Development at Gavray Drive, Bicester

Site Enabling Earthworks
& Pond Retention Proposals

GALLAGHER ESTATES

Consulting Civil, Structural & Environmental Engineers **Development Consultants** **Project Managers**

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Paul Drew – Paul Drew Design	0	1				
David Keene – David Lock Associates	0	1				
Rob Rowlands - EDP	0	1				

CONTENTS

APPENDIX

1 INTRODUCTION

1.1 Brookbanks Consulting Limited (BCL) has been appointed by Gallagher Estates to develop proposals relating to site enabling works and infrastructure provision for a proposed development known as Gavray Drive in Bicester.

1.2 To date, the work has involved preliminary design of the following elements:

- Storm and foul water drainage
- Site enabling earthworks
- Site highways
- Building and plot levels

1.3 While preliminary site drainage and earthworks drawings have been developed and circulated, it is understood that the project ecologist requires further supporting information to outline how the engineering works will interface with a number of retained landscape and ecological elements. The points requiring amplification are as follows:

- Site earthworks proposals in relation to retained hedges and trees across the site and development interfaces.

- Proposals relating to pond retention and water supply for the new and existing ponds.

1.4 This statement deals with the above by outlining the methods that will be employed at the site to ensure there are no adverse impacts relating to the essential engineering activities. The proposals will also been used to inform design relating to the Planning Consent Condition No 8 requiring the preparation of a Masterplan and Condition No 12 requiring the submission of an Implementation Plan.

2 BACKGROUND INFORMATION

Location & Details

2.1 The proposed development lies approximately 1.5km south east of Bicester town centre. The land is bounded by the existing urban fringe and Gavray Drive to the south, Charbridge Lane to the east and the Chiltern and Oxford & Bletchley Branch railway lines to the north and west respectively. The site location is shown on Figure 2a, below.

2.2 It is understood that the greater part of the land is historically undeveloped.

Development Criteria

2.3 It is proposed to develop a sustainable urban extension of up to 500 dwellings over two discrete development areas to the west and east of an existing watercourse, known as Langford Brook. The western and eastern development areas extend to circa 4.3 & 10.0ha respectively.

2.4 The preliminary development layout is shown on drawings 1296/CS/01 and 1296/CS/02 in the Appendix.

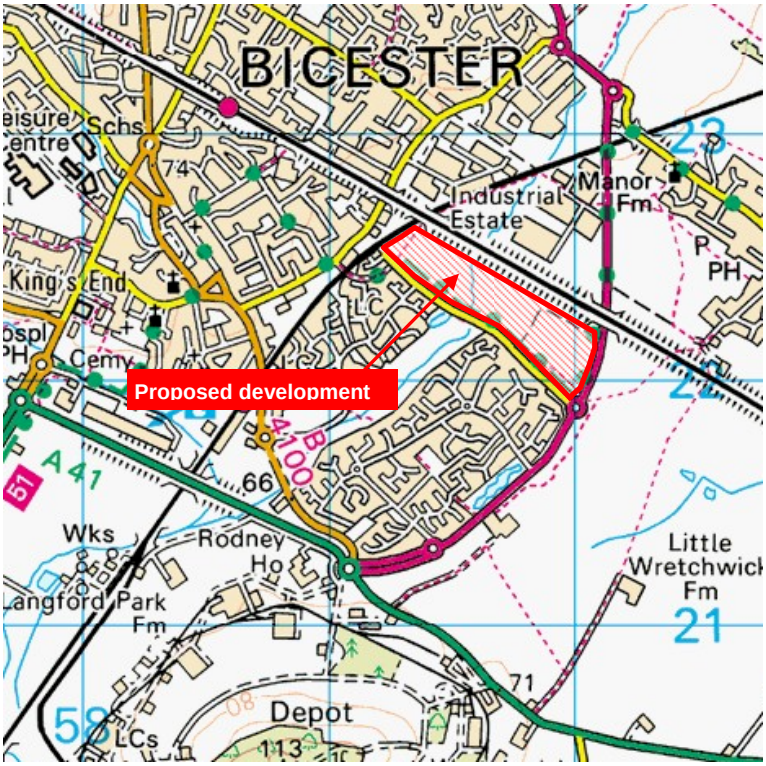


Figure 2a: Site location

Topography & Site Survey

2.5 Site topography has been mapped using both traditional and GPS surveying techniques to provide accurate site location and level data. The site survey is shown on drawing 1296/SV/01 in the Appendix.

2.6 Topography to the west of Langford Brook is characterised by moderate gradients as levels fall from a high point of circa 69.4m AOD on the western boundary, down to the watercourse to the east at a low point of 66.5m AOD at the bank.

2.7 To the east of Langford Brook, levels rise from the low point at the watercourse bank to a ridge bisecting the land in a north east to south west direction, close to the centre of the eastern development area. The high point along the ridge is at circa 67.7m AOD. To the east of the ridge, the land falls in a south easterly direction towards Charbridge Lane and a low point adjacent to the highway of 64.7m AOD.

Ground Conditions

2.8 Geology across the site has been proven by way of a desk study and intrusive investigations completed by Wardell Armstrong between November 2006 and January 2007. The ground conditions may be summarised as follows:

Material	Description
Orange brown sandy clay (Reworked materials)	Maximum depth 1.28m. Mean thickness: 0.50m
Brown sand and clays (Superficial deposits)	Depth to base being a maximum of 3.15m BGL
Firm to stiff grey and brown silty clays (solid formation)	Encountered at 0.45 – 3.15m BGL.

Figure 2b: Summary of site geology

2.9 Interpretations completed by Wardell Armstrong suggest the soil permeability to be in the order of 1 x 10^{-7} m/s. The strata may therefore be described as ranging from having very poor drainage characteristics to being practically impervious.

Watercourse Systems & Drainage

2.10 Reference to the Wallingford Flood Estimation Handbook CD dataset confirms the majority of the undeveloped site to lie within the catchment of Langford Brook, which bisects the centre of the site in a north east to south westerly direction. However, the eastern reaches of the land convey water away from Langford Brook in south easterly direction.

2.11 The urban development to the west of the site is well serviced with a network of adopted storm and foul water sewers servicing the urban development. It is understood that the sewers to the west have been designed to accommodate the flows from the planned development. Accordingly, drainage from the development will generally be conveyed in a south and westerly direction to reach the existing sewers in Charbridge Lane and Gavray Drive.

3 ENABLING EARTHWORKS

Background

3.1 The previous revision of this report addressed the matter of servicing the development with a gravity storm and foul water system and connection to the existing sewers in Charbridge Lane and Gavray Drive. In the interim period Oxfordshire County Highways have adopted a new SuDs policy for the purpose of draining adopted highways. The earthworks strategy for the proposed development has been significantly affected by the new policy adopted by the council, as the surface water strategy for the development has been adapted to accord with same.

OCC SuDs Policy

3.2 In line with the Flood and Water Management which received Royal Assent on the 8th April 2010, OCC Highways have adopted a new policy on the use of sustainable urban drainage methods in the servicing of adopted highways. The County have advised that henceforth all new developments should where practical look to employ porous paving in the construction of site highways.

3.3 Following discussions with OCC highways it was agreed that a porous paving based system would be employed throughout the Gavray Drive development, incorporating both adopted and private surfaces. In committing to provide such a system it was also agreed that run-off from other paved surfaces and roof tops would be directed in to the porous paving system. The use of an integrated porous paving network within the development has effectively negated the need to employ a traditional pipe drainage system for management of surface water, with run-off conveyed along the sub-formation of the road network towards the point of outfall at the site access.

3.4 Surface water run-off is filtered through a series of aggregate layers in to a high voidage sub-base layer where water is retained before discharging at a reduced rate in to the ground, or to a dedicated receptor such as a watercourse or sewer. As site water passes though the various layers of sand, gravel, and single sized stone, it is effectively polished, removing a number of the harmful contaminants associated with run-off from urban areas such as roads and car-parks.

Infilling Proposals

3.5 The requirement to raise site levels had been dictated by the invert levels of the adopted storm sewers in Gavray Drive and Charbridge Lane, into which development run-off was to be discharged. As indicated below the enabling earthworks proposals related to the previous scheme involved the placement of significant volumes of imported material.

Figure 3a: Site infilling – Pipe Based System

3.6 The adoption of the porous paved system has significantly reduced the extent of enabling earthworks required, as demonstrated below:

Figure 3b: Site infilling – Porous Paving System

3.7 Minimum highway and floor slab levels across the site and hence the finished surface profile have been reassessed to accord with the new surface water drainage strategy. A revised isopachyte analysis has then been completed, using computer aided three dimensional modelling techniques, to identify and show graphically the thicknesses of fill that is required across the land to achieve the require levels.

3.8 Given the significant reduction in the volume of material required to complete the enabling earthworks scheme it is proposed that same be completed using material generated within the development from the construction of highways, the foul drainage sewers, and foundations.

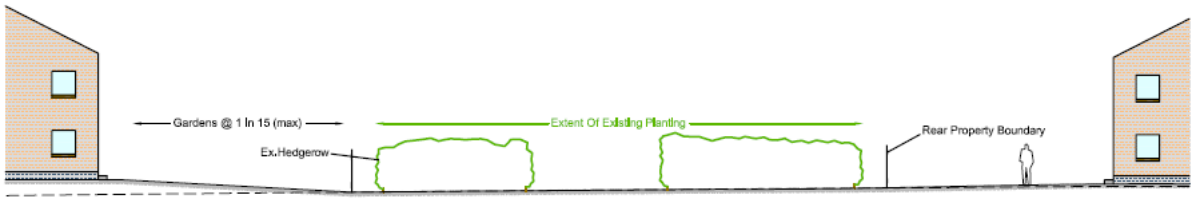
3.9 The revised site infilling proposals are indicated in figure 3b above, and shown in detail on drawings 1296/EW/01 and 1296/EW/02 contained in the Appendix.

3.10 To the west of the site, the increase in ground levels is concentrated on the eastern half of the development land, where levels will be altered by no more than 0.5m on average. The maximum increase in level within the residential land is just of over 0.75m in the area adjacent to the eastern site boundary. Enabling works associated with providing the school land will require that ground levels be raised by up to a meter, although this is primarily to satisfy the EA's flood resilience requirements for public buildings.

3.11 The east parcel is the subject of a lower proportion of level raising works. Approximately a sixth of the land will need to be raised. On average site levels will be altered by no more than 0.5m. The maximum height of level increase is again just of over 0.75m in the north western and south western corner of the parcel.

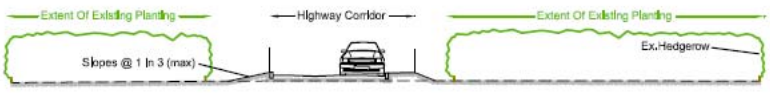
3.12 As with the previous site proposals, all land raising will be completed in a manner that harmonises with the prevailing topography, and once complete will be indiscernible from the natural profiles of the land. No sharp steps in profile will be introduced and the interfaces with the undisturbed land and associated features will be carefully detailed to ensure that the finished levels look natural and are not detrimental to retained features such as existing hedges and ponds.

3.13 To demonstrate that the important interfaces can be appropriately detailed, a series of cross sections have been taken and the existing and proposed surface profiles plotted, working closely with the project ecologist and landscaping master planner to develop satisfactory solutions. The locations of these sections have been taken at the interfaces with existing hedges, ponds, and retained open space adjacent to, or within the development area. The cross section locations are shown on drawing 1296/CS/01 and 1296/CS/02 contained in the Appendix. Illustrative sections of the key interface areas are shown across the following pages to demonstrative how development will interact with the existing and retained features.



