HERMISTON SECURITIES

GLASGOW BUSINESS PARK
SITE A

Drainage Statement

Revision	Purpose of Issue	Prepared By	Signed	Date
-	For Information	K. Stevenson	[redacted]	12/04/2021

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Introduction

It is proposed to develop the site known as "Site A" at Glasgow Business Park. The site is located in the southwest area of the business park. In relation to the original plot numbers, the site will occupy Plot 2600 with an approximate area of 1.77Ha.

The site is bounded by an existing trade park to the east and by landscaped zones to the west and south. The Glasgow Business Park Plot 2500 forms the north boundary. A separate detailed planning application has been submitted for a similar development on Plot 2500.

A location plan for the site is shown Appendix A.

A large-scale bulk earthworks exercise was carried out around 1995 to form platforms for development.

A layout of Glasgow Business Park, showing the proposed development in relation to existing Plot numbers, is shown in Appendix B.

This report explains the drainage strategy for the new site in support of the Planning Application lodged by Zander Planning Ltd. on behalf of Hermiston Securities.

Existing Site

As mentioned above, the site was previously platformed in 1995 as part of the whole business park development. Engineered platforms, and services infrastructure, were constructed to facilitate future development. The platforms were formed by excavating and filling using site contained material. There is therefore no imported material used as fill. All fill used has been reworked natural material, mainly stiff clays and sand.

Pre developed site levels are relatively flat ranging from 75.4m aod in the northwest to 74.0m aod in the southeast.

The undeveloped site is currently a vacant plot overgrown with wild grass/weeds. There is currently no formal drainage within the site. Surface water currently ponds in low lying areas and infiltrates/evaporates during the spring and summer months.

Recent site investigation confirmed that below the thin layer of vegetation is firm clay either natural or "reworked".

Existing watercourse/drainage within this site includes the culverted Monklands Canal. The piped canal runs along the northern boundary of Glasgow Business Park and therefore remote from Site A. A conjectured line is indicated on the plot designation plan in Appendix B.

Foul and surface water drainage exists beneath Springhill Drive North to the northeast of the site. This is currently not adopted by Scottish Water. However, the intention will be to apply for formal adoption of these existing sewers following planning consent.

Proposed Site

It is proposed to develop the site by providing a 47,000 sqft industrial unit along with service yard, and a car park.

The new building will be a steel portal frame shed with a height to eaves of approx. 10m.

An earthworks exercise will form a formation level for the building and externals. The level of the building slab is proposed as 75.6m aod.

Development has progressed to the east of Glasgow Business Park and this has included the extension of Springhill Drive North. It is proposed to extend Springhill Drive North further west, as part of the Plot 2500 development, providing access to Site A. Site A therefore needs to be formed at a level compatible with access and drainage connections to Springhill Drive North. Application for Road Construction Consent and sewer adoption will be made for the new road and drainage works following Planning consent for Plot 2500.

Proposed Drainage

The developed site will have new and separate foul and surface water systems designed as follows. The proposed drainage layout is shown in Appendix C.

Foul Drainage Proposals

The only wastewater generated by the development will be from staff toilets and possibly sinks in break out areas. The new foul drainage will be routed north and connect to foul manhole F1.0 with invert level of 72.85m aod (approx.). The foul drain from F100 to F1.0 will be installed as part of the Plot 2500 Development.

The dock loader area is considered to be "medium risk" of oil spillage and therefore run off within the dock loader area only, is routed to the foul drain via a Class 2 full retention separator.

Surface Water Drainage

Masterplan drainage for future development at Glasgow Business Park has been designed previously by URS. The URS Drainage Strategy Report provides allowable flows and required storage volumes for each Plot. An extract of the URS report is shown in Appendix D. In summary, Table 3.3 shows:

Plot 2600 has a permitted discharge flow of 6.6 l/s and a minimum storage volume requirement of 510m^3

The above flows, calculated by URS relate to the 1 in 200-year return period.

The existing surface water infrastructure, off-site, is routed south towards an existing detention basin. It is proposed to make a new connection to the existing surface water drain in Springhill Drive North at manhole S1.1 with invert level of 71.06m aod (approx.) The surface water drain from S100 to S1.1 will be installed as part of the Plot 2500 Development.

Treatment and Attenuation

The URS report explains that surface water from the developed plots will be routed to a detention basin, via attenuation, where additional treatment will be provided. This provides "site wide" above ground storage recognising the requirements of point 8.4, Table 1 within GCC SG8 document.

Due to the area of proposed roof and hardstanding at the site, it is not possible to provide the required storage volume above ground however, the offsite basin provides above ground storage to an extent.

By referring to Table 26.2 of the Ciria SUDS Guide (Appendix E) we can see that the Pollution Hazard Indices for a commercial yard are:

TSS – 0.7
Metals – 0.6
Hydrocarbons – 0.7

By referring to Table 26.3 (Appendix E) we can see that the Mitigation Indices for a detention basin are:

TSS – 0.5
Metals – 0.5
Hydrocarbons – 0.6

As this falls short of the required Hazard Indices, it is proposed to specify an upstream Suds device:

- A storage system with integral treatment. Stormtech attenuation system provides treatment to the "first flush" by wrapping the "isolator row" in geotextile. The attenuation units are surrounded in filter stone providing further treatment. From research and testing at the University of New Hampshire Stormwater Centre, SEPA testing and testing of existing projects, the mitigation indices for this particular system have been found to be:

TSS – 0.8
Metals – 0.8
Hydrocarbons – 0.9

Information on the Stormtech system and treatment research is included in Appendix F.

