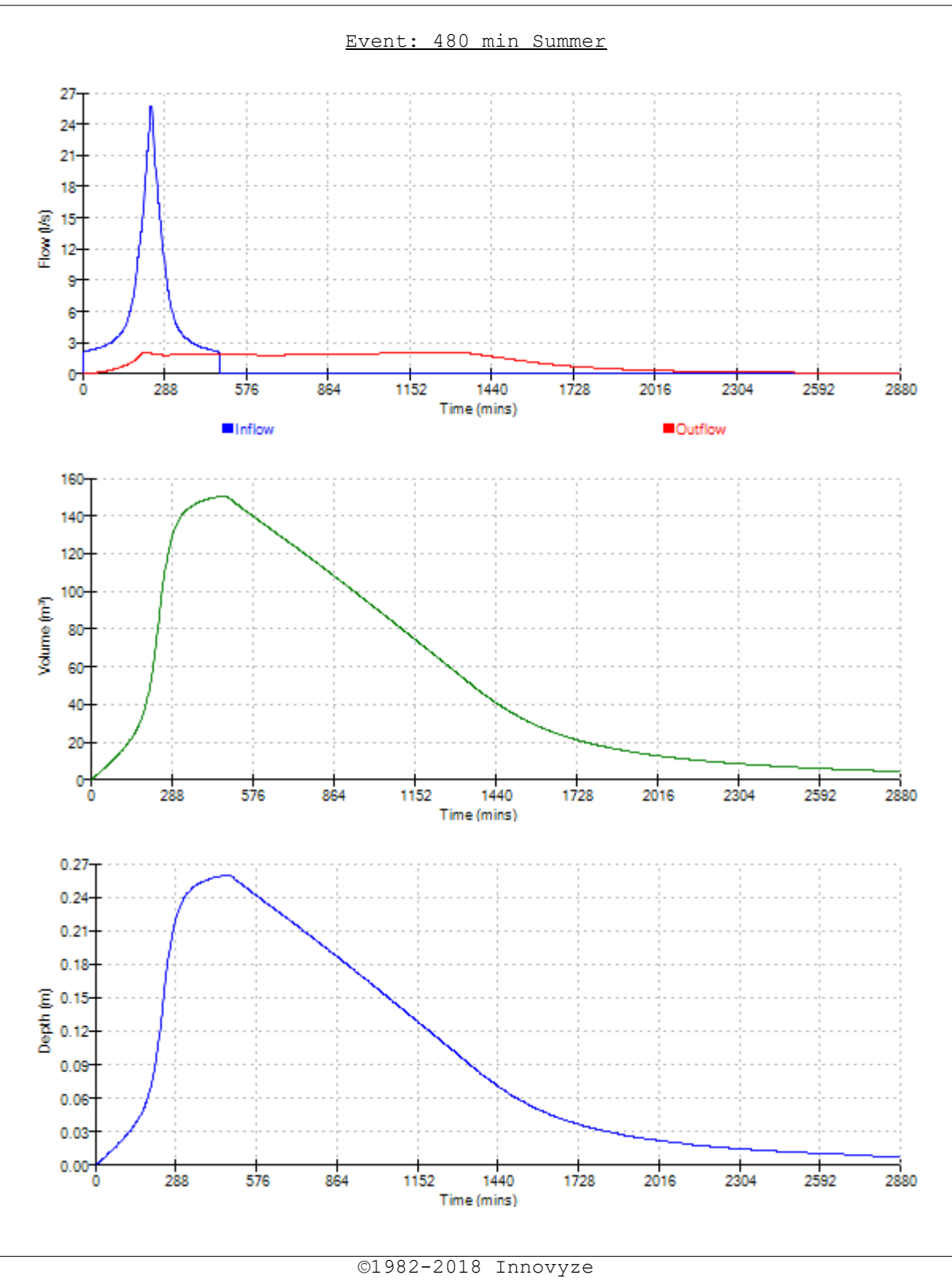
The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	2.0	1.200	3.8	3.000	5.8	7.000	8.8
0.200	1.9	1.400	4.1	3.500	6.2	7.500	9.1
0.300	2.0	1.600	4.3	4.000	6.7	8.000	9.4
0.400	2.3	1.800	4.6	4.500	7.1	8.500	9.7
0.500	2.5	2.000	4.8	5.000	7.4	9.000	10.0
0.600	2.7	2.200	5.0	5.500	7.8	9.500	10.3
0.800	3.1	2.400	5.2	6.000	8.2		
1.000	3.5	2.600	5.4	6.500	8.5		