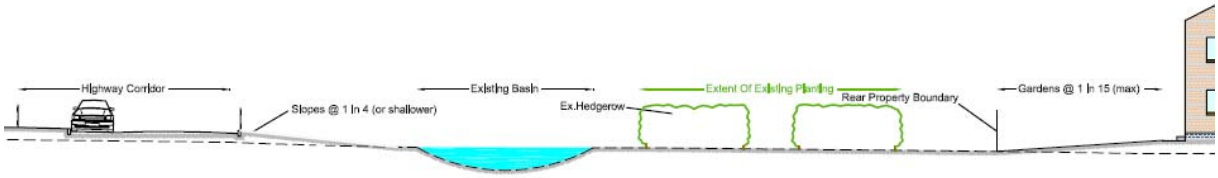
ILLUSTRATIVE CROSS SECTION E1

3.14 The very limited amount of infilling works required will be tailored to accommodate the interfaces between the raised areas and the natural areas within the back gardens of developments. The following illustrations show this concept. Gradients have been kept to an appropriate maximum of 1 in 15 across the gardens to ensure site occupiers have a pleasant and manageable garden space. In a number of locations, the gardens areas are insufficiently long to bring levels within the land. In these circumstances, a localised steepening at the boundary has been employed at the introduction of structural landscape planting to soften the development edge. At such locations, the slope is intended to be no greater than 1 in 4 and over a maximum height of no greater than 0.5m, so that no unnatural interface is created.



ILLUSTRATIVE CROSS SECTION E2

3.15 The proposals will not result in unacceptably steep slopes on the site or change physical elements such as drainage flow paths and the like. No infilling will be completed within 1m of the canopy of retained hedges or trees. The cross sections show how this will be achieved. It can be seen that existing hedges will not be situated at the base of a steeply infilled slope, or within an artificial channel created by the land raising. The existing retained vegetation will not be materially affected by the works. The land in the retained areas will not become saturated as the natural infiltration characteristics of the infilled land will be maintained and water will not be discharged into a 'trapped area'. Additionally, gravel filled French drains will be installed where appropriate to maintain the baseline hydraulic flow paths of the site in the completed development.



ILLUSTRATIVE CROSS SECTION E4

3.16 Similarly, no infilling will be completed adjacent to existing ponds and these, along with the retained vegetation, will be carefully protected during the works by fencing.

Summary

3.17 The appraisal clearly shows that the land raising works can be accommodated in a manner that is not detrimental to the existing landscape or retained features in the form of existing ponds and hedge rows.

3.18 The proposed implementation of sustainable drainage methods to serve the development and provide a high standard of passive water treatment, and the sensitive management of interaction between existing and proposed levels will ensure that the localised land raising works can therefore be described as the most sustainable means to develop the site.

4 POND RETENTION & CREATION

Background

4.1 The project ecologist and landscape architect have developed proposal that retain three existing ponds within the eastern development area. These ponds are known as Pond 2, Pond 4 & Pond 6, and are shown on drawing 1296/CP/01 contained in the Appendix.

4.2 It is understood that the ponds in the baseline condition are seasonally wet; occasionally drying out in the summer months. Evidence from the site investigation completed by Wardell Armstrong indicates that the ponds are in continuity with the ground water, coupled with a small, but potentially important natural catchment of water fed from rainfall related run-off on the undeveloped land.

4.3 Development will potentially alter the natural rainfall infiltration at the site and if not managed appropriately, this mechanism may result in a reduced water supply to the ponds, resulting in detriment to the ecology of the features.

4.4 Proposals have therefore been developed to ensure the existing ponds are maintained with a natural water supply that closely reflects the baseline conditions and are in essence designed to mimic the natural hydrology of the site.

4.5 Proposals have also been developed to establish a new pond complex in the eastern area of the development, close to the edge of the 1 in 100 year floodplain of Langford Brook and Gavray Drive. Proposals have also been developed to ensure that the pond complex is provided with water from the catchment.

Existing Pond Proposals

4.6 To understand the potential impact on the ponds, it is firstly necessary to understand the catchments and water supply mechanisms of the features. Accordingly, information contained within the site investigation has been used in conjunction with the site survey to develop postulated ground water flow paths and hence catchments for the ponds. These catchments are shown on drawing 1296/CP/01 contained in the Appendix. The sizes of the catchments are also shown in Figure 4a, below.

4.7 Given the extent of the catchment, recognised methods of assessing surface water run-off from small rural catchments have been used to predict the potential maximum rate of water supply to the ponds. This simplistic method of assessment has been used to give conservative results, over a more accurate water cycle; rainfall, recharge, evapo-transpiration, run-off model that would otherwise be required, which is unnecessary for this assessment. Two methods have been employed to estimate the baseline run-off from to the ponds, being ADAS345 and IoH124. The summary calculations are contained in the Appendix.

4.8 To provide robust results, the higher run-off figures determined using ADAS345 have been used to estimate the potential peak discharge to the ponds from their prevailing catchments. The estimated peak run-off rates that would occur during a 1 in 1 year storm event on a saturated catchment are as follows:

Location	Catchment (m^2)	ADAS 345 rate (l/s/ha)	Peak run-off (l/s)
Pond 1	4,190	5.6	2.35
Pond 2	2,191	5.6	1.23
Pond 6	408	5.6	0.22

Figure 4a: Estimated peak run-off to existing site ponds during a 1 in 1 year storm event

4.9 Given the proposed build density at the site, hard cover made up of building roofs, parking areas and highways will account for approximately 55% of the net development area. The soft areas within the development, by way of gardens, open space and structural landscaping will continue to contribute to the water supply of the ponds. It is therefore only necessary to compensate for the loss of catchment associated with hard covered areas, where surface waters will be discharged away from the localised pond catchments in sewers draining the development.

4.10 To mimic the baseline conditions, it is important that the water supply is not only of approximately the same annual quantum of water, but also that peak rates of flow are not significantly increased. Proposals have therefore been developed that provide compensatory catchments by directing water from building roof areas across the planned development to the ponds.

4.11 In order to ensure that the annual quantum of water is similar to the baseline conditions, the proposed compensatory catchment (total roof area) is similar to that lost due to hard cover as follows:

Location	Catchment (m^2)	Impermeability	Compensatory catchment (m^2)
Pond 1	4,190	55%	2,305
Pond 2	2,191	55%	1,205
Pond 6	408	55%	224

Figure 4c: Approximate compensatory catchments for ponds

4.12 Drawing 1296/DR/03 contained in the Appendix outlines the proposed compensatory drainage scheme.

4.13 Based on the build density and likely impermeability factor, the existing ponds will require compensatory surface water flows amounting to the following:

Location	Peak run-off (l/s) (Fig 4a)	Impermeability	Peak run-off (l/s)
Pond 1	2.35	55%	1.29
Pond 2	1.23	55%	0.68
Pond 6	0.22	55%	0.12

Figure 4b: Estimated peak compensatory flows during a 1 in 1 year storm event

4.14 Drainage from the compensatory catchments will be attenuated to the maximum discharge rates shown in Figure 4b, above, to ensure that the ponds are not inundated with the 'peaky' discharges normally associated with hard surface run-off. Attenuation of the surface water discharge will be achieved in a gravel lined trench

that will be design to collect water from roof down pipes and any ground water associated with the run-off from soft landscaped areas. Illustrative detention calculation summaries are contained in the Appendix to outline the preliminary volumetric requirements. The requirements are summarised Figure 4d, below.

Location	Compensatory catchment (m^2)	Peak run-off (l/s)	Detention volume (m^3)
Pond 1	2,305	1.29	26.4
Pond 2	1,205	0.68	13.9
Pond 6	224	0.12	2.5

Figure 4c: Existing pond compensatory catchment requirements

4.15 The proposed compensatory catchments will provide a source of water for the existing ponds that closely reflects the baseline hydrological conditions. As development related water will be taken from roof areas alone, and not parking areas or highways, the water supply will be clean and uncontaminated by the background chemicals and silt deposits that are often associated with urban run-off.

Proposed Pond Complex

4.16 The proposed pond complex is shown on drawing 1296/DR/04 contained in the Appendix. A series of hydraulically linked units are proposed that are both in continuity with the local ground water but are also lined with naturally occurring site won materials and fed with a water supply by way of a typical herringbone field drainage system positioned in green areas not part of the County Wildlife Site.

4.17 The site investigation has shown ground water in the vicinity of the new pond complex to be close to the surface at circa 0.25m below ground level. Hence, with appropriate outflow connections, the level of water in the ponds can will be controlled at the required elevation and maintained in part by ground water supplies.

4.18 Given the potential fluctuation of ground water levels, the ponds will be lined with the low permeability soils found across the site to provide greater continuity of water level. The site investigation interprets areas of site material to have a permeability of circa 1×10^{-7} m/s, which while not being puddle clay, will if carefully placed at an appropriate thickness, provide a lining to restrict infiltration and the outflow of water below the controlled water level.

4.19 A herringbone drainage system is proposed to extend the natural catchment of the new pond complex by collecting and conveying water infiltrated across the open space area of the eastern development to the ponds. An illustrative layout of the proposed herringbone drainage system is shown on drawing 1296/DR/04 contained in the Appendix.

5 SUMMARY

Enabling Earthworks

5.1 Proposals have been developed that permit a gravity drainage system to be employed at the site by raising various areas to the minimum necessary to provide an adoptable drainage network. The raising of levels can be completed without detriment to the existing retained landscape or ecology by careful detailing at the various interfaces.

5.2 The proposals are the most sustainable means of developing the site, which would otherwise potentially require large storm water pumps to convey water into the existing drainage systems in Charbridge Lane and Gavray Drive, and would potentially be unadoptable by Thames Water,

Existing Pond Proposals

5.3 Measures have also been developed to ensure that three existing ponds on the site are retained and maintained in a manner that secures the long term water supply and ecological viability of the features. The potential reduction in water supply associated with hard paving the site will be compensated by a compensatory catchment collecting water from building roofs and garden areas.

5.4 The compensatory catchments will be design to ensure that both the annual volume and peak discharge of water closes reflects the baseline site conditions.

New Pond Complex Proposals

5.5 The new pond complex will be designed to have surface water in continuity with the available ground water. Continuity of water level will be provided by lining the base of the features with site won naturally occurring low permeability soils with an inflow from a herringbone field drainage system.

6 LIMITATIONS

6.1 The benefits of this report are provided solely to Gallagher Estates for the proposed 500 unit development at Gavray Drive in Bicester only. Brookbanks Consulting do not confer any third party rights for the information contained in the report.

6.2 The conclusions and recommendations contained herein are limited to those given the general availability of background information and the planned usage of the site.

6.3 Third party information has been used in the preparation of this report, which Brookbanks Consulting, by necessity assume is correct at the time of writing. While all reasonable checks have been made on data sources and the accuracy of data, Brookbanks Consulting Ltd accepts no liability for same.

6.4 Illustrative proposals outlined in this document are subject to final design and assessment.

APPENDIX

1296 / SV / 01

NOTES

1.) Do not scale from this drawing.

2.) The Data contained within this survey has been collected by a third party on behalf of JJ Gallagher. Brookbanks Consulting Ltd accept no responsibility for the accuracy of this data.

3.) The earthworks shown herein are based on third party data and as such they are a best representation.

4.) This drawing is to be read in conjunction with BCL drawing no. 1296/EW/04

5.) The contours shown on this drawing show the net filling requirements to achieve gravity drainage. No allowance has been made for topsoil strip.

