CAPITA

Zone A Plot 2
North Kettering Business Park

Flood Risk Assessment

06 September 2018

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Quality Management

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Title	Flood Risk Assessment		
Client	Prologis		
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-	18/7/18	-	PWE	NRB
A	06/9/18	Updated drawings and in-text references to reflect recent changes	JD	

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Appendices

1. Introduction

1.1 Appointment

1.1.1 Capita Property and Infrastructure Limited was appointed by Prologis (the Client) to undertake a Flood Risk Assessment for the site known as Zone A Plot 2 of North Kettering Business Park in Northamptonshire.

1.2 Site Location

1.2.1 North Kettering Business Park is located approximately 1km north-west of Kettering town centre, close to junction 7 of the A14 highway. Zone A Plot 2 is situated to the north of Glendon Road in the north-western sector of the Park and is centred on Ordnance Survey National Grid Reference 485910, 281670. Its approximate postcode is NN14 1UB.

1.3 Site Description

1.3.1 The site is irregular in plan shape and covers an area of about 9 hectares. The southern, south-eastern and far western sectors are generally flat, the surface comprising stony clay soil with sporadic vegetation. A 2008 topographic survey by MK Surveys (see Appendix A) indicates ground levels in these areas ranges between circa 103 and 106mAOD, generally falling towards the south.

1.3.2 A large stockpile of gravelly clay soil is positioned in the northern sector, understood to comprise excess soil arisings from earthworks operations during construction activities elsewhere across the business park. Surface level at the top of the stockpile is around 109 to 110mAOD, i.e. approximately 5m above surrounding ground level, and levels at the top of a higher topsoil mound (on top of the gravelly clay) are circa 114mAOD.

1.3.3 An electricity pylon is situated in the far western corner of the site, supporting overhead power lines passing roughly south-west to north-east. An electricity substation is situated immediately beyond the site's south-east corner, within a fenced enclosure.

1.4 Surrounding Land Use

1.4.1 Immediately north-east of the site, beyond a steel palisade fence, is Zone A Plot 1 of the business park, currently occupied by a large warehouse-type unit used as a storage/distribution centre by Wincanton. Areas to the north and west are predominantly open fields / agricultural land. To the south and south-east are Zones B and C of the park, comprising several similar portal-framed industrial units with external concrete service yards.

1.5 Proposed Development

1.5.1 It is understood that the Zone A Plot 2, which is currently unoccupied, is to be redeveloped to comprise two light industrial units with associated offices, car parking, landscaping and access roads. An approximately 1 hectare landscaped buffer located in the low lying western boundary of the site will be provided to improve the visual amenity of the site. Additional landscaping will be provided elsewhere within the site.

1.5.2 The proposed site layout can be seen on the Architect's drawing in Appendix B.

1.6 Background Information

1.6.1 In support of the original outline planning application (ref KE/02/0943) for the overall business park an FRA was completed by Symonds (now part of Capita) in February 2003. Following this a park-wide drainage strategy was completed by URS (now part of Aecom) in May 2003, and both of these reports were approved by the Environment Agency.

1.6.2 A detailed drainage strategy for Zone A Plot 2 was drafted by Capita in February 2007 as part of the North Kettering Compliance Procedure and this too was approved by the EA. The strategy followed the approach outlined in the URS overall strategy.

1.6.3 A further FRA was produced in March 2015 to support a planning application for a single unit development on the site. That FRA was also approved by the applicable regulators.

1.6.4 Following approval of the original outline planning application, a staged development process has occurred and the majority of the business park has been constructed. Zone A Plot 2 is due to be one of the last plots to be developed. Changes to its original red line boundary have taken place such that it now incorporates an additional 3 ha of land west of the initial site. The revised boundary includes the landscaped buffer noted above, and further warehouse and car parking space.

1.6.5 The URS 2003 drainage strategy involved discharging surface water into an attenuation pond located in the south west corner of the wider business park via adoptable surface water sewers. A copy is provided in Appendix C for reference. An updated strategy has been developed for this Zone A Plot 2 scheme and is presented in Appendix G and discussed in Section 6 of this report.

1.7 Report Objectives

1.7.1 The Flood Risk Assessment presented herein has been completed taking cognisance of the National Planning Policy Framework (NPPF) published in July 2018 by the Department for Communities and Local Government (DCLG) and other applicable technical guidance. Its objectives can be defined as:

- Review all sources of flooding which are likely to affect the development site, both now and in the future.
- Consider the merit and practicability of various Sustainable Drainage Systems (SuDS).

- Provide an assessment of whether the site development will increase flood risk elsewhere.
- Establish whether current measures (where they exist) to mitigate risks are appropriate.

2. Site Setting

2.1 Introduction

2.1.1 Detailed information regarding the site's environmental setting is provided in the following previous Capita report:

- Geo-environmental Investigation and Assessment, ref. SS015865-PE-12-090-R dated 19th July 2012.

2.2 Mapped Geology

2.2.1 British Geological Survey Digital Geological Map of Great Britain (at 1:10,000) indicates the site to be underlain by Infilled Ground (recent artificial deposits) over the Northampton Sand Formation. The mapped infilled ground most likely relates to historical ironstone quarrying.

2.2.2 The Northampton Sand is underlain by the Whitby Mudstone Formation, part of the Lower Jurassic Lias Group.

2.2.3 A copy of the geology map extract covering the site is provided in Appendix D.

2.3 Encountered Geology

2.3.1 A ground investigation was carried out at the site by Capita in May and June 2012 comprising twenty-four mechanically-excavated trial pits (maximum 5.5m deep) and four cable percussion boreholes (maximum base depth 25m below surface).

2.3.2 The encountered stratigraphy comprised variable Made Ground to a base level of between 99 and 100mAOD, corresponding to a thickness of between 5 and 11m, over an unproven thickness of Lias Group clay. The Made Ground comprised quarry spoil generally consisting of soft to firm orange-brown sandy silt and clay, with a varying fraction of ironstone gravel and occasional cobbles. The Lias was found to comprise stiff and very stiff dark grey silty clay.

2.4 Hydrogeology

2.4.1 The site is mapped to be underlain by a Secondary Aquifer associated with Northampton Sand Formation (notwithstanding that this appears to have been largely mined out below the subject site). The site is not situated within an Environment Agency-designated Groundwater Source Protection Zone and there are no known operational groundwater abstraction wells within 1km.

2.5 Hydrology

2.5.1 The nearest surface water feature is Slade Brook, situated approximately 500m to the south at its nearest point. The River Ise is located approximately 1km to the north of the site.

2.6 Groundwater

2.6.1 Measurement of resting water levels within monitoring standpipes was undertaken on two occasions in June 2012. The recorded depth to groundwater ranged between about 101 and 103 mAOD and was considered to relate to isolated pockets of perched water resting within gravelly clay horizons of the Made Ground. A continuous body of water-bearing soils (i.e. an aquifer) was not observed.

3. Policy and Guidance

3.1 National Planning Policy Framework (July 2018)

3.1.1 In determining an approach for the assessment of flood risk for the development proposal there is a need to review the policy context. Government guidance requires that consideration be given to flood risk in the planning process. The National Planning Policy Framework (NPPF) was last updated in July 2018 and outlines the national policy position on development and flood risk assessment.

3.1.2 The Framework states that inappropriate development in areas at risk of flooding should be avoided by directing development away from areas at highest risk. Where development is necessary in flood risk areas, it can be permitted provided it is made safe without increasing flood risk elsewhere.

3.1.3 The essence of NPPF is that:

- Local Plans should be supported by Strategic Flood Risk Assessment and develop policies to manage flood risk from all sources, taking advice from the Environment Agency and other relevant flood risk management bodies, such as lead local flood authorities and internal drainage boards.
- Polices in development plans should outline the consideration, which will be given to flooding issues, recognising the uncertainties that are inherent in the prediction of flooding and that flood risk is expected to increase as a result of climate change.
- Planning authorities should apply the precautionary principle to the issue of flood risk, using a risk-based search sequence to avoid such risk where possible and managing it elsewhere;
- The vulnerability of a proposed land use should be considered when assessing flood risk;
- Opportunities offered by new developments should be used to reduce the causes and impacts of flooding;
- Planning authorities should recognise the importance of functional floodplains, where water flows or is held at times of flood, and avoid inappropriate development on undeveloped and undefended floodplains; and
- The concept of Flood Risk Reduction, particularly in circumstances where development has been sanctioned on the basis of the “Exception Test”.

3.2 Flood and Water Management Act 2010

3.2.1 Combined with the Flood Risk Regulations 2009 (‘the Regulations’), (which enact the EU Floods Directive in the England and Wales) the Flood and Water Management Act 2010 (‘the Act’) places significantly greater responsibility on Local Authorities to manage and lead on local flooding issues.

3.2.2 The Act and the Regulations together raise the requirements and targets Local Authorities need to meet, including:

- Playing an active role leading Flood Risk Management;
- Development of Local Flood Risk Management Strategies (LFRMS);
- Implementing requirements of Flood and Water Management legislation;
- Development and implementation of drainage and flooding management strategies;
- Responsibility for first approval, then adopting, management and maintenance of Sustainable Drainage System (SuDS) where they service more than one property.

3.2.3 The Flood and Water Management Act also clarifies three key areas that influence development:

1. ***Sustainable Drainage Systems (SuDS)*** - the Act makes provision for a national standard to be prepared on SuDS, and developers will be required to obtain local authority approval for SuDS in accordance with the standards, likely with conditions. Supporting this, the Act requires local authorities to adopt and maintain SuDS, removing any ongoing responsibility for developers to maintain SuDS if they are designed and constructed robustly.
2. ***Flood risk management structures*** - the Act enables the EA and local authorities to designate structures such as flood defences or embankments owned by third parties for protection if they affect flooding or coastal erosion. A developer or landowner will not be able to alter, remove or replace a designated structure or feature without first obtaining consent from the relevant authority.
3. ***Permitted flooding of third party land*** - The EA and local authorities have the power to carry out work which may cause flooding to third party land where the works are deemed to be in the interest of nature conservation, the preservation of cultural heritage or people's enjoyment of the environment or of cultural heritage.

3.3 Planning Practice Guidance (March 2014)

3.3.1 The National Planning Policy Framework sets strict tests to protect people and property from flooding which all local planning authorities are expected to follow. The main steps to be followed are designed to ensure that if there are better sites in terms of flood risk, or a proposed development cannot be made safe, it should not be permitted.

3.3.2 The Planning Practice Guidance for Flood Risk and Coastal Change (PPG) document provides guidance on how the local planning authorities should:

- Assess flood risk;
- Avoid flood risk; and
- Manage and Mitigate flood risk and coastal change.

3.3.3 There is also information on the requirements to consult the Environment Agency, on the role of lead local flood authorities and on flood risk in relation to minor developments.

3.4 Kettering and Wellingborough Level 1 Strategic Flood Risk Assessment, February 2011

3.4.1 The objective of the SFRA is to provide an overview of all sources of flooding within the applicable administrative area and to set out a number of approaches to avoid, reduce and manage this risk as part of a wider objective to ensure a sustainable environment.

3.5 River Nene Catchment Flood Management Plan, December 2010

3.5.1 The role of Catchment Flood Management Plans (CFMPs) is to establish flood risk management policies which will deliver sustainable flood risk management for the long term.

3.5.2 The proposed development is located in sub area 4 (Kettering, Wellingborough, Peterborough and the Nene Washes) in the River Nene CFMP. In Kettering, 208 properties are indicated to be at risk during a 1% annual exceedance probability flood event. It is anticipated that this will increase to 311 properties by 2100.

3.5.3 This area falls under Policy Option 4 – areas of low, moderate or high flood risk where the flood risk is already being managed effectively but where further action may need to be taken to keep pace with climate change.

4. Flood Probability and Hazard

4.1 Fluvial Flood Risk and EA Flood Zone

4.1.1 Fluvial flooding occurs when the amount of water exceeds the flow capacity of the channel. Most rivers have a natural floodplain into which the water spills in times of flood.

4.1.2 A review of Environment Agency Flood Zone Maps shows that all of the area within the site boundary falls within Flood Zone 1, which is described as having a "Low Probability" of flooding. Flood Zone 1 is defined as: "Land having a less than 1 in 1,000 annual probability of river or sea flooding."

4.1.3 The proposed development comprises buildings for storage and distribution use and as such is considered to fall under the classification of 'Less Vulnerable' based on Table 2 of Planning Practice Guidance Flood Risk and Coastal Change. Table 3: Flood Risk Vulnerability and Flood Zone Compatibility of the same document, states that these land uses are compatible in Flood Zone 1.

4.1.4 A copy of the Environment Agency flood zone map covering the site is provided in Appendix E.

4.2 Historic Flooding

4.2.1 The Kettering and Wellingborough Level 1 SFRA indicates (on Figure 6a) the locations at which Historical Flooding Incidents are recorded to have occurred within the Borough of Kettering. None of these are at or within 500 m of the study site.

4.3 Canal Flooding

4.3.1 There are no canals within 1 km of the site and the risk of flooding from this source can be discounted.

4.4 Flooding From Land

4.4.1 The topographical survey indicates that there are no obvious overland flow paths which would direct water to Zone A Plot 2 and cause flooding of the site. The topography surrounding the site slopes to the southwest.

4.4.2 The increase in impermeable surfaces has the potential to increase surface water flows from the current Greenfield rate. Post-development flow routes have been considered during the drainage design of the wider business park with the main balancing pond being positioned in the lowest area of the site, which allows for a gravity fed drainage system. In essence, overland flow will be collected by the positively drained sewer system and directed to the main pond. This is discussed further in Sections 5 and 6.

4.5 Flooding From Sewers

4.5.1 The outline surface water drainage design for the overall business park, including the balancing pond, has been designed to manage surface water flows from a 1 in 200 year event, with run-off from a majority of the site restricted to a Greenfield rate. The entire surface water sewer network has been designed to the masterplan specifications and as a result exceedance of the drainage system is managed via overland flow-paths which mean excess water does not result in unacceptable flood risk to site users or third parties.

4.6 Flooding from Groundwater

4.6.1 Groundwater flooding is caused by subterranean water that flows back above ground from the underlying aquifer, at the point where the water table meets the surface. It usually occurs following a prolonged period of low intensity rainfall.

4.6.2 Given the low permeability of the ground below the site, and ground levels relative to surrounding land, the risk of flooding from groundwater is considered to be negligible.

4.7 Climate Change

4.7.1 Projections of the likely impact of climate change indicate that more frequent short-duration, high intensity rainfall events can be expected in the UK, as well as more frequent prolonged periods of rainfall. The surface water drainage strategy for the proposed development, presented in Chapter 6, takes cognisance of this anticipated change.

5. Surface Run Off

5.1 Pre-Development Run Off

5.1.1 Zone A Plot 2 is currently a Greenfield site and the surrounding area has been developed according to the Kettering Business Park masterplans. The Greenfield run-off rates have been calculated using the Institute of Hydrology Report 124 Flood Estimation for Small Catchments, FSR 3 parameter equation. The publication provides the essential design elements for determining the estimated Greenfield runoff rate, based on the site area, soil type, and average annual rainfall based on site location.

5.1.2 The IOH 124 equation to calculate runoff is:

$Qbar = 0.00108^{0.89} SAAR^{1.17} SOIL^{2.17}$

where

Qbar = Mean Annual Flood (m^3/s)

SAAR = Average Annual Rainfall (mm)

A = Area (ha)

SOIL = Value obtained from Soil Maps

5.1.3 The SAAR value for the site is 647mm. A soil factor of 0.4 has been used for the clay soil types found at the site.

5.1.4 The analysis for determining the peak Greenfield discharge rate uses 50 ha in the formula and linearly interpolates the flow rate value based on the ratio of the development to 50ha.

5.1.5 The Greenfield runoff rates for a range of storm return periods are listed below. Qbar equals 3.1 l/s/ha, and increases to 13.3 l/s/ha for the 1 in 200 year event.

Return Period (years)	Greenfield Run-off Rate (l/s/ha)	Existing Total Discharge Rates from site (l/s)
1	2.7	25.1
2	2.8	25.4
10	5.1	47.1
30	8.1	74.8
100	11.0	101.6
200	13.3	119.9

5.1.6 The associated calculations can be found in full within Appendix F.

5.2 Post-Development Run Off

5.2.1 Correspondence with the EA during the 2003 FRA identified a requirement that the discharge from the entire North Kettering Business Park comply with the rates outlined in a report of the River Nene sub-catchments commissioned by the EA in 1999, as summarised in Table 5.1:

Return Period (years)	Permissible discharge rate (l/s/ha)
100	3.8
200	4.1
200 + CC	4.9

5.2.2 These permissible rates are approximately 30% - 35% of the calculated Greenfield rates.

5.2.3 The EA also stated that the outline surface water drainage strategy for the overall business park must accommodate runoff generated during a 1:200 year return period during a critical storm duration of 720 minutes.

6. Drainage Strategy and SuDS

6.1 Introduction

6.2 Planning policy requires that, where possible, the use of Sustainable Drainage Systems (SuDS) should be incorporated into new development proposals. Such systems have the potential to reduce the peak run-off flows and can improve the amenity and wildlife interest of a development. The following paragraphs consider various SuDS measures and their suitability within the Zone A Plot 2 scheme.

6.3 Infiltration devices

6.3.1 As discussed in Sections 2.2 and 2.3, the site is underlain by an extensive thickness of re-worked gravelly clay overlying stiff natural clay soils. Such low permeability material has a low infiltration coefficient such that soakaways are not suitable within the built development.

6.4 Green Roofs

6.4.1 The site is proposed to be developed for a new steel-framed industrial / commercial unit. By their nature such buildings span wide areas and are of lightweight and economic construction. The adoption of green roofs would require significant and costly modifications to the structural design including significantly upgraded foundations and more extensive use of structural steelwork. It has consequently been determined that such an option is not compatible within the proposed development.

6.5 Tanked Systems

6.5.1 Underground storage to receive surface run-off would be a suitable and beneficial SuDS option for the proposed development and would be compatible and appropriate within the scheme layout. Attenuation through below ground storage to restrict run-off to a suitable Greenfield rate could be achieved through oversized pipework and/or underground tanks.

6.6 Drainage Strategy

6.6.1 As noted in Section 1.6 above, the original 2003 drainage strategy for the overall site involved discharging surface water into an attenuation pond located in the south west corner of the business park via adoptable surface water sewers. This pond has a design capacity of 22550m^3 of water and allows a controlled discharge of 99l/s to Slade Brook from a chamber fitted with a vortex flow control device.

6.6.2 Compliance auditing of the drainage system has been completed to meet the conditions placed on the planning application. The volumes of run-off currently entering the main pond are as follows:

Application Name	Volume entering attenuation pond during critical 720 minute storm (m^3)
Earthworks	0
Access Road	312
Zone A Plot 1	Not applicable *
Zone B Plot 1	622
Zone B Plot 2	4363
Zone B Plot 3	474
Zone C Plot 1	4387
Zone C Plot 2	1435
Zone C Plot 3	1652
Zone C Plots 4 and 5	725
Total	13970
Volume of Pond	22550
Volume permanently in flood	1800
Volume available	**6780**

* Zone A Plot 1 does not discharge into the main attenuation pond.

6.6.3 The original design assumed a volume of 1628m^3 would enter the pond from Zone A Plot 2, i.e. well within the design capacity. The proposed development now covers a greater area than originally assumed and a total run-off of 4016m^3 has been calculated. Consequently the drainage strategy has been modified to accommodate the additional volume.

6.6.4 It is proposed that off-site discharge will be at same rate as originally envisaged for the smaller plan area, and that run-off from the additional area will be restricted to a Greenfield rate of 4.1 l/s/ha using a Hydro-Brake flow control and by installing 2102 m^3 of below-ground attenuation. Due to the site topography it is not possible to contain flood waters above ground for return periods in excess of 1 in 30 years. Therefore the drainage network and below-ground storage have been designed to contain critical design storms up to and including a 1 in 100 year return period plus a 20% allowance for climate change.

6.6.5 Surface water is to discharge under a controlled flow directly into an existing adoptable surface water sewer in Glendon Road and reach the balancing pond via a series of interconnected underground pipes.

6.6.6 To minimise the possibility of water pollution it is the current intention to drain run-off from the roof directly into an existing adoptable surface water sewer, while the run-off from the external area will pass through a petrol interceptor.

6.6.7 Further details of the proposed strategy, including drainage layouts drawings, are provided in Appendix G.

6.7 Glendon Road Improvement

6.7.1 It should be noted that at present surface water run-off from Glendon Road, which bounds the site to the south-west, drains on to adjacent soft verges where it soaks into the ground. The road is proposed to be widened as part of the Zone A Plot 2 development and new drainage infrastructure will be installed.

6.7.2 The location and levels of the existing carriageway do not make it feasible to drain the road by gravity to any part of North Kettering Business Park. Surface run-off is therefore proposed to be managed separately from the main development by kerbing the road and installing a system of trapped gullies. The gullies will then discharge into filter drains, consisting of porous pipes within stone filled trenches, which will store the surface water and allow it to slowly soak into the subsoil. Further information in this regard is provided in Appendix H.

7. Conclusions

7.1 Capita Property and Infrastructure Limited was appointed by Prologis (the Client) to undertake a Flood Risk Assessment for Zone A Plot 2 of North Kettering Business Park. The site is currently vacant and is proposed to be developed to comprise a new warehouse unit with ancillary offices and external service yards and car parking.

7.2 The site is located in Flood Zone 1 and is at low probability of flooding from fluvial or tidal sources. Flood risk, both on and off-site, from site-generated runoff has been addressed via a surface water drainage strategy.

7.3 The surface water strategy for the development comprises the use of below ground storage devices to restrict run-off to a Greenfield rate of 4.1l/s/ha. Run-off is to be directed into an existing surface water attenuation pond situated in the south-west corner of the wider business park.

7.4 This FRA has been produced to demonstrate that appropriate attenuation measures and SuDS techniques can be incorporated into the development. The surface water strategy has been designed to accommodate the critical 1 in 100 year +20% climate change storm event whilst still preventing off-site flooding. The site is therefore considered to be at low risk from flooding and is not considered to increase flood risk to others.

Appendix A – Topographical Survey

ARGOS DISTRIBUTION WAREHOUSE

KEY

SURVEY STATION	△ 5		
BANKING	TOP / BOTTOM		
HEDGE SPREADS			
WOODLAND CANOPY			
MARSH / WATERLOGGED			
TREES	SPREAD & GIRTH SHOWN TO SCALE		
GATE			
KERB CHANNEL			
ROAD UNKERBED			
FOOTPATH			
CHANGE IN SURFACE			
FENCE			
WALL			
OVERHEAD ELECTRIC			
OVERHEAD TELECOM			
SEWERS FOUL			
SEWERS STORM			
BUILDING			
OPEN SIDED BUILDING			
GLASSHOUSE			
CONTOUR	127		
SPOT LEVEL	+127.13		
BORE HOLE	BH		
TRIAL HOLE	TH		

GENERAL ABBREVIATIONS

AIR VALVE	AV
BACK DROP	BD
BRICK	BK
BOLLARD	BO
BUS STOP	BT
CHAMBER	CH
CABLE TV COVER	CATV
CONTROL BOX	CB
COVER LEVEL	CL
CATCH PIT	C/PIT
DROP KERB	DK
ELECTRICITY CONTROL BOX	EB
ELECTRICITY POLE	EP
EARTH ROD	ER
FIRE HYDRANT	FH
FLOOR LEVEL	FL
FOOTPATH	FP
FOUL WATER SEWER	FWS
GAS VALVE	GV
GATE POST	GP
GAULY	GY
INSPECTION COVER	IC
INVERT LEVEL	IL
KERB OUTLET	KO
LAMP POST	LP
LETTER BOX	LB
LITTER BIN	BIN
MANHOLE	MH
MARKER POST	MK
METER	MT
ORDNANCE SURVEY BENCH MARK	OSBM
PEDESTAL	PD
ROAD SIGN	RS
RAIN WATER PIPE	RWP
RETAINING WALL	RW
STOP COCK	SC
STREET NAME PLATE	SNP
STAY CABLES	ST
SURFACE WATER SEWER	SWS
STOP VALVE	SV
TELEPHONE CALL BOX	TCB
TRAFFIC LIGHT	TL
TELEGRAPH POLE	TP
UNABLE TO LIFT	UTL
VENT PIPE	VP
WATER TANK	WT
WATER METER	WM
WASH OUT	WO

FENCE ABBREVIATIONS

BARBED WIRE FENCE	B/W
CLOSE BOARDED FENCE	C/B
CHAIN LINK & RAIL FENCE	C/R
CHAIN LINK FENCE	C/L
CHESTNUT PALING	CNP
IRON RAILINGS	I/R
POST AND RAIL FENCE	P/R
POST AND WIRE FENCE	P/W
WIRE MESH FENCE	W/M

Coordinate Table

Station	Description	Easting	Northing	Level
GPS1	HILTI NAIL	485804.871	281519.339	102.913
GPS2	PEG	485859.031	281784.782	115.087
GPS3	PEG	485848.237	281734.408	114.263
GPS4	PEG	485981.013	281701.772	110.454
GPS5	ROAD NAIL	486063.094	281488.324	105.373
A1	ROAD NAIL	485907.129	281471.566	103.899
A2	ROAD NAIL	485799.066	281497.696	101.740

Revisions:

R1. (23/07/07) – PROBE LOCATIONS SURVEYED (SHOWN RED).

