STORMWATER AUDIT (STAGE 1)

JBA Project Code	2021s1635
Contract	SHD, Dundrum CMH, Dundrum, Co Dublin
Client	Land Development Agency
Prepared by	Chris Wason
Subject	Stormwater Audit Stage 1 Report

Revision History

Issue	Date	Status	Issued to
S3.P01	21/01/2022	First issue	BMCE
S3.P02	28/02/2022	Final issue	BMCE

1 Introduction

JBA Consulting have been contracted by Land Development Agency to undertake a Stage 1 SW Audit of the surface water drainage design prepared by Barrett Mahony Consulting Engineers (BMCE) for the proposed SHD at Dundrum Central Mental Hospital site, Dundrum, Co. Dublin. The surface water audit was undertaken in advance of a Strategic Housing Development (SHD) planning submission to An Bord Pleanála.

The subject of this Stage 1 stormwater audit is to review the proposed surface water drainage design and sustainable urban drainage system (SuDS) proposals for the proposed development. The audit has been completed in accordance with Dún Laoghaire Rathdown County Council's (DLRCC) Stormwater Audit Procedure (Rev 0, Jan 2012) as set out below.

Stage 1 – Pre Planning Stage: *A Stage 1 audit shall be carried out of the Stormwater Impact Assessment (SIA) prepared by the applicant. The audit will focus on the SUDS management train and whether the applicant has carefully considered all known SUDS techniques and applied the most appropriate type(s) for the site that will ensure improved water quality, biodiversity and volume control*.

1.1 Report Structure

The Feedback Form in Appendix A identifies queries raised in this report which are to be answered by the Design Engineers. Once an 'Acceptable' status is achieved for each query the audit is deemed to be closed out.

The results of the audit are set out hereunder, where items raised in the feedback form are shown in bold within this report.

1.2 Relevant Studies and Documents

The following documents were considered as part of this surface water audit:

- Greater Dublin Strategic Drainage Strategy (GDSDS);
- Greater Dublin Regional Code of Practice for Drainage Works;
- The SUDs Manual (CIRIA C753).
- Current Development Plan

1.3 Key Considerations and Benefits of SuDS

The key benefits and objectives of SuDS considered as part of this audit and listed below include:

- Water Quantity
- Water Quality
- Amenity
- Biodiversity

Which can be achieved by;

- Storing runoff and releasing it slowly (attenuation)
- Harvesting and using the rain close to where it falls
- Allowing water to soak into the ground (infiltration)
- Slowly transporting (conveying) water on the surface
- Filtering out pollutants
- Allowing sediments to settle out by controlling the flow of the water

1.3.1 SuDs Management Train

A SuDs Management Train is a robust pollutant removal strategy. The treatment train can comprise four stages:

1. *Prevention*
2. *Source Control*
3. *Site Control*
4. *Regional control*

In s2.4 of the report BMCE have demonstrated that a SuDs management train has been sufficiently demonstrated for the majority of runoff with at least two SuDS components, except for some locations identified above. A 'Simple Index Approach' has been applied to pollutant hazard analysis which is considered appropriate.

2 Proposed Development (SHD) at Dundrum CMH, Dundrum, Co. Dublin

The subject site is located the Central Mental Hospital, Dundrum Road, Dundrum, Dublin 14 as shown in Figure 1

Figure 1- Site Location

The total area is c9.42ha.and the positively drained area is c6.46ha. comprising of three catchment areas

of Catchment A (1.403ha.), Catchment B1 (4.05ha.) and Catchment B2 (1.014ha.).

Existing buildings and infrastructure on the site will be demolished. The existing buildings discharge to a combined drainage system which connects to the DN300 combined sewer in the Dundrum Road.

