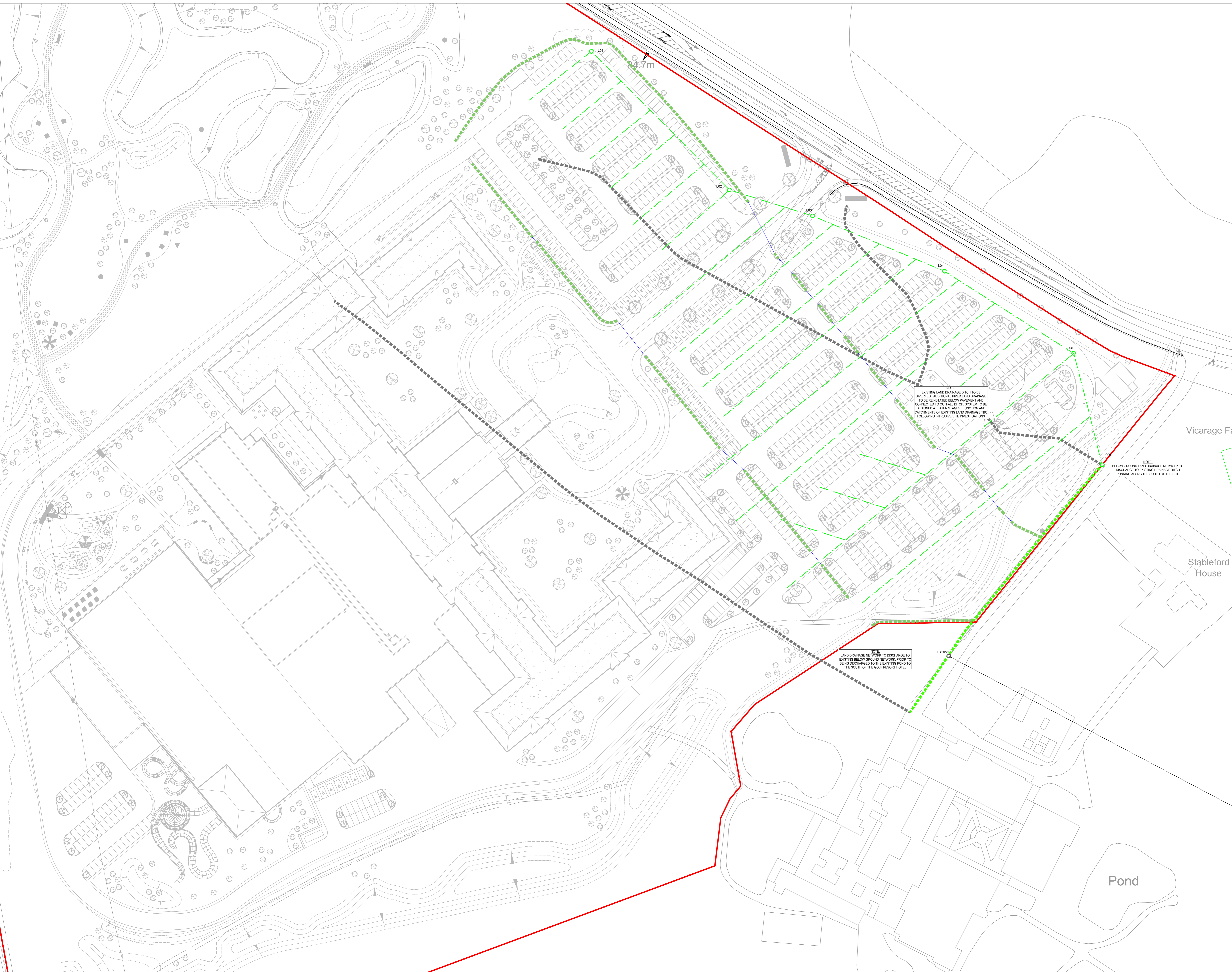


GENERAL NOTES:

1. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL RELEVANT ARCHITECTS AND ENGINEERS DRAWINGS AND SPECIFICATIONS.
2. DO NOT SCALE FROM THIS DRAWING. ALL DETAILS AND DIMENSIONS AND LEVELS ARE TO BE CHECKED BY THE CONTRACTOR PRIOR TO COMMENCEMENT OF CONSTRUCTION. ANY DISCREPANCIES ARE TO BE REPORTED TO THE ENGINEER.
3. ALL LEVELS ARE IN METERS & DIMENSIONS IN METERS UNLESS NOTED OTHERWISE.
4. DESIGN BASED ON TOPOGRAPHICAL & CCTV SURVEY AVAILABLE AT THE TIME OF DESIGN. ALL EXISTING SEWERS, CONNECTIONS, PIPE SIZES AND INVERT LEVELS TO BE CONFIRMED BY CONTRACTOR PRIOR TO COMMENCEMENT OF WORKS TO ENSURE CONNECTIVITY. ANY VARIANCE FROM THE INFORMATION SHOWN SHOULD BE REPORTED TO THE ENGINEER FOR REVIEW.
5. ALL PREWORK TO BE REPORTED TO THE ENGINEER FOR REVIEW.
6. WHERE EXISTING DRAINAGE IS BEING USED, ALLOWANCES SHOULD BE MADE TO RELOCATE THIS DRAINAGE IN LINE WITH AVAILABLE CCTV SURVEY INFORMATION.
7. WHERE THERE IS NO REQUIREMENT TO KEEP EXISTING DRAINAGE, ALLOWANCES SHOULD BE MADE TO ABANDON THIS IN LINE WITH CURTINS DRAINAGE SPECIFICATION.
8. ALL INTERNAL DRAINAGE POINTS ARE SHOWN INDICATIVELY AND ARE TO BE DESIGNED AND SET OUT BY THE M&E ENGINEER.
9. ANY DRAINAGE RUNS AND THEIR CONNECTIONS DAMAGED THROUGH CONSTRUCTION WORKS SHOULD BE REPLACED TO SUFFICIENT STANDARD. CURTINS ACCEPT NO RESPONSIBILITY FOR DEFECTS OR INADEQUACIES OF EXISTING DRAINAGE SYSTEMS. FAILURE OF SITE DRAINAGE DUE TO AN ISSUE WITH THESE NETWORKS ARE OUTSIDE OF OUR REMIT UNLESS SPECIFICALLY INSTRUCTED OTHERWISE.
11. THIS DRAWING IS NOT TO BE USED FOR CONSTRUCTION PURPOSES.
12. LATERAL BRANCHES TO MAIN BELOW GROUND LAND DRAINAGE RUNS NOT SHOWN FOR CLARITY. LAND DRAINAGE TO BE INSTALLED IN A HERRINGBONE PATTERN, WITH DRAIN SPACING TO CONFIRMED FOLLOWING COMPLETION OF DETAILED GEOLOGICAL INVESTIGATIONS.

- - - - - EXISTING SURFACE WATER SEWER
- EXISTING LAND DRAINS TO BE RETAINED
- EXISTING LAND DRAINS TO BE DIVERTED
- PROPOSED DIVERTED LAND DRAIN
- PROPOSED PERFORATED LAND DRAINAGE
- PROPOSED LAND DRAINAGE CHAMBER



NOTE
EXISTING LAND DRAINAGE DITCH TO BE DIVERTED. ADDITIONAL PIPED LAND DRAINAGE TO BE INSTALLED BELOW PAVEMENT AND CONNECTED TO OUTFALL DITCH SYSTEM TO BE RESIGNED AT LATER STAGES. FUNCTION AND CATCHMENTS OF EXISTING LAND DRAINAGE TO FOLLOWING INTRUSIVE SITE INVESTIGATIONS.

NOTE
BELOW GROUND LAND DRAINAGE NETWORK TO DISCHARGE TO EXISTING DRAINAGE DITCH RUNNING ALONG THE SOUTH OF THE SITE.