Notes :

1. GRID AND LEVELS BASED ON OSGB36 NATIONAL DATUM DERIVED FROM NATIONAL GPS NETWORK (LSF USED IN ALL CALCULATIONS).
2. TREE AND HEDGE SPECIES HAVE BEEN IDENTIFIED AS ACCURATELY AS POSSIBLE BUT SHOULD BE CROSS CHECKED IN CRITICAL AREAS.

Topographical Survey :

ProLogis Park
Zone A - Plot 2
Kettering - Northants

Client :

ProLogis

Job Number :	Sheet Number :	Revision :
12951	-	-
Scale :	Date :	Surveyed By :
1 : 500	March 2008	BcW/SD

MILTON KEYNES SURVEYS LTD.
Land & Buildling Surveys • 3D Laser Scanning • CAD Bureau
Datum House
41 Burners Lane South
Kiln Farm
Milton Keynes
MK11 3HA
Tel : 01908 565561
Fax : 01908 261030
E-mail : mail@mksurveys.co.uk
Web : www.mksurveys.co.uk

Appendix B – Architect's Proposed Development Layout

10002 P157-002

Pylon CG33

SITE AREA SCHEDULE		
Name	**Hectares**	**Acres**
Planning Application Boundary	9.45 hectare	23.35 acres
Unit 1 Site Area	4.35 hectare	10.74 acres
Unit 2 Site Area	2.00 hectare	4.94 acres

SCALE 1:1000

0m 50m 100m

3 Masterplan
1 : 1000

GEA AREA SCHEDULE - UNIT 1 (DC244)		
Name	**Area**	**Area (ft²)**
GEA Ground Floor	22595.51 m²	243,216.02 ft²
GEA Office FF	423.56 m²	4,559.17 ft²
GEA HUB FF	266.90 m²	2,872.91 ft²
Total GEA	23285.97 m²	250,648.10 ft²

AREA SCHEDULE - UNIT 1 (DC244)		
Name	Area sq.m.	Area sq.ft.
Warehouse GIA	21,582.12 m²	232,308.04 ft²
Main Office GF GIA	378.20 m²	4,070.92 ft²
Main Office FF GIA	378.20 m²	4,070.92 ft²
Hub Office GF GIA	232.70 m²	2,504.73 ft²
Hub Office FF GIA	232.70 m²	2,504.73 ft²
Gatehouse	24.34 m²	262.02 ft²
Total GIA	22,828.26 m²	245,721.36 ft²

UNIT 1 CAR PARKING	
Description	**Actual**
UNIT 1	
Accessible Car Parking	18
Car Electric Parking	2
Car Parking	154
Shared Car Parking	9
Total Car Parking Spaces	183

UNIT 1 - (DC244) PROVISION				
Unit Ref	Level Access Docks	Dock Levellers	HGV Yard Depth	Haunch Height
DC243 (1:2)	3	24	55000	12500

UNIT 1 PARKING (OTHER)	
Description	**Actual**
Cycle Parking	70
HGV Tractor Parking	55
Motorcycle Parking	8

GEA AREA SCHEDULE - UNIT 2 (DC93)		
Name	**Area**	**Area (ft²)**
GEA GF	8575.17 m²	92,302.31 ft²
GEA Office FF	264.55 m²	2,847.56 ft²
Total GEA	8839.71 m²	95,149.87 ft²

AREA SCHEDULE - UNIT 2 (DC93)		
Name	**Area (m²)**	**Area (ft²)**
Warehouse GIA	8,111.72 m²	87,313.80 ft²
Office GF GIA	232.53 m²	2,502.92 ft²
Office FF GIA	232.53 m²	2,502.92 ft²
Total GIA	8,576.78 m²	92,319.64 ft²

UNIT 2 CAR PARKING	
Description	**Actual**
UNIT 2	
Accessible Car Parking	8
Car Electric Parking	2
Car Parking	62
Shared Car Parking	7
Total Car Parking Spaces	79

UNIT 2 - (DC93) PROVISION				
Unit Ref	Level Access Docks	Dock Levellers	HGV Yard Depth	Haunch Height
DC92 (1:1.8)	2	9	50000	12500

UNIT 2 PARKING (OTHER)	
Description	**Actual**
Cycle Parking	20
HGV Tractor Parking	29
Motorcycle Parking	5

Rev	Date	By	Description

Key:

Existing Bridleway

Notes

Ordanance Survey and Topographical Survey Data licensed from Site Vendor.

All levels and retaining strucures subject to cut and fi analysis by engineer.

Infrastructure works and landscape design subject to detailed design by specialist consultants.

To be read in conjunction with Development Framework Plan & Schedule

PROLOGIS®

Stephen George
+ Partners LLP
Architects + Masterplanners
1 Monkspath Hall Road Solihull
West Midlands B90 4FY
t: +44 (0)121 711 6929
www.stephengeorge.co.uk

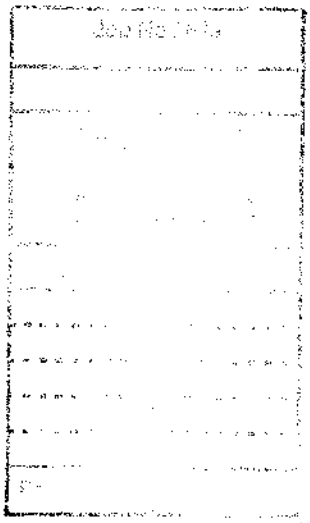
Kettering Prologis Park
Rockingham Road
Zone A Plot 2

Unit 1&2
Site Plan

CDE Reference:

Drawing Status: Preliminary
Model Reference: 10002-Kettering-ZAP2-Site
Drawn: TK
Team: JN
Date: 08/05/18
Scale: As indicated@A1
Project: 10002
Dwg no: P157-002
Rev :

Appendix C – 2003 URS Drainage Strategy



NORTH KETTERING BUSINESS PARK

DRAINAGE STRATEGY REPORT FOR LAND WEST OF THE A6003 ROCKINGHAM ROAD

41563-028

MAY 2003

Contract Title: North Kettering Business Park

Contract No: 41563-028

Client: Prologis Developments Ltd

Issued By:
URS Corporation Ltd.
URS House
Horne Lane
Bedford MK40 1TS
United Kingdom
Tel: + 44 (0) 1234 349 641
Fax: + 44 (0) 1234 216 268
www.urscorp.com

Document: Drainage Strategy Report for Land West of the A6003 Rockingham Road

Document Production / Approval Record

Issue No. : 3	Name	Signature	Date	Position
Prepared by	Paul Swannell	PS	18/02/04	Engineer
Checked by	Geoff Thompson	GAT	18/02/04	Senior Engineer
Approved by	John Holland	FJH	18/02/04	Technical Director

Document Revision Record

Issue No.	Date	Details of Revisions
1	May 2003	Original issue.
2	July 2003	Flow rates, storage volumes and pond sequence/arrangement amended. Flow controls amended to suit new flow rates.
3	Feb 2004	Replacement of drawing nos. 41563-028/T/DP/504 Rev A and 505 Rev A with 504 Rev B and 505 Rev C. Inclusion of Symonds Group approval letter of Drainage Strategy

CONTENTS

1. SUMMARY

1.1. The on-site design of the surface water drainage will require three main attenuation facilities in order to restrict the total discharge into Slade Brook to a maximum of 144 l/s during a 1 in 200 year storm. This is an Environment Agency requirement and is referred to in point 6.26 of the Symonds Group Flood Risk Assessment Report.

1.2. Two of the attenuation facilities, the wet woodland and the SINC are designed to manage flows from Unit 1 in the north east of the site. They have a combined storage capacity of approximately 16,350m^3 and will discharge directly to Slade Brook at a maximum flow rate of 45 l/s.

1.3. The third attenuation facility is the main pond in the south west of the site, which has a storage capacity of 22,550m^3. This will also drain directly to Slade Brook at a maximum flow rate of 99 l/s.

1.4. A cut off drain along the western site boundary will intercept all green field surface water runoff and direct it into the attenuation pond prior to discharge into Slade Brook. A cut off drain is provided along the southern site boundary in order to convey water from the SINC to Slade Brook. Due to the site topography, this drain will intercept very little water, as most will be intercepted by the main pond or the southern cut off drain.

1.5. Symonds Group confirmed in their letter of 2nd October 2003 that the strategy described in this report is in accordance with the requirements of their Flood Risk Assessment. A copy of the letter is included in Appendix D.

2. INTRODUCTION

2.1. As part of the proposed North Kettering Business Park development, URS Corporation Ltd. have been commissioned by Prologis Developments Ltd. to produce the detailed design of the on-site and off-site drainage.

2.2. The on-site drainage design comprises the design of ponds to attenuate the surface water runoff flows from the development prior to discharge into Slade Brook, as well as the main access road drainage. The off-site design involves the provision of drainage required for the widening of the A6003.

2.3. The on-site drainage design is based on the recommendations given in the Symonds Group Flood Risk Assessment Report, dated January 2003. The Environment Agency approved the use of this report as the basis for the design in February 2003 (Reference meeting held at EA offices in Kettering on 25/2/03).

2.4. The drainage design for the widened A6003 will be based upon normal highway drainage design standards as given in the Design Manual for Roads and Bridges.

2.5. This report aims to provide details of the on-site drainage design.

3. ON-SITE DRAINAGE

3.1. The Symonds Report investigates in detail the potential effects of the development upon the hydrology of the surrounding area and in particular the effects that could be experienced downstream of the site.

3.2. As far as the development site drainage is concerned, the most important finding of the report is that the ultimate flow rate into the watercourse, Slade Brook, should be limited to 144 litres per second during a 1 in 200 year storm. The attenuation ponds should therefore have sufficient capacity to cope with this return period.

3.3. The report identifies two areas that would be suitable for such storage. These being an area of field in the south west corner of the site (referred to as the "main pond") and an existing low lying area on the eastern boundary of the site, adjacent to the A6003, which is referred to as the SINC (Site of Importance for Nature Conservation).

3.4. The Symonds Report estimated that the total storage requirement for these ponds would be in the region of 41,000m^3 for the 1 in 200 year storm event.

3.5. The detailed design of these storage facilities has been carried out using the MicroDrainage WinDes version 8.1 Source Control software package. Information on the rainfall characteristics of the site for use within the software was taken from the Flood Estimation Handbook CD-ROM. Information on the extent of permeable and impermeable areas has been taken from the Stephen George and Partners drawing number 10002F011-V001, March 2003. This drawing shows the current envisaged layout of the development and was the most accurate information at the time of the design. A copy of the plan is included in Appendix B.

3.6. The areas were calculated using a planimeter and were measured in the form of time-area diagrams for the main pond and the SINC, as shown in the tables below. It was assumed that only Unit 1 would drain to the SINC whilst the remaining units would drain to the main pond. Extra impermeable area was allowed for at Units 1, 3, 4 and 6 to allow for the possible future expansion of car parking areas.

Time-Area Diagram for the Main Pond

Time (mins)	Impermeable Area (ha)	Total Area (ha)	Permeable Area (ha)	Model Area (ha) (Imp Area + 0.32 Permeable Area)
0-4	0.91	2.26	1.35	1.342
4-8	4.718	7.16	2.442	5.499
8-12	6.907	9.48	2.573	7.73
12-16	6.227	10.0	3.773	7.43
16-20	3.348	7.05	3.702	4.53
20-24	1.40	1.68	0.28	1.489
Total	23.51	37.63	14.12	28.02

Time-Area Diagram for the SINC				
Time (mins)	Impermeable Area (ha)	Total Area (ha)	Permeable Area (ha)	Model Area (ha) (Imp Area + 0.32 Permeable Area)
0-4	1.097	4.93	3.83	2.32
4-8	2.45	3.30	0.85	2.72
8-12	3.234	3.76	0.526	3.40
12-16	3.234	3.85	0.616	3.43
16-20	3.665	4.2	0.535	3.836
20-24	1.482	2.25	0.768	1.728
Total	15.162	22.29	7.125	17.434

The permeable areas have been factored down by a value of 0.32, which is the value of SPRHOST for the site from the FEH CD-ROM. This was carried out as it is not possible to differentiate between areas of varying permeability within the design software. The factoring therefore allows an equivalent impermeable area to be modelled.

3.7. The ponds were then designed individually to assess their basic storage volume requirements. This process found that the main pond needed a storage capacity of 22550m^3 whilst the SINC needed to store approximately 16350m^3. A check on the areas allocated for these ponds was carried out, which determined that whilst there was adequate space for the main pond, the SINC was not large enough.

3.8. As no earthworks or reshaping was allowed within the SINC, other than for the construction of the site access road, it was therefore proposed that space be allocated elsewhere. As part of the landscaping works it is necessary to replace another part of the SINC that is to be lost with an equivalent area of wet woodland. This will lend itself very well to act as a storage facility. Further modelling with the SINC and wet woodland area in a cascade sequence was carried out and determined that this storage area should have a nominal capacity of 6250m^3, whilst that required at the SINC reduced to 10100m^3.

3.9. Roscoe Capita carried out infiltration testing in the area of the wet woodland, SINC and main pond. Their results indicated that the rate of infiltration was low, in the order of 7.5 x 10^{-6} m/s. As a consequence it was decided that infiltration would not be taken into account when determining the storage volume.

3.10. The modelling results for each of the storage areas is provided in Appendix A. Drawings showing the location/layout of the storage facilities are provided in Appendix C.

Pond	Required Volume (m^3)	Actual Volume (m^3)
Wet Woodland	6250	6500
SINC	10100	10200
Main Pond	22550	22550
Total	38900	39250

Table of pond storage volumes

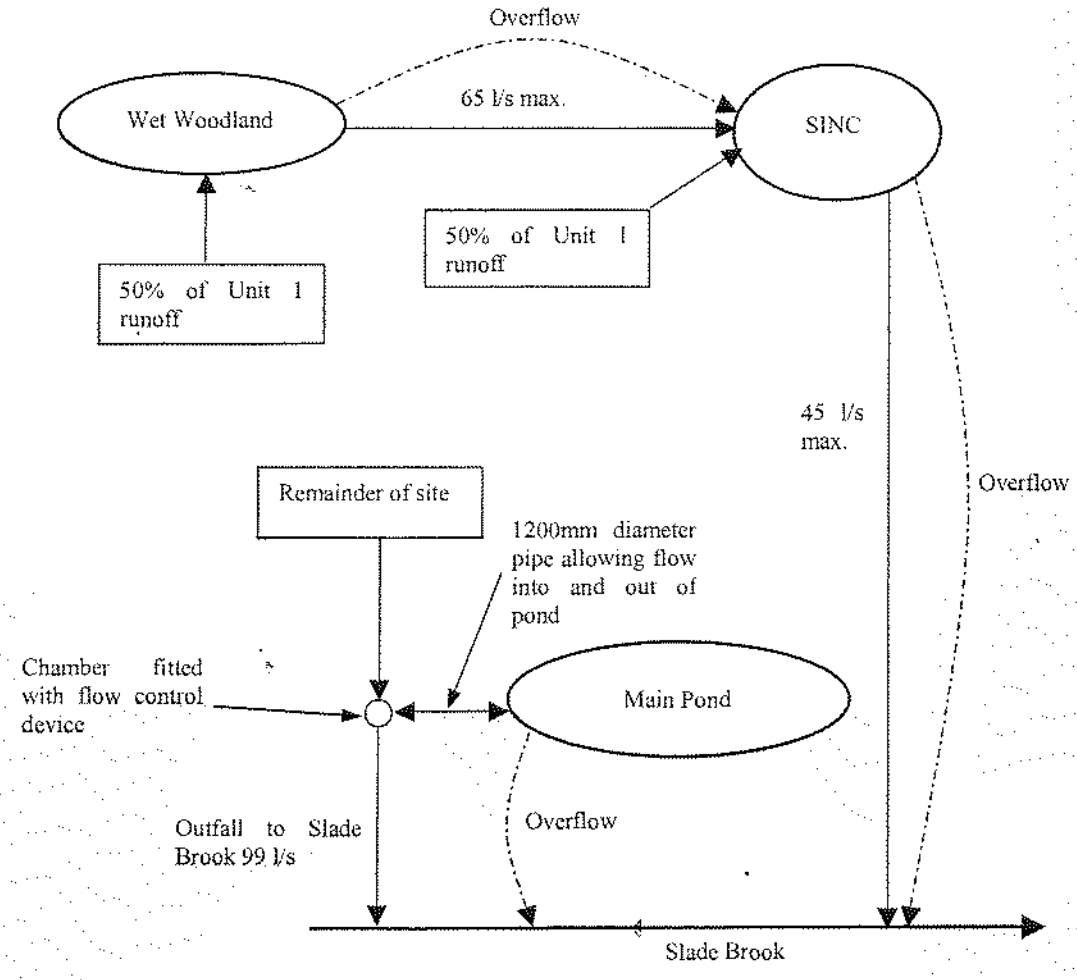


Diagram showing schematic arrangement of storage ponds

4. POND/STORAGE AREA DESIGN

4.1. As described above, there are to be 3 storage facilities within the site. Two of these areas, the wet woodland and the SINC, will manage runoff arising solely from Unit 1, whilst the main pond will manage unattenuated flows from the remainder of the site.

4.2. 50% of the surface water from Unit 1 will discharge into the wet woodland area. This has a storage requirement of 6250m^3. A surcharged orifice of 173mm diameter will be used to limit flows to approximately 65 l/s. The outflow will be set 200mm above the bed level, such that some water will be retained in order to mimic the existing situation in that area. The controlled discharge from the wet woodland will be directed via pipes to the SINC. It is expected that a small proportion of the water entering the wet woodland will infiltrate into the ground. The maximum storage depth within the wet woodland will be 1m, after which excess flow will be directed to the SINC via an overflow chamber positioned downstream of the orifice control. A freeboard of 300mm has been allowed between the overflow level and the proposed ground level.

4.3. The remaining 50% of the surface water from Unit 1 will discharge directly into the SINC. This has a storage requirement of 10100m^3. A 210mm diameter surcharged hydrobrake control will be used to limit flows to approximately 45 l/s. The controlled discharge from the SINC will be directed via pipes and a swale along the eastern and southern boundaries of the site directly into Slade Brook. The outflow will be set 1m above the bed level, such that some water will be retained in order to mimic the existing situation in that area. It is expected that a small proportion of the water entering the SINC will infiltrate into the ground. The maximum storage depth within the SINC will be 3m, after which excess flow will be directed to Slade Brook via an overflow chamber positioned downstream of the hydrobrake control. A freeboard of 500mm has been allowed between the overflow level and the existing ground level.

4.4. The rest of the site, both in the undeveloped and developed state will drain to the main pond, which has a storage requirement of 22550m^3. A cut off drain is to be provided along the western site boundary which will intercept surface runoff of the undeveloped site and direct it to the main pond (reference to points 6.14 and 6.16 of the Symonds Report). Flows from the rest of the site will enter the pond via a chamber and 1200mm diameter pipe at the north end. This chamber will also have a pipe connection directly to Slade Brook as well as the pond and it will be fitted with a surcharged 346mm diameter hydrobrake to restrict flows into Slade Brook to 99 l/s. Flows in excess of 99 l/s will enter the pond via the 1200mm diameter pipe. The western cut off drain will enter the pond adjacent to the main inlet/outlet. The maximum storage depth within the main pond will be 1.5m, after which excess flow will be directed to Slade Brook via an armoured overflow spillway. A freeboard of 500mm has been allowed between the overflow level and the top of the embankment/berm.

The total volume of water within the main pond will be 24350m^3, with 1800m^3 being held permanently below the outlet level. The pond is therefore outside the remit of the Reservoirs Act. Any water stored above the overflow spillway level is defined by the Act as transient storage and is not taken into account in volume calculations.

5. CONSTRUCTION SEQUENCING

5.1. In order to meet the Environment Agency's requirements, the attenuation facilities must be operational prior to any impermeable areas being constructed.

5.2. It will therefore be a priority to construct the main pond, cut off drains and the SINC inlet and outlets. No earthworks are required in the SINC area other than those resulting from the construction of the development access road. Once complete it will then be possible to drain 50% of the impermeable area of Unit 1 to the SINC. The wet woodland area does not need to be constructed immediately, but will have to be functional before Unit 1 is completed as the SINC is not large enough to cope with the runoff from the whole Unit 1 area.

Appendix D – BGS Geology Map

Geology 1:10,000 Maps Legends

Artificial Ground and Landslip

Map Colour	Lex Code	Rock Name	Rock Type	Min and Max Age
	WMGR	Infilled Ground	Artificial Deposit	Present Day - Present Day

Superficial Geology

Map Colour	Lex Code	Rock Name	Rock Type	Min and Max Age
	ALV	Alluvium	Clay, Silt, Sand and Gravel	Flandrian - Flandrian
	TILMP	TILL, MID PLEISTOCENE	Diamicton	Ipswichian - Cromerian

Bedrock and Faults

Map Colour	Lex Code	Rock Name	Rock Type	Min and Max Age
	LLL	Lower Lincolnshire Limestone Member	Limestone	Bajocian - Bajocian
	RLD	Rutland Formation	Mudstone	Bathonian - Bajocian
	NS	Northampton Sand Formation	Ooidal Ironstone	Aalenian - Aalenian
	GRF	Grantham Formation	Sandstone, Siltstone and Mudstone	Aalenian - Aalenian
	WHM	Whitby Mudstone Formation	Mudstone	Toarcian - Toarcian
	Fault			

CAPITA SYMONDS

Geology 1:10,000 Maps

This report contains geological map extracts taken from the BGS Digital Geological map of Great Britain at 1:10,000 scale and is designed for users carrying out preliminary site assessments who require geological maps for the area around a site. This mapping may be more up to date than previously published paper maps.

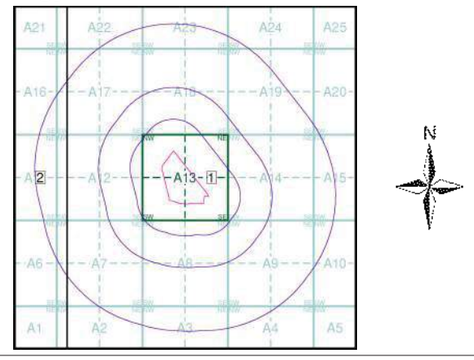
The various geological layers - artificial and landslip deposits, superficial geology and solid (bedrock) geology are displayed in separate maps, but superimposed on the final 'Combined Surface Geology' map. All map legends feature on this page.

Please Note: Not all of the layers have complete nationwide coverage, so availability of data for relevant map sheets is indicated below.

Geology 1:10,000 Maps Coverage

Map ID:	1	**Map ID:**	2
Map Name:	SP88SE	**Map Name:**	SP88SW
Map Date:	2001	**Map Date:**	2001
Bedrock Geology:	Available	**Bedrock Geology:**	Available
Superficial Geology:	Available	**Superficial Geology:**	Available
Artificial Geology:	Available	**Artificial Geology:**	Available
Faults:	Available	**Faults:**	Available
Landslip:	Not Available	**Landslip:**	Not Available
Rock Segments:	Not Available	**Rock Segments:**	Not Available

Geology 1:10,000 Maps - Slice A



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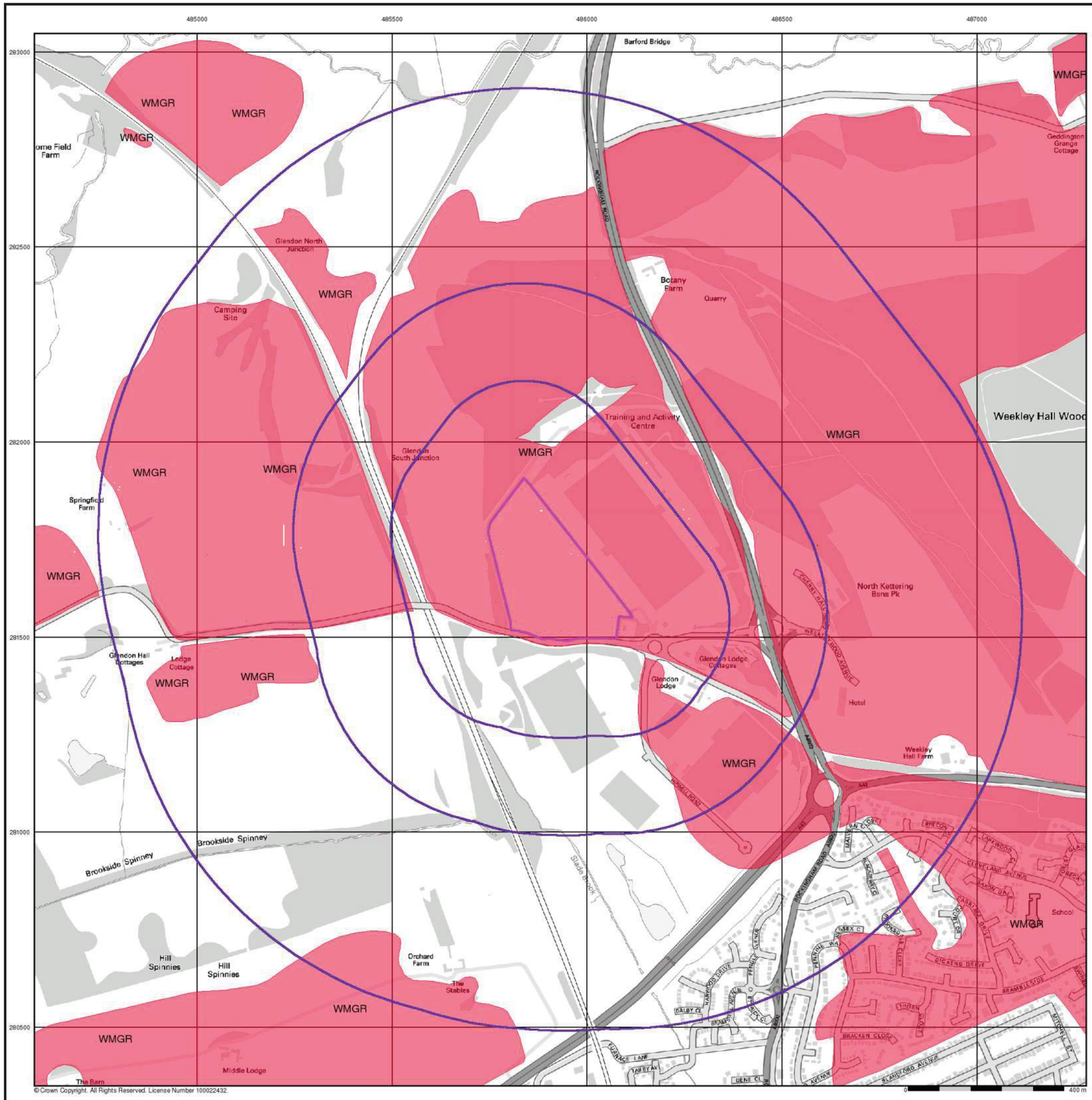
Site Area (Ha):	8.58
Search Buffer (m):	1000

Site Details

Zone A Plot 2, North Kettering Business Park, KETTERING, Northamptonshire, NN14

Landmark Information Group

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



CAPITA SYMONDS

Artificial Ground and Landslip

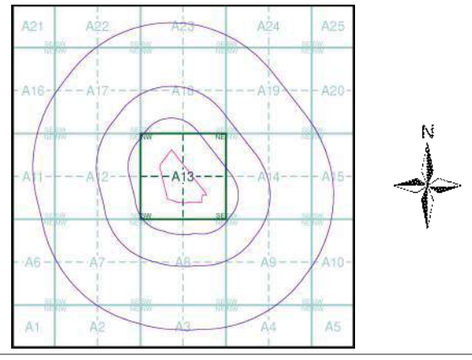
Artificial ground is a term used by BGS for those areas where the ground surface has been significantly modified by human activity. Information about previously developed ground is especially important, as it is often associated with potentially contaminated material, unpredictable engineering conditions and unstable ground.