As we have two components in series, the second component must have a factor of 0.5 applied. The Total SUDS mitigation index can therefore be calculated as follows:

TSS => 0.8 + (0.5 x 0.5) = 1.05 > 0.7

Metals => 0.8 + (0.5 x 0.5) = 1.05 > 0.6

Hydrocarbons => 0.9 + (0.5 x 0.6) = 1.15 > 0.7

Given that the yard has higher hazard indices than the roofs, by inspection, the mitigation indices provided are more than adequate for contaminants in the roof water run off.

Flooding

New Development Surface Water Drainage

As stated above, the attenuation volumes, per plot, have been calculated previously by URS. Nonetheless, the drainage system for the developed site will be designed for the detailed application using micro drainage software. Flooding checks will be carried out to ensure that no new or existing building is at risk from flooding. The system will be designed such that there will be no flooding above ground level for return periods up to and including 1 in 200 modelled using the critical duration. All run off will therefore be contained on site below ground.

Overland Flooding from other Sources

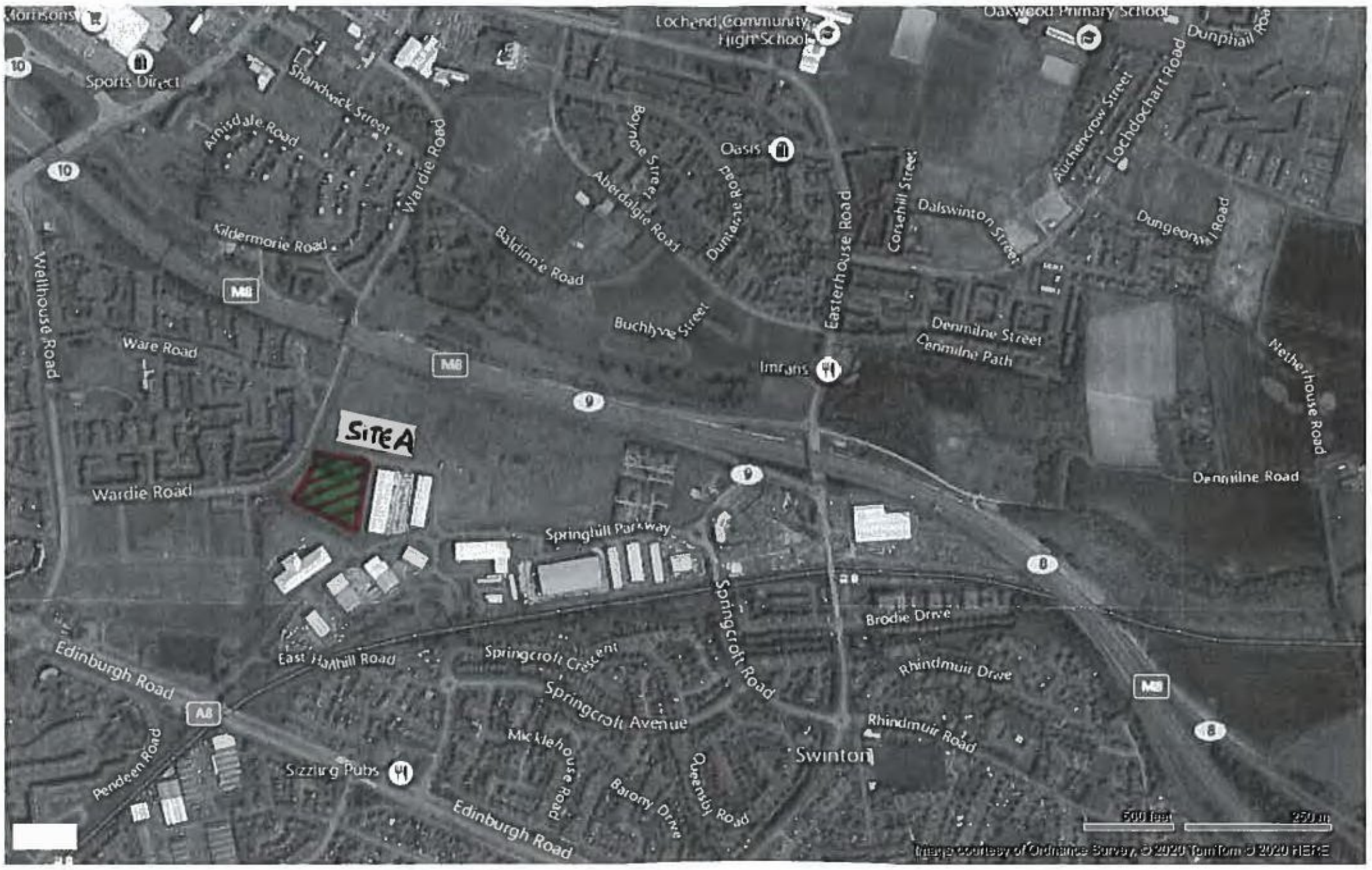
The SEPA flood map (Appendix G) shows that the site will not be affected by flooding from the Tollcross Burn. The map shows a small area of surface water flooding however, this is due to rainwater ponding in a low lying area of the site and not from an external source. Once the site is developed, surface water will be managed by way of the permanent drainage system.

