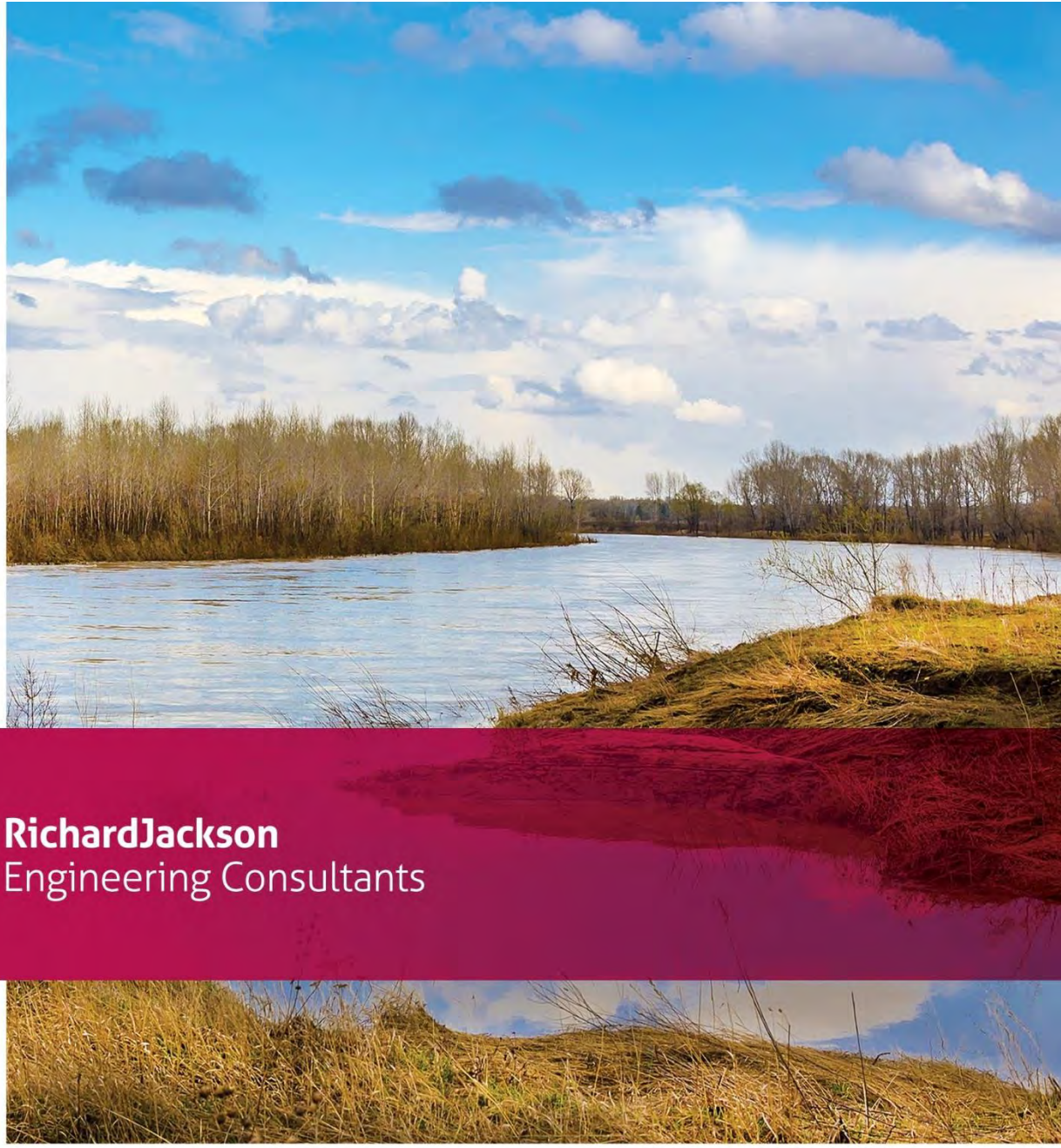

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Engineering Consultants

SITE SPECIFIC FLOOD RISK ASSESSMENT

Land off Howlett Way, Trimley St Martin

Client(s): Trinity College, Cambridge

December 2019

Project no: 48055

RichardJackson
Engineering Consultants

Document Review Sheet: -

Document prepared by: -	Raymond Long BSc (Hons) IEng MCIHT MICE on behalf of Richard Jackson Ltd
Date: -	10 December 2019
Document checked by: -	Martin Doughty BEng(Hons) CEng FICE FCIHT MAPM on behalf of Richard Jackson Ltd
Date: -	11 December 2019
Document Approved by: -	Martin Doughty BEng(Hons) CEng FICE FCIHT MAPM on behalf of Richard Jackson Ltd
Date: -	12 December 2019

Document Status

DRAFT	FINAL
☐	☒

Revision Status

Issue	Date	Description	Prepared	Checked	Approved

RichardJackson Engineering Consultants

Contents:-

1. Introduction 2

2. Development Description and Location 3

3. Definition of a Flood Hazard 3

4. Probability of Flooding 5

5. Climate Change 6

6. Flood Risk Impact 6

7. Flood Risk Management 13

8. Flood Risk Management Measures 15

9. Management and Maintenance Plan 16

10. Residual Risks 17

11. Conclusions 18

12. Limitations 18

Figures/Drawings

Figure 1	Site Location Plan
Figure 2	Flood Risk Plan (Rivers & Sea)
Figure 3	Groundwater Vulnerability Map
Figure 4	Surface Flood Water Mapping (High & Medium Risk)
Figure 5	Surface Flood Water Mapping (Low Risk)
48055/PP/SK01	Preliminary Surface Water Drainage Strategy

Appendices

Appendix A	Topographical Survey
Appendix B	FEH Rainfall Data
Appendix C	Development Masterplan
Appendix D	Soils Investigation Data, dated March 2018
Appendix E	Drainage Calculations – Dwellings / Private Drives / Roads
Appendix F	Drainage Calculations for Highway Infiltration / Detention Basins
Appendix G	Drainage Calculations – Early Years Centre
Appendix H	Suffolk County Council Surface Water Drainage Proforma
Appendix I	Health & Safety Risk Assessment

RichardJackson
Engineering Consultants

APPENDIX A

14780 Land off Howlett Way, Trimley St. Martin

Control Schedule

Stn No.	Easting	Northing	Level
1	627483.744	237356.860	24.406
2	627556.481	237438.792	24.277
3	627691.490	237512.620	23.387
4	627792.621	237546.750	23.863
5	627708.102	237409.601	23.796
6	627962.974	237326.812	20.786
7	627845.731	237494.818	21.745
8	627646.208	237471.791	24.166
9	627474.913	237388.705	24.255
10	627674.967	237245.797	23.797
11	627885.424	237465.305	20.810
12	627894.325	237495.356	21.963
13	627913.667	237480.238	22.196
14	627928.298	237449.688	20.997
15	627952.001	237423.313	18.623
16	627968.595	237386.693	17.794
17	627982.159	237364.179	17.934
18	627991.212	237339.855	19.618
19	628014.977	237316.030	21.980
20	628032.819	237293.961	22.481
21	628090.273	237265.411	23.137
22	628072.486	237238.916	23.475
23	628088.702	237206.594	24.187
24	628078.828	237162.607	23.834
25	628104.265	237206.066	23.928
26	627530.736	237363.751	24.385

Only Station 5 has O.S. National Grid co-ordinates based on GPS observations. All other stations have had a mean Scale Factor of 1.00029 applied to transform their co-ordinates to O.S. National Grid.

627500 E
627600 E
627700 E
627800 E
627900 E
237500 N
237400 N
237300 N
237200 N

HOWLETT WAY
A14 SLIP ROAD
STN1
STN2
STN3
STN4
STN5
STN6
STN7
STN8
STN9
STN10
STN11
STN12
STN13
STN14
STN15
STN26

CONTROL DATA

Survey stations STN
Boundary posts BP

LEVEL DATA

Spot levels +23.62
Contours 23
Steep slopes

TREES

1.4.7 Girth (Circumference) , spread (radius), height
Orig - Dump
Trees shown on this drawing have been identified to the best of the surveyors' ability. Where guaranteed identification of tree species may become important in the project design we would strongly recommend that the services of a specialist arboriculturist be employed. It should be noted that Randall Surveys LLP are not specialists in the field of tree identification.

Datum used : Newlyn. All units are metric.

FEATURES

Fences shown thus
Walls shown thus
Hedges shown thus
Undefined Boundary
Gates

OVERHEAD CABLES

British Telecom
Electric

FENCE TYPES

B/W	Barbed wire	I/R	Iron railing
C/B	Close boarded	L/L	Larch lap
C/I	Corrugated iron	P/F	Picket fence
C/L	Chain link	P/R	Post and rail
C/P	Chestnut paling	P/W	Post and wire
E/F	Electric fence	W/F	Wooden fence

ABBREVIATIONS

AV Air valve
BB Bakelite beacon
BD Back drop
BH Borehole
Bol Bollard
BT/PO British Telecom cover
BTJB BT Junction box
CATV Cable TV cover
CDP Cattle draw pit
CL Cover level
CM Cattle marker
CNF Could not find
CNL Could not lift
CNT Could not trace
CPL Coping level
DC Drainage Channel
EJB Elec. junction box
EJB Elec. junction box
EOR End of record
EOT End of trace
EP Electricity pole
ER Earth rod
FB Flower bed
FH Fire hydrant
FL Floodlight
FRL Flat roof level
G Gully
GV Gate valve
IC Inspection cover
IL Invert level
JB Junction box
KO Kerb outlet
LP Lamp post
MH Manhole
Mkr Marker
NB Name board
OF Outfall
RB Road box
RM Parking meter
RS Road signs
RC Roying cable
RE Rodding eye
Ret. Retaining
RG Road sign
RWP Rain water pipe
SC Stop cock
SL Sump level
SL Soil level
SP Stand pipe
SV Stop valve
SVP Soil vent pipe
TCB Telephone call box
TCP Tactile paving
TL Traffic light
TP Telegraph pole
TPL Top of pipe level
TS Traffic signal
VP Vent pipe
WC Water cock
WL Water level
WM Water meter
WSC Water stop cock

IMPORTANT NOTES

The details and information shown hereon relating to underground drains, cables etc, are as obtained by normal field survey observations subject to the restrictions listed in the NJSC guidelines. Service Co. and sewer records will only have been consulted on specific request and, although all reasonable effort will have been made, no guarantee of accuracy of these records can be given.

Sewer and manhole details shown on this drawing have been obtained by observation and measurement from the surface and as such cannot be guaranteed. Where precise sewer details will be critical to the project design we would recommend that entry into the chamber be undertaken using a specialist team, appropriately qualified for confined space entry. These teams can be supplied upon request.

The pipe and cable routes shown on this drawing have been located using electronic surface detection equipment and/or ground penetrating radar, no trial holes have been dug in order to confirm their presence and position. Whilst the information presented is believed to be correct at the time of the survey due care must be taken when any excavation is undertaken on the site. Trace depths are quoted in metres.

The portrayal of a service on this drawing may indicate the presence of multiple cables/pipes. The exact number will only be indicated where this could be accurately determined.

Hatching denotes an area containing possible services which could not be traced electronically or by GPR, where used, but have been abstracted from service drawings.

The plan position and depth of any service portrayed on this drawing is accurate to +/- 10% of the depth of that service.

Where the precise location and/or depth of a service is critical to design and/or construction, trial holes are recommended to confirm the details provided on this drawing.

This drawing should be read in conjunction with any record drawings available from the statutory authorities.

SHEET LAYOUT

1
2

NOTES

1. Survey Grid is O.S. National Grid. A mean scale factor of 1.00029 has been applied to this survey with an origin at Stn 5 (627708.102 Eastings, 237409.601 Northings).
2. Levels are related to the O.S. National GPS network.

PLAN PRODUCTION BY

RANDALL SURVEYS LLP

SURVEY & DESIGN CENTRE
HIGH STREET, BURES, SUFFOLK CO8 5HZ
Tel: 01787 227580 Fax: 01787 228329
WWW.RANDALLSURVEYS.CO.UK

Land and Hydrographic Surveyors
Architectural Building Surveyors
Underground Services Location

THE SURVEY ASSOCIATION
ISO 9001 REGISTERED FIRM
RICS

PROJECT NAME

LAND OFF HOWLETT WAY
TRIMLEY ST MARTIN

DRAWING TITLE

EXISTING SITE LAYOUT

SCALE	1:500	DRAWN	GWJN	PAPER SIZE	A0
DATE	January 2018	CHECKED	DRD	REVISION	

Dwg No. 14780/GN/1

14780 Land off Howlett Way, Trimley St. Martin

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Boundary points BP

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Contours 23
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Walls shown thus
Hedges shown thus
Undefined Boundary
Gates

OVERHEAD CABLES
British Telecom
Electric

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E/F	Electric fence	W/F	Wooden fence

ABBREVIATIONS

AV Air valve	ER Earth rod	Ret. Retaining
BB Bakelite beacon	FB Flower bed	RS Road sign
BD Back drop	FH Fire hydrant	RWP Rain water pipe
BH Borehole	FL Floodlight	SC Stop cock
Bol Bollard	FRL Flat roof level	SL Sump level
BT Box British Telecom cover	G Gully	SP Soil vent pipe
BTJB BT junction box	GV Gate valve	ST Stand pipe
CATV Cable TV cover	IC Inspection cover	SV Stop valve
CDP Cable draw pit	IL Invert level	SVP Soil vent pipe
CL Cover level	JB Junction box	TCB Telephone call box
CM Cable marker	KO Kerb outlet	TCP Tactile paving
CNF Could not find	LP Lamp post	TL Traffic light
CNL Could not lift	MH Manhole	TP Telegraph pole
CNT Could not trace	Mkr Marker	TPL Top of pipe level
CPL Coping level	NB Name board	TS Traffic signal
DC Drainage Channel	OF Outfall	VP Vent pipe
DP Down pipe	PB Post box	WC Water course
EJB Elec. junction box	PM Parking meter	WH Wash head
EOR End of record	PO Pollard trees	WM Water meter
EOT End of trace	RC Racing cable	WSC Water stop cock
EP Electricity pole	RE Rodding eye	

IMPORTANT NOTES

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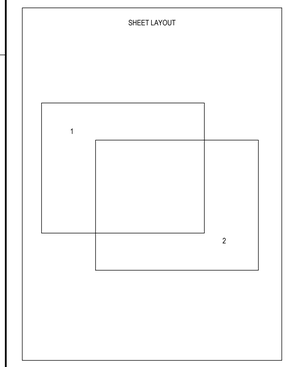
SHEET LAYOUT



NOTES

1. Survey Grid is O.S. National Grid. A mean scale factor of 1.00029 has been applied to this survey with an origin at Stn 5 (627708.102 Eastings, 237409.601 Northings).
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PLAN PRODUCTION BY

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Land and Hydrographic Surveyors
Architectural Building Surveyors
Underground Services Location

THE SURVEY ASSOCIATION

PROJECT NAME

LAND OFF HOWLETT WAY

TRIMLEY ST MARTIN

DRAWING TITLE

EXISTING SITE LAYOUT

SCALE	1/500	DRAWN	GWJN	PAPER SIZE	A0
DATE	January 2018	CHECKED	DRD	REVISION	

Dwg No. 14780/GN/2

APPENDIX B

VERSION	"FEH CD-RC	Version	3	exported a	16:34:41	GMT	Thu	12-Apr-18
CATCHMENT	GB	628650	237150	TM 28650	37150			
CENTROID	GB	628032	237437	TM 28032	37437			
AREA	1.175							
ALTBAR	23							
ASPBAR	98							
ASPVAR	0.4							
BFIHOST	0.851							
DPLBAR	0.93							
DPSBAR	21.1							
FARL	1							
FPEXT	0.1596							
FPDBAR	0.634							
FPLOC	1.15							
LDP	1.77							
PROPWET	0.26							
RMED-1H	10.8							
RMED-1D	28.4							
RMED-2D	34.5							
SAAR	553							
SAAR4170	553							
SPRHOST	18.21							
URBCONC1990	0.718							
URBEXT1990	0.0851							
URBLOC1990	1.37							
URBCONC2000	0.889							
URBEXT2000	0.1223							
URBLOC2000	1.342							
C	-0.019							
D1	0.27775							
D2	0.21014							
D3	0.28302							
E	0.3108							
F	2.5158							
C(1 km)	-0.019							
D1(1 km)	0.279							
D2(1 km)	0.224							
D3(1 km)	0.275							
E(1 km)	0.31							
F(1 km)	2.522							

RichardJackson
Engineering Consultants

APPENDIX C

JUNCTION TO DETAILED DESIGN BY HIGHWAYS CONSULTANT

HOWLETT WAY

A14

Old Poultry Farm

Trimley Old Rectory

EARLY YEARS CENTRE

FOUL WATER PUMP HOUSE

EMERGENCY ACCESS ONLY INTO MAIN SITE

HIGH ROAD

GUN LANE

CHURCH LANE

ST MARTINS GREEN

NORTH

NOTES

This drawing to be read in accordance with the specification/Bills of Quantities and related drawings.

No Dimensions to be scaled from this drawing. All stated dimensions to be verified on site and the Architect notified of any discrepancies.

0 100

Scale bar 100mm at 1:1

NOTE: TREES LOCATED IN PRIVATE PLOTS ARE SHOWN INDICATIVELY; TREES IN PUBLIC AREAS ARE PROPOSED.

KEY:

- FLATS
- HOUSES
- PROPOSED DRAINAGE BASINS
- PROPOSED ZEBRA CROSSING
- EXISTING MATURE TREES (UN-SURVEYED)
- EXISTING PUBLIC RIGHT OF WAY (SHOWN BLUE DOTTED)

FOR PLANNING

REV	DATE	NOTE	
A	01/20	UPDATES TO VILLAGE GREEN	JH

Project

TRIMLEY ST MARTIN
LAND OFF HOWLETT WAY
RESIDENTIAL DEVELOPMENT

Title

ILLUSTRATIVE SITE LAYOUT

Scale 1:1000 @A1	Date Dec 2019
Drawn SD	Checked AL
Drawing Number 7845/P101	Revision A

Saunders
Architecture+Urban Design

saundersarchitects.com | 01707 385300 | London | Manchester | Bristol | Welwyn

RichardJackson
Engineering Consultants

APPENDIX D

RichardJackson
Engineering Consultants

Our Ref: KO/48055
Your Ref:

18 May 2018

Mr R Landman
Trinity College, Cambridge
c/o Sam Metson
Bidwells
Victoria House, Victoria Road
Chelmsford
Essex
CM1 1JR

BY POST & EMAIL TO:
sam.metson@bidwells.co.uk

Dear Mr Landman

Re: Howlett Way, Trimley St. Martin – Infiltration Assessment

As you are aware we recently attended the above site to undertake an infiltration assessment for use in the design of sustainable drainage at the site, and to inform a flood risk assessment (FRA). The findings of this assessment are summarised in this letter and shall be read in accordance with our limitations of investigation, which are enclosed.

Project Understanding

It is our understanding that residential development comprising the construction of 360+ dwellings is proposed for land located off Howlett Way, Trimley St, Martin, Suffolk, IP11 0UY. An indicative proposed development plan is enclosed.

Site Location & Description

The site was located to the southeast of Howlett Way, Trimley St. Martin, Suffolk. The approximate Ordnance Survey grid reference for the centre of the site was TM 277 374. A site location plan is presented as Figure 1 in Appendix A.

Fieldwork

The fieldwork on which this letter is based was undertaken on 30th April and 1st May 2018 and comprised the mechanical excavation of 9no. trial pits (TP1 – TP9). An exploratory hole location plan is enclosed as Figure 3 and indicates the location of the trial pits with respect to existing site layout.

Disturbed samples were recovered from throughout the depth of each exploratory hole for record keeping purposes. The exploratory hole logs are enclosed and give descriptions and depths of strata encountered, together with details of samples taken and other relevant information.