Artificial ground includes:

- Made ground - man-made deposits such as embankments and spoil heaps on the natural ground surface.
- Worked ground - areas where the ground has been cut away such as quarries and road cuttings.
- Infilled ground - areas where the ground has been cut away then wholly or partially backfilled.
- Landscaped ground - areas where the surface has been reshaped.
- Disturbed ground - areas of ill-defined shallow or near surface mineral workings where it is impracticable to map made and worked ground separately.

Mass movement (landslip) deposits on BGS geological maps are primarily superficial deposits that have moved down slope under gravity to form landslips. These affect bedrock, other superficial deposits and artificial ground. The dataset also includes foundered strata, where the ground has collapsed due to subsidence.

Artificial Ground and Landslip Map - Slice A



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CAPITA SYMONDS

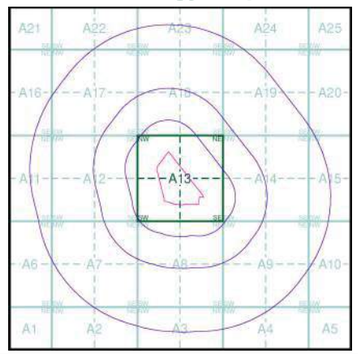
Superficial Geology

BGS 1:10,000 Superficial Deposits are the youngest geological deposits formed during the most recent period of geological time, 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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National Grid Reference:	485910, 281670
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Site Area (Ha):	8.58
Search Buffer (m):	1000

Site Details

Zone A Plot 2, North Kettering Business Park, KETTERING, Northamptonshire, NN14

Landmark Information Group

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

CAPITA SYMONDS

Bedrock and Faults

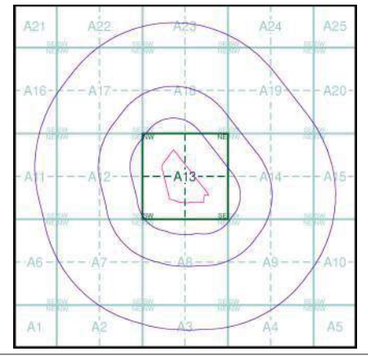
Bedrock geology is a term used for the main mass of rocks forming the Earth and are present everywhere, whether exposed at the surface in outcrops or concealed beneath superficial deposits or water.

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 and thin beds mapped as lines such as coal seams and mineral veins. These are not restricted by age and could relate to features of any of the 1:10,000 geology datasets.

Bedrock and Faults Map - Slice A



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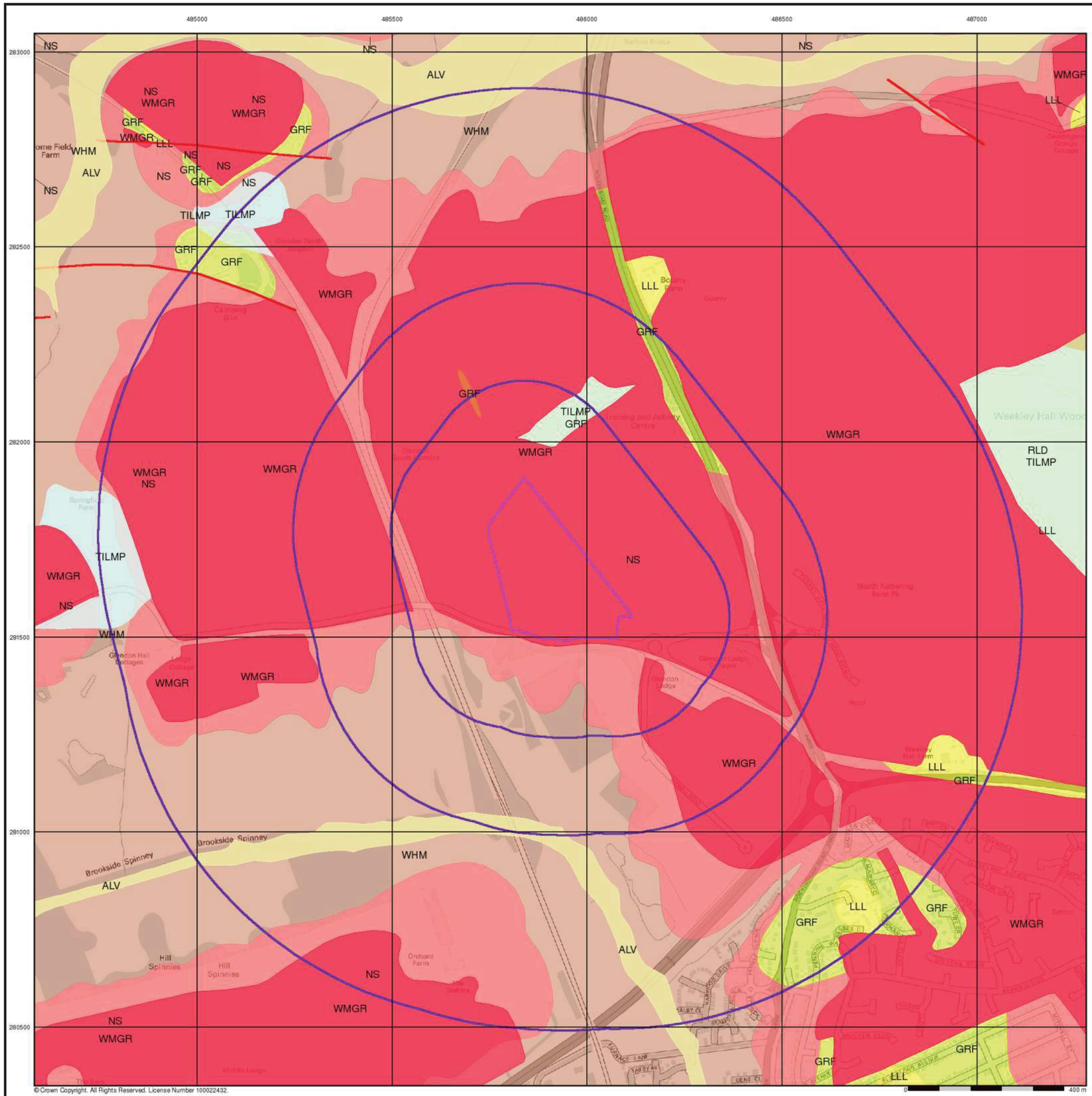
Site Details

Zone A Plot 2, North Kettering Business Park, KETTERING, Northamptonshire, NN14



CAPITA SYMONDS

Combined Surface Geology

The Combined Surface Geology map combines all the previous maps into one combined geological overview of your site.

Please consult the legends to the previous maps to interpret the Combined "Surface Geology" map.

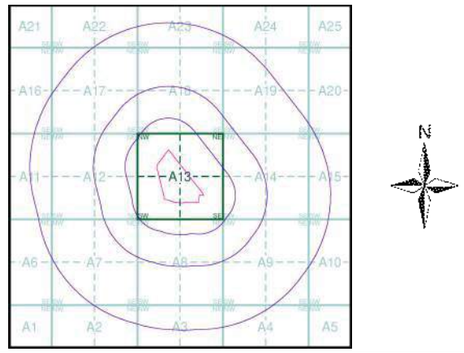
Additional Information

More information on 1:10,000 Geological mapping and explanations of rock classifications can be found on the BGS website. Using the LEX Codes in this report, further descriptions of rock types can be obtained by interrogating the 'BGS Lexicon of Named Rock Units'. This database can be accessed by following the 'Information and Data' link on the BGS website.

Contact

British Geological Survey
Kingsley Dunham Centre
Keyworth
Nottingham
NG12 5GG
Telephone: 0115 936 3143
Fax: 0115 936 3276
email: enquiries@bgs.ac.uk
website: www.bgs.ac.uk

Combined Geology Map - Slice A



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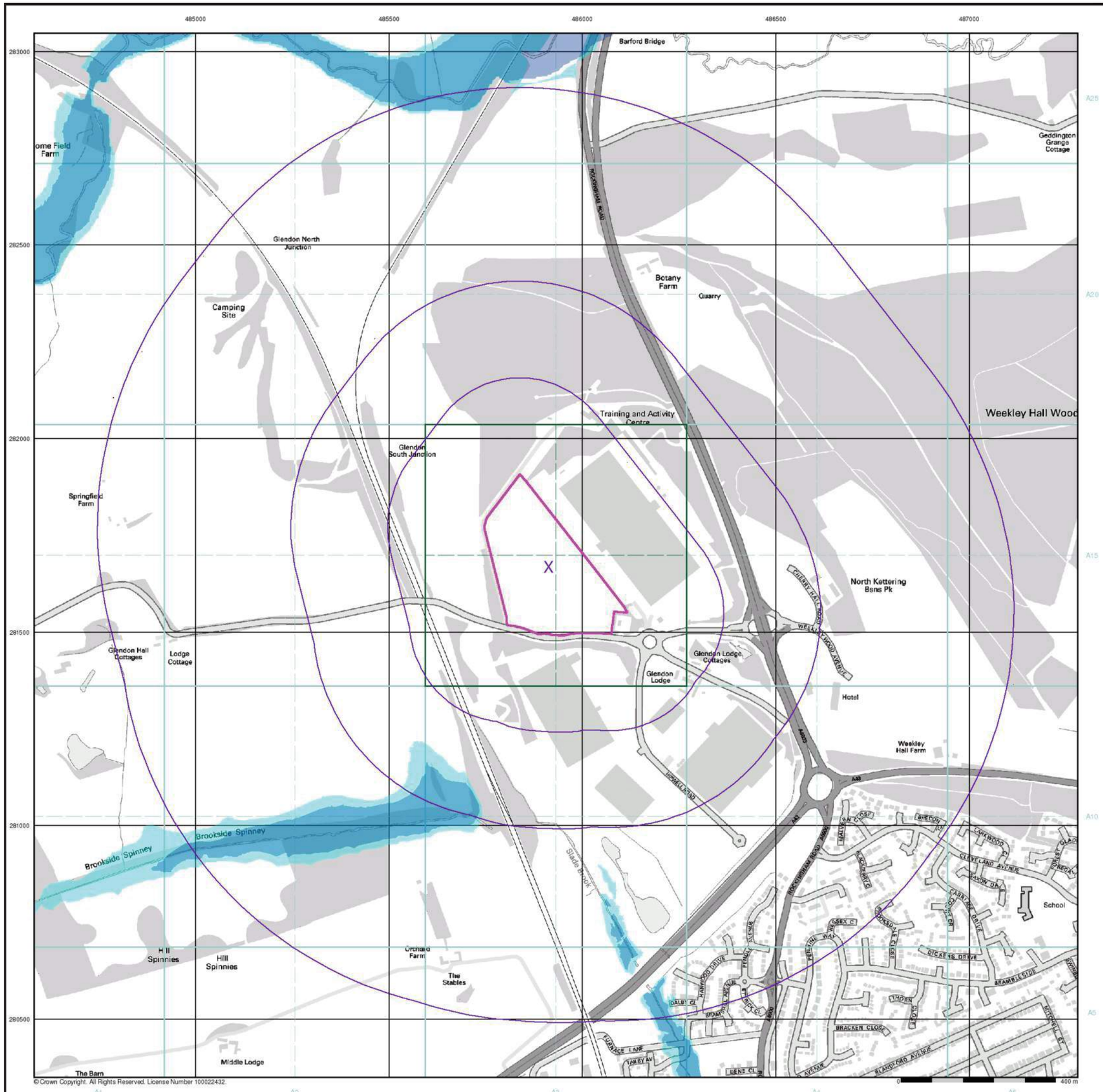
National Grid Reference:	485910, 281670
Slice:	A
Site Area (Ha):	8.58
Search Buffer (m):	1000

Site Details

Zone A Plot 2, North Kettering Business Park, KETTERING, Northamptonshire, NN14

Appendix E – EA Flood Zone Map



CAPITA SYMONDS

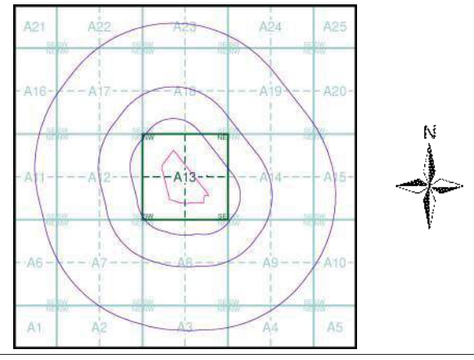
General

- Specified Site
- Specified Buffer(s)
- Bearing Reference Point

Agency and Hydrological (Flood)

- Extreme Flooding from Rivers or Sea without Defences (Zone 2)
- Flooding from Rivers or Sea without Defences (Zone 3)
- Area Benefiting from Flood Defence
- Flood Water Storage Areas
- Flood Defence

Flood Map - Slice A



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Slice:	A
Site Area (Ha):	8.58
Search Buffer (m):	1000

Site Details

Zone A Plot 2, North Kettering Business Park, KETTERING, Northamptonshire, NN14

Landmark Information Group

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

Appendix F – 2007 Run-Off Calculations

CAPITA SYMONDS

Project Title
Kettering Site A Plot 2

Job Number	**CS027175**		
Version	**Final**		
File Path	I/env/zwet/CS027175		
Produced by	KL	**Date**	31/10/07
Checked by	JR	**Date**	30/11/07

Rainfall Data **NGR** **486070 281030**

Return Period		1	2	10	30	100	100 + CC	200	200+CC
Duration (mins)	Duration (hrs)								
15	0.25	4.59	7.52	14.37	21.22	38.21	45.852	48.59	58.308
30	0.5	6	9.94	18.38	26.61	44.87	53.844	56.39	67.668
60	1	7.83	12.96	23.2	32.93	52.7	63.24	65.43	78.516
120	2	10.23	16.75	29.01	40.38	61.9	74.28	75.93	91.116
240	4	13.36	21.49	36.03	49.17	72.69	87.228	88.1	105.72
360	6	15.62	24.8	40.8	55.05	79.86	95.832	96.11	115.332
480	8	17.45	27.44	44.52	59.59	85.38	102.456	102.23	122.676
600	10	19.02	29.66	47.62	63.34	89.91	107.892	107.25	128.7
720	12	20.4	31.59	50.3	66.55	93.8	112.56	111.53	133.836
840	14	21.28	32.79	51.82	68.27	95.53	114.636	113.29	135.948
1440	24	24.64	35.27	57.45	71.76	101.86	122.232	119.67	143.604
2880	48	29.76	43.89	65.46	83.27	110.62	132.744	128.4	154.08

Notes

Rainfall data sourced from FEH CD ROM using depth duration frequency (DDF) model. Should be in millimetres (mm).

Rainfall data at return periods less than 1 in 2 years are not considered reliable and should not be used in detailed design calculations.

Climate change rainfall intensities are based on Table B.2 of PPS 25 and assume a development design life of 50 year (i.e. rainfall increase of 20%). It may be necessary to increase/decrease the climate change allowance depending upon the development design life.

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Calculation of Greenfield Runoff Rates - Institute of Hydrology Report 124 FSR 3-parameter equation

Site name	AREA (km)	SPRHOST (%)	SAAR (mm)	SOIL	QBAR (m^3/s)
Kettering Zone A Plot 2	0.50	32.1	647	0.4	0.15514409

For Small Catchments
$QBAR(rural) = 0.00108*AREA^{0.89}*SAAR^{1.17}*SOIL^{2.17}$

Greenfield runoff in m3/s	**Return Period**								
	QBAR	**1**	**2**	**10**	**30**	**100**	**100 + CC**	**200**	**200+CC**
Region	0.16	0.14	0.14	0.26	0.41	0.55	0.66	0.65	0.78
5	0.00	0.88	0.89	1.65	2.62	3.56	4.27	4.2	5.04

Greenfield runoff in l/s for 50 ha Area	**Return Period**								
	QBAR	**1**	**2**	**10**	**30**	**100**	**100 + CC**	**200**	**200+CC**
	155.14	136.53	138.08	255.99	406.48	552.31	662.78	651.61	781.93

Greenfield runoff in l/s/ha	**Return Period**					**EA Allowable Discharge Rates**			
	QBAR	**1**	**2**	**10**	**30**	**100**	**100 + CC**	**200**	**200+CC**
	1.03429	0.91	2.76	5.12	8.13	3.81	4.57	4.11	4.93

Actual Site Area (Existing)	9.2 ha								
	Return Period					**EA Allowable Discharge Rates**			
	QBAR	**1**	**2**	**10**	**30**	**100**	**100 + CC**	**200**	**200+CC**
Existing total discharge from site (l/s)	9.52	8.37	25.41	47.10	74.79	35.04	42.05	37.82	45.39

Notes

REFERENCES

Interim Code of Practice for Sustainable Drainage Systems (2004) National SUDS Working Group. This document provides guidelines for the calculation of Greenfield runoff. Pg 49 and Table 6.1. Based on guidance from the National SUDS Working Group (2004) the IOH 124 method only applies to catchments of 50ha and above and for smaller catchment should be linearly interpolated from a 50ha area. (Table 6.1 Interim code of practice on sustainable drainage systems).

Technical Report W5-07A/TR1 Preliminary Rainfall Runoff Management for Developments The 1 in 1 year return period event is defined as the highest probability event to be specifically considered to ensure that flows to the watercourse are tighly contolled for thes more frequent events.

For SOIL Index: **Flood Studies Report (FSR) Vol. 1 Pg 303 and 312.**

For small catchments: **IoH Report No. 124, Institute of Hydrology, 1994.**

For Growth Curve Factors: **Flood Studies Supplementary Report (FSSR) 14, UK Hydrological Growth Curve Regions**

SOIL INDEX

=(0.15S1+0.30S2+0.40S3+0.45S4+0.50S5)/(S1+S2+S3+S4+S5)
Where S1..... S5 are classifications from the Winter Rain Soil Acceptance (WRAP) map.

It is also recognised in Report 124 (1994) pg29 that ' It is possible that, for small catchments in particular, the generalised nature of the soil map could lead to misleading data being assigned to the catchment'.

SOIL values can be verified using Soil survey Maps of England and Wales for reference. Site investigation results (borehole data) can also be used for reference where available.

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Kettering Zone A Plot 2

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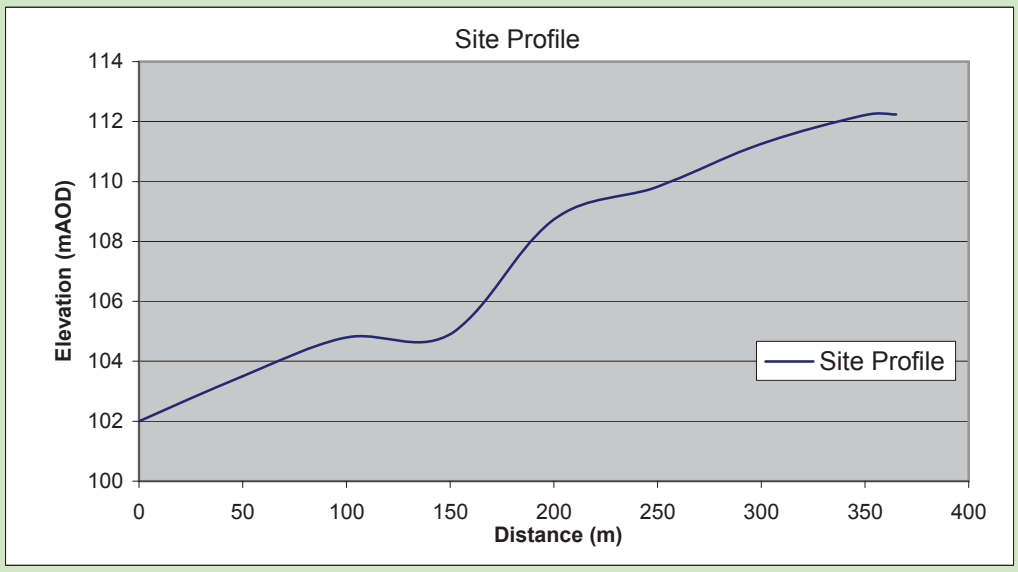
Calculation of Average Site Slope - Weighted Height-Distance Method

Elevation (mAOD)	Height Difference (m)	Cumulative Distance (x)	Change in Distance (X)	Average Height (-h)	Average of change (A)
102	0	0	0	0	0
103.5	1.5	50	50	102.75	5137.5
104.8	2.8	100	50	103.9	5195
104.9	2.9	150	50	104.85	5242.5
108.73	6.73	200	50	106.8	5340
109.82	7.82	250	50	109.3	5465
111.26	9.26	300	50	110.5	5525
112.22	10.22	350	50	111.74	5587
112.24	10.24	365	50	112.23	5611.5
		TOTAL	400		43103.5
		Average Site Slope (S)			**0.5388**

$$S = \frac{2x(\sum A)}{(\sum X)^2}$$



Time of Concentration for Small Catchments
$Tc = 0.00025(L/S^{0.5})^{0.8}$ Shaw (1994)

Area (Ha)	Length (m)	Highest Point	Lowest Point	Slope	Time of Concentrati
8.02	365	112.24	102.00	0.5388	2.15

Notes

A weighted average method is used to determine the average slope across a site. Taking the high and low points on a site and the site length is not necessarily representative of the actual slope across a site for the purposes of determining time of concentration (ToC). On small sites this will make little difference in theToC, however can potentially affect ToC of large sites.

Time of concentration is the time required for rain falling at the farthest point of the catchment to flow to the measureing point of the river. This is where the flow **Q** is peak for the catchment/site. Tc can be used to define the **CRITICAL DURATION** for the site/catchment.

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Calculation of Post Development Peak Runoffs and Volumes from Impermeable Areas ONLY

Modified Rational Method: Peak Flow for Impermeable Areas
Q = 2.78 Cv* Cr*I*A/1000
Where
Cr = Routing Coefficient (1.3 for Urban areas)
Cv = Runoff Coefficient
I = Rainfall intensity (mm/hr)
A = Area (ha)

Calculation of Runoff Coefficient (Cv)

Surface	Area (ha)	Cv	Weighted Cv
Greenfield Open Space	N/A	N/A	N/A
Macadam			0
Hardstanding	7.7	0.9	0.9
Other			0
Total	**7.70**		**0.9**

Return Period	1 in 1	**Year**	

Duration (mins)	FEH rainfall Depth (mm)	Intensity (mm/hr)	Peak Flow Rate (m3/s)	Volume of Runoff (m3)
15	4.59	18.36	0.460	318
30	6	12.00	0.301	416
60	7.83	7.83	0.196	543
120	10.23	5.12	0.128	709
240	13.36	3.34	0.084	926
360	15.62	2.60	0.065	1082
480	17.45	2.18	0.055	1209
600	19.02	1.90	0.048	1318
720	20.4	1.70	0.043	1414
840	21.28	1.52	0.038	1475
1440	24.64	1.03	0.026	1708
2880	29.76	0.62	0.016	2062

Calculation of Post Development Peak Runoffs and Volumes from Greenfield Areas ONLY

Post Development Greenfield Area	1.5 ha		
	QBAR	**Return Period 1**	
Greenfield Runoff Rate (l/s/ha)	1.03	0.91	
Greenfield Runoff from Open Space (l/s)	1.55	1.37	Refer greenfield runoff calcs

NOTES
Wnere necessary interpolate between the duration values once Tc has been calculated.

