LK CONSULT LIMITED

PART OF THE LK GROUP

LAND OFF ST. MARY'S ROAD
HAYLING ISLAND

FLOOD RISK ASSESSMENT
& OUTLINE DRAINAGE STRATEGY

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Date: November 2016

Ref: FRA 16 1021

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Document Verification

Site Address	Land off St. Mary's Road, Hayling Island, Hampshire, PO11 9BY		
Report Title	Flood Risk Assessment & Outline Drainage Strategy		
Job Number	FRA 16 1021	**Document Ref.**	FRA 16 1021 – R0
Date Issued	November 2016	**Report Version**	F0
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EXECUTIVE SUMMARY

Scope and Background

This Flood Risk Assessment (FRA) has been undertaken by LK Consult Ltd (LKC) to support a planning application for residential development of Land off St. Mary's Road, Hayling Island. The site is currently used for agricultural purposes.

LKC has prepared this Flood Risk Assessment (FRA) in line with the NPPF and Technical Guidance where appropriate.

In considering the proposals the following key principles have therefore been applied:-

- Identification of flood risks.
- Protection of users of the new development.
- No increased flood risk to third parties.

Consultations

The Environment Agency (EA) has been consulted to inform the preparation of this report. They have provided a more detailed surface water risk map but no modelled data was available.

Hampshire County Council and Southern Water Ltd were also consulted concerning flood risk.

All relevant consultees have confirmed that there is a very low to low risk of flooding to this site from all sources.

Flood Risk

The site is shown on the Environment Agency's (EA) website Flood Zone Mapping as being in Flood Zone 1, (PPG Table 1). – Very Low Risk, with a Low annual probability of flooding less than 0.1% (1 in 1000).

There are low risks for pluvial, surface water, ground water and tidal flooding.

Mitigation

Design

Site falls will be arranged to allow reasonably level access for occupants and visitors and allowing the site to be free-draining in case of local ponding at times of heavy rainfall. Floor levels of dwellings will be set as high as possible above the flood level giving regard to necessary access for the less-able.

The development will not result in any reduction in flood plain storage compared to the existing situation.

In considering the potential drainage options for the site at present it is assumed that surface water runoff arising from the development will discharge to two separate catchments. The northern catchment will discharge into the existing central ditch flowing towards the western boundary and the southern catchment will drain towards a ditch on the eastern boundary.

The proposed development will significantly increase the proportion of the site covered by impermeable surfaces and will therefore generate more runoff. Attenuation will therefore be required.

The outline drainage strategy considers the use of attenuation based SuDS to be feasible. Therefore the most effective strategy, in line with the SuDS management train, would be to have a detention basin at the western boundary and one towards the southeast corner. The required detention pond or similar for the northern catchment has been estimated to be **506.5m^3** for the 1 in 30 year greenfield flow restriction. The required detention pond or similar for the southern catchment has been estimated to be **422.8m^3** for the 1 in 30 year greenfield flow restriction.

The estimated volume to be retained on site for the northern catchment for the 1 in 100 year storm event including the allowance for climate change is between **839.8m^3** and **1046.7m^3**.Similarly the estimated volume to be retained on site for the southern catchment for the 1 in 100 year storm event including the allowance for climate change is between **701.0m^3** and **873.6m^3**.

The site is considered to be at low risk of flooding. It is recommended that the minimum finished floor levels for the development should be set at a nominal height above the proposed ground levels. This is to allow for overland flow during exceedance flows from an extreme event or a drainage failure.

Access

Access close to the site is elevated above potential flood levels and will always provide safe access to and from St Mary's Road to the east of the site.

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1 INTRODUCTION

1.1 Background

LK Consult Ltd (LKC) were commissioned to carry out a Flood Risk Assessment (FRA) and Outline Drainage Strategy by Gladman Developments Ltd. The report was undertaken in support of a future planning application to redevelop the site for residential use.

The report will address the vulnerability to flooding from all possible sources and will also consider the impact of the development on surface water runoff accounting for climate change and the potential to increase flood risk elsewhere. The Outline Drainage Strategy in Section 5 will provide an overview of the SuDS techniques which could be considered on the site. The issues of actual flood risk are discussed in Section 4.

Government policy with respect to development in flood risk areas is contained within the Department of Communities and Local Government National Planning Policy Framework[1] and accompanying Technical Guidance of March 2012 (revised to the Planning Practice Guidance (PPG)[2], which supersedes Planning Policy Statement 25 (PPS25) 'Development and Flood Risk'. The guidance on Climate Change allowance issued by the Environment Agency in February 2016 has also been considered.

LKC has prepared this Flood Risk Assessment (FRA) in line with the NPPF and the PPG where appropriate.

The level of detail entered into in any flood risk assessment is dependent upon the scale and potential impact of the proposed development, and the vulnerability classification of the proposed land-use.

[1] DCL (2012). "National Planning Policy Framework." Department of Communities and Local Government. March 2012.
[2] DCL (2014). "Planning Practice Guidance" http://planningguidance.communities.gov.uk, April 2014.

1.2 Site Details

A summary of general site details is presented in Table 1-1. Plans, Drawings and Figures are provided in Appendix A. Figures 1 and 2 indicate the site location and boundary.

Site Details	
Location	To the northwest of St. Mary's Road, Hayling Island, PO11 9BY. Centred at approximate National Grid Reference 471930E 99800N.
Area	11.81ha
Topography	8.5 metres above ordnance datum (AOD) in the north of the site and 6.5m AOD in the south. The site is sloping down gently to the south.
Current Land Use	Site The site comprises of arable farmland over the majority of the area with a drain running east and west across the centre of the site. A farm building, pond and embankments are present in the centre of the study area. An area in the east comprises open grassland with a stockpile of compost, farm machinery and waste. Surrounding Area North: Open grassland, St. Mary's Church and grave yard. East: Residential dwellings. South: Residential dwellings. West: Open grassland and residential dwellings.
Proposed Development	Residential dwellings (including up to 30% affordable housing), structural planting and landscaping, informal public open space, children's play areas, sustainable drainage systems (SuDS), vehicular access from St. Mary's Drive and associated ancillary works.

Table 1-1: Summary of site details for land off St. Mary's Road, Hayling Island.

2 SITE SETTING

2.1 Vulnerability

As an initial phase in identifying whether a site is potentially at risk of flooding, LKC has consulted the Environment Agency's (EA) website Flood Zone Mapping. This mapping is (often) based on coarse scale modelling and provides only an initial indication of the flood risk to a site. The Environment Agency Flood Zone maps were developed using a very coarse Digital Elevation Map (DEM) and are superseded by a more detailed analysis of modelled flood levels and topographic survey levels.

The Flood Zones divide the floodplain into three categories of flood risk, and do not take flood defences into account. The NPPF defines the Flood Zones as:-

- Flood Zone 1 – little or no risk, with annual probability of flooding from rivers and the sea of less than 0.1% (1 in 1000).
- Flood Zone 2 – low to medium risk, with annual probability of flooding of 0.1 to 1.0% from rivers and 0.1 to 0.5% from the sea.
- Flood Zone 3 – high risk of flooding with an annual probability of flooding of 1.0% or greater from rivers, and 0.5% or greater from the sea.

The Flood Zone Mapping indicates the site as being within Flood Zone 1 (PPG paragraph 065, Table 1).

The development site is over 1 hectare in size, so under current regulations a Flood Risk Assessment will be necessary to accompany the Planning Application.

The proposed development is for residential end use and this is classified within the 'More Vulnerable' category in Table 2 of paragraph 066 of the PPG Technical Guidance.

2.2 The Sequential and Exception Tests

The NPPF does not require that the Sequential Test be applied to development proposals in Flood Zone 1. Since the site has been shown to be located in Zone 1 for flood risk (see section 4.1), a sequential approach should not be required for planning.

However, the principles should still be applied for developments within the site such that, for example, dwellings are situated on a high part of the site when there is a risk of local surface water flooding. The issues of actual flood risk are discussed below. The issues of safety and reduction in flood risk to others required by an Exception Test are also addressed in this document.

The Local Planning Authority (LPA) will make the final decision with regard to any planning application.

2.3 Environmental Setting

LKC have previously undertaken a Preliminary Risk Assessment for the site (LKC 16 1109 May 2016)[3] and pertinent environmental information for the site is provided in Table 2-1 below.

[3] Preliminary Risk Assessment LKC 16 1109 May 2016

Summary of Environmental Setting		
Geology	Superficial	River Terrace Deposits (sand, silt and gravel).
	Bedrock	London Clay Formation (clay, silt and sand).
	BGS Boreholes	BH Ref: SZ29NW15, NW of the study area: compact sandy gravel 3.65m, firm brown silty clay to 4.57m, compact brown sand to 5.18m, firm grey clayey silt to 6.7m. BH Ref: SZ29NW14, approximately 10m W of the study area: topsoil to 0.8m, soft brown sandy clay to 2.1m, brown sandy clayey gravel to 2.74m, brown sandy gravel to 3.96m, soft brown silty clay to 4.27m. BH Ref: SZ29NW13, approximately 80m W of the study area: firm brown sandy clay to 1.8m, grey / brown sandy clayey gravel to 2.43m, grey silty clay to 3.35m, brown compact sand to 3.81m, grey sandy clay with flints to 4.26m.
Hydrogeology	Superficial	Secondary A.
	Bedrock	Unproductive Strata.
Hydrology	Surface water	There is a length of ditch along the northern boundary flowing towards St. Mary's Road. There is a watercourse bisecting the site flowing east and west from the central pond. The central pond appeared on the mapping in the 1960's. There is a shallow ditch along the southern part of the western boundary. There is a ditch along the southern part of the eastern section that flows towards the southeast corner towards an existing headwall and off site.
Site History		The central pond appears on the mapping during the 1960's on the line of the central bisecting ditch.

Table 2-1: Environmental setting for land off St. Mary's Road, Hayling Island.

2.4 Site Reconnaissance

A site visit was undertaken in May 2016 and photographs are provided in Appendix B.

- The site is currently arable farmland over the majority of the site with open drains on each boundary and bisecting the site.
- The bisecting ditch has outfalls on both the east and west boundaries but the invert levels vary along its length. Indications are that the majority of the northern catchment will fall to the west. The outfall to the west is to an open watercourse, to the east it is to a drain that flows beneath a private garden.
- The ditch on the eastern boundary to the southern section has an incoming pipe from beneath the existing housing to the east of the boundary.
- The ditch along the eastern boundary outfalls into a 225/300mm dia. pipe running beneath a garden fence.
- A farm building, pond and embankments are present in the centre of the study area.
- An area in the east comprises open grassland with a stockpile of compost, farm machinery and waste.
- Made ground was observed, which contained rare ash, plastic and brick fragments to 0.3m underlain by natural slightly sandy gravelly clay.
- Access to the site is via a gate off St. Marys Road and via Rook Farm Way.

2.5 Site and Access Levels

A topographic survey of the site has been undertaken to OS GPS datum, and information is included on the drawings in Appendix A. The site falls generally to the south from the high

point on the northern boundary. The fall is approximately 2m to the southern boundary with a slight fall towards the east and west boundaries within the northern part of the site. The final site levels and ground floor levels of dwellings have not yet been determined. The proposed access would join St. Mary's Road at around 7.0m AOD.

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3 CONSULTATIONS

Information from consultees (Environment Agency (EA), Hampshire County Council (Lead Local Flood Authority) and Southern Water Ltd is summarised in Table 3-1 below.

Relevant correspondence / information are provided in Appendices C (EA) and D (others).

Source	Details	
Environment Agency	Flood Zone 1: little or no risk, with annual probability of flooding from rivers and the sea of less than 0.1% (1 in 1000).	
	Modelled Levels for Hayling Island	No relevant information available.
	Records of Flooding	No records of flooding recorded.
	Records of Flood Warning Service	Not within a Fluvial Flood warning service area.
	Surface Water Flooding	A low potential for surface water flooding up to a depth of 300mm is recorded in one area adjacent to the central western boundary where a slight depression in the ground is shown on the topographical survey. The remainder of the site is very low risk.
	Flooding from reservoirs	No risk from reservoirs.
	Groundwater Source Protection Zone	Not within a Source Protection Zone.
Hampshire County Council (Lead Local Flood Authority)	Flood incidents	An incident of flooding was recorded in Beech Grove approximately 450m to the east of the boundary relating to the capacity of an existing ditch. Church Road surface water flooding due to a blocked culvert and unmaintained watercourse.
	Other	A 10% addition for urban creep should be added for storage estimates. The site itself is not shown to be vulnerable to surface water in a 1 in 30 year rainfall event. There does not appear to be significant vulnerability from ground water flooding however much of Hampshire is prone to high levels of groundwater so further investigations would be recommended.
Southern Water Ltd (SWL)	Likely conditions for connecting into their sewerage system	SWL would normally request conditions for a separate system with only foul draining to foul / combined sewers and surface water draining to soakaway/SuDS, watercourse or surface water sewer. SWL was contacted regarding sewer flooding history for the site. No reply has been received at the time of writing the report.
	Sewer map	There is a deep 525mm dia foul sewer cutting through the northwest corner of the site flowing to the north west. There is a 225mm dia foul sewer within St. Mary's Road to the east. In Rook Farm Way there is a 225mm dia surface water drain but no onward route shown. There is also a 150mm dia foul drain flowing towards St Mary's Road. There is a 300/375 mm dia surface water drain in the section of St. Mary's Road to the south of the site which may be the onward route of the watercourse in the southeast corner of the site.

Table 3-1: Summary of available information for land off St Mary's Road, Hayling Island

Source	Details	
Strategic Flood Risk Assessment (SFRA)	Level 1 SFRA[4]	In Havant Borough, Hayling Island is the most sensitive area to sea level rise, particularly the southern half of the island. With much of the island low-lying, predicted sea-level rise could result in extreme tidal events inundating more of the island. The SFRA recommends that all applications for development within the vicinity of the southern frontage of Hayling Island include an assessment of extreme wave overtopping, regardless of which Flood Zone the site is in. Wave energy mapping data contained in the SFRA indicates that My Lord's Pond may be susceptible to low wave energy frontage. The level within the SFRA for the Zone 1 coastal flooding is 4.7m AOD. The site has no history of flooding from any source.
Preliminary Flood Risk Assessment (PFRA)[5]	The PFRA for the area indicates that there are no records of flooding for the area which conforms with information supplied by the EA. The PFRA also indicates that the site is not in an area susceptible to groundwater flooding.	

Table 3-1 (continued): Summary of available information for land off St. Mary's Road, Hayling Island

[4] Strategic Flood Risk Assessment Level 12016, update V3.0 Final: Partnership for Urban South Hampshire.
[5] Preliminary Flood Risk Assessment 2011 - 2017. Hampshire County Council; June 2011.

4 ASSESSMENT OF FLOOD RISK

4.1 Flood Zones

The detailed flood map provided by the EA indicates that the site is in Flood Zone 1 (see Appendix C).

There are no main rivers that may influence the development of the site. The extents of the 0.1% (1000-year) flood level remain outside of the development area.

4.2 Sources of flooding

The risk of flooding from the following flood sources has been considered:

Fluvial – The EA has confirmed the study area is within Flood Zone 1. Therefore the flood risk associated with this source is considered very low.

Tidal – The site is relatively close to the sea and tidally influenced water bodies; therefore, the flood risk associated with this source should be considered. The lowest part of the site is 1.8m above the estimated tidal inundation level including climate change shown within the SFRA of 4.7m. Therefore the flood risk from this source is considered low.

Pluvial (Rainfall) –This site is drained by a number of boundary ditches and a bisecting watercourse. There is a limited area at low risk of shallow flooding adjacent to the western boundary where there is a slight depression in the land form. The site generally gently falls to the south and the existing boundary ditches. If there was a drainage failure causing overland flow it would flow towards the southeast and southwest corners. No areas of shallow standing water were observed during the site visit. The risk to property and life will be low, but there is the potential to have areas of standing water in gardens and landscaped areas not positively drained if overland flow routes are not considered. Therefore, the risk of flooding from surface water flooding should be considered further during the detailed design.

Surface Water (Overland flow) - The only observed impermeable area at a level generally above that of the site area is the caravan park to the northwest. There is a ditch on the northern boundary that would intercept overland flow. There is the potential for the culvert taking flows from the ditch on the eastern boundary to be blocked if not maintained. This could restrict flow from the site, but this would not be an increased risk from the proposed sustainable drainage for the development. Therefore, the flood risk from this source is considered low.

Groundwater – The BGS has groundwater records adjacent to the site in the form of borehole records. The records show the water table is recorded at 1.5 to 3m below the surface indicating the possibility that groundwater may be encountered with deeper excavations. The LLFA has recorded no incidences of groundwater flooding in the area. No evidence of shallow groundwater was observed during the walkover. Therefore, the flood risk associated with this source is considered low.

Sewers – Southern Water sewer records show a deep foul sewer within the northwest corner of the site. If this sewer was blocked downstream of the site the backing up water would probably emerge from the manholes to the southwest of the site. The 'Drainage and Water Enquiry' states that no property on the site is at risk of internal flooding due to overloaded public sewers. There are no records of sewer flooding at the site location. The

entrance to the site in St. Mary's Road is raised above the level of the road so it is unlikely that water would flow onto the site. Therefore, the flood risk associated with this source is considered very low.

Artificial sources – According to the EA online maps, the study area is not at risk from reservoir flooding. The pond located towards the centre of the site has a limited catchment from the northeast of the site so is unlikely to cause a significant risk. If it were to overflow it would flow into the adjacent watercourse. The ditches at the perimeters of the site are generally fairly flat but of limited catchment. The flood risk associated with artificial sources is therefore considered very low.

4.3 Summary of Flood Risk

Source of Flooding	Risk assessment Level
Fluvial	Very Low
Pluvial (Rainfall)	Low
Surface Water	Low
Tidal	Low
Groundwater	Low
Sewers	Very Low
Artificial Sources	Very Low

Table 4-1 Summary of Existing Risk Level for land off St. Mary's Road, Hayling Island

The site is located within Flood Zone 1 and a low risk of flooding from tidal, pluvial, surface water and groundwater sources have been identified for the site. LKC therefore consider that a strategy for surface water management will be required at the site to mitigate the risk. The assessments of a range of measures that are feasible for the site are outlined in Section 5.

4.4 External Flood Risk Issues

There are flood risk issues associated with the main access to the island via the Langstone Bridge with the potential for flooding to affect the highway during extreme conditions. This will be investigated further during the course of the application process.

5 SURFACE WATER MANAGEMENT

The NPPF recognises that flood risk and other environmental damage can be managed by minimising changes in the volume and rate of surface run-off from development sites through the use of Sustainable Drainage Systems (SuDS), this being complementary to the control of development within the floodplain.

SuDS will not alleviate flooding in an area prone to flooding; however, properly designed SuDS have the potential to prevent the surface water runoff from new development worsening the flood risk. The effective disposal of surface water from development is a material planning consideration in determining proposals for the development and use of land.

The accepted principles are that surface water arising from a developed area should, as far as practicable, be managed in a sustainable manner to mimic the surface water flows arising from the site prior to the proposed development, while reducing the flood risk to the site itself and elsewhere, taking climate change into account.

The Building Regulations Requirement H3[6] stipulates that rainwater from roofs and paved areas is carried away from the surface to discharge to one of the following, listed in order of priority:

a) an adequate soakaway or other adequate infiltration system,
b) a watercourse or, where that is not practicable,
c) a sewer.

The concept of a sustainable drainage system has been incorporated into the outline drainage strategy for the study area in order to comply with the Flood and Water Management Act 2010[7].

5.1 Infiltration

The Groundwater Source Protection Zone mapping from the EA website shows that the site is not within any identified protection zones.

A summary of the British Geological Survey superficial soils and bedrock aquifer classification supplemented by local records is shown in Table 5-1 below:

Classification	Description	Aquifer Description	Recorded Water Table Depth	Soakaway Potential
River Terrace Deposits	Silty, sandy gravelly clay bands.	Secondary A	1.5-3.0m	Limited
London Clay Formation	Clay silt and sands.	Unproductive	N/A	Poor

Table 5-1 – Geological and Hydrogeological Setting for land off St. Mary's Road, Hayling Island

Infiltration testing was undertaken to inform the drainage strategy, the results and calculations are shown in Appendix F. This gave a range of permeability readings.

[6] HM Government (2015) "Approved Document H – Drainage and Waste Disposal.
[7] HMSO (2010) "Flood and Water Management Act".

At TP 1 the tests failed to drain due to the depth of clay recorded with a water strike at the base of the clay at 2.7m.

At TP2 the test showed some potential for infiltration between the clay layer and the water table but had a lowest permeability reading of $k=2.08x10^{-6}$m/s.

At TP3 the test showed the greatest potential for infiltration below the clay layer and had a permeability reading of $k=1.0x10^{-5}$m/s. the location of the pit was towards the highest topographical level within the site and would not be practical without pumping of any flows from the lower levels of the site.

Infiltration methods such as soakaways are unlikely to be feasible, but this may be investigated further at the detailed design stage if required.

There is a slope over the site and surrounding area which indicates that any emerging groundwater in the vicinity of the site would drain towards the south.

There are a number of open watercourses adjacent to the boundaries and a watercourse bisecting the site from east to west that currently collect runoff from the site.

There is a surface water sewer within Rook Farm Way but this appears to feed into the ditch on the eastern boundary.

5.2 Surface Water Drainage Strategy

The drainage options relating to the final discharge of surface water for this section of the site are listed in Table 5-2 in order of priority within the NPPF:

Option No:	Drainage Solution	Most feasible solution	Comments
a	Soakaway/Infiltration	2	There is a relatively high water table recorded in local boreholes associated with the sand and gravel layer below the clay within the boreholes. The lower areas of the site had a lower potential due to the ground water level.
b	Connection to Watercourse	1	There are a number of watercourses within the boundary that may be suitable for a connection subject to the approval of the LLFA.
c	Discharge into a sewer	3	The connection to the surface water sewers within St. Mary's Road would require a pumped system. The effect of a connection to the surface water sewer in Rook Farm Way would be limited as it appears to connect to the ditch within the site boundary. Any connection would be subject to approval from LLFA/SWL.

Table 5-2: Drainage options for land off St. Mary's Road, Hayling Island

Table 5-3 provides a summary of the SuDS options appraisal with consideration of CIRIA C697 (The SUDS Manual)[8] for the development:

SuDS Option	Appropriate to Development	Comments
Soakaways	*	Due to the nature of the ground conditions, the use of infiltration systems may be feasible at shallow depth where the sandy gravelly layers are above the water table.
Infiltration basin	X	Depressions that store and dispose of water via infiltration. May not be appropriate in the lower areas given the local ground conditions and the potential to allow groundwater emergence through the base of the basin.
Sand filter	*	Treatment devices using sand beds as filter media.
Filter strip	✓	Engineered filters that use vegetation to remove and treat runoff. The filter strip is sloped to allow sheet flow across the vegetated strip. A filter strip offers no storage and is used solely to remove pollutants from surface water.
Filter drains	*	Linear trenches filled with a permeable granular material, often with a perforated pipe in the base of the trench.
Detention basin	✓	Dry depressions designed to hold water for a specific retention time.
Swales	✓	Swales are shallow grass-lined channels that provide capacity for conveying flows at a controlled rate into ponds and watercourses.
Rain water harvesting	*	Rainwater harvesting collects the rain which falls onto roofs, then stores it in a tank until required for a non-potable use. A volume of water is kept out of the storm-water management system, thereby helping to reduce flooding risks. Rainwater harvesting systems are currently not included in the development proposals.
Green roofs	*	Green roof installations can help to reduce surface water runoff from roof areas depending on the system specified. Green roofs are not currently included in the development proposals.
Geo-cellular storage systems	*	Modular block systems can be used to provide an underground storage facility. Any geo-cellular storage systems should be lined with a geo-membrane to provide attenuation storage the relatively shallow watercourses would limit their application due to depth.
Permeable Pavements – with granular under pavement drainage.	✓	Permeable pavements allow inflow of rainwater into underlying construction. Any storage systems would have to be lined with an impermeable membrane to provide storage rather than infiltration for runoff from highways.
Ponds	✓	Attenuation ponds can be used to offset the increase in surface water flows attributable to increased area of hard standing, in order to minimise the risk of flooding to and from the proposed development. Ponds will attenuate the surface water flow prior to discharging to the water course. The storage volume afforded by these features should not include any permanent water in the pond.
Oversized Pipes	✓	Oversizing the pipes that make up the on-site drainage network is a cost effective method for providing attenuation storage within the network. Such systems could be considered on the parts of the development where gradients are relatively flat.
Tanks	✓	Prefabricated underground tanks could be considered at the detailed design stage in order to provide storage to attenuate surface water runoff. The depth of the receiving watercourse would limit their use.
Flow control devices	✓	The peak flow rates will be controlled by flow control devices e.g. hydrobrake style flow control systems, and restricted orifices. Flow control devices enable the discharge to be restricted to a constant rate from the development.

Table 5-3: Summary of the SuDS options appraisal for land off St. Mary's Road, Hayling Island

Notes

✓ Suitable for use given the nature and scale of the development

* Possibly suitable for use – not included in the client and architect design proposal at present

X Not suitable

[8] CIRIA C697 - The SUDS Manual. London 2015

5.3 Surface Water Attenuation Requirements

From correspondence with the LLFA it is assumed that the flow should be limited to a 'greenfield scenario' for estimating the attenuation volumes required. It is estimated from the supplied plan (see Appendix A) that the site will have the following designated areas (Table 5-4). The strategy assumes an area of 1.44ha to the northwest of the site will be drained separately to the watercourse, so this has been excluded from the greenfield runoff calculations.

Designated Areas	Plot Area
Total area (ha)	11.81
Development Area (ha)	7.53
Green Infrastructure (ha)	4.28
Northern Contributing Catchment	
Catchment Area (ha)	5.68
Developable Area (ha)	3.80
Impermeable split (ha)	1.90
Permeable split (ha)	1.90
Green Infrastructure (ha)	1.88
Southern Contributing Catchment	
Catchment Area (ha)	4.70
Developable Area (ha)	3.73
Impermeable split (ha)	1.87
Permeable split (ha)	1.86
Green Infrastructure (ha)	0.97

Table 5-4: Assumed plot areas for land off St. Mary's Road, Hayling Island.

Table 5-4 shows the assumed split in area included within the calculations.

5.3.1 Attenuation Estimate

Surface water storage and Greenfield Runoff estimations based on the HR Wallingford procedure (IH 124[9]) have been undertaken for the development and the output report is presented in Appendix E.

<u>Northern Catchment</u>

For the contributing catchment an estimate has been produced assuming a developable area of 3.80ha and a public open space of 1.88ha from the 5.68ha catchment plot. Assuming conservatively that 50% of the developed area comprises roofs and hard surfacing. An addition of 10% has been added to the proposed impermeable area as an allowance for urban creep. The resulting impermeable area would therefore be 2.09ha. This gives the following runoff rates and attenuation requirements for this section based on the Wallingford IH 124 method:

- Q_{bar}: **19.33 l/s**
- 1 in 1 year greenfield runoff rate: **16.43 l/s**
- 1 in 30 year greenfield runoff rate: **43.09 l/s**
- 1 in 100 year greenfield runoff rate: **60.87 l/s**

All greenfield runoff estimates and subsequent storage estimates are included in Appendix E.

[9] IH124 Flood Estimation of Small Catchments

The following attenuation has been estimated for the northern section of the development using greenfield runoff rates and utilises the FSR methodology[10] as:

- Attenuation storage volume: **506.5 m^3** (1 in 30 year event)
- Retention on site volume: **839.8 m^3** (1 in 100 year + 20% Climate Change)
- Retention on site volume: **1046.7 m^3** (1 in 100 year + 40% Climate Change)

The attenuation required for a 1 in 30 year storm event, requires a storage volume of **506.5m^3** and for the 1 in 100 year event, a storage capacity of between **839.8 m^3** and **1046.7 m^3** will be required from on-site storage as well as SuDS systems. All volumes can be stored within the site boundary and discharges will be limited by flow control devices to the central on-site watercourse.

Southern Catchment

Similarly for the contributing catchment an estimate has been produced assuming a developable area of 3.73ha and a public open space of 0.97ha from the 4.70ha catchment plot. Assuming conservatively that 50% of the developed area comprises roofs and hard surfacing. An addition of 10% has been added to the proposed impermeable area as an allowance for urban creep. The resulting impermeable area would therefore be 2.057ha. This gives the following runoff rates and attenuation requirements for this section based on the Wallingford IH 124 method:

- Q_{bar}: **15.99 l/s**
- 1 in 1 year greenfield runoff rate: **13.59 l/s**
- 1 in 30 year greenfield runoff rate: **35.66 l/s**
- 1 in 100 year greenfield runoff rate: **50.37 l/s**

The following attenuation has been estimated for the northern section of the development using greenfield runoff rates and utilises the FSR methodology as:

- Attenuation storage volume: **422.8 m^3** (1 in 30 year event)
- Retention on site volume: **701.0 m^3** (1 in 100 year + 20% Climate Change)
- Retention on site volume: **873.6 m^3** (1 in 100 year + 40% Climate Change)

Attenuation storage aims to limit the peak rate of runoff from the development to the corresponding greenfield runoff for a range of annual flow rate probabilities before discharge to watercourse. As the flow from the development would be restricted to the greenfield equivalent there should be little change in the flows that enter the unnamed watercourses and thus the risk of flooding and the level of erosion created as a result from the development should be negligible.

The attenuation required for a 1 in 30 year storm event, requires a storage volume of **506.5m^3** and for the 1 in 100 year event, a storage capacity of between **839.8 m^3** and **1046.7 m^3** will be required from on-site storage as well as SuDS systems. All volumes can be stored within the site boundary and discharges will be limited by flow control devices to the southeast corner on-site watercourse.

The use of permeable paving may be viable dependant on the detailed design of the proposed development. If this drainage technique is considered to be feasible then it will reduce the requirement for attenuation as it will reduce the contributing area.

[10] Flood Studies Report Wallingford NERC 1975

Assuming that the outline drainage strategy is acceptable to the Local Authority, a more detailed design can be presented and agreed with the appropriate regulatory bodies during the detailed design phase.

A preliminary drainage strategy (shown in Appendix G) has been developed based on an indicative development plan.

5.4 Foul Drainage

The potential foul drainage strategy is considered in the submitted foul drainage assessment undertaken by ULS.

6 MITIGATION MEASURES

6.1 Proposed Site levels and Development Level

Current Environment Agency guidance recommends that the minimum ground floor levels of residential developments are set at a minimum of 600mm above the 1% annual probability (1 in 100 year) flood level including 30% additional fluvial allowance for climate change. It is generally accepted that vehicle parking can be accommodated within the flood zone with suitable safeguards. The 'design' flood level for the site should therefore be the 1% annual probability event with allowance for climate change plus an allowance for freeboard.

This and the 0.1% annual probability (1 in 1000-year) flood level are below the lowest existing ground level measured on site by approximately 2.0m. The tidal breach level quoted from the SFRA is 4.7m. On this basis the finished floor levels (FFL) should be set at a nominal height above the finalised ground levels to allow for any overland flow from a drainage failure. No further mitigation measures are therefore recommended.

6.2 Safe Access

Safe and dry access is available via St Mary's Road (7.0m AOD) to the east at 3.3m above the tidal breach event level of 4.7m AOD. Therefore no mitigation is proposed.

6.3 Flood Resistance and Resilience

The development proposed may be subject to flooding at more extreme events than those considered. However the risk appears to be sufficiently low that flood resilience measures need not be included into ground floor construction to aid recovery after any event. If utilised, typical measures would include solid floors, use of suitable materials and services fed from upper floors with outlets at high level. There is a potential for water to enter deep excavations due to the shallow recorded ground water level. De-watering may need to be included for these excavations. The need can be discussed and agreed with Building Control officers during detailed design.

6.4 Residual Risks

It is impossible to completely guard against flooding since extreme events greater than the design standard event are always possible. However, it is likely that with the 1% annual probability flood event with allowance for climate change significantly below the lowest site levels, the relatively elevated position of the development will safeguard it from localised fluvial flooding during extreme rainfall events and tidal flooding events outside the scope of this assessment. However, ground floor levels should be set above proposed levels across the site and provide a nominal freeboard to allow overland flow under exceptional conditions. Overland flow routes should be considered in case of drainage failure and the extreme events.

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7 CONCLUSIONS

The site is shown on published mapping to be located within the Environment Agency's Flood Zone 1 - very low risk of flooding.

Low risks of flooding from tidal, pluvial, surface water and groundwater sources have been identified.

An assessment of these risks in conjunction with the development proposals have resulted in the following recommendations for the safe development of the site:

- The finished floor level should be set at a nominal height above the finished ground levels to allow for overland flow routes in extreme events and drainage failures.
- Pedestrian and vehicular safe access to and from the site is achievable under all conditions via the access road off St. Mary's Road.
- Potential for soakaway use for rainwater disposal is limited due to the high water table and depth of silty clays on the lower areas of the site; however this could be investigated further at the detailed design phase if required.
- Surface water flow will be attenuated to the greenfield runoff rate or a rate.
- Surface water arising from the north of the site could potentially discharge into the central bisecting watercourse. The southern part of the site could discharge into the watercourse towards the Southeast corner.
- A formal evacuation plan is not considered to be required.

Further details on the proposed mitigation measures are provided in Section 6. All proposed measures should be agreed with the Local Authority prior to commencement of the development.

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APPENDIX A

FIGURES, PLANS, AND DRAWINGS

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Figure 1: Study Area Location Plan, Land at St Mary's Road, Hayling Island

Drawn: April 2016 Scale: 1:25,000 @ A4 (see scale bar)

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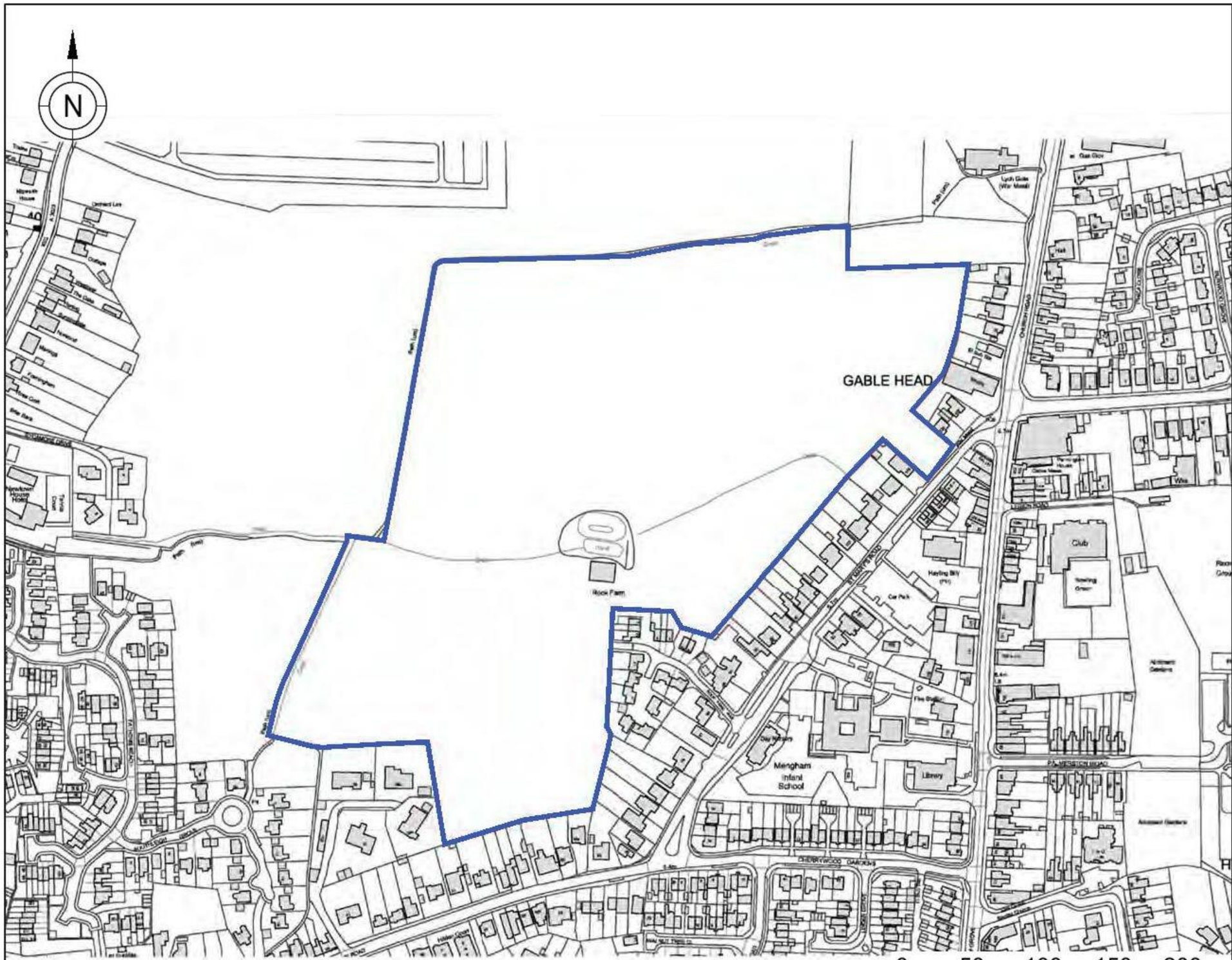

Extract from: Gladman
Drawing Ref: Location Plan, 2016-026-01 (16/03/2016)

KEY

Study Area Boundary

Sampling Locations and features annotated by LK Consult Ltd are approximate and are based upon observed measurements unless otherwise stated. Do not scale from this drawing and work from marked dimensions only. All dimensions and features should be confirmed on site by the Contractor. Where this drawing includes information provided to LK Consult Ltd by others, LK Consult Ltd gives no warranty, representation or assurance as to the accuracy of such information.