Should there be overland flow due to drainage failure, then levels have been designed such that water will be routed to both the road access to the north of the site and to Springhill Parkway to the southeast. From here, flow would continue east along the business park road infrastructure.

Appendix A

Site Location Plan

SITE A
LOCATION PLAN



Appendix B

Plot Layout

PLOT 2500
AREA-16560m²
(4.09acres)

PLOT 2400
AREA- 12323m²
(3.04acres)

Total Future Development Area
111,980m²
(27.67 Acres)

PLOT 2100
AREA-10505m²
(2.60acres)

PLOT 1400
AREA-12565m²
(3.10acres)

PLOT 1200
AREA- 22,870m²
(5.65 Acres)

PLOT 1100
AREA-14390m²
(3.56 Acres)

PLOT 2600
AREA-17675m²
(4.38acres)

Glasgow Trade Park

PLOT 2000
AREA- 7030m²
(1.74 acres)

PLOT 1300
AREA-12435m²
(3.07acres)

M8

PLOT 1100

PLOT 1000
AREA- 9,815m²
(2.43 Acres)

RB1

PLOT 2700 (B)
Approx. Site Area:
5760sqm
(1.42 Acres)

Approx. Total Gross Floor Area
1495sqm
(16,090sqft)

PLOT 2700
AREA- 17165m²
(4.24 acres)

RB3

PLOT 3200
(AREA - 16,210m²
(4.01 acres)

PLOT 3300
AREA - 19,320m²
(4.77 acres)

Springhill Business Village

Parkway Point

PLOT 4000

PLOT 3400

PLOT 3100
AREA - 17,450m²
(4.31acres)

PLOT 3000
Area- 12,838m²
(3.17 acres)

RAILWAY

(m) 0 10 20 30 40 50 100

GLASGOW BUSINESS PARK LAYOUT 1:250

REV	DATE	DESCRIPTION	BY	CHKD
B	18/8/09	ACCESS ROAD AT TRADE PARK AMENDED. PLOT BOUNDARIES INDICATED. DEVELOPMENT SITE AREA UPDATED	GF	GF
A	18/9/08	FUTURE DEVELOPMENT SITE AREA AMENDED	GF	GF

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Architects & Surveyors

Status: INFORMATION

Client: GLASGOW BUSINESS PARK LIMITED

Project: GLASGOW BUSINESS PARK MASTERPLAN

Title: FUTURE DEVELOPMENT PLAN

Drawn: GF
Checked: GF
Date: SEP '08
Scale: 1:1250
Original: A1

Project No.	Drawing No.	Rev
6894	L(00) 001	B

Appendix C

Proposed Drainage Layout

DO NOT SCALE

PROJECTED CARRIAGEWAY EXTENSION

DIS CON MH F3.0 CL 75.55 IL 73.00

DIS CON MH S3.0 CL 75.70 IL 71.10

MH F1.0 CL 75.30 IL 72.85

MH S1.0 CL 75.53 IL 74.00

PROP 150ø @1:40->

<-225ø

MH S1.1 CL 75.23 IL 71.06

PROP 150ø @1:100->

PROP 225ø @1:160->

MH F100.0 CL 75.0 IL 72.53(Est)

MH S100.0 CL 74.94 IL 70.88(Est)

EXISTING FOUL SEWER 150ø @1:100->

EXISTING SURFACE SEWER 225ø @1:160->

DIS CON MH F2.0 CL 75.40 IL 73.00

DIS CON MH S2.0 CL 75.40 IL 71.10

FOUL ->

SURFACE->

POROUS BLOCK

<-FOUL

POROUS BLOCK

DRAINAGE CHANNEL->

HYDROBRAKE

SURFACE->

FOUL ->

OFFICE

ECOLOGICAL ZONE

STORMTECH TREATMENT AND ATTENUATION TANK

ISOLATOR ROW

<-DRAINAGE CHANNEL->

INTERCEPTOR

DRAINAGE CHANNEL (FOUL)->

<-SURFACE

SIPHONIC RWP

<-SURFACE

SIPHONIC RWP

<-SURFACE

retention

GRASS

DENSE VEGETATION

BUSH

NOTES:-

1 THE DRAINAGE WORKS, INCLUDING MATERIALS, PIPES & WORKMANSHIP ARE TO BE IN ACCORDANCE WITH SEWERS FOR ADOPTION (LATEST EDITION) & BS EN 752, DRAINS & SEWER SYSTEM OUTSIDE BUILDINGS (UNO). ALL WORKS TO BE TO THE SATISFACTION OF THE LOCAL DRAINAGE AUTHORITY.

2 THE CONTRACTOR SHALL CONFIRM THE INVERT LEVEL BOTH UP AND DOWN STREAM OF PROPOSED CONNECTION PRIOR TO COMMENCEMENT OF DRAINAGE WORKS AND REPORT ANY DISCREPANCIES TO THE ENGINEER.