Cont'd.../

Soakage tests were undertaken in each of the trial pits in accordance with BRE Digest 365 (2016).

Where applicable, investigation techniques, sampling and logging of soils complied with the requirements of British Standard BS:5930:- 'Code of Practice for Site Investigations' (2015).

Trial Pitting

A mechanical excavator was used to form 9no. trial pits (TP1 – TP9) to provide information for use in the FRA and to provide information for consideration in the design of sustainable drainage at the site. The trial pits were excavated as follows:

- TP4-TP6 & TP8 were formed to depths of between 0.70m below ground level (bgl) and 0.75m to provide information for consideration in the design of permeable paving;
- TP1-TP3, TP7 & TP9 were formed to depths of 2.50m bgl to provide information for consideration in the design of conventional soakaway drainage.

Infiltration Testing

Infiltration testing was undertaken in the trial pits in accordance with current guidance as given in BRE Digest 365 'Soakaway Design' (2016).

The trial pits were filled with clean water from a water tanker and the fall in water level in the trial pits was monitored at regular intervals. A single test was undertaken in each of the trial pits with the exception of TP2, which was abandoned due to surface water ingress. Further repeat tests were also undertaken in TP1, TP3, TP4, TP5 and TP9. Repeat tests were not undertaken in the remaining trial pit locations due to the observed poor infiltration and associated time constraints.

In order to derive soil infiltration rates, the recommended calculation in BRE Digest 365 (2016) has been used. Due to time constraints the tests in the below locations did not achieve 75% fall in water level during the period of monitoring:

- TP1, test 1;
- TP3, test 2;
- TP4, test 2;
- TP5, test 2;
- TP9, test 1.

In order to derive infiltration rates for these tests, extrapolation of the measured tests data has been carried out, prior to the application of the recommended BRE Digest 365 calculation. It should be noted that extrapolation of the data plots is very subjective and therefore, the calculated infiltration rates should be treated with caution as they may over estimate true soil infiltration.

Infiltration rates have not been determined for the following tests:

- TP3, test 1 – due to repeated trial pit collapse during testing;
- TP7, test 1 – due to insufficient observed infiltration.

Table 1 provide a summary of the calculated infiltration rates. Full results of the infiltration testing are enclosed.

Cont'd.../

Table 1: Results of Infiltration Testing

Exploratory Hole	Infiltration Rate (m/s)	
	Test 1	**Test 2**
TP1	*1.2 X 10^{-5}	1.6 X 10^{-5}
TP2	n/a	n/a
TP3	n/a	1.0 x 10^{-5}
TP4	1.5 x 10^{-5}	*1.1 x 10^{-5}
TP5	9.3 x 10^{-6}	*7.6 x 10^{-6}
TP6	5.4 x 10^{-6}	n/a
TP7	n/a	n/a
TP8	2.1 x 10^{-5}	1.1 x 10^{-5}
TP9	5.0 x 10^{-6}	n/a
**Denotes infiltration rates determined using extrapolated data.*		

Ground Conditions

This investigation encountered the following sequence of strata from ground level:

- Topsoil
- Kesgrave Catchment Subroup

Topsoil

Topsoil was encountered from the surface to 0.30m bgl in each of the 9no. trial pits. The topsoil was typically encountered as a brown, medium to coarse sand.

Kesgrave Catchment Subgroup

Soils interpreted to represent the Kesgrave Catchment were encountered beneath the topsoil in each of the trial pits. The base of the Kesgrave Catchment Subgroup remained unproven in this investigation, which extended to a maximum depth of 2.50m bgl.

The Kesgrave catchment Subgroup was typically encountered as a slightly silty sand, with occasionally clayey, gravelly pockets.

Groundwater

Groundwater was not encountered during formation of the trial pits.

Cont'd.../

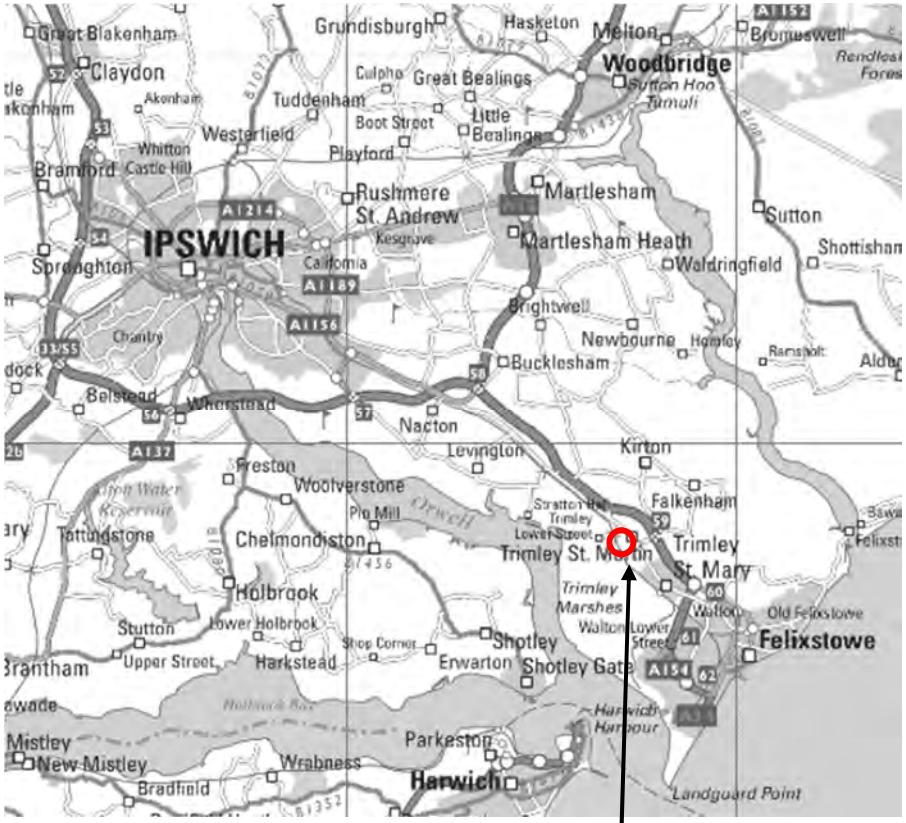
General

We trust that the above and enclosed are clear and acceptable, however, should you have any questions or queries please do not hesitate to contact us.

Yours sincerely

Kay O'Reilly MSci, FGS
Geotechnical Engineer
on behalf of Richard Jackson Limited

Enc Figure 1 – Site Location Plan
Figure 3 – Exploratory Hole Location Plan
Exploratory Hole Logs
Soakage Tests Calculations
Limitations of Investigation



SITE LOCATION

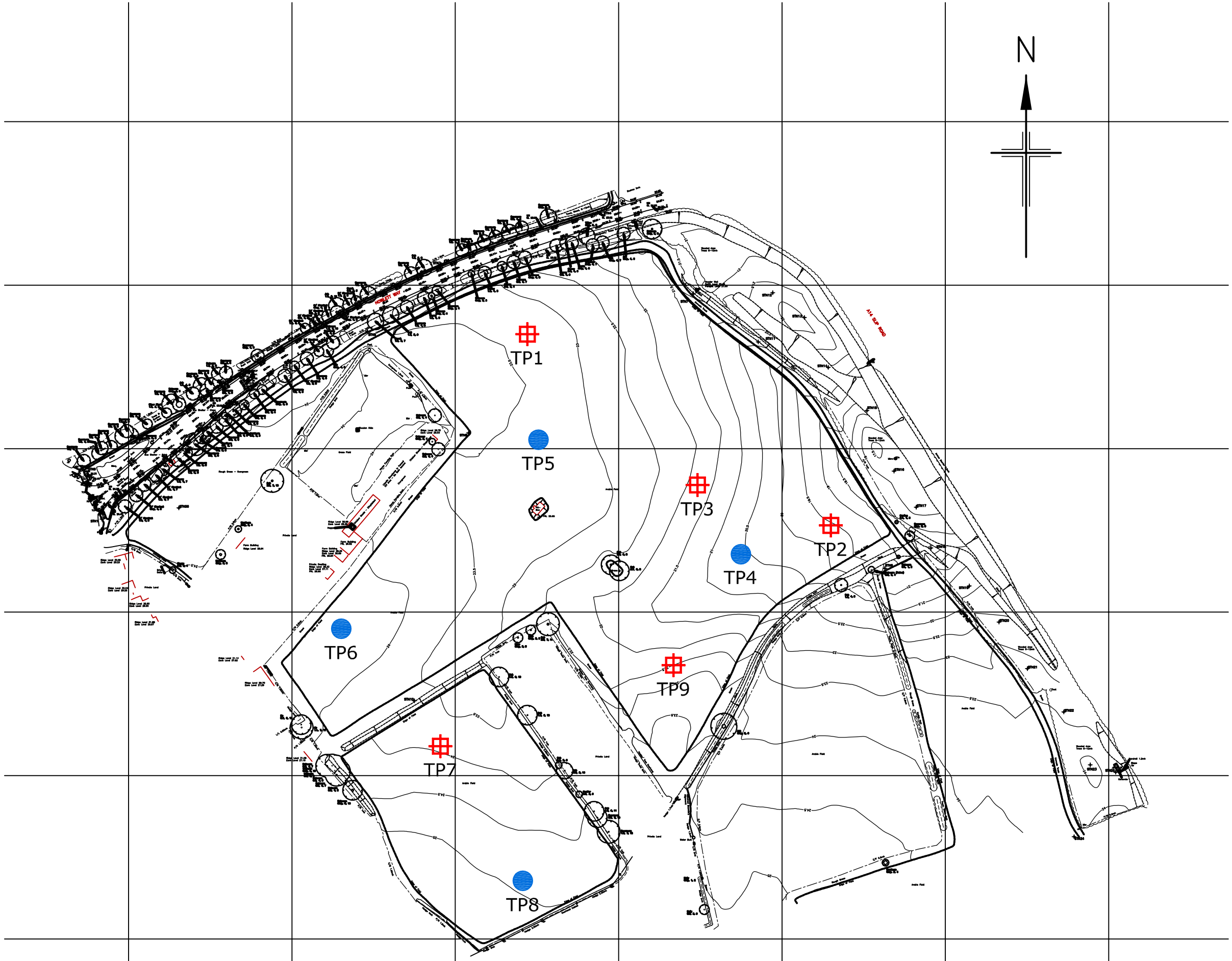
SITE LOCATION

Howlett Way, Trimley St Martin Site Location Grid Reference 627730, 237330 and Postcode IP11 0SW

Client:	Drawing Title:		
Trinity College, Cambridge	**Site Location Plan**		
Job Title:	Date:	Job No:	Dwg No:
Land off Howlett Way, Trimley St Martin	**05/04/18**	**48055**	**Fig. 1**

RichardJackson Engineering Consultants
4 The Old Church, St Matthews Road, Norwich, NR1 1SP
Tel. 01603 230240
www.richardjackson.uk.com

DO NOT SCALE



KEY

:Soakage Pit

:Permeable Paving Pit

REV	DATE	DESCRIPTION	DRAWN	CHKD

REVISIONS

This drawing is to be read in conjunction with all other Engineer's drawings and all other project information. Any discrepancy between the Engineer's drawings and other project information is to be reported to the Engineer immediately.

Project

LAND OFF HOWLETT WAY,
TRIMLEY ST.MARTIN, SUFFOLK

Title

EXPLORATORY HOLE LOCATION PLAN

Client

TRINITY COLLEGE CAMBRIDGE

Scale	Drawn	Date
NTS	JB	MAY 2018
Job Manager	Checked	Approved
RL	KO	KO

RichardJackson Engineering Consultants

847 The Crescent, Colchester, Essex CO4 9YQ Tel: 01206 228800
3rd Floor, Rennie House, 57-60 Aldgate High Street, London EC3N 1AL Tel: 020 7448 9910
5 Quern House, Mill Court, Great Shelford, Cambs CB22 5LD Tel: 01223 314794
4 The Old Church, St. Matthews Road, Norwich, Norfolk NR1 1SP Tel: 01603 230240
The Wheelhouse, Bonds Mill, Stonehouse, Gloucestershire GL10 3RF Tel: 01172 020070
Email Address: mail@rj.uk.com Website: http://www.rj.uk.com

Drawing No.

48055/G/FIG03

Revision

Drawing Status

☒ INFORMATION ☐ APPROVAL ☐ COSTING
☐ TENDER ☐ CONSTRUCTION ☐ AS CONSTRUCTED

A3

RichardJackson Engineering Consultants

847 The Crescent
Colchester
Essex
CO4 9YQ

Trial Pit No.
TP1
Sheet 1 of 1

Project Name: Land off Howlett Way	**Project No.** 48055	**Co-ords:** / **Orientation:**	Date **30/04/2018**
Location: Trimley St. Martin, Suffolk, IP11 0UY		**Level (m, aOD):**	**Dimensions (m)** 1.30 × 0.45 — Scale **1:20**
Client: Trinity College Cambridge		**Depth (m):** 2.50	Logged **TS**

Ground water	Samples & In Situ Testing: Depth	Type	Results	Level (m)	Depth (m)	Legend	Stratum Description
					0.30		Brown, medium to coarse SAND. TOPSOIL
							Brownish, yellowish orange, slightly silty, medium SAND. KESGRAVE CATCHMENT SUBGROUP
							...occasional, subangular to subrounded, fine to medium flint gravel from 1.10m
							...band of firm, brown, silty clay at 1.40m
							...becoming orange at 1.60m
	2.00	B1					
					2.50		End of Pit at 2.500m

Groundwater: Not encountered.

Stability: Some side instability from 1.30m.

Remarks: Soakage tests undertaken from 1.20m.

Key

D	Disturbed	**IVN**	Hand Vane
B	Bulk	**PID**	PID Reading
ES	Environmental	**PP**	Pocket Penetrometer
	Groundwater strike		Standing water level

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Trial Pit No.
TP2
Sheet 1 of 1

Project Name: Land off Howlett Way	**Project No.** 48055	**Co-ords:**	Date **30/04/2018**
Location: Trimley St. Martin, Suffolk, IP11 0UY		**Orientation:**	Scale **1:20**
Client: Trinity College Cambridge		**Level (m, aOD):**	Logged **TS**
		Depth (m): 2.50	**Dimensions (m)** 1.60 × 0.45

Ground water	Samples & In Situ Testing: Depth	Type	Results	Level (m)	Depth (m)	Legend	Stratum Description
					0.30		Dark brown medium to coarse SAND. TOPSOIL
					1.00		Brown, silty, fine to medium SAND. KESGRAVE CATCHMENT SUBGROUP
	2.00	B1					Yellowish, orange/brown, slightly silty, fine to medium SAND. KESGRAVE CATCHMENT SUBGROUP *...becoming orange mottled white with occasional brown iron staining from 1.80m*
					2.50		End of Pit at 2.500m

Groundwater: Not encountered.

Stability: Stable.

Remarks: Soakage test undertaken from 1.40m.

Key

D	Disturbed	**IVN**	Hand Vane
B	Bulk	**PID**	PID Reading
ES	Environmental	**PP**	Pocket Penetrometer
	Groundwater strike		Standing water level

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Trial Pit No.
TP3
Sheet 1 of 1

Project Name: Land off Howlett Way	**Project No.** 48055	**Co-ords:**	Date **30/04/2018**
Location: Trimley St. Martin, Suffolk, IP11 0UY		**Level (m, aOD):**	Scale **1:20**
Client: Trinity College Cambridge		**Depth (m):** 2.50	Logged **TS**

Orientation: — **Dimensions (m)**: 1.40 × 0.55

Ground water	Samples & In Situ Testing: Depth	Type	Results	Level (m)	Depth (m)	Legend	Stratum Description
					0.30		Dark brown, medium to coarse SAND. TOPSOIL
	2.00	B1					Yellowish, whitish orange, slightly silty, fine to medium SAND with occasional subrounded, fine to medium flint gravel. KESGRAVE CATCHMENT SUBGROUP
					2.50		End of Pit at 2.500m

Groundwater: Not encountered.

Stability: Pit collapse from 0.30m during 2nd soakage tests.

Remarks: Soakage test undertaken from 0.95m.

Key

D	Disturbed	**IVN**	Hand Vane
B	Bulk	**PID**	PID Reading
ES	Environmental	**PP**	Pocket Penetrometer
	Groundwater strike		Standing water level

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Trial Pit No.
TP4
Sheet 1 of 1

Project Name: Land off Howlett Way	**Project No.** 48055	**Co-ords:**	Date **30/04/2018**
		Orientation:	**Dimensions (m)**
Location: Trimley St. Martin, Suffolk, IP11 0UY		**Level (m, aOD):**	1.60 × 0.55 — Scale **1:20**
Client: Trinity College Cambridge		**Depth (m):** 0.70	Logged **TS**

Ground water	Samples & In Situ Testing: Depth	Type	Results	Level (m)	Depth (m)	Legend	Stratum Description
	0.60	B1			0.30		Dark brown, medium to coarse SAND. TOPSOIL
					0.70		Brown, slightly silty, fine SAND. KESGRAVE CATCHMENT SUBGROUP
							End of Pit at 0.700m

Groundwater: Not encountered.

Stability: Stable.

Remarks: Soakage tests undertaken from 0.33m

Key

D	Disturbed	**IVN**	Hand Vane
B	Bulk	**PID**	PID Reading
ES	Environmental	**PP**	Pocket Penetrometer
	Groundwater strike		Standing water level

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Trial Pit No.
TP5
Sheet 1 of 1

Project Name: Land off Howlett Way	**Project No.** 48055	**Co-ords:**	Date **01/05/2018**
Location: Trimley St. Martin, Suffolk, IP11 0UY		**Level (m, aOD):**	**Dimensions (m)** 1.30 × 0.50 — Scale **1:20**
Client: Trinity College Cambridge		**Depth (m):** 0.70	Logged **TS**

Ground water	Samples & In Situ Testing: Depth	Type	Results	Level (m)	Depth (m)	Legend	Stratum Description
	0.60	B1			0.30		Dark brown, medium to coarse SAND. TOPSOIL
					0.70		Brownish yellow, slightly silty, slightly gravelly, fine to medium SAND. Gravel is subrounded, fine to medium flint. KESGRAVE CATCHMENT SUBGROUP
							End of Pit at 0.700m

1
2
3
4

Groundwater: Not encountered.

Stability: Stable.

Remarks: Soakage tests undertaken from 0.265m.

Key

D	Disturbed	**IVN**	Hand Vane
B	Bulk	**PID**	PID Reading
ES	Environmental	**PP**	Pocket Penetrometer
	Groundwater strike		Standing water level

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Trial Pit No.
TP6
Sheet 1 of 1

Project Name: Land off Howlett Way	**Project No.** 48055	**Co-ords:**	Date **01/05/2018**
		Orientation:	**Dimensions (m)** 1.20 × 0.50
Location: Trimley St. Martin, Suffolk, IP11 0UY		**Level (m, aOD):**	Scale **1:20**
Client: Trinity College Cambridge		**Depth (m):** 0.70	Logged **TS**

Ground water	Samples & In Situ Testing: Depth	Type	Results	Level (m)	Depth (m)	Legend	Stratum Description
	0.60	B1			0.30		Dark brown, medium to coarse SAND. TOPSOIL
					0.70		Orange / brown, slightly gravelly, clayey, fine to medium SAND. Gravel is subangular to subrounded, fine to medium flint. KESGRAVE CATCHMENT SUBGROUP
							End of Pit at 0.700m

Groundwater: Not encountered.

Stability: Stable.