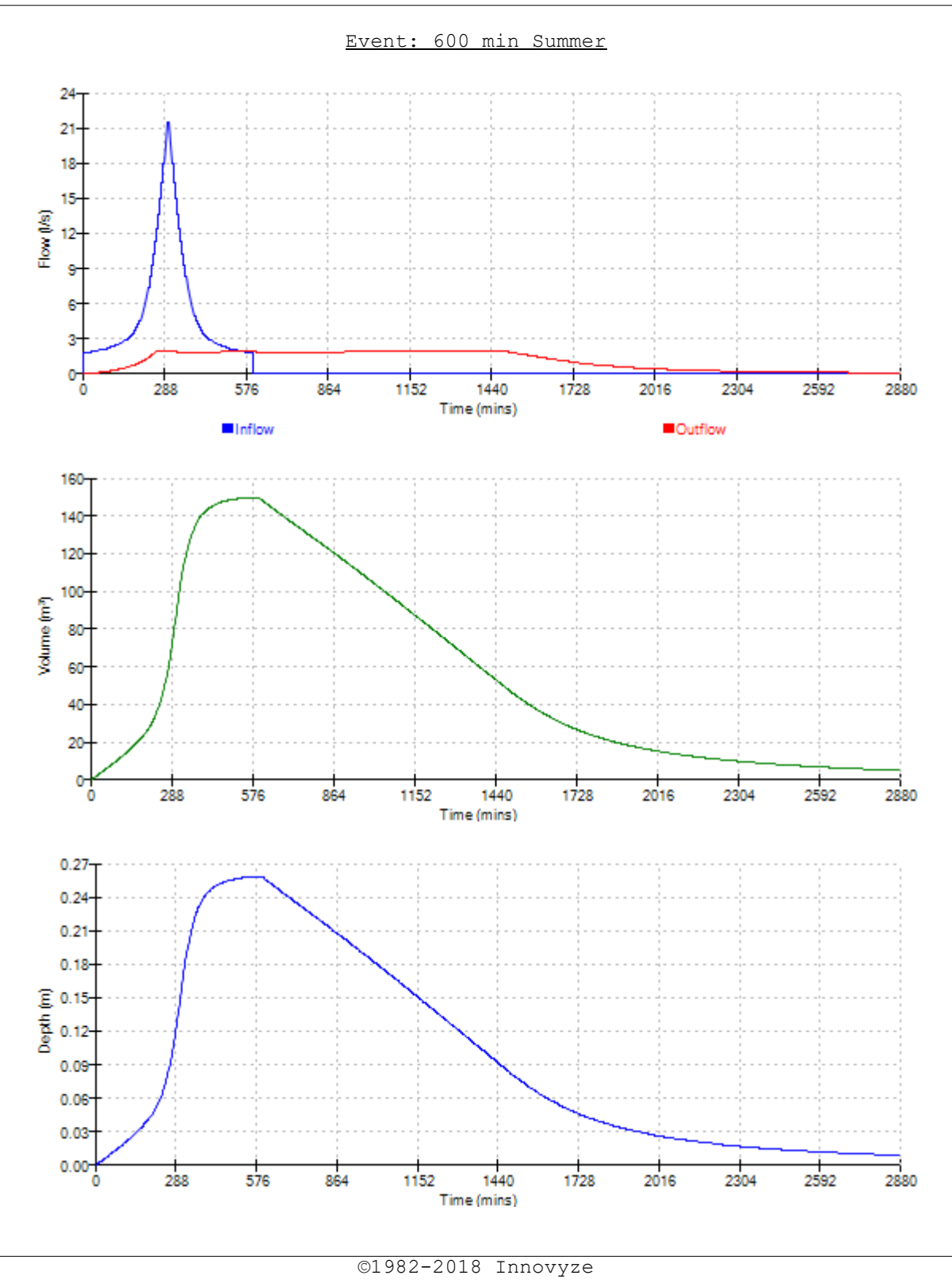
Waterco Ltd		Page 5
Eden Court Lon Parcwr Business Park Denbighshire LL15 1NJ	W10748	
	Harts Farm Way, Havant 1 in100 + 20% CC	
Date 10/09/2018	Designed by HW	
File W10748-1 IN100+20% - CO...	Checked by AW	
XP Solutions	Source Control 2018.1	