Rev.	Revision Details	Drawn	Checked	Approved	Date
	PRELIMINARY	PAB			15.5.07

Issue Status		Approved	Date
Drawn KD	Checked PAB	Date	MAY 07

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GALLAGHER ESTATES

Gavray Drive
Bicester, Oxfordshire

Topographical Site Survey Plan

Scale at A1	Drawing No.	Rev.
1 / 2000	1296 / SV / 01	

Original Drawing Size A1

1296 / EW / 01

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KEY

Level of Fill Material

	0.75m > 1.00m
	0.50m > 0.75m
	0.25m > 0.50m

Rev.	Revision Details	Drawn	Checked	Approved	Date
G	School Land requirements added	RD	PAB	PAB	22.4.10
F	Rev. to suit porous paving	RD	PAB	PAB	20.4.10
E	Rev. to show boundary treatment	RD	PAB	PAB	12.10.7
D	Rev. to show retained hedges	RD	PAB	PAB	30.5.07
C	Rev. to show fill in col. wash	RD	PAB	PAB	11.5.07
B	Rev. to suit latest masterplan	RD	PAB	PAB	05.3.07
A	SW route revised to Chrbge Ln	RD	PAB	PAB	4.10.06
	PRELIMINARY	PAB			15.9.06
	Issue Status			Approved	Date
Drawn	RD	Checked	PAB	Date	SEP 06

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GALLAGHER ESTATES

Gavray Drive
Bicester, Oxfordshire

Illustrative Site
Earthworks Proposals
Western Development Land

Scale at A1	Drawing No.	Rev.
1 / 1000	1296 / EW / 01	G

Original Drawing Size A1

1296 / EW / 02

NOTES

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	0.25m > 0.50m

Rev.	Revision Details	Drawn	Checked	Approved	Date
F	Rev. to suit porous paving	RD	PAB	PAB	20.4.10
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B	Rev. to suit latest masterplan	RD	PAB	PAB	05.3.07
A	SW route revised to Chrbge Ln	RD	PAB	PAB	4.10.06
	PRELIMINARY	PAB			15.9.06
	Issue Status			Approved	Date
Drawn	RD	Checked	PAB	Date	SEP 06

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GALLAGHER ESTATES

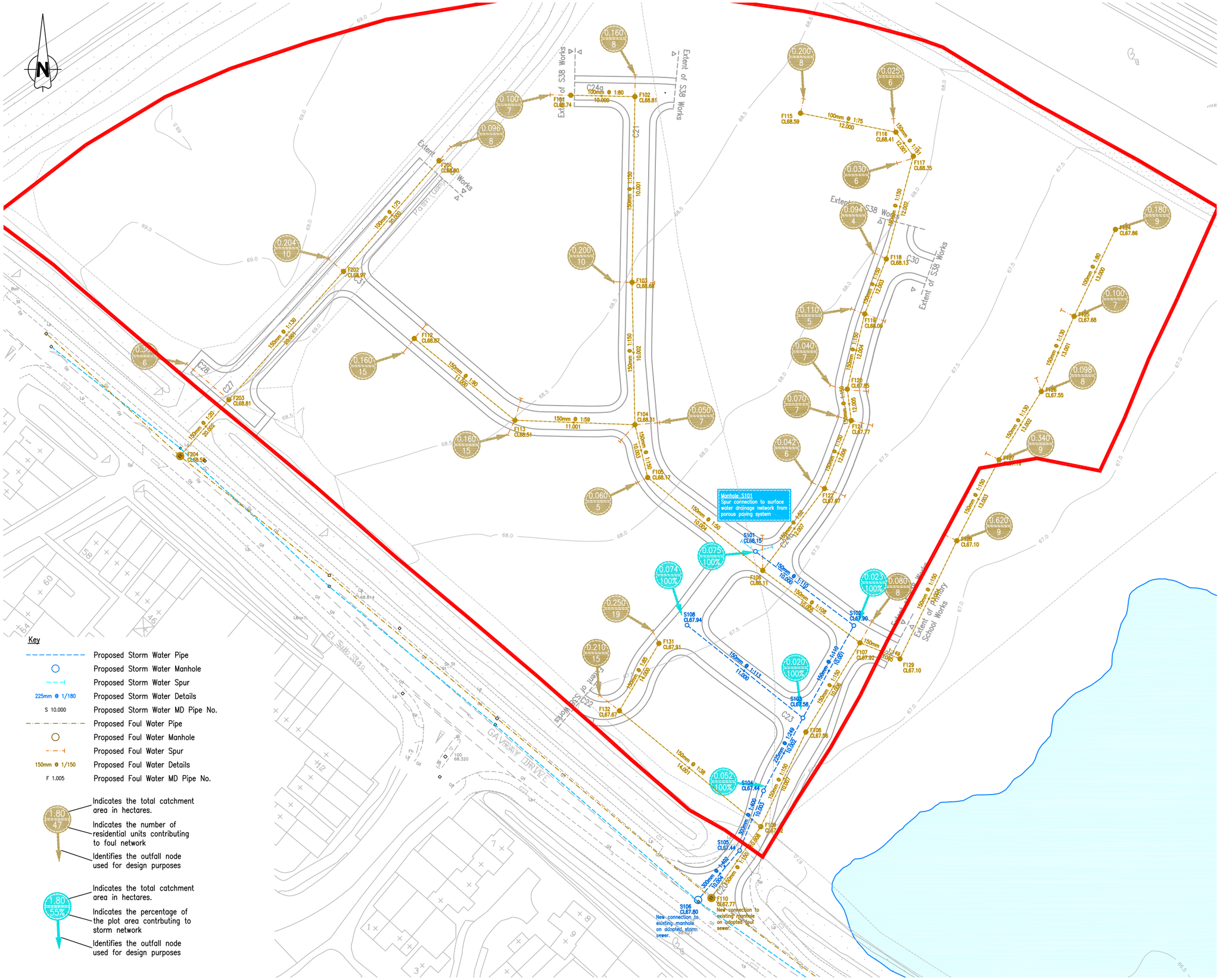
Gavray Drive
Bicester, Oxfordshire

Illustrative Site
Earthworks Proposals
Eastern Development Land

Scale at A1	Drawing No.	Rev.
1 / 1000	1296 / EW / 02	F

Original Drawing Size A1

1296 / DR / 10



Key

- Proposed Storm Water Pipe
- Proposed Storm Water Manhole
- Proposed Storm Water Spur
- 225mm @ 1/180 — Proposed Storm Water Details
- S 10.000 — Proposed Storm Water MD Pipe No.
- Proposed Foul Water Pipe
- Proposed Foul Water Manhole
- Proposed Foul Water Spur
- 150mm @ 1/150 — Proposed Foul Water Details
- F 1.005 — Proposed Foul Water MD Pipe No.

1.80 / 47 — Indicates the total catchment area in hectares. Indicates the number of residential units contributing to foul network. Identifies the outfall node used for design purposes.

1.80 / 55% — Indicates the total catchment area in hectares. Indicates the percentage of the plot area contrbuting to storm network. Identifies the outfall node used for design purposes.

0 10 20 30 40 50
METRES

Original Drawing Size A1

Notes

1.) Do not scale from this drawing.

2.) This drawing is to be read in conjunction with the Contract Specification and all relevant Architect's, Engineer's and Specialist's drawings.

3.) All materials and workmanship to be in accordance with the Contract Spec. Main drainage within highway to be to SfA adoptable standards.

4.) It is the Contractor's responsibility to liaise with all relevant services companies to ensure that all services are accurately located and adequately protected during construction.

5.) Pipes up to and including 300mm diameter shall be vitrified clay to BS EN 295 with either sleeved or spigot and socket flexible joints and shall satisfy the minimum crushing strengths stated below:–

100ø – 28 kN/m2 225ø – 28 kN/m2
150ø – 28 kN/m2 300ø – 36 kN/m2

6.) Pipes of 375mm diameter and above shall be precast concrete Class M with flexible joints to BS 5911 Part 100.

7.) All pipes to be laid in accordance with the manufacturer's recommendations and sitework instructions.

8.) All new sewer stubs are to be capped, their location coordinates noted and their position pegged.

9.) All new sewer stubs are to be constructed to the following criteria unless noted otherwise:–

Storm – 150mm Dia Pipe @ min. 1/150
Foul – 100mm Dia Pipe @ min. 1/80

All stubs are to extend beyond the back of footway, so as to allow for future connection without the need for breaking out of footways etc.

10.) Manhole cover levels are to be set at finished surface level.

11.) This drawing is to be read in conjunction with the appropriate Micro Drainage schedules.

Rev.	Revision Details	Drawn	Checked	Approved	Date
B	Local Flood plain data added	RD	BRD	PAB	19.4.10
A	Drainage layout revised	RD	BRD	PAB	08.3.10
	PRELIMINARY	PAB			08.05.08
	Issue Status			Approved	Date
	Drawn RD	Checked BRD		Date MAY 08	

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GALLAGHER ESTATES

Gavray Drive
Bicester, Oxon

Proposed Western
Residential Site
Sec.104 Drainage Layout

Scale at A1	Drawing No.	Rev.
1 / 500	1296 / DR / 10	B

1296 / DR / 20

1296/HL/21
1296/HL/20

Manhole S201
Spur connection to surface water drainage network from porous paving system

Manhole S202
Spur connection to surface water drainage network from porous paving system

Manhole S203
Spur connection to surface water drainage network from porous paving system

Extent of S38 Works

Key

- Proposed Foul Water Pipe
- Proposed Foul Water Manhole
- Proposed Foul Water Spur
- 150mm ● 1/150 — Proposed Foul Water Details
- F 1.005 — Proposed Foul Water MD Pipe No.
- 1.80 / 47 — Indicates the total catchment area in hectares. Indicates the number of residential units contributing to foul network. Identifies the outfall node used for design purposes

0 10 20 30 40 50
METRES

Notes

1.) Do not scale from this drawing.

2.) This drawing is to be read in conjunction with the Contract Specification and all relevant Architect's, Engineer's and Specialist's drawings.

3.) All materials and workmanship to be in accordance with the Contract Spec. Main drainage within highway to be to SfA adoptable standards.

4.) It is the Contractor's responsibility to liaise with all relevant services companies to ensure that all services are accurately located and adequately protected during construction.

5.) Pipes up to and including 300mm diameter shall be vitrified clay to BS EN 295 with either sleeved or spigot and socket flexible joints and shall satisfy the minimum crushing strengths stated below:–

100ø – 28 kN/m2 225ø – 28 kN/m2
150ø – 28 kN/m2 300ø – 36 kN/m2

6.) Pipes of 375mm diameter and above shall be precast concrete Class M with flexible joints to BS 5911 Part 100.

7.) All pipes to be laid in accordance with the manufacturer's recommendations and sitework instructions.

8.) All new sewer stubs are to be capped, their location coordinates noted and their position pegged.

9.) All new sewer stubs are to be constructed to the following criteria unless noted otherwise:–

Storm – 150mm Dia Pipe @ min. 1/150
Foul – 100mm Dia Pipe @ min. 1/80

All stubs are to extend beyond the back of footway, so as to allow for future connection without the need for breaking out of footways etc.

10.) Manhole cover levels are to be set at finished surface level.

11.) This drawing is to be read in conjunction with the appropriate Micro Drainage schedules.