Remarks: Soakage test undertaken from 0.27m

Key

D	Disturbed	**IVN**	Hand Vane
B	Bulk	**PID**	PID Reading
ES	Environmental	**PP**	Pocket Penetrometer
▽	Groundwater strike	▼	Standing water level

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Trial Pit No.
TP7
Sheet 1 of 1

Project Name: Land off Howlett Way	**Project No.** 48055	**Co-ords:** / **Orientation:**	Date **01/05/2018**
Location: Trimley St. Martin, Suffolk, IP11 0UY		**Level (m, aOD):**	**Dimensions (m)** 1.40 × 0.50 — Scale **1:20**
Client: Trinity College Cambridge		**Depth (m):** 2.50	Logged **TS**

Ground water	Samples & In Situ Testing: Depth	Type	Results	Level (m)	Depth (m)	Legend	Stratum Description
					0.30		Dark brown, medium to coarse SAND. TOPSOIL
					0.90		Brown, silty, fine to medium SAND. KESGRAVE CATCHMENT SUBGROUP
	1.50	B1					Yellowish brown, fine to medium SAND. KESGRAVE CATCHMENT SUBGROUP
							...becoming orange at 1.60m
	2.00	B2					*...becoming gravelly with subangular to subrounded, fine to coarse flint gravel at 1.90m*
					2.50		End of Pit at 2.500m

1
2
3
4

Groundwater: Not encountered.

Stability: Some side wall collapse during soakage test.

Remarks: Soakage test undertaken from 0.99m

Key

D	Disturbed	**IVN**	Hand Vane
B	Bulk	**PID**	PID Reading
ES	Environmental	**PP**	Pocket Penetrometer
	Groundwater strike		Standing water level

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Trial Pit No.
TP8
Sheet 1 of 1

Project Name: Land off Howlett Way	**Project No.** 48055	**Co-ords:**	Date **01/05/2018**
Location: Trimley St. Martin, Suffolk, IP11 0UY		**Level (m, aOD):**	**Dimensions (m)** 1.40 × 0.50 — Scale **1:20**
Client: Trinity College Cambridge		**Depth (m):** 0.75	Logged **TS**

Ground water	Samples & In Situ Testing: Depth	Type	Results	Level (m)	Depth (m)	Legend	Stratum Description
	0.60	B1			0.30		Dark brown, medium to coarse SAND. TOPSOIL
					0.75		Brownish yellow, slightly gravelly, silty, fine to medium SAND. Gravel of subangular to subrounded, fine to coarse flint. KESGRAVE CATCHMENT SUBGROUP
							End of Pit at 0.750m

1
2
3
4

Groundwater: Not encountered.

Stability: Stable

Remarks: Soakage tests undertaken from 0.29m

Key

D	Disturbed	**IVN**	Hand Vane
B	Bulk	**PID**	PID Reading
ES	Environmental	**PP**	Pocket Penetrometer
▽	Groundwater strike	▼	Standing water level

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Trial Pit No.
TP9
Sheet 1 of 1

Project Name: Land off Howlett Way	**Project No.** 48055	**Co-ords:**	Date **01/05/2018**
		Orientation:	**Dimensions (m)**
Location: Trimley St. Martin, Suffolk, IP11 0UY		**Level (m, aOD):**	1.40 × 0.50 — Scale **1:20**
Client: Trinity College Cambridge		**Depth (m):** 2.50	Logged **TS**

Ground water	Samples & In Situ Testing: Depth	Type	Results	Level (m)	Depth (m)	Legend	Stratum Description
					0.30		Dark brown medium to coarse SAND. TOPSOIL
	2.00	B1					Brownish orange, slightly gravelly, slightly clayey, fine to medium SAND. Gravel of subangular to subrounded, fine to coarse flint. KESGRAVE CATCHMENT SUBGROUP
					2.50		End of Pit at 2.500m

1
2
3
4

Groundwater: Not encountered.

Stability: Stable.

Remarks: Soakage test undertaken from 0.925m.

Key

D	Disturbed	**IVN**	Hand Vane
B	Bulk	**PID**	PID Reading
ES	Environmental	**PP**	Pocket Penetrometer
▽	Groundwater strike	▼	Standing water level

Soil Infiltration Rate (f) = Vp_{75-25}/ (ap_{50}*tp_{75-25})

Red text = Extrapolated data

Infiltration TP1 - Test 1 of 2
Date: 30/04/2018

Trial Pit Dimensions

Length (m)	1.30
Width (m)	0.45
Depth (m)	2.50
Effective Depth (m)	1.30
$tp_{75\ (mins)}$	200
$tp_{25\ (mins)}$	17

Calculations

Vp_{75-25}	0.38
ap_{50}	2.86
tp_{75-25}	183

f = 1.21088E-05 m/s

Infiltration TP1 - Test 2 of 2
Date: 30/04/2018

Trial Pit Dimensions

Length (m)	1.30
Width (m)	0.45
Depth (m)	2.15
Effective Depth (m)	0.69
$tp_{75\ (mins)}$	148
$tp_{25\ (mins)}$	33

Calculations

Vp_{75-25}	0.20
ap_{50}	1.79
tp_{75-25}	115

f = 1.6318E-05 m/s

Infiltration TP2 - Test 1 of 1
Date: 30/04/2018

Trial Pit Dimensions

Length (m)	1.60
Width (m)	0.45
Depth (m)	2.50
Effective Depth (m)	1.10
$tp_{75\ (mins)}$	**n/a**
$tp_{25\ (mins)}$	**n/a**

Calculations

Test abandonned due to surface water ingress following prolonger period of intense rainfall.

f = **n/a** m/s

Infiltration TP3 - Test 1 of 2
Date: 30/04/2018

Trial Pit Dimensions

Length (m)	1.40
Width (m)	0.55
Depth (m)	1.60
Effective Depth (m)	0.57
$tp_{75\ (mins)}$	**n/a**
$tp_{25\ (mins)}$	**n/a**

Calculations

Test abandonned due to repeated pit collapse.

f = **n/a** m/s

Infiltration TP3 - Test 2 of 2
Date: 30/04/2018

Trial Pit Dimensions

Length (m)	1.40
Width (m)	0.55
Depth (m)	1.60
Effective Depth (m)	0.65
$tp_{75\ (mins)}$	241
$tp_{25\ (mins)}$	**39**

Calculations

Vp_{75-25}	0.25
ap_{50}	2.04
tp_{75-25}	202

f = 1.01338E-05 m/s

Soil Infiltration Rate (f) = Vp_{75-25}/ (ap_{50}*tp_{75-25})

Infiltration TP4 - Test 1 of 2
Date: 30/04/2018

Trial Pit Dimensions

Length (m)	1.60
Width (m)	0.55
Depth (m)	0.70
Effective Depth (m)	0.37
$tp_{75\ (mins)}$	127
$tp_{25\ (mins)}$	21

Calculations

Vp_{75-25}	0.16
ap_{50}	1.68
tp_{75-25}	106

f = **1.52775E-05** m/s

Infiltration TP4 - Test 2 of 2
Date: 30/04/2018

Trial Pit Dimensions

Length (m)	1.60
Width (m)	0.55
Depth (m)	0.70
Effective Depth (m)	0.29
$tp_{75\ (mins)}$	172
$tp_{25\ (mins)}$	40

Calculations

Vp_{75-25}	0.13
ap_{50}	1.50
tp_{75-25}	132

f = **1.07157E-05** m/s

Infiltration TP5 - Test 1 of 2
Date: 01/05/2018

Trial Pit Dimensions

Length (m)	1.30
Width (m)	0.50
Depth (m)	0.70
Effective Depth (m)	0.44
$tp_{75\ (mins)}$	218
$tp_{25\ (mins)}$	41

Calculations

Vp_{75-25}	0.14
ap_{50}	1.44
tp_{75-25}	177

f = **9.33784E-06** m/s

Infiltration TP5 - Test 2 of 2
Date: 01/05/2018

Trial Pit Dimensions

Length (m)	1.30
Width (m)	0.50
Depth (m)	0.70
Effective Depth (m)	0.41
$tp_{75\ (mins)}$	315
$tp_{25\ (mins)}$	104

Calculations

Vp_{75-25}	0.13
ap_{50}	1.39
tp_{75-25}	211

f = **7.58305E-06** m/s

Infiltration TP6 - Test 1 of 1
Date: 01/05/2018

Trial Pit Dimensions

Length (m)	1.20
Width (m)	0.50
Depth (m)	0.70
Effective Depth (m)	0.435
$tp_{75\ (mins)}$	345
$tp_{25\ (mins)}$	46

Calculations

Vp_{75-25}	0.13
ap_{50}	1.34
tp_{75-25}	299

f = **5.43057E-06** m/s

Soil Infiltration Rate (f) = Vp_{75-25}/ (ap_{50}*tp_{75-25})

Infiltration TP7 - Test 1 of 1
Date: 01/05/2018

Trial Pit Dimensions

Length (m)	1.40
Width (m)	0.50
Depth (m)	2.50
Effective Depth (m)	1.51
$tp_{75\ (mins)}$	**Not achieved**
$tp_{25\ (mins)}$	235

Calculations

Vp_{75-25}	0.53
ap_{50}	3.57
tp_{75-25}	n/a

f = **n/a** m/s

Infiltration TP8 - Test 1 of 2
Date: 01/05/2018

Trial Pit Dimensions

Length (m)	1.40
Width (m)	0.50
Depth (m)	0.75
Effective Depth (m)	0.46
$tp_{75\ (mins)}$	97
$tp_{25\ (mins)}$	17

Calculations

Vp_{75-25}	0.16
ap_{50}	1.57
tp_{75-25}	80

f = **2.13098E-05** m/s

Infiltration TP8 - Test 2 of 2
Date: 01/05/2018

Trial Pit Dimensions

Length (m)	1.40
Width (m)	0.50
Depth (m)	0.70
Effective Depth (m)	0.40
$tp_{75\ (mins)}$	185
$tp_{25\ (mins)}$	37

Calculations

Vp_{75-25}	0.14
ap_{50}	1.46
tp_{75-25}	148

f = **1.07985E-05** m/s

Infiltration TP9 - Test 1 of 1
Date: 01/05/2018

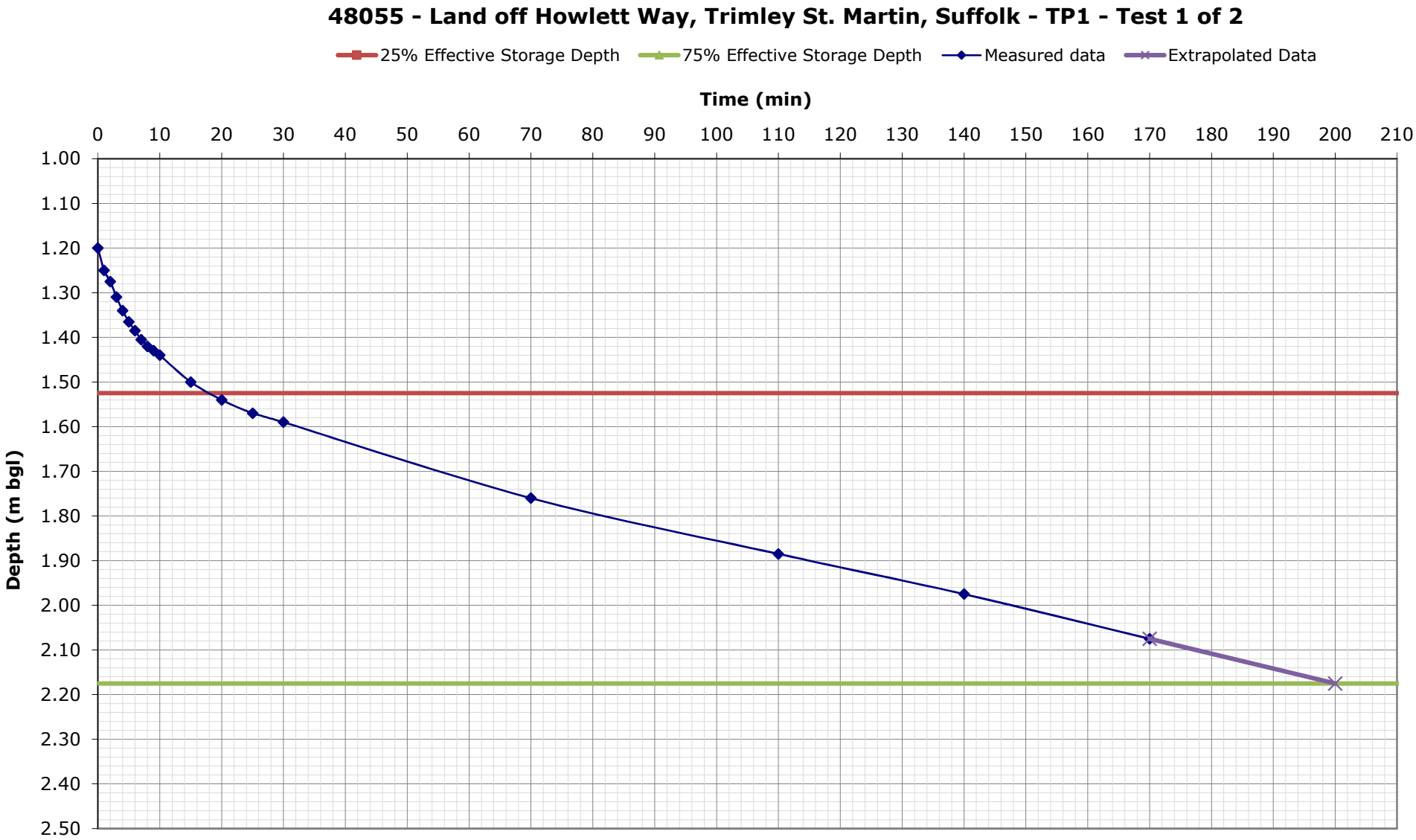
Trial Pit Dimensions

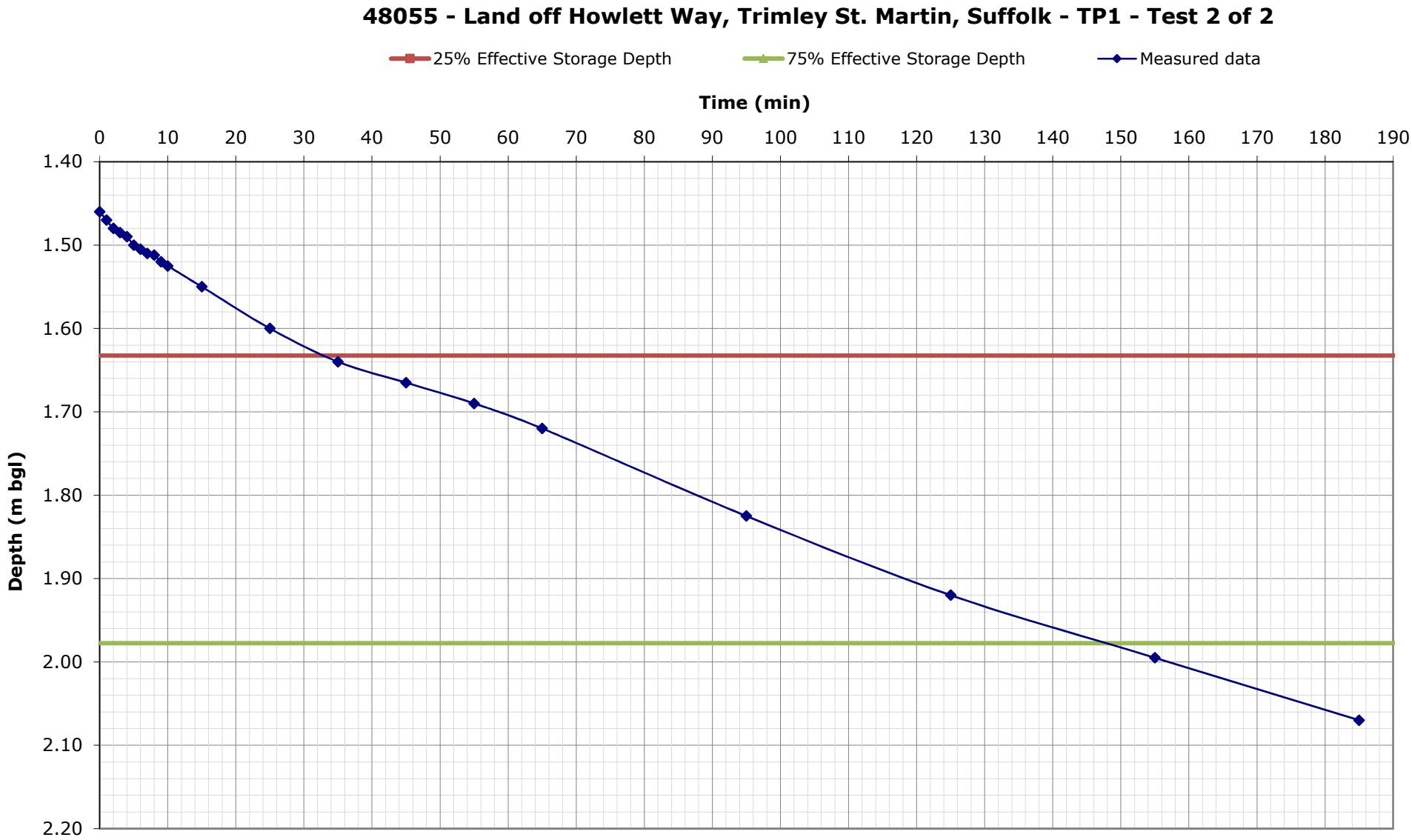
Length (m)	1.40
Width (m)	0.50
Depth (m)	2.50
Effective Depth (m)	1.58
$tp_{75\ (mins)}$	573
$tp_{25\ (mins)}$	72