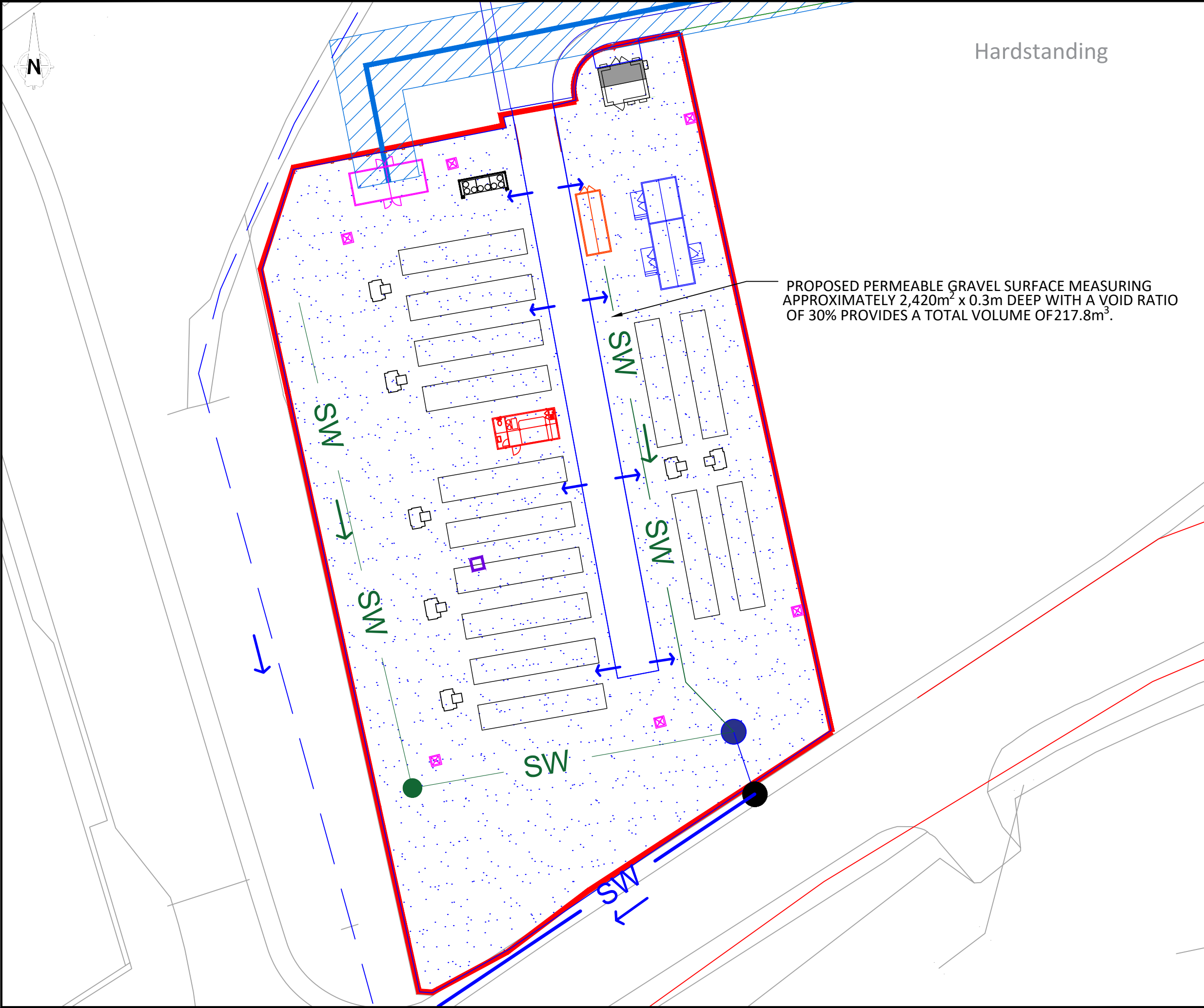
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	Harts Farm Way, Havant 1 in100 + 20% CC	
Date 10/09/2018	Designed by HW	
File W10748-1 IN100+20% - CO...	Checked by AW	
XP Solutions	Source Control 2018.1	