Rev.	Revision Details	Drawn	Checked	Approved	Date
B	Local Flood plain data added	HDB	RD	PAB	19.4.10
A	Drainage layout revised	HDB	RD	PAB	09.3.10
	PRELIMINARY	PAB			08.05.08
	Issue Status			Approved	Date
	Drawn TWB Checked RD			Date	MAY 08

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GALLAGHER ESTATES

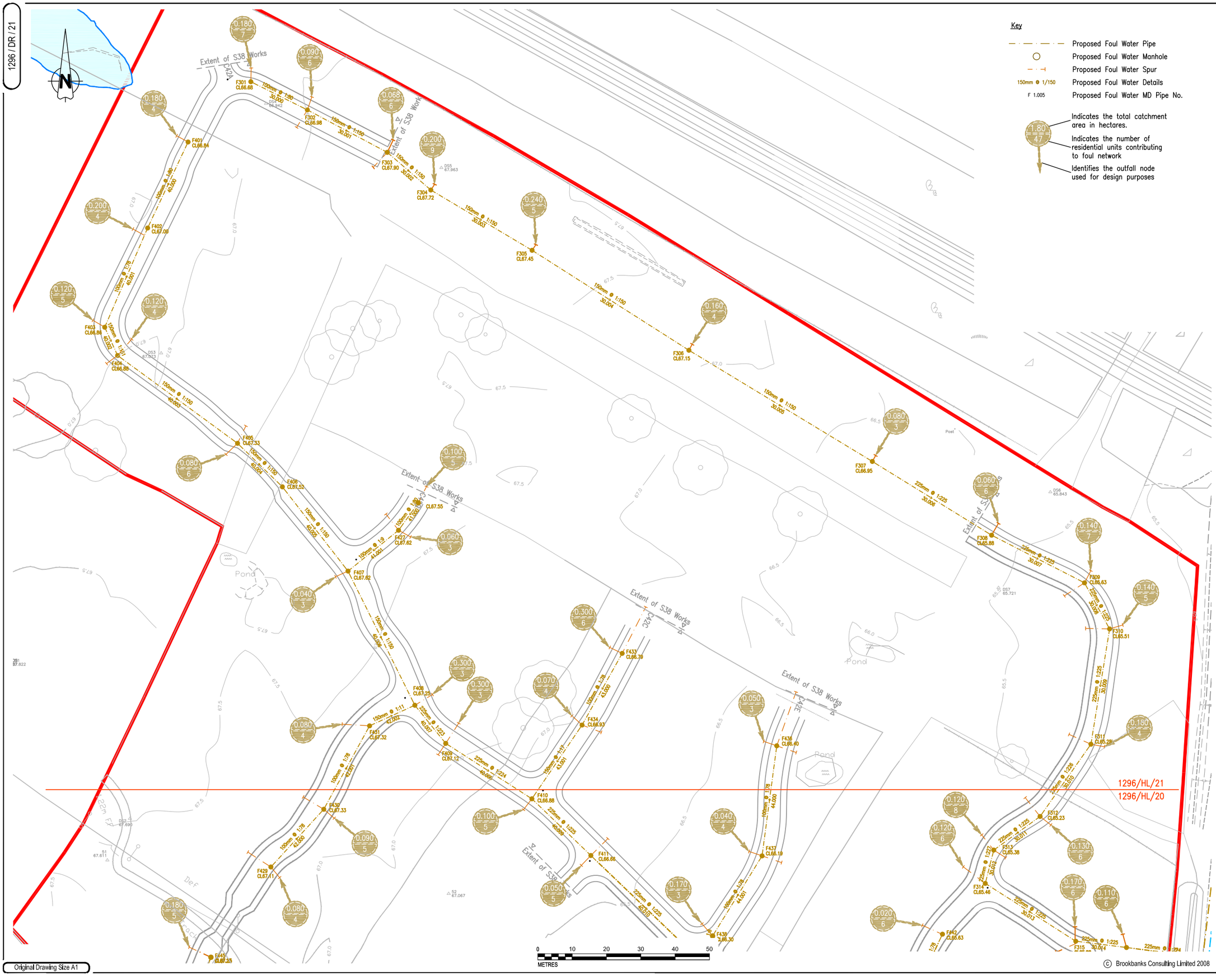
Gavray Drive
Bicester, Oxon

Proposed Eastern Residential Site
Sec.104 Drainage Layout
Sheet 1 of 2

Scale at A1	Drawing No.	Rev.
1 / 500	1296 / DR / 20	B

Original Drawing Size A1

1296 / DR / 21



Key

- Proposed Foul Water Pipe
- Proposed Foul Water Manhole
- Proposed Foul Water Spur
- 150mm @ 1/150 — Proposed Foul Water Details
- F 1.005 — Proposed Foul Water MD Pipe No.
- 1.80 / 47 — Indicates the total catchment area in hectares. Indicates the number of residential units contributing to foul network. Identifies the outfall node used for design purposes

Notes

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2.) This drawing is to be read in conjunction with the Contract Specification and all relevant Architect's, Engineer's and Specialist's drawings.

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150ø – 28 kN/m2 300ø – 36 kN/m2

6.) Pipes of 375mm diameter and above shall be precast concrete Class M with flexible joints to BS 5911 Part 100.

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Foul – 100mm Dia Pipe @ min. 1/80

All stubs are to extend beyond the back of footway, so as to allow for future connection without the need for breaking out of footways etc.

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11.) This drawing is to be read in conjunction with the appropriate Micro Drainage schedules.

Rev.	Revision Details	Drawn	Checked	Approved	Date
B	Local Flood plain data added	HZB	RD	PAB	19.4.10
A	Drainage layout revised	HZB	RD	PAB	09.3.10
	PRELIMINARY			PAB	08.05.08
	Issue Status			Approved	Date
	Drawn TWB	Checked RD		Date	MAY 08

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GALLAGHER ESTATES

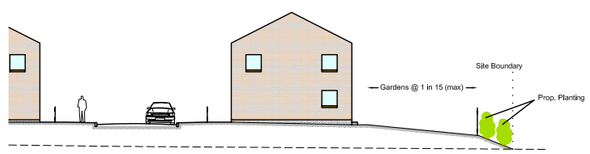
Gavray Drive
Bicester, Oxon

Proposed Eastern Residential Site
Sec.104 Drainage Layout
Sheet 2 of 2

Scale at A1	Drawing No.	Rev.
1 / 500	1296 / DR / 21	B

Original Drawing Size A1

1296 / CS / 01



ILLUSTRATIVE CROSS SECTION W1

0 400 800 1200 1600 2000
METRES

NOTES

1.) Do not scale from this drawing.

2.) The Data contained within this survey has been collected by a third party on behalf of JJ Gallagher. Brookbanks Consulting Ltd accept no responsibility for the accuracy of this data.

3.) This drawing is to be read in conjunction with BCL drawing no's. 1296/EW/01 & 03.

Rev.	Revision Details	Drawn	Checked	Approved	Date
	PRELIMINARY	PAB			15.5.07
	Issue Status			Approved	Date
	Drawn KD	Checked PAB		Date	MAY 07

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GALLAGHER ESTATES

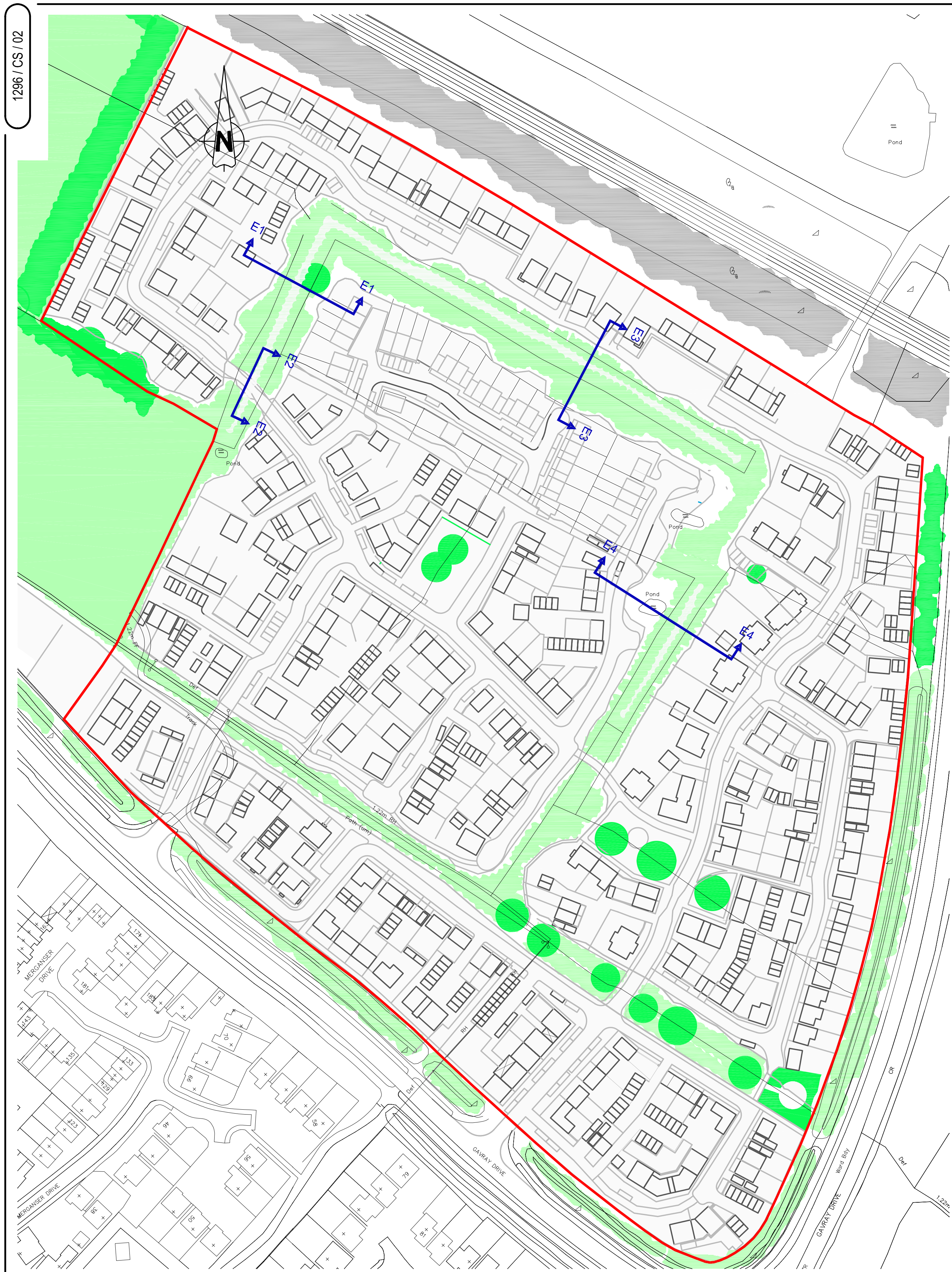
Gavray Drive
Bicester, Oxfordshire

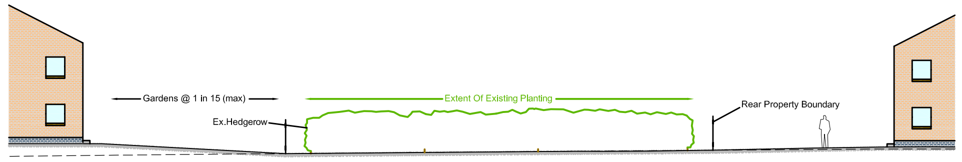
Illustrative Site
Earthworks Reprofiling
Western Development Land

Scale at A1	Drawing No.	Rev.
1 / 2000	1296 / CS / 01	

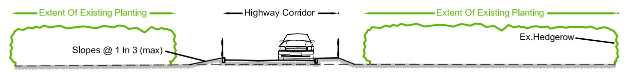
Original Drawing Size A1

1296 / CS / 02

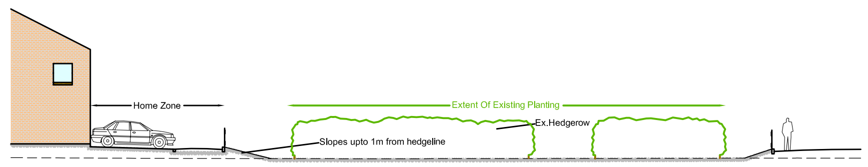




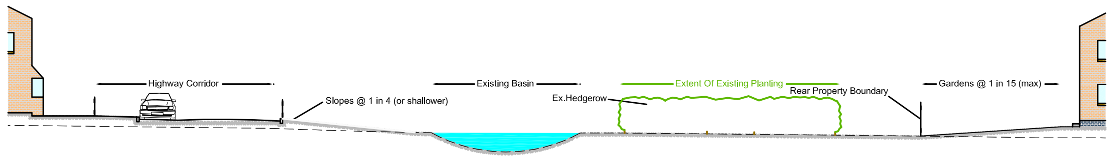
ILLUSTRATIVE CROSS SECTION E1



ILLUSTRATIVE CROSS SECTION E2



ILLUSTRATIVE CROSS SECTION E3



ILLUSTRATIVE CROSS SECTION E4

NOTES

1.) Do not scale from this drawing.

2.) The Data contained within this survey has been collected by a third party on behalf of JJ Gallagher. Brookbanks Consulting Ltd accept no responsibility for the accuracy of this data.

3.) This drawing is to be read in conjunction with BCL drawing no's. 1296/EW/02 & 04.