Reference Modified Rational Method
This worksheet considers the following scenario:

The site in question is currently considered greenfield i.e. undeveloped in its entirety. Greenfield rnuoff rates have been used to determine allowable discharge on the previous worksheets.

The post development scenario will include an increase in impermeable surfaces due to the proposed development. This worksheet determines the runoff from the post-development impermeable areas only. Refer the follow worksheet for the total peak runoff rates and volumes taking into consideration the post-development greenfield areas in addition to the impermeable areas.

Reference is made to Preliminary Managment of Rainfall Runoff for Developments.
Ref. Technical Report W5-07A/TR1Preliminary Rainfall Runoff Management for Developments (2004) Rev B.
Cv = Example of Reference for Cv Values
Urban Drainage (Butler and Davis) 2005, Spon Press, Oxford

The documents referenced here are available on the internet.

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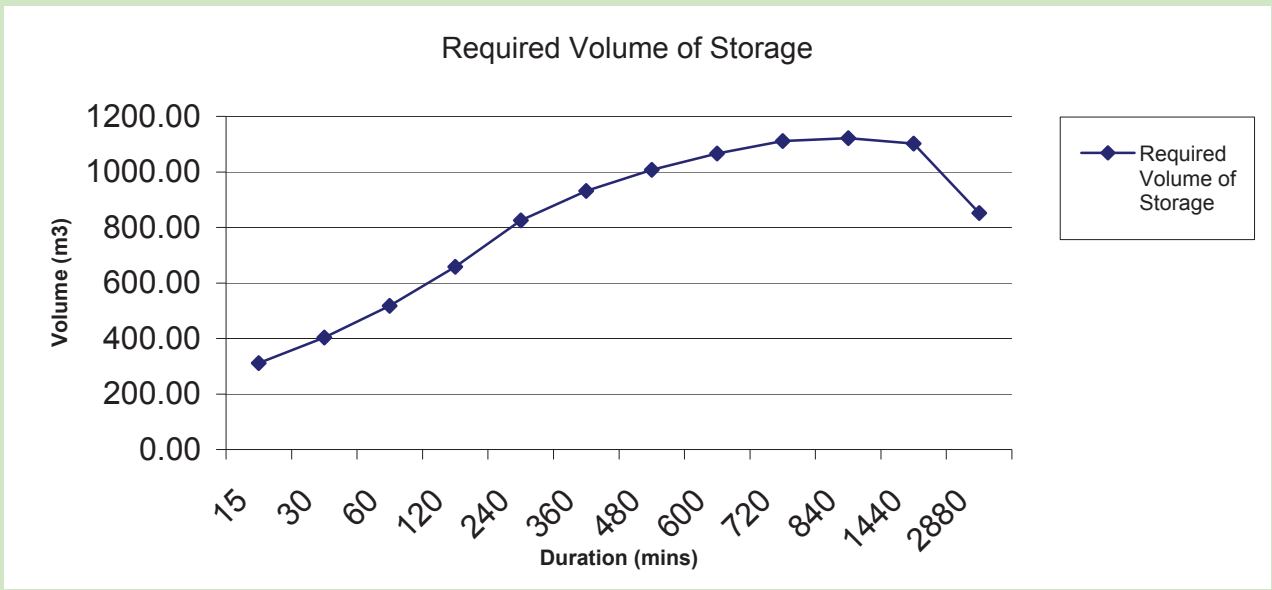
Produced by	KL	**Date**	31/10/2007
Checked by	JR	**Date**	30/11/2007

Calculation of TOTAL Post Development Peak Runoffs and Volumes and Required Storage

Return Period	1 in 1	**Year**

Storm Duration (minutes)	Existing or Permitted Discharge Runoff Rate m³/s	Post-Development Runoff Rate m³/s	Existing or Permitted Outflow Volume (Greenfield) m³	Post-Development Runoff Volume m³	Storage, Inflow - Outflow m³
15	0.0084	0.461	7.54	319.32	311.78
30	0.0084	0.302	15.07	418.26	403.18
60	0.0084	0.197	30.15	547.53	517.39
120	0.0084	0.129	60.29	718.77	658.48
240	0.0084	0.085	120.58	945.51	824.93
360	0.0084	0.067	180.87	1111.96	931.09
480	0.0084	0.056	241.16	1248.60	1007.44
600	0.0084	0.049	301.45	1367.24	1065.78
720	0.0084	0.044	361.74	1472.70	1110.96
840	0.0084	0.039	422.03	1543.51	1121.48
1440	0.0084	0.027	723.48	1825.51	1102.03
2880	0.0084	0.017	1446.97	2298.29	851.32

Required Storage	**1121.48**	**m³**



Notes

Post-Development runoff volumes are a combination of runoff volumes from impermeable areas and runoff volumes from greenfield areas.

Greenfield runoff rates are not duration dependent using the IoH124 method, however greenfield runoff volumes have been calculated for the storm durations above and added to the duration dependent volumes from the impermeable areas (which use the Modified Rational Method)

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Calculation of Post Development Peak Runoffs and Volumes from Impermeable Areas ONLY

Modified Rational Method: Peak Flow for Impermeable Areas
Q = 2.78 Cv* Cr*I*A/1000
Where
Cr = Routing Coefficient (1.3 for Urban areas)
Cv = Runoff Coefficient
I = Rainfall intensity (mm/hr)
A = Area (ha)

Calculation of Runoff Coefficient (Cv)

Surface	Area (ha)	Cv	Weighted Cv
Greenfield Open Space	N/A	N/A	N/A
Macadam	0	0	0
Hardstanding	7.7	0.9	0.9
Other	0	0	0
Total	**7.70**		**0.9**

Return Period	1 in 100	**Year**	

Duration (mins)	FEH rainfall Depth (mm)	Intensity (mm/hr)	Peak Flow Rate (m3/s)	Volume of Runoff (m3)
15	38.21	152.84	3.828	2648
30	44.87	89.74	2.248	3109
60	52.7	52.70	1.320	3652
120	61.9	30.95	0.775	4290
240	72.69	18.17	0.455	5037
360	79.86	13.31	0.333	5534
480	85.38	10.67	0.267	5917
600	89.91	8.99	0.225	6231
720	93.8	7.82	0.196	6500
840	95.53	6.82	0.171	6620
1440	101.86	4.24	0.106	7059
2880	110.62	2.30	0.058	7666

Calculation of Post Development Peak Runoffs and Volumes from Greenfield Areas ONLY

Post Development Greenfield Area	1.5 ha		
	QBAR	**Return Period 100**	
Greenfield Runoff Rate (l/s/ha)	1.03	3.81	
Greenfield Runoff from Open Space (l/s)	1.55	5.71	Refer greenfield runoff calcs

NOTES
Wnere necessary interpolate between the duration values once Tc has been calculated.

Reference Modified Rational Method - The Wallingford Procedure Vol. 4 'The Modified Rational Method' Water Research Council (1981)

This worksheet considers the following scenario:

The site in question is currently considered greenfield i.e. undeveloped in its entirety. Greenfield runoff rates have been used to determine allowable discharge on the previous worksheets.

The post development scenario will include an increase in impermeable surfaces due to the proposed development. This worksheet determines the runoff from the post-development impermeable areas only. Refer the follow worksheet for the total peak runoff rates and volumes taking into consideration the post-development greenfield areas in addition to the impermeable areas.

Reference is made to Preliminary Managment of Rainfall Runoff for Developments.
Ref. Technical Report W5-07A/TR1Preliminary Rainfall Runoff Management for Developments (2004) Rev B.
Cv = Example of Reference for Cv Values
Urban Drainage (Butler and Davis) 2005, Spon Press, Oxford

The documents referenced here are available on the internet.

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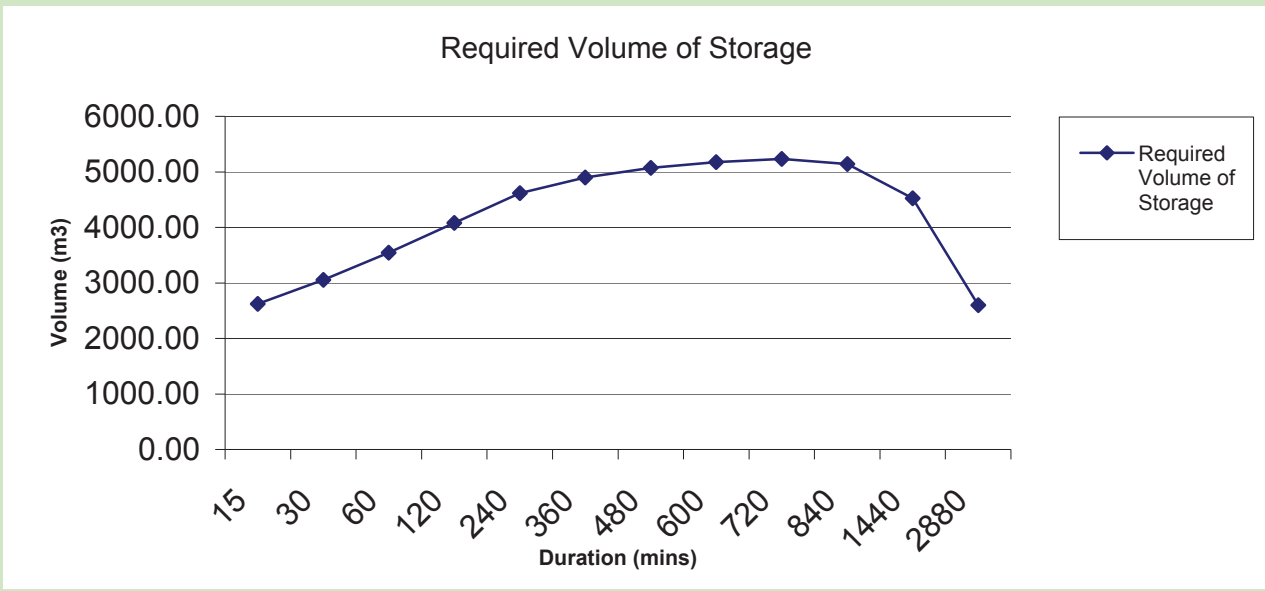
Calculation of TOTAL Post Development Peak Runoffs and Volumes and Required Storage

Return Period	1 in 100	**Year**

Storm Duration (minutes)	Existing or Permitted Discharge Runoff Rate m³/s	Post-Development Runoff Rate m³/s	Existing or Permitted Outflow Volume (Greenfield) m³	Post-Development Runoff Volume m³	Storage, Inflow - Outflow m³
15	0.0350	3.834	31.54	2653.10	2621.56
30	0.0350	2.253	63.08	3119.78	3056.70
60	0.0350	1.326	126.16	3672.68	3546.52
120	0.0350	0.781	252.31	4330.81	4078.50
240	0.0350	0.461	504.62	5119.69	4615.07
360	0.0350	0.339	756.94	5657.71	4900.78
480	0.0350	0.273	1009.25	6081.39	5072.14
600	0.0350	0.231	1261.56	6436.45	5174.89
720	0.0350	0.201	1513.87	6747.17	5233.30
840	0.0350	0.177	1766.18	6908.19	5142.01
1440	0.0350	0.112	3027.74	7552.55	4524.81
2880	0.0350	0.063	6055.48	8653.27	2597.79

Required Storage **5233.30 m³**



Notes

Post-Development runoff volumes are a combination of runoff volumes from impermeable areas and runoff volumes from greenfield areas.

Greenfield runoff rates are not duration dependent using the IoH124 method, however greenfield runoff volumes have been calculated for the storm durations above and added to the duration dependent volumes from the impermeable areas (which use the Modified Rational Method)

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Calculation of Post Development Peak Runoffs and Volumes from Impermeable Areas ONLY

Modified Rational Method: Peak Flow for Impermeable Areas
Q = 2.78 Cv* Cr*I*A/1000
Where
Cr = Routing Coefficient (1.3 for Urban areas)
Cv = Runoff Coefficient
I = Rainfall intensity (mm/hr)
A = Area (ha)

Calculation of Runoff Coefficient (Cv)

Surface	Area (ha)	Cv	Weighted Cv
Greenfield Open Space	N/A	N/A	N/A
Macadam	0	0	0
Hardstanding	7.7	0.9	0.9
Other	0	0	0
Total	**7.70**		**0.9**

Return Period	1 in 100 + CC	**Year**	

Duration (mins)	FEH rainfall Depth (mm)	Intensity (mm/hr)	Peak Flow Rate (m3/s)	Volume of Runoff (m3)
15	45.852	183.41	4.593	3178
30	53.844	107.69	2.697	3731
60	63.24	63.24	1.584	4383
120	74.28	37.14	0.930	5148
240	87.228	21.81	0.546	6045
360	95.832	15.97	0.400	6641
480	102.456	12.81	0.321	7100
600	107.892	10.79	0.270	7477
720	112.56	9.38	0.235	7800
840	114.636	8.19	0.205	7944
1440	122.232	5.09	0.128	8471
2880	132.744	2.77	0.069	9199

Calculation of Post Development Peak Runoffs and Volumes from Greenfield Areas ONLY

Post Development Greenfield Area	1.5 ha		
	QBAR	**Return Period 100 + CC**	
Greenfield Runoff Rate (l/s/ha)	1.03	4.57	
Greenfield Runoff from Open Space (l/s)	1.55	6.86	Refer greenfield runoff calcs

NOTES
Wnere necessary interpolate between the duration values once Tc has been calculated.

Reference Modified Rational Method - The Wallingford Procedure Vol. 4 'The Modified Rational Method' Water Research Council (1981)

This worksheet considers the following scenario:

The site in question is currently considered greenfield i.e. undeveloped in its entirety. Greenfield runoff rates have been used to determine allowable discharge on the previous worksheets.

The post development scenario will include an increase in impermeable surfaces due to the proposed development. This worksheet determines the runoff from the post-development impermeable areas only. Refer the follow worksheet for the total peak runoff rates and volumes taking into consideration the post-development greenfield areas in addition to the impermeable areas.

Reference is made to Preliminary Managment of Rainfall Runoff for Developments.
Ref. Technical Report W5-07A/TR1Preliminary Rainfall Runoff Management for Developments (2004) Rev B.
Cv = Example of Reference for Cv Values
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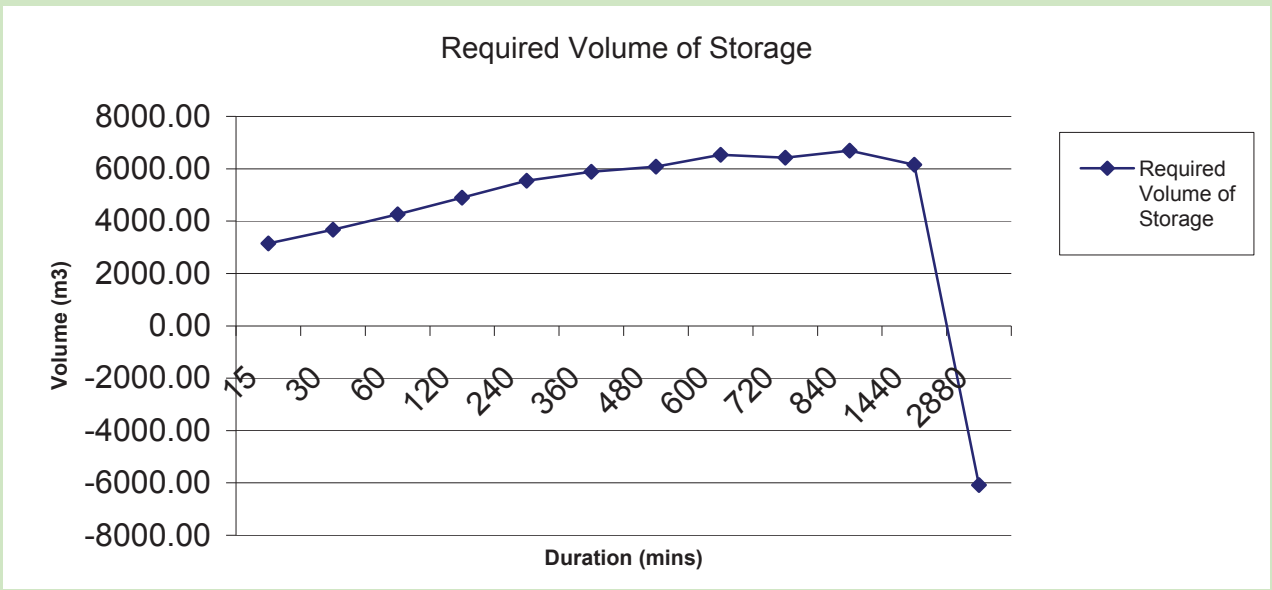
Calculation of TOTAL Post Development Peak Runoffs and Volumes and Required Storage

Return Period	1 in 100 + CC	**Year**

Storm Duration (minutes)	Existing or Permitted Discharge Runoff Rate m^3/s	Post-Development Runoff Rate m^3/s	Existing or Permitted Outflow Volume (Greenfield) m^3	Post-Development Runoff Volume m^3	Storage, Inflow - Outflow m^3
15	0.0421	4.600	37.85	3183.71	3145.87
30	0.0421	2.704	75.69	3743.73	3668.04
60	0.0421	1.591	151.39	4407.21	4255.83
120	0.0421	0.937	302.77	5196.97	4894.20
240	0.0421	0.553	605.55	6143.63	5538.08
360	0.0421	0.407	908.32	6789.25	5880.93
480	0.0421	0.328	1211.10	7297.66	6086.57
600	0.0421	0.242	1513.87	8047.23	6533.36
720	0.0421	0.212	1816.64	8240.47	6423.82
840	0.0421	0.134	2119.42	8816.24	6696.82
1440	0.0421	0.076	3633.29	9791.54	6158.25
2880	0.0421	0.007	7266.58	1184.77	-6081.81

Required Storage **6696.82** m^3



Notes

Post-Development runoff volumes are a combination of runoff volumes from impermeable areas and runoff volumes from greenfield areas.

Greenfield runoff rates are not duration dependent using the IoH124 method, however greenfield runoff volumes have been calculated for the storm durations above and added to the duration dependent volumes from the impermeable areas (which use the Modified Rational Method)

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Produced by	KL	**Date**	31/10/2007
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Calculation of Post Development Peak Runoffs and Volumes from Impermeable Areas ONLY

Modified Rational Method: Peak Flow for Impermeable Areas
Q = 2.78 Cv* Cr*I*A/1000
Where
Cr = Routing Coefficient (1.3 for Urban areas)
Cv = Runoff Coefficient
I = Rainfall intensity (mm/hr)
A = Area (ha)

Calculation of Runoff Coefficient (Cv)

Surface	Area (ha)	Cv	Weighted Cv
Greenfield Open Space	N/A	N/A	N/A
Macadam	0	0	0
Hardstanding	7.7	0.9	0.9
Other	0	0	0
Total	**7.70**		**0.9**

Return Period	1 in 200	**Year**	

Duration (mins)	FEH rainfall Depth (mm)	Intensity (mm/hr)	Peak Flow Rate (m3/s)	Volume of Runoff (m3)
15	48.59	194.36	4.868	3367
30	56.39	112.78	2.825	3908
60	65.43	65.43	1.639	4534
120	75.93	37.97	0.951	5262
240	88.1	22.03	0.552	6105
360	96.11	16.02	0.401	6660
480	102.23	12.78	0.320	7085
600	107.25	10.73	0.269	7432
720	111.53	9.29	0.233	7729
840	113.29	8.09	0.203	7851
1440	119.67	4.99	0.125	8293
2880	128.4	2.68	0.067	8898

Calculation of Post Development Peak Runoffs and Volumes from Greenfield Areas ONLY

Post Development Greenfield Area	1.5 ha		
	QBAR	**Return Period 200**	
Greenfield Runoff Rate (l/s/ha)	1.03	4.11	
Greenfield Runoff from Open Space (l/s)	1.55	6.17	Refer greenfield runoff calcs

NOTES
Wnere necessary interpolate between the duration values once Tc has been calculated.

Reference Modified Rational Method - The Wallingford Procedure Vol. 4 'The Modified Rational Method' Water Research Council (1981)

This worksheet considers the following scenario:

The site in question is currently considered greenfield i.e. undeveloped in its entirety. Greenfield runoff rates have been used to determine allowable discharge on the previous worksheets.

The post development scenario will include an increase in impermeable surfaces due to the proposed development. This worksheet determines the runoff from the post-development impermeable areas only. Refer the follow worksheet for the total peak runoff rates and volumes taking into consideration the post-development greenfield areas in addition to the impermeable areas.

Reference is made to Preliminary Managment of Rainfall Runoff for Developments.
Ref. Technical Report W5-07A/TR1Preliminary Rainfall Runoff Management for Developments (2004) Rev B.
Cv = Example of Reference for Cv Values
Urban Drainage (Butler and Davis) 2005, Spon Press, Oxford

The documents referenced here are available on the internet.

CAPITA SYMONDS

Project Title
Kettering Zone A Plot 2

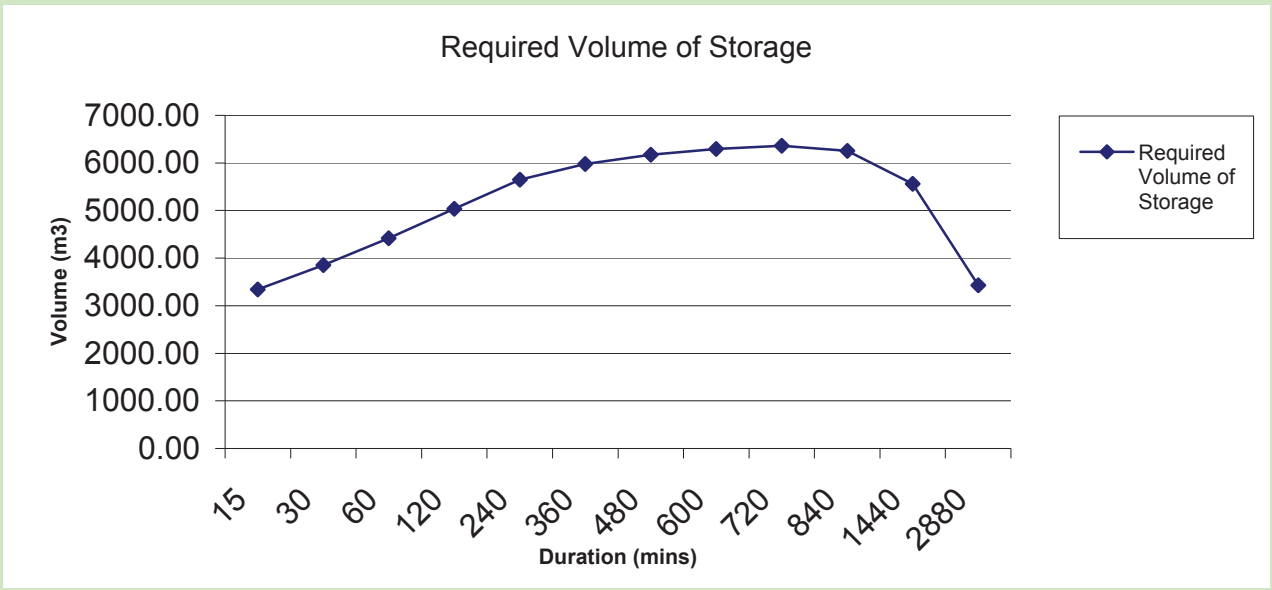
Job Number	**CS027175**		
Version	**Final**		
File Path	l/env/zwet/CS027175		
Produced by	KL	**Date**	31/10/2007
Checked by	JR	**Date**	30/11/2007

Calculation of TOTAL Post Development Peak Runoffs and Volumes and Required Storage

Return Period	1 in 200	**Year**

Storm Duration (minutes)	Existing or Permitted Discharge Runoff Rate m³/s	Post-Development Runoff Rate m³/s	Existing or Permitted Outflow Volume (Greenfield) m³	Post-Development Runoff Volume m³	Storage, Inflow - Outflow m³
15	0.0378	4.874	34.04	3372.84	3338.80
30	0.0378	2.831	68.08	3918.93	3850.85
60	0.0378	1.645	136.16	4556.50	4420.34
120	0.0378	0.957	272.32	5306.35	5034.03
240	0.0378	0.558	544.64	6194.13	5649.49
360	0.0378	0.407	816.95	6793.62	5976.67
480	0.0378	0.326	1089.27	7262.14	6172.87
600	0.0378	0.275	1361.59	7654.42	6292.84
720	0.0378	0.239	1633.91	7995.43	6361.52
840	0.0378	0.209	1906.22	8161.79	6255.57
1440	0.0378	0.131	3267.81	8825.93	5558.12
2880	0.0378	0.073	6535.62	9963.71	3428.09

Required Storage **6361.52 m³**



Notes

Post-Development runoff volumes are a combination of runoff volumes from impermeable areas and runoff volumes from greenfield areas.