NOTE
LAND DRAINAGE NETWORK TO DISCHARGE TO EXISTING BELOW GROUND NETWORK, PRIOR TO BEING DISCHARGED TO THE EXISTING POND TO THE SOUTH OF THE GOLF RESORT HOTEL.

Vicage Farm

Stableford House

Pond

P02	UPDATED FOLLOWING COMMENTS	11.11.19	MS	TL
P01	PRELIMINARY ISSUE	17.09.19	MS	TL

Rev	Description	Date	By	Chk



PRELIMINARY

Project: GREAT WOLF LODGE

Dwg Title: PROPOSED LAND DRAINAGE GENERAL ARRANGEMENT

Date	Date	Drawn By	Designed By	Checked By
A0	17.09.19	MCS	MCS	TL

Project No	Originator	Zone	Level	Type	Discipline	Category/Number	Rev.
06535	CUR	00	XX	DR	C	92003	P02

Appendix J – Operations and Maintenance Manual

Proposed Great Wolf Lodge Chesterton, Bicester

Drainage Operations and Maintenance Manual

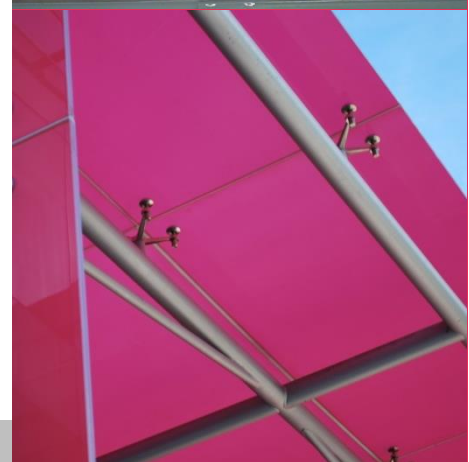
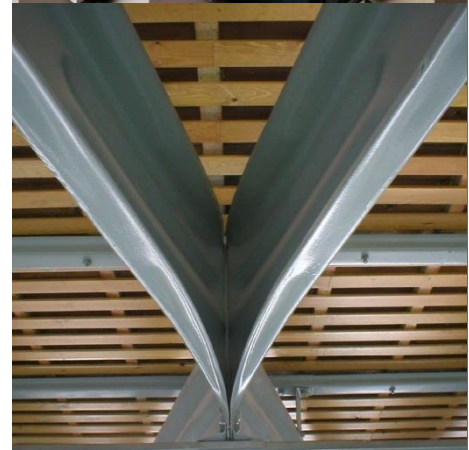
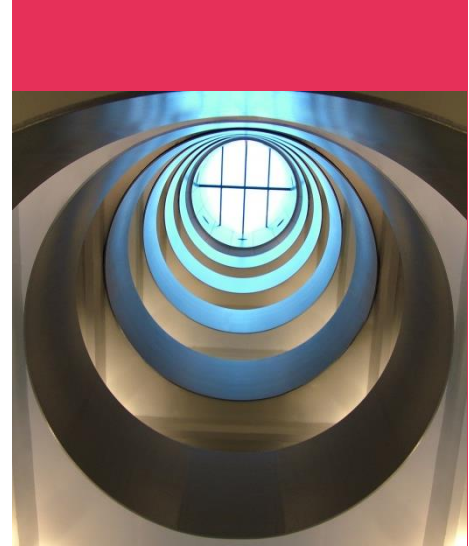
Curtins Ref: 068535-CUR-00-XX-RP-C-00003

Revision: P01

Issue Date: November 2019

Client Name: Great Lakes UK Limited

Site Address: Land to the east of M40 and South of A4095, Chesterton, Bicester



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Proposed Great Wolf Lodge Chesterton, Bicester
Drainage Operations and Maintenance Manual



Rev	Description	Issued by	Checked	Date
P01	Preliminary Issue	DH	MS	11/11/2019

This report has been prepared for the sole benefit, use, and information for the client. The liability of Curtins Consulting Limited with respect to the information contained in the report will not extend to any third party.