Rev.	Revision Details	Drawn	Checked	Approved	Date

Issue Status	Approved	Date
PRELIMINARY	PAB	15.5.06

Drawn RD | Checked PAB | Date MAY 07

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GALLAGHER ESTATES

Gavray Drive
Bicester, Oxfordshire

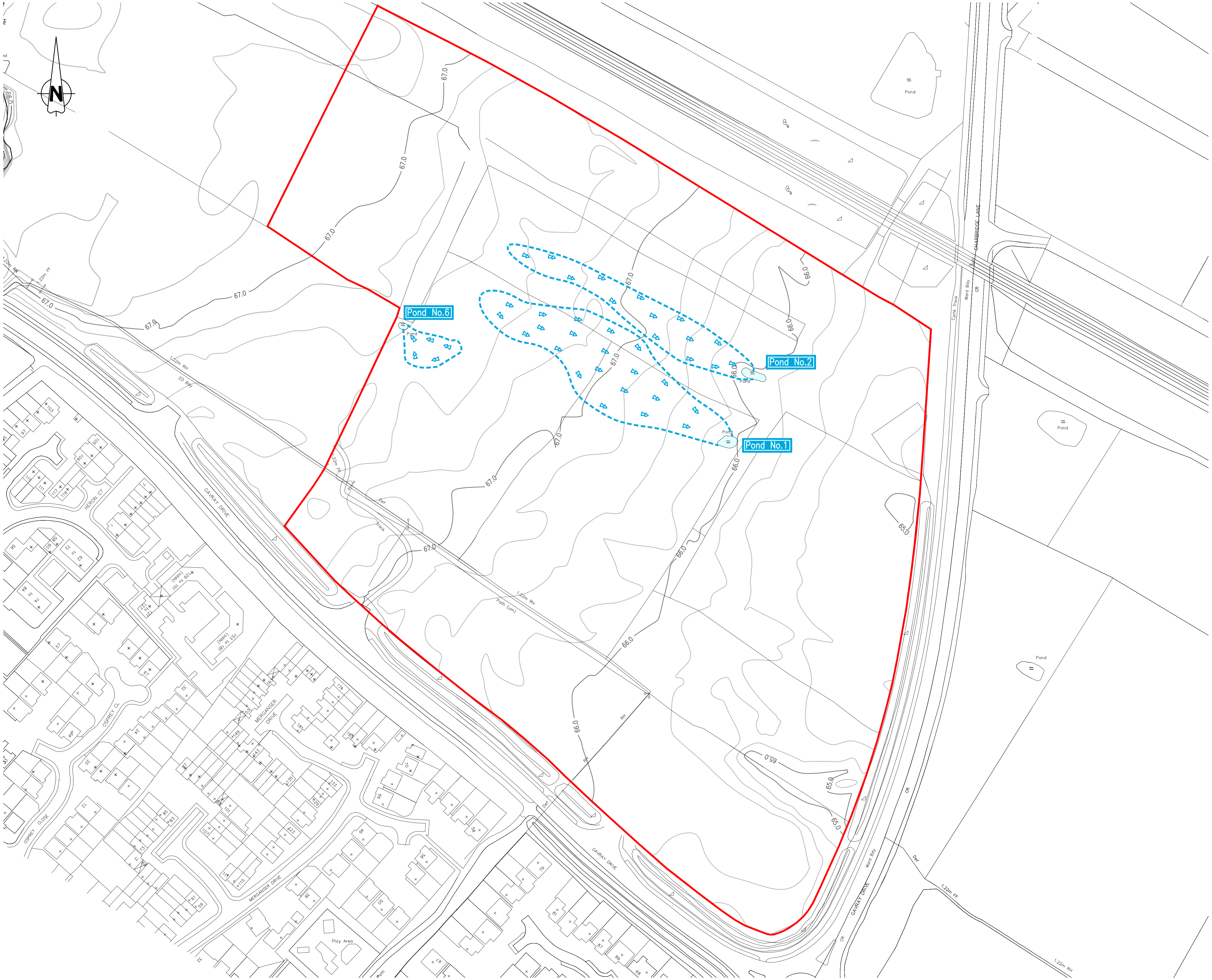
Illustrative Site
~~~~~~~~ Proposals
Eastern Development Land

Scale at A1	Drawing No.	Rev.
1 / 1000	1296 / CS / 02	A

0 20 40 60 80 100
METRES

Original Drawing Size A1
~~~~~~~~

1296 / CP / 01



NOTES

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KEY

Existing Pond to be retained as part of the completed development

Existing Pond Hydrological Catchment Area

Rev.	Revision Details	Drawn	Checked	Approved	Date

Issue Status	Approved	Date
PRELIMINARY	PAB	15.5.07

Drawn RD Checked PAB Date MAY 07

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GALLAGHER ESTATES

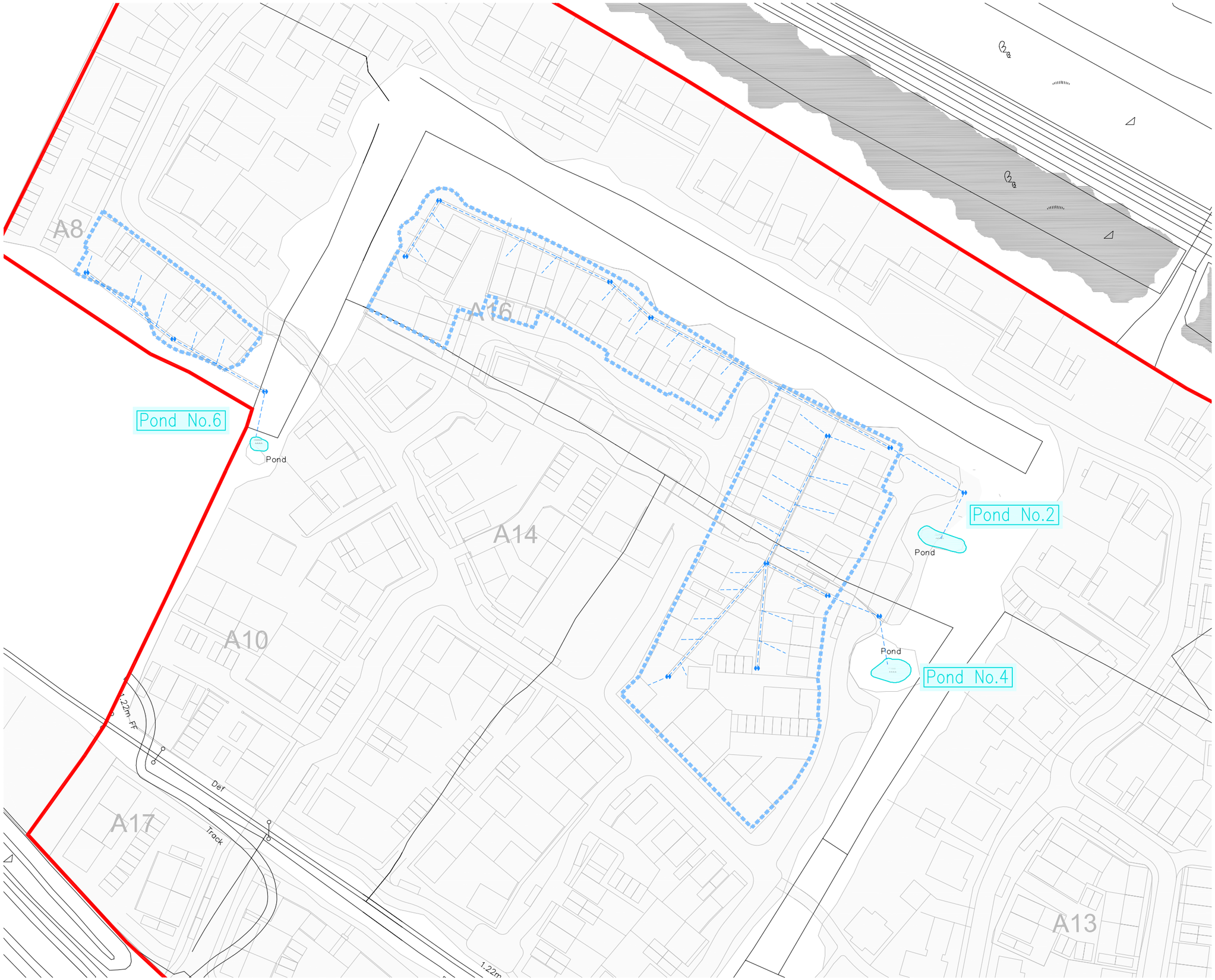
Gavray Drive
Bicester, Oxfordshire

Illustrative Site
Retained Pond Catchments

Scale at A1	Drawing No.	Rev.
1 / 1000	1296 / CP / 01	A

Original Drawing Size A1

1296 / DR / 03



NOTES

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KEY

Perforated Fin Drain (1m Wide Gravel Trench)

Roof Water Connection

N

Rev.	Revision Details	Drawn	Checked	Approved	Date
	PRELIMINARY	PAB			15.5.07
	Issue Status			Approved	Date
	Drawn RD	Checked PAB		Date MAY 07	

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GALLAGHER ESTATES

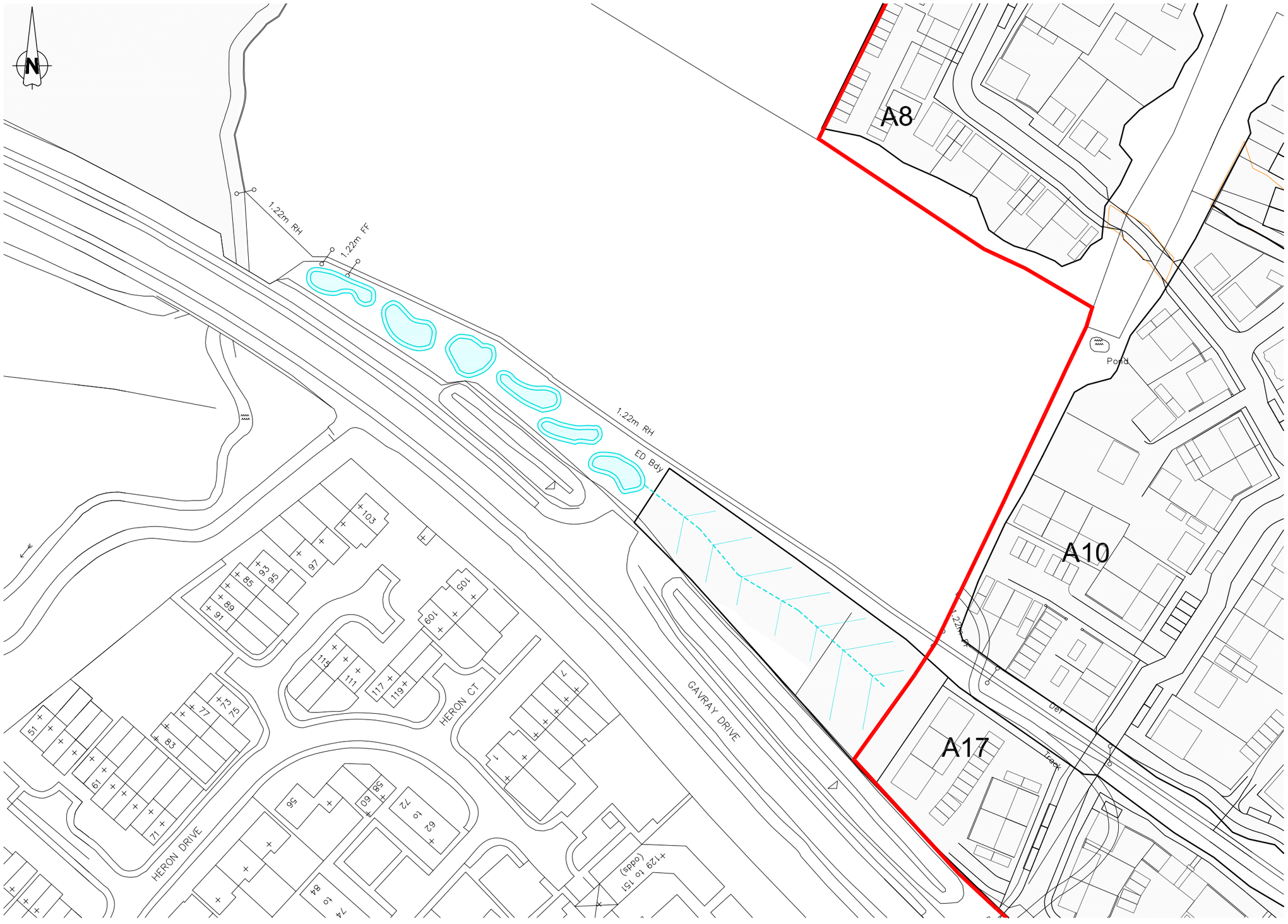
Gavray Drive
Bicester, Oxfordshire

Illustrative Site
Retained Pond
Urban Catchments

Scale at A1	Drawing No.	Rev.
1 / 1000	1296 / DR / 03	

Original Drawing Size A1

1296 / DR / 04



NOTES

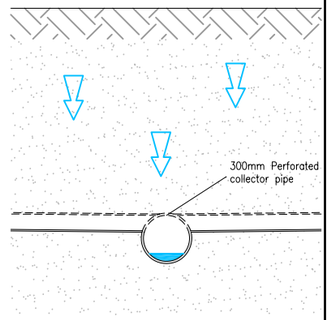
1.) Do not scale from this drawing.