Greenfield runoff rates are not duration dependent using the IoH124 method, however greenfield runoff volumes have been calculated for the storm durations above and added to the duration dependent volumes from the impermeable areas (which use the Modified Rational Method)

CAPITA SYMONDS

Project Title	**Kettering Zone A Plot 2**

Job Number	**CS027175**		
Version	**Final**		
File Path	l/env/zwet/CS027175		
Produced by	KL	**Date**	31/10/2007
Checked by	JR	**Date**	30/11/2007

Calculation of Post Development Peak Runoffs and Volumes from Impermeable Areas ONLY

Modified Rational Method: Peak Flow for Impermeable Areas
Q = 2.78 Cv* Cr*I*A/1000
Where
Cr = Routing Coefficient (1.3 for Urban areas)
Cv = Runoff Coefficient
I = Rainfall intensity (mm/hr)
A = Area (ha)

Calculation of Runoff Coefficient (Cv)

Surface	Area (ha)	Cv	Weighted Cv
Greenfield Open Space	N/A	N/A	N/A
Macadam	0	0	0
Hardstanding	7.7	0.9	0.9
Other	0	0	0
Total	**7.70**		**0.9**

Return Period	1 in 200 + CC	**Year**	

Duration (mins)	FEH rainfall Depth (mm)	Intensity (mm/hr)	Peak Flow Rate (m3/s)	Volume of Runoff (m3)
15	58.308	233.23	5.841	4041
30	67.668	135.34	3.389	4689
60	78.516	78.52	1.966	5441
120	91.116	45.56	1.141	6314
240	105.72	26.43	0.662	7326
360	115.332	19.22	0.481	7993
480	122.676	15.33	0.384	8501
600	128.7	12.87	0.322	8919
720	133.836	11.15	0.279	9275
840	135.948	9.71	0.243	9421
1440	143.604	5.98	0.150	9952
2880	154.08	3.21	0.080	10678

Calculation of Post Development Peak Runoffs and Volumes from Greenfield Areas ONLY

Post Development Greenfield Area	1.5 ha		
	QBAR	**Return Period 200 + CC**	
Greenfield Runoff Rate (l/s/ha)	1.03	4.93	
Greenfield Runoff from Open Space (l/s)	1.55	7.40	Refer greenfield runoff calcs

NOTES
Wnere necessary interpolate between the duration values once Tc has been calculated.

Reference Modified Rational Method - The Wallingford Procedure Vol. 4 'The Modified Rational Method' Water Research Council (1981)

This worksheet considers the following scenario:

The site in question is currently considered greenfield i.e. undeveloped in its entirety. Greenfield runoff rates have been used to determine allowable discharge on the previous worksheets.

The post development scenario will include an increase in impermeable surfaces due to the proposed development. This worksheet determines the runoff from the post-development impermeable areas only. Refer the follow worksheet for the total peak runoff rates and volumes taking into consideration the post-development greenfield areas in addition to the impermeable areas.

Reference is made to Preliminary Managment of Rainfall Runoff for Developments.
Ref. Technical Report W5-07A/TR1Preliminary Rainfall Runoff Management for Developments (2004) Rev B.
Cv = Example of Reference for Cv Values
Urban Drainage (Butler and Davis) 2005, Spon Press, Oxford

The documents referenced here are available on the internet.

CAPITA SYMONDS

Project Title	**Kettering Zone A Plot 2**

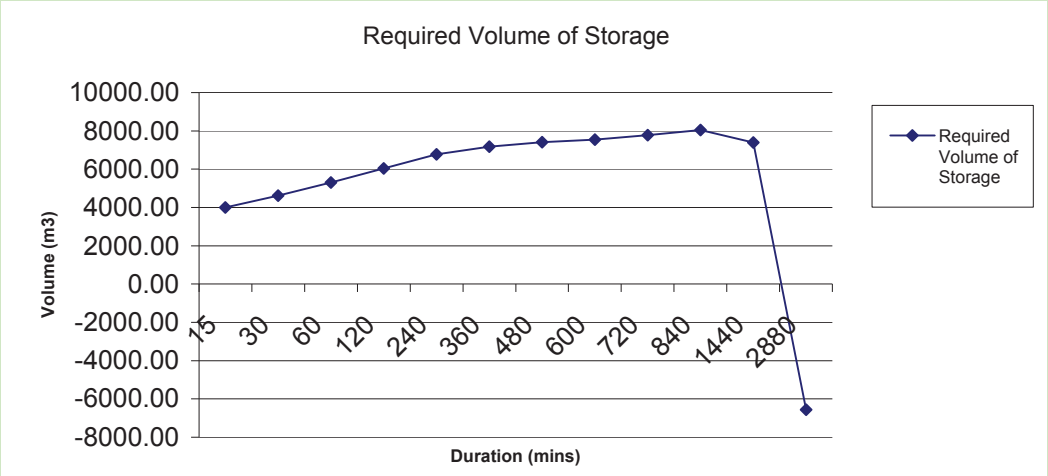
Job Number	**CS027175**		
Version	**Final**		
File Path	l/env/zwet/CS027175		
Produced by	KL	**Date**	31/10/2007
Checked by	JR	**Date**	30/11/2007

Calculation of TOTAL Post Development Peak Runoffs and Volumes and Required Storage

Return Period	1 in 200 + CC	**Year**

Storm Duration (minutes)	Existing or Permitted Discharge Runoff Rate m^3/s	Post-Development Runoff Rate m^3/s	Existing or Permitted Outflow Volume (Greenfield) m^3	Post-Development Runoff Volume m^3	Storage, Inflow - Outflow m^3
15	0.0454	5.849	40.85	4047.40	4006.56
30	0.0454	3.397	81.70	4702.71	4621.02
60	0.0454	1.974	163.39	5467.80	5304.41
120	0.0454	1.148	326.78	6367.62	6040.84
240	0.0454	0.669	653.56	7432.96	6779.39
360	0.0454	0.489	980.34	8152.35	7172.00
480	0.0454	0.391	1307.12	8714.56	7407.44
600	0.0454	0.330	1633.91	9185.31	7551.40
720	0.0454	0.251	1960.69	9740.87	7780.19
840	0.0454	0.157	2287.47	10324.71	8037.25
1440	0.0454	0.088	3921.37	11317.10	7395.73
2880	0.0454	0.007	7842.74	1278.71	-6564.04

Required Storage	**8037.25 m^3**



Notes

Post-Development runoff volumes are a combination of runoff volumes from impermeable areas and runoff volumes from greenfield areas.

Greenfield runoff rates are not duration dependent using the IoH124 method, however greenfield runoff volumes have been calculated for the storm durations above and added to the duration dependent volumes from the impermeable areas (which use the Modified Rational Method)

Appendix G – Drainage Strategy and Drawings

CAPITA

STRATEGY OF THE PROPOSED PROVISION OF

SITE DRAINAGE TO ZONE ‘A’ PLOT ‘2’

2-Unit Scheme

FORMING PART OF NORTH KETTERING BUSINESS PARK

Revision - – 06.09.2018

CS/075709/NRB/GM/18/076

CAPITA

Introduction

Capita Property and Infrastructure has been commissioned by ProLogis Developments Ltd to produce detail drainage design proposals to the individual site identified as Zone 'A' Plot '2' forming part of North Kettering Business Park Development.

The site was originally assessed as part of the wider business park proposals and was granted outline planning permission under reference KE02/0943. In 2008 the subject site was subject to a full planning application. This was approved, and then renewed, in 2011 (reference KET/2011/0483). The current proposals comprise an alternative full scheme, to that which has already been granted full planning permission, for the site and which has been partially implemented.

The details set out in this note and accompanying Capita drawings (see [iv] below) confirm that the current proposals conform with the original drainage strategy for the North Kettering Business Park and the associated conditions C2 (in part) and C24 of the outline permission. They also reflect the agreed drainage strategy which was approved under the more recent full proposals for the site.

Reference should be made to the following:-

(i) Report produced by URS Corporation Ltd entitled "Drainage Strategy for Land West of the A6003 Rockingham Road"

This report deals with the proposed on site and off site drainage infrastructure for the complete North Kettering Business Park. It outlines the provisions required with regards to site attenuation and demonstrates that the surface water drainage infrastructure is in compliance with Capita Flood Risk Assessment Report dated Jan 2003.

(ii) Flood Risk Assessment Report produced by Capita. This report was approved by the Environment Agency as the basis of the on-site surface water drainage design for North Kettering Business Park.

(iii) Planning drawings produced by SGP Architects including drawing no. 10002 – P157 – 002 entitled "Zone 'A' Plot '2' Unit 1 and 2 Site Plan".

(iv) Capita drawings CS075709-25/P02, 26/P03 and 27/P02 show the drainage proposals to site Zone 'A' Plot '2'.

(v) "Statement on Glendon Road improvement – Surface Water Drainage" by URS dated 31 March 2008.

This report aims to provide a synopsis of the individual plot drainage details and to demonstrate compatibility with the main infrastructure reports referred to above.

CAPITA

Surface Water Drainage Proposals

As can be seen from the Architect's drawings Zone 'A' Plot '2' is located North of Glendon Road with the existing Distributor Road running from the new Glendon Road roundabout directly South to the A43.

Clearly Zone 'A' Plot '2' has increased in plan area to that originally proposed within URS Report Ref (i) above. It is the intention to discharge from the site to the same rate as originally envisaged for the smaller plan area but restrict the run off from the additional area to a Greenfield discharge rate of 4.1 l/s/ha using a Hydro-Brake flow control and by installing 2102m³ attenuation installed within Zone 'A' Plot '2' site boundary. Due to the topography of the south and west ends of the developed site (service yard and access roads) it is not possible to contain the above ground flood waters over and above a return period of 1 in 30 years. Therefore the drainage network and below ground storage have been designed to contain critical design storms up to and including a 1 in 100 year return period plus a 20% allowance for climate change.

Consequently as can also be seen on Capita drawings, Zone 'A' Plot '2' surface water is to discharge under a controlled flow directly into the existing adoptable surface water sewer in Glendon Road and beneath the Distributor Road through a network of underground pipes and via suitably constructed connections into the Balancing Pond at the South West corner of the complete site.

Referring to the URS Report the balancing pond has been sized to accommodate a 1:200 year event storm as recommended in the Flood Risk Assessment Report.

To minimise the possibility of water pollution it is the current intention to drain water run off from the roof direct to the new existing adoptable surface water sewer, while the run off from the external area will pass through a petrol interceptor.

Detailed design work for the Glendon Road improvement works has necessitated an update to the original URS highways drawing (49325010/P/RO/001) referred to in the appended Surface Drainage Statement. The updated scheme drawing (S278 Drawing No. 085/100A) now forms part of the current application proposals and we can confirm that the conclusions of the previously submitted Drainage Statement remain valid.

Foul Water Drainage Proposals

Foul water sewers serving Zone 'A' Plot '2' will discharge the effluent into the new existing adoptable foul water sewer which runs from the new roundabout at Glendon Road beneath the new existing site distributor road routed South across the Business Park to the footpath which runs adjacent and parallel with the A43 whereby it turns in a West direction to meet up with the Anglian Water Authority public sewer located at the South West extremity of North Kettering Business Park.

CAPITA

Conclusion

The surface water drainage scheme as shown on the Capita Drawings demonstrate compatibility with the URS main drainage infrastructure report and consequently the Flood Risk Strategy for North Kettering Business Park.

The foul water drainage is to connect into the main site foul water infrastructure system which in turn feeds into the Anglian Water Public Sewer

For and on behalf of
CAPITA PROPERTY AND INFRASTRUCTURE LIMITED

WIOLETTA FIRGOLSKA-GESICKA
MSc (Hons) CEng MIStructE

ASSOCIATE DIRECTOR

Capita Property and Infrastructure Ltd
1st Floor Oak House
Reeds Crescent
Watford
Hertfordshire

Tel +44 (0)1923 817537
Fax+44 (0)1923 228516

www.capita.co.uk

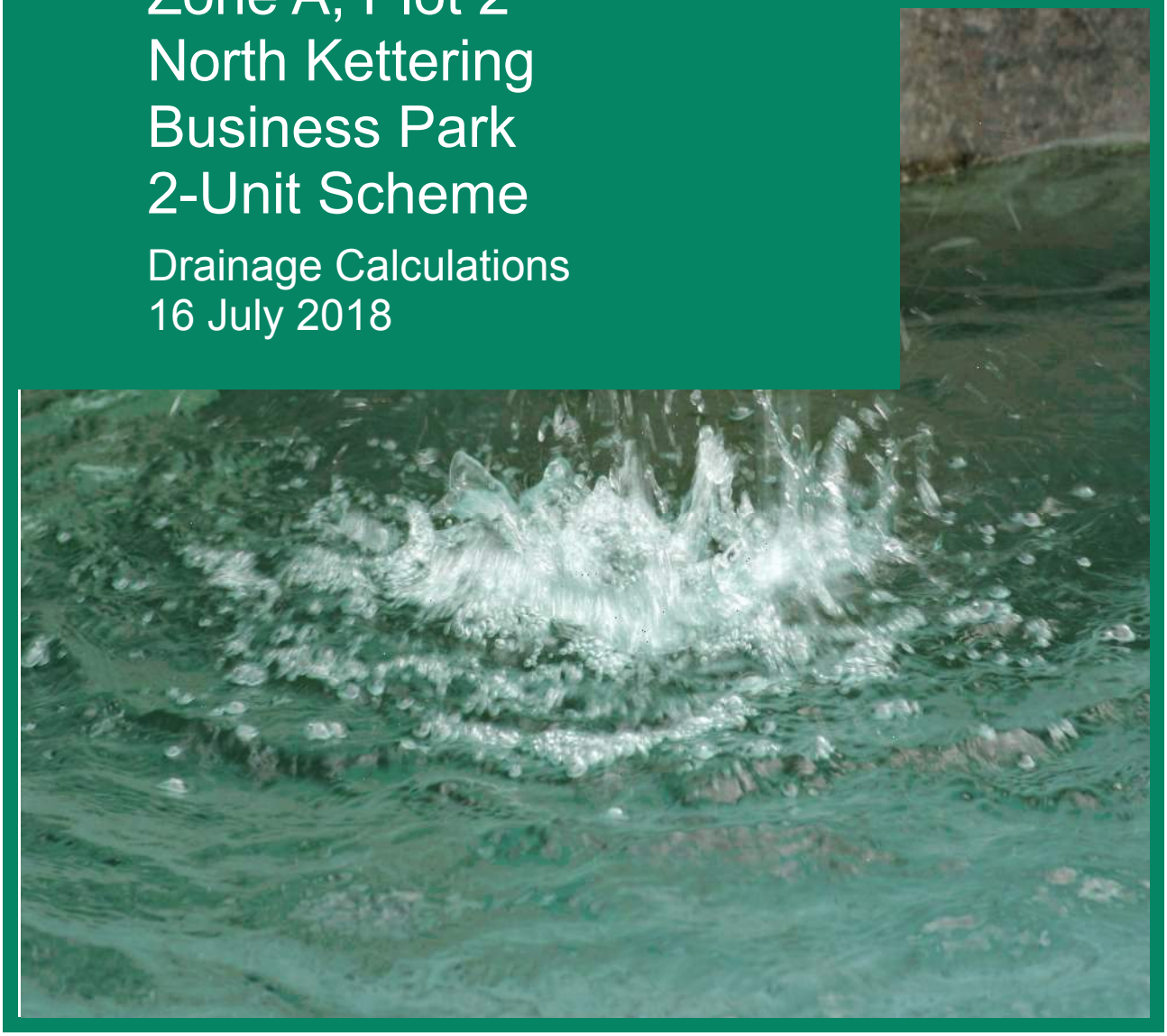
CAPITA

Commercial in Confidence

Zone A, Plot 2 North Kettering Business Park 2-Unit Scheme

Drainage Calculations

16 July 2018



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Contents

Time Area Diagram for Storm

Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	1.119	4-8	3.794	8-12	1.015

Total Area Contributing (ha) = 5.929

Total Pipe Volume (m³) = 200.988

Existing Network Details for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type
1.000	19.465	0.080	243.3	0.831	6.00	0.0	0.600	o	450	Pipe/Conduit
1.001	21.990	0.045	488.7	0.546	0.00	0.0	0.600	o	600	Pipe/Conduit
1.002	22.415	0.060	373.6	0.542	0.00	0.0	0.600	o	675	Pipe/Conduit
1.003	20.140	0.050	402.8	0.000	0.00	0.0	0.600	o	675	Pipe/Conduit
2.000	5.620	0.040	140.5	0.382	6.00	0.0	0.600	o	300	Pipe/Conduit
2.001	34.040	0.120	283.7	0.041	0.00	0.0	0.600	o	375	Pipe/Conduit
3.000	5.010	0.160	31.3	0.141	6.00	0.0	0.600	o	225	Pipe/Conduit
2.002	3.840	0.015	256.0	0.000	0.00	0.0	0.600	o	375	Pipe/Conduit
2.003	4.227	0.050	84.5	0.000	0.00	0.0	0.600	o	375	Pipe/Conduit
2.004	9.745	0.135	72.2	0.000	0.00	0.0	0.600	o	375	Pipe/Conduit
1.004	38.475	0.100	384.8	0.036	0.00	0.0	0.600	o	750	Pipe/Conduit
1.005	24.310	0.610	39.9	0.289	0.00	0.0	0.600	o	750	Pipe/Conduit
1.006	40.355	1.495	27.0	0.000	0.00	0.0	0.600	o	750	Pipe/Conduit
4.000	13.290	1.125	11.8	0.024	6.00	0.0	0.600	o	150	Pipe/Conduit
5.000	9.815	0.100	98.2	0.203	6.00	0.0	0.600	o	225	Pipe/Conduit
5.001	21.915	0.220	99.6	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit

Network Results Table

PN	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Vel (m/s)	Cap (l/s)
1.000	107.690	0.831	0.0	1.30	206.6
1.001	107.460	1.377	0.0	1.09	309.6
1.002	107.340	1.919	0.0	1.35	483.1
1.003	107.280	1.919	0.0	1.30	465.1
2.000	107.965	0.382	0.0	1.32	93.6
2.001	107.850	0.423	0.0	1.07	118.3
3.000	108.040	0.141	0.0	2.35	93.3
2.002	107.730	0.564	0.0	1.13	124.6
2.003	107.715	0.564	0.0	1.97	217.8
2.004	107.665	0.564	0.0	2.13	235.8
1.004	107.155	2.519	0.0	1.42	627.6
1.005	107.055	2.808	0.0	4.44	1961.9
1.006	106.445	2.808	0.0	5.40	2385.1
4.000	107.275	0.024	0.0	2.95	52.1
5.000	106.835	0.203	0.0	1.32	52.5
5.001	106.735	0.203	0.0	1.31	52.1

Existing Network Details for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type
6.000	15.565	0.355	43.8	0.535	6.00	0.0	0.600	o	375	Pipe/Conduit
5.002	21.290	0.060	354.8	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit
7.000	20.680	0.545	37.9	0.182	6.00	0.0	0.600	o	225	Pipe/Conduit
5.003	78.765	0.395	199.4	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit
8.000	20.680	0.940	22.0	0.125	6.00	0.0	0.600	o	225	Pipe/Conduit
5.004	3.000	0.010	300.0	0.000	0.00	0.0	0.600	o	525	Pipe/Conduit
5.005	13.710	0.100	137.1	0.000	0.00	0.0	0.600	o	525	Pipe/Conduit
5.006	5.245	0.015	349.7	0.000	0.00	0.0	0.600	o	525	Pipe/Conduit
1.007	31.180	0.210	148.5	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit
9.000	8.615	0.295	29.2	0.047	6.00	0.0	0.600	o	150	Pipe/Conduit
9.001	38.185	1.530	25.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit
1.008	14.400	0.100	144.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit
1.009	88.050	1.425	61.8	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit

Network Results Table

PN	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Vel (m/s)	Cap (l/s)
6.000	106.720	0.535	0.0	2.74	302.9
5.002	106.290	0.738	0.0	1.07	170.7
7.000	107.000	0.182	0.0	2.13	84.7
5.003	106.230	0.920	0.0	1.44	228.4
8.000	107.000	0.125	0.0	2.80	111.4
5.004	105.760	1.045	0.0	1.29	278.8
5.005	105.750	1.045	0.0	1.91	413.7
5.006	105.650	1.045	0.0	1.19	258.1
1.007	104.850	3.877	0.0	1.07	42.6
9.000	108.340	0.047	0.0	1.87	33.0
9.001	108.045	0.047	0.0	2.02	35.8
1.008	104.640	3.924	0.0	1.09	43.2
1.009	104.540	3.924	0.0	1.67	66.3

Existing Network Details for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type
10.000	27.530	0.695	39.6	0.196	6.00	0.0	0.600	o	225	Pipe/Conduit
10.001	24.555	2.100	11.7	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit
11.000	4.295	1.025	4.2	0.106	6.00	0.0	0.600	o	150	Pipe/Conduit
12.000	17.050	0.895	19.1	0.079	6.00	0.0	0.600	o	150	Pipe/Conduit
10.002	30.185	0.830	36.4	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit
13.000	9.490	0.065	146.0	0.096	6.00	0.0	0.600	o	225	Pipe/Conduit
10.003	3.635	0.015	242.3	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit
10.004	7.400	0.100	74.0	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit
10.005	4.000	0.015	266.7	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit
1.010	52.545	0.390	134.7	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit
14.000	3.000	0.025	120.0	0.152	6.00	0.0	0.600	o	300	Pipe/Conduit
14.001	26.845	0.160	167.8	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit
15.000	43.190	0.290	148.9	0.060	6.00	0.0	0.600	o	225	Pipe/Conduit

Network Results Table

PN	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Vel (m/s)	Cap (l/s)
10.000	106.870	0.196	0.0	2.08	82.9
10.001	106.175	0.196	0.0	3.85	153.0
11.000	105.175	0.106	0.0	4.96	87.6
12.000	105.045	0.079	0.0	2.32	41.0
10.002	104.000	0.381	0.0	2.62	184.9
13.000	103.310	0.096	0.0	1.08	42.9
10.003	103.020	0.477	0.0	1.30	207.0
10.004	103.005	0.477	0.0	2.37	376.2
10.005	102.905	0.477	0.0	1.24	197.2
1.010	102.890	4.401	0.0	1.75	278.3
14.000	103.325	0.152	0.0	1.43	101.4
14.001	103.300	0.152	0.0	1.21	85.6
15.000	103.505	0.060	0.0	1.07	42.5

Existing Network Details for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type
14.002	2.845	0.030	94.8	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit
16.000	40.350	0.345	117.0	0.429	6.00	0.0	0.600	o	300	Pipe/Conduit
14.003	5.000	0.030	166.7	0.000	0.00	0.0	0.600	o	375	Pipe/Conduit
14.004	8.580	0.100	85.8	0.000	0.00	0.0	0.600	o	375	Pipe/Conduit
14.005	18.045	0.100	180.5	0.000	0.00	0.0	0.600	o	375	Pipe/Conduit
14.006	10.960	0.605	18.1	0.000	0.00	0.0	0.600	o	750	Pipe/Conduit
1.011	71.040	0.470	151.1	0.000	0.00	0.0	0.600	o	750	Pipe/Conduit
17.000	7.275	0.050	145.5	0.053	6.00	0.0	0.600	o	225	Pipe/Conduit
17.001	47.700	0.320	149.1	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit
17.002	5.365	0.035	153.3	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit
17.003	21.965	0.100	219.7	0.148	0.00	0.0	0.600	o	300	Pipe/Conduit
17.004	24.295	0.545	44.6	0.274	0.00	0.0	0.600	o	300	Pipe/Conduit
18.000	24.410	0.195	125.2	0.155	6.00	0.0	0.600	o	225	Pipe/Conduit
18.001	34.995	0.280	125.0	0.007	0.00	0.0	0.600	o	225	Pipe/Conduit
17.005	19.120	0.300	63.7	0.000	0.00	0.0	0.600	o	375	Pipe/Conduit

Network Results Table

PN	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Vel (m/s)	Cap (l/s)
14.002	103.140	0.212	0.0	1.61	114.1
16.000	103.455	0.429	0.0	1.45	102.7
14.003	103.035	0.641	0.0	1.40	154.7
14.004	103.005	0.641	0.0	1.96	216.2
14.005	102.905	0.641	0.0	1.35	148.6
14.006	102.805	0.641	0.0	6.59	2912.8
1.011	102.200	5.042	0.0	2.27	1004.6
17.000	104.175	0.053	0.0	1.08	43.0
17.001	104.125	0.053	0.0	1.07	42.5
17.002	103.805	0.053	0.0	1.05	41.9
17.003	103.695	0.201	0.0	1.06	74.7
17.004	103.595	0.475	0.0	2.36	166.9
18.000	103.600	0.155	0.0	1.17	46.4
18.001	103.405	0.162	0.0	1.17	46.4
17.005	102.975	0.637	0.0	2.27	251.0

Existing Network Details for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type
19.000	18.410	0.720	25.6	0.206	6.00	0.0	0.600	o	225	Pipe/Conduit
20.000	17.560	0.175	100.3	0.044	6.00	0.0	0.600	o	150	Pipe/Conduit
19.001	13.175	0.135	97.6	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit
19.002	2.110	0.050	42.2	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit
19.003	4.065	0.490	8.3	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit
17.006	7.650	0.050	153.0	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit
17.007	6.100	0.520	11.7	0.000	0.00	0.0	0.600	o	750	Pipe/Conduit
1.012	31.960	0.213	150.0	0.000	0.00	0.0	0.600	o	750	Pipe/Conduit

Network Results Table

PN	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Vel (m/s)	Cap (l/s)
19.000	104.220	0.206	0.0	2.60	103.3
20.000	103.750	0.044	0.0	1.00	17.7
19.001	103.425	0.250	0.0	1.59	112.5
19.002	103.290	0.250	0.0	2.43	171.6
19.003	103.240	0.250	0.0	5.49	388.1
17.006	102.600	0.887	0.0	1.64	261.0
17.007	102.250	0.887	0.0	8.20	3621.1
1.012	101.730	5.929	0.0	2.28	1008.3

