C
D
S

Discover what's beneath

Drainage Strategy Report for East Cambridgeshire District Council

Address: Former Mepal Outdoor Centre, Chatteris Road, Mepal, Ely, East Cambridgeshire, CB6 2AZ

Date: June 2021

The CDS Group, Building 51, Wrest Park, Silsoe, Bedfordshire, MK45 4HS
W: www.thecdsgroup.co.uk
T: 01525 864387



Contents

1 Site Description 1
2 Development Proposals 2
3 Surface Water Drainage 2
3.1 Existing Surface Water Drainage 2
3.2 Proposed Surface Water Drainage 2
4 Foul Water Drainage 3
4.1 Existing Foul Water Drainage 3
4.2 Proposed Foul Water Drainage 4
5 Conclusion 4

Appendix A Site Plan
Appendix B Anglian Water Sewer Records
Appendix C Outline Surface Water Calculations
Appendix D Greenfield Runoff Estimation
Appendix E Drainage Strategy Drawing

Figures

Figure 1. Map of the site (boundary indicated in red) 1
Figure 2. Aerial photograph of the site (boundary indicated in red) 1

Tables

Table 1. Undeveloped greenfield runoff rate 3

1 Site Description

The CDS Group have been asked to undertake a drainage strategy for planning for the construction of a crematorium and associated service and administration building, function building, memorial garden, natural burial areas, pet cemetery, car parking, reinstatement of existing vehicular access from the A142 to the north of the site and landscaping at the site of the former Mepal Outdoor Centre site, Chatteris Road, Mepal, East Cambridgeshire, CB6 2AZ, grid reference 542308, 282928. The site area is approximately 13.1 hectares in size.

The site, as detailed above, was previously used as an outdoor activity centre where activities such as archery, rock climbing, sailing, and canoeing took place. However, this usage was not financially viable, and the site has been vacant for several years and has suffered from antisocial behaviour, vandalism and arson. A large proportion of the site to the north and west contains a lake, whilst the south eastern area includes a cluster of buildings of different scale and design, all associated with the outdoor centre. This area also contains a large surface level car park with a vehicular access and a second vehicular access point further north on the A142.

Figure 1. Map of the site (boundary indicated in red)

Figure 2. Aerial photograph of the site (boundary indicated in red)

The part of the site that the crematorium and associated car park is proposed, sits at maximum of around 3.08mAOD towards the eastern side of the site and in general tends to fall to the south of the site and towards the lake where the lowest point of the site is located at -1.19mAOD. However, the true high point of the site is towards the northern edge, sitting at around 3.73mAOD.

2 Development Proposals

The proposed development will consist of a construction of a crematorium and associated service and administration building, function building, memorial garden, natural burial areas, pet cemetery, car parking, reinstatement of existing vehicular access from the A142 to the north of the site and landscaping.

A proposed site plan can be seen in Appendix A.

3 Surface Water Drainage

3.1 Existing Surface Water Drainage

The existing drainage on site is in a poor condition and cannot be reused for the proposed development. Additionally, this means that tracing the drainage has proved difficult. The existing outfalls for both the surface water and foul water are therefore unknown.

According to the Anglian Water sewer records, that can be seen in Appendix B, there are no public sewers in the vicinity of the site. It is therefore likely that the existing surface water drainage either drains into below ground soakaways or simply runs off onto permeable ground and soaks away or is discharged into the lake, either at an attenuated controlled flow rate or not.

3.2 Proposed Surface Water Drainage

All roofs and hardstanding areas on site will be drained into a piped drainage system, which will then discharge into a below ground soakaway, constructed from soakaway crates. The roof and hardstand area required to be drained is 1186m^2. The roads and car parks will all be constructed as permeable and will therefore require no piped system.

Due to the fact that the site is made up of placed reject sand, the proposed soakaway will need to be placed a minimum of 10m away from proposed structures due to the risk of inundation settlement, which could lead to damage of building foundations.

All piped drainage on site will be designed to not flood at any point during a 1 in 100-year storm event. This will include a 40% allowance for climate change in the calculation. Full surface water drainage calculations can be provided prior to the commencement of the construction of the drainage system. Outline soakaway sizing calculations can be seen in Appendix C. This uses an assumed infiltration rate, based on the soil characteristics found on site during trial pitting, of $8.40x10^{-5}$m/s. Using the assumed infiltration rate and the area required to be drained, a storage volume of 55.92m^3 is required. A soakaway with dimensions of 3.00m x 50.00m x 0.40m provides a storage volume of 57.00m^3 once the typical geocellular crate void ratio of 95% has been applied. It should be noted that because the soakaway is below a permeable surface then the soakaway must also provide storage for its own footprint area of 150m^2.