2.) The Data contained within this survey has been collected by a third party on behalf of JJ Gallagher. Brookbanks Consulting Ltd accept no responsibility for the accuracy of this data.

3.) The earthworks shown herein are based on third party data and as such they are a best representation.

4.) This drawing is to be read in conjunction with BCL drawing no. 1296/EW/04

5.) The contours shown on this drawing show the net filling requirements to achieve gravity drainage. No allowance has been made for topsoil strip.



TYPICAL CROSS SECTION THRU PROPOSED HERRINGBONE DRAINGE SYSTEM

Rev.	Revision Details	Drawn	Checked	Approved	Date
	PRELIMINARY	PAB			15.5.07
	Issue Status			Approved	Date
Drawn	RD	Checked	PAB	Date	MAY 07

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GALLAGHER ESTATES

Gavray Drive
Bicester, Oxfordshire

Illustrative Site
Newt Ponds

Scale at A1	Drawing No.	Rev.
1 / 1000	1296 / DR / 04	A

Original Drawing Size A1

ADAS 345

Input

Area (Ha)	4.120	AAR (mm)	650	Dominant Crop Type	Grass
Length (m)	160.000	Soil Type Factor (St)	1.000	Region Number	6
Average Slope (1:x)	80.0	Paved Area (%)	5.000		

Results	**l/s**
Q0 - Peak Flood Flow	21.8
Total Q0	22.9
QBAR	27.0
Q 1 year	22.9
Q 1 year	22.9
Q 2 years	23.7
Q 5 years	34.5
Q 10 years	43.7
Q 20 years	54.0
Q 25 years	57.9
Q 30 years	61.1
Q 50 years	70.6
Q 100 years	86.0
Q 200 years	101.1
Q 250 years	105.9
Q 1000 years	139.1

IH 124 Mean Annual Flood

Input

Return Period (years)	1	SAAR (mm)	650.000	Urban	0.021
Area (Ha)	4.120	Soil	0.450	Region Number	6

Results l/s

QBAR Rural	21.8
QBAR Urban	22.7
Q 1 year	19.3
Q 1 year	19.3
Q 2 years	20.1
Q 5 years	29.1
Q 10 years	36.7
Q 20 years	45.2
Q 25 years	48.4
Q 30 years	50.9
Q 50 years	58.6
Q 100 years	71.2
Q 200 years	83.4
Q 250 years	87.4
Q 1000 years	114.2

Summary of Results for 1 year Return Period

Half Drain Time : 208 minutes

Storm Duration (mins)	Maximum Control (l/s)	Maximum Filtration (l/s)	Maximum Overflow (l/s)	Maximum Outflow (l/s)	Maximum Water Level (m OD)	Maximum Depth (m)	Overflow Volume (m³)	Maximum Volume (m³)	Status
15 Summer	0.9	0.0	0.0	0.9	65.4592	0.4592	0.0	12.8	O K
30 Summer	1.0	0.0	0.0	1.0	65.5738	0.5737	0.0	16.3	O K
60 Summer	1.1	0.0	0.0	1.1	65.6823	0.6823	0.0	19.5	O K
120 Summer	1.1	0.0	0.0	1.1	65.7628	0.7628	0.0	21.9	O K
180 Summer	1.1	0.0	0.0	1.2	65.7888	0.7888	0.0	22.7	O K
240 Summer	1.2	0.0	0.0	1.2	65.8023	0.8023	0.0	23.1	O K
360 Summer	1.2	0.0	0.0	1.2	65.8063	0.8063	0.0	23.2	O K
480 Summer	1.2	0.0	0.0	1.2	65.7958	0.7958	0.0	22.9	O K
600 Summer	1.1	0.0	0.0	1.2	65.7793	0.7793	0.0	22.4	O K
720 Summer	1.1	0.0	0.0	1.1	65.7608	0.7608	0.0	21.9	O K
960 Summer	1.1	0.0	0.0	1.1	65.7208	0.7208	0.0	20.7	O K
1440 Summer	1.0	0.0	0.0	1.0	65.6468	0.6468	0.0	18.5	O K
2160 Summer	1.0	0.0	0.0	1.0	65.5542	0.5542	0.0	15.7	O K
2880 Summer	0.9	0.0	0.0	0.9	65.4803	0.4802	0.0	13.5	O K
4320 Summer	0.8	0.0	0.0	0.8	65.3717	0.3717	0.0	10.2	O K
5760 Summer	0.7	0.0	0.0	0.7	65.2977	0.2977	0.0	8.0	O K
7200 Summer	0.6	0.0	0.0	0.6	65.2448	0.2447	0.0	6.4	O K
8640 Summer	0.6	0.0	0.0	0.6	65.2063	0.2062	0.0	5.2	O K
10080 Summer	0.5	0.0	0.0	0.5	65.1763	0.1762	0.0	4.3	O K
15 Winter	0.9	0.0	0.0	0.9	65.5123	0.5122	0.0	14.4	O K
30 Winter	1.0	0.0	0.0	1.0	65.6423	0.6423	0.0	18.3	O K
60 Winter	1.1	0.0	0.0	1.1	65.7678	0.7678	0.0	22.1	O K
120 Winter	1.2	0.0	0.0	1.2	65.8673	0.8673	0.0	25.1	O K
180 Winter	1.2	0.0	0.0	1.2	65.8998	0.8998	0.0	26.0	O K
240 Winter	1.2	0.0	0.0	1.3	65.9108	0.9108	0.0	26.4	O K
360 Winter	1.2	0.0	0.0	1.3	65.9108	0.9108	0.0	26.4	O K
480 Winter	1.2	0.0	0.0	1.2	65.8908	0.8908	0.0	25.8	O K
600 Winter	1.2	0.0	0.0	1.2	65.8633	0.8633	0.0	24.9	O K
720 Winter	1.2	0.0	0.0	1.2	65.8328	0.8328	0.0	24.0	O K
960 Winter	1.1	0.0	0.0	1.1	65.7703	0.7703	0.0	22.2	O K
1440 Winter	1.0	0.0	0.0	1.1	65.6578	0.6578	0.0	18.8	O K
2160 Winter	0.9	0.0	0.0	0.9	65.5258	0.5257	0.0	14.8	O K
2880 Winter	0.8	0.0	0.0	0.8	65.4277	0.4277	0.0	11.9	O K
4320 Winter	0.7	0.0	0.0	0.7	65.2983	0.2982	0.0	8.0	O K
5760 Winter	0.6	0.0	0.0	0.6	65.2208	0.2207	0.0	5.7	O K
7200 Winter	0.5	0.0	0.0	0.5	65.1708	0.1708	0.0	4.1	O K
8640 Winter	0.5	0.0	0.0	0.5	65.1373	0.1373	0.0	3.1	O K
10080 Winter	0.4	0.0	0.0	0.4	65.1148	0.1148	0.0	2.3	O K

Storm Duration (mins)	Rain (mm/hr)	Time-Peak (mins)
15 Summer	31.07	18
30 Summer	20.24	33
60 Summer	12.80	62
120 Summer	7.93	120
180 Summer	5.96	156
240 Summer	4.87	186
360 Summer	3.63	252
480 Summer	2.94	322
600 Summer	2.50	392
720 Summer	2.19	460
960 Summer	1.77	596
1440 Summer	1.32	864
2160 Summer	0.98	1252
2880 Summer	0.79	1616
4320 Summer	0.59	2336
5760 Summer	0.48	3064
7200 Summer	0.41	3816
8640 Summer	0.36	4496
10080 Summer	0.32	5240
15 Winter	31.07	18
30 Winter	20.24	32
60 Winter	12.80	60
120 Winter	7.93	118
180 Winter	5.96	170
240 Winter	4.87	194
360 Winter	3.63	272
480 Winter	2.94	348
600 Winter	2.50	422
720 Winter	2.19	498
960 Winter	1.77	638
1440 Winter	1.32	912
2160 Winter	0.98	1300
2880 Winter	0.79	1676
4320 Winter	0.59	2420
5760 Winter	0.48	3120
7200 Winter	0.41	3824
8640 Winter	0.36	4576
10080 Winter	0.32	5248

Rainfall Details

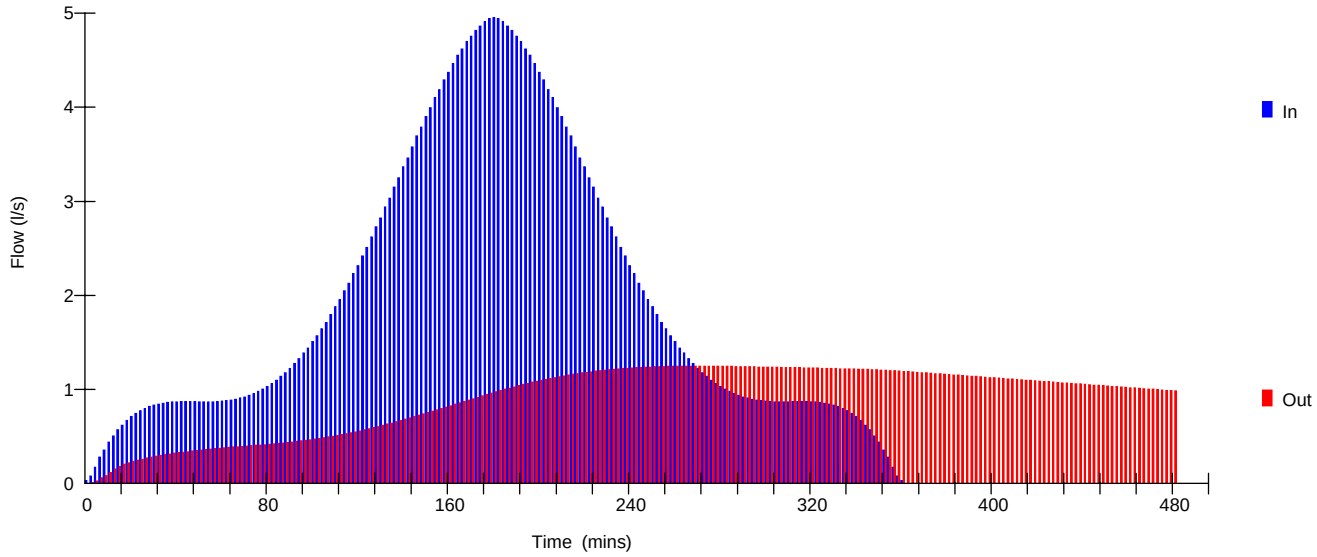
Region	ENG+WAL	Ratio-R	0.403	Shortest Storm (mins)	15	Winter Storms	Yes
Return Period (years)	1	Cv (Summer)	0.750	Longest Storm (mins)	10080	Climate Change %	+0
M5-60 (mm)	20.000	Cv (Winter)	0.840	Summer Storms	Yes		