Manhole Schedules for Storm

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	Pipe Out PN	Pipe Out Invert Level (m)	Pipe Out Diameter (mm)	Pipes In PN	Pipes In Invert Level (m)	Pipes In Diameter (mm)	Backdr (mm)
S1	109.140	1.450	Open Manhole	1500	1.000	107.690	450				
S2	109.140	1.680	Open Manhole	1800	1.001	107.460	600	1.000	107.610	450	
S3	109.140	1.800	Open Manhole	1800	1.002	107.340	675	1.001	107.415	600	
S4	109.140	1.860	Open Manhole	1800	1.003	107.280	675	1.002	107.280	675	
SP	109.015	1.050	Open Manhole	1000 x 1000	2.000	107.965	300				
S12	109.075	1.225	Open Manhole	1500	2.001	107.850	375	2.000	107.925	300	
SP	109.015	0.975	Open Manhole	750 x 750	3.000	108.040	225				
S13	109.075	1.345	Open Manhole	1500	2.002	107.730	375	2.001	107.730	375	
								3.000	107.880	225	
PI IN	109.075	1.360	Open Manhole	1500	2.003	107.715	375	2.002	107.715	375	
PI OUT	109.075	1.410	Open Manhole	1500	2.004	107.665	375	2.003	107.665	375	
S5	109.035	1.880	Open Manhole	1800	1.004	107.155	750	1.003	107.230	675	
								2.004	107.530	375	
S6	109.070	2.015	Open Manhole	1800	1.005	107.055	750	1.004	107.055	750	
S7	108.255	1.810	Open Manhole	1800	1.006	106.445	750	1.005	106.445	750	
S18	108.710	1.435	Open Manhole	1200	4.000	107.275	150				
SP	107.810	0.975	Open Manhole	750 x 750	5.000	106.835	225				
S14	107.950	1.215	Open Manhole	1200	5.001	106.735	225	5.000	106.735	225	
SP	107.845	1.125	Open Manhole	1000 x 1000	6.000	106.720	375				
S15	108.120	1.830	Open Manhole	1500	5.002	106.290	450	5.001	106.515	225	
								6.000	106.365	375	
SP	107.975	0.975	Open Manhole	750 x 750	7.000	107.000	225				
S16	108.490	2.260	Open Manhole	1500	5.003	106.230	450	5.002	106.230	450	
								7.000	106.455	225	
SP	107.975	0.975	Open Manhole	750 x 750	8.000	107.000	225				
S17	108.490	2.730	Open Manhole	1500	5.004	105.760	525	5.003	105.835	450	
								8.000	106.060	225	
PI IN	108.490	2.740	Open Manhole	1500	5.005	105.750	525	5.004	105.750	525	
PI OUT	108.490	2.840	Open Manhole	1500	5.006	105.650	525	5.005	105.650	525	
S8	108.110	3.260	Open Manhole	1200	1.007	104.850	225	1.006	104.950	750	6
								4.000	106.150	150	122
								5.006	105.635	525	108
SP	109.240	0.900	Open Manhole	600 x 600	9.000	108.340	150				
S19	109.195	1.150	Open Manhole	1200	9.001	108.045	150	9.000	108.045	150	
S9	108.110	3.470	Open Manhole	1200	1.008	104.640	225	1.007	104.640	225	
								9.001	106.515	150	180
S10	107.925	3.385	Open Manhole	1200	1.009	104.540	225	1.008	104.540	225	
SP	107.845	0.975	Open Manhole	750 x 750	10.000	106.870	225				

Manhole Schedules for Storm

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	Pipe Out PN	Pipe Out Invert Level (m)	Pipe Out Diameter (mm)	Pipes In PN	Pipes In Invert Level (m)	Pipes In Diameter (mm)	Backdr (mm)
S20	107.400	1.225	Open Manhole	1200	10.001	106.175	225	10.000	106.175	225	
SP	106.075	0.900	Open Manhole	600 x 600	11.000	105.175	150				
SP	105.945	0.900	Open Manhole	600 x 600	12.000	105.045	150				
S21	106.000	2.000	Open Manhole	1500	10.002	104.000	300	10.001	104.075	225	
								11.000	104.150	150	
								12.000	104.150	150	
SP	104.135	0.825	Open Manhole	750 x 750	13.000	103.310	225				
S22	104.600	1.580	Open Manhole	1500	10.003	103.020	450	10.002	103.170	300	
								13.000	103.245	225	
PI IN	104.300	1.295	Open Manhole	1500	10.004	103.005	450	10.003	103.005	450	
PI OUT	104.300	1.395	Open Manhole	1500	10.005	102.905	450	10.004	102.905	450	
S11	104.000	1.110	Open Manhole	1500	1.010	102.890	450	1.009	103.115	225	
								10.005	102.890	450	
SP	103.875	0.550	Open Manhole	1000 x 1000	14.000	103.325	300				
S61a	105.035	1.735	Open Manhole	1500	14.001	103.300	300	14.000	103.300	300	
SP	104.180	0.675	Open Manhole	750 x 750	15.000	103.505	225				
S61	104.235	1.095	Open Manhole	1500	14.002	103.140	300	14.001	103.140	300	
								15.000	103.215	225	
SP	104.505	1.050	Open Manhole	1000 x 1000	16.000	103.455	300				
S62	104.165	1.130	Open Manhole	1500	14.003	103.035	375	14.002	103.110	300	
								16.000	103.110	300	
PI IN	104.165	1.160	Open Manhole	1500	14.004	103.005	375	14.003	103.005	375	
PI OUT	104.165	1.260	Open Manhole	1500	14.005	102.905	375	14.004	102.905	375	
S63	104.600	1.795	Open Manhole	1800	14.006	102.805	750	14.005	102.805	375	
0451	104.150	1.950	Open Manhole	1800	1.011	102.200	750	1.010	102.500	450	
								14.006	102.200	750	
SP	105.150	0.975	Open Manhole	750 x 750	17.000	104.175	225				
S51	105.200	1.075	Open Manhole	1200	17.001	104.125	225	17.000	104.125	225	
S52	105.205	1.400	Open Manhole	1200	17.002	103.805	225	17.001	103.805	225	
S53	105.205	1.510	Open Manhole	1500	17.003	103.695	300	17.002	103.770	225	
S54	105.205	1.610	Open Manhole	1500	17.004	103.595	300	17.003	103.595	300	
S58	104.825	1.225	Open Manhole	1200	18.000	103.600	225				
S59	104.655	1.250	Open Manhole	1200	18.001	103.405	225	18.000	103.405	225	
S55	105.400	2.425	Open Manhole	1500	17.005	102.975	375	17.004	103.050	300	
								18.001	103.125	225	
SP	105.195	0.975	Open Manhole	750 x 750	19.000	104.220	225				
RG	104.650	0.900	Open Manhole	450 x 450	20.000	103.750	150				
S60	105.240	1.815	Open Manhole	1500	19.001	103.425	300	19.000	103.500	225	

Manhole Schedules for Storm

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	Pipe Out PN	Pipe Out Invert Level (m)	Pipe Out Diameter (mm)	Pipes In PN	Pipes In Invert Level (m)	Pipes In Diameter (mm)	Backdrop (mm)
								20.000	103.575	150	
PI IN	105.635	2.345	Open Manhole	1500	19.002	103.290	300	19.001	103.290	300	
PI OUT	105.635	2.395	Open Manhole	1500	19.003	103.240	300	19.002	103.240	300	
S56	105.700	3.100	Open Manhole	1500	17.006	102.600	450	17.005	102.675	375	
								19.003	102.750	300	
S57	105.400	3.150	Open Manhole	1800	17.007	102.250	750	17.006	102.550	450	
0450	104.940	3.210	Open Manhole	1800	1.012	101.730	750	1.011	101.730	750	
								17.007	101.730	750	
1453	105.200	3.683	Open Manhole	1800		OUTFALL		1.012	101.517	750	

PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.000	o	450	S1	109.140	107.690	1.000	Open Manhole	1500
1.001	o	600	S2	109.140	107.460	1.080	Open Manhole	1800
1.002	o	675	S3	109.140	107.340	1.125	Open Manhole	1800
1.003	o	675	S4	109.140	107.280	1.185	Open Manhole	1800
2.000	o	300	SP	109.015	107.965	0.750	Open Manhole	1000 x 1000
2.001	o	375	S12	109.075	107.850	0.850	Open Manhole	1500
3.000	o	225	SP	109.015	108.040	0.750	Open Manhole	750 x 750
2.002	o	375	S13	109.075	107.730	0.970	Open Manhole	1500
2.003	o	375	PI IN	109.075	107.715	0.985	Open Manhole	1500
2.004	o	375	PI OUT	109.075	107.665	1.035	Open Manhole	1500
1.004	o	750	S5	109.035	107.155	1.130	Open Manhole	1800
1.005	o	750	S6	109.070	107.055	1.265	Open Manhole	1800
1.006	o	750	S7	108.255	106.445	1.060	Open Manhole	1800
4.000	o	150	S18	108.710	107.275	1.285	Open Manhole	1200
5.000	o	225	SP	107.810	106.835	0.750	Open Manhole	750 x 750

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.000	19.465	243.3	S2	109.140	107.610	1.080	Open Manhole	1800
1.001	21.990	488.7	S3	109.140	107.415	1.125	Open Manhole	1800
1.002	22.415	373.6	S4	109.140	107.280	1.185	Open Manhole	1800
1.003	20.140	402.8	S5	109.035	107.230	1.130	Open Manhole	1800
2.000	5.620	140.5	S12	109.075	107.925	0.850	Open Manhole	1500
2.001	34.040	283.7	S13	109.075	107.730	0.970	Open Manhole	1500
3.000	5.010	31.3	S13	109.075	107.880	0.970	Open Manhole	1500
2.002	3.840	256.0	PI IN	109.075	107.715	0.985	Open Manhole	1500
2.003	4.227	84.5	PI OUT	109.075	107.665	1.035	Open Manhole	1500
2.004	9.745	72.2	S5	109.035	107.530	1.130	Open Manhole	1800
1.004	38.475	384.8	S6	109.070	107.055	1.265	Open Manhole	1800
1.005	24.310	39.9	S7	108.255	106.445	1.060	Open Manhole	1800
1.006	40.355	27.0	S8	108.110	104.950	2.410	Open Manhole	1200
4.000	13.290	11.8	S8	108.110	106.150	1.810	Open Manhole	1200
5.000	9.815	98.2	S14	107.950	106.735	0.990	Open Manhole	1200

PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
5.001	o	225	S14	107.950	106.735	0.990	Open Manhole	1200
6.000	o	375	SP	107.845	106.720	0.750	Open Manhole	1000 x 1000
5.002	o	450	S15	108.120	106.290	1.380	Open Manhole	1500
7.000	o	225	SP	107.975	107.000	0.750	Open Manhole	750 x 750
5.003	o	450	S16	108.490	106.230	1.810	Open Manhole	1500
8.000	o	225	SP	107.975	107.000	0.750	Open Manhole	750 x 750
5.004	o	525	S17	108.490	105.760	2.205	Open Manhole	1500
5.005	o	525	PI IN	108.490	105.750	2.215	Open Manhole	1500
5.006	o	525	PI OUT	108.490	105.650	2.315	Open Manhole	1500
1.007	o	225	S8	108.110	104.850	3.035	Open Manhole	1200
9.000	o	150	SP	109.240	108.340	0.750	Open Manhole	600 x 600
9.001	o	150	S19	109.195	108.045	1.000	Open Manhole	1200

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
5.001	21.915	99.6	S15	108.120	106.515	1.380	Open Manhole	1500
6.000	15.565	43.8	S15	108.120	106.365	1.380	Open Manhole	1500
5.002	21.290	354.8	S16	108.490	106.230	1.810	Open Manhole	1500
7.000	20.680	37.9	S16	108.490	106.455	1.810	Open Manhole	1500
5.003	78.765	199.4	S17	108.490	105.835	2.205	Open Manhole	1500
8.000	20.680	22.0	S17	108.490	106.060	2.205	Open Manhole	1500
5.004	3.000	300.0	PI IN	108.490	105.750	2.215	Open Manhole	1500
5.005	13.710	137.1	PI OUT	108.490	105.650	2.315	Open Manhole	1500
5.006	5.245	349.7	S8	108.110	105.635	1.950	Open Manhole	1200
1.007	31.180	148.5	S9	108.110	104.640	3.245	Open Manhole	1200
9.000	8.615	29.2	S19	109.195	108.045	1.000	Open Manhole	1200
9.001	38.185	25.0	S9	108.110	106.515	1.445	Open Manhole	1200

PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.008	o	225	S9	108.110	104.640	3.245	Open Manhole	1200
1.009	o	225	S10	107.925	104.540	3.160	Open Manhole	1200
10.000	o	225	SP	107.845	106.870	0.750	Open Manhole	750 x 750
10.001	o	225	S20	107.400	106.175	1.000	Open Manhole	1200
11.000	o	150	SP	106.075	105.175	0.750	Open Manhole	600 x 600
12.000	o	150	SP	105.945	105.045	0.750	Open Manhole	600 x 600
10.002	o	300	S21	106.000	104.000	1.700	Open Manhole	1500
13.000	o	225	SP	104.135	103.310	0.600	Open Manhole	750 x 750
10.003	o	450	S22	104.600	103.020	1.130	Open Manhole	1500
10.004	o	450	PI IN	104.300	103.005	0.845	Open Manhole	1500
10.005	o	450	PI OUT	104.300	102.905	0.945	Open Manhole	1500
1.010	o	450	S11	104.000	102.890	0.660	Open Manhole	1500
14.000	o	300	SP	103.875	103.325	0.250	Open Manhole	1000 x 1000

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.008	14.400	144.0	S10	107.925	104.540	3.160	Open Manhole	1200
1.009	88.050	61.8	S11	104.000	103.115	0.660	Open Manhole	1500
10.000	27.530	39.6	S20	107.400	106.175	1.000	Open Manhole	1200
10.001	24.555	11.7	S21	106.000	104.075	1.700	Open Manhole	1500
11.000	4.295	4.2	S21	106.000	104.150	1.700	Open Manhole	1500
12.000	17.050	19.1	S21	106.000	104.150	1.700	Open Manhole	1500
10.002	30.185	36.4	S22	104.600	103.170	1.130	Open Manhole	1500
13.000	9.490	146.0	S22	104.600	103.245	1.130	Open Manhole	1500
10.003	3.635	242.3	PI IN	104.300	103.005	0.845	Open Manhole	1500
10.004	7.400	74.0	PI OUT	104.300	102.905	0.945	Open Manhole	1500
10.005	4.000	266.7	S11	104.000	102.890	0.660	Open Manhole	1500
1.010	52.545	134.7	0451	104.150	102.500	1.200	Open Manhole	1800
14.000	3.000	120.0	S61a	105.035	103.300	1.435	Open Manhole	1500

PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
14.001	o	300	S61a	105.035	103.300	1.435	Open Manhole	1500
15.000	o	225	SP	104.180	103.505	0.450	Open Manhole	750 x 750
14.002	o	300	S61	104.235	103.140	0.795	Open Manhole	1500
16.000	o	300	SP	104.505	103.455	0.750	Open Manhole	1000 x 1000
14.003	o	375	S62	104.165	103.035	0.755	Open Manhole	1500
14.004	o	375	PI IN	104.165	103.005	0.785	Open Manhole	1500
14.005	o	375	PI OUT	104.165	102.905	0.885	Open Manhole	1500
14.006	o	750	S63	104.600	102.805	1.045	Open Manhole	1800
1.011	o	750	0451	104.150	102.200	1.200	Open Manhole	1800
17.000	o	225	SP	105.150	104.175	0.750	Open Manhole	750 x 750
17.001	o	225	S51	105.200	104.125	0.850	Open Manhole	1200
17.002	o	225	S52	105.205	103.805	1.175	Open Manhole	1200
17.003	o	300	S53	105.205	103.695	1.210	Open Manhole	1500
17.004	o	300	S54	105.205	103.595	1.310	Open Manhole	1500

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
14.001	26.845	167.8	S61	104.235	103.140	0.795	Open Manhole	1500
15.000	43.190	148.9	S61	104.235	103.215	0.795	Open Manhole	1500
14.002	2.845	94.8	S62	104.165	103.110	0.755	Open Manhole	1500
16.000	40.350	117.0	S62	104.165	103.110	0.755	Open Manhole	1500
14.003	5.000	166.7	PI IN	104.165	103.005	0.785	Open Manhole	1500
14.004	8.580	85.8	PI OUT	104.165	102.905	0.885	Open Manhole	1500
14.005	18.045	180.5	S63	104.600	102.805	1.420	Open Manhole	1800
14.006	10.960	18.1	0451	104.150	102.200	1.200	Open Manhole	1800
1.011	71.040	151.1	0450	104.940	101.730	2.460	Open Manhole	1800
17.000	7.275	145.5	S51	105.200	104.125	0.850	Open Manhole	1200
17.001	47.700	149.1	S52	105.205	103.805	1.175	Open Manhole	1200
17.002	5.365	153.3	S53	105.205	103.770	1.210	Open Manhole	1500
17.003	21.965	219.7	S54	105.205	103.595	1.310	Open Manhole	1500
17.004	24.295	44.6	S55	105.400	103.050	2.050	Open Manhole	1500

PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
18.000	o	225	S58	104.825	103.600	1.000	Open Manhole	1200
18.001	o	225	S59	104.655	103.405	1.025	Open Manhole	1200
17.005	o	375	S55	105.400	102.975	2.050	Open Manhole	1500
19.000	o	225	SP	105.195	104.220	0.750	Open Manhole	750 x 750
20.000	o	150	RG	104.650	103.750	0.750	Open Manhole	450 x 450
19.001	o	300	S60	105.240	103.425	1.515	Open Manhole	1500
19.002	o	300	PI IN	105.635	103.290	2.045	Open Manhole	1500
19.003	o	300	PI OUT	105.635	103.240	2.095	Open Manhole	1500
17.006	o	450	S56	105.700	102.600	2.650	Open Manhole	1500
17.007	o	750	S57	105.400	102.250	2.400	Open Manhole	1800
1.012	o	750	0450	104.940	101.730	2.460	Open Manhole	1800

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
18.000	24.410	125.2	S59	104.655	103.405	1.025	Open Manhole	1200
18.001	34.995	125.0	S55	105.400	103.125	2.050	Open Manhole	1500
17.005	19.120	63.7	S56	105.700	102.675	2.650	Open Manhole	1500
19.000	18.410	25.6	S60	105.240	103.500	1.515	Open Manhole	1500
20.000	17.560	100.3	S60	105.240	103.575	1.515	Open Manhole	1500
19.001	13.175	97.6	PI IN	105.635	103.290	2.045	Open Manhole	1500
19.002	2.110	42.2	PI OUT	105.635	103.240	2.095	Open Manhole	1500
19.003	4.065	8.3	S56	105.700	102.750	2.650	Open Manhole	1500
17.006	7.650	153.0	S57	105.400	102.550	2.400	Open Manhole	1800
17.007	6.100	11.7	0450	104.940	101.730	2.460	Open Manhole	1800
1.012	31.960	150.0	1453	105.200	101.517	2.933	Open Manhole	1800

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
1.012	1453	105.200	101.517	0.000	1800	0

Simulation Criteria for Storm

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	3.000
Hot Start (mins)	0	Inlet Coeffiecient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1

Number of Input Hydrographs	0	Number of Storage Structures	1
Number of Online Controls	1	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	5	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.900	Storm Duration (mins)	30
Ratio R	0.413		

Online Controls for Storm

Hydro-Brake® Optimum Manhole: S8, DS/PN: 1.007, Volume (m³): 21.9

Unit Reference	MD-SHE-0172-1600-1550-1600
Design Head (m)	1.550
Design Flow (l/s)	16.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	172
Invert Level (m)	104.850
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1500

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.550	16.0
Flush-Flo™	0.457	15.9
Kick-Flo®	0.984	12.9
Mean Flow over Head Range	-	13.8

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	6.1	1.200	14.2	3.000	21.9	7.000	32.9
0.200	14.3	1.400	15.2	3.500	23.6	7.500	34.0
0.300	15.4	1.600	16.2	4.000	25.1	8.000	35.1
0.400	15.9	1.800	17.2	4.500	26.6	8.500	36.1
0.500	15.9	2.000	18.0	5.000	28.0	9.000	37.2
0.600	15.7	2.200	18.9	5.500	29.3	9.500	38.1
0.800	15.0	2.400	19.7	6.000	30.5		
1.000	13.0	2.600	20.4	6.500	31.7		

Storage Structures for Storm

Cellular Storage Manhole: S8, DS/PN: 1.007

Invert Level (m) 104.850 Safety Factor 1.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	1428.0	1428.0	1.300	1428.0	1624.5
0.100	1428.0	1443.1	1.400	1428.0	1639.6
0.200	1428.0	1458.2	1.500	1428.0	1654.7
0.300	1428.0	1473.3	1.550	1428.0	1662.3
0.400	1428.0	1488.5	1.551	0.0	1662.4
0.500	1428.0	1503.6	1.800	0.0	1662.4
0.600	1428.0	1518.7	1.900	0.0	1662.4
0.700	1428.0	1533.8	2.000	0.0	1662.4
0.800	1428.0	1548.9	2.100	0.0	1662.4
0.900	1428.0	1564.0	2.200	0.0	1662.4
1.000	1428.0	1579.2	2.300	0.0	1662.4
1.100	1428.0	1594.3	2.400	0.0	1662.4
1.200	1428.0	1609.4	2.500	0.0	1662.4

2 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	3.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs	0	Number of Storage Structures	1
Number of Online Controls	1	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model		FSR	Ratio R 0.413
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	19.900	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	75.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	ON
DVD Status	ON
Inertia Status	ON

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years)	2, 30, 100
Climate Change (%)	0, 0, 20

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
1.000	S1	15 Winter	2	+0%	30/15 Summer	100/15 Summer		
1.001	S2	15 Winter	2	+0%	30/15 Summer			
1.002	S3	15 Winter	2	+0%	30/15 Summer			
1.003	S4	15 Winter	2	+0%	30/15 Summer			
2.000	SP	15 Winter	2	+0%	30/15 Summer	100/15 Summer		
2.001	S12	15 Winter	2	+0%	30/15 Summer			
3.000	SP	15 Winter	2	+0%	30/15 Summer			
2.002	S13	15 Winter	2	+0%	30/15 Summer			
2.003	PI IN	15 Winter	2	+0%	30/15 Summer			
2.004	PI OUT	15 Winter	2	+0%	30/15 Summer			
1.004	S5	15 Winter	2	+0%	30/15 Summer			
1.005	S6	15 Winter	2	+0%				
1.006	S7	15 Winter	2	+0%	100/480 Winter			
4.000	S18	15 Winter	2	+0%				
5.000	SP	15 Winter	2	+0%	30/15 Summer	100/15 Summer		
5.001	S14	15 Winter	2	+0%	30/15 Summer			
6.000	SP	15 Winter	2	+0%	30/15 Winter	100/15 Winter		

2 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	S1	108.005	-0.135	0.000	0.82		136.3	OK	4
1.001	S2	107.918	-0.142	0.000	0.93		210.8	OK	
1.002	S3	107.814	-0.201	0.000	0.78		282.1	OK	
1.003	S4	107.751	-0.204	0.000	0.82		279.8	OK	
2.000	SP	108.221	-0.044	0.000	1.00		61.4	OK	4
2.001	S12	108.163	-0.062	0.000	0.61		64.5	OK	
3.000	SP	108.141	-0.124	0.000	0.42		23.6	OK	
2.002	S13	108.101	-0.004	0.000	1.01		81.1	OK	
2.003	PI IN	107.959	-0.131	0.000	0.76		81.0	OK	
2.004	PI OUT	107.868	-0.172	0.000	0.56		80.9	OK	
1.004	S5	107.626	-0.279	0.000	0.71		361.4	OK	
1.005	S6	107.346	-0.459	0.000	0.32		388.9	OK	
1.006	S7	106.674	-0.521	0.000	0.20		389.8	OK	
4.000	S18	107.304	-0.121	0.000	0.08		4.0	OK	
5.000	SP	106.985	-0.075	0.000	0.78		33.9	OK	4
5.001	S14	106.876	-0.084	0.000	0.70		33.5	OK	
6.000	SP	106.881	-0.214	0.000	0.38		89.5	OK	1