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Client:	Gladman Developments Ltd
Site:	Land at St Mary's Road, Hayling Island
Title:	Study Area Boundary Plan

Job No.:	Scale (See Scale Bar):	Figure:	Revision:
LKC 16 1109	1:4000 @ A4	2	

Drawn By:	Checked By:	Drawn:
AC	TB	Apr 2016

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APPENDIX B

SITE INFORMATION

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NOTES

THIS SURVEY IS ORIENTATED TO ORDNANCE SURVEY GRID NORTH, THE SURVEY IS TO A PLANE GRID. HORIZONTAL MEASUREMENTS TAKEN FROM THIS SURVEY WILL BE GROUND DISTANCES.

ALL LEVELS RELATE TO ORDNANCE SURVEY DATUM GENERATED BY ACTIVE GPS NETWORK.

LEGEND

- SPOT LEVEL
- SURVEY STATION
- SAPLING
- BUSH/SHRUB
- TREE (INDICATIVE ONLY)
- HEDGE/AREA OF UNDERGROWTH
- CONTOUR
- GATE
- OVERHEAD CABLE
- FENCE

ABBREVIATIONS

AL	ARCH LEVEL	LB	LETTER BOX
AV	AIR VALVE	LP	LAMPOST
B	BOLLARD	MH	MANHOLE
BB	BILLBOARD/BEACON	MR	MOORING
BH	BOREHOLE	OHC	OVERHEAD CABLE
BL	BED LEVEL	Opl.	OPENING LEVEL
BS	BUS STOP	OSBM	OS BENCHMARK
ST	ST COVER	P	POST
CF	CHAIN LINK FENCE	PR	POST AND RAIL FENCE
CL	CHAIN LINK FENCE	PW	POST AND WIRE FENCE
CATV	CABLE TELEVISION COVER	PEC	PEDESTRIAN CROSSING
CC	CONTROL CABIN	PM	PARKING METER
COL	COLUMN	RE	RODDING EYE
CPF	CONCRETE PANEL FENCE	RWL	RAINWATER WALL
CPY	CANOPY	SAP	SAPLING
CL	CROWN LEVEL	SEC	SECURITY CAMERA
Cdy	CABLE DRY	SGY	STRIP GULLY
CTV	CABLE TELEVISION POINT	Bot.	BOTTY LEVEL
CV	CONCRETE	SL	SIGNALS
DK	DROPPED KERB	Spl.	SPRINGING LEVEL
DP	DOWNPIPE	SV	STOP VALVE
EP	ELECTRIC INLET POINT	TPN	TRIAL PIT
EC	ELECTRIC INSPECTION COVER	TB	TELEPHONE BOX
EP	ELECTRICITY SUPPLY POLE	TS/T	TREE + NUMBER
ER	EARTH ROD	THL	THRESHOLD LEVEL
FH	FIRE HYDRANT	TL	TRAFFIC LIGHT
FL	FLAG	TSP	TRAFFIC SIGNPOST
GEP	GULLY AND DOWNPIPE	ToW	TOP OF WALL
GP	GATE POST	TP	TELEPHONE POLE
Gpl	GAS PIPE	WM	WIRE MESH FENCE
GV	GAS VALVE	WP	WOODEN PANEL FENCE
IC	INSPECTION CHAMBER	WR	WOODEN RAIL
IL	INVERT LEVEL	WM	WATER METER
IR	IRON RAILING FENCE	WO	WASH OUT
KO	KERB OUTLET		

STATION CO-ORDINATES

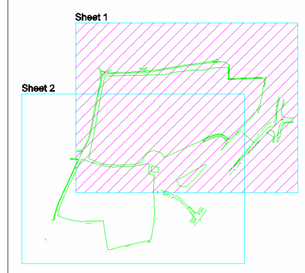
STATION	EASTING	NORTHING	LEVEL	DESCRIPTION
STN1	472108.55	104155.64	4.60	Survey Nail
STN2	472005.28	104424.34	5.31	Survey Nail
STN3	471996.85	104545.72	5.04	Survey Nail
STN4	472011.80	99981.70	8.83	Survey Nail
STN5	472114.42	99815.98	8.73	Survey Nail
STN6	472129.43	99693.30	8.70	Survey Nail
STN18	471946.45	99698.32	7.46	Survey Nail
STN17	471987.76	99628.02	7.71	Survey Nail
STN16	472011.93	99555.10	8.67	Survey Nail
STN19	472017.92	99637.99	8.70	Survey Nail

TREE SCHEDULE

No.	DIAM.	SPREAD Ø	HEIGHT
TE/1	0.75	18	14
TE/2	0.35	6	7
TE/3	0.25	7	6
TE/4	0.30	10	6
TE/5	1.20	20	18
TE/6	0.35	8	10
TE/7	0.70	9	10
TE/8	0.40	10	14
TE/9	0.25	10	11
TE/10	0.30	8	8
TE/11	1.00	20	18
TE/12	0.50	8	8
TE/13	0.30	8	8
TE/14	0.65	13	8
TE/15	0.20	6	6
TE/16	0.60	10	10
TE/17	0.80	14	18
TE/18	0.65	14	10
TE/19	0.40	8	8
TE/20	N/S	4	6

TREE DIAMETER MEASURED APPROXIMATELY 1.0M ABOVE GROUND LEVEL. TREE SPREADS ARE SYMBOLIC ONLY AND ARE REPRESENTATIVE OF THE GENERALISED CANOPY SIZE. TREE SOLE MAY NOT SIT CENTRALLY TO THE CANOPY. TREE HEIGHT ESTIMATED FROM GROUND LEVEL.

PLOT LOCATIONS



**Sheet 3 is Langstone Bridge to the North of the site

Rev	Date	Revision notes	By
*	*	*	*

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Status

INFORMATION

Project

ST MARY'S ROAD, HAYLING ISLAND

Title

TOPOGRAPHICAL SURVEY AS OF 26.04.15 SHEET 1 OF 3

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JW	09.05.16	1:500	A0

Project no.	Drawing no.	Revision
2016-026	Topo_01_2D	0

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STN18	471946.49	99908.32	7.46	Survey Nail
STN17	471987.70	99628.02	7.71	Survey Nail
STN16	472011.93	99658.10	8.07	Survey Nail
STN19	472017.92	99637.99	8.70	Survey Nail

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TE/7	0.55	8	10
TE/8	0.70	10	14
TE/9	0.40	10	11
TE/10	0.30	8	8
TE/11	1.00	20	18
TE/12	0.30	8	8
TE/13	0.50	8	8
TE/14	0.65	10	8
TE/15	0.20	6	6
TE/16	0.60	10	10
TE/17	0.80	14	18
TE/18	0.65	14	10
TE/19	0.40	8	8
TE/20	0.20	4	6

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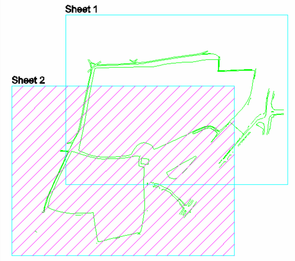
PLOT LOCATIONS

Sheet 1

Sheet 2



**Sheet 3 is Langstone Bridge to the North of the site

Rev	Date	Revision notes	By
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Status

INFORMATION

Project

ST MARY'S ROAD, HAYLING ISLAND

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TOPOGRAPHICAL SURVEY AS OF 26.04.15 SHEET 2 OF 3

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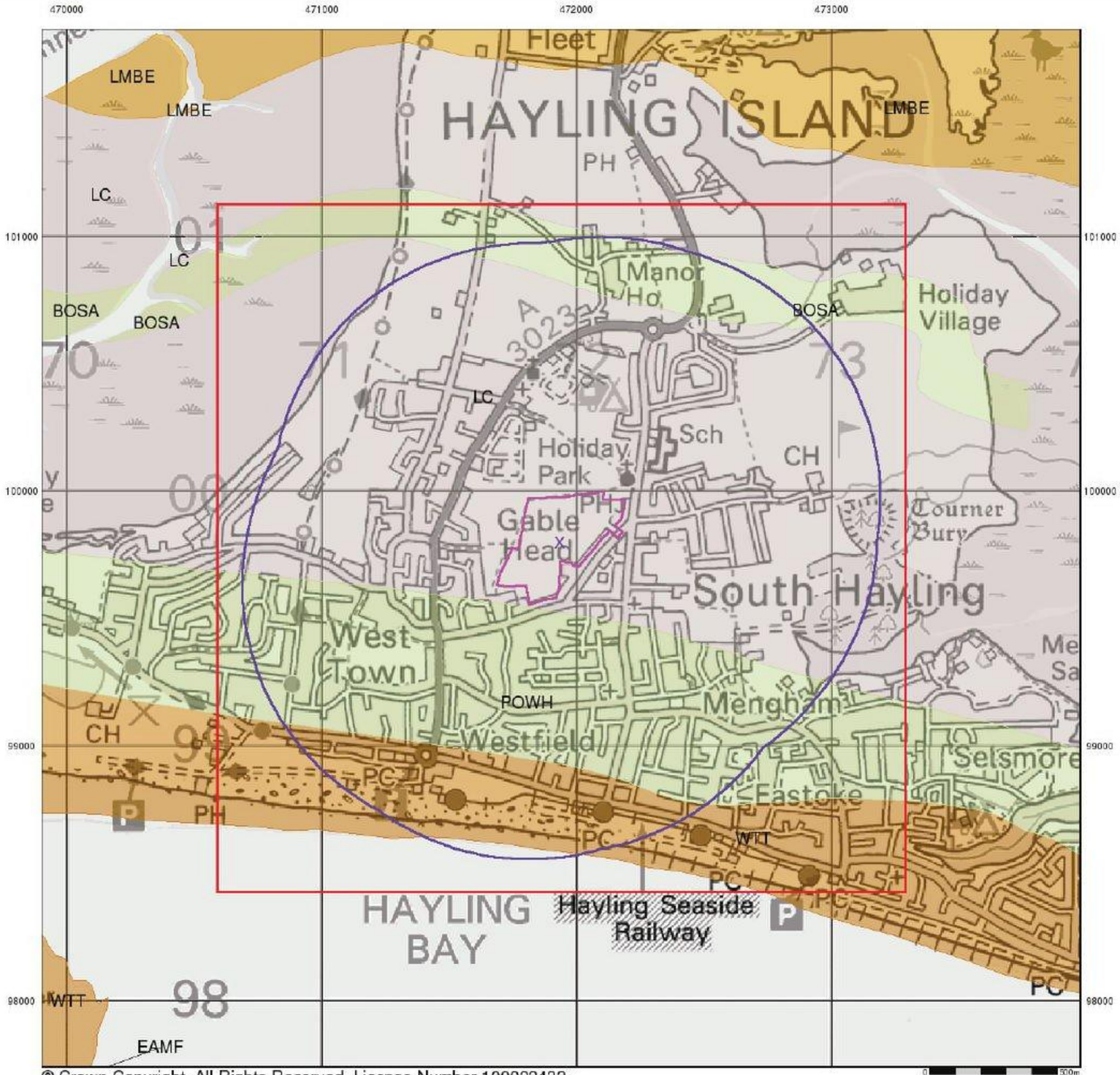

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Bedrock and Faults

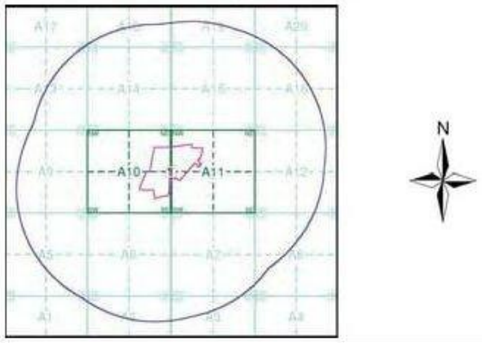
Bedrock geology is a term used for the main mass of rocks forming the Earth and are present everywhere, whether exposed at the surface in outcrops or concealed beneath superficial deposits or water.

The bedrock has formed over vast lengths of geological time ranging from ancient and highly altered rocks of the Proterozoic, some 2500 million years ago, or older, up to the relatively young Pliocene, 1.8 million years ago.

The bedrock geology includes many lithologies, often classified into three types based on origin: igneous, metamorphic and sedimentary.

The BGS Faults and Rock Segments dataset includes geological faults (e.g. normal, thrust), and thin beds mapped as lines (e.g. coal seam, gypsum bed). Some of these are linked to other particular 1:50,000 Geology datasets, for example, coal seams are part of the bedrock sequence, most faults and mineral veins primarily affect the bedrock but cut across the strata and post date its deposition.

Bedrock and Faults Map - Slice A



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National Grid Reference:	471930, 99800
Slice:	A
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Search Buffer (m):	1000

Site Details:

Site at 471930E, 099820N

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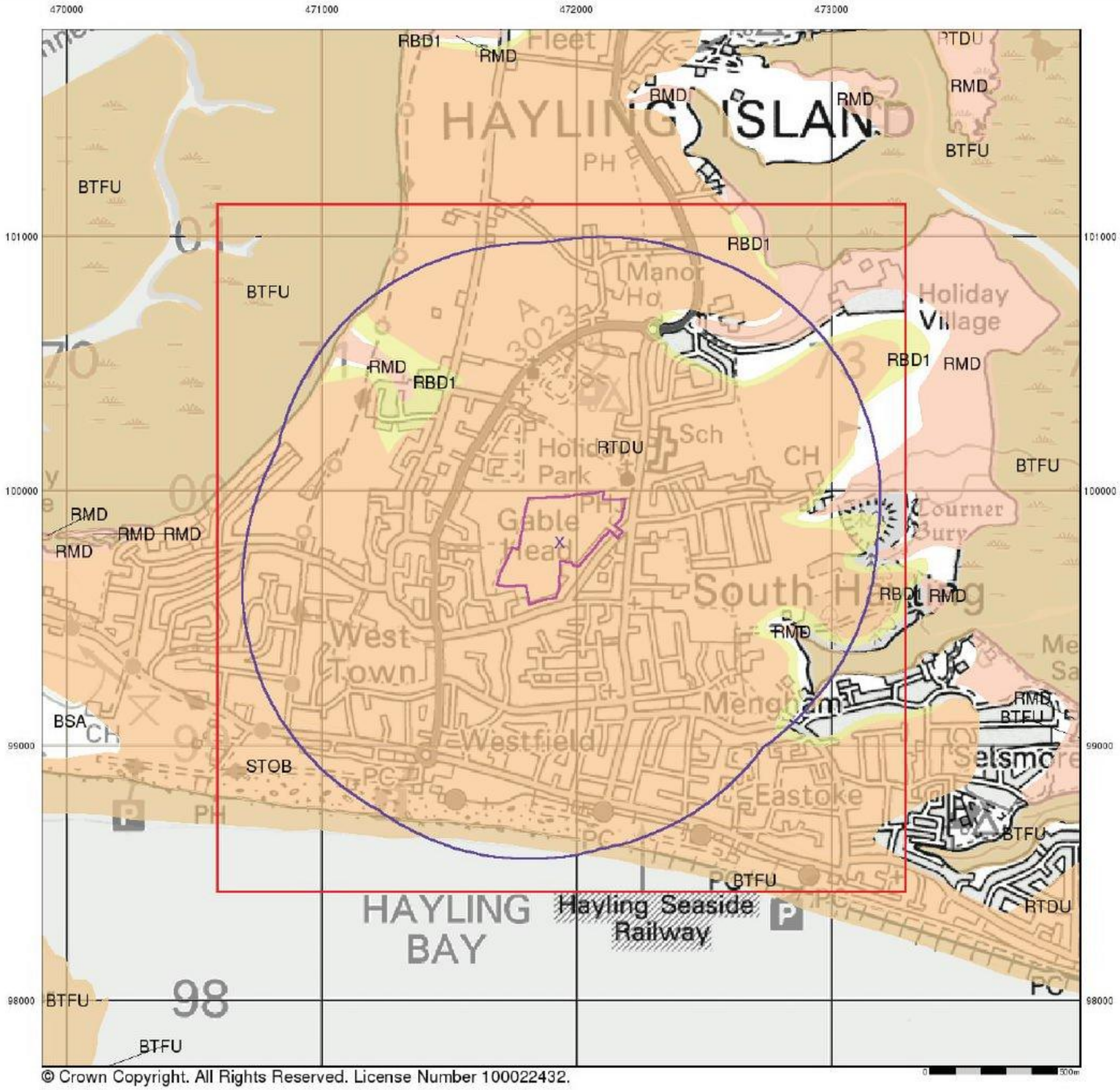

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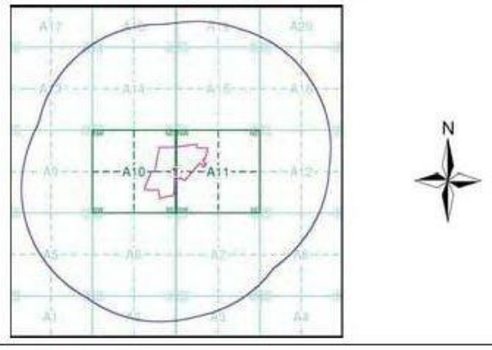
Superficial Geology

Superficial Deposits are the youngest geological deposits formed during the most recent period of geological time, the Quaternary, which extends back about 1.8 million years from the present.

They rest on older deposits or rocks referred to as Bedrock. This dataset contains Superficial deposits that are of natural origin and 'in place'. Other superficial strata may be held in the Mass Movement dataset where they have been moved, or in the Artificial Ground dataset where they are of man-made origin.

Most of these Superficial deposits are unconsolidated sediments such as gravel, sand, silt and clay, and onshore they form relatively thin, often discontinuous patches or larger spreads.

Superficial Geology Map - Slice A



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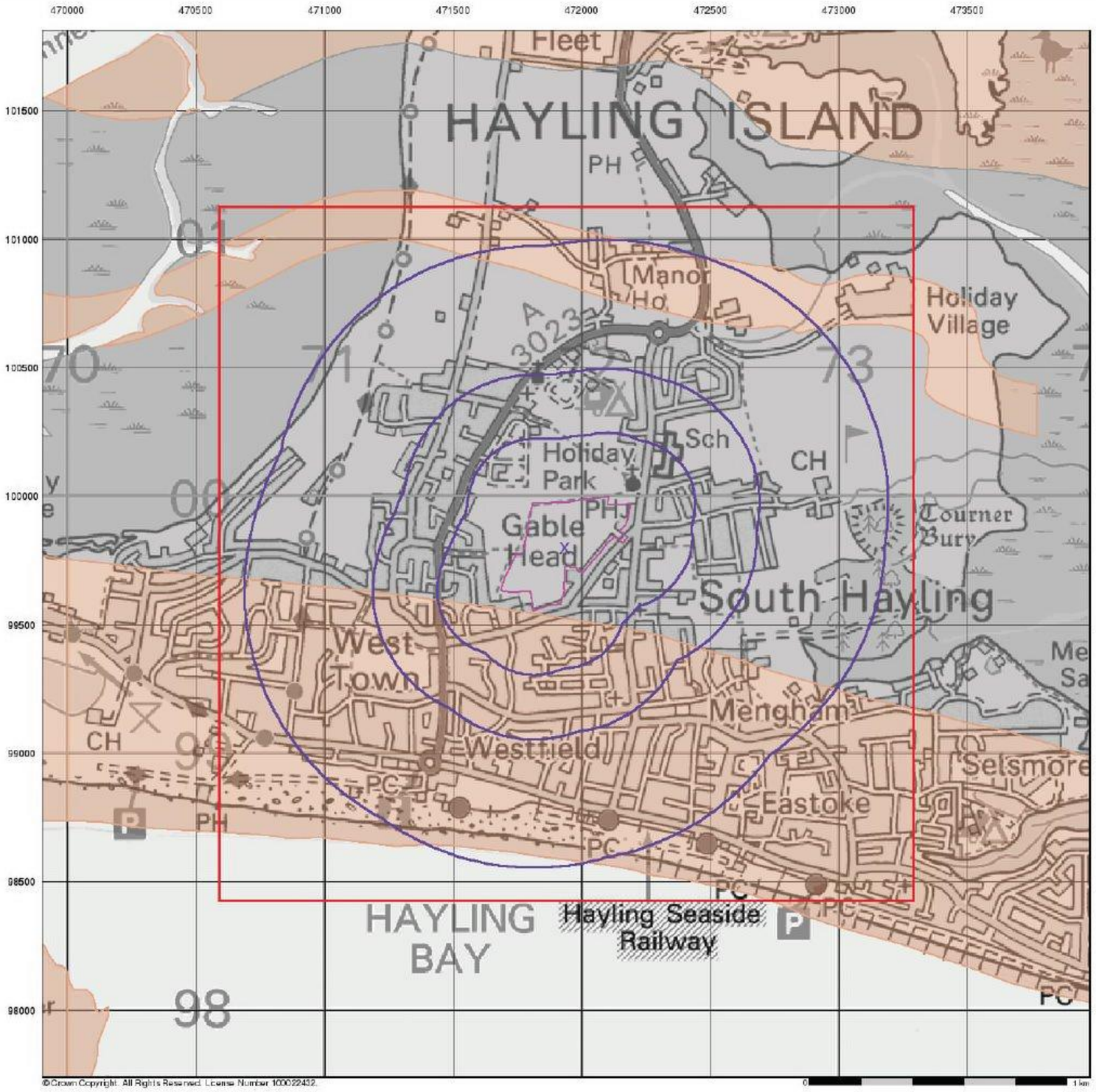

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Bedrock Aquifer Designation

General

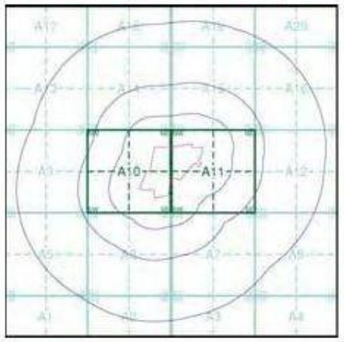
Specified Site
Specified Buffer(s)
Bearing Reference Point
Slice
Map ID

Agency and Hydrological

Geological Classes

- Principal Aquifer
- Secondary A Aquifer
- Secondary B Aquifer
- Secondary Undifferentiated
- Unproductive Strata
- Unknown
- Unknown (Lakes and Landslip)

Site Sensitivity Context Map - Slice A



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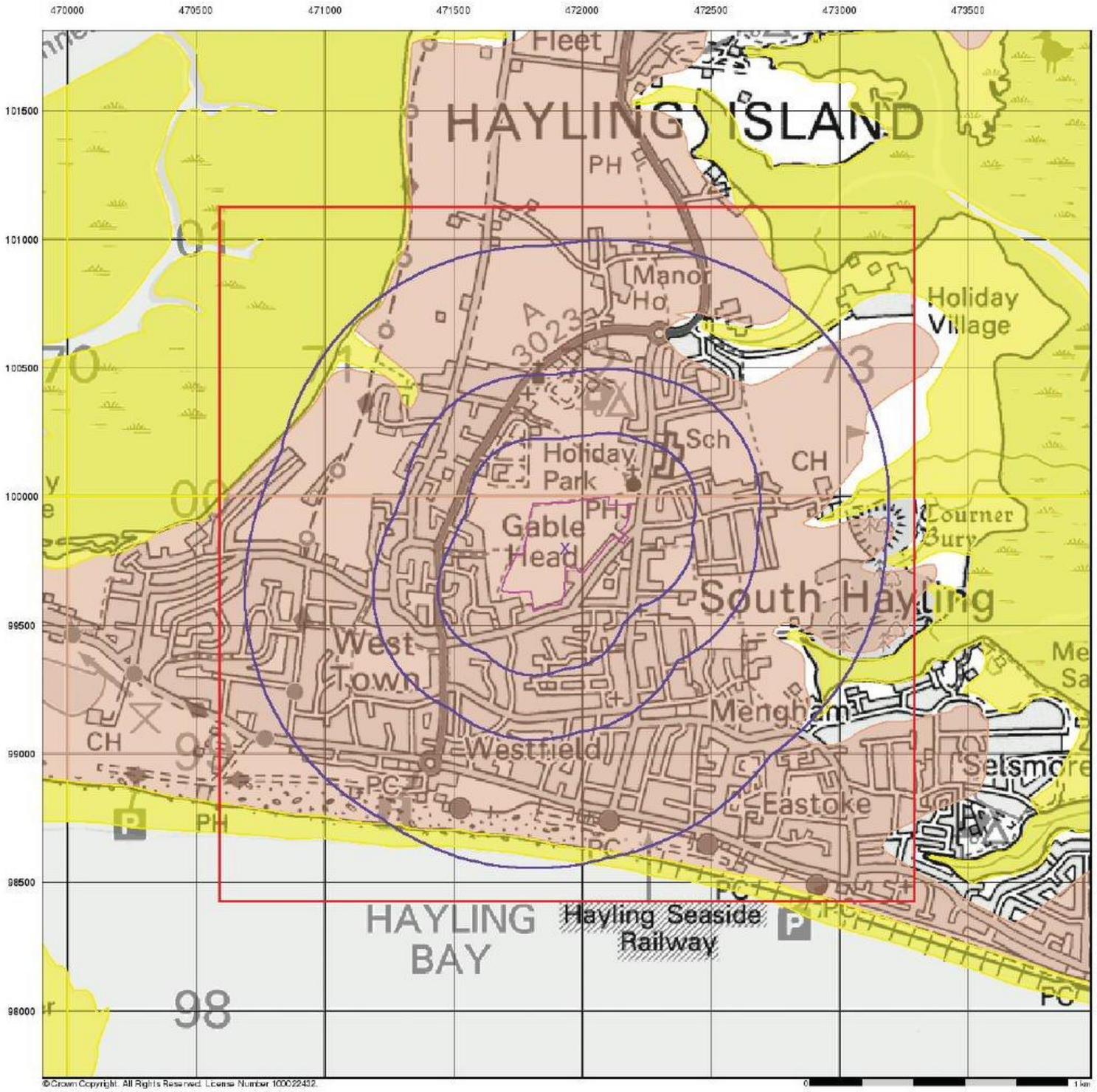

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Superficial Aquifer Designation

General

Specified Site
Specified Buffer(s)
Bearing Reference Point
Slice
Map ID

Agency and Hydrological

Geological Classes

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- Secondary Undifferentiated
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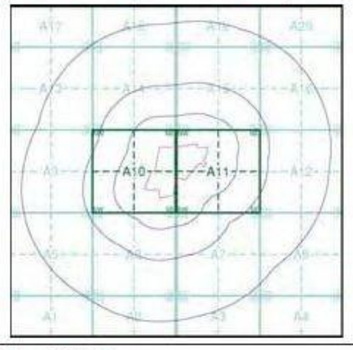

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Order Details

Order Number:	83759459_1_1
Customer Ref:	LKC 16 1109
National Grid Reference:	471930, 99800
Slice:	A
Site Area (Ha):	11.92
Search Buffer (m):	1000

Site Details

Site at 471930E, 099820N

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LK CONSULT LIMITED

Groundwater Vulnerability

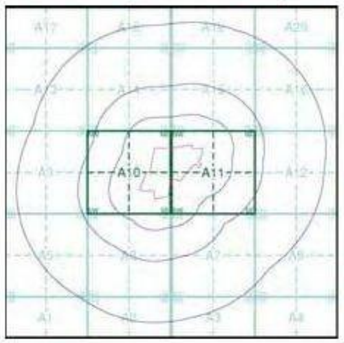
General

Specified Site
Specified Buffer(s)
Bearing Reference Point
Slice
Map ID

Agency and Hydrological

Geological Classes	Soil Classes
Major Aquifer (Highly Permeable)	High (H) 1, 2, 3, U
	Intermediate (I) 1, 2
	Low
Minor Aquifer (Variably Permeable)	High (H) 1, 2, 3, U
	Intermediate (I) 1, 2
	Low
Non Aquifer (Negligibly Permeable)	
Water or Sea	
Drift Deposit	

Site Sensitivity Context Map - Slice A



N

Order Details

Order Number: 83759459_1_1
Customer Ref: LKC 16 1109
National Grid Reference: 471930, 99800
Slice: A
Site Area (Ha): 11.92
Search Buffer (m): 1000

Site Details

Site at 471930E, 099820N

Landmark Information Group
Tel: 0844 844 9952
Fax: 0844 844 9951
Web: www.envirocheck.co.uk

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	Photograph 1 (facing NW): Access to study area from St. Mary's Road in the east.
	Photograph 2 (facing NW): Northeast of study area, facing northwest across site.
	Photograph 3 (facing S): View towards south, taken from northern boundary.

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	Photograph 4 (facing S): Western site boundary, taken from northwest corner of site.
	Photograph 5 (facing NW): Northern boundary with residential housing.
	Photograph 6 (facing S): View towards southwestern corner of site, taken at western boundary.

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	Photograph 7 (facing N): Farm building at centre of site.
	Photograph 8 (facing NE): East of site, facing towards eastern boundary.
	Photograph 9 (facing S): Taken within central area of site.

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	Photograph 10 (facing E): Ditch between fields, facing towards central area of site.
	Photograph 11 (facing NE): Eastern site boundary, facing northeast.

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APPENDIX C

ENVIRONMENT AGENCY DATA

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Matthew Craig

From: Haydon, Alex [redacted]
Sent: 09 September 2016 11:27
To: Matthew Craig
Cc: SSD Enquiries
Subject: SSD20897 Flood Risk Assessment
Attachments: Flooding Information Sheet - Your Questions Answered.pdf; Open Government Licence.pdf; Product 4.pdf; Risk of Flood from Surface Water Map 1 in 1000yr Depth.pdf; Detailed Rivers Map.pdf

Follow Up Flag: Follow up
Flag Status: Flagged

Dear Mr Craig,

Please find attached the Product 4 information for the site on Hayling Island.

Kind Regards,
Alex Haydon MEng

[redacted]

Partnership & Strategic Overview (P&SO)
Hampshire & the Isle of Wight
Solent & South Downs

my LinkedIn profile

Environment Agency

Romsey District Office
Canal Walk
Romsey
Hampshire
SO51 7LP

Alex.Haydon@environment-agency.gov.uk
Alex.Haydon@mottmac.com
www.gov.uk/environment-agency

protect invest improve
Planning for the future of water
FLOODS DESTROY BE PREPARED

Information in this message may be confidential and may be legally privileged. If you have received this message by mistake, please notify the sender immediately, delete it and do not copy it to anyone else.

mailto:m.craig@thelkgroup.com

Our ref: SSD/20897
Your ref:

Date: 09/09/2016

Dear Matthew Craig

Provision of *Product 4* for *Flood Risk Assessment*

Thank you for your request of *12 August 2016* to use Environment Agency data, *Product 4,* in the development of the *Flood Risk Assessment*. The information is attached.

Further details about the Environment Agency information supplied can be found on the GOV.UK website:

https://www.gov.uk/browse/environment-countryside/flooding-extreme-weather

If you have requested this information to help inform a development proposal, then you should note the information on GOV.UK on the use of Environment Agency Information for Flood Risk Assessments

https://www.gov.uk/planning-applications-assessing-flood-risk
https://www.gov.uk/government/publications/pre-planning-application-enquiry-form-preliminary-opinion

We can confirm that the above property/site is located in Flood Zone 1 - an area where the chance of flooding from both rivers and the sea has been assessed as less than 0.1% in any year (1 chance in 1,000 in any year).

The Environment Agency has no record of flooding to this property/area, but not all flooding events are reported to us and further information may be available from Havant District Council.

The Environment Agency is not aware of any flood defences in this area.

Information on any nearby sea defences is available from Hampshire County Council.

Environment Agency
Romsey Depot, Canal Walk, Romsey, SO51 8DU
Customer services line: 08708 506 506
Email: enquiries@environment-agency.gov.uk
www.environment-agency.gov.uk

This information is provided subject to the enclosed *notice*, which you should read.

I hope that we have correctly interpreted your request. Please see the attached Standard Notice or licence for details of permitted use.

We respond to requests for recorded information that we hold under the Freedom of Information Act 2000 (FOIA) and the associated Environmental Information Regulations 2004 (EIR).

If you are not satisfied with our response to your request for information you can contact us within 2 calendar months to ask for our decision to be reviewed.
If you have any queries or would like to discuss the content of this letter further please call us on 08708 506506.

If you have any queries or would like to discuss the content of this letter further please contact the Partnership and Strategic Overview Team at the Environment Agency.