Author	Signature	Date
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Reviewed	Signature	Date
Michael Smith MEng (Hons) Senior Infrastructure Engineer		11/11/2019

Table of Contents

Contents

Table of Contents	ii
1.0 Introduction	1
1.1 Project Background	1
1.2 Scope of O&M Manual	1
2.0 Pipes (Including Oversized)	2
2.1 Location and Description	2
2.2 Operation	2
2.3 Inspection and Maintenance Regime	2
3.0 Green Roofs	4
3.1 Location and Description	4
3.2 Operation	4
3.3 Inspection and Maintenance Regime	4
4.0 Filter Strips, French Drains and Underdrained Swales	6
4.1 Location and Description	6
4.2 Operation	6
4.3 Inspection and Maintenance Regime	6
5.0 Permeable Pavements	8
5.1 Location and Description	8
5.2 Operation	8
5.3 Inspection and Maintenance Regime	8
6.0 Swales	10
6.1 Location and Description	10
6.2 Operation	10
6.3 Inspection and Maintenance Regime	10
7.0 Attenuation Tank (Concrete Tanks)	12



7.1	Location and Description.....	12
7.2	Operation.....	12
7.3	Inspection and Maintenance Regime.....	12
8.0	Attenuation Tank (Geocellular Units)	14
8.1	Location and Description.....	14
8.2	Operation.....	14
8.3	Inspection and Maintenance Regime.....	14

1.0 Introduction

1.1 Project Background

Curtins Consulting Limited has been appointed by Great Lakes UK Limited to prepare a Surface Water Drainage Operations and Maintenance Manual as part of the Drainage Strategy, 068535-CUR-00-DR-RP-C-00002, for the proposed Great Wolf Lodge development. This should also be read in conjunction with the Flood Risk Assessment (FRA).

This report is based on currently best practice guidance.

Proposals contained or forming part of this report represent the design intent and may be subject to alteration or adjustment in completing the detailed design for this project. Where such adjustments are undertaken as part of the detailed design and are deemed a material derivation from the intent contained in this document, prior approval shall be obtained from the relevant authority in advance of commencing such works.

In accordance with the FRA the surface water network has been designed to accommodate the 1 in 100-year event plus an allowance of 40% for climate change.

1.2 Scope of O&M Manual

This manual is intended to give an overview of the operation and maintenance for the range of SuDS features included with the drainage strategy and in relation to typical details only. Where proprietary products are specified the manufacturer's instructions and recommendations should be followed in priority to this document unless specifically noted otherwise due to project constraints.

The recommended operations and frequencies are typical only and should be more frequent initially to ensure that there are no unforeseen issues with the operation and then adjusted to suit the Site requirements.

2.0 Pipes (Including Oversized)

2.1 Location and Description

Pipes are the main conveyance across the Site with the network.

Pipes are proprietary products and the materials can vary across the Site and as such where used the manufacture's recommendations should be followed. Regardless of the product used, the pipes will be fully compliant with the Curtins drainage specification once the design has been progressed.

2.2 Operation

Pipes are intended to be the main conveyance across the development and where oversized they form the attenuation volume required by the limitation of the discharge rate. They are intended to be dry except for during rainfall events. These have been designed to be self-cleansing where possible for smaller diameter pipes, and for larger diameters the risk is reduced due to the overall pipe size.

Access for maintenance is provided through access chambers, manholes, rodding plates and rodding eyes.

2.3 Inspection and Maintenance Regime

Regular inspection and maintenance is important to identify areas which may have been obstructed/clogged and may not be drainage correctly thus exposing the development to a greater level of flood risk. Maintenance responsibility for the pipes should be placed with the individual owners of the property for laterals and Thames Water for adopted sewers.

Sediment/material removal should be undertaken in consultation with the environmental regulator to confirm appropriate protocols, as run-off is taken from potentially contaminated areas such as car parks/service yards.

