B411 – Teversham Road, Fulbourn, Cambridgeshire
Discharge of Conditions - surface water management
For Castlefield International Ltd
27th February 2020

This note includes revised surface water management drawings and calculations to reflect the updated development layout. It also addresses queries raised by the Lead Local Flood Authority (LLFA) in their role as statutory consultee on surface water management as well as comments from Cambridge City Council/South Cambridgeshire District Council representatives. This note has been prepared following informal discussions and liaison with the LLFA.

LLFA responses FR/19-000423 and FR/19-000431

Access

The parcels of development and the roads linking them will be set above the modelled floodwater so access to the parcels from Teversham Road will be maintained during the modelled 1 in 100 event plus 40 %. The Cox's Drove access is an emergency access, not the primary access.

1 and 2 Drain down times and control sizes

The drain down time is necessarily long because the greenfield rate is so low. We have increased the outflow slightly to reduce the half drain down to less than 7 days.

As suggested we have increased the flow control sizes to at least 20 mm, each control will be protected by two filters (in the control chamber and at the inlets/outlet to the bio-retention/swale features).

3 Freeboard

The 300 mm figure discussed in C753 as being applicable to large, end of pipe/network, basins (the typical 1.5 m deep basin design to store 1.2 m of water).

Freeboard is discussed in C753 with reference to both additional storage in the system and also the distance between water levels and floor levels. With regard to the latter, finished floor levels are still to be detailed (at the detailed design stage). However, currently we are working on water levels (during the 1 in 100 plus 40 % storm) being between 150 to 300 mm below finished floor levels for the respective surface water Facility/complex.

With regards to the latter the argument is that the storage provided in the system is precautious enough for additional freeboard volume to not be necessary. The scheme is sized based on 10 % creep, relatively swift entry of runoff into the attenuation, 0.95 effective runoff, and no incidential loss or interception/depression storage. The scheme also manages the 7 day storm (a lengthy and precautious duration by most standards).

Notwithstanding the above, we have assessed and adjusted the attenuation volumes of Facilities A to D so that they are able to accommodate a six hour duration 1 in 10 storm (7 mm/hr or 42 mm total)

within 24 hours of the end of the 7 day 1 in 100 storm plus 40 % climate change. The figures for each are summarised below. It is worth noting that Facility D provides some of the additional storage for Catchment C. This would be achieved by a high level outlet from Facility C to Facility D.

Catchment	Spare volume 24 hours after a 7 day rainfall event	1 in 10 volume (assuming 95 % runoff and no losses)
A	277	269
B	251	241
C	98	201
D	200	87

4 Maintenance

At this stage maintenance of the various facilities would follow the attached schedules (based on C753).

The specific party who will maintain the surface water scheme will depend on later stage work and negotiations and agreements (ideally Anglian Water will adopt the whole scheme). At this stage the details of the maintainer will be necessarily non-specific, but will realistically be either a communally funded private management company or Anglian Water.

5 Network

The scheme does not include a traditional piped network. Instead it relies on source control with no dominant piped conveyance of flows from impermeable catchments to the attenuation facilities. It is proposed to drain the potentially adoptable spine roads in the east overland to the permeable paved private roads (with the western spine road draining to the grassed filter drain). Runoff from the spine roads in the east will enter the crates through the permeable paving (having been conveyed overland along the road channels).

The location of the outfalls will depend on the later stage vegetation clearance so we haven't shown them or the connective pipework as precise locations.

Cambridge City/South Cambridgeshire response to S/3209/19/DC dated 28/09/19

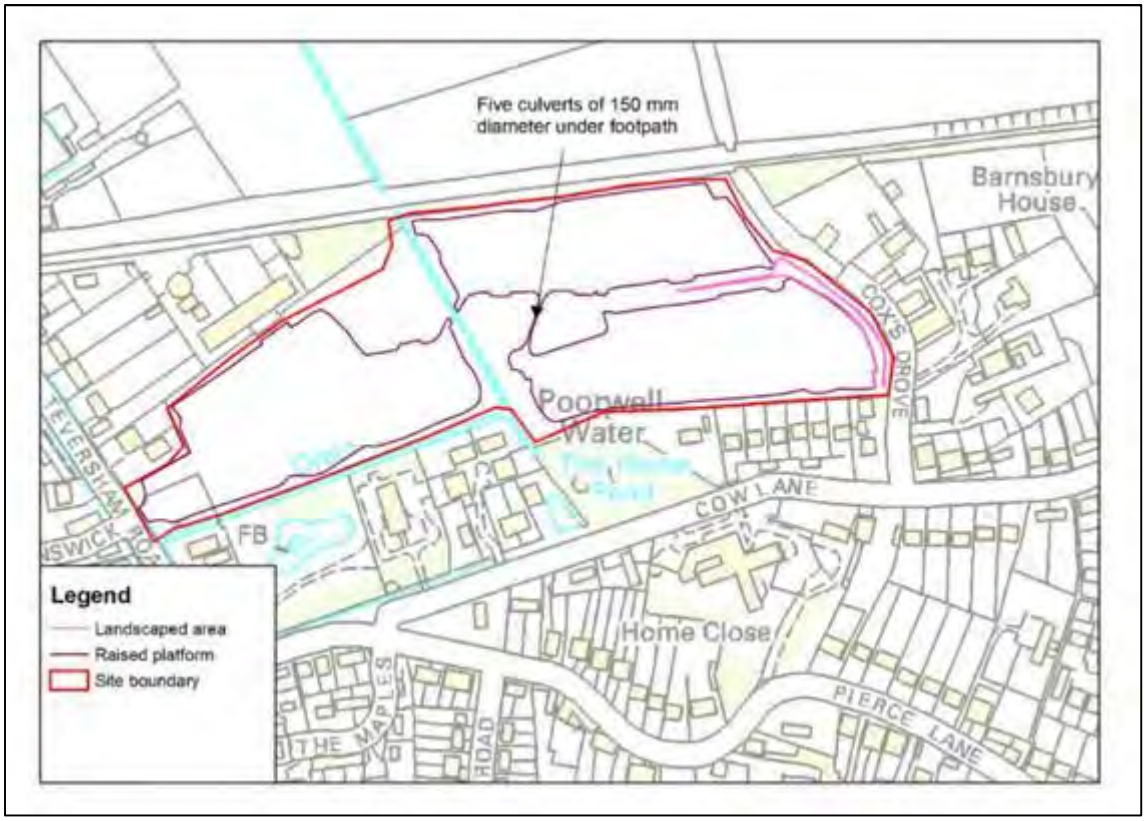
As a point of clarification, the surface water management network is entirely separate from the floodwater management with one not influencing the other. This separation of floodwater is by virtue of the development parcels being raised above the floodwater.

The proposal to move the originally proposed/approved flood management bund west provides more space for flood water in the flood storage area (as does the removal of a section of road in the revised

masterplan). This in turn allows for the shallow post development floodwater on the site of the LEAP to be stored upstream of the LEAP.

Should flood levels in the floodwater storage area increase when the final detailed design is modelled at the post application stages then external ground levels and/or finished floor levels (determined during the detailed design stage) would be increased slightly to suit.

It is worth clarifying that the five 150 mm diameter pipes (their purpose being to restrict flows from the floodwater storage area) are in the original model and are not new (see image below from the FRA which supported the 2017 outline application).



Taking the above into account the current model (used to support the outline permission) is therefore suitable to support the Reserved Matters (RM) application.

The outlet from the existing pond will be to the ditch which separates the development from the pumping house garden. The current route of the channel follows the cycleway/footway which runs from the site to the pumping house garden. The channel will be flat (effectively an extension of the pond with flow being driven by head). Levels will be subject to the usual detailed design and further investigations. The currently proposed invert level of the channel is approximately 9.25 m AOD.

Cambridge City/South Cambridgeshire response to S3290/19/RM dated 14/12/19.

Comments 1, 2, and 3

Typical sections of the proposed facilities are appended. Detailed design drawings will be prepared at the post planning stages. Silt control would be via the usual geotextile.

Comment 4

Please see attached for typical sections of potential 'headwalls'. Details of precise locations will be established following the post planning ecological site work (to assess the current vegetation and propose areas for thinning/removal as part of the improvement of the watercourse). As advised by the team ecologist, the process of assessment and thinning/removal is best carried out in one operation (combining assessment, guidance and supervision in one).

Comment 5

Detailed drawings would be prepared at the detailed design stages. The scheme is effectively four large/flat multi part source control systems with the majority of pipework limited to connecting pipes between crates. Discharge will be head driven. As discussed above the precise locations of outlets (and upstream pipework) will be rely on later stage ecological survey work.

Comment 6

Drawing 302 shows the impermeable catchments labelled by their respective attenuation facilities (A to D).

Comment 7

Crate areas, heights, volumes, and performance are included on drawing 300 and in the submitted MicroDrainage calculations. Detailed design will be undertaken at the appropriate later stages.

Comments 8 and 9

No temporary storage is expected to be necessary. Raising the parcels will involve the early creation/installation of the attenuation (the crates form part of the 'imported material' to form the raised parcels).

Comment 10

The detailed design of the external levels will follow the usual guidance to allow overland flow.

Comment 11

Details of the party responsible for adopting and/or maintaining the surface water management scheme will depend on later stage work and agreements (commercial arrangements, management companies, detailed approval from Anglian Water, etc). The two realistic options for maintenance are

a communally funded private management company or Anglian Water (as part of their recent push to take on SuDS). Maintenance activities would be as per the attached 'C753 schedules' with the usual evolution in response to the observed field performance of the features.