Soakaway testing to the standards set out in BRE365 will be required prior to the confirmation of the drainage design and commencement of the drainage works on site. If soakaway testing shows that soakaways will not be a practical solution on site, then the surface water will be attenuated and discharged to the lake at a controlled flow rate, equivalent to the QBar value for the site. As the site is brownfield, attenuating to the greenfield runoff rate is not a strict requirement, however, it is recognised that, where possible, brownfield sites should strive to return the surface water discharge to greenfield levels. The proposed development will therefore provide a large degree of betterment in this regard.

Based on trial pitting undertaken on site, permeable roads, car parks and paths are considered to be a viable solution. The final design will however depend on successful shallow infiltration tests being undertaken and these will therefore be carried out prior to the commencement of construction. If these tests show that permeable surfaces are not viable then these surfaces will be piped into the drainage system described above.

The HR Wallingford Greenfield Runoff Estimation Tool has been used to estimate the greenfield flows from the existing site. The results of this estimation can be seen in Table 1 below and the full calculation can be seen in Appendix D.

Table 1. Undeveloped greenfield runoff rate

Event	Flow Rate (l/s)
Qbar	1.56
1 in 1 year	1.36
1 in 30 year	3.82
1 in 100 year	5.55

As Qbar is below 2l/s, the limiting discharge rates may be set at 2l/s. Additionally, if the surface water outfall flows into the lake, there may be a risk of blockages occurring at the outfall and as per note 2 of the HR Wallingford Greenfield Runoff Rate Estimation Tool the discharge rate may be set at 5l/s if this risk is present. Any flow at a rate above this will need to be managed in accordance with Sustainable Drainage System (SuDS) methodology.

Therefore, if the proposed surface water drainage system requires an attenuated discharge to the lake it will include an attenuation structure and flow control which will ensure that any runoff from site that exceeds the limiting discharge rate (Q/bar) will be attenuated. If the water is to be attenuated below ground, then it will also require a proprietary treatment system as outlined in Chapter 26 of the CIRIA SuDS Manual.

The drainage strategy drawing can be seen in Appendix E.

4 Foul Water Drainage

4.1 Existing Foul Water Drainage

The existing drainage on site is in a poor condition and cannot be reused for the proposed development. Additionally, this means that tracing the drainage has proved difficult. The existing outfalls for both the surface water and foul water are therefore unknown.

According to the Anglian Water sewer records, that can be seen in Appendix B, there are no public sewers in the vicinity of the site. It is therefore likely that the existing foul water drainage either drains into an existing cess pit or septic tank, although neither of these have been identified or surveyed to date.

4.2 Proposed Foul Water Drainage

The foul water drainage on site will drain the soil vent pipes from the crematorium building into a piped system, which will then flow into a below ground cess pit. There are no public foul water sewers in the vicinity of the site to discharge raw sewage into and no flowing ditches to discharge treated effluent into. There is also insufficient space on site for a foul water drainage field to be installed.

The proposed cess pit has been sized based on flow estimations from British Water Flows and Loads 4 and will require emptying at regular intervals of 14 days at first, this interval may be increased by installing a larger cess pit and by monitoring usage over a period of months to ascertain a more accurate flow rate once the site has become active allowing a potentially more efficient cess pit emptying timetable.

British Water Flows and Loads 4 does not have specific information for crematoria. However, based on 5 full-time staff and taking a value for the crematorium attendees akin to that of 'non-residential conference guests', the numbers of which are taken as the capacity of the service hall, based on the fact that people will mostly be sitting and listening to the service, although because there will be no food or drink facilities, this is a conservative estimation. Additionally, the crematorium will only run services between 10:00 and 16:00 whereas a conference guest would be expected to attend for 8 hours a day. Therefore, one seat in the service hall has been taken to be the equivalent of 0.75 conference guests for the purposes of this calculation.

$$V = N_S \times Q_S + N_A \times Q_A$$

$$V = 5 \times 90 + 108 \times 60 \times 0.75$$

$$V = 5{,}310 \ litres$$

V = Total daily volume of foul water (litres)
N_S = Number of Staff
Q_S = Flow per staff member, per day (litres)
N_A = Number of seats in service hall
Q_A = Flow per seat, per day (litres)

The crematorium will operate Monday to Friday and therefore a weekly flow will be for 5 days, not 7. For 14-day collection intervals (plus an extra 24 hours for emergency storage) this equates to a tank with a total storage capacity of at least 58,410 litres. This storage capacity can be adjusted to suit a variety of collection intervals in the final design.