Maintenance Schedule	Required Action	Frequency
Monitoring (to be undertaken more regularly within the first year of operation and adjusted as required)	Initial inspection should be provided as post construction CCTV survey.	N/A
	Inspect for evidence of poor operation via water level in chambers. If required, take remedial action.	3-monthly, 48 hours after large storms.
Occasional maintenance	Check and remove large vegetation growth near pipe runs.	Every 6 months
Remedial actions	Rod through poorly performing runs as initial remediation.	As required.
	If continued poor performance jet and CCTV survey poorly performing runs.	As required.
	Seek advice as to remediation techniques suitable for the type of performance issue and location.	As required If above does not improve performance.

3.0 Green Roofs

3.1 Location and Description

Green roofs are proposed on top of the Family Entertainment Centre (FEC) section of the proposed development. Further detail of the green roofs system is shown in EPR's Design & Access Statement and plans and drawings submitted with the planning application.

Green roofs are areas of vegetation that provide visual benefit, ecological value and reduce surface water runoff. A green roof consists of a system in which several materials are layered to achieve the desired vegetative cover and drainage characteristics.

3.2 Operation

Green roofs can provide benefits in terms of reducing peak flow rates to the Site drainage system. The depth of rainfall that will be stored in any rainfall event is a function of the antecedent soil moisture, the soil depth, the roof gradient and any specific storage provision designed within the drainage layer.

3.3 Inspection and Maintenance Regime

Green roofs are likely to require regular inspection and maintenance. Access routes to the roof should be designed and maintained to be safe and efficient, and walkways should always be kept clear of obstructions.

All maintenance actions carried out at roof level must be in full compliance with the appropriate health and safety regulations, and particularly those specifically dealing with working at height.

Maintenance Schedule	Required Action	Frequency
Regular inspections	Inspect all components including soil substrate, vegetation, drains, irrigation systems (if applicable), membranes and roof structure for proper operation, integrity of waterproofing and structural stability	Annually and after severe storms
	Inspect soil substrate for evidence of erosion channels and identify any sediment sources	Annually and after severe storms
	Inspect drain inlets to ensure unrestricted runoff from the drainage layer to the conveyance or roof drain system	Annually and after severe storms
	Inspect underside of roof for evidence of leakage	Annually and after severe storms
Regular maintenance	Remove debris and litter to prevent clogging of inlet drains and interference with plant growth	Six monthly and annually or as required
	During establishment (i.e. year one), replace dead plants as required	Monthly (but usually responsibility of manufacturer)
	Post establishment, replace dead plant as required (where > 5% of coverage)	Annually (in autumn)
	Remove fallen leaves and debris from deciduous plant foliage	Six monthly or as required
	Remove nuisance and invasive vegetation, including weeds	Six monthly or as required
	Mow grasses, prune shrubs and manage other planting (if appropriate) as required – clippings should be removed and not allowed to accumulate	Six monthly or as required
Remedial actions	If erosion channels are evident, these should be stabilised with extra soil substrate similar to the original material, and sources of erosion damage should be identified and controlled	As required
	If drain inlet has settled, cracked or moved, investigate and repair as appropriate	As required

4.0 Filter Strips, French Drains and Underdrained Swales

4.1 Location and Description

The features are located as shown on the Proposed surface Water Drainage Strategy drawing 068535-CUR-00-XX-DR-C-92000.

The features will be designed in accordance with CIRIA C753.

4.2 Operation

The filter strips, French drains and underdrained swales are intended to be the surface water conveyance, water quality and attenuation storage features. These features are intended to be dry except during rainfall events.

The surface water should permeate through the upper layer of the feature in to the permeable stone below. The water is then collected and conveyed in the perforate pipe within the aggregate trench.

Access for maintenance has been provided through access chambers and rodding points.

4.3 Inspection and Maintenance Regime

Regular inspection and maintenance are important for the effective operation of the features. Maintenance responsibility for the features and their surrounding area should be placed with Great Lakes UK Limited.