3 ALL PIPES TO BE TO ESVC BS 65 OR APPROVED PLASTIC EQUAL UP TO 225mm, PIPES OVER 225mm DIA TO BE SPUN CONCRETE

4. ALL CONNECTIONS TO MANHOLES TO BE MADE INVERT TO INVERT OF INCOMING PIPES UNLESS NOTED OTHERWISE.

5. THIS DRAWING SHOULD BE READ IN CONJUNCTION WITH ALL ARCHITECT AND SERVICE ENGINEERS DRAWINGS.

6. FOR SETTING OUT OF POP UPS AND FLOOR GULLIES REFER TO ARCHITECTS DRAWINGS.

7. INTERNAL MANHOLE COVERS TO BE DOUBLE SEALED RECESSED TYPE. REFER ARCHITECT FOR FINISH REQUIREMENTS & SETTING OUT TO COVERS.

8. VEHICULAR TRAFFICKED AREAS ~ MH COVERS & FRAMES TO BE DUCTILE IRON, HEAVY DUTY GRADE D400 TO BS EN 124. (RECESSED COVERS MAY BE REQUIRED, ARCHITECT TO CONFIRM LOCATION AND FINISH REQUIREMENTS).

9. NON-VEHICLE TRAFFICKED AREAS ~ MH COVERS & FRAMES TO BE DUCTILE IRON, GRADE C250 CIRCULAR OR RECTANGULAR TO BS EN 124. (RECESSED COVERS MAY BE REQUIRED, ARCHITECT TO CONFIRM LOCATION AND FINISH REQUIREMENTS).

10. CONTRACTOR TO CARRY OUT CCTV DRAINAGE SURVEY ON ALL EXTERNAL UNDERGROUND PIPE WORK AND MAINLINE INTERNAL PIPE WORK BETWEEN MH's FOLLOWING COMPLETION .

11. PIPES TO HAVE CONCRETE SURROUND IF DEPTH TO CROWN OF PIPE IS LESS THAN 1.2m BELOW ROADS & HARD STANDING AND IF LESS THAN 0.9m BELOW LANDSCAPED AND NON TRAFFICKED AREAS.

12. ALL POROUS BLOCK AREAS TO BE PROTECTED FROM CONSTRUCTION TRAFFIC AND MATERIALS TO ENSURE THE STRUCTURAL INTEGRITY AND FILTRATION CHARACTERISTICS ARE MAINTAINED. ALL POROUS BLOCK AREAS TO BE PROTECTED DURING LANDSCAPING WORKS TO ENSURE SOILS AND VEGETATION DO NOT COME IN CONTACT WITH THE SYSTEM. ANY COMPROMISED AREA TO BE LIFTED, CLEANED AND RE-LAID.

13. CONTRACTOR TO MAKE ALLOWANCE FOR REDUCING GROUND WATER LEVELS DURING CONSTRUCTION OF DRAINAGE AND ALL BELOW GROUND WORKS. REFER S.I. REPORT FOR GROUND CONDITIONS.

14. CONTRACTOR TO CONSTRUCT MH BISCUIT & STEP IRONS SUCH THAT THE COVERS WILL BE ORIENTATED PARALLEL / PERPENDICULAR TO BUILDING & PAVING LINES WHILST ENSURING ACCESS AND LANDING REQUIREMENTS ARE MAINTAINED RELATIVE TO PIPES.

15. ALLOWANCE TO BE MADE FOR EXTENDING EXISTING MH'S AND NEW BISCUITS, FRAMES AND COVERS TO SUIT NEW GROUND LEVEL AND LOADING REQUIREMENTS TO EXISTING SEWERS BEING RETAINED WITHIN ALL SITE WORKS.

16. STORMTECH ATTENUATION TANK TO BE INSTALLED WITH IMPERMEABLE MEMBRANE. TANK TO BE INSTALLED AND BACKFILLED IN ACCORDANCE WITH MANUFACTURERS DETAILS AND SPECIFICATIONS. (CONTRACTOR DESIGNED) UNDERGROUND STORAGE SYSTEM SHALL PROVIDE ONE LEVEL OF TREATMENT TO SURFACE WATER IN TERMS OF SUDS.

Rev	Description	Drawn	App	Date

Client

HERMISTON SECURITIES LTD

Project

GLASGOW BUSINESS PARK

Drawing Title

SITE A
PRELIMINARY DRAINAGE CONCEPT

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Drawn	Scale	Checked	Approved	Date
GM	1:250		KS	Mar21

Status	Drg. No.	Rev
INFORMATION	3078/ SK200	

ORIGINAL DRAWING A1

Appendix D

Extract from URS Report

Furthermore, the modelling identified the storage volumes for the following storm return periods:

Table 3.2 – Basin Storage Volume Requirements		
Return Period	**Storage Volume (m^3)**	**Water Level (m AOD)**
1	350	63.107
30	830	63.869
200	1320	64.444

The modelling identified that the strategy to serve the proposed development site was adequate at protecting the watercourse from extreme flood events without increasing flood risk to either development plots or to the burn itself.

A set of the simulation results can be found in Appendix J.

3.4. Post Development Implementation

In order to comply with the basin design, future plots will be required to provide the following onsite storage volumes and to limit the post development flows to the allowable discharge figures identified in Table 3.3 below.

It is the Clients intention to present an approved version of this document to developers to make them aware of the required drainage strategy. Document to be used as reference document for planning process.