Comment 12

Treatment will be provided by the permeable paving, filter drains and bio-retention features. Construction phase pollution prevention and control would be addressed as part of the application to discharge Condition 16 (CEMP).

Appended information

Drawing B411-PL-SK-300 - SW strategy
Drawing B411-PL-SK-301 - SW strategy above ground
Drawing B411-PL-SK-302 - Catchment plan
Drawing B411-PL-SK-303 - Sections
Drawing B411-PL-SK-304 - Typical sections
Drawing B411-PL-SK-305 - Typical outfalls
Drawing B411-PL-SK-306 - Below ground maintenance plan
Drawing B411-PL-SK-307 - Above ground maintenance plan
Drawing B411-PL-SK-308 - Exceedance route plan
MicroDrainage calculations, catchments A to D and western spine road.

N

RAILWAY TRACK

ATTENUATION FACILITY B

OUTFALL LEVEL = 8.60m

OUTFALL LEVEL = 8,65m

CL = 9,35
IL = 8.68m

CL = 9,35
IL = 8.75m

CL = 10.70m
IL = 9,65m

CL = 10,55m
IL = 9.49m

CL = 10.50m
IL = 9.38m

CL = 10.00m
IL = 9.05m

CL = 10.45m
IL = 9.30m

CL = 10.00m
IL = 9.00m

CL = 10.00m
IL = 9.2m

CL = 9.65m
IL = 8.93m

OUTFALL LEVEL = 8.90m

ATTENUATION FACILITY A

ATTENUATION FACILITY C

ATTENUATION FACILITY D

OUTFALL TO EXISTING DITCH

PUMPING HOUSE POND PROVIDING APPROXIMATELY 500mm OF STORAGE

PUMPING STATION

SUB STATION

Public Well

Horse Pond

COW LANE

COW LANE

HINTON ROAD

PIERCE LANE

KEY

- 2 x 0.15m HIGH SUB-BASE REPLACEMENT CRATES. PERMAVOID OR SIMILAR APPROVED
- 3 x 0.15m HIGH SUB-BASE REPLACEMENT CRATES. PERMAVOID OR SIMILAR APPROVED
- 4 x 0.15m HIGH SUB-BASE REPLACEMENT CRATES. PERMAVOID OR SIMILAR APPROVED
- 3 x 0.15m AND 1 x 0.085m HIGH SUB-BASE REPLACEMENT CRATES. PERMAVOID OR SIMILAR APPROVED
- SW NETWORK (SECTIONS OF CONNECTING PIPEWORK)
- ORIFICE CONTROL CHAMBER
- HEADWALL
- ROADSIDE FILTER DRAIN
- RILL/CHANNEL DRAIN TAKING FLOW TO AND FROM THE PUMPING HOUSE POND
- DEBRIS FILTER
- OVERFLOW BETWEEN FACILITY C AND D TO MANAGE THE 1 in 10 STORM

NOTES

LEVELS ARE SUBJECT TO LONG TERM GROUND WATER MONITORING AND DETAILED DESIGN.

REV	DESCRIPTION	DE	DR	CH	DATE
P04	REVISED TO REFLECT CHANGING LAYOUT		DP	-	FEB 2020
P03	SURFACE WATER MANAGEMENT STRATEGY REVISED		DP	-	FEB 2020
P02	REVISED TO REFLECT CHANGING LAYOUT		DP	-	JAN 2020
P01	REVISED TO REFLECT CHANGING LAYOUT LEAP CRATES REVISED		JAM	JOH	SEPT 2019

DESIGNED BY	DRAWN BY	CHECKED BY
-	DP	-

SCALE @ A1 SIZE	DATE
D.N.S.	21/08/2019

PROJECT TITLE

LAND AT TEVERSHAM ROAD, FULBOURN, CAMBRIDGESHIRE

DRAWING TITLE

DETAILED SURFACE WATER MANAGEMENT STRATEGY

CLIENT

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DRAWING NUMBER	REV.
B411 - PL - SK - 300	P04

M:\B411 Fulbourn, CAMBS\DRAWINGS\AUTOCAD\CURRENT DRGS\B411 - PL - SK - 300 - P04 - SW STRATEGY

KEY

- ATTENUATION BASIN
- PERMEABLE PAVING
- ROADSIDE FILTER DRAIN
- RILL/CHANNEL DRAIN TAKING FLOW TO AND FROM THE PUMPING HOUSE POND
- DEBRIS FILTER
- HEADWALL
- FLOW ROUTES

NOTES

REFER TO DRAWING B411-PL-SK-303 FOR SECTIONS

REV	DESCRIPTION	DE	DR	CH	DATE
P04	REVISED TO REFLECT CHANGING LAYOUT		DP	-	FEB 2020
P03	SURFACE WATER MANAGEMENT STRATEGY REVISED		DP	-	FEB 2020
P02	REVISED TO REFLECT CHANGING LAYOUT		DP	-	JAN 2020
P01	REVISED TO REFLECT CHANGING LAYOUT		JAM	JOH	SEPT 2019

DESIGNED BY	DRAWN BY	CHECKED BY
-	DP	-

SCALE @ A1 SIZE	DATE
D.N.S.	21/08/2019

PROJECT TITLE

LAND AT TEVERSHAM ROAD, FULBOURN, CAMBRIDGESHIRE

DRAWING TITLE

DETAILED SURFACE WATER MANAGEMENT STRATEGY (ABOVE GROUND)

CLIENT

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DRAWING NUMBER	REV.
B411 - PL - SK - 301	P04

M:\B411 Fulbourn, CAMBS\DRAWINGS\AUTOCAD\CURRENT DRGS\B411 - PL - SK - 301 - P04 - SW STRATEGY ABOVE GROUND

KEY

- IMPERMEABLE CATCHMENT AREA DRAINING TO ATTENUATION FACILITY A
- IMPERMEABLE CATCHMENT AREA DRAINING TO EXISTING POND
- IMPERMEABLE CATCHMENT AREA DRAINING TO ATTENUATION FACILITY B
- IMPERMEABLE CATCHMENT AREA DRAINING TO ATTENUATION FACILITY C
- IMPERMEABLE CATCHMENT AREA DRAINING TO ATTENUATION FACILITY D

NOTES

REV	DESCRIPTION	DE	DR	CH	DATE
P04	REVISED TO REFLECT CHANGING LAYOUT		DP	-	FEB 2020
P03	CATCHMENT AREAS REVISED		DP	-	FEB 2020
P02	REVISED TO REFLECT CHANGING LAYOUT		DP	-	JAN 2020
P01	REVISED TO REFLECT CHANGING LAYOUT		JAM	JOH	SEPT 2019

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-	DP	-

SCALE @ A1 SIZE	DATE
D.N.S.	21/08/2019

PROJECT TITLE

LAND AT TEVERSHAM ROAD, FULBOURN, CAMBRIDGESHIRE

DRAWING TITLE

CATCHMENT PLAN

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DRAWING NUMBER	REV.
B411 - PL - SK - 302	P04

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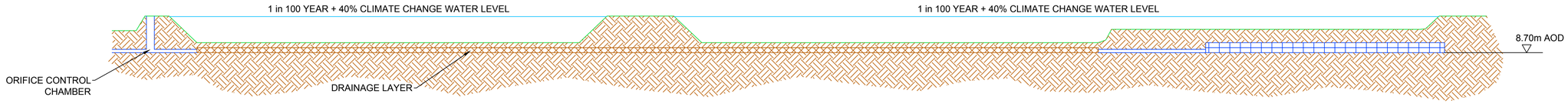
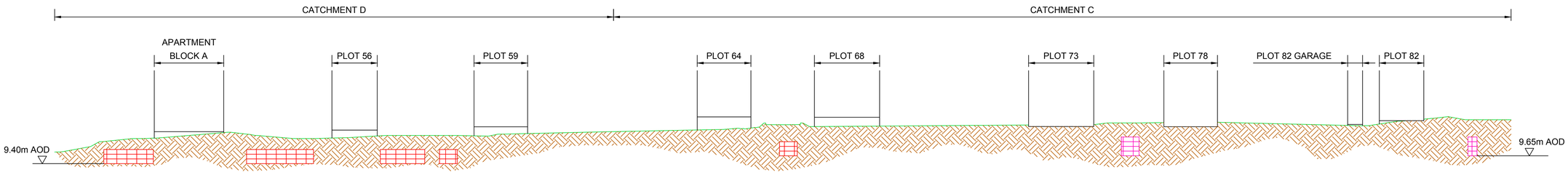
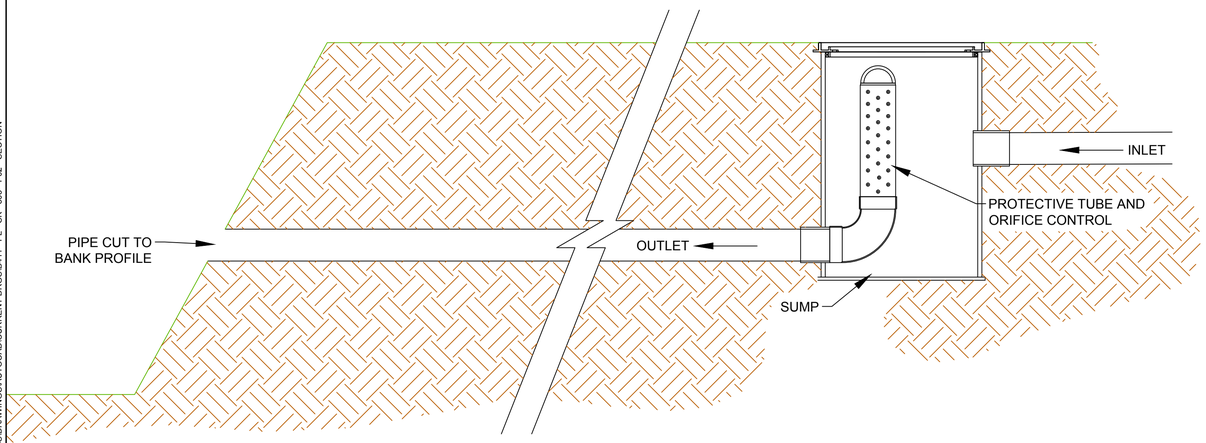