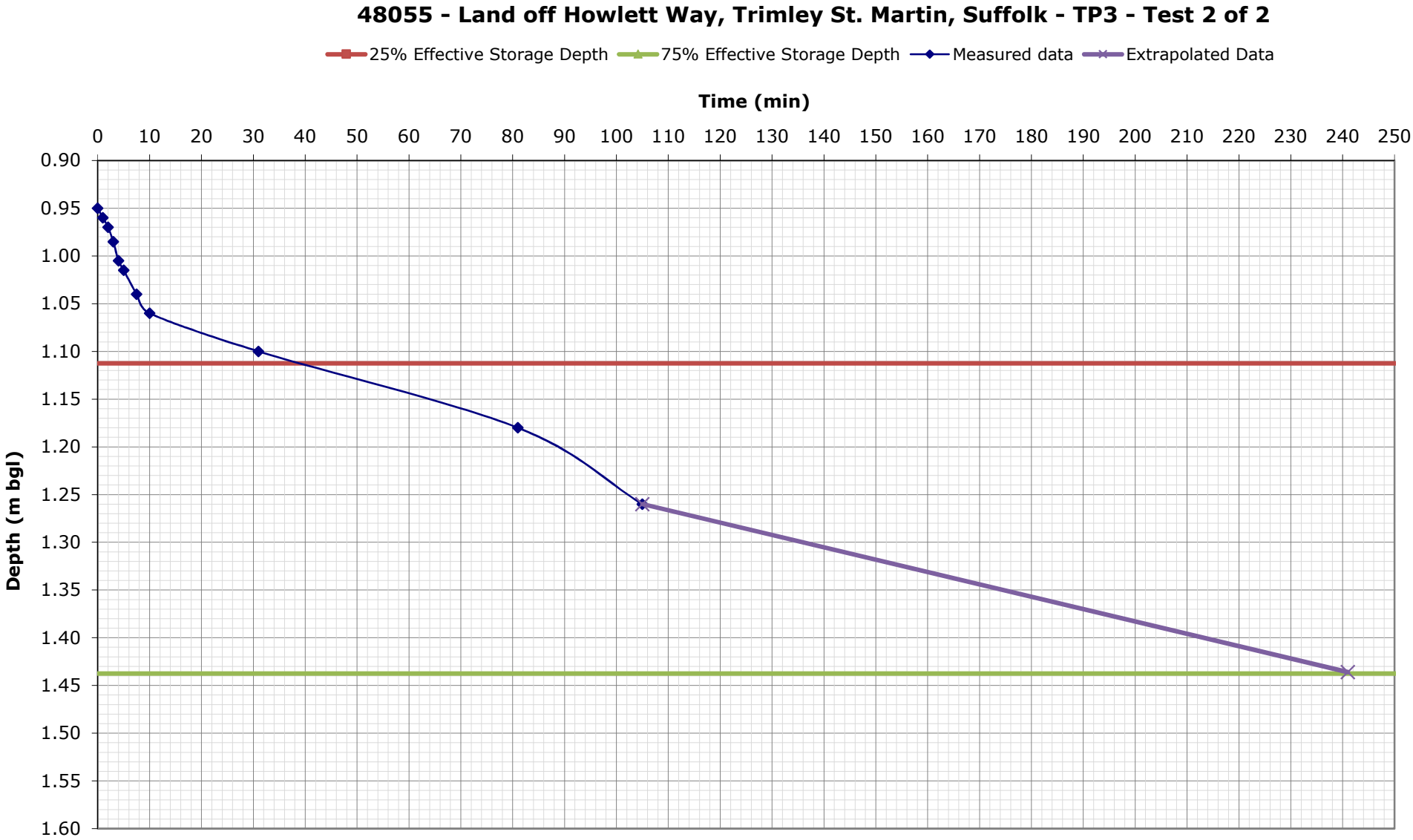
Calculations

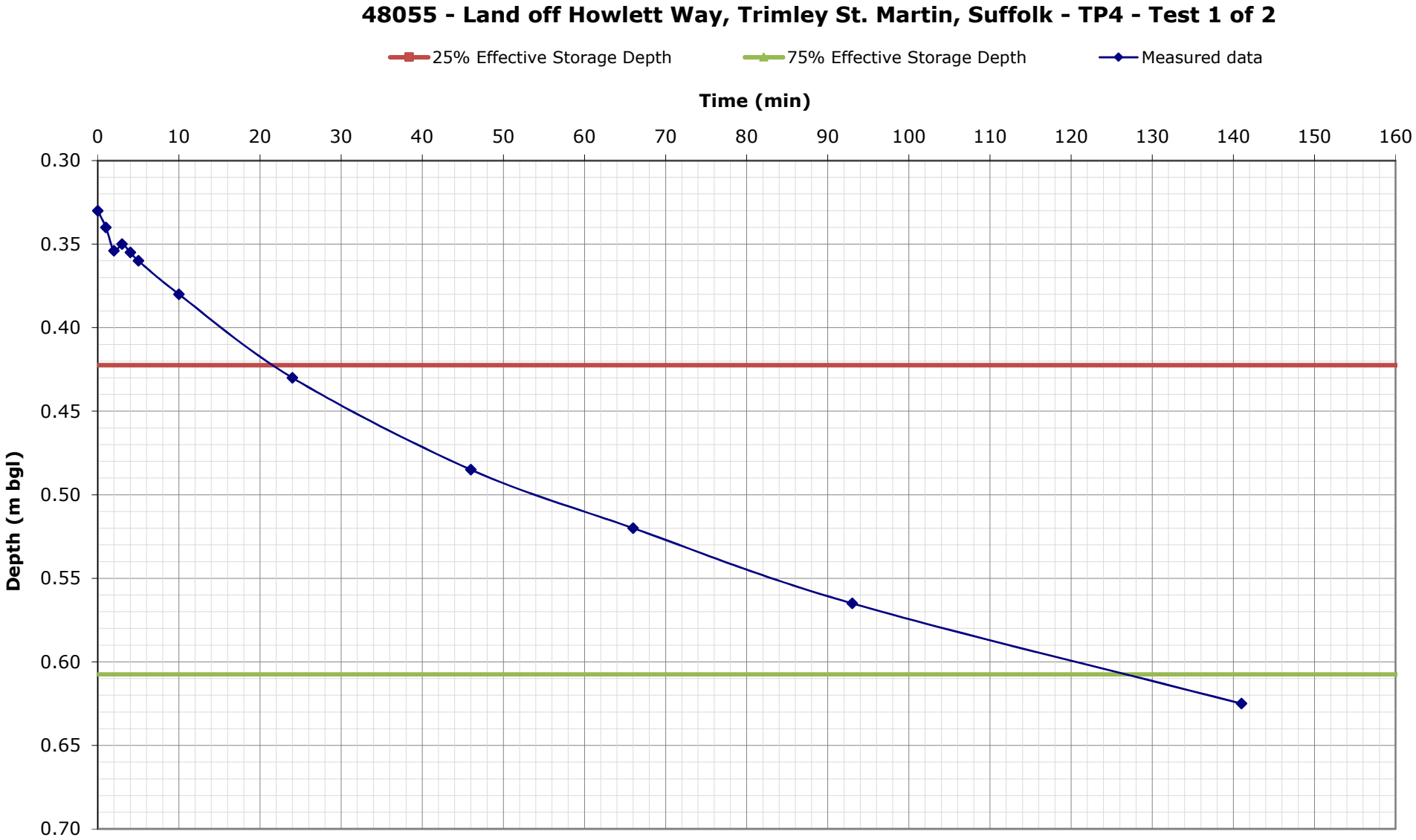
Vp_{75-25}	0.55
ap_{50}	3.70
tp_{75-25}	501

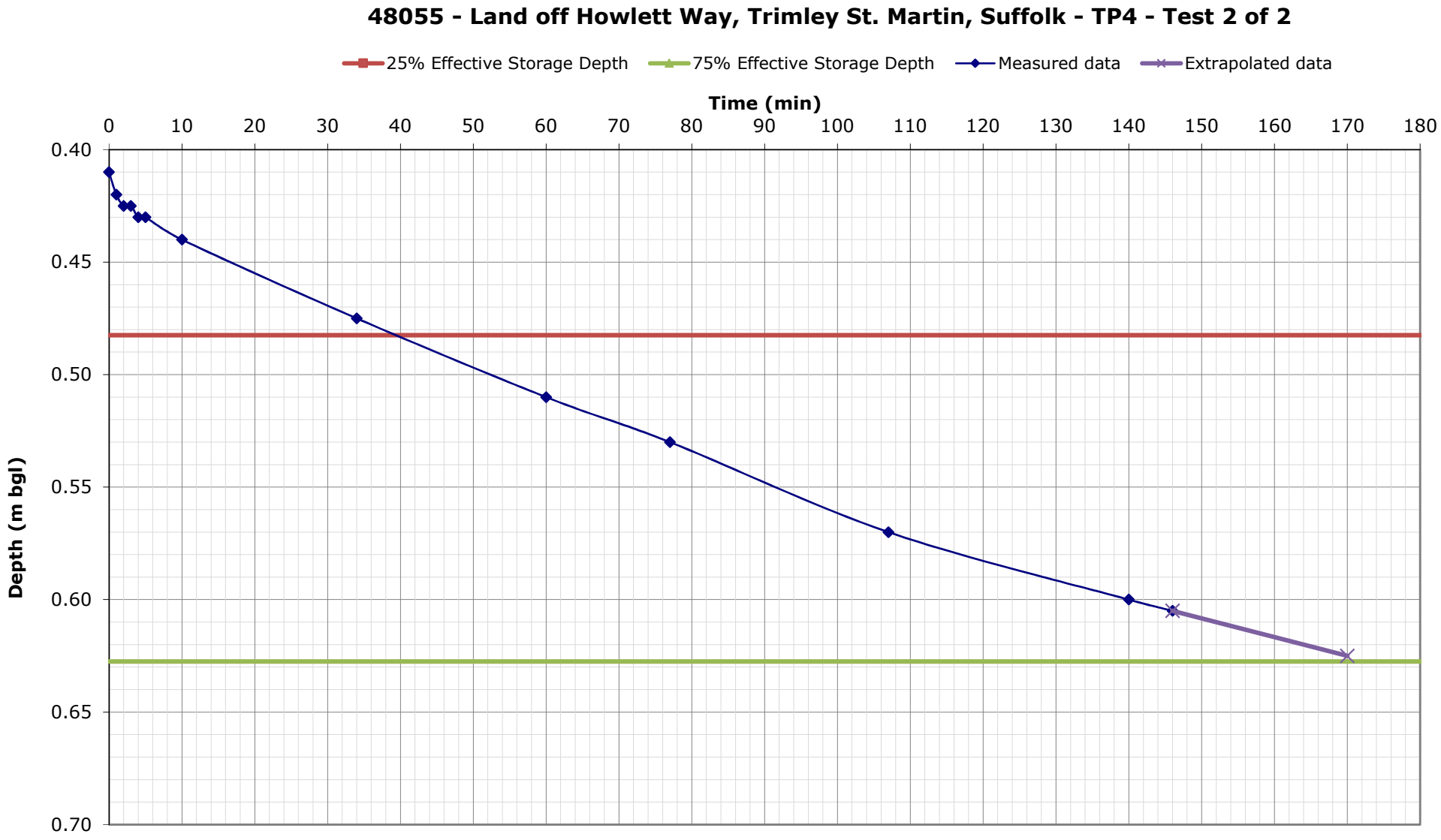
f = **4.96935E-06** m/s

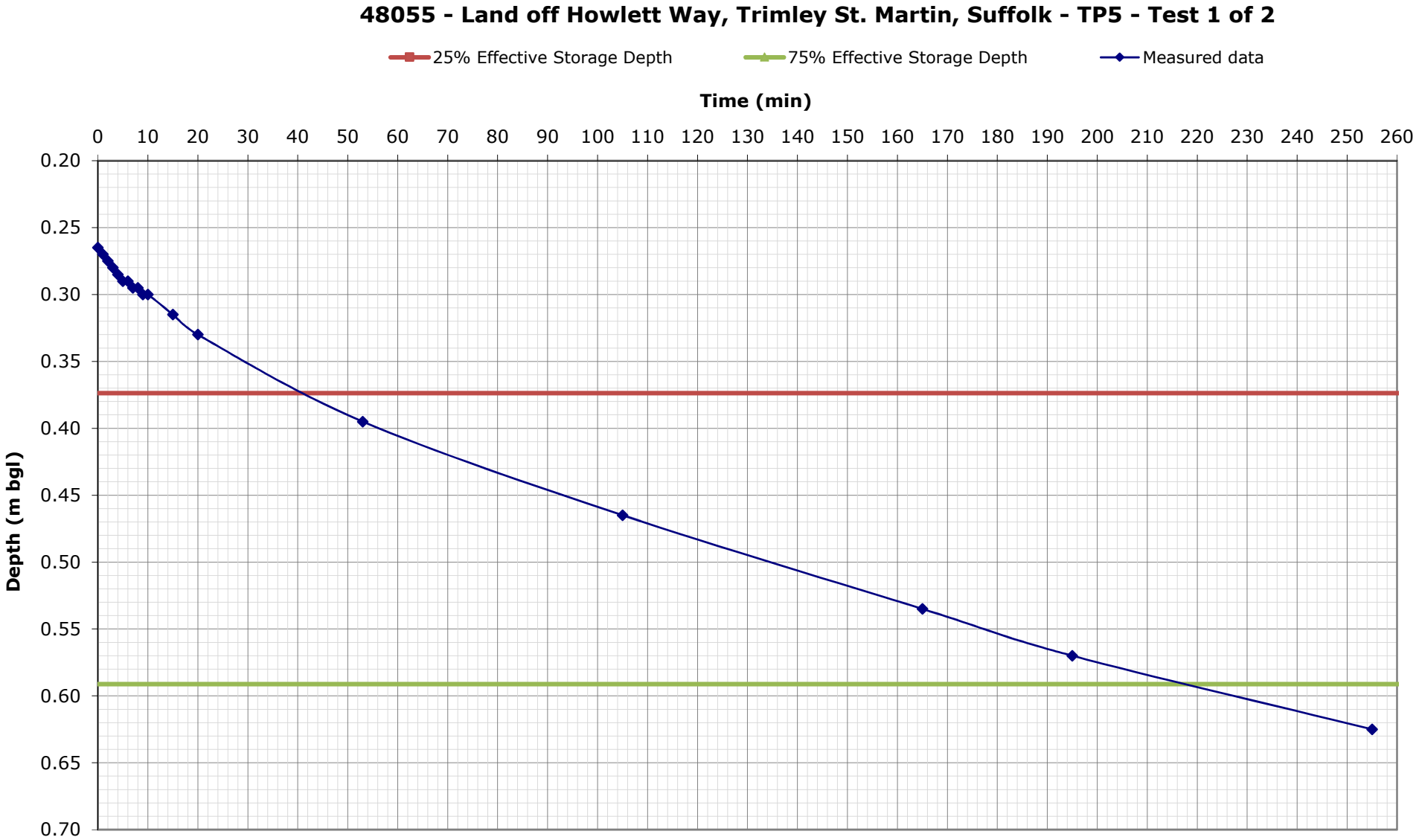

48055 - Land off Howlett Way, Trimley St. Martin, Suffolk - TP1 - Test 1 of 2
25% Effective Storage Depth
75% Effective Storage Depth
Measured data
Extrapolated Data
Time (min)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
170
180
190
200
210
Depth (m bgl)
1.00
1.10
1.20
1.30
1.40
1.50
1.60
1.70
1.80
1.90
2.00
2.10
2.20
2.30
2.40
2.50

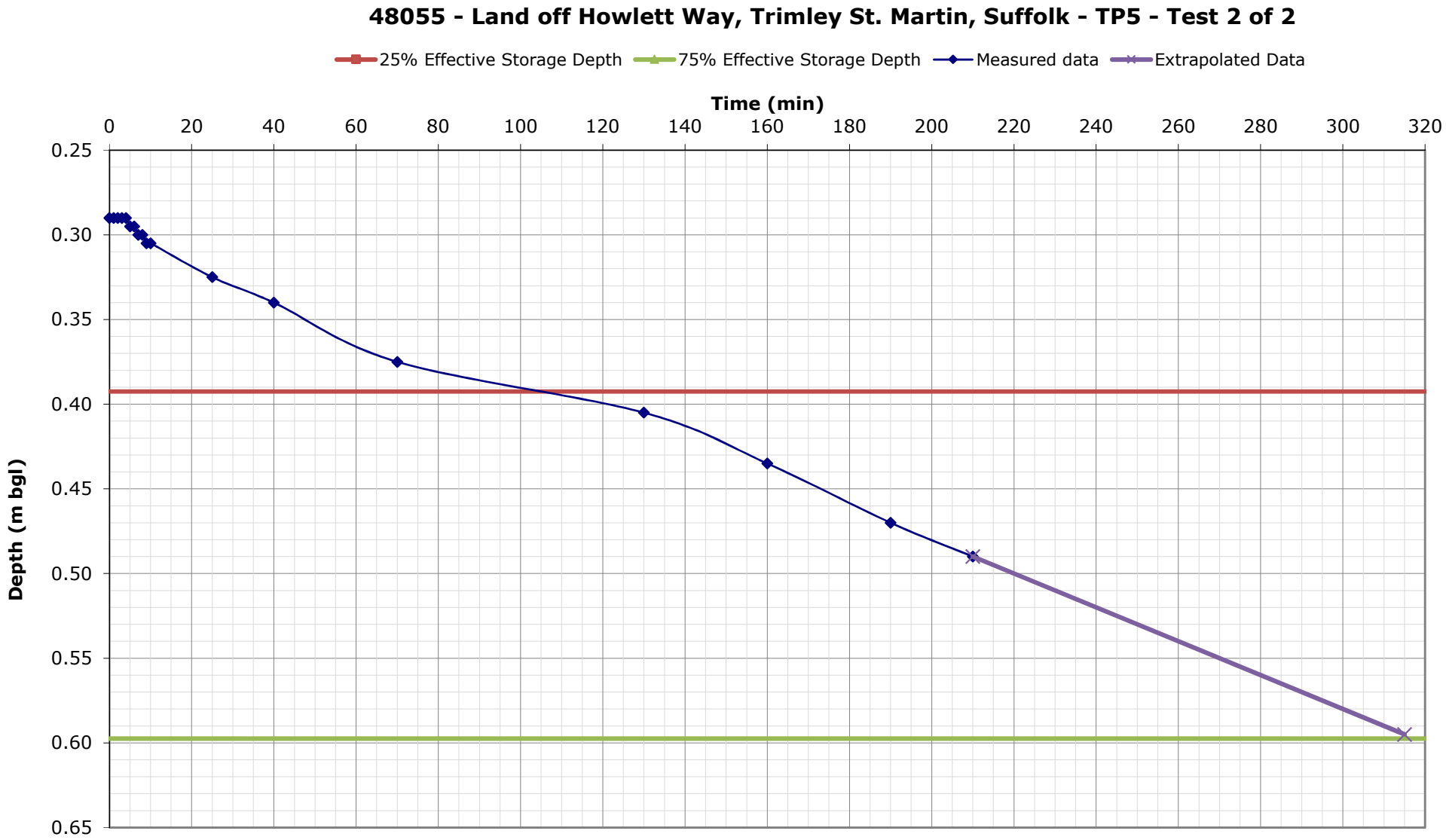

48055 - Land off Howlett Way, Trimley St. Martin, Suffolk - TP1 - Test 2 of 2
25% Effective Storage Depth
75% Effective Storage Depth
Measured data
Time (min)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
170
180
190
Depth (m bgl)
1.40
1.50
1.60
1.70
1.80
1.90
2.00
2.10
2.20

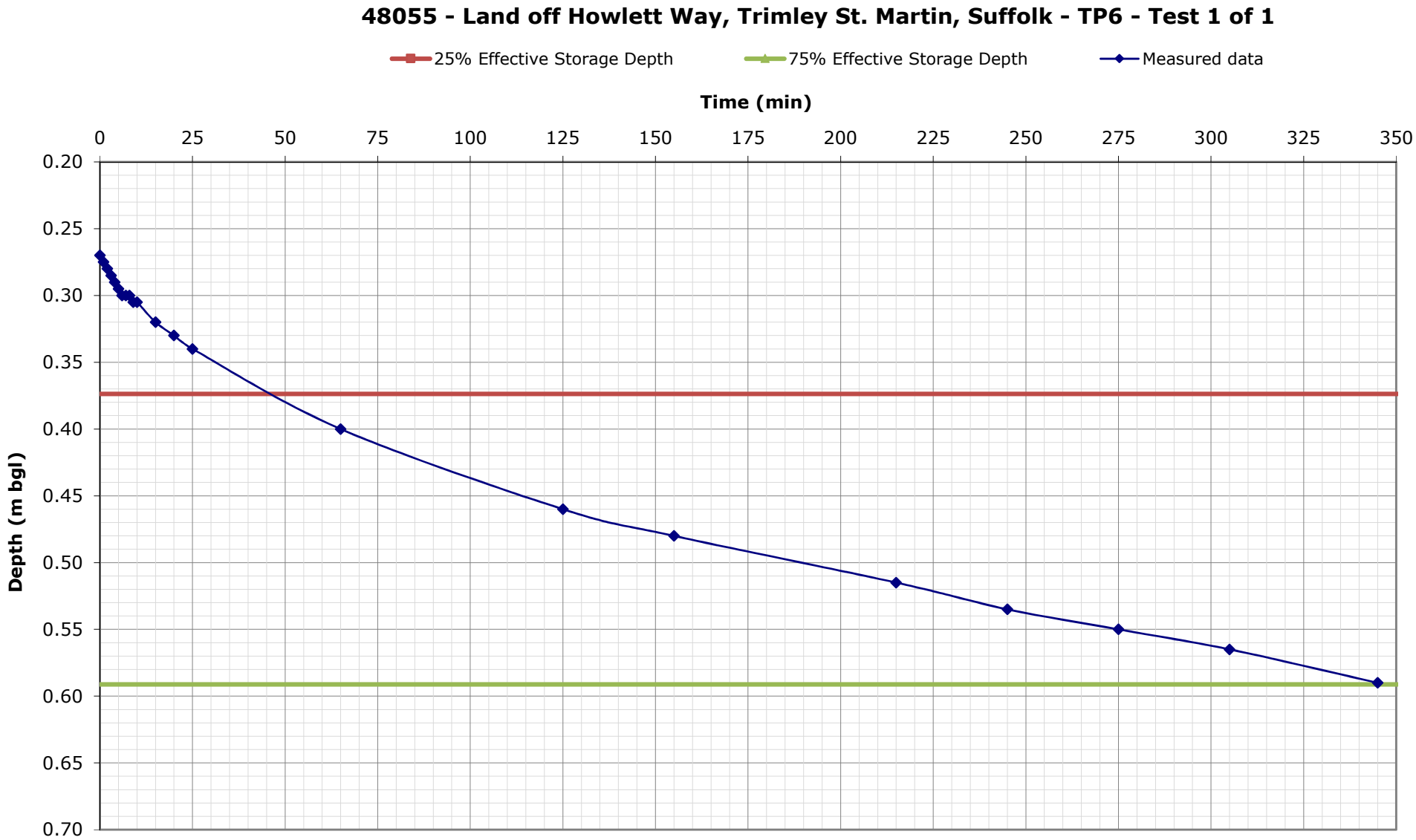

48055 - Land off Howlett Way, Trimley St. Martin, Suffolk - TP3 - Test 2 of 2
25% Effective Storage Depth
75% Effective Storage Depth
Measured data
Extrapolated Data
Time (min)
0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210 220 230 240 250
Depth (m bgl)
0.90 0.95 1.00 1.05 1.10 1.15 1.20 1.25 1.30 1.35 1.40 1.45 1.50 1.55 1.60