Table 3.3 – Summary of Modelled Storage Volumes for Future Sites				
Plot	**Development Area (Ha)**	**Discharge (l/s)**	**Storage Volume (m^3)**	
			1:30	**1:200[1]**
1200	1.80	10.80	580	830
1300	1.00	6.00	320	460
1400	1.00	6.00	320	460
2000	0.71	4.26	230	330
2100	0.80	4.80	260	370
2300	1.00	6.00	320	460
2400	0.90	0.81	290	420
2500	1.14	6.84	360	510
2600	1.10	6.60	360	510
Detention Basin	1.00	6.00	830	1320

Appendix E

Hazard and Mitigation Indices

TABLE 26.2 Pollution hazard indices for different land use classifications

Land use	Pollution hazard level	Total suspended solids (TSS)	Metals	Hydro-carbons
Residential roofs	Very low	0.2	0.2	0.05
Other roofs (typically commercial/ industrial roofs)	Low	0.3	0.2 (up to 0.8 where there is potential for metals to leach from the roof)	0.05
Individual property driveways, residential car parks, low traffic roads (eg cul de sacs, homezones and general access roads) and non-residential car parking with infrequent change (eg schools, offices) ie < 300 traffic movements/day	Low	0.5	0.4	0.4
Commercial yard and delivery areas, non-residential car parking with frequent change (eg hospitals, retail), all roads except low traffic roads and trunk roads/motorways[1]	Medium	0.7	0.6	0.7
Sites with heavy pollution (eg haulage yards, lorry parks, highly frequented lorry approaches to industrial estates, waste sites), sites where chemicals and fuels (other than domestic fuel oil) are to be delivered, handled, stored, used or manufactured; industrial sites; trunk roads and motorways[1]	High	0.8[2]	0.8[2]	0.9[2]

Notes

1 Motorways and trunk roads should follow the guidance and risk assessment process set out in Highways Agency (2009).

2 These should only be used if considered appropriate as part of a detailed risk assessment – required for all these land use types (Table 4.3). When dealing with high hazard sites, the environmental regulator should first be consulted for pre-permitting advice. This will help determine the most appropriate approach to the development of a design solution.

Where a site land use falls outside the defined categories, the indices should be adapted (and agreed with the drainage approving body) or else the more detailed risk assessment method should be adopted.

Where nutrient or bacteria and pathogen removal is important for a particular receiving water, equivalent indices should be developed for these pollutants (if acceptable to the drainage approving body) or the risk assessment method adopted.

Where the mitigation index of an individual component is insufficient, two components (or more) in series will be required, where:

$$\text{Total SuDS mitigation index} = \text{mitigation index}_1 + 0.5\ (\text{mitigation index}_2)$$

Where:

$\text{mitigation Index}_n$ = mitigation index for component n

A factor of 0.5 is used to account for the reduced performance of secondary or tertiary components associated with already reduced inflow concentrations.

TABLE 26.3 Indicative SuDS mitigation indices for discharges to surface waters

	Mitigation indices[1]		
Type of SuDS component	**TSS**	**Metals**	**Hydrocarbons**
Filter strip	0.4	0.4	0.5
Filter drain	0.4[2]	0.4	0.4
Swale	0.5	0.6	0.6
Bioretention system	0.8	0.8	0.8
Permeable pavement	0.7	0.6	0.7
Detention basin	0.5	0.5	0.6
Pond[4]	0.7[3]	0.7	0.5
Wetland	0.8[3]	0.8	0.8
Proprietary treatment systems[5,6]	These must demonstrate that they can address each of the contaminant types to acceptable levels for frequent events up to approximately the 1 in 1 year return period event, for inflow concentrations relevant to the contributing drainage area.		

Notes

1 SuDS components only deliver these indices if they follow design guidance with respect to hydraulics and treatment set out in the relevant technical component chapters.

2 Filter drains can remove coarse sediments, but their use for this purpose will have significant implications with respect to maintenance requirements, and this should be taken into account in the design and Maintenance Plan.

3 Ponds and wetlands can remove coarse sediments, but their use for this purpose will have significant implications with respect to the maintenance requirements and amenity value of the system. Sediment should normally be removed upstream, unless they are specifically designed to retain sediment in a separate part of the component, where it cannot easily migrate to the main body of water.

4 Where a wetland is not specifically designed to provide significantly enhanced treatment, it should be considered as having the same mitigation indices as a pond.

5 See Chapter 14 for approaches to demonstrate product performance. A British Water/Environment Agency assessment code of practice is currently under development that will allow manufacturers to complete an agreed test protocol for systems intended to treat contaminated surface water runoff. Full details can be found at: **http://tinyurl.com/qf7yuj7**

6 SEPA only considers proprietary treatment systems as appropriate in exceptional circumstances where other types of SuDS component are not practicable. Proprietary treatment systems may also be considered appropriate for existing sites that are causing pollution where there is a requirement to retrofit treatment. SEPA (2014) also provides a flowchart with a summary of checks on suitability of a proprietary system.

Appendix F

Attenuation Information

STORMTECH ISOLATOR ROW

An important component of any Stormwater Pollution Prevention Plan is inspection and maintenance. The StormTech Isolator Row is a technique to inexpensively enhance Total Suspended Solids (TSS) removal and provide easy access for inspection and maintenance.