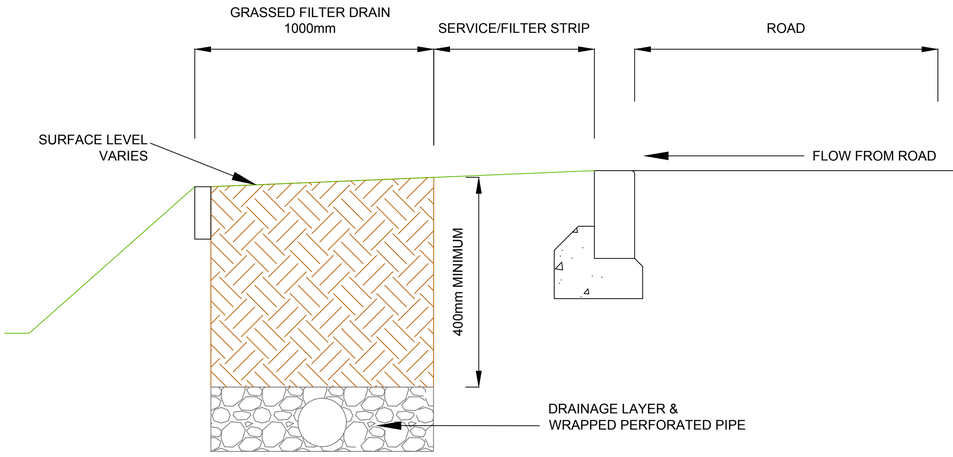
SECTION A-A



SECTION B-B



TYPICAL SECTION OF OUTFALL AND ORIFICE CONTROL CHAMBER



TYPICAL SECTION OF GRASSED FILTER DRAIN

KEY

1 x 0.15m HIGH SUB-BASE REPLACEMENT CRATES. PERMAVOID OR SIMILAR APPROVED

2 x 0.15m HIGH SUB-BASE REPLACEMENT CRATES. PERMAVOID OR SIMILAR APPROVED

3 x 0.15m HIGH SUB-BASE REPLACEMENT CRATES. PERMAVOID OR SIMILAR APPROVED

4 x 0.15m HIGH SUB-BASE REPLACEMENT CRATES. PERMAVOID OR SIMILAR APPROVED

NOTES

REFER TO DRAWING B411-PL-SK-301 FOR SECTION LOCATIONS

REV	DESCRIPTION		DE	DR	CH	DATE
P02	SECTIONS REVISED			DP		02/2020
P01	SECTIONS REVISED			DP		02/2020

DESIGNED BY	DRAWN BY	CHECKED BY
-	DP	-

SCALE @ A1 SIZE	DATE
D.N.S.	21/08/2019

PROJECT TITLE

LAND AT TEVERSHAM ROAD, FULBOURN, CAMBRIDGESHIRE

DRAWING TITLE

SECTIONS PLAN

CLIENT

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DRAWING NUMBER	REV.
B411 - PL - SK - 303	P02

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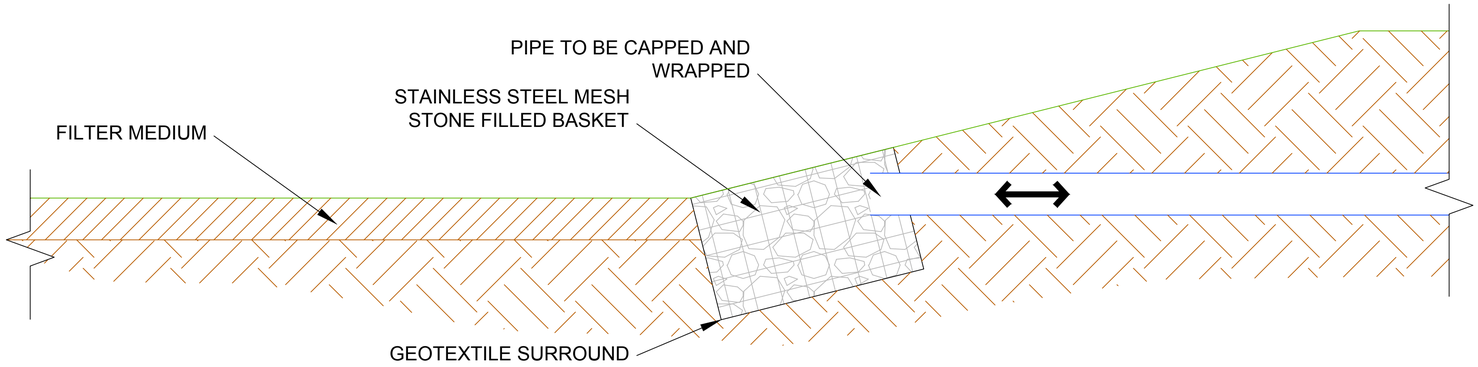
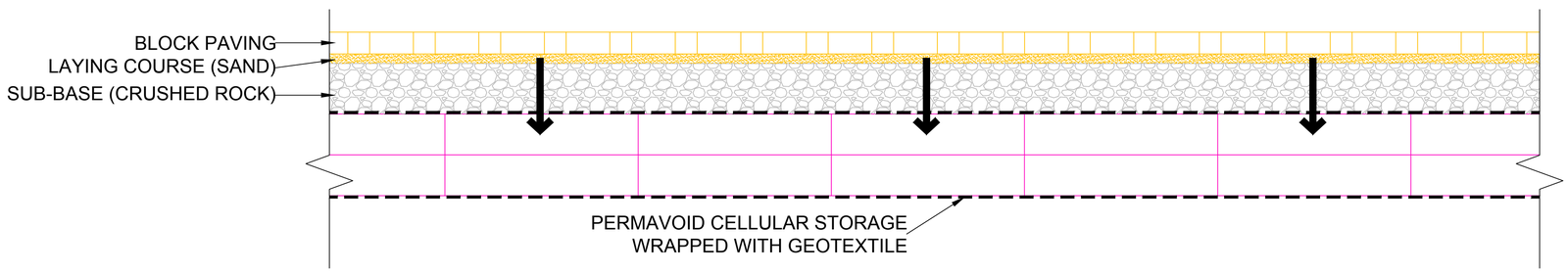
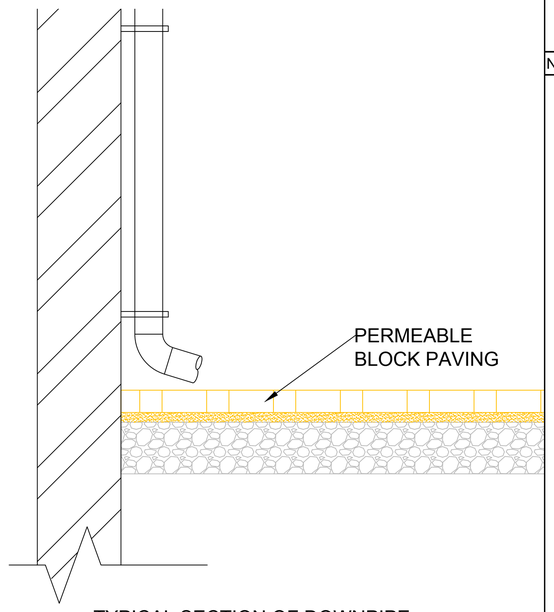


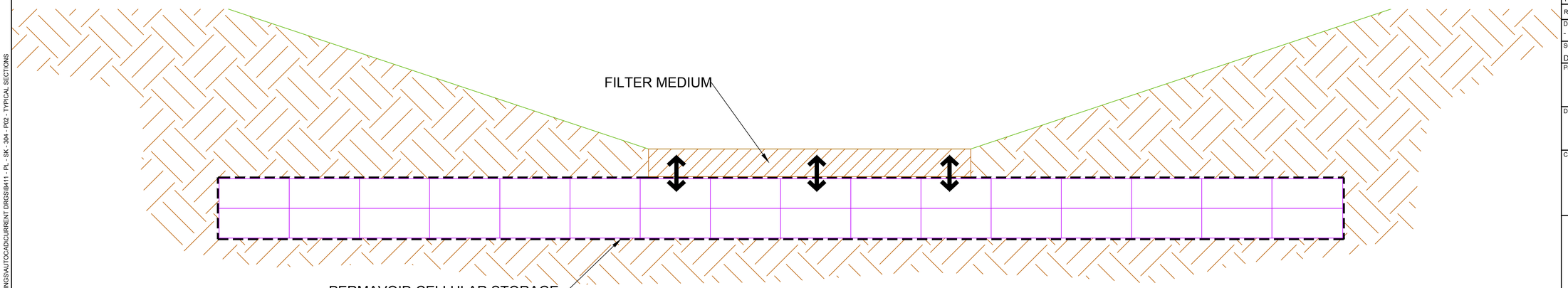
TYPICAL SECTION OF DEBRIS FILTER



TYPICAL SECTION OF PERMEABLE
PAVING OVER CRATES



TYPICAL SECTION OF DOWNPIPE
SPILLING ONTO PERMEABLE PAVING



TYPICAL SECTION OF BASIN
OVER CRATES

KEY

DIRECTION OF FLOW

NOTES

REV	DESCRIPTION	DE	DR	CH	DATE
P02	SECTION ADDED	-	DP	-	02/2020
P01	SECTIONS REVISED	-	DP	-	02/2020

DESIGNED BY	DRAWN BY	CHECKED BY
-	DP	-

SCALE @ A1 SIZE	DATE
D.N.S.	20/01/2020

PROJECT TITLE
LAND AT TEVERSHAM ROAD,
FULBOURN, CAMBRIDGESHIRE

DRAWING TITLE
TYPICAL SECTIONS

CLIENT
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DRAWING NUMBER	REV.
B411 - PL - SK - 304	P02