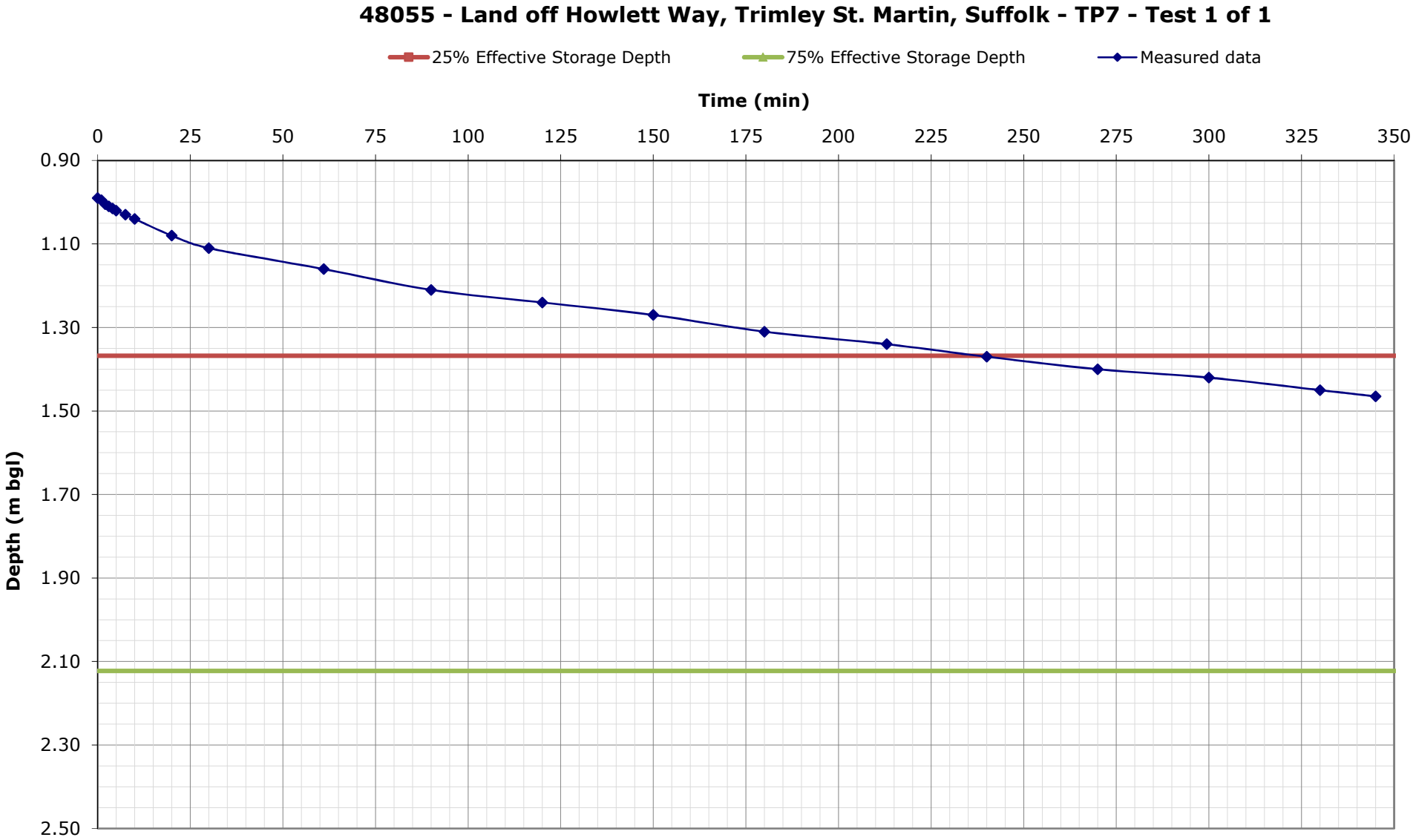

48055 - Land off Howlett Way, Trimley St. Martin, Suffolk - TP4 - Test 1 of 2
25% Effective Storage Depth
75% Effective Storage Depth
Measured data
Time (min)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
Depth (m bgl)
0.30
0.35
0.40
0.45
0.50
0.55
0.60
0.65
0.70

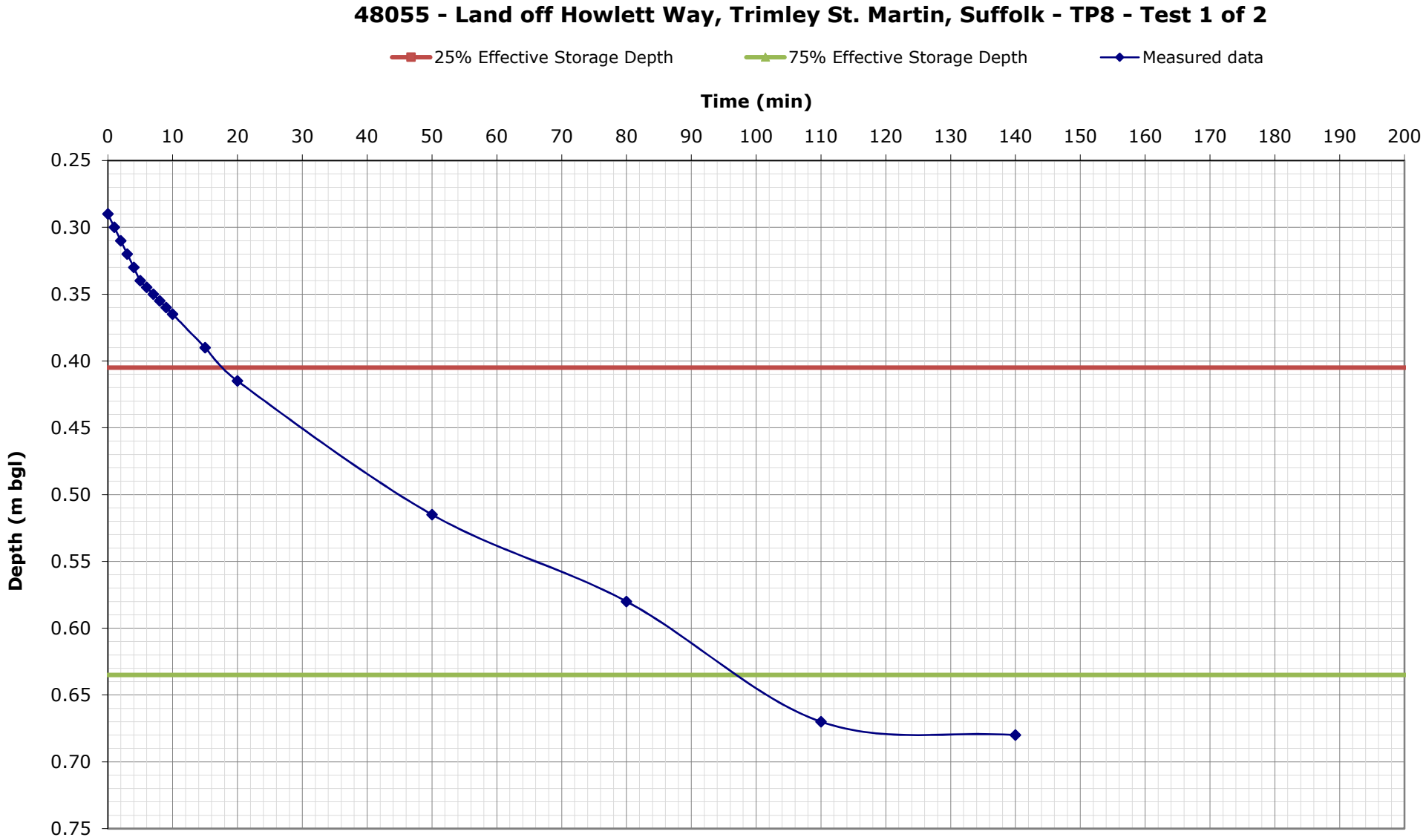

48055 - Land off Howlett Way, Trimley St. Martin, Suffolk - TP4 - Test 2 of 2
25% Effective Storage Depth
75% Effective Storage Depth
Measured data
Extrapolated data
Time (min)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
170
180
Depth (m bgl)
0.40
0.45
0.50
0.55
0.60
0.65
0.70

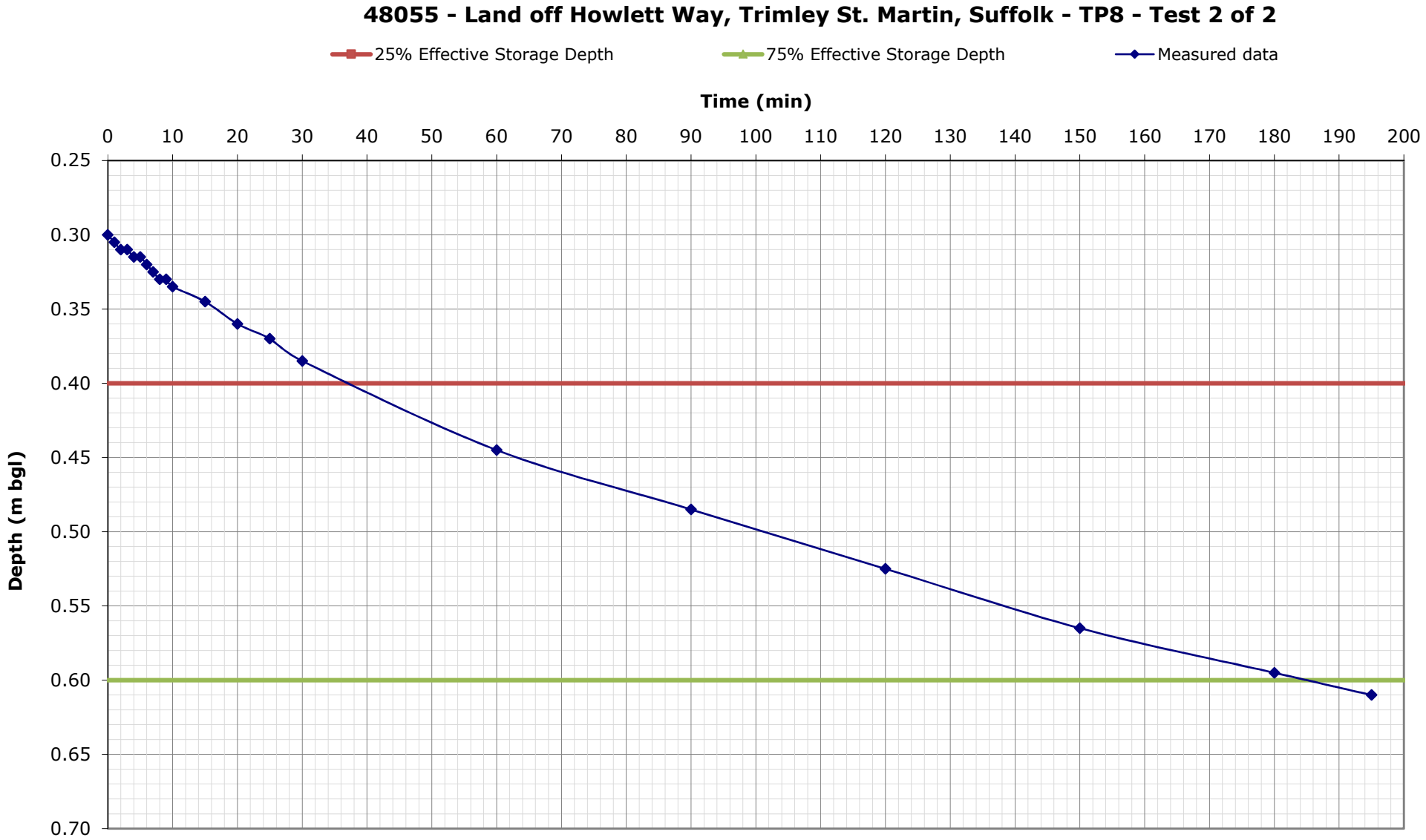

48055 - Land off Howlett Way, Trimley St. Martin, Suffolk - TP5 - Test 1 of 2
25% Effective Storage Depth
75% Effective Storage Depth
Measured data
Time (min)
0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210 220 230 240 250 260
Depth (m bgl)
0.20 0.25 0.30 0.35 0.40 0.45 0.50 0.55 0.60 0.65 0.70

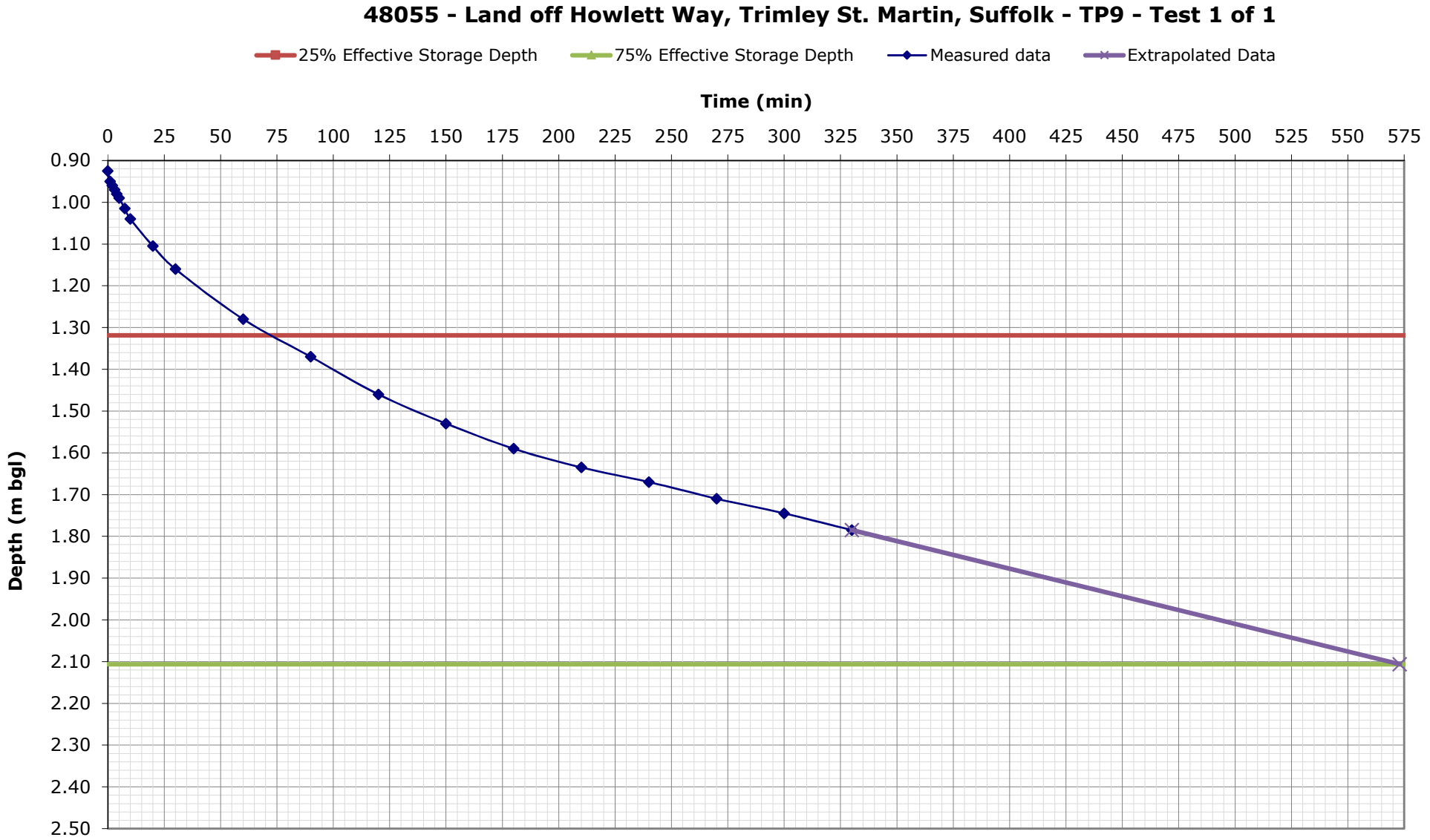

48055 - Land off Howlett Way, Trimley St. Martin, Suffolk - TP5 - Test 2 of 2
25% Effective Storage Depth
75% Effective Storage Depth
Measured data
Extrapolated Data
Time (min)
0
20
40
60
80
100
120
140
160
180
200
220
240
260
280
300
320
Depth (m bgl)
0.25
0.30
0.35
0.40
0.45
0.50
0.55
0.60
0.65


48055 - Land off Howlett Way, Trimley St. Martin, Suffolk - TP6 - Test 1 of 1
25% Effective Storage Depth
75% Effective Storage Depth
Measured data
Time (min)
0
25
50
75
100
125
150
175
200
225
250
275
300
325
350
Depth (m bgl)
0.20
0.25
0.30
0.35
0.40
0.45
0.50
0.55
0.60
0.65
0.70


48055 - Land off Howlett Way, Trimley St. Martin, Suffolk - TP7 - Test 1 of 1
25% Effective Storage Depth
75% Effective Storage Depth
Measured data
Time (min)
0
25
50
75
100
125
150
175
200
225
250
275
300
325
350
Depth (m bgl)
0.90
1.10
1.30
1.50
1.70
1.90
2.10
2.30
2.50


48055 - Land off Howlett Way, Trimley St. Martin, Suffolk - TP8 - Test 1 of 2
25% Effective Storage Depth
75% Effective Storage Depth
Measured data
Time (min)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
170
180
190
200
Depth (m bgl)
0.25
0.30
0.35
0.40
0.45
0.50
0.55
0.60
0.65
0.70
0.75


48055 - Land off Howlett Way, Trimley St. Martin, Suffolk - TP8 - Test 2 of 2
25% Effective Storage Depth
75% Effective Storage Depth
Measured data
Time (min)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
170
180
190
200
Depth (m bgl)
0.25
0.30
0.35
0.40
0.45
0.50
0.55
0.60
0.65
0.70


48055 - Land off Howlett Way, Trimley St. Martin, Suffolk - TP9 - Test 1 of 1
25% Effective Storage Depth
75% Effective Storage Depth
Measured data
Extrapolated Data
Time (min)
0
25
50
75
100
125
150
175
200
225
250
275
300
325
350
375
400
425
450
475
500
525
550
575
Depth (m bgl)
0.90
1.00
1.10
1.20
1.30
1.40
1.50
1.60
1.70
1.80
1.90
2.00
2.10
2.20
2.30
2.40
2.50

Limitations of Use

This report is based on the results of the exploratory boreholes, the laboratory testing carried out on samples recovered from those boreholes and on details of the scheme provided by the Client.