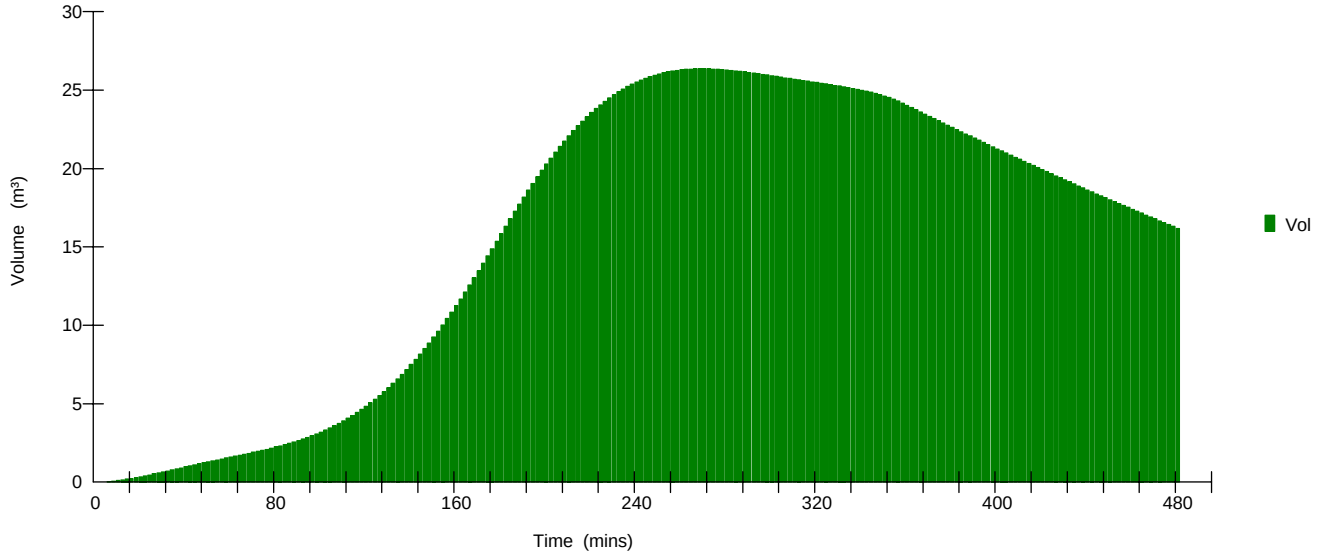
Time / Area Diagram

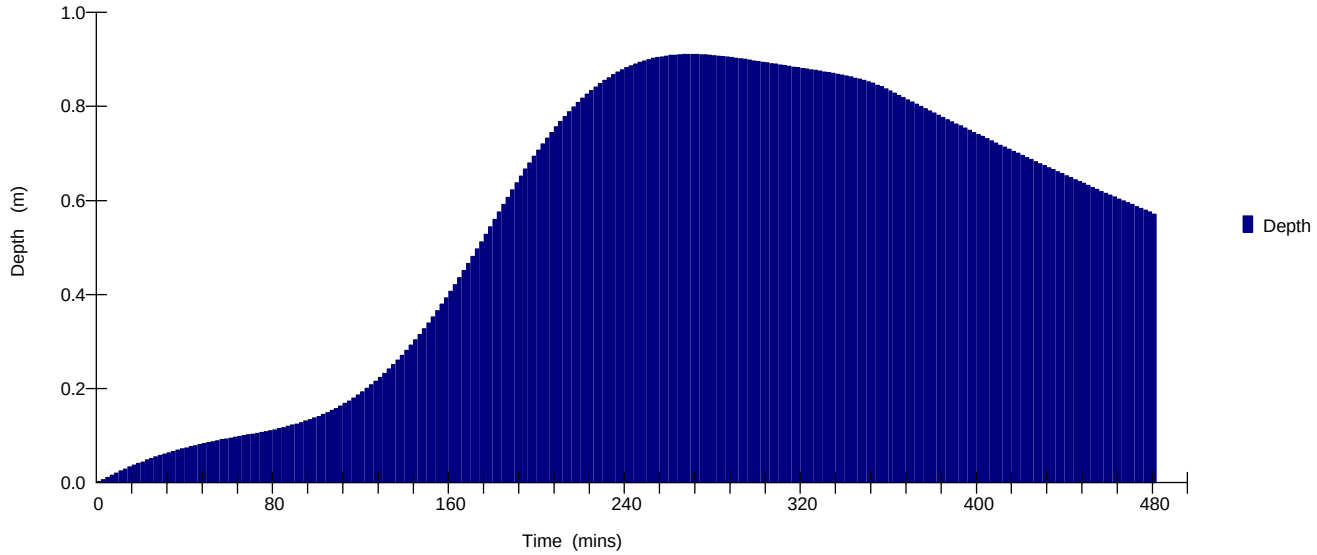
Total Area (ha) = 0.231

Time from:	(mins) to:	Area (ha)
0	4	0.231

Storm Duration 360 Mins (Winter)







Summary of Results for 1 year Return Period

Half Drain Time : 207 minutes

Storm Duration (mins)	Maximum Control (l/s)	Maximum Filtration (l/s)	Maximum Overflow (l/s)	Maximum Outflow (l/s)	Maximum Water Level (m OD)	Maximum Depth (m)	Overflow Volume (m³)	Maximum Volume (m³)	Status
15 Summer	0.5	0.0	0.0	0.5	65.4553	0.4552	0.0	6.7	O K
30 Summer	0.5	0.0	0.0	0.5	65.5758	0.5757	0.0	8.5	O K
60 Summer	0.6	0.0	0.0	0.6	65.6908	0.6908	0.0	10.3	O K
120 Summer	0.6	0.0	0.0	0.6	65.7768	0.7768	0.0	11.6	O K
180 Summer	0.6	0.0	0.0	0.6	65.8053	0.8053	0.0	12.0	O K
240 Summer	0.6	0.0	0.0	0.6	65.8208	0.8208	0.0	12.2	O K
360 Summer	0.6	0.0	0.0	0.6	65.8273	0.8273	0.0	12.3	O K
480 Summer	0.6	0.0	0.0	0.6	65.8178	0.8178	0.0	12.2	O K
600 Summer	0.6	0.0	0.0	0.6	65.8023	0.8023	0.0	11.9	O K
720 Summer	0.6	0.0	0.0	0.6	65.7838	0.7838	0.0	11.7	O K
960 Summer	0.6	0.0	0.0	0.6	65.7433	0.7433	0.0	11.0	O K
1440 Summer	0.5	0.0	0.0	0.6	65.6658	0.6658	0.0	9.9	O K
2160 Summer	0.5	0.0	0.0	0.5	65.5693	0.5692	0.0	8.4	O K
2880 Summer	0.5	0.0	0.0	0.5	65.4922	0.4922	0.0	7.3	O K
4320 Summer	0.4	0.0	0.0	0.4	65.3798	0.3797	0.0	5.6	O K
5760 Summer	0.4	0.0	0.0	0.4	65.3033	0.3032	0.0	4.4	O K
7200 Summer	0.3	0.0	0.0	0.3	65.2483	0.2482	0.0	3.6	O K
8640 Summer	0.3	0.0	0.0	0.3	65.2093	0.2092	0.0	3.0	O K
10080 Summer	0.3	0.0	0.0	0.3	65.1783	0.1782	0.0	2.6	O K
15 Winter	0.5	0.0	0.0	0.5	65.5107	0.5107	0.0	7.6	O K
30 Winter	0.5	0.0	0.0	0.5	65.6478	0.6478	0.0	9.6	O K
60 Winter	0.6	0.0	0.0	0.6	65.7798	0.7798	0.0	11.6	O K
120 Winter	0.6	0.0	0.0	0.6	65.8853	0.8853	0.0	13.2	O K
180 Winter	0.6	0.0	0.0	0.7	65.9208	0.9208	0.0	13.7	O K
240 Winter	0.7	0.0	0.0	0.7	65.9333	0.9333	0.0	13.9	O K
360 Winter	0.7	0.0	0.0	0.7	65.9353	0.9353	0.0	13.9	O K
480 Winter	0.6	0.0	0.0	0.7	65.9158	0.9158	0.0	13.6	O K
600 Winter	0.6	0.0	0.0	0.6	65.8883	0.8883	0.0	13.2	O K
720 Winter	0.6	0.0	0.0	0.6	65.8573	0.8573	0.0	12.8	O K
960 Winter	0.6	0.0	0.0	0.6	65.7938	0.7938	0.0	11.8	O K
1440 Winter	0.6	0.0	0.0	0.6	65.6763	0.6763	0.0	10.0	O K
2160 Winter	0.5	0.0	0.0	0.5	65.5388	0.5387	0.0	8.0	O K
2880 Winter	0.4	0.0	0.0	0.4	65.4372	0.4372	0.0	6.5	O K
4320 Winter	0.4	0.0	0.0	0.4	65.3028	0.3027	0.0	4.4	O K
5760 Winter	0.3	0.0	0.0	0.3	65.2228	0.2227	0.0	3.2	O K
7200 Winter	0.3	0.0	0.0	0.3	65.1718	0.1717	0.0	2.5	O K
8640 Winter	0.2	0.0	0.0	0.2	65.1373	0.1373	0.0	2.0	O K
10080 Winter	0.2	0.0	0.0	0.2	65.1133	0.1133	0.0	1.6	O K

Storm Duration (mins)	Rain (mm/hr)	Time-Peak (mins)
15 Summer	31.07	18
30 Summer	20.24	33
60 Summer	12.80	62
120 Summer	7.93	120
180 Summer	5.96	154
240 Summer	4.87	186
360 Summer	3.63	252
480 Summer	2.94	322
600 Summer	2.50	392
720 Summer	2.19	460
960 Summer	1.77	596
1440 Summer	1.32	864
2160 Summer	0.98	1252
2880 Summer	0.79	1616
4320 Summer	0.59	2336
5760 Summer	0.48	3064
7200 Summer	0.41	3816
8640 Summer	0.36	4496
10080 Summer	0.32	5240
15 Winter	31.07	18
30 Winter	20.24	32
60 Winter	12.80	60
120 Winter	7.93	118
180 Winter	5.96	170
240 Winter	4.87	194
360 Winter	3.63	270
480 Winter	2.94	348
600 Winter	2.50	422
720 Winter	2.19	498
960 Winter	1.77	638
1440 Winter	1.32	910
2160 Winter	0.98	1300
2880 Winter	0.79	1676
4320 Winter	0.59	2420
5760 Winter	0.48	3120
7200 Winter	0.41	3824
8640 Winter	0.36	4576
10080 Winter	0.32	5248

Rainfall Details

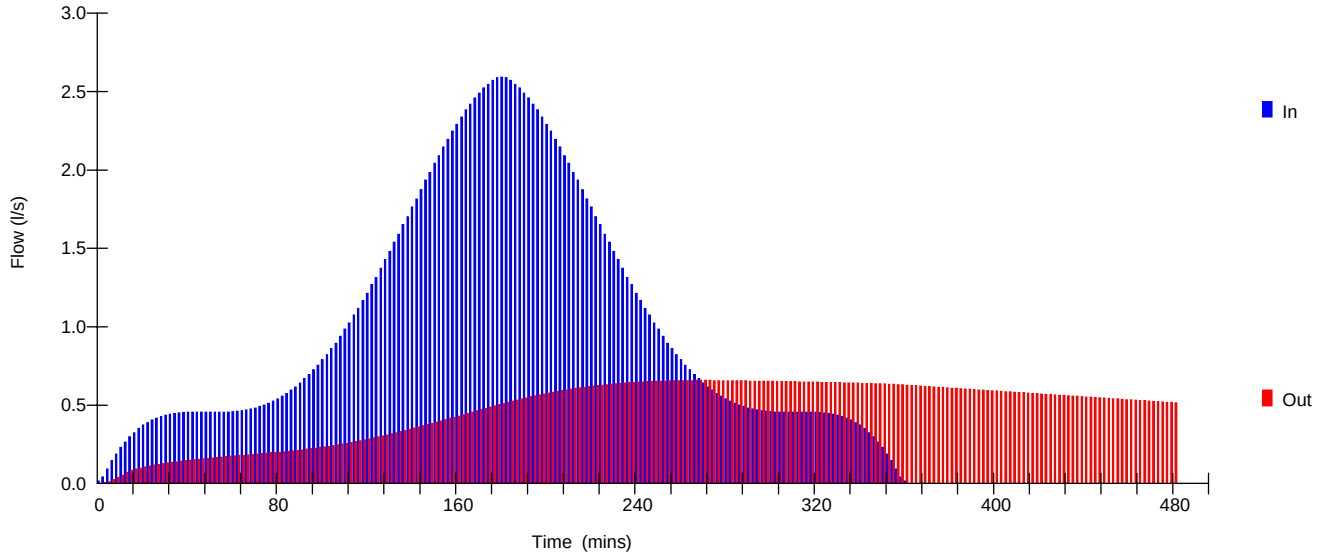
Region	ENG+WAL	Ratio-R	0.403	Shortest Storm (mins)	15	Winter Storms	Yes
Return Period (years)	1	Cv (Summer)	0.750	Longest Storm (mins)	10080	Climate Change %	+0
M5-60 (mm)	20.000	Cv (Winter)	0.840	Summer Storms	Yes		