Yours faithfully

Alex Haydon
Partnership and Strategic Overview team, Hampshire and Isle of Wight Environment Agency

Email psohiow@environment-agency.gov.uk

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Detailed River Network Map

Environment Agency

Legend

Detailed River Network

- Primary River
- Secondary River
- Tertiary River
- Lake / Reservoir
- Canal
- Canal Tunnel
- Extended Culvert
- Multiple Channel Culvert
- Underground River (potential sewer)
- Underground River (inferred)
- Underground River (local knowledge)
- Undefined

Offline Drainage features

0 50 100 150
Metres

N W E S

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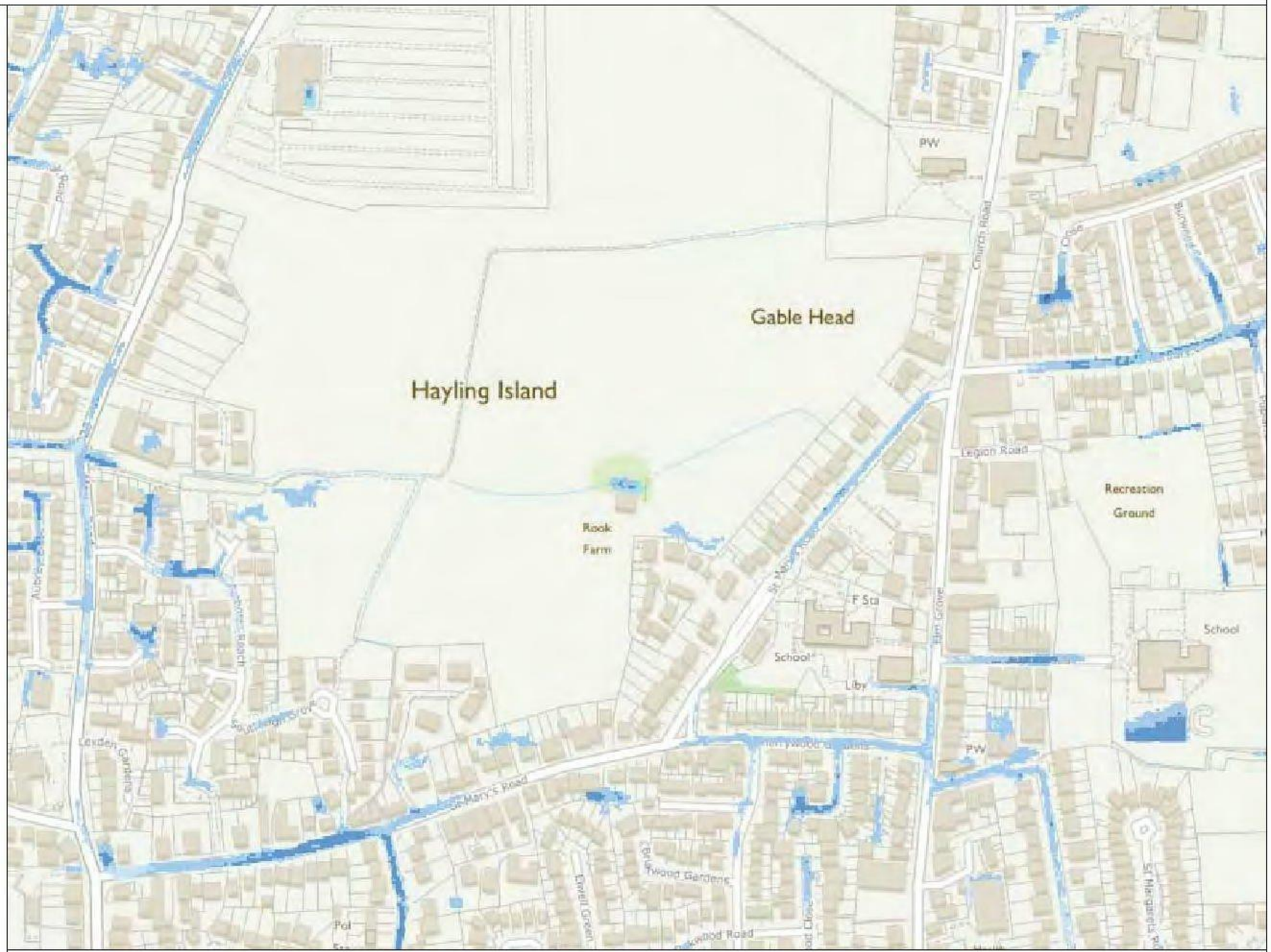
Risk of Flood from Surface Water Map 1 in 1000yr Depth

Environment Agency

Legend

Flood Depth 1 in 1000

- Below 150mm
- 150-300mm
- 300-600mm
- 600-900mm
- 900-1200mm
- Over 1200mm



0 50 100 150

Metres

N W E S

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APPENDIX D

CONSULTEE CORRESPONDENCE

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Matthew Craig

From: FWM Statutory SWM Consultee mailbox [redacted]
Sent: 13 September 2016 09:35
To: Matthew Craig
Subject: Flood and Water Management Advice Rewquest FWM 842572
Attachments: Flood and Water Management Advice Request; FWM 842572 _(HF000012462854).pdf; FWM Response to Request for Information - LLFA-Advice-2016-0022_(HF000012462849).docx

Follow Up Flag: Follow up
Flag Status: Flagged

Dear Matthew

Thank you for your request for Historic Flood and Water information within Hampshire. Please find attached the information you have requested.

You should have received an invoice for this service: 3610810589

Regards

Flood and Water Management Team
Economy Transport and Environment
EII Court West
The Castle
Winchester
Hampshire
SO23 8UD
Tel: 01962 846730 Fax: 01962 847055
Email: swm.consultee@hants.gov.uk
Web: http://www3.hants.gov.uk/flooding

Hampshire Services offers a range of professional consultancy services to partner organisations.
www.hants.gov.uk/sharedexpertise

Copyright Hampshire County Council 2004 Disclaimer Privacy Statement

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Your Search Results :
Land off
St Marys Road
Hayling Island
Hampshire
PO11 9ES

Southern Water

Southern Water

Searchflow
42,Kings Hill Avenue

West Malling
Kent
ME19 4AJ

Your Ref
SF23543564000 LKS/Hayling Isl
Our Ref
LS/K1183660/N.M.
Date
4 Apr 2016
Contact
searches@southernwater.co.uk

Dear Sir/Madam

Your Search Results: Land off, St Marys Road

Please find enclosed the results of your property search request. If you have any questions arising from the results please call our helpline on 0330 303 0276, which is open from 08.00 to 17.00hrs or send your enquiry to the following email address: Searches@southernwater.co.uk.

Yours faithfully

Southern Water Land Searches

Land off
St Marys Road
Hayling Island
Hampshire
PO11 9ES

Land Search Results

Land Search:	Land off, St Marys Road, Hayling Island, Hampshire, PO11 9ES
Ref:	LS/K1183660/N.M.
Date:	4 Apr 2016
Contact:	Southern Water Services
Tel:	0330 303 0276
Email:	searches@southernwater.co.uk

MAPS

Public Sewer Map

1.1 Q: Where relevant, please include a copy of an extract from the public sewer map.

A: A copy of the statutory sewer map is provided

1.The Water Industry Act 1991 defines Public sewers as those which The Company have responsibility for.Other assets and rivers, watercourses, ponds, culverts or highway drains may be shown for information purpose only.

2. Any Private Sewers or Lateral drains which are indicated on the extract of the public sewer map as being subject to an agreement under section 104 of the Water Industry Act 1991 are not an 'as constructed' record. It is recommended these details be checked with the developer.

Map of Waterworks

1.2 Q: Where relevant, please include a copy of an extract from the map of waterworks.

A: The water supply for this area is provided by Portsmouth Water Plc, PO Box 8, West Street, Havant, Hants, PO9 1LG. Tel No: 02392 499888 and a copy of the map of waterworks is provided.

1. Assets other than vested water mains may be shown on the plan, for information only.

2. The company is not responsible for private supply pipes connecting the property to the public water main and does not hold details of these. These may pass through land outside of the control of the seller, or may be shared with adjacent properties. The buyer may wish to investigate whether separate rights or easements are needed for their inspection, repair or renewal.

3. If an extract of the public water main record is enclosed. This will show known public water mains in the vicinity of the property. It should be possible to estimate the likely length and route of any private water supply pipe connecting the property to the public water network.

DRAINAGE

Foul Water

2.1 Q: Does foul drainage from the property drain to a public sewer?

A: The company's records indicate that foul water from the property does not drain to the public sewerage system.

1. The company is not responsible for those private drains and sewers which connect the property to the public sewerage system., and does not hold details of these. The property owner will normally have some responsibility for private drains serving the property and may have shared responsibility, with other users, if the property is served by a private sewer which also serves other properties. These may pass through land outside of the control of the sewer, the buyer may wish to investigate whether separate rights or easements are needed for their inspection, repair or renewal.

2. An extract from the public sewer map is enclosed. This will show known public sewers in the vicinity of the property and it should possible to estimate the likely length and route of any private drains and/or sewers connecting the property to the public sewerage system.

3. If foul water does not drain to the public sewerage system the property may have private facilities in the form of a cesspit, septic tank or other type of treatment plant.

Surface Water Drainage

2.2 Q: Does surface water from the property drain to a public sewer?

A: The company's records indicate that surface water from the property does not drain to the public sewerage system.

1. The company is not responsible for private drains and sewers that connect the property to the public sewerage system and does not hold details of these. The property owner will normally have some responsibility for private drains serving the property and may have shared responsibility, with other users, if the property is served by a private sewer which also serves other properties. These may pass through land outside of the control of the sewer, the buyer may wish to investigate whether separate rights or easements are needed for their inspection, repair or renewal.

2. An extract from the public sewer map is enclosed. This will show known public sewers in the vicinity of the property and it should be possible to estimate the likely length and route of any private drains and/or sewers connecting the property to the public sewerage system.

3. In some cases company records do not distinguish between foul and surface water connections to the public sewerage system. If on inspection the buyer finds that the property is not connected for surface water drainage, the property may be eligible for a rebate of the surface water drainage charge. Details can be obtained from the company.

4. If surface water does not drain to the public sewerage system the property may have private facilities in the form of a soakaway or private connection to a watercourse

Surface Water Drainage Charges

2.3 Q: Is a surface water drainage charge payable?

A: Records confirm that a surface water drainage charge is not payable for the property.

1. Where surface water from a property does not drain to the public sewerage system no surface water drainage charges are payable.

2. Where surface water drainage charges are payable but on inspection the buyer finds that the property is not connected for surface water drainage, the property may be eligible for rebate of the surface water drainage charge. Details can be obtained from the Sewerage Undertaker.

Location of Sewers

2.4 Q: Does the public sewer map indicate any public sewer, disposal main or lateral drain within the boundaries of the property?

A: The public sewer map included indicates that there is a public sewer, disposal main or lateral drain within the boundaries of the property. However, from the 1st October 2011 there may be additional public sewers, disposal mains or lateral drains which are not recorded on the public sewer map but which may further prevent or restrict development of the property. For further information please go to: http://www.southernwater.co.uk/BusinessCustomers/propertySearches/faqPropertySearches.asp

1. The Company has a statutory right of access to carry work on its assets. Employees of The Company or its contractors may, therefore, need to enter the property to carry out work.

2. The Approximate boundary of the property has been determined by reference to the Ordnance Survey record or the map supplied.

Sewer within 100 feet

2.5 Q: Does the public sewer map indicate any public sewer within 30.48 meters (100 feet) of any buildings within the property?

A: The public sewer map indicates that there are no public sewers within 30.48 metres (100 feet) of a building within the property.

1. It is recommended that investigations are made into the drainage arrangements of the property as the owner may be liable for repairs to the drainage system..

Adoption Agreements

2.6 Q: Are any sewers or lateral drains serving or which are proposed to serve the property the subject of an existing adoption agreement or an application for such an agreement?

A: The company's records indicate that the sewers serving the development, of which this property forms part, are not the subject of an application for adoption under S104 of the Water Industry Act 1991. Where the property is part of an established development it would not normally be subject to an adoption agreement under Section 104 of the Water Industry Act 1991.

1. Where the property is part of a very recent or ongoing development and the sewers are not the subject of an adoption application, buyers should consult with the developer to ascertain the extent of private drains and sewers for which they will hold maintenance and renewal liabilities.

2. Final adoption is subject to the developer complying with the terms of the adoption agreement under Section 104 of the Water Industry Act 1991.

Building Over Agreement

2.7 Q: Has the sewerage undertaker approved or been consulted about any plans to erect a building or extension on the property over or in the vicinity of a public sewer, disposal main or drain?

A: The company's records indicate that there is not a statutory agreement or consent in respect of building over a public sewer at this property. For historical reasons the company may not be aware of some agreements or consent's which have been entered into by the local authority.

Risk of Flooding Due to Overloading Public Sewers

2.8 Q: Is any building which is or forms part of the property at risk of internal flooding due to overloaded public sewers?

A: The property is not recorded as being at risk of internal flooding due to overloaded public sewers. From the 1st October 2011 private sewers, disposal mains and lateral drains were transferred into public ownership. It is therefore possible that a property may be at risk of internal flooding due to an overloaded public sewer which the sewerage undertaker is not aware of. For further information it is recommended that enquiries are made of the vendor.

1. A sewer is "overloaded" when the flow from a storm is unable to pass through it due to a permanent problem (e.g. flat gradient, small diameter). Flooding as a result of temporary problems such as blockages, siltation, collapses and equipment or operational failures are excluded.

2. "Internal flooding" from the public sewers is defined as flooding, which enters a building or passes below a suspended floor. For reporting purposes, buildings are restricted to those normally occupied and used for residential, public, commercial, business or industrial purposes.

3. "At Risk" properties are those that the water company is required to include in the Regulatory Register that is reported annually to the Water Services Regulatory Authority. These are defined as properties that have suffered or are likely to suffer internal flooding from the public foul, combined or surface water sewers due to overloading of the sewerage system more frequently than the relevant reference period (either once or twice in ten years) as determined by the Sewerage Undertaker's reporting procedure.

4. Flooding as a result of storm events proven to be exceptional and beyond the reference period of one in ten years are not included on the at Risk register.

5. Properties may be at risk of flooding but not included on the Register where flooding incidents have not been reported to the Sewerage Undertaker.

6. Public Sewers are defined as those for which the Sewerage Undertaker holds statutory responsibility under the Water Industry Act 1991.

7. It should be noted that flooding can occur from private sewers and drains which are not the responsibility of the Sewerage Undertaker. This report excludes flooding from the private sewers and drains and the Sewerage Undertaker makes no comment upon this matter.

Sewerage Treatment Works

2.9 Q: Please state the distance from the property to the nearest boundary of the nearest sewage treatment works.

A: The nearest sewage treatment works is 5.44 kilometres North North West of the property.The name of the sewage treatment works is BUDDS FARM HAVANT WTW , which is responsibility of Southern Water Services, Southern House, Capstone Road, Chatham, Kent ME5 7QA company.

1. The nearest sewerage treatment works will not always be the sewerage treatment works serving the catchment within which the property is situated.

2. The Sewerage undertaker's records were inspected to determine the nearest sewerage treatment works.

3. It should be noted therefore that there may be private sewerage treatment works closer than the one detailed above that have not been identified.

WATER

Connection to Mains Water Supply

3.1 Q: Is the property connected to mains water supply?

A: Please contact Portsmouth Water Plc, PO Box 8, West Street, Havant, Hants, PO9 1LG. Tel No: 02392 499888 for this information.

Location of Water Mains

3.2 Q: Are there any water mains, resource mains or discharge pipes within the boundaries of the property?

A: The water supply for this area is provided by Portsmouth Water Plc, PO Box 8, West Street, Havant, Hants, PO9 1LG. Tel No: 02392 499888 whose records do not show any vested water mains within the boundary of the property.

1. The boundary of the property has been determined by reference to the Ordnance Survey records.

2. The presence of a vested water main within the boundary of the property may restrict further development within it. The company has a statutory right of access to carry out work on its assets, subject to notice. This may result in employees of the company or its contractors needing to enter the property to carry out work.

Adoption of Water Mains and Services Pipes

3.3 Q: Is any water main or service pipe serving or which is proposed to serve the property the subject of an existing adoption agreement or an application for such an agreement?

A: Records confirm that water mains or service pipes serving the property are not the subject of an existing adoption agreement or an application for such an agreement.

1. This enquiry is of interest to purchasers of new homes who will want to know whether or not the property will be linked to the mains water supply.

Risk of Low Water Pressure or Flow

3.4 Q: Is the property at risk of receiving low water pressure or flow?

A: Records confirm that the property is not recorded on a register kept by the water undertaker as being at risk of receiving low water pressure or flow.

1. The boundary of the property has been determined by reference to the Ordnance Survey records.

2. "Low water pressure" means water pressure below the regulatory reference level which is the minimum pressure when demand on the system is not abnormal.

3. Water Companies are required to include in the Regulatory Register that is reported annually to the Water Services Regulatory Authority properties receiving pressure below the reference level, provided that allowable exclusions do not apply (i.e. events which can cause pressure to temporarily fall below the reference level).

4. The reference level of service is a flow of 9 litres/minute at a pressure of 10metres head on the customers side of the main stop tap (mst). The reference level of service must be applied on the customers side of a meter or any other company fittings that are on the customers side of the main stop tap.

The reference level applies to a single property. Where more than one property is served by a common service pipe, the flow assumed in the reference level

must be appropriately increased to take account of the total number of properties served.

For two properties, a flow of 18 litres/minute at a pressure of 10metres head on the customers' side of the mst is appropriate. For three or more properties

the appropriate flow should be calculated from the standard loadings provided in BS6700 or Institute of Plumbing handbook.

5. Allowable exclusions

The Company is required to include in the Regulatory Register properties receiving pressure below the reference level, provided that allowable

exclusions listed below do not apply

6. Abnormal demand:

This exclusion is intended to cover abnormal peaks in demand and not the daily, weekly or monthly peaks in demand which are normally expected.

Companies should exclude from the reported DG2 figures properties which are affected by low pressure only on those days with the highest peak

demands. During the report year companies may exclude, for each property, up to five days of low pressure caused by peak demand.

7. Planned maintenance:

Companies should not report under DG2 low pressures caused by planned maintenance.

It is not intended that companies identify the number of properties affected in each instance. However, companies must maintain sufficiently accurate

records to verify that low pressure incidents that are excluded from DG2 because of planned maintenance are actually caused by maintenance.

8. One-off incidents:

This exclusion covers a number of causes of low pressure; mains bursts; Failures of company equipment (such as PRVs or booster pumps);

Firefighting; and Action by a third party. However, if problems of this type affect a property frequently, they cannot be

classed as one-off events and further investigation will be required before they can be excluded.

9. Low pressure incidents of short duration:

Properties affected by low pressures which only occur for a short period, and for which there is evidence that incidents of a longer duration would not occur

during the course of the year, may be excluded from the reported DG2 figures.

Water Quality Analysis

3.5 Q: Please include details of a water quality analysis made by the water undertaker for the water supply zone in respect of the most recent calendar year.

A: The analysis confirmed that tests failed to meet the standards prescribed by the 2000 Regulations or the 2001 Regulations in relation to another substance or substances, please find a report attached.

1. Water companies have a duty to provide wholesome water that meets the standards of the Water Supply (Water Quality) Regulations 2000.

However, the householder is responsible for any deterioration in water quality that is a result of the domestic distribution system (the supply pipe and the plumbing within the property) that results in the standards not being met.

2. In England and Wales these Regulations implement the requirements of the European Drinking Directive 98/83/EC. The 2000 Regulations impose standards for a range of parameters, which are either health based to ensure the water is safe to drink or to ensure the water is aesthetically acceptable. They also require that drinking water should not contain any element, organism or substance (whether or not a parameter) at a concentration or value which would be detrimental to public health.

3. Water quality is normally tested at the tap used for domestic consumption, normally the kitchen. However, the householder is responsible for any deterioration in water quality that is a result of the domestic distribution system (the supply pipe and the plumbing within the property) that results in the standards not being met.

4. If there are concerns that lead pipes within the property may be causing high levels of lead in your drinking water please contact your water company (give contact details) for further advice.

5. The water company undertakes a monitoring programme to establish water quality that includes random sampling from domestic properties. It will notify the consumers of any failures to meet the water quality standards that are due to the condition or maintenance of the domestic distribution system.

6. The data collected by the company is subject to external review by the drinking water inspectorate (DWI) and by local and health authorities. In addition to reviewing quality data the DWI also carry out audits during which any area of the company's operational can be examined.

7. If there are concerns that lead pipes within the property may be causing high levels of lead in your drinking water please contact the company (see below) for further advice.

Water Quality Standards

3.6 Q: Please include details of any departures authorised by the Secretary of State or National Assembly for Wales under Part 6 of the 2000 Regulations from the provisions of Part 3 of those Regulations.

A: There are no such authorised departures for the water supply zone.

1. Authorised departments are not permitted if the extent of the departure from the standard is likely to constitute a potential danger to human health.

2. Please contact your water company if you require further information.

Water Meters

3.7 Q: Please include details of the location of any water meter serving the property.

A: Records indicate that the property is not served by a water meter.

1. Where the property is not served by a water meter and the customer wishes to consider this method of charging they should contact:
Portsmouth Water Plc, PO Box 8, West Street, Havant, Hants, PO9 1LG. Tel No: 02392 499888

CHARGING

Sewerage And Water Undertakers

4.1 Q: Who are the sewerage and water undertakers for the area?

A: The sewerage undertaker for the area is Southern Water Services, Southern House, Yeoman Road, Worthing, Sussex BN13 3NX

Portsmouth Water Plc, PO Box 8, West Street, Havant, Hants, PO9 1LG. Tel No: 02392 499888

Sewerage Bills

4.2 Q: Who bills the property for sewerage services?

A: The property is not billed for sewerage services.

Water Bills

4.3 Q: Who bills the property for water services?

A: The property is not billed for water services.

Current Basis for Sewerage and Water Charges

4.4 Q: What is the current basis for charging for sewerage and/or water services at the property?

A: Where no change of use is made, on change of occupation charges will be made on an unmeasured basis (please note a meter may be installed at the property upon request to PORTSMOUTH WATER)

1. Measured (metered) charges can apply where the buyer makes a change of use of the property or where the buyer uses water
· where the principal use of the premises is not as a home
· where there is garden watering other than by hand
· which automatically replenishes a pond or swimming pool with a capacity in excess of 10,000litres
· in a bath with a capacity in excess of 230Litres
· in a power shower
· in a reverse osmosis unit

2. If a property is measured (metered) upon change of occupation this property will remain as a metered property.

3. Water and sewerage companies full charges are set out in their charges schemes which are available from the company free of charge upon request.

Trade Effluent Information

4.5 Q: Is there a Consent, on this property, to discharge Trade Effluent under S118 of the Water Industry Act (1991) into the public sewerage system?

A: The trader operating at this commercial property does not hold either a Trade Effluent Consent, or an acknowledgement of a trade effluent discharge, as issued by Southern Water.

1.Please note any existing consent is dependant on the business being carried out at the property and will not transfer automatically upon change of ownership.

Other Information

Is there a Meter fitted at the property?

Please contact Portsmouth Water Plc, PO Box 8, West Street, Havant, Hants, PO9 1LG. Tel No: 02392 499888 for this information.

If not, Rateable Value used for charging purposes:

ADDITIONAL METER INFORMATION

Southern Water does not hold meter serial or location details for this property. This is because Southern Water does not supply the water for this property.

DISCLAIMER - These replies and information, including that shown on the enclosed plans(s), are given on the distinct understanding that neither the company nor any of its representatives is legally liable for its accuracy or for any action or omission to act whatsoever by anyone on the strength of that information, save as to obvious error. In particular, any person proposing to construct or excavate on land on the basis of information hereby provided should carry out all necessary on-site investigations.

A GUIDE TO NEW DEVELOPMENT

WASTEWATER INFORMATION

The information contained below is for general guidance only. It is recommended that Southern Water's Network Development department be contacted for further details concerning new infrastructure development.

Sewer Requisitions
It may be necessary for a developer to request that Southern Water provides a public sewer to connect a development site to the existing public system. The developer is responsible for the cost of the work, although a discount will be applied based on the future predicted income from the development served by the new sewer.

Sewer Diversions
If a public sewer crosses private land, it may be possible for the landowner/developer to request the sewer be diverted. In the majority of cases Southern Water will allow the developer to undertake this work under close supervision. Whether Southern Water or the developer undertakes the diversionary works the costs are the responsibility of the developer.

Building-over Sewers
Public sewers are afforded statutory protection and consequently there is no right to build over or in close proximity to a public sewer. If an existing public sewer either crosses a development site or is located in close proximity to a development site it is essential that a developer contact Southern Water.

Sewer Connections
A developer can serve notice on Southern Water that it wishes to make a connection to the public sewerage system. The developer must provide 21 days notice and the work will be supervised by Southern Water.

Contact Us
For specific information on Southern Water's Network Development service, including details on how to contact the right person, please visit our website on:-

FURTHER QUERIES

SOUTHERN WATER LAND SEARCH SERVICE

If you have any queries regarding this Commercial Landsearch, please do not hesitate to contact the Southern Water Land Search Service using the details below.

Mailing Address:	The Land Search Service SOUTHERN WATER SOUTHERN House Capstone Road Chatham Kent ME5 7QA
Email Address:	searches@southernwater.co.uk
Helpdesk Tel:	0330 303 0276
Helpdesk Fax:	01634 844514
DX:	400450 Chatham 5

SOUTHERN WATER NETWORK DEVELOPMENT SERVICE

Contact Us
For specific information on Southern Water's Network Development service, including details on how to contact the right person, please visit our website on:-
www.southernwater.co.uk/developers

COMMERCIAL DRAINAGE & WATER ENQUIRY
TERMS AND CONDITIONS

Customer and Clients are asked to note these terms, which govern the basis on which this commercial drainage and water report is supplied

Definitions
'Company' means the water service company operating within the Southern Water drainage area that provides information to Southern Water for this commercial search Report.
'Order' means any request completed by the Customer requesting the Report.
'Report' means the drainage and water report prepared by The Company in respect of the Property.
'Property' means the address or location supplied by the Customer in the Order.
'Customer' means the person, company, firm or other legal body placing the Order, either on their own behalf as Client, or, as an agent for a Client.
'Client' means the person, company or body who is the intended recipient of the Report with an actual or potential interest in the Property.

Agreement
1. Southern Water agrees to supply the Report subject to these terms. The scope and limitations of the Report are described in paragraph 2 of these terms. Where the Customer is acting as an agent for the Client then the Customer shall be responsible for bringing these terms to the attention of the Client.
The Customer and Client agree that the placing of an Order for a Report indicates their acceptance of these terms.

The Report
2. Whilst Southern Water will use reasonable care and skill in producing the Report, it is provided to the Client on the basis that they acknowledge and agree to the following:-

2.1 The information contained in the Report can change on a regular basis so Southern Water cannot be responsible to the Client for any change in the information contained in the Report after the date on which the Report was produced and sent to the Client.

2.2 The Report does not give details about the actual state or condition of the Property nor should it be used or taken to indicate or exclude actual suitability or unsuitability of the Property for any particular purpose, or relied upon for determining saleability or value, or used as a substitute for any physical investigation or inspection. Further advice and information from appropriate experts and professionals should always be obtained.

2.3 The information contained in the Report is based upon the accuracy of the address supplied by the Customer or Client.

2.4 The Report provides information as to the location & connection of existing services, and details of trade effluent consents. It should not be relied upon for any other purpose. The Report may contain opinions or general advice to the Customer and the Client and Southern Water cannot ensure that any such opinion or general advice is accurate, complete or valid and accepts no liability therefore.

2.5 The position and depth of apparatus shown on any maps attached to the Report are approximate, and are furnished as a general guide only, and no warranty as to its correctness is given or implied. The exact positions and depths should be obtained by excavation trial holes.

Liability
3.1 Southern Water shall not be liable to the Client for any failure defect or non-performance of its Obligations arising from any failure of or defect in any machine, processing system or transmission link or anything beyond Southern Water's reasonable control or the acts or omissions or any party for whom Southern Water is not responsible.

3.2 Where a Report is requested for an address falling within a geographical area where Southern Water and another Company separately provide Water and Sewerage Services, then it shall be deemed that liability for the information given by Southern Water or the Company as the case may be will remain with Southern Water or the Company as the case may be in respect of the accuracy of the information supplied. Where Southern Water is supplying information which has been provided to it by another Company for the purposes outlined in this agreement, Southern Water will therefore not be liable in any way for the accuracy of that information.

3.3 Where the Customer sells this Report to a Client (other than in the case of a bona fide legal adviser recharging the cost of the Report as a disbursement) Southern Water or the company as the case may be shall not in any circumstances (whether for breach of contract, negligence or any other tort, under statute or statutory duty or otherwise at all) be liable for any loss or damage whatsoever (save to the extent provided by clause 3.4) and the Customer shall indemnify Southern Water in respect of any claim (other than a claim covered by clause 3.4) by the Client.

3.4 Southern Water shall accept liability for death or personal injury arising from its negligence.

3.5 The entire liability of Southern Water or the Company as the case may be in respect of all causes of action arising under or in connection with the Report (whether for breach of contract, negligence or any other tort, under statute or statutory duty or otherwise at all) shall not exceed £2,000,000 (two million pounds); and
Southern Water or the Company as the case may be shall not in any circumstances (whether for breach of contract, negligence or any other tort, under statute or statutory duty or otherwise at all) be liable for any loss of profit, loss of goodwill, loss of reputation, loss of business or any indirect, special or consequential loss, damage or other claims, costs or expenses;

Copyright and Confidentiality

4.1 The Customer and the Client acknowledge that the Report is confidential and is intended for the personal use of the Client. The copyright and any other intellectual property rights in the Report shall remain the property of Southern Water. No intellectual or other property rights are transferred or licensed to the Customer or the Client except to the extent expressly provided.

4.2 The Customer or Client is entitled to make copies of the Report (other than any maps contained in the, or attached to the Report, where no copying is permitted).

4.3 The Customer and Client agree (in respect of both the original and any copies made) to respect and not to alter any trademark, copyright notice or other property marking which appears on the Report.

4.4 The maps contained in the Report are protected by Crown Copyright and must not be used for any purpose outside the context of the Report.

4.5 The Customer and the Client agree to indemnify Southern Water or the Company as the case may be against any losses, costs, claims and damage suffered by Southern Water or the Company as the case may be, as a result of any breach by either of them of the terms of paragraphs 4.1 to 4.4 inclusive.

Payment

5.1 Unless otherwise stated all prices are inclusive of VAT. The Customer shall pay for the price of the Report specified by Southern Water, without any set off, deduction or counterclaim. Unless the Customer or Client has an account with Southern Water for payment for Reports, payments for Reports must be received in full by Southern Water before the Report is produced. For Customers or Clients with accounts, payment terms will be as agreed with Southern Water.

General

6.1 If any provision of these terms is or becomes invalid or unenforceable, it will be taken to be removed from the rest of these terms to the extent that it is invalid or unenforceable. No other provision of these terms shall be affected.

6.2 These terms shall be governed by English law and all parties submit to the exclusive jurisdiction of the English courts.

6.3 Nothing in this notice shall in any way restrict your statutory or any other rights of access to the information contained in the Report.

Complaints Procedure for the CON29DW Residential Search and the Commercial Drainage and Water Search

When we get it wrong

You deserve the highest standard of service from us, but sometimes we make mistakes. If we do, please let us know and we will investigate and review your concerns.

Whilst we always try to resolve all complaints straightaway, if this is not possible and you are not happy with the course of action taken by us, you can ask us to escalate the issue internally or take your complaint to an independent third party.

How you contact us

Firstly please call us and we will try to sort out your problem straight away. You can call us between 9am and 5pm, Monday to Friday on **0845 270 0212** or **0330 303 0276** (individual consumers);

Email us at searches@southernwater.co.uk or write to us at Southern Water LandSearch, Southern House, Capstone Road, Chatham, Kent, ME5 7QA.

What you can expect

You will receive a full, fair and courteous response from someone who can effectively deal with your problem.

If we can remedy the problem straight away we will do it but if we cannot immediately resolve your problem we will keep you informed of actions being taken.

The process

We will try to resolve any telephone contact or complaint at the time of the call, however, if that isn't possible, we will take the details of your complaint and we will investigate and get back to you within 10 working days.

We will respond to written complaints within 10 working days of the date received, but we will always aim to respond more quickly. Depending on the scale of investigation required, we will keep you informed of the progress and update you with new timescales if necessary.

If you are still not satisfied with our response or action we will refer the matter to a Senior Manager for resolution. At your request we will liaise with a third party representative acting on your behalf.

Our commitment to you

If we do not respond to your complaint within 10 working days of receipt of your contact, we will compensate you in line with Southern Water's Customer services — Guaranteed standards of service for business customers.

If we find your complaint to be justified, or we have made any errors that substantially change the outcome in your search result, we will refund the search fee. We will also provide you with a revised search and undertake the necessary action to put things right as soon as practically possible. You will be kept informed of the progress of any action required.

If you remain dissatisfied

While we aim to resolve your complaint first time, in the event that we are unable to resolve the issue to your satisfaction, ultimately you can contact a third party. Please make sure that you have followed the process above first, if not, your complaint will be passed back to us.