This report has been prepared for the benefit of Trinity College, Cambridge, and its contents should not be relied upon by others without the written authority of Richard Jackson Ltd. If any unauthorised third party makes use of this report they do so at their own risk and Richard Jackson Ltd owes them no duty of care or skill.

All information provided by others is taken as being in good faith as being accurate, but Richard Jackson Ltd cannot, and does not, accept any liability for the detailed accuracy, errors or omissions in such information.

Subsoils are by their nature hidden from view and no investigation can be exhaustive to the extent that all soil conditions are revealed. Conditions may well be present beneath the site which was not evident from the investigations carried out.

Geological data, with the exception of geological maps held by Richard Jackson Ltd, Ordnance Survey maps and aerial photographs have not been inspected, nor has any other data relating to site conditions past or present, or any information regarding underground services, other than as indicated.

Groundwater levels can be subject to considerable seasonal variations, and the conditions encountered in the exploratory holes may not reflect long-term conditions.

There can be no guarantee that the samples analysed represent the highest concentrations of contamination present beneath the site. The chemical analysis results have been assessed to standards appropriate at the time of investigation.

Unless a greater period of retention of samples is agreed, it is our normal practice to discard all samples one month after submission of our final report.

RichardJackson
Engineering Consultants

APPENDIX E

Summary of Results for 100 year Return Period (+40%)

Half Drain Time : 539 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	18.251	0.441	0.1	3.9	Flood Risk
30 min Summer	18.296	0.486	0.1	4.4	Flood Risk
60 min Summer	18.341	0.531	0.1	4.9	Flood Risk
120 min Summer	18.382	0.572	0.1	5.4	Flood Risk
180 min Summer	18.399	0.589	0.1	5.6	Flood Risk
240 min Summer	18.406	0.596	0.1	5.7	Flood Risk
360 min Summer	18.404	0.594	0.1	5.7	Flood Risk
480 min Summer	18.393	0.583	0.1	5.6	Flood Risk
600 min Summer	18.382	0.572	0.1	5.4	Flood Risk
720 min Summer	18.371	0.561	0.1	5.3	Flood Risk
960 min Summer	18.339	0.529	0.1	4.9	Flood Risk
1440 min Summer	18.283	0.473	0.1	4.3	Flood Risk
2160 min Summer	18.212	0.402	0.1	3.4	Flood Risk
2880 min Summer	18.155	0.345	0.1	2.8	O K
4320 min Summer	18.077	0.267	0.1	1.9	O K
5760 min Summer	18.029	0.219	0.1	1.3	O K
7200 min Summer	18.004	0.194	0.1	1.0	O K
8640 min Summer	17.985	0.175	0.1	0.8	O K
10080 min Summer	17.969	0.159	0.1	0.7	O K
15 min Winter	18.294	0.484	0.1	4.4	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15 min Summer	222.561	0.0	19
30 min Summer	127.086	0.0	34
60 min Summer	72.568	0.0	64
120 min Summer	41.437	0.0	122
180 min Summer	29.856	0.0	182
240 min Summer	23.661	0.0	242
360 min Summer	17.048	0.0	360
480 min Summer	13.511	0.0	428
600 min Summer	11.281	0.0	482
720 min Summer	9.735	0.0	544
960 min Summer	7.594	0.0	672
1440 min Summer	5.351	0.0	938
2160 min Summer	3.770	0.0	1336
2880 min Summer	2.941	0.0	1704
4320 min Summer	2.116	0.0	2420
5760 min Summer	1.675	0.0	3064
7200 min Summer	1.397	0.0	3752
8640 min Summer	1.205	0.0	4496
10080 min Summer	1.063	0.0	5240
15 min Winter	222.561	0.0	19

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
30 min Winter	18.345	0.535	0.1	5.0	Flood Risk
60 min Winter	18.397	0.587	0.1	5.6	Flood Risk
120 min Winter	18.445	0.635	0.1	6.2	Flood Risk
180 min Winter	18.467	0.657	0.1	6.4	Flood Risk
240 min Winter	18.479	0.669	0.1	6.5	Flood Risk
360 min Winter	18.483	0.673	0.1	6.6	Flood Risk
480 min Winter	18.474	0.664	0.1	6.5	Flood Risk
600 min Winter	18.458	0.648	0.1	6.3	Flood Risk
720 min Winter	18.442	0.632	0.1	6.1	Flood Risk
960 min Winter	18.403	0.593	0.1	5.7	Flood Risk
1440 min Winter	18.325	0.515	0.1	4.8	Flood Risk
2160 min Winter	18.222	0.412	0.1	3.6	Flood Risk
2880 min Winter	18.138	0.328	0.1	2.6	O K
4320 min Winter	18.035	0.225	0.1	1.4	O K
5760 min Winter	17.996	0.186	0.1	0.9	O K
7200 min Winter	17.970	0.160	0.1	0.7	O K
8640 min Winter	17.950	0.140	0.1	0.5	O K
10080 min Winter	17.934	0.124	0.1	0.4	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
30 min Winter	127.086	0.0	33
60 min Winter	72.568	0.0	62
120 min Winter	41.437	0.0	120
180 min Winter	29.856	0.0	178
240 min Winter	23.661	0.0	236
360 min Winter	17.048	0.0	350
480 min Winter	13.511	0.0	458
600 min Winter	11.281	0.0	560
720 min Winter	9.735	0.0	584
960 min Winter	7.594	0.0	730
1440 min Winter	5.351	0.0	1024
2160 min Winter	3.770	0.0	1432
2880 min Winter	2.941	0.0	1816
4320 min Winter	2.116	0.0	2460
5760 min Winter	1.675	0.0	3120
7200 min Winter	1.397	0.0	3816
8640 min Winter	1.205	0.0	4504
10080 min Winter	1.063	0.0	5240

Rainfall Details

Rainfall Model	FEH	D3 (1km)	0.275	Cv (Winter)	0.840
Return Period (years)	100	E (1km)	0.310	Shortest Storm (mins)	15
Site Location		F (1km)	2.522	Longest Storm (mins)	10080
C (1km)	-0.019	Summer Storms	Yes	Climate Change %	+40
D1 (1km)	0.279	Winter Storms	Yes		
D2 (1km)	0.224	Cv (Summer)	0.750		

Time Area Diagram

Total Area (ha) 0.010

Time (mins) From:	To:	Area (ha)
0	4	0.010

Model Details

Storage is Online Cover Level (m) 18.500

Porous Car Park Structure

Infiltration Coefficient Base (m/hr)	0.01940	Width (m)	3.0
Membrane Percolation (mm/hr)	1000	Length (m)	13.0
Max Percolation (l/s)	10.8	Slope (1:X)	60.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	17.810	Cap Volume Depth (m)	0.625

Summary of Results for 100 year Return Period (+40%)

Half Drain Time : 1153 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	18.253	0.493	1.3	91.1	Flood Risk
30 min Summer	18.288	0.528	1.3	104.3	Flood Risk
60 min Summer	18.326	0.566	1.3	118.6	Flood Risk
120 min Summer	18.366	0.606	1.3	133.6	Flood Risk
180 min Summer	18.389	0.629	1.3	142.0	Flood Risk
240 min Summer	18.403	0.643	1.3	147.5	Flood Risk
360 min Summer	18.421	0.661	1.3	154.1	Flood Risk
480 min Summer	18.430	0.670	1.3	157.4	Flood Risk
600 min Summer	18.433	0.673	1.3	158.8	Flood Risk
720 min Summer	18.434	0.674	1.3	158.9	Flood Risk
960 min Summer	18.420	0.660	1.3	153.9	Flood Risk
1440 min Summer	18.398	0.638	1.3	145.5	Flood Risk
2160 min Summer	18.368	0.608	1.3	134.3	Flood Risk
2880 min Summer	18.340	0.580	1.3	123.7	Flood Risk
4320 min Summer	18.299	0.539	1.3	108.4	Flood Risk
5760 min Summer	18.264	0.504	1.3	95.3	Flood Risk
7200 min Summer	18.237	0.477	1.3	85.3	Flood Risk
8640 min Summer	18.212	0.452	1.2	76.8	Flood Risk
10080 min Summer	18.190	0.430	1.2	69.5	O K
15 min Winter	18.284	0.524	1.3	102.9	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15 min Summer	222.561	0.0	23
30 min Summer	127.086	0.0	37
60 min Summer	72.568	0.0	68
120 min Summer	41.437	0.0	126
180 min Summer	29.856	0.0	186
240 min Summer	23.661	0.0	244
360 min Summer	17.048	0.0	364
480 min Summer	13.511	0.0	482
600 min Summer	11.281	0.0	602
720 min Summer	9.735	0.0	720
960 min Summer	7.594	0.0	860
1440 min Summer	5.351	0.0	1084
2160 min Summer	3.770	0.0	1472
2880 min Summer	2.941	0.0	1876
4320 min Summer	2.116	0.0	2680
5760 min Summer	1.675	0.0	3456
7200 min Summer	1.397	0.0	4184
8640 min Summer	1.205	0.0	4936
10080 min Summer	1.063	0.0	5656
15 min Winter	222.561	0.0	23

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
30 min Winter	18.324	0.564	1.3	117.8	Flood Risk
60 min Winter	18.367	0.607	1.3	134.0	Flood Risk
120 min Winter	18.413	0.653	1.3	151.1	Flood Risk
180 min Winter	18.439	0.679	1.3	160.9	Flood Risk
240 min Winter	18.457	0.697	1.3	167.4	Flood Risk
360 min Winter	18.480	0.720	1.3	175.5	Flood Risk
480 min Winter	18.493	0.733	1.3	179.9	Flood Risk
600 min Winter	18.500	0.740	1.3	182.2	Flood Risk
720 min Winter	18.501	0.741	1.3	183.1	FLOOD
960 min Winter	18.489	0.729	1.3	178.7	Flood Risk
1440 min Winter	18.456	0.696	1.3	167.2	Flood Risk
2160 min Winter	18.417	0.657	1.3	152.5	Flood Risk
2880 min Winter	18.378	0.618	1.3	137.8	Flood Risk
4320 min Winter	18.317	0.557	1.3	115.2	Flood Risk
5760 min Winter	18.266	0.506	1.3	96.2	Flood Risk
7200 min Winter	18.229	0.469	1.3	82.5	Flood Risk
8640 min Winter	18.197	0.437	1.2	71.5	O K
10080 min Winter	18.168	0.408	1.1	62.3	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
30 min Winter	127.086	0.0	37
60 min Winter	72.568	0.0	66
120 min Winter	41.437	0.0	124
180 min Winter	29.856	0.0	182
240 min Winter	23.661	0.0	240
360 min Winter	17.048	0.0	358
480 min Winter	13.511	0.0	472
600 min Winter	11.281	0.0	588
720 min Winter	9.735	0.7	700
960 min Winter	7.594	0.0	918
1440 min Winter	5.351	0.0	1160
2160 min Winter	3.770	0.0	1604
2880 min Winter	2.941	0.0	2048
4320 min Winter	2.116	0.0	2892
5760 min Winter	1.675	0.0	3640
7200 min Winter	1.397	0.0	4400
8640 min Winter	1.205	0.0	5184
10080 min Winter	1.063	0.0	5944

Rainfall Details

Rainfall Model	FEH	D3 (1km)	0.275	Cv (Winter)	0.840
Return Period (years)	100	E (1km)	0.310	Shortest Storm (mins)	15
Site Location		F (1km)	2.522	Longest Storm (mins)	10080
C (1km)	-0.019	Summer Storms	Yes	Climate Change %	+40
D1 (1km)	0.279	Winter Storms	Yes		
D2 (1km)	0.224	Cv (Summer)	0.750		

Time Area Diagram

Total Area (ha) 0.236

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.125	4	8	0.111

Model Details

Storage is Online Cover Level (m) 18.500

Porous Car Park Structure

Infiltration Coefficient Base (m/hr)	0.01940	Width (m)	25.0
Membrane Percolation (mm/hr)	1000	Length (m)	50.0
Max Percolation (l/s)	347.2	Slope (1:X)	100.0
Safety Factor	5.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	17.760	Cap Volume Depth (m)	0.675

APPENDIX F

Summary of Results for 100 year Return Period (+20%)

Half Drain Time : 2551 minutes.

	Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15	min Summer	22.093	0.893	1.9	329.9	O K
30	min Summer	22.170	0.970	2.0	375.9	O K
60	min Summer	22.253	1.053	2.1	427.4	O K
120	min Summer	22.340	1.140	2.3	483.7	O K
180	min Summer	22.391	1.191	2.3	518.2	O K
240	min Summer	22.427	1.227	2.4	542.9	O K
360	min Summer	22.476	1.276	2.4	577.0	O K
480	min Summer	22.508	1.308	2.5	599.8	O K
600	min Summer	22.531	1.331	2.5	616.1	O K
720	min Summer	22.547	1.347	2.5	627.9	O K
960	min Summer	22.553	1.353	2.5	632.2	O K
1440	min Summer	22.545	1.345	2.5	626.5	O K
2160	min Summer	22.516	1.316	2.5	605.7	O K
2880	min Summer	22.491	1.291	2.5	587.6	O K
4320	min Summer	22.464	1.264	2.4	568.6	O K
5760	min Summer	22.433	1.233	2.4	546.6	O K
7200	min Summer	22.399	1.199	2.3	523.7	O K
8640	min Summer	22.365	1.165	2.3	500.9	O K
10080	min Summer	22.332	1.132	2.3	478.7	O K
15	min Winter	22.159	0.959	2.0	369.7	O K

	Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15	min Summer	190.767	0.0	43
30	min Summer	108.930	0.0	57
60	min Summer	62.201	0.0	86
120	min Summer	35.518	0.0	146
180	min Summer	25.591	0.0	204
240	min Summer	20.281	0.0	264
360	min Summer	14.613	0.0	382
480	min Summer	11.581	0.0	500
600	min Summer	9.669	0.0	618
720	min Summer	8.344	0.0	736
960	min Summer	6.509	0.0	974
1440	min Summer	4.586	0.0	1446
2160	min Summer	3.232	0.0	1864
2880	min Summer	2.521	0.0	2228
4320	min Summer	1.813	0.0	3004
5760	min Summer	1.436	0.0	3824
7200	min Summer	1.197	0.0	4632
8640	min Summer	1.033	0.0	5464
10080	min Summer	0.911	0.0	6272
15	min Winter	190.767	0.0	43

Summary of Results for 100 year Return Period (+20%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
30 min Winter	22.243	1.043	2.1	421.4	O K
60 min Winter	22.333	1.133	2.3	479.2	O K
120 min Winter	22.427	1.227	2.4	542.7	O K
180 min Winter	22.483	1.283	2.5	581.9	O K
240 min Winter	22.522	1.322	2.5	610.0	O K
360 min Winter	22.576	1.376	2.6	649.2	O K
480 min Winter	22.611	1.411	2.6	675.6	O K
600 min Winter	22.637	1.437	2.7	694.8	O K
720 min Winter	22.655	1.455	2.7	709.0	O K
960 min Winter	22.664	1.464	2.7	715.8	O K
1440 min Winter	22.661	1.461	2.7	713.5	O K
2160 min Winter	22.634	1.434	2.7	692.5	O K
2880 min Winter	22.600	1.400	2.6	667.2	O K
4320 min Winter	22.565	1.365	2.6	640.9	O K
5760 min Winter	22.521	1.321	2.5	608.9	O K
7200 min Winter	22.474	1.274	2.4	575.7	O K
8640 min Winter	22.427	1.227	2.4	542.9	O K
10080 min Winter	22.381	1.181	2.3	511.5	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
30 min Winter	108.930	0.0	57
60 min Winter	62.201	0.0	86
120 min Winter	35.518	0.0	144
180 min Winter	25.591	0.0	202
240 min Winter	20.281	0.0	260
360 min Winter	14.613	0.0	374
480 min Winter	11.581	0.0	490
600 min Winter	9.669	0.0	606
720 min Winter	8.344	0.0	722
960 min Winter	6.509	0.0	954
1440 min Winter	4.586	0.0	1406
2160 min Winter	3.232	0.0	2044
2880 min Winter	2.521	0.0	2324
4320 min Winter	1.813	0.0	3224
5760 min Winter	1.436	0.0	4152
7200 min Winter	1.197	0.0	5048
8640 min Winter	1.033	0.0	5896
10080 min Winter	0.911	0.0	6768

Rainfall Details

Rainfall Model	FEH	D3 (1km)	0.275	Cv (Winter)	0.840
Return Period (years)	100	E (1km)	0.310	Shortest Storm (mins)	15
Site Location		F (1km)	2.522	Longest Storm (mins)	10080
C (1km)	-0.019	Summer Storms	Yes	Climate Change %	+20
D1 (1km)	0.279	Winter Storms	Yes		
D2 (1km)	0.224	Cv (Summer)	0.750		

Time Area Diagram

Total Area (ha) 0.930

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.000	8	12	0.155	16	20	0.155	24	28	0.155
4	8	0.155	12	16	0.155	20	24	0.155			

Model Details

Storage is Online Cover Level (m) 23.000

Infiltration Basin Structure

Invert Level (m) 21.200 Safety Factor 5.0
Infiltration Coefficient Base (m/hr) 0.03600 Porosity 1.00
Infiltration Coefficient Side (m/hr) 0.03600

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	217.6	0.601	499.0	1.801	0.0
0.600	361.0	1.800	892.0		

Summary of Results for 100 year Return Period (+40%)

Half Drain Time : 2804 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	22.185	0.985	2.1	385.2	O K
30 min Summer	22.271	1.071	2.2	439.0	O K
60 min Summer	22.363	1.163	2.3	499.2	O K
120 min Summer	22.460	1.260	2.4	565.4	O K
180 min Summer	22.517	1.317	2.5	606.1	O K
240 min Summer	22.557	1.357	2.6	635.4	O K
360 min Summer	22.612	1.412	2.6	676.3	O K
480 min Summer	22.649	1.449	2.7	703.9	O K
600 min Summer	22.674	1.474	2.7	723.8	O K
720 min Summer	22.694	1.494	2.7	738.7	O K
960 min Summer	22.703	1.503	2.8	745.7	Flood Risk
1440 min Summer	22.699	1.499	2.7	742.8	O K
2160 min Summer	22.670	1.470	2.7	720.7	O K
2880 min Summer	22.644	1.444	2.7	700.6	O K
4320 min Summer	22.618	1.418	2.6	680.8	O K
5760 min Summer	22.587	1.387	2.6	657.7	O K
7200 min Summer	22.554	1.354	2.5	633.0	O K
8640 min Summer	22.520	1.320	2.5	608.4	O K
10080 min Summer	22.486	1.286	2.5	584.1	O K
15 min Winter	22.259	1.059	2.2	431.6	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15 min Summer	222.561	0.0	43
30 min Summer	127.086	0.0	57
60 min Summer	72.568	0.0	86
120 min Summer	41.437	0.0	146
180 min Summer	29.856	0.0	204
240 min Summer	23.661	0.0	264
360 min Summer	17.048	0.0	382
480 min Summer	13.511	0.0	500
600 min Summer	11.281	0.0	618
720 min Summer	9.735	0.0	738
960 min Summer	7.594	0.0	974
1440 min Summer	5.351	0.0	1448
2160 min Summer	3.770	0.0	1948
2880 min Summer	2.941	0.0	2292
4320 min Summer	2.116	0.0	3052
5760 min Summer	1.675	0.0	3880
7200 min Summer	1.397	0.0	4696
8640 min Summer	1.205	0.0	5536
10080 min Summer	1.063	0.0	6360
15 min Winter	222.561	0.0	43