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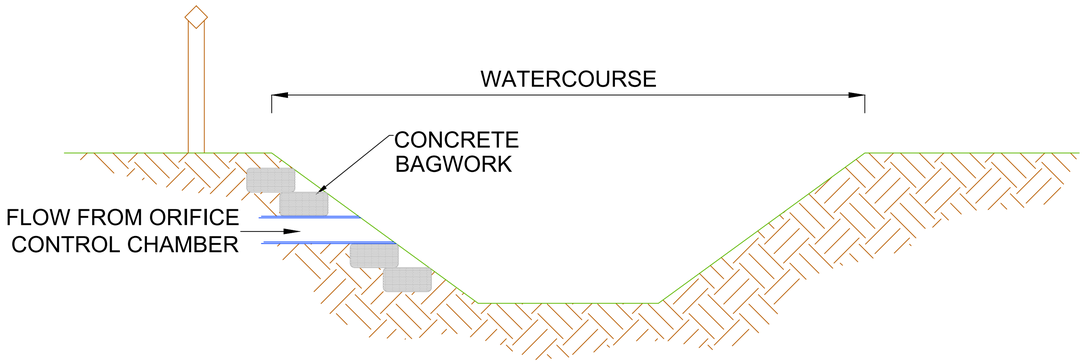

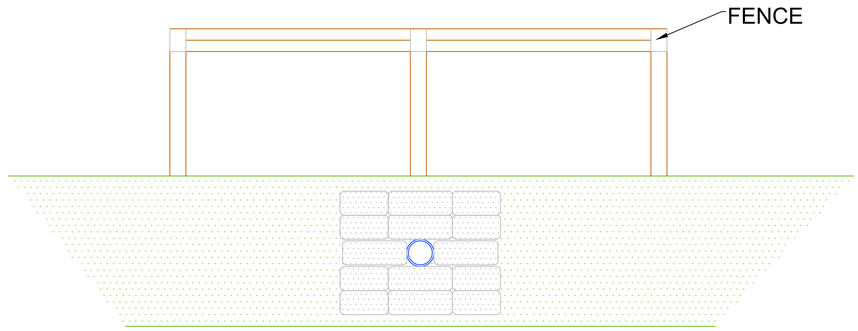

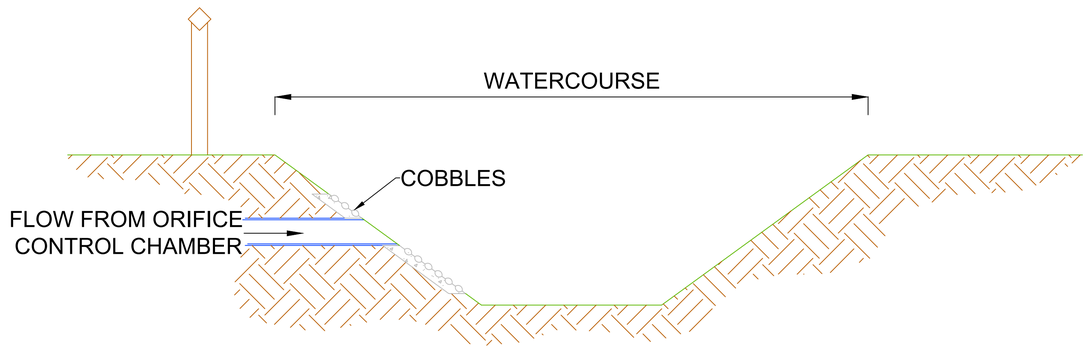

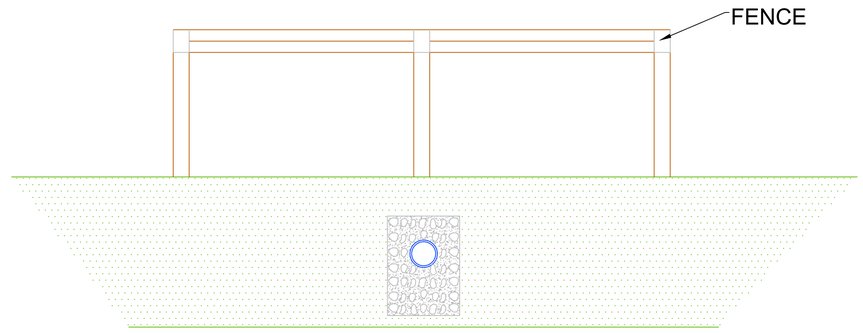

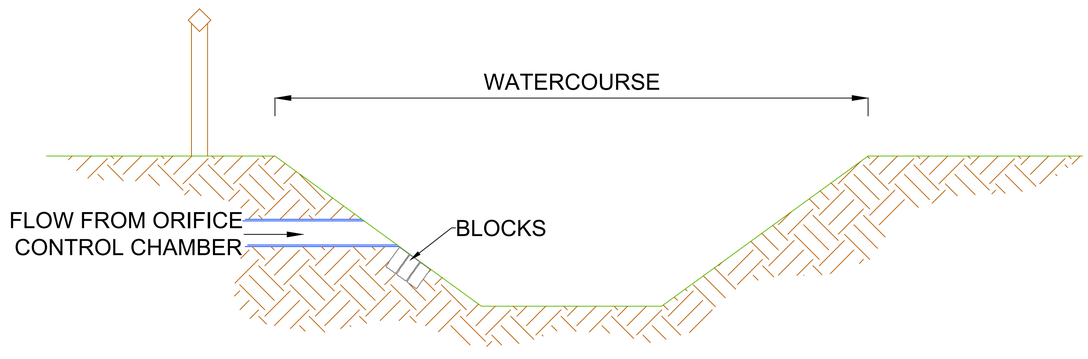

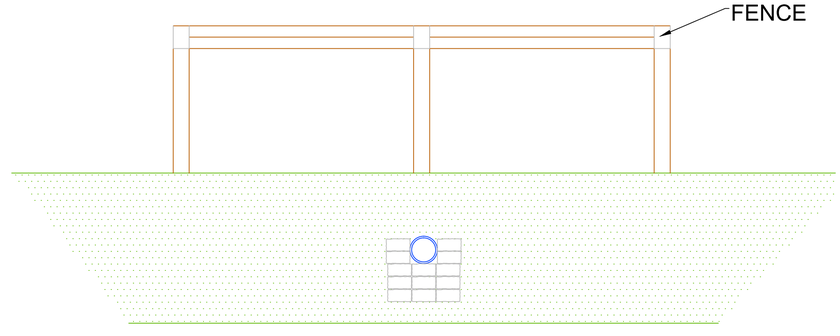

KEY

NOTES

REV	DESCRIPTION	DE	DR	CH	DATE

DESIGNED BY	DRAWN BY	CHECKED BY
-	DP	-

SCALE @ A1 SIZE	DATE
D.N.S.	20/01/2020

PROJECT TITLE
LAND AT TEVERSHAM ROAD,
FULBOURN, CAMBRIDGESHIRE

DRAWING TITLE
TYPICAL OUTFALLS

CLIENT
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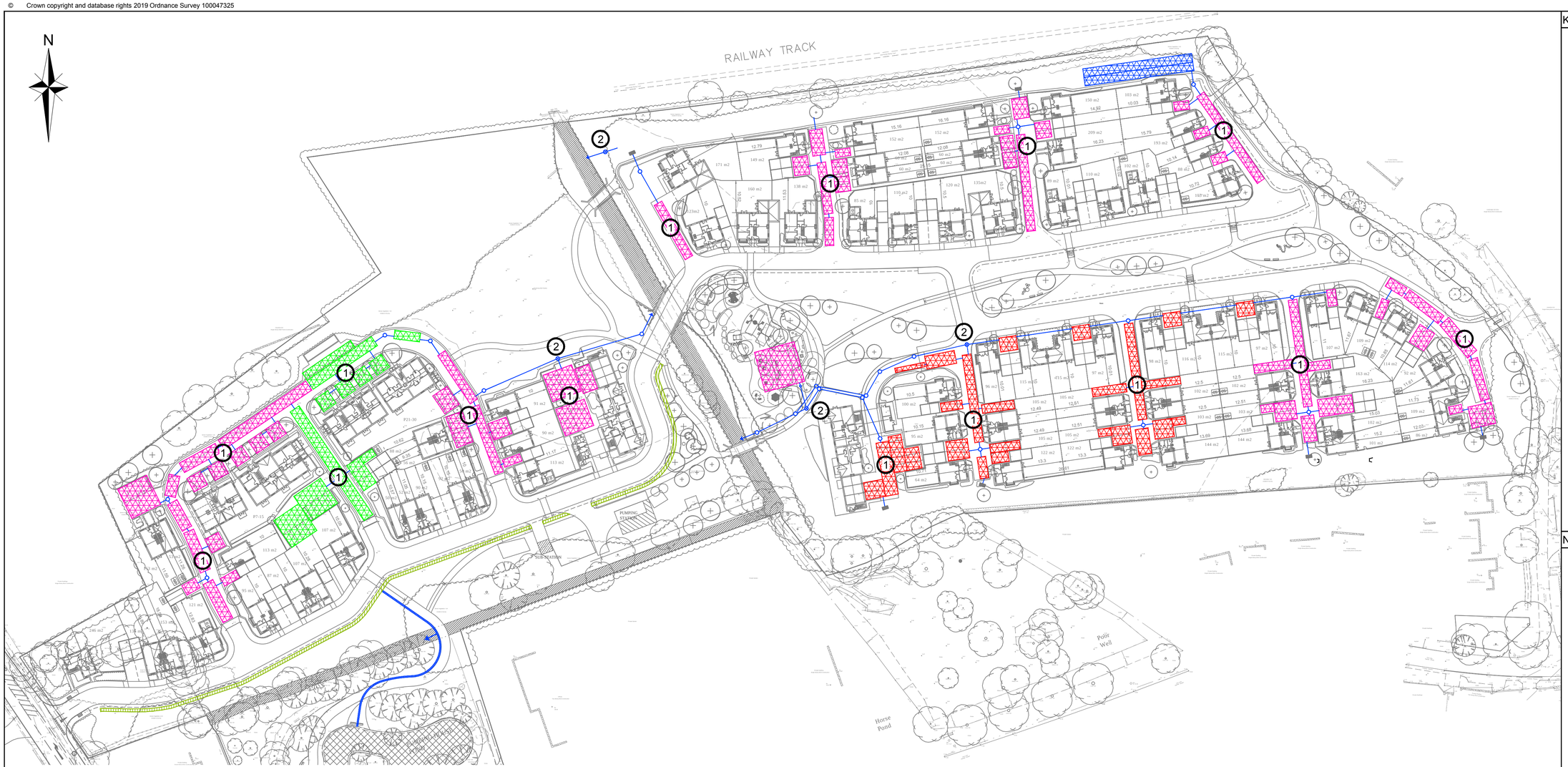
DRAWING NUMBER	REV.
B411 - PL - SK - 305	-

M:\B411 Fulbourn, CAMB\S\DRAWINGS\AUTOCAD\CURRENT DRGS\B411 - PL - SK - 305 - TYPICAL OUTFALLS



KEY

1. CELLULAR STORAGE CRATES
2. ORIFICE CONTROL CHAMBER

NOTES

1 - MAINTENANCE PLAN SUBJECT TO REGULAR REVISION AND UPDATE.

(1)

Maintenance schedule	Required action	Frequency
Regular maintenance	Inspect to identify any area of underperformance and correct (repair, improve etc)	Monthly for 3 months then annually
	Remove debris from drained area to prevent entry to the system	Monthly
	Check any infiltration surfaces which allow water to percolate into the tanks for blockages, correct as necessary	Annually
	Remove sediment from traps	Annually/as required
Remedial actions	Repair/replace inlets, outlets, overflows, and vents	As required.
Monitoring	Check that outlets, inlets, vents, and overflows are in good condition and working as intended	Annually
	Inspect tank internally, remove any sediment if present and if required	Every 5 years (or more frequently if necessary)

(2)

Maintenance schedule	Required action	Frequency
Remedial actions	Repair/replace inlets, outlets, overflows.	As required
Monitoring	Check that controls, protection, outlets, inlets and overflows are in good condition and working as intended	Half Yearly

REV	DESCRIPTION	DE	DR	CH	DATE

DESIGNED BY	DRAWN BY	CHECKED BY
-	DP	-

SCALE @ A1 SIZE	DATE
D.N.S.	27/02/2020

PROJECT TITLE

LAND AT TEVERSHAM ROAD, FULBOURN, CAMBRIDGESHIRE

DRAWING TITLE

BELOW GROUND MAINTENANCE PLAN

CLIENT

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DRAWING NUMBER: B411 - PL - SK - 306

REV.: -

M:\B411 Fulbourn_CAMBS\DRAWINGS\AUTOCAD\CURRENT DRGS\B411 - PL - SK - 306 - BELOW GROUND MAINTENANCE SCHEDULE

KEY

1. ATTENUATION BASIN
2. PERMEABLE PAVING
3. CHANNEL DRAIN
4. FILTER DRAIN

NOTES

1 - MAINTENANCE PLAN SUBJECT TO REGULAR REVISION AND UPDATE.

2 - DEAD VEGETATION, TRIMMINGS, SILT ETC TO BE APPLIED/STORED IN GREEN SPACE OR REMOVED FROM SITE AS APPROPRIATE.

1

Maintenance schedule	Required action	Frequency
Regular maintenance	Removal of litter and debris	Monthly
	Cut grass	Half yearly
	Manage other vegetation	Monthly then as required
	Inspect and clear inlets, outlets, overflows etc	Monthly
	Inspect and repair banks, pipes, headwalls etc	Monthly
	Inspect inlets and basin for silt accumulation	Monthly until able to establish the required silt removal frequency, then in accordance with established frequency
	Manage vegetation in wetter areas (micro-pools etc)	Annually or as established by ecologist/landscape architect