Plant management, to achieve the required habitat/appearance, should be specified clearly in a maintenance schedule by the landscape architect planned to coincide with other site wide maintenance operations.

Sediment/material removal should be undertaken in consultation with the environmental regulator to confirm appropriate protocols, especially where run-off is taken from potentially contaminated areas such as car parks/service yards.

Maintenance Schedule	Required Action	Frequency
Monitoring (to be undertaken more regularly within the first year of operation and adjusted as required)	Inspect feature surface to identify evidence of erosion, compaction, ponding, sedimentation and contamination	Half yearly and after large storms.
	Check feature surface for even gradients	Half yearly
	Inspect gravel diaphragm trench upstream of filter strip for clogging	Half yearly.
	Inspect silt accumulation rates and establish appropriate removal frequencies.	Half yearly.
Regular maintenance\inspection	Litter and debris removal	Monthly or as required
	Grass cutting (to maintain grass height within landscape architect's specified design range)	To be confirmed by Landscape Architect [Monthly (during growing season) or as required]
	Manage other vegetation and remove nuisance plants/dead growth.	Monthly (at start, then as required).
	Remove sediment from main channel.	Annually (or as required after heavy rainfall events)
Occasional maintenance	Check for poor vegetation growth due to lack of sunlight or dropping of leaf litter and cut back adjacent vegetation where possible.	Annually, or as required. As per landscape architect's specification.
	Re-seed areas of poor vegetation growth (seed mix to landscape architect's specification).	Annually, or as required. As per landscape architect's specification
Remedial actions	Repair of erosion or other damage by re-seeding or re-turfing. Soil reinforcement such as coir matting should be used and staked in accordance with manufacturer's instructions.	As required.
	Realignment of flow channel/dished surface.	As required.
	Scarify and spike topsoil layer to improve infiltration performance, break up silt deposits and prevent compaction of the soil surface	As required.
	Re-level uneven surfaces and reinstate design levels. This may be required as part of sediment removal.	As required.
	Replace geotextiles and clean and replace filter media, if clogging occurs. Terram 1000 typical design life is 25 years.	As required.
	Excavate trench walls to expose clean soils if infiltration performance reduces to unacceptable levels	As required.

5.0 Permeable Pavements

5.1 Location and Description

Permeable paving is proposed across the site, forming the majority collection system for all ground level hardstanding and car parking. The extents of the permeable paving can be seen on the Drainage General Arrangement drawing 068535-CUR-00-XX-DR-C-92000.

The permeable pavement has been designed in accordance with CIRIA C753.

Permeable pavements contain proprietary products and as such, the manufacture's recommendations should be followed where used.

5.2 Operation

Permeable pavements are an efficient mean of managing surfaces water runoff close to its source – intercepting runoff, reducing the volume and frequency of runoff, and providing a treatment medium. The permeable pavements may also be utilised as an infiltration area or soakaway for other areas of the development.

The surface has been designed to be porous or to contain gaps where rain can flow through the upper construction layers in to the voided stone which makes up the sub-base.

5.3 Inspection and Maintenance Regime

Regular inspection and maintenance is important for the effective operation of the pervious pavement. Maintenance responsibility for the pavement and its surrounding area should be placed with Great Lakes UK Ltd.

Sediment/material removal should be undertaken in consultation with the environmental regulator to confirm appropriate protocols, as run-off is taken from potentially contaminated areas such as car parks/service yards.