CON29DW
DRAINAGE AND WATER ENQUIRY

COMMERCIALDW
DRAINAGE AND WATER ENQUIRY

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SEWER RECORDS PAGE 1 OF 2

100076

99498

471524

472466

O.S. REF. SZ7199NE	Drawn by: mondaln	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 determnined on site. WARNING: BAC pipes are constructed of Bonded Asbestos Cement WARNING: Unknown (UNK) materials may include Bonded Asbestos Cement	N
	Scale: 1:2500		
Title: Land off St Marys Road	Date: 04/04/2016	Based upon Ordnance Survey Digital Data with the permission of the controller of H.M.S.O. Crown Copyright Reserved Licence No. WU 298530.	Southern Water

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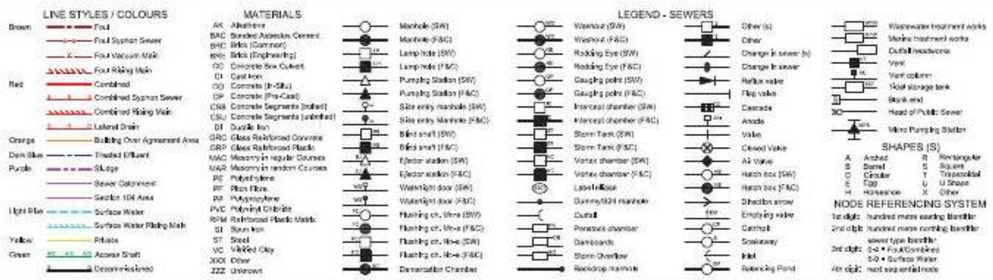
SEWER RECORDS PAGE 2 OF 2

Node	Cover	Invert	Size	Material	Shape	
0501X	6.33	4.16	300	CP	CIRC	
0502X	6.24	4.28	300	CP	CIRC	
0503X	6.27	4.47	225	CP	CIRC	
0504X			UNK	PF	CIRC	
0505X			UNK	PF	CIRC	
0550X	6.35	5.34	150	CP	CIRC	
0551X	6.39	5.45	150	CP	CIRC	
0552X	6.37	5.57	150	CP	CIRC	
0553X	6.34	5.46	225	CP	CIRC	
0601X	6.49	4.9	225	VC	CIRC	
0602X	6.75	5.75	225	VC	CIRC	*
0602Y	6.75	5.75	225	VC	CIRC	*
0603X	6.693		225	VC	CIRC	
0605X	6.693	5.522	150	VC	CIRC	
0650X	6.781	5.76	225	CP	CIRC	
0651X	6.85	6.06	225	CP	CIRC	
0652X	6.589	6.18	150	VC	CIRC	
0701X	6.67	4.88	225	VC	CIRC	
1501X	6.17	3.12	300	CP	CIRC	
1502X	6.2	3.57	300	CP	CIRC	
1503X	6.28	3.96	300	CP	CIRC	
1504X	6.22	4.25	225	CP	CIRC	
150DX			100	PF	CIRC	
1550X	6.34	5.25	225	CP	CIRC	
1551X	6.24	4.67	225	CP	CIRC	
1552X	6.17	3.92	750	CP	CIRC	
1553X	6.21	5.14	225	CP	CIRC	
1601X	6.29	3.39	300	CP	CIRC	
1602X	6.58	3.56	300	CP	CIRC	
1650X	6.26	4.21	750	CP	CIRC	
1651X	6.56	4.46	675	CP	CIRC	
1801X	6.67	4.61	225	VC	CIRC	
2001X	7.57	5.27	225	VC	CIRC	
2002Y	7.65	5.51	150	VC	CIRC	*
2002X	7.65	5.49	225	VC	CIRC	*
2004X			UNK	UNK	CIRC	
2005X			UNK	UNK	CIRC	
2006X			UNK	UNK	CIRC	
201DX			UNK	UNK	CIRC	
2501X	5.83	3.78	225	VC	CIRC	
2502X	5.89	4.01	225	VC	CIRC	
2506X			UNK	UNK	UNK	
250DX			UNK	UNK	CIRC	
251DX			225	VC	CIRC	
2602X			225	VC	CIRC	
2603X			UNK	UNK	CIRC	
260DX			UNK	UNK	CIRC	
262DX			UNK	UNK	CIRC	
263DX			225	VC	CIRC	
264DX			UNK	UNK	CIRC	
2701X			225	VC	CIRC	
2702X	6.93	3.94	300	CP	CIRC	
2703X	6.95	3.81	300	CP	CIRC	
2704X			UNK	UNK	CIRC	
2705X			UNK	UNK	CIRC	
2706X			UNK	UNK	CIRC	
2707X			UNK	UNK	CIRC	
2708X			UNK	UNK	CIRC	
270DX			UNK	UNK	CIRC	
271DX			UNK	UNK	CIRC	
272DX			300	CP	CIRC	
273DX			300	CP	CIRC	
274DX			UNK	UNK	CIRC	
2750X	6.91	4.66	675	CP	CIRC	
2751X	6.92	4.84	675	CP	CIRC	

Node	Cover	Invert	Size	Material	Shape	
2752X	6.88	5.96	225	VC	CIRC	
2753X	6.98	5.73	300	CP	CIRC	
27ADX			300	CP	CIRC	
2801Y	6.81	4.27	225	VC	CIRC	*
2801X	6.81	4.22	300	CP	CIRC	*
2802X	6.78		300	CP	CIRC	
2803X	6.44	4.96	225	VC	CIRC	
2850X	6.22	4.8	225	CP	CIRC	
2851X	6.74	5.18	600	CP	CIRC	
2853X	6.76	5	600	CP	CIRC	
285DX			600	CP	CIRC	
2901X	7.28		225	VC	CIRC	
2902X			UNK	UNK	CIRC	
2903X			UNK	UNK	CIRC	
290BX			UNK	UNK	CIRC	
290DX			UNK	UNK	CIRC	
291BX			225	VC	CIRC	
291DX			225	VC	CIRC	
292DX			UNK	UNK	CIRC	
293DX			UNK	UNK	CIRC	
294DX			225	VC	CIRC	
2950X	6.17	4.75	225	VC	CIRC	
3001X	6.87	5.13	150	PF	CIRC	
3050X	6.9	5.76	225	CP	CIRC	
3801X	5.95	3.67	225	VC	CIRC	
3802X	5.89	3.99	225	VC	CIRC	
3803X	5.93	4.13	150	PF	CIRC	
3804X			225	VC	CIRC	
3806X			UNK	UNK	CIRC	
3850X	5.83	4.25	375	CP	CIRC	
3851X	5.86	4.58	300	CP	CIRC	
3852X	5.8	4.66	225	CP	CIRC	
385DX			300	CP	CIRC	
3901X	6.19	4.46	150	PF	CIRC	
3902X	6.58	4.85	150	VC	CIRC	
3903X	6.68	5.21	150	VC	CIRC	
3904X	6.72	5.38	150	VC	CIRC	
3906X			UNK	UNK	CIRC	
3907X			UNK	UNK	CIRC	
3908X			UNK	UNK	CIRC	
3909X			UNK	UNK	CIRC	
391DX			150	PF	CIRC	
394DX			UNK	UNK	CIRC	
3950X	6.23	5.37	225	CP	CIRC	
3951X	6.23	4.67	225	VC	CIRC	
3952X	6.51	4.77	225	VC	CIRC	
3953X	6.68	4.9	225	VC	CIRC	
3954X	6.84	5.04	225	VC	CIRC	
4052X	6.61	5.61	225	VC	CIRC	
4053X	6.49	5.59	150	CP	CIRC	
4701X	6.01	4.33	175	VC	CIRC	
485DX			375	CP	CIRC	
4902X	6.09		150	VC	CIRC	
4903X	5.89	4.85	150	VC	CIRC	
4904X	6.05		150	VC	CIRC	
4906X	5.91	3.46	225	VC	CIRC	
4952X	5.87	4.75	150	VC	CIRC	
4953X	5.82	5.16	225	CP	CIRC	
4954X	6.27	5.33	225	CP	CIRC	
5001X	5.48	3.08	225	VC	CIRC	
500DX			225	VC	CIRC	
5050Y	5.33	4.84	150	VC	CIRC	*
5050X	5.33	4.55	375	CP	CIRC	*
5051X	5.48	4.48	375	CP	CIRC	
5052X	5.58	4.97	225	VC	CIRC	

Node	Cover	Invert	Size	Material	Shape
5053X	5.84	5.05	150	VC	CIRC
5501X	7.16	5.53	225	VC	CIRC
5502X	7.29	5.67	225	VC	CIRC
5503X	7.32	5.81	150	VC	CIRC
5504X	7.29	5.92	225	VC	CIRC
5505X	7.01	5.65	150	VC	CIRC
5550X	7.15	4.52	525	CP	CIRC
5551X	7.26	4.61	525	CP	CIRC
5552X	7.36	4.82	375	CP	CIRC
5553X	7.32	4.74	375	CP	CIRC
5555X	7.25	5.04	225	VC	CIRC
5556X	7.01	4.87	300	CP	CIRC
5557X	7.01	5.13	300	CP	CIRC
5601X	6.35	5.02	225	VC	CIRC
5602X	6.76	5.18	225	VC	CIRC
5603X	6.92	5.43	225	VC	CIRC
5607X			225	UNK	CIRC
5651X	6.18	3.6	675	CP	CIRC
5653X	6.15	3.67	600	CP	CIRC
5654X	6.33	4.19	525	CP	CIRC
5655X	6.71	4.21	525	CP	CIRC
5656X	6.92	4.36	525	CP	CIRC
5701X	6.27	4.31	525	CP	CIRC
5702X	6.61	4.13	525	CP	CIRC
5703X	6.48	4.24	525	CP	CIRC
5704X	6.61	4.81	225	VC	CIRC
5705X	6.74	4.92	225	VC	CIRC
5706X	6.47	4.95	225	VC	CIRC
5752X	6.5	5.11	150	VC	CIRC
5901X	5.8	2.9	225	VC	CIRC
6501X	7.16	6.16	150	VC	CIRC
6502X	7.2	6.3	150	VC	CIRC
6503X			100	RPM	CIRC
6504X			100	RPM	CIRC
6505X			100	RPM	CIRC
6506X	7.2		UNK	UNK	CIRC
6507X			UNK	UNK	CIRC
6550X	7.15	4.89	375	CP	CIRC
6551X	7.2	4.98	375	CP	CIRC
6552X	7.41	5.03	375	CP	CIRC
6553X	7.2	5.11	375	CP	CIRC
6554X	6.65	5.29	300	CP	CIRC
6601X			UNK	UNK	CIRC
6602X			UNK	UNK	CIRC
660DX			UNK	UNK	CIRC
6801X	6.45	3.91	525	CP	CIRC
7801X	6.51	3.87	525	CP	CIRC
7901X	7.15	3.79	525	CP	CIRC
8001X	8.24	3.69	525	CP	CIRC
8501X	6.48	4.44	225	VC	CIRC
8550X	6.39	5.07	300	CP	CIRC
8551X	6.46	4.96	300	CP	CIRC
8552X	6.38	5.81	150	VC	CIRC
9501X	6.37	4.65	225	VC	CIRC
9503X			100	PF	CIRC
9505X			100	PF	CIRC
9506X			UNK	UNK	CIRC
9507X			UNK	UNK	CIRC
9509X			UNK	UNK	CIRC
950DX			100	PF	CIRC
9510X			UNK	UNK	CIRC
9511X			UNK	UNK	CIRC
951DX			UNK	UNK	CIRC
9550X	6.46	5.67	225	CP	CIRC
9551X	6.38	5.58	225	CP	CIRC

Node	Cover	Invert	Size	Material	Shape	
9552X	6.32	5.48	225	CP	CIRC	
9553X	6.36	5.65	150	CP	CIRC	
9554X	6.327		150	CP	CIRC	
9555X	6.36	5.23	300	VC	CIRC	
9556X	6.38	5.4	300	CP	CIRC	
9601X	7.555		150	VC	CIRC	
9602X	7.526		150	VC	CIRC	
9603Y	7.062		150	VC	CIRC	*
9603X	7.062	5.747	150	VC	CIRC	*
9650X	7.544	6.46	225	VC	CIRC	
9651X	7.537	6.401	225	VC	CIRC	



Drawn by: mondaln	Southern Water
Title: Land off St Marys Road	
Date: 04/04/2016	

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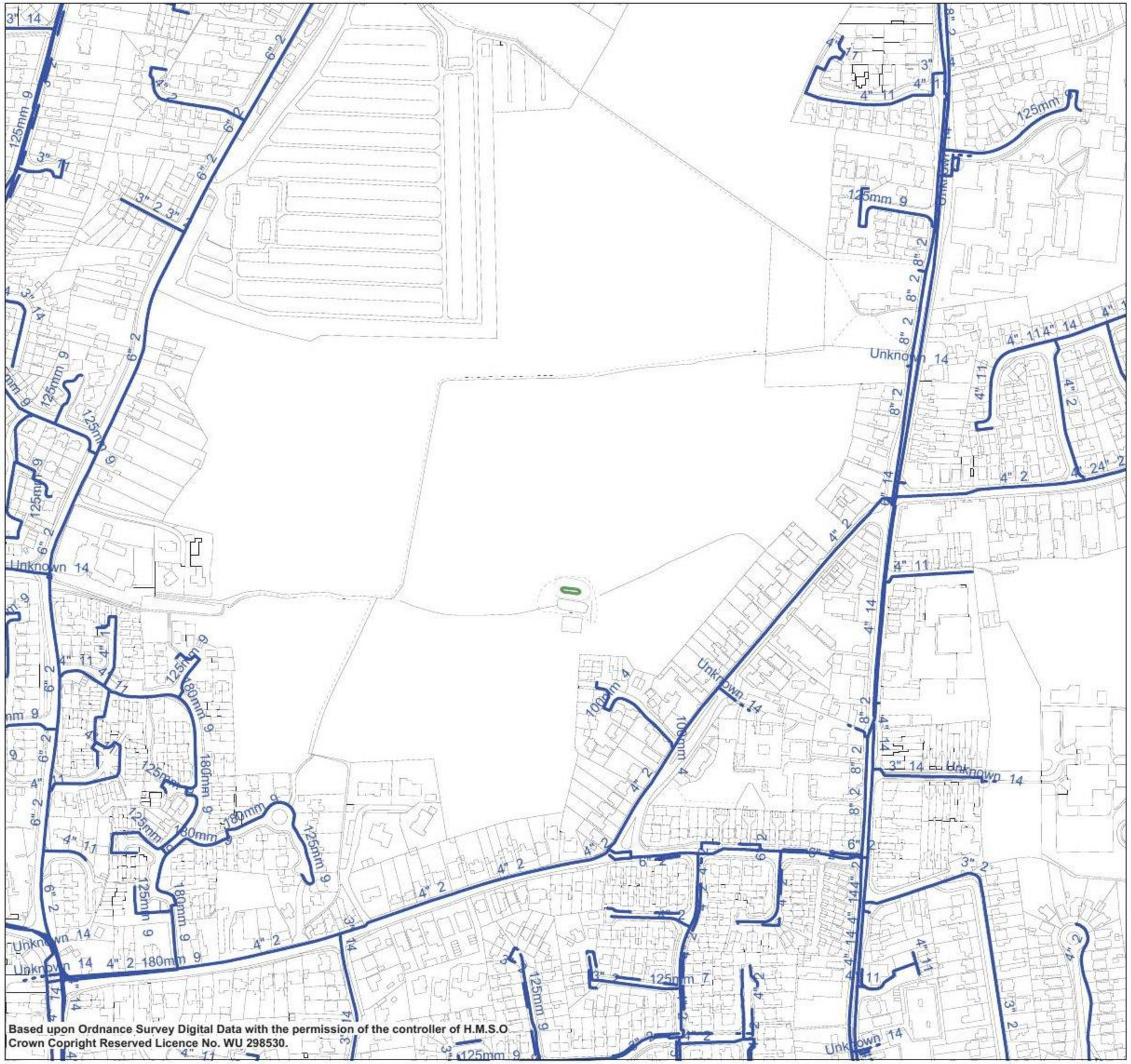

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Portsmouth Water

Southern Water

This information is provided as part of a CON29DW by:

LandSearches from Southern Water

Southern House
Capstone Road
Chatham
Kent ME5 7QA
Telephone: 0845 270 0212
Fax: 01634 844514

The information supplied is given in good faith as a guide to locating underground apparatus. It's accuracy cannot be guaranteed, nor does it include comprehensive information about the existence or location of services pipes or cables to individual premises. The responsibility for locating and avoiding damage to apparatus on site shall be that of the persons proposing to excavate in the street who shall be liable to the apparatus owner and any third party who may be affected in any way for any loss or damage caused by their failure to do so.

Legend

- Water Main
- Abandoned Main
- Private Main
- Hydrants / Washout Hydrants
- Valves / Fittings

Materials

BP	Black Polyethelene	MDPE	Medium Density Polyethelene
CI	Cast Iron	PSC	Pre-Stressed Concrete
CP	Copper	PVC	Polyvinyl Chloride
DI	Ductile Iron	ST	Steel
FRC	Fibre Reinforced Cement	??	Unknown
HDPE	High Density Polyethelene		

Scale	1:1250	Date:	4.4.2016

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COMMERCIALDW

DRAINAGE AND WATER ENQUIRY

Portsmouth Water Ltd
Public Record - Water Quality Summary
01/01/2014 to 31/12/2014
Havant Supply Zone

General Information	ZONE – Havant	2014

Comments on Water Quality:

A sample taken in February from a property in Cosham failed the PCV for Lead (10 ug/l) with a result of 11.0 ug/l. Lead is not present in the water that is supplied to this zone and the zone is considered to be optimised in terms of plumbosolvency treatment. A Water Regulations inspection found that there was lead pipework within the property – which the owner was already planning to remove as part of a redevelopment.
In all other respects this water meets the chemical and microbiological requirements of the Water Supply (Water Quality) Regulations 2000 (Amendment) Regulations 2007

Action taken to comply with Section 19 undertakings

Phosphate is dosed in the water to reduce pick-up of lead from lead pipework

Determinands Analysed

METALS		
SUBSTANCE TESTED	**WHAT IT MEANS**	**REGULATORY STANDARD**
Antimony	These metals can occur naturally in source water at low levels. Some may also come from plumbing systems and industrial processes. The standards provide wide safety margins on known levels of toxicity.	5.0 µg /l
Cadmium		5.0 µg/l
Chromium		50 µg /l
Nickel		20 µg/l
Mercury		1.0 µg /l
Selenium		10 µg /l
Aluminium	Aluminium occurs naturally and is also used during treatment to remove impurities. Concerns have been expressed about a link between aluminium and Alzheimer's disease, but there is no proven connection, although research on this is ongoing.	200 µg/l
Arsenic	This occurs naturally in water at low levels.	10 µg /l
Boron	Low levels of boron can be found in some waters due to its use in detergents.	1.0 mg/l
Copper	Traces of copper can sometimes be found in water, usually as a result of old, corroding plumbing or new plastic pipes. This can cause a metallic taste.	2.0 mg/l
Lead	Lead is rarely present in water sources but many properties built before the mid-1960's have a lead supply pipe or some lead plumbing. Portsmouth Water adds phosphate to most of the water supplied to reduce the amount of lead dissolved from pipes.	10 µg /l
Iron	Iron can naturally occur in some water sources and is removed during treatment. Iron in the water supplies may also be derived from old iron mains or domestic pipe work. This is not a health hazard, but can cause the water to become discoloured.	200 µg/l
Manganese	This can naturally occur in some water sources and is removed during treatment. Disruption to water mains can stir up sediment, containing manganese.	50 µg/l
Sodium	Sodium is a naturally occurring substance that can increase as an effect of softening the water. If you use a water softener you should retain an un-softened supply for drinking.	200 mg/l

NON-METALS		
SUBSTANCE TESTED	**WHAT IT MEANS**	**REGULATORY STANDARD**
Ammonium	Ammonia occurs naturally in many water sources. It is not harmful and is normally removed by treatment.	0.5 mg/l
Bromate	Bromate can potentially form when hypochlorite or ozone are used in water treatment. We control the treatment process tightly to minimize this.	10 µg/l
Chloride	Chloride occurs naturally in water but may give a salty taste to the water and contribute to corrosion.	250 mg/l
Cyanide	Cyanide is rarely found in water. When it is detected it is normally in areas of heavy industry.	50 µg/l
Fluoride	Fluoride occurs naturally at low levels in some of Portsmouth Water's supplies. None of our supplies are artificially fluoridated.	1.5 mg/l
Nitrate	Nitrate arises from the use of fertilizer on agricultural land.	50 mg/l
Nitrite	Nitrite occurs at much lower levels than nitrate and conversion from one form to another occurs readily. The regulations also require that the Nitrate:Nitrite ratio [nitrate]/50 + [nitrite]/3 is ≤ 1.0.	0.5 mg/l at Customers tap 0.1 mg/l at Water Treatment Works
Sulphate	Sulphate occurs naturally in water and comes from mineral deposits.	250 mg/l

BACTERIA		
SUBSTANCE TESTED	**WHAT IT MEANS**	**REGULATORY STANDARD**
Faecal Coliforms (E.coli)	These bacteria are specific inhabitants of the digestive systems of warm blooded animals. They are an indication of possible contamination (with other harmful bacteria possibly being present). Any detection is investigated as a matter of urgency.	0 per 100ml
Total Coliforms	These are bacteria that provide a general and very sensitive measure of microbiological quality. They are removed by water treatment processes, but where they are detected it is often because they can grow within taps in the home. Any detection is investigated as a matter of urgency.	0 per 100ml
Enterococci	As with coliforms, the presence of these organisms can indicate possible contamination in the water supply so they are investigated as a matter of urgency.	0 per 100ml
Colony Count at 37°C	Small numbers of bacteria can be present in treated water. The information obtained from these tests is used to maintain the efficiency of the water treatment processes and the cleanliness of water mains. Any unusually high levels are investigated.	No abnormal change from a long term average. Number per 1ml
Colony Count at 22°C		
Clostridium Perfringens	As with coliforms, the presence of these organisms can indicate contamination in the water supply so they are investigated as a matter of urgency.	0 per 100ml

ORGANIC CHEMICALS: PESTICIDES		
SUBSTANCE TESTED	**WHAT IT MEANS**	**REGULATORY STANDARD**
Aldrin	Pesticides consist of chemicals used by farmers, local authorities and gardeners. The traces of these found in untreated water are typically far less than the maximum advised to protect public health. The pesticides tested for will vary from area to area, depending on the usage of pesticides in the surrounding area of each water source.	0.03 µg/l
Dieldrin		0.03 µg/l
Heptachlor		0.03 µg/l
Heptachlor epoxide		0.03 µg/l
Other individual Pesticides		0.1 µg/l
Total Pesticides	This is the total amount of each pesticide detected in the water sample tested.	0.5 µg/l

ORGANIC CHEMICALS: OTHERS		
SUBSTANCE TESTED	**WHAT IT MEANS**	**REGULATORY STANDARD**
Benzene	Benzene is rarely found in water but is removed in treatment processes. It arises from petroleum products and industries.	1.0 µg/l
Trichloromethane ⅄	These compounds are known as trihalomethanes (THM's). They are formed when chlorine comes into contact with organic compounds in untreated water.	100 ug/l (⅄For the total amount of these four compounds)
Dichlorobromomethane ⅄		
Dibromochloromethane ⅄		
Tribromomethane ⅄		
Tetrachloromethane	These substances are known as solvents. They arise from industrial processes and are removed from the water during the treatment stage.	3.0 µg/l
1,2 Dichloroethane		3.0 µg/l
Trichloroethene × and Tetrachloroethene ×		10 µg/l (×For the total amount of these two compounds)
Benzo-a-pyrene	These compounds are known as polycyclic aromatic hydrocarbons (PAH's). They are rare substances and are seldom found in water. Where they do occur, the cause is usually coal tar pitch lining from iron mains.	0.01 µg/l
Benzo-b-fluoranthene *		0.1 µg/l (*For the total amount of these four compounds)
Benzo-k-fluoranthene *		
Benzo-ghi-perylene *		
Indeno-123-cd-pyrene *		

OTHER PARAMETERS		
SUBSTANCE TESTED	**WHAT IT MEANS**	**REGULATORY STANDARD**
Colour	Chemical changes in the water source or pressure changes in the distribution main can give the water a tinge of colour.	20 mg/l Pt/Co
Conductivity	This is a measure of the level of natural mineral salts contained in the water. This is measured by passing an electrical current through the water.	2500 µS per cm at 20°C
pH (Hydrogen Ion)	This is a measure of the acidity or alkalinity of the water. A pH of 7 is neutral.	Between 6.5 and 9.5
Taste Dilution Number	This is to check if the water has any unpleasant taste or smell. It is measured using panellists to taste and smell the water in strictly controlled conditions.	Dilution Number 0 at 25°C
Odour Dilution Number		
Temperature	Temperature is checked to monitor changes in the water system.	No legal limit
Total Chlorine	Sufficient chlorine is added to all our supplies to ensure the absence of harmful bacteria. Portsmouth Water also aims to keep the levels at customer's taps low to minimize associated taste and odour issues.	No legal limit
Free Chlorine		
Total Organic Carbon	TOC is a measure of the organic material present in the water. It varies naturally depending on the source of the water and is monitored for any unusual changes (which could be caused by oil spills or other pollutants).	No abnormal change
Turbidity	This is a measure of suspended material in the water.	4.0 NTU at Customers tap 1.0 NTU at Water Treatment Works

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APPENDIX E

CALCULATIONS

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MasterDrain HY 9.36	**The LK Group** www.thelkgroup.com	Eton Business Park, Eton Hill Road, Radcliff M26 2ZS Tel: 0161 763 7200 email: m.jones@thelkgroup.com	Job No. Sheet no. 1 Date 28/09/16
	Project: Greenfield runoff north section		By / Checked / Reviewed
	Title: IoH 124 Runoff calcs for Hayling Island centre		

Hydrological Data:-

FSR Hydrology:-

Location	= Hayling Island centre	Grid reference	= SZ7199
M5-60 (mm)	= 18	r	= 0.35
Soil runoff	= 0.40	SAAR (mm/yr)	= 700
WRAP	= 3	Area = England & Wales	
Hydrological area = 7		Hydrological zone = 4	

Soil classification for WRAP type 3
i) Relatively impermeable soils in boulder and sedimentary clays, and in alluvium, especially in eastern England;
ii) Permeable soils with shallow ground water in low-lying areas;
iii) Mixed areas of permeable and impermeable soils, in approximately equal proportions.

Design data:-

Area = 0.0568 Km^2 - 5.68 Ha - 56800 m^2

Calculation method:-

Runoff is calculated from:-

$$Q_{BAR(rural)} = 0.00108\ AREA^{0.89}\ .\ SAAR^{1.17}\ .\ SOIL^{2.17}$$

where
AREA = Site area in Km^2
SAAR = Standard Average Annual Rainfall (mm/yr)
SOIL = Soil value derived from Winter Rainfall Acceptance Potential
$Q_{BAR(rural)}$ = Runoff (cumecs)

$Q_{BAR(rural)}$ is then multiplied by a growth factor - GC(T) - for different storm return periods derived from EA publication W5-074/A.

Calculated data:-

For areas less than 50Ha, a modified calculation which multiplies the 50Ha runoff value by the ratio of the site area to 50Ha is used
Reducing factor used for these calculations is 0.114

Mean Annual Peak Flow $Q_{BAR(rural)}$ = 19.33 l/s

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MasterDrain
HY 9.36

Job No.			
Sheet no.	2		
Date	28/09/16		
Project	Greenfield runoff north section	By	Checked	Reviewed
Title	IoH 124 Runoff calcs for Hayling Island centre			

Values for $Q_{BAR(rural)}$

Ret. per.	m³/hr	l/s	l/s/ha	Ret. per.	m³/hr	l/s	l/s/ha
1yr	59.135	16.426	2.892	100yr	219.146	60.874	10.717
2yr	61.222	17.006	2.994	100yr+20%	262.975	73.049	12.861
5yr	89.050	24.736	4.355	100yr+30%	284.890	79.136	13.932
10yr	112.704	31.307	5.512	200yr	257.409	71.503	12.588
30yr	155.141	43.095	7.587	500yr	312.370	86.769	15.276
50yr	182.274	50.632	8.914	1000yr	358.982	99.717	17.556

Growth factors -

1yr	2yr	5yr	10yr	30yr	50yr	100yr	200yr	500yr	1000yr
0.85	0.88	1.28	1.62	2.23	2.62	3.15	3.70	4.49	5.16

The above is based on the Institute of Hydrology Report 124
to which you are referred for further details (see Sect 7).
Note that the 200 and above year growth curves were taken from W5-074.

MasterDrain HY 9.36	**The LK Group** www.thelkgroup.com	Eton Business Park, Eton Hill Road, Radcliff M26 2ZS Tel: 0161 763 7200 email: m.jones@thelkgroup.com	Job No. Sheet no. 1 Date 28/09/16
	Project: Greenfield runoff south section		By / Checked / Reviewed
	Title: IoH 124 Runoff calcs for Hayling Island centre		

Hydrological Data:-

FSR Hydrology:-

Location	= Hayling Island centre	Grid reference	= SZ7199
M5-60 (mm)	= 18	r	= 0.35
Soil runoff	= 0.40	SAAR (mm/yr)	= 700
WRAP	= 3	Area = England & Wales	
Hydrological area = 7		Hydrological zone = 4	

Soil classification for WRAP type 3
i) Relatively impermeable soils in boulder and sedimentary clays, and in alluvium, especially in eastern England;
ii) Permeable soils with shallow ground water in low-lying areas;
iii) Mixed areas of permeable and impermeable soils, in approximately equal proportions.

Design data:-

Area = 0.047 Km^2 - 4.7 Ha - 47000 m^2

Calculation method:-

Runoff is calculated from:-

$$Q_{BAR(rural)} = 0.00108\ AREA^{0.89}\ .\ SAAR^{1.17}\ .\ SOIL^{2.17}$$

where
AREA = Site area in Km^2
SAAR = Standard Average Annual Rainfall (mm/yr)
SOIL = Soil value derived from Winter Rainfall Acceptance Potential
$Q_{BAR(rural)}$ = Runoff (cumecs)

$Q_{BAR(rural)}$ is then multiplied by a growth factor - GC(T) - for different storm return periods derived from EA publication W5-074/A.

Calculated data:-

For areas less than 50Ha, a modified calculation which multiplies the 50Ha runoff value by the ratio of the site area to 50Ha is used
Reducing factor used for these calculations is 0.094

Mean Annual Peak Flow $Q_{BAR(rural)}$ = 15.99 l/s

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MasterDrain
HY 9.36

Job No.	
Sheet no.	2
Date	28/09/16
Project	Greenfield runoff south section
Title	IoH 124 Runoff calcs for Hayling Island centre
By	
Checked	
Reviewed	

Values for $Q_{BAR(rural)}$

Ret. per.	m³/hr	l/s	l/s/ha	Ret. per.	m³/hr	l/s	l/s/ha
1yr	48.932	13.592	2.892	100yr	181.335	50.371	10.717
2yr	50.659	14.072	2.994	100yr+20%	217.603	60.445	12.861
5yr	73.686	20.468	4.355	100yr+30%	235.736	65.482	13.932
10yr	93.258	25.905	5.512	200yr	212.997	59.166	12.588
30yr	128.374	35.659	7.587	500yr	258.475	71.799	15.276
50yr	150.825	41.896	8.914	1000yr	297.045	82.512	17.556

Growth factors -

1yr	2yr	5yr	10yr	30yr	50yr	100yr	200yr	500yr	1000yr
0.85	0.88	1.28	1.62	2.23	2.62	3.15	3.70	4.49	5.16

The above is based on the Institute of Hydrology Report 124
to which you are referred for further details (see Sect 7).
Note that the 200 and above year growth curves were taken from W5-074.

The LK Group	Eton Business Park, Eton Hill Road, Radcliff M26 2ZS Tel: 0161 763 7200 email: m.jones@thelkgroup.com	Job No.		
www.thelkgroup.com		Sheet no. 1		
		Date 28/09/16		
MasterDrain SW	Project North section 30yr event	By	Checked	Reviewed
	Title Peak flow storage calcs for Hayling Island centre			

Data:-

FSR Hydrology:-

Location	= Hayling Island centre	Grid reference	= SZ7199
M5-60 (mm)	= 18	r	= 0.35
Soil index	= 0.40	SAAR (mm/yr)	= 700
Return period	= 30	WRAPx	= 3
UCWI	= 72.7		

i) Relatively impermeable soils in boulder and sedimentary clays, and in alluvium, especially in eastern England;
ii) Permeable soils with shallow ground water in low-lying areas;
iii) Mixed areas of permeable and impermeable soils, in approximately equal proportions.

Runoff factor (RF) = 25.0, calculated from:-

Runoff factor = (0.829*PIMP)+(25*SOIL)+(0.078*UCWI)-20.7
where
PIMP = Impervious Area*100/(Impervious Area+Pervious Area)
UCWI = Calculated value for Wetness Index

Design data:-

Imperv. area	= 20900 m²	Pervious area	= 37800 m²
Total area (TA)	= 58700 m²	Equiv area	= 14675 m² (TA x RF).
Allowed discharge rate	= 43.090 l/s	Areal reduction factor	= 1.000
Additional flow	= 0.00 l/s	Climate change factor	= 0

Calculated data:-

Time to max	= 88.0 mins	Calculated storage volume	= 506.5 m³
Rainfall at max	= 21.32 mm/hr	Allowed discharge rate	= 43.090 l/s
Pipeline storage	= 0.0 m³	Available MH storage	= 0.0 m³
Offline storage	= 0.0 m³		

Fixed 6 hour data:-

Rainfall event	= 6 hours	Calculated storage volume	= 156.1 m³
Rainfall rate	= 8.00 mm/hr	Allowed discharge rate	= 43.090 l/s

Rainfall intensities calculated using the Wallingford Procedure

Storage lengths for initial calculation (x 1.1, 1.2, 1.3 or 1.5 as above if required) :-

Diam	Len	Diam	Len	Ovoid	Len	Box culvert	Len
100	64504.8	1125	509.7	400 x 600	2814.0	500 x 500	2026.1
150	28668.8	1200	448.0	600 x 900	1225.3	500 x 750	1350.7
225	12741.7	1275	396.8	800 x 1200	689.1	500 x 1000	1013.0
300	7167.2	1350	353.9			750 x 1000	675.4
375	4587.0	1425	317.7			750 x 1200	562.8
450	3185.4	1500	286.7			750 x 1500	450.2
525	2340.3	1575	260.0			1000 x 1000	506.5
600	1791.8	1650	236.9			1000 x 1200	422.1
675	1415.7	1725	216.8			1000 x 1500	337.7
750	1146.8	1800	199.1			1000 x 1800	281.4
825	947.7	1875	183.5			1000 x 2000	253.3
900	796.4	1950	169.6			1500 x 1500	225.1
975	678.6	2025	157.3			1500 x 1800	187.6
1050	585.1	2100	146.3			1500 x 2000	168.8

The LK Group	Eton Business Park, Eton Hill Road, Radcliff M26 2ZS Tel: 0161 763 7200 email: m.jones@thelkgroup.com	Job No.		
www.thelkgroup.com		Sheet no. 2		
		Date 28/09/16		
Project North section 30yr event		By	Checked	Reviewed
Title Peak flow storage calcs for Hayling Island centre				