	Tidy dead growth	Annually (as per growing season)
	Remove sediment from traps, forebays etc	Annually
Occasional maintenance	Reseed	As required.
	Prune adjacent trees	Every 2 years, or as otherwise advised
	Silt removal	Every 5 years (depending on the requirement for regular maintenance)
Remedial actions	Repair erosion or other damage	As required
	Repair inlets, outlets and overflows	As required

2

Maintenance schedule	Required action	Frequency
Regular inspections	Check function of perforated pipes and drainage layer (inspection after rainfall)	Annually
	Check planting for health, weeds etc and replace as required	Quarterly
	Check inlets outlet and overflows	Quarterly
Regular maintenance	Removal of litter, debris and weeds	As required (at least quarterly)
	Re-plant / replace plants	As required
	Removed litter, silt etc	Quarterly to biannually as required
Occasional maintenance	Redress surface (mulch etc) general making good of surface, re-levelling etc	As required.
Remedial actions	Replace filter medium and vegetation	As required*

3

Maintenance schedule	Required action	Frequency
Regular Maintenance	Litter removal. Also removal of debris from site.	Monthly
Occasional Maintenance	Removal of leaves during the autumn to prevent blockage.	As required

4

Maintenance schedule	Required action	Frequency
Regular inspections	Check function of perforated pipes and drainage layer (inspection after rainfall)	Annually
	Check planting for health, weeds etc and replace as required	Quarterly
	Check inlets outlet and overflows	Quarterly
Regular maintenance	Removal of litter, debris and weeds	As required (at least quarterly)
	Re-plant / replace plants	As required
	Removed litter, silt etc	Quarterly to biannually as required
Occasional maintenance	Redress surface (mulch etc) general making good of surface, re-levelling etc	As required.
Remedial actions	Replace filter medium and vegetation	As required*

REV	DESCRIPTION	DE	DR	CH	DATE

DESIGNED BY	DRAWN BY	CHECKED BY
-	DP	-

SCALE @ A1 SIZE	DATE
D.N.S.	27/02/2020

PROJECT TITLE
LAND AT TEVERSHAM ROAD, FULBOURN, CAMBRIDGESHIRE

DRAWING TITLE
ABOVE GROUND MAINTENANCE PLAN

CLIENT
CASTLEFIELD INTERNATIONAL LTD

CANNON CONSULTING ENGINEERS
Highways, Transport & Infrastructure Planning

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DRAWING NUMBER: B411 - PL - SK - 307
REV.: -

M:\B411 Fulbourn, CAMBS\DRAWINGS\AUTOCAD\CURRENT DRGS\B411 - PL - SK - 307 - ABOVE GROUND MAINTENANCE SCHEDULE

N

RAILWAY TRACK

HINTON ROAD

PIERCE LANE

COW LANE

COW LANE

PUMPING STATION

G.S. STATION

Horse Pond

Pond

Well

KEY

EXCEEDANCE ROUTE

NOTES

REV	DESCRIPTION	DE	DR	CH	DATE

DESIGNED BY	DRAWN BY	CHECKED BY
-	DP	-

SCALE @ A1 SIZE	DATE
D.N.S.	27/02/2020

PROJECT TITLE

LAND AT TEVERSHAM ROAD, FULBOURN, CAMBRIDGESHIRE

DRAWING TITLE

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DRAWING NUMBER	REV.
B411 - PL - SK - 308	-

M:\B411 Fulbourn, CAMBS\DRAWINGS\AUTOCAD\CURRENT DRGS\B411 - PL - SK - 308 - EXCEEDANCE ROUTE PLAN

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

Outflow is too low. Design is unsatisfactory.