Maintenance Schedule	Required Action	Frequency
Monitoring (to be undertaken more regularly within the first year of operation and adjusted as required)	Initial inspection.	Monthly for three months after installation.
	Inspect for evidence of poor operation and/or weed growth. If required, take remedial action.	3-monthly, 48 hours after large storms in first six months.
	Inspect silt accumulation rates and establish appropriate brushing frequencies.	Annually.
	Monitor inspection chambers.	Annually.
Regular maintenance/inspection	Brushing and vacuuming.	Three times/year at end of winter, mid-summer, after autumn leaf fall, or as required based on site-specific observations of clogging or manufacturers' recommendations.
Occasional maintenance	Removal of weed or management using glyphosate applied directly into the weeds by an applicator rather than spraying.	As required – one per year on less frequently used pavements.
	Stabilise and mow contributing and adjacent areas.	As required.
Remedial Actions	Remediate any landscaping which, through vegetation maintenance or soil slip, has been raised to within 50 mm of the level of the paving.	As required.
	Remedial work to any depressions, rutting and cracked or broken blocks considered detrimental to the structural performance or a hazard to users, and replace lost jointing materials.	As required.
	Rehabilitation of surface and upper substructure by remedial sweeping.	Every 10 to 15 years or as required (if infiltration performance is reduced due to significant clogging).

6.0 Swales

6.1 Location and Description

The swales are located to the boundary of the Site, as shown on the Proposed Surface Water Drainage Strategy drawing 068535-CUR-00-XX-DR-C-92000

The swales have been designed in accordance with CIRIA C753.

6.2 Operation

The swales are intended to be the surface water conveyance, water quality and potentially attenuation storage features. These features are intended to be dry except during rainfall events.

The surface water should flow contained within the swale as a form of conveyance until connected to another feature.

6.3 Inspection and Maintenance Regime

Regular inspection and maintenance is important for the effective operation of the swales. Maintenance responsibility for the swales and its surrounding area should be placed with Great Lakes UK Limited.

Plant management, to achieve the required habitat/appearance, should be specified clearly in a maintenance schedule by the landscape architect planned to coincide with other site wide maintenance operations.

Sediment/material removal should be undertaken in consultation with the environmental regulator to confirm appropriate protocols, especially where run-off is taken from potentially contaminated areas such as car parks/service yards.

Maintenance Schedule	Required Action	Frequency
Monitoring (to be undertaken more regularly within the first year of operation and adjusted as required)	Inspect feature surface to identify evidence of erosion, compaction, ponding, and contamination. Record areas where water is ponding for >48 hours.	Every three months and after large storms.
	Check feature surface for even gradients	Half yearly
	Inspect inlets, outlets and overflows for blockages, and clear if required	Monthly.
	Inspect silt accumulation rates and establish appropriate removal frequencies.	Half yearly.
Regular maintenance\inspection	Litter and debris removal	Monthly or as required
	Grass cutting (to maintain grass height within landscape architect's specified design range)	To be confirmed by Landscape Architect [Monthly (during growing season) or as required]
	Manage other vegetation and remove nuisance plants/dead growth.	Monthly (at start, then as required).
Occasional maintenance	Check for poor vegetation growth due to lack of sunlight or dropping of leaf litter and cut back adjacent vegetation where possible.	Annually, or as required. As per landscape architect's specification.
	Re-seed areas of poor vegetation growth (seed mix to landscape architect's specification).	Annually, or as required. As per landscape architect's specification
Remedial actions	Repair of erosion or other damage by re-seeding or re-turfing. Soil reinforcement such as coir matting should be used and staked in accordance with manufacturer's instructions.	As required.
	Realignment of flow channel/dished surface.	As required.
	Scarify and spike topsoil layer to improve infiltration performance, break up silt deposits and prevent compaction of the soil surface	As required.
	Re-level uneven surfaces and reinstate design levels. This may be required as part of sediment removal.	As required.
	Replace geotextiles\geomembranes (if present) if damaged. Terram 1000 typical design life is 25 years.	As required.

7.0 Attenuation Tank (Concrete Tanks)

7.1 Location and Description

The concrete attenuation tank is located in the car parking area to the west of the Site, as shown on the Proposed Surface Water Drainage Strategy drawing 068535-CUR-00-XX-DR-C-92000.

The tank will be designed in accordance with CIRIA C753.

The concrete units are yet to be confirmed if proprietary products or cast in situ, therefore manufacturer's recommendations should also be taken in to consideration. Additionally, different manufacturers may have different connection types and arrangements which will need to be taken in to consideration.