2 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
5.002	S15	15 Winter	2	+0%	30/15 Summer			
7.000	SP	15 Winter	2	+0%	100/15 Summer			
5.003	S16	15 Winter	2	+0%	30/15 Summer			
8.000	SP	15 Winter	2	+0%	100/600 Winter			
5.004	S17	15 Winter	2	+0%	30/15 Summer			
5.005	PI IN	15 Winter	2	+0%	30/15 Summer			
5.006	PI OUT	15 Winter	2	+0%	30/15 Summer			
1.007	S8	360 Winter	2	+0%	2/15 Winter			
9.000	SP	15 Winter	2	+0%				
9.001	S19	15 Winter	2	+0%				
1.008	S9	60 Winter	2	+0%				
1.009	S10	60 Winter	2	+0%				
10.000	SP	15 Winter	2	+0%	100/15 Summer			
10.001	S20	15 Winter	2	+0%				
11.000	SP	15 Winter	2	+0%				
12.000	SP	15 Winter	2	+0%	100/15 Summer			
10.002	S21	15 Winter	2	+0%	100/15 Summer			
13.000	SP	15 Winter	2	+0%	30/15 Summer			
10.003	S22	15 Winter	2	+0%	30/15 Summer			
10.004	PI IN	15 Winter	2	+0%	30/15 Summer			
10.005	PI OUT	15 Winter	2	+0%	30/15 Winter			
1.010	S11	15 Winter	2	+0%				
14.000	SP	15 Winter	2	+0%	30/15 Summer	100/15 Summer		
14.001	S61a	15 Winter	2	+0%	30/15 Summer			
15.000	SP	15 Winter	2	+0%	30/15 Winter			
14.002	S61	15 Winter	2	+0%	30/15 Summer			
16.000	SP	15 Winter	2	+0%	30/15 Summer	100/15 Summer		
14.003	S62	15 Winter	2	+0%	30/15 Summer			
14.004	PI IN	15 Winter	2	+0%	30/15 Summer			
14.005	PI OUT	15 Winter	2	+0%	30/15 Summer			
14.006	S63	15 Summer	2	+0%				
1.011	0451	15 Winter	2	+0%				
17.000	SP	15 Winter	2	+0%	100/15 Summer			
17.001	S51	15 Winter	2	+0%	100/15 Summer			
17.002	S52	15 Winter	2	+0%	30/15 Summer			
17.003	S53	15 Winter	2	+0%	30/15 Summer			
17.004	S54	15 Winter	2	+0%	30/15 Summer			
18.000	S58	15 Winter	2	+0%	30/15 Summer			
18.001	S59	15 Winter	2	+0%	30/15 Summer			
17.005	S55	15 Winter	2	+0%	30/15 Summer			
19.000	SP	15 Winter	2	+0%	100/15 Summer			
20.000	RG	15 Winter	2	+0%	100/15 Summer			
19.001	S60	15 Winter	2	+0%	30/15 Summer			
19.002	PI IN	15 Winter	2	+0%	30/15 Summer			
19.003	PI OUT	15 Winter	2	+0%	100/15 Summer			
17.006	S56	15 Winter	2	+0%	30/15 Summer			
17.007	S57	15 Winter	2	+0%				
1.012	0450	15 Winter	2	+0%				

2 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
5.002	S15	106.618	-0.122	0.000	0.87		121.9	OK	
7.000	SP	107.098	-0.127	0.000	0.40		30.5	OK	
5.003	S16	106.510	-0.170	0.000	0.68		146.5	OK	
8.000	SP	107.069	-0.156	0.000	0.21		20.9	OK	
5.004	S17	106.165	-0.120	0.000	0.95		163.0	OK	
5.005	PI IN	106.124	-0.151	0.000	0.65		161.4	OK	
5.006	PI OUT	106.089	-0.086	0.000	1.00		160.1	OK	
1.007	S8	105.314	0.239	0.000	0.40		15.9	SURCHARGED	
9.000	SP	108.393	-0.097	0.000	0.27		7.9	OK	
9.001	S19	108.093	-0.102	0.000	0.23		7.9	OK	
1.008	S9	104.748	-0.117	0.000	0.47		17.8	OK	
1.009	S10	104.620	-0.145	0.000	0.28		17.8	OK	
10.000	SP	106.972	-0.123	0.000	0.43		32.8	OK	
10.001	S20	106.248	-0.152	0.000	0.23		32.8	OK	
11.000	SP	105.229	-0.096	0.000	0.28		17.7	OK	
12.000	SP	105.106	-0.089	0.000	0.35		13.2	OK	
10.002	S21	104.128	-0.172	0.000	0.38		63.7	OK	
13.000	SP	103.416	-0.119	0.000	0.45		16.1	OK	
10.003	S22	103.288	-0.182	0.000	0.66		79.6	OK	
10.004	PI IN	103.216	-0.239	0.000	0.44		79.2	OK	
10.005	PI OUT	103.176	-0.179	0.000	0.67		79.8	OK	
1.010	S11	103.073	-0.267	0.000	0.35		87.7	OK	
14.000	SP	103.465	-0.160	0.000	0.44		25.2	OK	6
14.001	S61a	103.444	-0.156	0.000	0.32		24.6	OK	
15.000	SP	103.581	-0.149	0.000	0.24		9.8	OK	
14.002	S61	103.424	-0.016	0.000	0.55		33.8	OK	
16.000	SP	103.650	-0.105	0.000	0.73		70.1	OK	4
14.003	S62	103.383	-0.027	0.000	1.00		94.2	OK	
14.004	PI IN	103.251	-0.129	0.000	0.76		94.2	OK	
14.005	PI OUT	103.153	-0.127	0.000	0.77		94.2	OK	
14.006	S63	102.943	-0.612	0.000	0.08		94.2	OK	
1.011	0451	102.430	-0.520	0.000	0.20		180.8	OK	
17.000	SP	104.256	-0.144	0.000	0.28		8.9	OK	
17.001	S51	104.196	-0.154	0.000	0.21		8.7	OK	
17.002	S52	103.888	-0.142	0.000	0.29		8.7	OK	
17.003	S53	103.839	-0.156	0.000	0.46		30.2	OK	
17.004	S54	103.742	-0.153	0.000	0.48		71.5	OK	
18.000	S58	103.727	-0.098	0.000	0.60		25.8	OK	
18.001	S59	103.533	-0.097	0.000	0.61		26.5	OK	
17.005	S55	103.155	-0.195	0.000	0.46		96.9	OK	
19.000	SP	104.315	-0.130	0.000	0.37		34.5	OK	
20.000	RG	103.820	-0.080	0.000	0.44		7.4	OK	
19.001	S60	103.567	-0.158	0.000	0.45		41.9	OK	
19.002	PI IN	103.472	-0.118	0.000	0.68		41.6	OK	
19.003	PI OUT	103.339	-0.201	0.000	0.24		41.7	OK	
17.006	S56	102.914	-0.136	0.000	0.83		139.3	OK	
17.007	S57	102.424	-0.576	0.000	0.12		139.4	OK	

2 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.012	0450	102.074	-0.406	0.000	0.43		312.6	OK	

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	3.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs	0	Number of Storage Structures	1
Number of Online Controls	1	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model		FSR	Ratio R 0.413
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	19.900	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	75.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	ON
DVD Status	ON
Inertia Status	ON

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years)	2, 30, 100
Climate Change (%)	0, 0, 20

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
1.000	S1	15 Winter	30	+0%	30/15 Summer	100/15 Summer		
1.001	S2	15 Winter	30	+0%	30/15 Summer			
1.002	S3	15 Winter	30	+0%	30/15 Summer			
1.003	S4	15 Winter	30	+0%	30/15 Summer			
2.000	SP	15 Winter	30	+0%	30/15 Summer	100/15 Summer		
2.001	S12	15 Winter	30	+0%	30/15 Summer			
3.000	SP	15 Winter	30	+0%	30/15 Summer			
2.002	S13	15 Winter	30	+0%	30/15 Summer			
2.003	PI IN	15 Winter	30	+0%	30/15 Summer			
2.004	PI OUT	15 Winter	30	+0%	30/15 Summer			
1.004	S5	15 Winter	30	+0%	30/15 Summer			
1.005	S6	15 Winter	30	+0%				
1.006	S7	15 Winter	30	+0%	100/480 Winter			
4.000	S18	15 Winter	30	+0%				
5.000	SP	15 Winter	30	+0%	30/15 Summer	100/15 Summer		
5.001	S14	15 Winter	30	+0%	30/15 Summer			
6.000	SP	15 Winter	30	+0%	30/15 Winter	100/15 Winter		

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	S1	108.538	0.398	0.000	1.36		225.6	SURCHARGED	4
1.001	S2	108.373	0.313	0.000	1.59		359.1	SURCHARGED	
1.002	S3	108.239	0.224	0.000	1.35		488.9	SURCHARGED	
1.003	S4	108.085	0.130	0.000	1.44		489.5	SURCHARGED	
2.000	SP	108.667	0.402	0.000	1.67		102.5	SURCHARGED	4
2.001	S12	108.494	0.269	0.000	1.04		110.3	SURCHARGED	
3.000	SP	108.486	0.221	0.000	0.68		38.1	SURCHARGED	
2.002	S13	108.359	0.254	0.000	1.83		146.8	SURCHARGED	
2.003	PI IN	108.215	0.125	0.000	1.37		146.9	SURCHARGED	
2.004	PI OUT	108.074	0.034	0.000	1.02		146.6	SURCHARGED	
1.004	S5	107.935	0.030	0.000	1.25		637.2	SURCHARGED	
1.005	S6	107.457	-0.348	0.000	0.55		677.5	OK	
1.006	S7	106.753	-0.442	0.000	0.35		676.1	OK	
4.000	S18	107.315	-0.110	0.000	0.16		7.6	OK	
5.000	SP	107.399	0.339	0.000	1.18		51.4	SURCHARGED	4
5.001	S14	107.255	0.295	0.000	1.08		51.2	SURCHARGED	
6.000	SP	107.191	0.096	0.000	0.66		154.4	SURCHARGED	1

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
5.002	S15	15 Winter	30	+0%	30/15 Summer			
7.000	SP	15 Winter	30	+0%	100/15 Summer			
5.003	S16	15 Winter	30	+0%	30/15 Summer			
8.000	SP	15 Winter	30	+0%	100/600 Winter			
5.004	S17	15 Winter	30	+0%	30/15 Summer			
5.005	PI IN	15 Winter	30	+0%	30/15 Summer			
5.006	PI OUT	15 Winter	30	+0%	30/15 Summer			
1.007	S8	600 Winter	30	+0%	2/15 Winter			
9.000	SP	15 Winter	30	+0%				
9.001	S19	15 Winter	30	+0%				
1.008	S9	30 Winter	30	+0%				
1.009	S10	30 Winter	30	+0%				
10.000	SP	15 Winter	30	+0%	100/15 Summer			
10.001	S20	15 Winter	30	+0%				
11.000	SP	15 Winter	30	+0%				
12.000	SP	15 Winter	30	+0%	100/15 Summer			
10.002	S21	15 Winter	30	+0%	100/15 Summer			
13.000	SP	15 Winter	30	+0%	30/15 Summer			
10.003	S22	15 Winter	30	+0%	30/15 Summer			
10.004	PI IN	15 Winter	30	+0%	30/15 Summer			
10.005	PI OUT	15 Winter	30	+0%	30/15 Winter			
1.010	S11	15 Winter	30	+0%				
14.000	SP	15 Winter	30	+0%	30/15 Summer	100/15 Summer		
14.001	S61a	15 Winter	30	+0%	30/15 Summer			
15.000	SP	15 Winter	30	+0%	30/15 Winter			
14.002	S61	15 Winter	30	+0%	30/15 Summer			
16.000	SP	15 Winter	30	+0%	30/15 Summer	100/15 Summer		
14.003	S62	15 Winter	30	+0%	30/15 Summer			
14.004	PI IN	15 Winter	30	+0%	30/15 Summer			
14.005	PI OUT	15 Winter	30	+0%	30/15 Summer			
14.006	S63	15 Winter	30	+0%				
1.011	0451	15 Winter	30	+0%				
17.000	SP	15 Winter	30	+0%	100/15 Summer			
17.001	S51	15 Winter	30	+0%	100/15 Summer			
17.002	S52	15 Winter	30	+0%	30/15 Summer			
17.003	S53	15 Winter	30	+0%	30/15 Summer			
17.004	S54	15 Winter	30	+0%	30/15 Summer			
18.000	S58	15 Winter	30	+0%	30/15 Summer			
18.001	S59	15 Winter	30	+0%	30/15 Summer			
17.005	S55	15 Winter	30	+0%	30/15 Summer			
19.000	SP	15 Winter	30	+0%	100/15 Summer			
20.000	RG	15 Winter	30	+0%	100/15 Summer			
19.001	S60	15 Winter	30	+0%	30/15 Summer			
19.002	PI IN	15 Winter	30	+0%	30/15 Summer			
19.003	PI OUT	15 Winter	30	+0%	100/15 Summer			
17.006	S56	15 Winter	30	+0%	30/15 Summer			
17.007	S57	15 Winter	30	+0%				
1.012	0450	15 Winter	30	+0%				

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
5.002	S15	107.003	0.263	0.000	1.35		188.2	SURCHARGED	
7.000	SP	107.147	-0.078	0.000	0.75		57.8	OK	
5.003	S16	106.895	0.215	0.000	1.08		231.3	SURCHARGED	
8.000	SP	107.098	-0.127	0.000	0.39		39.7	OK	
5.004	S17	106.463	0.178	0.000	1.48		252.8	SURCHARGED	
5.005	PI IN	106.352	0.077	0.000	1.02		252.7	SURCHARGED	
5.006	PI OUT	106.242	0.067	0.000	1.58		252.3	SURCHARGED	
1.007	S8	105.826	0.751	0.000	0.40		15.9	SURCHARGED	
9.000	SP	108.416	-0.074	0.000	0.52		14.9	OK	
9.001	S19	108.114	-0.081	0.000	0.43		14.9	OK	
1.008	S9	104.776	-0.089	0.000	0.68		25.7	OK	
1.009	S10	104.639	-0.126	0.000	0.40		25.7	OK	
10.000	SP	107.024	-0.071	0.000	0.81		62.3	OK	
10.001	S20	106.280	-0.120	0.000	0.44		62.3	OK	
11.000	SP	105.253	-0.072	0.000	0.53		33.7	OK	
12.000	SP	105.134	-0.061	0.000	0.66		25.1	OK	
10.002	S21	104.190	-0.110	0.000	0.72		121.0	OK	
13.000	SP	103.594	0.059	0.000	0.82		29.3	SURCHARGED	
10.003	S22	103.500	0.030	0.000	1.24		148.8	SURCHARGED	
10.004	PI IN	103.467	0.012	0.000	0.84		150.2	SURCHARGED	
10.005	PI OUT	103.361	0.006	0.000	1.27		150.6	SURCHARGED	
1.010	S11	103.157	-0.183	0.000	0.66		167.1	OK	
14.000	SP	103.847	0.222	0.000	0.64		36.6	FLOOD RISK	6
14.001	S61a	103.816	0.216	0.000	0.42		32.5	SURCHARGED	
15.000	SP	103.754	0.024	0.000	0.43		17.2	SURCHARGED	
14.002	S61	103.711	0.271	0.000	0.71		43.3	SURCHARGED	
16.000	SP	104.091	0.336	0.000	1.17		112.1	SURCHARGED	4
14.003	S62	103.627	0.217	0.000	1.62		152.5	SURCHARGED	
14.004	PI IN	103.473	0.093	0.000	1.24		153.1	SURCHARGED	
14.005	PI OUT	103.319	0.039	0.000	1.25		153.3	SURCHARGED	
14.006	S63	102.981	-0.574	0.000	0.13		153.2	OK	
1.011	0451	102.507	-0.443	0.000	0.35		311.1	OK	
17.000	SP	104.292	-0.108	0.000	0.53		16.8	OK	
17.001	S51	104.226	-0.124	0.000	0.40		16.5	OK	
17.002	S52	104.053	0.023	0.000	0.81		24.3	SURCHARGED	
17.003	S53	104.025	0.030	0.000	0.90		59.3	SURCHARGED	
17.004	S54	103.948	0.053	0.000	0.98		145.4	SURCHARGED	
18.000	S58	103.929	0.104	0.000	1.03		44.0	SURCHARGED	
18.001	S59	103.724	0.094	0.000	1.07		46.8	SURCHARGED	
17.005	S55	103.429	0.079	0.000	0.88		184.1	SURCHARGED	
19.000	SP	104.360	-0.085	0.000	0.71		65.5	OK	
20.000	RG	103.874	-0.026	0.000	0.82		13.6	OK	
19.001	S60	103.753	0.028	0.000	0.84		77.6	SURCHARGED	
19.002	PI IN	103.626	0.036	0.000	1.28		78.4	SURCHARGED	
19.003	PI OUT	103.381	-0.159	0.000	0.45		78.8	OK	
17.006	S56	103.196	0.146	0.000	1.56		262.9	SURCHARGED	
17.007	S57	102.494	-0.506	0.000	0.23		262.1	OK	

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.012	0450	102.231	-0.249	0.000	0.78		560.8	OK	

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	3.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs	0	Number of Storage Structures	1
Number of Online Controls	1	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model		FSR	Ratio R 0.413
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	19.900	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	75.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	ON
DVD Status	ON
Inertia Status	ON

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years)	2, 30, 100
Climate Change (%)	0, 0, 20

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
1.000	S1	15 Winter	100	+20%	30/15 Summer	100/15 Summer		
1.001	S2	15 Winter	100	+20%	30/15 Summer			
1.002	S3	15 Winter	100	+20%	30/15 Summer			
1.003	S4	15 Winter	100	+20%	30/15 Summer			
2.000	SP	15 Winter	100	+20%	30/15 Summer	100/15 Summer		
2.001	S12	15 Winter	100	+20%	30/15 Summer			
3.000	SP	15 Winter	100	+20%	30/15 Summer			
2.002	S13	15 Winter	100	+20%	30/15 Summer			
2.003	PI IN	15 Winter	100	+20%	30/15 Summer			
2.004	PI OUT	15 Winter	100	+20%	30/15 Summer			
1.004	S5	15 Winter	100	+20%	30/15 Summer			
1.005	S6	15 Winter	100	+20%				
1.006	S7	720 Winter	100	+20%	100/480 Winter			
4.000	S18	720 Winter	100	+20%				
5.000	SP	15 Winter	100	+20%	30/15 Summer	100/15 Summer		
5.001	S14	15 Winter	100	+20%	30/15 Summer			
6.000	SP	15 Winter	100	+20%	30/15 Winter	100/15 Winter		

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	S1	109.157	1.017	16.833	1.88		312.2	FLOOD	4
1.001	S2	108.957	0.897	0.000	2.17		489.6	SURCHARGED	
1.002	S3	108.718	0.703	0.000	1.96		708.7	SURCHARGED	
1.003	S4	108.406	0.451	0.000	2.07		701.8	SURCHARGED	
2.000	SP	109.028	0.763	13.374	2.02		124.0	FLOOD	4
2.001	S12	108.876	0.651	0.000	1.23		130.0	SURCHARGED	
3.000	SP	108.936	0.671	0.000	1.09		61.5	SURCHARGED	
2.002	S13	108.728	0.623	0.000	2.25		180.7	SURCHARGED	
2.003	PI IN	108.519	0.429	0.000	1.68		180.6	SURCHARGED	
2.004	PI OUT	108.309	0.269	0.000	1.25		179.9	SURCHARGED	
1.004	S5	108.098	0.193	0.000	1.75		891.0	SURCHARGED	
1.005	S6	107.568	-0.237	0.000	0.79		970.0	OK	
1.006	S7	107.398	0.203	0.000	0.06		117.1	SURCHARGED	
4.000	S18	107.395	-0.030	0.000	0.02		1.0	OK	
5.000	SP	107.820	0.760	10.219	1.54		67.3	FLOOD	4
5.001	S14	107.747	0.787	0.000	1.42		67.7	SURCHARGED	
6.000	SP	107.849	0.754	4.040	0.81		189.0	FLOOD	1

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
5.002	S15	15 Winter	100	+20%	30/15 Summer			
7.000	SP	15 Winter	100	+20%	100/15 Summer			
5.003	S16	15 Winter	100	+20%	30/15 Summer			
8.000	SP	720 Winter	100	+20%	100/600 Winter			
5.004	S17	600 Winter	100	+20%	30/15 Summer			
5.005	PI IN	600 Winter	100	+20%	30/15 Summer			
5.006	PI OUT	600 Winter	100	+20%	30/15 Summer			
1.007	S8	600 Winter	100	+20%	2/15 Winter			
9.000	SP	15 Winter	100	+20%				
9.001	S19	15 Winter	100	+20%				
1.008	S9	15 Winter	100	+20%				
1.009	S10	15 Winter	100	+20%				
10.000	SP	15 Winter	100	+20%	100/15 Summer			
10.001	S20	15 Winter	100	+20%				
11.000	SP	15 Winter	100	+20%				
12.000	SP	15 Winter	100	+20%	100/15 Summer			
10.002	S21	15 Winter	100	+20%	100/15 Summer			
13.000	SP	15 Winter	100	+20%	30/15 Summer			
10.003	S22	15 Winter	100	+20%	30/15 Summer			
10.004	PI IN	15 Winter	100	+20%	30/15 Summer			
10.005	PI OUT	15 Winter	100	+20%	30/15 Winter			
1.010	S11	15 Winter	100	+20%				
14.000	SP	15 Winter	100	+20%	30/15 Summer	100/15 Summer		
14.001	S61a	15 Winter	100	+20%	30/15 Summer			
15.000	SP	15 Winter	100	+20%	30/15 Winter			
14.002	S61	15 Winter	100	+20%	30/15 Summer			
16.000	SP	15 Winter	100	+20%	30/15 Summer	100/15 Summer		
14.003	S62	15 Winter	100	+20%	30/15 Summer			
14.004	PI IN	15 Winter	100	+20%	30/15 Summer			
14.005	PI OUT	15 Summer	100	+20%	30/15 Summer			
14.006	S63	15 Winter	100	+20%				
1.011	0451	15 Winter	100	+20%				
17.000	SP	15 Winter	100	+20%	100/15 Summer			
17.001	S51	15 Winter	100	+20%	100/15 Summer			
17.002	S52	15 Winter	100	+20%	30/15 Summer			
17.003	S53	15 Winter	100	+20%	30/15 Summer			
17.004	S54	15 Winter	100	+20%	30/15 Summer			
18.000	S58	15 Winter	100	+20%	30/15 Summer			
18.001	S59	15 Winter	100	+20%	30/15 Summer			
17.005	S55	15 Winter	100	+20%	30/15 Summer			
19.000	SP	15 Winter	100	+20%	100/15 Summer			
20.000	RG	15 Winter	100	+20%	100/15 Summer			
19.001	S60	15 Winter	100	+20%	30/15 Summer			
19.002	PI IN	15 Winter	100	+20%	30/15 Summer			
19.003	PI OUT	15 Winter	100	+20%	100/15 Summer			
17.006	S56	15 Winter	100	+20%	30/15 Summer			
17.007	S57	15 Winter	100	+20%				
1.012	0450	15 Winter	100	+20%				

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
5.002	S15	107.622	0.882	0.000	1.65		229.6	SURCHARGED	
7.000	SP	107.928	0.703	0.000	0.91		69.6	FLOOD RISK	
5.003	S16	107.467	0.787	0.000	1.36		292.0	SURCHARGED	
8.000	SP	107.398	0.173	0.000	0.05		5.2	SURCHARGED	
5.004	S17	107.414	1.129	0.000	0.29		50.4	SURCHARGED	
5.005	PI IN	107.419	1.144	0.000	0.20		50.4	SURCHARGED	
5.006	PI OUT	107.425	1.250	0.000	0.32		50.4	SURCHARGED	
1.007	S8	107.423	2.348	0.000	0.51		20.2	SURCHARGED	
9.000	SP	108.442	-0.048	0.000	0.80		23.2	OK	
9.001	S19	108.135	-0.060	0.000	0.67		23.3	OK	
1.008	S9	104.810	-0.055	0.000	0.92		34.9	OK	
1.009	S10	104.658	-0.107	0.000	0.52		33.8	OK	
10.000	SP	107.330	0.235	0.000	1.16		89.2	SURCHARGED	
10.001	S20	106.305	-0.095	0.000	0.63		88.9	OK	
11.000	SP	105.282	-0.043	0.000	0.83		52.3	OK	
12.000	SP	105.349	0.154	0.000	0.92		35.2	SURCHARGED	
10.002	S21	104.619	0.319	0.000	1.02		171.5	SURCHARGED	
13.000	SP	103.849	0.314	0.000	1.23		43.8	SURCHARGED	
10.003	S22	103.754	0.284	0.000	1.78		213.9	SURCHARGED	
10.004	PI IN	103.609	0.154	0.000	1.20		213.6	SURCHARGED	
10.005	PI OUT	103.463	0.108	0.000	1.80		214.3	SURCHARGED	
1.010	S11	103.242	-0.098	0.000	0.96		244.7	OK	
14.000	SP	103.888	0.263	13.302	0.75		42.8	FLOOD	6
14.001	S61a	103.883	0.283	0.000	0.55		42.4	SURCHARGED	
15.000	SP	104.004	0.274	0.000	0.64		26.0	SURCHARGED	
14.002	S61	103.873	0.433	0.000	0.76		46.9	SURCHARGED	
16.000	SP	104.515	0.760	9.666	1.46		139.5	FLOOD	4
14.003	S62	103.796	0.386	0.000	1.88		177.4	SURCHARGED	
14.004	PI IN	103.586	0.206	0.000	1.44		178.2	SURCHARGED	
14.005	PI OUT	103.377	0.097	0.000	1.44		177.1	SURCHARGED	
14.006	S63	102.996	-0.559	0.000	0.15		177.5	OK	
1.011	0451	102.586	-0.364	0.000	0.47		420.9	OK	
17.000	SP	104.990	0.590	0.000	0.79		24.9	SURCHARGED	
17.001	S51	104.916	0.566	0.000	0.69		28.1	SURCHARGED	
17.002	S52	104.837	0.807	0.000	1.28		38.2	SURCHARGED	
17.003	S53	104.826	0.831	0.000	1.20		79.0	SURCHARGED	
17.004	S54	104.699	0.804	0.000	1.29		191.1	SURCHARGED	
18.000	S58	104.730	0.905	0.000	1.41		60.4	SURCHARGED	
18.001	S59	104.329	0.699	0.000	1.44		62.9	SURCHARGED	
17.005	S55	103.775	0.425	0.000	1.17		245.2	SURCHARGED	
19.000	SP	104.667	0.222	0.000	0.97		90.3	SURCHARGED	
20.000	RG	104.222	0.322	0.000	1.18		19.6	SURCHARGED	
19.001	S60	103.990	0.265	0.000	1.18		108.3	SURCHARGED	
19.002	PI IN	103.802	0.212	0.000	1.77		108.8	SURCHARGED	
19.003	PI OUT	103.614	0.074	0.000	0.63		109.7	SURCHARGED	
17.006	S56	103.370	0.320	0.000	2.08		351.6	SURCHARGED	
17.007	S57	102.536	-0.464	0.000	0.31		351.9	OK	

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.012	0450	102.459	-0.021	0.000	1.00		722.6	OK	

UNIT 1

M & E contractor to provide a suitable pipework configuration to enable water discharged during sprinkler testing to be recycled back to tanks.