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	9.588	0.098	0.2	97.7	O K
30 min Summer	9.616	0.126	0.3	125.8	O K
60 min Summer	9.644	0.154	0.3	153.6	O K
120 min Summer	9.684	0.194	0.4	193.9	O K
180 min Summer	9.708	0.218	0.4	218.1	O K
240 min Summer	9.725	0.235	0.4	234.5	O K
360 min Summer	9.745	0.255	0.4	254.9	O K
480 min Summer	9.757	0.267	0.4	266.8	O K
600 min Summer	9.764	0.274	0.4	274.5	O K
720 min Summer	9.770	0.280	0.4	279.7	O K
960 min Summer	9.776	0.286	0.4	285.9	O K
1440 min Summer	9.780	0.290	0.4	290.2	O K
2160 min Summer	9.781	0.291	0.4	290.6	O K
2880 min Summer	9.779	0.289	0.4	289.1	O K
4320 min Summer	9.775	0.285	0.4	285.3	O K
5760 min Summer	9.773	0.283	0.4	283.3	O K
7200 min Summer	9.775	0.285	0.4	285.2	O K
8640 min Summer	9.779	0.289	0.4	289.1	O K
10080 min Summer	9.784	0.294	0.4	294.4	O K
15 min Winter	9.588	0.098	0.2	97.7	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	157.360	0.0	20.0	23
30 min Summer	101.360	0.0	23.0	38
60 min Summer	62.020	0.0	49.2	68
120 min Summer	39.270	0.0	56.0	128
180 min Summer	29.549	0.0	59.5	188
240 min Summer	23.905	0.0	61.6	248
360 min Summer	17.430	0.0	63.7	366
480 min Summer	13.768	0.0	64.5	486
600 min Summer	11.401	0.0	64.6	606
720 min Summer	9.742	0.0	64.4	726
960 min Summer	7.561	0.0	63.3	966
1440 min Summer	5.244	0.0	59.9	1444
2160 min Summer	3.633	0.0	122.3	2164
2880 min Summer	2.812	0.0	117.7	2880
4320 min Summer	1.987	0.0	107.3	4320
5760 min Summer	1.574	0.0	224.5	4904
7200 min Summer	1.330	0.0	220.2	5688
8640 min Summer	1.171	0.0	214.3	6400
10080 min Summer	1.060	0.0	206.9	7256
15 min Winter	157.360	0.0	20.0	23

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
30 min Winter	9.616	0.126	0.3	125.8	O K
60 min Winter	9.644	0.154	0.3	153.6	O K
120 min Winter	9.684	0.194	0.4	193.9	O K
180 min Winter	9.708	0.218	0.4	218.2	O K
240 min Winter	9.725	0.235	0.4	234.6	O K
360 min Winter	9.745	0.255	0.4	255.0	O K
480 min Winter	9.757	0.267	0.4	266.9	O K
600 min Winter	9.765	0.275	0.4	274.5	O K
720 min Winter	9.770	0.280	0.4	279.8	O K
960 min Winter	9.776	0.286	0.4	286.0	O K
1440 min Winter	9.780	0.290	0.4	290.4	O K
2160 min Winter	9.781	0.291	0.4	291.1	O K
2880 min Winter	9.780	0.290	0.4	290.0	O K
4320 min Winter	9.777	0.287	0.4	287.3	O K
5760 min Winter	9.775	0.285	0.4	284.6	O K
7200 min Winter	9.775	0.285	0.4	284.8	O K
8640 min Winter	9.778	0.288	0.4	288.0	O K
10080 min Winter	9.782	0.292	0.4	292.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
30 min Winter	101.360	0.0	23.0	38
60 min Winter	62.020	0.0	49.2	68
120 min Winter	39.270	0.0	56.0	126
180 min Winter	29.549	0.0	59.5	186
240 min Winter	23.905	0.0	61.6	244
360 min Winter	17.430	0.0	63.7	362
480 min Winter	13.768	0.0	64.5	482
600 min Winter	11.401	0.0	64.7	600
720 min Winter	9.742	0.0	64.4	718
960 min Winter	7.561	0.0	63.4	954
1440 min Winter	5.244	0.0	59.9	1426
2160 min Winter	3.633	0.0	122.4	2120
2880 min Winter	2.812	0.0	117.9	2800
4320 min Winter	1.987	0.0	107.6	4144
5760 min Winter	1.574	0.0	224.7	5360
7200 min Winter	1.330	0.0	220.5	5768
8640 min Winter	1.171	0.0	214.8	6664
10080 min Winter	1.060	0.0	207.5	7568

Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 550950 257200 TL 50950 57200
Data Type	Catchment
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.950
Cv (Winter)	0.950
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.262

Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)
0	4	0.162	4	8	0.100

Model Details

Storage is Online Cover Level (m) 10.090

Tank or Pond Structure

Invert Level (m) 9.490

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	1000.0	0.600	1000.0

Orifice Outflow Control

Diameter (m) 0.020 Discharge Coefficient 0.600 Invert Level (m) 9.490

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

Half Drain Time : 9648 minutes.

Outflow is too low. Design is unsatisfactory.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	9.338	0.138	0.0	0.4	0.4	237.7	O K
30 min Summer	9.378	0.178	0.0	0.5	0.5	306.0	O K
60 min Summer	9.417	0.217	0.0	0.5	0.5	374.0	O K
120 min Summer	9.474	0.274	0.0	0.6	0.6	472.5	O K
180 min Summer	9.509	0.309	0.0	0.7	0.7	532.0	O K
240 min Summer	9.533	0.333	0.0	0.7	0.7	572.6	O K
360 min Summer	9.562	0.362	0.0	0.7	0.7	623.4	O K
480 min Summer	9.580	0.380	0.0	0.7	0.7	653.7	O K
600 min Summer	9.591	0.391	0.0	0.7	0.7	673.7	O K
720 min Summer	9.599	0.399	0.0	0.7	0.7	687.8	O K
960 min Summer	9.610	0.410	0.0	0.8	0.8	705.6	O K
1440 min Summer	9.619	0.419	0.0	0.8	0.8	721.3	O K
2160 min Summer	9.624	0.424	0.0	0.8	0.8	730.4	O K
2880 min Summer	9.627	0.427	0.0	0.8	0.8	734.5	O K
4320 min Summer	9.630	0.430	0.0	0.8	0.8	740.7	O K
5760 min Summer	9.633	0.433	0.0	0.8	0.8	745.2	O K
7200 min Summer	9.637	0.437	0.0	0.8	0.8	752.6	O K
8640 min Summer	9.645	0.445	0.0	0.8	0.8	765.8	O K
10080 min Summer	9.655	0.455	0.0	0.8	0.8	783.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	157.360	0.0	35.1	27
30 min Summer	101.360	0.0	40.3	42
60 min Summer	62.020	0.0	87.2	72
120 min Summer	39.270	0.0	98.7	132
180 min Summer	29.549	0.0	104.7	192
240 min Summer	23.905	0.0	108.2	252
360 min Summer	17.430	0.0	111.8	372
480 min Summer	13.768	0.0	113.0	490
600 min Summer	11.401	0.0	113.2	610
720 min Summer	9.742	0.0	112.7	730
960 min Summer	7.561	0.0	110.7	970
1440 min Summer	5.244	0.0	104.6	1448
2160 min Summer	3.633	0.0	217.8	2168
2880 min Summer	2.812	0.0	209.4	2884
4320 min Summer	1.987	0.0	190.4	4324
5760 min Summer	1.574	0.0	413.3	5760
7200 min Summer	1.330	0.0	403.3	6712
8640 min Summer	1.171	0.0	390.9	7352
10080 min Summer	1.060	0.0	376.3	8160

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

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Winter	9.338	0.138	0.0	0.4	0.4	237.7	O K
30 min Winter	9.378	0.178	0.0	0.5	0.5	306.0	O K
60 min Winter	9.417	0.217	0.0	0.5	0.5	374.0	O K
120 min Winter	9.474	0.274	0.0	0.6	0.6	472.5	O K
180 min Winter	9.509	0.309	0.0	0.7	0.7	532.1	O K
240 min Winter	9.533	0.333	0.0	0.7	0.7	572.6	O K
360 min Winter	9.562	0.362	0.0	0.7	0.7	623.5	O K
480 min Winter	9.580	0.380	0.0	0.7	0.7	653.8	O K
600 min Winter	9.591	0.391	0.0	0.7	0.7	673.8	O K
720 min Winter	9.600	0.400	0.0	0.7	0.7	687.9	O K
960 min Winter	9.610	0.410	0.0	0.8	0.8	705.8	O K
1440 min Winter	9.619	0.419	0.0	0.8	0.8	721.7	O K
2160 min Winter	9.625	0.425	0.0	0.8	0.8	731.1	O K
2880 min Winter	9.627	0.427	0.0	0.8	0.8	735.7	O K
4320 min Winter	9.632	0.432	0.0	0.8	0.8	743.2	O K
5760 min Winter	9.635	0.435	0.0	0.8	0.8	749.6	O K
7200 min Winter	9.641	0.441	0.0	0.8	0.8	758.7	O K
8640 min Winter	9.647	0.447	0.0	0.8	0.8	769.5	O K
10080 min Winter	9.655	0.455	0.0	0.8	0.8	783.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Winter	157.360	0.0	35.1	27
30 min Winter	101.360	0.0	40.3	42
60 min Winter	62.020	0.0	87.2	72
120 min Winter	39.270	0.0	98.7	130
180 min Winter	29.549	0.0	104.7	190
240 min Winter	23.905	0.0	108.2	248
360 min Winter	17.430	0.0	111.8	368
480 min Winter	13.768	0.0	113.1	486
600 min Winter	11.401	0.0	113.2	604
720 min Winter	9.742	0.0	112.8	722
960 min Winter	7.561	0.0	110.8	960
1440 min Winter	5.244	0.0	104.8	1430
2160 min Winter	3.633	0.0	218.0	2136
2880 min Winter	2.812	0.0	209.6	2828
4320 min Winter	1.987	0.0	190.8	4196
5760 min Winter	1.574	0.0	413.8	5536
7200 min Winter	1.330	0.0	403.9	6840
8640 min Winter	1.171	0.0	391.7	8040
10080 min Winter	1.060	0.0	377.3	8376

Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 550950 257200 TL 50950 57200
Data Type	Catchment
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.950
Cv (Winter)	0.950
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.637

Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)
0	4	0.213	4	8	0.212	8	12	0.212

Model Details

Storage is Online Cover Level (m) 10.100

Complex Structure

Cellular Storage

Invert Level (m) 9.200 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	1120.7	1120.7	0.601	0.0	1201.1
0.600	1120.7	1201.0			

Cellular Storage

Invert Level (m) 9.200 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	691.5	691.5	0.536	0.0	747.8
0.535	691.5	747.8			

Orifice Outflow Control

Diameter (m) 0.024 Discharge Coefficient 0.600 Invert Level (m) 9.200

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

Half Drain Time : 7562 minutes.