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
30 min Winter	22.352	1.152	2.3	492.0	O K
60 min Winter	22.451	1.251	2.4	559.7	O K
120 min Winter	22.556	1.356	2.6	634.3	O K
180 min Winter	22.618	1.418	2.6	680.4	O K
240 min Winter	22.661	1.461	2.7	713.8	O K
360 min Winter	22.721	1.521	2.8	760.5	Flood Risk
480 min Winter	22.761	1.561	2.8	792.4	Flood Risk
600 min Winter	22.790	1.590	2.9	815.8	Flood Risk
720 min Winter	22.812	1.612	2.9	833.4	Flood Risk
960 min Winter	22.824	1.624	2.9	843.3	Flood Risk
1440 min Winter	22.825	1.625	2.9	844.3	Flood Risk
2160 min Winter	22.801	1.601	2.9	824.7	Flood Risk
2880 min Winter	22.765	1.565	2.8	795.7	Flood Risk
4320 min Winter	22.732	1.532	2.8	769.0	Flood Risk
5760 min Winter	22.690	1.490	2.7	735.7	O K
7200 min Winter	22.643	1.443	2.7	699.9	O K
8640 min Winter	22.596	1.396	2.6	664.2	O K
10080 min Winter	22.549	1.349	2.5	629.3	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
30 min Winter	127.086	0.0	57
60 min Winter	72.568	0.0	86
120 min Winter	41.437	0.0	144
180 min Winter	29.856	0.0	202
240 min Winter	23.661	0.0	260
360 min Winter	17.048	0.0	376
480 min Winter	13.511	0.0	492
600 min Winter	11.281	0.0	608
720 min Winter	9.735	0.0	724
960 min Winter	7.594	0.0	956
1440 min Winter	5.351	0.0	1410
2160 min Winter	3.770	0.0	2060
2880 min Winter	2.941	0.0	2576
4320 min Winter	2.116	0.0	3264
5760 min Winter	1.675	0.0	4200
7200 min Winter	1.397	0.0	5112
8640 min Winter	1.205	0.0	5976
10080 min Winter	1.063	0.0	6864

Rainfall Details

Rainfall Model	FEH	D3 (1km)	0.275	Cv (Winter)	0.840
Return Period (years)	100	E (1km)	0.310	Shortest Storm (mins)	15
Site Location		F (1km)	2.522	Longest Storm (mins)	10080
C (1km)	-0.019	Summer Storms	Yes	Climate Change %	+40
D1 (1km)	0.279	Winter Storms	Yes		
D2 (1km)	0.224	Cv (Summer)	0.750		

Time Area Diagram

Total Area (ha) 0.930

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.000	8	12	0.155	16	20	0.155	24	28	0.155
4	8	0.155	12	16	0.155	20	24	0.155			

Model Details

Storage is Online Cover Level (m) 23.000

Infiltration Basin Structure

Invert Level (m) 21.200 Safety Factor 5.0
Infiltration Coefficient Base (m/hr) 0.03600 Porosity 1.00
Infiltration Coefficient Side (m/hr) 0.03600

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	217.6	0.601	499.0	1.801	0.0
0.600	361.0	1.800	892.0		

Summary of Results for 100 year Return Period (+20%)

Half Drain Time : 2379 minutes.

	Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15	min Summer	17.688	0.988	1.9	304.2	O K
30	min Summer	17.767	1.067	2.0	346.5	O K
60	min Summer	17.850	1.150	2.1	393.7	O K
120	min Summer	17.936	1.236	2.2	445.4	O K
180	min Summer	17.986	1.286	2.3	476.9	O K
240	min Summer	18.021	1.321	2.4	499.3	O K
360	min Summer	18.068	1.368	2.4	530.1	O K
480	min Summer	18.098	1.398	2.5	550.4	O K
600	min Summer	18.119	1.419	2.5	564.7	O K
720	min Summer	18.133	1.433	2.5	574.9	O K
960	min Summer	18.137	1.437	2.5	577.6	O K
1440	min Summer	18.126	1.426	2.5	569.8	O K
2160	min Summer	18.098	1.398	2.5	550.8	O K
2880	min Summer	18.075	1.375	2.4	534.7	O K
4320	min Summer	18.048	1.348	2.4	517.2	O K
5760	min Summer	18.017	1.317	2.3	496.7	O K
7200	min Summer	17.984	1.284	2.3	475.6	O K
8640	min Summer	17.951	1.251	2.2	454.6	O K
10080	min Summer	17.918	1.218	2.2	434.4	O K
15	min Winter	17.756	1.056	2.0	340.8	O K

	Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15	min Summer	190.767	0.0	35
30	min Summer	108.930	0.0	50
60	min Summer	62.201	0.0	80
120	min Summer	35.518	0.0	138
180	min Summer	25.591	0.0	198
240	min Summer	20.281	0.0	256
360	min Summer	14.613	0.0	376
480	min Summer	11.581	0.0	494
600	min Summer	9.669	0.0	612
720	min Summer	8.344	0.0	732
960	min Summer	6.509	0.0	970
1440	min Summer	4.586	0.0	1444
2160	min Summer	3.232	0.0	1796
2880	min Summer	2.521	0.0	2148
4320	min Summer	1.813	0.0	2952
5760	min Summer	1.436	0.0	3768
7200	min Summer	1.197	0.0	4616
8640	min Summer	1.033	0.0	5448
10080	min Summer	0.911	0.0	6248
15	min Winter	190.767	0.0	35

Summary of Results for 100 year Return Period (+20%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
30 min Winter	17.840	1.140	2.1	388.3	O K
60 min Winter	17.929	1.229	2.2	441.4	O K
120 min Winter	18.021	1.321	2.4	499.6	O K
180 min Winter	18.075	1.375	2.4	535.3	O K
240 min Winter	18.113	1.413	2.5	560.8	O K
360 min Winter	18.164	1.464	2.6	596.1	O K
480 min Winter	18.197	1.497	2.6	619.7	O K
600 min Winter	18.220	1.520	2.7	636.5	Flood Risk
720 min Winter	18.237	1.537	2.7	648.8	Flood Risk
960 min Winter	18.243	1.543	2.7	653.6	Flood Risk
1440 min Winter	18.237	1.537	2.7	648.9	Flood Risk
2160 min Winter	18.206	1.506	2.6	626.6	Flood Risk
2880 min Winter	18.176	1.476	2.6	604.9	O K
4320 min Winter	18.139	1.439	2.5	579.1	O K
5760 min Winter	18.095	1.395	2.5	548.5	O K
7200 min Winter	18.048	1.348	2.4	517.3	O K
8640 min Winter	18.002	1.302	2.3	486.9	O K
10080 min Winter	17.956	1.256	2.3	458.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
30 min Winter	108.930	0.0	49
60 min Winter	62.201	0.0	78
120 min Winter	35.518	0.0	136
180 min Winter	25.591	0.0	194
240 min Winter	20.281	0.0	252
360 min Winter	14.613	0.0	368
480 min Winter	11.581	0.0	486
600 min Winter	9.669	0.0	602
720 min Winter	8.344	0.0	718
960 min Winter	6.509	0.0	948
1440 min Winter	4.586	0.0	1396
2160 min Winter	3.232	0.0	2016
2880 min Winter	2.521	0.0	2264
4320 min Winter	1.813	0.0	3172
5760 min Winter	1.436	0.0	4096
7200 min Winter	1.197	0.0	4976
8640 min Winter	1.033	0.0	5808
10080 min Winter	0.911	0.0	6664

Rainfall Details

Rainfall Model	FEH	D3 (1km)	0.275	Cv (Winter)	0.840
Return Period (years)	100	E (1km)	0.310	Shortest Storm (mins)	15
Site Location		F (1km)	2.522	Longest Storm (mins)	10080
C (1km)	-0.019	Summer Storms	Yes	Climate Change %	+20
D1 (1km)	0.279	Winter Storms	Yes		
D2 (1km)	0.224	Cv (Summer)	0.750		

Time Area Diagram

Total Area (ha) 0.856

Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)
0	4	0.000	8	12	0.214	16	20	0.214
4	8	0.214	12	16	0.214			

Model Details

Storage is Online Cover Level (m) 18.500

Infiltration Basin Structure

Invert Level (m) 16.700 Safety Factor 5.0
Infiltration Coefficient Base (m/hr) 0.03600 Porosity 1.00
Infiltration Coefficient Side (m/hr) 0.03600

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	152.4	0.601	398.4	1.801	0.0
0.600	271.6	1.800	850.3		

Summary of Results for 100 year Return Period (+40%)

Half Drain Time : 2560 minutes.

	Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15	min Summer	17.782	1.082	2.0	355.0	O K
30	min Summer	17.868	1.168	2.1	404.5	O K
60	min Summer	17.959	1.259	2.3	459.8	O K
120	min Summer	18.053	1.353	2.4	520.4	O K
180	min Summer	18.108	1.408	2.5	557.6	O K
240	min Summer	18.147	1.447	2.6	584.2	O K
360	min Summer	18.199	1.499	2.6	621.0	O K
480	min Summer	18.232	1.532	2.7	645.6	Flood Risk
600	min Summer	18.256	1.556	2.7	663.1	Flood Risk
720	min Summer	18.273	1.573	2.8	675.9	Flood Risk
960	min Summer	18.280	1.580	2.8	680.7	Flood Risk
1440	min Summer	18.272	1.572	2.8	674.9	Flood Risk
2160	min Summer	18.243	1.543	2.7	653.6	Flood Risk
2880	min Summer	18.219	1.519	2.7	635.5	Flood Risk
4320	min Summer	18.193	1.493	2.6	617.0	O K
5760	min Summer	18.162	1.462	2.6	595.1	O K
7200	min Summer	18.129	1.429	2.5	572.1	O K
8640	min Summer	18.096	1.396	2.5	549.1	O K
10080	min Summer	18.062	1.362	2.4	526.6	O K
15	min Winter	17.856	1.156	2.1	397.7	O K

	Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15	min Summer	222.561	0.0	35
30	min Summer	127.086	0.0	50
60	min Summer	72.568	0.0	80
120	min Summer	41.437	0.0	138
180	min Summer	29.856	0.0	198
240	min Summer	23.661	0.0	258
360	min Summer	17.048	0.0	376
480	min Summer	13.511	0.0	494
600	min Summer	11.281	0.0	614
720	min Summer	9.735	0.0	732
960	min Summer	7.594	0.0	970
1440	min Summer	5.351	0.0	1446
2160	min Summer	3.770	0.0	1852
2880	min Summer	2.941	0.0	2220
4320	min Summer	2.116	0.0	2996
5760	min Summer	1.675	0.0	3816
7200	min Summer	1.397	0.0	4624
8640	min Summer	1.205	0.0	5456
10080	min Summer	1.063	0.0	6264
15	min Winter	222.561	0.0	35

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
30 min Winter	17.948	1.248	2.2	453.3	O K
60 min Winter	18.045	1.345	2.4	515.4	O K
120 min Winter	18.146	1.446	2.6	583.8	O K
180 min Winter	18.205	1.505	2.6	625.8	Flood Risk
240 min Winter	18.247	1.547	2.7	656.1	Flood Risk
360 min Winter	18.302	1.602	2.8	698.1	Flood Risk
480 min Winter	18.339	1.639	2.9	726.6	Flood Risk
600 min Winter	18.365	1.665	2.9	747.1	Flood Risk
720 min Winter	18.385	1.685	2.9	762.4	Flood Risk
960 min Winter	18.394	1.694	3.0	769.6	Flood Risk
1440 min Winter	18.391	1.691	2.9	767.4	Flood Risk
2160 min Winter	18.363	1.663	2.9	745.3	Flood Risk
2880 min Winter	18.330	1.630	2.8	719.6	Flood Risk
4320 min Winter	18.296	1.596	2.8	693.0	Flood Risk
5760 min Winter	18.252	1.552	2.7	660.3	Flood Risk
7200 min Winter	18.206	1.506	2.6	626.2	Flood Risk
8640 min Winter	18.159	1.459	2.6	592.6	O K
10080 min Winter	18.112	1.412	2.5	560.3	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
30 min Winter	127.086	0.0	49
60 min Winter	72.568	0.0	78
120 min Winter	41.437	0.0	136
180 min Winter	29.856	0.0	194
240 min Winter	23.661	0.0	252
360 min Winter	17.048	0.0	370
480 min Winter	13.511	0.0	486
600 min Winter	11.281	0.0	602
720 min Winter	9.735	0.0	718
960 min Winter	7.594	0.0	950
1440 min Winter	5.351	0.0	1400
2160 min Winter	3.770	0.0	2040
2880 min Winter	2.941	0.0	2312
4320 min Winter	2.116	0.0	3212
5760 min Winter	1.675	0.0	4144
7200 min Winter	1.397	0.0	5040
8640 min Winter	1.205	0.0	5888
10080 min Winter	1.063	0.0	6760

Rainfall Details

Rainfall Model	FEH	D3 (1km)	0.275	Cv (Winter)	0.840
Return Period (years)	100	E (1km)	0.310	Shortest Storm (mins)	15
Site Location		F (1km)	2.522	Longest Storm (mins)	10080
C (1km)	-0.019	Summer Storms	Yes	Climate Change %	+40
D1 (1km)	0.279	Winter Storms	Yes		
D2 (1km)	0.224	Cv (Summer)	0.750		

Time Area Diagram

Total Area (ha) 0.856

Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)
0	4	0.000	8	12	0.214	16	20	0.214
4	8	0.214	12	16	0.214			

Model Details

Storage is Online Cover Level (m) 18.500

Infiltration Basin Structure

Invert Level (m) 16.700 Safety Factor 5.0
Infiltration Coefficient Base (m/hr) 0.03600 Porosity 1.00
Infiltration Coefficient Side (m/hr) 0.03600

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	152.4	0.601	398.4	1.801	0.0
0.600	271.6	1.800	850.3		

APPENDIX G

Summary of Results for 100 year Return Period (+20%)

Half Drain Time : 2201 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	20.912	0.312	0.1	7.1	O K
30 min Summer	20.955	0.355	0.1	8.1	O K
60 min Summer	21.003	0.403	0.1	9.2	O K
120 min Summer	21.054	0.454	0.1	10.3	O K
180 min Summer	21.085	0.485	0.1	11.0	O K
240 min Summer	21.106	0.506	0.1	11.5	O K
360 min Summer	21.135	0.535	0.1	12.2	O K
480 min Summer	21.153	0.553	0.1	12.6	O K
600 min Summer	21.165	0.565	0.1	12.9	O K
720 min Summer	21.173	0.573	0.1	13.1	O K
960 min Summer	21.171	0.571	0.1	13.0	O K
1440 min Summer	21.154	0.554	0.1	12.6	O K
2160 min Summer	21.122	0.522	0.1	11.9	O K
2880 min Summer	21.094	0.494	0.1	11.3	O K
4320 min Summer	21.061	0.461	0.1	10.5	O K
5760 min Summer	21.029	0.429	0.1	9.8	O K
7200 min Summer	21.000	0.400	0.1	9.1	O K
8640 min Summer	20.973	0.373	0.1	8.5	O K
10080 min Summer	20.947	0.347	0.1	7.9	O K
15 min Winter	20.950	0.350	0.1	8.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15 min Summer	190.767	0.0	23
30 min Summer	108.930	0.0	38
60 min Summer	62.201	0.0	68
120 min Summer	35.518	0.0	128
180 min Summer	25.591	0.0	188
240 min Summer	20.281	0.0	248
360 min Summer	14.613	0.0	366
480 min Summer	11.581	0.0	486
600 min Summer	9.669	0.0	606
720 min Summer	8.344	0.0	726
960 min Summer	6.509	0.0	966
1440 min Summer	4.586	0.0	1444
2160 min Summer	3.232	0.0	1796
2880 min Summer	2.521	0.0	2164
4320 min Summer	1.813	0.0	2944
5760 min Summer	1.436	0.0	3800
7200 min Summer	1.197	0.0	4608
8640 min Summer	1.033	0.0	5440
10080 min Summer	0.911	0.0	6248
15 min Winter	190.767	0.0	23

Summary of Results for 100 year Return Period (+20%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
30 min Winter	20.998	0.398	0.1	9.1	O K
60 min Winter	21.051	0.451	0.1	10.3	O K
120 min Winter	21.110	0.510	0.1	11.6	O K
180 min Winter	21.145	0.545	0.1	12.4	O K
240 min Winter	21.170	0.570	0.1	13.0	O K
360 min Winter	21.203	0.603	0.1	13.8	O K
480 min Winter	21.225	0.625	0.1	14.3	O K
600 min Winter	21.240	0.640	0.1	14.6	O K
720 min Winter	21.251	0.651	0.1	14.8	O K
960 min Winter	21.251	0.651	0.1	14.9	O K
1440 min Winter	21.239	0.639	0.1	14.6	O K
2160 min Winter	21.205	0.605	0.1	13.8	O K
2880 min Winter	21.171	0.571	0.1	13.0	O K
4320 min Winter	21.127	0.527	0.1	12.0	O K
5760 min Winter	21.083	0.483	0.1	11.0	O K
7200 min Winter	21.040	0.440	0.1	10.0	O K
8640 min Winter	21.000	0.400	0.1	9.1	O K
10080 min Winter	20.963	0.363	0.1	8.3	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
30 min Winter	108.930	0.0	38
60 min Winter	62.201	0.0	68
120 min Winter	35.518	0.0	126
180 min Winter	25.591	0.0	186
240 min Winter	20.281	0.0	244
360 min Winter	14.613	0.0	362
480 min Winter	11.581	0.0	480
600 min Winter	9.669	0.0	596
720 min Winter	8.344	0.0	712
960 min Winter	6.509	0.0	944
1440 min Winter	4.586	0.0	1390
2160 min Winter	3.232	0.0	2016
2880 min Winter	2.521	0.0	2280
4320 min Winter	1.813	0.0	3200
5760 min Winter	1.436	0.0	4096
7200 min Winter	1.197	0.0	4976
8640 min Winter	1.033	0.0	5872
10080 min Winter	0.911	0.0	6664

Rainfall Details

Rainfall Model	FEH	D3 (1km)	0.275	Cv (Winter)	0.840
Return Period (years)	100	E (1km)	0.310	Shortest Storm (mins)	15
Site Location		F (1km)	2.522	Longest Storm (mins)	10080
C (1km)	-0.019	Summer Storms	Yes	Climate Change %	+20
D1 (1km)	0.279	Winter Storms	Yes		
D2 (1km)	0.224	Cv (Summer)	0.750		

Time Area Diagram

Total Area (ha) 0.020

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.000	4	8	0.020

Model Details

Storage is Online Cover Level (m) 22.000

Cellular Storage Structure

Invert Level (m) 20.600 Safety Factor 3.0
Infiltration Coefficient Base (m/hr) 0.01800 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.01800

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	24.0	24.0	0.801	0.0	40.0
0.800	24.0	40.0			

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APPENDIX H

Suffolk County Council - Drainage proforma for SW Aspects of Planning Applications

Suffolk County Council

DO NOT PRINT... Appropriate parts of sheet 1 and all of sheet 2 to be completed, starting at top left of sheet1. Yellow cells to be completed by applicant or agent. Most cells have drop down boxes and guidance. Required data will vary, depending on previous answers. Amber cells warn of possible error, lack of required information, non compliance with policies or standards or where special considerations /information may be required. Red cells indicate missing information required for detailed applications . Purple Cells indicate missing information required for outline or detailed applications.