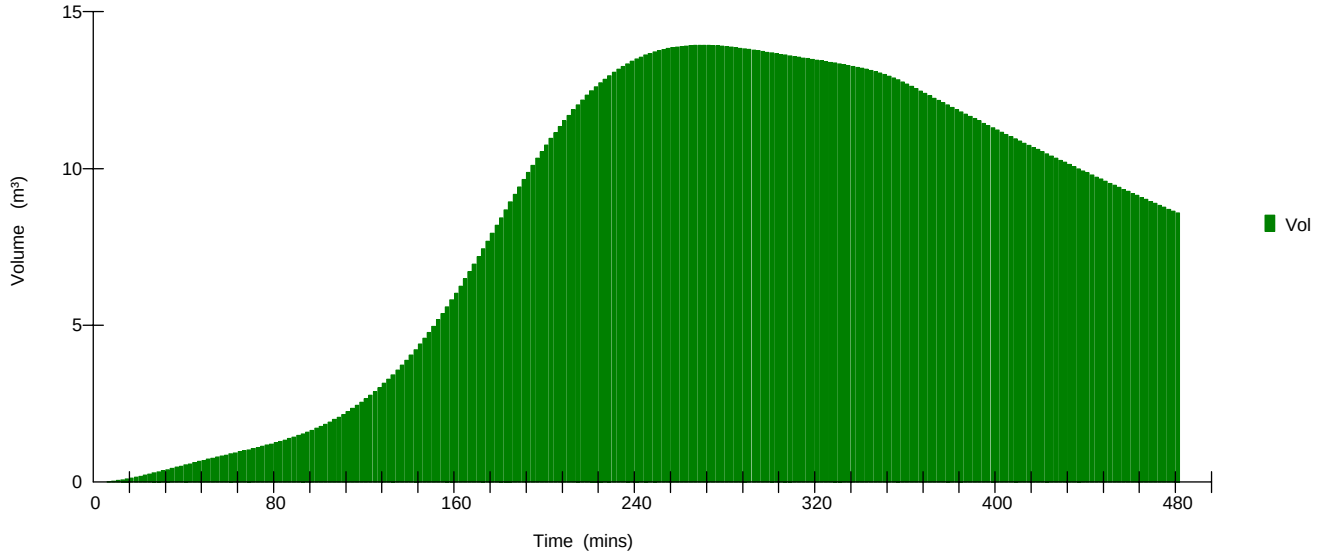
Time / Area Diagram

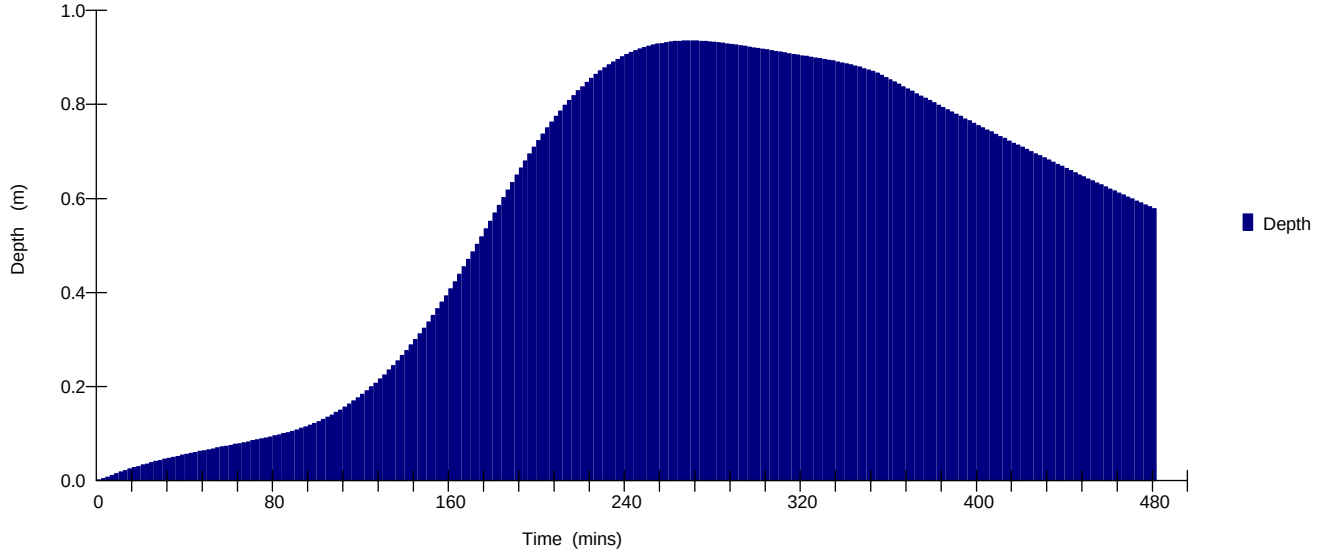
Total Area (ha) = 0.121

Time from:	(mins) to:	Area (ha)
0	4	0.121

Storm Duration 360 Mins (Winter)







Summary of Results for 1 year Return Period

Half Drain Time : 205 minutes

Storm Duration (mins)	Maximum Control (l/s)	Maximum Filtration (l/s)	Maximum Overflow (l/s)	Maximum Outflow (l/s)	Maximum Water Level (m OD)	Maximum Depth (m)	Overflow Volume (m³)	Maximum Volume (m³)	Status
15 Summer	0.1	0.0	0.0	0.1	65.1573	0.1572	0.0	1.2	O K
30 Summer	0.1	0.0	0.0	0.1	65.2008	0.2007	0.0	1.6	O K
60 Summer	0.1	0.0	0.0	0.1	65.2423	0.2422	0.0	1.9	O K
120 Summer	0.1	0.0	0.0	0.1	65.2733	0.2732	0.0	2.1	O K
180 Summer	0.1	0.0	0.0	0.1	65.2833	0.2832	0.0	2.2	O K
240 Summer	0.1	0.0	0.0	0.1	65.2888	0.2887	0.0	2.2	O K
360 Summer	0.1	0.0	0.0	0.1	65.2903	0.2902	0.0	2.2	O K
480 Summer	0.1	0.0	0.0	0.1	65.2868	0.2867	0.0	2.2	O K
600 Summer	0.1	0.0	0.0	0.1	65.2808	0.2807	0.0	2.1	O K
720 Summer	0.1	0.0	0.0	0.1	65.2738	0.2737	0.0	2.1	O K
960 Summer	0.1	0.0	0.0	0.1	65.2588	0.2587	0.0	2.0	O K
1440 Summer	0.1	0.0	0.0	0.1	65.2308	0.2307	0.0	1.8	O K
2160 Summer	0.1	0.0	0.0	0.1	65.1963	0.1962	0.0	1.5	O K
2880 Summer	0.1	0.0	0.0	0.1	65.1688	0.1687	0.0	1.3	O K
4320 Summer	0.1	0.0	0.0	0.1	65.1283	0.1283	0.0	1.0	O K
5760 Summer	0.1	0.0	0.0	0.1	65.1013	0.1013	0.0	0.8	O K
7200 Summer	0.1	0.0	0.0	0.1	65.0838	0.0838	0.0	0.6	O K
8640 Summer	0.1	0.0	0.0	0.1	65.0708	0.0708	0.0	0.5	O K
10080 Summer	0.0	0.0	0.0	0.1	65.0613	0.0612	0.0	0.4	O K
15 Winter	0.1	0.0	0.0	0.1	65.1773	0.1772	0.0	1.4	O K
30 Winter	0.1	0.0	0.0	0.1	65.2273	0.2272	0.0	1.7	O K
60 Winter	0.1	0.0	0.0	0.1	65.2748	0.2747	0.0	2.1	O K
120 Winter	0.1	0.0	0.0	0.1	65.3127	0.3127	0.0	2.4	O K
180 Winter	0.1	0.0	0.0	0.1	65.3248	0.3247	0.0	2.5	O K
240 Winter	0.1	0.0	0.0	0.1	65.3293	0.3292	0.0	2.5	O K
360 Winter	0.1	0.0	0.0	0.1	65.3298	0.3297	0.0	2.5	O K
480 Winter	0.1	0.0	0.0	0.1	65.3223	0.3222	0.0	2.5	O K
600 Winter	0.1	0.0	0.0	0.1	65.3117	0.3117	0.0	2.4	O K
720 Winter	0.1	0.0	0.0	0.1	65.3007	0.3007	0.0	2.3	O K
960 Winter	0.1	0.0	0.0	0.1	65.2772	0.2772	0.0	2.1	O K
1440 Winter	0.1	0.0	0.0	0.1	65.2348	0.2347	0.0	1.8	O K
2160 Winter	0.1	0.0	0.0	0.1	65.1858	0.1857	0.0	1.4	O K
2880 Winter	0.1	0.0	0.0	0.1	65.1498	0.1498	0.0	1.2	O K
4320 Winter	0.1	0.0	0.0	0.1	65.1023	0.1023	0.0	0.8	O K
5760 Winter	0.1	0.0	0.0	0.1	65.0758	0.0758	0.0	0.6	O K
7200 Winter	0.0	0.0	0.0	0.0	65.0593	0.0592	0.0	0.4	O K
8640 Winter	0.0	0.0	0.0	0.0	65.0483	0.0482	0.0	0.3	O K
10080 Winter	0.0	0.0	0.0	0.0	65.0403	0.0402	0.0	0.2	O K

Storm Duration (mins)	Rain (mm/hr)	Time-Peak (mins)
15 Summer	31.07	18
30 Summer	20.24	33
60 Summer	12.80	62
120 Summer	7.93	120
180 Summer	5.96	154
240 Summer	4.87	186
360 Summer	3.63	252
480 Summer	2.94	322
600 Summer	2.50	390
720 Summer	2.19	460
960 Summer	1.77	596
1440 Summer	1.32	864
2160 Summer	0.98	1252
2880 Summer	0.79	1616
4320 Summer	0.59	2336
5760 Summer	0.48	3064
7200 Summer	0.41	3816
8640 Summer	0.36	4496
10080 Summer	0.32	5240
15 Winter	31.07	18
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180 Winter	5.96	170
240 Winter	4.87	194
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480 Winter	2.94	348
600 Winter	2.50	422
720 Winter	2.19	496
960 Winter	1.77	638
1440 Winter	1.32	910
2160 Winter	0.98	1300
2880 Winter	0.79	1676
4320 Winter	0.59	2420
5760 Winter	0.48	3120
7200 Winter	0.41	3824
8640 Winter	0.36	4504
10080 Winter	0.32	5248

Rainfall Details

Region	ENG+WAL	Ratio-R	0.403	Shortest Storm (mins)	15	Winter Storms	Yes
Return Period (years)	1	Cv (Summer)	0.750	Longest Storm (mins)	10080	Climate Change %	+0
M5-60 (mm)	20.000	Cv (Winter)	0.840	Summer Storms	Yes		

Time / Area Diagram

Total Area (ha) = 0.022

Time from:	(mins) to:	Area (ha)
0	4	0.022

Storm Duration 360 Mins (Winter)