Outflow is too low. Design is unsatisfactory.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	9.197	0.497	0.0	0.6	0.6	216.9	O K
30 min Summer	9.267	0.567	0.0	0.6	0.6	279.1	O K
60 min Summer	9.331	0.631	0.0	0.7	0.7	340.9	O K
120 min Summer	9.417	0.717	0.0	0.7	0.7	430.3	O K
180 min Summer	9.463	0.763	0.0	0.7	0.7	484.1	O K
240 min Summer	9.493	0.793	0.0	0.7	0.7	520.6	O K
360 min Summer	9.530	0.830	0.0	0.8	0.8	565.9	Flood Risk
480 min Summer	9.550	0.850	0.0	0.8	0.8	592.4	Flood Risk
600 min Summer	9.563	0.863	0.0	0.8	0.8	609.6	Flood Risk
720 min Summer	9.572	0.872	0.0	0.8	0.8	621.3	Flood Risk
960 min Summer	9.583	0.883	0.0	0.8	0.8	635.4	Flood Risk
1440 min Summer	9.590	0.890	0.0	0.8	0.8	645.5	Flood Risk
2160 min Summer	9.592	0.892	0.0	0.8	0.8	647.5	Flood Risk
2880 min Summer	9.590	0.890	0.0	0.8	0.8	645.3	Flood Risk
4320 min Summer	9.586	0.886	0.0	0.8	0.8	639.7	Flood Risk
5760 min Summer	9.581	0.881	0.0	0.8	0.8	633.5	Flood Risk
7200 min Summer	9.581	0.881	0.0	0.8	0.8	633.5	Flood Risk
8640 min Summer	9.586	0.886	0.0	0.8	0.8	639.5	Flood Risk
10080 min Summer	9.593	0.893	0.0	0.8	0.8	649.7	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	157.360	0.0	48.6	27
30 min Summer	101.360	0.0	52.0	42
60 min Summer	62.020	0.0	107.7	72
120 min Summer	39.270	0.0	115.3	132
180 min Summer	29.549	0.0	119.0	192
240 min Summer	23.905	0.0	121.1	252
360 min Summer	17.430	0.0	122.9	370
480 min Summer	13.768	0.0	123.4	490
600 min Summer	11.401	0.0	123.3	610
720 min Summer	9.742	0.0	122.8	730
960 min Summer	7.561	0.0	121.2	970
1440 min Summer	5.244	0.0	116.7	1448
2160 min Summer	3.633	0.0	238.4	2168
2880 min Summer	2.812	0.0	232.0	2884
4320 min Summer	1.987	0.0	217.6	4324
5760 min Summer	1.574	0.0	454.3	5712
7200 min Summer	1.330	0.0	445.0	6280
8640 min Summer	1.171	0.0	434.0	7096
10080 min Summer	1.060	0.0	421.5	7872

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

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Winter	9.197	0.497	0.0	0.6	0.6	216.9	O K
30 min Winter	9.267	0.567	0.0	0.6	0.6	279.1	O K
60 min Winter	9.331	0.631	0.0	0.7	0.7	340.9	O K
120 min Winter	9.418	0.718	0.0	0.7	0.7	430.3	O K
180 min Winter	9.464	0.764	0.0	0.7	0.7	484.2	O K
240 min Winter	9.494	0.794	0.0	0.7	0.7	520.7	O K
360 min Winter	9.530	0.830	0.0	0.8	0.8	566.1	Flood Risk
480 min Winter	9.550	0.850	0.0	0.8	0.8	592.7	Flood Risk
600 min Winter	9.564	0.864	0.0	0.8	0.8	609.9	Flood Risk
720 min Winter	9.573	0.873	0.0	0.8	0.8	621.7	Flood Risk
960 min Winter	9.583	0.883	0.0	0.8	0.8	635.9	Flood Risk
1440 min Winter	9.591	0.891	0.0	0.8	0.8	646.3	Flood Risk
2160 min Winter	9.593	0.893	0.0	0.8	0.8	648.9	Flood Risk
2880 min Winter	9.592	0.892	0.0	0.8	0.8	647.4	Flood Risk
4320 min Winter	9.589	0.889	0.0	0.8	0.8	643.5	Flood Risk
5760 min Winter	9.586	0.886	0.0	0.8	0.8	639.5	Flood Risk
7200 min Winter	9.586	0.886	0.0	0.8	0.8	639.2	Flood Risk
8640 min Winter	9.587	0.887	0.0	0.8	0.8	641.6	Flood Risk
10080 min Winter	9.594	0.894	0.0	0.8	0.8	650.1	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Winter	157.360	0.0	48.6	27
30 min Winter	101.360	0.0	52.0	42
60 min Winter	62.020	0.0	107.7	72
120 min Winter	39.270	0.0	115.3	130
180 min Winter	29.549	0.0	119.0	190
240 min Winter	23.905	0.0	121.0	248
360 min Winter	17.430	0.0	122.9	366
480 min Winter	13.768	0.0	123.4	486
600 min Winter	11.401	0.0	123.2	604
720 min Winter	9.742	0.0	122.7	722
960 min Winter	7.561	0.0	121.0	958
1440 min Winter	5.244	0.0	116.4	1430
2160 min Winter	3.633	0.0	238.1	2128
2880 min Winter	2.812	0.0	231.5	2828
4320 min Winter	1.987	0.0	217.0	4192
5760 min Winter	1.574	0.0	453.8	5488
7200 min Winter	1.330	0.0	444.5	6776
8640 min Winter	1.171	0.0	433.6	7864
10080 min Winter	1.060	0.0	421.3	8072

Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 550950 257200 TL 50950 57200
Data Type	Catchment
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.950
Cv (Winter)	0.950
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.582

Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)
0	4	0.194	4	8	0.194	8	12	0.194

Model Details

Storage is Online Cover Level (m) 9.800

Complex Structure

Cellular Storage

Invert Level (m) 8.700 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	204.5	204.5	0.301	0.0	221.7
0.300	204.5	221.7			

Tank or Pond

Invert Level (m) 9.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	107.0	0.800	456.0

Tank or Pond

Invert Level (m) 9.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	54.0	0.400	212.0	0.401	294.0	0.800	605.0

Cellular Storage

Invert Level (m) 9.000 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	612.6	612.6	0.601	0.0	672.1
0.600	612.6	672.0			

Orifice Outflow Control

Diameter (m) 0.020 Discharge Coefficient 0.600 Invert Level (m) 8.700

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

Half Drain Time : 9644 minutes.

Outflow is too low. Design is unsatisfactory.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	9.820	0.170	0.0	0.3	0.3	182.9	O K
30 min Summer	9.867	0.217	0.0	0.4	0.4	235.5	O K
60 min Summer	9.913	0.263	0.0	0.4	0.4	287.8	O K
120 min Summer	9.978	0.328	0.0	0.5	0.5	363.5	O K
180 min Summer	10.016	0.366	0.0	0.5	0.5	409.3	O K
240 min Summer	10.042	0.392	0.0	0.5	0.5	440.5	O K
360 min Summer	10.075	0.425	0.0	0.5	0.5	479.6	O K
480 min Summer	10.093	0.443	0.0	0.5	0.5	502.9	O K
600 min Summer	10.108	0.458	0.0	0.6	0.6	518.3	O K
720 min Summer	10.121	0.471	0.0	0.6	0.6	529.1	O K
960 min Summer	10.136	0.486	0.0	0.6	0.6	542.7	O K
1440 min Summer	10.150	0.500	0.0	0.6	0.6	554.7	O K
2160 min Summer	10.157	0.507	0.0	0.6	0.6	561.6	O K
2880 min Summer	10.161	0.511	0.0	0.6	0.6	564.7	O K
4320 min Summer	10.166	0.516	0.0	0.6	0.6	569.3	O K
5760 min Summer	10.169	0.519	0.0	0.6	0.6	572.5	O K
7200 min Summer	10.175	0.525	0.0	0.6	0.6	577.9	O K
8640 min Summer	10.186	0.536	0.0	0.6	0.6	587.6	O K
10080 min Summer	10.200	0.550	0.0	0.6	0.6	600.7	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	157.360	0.0	27.5	19
30 min Summer	101.360	0.0	31.4	34
60 min Summer	62.020	0.0	67.5	64
120 min Summer	39.270	0.0	75.9	124
180 min Summer	29.549	0.0	80.1	184
240 min Summer	23.905	0.0	82.6	244
360 min Summer	17.430	0.0	85.1	364
480 min Summer	13.768	0.0	85.9	484
600 min Summer	11.401	0.0	86.0	604
720 min Summer	9.742	0.0	85.7	724
960 min Summer	7.561	0.0	84.3	964
1440 min Summer	5.244	0.0	80.1	1442
2160 min Summer	3.633	0.0	166.1	2164
2880 min Summer	2.812	0.0	160.0	2880
4320 min Summer	1.987	0.0	146.5	4320
5760 min Summer	1.574	0.0	316.2	5760
7200 min Summer	1.330	0.0	309.1	6840
8640 min Summer	1.171	0.0	300.6	7352
10080 min Summer	1.060	0.0	290.7	8168