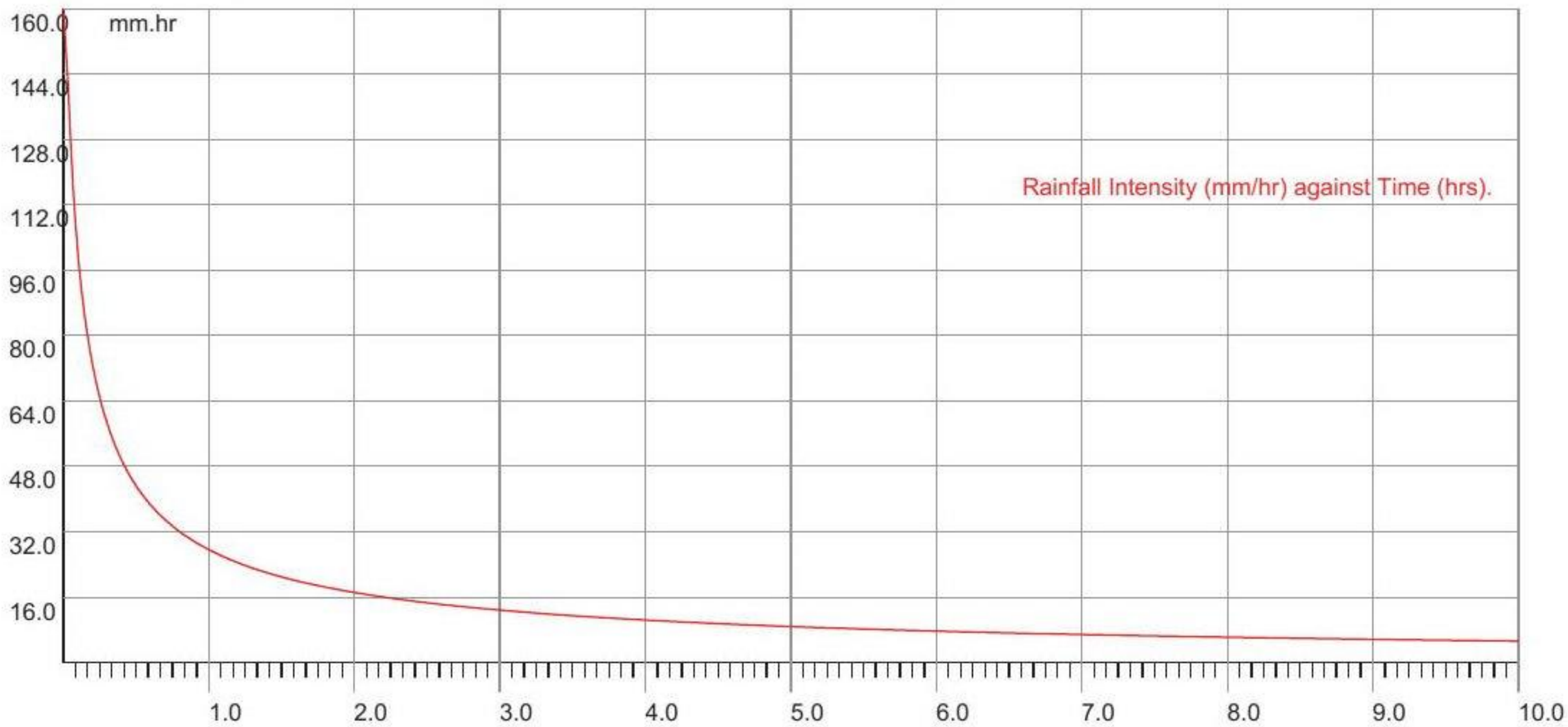
MasterDrain SW

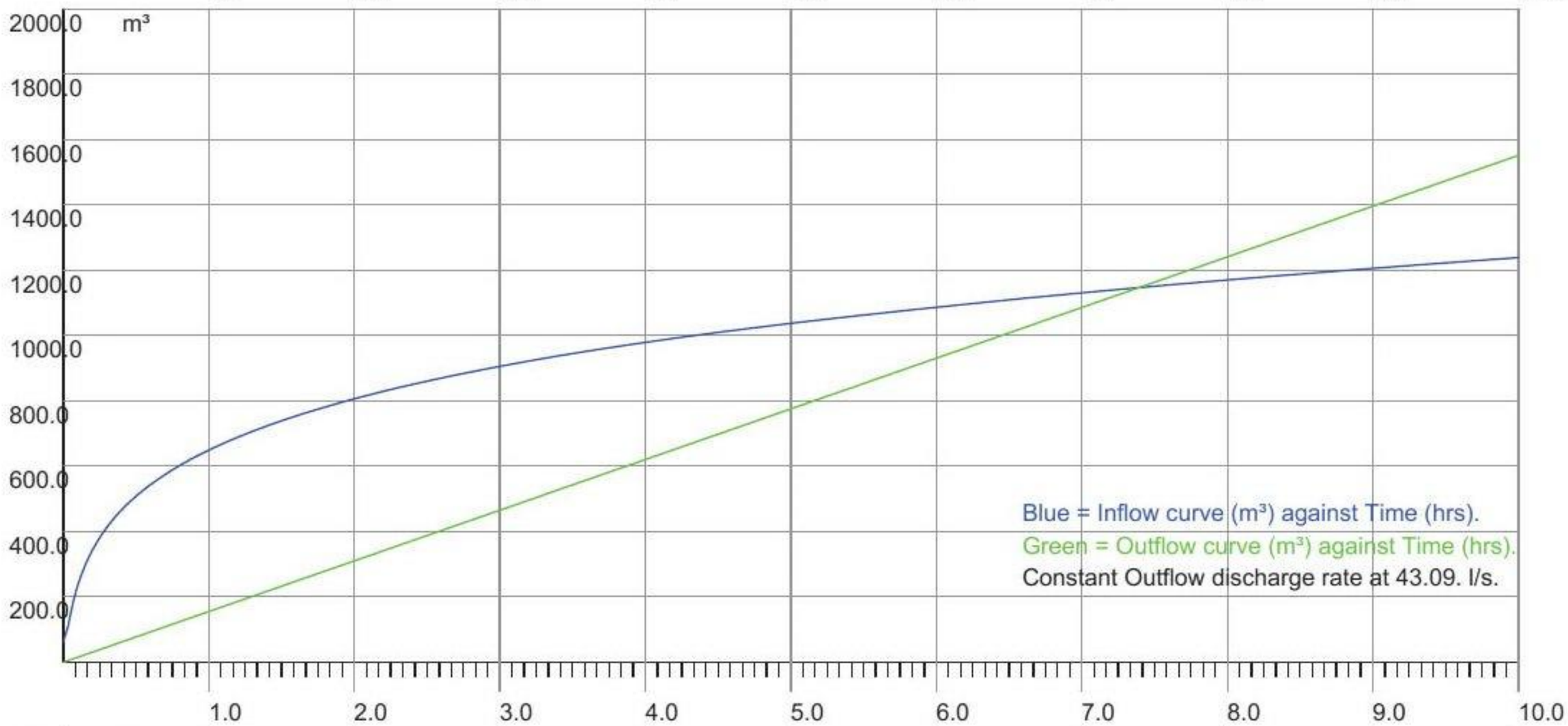
Data:-

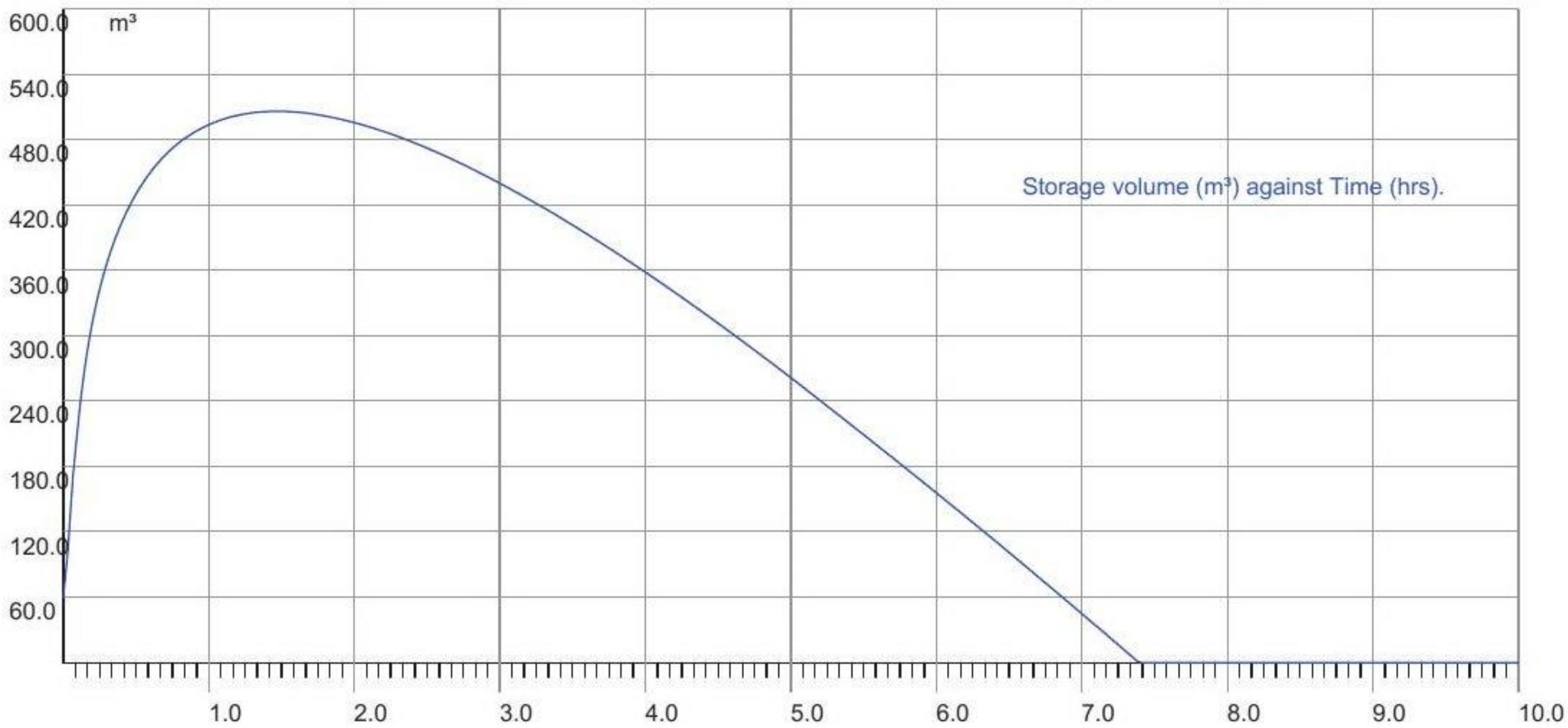
Time (mins)	Rain mm/hr	Inflow (m3)	Outflow (m3)	Balance (m3)
10	80.0	313.052	25.854	287.198
20	55.0	432.471	51.708	380.763
30	43.0	508.254	77.562	430.692
40	36.0	564.958	103.416	461.542
50	31.0	610.713	129.270	481.443
60	28.0	649.301	155.124	494.177
70	25.0	682.800	180.978	501.822
80	23.0	712.477	206.832	505.645
90	21.0	739.169	232.686	506.483
100	20.0	763.455	258.540	504.915
110	18.0	785.756	284.394	501.362
120	17.0	806.387	310.248	496.139
130	16.0	825.593	336.102	489.491
140	15.0	843.564	361.956	481.608
150	15.0	860.455	387.810	472.645
160	14.0	876.393	413.664	462.729
170	13.0	891.479	439.518	451.961
180	13.0	905.804	465.372	440.432
190	12.0	919.439	491.226	428.213
200	12.0	932.449	517.080	415.369
210	11.0	944.889	542.934	401.955
220	11.0	956.805	568.788	388.017
230	11.0	968.239	594.642	373.597
240	10.0	979.228	620.496	358.732
250	10.0	989.804	646.350	343.454
260	10.0	999.997	672.204	327.793
270	10.0	1009.831	698.058	311.773
280	9.0	1019.330	723.912	295.418
290	9.0	1028.516	749.766	278.750
300	9.0	1037.406	775.620	261.786
310	9.0	1046.018	801.474	244.544
320	8.0	1054.369	827.328	227.041
330	8.0	1062.471	853.182	209.289
340	8.0	1070.807	879.036	191.771
350	8.0	1078.892	904.890	174.002
360	8.0	1086.795	930.744	156.051
370	8.0	1094.527	956.598	137.929
380	7.0	1102.096	982.452	119.644
390	7.0	1109.508	1008.306	101.202
400	7.0	1116.772	1034.160	82.612
410	7.0	1123.894	1060.014	63.880
420	7.0	1130.879	1085.868	45.011
430	7.0	1137.735	1111.722	26.013
440	7.0	1144.466	1137.576	6.890
450	7.0	1151.077	1163.430	0.000
460	6.0	1157.573	1189.284	0.000
470	6.0	1163.958	1215.138	0.000
480	6.0	1170.237	1240.992	0.000
490	6.0	1176.414	1266.846	0.000
500	6.0	1182.492	1292.700	0.000
510	6.0	1188.475	1318.554	0.000
520	6.0	1194.366	1344.408	0.000
530	6.0	1200.169	1370.262	0.000
540	6.0	1205.885	1396.116	0.000
550	6.0	1211.519	1421.970	0.000
560	6.0	1217.072	1447.824	0.000
570	5.0	1222.548	1473.678	0.000
580	5.0	1227.949	1499.532	0.000
590	5.0	1233.277	1525.386	0.000
600	5.0	1238.534	1551.240	0.000

Storage volume (m^3) = 506.5 m^3

MasterDrain SW	**The LK Group** www.thelkgroup.com	Eton Business Park, Eton Hill Road, Radcliff M26 2ZS Tel: 0161 763 7200 email: m.jones@thelkgroup.com	Job No. Sheet no. 3 Date 28/09/16
	Project **North section 30yr event**		By / Checked / Reviewed
	Title **Peak flow storage calcs for Hayling Island centre**		







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www.thel grou .com		Sheet no. 1		
		Date 28/09/16		
MasterDrain SW	Project North section 100yr event +20%	By	Checked	Reviewed
	Title Peak flow storage calcs for Hayling Island centre			

Data:-

FSR Hydrology:-

Location	= Hayling Island centre	Grid reference	= SZ7199
M5-60 (mm)	= 18	r	= 0.35
Soil index	= 0.40	SAAR (mm/yr)	= 700
Return period	= 100	WRAPx	= 3
UCWI	= 72.7		

i) Relatively impermeable soils in boulder and sedimentary clays, and in alluvium, especially in eastern England;
ii) Permeable soils with shallow ground water in low-lying areas;
iii) Mixed areas of permeable and impermeable soils, in approximately equal proportions.

Runoff factor (RF) = 25.0, calculated from:-

Runoff factor = (0.829*PIMP)+(25*SOIL)+(0.078*UCWI)-20.7
where
PIMP = Impervious Area*100/(Impervious Area+Pervious Area)
UCWI = Calculated value for Wetness Index

Design data:-

Imperv. area	= 20900 m²	Pervious area	= 37800 m²
Total area (TA)	= 58700 m²	Equiv area	= 14675 m² (TA x RF).
Allowed discharge rate	= 60.870 l/s	Areal reduction factor	= 1.000
Additional flow	= 0.00 l/s	Climate change factor	= 20

Calculated data:-

Time to max	= 101.0 mins	Calculated storage volume	= 839.8 m³
Rainfall at max	= 30.58 mm/hr	Allowed discharge rate	= 60.870 l/s
Pipeline storage	= 0.0 m³	Available MH storage	= 0.0 m³
Offline storage	= 0.0 m³		

Fixed 6 hour data:-

Rainfall event	= 6 hours	Calculated storage volume	= 380.3 m³
Rainfall rate	= 12.00 mm/hr	Allowed discharge rate	= 60.870 l/s

Rainfall intensities calculated using the Wallingford Procedure

Storage lengths for initial calculation (x 1.1, 1.2, 1.3 or 1.5 as above if required) :-

Diam	Len	Diam	Len	Ovoid	Len	Box culvert	Len
100	106948.3	1125	845.0	400 x 600	4665.6	500 x 500	3359.2
150	47532.6	1200	742.7	600 x 900	2031.5	500 x 750	2239.5
225	21125.6	1275	657.9	800 x 1200	1142.5	500 x 1000	1679.6
300	11883.1	1350	586.8			750 x 1000	1119.7
375	7605.2	1425	526.7			750 x 1200	933.1
450	5281.4	1500	475.3			750 x 1500	746.5
525	3880.2	1575	431.1			1000 x 1000	839.8
600	2970.8	1650	392.8			1000 x 1200	699.8
675	2347.3	1725	359.4			1000 x 1500	559.9
750	1901.3	1800	330.1			1000 x 1800	466.6
825	1571.3	1875	304.2			1000 x 2000	419.9
900	1320.3	1950	281.3			1500 x 1500	373.2
975	1125.0	2025	260.8			1500 x 1800	311.0
1050	970.1	2100	242.5			1500 x 2000	279.9

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Job No.		
Sheet no. 2		
Date 28/09/16		
By	Checked	Reviewed

MasterDrain SW

Project: North section 100yr event +20%

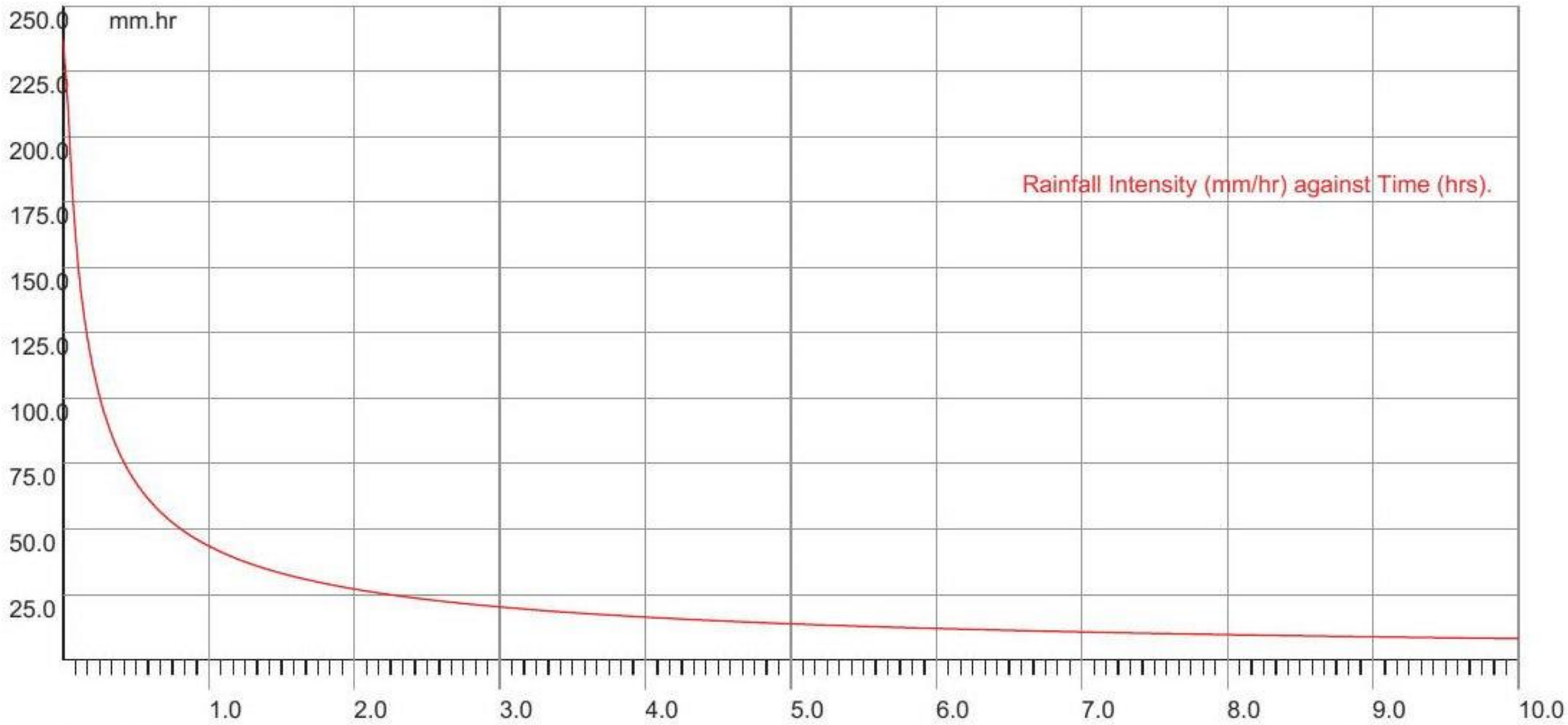
Title: Peak flow storage calcs for Hayling Island centre

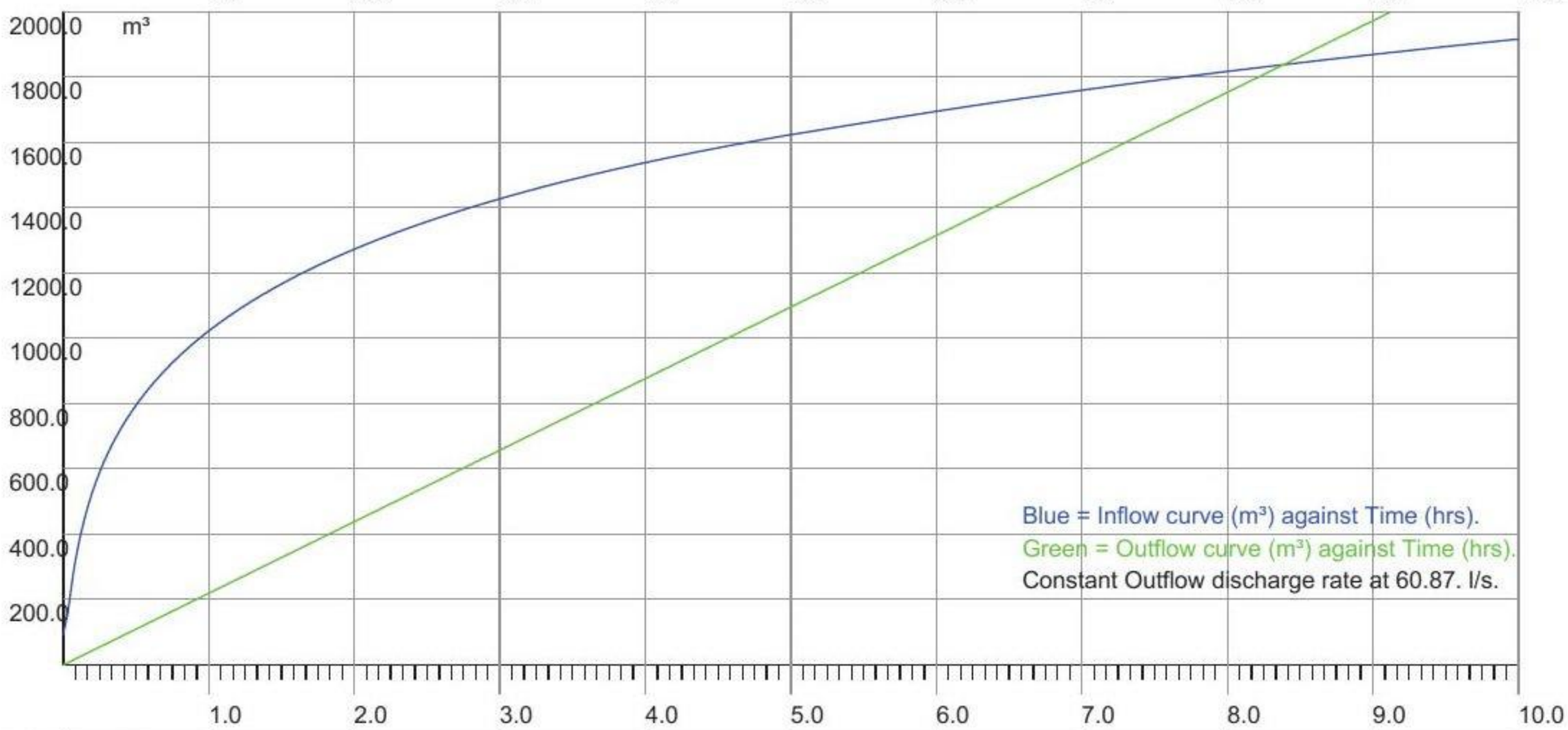
Data:-

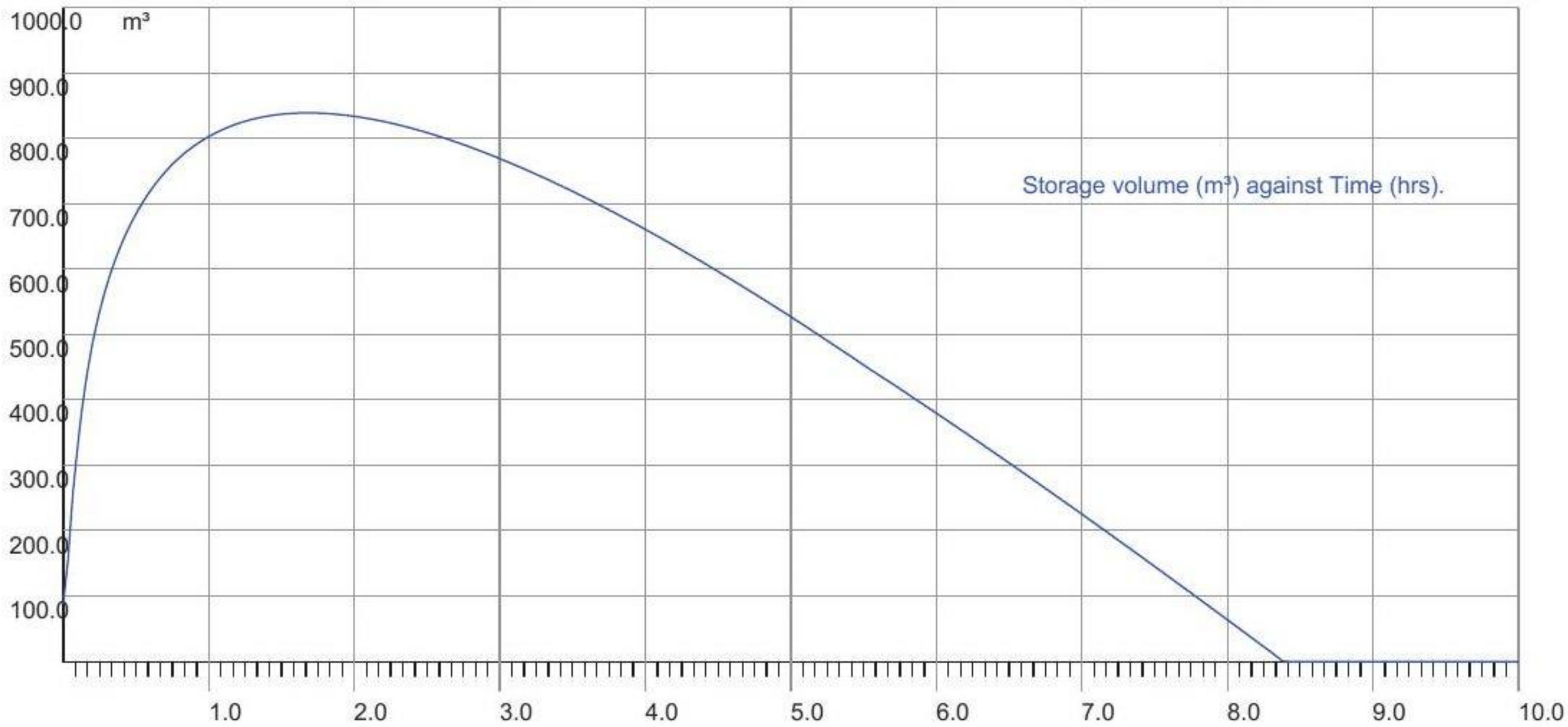
Time (mins)	Rain mm/hr	Inflow (m3)	Outflow (m3)	Balance (m3)
10	123.0	480.546	36.522	444.024
20	86.0	672.786	73.044	599.742
30	68.0	795.064	109.566	685.498
40	57.0	886.663	146.088	740.575
50	49.0	960.495	182.610	777.885
60	44.0	1022.626	219.132	803.494
70	39.0	1076.406	255.654	820.752
80	36.0	1123.893	292.176	831.717
90	33.0	1166.448	328.698	837.750
100	31.0	1205.018	365.220	839.798
110	29.0	1240.293	401.742	838.551
120	27.0	1272.792	438.264	834.528
130	26.0	1302.917	474.786	828.131
140	24.0	1330.984	511.308	819.676
150	23.0	1357.247	547.830	809.417
160	22.0	1381.916	584.352	797.564
170	21.0	1405.164	620.874	784.290
180	20.0	1427.135	657.396	769.739
190	19.0	1447.953	693.918	754.035
200	19.0	1467.723	730.440	737.283
210	18.0	1486.537	766.962	719.575
220	17.0	1504.474	803.484	700.990
230	17.0	1521.603	840.006	681.597
240	16.0	1537.986	876.528	661.458
250	16.0	1553.678	913.050	640.628
260	15.0	1568.725	949.572	619.153
270	15.0	1583.172	986.094	597.078
280	15.0	1597.059	1022.616	574.443
290	14.0	1610.419	1059.138	551.281
300	14.0	1623.285	1095.660	527.625
310	13.0	1635.686	1132.182	503.504
320	13.0	1647.648	1168.704	478.944
330	13.0	1659.195	1205.226	453.969
340	13.0	1671.544	1241.748	429.796
350	12.0	1683.445	1278.270	405.175
360	12.0	1695.071	1314.792	380.279
370	12.0	1706.433	1351.314	355.119
380	12.0	1717.546	1387.836	329.710
390	11.0	1728.421	1424.358	304.063
400	11.0	1739.069	1460.880	278.189
410	11.0	1749.501	1497.402	252.099
420	11.0	1759.725	1533.924	225.801
430	11.0	1769.752	1570.446	199.306
440	10.0	1779.588	1606.968	172.620
450	10.0	1789.242	1643.490	145.752
460	10.0	1798.721	1680.012	118.709
470	10.0	1808.033	1716.534	91.499
480	10.0	1817.183	1753.056	64.127
490	10.0	1826.178	1789.578	36.600
500	9.0	1835.023	1826.100	8.923
510	9.0	1843.723	1862.622	0.000
520	9.0	1852.284	1899.144	0.000
530	9.0	1860.712	1935.666	0.000
540	9.0	1869.009	1972.188	0.000
550	9.0	1877.180	2008.710	0.000
560	9.0	1885.231	2045.232	0.000
570	8.0	1893.164	2081.754	0.000
580	8.0	1900.984	2118.276	0.000
590	8.0	1908.693	2154.798	0.000
600	8.0	1916.295	2191.320	0.000

Storage volume (m^3) = 839.8 m^3

MasterDrain SW	**The LK Group** www.thel grou .com	ton Business ar ton ill Road Radcliff 26 2 S Tel 0161 763 7200 email m. ones thel grou .com	Job No. Sheet no. 3 Date 28/09/16
	Project **North section 100yr event +20%**		By / Checked / Reviewed
	Title **Peak flow storage calcs for Hayling Island centre**		







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www.thel grou .com		Sheet no. 1		
		Date 28/09/16		
MasterDrain SW	Project North section 100yr event +40%	By	Checked	Reviewed
	Title Peak flow storage calcs for Hayling Island centre			

Data:-

FSR Hydrology:-

Location	= Hayling Island centre	Grid reference	= SZ7199
M5-60 (mm)	= 18	r	= 0.35
Soil index	= 0.40	SAAR (mm/yr)	= 700
Return period	= 100	WRAPx	= 3
UCWI	= 72.7		

i) Relatively impermeable soils in boulder and sedimentary clays, and in alluvium, especially in eastern England;
ii) Permeable soils with shallow ground water in low-lying areas;
iii) Mixed areas of permeable and impermeable soils, in approximately equal proportions.

Runoff factor (RF) = 25.0, calculated from:-

Runoff factor = (0.829*PIMP)+(25*SOIL)+(0.078*UCWI)-20.7
where
PIMP = Impervious Area*100/(Impervious Area+Pervious Area)
UCWI = Calculated value for Wetness Index

Design data:-

Imperv. area	= 20900 m²	Pervious area	= 37800 m²
Total area (TA)	= 58700 m²	Equiv area	= 14675 m² (TA x RF).
Allowed discharge rate	= 60.870 l/s	Areal reduction factor	= 1.000
Additional flow	= 0.00 l/s	Climate change factor	= 40

Calculated data:-

Time to max	= 120.0 mins	Calculated storage volume	= 1046.7 m³
Rainfall at max	= 31.62 mm/hr	Allowed discharge rate	= 60.870 l/s
Pipeline storage	= 0.0 m³	Available MH storage	= 0.0 m³
Offline storage	= 0.0 m³		

Fixed 6 hour data:-

Rainfall event	= 6 hours	Calculated storage volume	= 662.8 m³
Rainfall rate	= 14.00 mm/hr	Allowed discharge rate	= 60.870 l/s

Rainfall intensities calculated using the Wallingford Procedure

Storage lengths for initial calculation (x 1.1, 1.2, 1.3 or 1.5 as above if required) :-

Diam	Len	Diam	Len	Ovoid	Len	Box culvert	Len
100	133290.1	1125	1053.2	400 x 600	5814.8	500 x 500	4186.6
150	59240.0	1200	925.6	600 x 900	2531.8	500 x 750	2791.1
225	26328.9	1275	819.9	800 x 1200	1424.0	500 x 1000	2093.3
300	14810.0	1350	731.4			750 x 1000	1395.5
375	9478.4	1425	656.4			750 x 1200	1163.0
450	6582.2	1500	592.4			750 x 1500	930.4
525	4835.9	1575	537.3			1000 x 1000	1046.7
600	3702.5	1650	489.6			1000 x 1200	872.2
675	2925.4	1725	447.9			1000 x 1500	697.8
750	2369.6	1800	411.4			1000 x 1800	581.5
825	1958.3	1875	379.1			1000 x 2000	523.3
900	1645.6	1950	350.5			1500 x 1500	465.2
975	1402.1	2025	325.0			1500 x 1800	387.7
1050	1209.0	2100	302.2			1500 x 2000	348.9

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Project North section 100yr event +40%		By	Checked	Reviewed
Title Peak flow storage calcs for Hayling Island centre				