Foul gully to collect small runoff from plant inside sprinkler tank pump house only to be confirmed by M & E contractor.

Siphonic Roof Drainage

5 no. primary siphonic downpipes to continue to adjacent, externally located, manholes on main drainage run.
Manholes to have vented covers, for overflow purposes, to an appropriate load class.
Secondary siphonic downpipes to be located to discharge directly onto hardstanding areas to north-west (car park) and south-west (service yard) elevations of the main building. Sizes of all siphonic downpipes to specialist's design and details.

Important Note:

The Contractor is to exercise extreme care when excavating for drainage pipes and manholes and not to undermine existing or new column bases and/or strip footings already cast. Refer also to note 4 on this drawing and `concreting of drains laid near foundations' detail on drg. no. SS/015865-08.

For new construction, column foundations/strip footings must be taken down to below invert level of any nearby, adjacent services (drainage, gas, water, etc.)

F.F.L. 109.400

Design parameters for Surface Water roof and pavement drainage system:
The surface water drainage layout has been designed to ensure self-cleansing pipe velocities and to cause no surcharging in manholes for design storms of return periods up to 1 in 2 years.
The overall pavement drainage system has been designed to accommodate design storms of return periods up to 1 in 100 years plus a 20% allowance for climate change. Refer also to note 16.

The original allowance for this development was unrestricted surface water discharge from 2.400ha of impermeable area. This is equal in area to the Unit 2 site and part of the Unit 1 service yard and access road (a total of 2.357 ha).
Run-off from all remaining impermeable areas (a total of 3.877 ha) is attenuated to a `greenfield' discharge rate of 4.1 l/sec/ha (16 l/sec total).

Class 1 full retention separator (pipe no. 5.005) with automatic closure device and high level audible alarm systems for oil and silt levels, bedded and surrounded in concrete to manufacturer's details, Type 'NS200' - 525 dia. pipework.
Allowance to be made for R.C. cover slab over unit with 1000mm min. bearing either side.

CL = 108.490
IL in = 105.750
IL out = 105.650

Class 1 bypass separator (pipe no. 2.003) with high level audible alarm systems for oil and silt levels, bedded and surrounded in concrete to manufacturer's details. Type 'NSB15' - 375 dia. pipework.
Allowance to be made for R.C. cover slab over unit with 1000mm min. bearing either side.

CL = 109.075
IL in = 107.715
IL out = 107.665

Drainage Notes

1. All private drainage works are to be carried out in accordance with BS EN 752:2008 and Building Regulations Part H.

2. All drainage works within adoptable areas are to comply with the requirements of the Water UK/Water Research Centre publication `Sewers for Adoption' (current edition).

3. All connections to existing public sewers to be in accordance with and to the satisfaction of the Local Authority.

4. Concrete protection (bedding class `Z') to pipework to be provided as follows;
(i) all pipework within soft areas with a cover of less than 600mm.
(ii) all pipework beneath roads, car parks and all other trafficked hardstanding areas with a cover less than 1200mm.
(iii) all pipework adjacent to existing and proposed trees/dense vegetation in landscaped areas.
An expansion joint shall be provided at all joint locations.

5. All below ground foul drainage from within building footprint to be 100mm dia. unless stated otherwise. Refer to separate note for recommended minimum gradients.
All below ground surface water drainage from RWP locations to main carrier drains to match the diameter of the downpipe (to Architect's and specialist contractor's details) unless stated otherwise.
All below ground drainage from road gullies to be 150mm dia. uness stated otherwise.

6. All pipework in manholes are to be laid soffit to soffit unless noted otherwise. All chamber invert levels, shown on the drawing, are for the outgoing pipe.

7. All internal drainage to be to the Architect's and M & E Engineer's drawings and details.

8. The position and invert levels of all existing drains, sewers and manholes to be confirmed by the contractor prior to the commencement of the proposed works and any discrepancies reported immediately to Capita (Property and Infrastructure) Ltd.

9. All pipes are to have a class `S' bed and surround unless noted otherwise (see note 4 above).

10. All concrete pipes are to be high strength and to be in accordance with BS EN 1916 and BS 5911.

11. All vitrified clay pipes are to be in accordance with BS EN 295.

12. Refer to drawing nos. 075709-CA-0-G00-DAS-SE-007 and 008 for drainage construction details.

13. For setting out of foul and rainwater outlets refer to the Architect's drawings.

14. This drawing to be read in conjunction with all other relevant Engineer's and Architect's drawings, specifications and documentation.

15. The contractor is to allow for grease traps in the kitchen and other appropriate areas.

16. Drainage channels and silt pits to be designed by a specialist manufacturer for critical storms of 1:5 year return period, to suit site conditions and in accordance with load class requirements as shown on the plan.
Design to be approved in writing by Capita (Property and Infrastructure) Ltd, prior to ordering.

17. All external finished levels and manhole cover levels shown on this drawing are indicative and subject to adjustment on site to suit the finished ground levels. For final levels refer to the Architect's drawings.

18. All levels are in metres and all dimensions are in millimetres unless noted otherwise.

19. Any coordinates provided for manholes or inspection chambers are relevant to the main drainage run intersection and not the centre of the manhole.

20. Chalk and limestone are not to be used as bedding or backfilling material in soils with a pH value less than 7.

21. A CCTV drainage survey is to be carried out both at the pre-commencement of construction and at the completion of the contract to prove the integrity of the as-built drainage systems. At the completion of the contract this is to be carried out prior to the issue of the practical completion certificate.

22. Sewers, manholes, gullies, drainage channels and silt pits should be inspected at 6 monthly intervals and cleaned out at 12 monthly intervals. A full CCTV survey should also be carried out at 10 yearly intervals. Refer also to specialist drainage channel and petrol interceptor manufacturer's information and maintenance requirements.
In all instances, inspection and cleaning should be carried out only by a specialist contractor and in accordance with the guidelines given in `Safe Working in Sewers and at Sewage Works' published by National Joint Health and Safety Committee for the Water Services.

FOR CONTINUATION REFER TO DRAWING 027

FOR CONTINUATION REFER TO DRAWING 026

SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION

Refer to the relevant Construction (Design and Management) documentation where applicable.

It is assumed that all works on this drawing will be carried out by a competent contractor, working where appropriate to an approved method statement.

LEGEND

- existing foul water drain with manhole
- existing surface water drain with manhole
- new foul water drain with manhole
- new surface water drain with manhole
- siphonic roof drainage (designed by others)
- new surface water manhole with vented cover
- linear drainage channel
- flow regulator
- 162.095 spot level
- 162.095 existing spot level
- concrete protection to pipework adjacent to tree roots

CL	Cover Level
IL	Invert level
SL	Sump level
S/A	Soakaway
RAI	Reverse Action Interceptor
bd	backdrop
re	rodding eye
svp	soil & vent pipe (rodable)
wvp	waste and vent pipe (rodable)
wp	waste pipe (rodable)
ss	stub stack (rodable)
sg	shower gully (rodable)
sp	silt pit (rodable)
ra	rodding access
rg	450ø x 900 deep precast concrete trapped, rodable, road gully with grating area greater than 900cm²
fg	floor gully (rodable)
rwp	rainwater downpipe (rodable)
psdp	primary siphonic downpipe
ssdp	secondary siphonic downpipe
vp	vent pipe (oil separator)
aav	air admittance valve
TOB	Top of base level
CI	Cast Iron
VC	Vitrified Clay
R	Flexible `Rocker' joint
PPIC	Polypropylene inspection chamber

Note: Final setting out of all drainage points at ground level to the Architect's and M and E Engineer's details.

Refer to the Architect's details for the internal, above ground, drainage layout.
Recommended minimum gradients for below ground foul drainage connections:
100 dia. at 1:40,
100 dia. at 1:80 with min 1 no. wc connection,
150 dia. at 1:150 with min 5 no. wc connections.
Final foul drainage connections to be coordinated with the Architect's internal drainage layout plans.

Rev	Date	By	Description	Rev' check
P02	06.09.18	GM	Site layout updated in accordance with the Architect's latest requirements (drawing 10002-P157-002) and drainage layout updated to suit.	WFG
P01	16.07.18	GM	Invert level added to manhole S18 and gradient of pipe 4.000 corrected.	WFG

Drawing status
PRELIMINARY

Client
PROLOGIS

Project
ZONE A, PLOT 2
PROLOGIS PARK, KETTERING

Drawing
DRAINAGE LAYOUT AND EXTERNAL LEVELS 2-UNIT SCHEME SHEET 1 OF 3

Scale @ A0	Drawn	Checked
1:250	G. Males	NRB
Project No.	Date	Office
CS/075709	Jun 2018	WATFORD

Drawing Identifier — BS1192:2007 / Avanti

project	origin	zone	level	file type	role	number	Compliant revision
075709	-CA-	0	- BG -	DR	- S -	025	- P02

CAPITA
Property and infrastructure
Consulting Civil, Structural and Geo-environmental Engineers

London Tele No: (+44) 0 20 7870 9300
Watford Tele No: (+44) 0 1923 817337
Manchester Tele No: (+44) 0 161 486 1521
Bristol Tele No: (+44) 0 1275 840831

Capita Property and Infrastructure Ltd.
Reg. office 71 Victoria Street, Westminster, London SW1H 0XA • No 2018542
www.capita.co.uk/property

UNIT 2

Siphonic Roof Drainage

4 no. primary siphonic downpipes to continue to adjacent, externally located, manholes on main drainage run.
Manholes to have vented covers, for overflow purposes, to an appropriate load class.
Secondary siphonic downpipes to be located to discharge directly onto hardstanding areas to south-east (car park) and south-west (service yard) elevations of the main building. Sizes of all siphonic downpipes to specialist's design and details.

F.F.L. 105.300

Electrical Sub-Station Site

2-Storey Main Offices

Class 1 bypass separator (pipe no. 19.002) with high level audible alarm systems for oil and silt levels, bedded and surrounded in concrete to manufacturer's details.
Type 'NSBK' - 300 dia. pipework.
Allowance to be made for R.C. cover slab over unit with 1000mm min. bearing either side.

CL = 105.635
IL in = 103.290
IL out = 103.240

Class 1 full retention separator (pipe no. 14.004) with automatic closure device and high level audible alarm systems for oil and silt levels, bedded and surrounded in concrete to manufacturer's details. Type 'NS125' - 375 dia. pipework.
Allowance to be made for R.C. cover slab over unit with 1000mm min. bearing either side.

CL = 104.165
IL in = 103.005
IL out = 102.905

Class 1 full retention separator (pipe no. 10.004) with automatic closure device and high level audible alarm systems for oil and silt levels, bedded and surrounded in concrete to manufacturer's details. Type 'NS100' - 450 dia. pipework.

CL = 104.300
IL in = 103.005
IL out = 102.905

Outlet pipe to MH S8 to have a Hydro-Brake flow regulator by Hydro International, or similar approved, to limit flow to 16 l/sec.
Design Head = 1.550m
Hydro-Brake type =
MD-SHE-0172-1600-1550-1600.
Final diameter of manhole, and any additional sump requirement, to be confirmed by flow regulator specialist.

For road junction tie-in levels refer to 278 Consulting drawing 254/D/SK02.

For road junction tie-in levels refer to 278 Consulting drawing 254/D/SK01.

Cellular storage cells to be installed strictly in accordance with the manufacturer's instructions/requirements and to be compatible/suitable for the given loading requirements and prevailing ground conditions (e.g. stratification, contamination etc.) as noted in the site investigation report.

Section through cellular storage system (1:25)

GL 107.350
1325
106.025
1550
104.475
100 thick course sand blinding

'VersaVoid' modular geo-void system, by Environmental Sustainable Solutions Ltd. (ESS), wrapped in an inner non-woven type geotextile membrane, wrapped in a waterproof butyl membrane and protected by a heavyweight, needle punched, non-woven type geotextile membrane all to the manufacturer's recommendations. The membrane is to be sealed at all edges and where the pipe enters and exits the membrane. (Cellular blocks 500mm x 500mm in plan x 250mm increments (+50mm) deep).
Cellular storage to be bedded on min. 100mm thick coarse sand blinding and covered with compacted backfill in accordance with Capita Symonds' specification. Manufacturer to provide calculations proving structural suitability taking cognisance of the applied loads and the prevailing ground conditions as detailed in the Site Investigation Report.

FOR CONTINUATION REFER TO DRAWING 025

FOR CONTINUATION REFER TO DRAWING 027

rsaVoid' modular geo-void system, by
, (ESS) or similar approved, wrapped in
brane, wrapped in a waterproof butyl
ght, needle punched, non-woven type
urer's recommendations. The membrane
e pipe enters and exits the membrane.
x 250mm increments (+50mm) deep).
the manufacturer's requirements and

l02m³ based on 16 l/sec allowable off-site

l0mm thick coarse sand blinding and
protection layer. Compacted backfill in

l drawings for construction which should
ess points for inspection and

SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION

Refer to the relevant Construction (Design and Management) documentation where applicable.

It is assumed that all works on this drawing will be carried out by a competent contractor, working where appropriate to an approved method statement.

Notes

1. For drainage notes and strategy refer to drawing 075709-CA-O-BG-DR-S-025.

LEGEND

- existing foul water drain with manhole
- existing surface water drain with manhole
- new foul water drain with manhole
- new surface water drain with manhole
- siphonic roof drainage (designed by others)
- new surface water manhole with vented cover
- linear drainage channel
- flow regulator
- 162.095 spot level
- 162.095 existing spot level
- concrete protection to pipework adjacent to tree roots

CL	Cover Level
IL	Invert level
SL	Sump level
S/A	Soakaway
RAI	Reverse Action Interceptor
bd	backdrop
re	rodding eye
svp	soil & vent pipe (rodable)
wvp	waste and vent pipe (rodable)
wp	waste pipe (rodable)
ss	stub stack (rodable)
sg	shower gully (rodable)
sp	silt pit (rodable)
ra	rodding access
rg	450Ø x 900 deep precast concrete trapped, rodable, road gully with grating area greater than 900cm²
fg	floor gully (rodable)
rwp	rainwater downpipe (rodable)
psdp	primary siphonic downpipe
ssdp	secondary siphonic downpipe
vp	vent pipe (oil separator)
aav	air admittance valve
TOB	Top of base level
CI	Cast Iron
VC	Vitrified Clay
R	Flexible 'Rocker' joint
PPIC	Polypropylene inspection chamber

Note: Final setting out of all drainage points at ground level to the Architect's and M and E Engineer's details.

Refer to the Architect's details for the internal, above ground, drainage layout.
Recommended minimum gradients for below ground foul drainage connections:
100 dia. at 1:40,
100 dia. at 1:80 with min 1 no. wc connection,
150 dia. at 1:150 with min 5 no. wc connections.
Final foul drainage connections to be coordinated with the Architect's internal drainage layout plans.

Rev	Date	By	Description	Rev' check
P03	06.09.18	GM	Site layout updated in accordance with the Architect's latest requirements (drawing 10002-P-157-002) and drainage layout updated to suit.	WFG
P02	16.07.18	GM	Pipe design numbers updated, Manhole S63 noted as level inverts, Pipe numbers 19.001 and 19.003 upgraded from 225Ø to 300Ø and pipe numbers 10.003, 10.004, 10.005 and 1.010 upgraded from 375Ø to 450Ø following final design calculations.	WFG
P01	13.07.18	GM	Route of foul drain downstream from manhole F9 revised and trench soakaway adjacent to mound (near AW MH 0401) reduced in length, All in accordance with comments from 278 Consulting (email dated 02/07/2018).	WFG

Drawing status
PRELIMINARY

Client
PROLOGIS

Project
ZONE A, PLOT 2
PROLOGIS PARK, KETTERING

Drawing
DRAINAGE LAYOUT AND EXTERNAL LEVELS 2-UNIT SCHEME SHEET 2 OF 3

Scale @ A0	Drawn	Checked
1:250	G. Males	NRB
Project No.	Date	Office
CS/075709	Jun 2018	WATFORD

Drawing Identifier — BS1192:2007 / Avanti Compliant

project	originator	zone	level	file type	role	number	revision
075709	-CA-	0	- BG	- DR	- S	- 026	- P03

CAPITA
Property and infrastructure
Consulting Civil, Structural and Geo-environmental Engineers

London Tele No: (+44) 0 20 7870 9000
Watford Tele No: (+44) 0 1923 817537
Manchester Tele No: (+44) 0 161 486 1521
Bristol Tele No: (+44) 0 1275 840831

Capita Property and Infrastructure Ltd.
Reg. office 71 Victoria Street, Westminster, London SW1H 0XA • No: 2018542
www.capita.co.uk/property

SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION

Refer to the relevant Construction (Design and Management) documentation where applicable.

It is assumed that all works on this drawing will be carried out by a competent contractor, working where appropriate to an approved method statement.

Notes

1. For drainage notes and strategy refer to drawing 075709-CA-0-BG-DR-S-025.

LEGEND

- existing foul water drain with manhole
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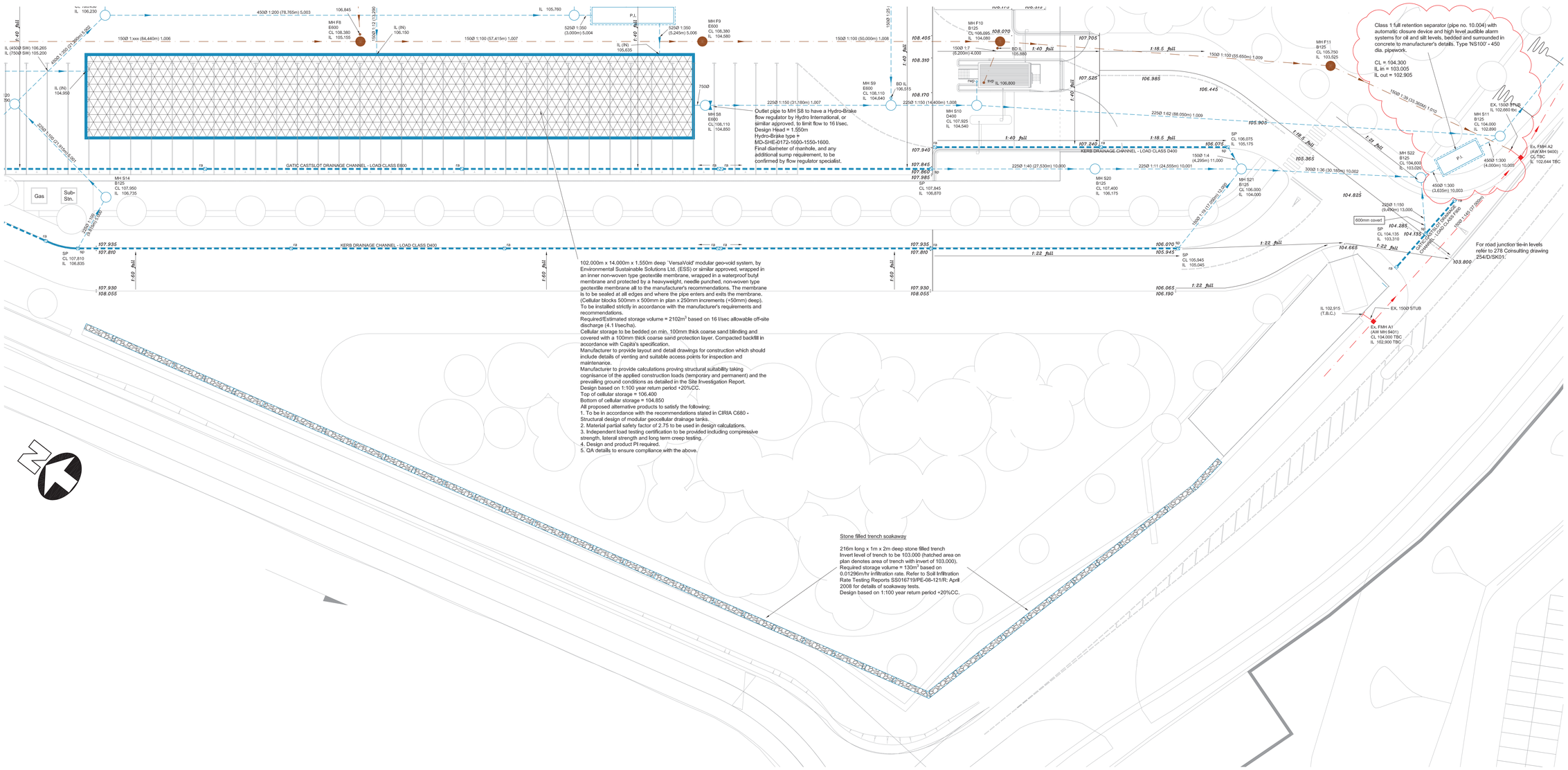
Note: Final setting out of all drainage points at ground level to the Architect's and M and E Engineer's details.

Refer to the Architect's details for the internal, above ground, drainage layout.
Recommended minimum gradients for below ground foul drainage connections:
100 dia. at 1:40,
100 dia. at 1:80 with min 1 no. wc connection,
150 dia. at 1:150 with min 5 no. wc connections.
Final foul drainage connections to be coordinated with the Architect's internal drainage layout plans.

FOR CONTINUATION REFER TO DRAWING 025

FOR CONTINUATION REFER TO DRAWING 026



Rev	Date	By	Description	Rev' check
P02	16.07.18	GM	Pipe numbers 10.003, 10.004 and 10.005 upgraded from 375Ø to 450Ø following final design calculations.	WFG
P01	13.07.18	GM	Route of foul drain downstream from manhole F9 revised and trench soakaway adjacent to mound (near AW MH 9401) reduced in length. All in accordance with comments from 278 Consulting (email dated 02/07/2018).	WFG

Drawing status

PRELIMINARY

Client

PROLOGIS

Project

ZONE A, PLOT 2
PROLOGIS PARK, KETTERING

Drawing

DRAINAGE LAYOUT
AND EXTERNAL LEVELS
2-UNIT SCHEME
SHEET 3 OF 3

Scale @ A0	Drawn	Checked
1:250	G. Males	NRB
Project No.	**Date**	**Office**
CS/075709	Jun 2018	WATFORD

Drawing Identifier — BS1192:2007 / Avanti Compliant

project	origin	zone	level	file type	role	number	revision
075709	-CA-	0	- BG -	DR	- S -	027	- P02

CAPITA

Property and infrastructure

Consulting Civil, Structural and Geo-environmental Engineers

London Tele No.(+44) 0 20 7870 9300
Watford Tele No.(+44) 0 1923 817537
Manchester Tele No.(+44) 0 161 486 1521
Bristol Tele No.(+44) 0 1275 840831

Capita Property and Infrastructure Ltd., Reg. office 71 Victoria Street, Westminster, London SW1H 0XA • No: 2019542
www.capita.co.uk/property

Appendix H - URS Statement on Glendon Road

North Kettering Business Park, Zone A Plot 2, Statement on Glendon Road Improvement Surface Water Drainage.

This note has been prepared in support of the planning application for Zone A Plot 2 and the associated widening of Glendon Road as shown on URS Drawing 49325010/P/RO/001

The existing Glendon Road east of the Glendon Road roundabout is approximately 5.5m wide and is not kerbed. Surface water currently drains "over the edge" to the verges where it soaks into the ground. The road lies within its own drainage catchment, falling from east to west by approximately 3m over the section of road to be widened and continues to fall westwards before passing over the London to Sheffield railway line.

The location and levels of the existing Glendon Road carriageway, in the vicinity of Zone A Plot 2, does not make it feasible to drain the road by gravity to any part of the North Kettering Business Park development. Surface water will therefore have to be managed separately from the main development site drainage, which will ensure that it cannot have any effect upon the surface water balancing facilities already designed and constructed for the main development site. In addition there is no direct route to drain surface water from the road into Slade Brook, which will ensure that there is no increased risk of flooding within the watercourse.

It is proposed to kerb the widened Glendon Road and to provide a system of trapped gullies to collect the surface water run-off from the carriageway. The gullies will then discharge into an infiltration drainage system in the form of filter drains, consisting of porous pipes within stone filled trenches, which will store the surface water and allow it to soak into the subsoil. This form of Sustainable Drainage System mimics the existing situation. Infiltration testing and initial modelling of the drainage system has been carried out to confirm that this method of drainage is suitable.

It is not intended to install a formal pollution control system for the widened road as the method of drainage proposed will ensure that the risk of a spillage entering the watercourse is minimal. Diffuse pollution e.g. dust from brake lining, tyre wear and oil leaks will be low. Infiltration drainage into the subsoils will permit the very low levels of diffuse pollution to be removed by filtration and absorption.

As the proposed drainage system is independent of the main development drainage system it is considered that no formal Certificate of Compliance with the original development Flood Risk Assessment is required with this application.

CAPITA

Capita Property and Infrastructure Limited
Oak House
Reeds Crescent
Watford
Hertfordshire
WD24 4QP

Tel +44 (0)1923 817537

www.capitaproperty.co.uk