5 Conclusion

The site is currently the vacant plot of land, which comprises a former outdoor activities centre. The existing drainage infrastructure is in a poor condition and it has therefore not been possible to accurately trace the layout of the exiting drainage infrastructure. The surface water drainage system likely drains straight to the ground via soakaways or is discharged directly into the adjacent lake. The foul water system most likely drains into a cess pit or septic tank.

The proposed development comprises the construction of a new construction of a crematorium and associated service and administration building, function building, memorial garden, natural burial areas, pet cemetery, car parking, reinstatement of existing vehicular access from the A142 to the north of the site and landscaping. The roof and non-permeable hardstanding areas will be drained by the surface water system into below ground soakaways, subject to successful BRE365 soakage testing. The roads, car park and footpaths will all be porous, subject to successful shallow infiltration testing (BRE151/NHBC5.3 tests).

If the BRE365 tests show that soakaways are not viable then the surface water will be attenuated and discharged to the lake at a controlled flow rate. If shallow infiltration tests show that porous paving and roads are not viable then these areas will be piped into the main surface water drainage system.

The surface water drainage system will be designed to cope with a 1 in 100-year storm event plus a 40% allowance for climate change, with no flooding occurring in the system.

If the site is required to discharge the surface water into the lake, then this will be via a controlled discharge rate of 5l/s as recommended in the HR Wallingford Greenfield Runoff Estimation Tool. Any flow above this will need to be attenuated. Any attenuated flow will require a water treatment element, the most likely attenuation method for this site will be a below ground attenuation tank in which case a proprietary treatment system will be installed as outlined in Chapter 26 of the CIRIA SuDS Manual.

The foul water drainage system will drain the soil vent pipes from the crematorium building into a cess pit. There are no public foul sewers or flowing ditches to discharge effluent into. The estimated foul water flow rate per day from the development is 5,310 litres. Based on 14-day collection intervals (plus a 24-hour emergency storage period) the minimum storage capacity required for the cess pit is 58,410 litres.

APPENDIX A

SITE PLAN

Legend

- Site application boundary
- Existing tarmac roadways
- Lake
- Existing trees and shubs
- Existing ground cover vegetation
- Area of existing open mosaic habitat
- Existing sandy area
- Proposed Crematorium buiding
- Proposed trees
- New proposed area of open mosaic habitat
- Proposed ornamental planting
- Proposed grass
- Proposed wild flower meadow
- Proposed timber decking and timber jetties
- Proposed resin-bonded gravel
- Proposed grid-reinforced gravel
- Proposed permeable buff coloured asphalt
- Proposed block paving
- Proposed buff-coloured sawn slab paving
- Proposed hoggin / crushed stone roadway / footpath
- Proposed country rail knee high fence
- Proposed metal mesh security fence
- Proposed bird hide

Rev	Date	Description	By
00	00.00.00	X	PC

CLIENT

EAST CAMBRIDGESHIRE DISTRICT COUNCIL

PROJECT

Former Mepal Outdoor Centre, Chatteris road, Mepal, Ely, Cambridgeshire, CB6 2AZ

TITLE

General Site Layout Plan

CDS
Cemeteries & Crematoria
Parks & Leisure
Environmental Solutions

The CDS Group
Building 51, Wrest Park
Silsoe, Bedfordshire
MK45 4HS
+44 (0)1525 864387
www.thecdsgroup.co.uk

Drawn by: JM / Approved by: BB / AJ	Drawing Status: ISSUED
Scale 1:1000 @ A1 / Sheet 1 of 1	Date: AUGUST 2021

Drawing : D210002-CDS-EN-ZZ-DR-L-001

APPENDIX B

ANGLIAN WATER SEWER RECORDS

Data updated: 01/10/19

Scale: 1:1250
Map Centre: 542135,283071
Date: 30/10/19
Our Ref: 340765 - 2
Wastewater Plan A2
Powered by digdat