7.2 Operation

The attenuation tank is intended to be the surface water storage feature to attenuate the discharge from the Site up to and including the 1 in 100 year plus 40% climate change event. The tank is intended to be empty between rainfall events.

Access for maintenance is yet to be confirmed, awaiting final design.

7.3 Inspection and Maintenance Regime

Regular inspection and maintenance are important for the effective operation of attenuation tanks as designed. As the feature is buried a regularly inspection regime is very important to ensure the correction functionality of the surface water drainage network. Maintenance responsibility for an attenuation tank and its surrounding area should be placed with Great Lake UK limited.

Sediment/material removal should be undertaken in consultation with the environmental regulator to confirm appropriate protocols, especially where run-off is taken from potentially contaminated areas such as car parks/service yards.

Maintenance Schedule	Required Action	Frequency
Monitoring (to be undertaken more regularly within the first year of operation and adjusted as required)	Inspect inlets, outlets and overflows for blockages, and clear if required. If faults persist jetting and CCTV survey may be required.	Monthly and after large storms.
	Check penstocks and other mechanical devices (if present).	Half yearly.
	Inspect ventilation cowl (if present)	Monthly and after large storms.
Regular maintenance\inspection	Inspect and identify any areas that are not operating correctly. If required, take remedial action.	Monthly for 3 months, then every six months
	Debris removal from catchment surface (where may cause risks to performance)	Monthly
	Where rainfall infiltrates into blocks from above, check surface of filter for blockage by silt, algae or other matter. Remove and replace surface infiltration medium as necessary.	Monthly (and after large storms)
	Remove sediment from pre-treatment structures	Annually (or as required after heavy rainfall events)
Remedial actions	Repair/rehabilitation of inlets, outlet, overflows and vents.	As required.

8.0 Attenuation Tank (Geocellular Units)

8.1 Location and Description

The attenuation tank is located to the north west of the Site, as shown on the Proposed Surface Water Drainage Strategy 068535-CUR-00-XX-DR-C-92000. The geocellular tank is to the north, accounting for 100m³ of attenuation.

The tank will be designed in accordance with CIRIA C753.

Geocellular units are proprietary products and therefore manufacturer's recommendations should also be taken in to consideration. Additionally, different manufacturers may have different connection types and arrangements which will need to be taken in to consideration.

8.2 Operation

The attenuation tank is intended to be the surface water storage feature to attenuate the discharge from the Site up to and including the 1 in 100 year plus 40% climate change event. The tank is intended to be empty between rainfall events.

8.3 Inspection and Maintenance Regime

Regular inspection and maintenance are important for the effective operation of attenuation tanks as designed. As the feature is buried a regularly inspection regime is very important to ensure the correction functionality of the surface water drainage network. Maintenance responsibility for an attenuation tank and its surrounding area should be placed with Great Lakes UK Limited.

Sediment/material removal should be undertaken in consultation with the environmental regulator to confirm appropriate protocols, especially where run-off is taken from potentially contaminated areas such as car parks/service yards.

Maintenance Schedule	Required Action	Frequency
Monitoring (to be undertaken more regularly within the first year of operation and adjusted as required)	Inspect inlets, outlets and overflows for blockages, and clear if required. If faults persist jetting and CCTV survey may be required.	Monthly and after large storms.
	Check penstocks and other mechanical devices (if present).	Half yearly.
	Inspect ventilation cowl (if present)	Monthly and after large storms.
Regular maintenance\inspection	Inspect and identify any areas that are not operating correctly. If required, take remedial action.	Monthly for 3 months, then every six months
	Debris removal from catchment surface (where may cause risks to performance)	Monthly
	Where rainfall infiltrates into blocks from above, check surface of filter for blockage by silt, algae or other matter. Remove and replace surface infiltration medium as necessary.	Monthly (and after large storms)
	Remove sediment from pre-treatment structures	Annually (or as required after heavy rainfall events)
Remedial actions	Repair/rehabilitation of inlets, outlet, overflows and vents.	As required.

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