Waterco Ltd		Page 7
Eden Court	W10748	
Lon Parcwr Business Park	Harts Farm Way, Havant	
Denbighshire LL15 1NJ	1 in100 + 20% CC	
Date 10/09/2018	Designed by HW	
File W10748-1 IN100+20% - CO...	Checked by AW	
XP Solutions	Source Control 2018.1	



Appendix H – Concept Drainage Sketch



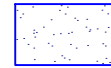
Hardstanding

PROPOSED PERMEABLE GRAVEL SURFACE MEASURING
APPROXIMATELY 2,420m² x 0.3m DEEP WITH A VOID RATIO
OF 30% PROVIDES A TOTAL VOLUME OF 217.8m³.

NOTES

1. ALL DIMENSIONS IN MILLIMETRES AND ALL LEVELS IN METRES ABOVE ORDNANCE DATUM UNLESS SHOWN OTHERWISE.
2. THIS DRAWING IS AN AMENDMENT OF A DEVELOPMENT PLAN PROVIDED BY GREEN FROG POWER LTD.
3. THIS DRAWING PROVIDES A CONCEPT ONLY AND IS NOT INTENDED FOR DETAILED DESIGN.

KEY

-  PROPOSED PERMEABLE GRAVEL SURFACE
-  EXISTING WATERCOURSE
-  EXISTING SURFACE WATER SEWER
-  PROPOSED PERFORATED DRAIN
-  EXISTING MANHOLE
-  HYDRO-BRAKE CHAMBER RESTRICTING FLOW TO 2 l/s
-  FLOW DIRECTION

SITE LOCATION
GRID REFERENCE: 470616, 105836
SITE ADDRESS: HARTS FARM WAY, HAVANT, PO9 1HS

P00	07-09-18	FIRST ISSUE	HW	AW	JR
REV.	DATE	DESCRIPTION	DSGND	CHKD	APPD

CLIENT
GFP11 LTD

PRINCIPAL DESIGNER


Waterco Ltd., Eden Court,
Lon Parcwr Business Park, Ruthin LL15 1NJ
tel (+44) 1824 702220
www.waterco.co.uk

SCHEME
HARTS FARM WAY, HAVANT

TITLE
CONCEPT DRAINAGE SKETCH

STATUS
PRELIMINARY

DESIGNED	CHECKED	APPROVED	SCALE / SHEET SIZE
HW	AW	JR	1 : A3

DRAWING NO.	REV
W10748	P00

Appendix I – Maintenance Schedule

Operation and Maintenance Requirements for Permeable Paving

Maintenance Schedule	Required Action	Typical Frequency
Regular maintenance	Brushing and vacuuming (standard cosmetic sweep over whole surface)	Once a year, after autumn leaf fall, or reduced frequency as required, based on site-specific observations of clogging or manufacturer's recommendations – pay particular attention to areas where water runs onto pervious surface from adjacent impermeable areas as this area is most likely to collect the most sediment
Occasional maintenance	Stabilise and move contributing and adjacent areas	As required
	Removal of weeds or management using glyphosate applied directly into the weeds by an applicator rather than spraying	As required – once per year on less frequently used pavements
Remedial actions	Remediate any landscaping which, through vegetation maintenance or soil slip, has been raised to within 50mm of the level of the paving	As required
	Rehabilitation of surface and upper substructure by remedial sweeping	Every 10 to 15 years or as required (if infiltration performance is reduced due to significant clogging)
Monitoring	Inspect for evidence of poor operation and / or weed growth – if required, take remedial action	Three-monthly, 48hr after large storms in first six months
	Inspect silt accumulation rates and establish appropriate brushing frequencies	Annually
	Monitor inspection chambers	Annually

Ref. Table 20.15, CIRIA C753 'The SuDS Manual

The maintenance requirements detailed above are to be undertaken by the site owner.

Name:

Position:

Date:

**Signed on behalf
Of the site owner**