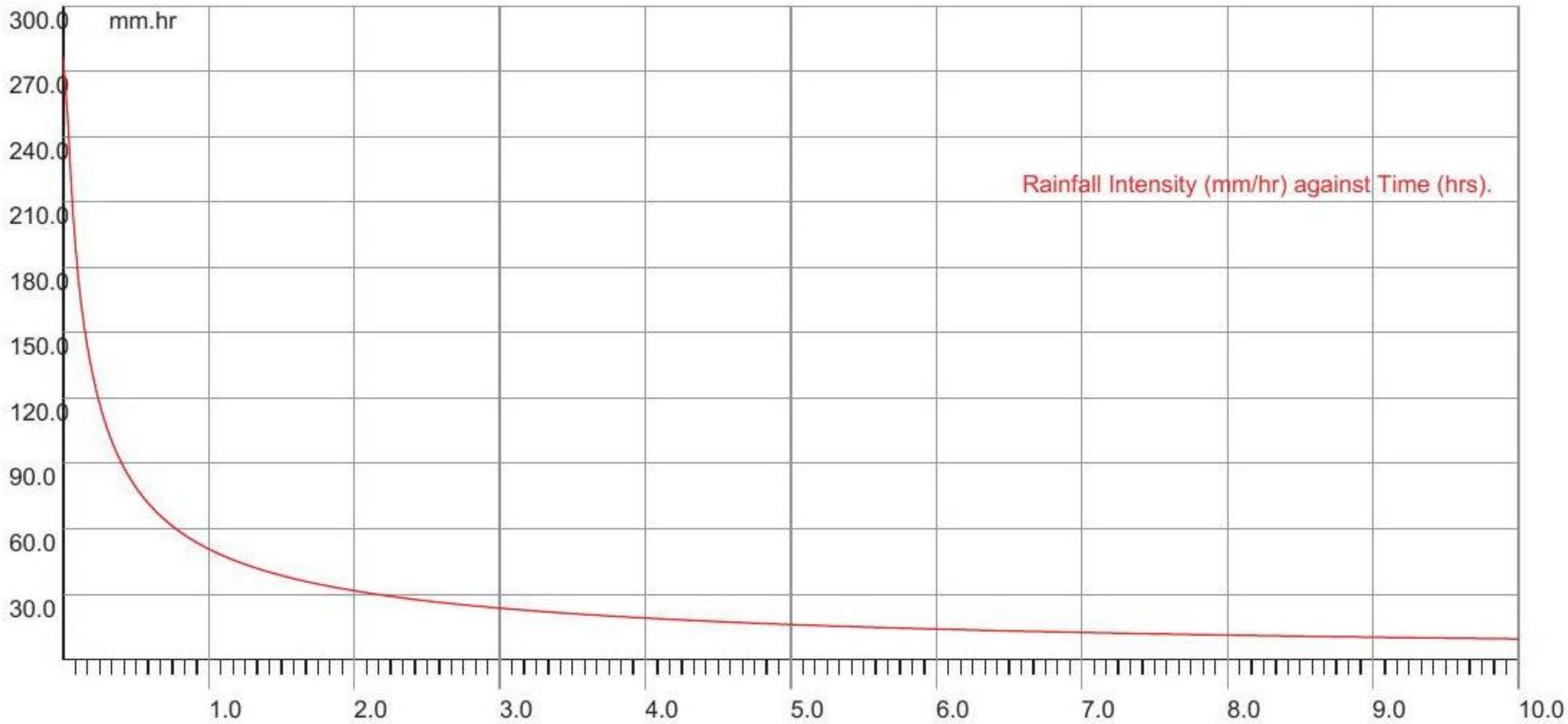
MasterDrain SW

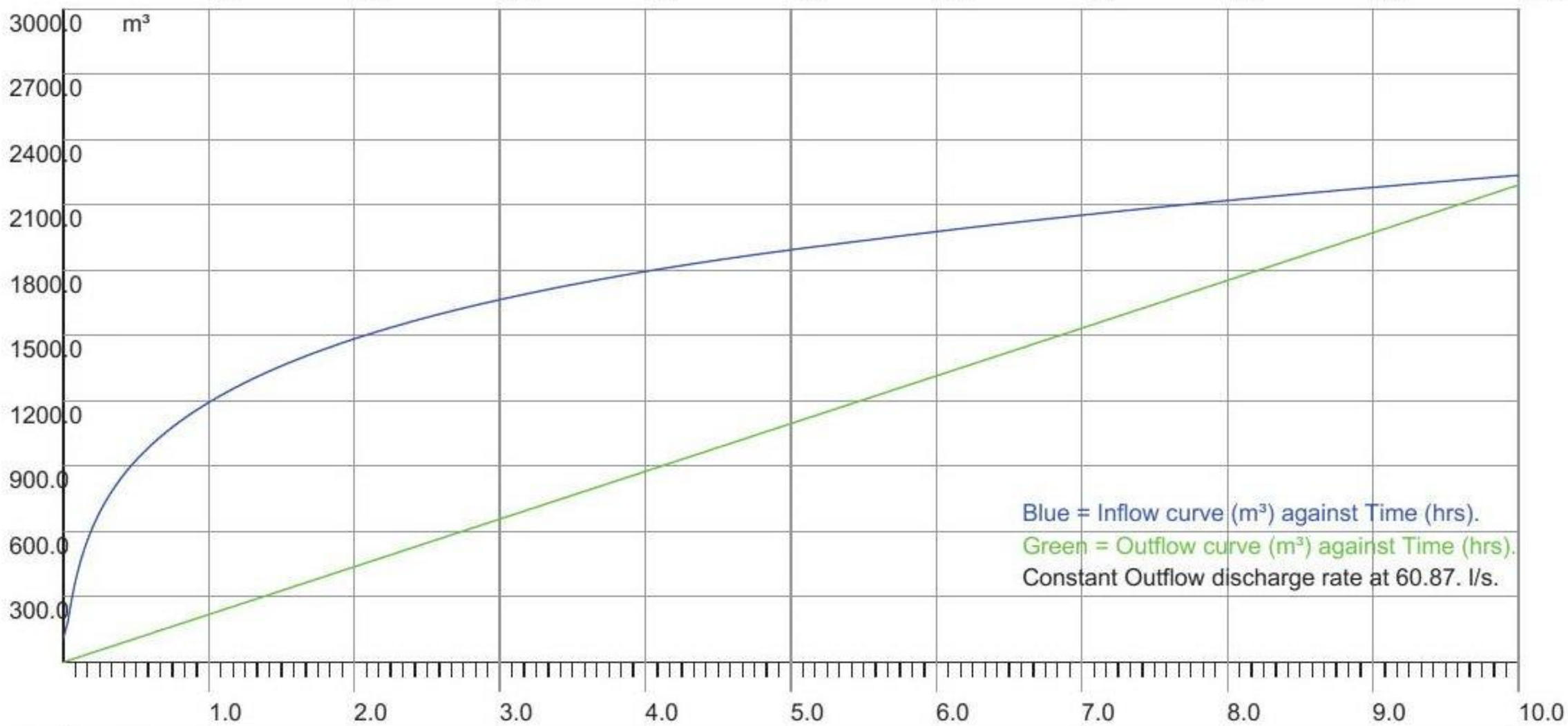
Data:-

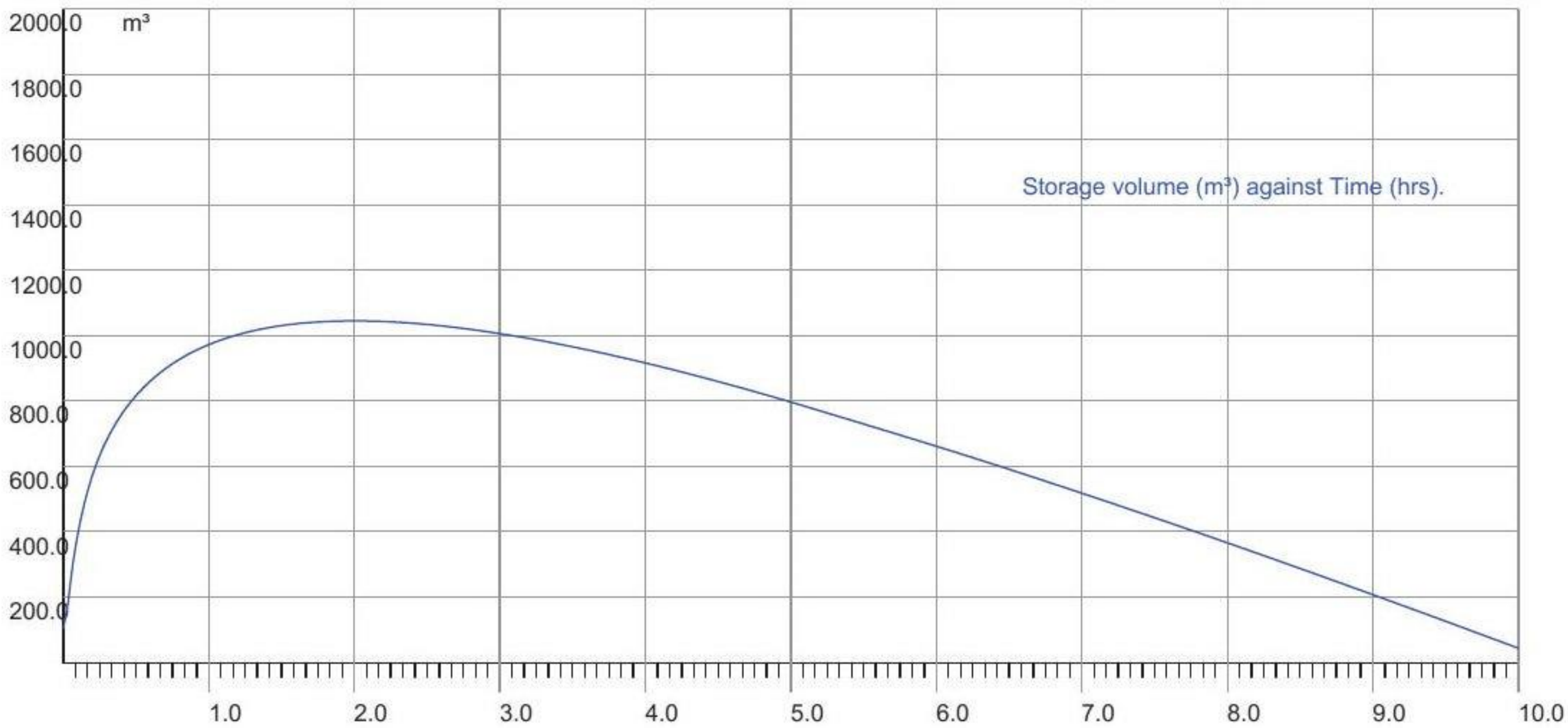
Time (mins)	Rain mm/hr	Inflow (m3)	Outflow (m3)	Balance (m3)
10	143.0	560.637	36.522	524.115
20	100.0	784.917	73.044	711.873
30	79.0	927.574	109.566	818.008
40	66.0	1034.440	146.088	888.352
50	57.0	1120.578	182.610	937.968
60	51.0	1193.063	219.132	973.931
70	46.0	1255.807	255.654	1000.153
80	42.0	1311.209	292.176	1019.033
90	39.0	1360.856	328.698	1032.158
100	36.0	1405.854	365.220	1040.634
110	34.0	1447.008	401.742	1045.266
120	32.0	1484.924	438.264	1046.660
130	30.0	1520.070	474.786	1045.284
140	28.0	1552.814	511.308	1041.506
150	27.0	1583.455	547.830	1035.625
160	26.0	1612.236	584.352	1027.884
170	25.0	1639.358	620.874	1018.484
180	24.0	1664.990	657.396	1007.594
190	23.0	1689.278	693.918	995.360
200	22.0	1712.344	730.440	981.904
210	21.0	1734.293	766.962	967.331
220	20.0	1755.219	803.484	951.735
230	20.0	1775.204	840.006	935.198
240	19.0	1794.317	876.528	917.789
250	19.0	1812.624	913.050	899.574
260	18.0	1830.179	949.572	880.607
270	17.0	1847.035	986.094	860.941
280	17.0	1863.235	1022.616	840.619
290	17.0	1878.822	1059.138	819.684
300	16.0	1893.832	1095.660	798.172
310	16.0	1908.300	1132.182	776.118
320	15.0	1922.255	1168.704	753.551
330	15.0	1935.728	1205.226	730.502
340	15.0	1950.135	1241.748	708.387
350	14.0	1964.020	1278.270	685.750
360	14.0	1977.582	1314.792	662.790
370	14.0	1990.839	1351.314	639.525
380	13.0	2003.804	1387.836	615.968
390	13.0	2016.491	1424.358	592.133
400	13.0	2028.914	1460.880	568.034
410	13.0	2041.084	1497.402	543.682
420	12.0	2053.013	1533.924	519.089
430	12.0	2064.710	1570.446	494.264
440	12.0	2076.186	1606.968	469.218
450	12.0	2087.449	1643.490	443.959
460	12.0	2098.508	1680.012	418.496
470	11.0	2109.372	1716.534	392.838
480	11.0	2120.047	1753.056	366.991
490	11.0	2130.540	1789.578	340.962
500	11.0	2140.860	1826.100	314.760
510	11.0	2151.010	1862.622	288.388
520	11.0	2160.999	1899.144	261.855
530	10.0	2170.830	1935.666	235.164
540	10.0	2180.510	1972.188	208.322
550	10.0	2190.044	2008.710	181.334
560	10.0	2199.436	2045.232	154.204
570	10.0	2208.691	2081.754	126.938
580	10.0	2217.814	2118.276	99.538
590	10.0	2226.808	2154.798	72.010
600	10.0	2235.677	2191.320	44.357

Storage volume (m^3) = 1046.7 m^3

MasterDrain SW	**The LK Group** www.thel grou .com	ton Business ar ton ill Road Radcliff 26 2 S Tel 0161 763 7200 email m. ones thel grou .com	Job No. Sheet no. 3 Date 28/09/16
	Project **North section 100yr event +40%**		By / Checked / Reviewed
	Title **Peak flow storage calcs for Hayling Island centre**		







MasterDrain SW	**The LK Group** www.thel grou .com	ton Business ar ton ill Road Radcliff 26 2 S Tel 0161 763 7200 email m. ones thel grou .com	Job No. Sheet no. 1 Date 28/09/16
	Project: Southern section 30yr event		By / Checked / Reviewed
	Title: Peak flow storage calcs for Hayling Island centre		

Data:-

FSR Hydrology:-

Location	= Hayling Island centre	Grid reference	= SZ7199
M5-60 (mm)	= 18	r	= 0.35
Soil index	= 0.40	SAAR (mm/yr)	= 700
Return period	= 30	WRAPx	= 3
UCWI	= 72.7		

i) Relatively impermeable soils in boulder and sedimentary clays, and in alluvium, especially in eastern England;
ii) Permeable soils with shallow ground water in low-lying areas;
iii) Mixed areas of permeable and impermeable soils, in approximately equal proportions.

Runoff factor (RF) = 30.0, calculated from:-

Runoff factor = (0.829*PIMP)+(25*SOIL)+(0.078*UCWI)-20.7
where
PIMP = Impervious Area*100/(Impervious Area+Pervious Area)
UCWI = Calculated value for Wetness Index

Design data:-

Imperv. area	= 20570 m²	Pervious area	= 28300 m²
Total area (TA)	= 48870 m²	Equiv area	= 14661 m² (TA x RF).
Allowed discharge rate	= 35.660 l/s	Areal reduction factor	= 1.000
Additional flow	= 0.00 l/s	Climate change factor	= 0

Calculated data:-

Time to max	= 89.0 mins	Calculated storage volume	= 422.8 m³
Rainfall at max	= 21.15 mm/hr	Allowed discharge rate	= 35.660 l/s
Pipeline storage	= 0.0 m³	Available MH storage	= 0.0 m³
Offline storage	= 0.0 m³		

Fixed 6 hour data:-

Rainfall event	= 6 hours	Calculated storage volume	= 134.5 m³
Rainfall rate	= 8.00 mm/hr	Allowed discharge rate	= 35.660 l/s

Rainfall intensities calculated using the Wallingford Procedure

Storage lengths for initial calculation (x 1.1, 1.2, 1.3 or 1.5 as above if required) :-

Diam	Len	Diam	Len	Ovoid	Len	Box culvert	Len
100	53847.4	1125	425.5	400 x 600	2349.1	500 x 500	1691.3
150	23932.2	1200	373.9	600 x 900	1022.8	500 x 750	1127.6
225	10636.5	1275	331.2	800 x 1200	575.3	500 x 1000	845.7
300	5983.0	1350	295.5			750 x 1000	563.8
375	3829.2	1425	265.2			750 x 1200	469.8
450	2659.1	1500	239.3			750 x 1500	375.9
525	1953.6	1575	217.1			1000 x 1000	422.8
600	1495.8	1650	197.8			1000 x 1200	352.4
675	1181.8	1725	181.0			1000 x 1500	281.9
750	957.3	1800	166.2			1000 x 1800	234.9
825	791.1	1875	153.2			1000 x 2000	211.4
900	664.8	1950	141.6			1500 x 1500	187.9
975	566.4	2025	131.3			1500 x 1800	156.6
1050	488.4	2100	122.1			1500 x 2000	140.9

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Job No.		
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Date 28/09/16		
By	Checked	Reviewed

MasterDrain SW

Project: Southern section 30yr event

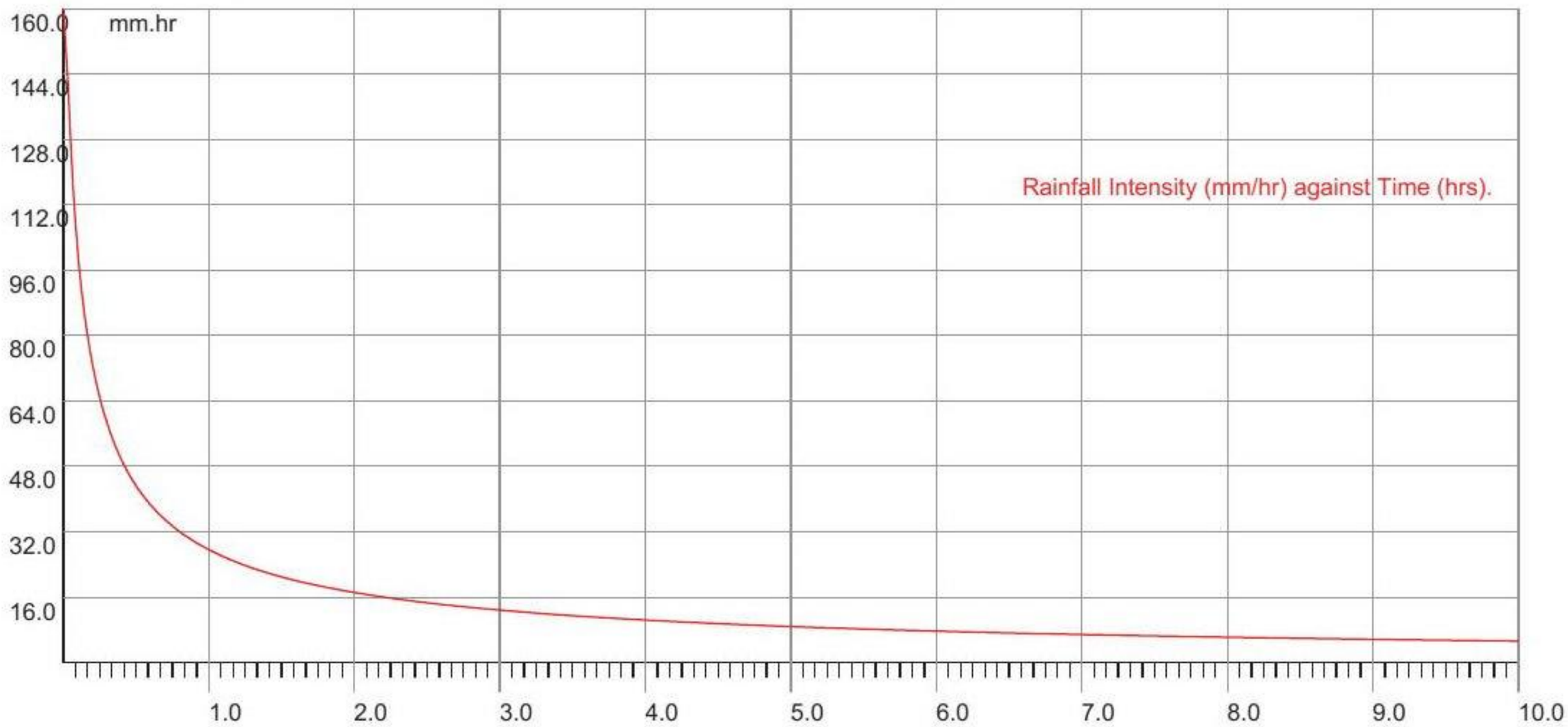
Title: Peak flow storage calcs for Hayling Island centre

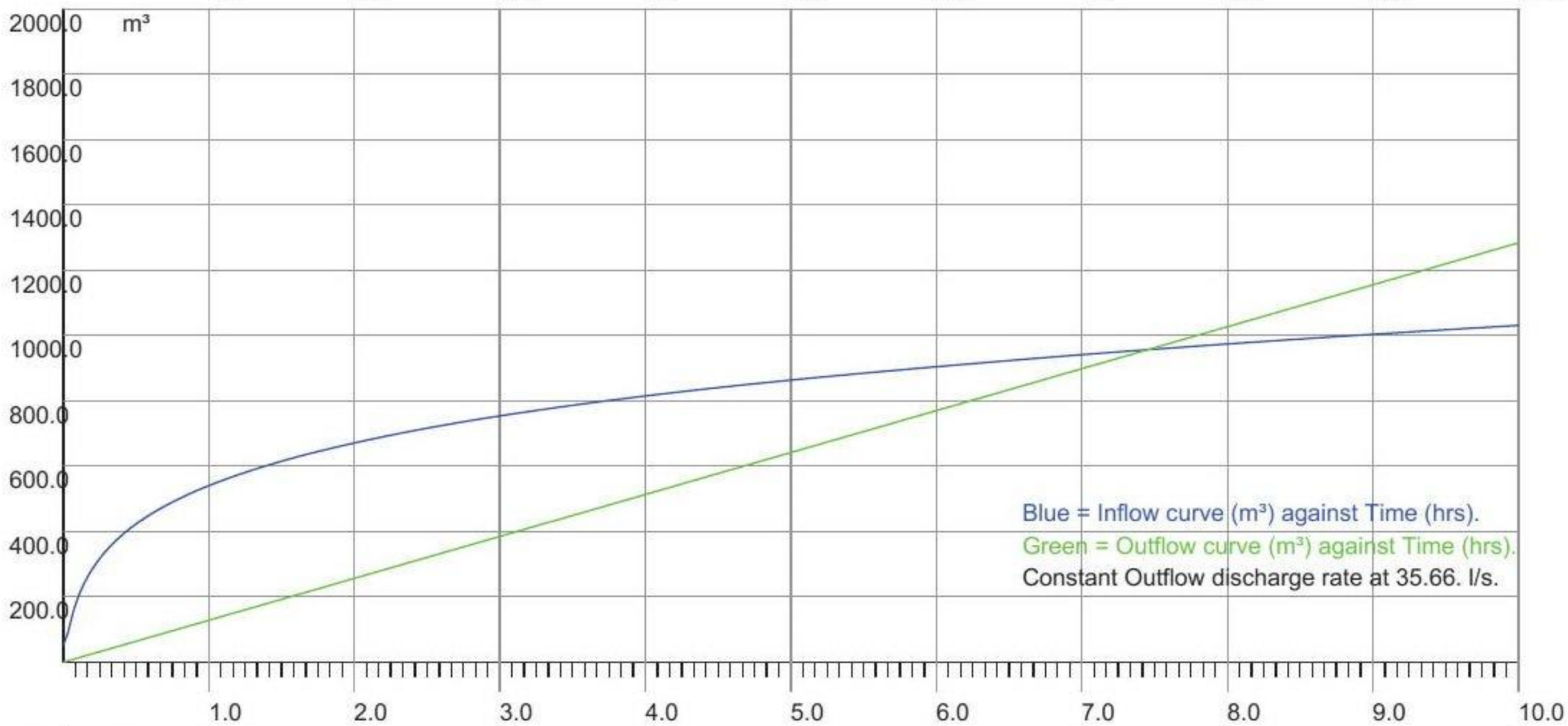
Data:-

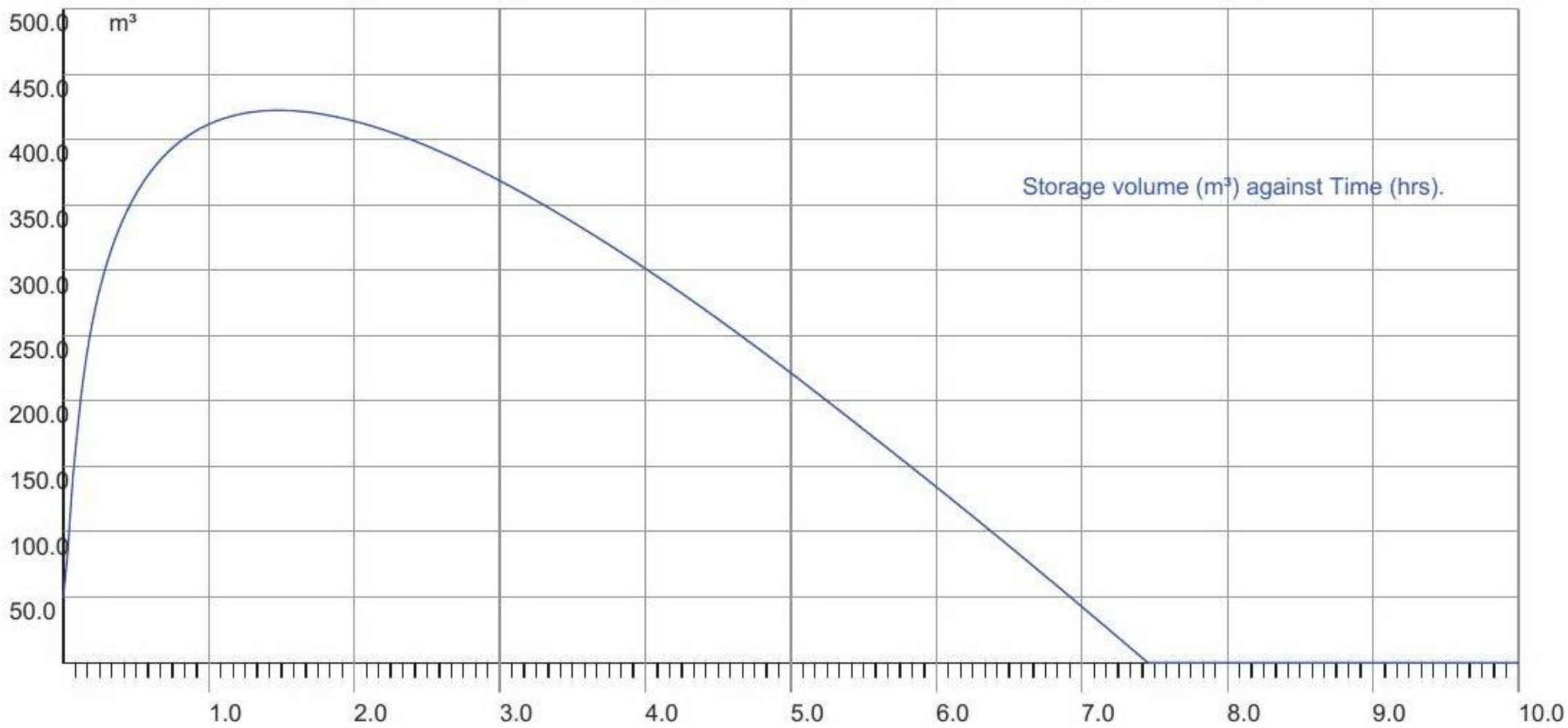
Time (mins)	Rain mm/hr	Inflow (m3)	Outflow (m3)	Balance (m3)
10	80.0	260.628	21.396	239.232
20	55.0	360.049	42.792	317.257
30	43.0	423.141	64.188	358.953
40	36.0	470.349	85.584	384.765
50	31.0	508.442	106.980	401.462
60	28.0	540.568	128.376	412.192
70	25.0	568.457	149.772	418.685
80	23.0	593.165	171.168	421.997
90	21.0	615.387	192.564	422.823
100	20.0	635.605	213.960	421.645
110	18.0	654.172	235.356	418.816
120	17.0	671.348	256.752	414.596
130	16.0	687.338	278.148	409.190
140	15.0	702.300	299.544	402.756
150	15.0	716.362	320.940	395.422
160	14.0	729.630	342.336	387.294
170	13.0	742.191	363.732	378.459
180	13.0	754.116	385.128	368.988
190	12.0	765.468	406.524	358.944
200	12.0	776.300	427.920	348.380
210	11.0	786.656	449.316	337.340
220	11.0	796.577	470.712	325.865
230	11.0	806.096	492.108	313.988
240	10.0	815.245	513.504	301.741
250	10.0	824.050	534.900	289.150
260	10.0	832.535	556.296	276.239
270	10.0	840.723	577.692	263.031
280	9.0	848.632	599.088	249.544
290	9.0	856.279	620.484	235.795
300	9.0	863.680	641.880	221.800
310	9.0	870.850	663.276	207.574
320	8.0	877.802	684.672	193.130
330	8.0	884.548	706.068	178.480
340	8.0	891.488	727.464	164.024
350	8.0	898.219	748.860	149.359
360	8.0	904.799	770.256	134.543
370	8.0	911.236	791.652	119.584
380	7.0	917.537	813.048	104.489
390	7.0	923.708	834.444	89.264
400	7.0	929.755	855.840	73.915
410	7.0	935.685	877.236	58.449
420	7.0	941.500	898.632	42.868
430	7.0	947.208	920.028	27.180
440	7.0	952.811	941.424	11.387
450	7.0	958.315	962.820	0.000
460	6.0	963.724	984.216	0.000
470	6.0	969.040	1005.612	0.000
480	6.0	974.267	1027.008	0.000
490	6.0	979.410	1048.404	0.000
500	6.0	984.470	1069.800	0.000
510	6.0	989.451	1091.196	0.000
520	6.0	994.356	1112.592	0.000
530	6.0	999.187	1133.988	0.000
540	6.0	1003.946	1155.384	0.000
550	6.0	1008.636	1176.780	0.000
560	6.0	1013.259	1198.176	0.000
570	5.0	1017.818	1219.572	0.000
580	5.0	1022.315	1240.968	0.000
590	5.0	1026.750	1262.364	0.000
600	5.0	1031.127	1283.760	0.000

Storage volume (m^3) = 422.8 m^3

MasterDrain SW	**The LK Group** www.thel grou .com	ton Business ar ton ill Road Radcliff 26 2 S Tel 0161 763 7200 email m. ones thel grou .com	Job No. Sheet no. 3 Date 28/09/16
	Project: **Southern section 30yr event**		By / Checked / Reviewed
	Title: **Peak flow storage calcs for Hayling Island centre**		







MasterDrain SW	**The LK Group** www.thel grou .com	ton Business ar ton ill Road Radcliff 26 2 S Tel 0161 763 7200 email m. ones thel grou .com	Job No. Sheet no. 1 Date 28/09/16
	Project: Southern section 100yr event +20%		By / Checked / Reviewed
	Title: Peak flow storage calcs for Hayling Island centre		

Data:-

FSR Hydrology:-

Location	= Hayling Island centre	Grid reference	= SZ7199
M5-60 (mm)	= 18	r	= 0.35
Soil index	= 0.40	SAAR (mm/yr)	= 700
Return period	= 100	WRAPx	= 3
UCWI	= 72.7		

i) Relatively impermeable soils in boulder and sedimentary clays, and in alluvium, especially in eastern England;
ii) Permeable soils with shallow ground water in low-lying areas;
iii) Mixed areas of permeable and impermeable soils, in approximately equal proportions.

Runoff factor (RF) = 30.0, calculated from:-

Runoff factor = (0.829*PIMP)+(25*SOIL)+(0.078*UCWI)-20.7
where
PIMP = Impervious Area*100/(Impervious Area+Pervious Area)
UCWI = Calculated value for Wetness Index

Design data:-

Imperv. area	= 20570 m²	Pervious area	= 28300 m²
Total area (TA)	= 48870 m²	Equiv area	= 14661 m² (TA x RF).
Allowed discharge rate	= 50.370 l/s	Areal reduction factor	= 1.000
Additional flow	= 0.00 l/s	Climate change factor	= 20

Calculated data:-

Time to max	= 102.0 mins	Calculated storage volume	= 701.0 m³
Rainfall at max	= 30.37 mm/hr	Allowed discharge rate	= 50.370 l/s
Pipeline storage	= 0.0 m³	Available MH storage	= 0.0 m³
Offline storage	= 0.0 m³		

Fixed 6 hour data:-

Rainfall event	= 6 hours	Calculated storage volume	= 323.2 m³
Rainfall rate	= 12.00 mm/hr	Allowed discharge rate	= 50.370 l/s

Rainfall intensities calculated using the Wallingford Procedure

Storage lengths for initial calculation (x 1.1, 1.2, 1.3 or 1.5 as above if required) :-

Diam	Len	Diam	Len	Ovoid	Len	Box culvert	Len
100	89275.5	1125	705.4	400 x 600	3894.6	500 x 500	2804.1
150	39678.0	1200	620.0	600 x 900	1695.8	500 x 750	1869.4
225	17634.7	1275	549.2	800 x 1200	953.7	500 x 1000	1402.1
300	9919.5	1350	489.9			750 x 1000	934.7
375	6348.5	1425	439.6			750 x 1200	778.9
450	4408.7	1500	396.8			750 x 1500	623.1
525	3239.0	1575	359.9			1000 x 1000	701.0
600	2479.9	1650	327.9			1000 x 1200	584.2
675	1959.4	1725	300.0			1000 x 1500	467.4
750	1587.1	1800	275.5			1000 x 1800	389.5
825	1311.7	1875	253.9			1000 x 2000	350.5
900	1102.2	1950	234.8			1500 x 1500	311.6
975	939.1	2025	217.7			1500 x 1800	259.6
1050	809.8	2100	202.4			1500 x 2000	233.7

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Job No.		
Sheet no. 2		
Date 28/09/16		
By	Checked	Reviewed

MasterDrain SW

Project: Southern section 100yr event +20%

Title: Peak flow storage calcs for Hayling Island centre

Data:-

Time (mins)	Rain mm/hr	Inflow (m3)	Outflow (m3)	Balance (m3)
10	123.0	400.073	30.222	369.851
20	86.0	560.120	60.444	499.676
30	68.0	661.921	90.666	571.255
40	57.0	738.181	120.888	617.293
50	49.0	799.649	151.110	648.539
60	44.0	851.375	181.332	670.043
70	39.0	896.149	211.554	684.595
80	36.0	935.684	241.776	693.908
90	33.0	971.113	271.998	699.115
100	31.0	1003.223	302.220	701.003
110	29.0	1032.591	332.442	700.149
120	27.0	1059.648	362.664	696.984
130	26.0	1084.728	392.886	691.842
140	24.0	1108.095	423.108	684.987
150	23.0	1129.960	453.330	676.630
160	22.0	1150.498	483.552	666.946
170	21.0	1169.853	513.774	656.079
180	20.0	1188.144	543.996	644.148
190	19.0	1205.476	574.218	631.258
200	19.0	1221.936	604.440	617.496
210	18.0	1237.599	634.662	602.937
220	17.0	1252.532	664.884	587.648
230	17.0	1266.793	695.106	571.687
240	16.0	1280.433	725.328	555.105
250	16.0	1293.496	755.550	537.946
260	15.0	1306.024	785.772	520.252
270	15.0	1318.052	815.994	502.058
280	15.0	1329.613	846.216	483.397
290	14.0	1340.735	876.438	464.297
300	14.0	1351.447	906.660	444.787
310	13.0	1361.771	936.882	424.889
320	13.0	1371.730	967.104	404.626
330	13.0	1381.344	997.326	384.018
340	13.0	1391.625	1027.548	364.077
350	12.0	1401.533	1057.770	343.763
360	12.0	1411.211	1087.992	323.219
370	12.0	1420.671	1118.214	302.457
380	12.0	1429.923	1148.436	281.487
390	11.0	1438.977	1178.658	260.319
400	11.0	1447.842	1208.880	238.962
410	11.0	1456.527	1239.102	217.425
420	11.0	1465.039	1269.324	195.715
430	11.0	1473.386	1299.546	173.840
440	10.0	1481.575	1329.768	151.807
450	10.0	1489.613	1359.990	129.623
460	10.0	1497.505	1390.212	107.293
470	10.0	1505.257	1420.434	84.823
480	10.0	1512.875	1450.656	62.219
490	10.0	1520.363	1480.878	39.485
500	9.0	1527.727	1511.100	16.627
510	9.0	1534.970	1541.322	0.000
520	9.0	1542.098	1571.544	0.000
530	9.0	1549.114	1601.766	0.000
540	9.0	1556.021	1631.988	0.000
550	9.0	1562.825	1662.210	0.000
560	9.0	1569.527	1692.432	0.000
570	8.0	1576.132	1722.654	0.000
580	8.0	1582.642	1752.876	0.000
590	8.0	1589.060	1783.098	0.000
600	8.0	1595.389	1813.320	0.000

Storage volume (m^3) = 701.0 m^3

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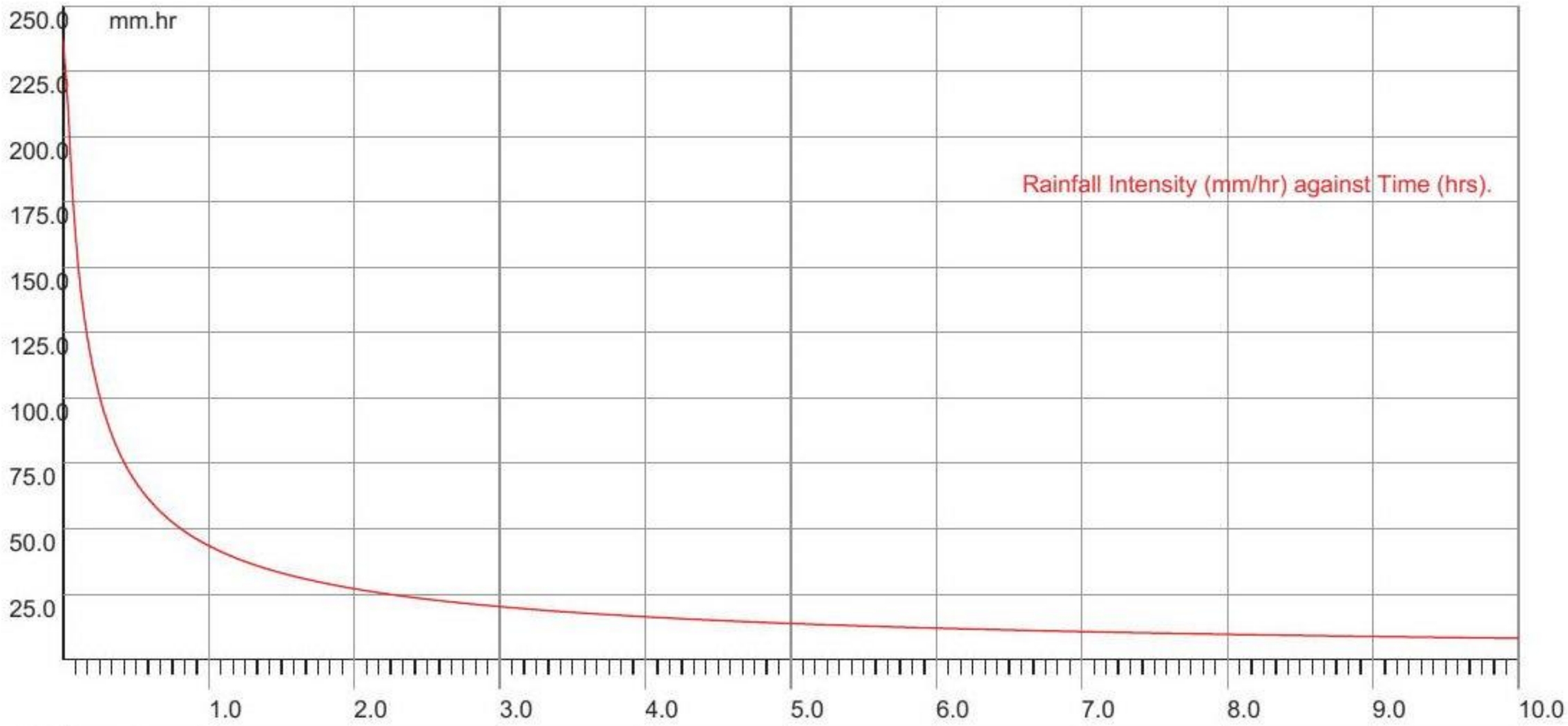
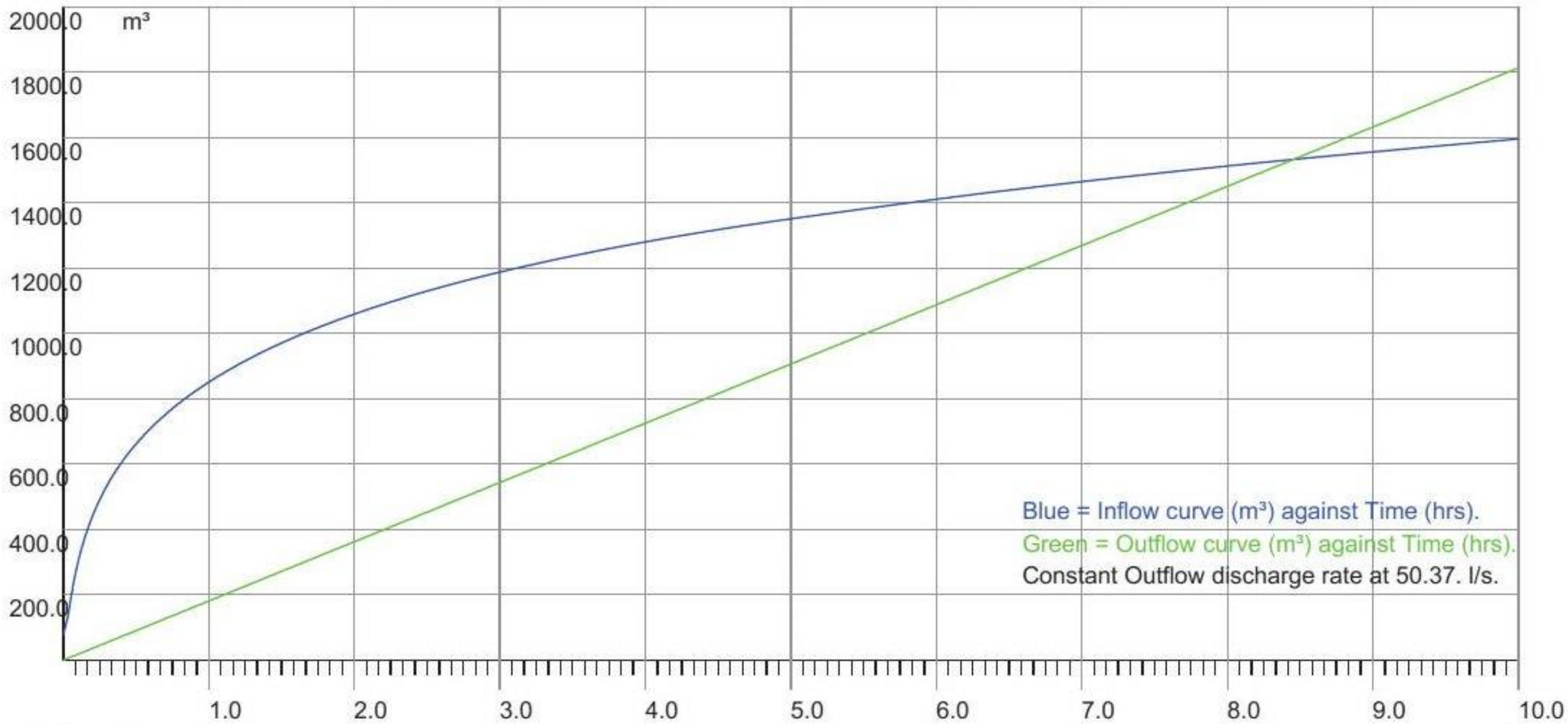
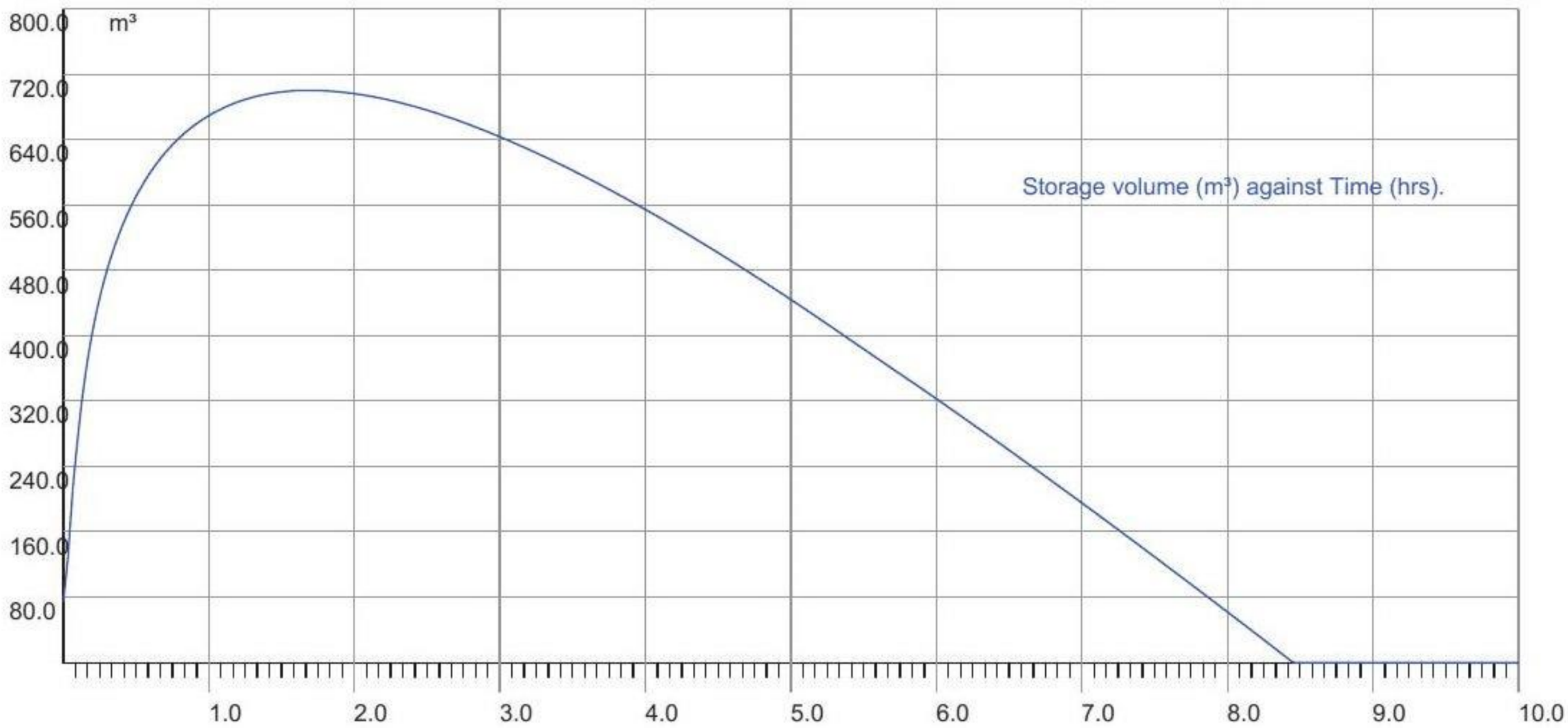
	Project: **Southern section 100yr event +20%**		By / Checked / Reviewed
	Title: **Peak flow storage calcs for Hayling Island centre**		







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www.thel grou .com		Sheet no. 1		
		Date 28/09/16		
MasterDrain SW	Project Southern section 100yr event +40%	By	Checked	Reviewed
	Title Peak flow storage calcs for Hayling Island centre			

Data:-

FSR Hydrology:-

Location	= Hayling Island centre	Grid reference	= SZ7199
M5-60 (mm)	= 18	r	= 0.35
Soil index	= 0.40	SAAR (mm/yr)	= 700
Return period	= 100	WRAPx	= 3
UCWI	= 72.7		

i) Relatively impermeable soils in boulder and sedimentary clays, and in alluvium, especially in eastern England;
ii) Permeable soils with shallow ground water in low-lying areas;
iii) Mixed areas of permeable and impermeable soils, in approximately equal proportions.