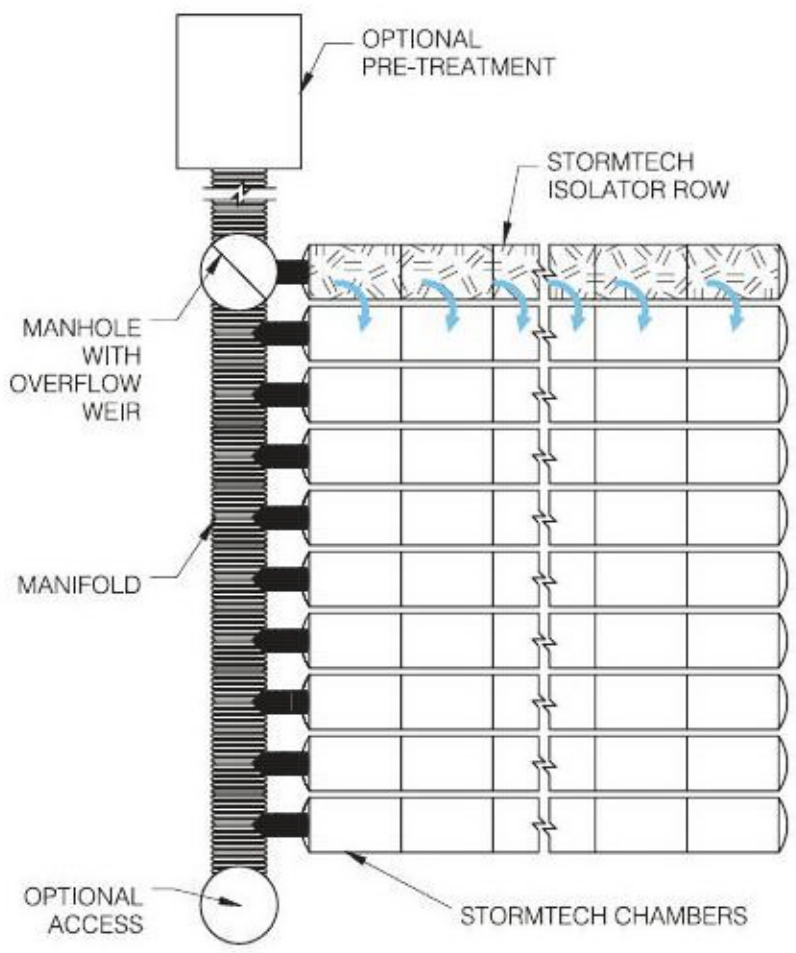
The Isolator Row is a row of StormTech chambers that is typically surrounded with filter fabric and connected to a closely located manhole for easy access. The fabric-wrapped chambers provide for settling and filtration of sediment as stormwater rises in the Isolator Row and ultimately passes through the filter fabric. The open bottom chambers and perforated sidewalls (SC-310, SC-310-3, and SC-740 models) allow stormwater to flow both vertically and horizontally out of the chambers. Sediments are captured in the Isolator Row, protecting the storage areas of the adjacent stone and chambers from sediment accumulation.

Two different fabrics are used for the Isolator Row. A woven geotextile fabric is placed between the stone and the Isolator Row chambers. The tough geotextile provides a media for stormwater filtration and provides a durable surface for maintenance operations. It is also designed to prevent scour of the underlying stone and remain intact during high pressure jetting. A non-woven fabric is placed over the chambers to provide a filter media for flows passing through the perforations in the sidewall of the chamber. The non-woven fabric is not required over the DC-780, MC-3500 or MC-4500 models as these chambers do not have perforated side walls.

The Isolator Row is typically designed to capture the "first flush" and offers the versatility to be sized on a volume basis or flow rate basis. An upstream manhole not only provides access to the Isolator Row, but typically includes a high flow weir such that stormwater flow rates or volumes that exceed the capacity of the Isolator Row crest the weir and discharge through a manifold to the other chambers. An alternative design using a "high/low" concept is an acceptable method. This creates a differential between the Isolator Row and the manifold thus allowing for settlement time in the Isolator Row.

The Isolator Row may also be part of a treatment train. By treating stormwater prior to entry into the chamber system, the service life can be extended and pollutants such as hydrocarbons can be captured. Pre-treatment best management practices can be as simple as deep sump catch basins and oil-water separators or can be innovative stormwater treatment devices. The design of the treatment train and selection of pretreatment devices by the design engineer is often driven by regulatory requirements. Whether pretreatment is used or not, the Isolator Row is recommended by StormTech as an effective means to minimize maintenance requirements and maintenance costs.

Note: See the StormTech Design Manual for detailed information on designing inlets for a StormTech system, including the Isolator Row.



StormTech Isolator Row with Overflow Spillway (not to scale)

Note: Non-woven fabric is only required over the inlet pipe connection into the end cap for DC-780, MC-3500 and MC-4500 chamber models and is not required over the entire Isolator Row.

INSPECTION

The frequency of Inspection and Maintenance varies by location. A routine inspection schedule needs to be established for each individual location based upon site specific variables. The type of land use (i.e. industrial, commercial, public, residential) anticipated pollutant load, percent imperviousness, climate, rain fall data, etc. all play a critical role in determining the actual frequency of inspection and maintenance practices.

