



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

Curtins Consulting Limited 40 Compton Street London EC1V 0BD Tel: 020 7324 2240 Email: london@curtins.com

CIVILS & STRUCTURES • TRANSPORT PLANNING • ENVIRONMENTAL • INFRASTRUCTURE • GEOTECHNICAL • CONSERVATION & HERITAGE • PRINCIPAL DESIGNE Birmingham • Bristol • Cambridge • Cardiff • Douglas • Dublin • Edinburgh • Glasgow • Kendal • Leeds • Liverpool • London • Manchester • Nottingham



Curtins



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
David Huntley BSc (Hons) Infrastructure Engineer	DLA	11/11/2019

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



Table of Contents

Contents

Table of	of Contentsii
1.0 I	ntroduction 1
1.1	Project Background 1
1.2	Scope of O&M Manual 1
2.0 I	Pipes (Including Oversized)
2.1	Location and Description2
2.2	Operation2
2.3	Inspection and Maintenance Regime2
3.0	Green Roofs 4
3.1	Location and Description4
3.2	Operation
3.3	Inspection and Maintenance Regime4
4.0 I	Filter Strips, French Drains and Underdrained Swales
4.1	Location and Description6
4.2	Operation
4.3	Inspection and Maintenance Regime6
5.0 I	Permeable Pavements
5.1	Location and Description
5.2	Operation
5.3	Inspection and Maintenance Regime
6.0	Swales
6.1	Location and Description
6.2	Operation
6.3	Inspection and Maintenance Regime10
7.0	Attenuation Tank (Concrete Tanks) 12



7.1	L	ocation and Description	12
7.2	2 0	Dperation	12
7.3	B In	nspection and Maintenance Regime	12
8.0	Attenu	uation Tank (Geocellular Units)	14
8.1	L	ocation and Description	14
8.2	2 0	Dperation	14
8.3	B In	nspection 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 rea din 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	Initial inspection should be provided as post construction CCTV survey.	N/A
year of operation and adjusted as required)	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.

068535-CUR-00-XX-RP-C-00003 **Proposed Great Wolf Lodge Chesterton, Bicester** Drainage Operations and Maintenance Manual



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 required 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.

068535-CUR-00-XX-RP-C-00003 Proposed Great Wolf Lodge Chesterton, Bicester Drainage Operations and Maintenance Manual



Maintenance Schedule	Required Action	Frequency	
Regular inspections	Inspect all components including soil substrate, vegetation, drains, irrigation systems (if applicable), membranes ad 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 sediments 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 appropriate0 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.

068535-CUR-00-XX-RP-C-00003 Proposed Great Wolf Lodge Chesterton, Bicester Drainage Operations and Maintenance Manual



Maintenance Schedule	Required Action	Frequency
Monitoring (to be undertaken more regularly within the first	Inspect feature surface to identify evidence of erosion, compaction, ponding, sedimentation and contamination	Half yearly and after large storms.
year of operation and adjusted as required)	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	Litter and debris removal	Monthly or as required
maintenance\inspection	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	Initial inspection.	Monthly for three months after installation.	
operation and adjusted as required)	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 o 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 require (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	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.	
adjusted as required)	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	Litter and debris removal	Monthly or as required	
maintenance\inspection	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.



			0	·	
Drainage	Operations	and	Maintenance	Manual	

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.
aujusteu as requireu)	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.

Our Locations

Birmingham

2 The Wharf Bridge Street Birmingham B1 2JS T. 0121 643 4694 birmingham@curtins.com

Bristol

Quayside 40-58 Hotwell Road Bristol BS8 4UQ T. 0117 302 7560 bristol@curtins.com

Cambridge

50 Cambridge Place Cambridge CB2 1NS T. 01223 631 799 cambridge@curtins.com

Cardiff

3 Cwrt-y-Parc Earlswood Road Cardiff CF14 5GH T. 029 2068 0900 cardiff@curtins.com

Douglas

Varley House 29-31 Duke Street Douglas Isle of Man IM1 2AZ T. 01624 624 585 douglas@curtins.com

Dublin

39 Fitzwilliam Square Dublin 2 Ireland T. 00353 1 507 9447 dublin@curtins.com

Edinburgh

1a Belford Road Edinburgh EH4 3BL T. 0131 225 2175 edinburgh@curtins.com

Glasgow

Queens House 29 St Vincent Place Glasgow G1 2DT T. 0141 319 8777 glasgow@curtins.com

Kendal

28 Lowther Street Kendal Cumbria LA9 4DH T. 01539 724 823 kendal@curtins.com

Leeds

Rose Wharf Ground Floor Leeds L29 8EE T. 0113 274 8509 leeds@curtins.com

Liverpool 51-55 Tithebarn Street Liverpool L2 2SB T. 0151 726 2000 liverpool@curtins.com

London

40 Compton Street London EC1V 0BD T. 020 7324 2240 london@curtins.com

Manchester

Merchant Exchange 17-19 Whitworth Street West Manchester M1 5WG T. 0161 236 2394 manchester@curtins.com

Nottingham

56 The Ropewalk Nottingham NG1 5DW T. 0115 941 5551 nottingham@curtins.com