Runoff factor (RF) = 30.0, calculated from:-

Runoff factor = (0.829*PIMP)+(25*SOIL)+(0.078*UCWI)-20.7
where
PIMP = Impervious Area*100/(Impervious Area+Pervious Area)
UCWI = Calculated value for Wetness Index

Design data:-

Imperv. area	= 20570 m²	Pervious area	= 28300 m²
Total area (TA)	= 48870 m²	Equiv area	= 14661 m² (TA x RF).
Allowed discharge rate	= 50.370 l/s	Areal reduction factor	= 1.000
Additional flow	= 0.00 l/s	Climate change factor	= 40

Calculated data:-

Time to max	= 121.0 mins	Calculated storage volume	= 873.6 m³
Rainfall at max	= 31.44 mm/hr	Allowed discharge rate	= 50.370 l/s
Pipeline storage	= 0.0 m³	Available MH storage	= 0.0 m³
Offline storage	= 0.0 m³		

Fixed 6 hour data:-

Rainfall event	= 6 hours	Calculated storage volume	= 558.4 m³
Rainfall rate	= 14.00 mm/hr	Allowed discharge rate	= 50.370 l/s

Rainfall intensities calculated using the Wallingford Procedure

Storage lengths for initial calculation (x 1.1, 1.2, 1.3 or 1.5 as above if required) :-

Diam	Len	Diam	Len	Ovoid	Len	Box culvert	Len
100	111250.5	1125	879.0	400 x 600	4853.3	500 x 500	3494.4
150	49444.7	1200	772.6	600 x 900	2113.2	500 x 750	2329.6
225	21975.4	1275	684.4	800 x 1200	1188.5	500 x 1000	1747.2
300	12361.2	1350	610.4			750 x 1000	1164.8
375	7911.1	1425	547.9			750 x 1200	970.7
450	5493.9	1500	494.4			750 x 1500	776.5
525	4036.3	1575	448.5			1000 x 1000	873.6
600	3090.3	1650	408.6			1000 x 1200	728.0
675	2441.7	1725	373.9			1000 x 1500	582.4
750	1977.8	1800	343.4			1000 x 1800	485.3
825	1634.5	1875	316.4			1000 x 2000	436.8
900	1373.5	1950	292.6			1500 x 1500	388.3
975	1170.3	2025	271.3			1500 x 1800	323.6
1050	1009.1	2100	252.3			1500 x 2000	291.2

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		Date 28/09/16		
Project Southern section 100yr event +40%		By	Checked	Reviewed
Title Peak flow storage calcs for Hayling Island centre				

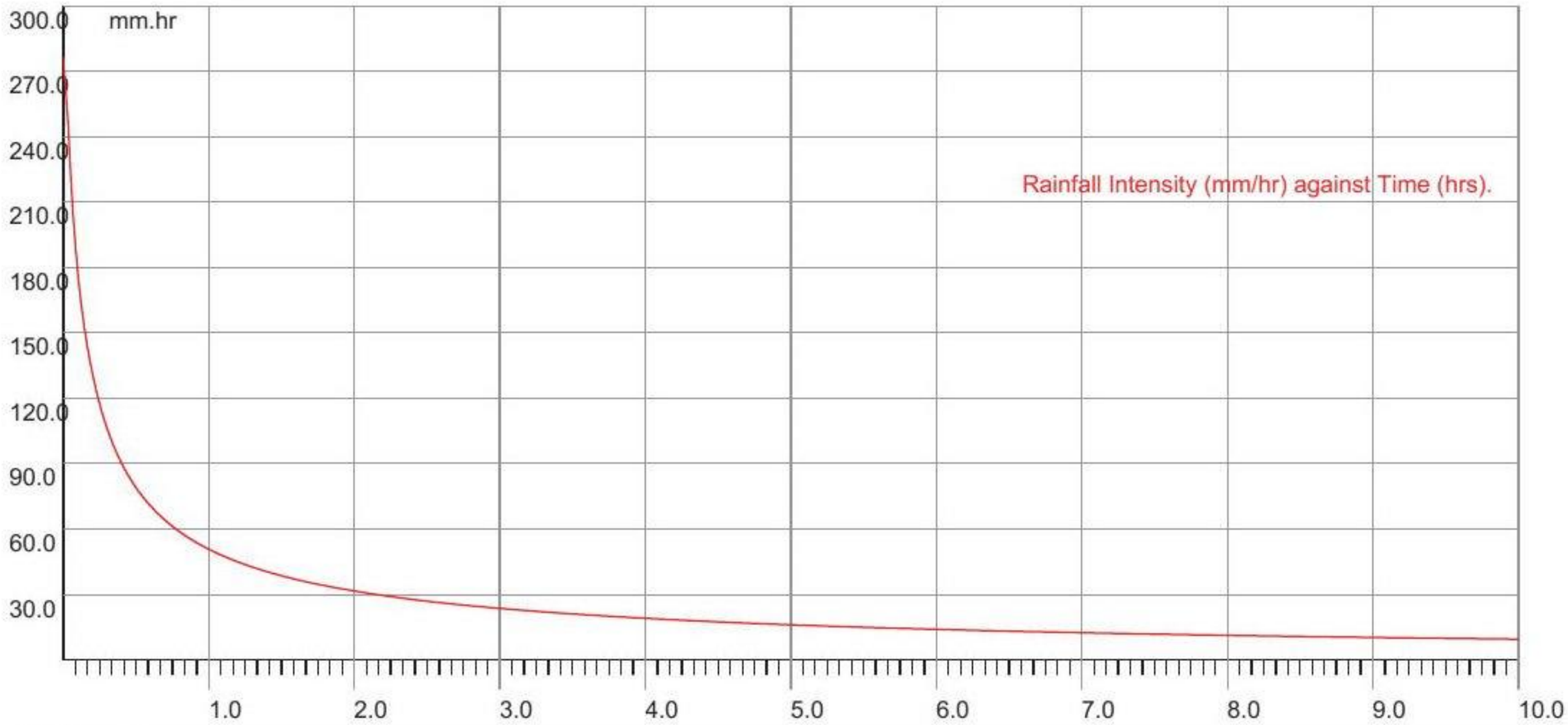
MasterDrain SW

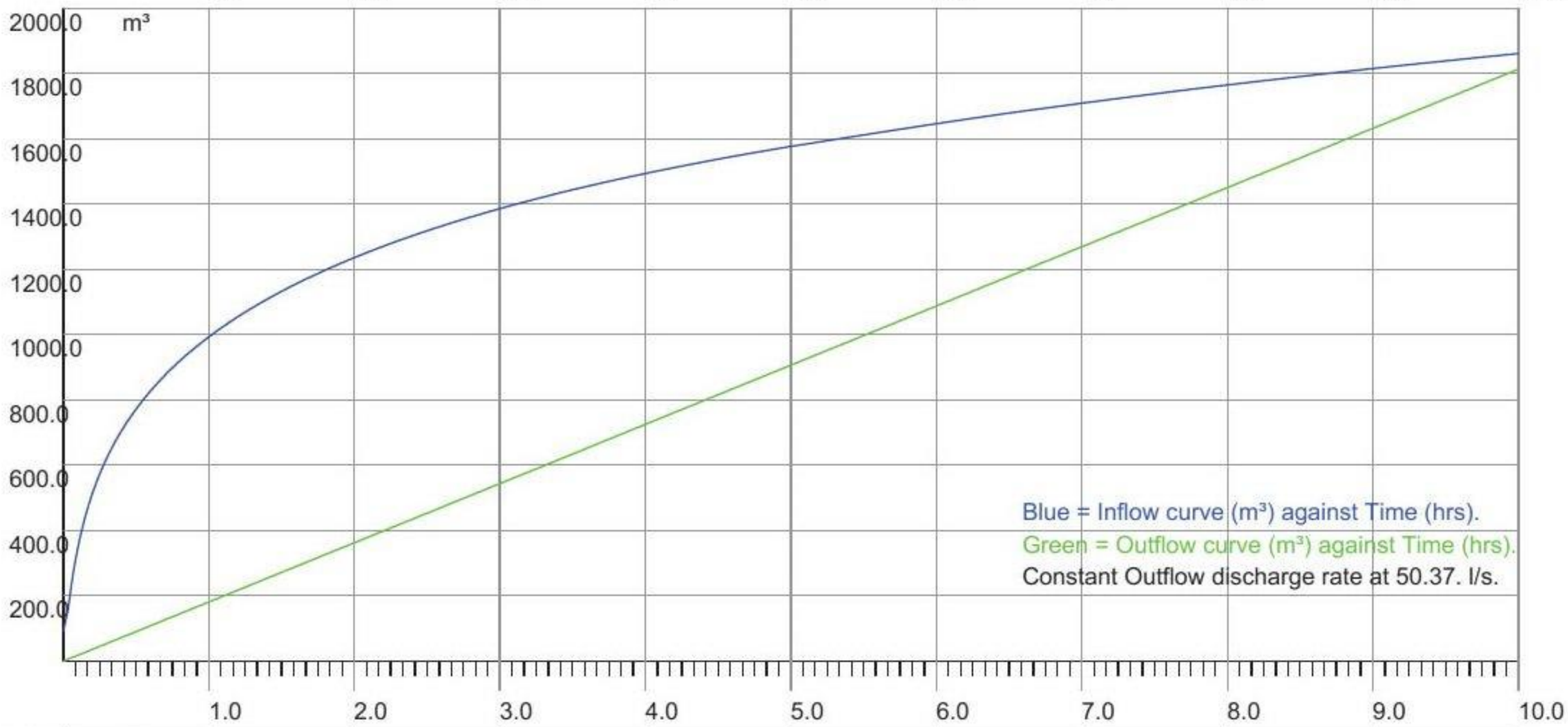
Data:-

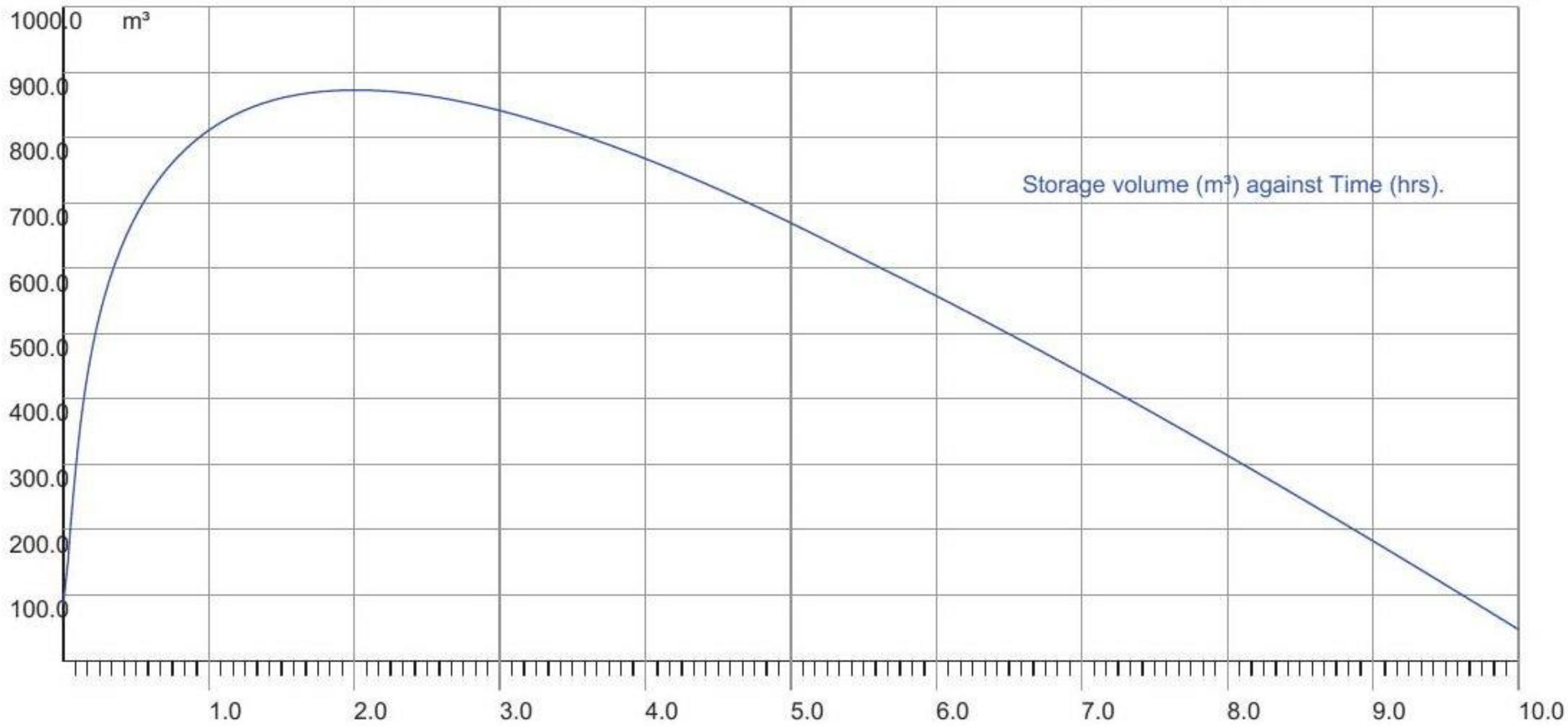
Time (mins)	Rain mm/hr	Inflow (m3)	Outflow (m3)	Balance (m3)
10	143.0	466.752	30.222	436.530
20	100.0	653.474	60.444	593.030
30	79.0	772.241	90.666	681.575
40	66.0	861.211	120.888	740.323
50	57.0	932.924	151.110	781.814
60	51.0	993.271	181.332	811.939
70	46.0	1045.507	211.554	833.953
80	42.0	1091.632	241.776	849.856
90	39.0	1132.965	271.998	860.967
100	36.0	1170.427	302.220	868.207
110	34.0	1204.690	332.442	872.248
120	32.0	1236.256	362.664	873.592
130	30.0	1265.516	392.886	872.630
140	28.0	1292.778	423.108	869.670
150	27.0	1318.287	453.330	864.957
160	26.0	1342.248	483.552	858.696
170	25.0	1364.828	513.774	851.054
180	24.0	1386.168	543.996	842.172
190	23.0	1406.389	574.218	832.171
200	22.0	1425.592	604.440	821.152
210	21.0	1443.865	634.662	809.203
220	20.0	1461.287	664.884	796.403
230	20.0	1477.925	695.106	782.819
240	19.0	1493.838	725.328	768.510
250	19.0	1509.079	755.550	753.529
260	18.0	1523.694	785.772	737.922
270	17.0	1537.727	815.994	721.733
280	17.0	1551.215	846.216	704.999
290	17.0	1564.191	876.438	687.753
300	16.0	1576.688	906.660	670.028
310	16.0	1588.733	936.882	651.851
320	15.0	1600.351	967.104	633.247
330	15.0	1611.567	997.326	614.241
340	15.0	1623.562	1027.548	596.014
350	14.0	1635.122	1057.770	577.352
360	14.0	1646.413	1087.992	558.421
370	14.0	1657.450	1118.214	539.236
380	13.0	1668.244	1148.436	519.807
390	13.0	1678.806	1178.658	500.148
400	13.0	1689.149	1208.880	480.269
410	13.0	1699.281	1239.102	460.179
420	12.0	1709.212	1269.324	439.888
430	12.0	1718.950	1299.546	419.404
440	12.0	1728.504	1329.768	398.736
450	12.0	1737.881	1359.990	377.891
460	12.0	1747.089	1390.212	356.877
470	11.0	1756.133	1420.434	335.699
480	11.0	1765.020	1450.656	314.364
490	11.0	1773.757	1480.878	292.879
500	11.0	1782.348	1511.100	271.248
510	11.0	1790.798	1541.322	249.476
520	11.0	1799.114	1571.544	227.570
530	10.0	1807.300	1601.766	205.534
540	10.0	1815.358	1631.988	183.370
550	10.0	1823.295	1662.210	161.085
560	10.0	1831.115	1692.432	138.683
570	10.0	1838.820	1722.654	116.166
580	10.0	1846.415	1752.876	93.539
590	10.0	1853.903	1783.098	70.805
600	10.0	1861.287	1813.320	47.967

Storage volume (m^3) = 873.6 m^3

MasterDrain SW	**The LK Group** www.thel grou .com	ton Business ar ton ill Road Radcliff 26 2 S Tel 0161 763 7200 email m. ones thel grou .com	Job No. Sheet no. 3 Date 28/09/16
	Project **Southern section 100yr event +40%**		By / Checked / Reviewed
	Title **Peak flow storage calcs for Hayling Island centre**		







lanatory notes for ea low Storage

1) This system uses the rainfall intensity/ duration curve calculated using either the allingford or method as selected.
2) The alance is calculated from the inflow minus the outflow.
3) The storage volume is the ma imum value of the alance curve.
4) This method was descri ed y avis (1963) see Butler avies 2nd edition 294
5) References to storm duration relate only to the hydrogra h method (v).
6) There are always 600 ste s in the calculation rocess thus a run time of 10 hours will e sam led every minute

lanatory notes for ydrogra h Storage

1) The user has the choice of Summer or inter curves
2) The mean intensity varies with the duration of the storm curve
3) There are always 120 ste s in the calculation rocess irres ective of storm duration.
4) The alance is calculated from the inflow minus the outflow.
5) The storage volume is the sum of the alance values for each ste .
6) arying durations should e tried to find the ma imum storage value this can e narrowed down very closely.

odelling using the flow characteristics of the restrictor is availa le using orte Control modelling function.
lease e aware that this function needs the full design data file to function.

hy do the two methods give different results

The rainfall characteristics for each method are very different.

The ea flow (using the Intensity/ uration/ re uency curve) does not model the actual rainfall. This curve is oined oints which re resent the mean intensity of a storm at a given duration i.e. a value of 19.5 mm/hr for a 60 minute storm indicates that over the si ty minute eriod the mean intensity was 19.5 mm/hr. The calculation method sam les the I curve for a given location and fre uency (Return eriod) and calculates the storage for that rate and duration less the outflow volume. The ma imum value is dis layed as the worst case storage.

The hydrogra h method uses a standard curve for either inter or Summer storms. Traditionally these are symmetrical a out the central ea . rainfall does not fit into this convenient curve so the calculations are dealing with a stylised set of data. The mean intensity for the storm is calculated from the I curve and a lied to the curve data calculating the storage for that ste less the outflow volume. The final storage volume is the sum of the storage for all the ste s.

It can e seen that these two methods are very different and the user may have the choice of which result to use. This is not an e act science though is often treated as such y those that do not understand the rinci les of the calculations.

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APPENDIX F

INFILTRATION TESTING

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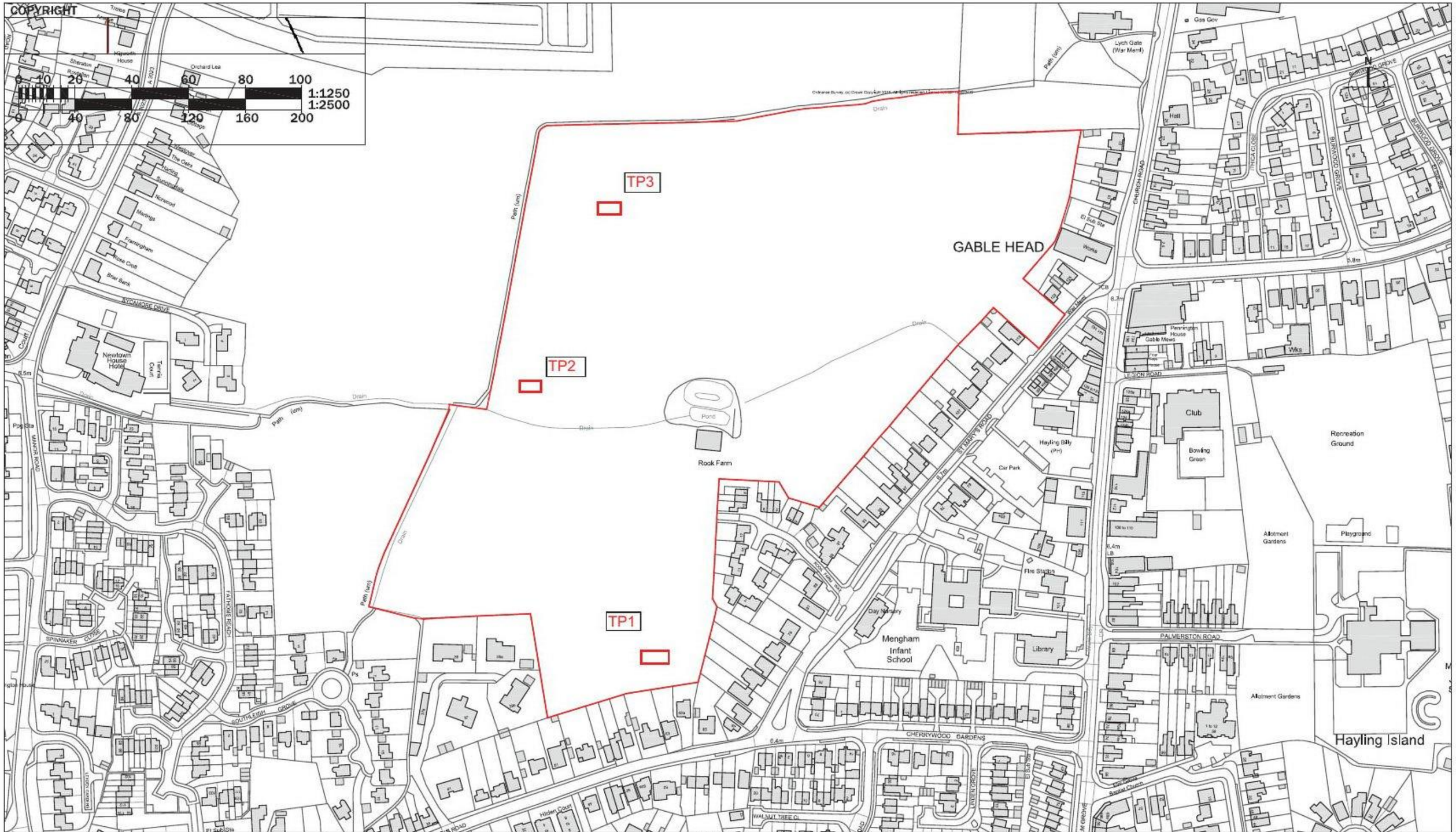

Rev	Date	By	Revision notes
*	*	*	*

Status

PRELIMINARY

Project

2016-026 St Mary's Road, Hayling Island

Title

LOCATION PLAN

Drawn by NL	Issue date 16-03-16
Title checked by *	Title checked date *
Highways checked by CHECKED_BY	Highways checked date CHECKED_DATE
Topo checked by CHECKED_BY	Topo checked date CHECKED_DATE

Scale(s)

NTS

Drawing No

2016-026-01

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LK CONSULT LTD Eton Business Park, Eton Hill Road, Radcliffe, M26 2ZS Tel: 0161 763 7200 web: www.thelkgroup.com	Site St Marys Road, Hayling Island	Borehole Number **WS101**

In Situ Permeability Type	Test No.	Ground Level (mOD)	Client	Job Number
Falling Head	1		Gladman Developments Ltd	LKC 16 1109
	Location	**Dates** 03-Nov-16	**Engineer** LKC	**Sheet** 1/7

Height of casing above ground level:	0.00 **m**
Depth to Base of Borehole:	3.00 **m bgl**
Depth to Base of Casing:	1.00 **m bgl**
Depth to equilibrium water level:	1.90 **m btoc**
Test Length L:	2.00 **m**
Diameter of Test Length D:	0.10 **m**
Area of Test Section:	0.0079 **m2**
Intake Factor F: (after condition D, figure 6, BS 5930)	3.4060

PERMEABILITY (after Hvorslev, 1951)

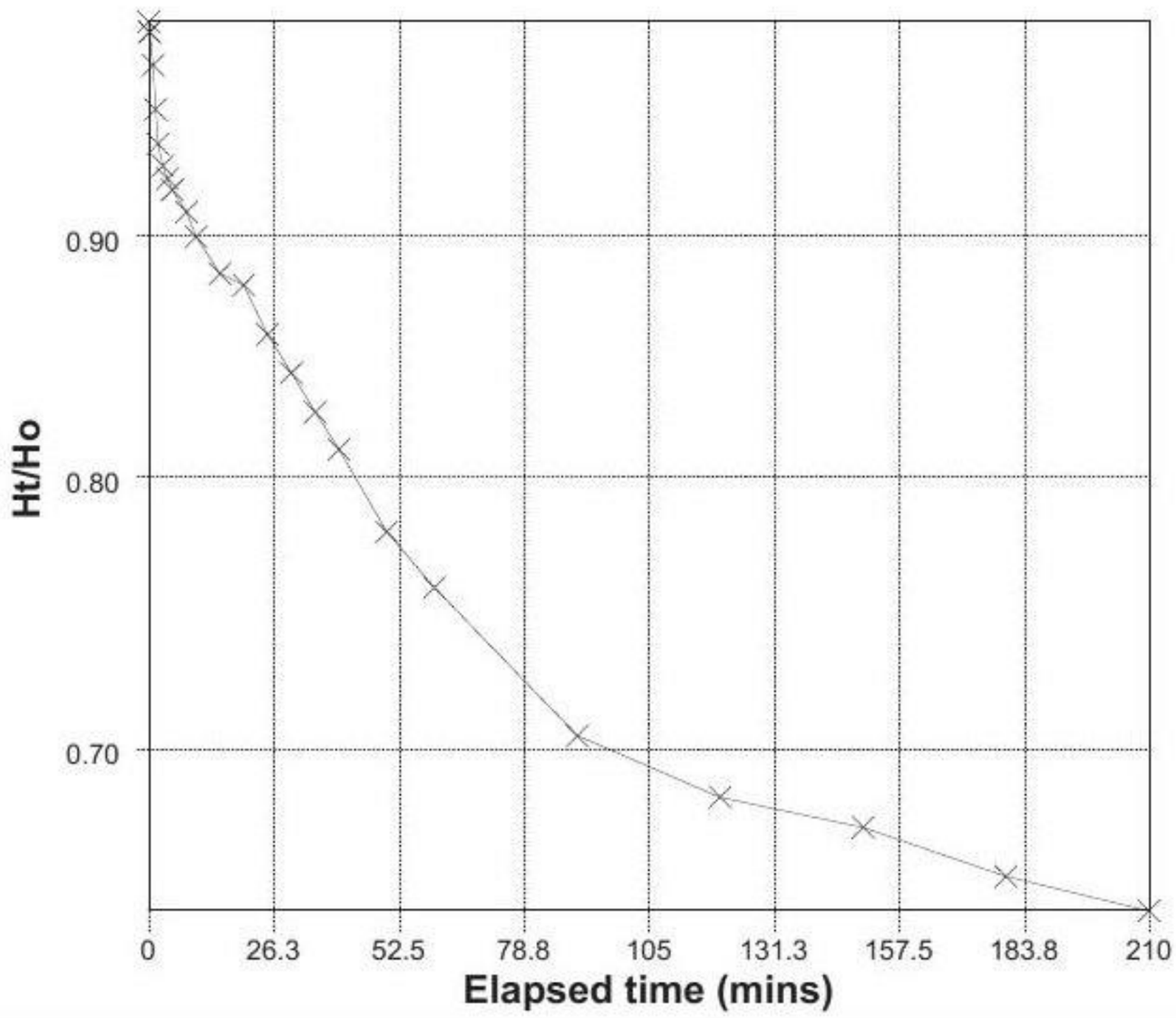
Basic Time Lag Analysis

The value T when Ht/Ho = 0.37 is the basic time lag, T

T =

k = **ms-1**

Elapsed time (mins)	Depth to water (m btoc)	Head of Water, H (m)	Ht / Ho
0.0	0.000	1.900	1.000
0.2	0.010	1.890	0.995
0.3	0.010	1.890	0.995
1.0	0.040	1.860	0.979
1.5	0.080	1.820	0.958
2.0	0.110	1.790	0.942
3.0	0.130	1.770	0.932
4.0	0.140	1.760	0.926
5.0	0.150	1.750	0.921
8.0	0.170	1.730	0.911
10.0	0.190	1.710	0.900
15.0	0.220	1.680	0.884
20.0	0.230	1.670	0.879
25.0	0.270	1.630	0.858
30.0	0.300	1.600	0.842
35.0	0.330	1.570	0.826
40.0	0.360	1.540	0.811
50.0	0.420	1.480	0.779
60.0	0.460	1.440	0.758
90.0	0.560	1.340	0.705
120.0	0.600	1.300	0.684
150.0	0.620	1.280	0.674
180.0	0.650	1.250	0.658
210.0	0.670	1.230	0.647



Remarks

Key: bgl = Below Ground Level btoc = Below Top of Casing

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LK CONSULT LTD Eton Business Park, Eton Hill Road, Radcliffe, M26 2ZS Tel: 0161 763 7200 web: www.thelkgroup.com	Site St Marys Road, Hayling Island	Borehole Number **WS102**

In Situ Permeability Type	Test No.	Ground Level (mOD)	Client	Job Number
Falling Head	1		Gladman Developments Ltd	LKC 16 1109
	Location	**Dates** 03-Nov-16	**Engineer** LKC	**Sheet** 2/7

Height of casing above ground level:	0.00 **m**
Depth to Base of Borehole:	3.00 **m bgl**
Depth to Base of Casing:	1.00 **m bgl**
Depth to equilibrium water level:	2.56 **m btoc**
Test Length L:	2.00 **m**
Diameter of Test Length D:	0.10 **m**
Area of Test Section:	0.0079 **m2**
Intake Factor F: (after condition D, figure 6, BS 5930)	3.4060

PERMEABILITY (after Hvorslev, 1951)