Form completed for Developer/applicant by (name)	Richard Jackson Ltd	Date	10.12.19	Contact email or telephone	mail@rj.uk.com
Form checked for LPA by		Date		Ref No.	
Form checked for SCC Floods by		Date			

District council	Suffolk Coastal		Site Name		
Total Site area (ha)	23.19		Address		
Number of homes	340		Road	Howlett Way	
Commercial area (ha)	0.00		Town	Trimley St Martin	
Commercial built area (ha)	0		County	Suffolk	
Area of POS (ha)			When was the last pre-app discussion with SCC Floods team?		None
Existing land status	Green Field		Is a complete FRA included in the application?		Yes
Highest Ground level (m AOD)	26.00		EA Flood Zone(s)		Fz1
Lowest ground level (m AOD)	19.00		Does adjacent existing highway drain into the site?		No
			Is site at risk of SW flooding?		No

Carry on filling in form. SCC Floods team will be consulted

RUNOFF DESTINATION (where proposed SW drainage from site will discharges to)

	scroll down to complete appropriate cells	**Sea or Estuary**	**Ground (Infiltration)**	**SW Body**	**Existing SWS, highway drain or another drainage system**	**Existing Combined Sewer**
Is Site next to Estuary or coast?		Neither				
Will the site be drained directly to sea or estuary?		No	Fill in cells in this column below			
SOIL TYPE			2			
Have on site ground investigations been undertaken?			Yes			
Is a ground investigation report included in application?			Yes			
Recommendation from GI Report regarding soakaways - Are conditions suitable?			9. Suitable for infiltration drainage			
Number of test pits that soakage tests were undertaken in.			7			
Number of test pits with completed test to BRE365			3			
Are field sheets, test results and calculations included in application?			Yes			
Min Infiltration rate from tests (mm/Hr)			18			
Max infiltration rate from tests (mm/Hr)			59			
Is infiltration type drainage proposed?			Yes			

Go To To Sheet2

Name / Location of SW Body			
Reasons (if any) for not draining to a surface water body			
Will SW be discharged to a surface water body?			

Carry on down column

Type of existing SW piped drainage system			
Description / Location of SW drainage system			
Reason 1 for not draining to SWS, highway drain			
Reason 2 for not draining to SWS , highway drain			
Will SW be discharged to an existing piped SW drainage system?			

Carry on down column

Fill appropriate column (s) (usually one only) for proposed destination

Existing impermeable area				
Proposed Impermeable area				
Method for calculating allowable discharges, existing or Green field flows				
Peak discharge rate to destination				
100 Year return period allowable discharge to SW or combined sewer agreed by AW or SCC (l/sec)				
1 year return period	Existing (l/sec)			
	Proposed with CC & creep (l/sec)			
100 year return period	Existing (l/sec)			
	Proposed with CC & creep (l/sec)			
	Proposed per ha (l/sec/ha)	0	0	
	Critical duration (minutes)			
Proposed minimum throttle(s) aperture (mm)				
Attenuation storage provided to limit peak flow (at critical duration)				

Volume control Required if proposed discharge > 2 l/sec/Ha in 100 Yr RP (see BS8582 5.2.2.4)			
Volume of runoff in 6 Hr duration event (cubic metres)			
100 Year RP existing			
100 Year RP + CC +creep proposed			
Additional capacity provided in SUDs to control volume			
Water quality (WQ) Reasons (if any) for not followng best practise for WQ:			
During construction period			
Permanent			
Proposed permament WQ SUDS:			
Volume of proposed treatment pond (Vt) expressed as mm of rain over the impermeable areas on the site.			
Depth of rain intercepted (refer to SUDS manual) expressed as mm of rain over the impermeable areas on the site			
Volume intercepted (cubic metres)			

Capacity of proposed attenuation & volume control SuDs (can be reduced by interception volume)			
Area of site taken up by proposed SuDs			
Are calculations and drawings included demonstrating there is sufficient and appropriate space for the proposed SUDS volume within the layout?			

Go to Sheet 2

Boxes below to be completed for all SW Systems

Proposed SW Drainage system

Extent of open SuDS	2. Open + some permeable paving

Go to management & maintenance

Does application include justification for not using open SUDS?	
Is pumping of SW proposed?	
Does application include justification for pumping?	

Management and maintenance arrangements	
Is a management plan included in the application?	Yes
Life time for plan and maintenance costs	100
Discount rate normally 3.5%	3.5%

Proposed SW drainage maintenance bodies	**Proposals for ensuring owners are aware of their SW drainage & maintenance requirements**
Owner (for drainage serving single property)	Homebuyers pack and deeds to include plan for private drainage
	Progress with setting up maintenance arrangements
Manage. Co.	3. Proposals for management co. not included in application
SCC Highways	1. Proposed adopting body has not been contacted
Owners -shared	3. Proposals for management co. not included in application
Other	1. Proposed adopting body has not been contacted

Please indicate who will maintain what	Location of SuDs elements				
SuD elements	**Private gardens or commercial land**	**Roads, verges and /or footways**	**Parking areas**	**POS**	**Other** eg Mews court
Vegetation, trees, shrubs etc	Owner	n/a	n/a	Manage. Co.	
Permeable paving.	Owner	n/a	Manage. Co.	Manage. Co.	
Rills	Owner	n/a	n/a	n/a	
Open SuDS - Erosion protection, De-silting, headwalls,dividing walls	Owner	SCC Highways	n/a	SCC Highways	
Open SuDS - Bollards or fencing	Owner	n/a	n/a	n/a	
Shallow pipes throttles/headwalls at driveway crossings over swales.		n/a			
Shallow pipes throttles / headwalls @ road crossings over swales		SCC Highways		n/a	
Litter picking including clearing grates and grilles	Owner	SCC Highways	Owners -shared	SCC Highways	
Gully Grates -repairs & replacement	Owner	SCC Highways	n/a	n/a	
Gully pots, connection pipes	Owner	SCC Highways	n/a	n/a	
Highway carrier drains		SCC Highways			
Soakaways	Owner	n/a	Other	n/a	
Oil or petrol interceptors	Owner	n/a	n/a	n/a	
Underground attenuation tanks	Owner	n/a	n/a	n/a	
Surface Water Sewer	Owner	SCC Highways	Manage. Co.	n/a	
Other - please state					
Other - please state					

Availabilty of 3.5m wide access for SuDs maintenance -	1. 3.5m wide access available to all proposed SuDS

Design flood return period for:	
Buildings	100
Gardens (unless designated to store water)	30
Roads	100

Design for blockage and /or Exceedance	
Are exceedance routes/ storage areas for 100 year RP event shown on submitted layout plan(s) including proposed floor and ground levels, buildings and roads.	Yes

SuDS details that are most likely to affect layout and maintenance	
Maximum depth of open SuDS (mm)	1800
Maximum depth of water in open SuDS in 100 Year RP (mm)	1500
Steepest side slope of open SuDS (1 vertical in x horizontal)	3
Steepest longintudinal gradient of any swales.	100
Are any buildings < 5m of open SUDS or undergr'd soakaways?	No
if yes describe location(s)	
Special protective measures	
means of access/repair SUDs	

Health and Safety - public and maintenance operatives	
Are Designers CDM Health and Safety Plan included?	Yes

Structural Integrity	
Have Structural design and specification details been provided for:	
Pipes -BS EN, Class, strength calcs including bed and surround.	
Tanks - including geocells / fabric surround	
Manholes BS EN, size, type etc (SFA 7th edition)	
Headwalls, dividing walls, bunds & slope stabilty.	

Other Information normally required (not exhaustive)

Are design calculations provided, cross-referenced to drawing(s -also provided) showing catchments and layout of SuDs, roads, footways and buildings?	Yes
Are landscaping /planting details shown on drawing(s) provided showing SuDS, and development layout?	Yes
Are details of SuDS including inlets, outlets, dividing walls, erosion control measures shown on provided plans.	No
Are extents of adoption by each body shown on drawings provided?	
Is a completed copy of SCC's Asset register sheet provided?	

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Engineering Consultants

APPENDIX I

Table B.5 SuDS health and safety risk assessment checklist	
Site/system overview	
Site ID	
Asset ID	
Location	Howlett Way, Trimley St Martin
SuDS component	Infiltration detention basins
Assessment date	12/12/19
Date of next assessment	As part of any reserved matters application and detail design of the masterplan and drainage strategy.
1 Establish context	
General description of component and its operation	Infiltration detention basins to accommodate adoptable highway surface water runoff
2 Identify potential hazards	Are hazards present? (Y/N)
Drowning or falling through ice in winter	Y
Slips, trips and falls	Y
Entry into pipes or confined spaces (note this is for inadvertent public access; follow relevant legislation and guidance for worker access)	Y
Water quality – health risk	Y

3 Drowning or falling through ice in winter		
Consider factors that might affect: • **the likelihood of people entering the water/accessing the ice** • **the potential consequence of entering the water/accessing the ice**	**Summary of influence of factor on likelihood of entry/access, including justification (consider for children < 5 years, children ≥ 5 years, adults)**	**Summary of influence of factor on consequence of entry or access, including justification (consider for children < 5 years, children ≥ 5 years, adults)**
Environmental factors		
Proximity to populated areas: schools, inns, retail/tourism, picnic areas, play areas, car park, roads, especially attractive features likely to be visited	SuDS features located within the centre of the site and on the eastern boundary. SuDS features located near to the main roads. Remote that the areas will be attractive areas to be visited other than for maintenance purposes. Water within the basins to a depth considered a risk will only be following an intense rainfall event. Typical rainfall events surface water depths will be shallow, otherwise is 'dry'.	There is a risk to maintenance workers attending the basin, but they are very unlikely to attend during the times when surface water will freeze and therefore can be instructed to avoid these times. Should a large amount of water be within the basin following an extreme storm event and freeze, the consequence of falling through ice is serious for all person types.
Features allowing or encouraging access (e.g. paths)	Paths are located near to the central basin but not directing people to the basin. Thus, the risk is reduced.	Should a large amount of water be within the basin following an extreme storm event and freeze, the consequence of falling through ice is serious for all
Physical accessibility of proposed drainage feature: consider intended use and inadvertent access (including of small children)	Basins are not intended to be used for public accessibility and are designed purely for the discharge of surface water. Side slopes are 1 in 3 and the basins have a 'wet bench' designed into them.	Should a large amount of water be within the basin following an extreme storm event and freeze, the consequence of falling through ice is serious for all person types.
Visibility and natural surveillance of proposed drainage features	SuDS features are located near to proposed housing and therefore have good surveillance to the features, that will not be obstructed by vegetation. Natural surveillance and 1 in 3 side slopes of the basins will reduce the likelihood and consequence.	Should a large amount of water be within the basin following an extreme storm event and freeze, the consequence of falling through ice is serious for all person types.
Behavioural factors		
Category and volume of expected users: swimmers, anglers, walkers, drivers, specialist water users, General public, dog walkers, teenagers, accompanied/unaccompanied children	General public consisting primarily the new residents which includes children and dog walkers will be within the main highways located a minimum of 3m away from the edge of the SuDS feature.	Should a large amount of water be within the basin following an extreme storm event and freeze, the consequence of falling through ice is serious for all person types.

Nature of development (housing, commercial, industrial etc)	Housing – See above	See above.
Any known existing risks (eg records of accidents) posed by water/drainage features at or close to the site?	None	None
Design factors – water's edge		
Type and nature of water-edge planting	Unknown – to be determined at reserved matters stage.	Unknown – to be determined at reserved matters stage.
Definition of water edge and nature of ground (eg soft/hard)	The dry bench of 3m width around the top of the basin is not part of the infiltration process and therefore can be designed to be reinforced landscaped areas, if required.	Should a large amount of water be within the basin following an extreme storm event and freeze, the consequence of falling through ice is serious for all person types.
Natural obstacles, barriers/fencing	None	None
Height of edge above water	300mm above maximum design water level.	Max depth of water to stand up in is 0.9m
Gradient and extent of slopes above, at and below water level	1 in 3	Wet bench and side slopes will reduce the consequence of falling through ice.

Note For definition of levels, see **Table 36.2 in Chapter 36**.

3 Drowning or falling through ice in winter		
Consider factors that might affect: • **the likelihood of people entering the water/accessing the ice** • **the potential consequence of entering the water/accessing the ice**	**Summary of influence of factor on likelihood of entry/access, including justification (consider for children < 5 years, children ≥ 5 years, adults)**	**Summary of influence of factor on consequence of entry or access, including justification (consider for children < 5 years, children ≥ 5 years, adults)**
Design factors – water body		
Water depth profile	Varies based on rainfall event and intensity. Up to 1.5m depth for the worst-case design event.	Should a large amount of water be within the basin following an extreme storm event and freeze, the consequence of falling through ice is serious for all person types.
Water surface area	Varies – up to 892m^2 in worst case storm event.	See Above.
Clarity	Water is from roads and adopted highway areas before entering landscaped basin. Clarity of water is therefore likely to be muddy.	See Above.
Underwater obstacles or traps	Inlets and headwalls only.	This is unlikely to increase or affect the consequence from previously indicated.
Potential currents, velocities	Still water – no currents	N/A
Potential increase in depth of water and rate of rise	Water to be up to 1.5m depth in worst case design storm event. Water within basin for the most intense storm event (15 Winter) for the 1 in 100-year event plus climate change would reach its maximum depth of 0.959m in 41 minutes. It would only reach a depth of 0.3m in 15 minutes. This allows sufficient time to exit basins.	This is unlikely to increase or affect the consequence from previously indicated.
Potential for ice formation and significant depth of water below in winter	As the basins are designed to infiltrate, they are designed to dissipate the attenuated water and remain dry when not raining. Ice is v. unlikely to form on large depths of water.	This is unlikely to increase or affect the consequence from previously indicated.

Public education		
Signage	To be confirmed as part of the reserved matters / detailed design stage.	This is unlikely to increase or affect the consequence from previously indicated.
Community engagement strategies	Not considered necessary as area is not forming community centre for the site.	This is unlikely to increase or affect the consequence from previously indicated.
Local education strategies (eg schools)	To be confirmed as part of the reserved matters / detailed design stage.	This is unlikely to increase or affect the consequence from previously indicated.
Overall assessment of likelihood of entry/access and consequences	**Likelihood**	**Consequences**
Children < 5 years Children > 5 years Adults	Rare Rare Unlikely	Extreme Extreme Serious

Summary of section 3 risk assessment for drowning or falling through ice						
Group	**Likelihood of entry to water**	**Likely consequence of entry to water**	**Overall level of risk posed by the design[1]**	**Further mitigation measures required**	**Action date**	**Final level of risk[1]**
Children < 5 years Children > 5 years Adults	Rare Rare Unlikely	Extreme Extreme Serious	Medium	Appropriate maintenance plan and risk assessment required for maintenance staff.	Reserved Matters Application.	Medium

Note For definition of levels, see **Table 36.2 in Chapter 36**.

4 Slips/trips/falls		
Factors that might affect likelihood of people slipping/tripping/falling	**Summary of influence of factor on likelihood of slip/ trip/fall, including justification (consider for children < 5 years, children ≥ 5 years, adults)**	**Summary of influence of factor on consequence of slip/ trip/fall, including justification (consider for children < 5 years, children ≥ 5 years, adults)**
Design factors – inlets and outlets or channels		
Headwall or channel location	Located at base of basins for inlet pipes. Positions to be confirmed at detailed design stage as will design of headwall(s).	Insignificant as should not create slip / trip risk.
Headwall height or channel depth and width	Design and height of headwall to be confirmed at reserved matters stage.	Minor
Slope of headwall or channel profile	To match the basin.	Insignificant.
Channels – profile and risk of freezing water	N/A	N/A
Design factors – surfaces		
Level changes	Designed based on LLFA / SuDS Manual best practice of a maximum of 1 in 3 with a wet bench 600mm from the base and maximum water depth of 1.5m.	Minor
Surfacing materials	Basin to be landscaped i.e. grass material.	Insignificant.

Summary of section 4 risk assessment for slips/trips/falls						
Group	**Likelihood of slips/ trips/falls/other injury**	**Likely consequence of slips/trips/falls/other injury**	**Overall level of risk posed by the design[1]**	**Further mitigation measures required**	**Action date**	**Final level of risk[1]**
Children < 5 years Children ≥ 5 years Adults	Rare Unlikely Unlikely	Minor Minor Minor	Low	Not required.		

Note

For definition of levels, see **Table 36.2 in Chapter 36**.

5 Entry into pipes or confined spaces (Note: This risk assessment covers inadvertent access by the public. Where specific access is required by workers the requirements of relevant health and safety legislation and guidance should be followed.)		
Factors that might affect likelihood of people entering pipes or confined spaces	**Summary of influence of factor on likelihood of entry into pipes or confined spaces, including justification (consider for children < 5 years, children ≥ 5 years, adults)**	**Summary of influence of factor on consequence of entering pipe or confined space, including justification (consider for children < 5 years, children ≥ 5 years, adults)**
Design factors – inlets and outlets		
Pipe diameter	<750mm diameter.	Moderate for younger children and Minor for adults.
Are grilles provided?	Yes, and will be securely locked.	Minor
Design factors – chambers		
Depth of chamber	Chamber depths to be designed to be minimum possible based on relevant design parameters.	Minor.
Is access possible?	V. unlikely with appropriate secure manhole covers.	Minor.

Summary of section 5 risk assessment for entry into pipes/confined spaces						
Group	**Likelihood of entry into pipes/ confined spaces**	**Likely consequence of entry into pipes/ confined spaces[1]**	**Overall level of risk posed by the design**	**Further mitigation measures required**	**Action date**	**Final level of risk[1]**
Children < 5 years Children ≥ 5 years Adults	Rare Rare Unlikely	Moderate Minor Minor	Low	Secure grills on headwalls	Detailed Design stage	Low

Note

For definition of levels, see **Table 36.2 in Chapter 36**.

6 Health issues		
Factors that might affect likelihood of people suffering from ill health due to SuDS water quality	**Summary of influence of factor on likelihood of poor health, including justification (consider for children < 5 years, children ≥ 5 years, adults)**	**Summary of influence of factor on consequence of resulting ill health, including justification (consider for children < 5 years, children ≥ 5 years, adults)**
Pollution treatment strategy		
Level of contamination of publically accessible water	Likely pollutants from surface water runoff from roads such as hydrocarbons and heavy metals. Water infiltrates through soil to remove contaminants.	Minor
Likely contamination from rat urine	Unlikely as rats will keep to watercourses and ditches away from general population. Removed once water passes through the soil.	Moderate
Likely contamination from dog or bird fouling	Unavoidable.	Minor
Likelihood of toxic algal blooms	Water within basins will eventually infiltrate and leave basin empty. Algal blooms rare	Moderate
Likelihood of vectors (organism which carries disease-causing microorganisms from one host to another)	Water within basins will eventually infiltrate and leave basin empty. Vectors considered to be rare.	Moderate
Public accessibility to any sediment accumulation zones	Sediment areas only located close to the inlet pipes of the basins. Can be removed during maintenance periods.	Minor
Public education and risk management		

Signs	To be assessed and confirmed at detailed design stage.	To be assessed and confirmed at detailed design stage.
Community engagement strategies	As above.	As above.
Local education strategies (eg schools)	As above.	As above.
Litter management and control	As above.	As above.
Dog fouling management and control	As above.	As above.

Summary of section 5 risk assessment for health issues						
Group	**Likelihood of ill health**	**Likely consequence of ill health**	**Overall level of risk posed by the design**	**Further mitigation measures required**	**Action date**	**Final level of risk**
Children < 5 years Children ≥ 5 years Adults	Rare Rare Unlikely	Moderate Minor Moderate	Low to Moderate	Appropriate maintenance plan and risk assessment required for maintenance staff.	Reserved Matters Application.	Medium

Note

For definition of levels, see **Table 36.2 in Chapter 36**.