At a minimum, StormTech recommends annual inspections. Initially, the Isolator Row should be inspected every 6 months for the first year of operation. For subsequent years, the inspection should be adjusted based upon previous observation of sediment deposition.

The Isolator Row incorporates a combination of standard manhole(s) and strategically located inspection ports (as needed). The inspection ports allow for easy access to the system from the surface, eliminating the need to perform a confined space entry for inspection purposes.

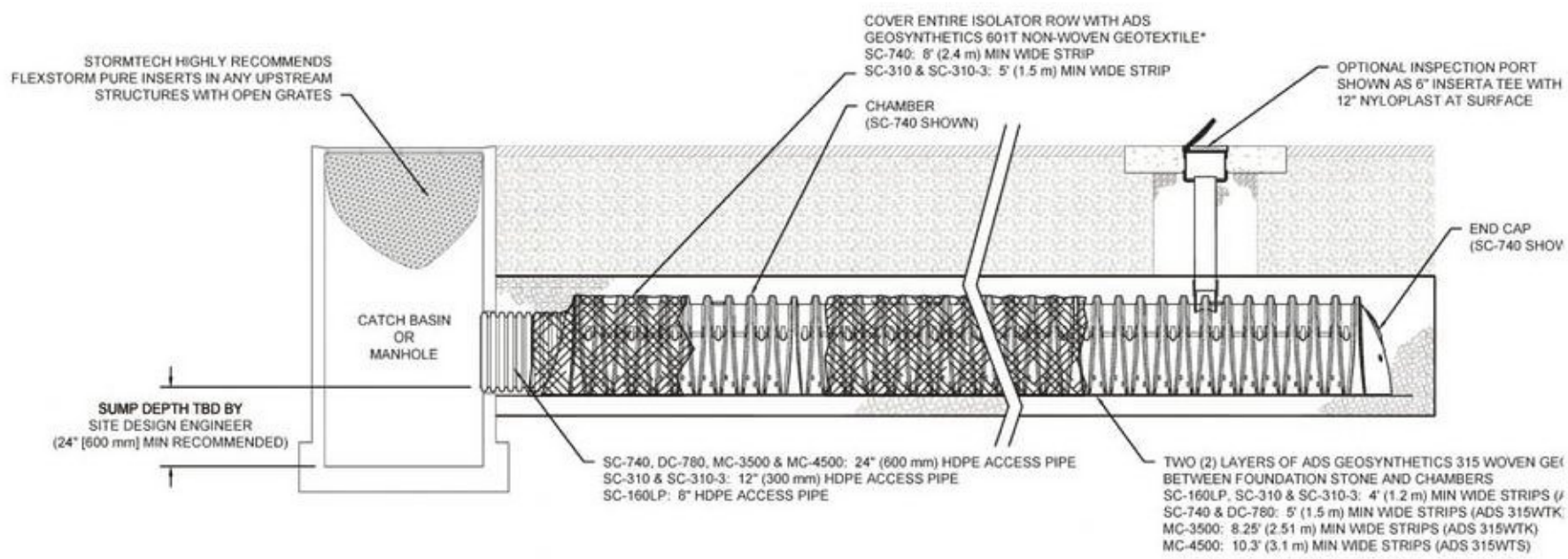
If, upon visual inspection it is found that sediment has accumulated, a stadia rod should be inserted to determine the depth of sediment. When the average depth of sediment exceeds 3 inches throughout the length of the Isolator Row, clean-out should be performed.

MAINTENANCE

The Isolator Row was designed to reduce the cost of periodic maintenance. By "isolating" sediments to just one row, costs are dramatically reduced by eliminating the need to clean out each row of the entire storage bed. If inspection indicates the potential need for maintenance, access is provided via a manhole(s) located on the end(s) of the row for cleanout. If entry into the manhole is required, please follow local and OSHA rules for a confined space entries.

Maintenance is accomplished with the jetvac process. The jetvac process utilizes a high pressure water nozzle to propel itself down the Isolator Row while scouring and suspending sediments. As the nozzle is retrieved, the captured pollutants are flushed back into the manhole for vacuuming. Most sewer and pipe maintenance companies have vacuum/jetvac combination vehicles. Selection of an appropriate jetvac nozzle will improve maintenance efficiency. Fixed nozzles designed for culverts or large diameter pipe cleaning are preferable. Rear facing jets with an effective spread of at least 45" are best. Most jetvac reels have 400 feet of hose allowing maintenance of an Isolator Row up to 50 chambers long. The jetvac process shall only be performed on StormTech Isolator Rows that have AASHTO class 1 woven geotextile (as specified by StormTech) over their angular base stone.

Examples of culvert cleaning nozzles appropriate for Isolator Row maintenance. (These are not StormTech products.)



* NOTE: NON-WOVEN FABRIC IS ONLY REQUIRED OVER THE INLET PIPE CONNECTION INTO THE END CAP FOR SC-160LP, DC-780, MC-3500 & MC-4500 CHAMBER MODELS AND IS NOT REQUIRED OVER THE ENTIRE ISOLATOR ROW.