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

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Winter	9.820	0.170	0.0	0.3	0.3	182.9	O K
30 min Winter	9.867	0.217	0.0	0.4	0.4	235.5	O K
60 min Winter	9.913	0.263	0.0	0.4	0.4	287.7	O K
120 min Winter	9.978	0.328	0.0	0.5	0.5	363.5	O K
180 min Winter	10.016	0.366	0.0	0.5	0.5	409.3	O K
240 min Winter	10.042	0.392	0.0	0.5	0.5	440.5	O K
360 min Winter	10.075	0.425	0.0	0.5	0.5	479.6	O K
480 min Winter	10.093	0.443	0.0	0.5	0.5	502.9	O K
600 min Winter	10.108	0.458	0.0	0.6	0.6	518.3	O K
720 min Winter	10.121	0.471	0.0	0.6	0.6	529.1	O K
960 min Winter	10.136	0.486	0.0	0.6	0.6	542.8	O K
1440 min Winter	10.150	0.500	0.0	0.6	0.6	555.0	O K
2160 min Winter	10.158	0.508	0.0	0.6	0.6	562.1	O K
2880 min Winter	10.162	0.512	0.0	0.6	0.6	565.6	O K
4320 min Winter	10.168	0.518	0.0	0.6	0.6	571.3	O K
5760 min Winter	10.173	0.523	0.0	0.6	0.6	576.0	O K
7200 min Winter	10.181	0.531	0.0	0.6	0.6	582.8	O K
8640 min Winter	10.190	0.540	0.0	0.6	0.6	590.9	O K
10080 min Winter	10.201	0.551	0.0	0.6	0.6	601.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Winter	157.360	0.0	27.5	19
30 min Winter	101.360	0.0	31.4	34
60 min Winter	62.020	0.0	67.5	64
120 min Winter	39.270	0.0	75.9	124
180 min Winter	29.549	0.0	80.2	182
240 min Winter	23.905	0.0	82.7	242
360 min Winter	17.430	0.0	85.1	362
480 min Winter	13.768	0.0	86.0	480
600 min Winter	11.401	0.0	86.0	598
720 min Winter	9.742	0.0	85.7	716
960 min Winter	7.561	0.0	84.3	954
1440 min Winter	5.244	0.0	80.1	1428
2160 min Winter	3.633	0.0	166.2	2136
2880 min Winter	2.812	0.0	160.2	2824
4320 min Winter	1.987	0.0	146.7	4192
5760 min Winter	1.574	0.0	316.4	5536
7200 min Winter	1.330	0.0	309.3	6840
8640 min Winter	1.171	0.0	300.9	8040
10080 min Winter	1.060	0.0	291.0	8376

Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 550950 257200 TL 50950 57200
Data Type	Catchment
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.950
Cv (Winter)	0.950
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.490

Time (mins) From:	To:	Area (ha)
0	4	0.490

Model Details

Storage is Online Cover Level (m) 10.550

Complex Structure

Cellular Storage

Invert Level (m) 9.650 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	392.0	392.0	0.451	0.0	427.7
0.450	392.0	427.6			

Cellular Storage

Invert Level (m) 9.650 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	607.1	607.1	0.601	0.0	666.3
0.600	607.1	666.2			

Tank or Pond

Invert Level (m) 9.650

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	38.0	0.600	146.0

Tank or Pond

Invert Level (m) 9.650

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	62.0	0.600	228.0

Orifice Outflow Control

Diameter (m) 0.020 Discharge Coefficient 0.600 Invert Level (m) 9.650

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

Half Drain Time : 4739 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	9.527	0.127	0.0	0.3	0.3	82.0	O K
30 min Summer	9.563	0.163	0.0	0.3	0.3	105.5	O K
60 min Summer	9.599	0.199	0.0	0.4	0.4	128.8	O K
120 min Summer	9.651	0.251	0.0	0.4	0.4	162.4	O K
180 min Summer	9.680	0.280	0.0	0.4	0.4	182.4	O K
240 min Summer	9.699	0.299	0.0	0.4	0.4	195.9	O K
360 min Summer	9.722	0.322	0.0	0.5	0.5	212.4	O K
480 min Summer	9.735	0.335	0.0	0.5	0.5	221.8	O K
600 min Summer	9.743	0.343	0.0	0.5	0.5	227.7	O K
720 min Summer	9.748	0.348	0.0	0.5	0.5	231.5	O K
960 min Summer	9.754	0.354	0.0	0.5	0.5	235.5	O K
1440 min Summer	9.755	0.355	0.0	0.5	0.5	236.8	O K
2160 min Summer	9.751	0.351	0.0	0.5	0.5	233.9	O K
2880 min Summer	9.745	0.345	0.0	0.5	0.5	229.4	O K
4320 min Summer	9.736	0.336	0.0	0.5	0.5	222.5	O K
5760 min Summer	9.732	0.332	0.0	0.5	0.5	219.7	O K
7200 min Summer	9.732	0.332	0.0	0.5	0.5	219.8	O K
8640 min Summer	9.734	0.334	0.0	0.5	0.5	221.2	O K
10080 min Summer	9.737	0.337	0.0	0.5	0.5	223.6	O K
15 min Winter	9.527	0.127	0.0	0.3	0.3	82.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	157.360	0.0	22.6	19
30 min Summer	101.360	0.0	26.0	34
60 min Summer	62.020	0.0	54.5	64
120 min Summer	39.270	0.0	62.2	124
180 min Summer	29.549	0.0	66.2	184
240 min Summer	23.905	0.0	68.6	244
360 min Summer	17.430	0.0	70.9	364
480 min Summer	13.768	0.0	71.7	484
600 min Summer	11.401	0.0	71.9	604
720 min Summer	9.742	0.0	71.6	722
960 min Summer	7.561	0.0	70.4	962
1440 min Summer	5.244	0.0	66.8	1442
2160 min Summer	3.633	0.0	133.4	2160
2880 min Summer	2.812	0.0	128.9	2880
4320 min Summer	1.987	0.0	118.1	3632
5760 min Summer	1.574	0.0	234.9	4376
7200 min Summer	1.330	0.0	232.3	5120
8640 min Summer	1.171	0.0	227.6	5968
10080 min Summer	1.060	0.0	220.7	6848
15 min Winter	157.360	0.0	22.6	19

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

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control Σ Outflow (l/s)	Max Volume (m³)	Status
30 min Winter	9.563	0.163	0.0	0.3	105.5	O K
60 min Winter	9.599	0.199	0.0	0.4	128.8	O K
120 min Winter	9.651	0.251	0.0	0.4	162.4	O K
180 min Winter	9.680	0.280	0.0	0.4	182.4	O K
240 min Winter	9.699	0.299	0.0	0.4	195.9	O K
360 min Winter	9.722	0.322	0.0	0.5	212.5	O K
480 min Winter	9.735	0.335	0.0	0.5	221.9	O K
600 min Winter	9.743	0.343	0.0	0.5	227.8	O K
720 min Winter	9.748	0.348	0.0	0.5	231.6	O K
960 min Winter	9.754	0.354	0.0	0.5	235.7	O K
1440 min Winter	9.756	0.356	0.0	0.5	237.2	O K
2160 min Winter	9.752	0.352	0.0	0.5	234.6	O K
2880 min Winter	9.747	0.347	0.0	0.5	230.8	O K
4320 min Winter	9.737	0.337	0.0	0.5	223.3	O K
5760 min Winter	9.731	0.331	0.0	0.5	219.1	O K
7200 min Winter	9.729	0.329	0.0	0.5	218.0	O K
8640 min Winter	9.729	0.329	0.0	0.5	218.0	O K
10080 min Winter	9.731	0.331	0.0	0.5	218.8	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
30 min Winter	101.360	0.0	26.0	34
60 min Winter	62.020	0.0	54.5	64
120 min Winter	39.270	0.0	62.3	122
180 min Winter	29.549	0.0	66.2	182
240 min Winter	23.905	0.0	68.6	242
360 min Winter	17.430	0.0	70.9	360
480 min Winter	13.768	0.0	71.8	478
600 min Winter	11.401	0.0	71.9	596
720 min Winter	9.742	0.0	71.7	714
960 min Winter	7.561	0.0	70.5	950
1440 min Winter	5.244	0.0	66.9	1414
2160 min Winter	3.633	0.0	133.5	2100
2880 min Winter	2.812	0.0	129.1	2768
4320 min Winter	1.987	0.0	118.3	4016
5760 min Winter	1.574	0.0	235.1	4496
7200 min Winter	1.330	0.0	232.6	5408
8640 min Winter	1.171	0.0	228.1	6392
10080 min Winter	1.060	0.0	221.3	7264

Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 550950 257200 TL 50950 57200
Data Type	Catchment
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.950
Cv (Winter)	0.950
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.220

Time (mins) From:	To:	Area (ha)
0	4	0.220

Model Details

Storage is Online Cover Level (m) 10.250

Complex Structure

Cellular Storage

Invert Level (m) 9.400 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	499.3	499.3	0.451	0.0	539.6
0.450	499.3	539.5			

Cellular Storage

Invert Level (m) 9.400 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	181.0	181.0	0.601	0.0	213.3
0.600	181.0	213.3			

Tank or Pond

Invert Level (m) 9.650

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	57.0	0.600	218.0

Orifice Outflow Control

Diameter (m) 0.020 Discharge Coefficient 0.600 Invert Level (m) 9.400