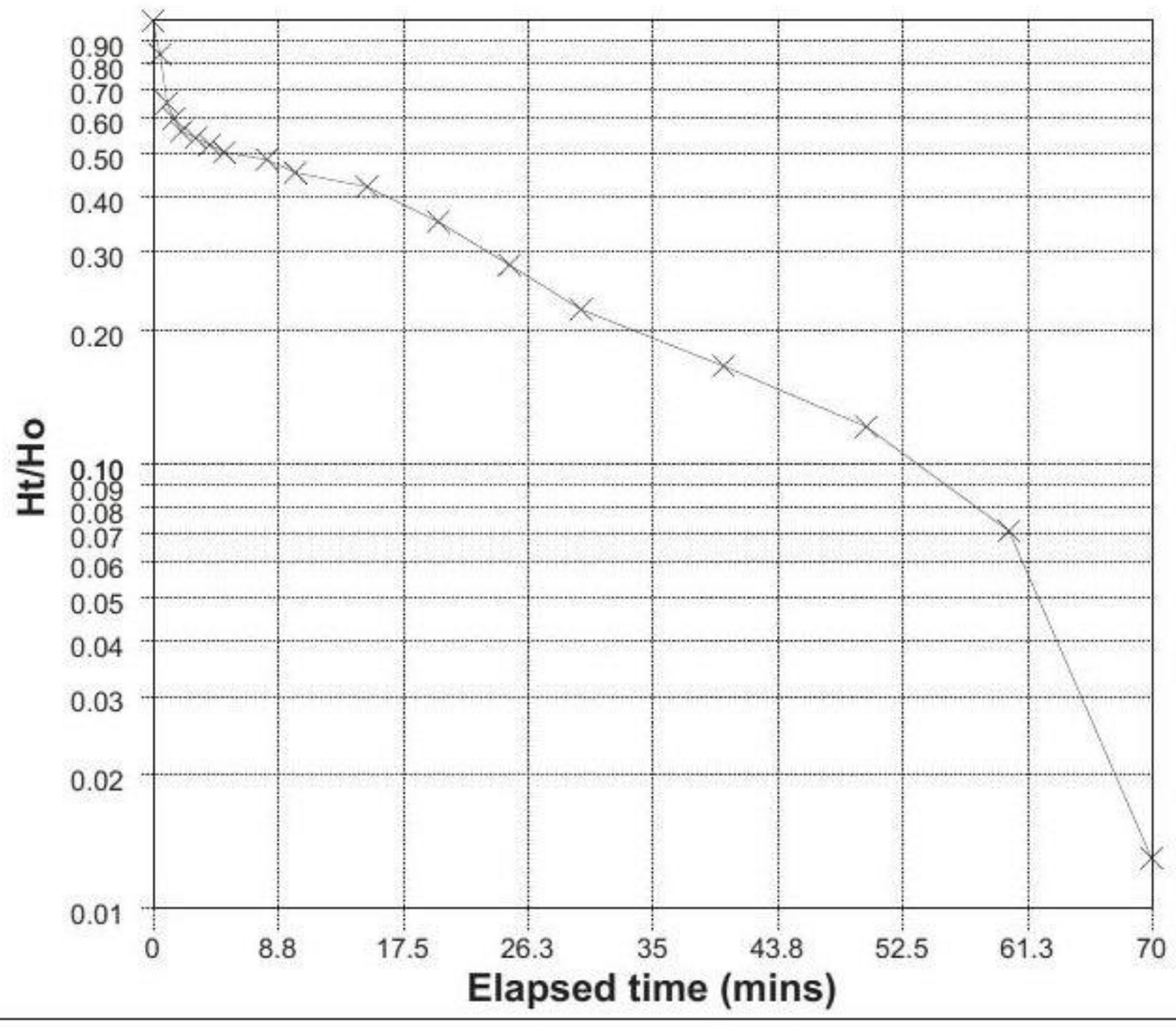
Basic Time Lag Analysis

The value T when Ht/Ho = 0.37 is the basic time lag, T

T = 18.79

k = 2.05E-06 **ms-1**

Elapsed time (mins)	Depth to water (m btoc)	Head of Water, H (m)	Ht / Ho
0.0	1.000	1.560	1.000
0.5	1.250	1.310	0.840
1.0	1.540	1.020	0.654
1.5	1.620	0.940	0.603
2.0	1.680	0.880	0.564
3.0	1.710	0.850	0.545
4.0	1.740	0.820	0.526
5.0	1.770	0.790	0.506
8.0	1.800	0.760	0.487
10.0	1.850	0.710	0.455
15.0	1.900	0.660	0.423
20.0	2.010	0.550	0.353
25.0	2.120	0.440	0.282
30.0	2.210	0.350	0.224
40.0	2.300	0.260	0.167
50.0	2.370	0.190	0.122
60.0	2.450	0.110	0.071
70.0	2.580	-0.020	0.013



Remarks

Key: bgl = Below Ground Level btoc = Below Top of Casing

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LK CONSULT LTD Eton Business Park, Eton Hill Road, Radcliffe, M26 2ZS Tel: 0161 763 7200 web: www.thelkgroup.com	Site St Marys Road, Hayling Island	Borehole Number **WS102**

In Situ Permeability Type	Test No.	Ground Level (mOD)	Client	Job Number
Falling Head	2		Gladman Developments Ltd	LKC 16 1109
	Location	**Dates** 03-Nov-16	**Engineer** LKC	**Sheet** 3/7

Height of casing above ground level:	0.00 **m**
Depth to Base of Borehole:	3.00 **m bgl**
Depth to Base of Casing:	1.00 **m bgl**
Depth to equilibrium water level:	2.56 **m btoc**
Test Length L:	2.00 **m**
Diameter of Test Length D:	0.10 **m**
Area of Test Section:	0.0079 **m2**
Intake Factor F: (after condition D, figure 6, BS 5930)	3.4060

PERMEABILITY (after Hvorslev, 1951)

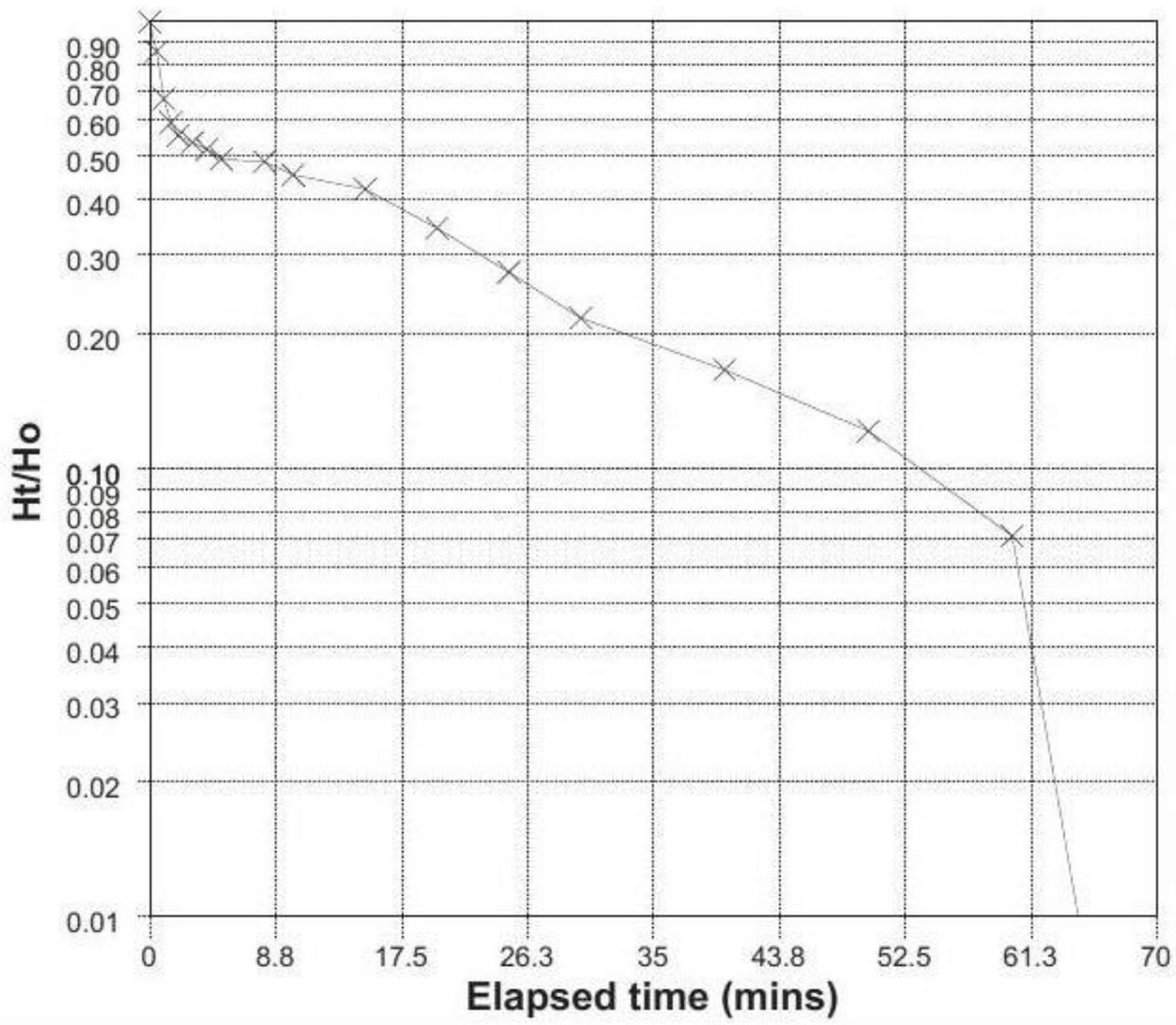
Basic Time Lag Analysis

The value T when Ht/Ho = 0.37 is the basic time lag, T

T = 18.44

k = 2.08E-06 **ms-1**

Elapsed time (mins)	Depth to water (m btoc)	Head of Water, H (m)	Ht / Ho
0.0	1.000	1.560	1.000
0.5	1.220	1.340	0.859
1.0	1.510	1.050	0.673
1.5	1.630	0.930	0.596
2.0	1.690	0.870	0.558
3.0	1.720	0.840	0.538
4.0	1.750	0.810	0.519
5.0	1.790	0.770	0.494
8.0	1.800	0.760	0.487
10.0	1.850	0.710	0.455
15.0	1.900	0.660	0.423
20.0	2.020	0.540	0.346
25.0	2.130	0.430	0.276
30.0	2.220	0.340	0.218
40.0	2.300	0.260	0.167
50.0	2.370	0.190	0.122
60.0	2.450	0.110	0.071
70.0	2.560	0.000	0.000



Remarks

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LK CONSULT LTD Eton Business Park, Eton Hill Road, Radcliffe, M26 2ZS Tel: 0161 763 7200 web: www.thelkgroup.com			Site St Marys Road, Hayling Island	Borehole Number **WS102**
In Situ Permeability Type Falling Head	**Test No.** 3	**Ground Level (mOD)**	**Client** Gladman Developments Ltd	**Job Number** LKC 16 1109
	Location	**Dates** 03-Nov-16	**Engineer** LKC	**Sheet** 4/7

Height of casing above ground level:	0.00	**m**
Depth to Base of Borehole:	3.00	**m bgl**
Depth to Base of Casing:	1.00	**m bgl**
Depth to equilibrium water level:	2.56	**m btoc**
Test Length L:	2.00	**m**
Diameter of Test Length D:	0.10	**m**
Area of Test Section:	0.0079	**m2**
Intake Factor F: (after condition D, figure 6, BS 5930)	3.4060	

PERMEABILITY (after Hvorslev, 1951)

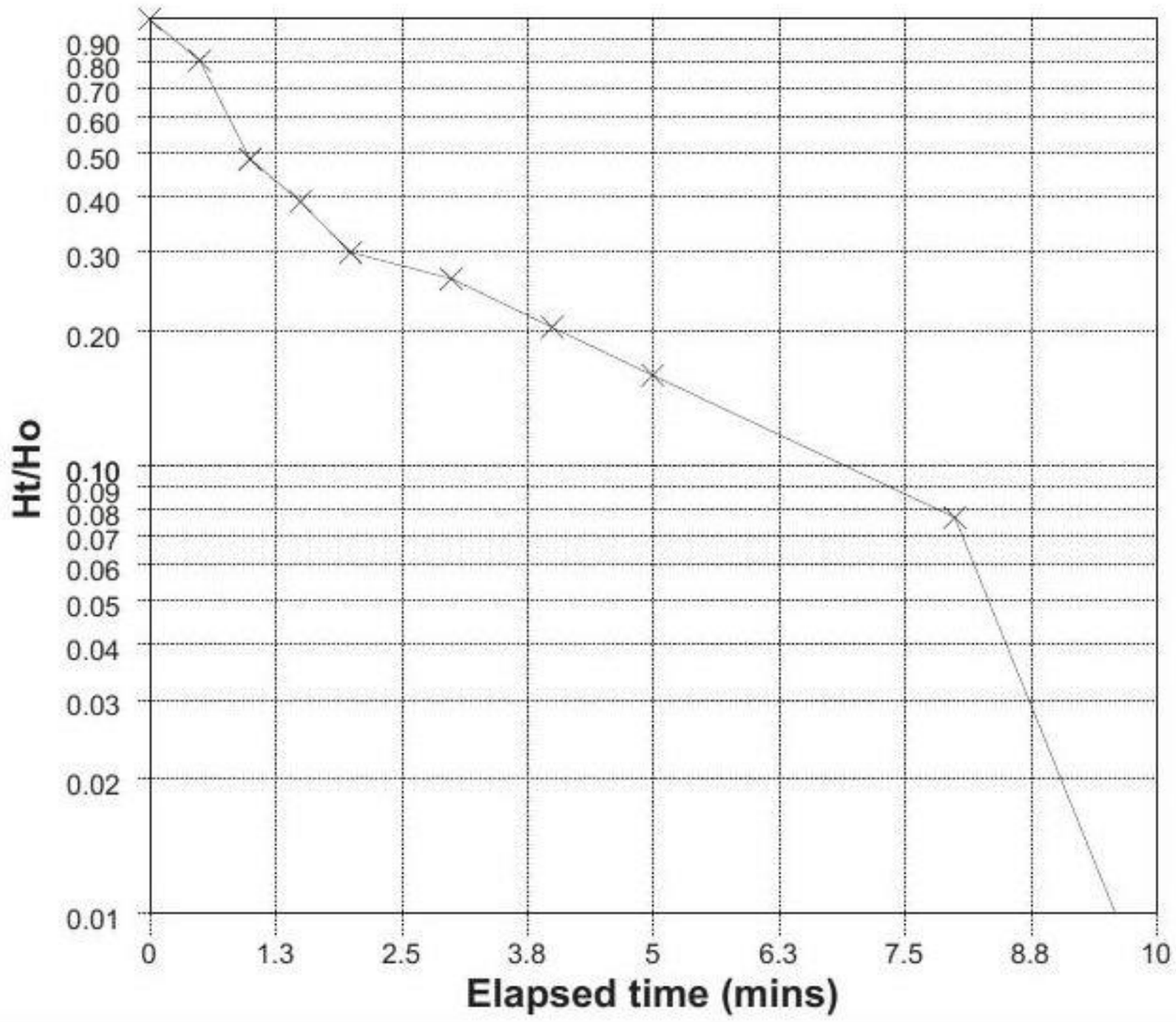
Basic Time Lag Analysis

The value T when Ht/Ho = 0.37 is the basic time lag, T

T = 1.62

k = 2.38E-05 **ms-1**

Elapsed time (mins)	Depth to water (m btoc)	Head of Water, H (m)	Ht / Ho
0.0	1.000	1.560	1.000
0.5	1.300	1.260	0.808
1.0	1.800	0.760	0.487
1.5	1.950	0.610	0.391
2.0	2.090	0.470	0.301
3.0	2.150	0.410	0.263
4.0	2.240	0.320	0.205
5.0	2.310	0.250	0.160
8.0	2.440	0.120	0.077
10.0	2.550	0.010	0.006



Remarks

Key: bgl = Below Ground Level btoc = Below Top of Casing

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In Situ Permeability Type	Test No.	Ground Level (mOD)	Client	Job Number
Falling Head	1		Gladman Developments Ltd	LKC 16 1109
	Location	**Dates** 03-Nov-16	**Engineer** LKC	**Sheet** 5/7

Height of casing above ground level:	0.00	**m**
Depth to Base of Borehole:	1.51	**m bgl**
Depth to Base of Casing:	1.00	**m bgl**
Depth to equilibrium water level:	1.51	**m btoc**
Test Length L:	0.51	**m**
Diameter of Test Length D:	0.10	**m**
Area of Test Section:	0.0079	**m2**
Intake Factor F: (after condition B, figure 6, BS 5930)	0.2750	

PERMEABILITY (after Hvorslev, 1951)

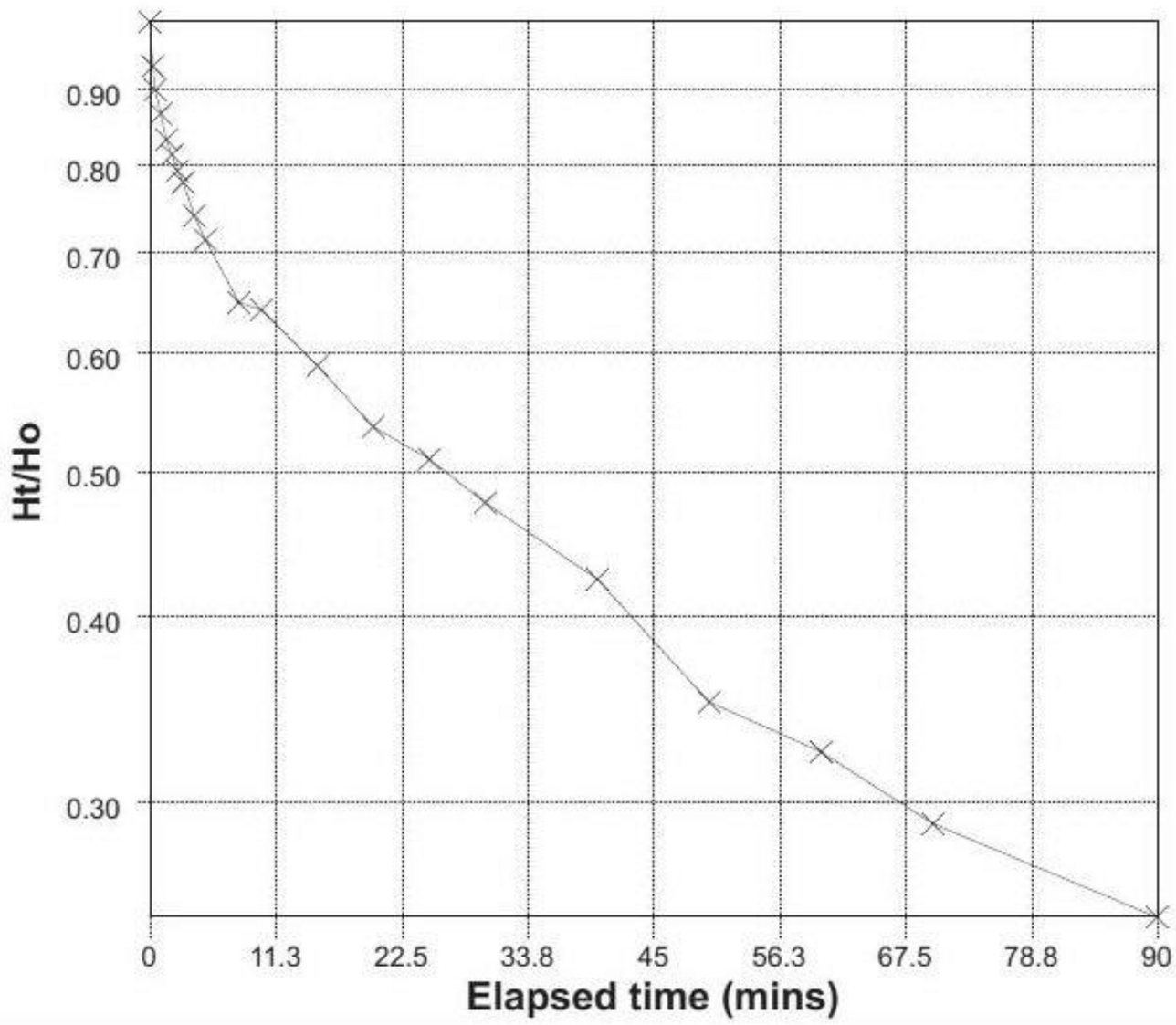
Basic Time Lag Analysis

The value T when Ht/Ho = 0.37 is the basic time lag, T

T = 47.40

k = 1.00E-05 **ms-1**

Elapsed time (mins)	Depth to water (m btoc)	Head of Water, H (m)	Ht / Ho
0.0	0.000	1.510	1.000
0.3	0.100	1.410	0.934
0.5	0.150	1.360	0.901
1.0	0.200	1.310	0.868
1.5	0.250	1.260	0.834
2.0	0.280	1.230	0.815
2.5	0.310	1.200	0.795
3.0	0.330	1.180	0.781
4.0	0.390	1.120	0.742
5.0	0.430	1.080	0.715
8.0	0.530	0.980	0.649
10.0	0.540	0.970	0.642
15.0	0.620	0.890	0.589
20.0	0.700	0.810	0.536
25.0	0.740	0.770	0.510
30.0	0.790	0.720	0.477
40.0	0.870	0.640	0.424
50.0	0.980	0.530	0.351
60.0	1.020	0.490	0.325
70.0	1.070	0.440	0.291
90.0	1.130	0.380	0.252



Remarks

Key: bgl = Below Ground Level btoc = Below Top of Casing

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LK CONSULT LTD Eton Business Park, Eton Hill Road, Radcliffe, M26 2ZS Tel: 0161 763 7200 web: www.thelkgroup.com	Site St Marys Road, Hayling Island	Borehole Number **WS103**

In Situ Permeability Type	Test No.	Ground Level (mOD)	Client	Job Number
Falling Head	2		Gladman Developments Ltd	LKC 16 1109
	Location	**Dates** 03-Nov-16	**Engineer** LKC	**Sheet** 6/7

Height of casing above ground level:	0.00	**m**
Depth to Base of Borehole:	1.51	**m bgl**
Depth to Base of Casing:	1.00	**m bgl**
Depth to equilibrium water level:	1.51	**m btoc**
Test Length L:	0.51	**m**
Diameter of Test Length D:	0.10	**m**
Area of Test Section:	0.0079	**m2**
Intake Factor F: (after condition B, figure 6, BS 5930)	0.2750	

PERMEABILITY (after Hvorslev, 1951)

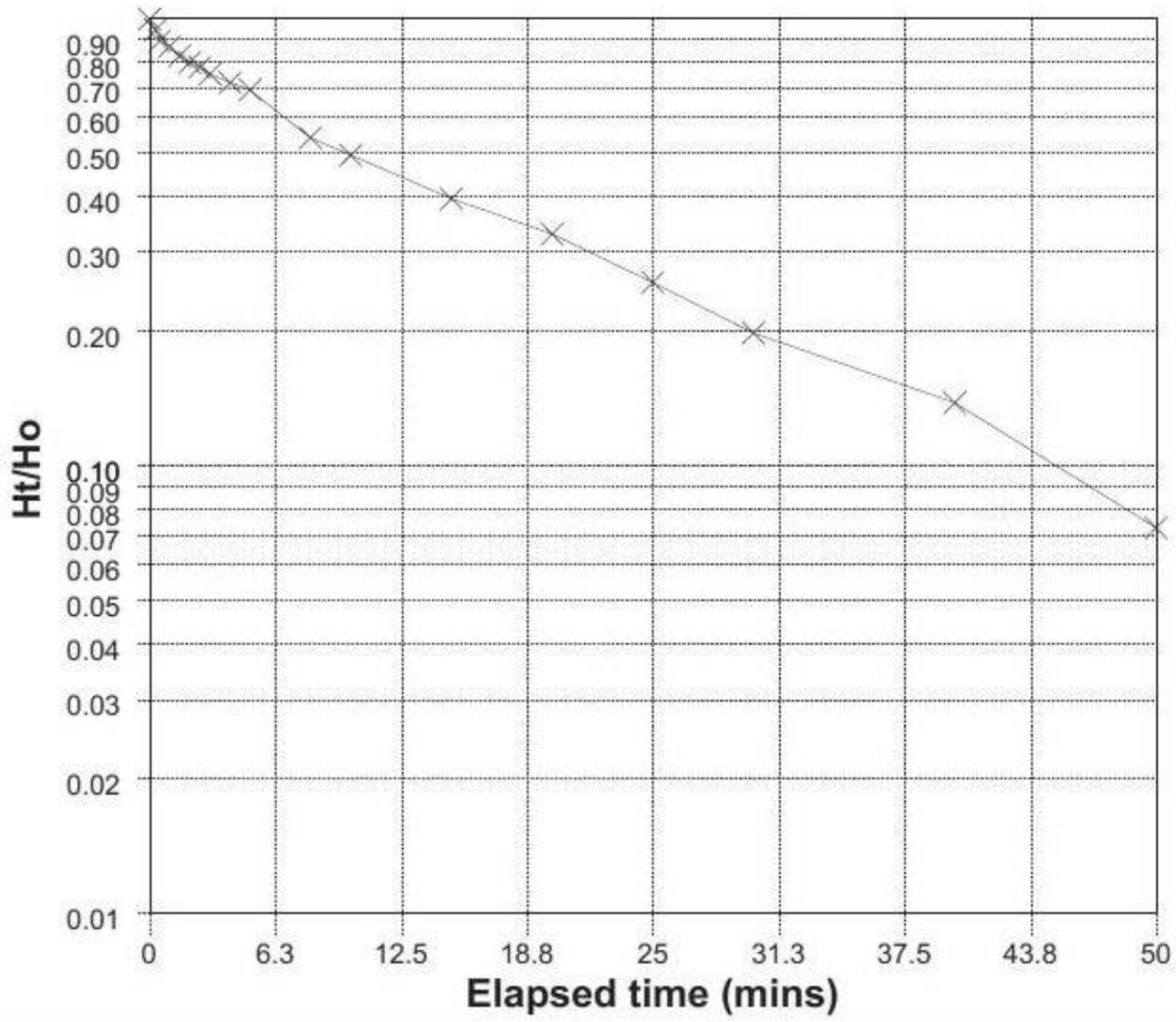
Basic Time Lag Analysis

The value T when Ht/Ho = 0.37 is the basic time lag, T

T = 17.05

k = 2.79E-05 **ms-1**

Elapsed time (mins)	Depth to water (m btoc)	Head of Water, H (m)	Ht / Ho
0.0	0.000	1.510	1.000
0.3	0.080	1.430	0.947
0.5	0.160	1.350	0.894
1.0	0.200	1.310	0.868
1.5	0.260	1.250	0.828
2.0	0.300	1.210	0.801
2.5	0.330	1.180	0.781
3.0	0.370	1.140	0.755
4.0	0.420	1.090	0.722
5.0	0.460	1.050	0.695
8.0	0.690	0.820	0.543
10.0	0.760	0.750	0.497
15.0	0.910	0.600	0.397
20.0	1.010	0.500	0.331
25.0	1.120	0.390	0.258
30.0	1.210	0.300	0.199
40.0	1.300	0.210	0.139
50.0	1.400	0.110	0.073



Remarks

Key: bgl = Below Ground Level btoc = Below Top of Casing

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LK CONSULT LTD Eton Business Park, Eton Hill Road, Radcliffe, M26 2ZS Tel: 0161 763 7200 web: www.thelkgroup.com	Site St Marys Road, Hayling Island	Borehole Number **WS103**

In Situ Permeability Type	Test No.	Ground Level (mOD)	Client	Job Number
Falling Head	3		Gladman Developments Ltd	LKC 16 1109
	Location	**Dates** 03-Nov-16	**Engineer** LKC	**Sheet** 7/7

Height of casing above ground level:	0.00 **m**
Depth to Base of Borehole:	1.51 **m bgl**
Depth to Base of Casing:	1.00 **m bgl**
Depth to equilibrium water level:	1.51 **m btoc**
Test Length L:	0.51 **m**
Diameter of Test Length D:	0.10 **m**
Area of Test Section:	0.0079 **m2**
Intake Factor F: (after condition B, figure 6, BS 5930)	0.2750

PERMEABILITY (after Hvorslev, 1951)

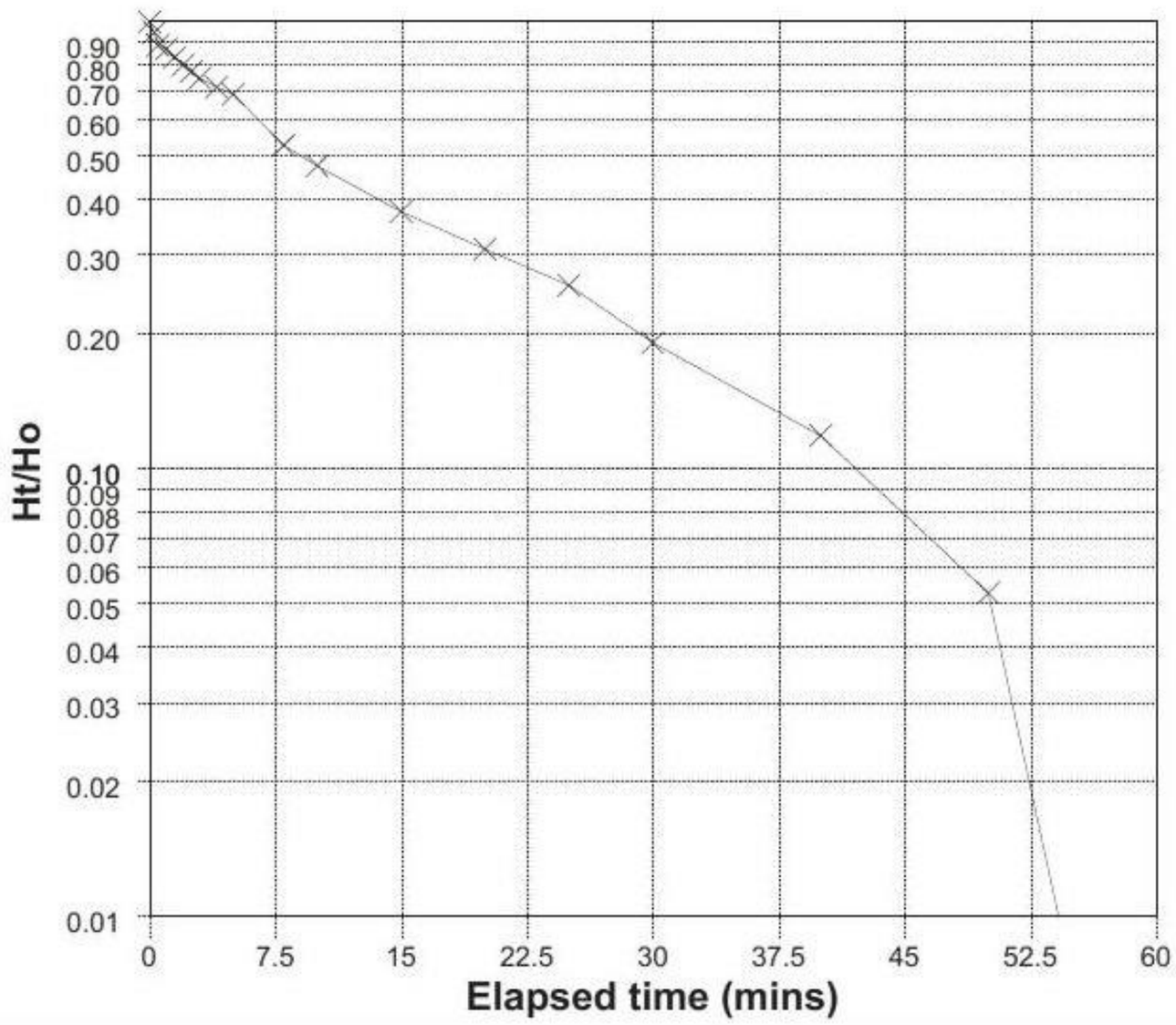
Basic Time Lag Analysis

The value T when Ht/Ho = 0.37 is the basic time lag, T

T = 15.53

k = 3.06E-05 **ms-1**

Elapsed time (mins)	Depth to water (m btoc)	Head of Water, H (m)	Ht / Ho
0.0	0.000	1.510	1.000
0.3	0.080	1.430	0.947
0.5	0.170	1.340	0.887
1.0	0.200	1.310	0.868
1.5	0.250	1.260	0.834
2.0	0.300	1.210	0.801
2.5	0.340	1.170	0.775
3.0	0.380	1.130	0.748
4.0	0.430	1.080	0.715
5.0	0.470	1.040	0.689
8.0	0.710	0.800	0.530
10.0	0.790	0.720	0.477
15.0	0.940	0.570	0.377
20.0	1.040	0.470	0.311
25.0	1.120	0.390	0.258
30.0	1.220	0.290	0.192
40.0	1.330	0.180	0.119
50.0	1.430	0.080	0.053
60.0	1.510	0.000	0.000



Remarks

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LK CONSULT LTD

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Tel: 0161 763 7200 web: www.thelkgroup.com

Site	Number
St Marys Road, Hayling Island	WS101

Excavation Method	Dimensions	Ground Level (mOD)	Client	Job Number
Drive-in Windowless Sampler			Gladman Developments Ltd	LKC 16 1109
	Location	**Dates** 03-11-2016	**Engineer** LKC	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(2.70)	Dark brown to light brown mottled grey / brown silty CLAY with rare gravel of flint.		1
			Water strike(1) at 2.70m, rose to 1.90m in 10 mins.		2.70 (0.30) 3.00	Wet brown sandy GRAVEL. Sand is fine to coarse. Gravel is fine to coarse, angular to sub-angular, of flint.		1
						Complete at 3.00m		

Remarks

Scale (approx)	Logged By
1:25	BS

Figure No. LKC 16 1109.WS101

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Eton Business Park, Eton Hill Road, Radcliffe, M26 2ZS
Tel: 0161 763 7200 web: www.thelkgroup.com

Site	Number
St Marys Road, Hayling Island	WS102

Excavation Method	Dimensions	Ground Level (mOD)	Client	Job Number
Drive-in Windowless Sampler			Gladman Developments Ltd	LKC 16 1109
	Location	**Dates** 03-11-2016	**Engineer** LKC	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.50)	Dark brown slightly gravelly silty CLAY. Gravel is fine to medium, angular, of flint.		
					0.50 (1.70)	Brown slightly clayey SAND and GRAVEL. Sand is fine to coarse. Gravel is fine to coarse, angular to sub-rounded, of flint.		
			Water strike(1) at 2.56m.		2.20 (0.80)	Brown gravelly SAND. Sand is fine to coarse. Gravel is fine to coarse, angular to sub-rounded, of flint.		∇1
					3.00	Complete at 3.00m		

Remarks

Scale (approx)	Logged By
1:25	BS

Figure No. LKC 16 1109.WS102

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Eton Business Park, Eton Hill Road, Radcliffe, M26 2ZS
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Site	Number
St Marys Road, Hayling Island	WS103

Excavation Method	Dimensions	Ground Level (mOD)	Client	Job Number
Drive-in Windowless Sampler			Gladman Developments Ltd	LKC 16 1109
	Location	**Dates** 03-11-2016	**Engineer** LKC	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(1.00)	Brown silty CLAY with occasional fine to medium, angular, gravel of chalk.		
					1.00 (0.20)	Very dense brown slightly sandy clayey GRAVEL.Sand is fine to coarse. Gravel is fine to coarse, sub-angular to sub-rounded, of flink and chalk in a clay matrix.		
					1.20 (1.50)	Brown SAND and GRAVEL with occasional bands of very stiff gravelly clay. Sand is fine to medium. Gravel is fine to medium, angular, of flint.		
					2.70	Slightly damp SAND. Sand is fine to medium.		
					2.75 (0.25)	Stiff silty CLAY.		
					3.00	Complete at 3.00m		

Remarks
No groundwater encountered.
Sampler refused at 3mbgl on very dense gravel.

Scale (approx)	Logged By
1:25	BS

Figure No. LKC 16 1109.WS103

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APPENDIX G

DRAINAGE STRATEGY PLAN

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Extract from: Gladman Developments Ltd
Drawing Ref: Development Framework Plan, No.7478-L-02

KEY

- Site Boundary
- Combined Kerb Drains (CKD)
- Headwall (HW)
- Swale
- Direction of Flow
- Chamber
- Detention Basin

North Catchment
Attenuation storage volume: **506.5 m^3**
(1 in 30 year event)
Retention on site volume: **839.8 m^3 - 1046.7 m^3**
(1 in 100 year event + Climate Change)

South Catchment
Attenuation storage volume: **422.8 m^3**
(1 in 30 year event)
Retention on site volume: **701.0 m^3 - 873.6 m^3**
(1 in 100 year event + Climate Change)

Do not scale from this drawing and work from marked dimensions only. All dimensions and features should be confirmed on site by the Contractor. Where this drawing includes information provided to LK Consult Ltd by others, LK Consult Ltd gives no warranty, representation or assurance as to the accuracy of such information.

LK CONSULT LIMITED

Client: Gladman Developments Ltd

Site: Land off St.Mary's Road, Hayling Island

Title: Drainage Strategy

Job No.:	Scale (See Scale Bar):	Figure:	Revision:
FRA 16 1021	1:2500 @ A3	3	

Drawn By:	Checked By:	Drawn:
AC	MJ	Nov 2016