Foul Sewer	Outfall*	Sewage Treatment Works	
Surface Sewer	Inlet*	Public Pumping Station	
Combined Sewer	Manhole*	Decommissioned Pumping Station	
Final Effluent Sewer			
Rising Main*			
Private Sewer*			
Decommissioned Sewer*			

*(Colour denotes effluent type)

marcelawray@cem-dev.co.uk

East Cambs DC Cremat

love every drop
anglianwater

APPENDIX C

OUTLINE SOAKWAY CALCULATIONS

Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	100	Maximum Rainfall (mm/hr)	50.0
Additional Flow (%)	40	Minimum Velocity (m/s)	1.00
FSR Region	England and Wales	Connection Type	Level Soffits
M5-60 (mm)	20.000	Minimum Backdrop Height (m)	0.200
Ratio-R	0.400	Preferred Cover Depth (m)	0.900
CV	0.750	Include Intermediate Ground	✓
Time of Entry (mins)	5.00	Enforce best practice design rules	✓

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Depth (m)
1	0.067	5.00	1.500	600	0.575
2			1.500	600	1.125
3			1.500	1200	1.329
4	0.067	5.00	1.500	600	0.575
5			1.500	600	1.125
SA			2.450	1200	2.335

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.000	1	2	39.351	0.600	0.925	0.375	0.550	71.5	225	5.42	50.0
1.001	2	3	24.480	0.600	0.375	0.171	0.204	120.0	225	5.77	50.0
2.000	4	5	32.768	0.600	0.925	0.375	0.550	59.6	225	5.32	50.0
2.001	5	3	14.010	0.600	0.375	0.221	0.154	91.0	225	5.49	50.0
1.002	3	SA	6.765	0.600	0.171	0.115	0.056	120.0	225	5.86	50.0

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
1.000	1.548	61.5	12.7	0.350	0.900	0.067	0.0	69	1.224
1.001	1.192	47.4	12.7	0.900	1.104	0.067	0.0	80	1.015
2.000	1.697	67.5	12.7	0.350	0.900	0.067	0.0	65	1.305
2.001	1.371	54.5	12.7	0.900	1.054	0.067	0.0	73	1.120
1.002	1.192	47.4	25.4	1.104	2.110	0.134	0.0	117	1.213

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.000	39.351	71.5	225	Circular	1.500	0.925	0.350	1.500	0.375	0.900
1.001	24.480	120.0	225	Circular	1.500	0.375	0.900	1.500	0.171	1.104
2.000	32.768	59.6	225	Circular	1.500	0.925	0.350	1.500	0.375	0.900
2.001	14.010	91.0	225	Circular	1.500	0.375	0.900	1.500	0.221	1.054
1.002	6.765	120.0	225	Circular	1.500	0.171	1.104	2.450	0.115	2.110

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.000	1	600	Manhole	Adoptable	2	600	Manhole	Adoptable
1.001	2	600	Manhole	Adoptable	3	1200	Manhole	Adoptable
2.000	4	600	Manhole	Adoptable	5	600	Manhole	Adoptable
2.001	5	600	Manhole	Adoptable	3	1200	Manhole	Adoptable
1.002	3	1200	Manhole	Adoptable	SA	1200	Manhole	Adoptable

Manhole Schedule

Node	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
1	1.500	0.575	600	0	1.000	0.925	225
2	1.500	1.125	600	1	1.000	0.375	225
				0	1.001	0.375	225
3	1.500	1.329	1200	1	2.001	0.221	225
				2	1.001	0.171	225
				0	1.002	0.171	225
4	1.500	0.575	600	0	2.000	0.925	225
5	1.500	1.125	600	1	2.000	0.375	225
				0	2.001	0.375	225
SA	2.450	2.335	1200	1	1.002	0.115	225

Simulation Settings

Rainfall Methodology	FSR	Analysis Speed	Normal
FSR Region	England and Wales	Skip Steady State	x
M5-60 (mm)	20.000	Drain Down Time (mins)	240
Ratio-R	0.400	Additional Storage (m³/ha)	20.0
Summer CV	0.750	Check Discharge Rate(s)	x
Winter CV	0.840	Check Discharge Volume	x

Storm Durations

15	30	60	120	180	240	360	480	600	720	960	1440

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
100	40	0	0

Node SA Soakaway Storage Structure

Base Inf Coefficient (m/hr)	0.09072	Invert Level (m)	0.115	Depth (m)	0.400
Side Inf Coefficient (m/hr)	0.30240	Time to half empty (mins)	170	Inf Depth (m)	0.400
Safety Factor	2.0	Pit Width (m)	3.000	Number Required	1
Porosity	0.95	Pit Length (m)	45.000		

Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 99.75%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	1	11	1.061	0.136	42.1	0.3556	0.0000	OK
120 minute winter	2	118	1.018	0.643	13.3	0.1819	0.0000	SURCHARGED
120 minute winter	3	118	1.017	0.846	26.6	0.9574	0.0000	SURCHARGED
15 minute winter	4	10	1.052	0.127	42.1	0.3315	0.0000	OK
120 minute winter	5	118	1.018	0.643	13.3	0.1819	0.0000	SURCHARGED
120 minute winter	SA	118	1.017	0.902	25.6	52.3843	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)
15 minute winter	1	1.000	2	40.7	1.128	0.662	1.2764
15 minute winter	2	1.001	3	41.1	1.034	0.867	0.9736
15 minute winter	3	1.002	SA	82.6	2.448	1.743	0.2691
15 minute winter	4	2.000	5	41.6	1.178	0.617	1.0294
15 minute winter	5	2.001	3	41.1	1.034	0.754	0.5572
60 minute winter	SA	Infiltration		3.3			

APPENDIX D

GREENFIELD RUNOFF ESTIMATION

HR Wallingford
Working with water

Greenfield runoff rate estimation for sites

www.uksuds.com | Greenfield runoff tool

Calculated by:	Peter Steele
Site name:	Mepal Outdoor Centre
Site location:	Mepal

This is an estimation of the greenfield runoff rates that are used to meet normal best practice criteria in line with Environment Agency guidance “Rainfall runoff management for developments”, SC030219 (2013) , the SuDS Manual C753 (Ciria, 2015) and the non-statutory standards for SuDS (Defra, 2015). This information on greenfield runoff rates may be the basis for setting consents for the drainage of surface water runoff from sites.

Site Details

Latitude:	52.42619° N
Longitude:	0.09054° E
Reference:	3554505418
Date:	Oct 22 2020 15:48

Runoff estimation approach

IH124

Site characteristics

Total site area (ha):	12.6

Methodology

Q_{BAR} estimation method:	Calculate from SPR and SAAR
SPR estimation method:	Calculate from SOIL type

Soil characteristics

	Default	Edited
SOIL type:	1	1
HOST class:	N/A	N/A
SPR/SPRHOST:	0.1	0.1

Hydrological characteristics

	Default	Edited
SAAR (mm):	539	539
Hydrological region:	5	5
Growth curve factor 1 year:	0.87	0.87
Growth curve factor 30 years:	2.45	2.45
Growth curve factor 100 years:	3.56	3.56
Growth curve factor 200 years:	4.21	4.21

Notes

(1) Is Q_{BAR} < 2.0 l/s/ha?

When Q_{BAR} is < 2.0 l/s/ha then limiting discharge rates are set at 2.0 l/s/ha.

(2) Are flow rates < 5.0 l/s?

Where flow rates are less than 5.0 l/s consent for discharge is usually set at 5.0 l/s if blockage from vegetation and other materials is possible. Lower consent flow rates may be set where the blockage risk is addressed by using appropriate drainage elements.

(3) Is SPR/SPRHOST ≤ 0.3?