Kenny Stevenson

From: Niall McDonald <Niall.McDonald@cubicm3.com>
Sent: 15 March 2018 09:23
To: Kenny Stevenson
Subject: RE: Stormtech Attenuation Mitigation Indices
Attachments: Lorry Park, Orwell Crossing - Simple Index.xlsx

Morning Kenny,

Yes, in order to qualify as a 'proprietary treatment system' under the SUDS mitigation indices in CIRIA C753 the proposed treatment system must have undertaken independent testing in relation to its water quality capabilities. Independent testing must also preferably include UK based studies.

The Stormtech system has demonstrated that it can address Total Suspended solids, Metals and Hydrocarbons to acceptable levels for frequent storm events. The Stormtech system uses a combination of two treatment levels to mitigate pollution concerns, firstly through the systems isolator row and secondly through the aggregate filter surround. This has been demonstrated in three separate independent water quality testing studies;

Stormtech Testing Results and CIRIA C753 Mitigation Indices Comparison

1. UNHSC – University of New Hampshire Stormwater Centre.

The Stormtech Isolator row which is the first level of treatment was tested for TSS, hydrocarbons and metal removal from the receiving stormwater.

Testing was done on the stormwater runoff from non – residential car parking with frequent change. In CIRIA C753 this type of land use is given a pollution hazard indices of TSS 0.7, Metals 0.6 and Hydrocarbons 0.7.

Results found the Stormtech isolator row could remove up to 80% of TSS, up to 80% of hydrocarbon and up to 53% of metals. In comparison a filtration layer that provides treatment e.g. porous paving, has a pollution mitigation index of TSS 0.7, Metals 0.6 and Hydrocarbons 0.7 but is inferior in TSS reduction to the Stormtech isolator row, slightly better in metal reduction but there is no data for hydrocarbons.

Therefore, as a first level of treatment the Stormtech Isolator row would have a conservative pollution mitigation index of TSS 0.7, Metals 0.6 and Hydrocarbons 0.7.

2. SEPA – Scottish Environment Protection Agency.

The Stormtech system was tested for TSS and hydrocarbon removal from receiving stormwater which combined the second treatment component of the Stormtech system the aggregate surround and the isolator row.

The stormwater testing was done on a commercial haulage site with potential heavy pollution in Broxburn near Edinburgh. In CIRIA C753 this type of land use is given a pollution hazard indices of TSS 0.8 and Hydrocarbons 0.9.

Results found the system could remove up to 96% of TSS and up to 90% of hydrocarbons which far exceeds any traditional SUDS pollution control method. A pollution mitigation index of TSS 0.8 and Hydrocarbons 0.9 would be achieved by the Stormtech system based on the water quality results.

3. SEPA – Scottish Environment Protection Agency.

The Stormtech system was tested for TSS and hydrocarbon removal from receiving stormwater which combined the second treatment component of the Stormtech system the aggregate surround and the isolator row.

The stormwater testing was done on a residential carpark in Denny, Scotland. In CIRIA C753 this type of land use is given a pollution hazard indices of TSS 0.5 and Hydrocarbons 0.4. Only TSS results were achieved in this testing as hydrocarbon levels were limited.

Results found the system could remove up to 87.5% of TSS which again far exceeds any traditional SUDS pollution control method. Again a conservative pollution mitigation index of TSS 0.7 would be achieved by the Stormtech system based on other water quality results in CIRIA C753.

Stormtech Example CIRIA C753 Pollution Mitigation Indices Projects

We have done a number of projects based on the Stormtech System water quality capabilities based on CIRIA C753 mitigation indices.

A recent project is the Orwell Truck Stop near Ipswich, the projects pollution indices was high TSS 0.8, Metals 0.8 and Hydrocarbons 0.9. Attached is the Simple Index Spreadsheet use for the project, look under the tool tab. Note, the isolator row was the first line of pollution control and the second treatment phase was the 'polishing' of the stormwater through the stone surround.

Another project (to be installed in April) is the Westfield Retail Park in Cumbernauld which had a pollution mitigation indices of indices of TSS 0.8, Metals 0.8 and Hydrocarbons 0.9. Again the isolator row was the first line of pollution control and the second treatment phase was the 'polishing' of the stormwater through the stone surround.

I hope this helps. If you have any further queries or need any further information please do not hesitate to contact me.

Kind regards,

Niall McDonald

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Stormwater Attenuation Tanks — Rainwater Harvesting Systems & Maintenance — Flood Defence Systems

From: Kenny Stevenson <Kenny.Stevenson@struer.co.uk>
Sent: 14 March 2018 11:21
To: Niall McDonald <Niall.McDonald@cubicm3.com>
Subject: Stormtech Attenuation Mitigation Indices

Niall,

Does the Stormtech system have SUDS Mitigation Indices for TSS, Metals and Hydrocarbons?

I usually just use the filter strip scores but I'm falling short on this occasion. Table 26.3 of the Suds Manual states that proprietary treatment systems need to demonstrate levels.

Kenny

Appendix G

SEPA Flood Map

SEPA
Scottish Environment Protection Agency
Buidheann Dìon Àrainneachd na h-Alba

Flood Maps

SEPA Home | Flooding Home | Map Creation Dates | Print Map | Help

 This map was developed using data from various sources. Full acknowledgement of data providers and participating parties is available here

0 0.3 0.6km

Map Scale - 1:19,000