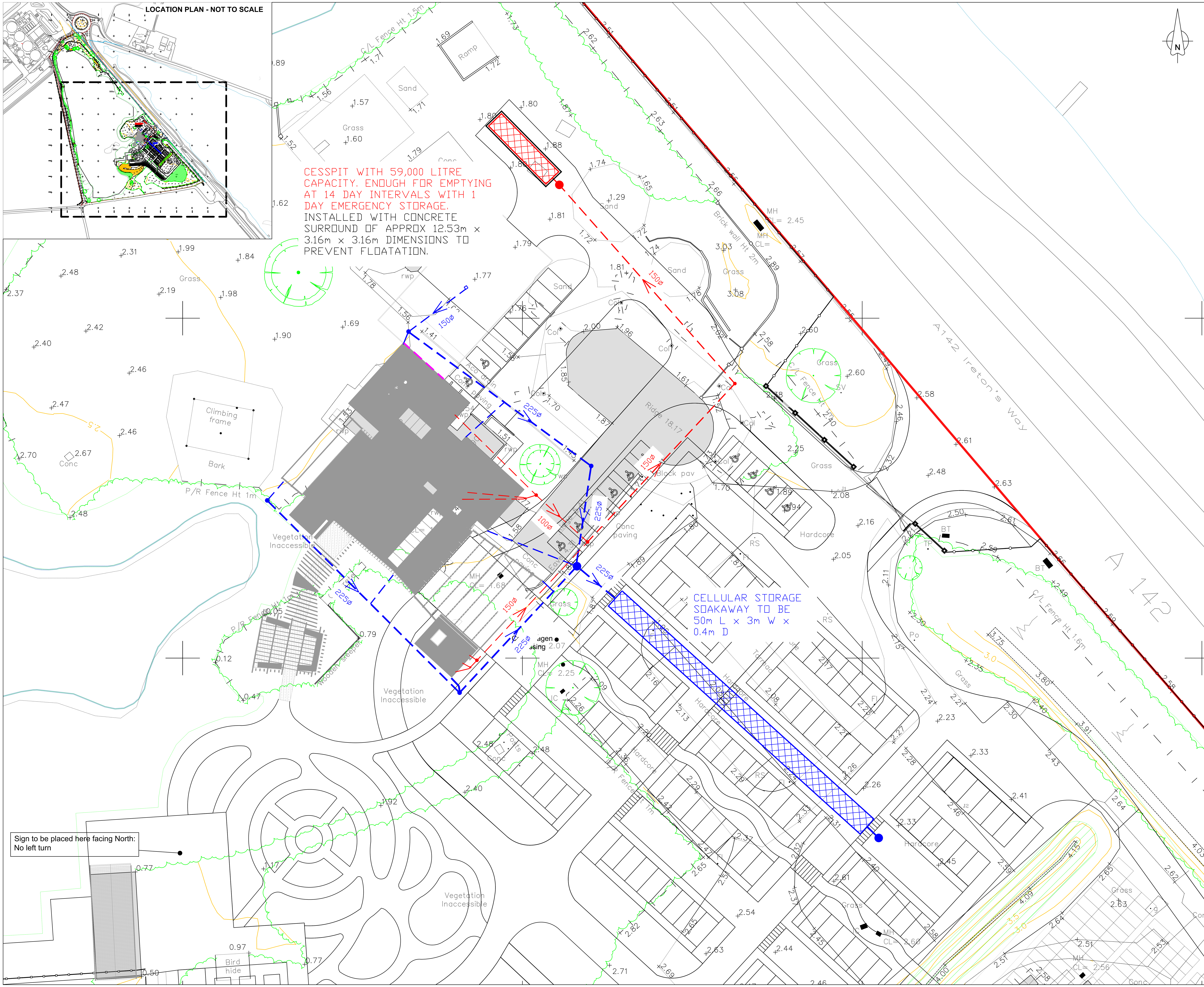
Where groundwater levels are low enough the use of soakaways to avoid discharge offsite would normally be preferred for disposal of surface water runoff.

Greenfield runoff rates

	Default	Edited
Q_{BAR} (l/s):	1.56	1.56
1 in 1 year (l/s):	1.36	1.36
1 in 30 years (l/s):	3.82	3.82
1 in 100 year (l/s):	5.55	5.55
1 in 200 years (l/s):	6.56	6.56

APPENDIX E

DRAINAGE STRATEGY DRAWING



LEGEND

- Application boundary
- Surface Water Sewer
- Foul Water Sewer
- Drainage Channel
- Surface Water Manhole
- Surface Water Inspection Chamber
- Foul Water Manhole
- Foul Water Inspection Chamber
- Surface Water Gully

Rev	Date	Description	By
01	19/05/21	Updated to suit site layout updates	PS

CLIENT
East Cambridgeshire District Council

PROJECT
Former Mepal Outdoor Centre, Chatteris road, Mepal, Ely, Cambridgeshire, CB6 2AZ

TITLE
Drainage Strategy Plan

CDS
Cemeteries & Crematoria
Parks & Leisure
Environmental Solutions

The CDS Group
Building 51, Wrest Park
Silsoe, Bedfordshire
MK45 4HS
+44 (0)1525 864387
www.thecdsgroup.co.uk

Drawn by: PS | Approved by: DK | Drawing Status: ISSUED

Scale 1:250 @ A1 | Sheet 1 of 1 | Date: May 2021

Drawing : D200004-CDS-EN-ZZ-DR-L-008