2.1 Review of SW Drainage Proposals

The review is based on the following documents provided by BMCE on 12th January;

- DCD-BMD-00-00-DR-C-1000 Roads Layout & Levels.pdf
- DCD-BMD-00-00-DR-C-1020 Buried Surface Water Drainage Layout.pdf
- DCD-BMD-00-00-DR-C-1021 Buried Foul Water Drainage Layout.pdf
- DCD-BMD-00-00-DR-C-1022 Buried Foul Water & Surface Water Drainage Layouts Combined.pdf
- DCD-BMD-00-00-DR-C-1025 Surface Water Overland Flow Routes.pdf
- DCD-BMD-00-00-DR-C-1030 SuDS Layout.pdf
- DCD-BMD-00-00-DR-C-1039 Existing Buried Drainage Layout.pdf
- DCD-BMD-00-00-DR-C-1115 Surface Water Drainage Longitudinal Sections Sheet 1 of 3.pdf
- DCD-BMD-00-00-DR-C-1116 Surface Water Drainage Longitudinal Sections Sheet 2 of 3.pdf
- DCD-BMD-00-00-DR-C-1117 Surface Water Drainage Longitudinal Sections Sheet 3 of 3.pdf
- DCD-BMD-00-00-DR-C-1205 SuDS Details. Typical Green & Blue Roof Details.pdf
- DCD-BMD-00-00-DR-C-1206 SuDS Details. Permeable Paving Details.pdf
- DCD-BMD-00-00-DR-C-1207 SuDS Details. Filter Drain Typical Details.pdf
- DCD-BMD-00-00-DR-C-1208 SuDS Details. Typical Stormtech Attenuation Tank Details.pdf
- DCD-BMD-00-00-DR-C-1209 SuDS Details. Typical Bio-retention Area & Tree Pit Details.pdf
- DCD-BMD-00-00-DR-C-1210 SuDS Details. Swales, Detention Basin & Over-the-edge Road Drainage .pdf
- DCD-BMD-00-00-DR-C-1225 Standard Surface Water Drainage Details.pdf
- IR.01 Infrastructure Report PL2_full.pdf

2.1.1 Pre-Planning Meeting

Various meetings and correspondence have been held with DLRCC which has been set out in s1.4 of the BMCE report.

2.1.2 Site Characteristics

A site investigation was carried out by S.I Ltd. In 11/21 and a summary of the report provided in Appendix 1 of the BMCE report. Four number soakage tests were completed. Two failed the test and two provided infiltration 'f' values of 7.36x10-5 m/s (SA02) and 2.2x10-4 m/s (SA703) which are located in the upper north/northwest of the development (Catchment B2). The ground is typically made ground overlying a black slightly sandy gravelly silty CLAY and natural ground conditions consistent with cohesive soils encountered across the site.

Groundwater was encountered in the majority of boreholes and a third of the trial pits, ranging in depth from 0.8mbgl to 3.3mbgl typically. Standpipes were provided in 5 locations. Details of where GW was encountered are not provided and consideration of SuDS proposals will have to take cognisance of the depth of GW rising within 1m of the base. It may be required to line SuDs features

Details of trial holes and boreholes are not included in the report submitted.

The SOIL type adopted by BMCE is SOIL 4 and SPR 0.47 which would seem appropriate with poor infiltration although the northwest area of the site Catchment B2 could be classed as good infiltration

BMCE to clarify whether infiltration has been considered within Catchment B2.

BMCE to provide more details and assessment of where GWL is across the site and identify which SuDS features mare to be lined and unlined.

The general fall across the lands is from south to north.

2.2 Design Parameters

Rainfall parameters can be estimated using Met Eireann data, using the Flood Studies Report (FSR) values or the values in the GDSDS. The Met Eireann method can be more representative of a site if selected correctly. The design values used by BMCE and considered by JBA are shown below:

Rainfall parameters	Designer values	JBA Comment
M5_60	1**8**	Ok - Met Eireann
Ratio R	0**.278**	Ok – Met Eireann
SAAR (mm)	772	From Met Eireann. Default in UKSuDS is 840 but use 772
Qbar l/s	31.86	34.97 - UKSuDs
Climate Change	20%	Ok – 10% required in GDSDS

The BMCE report states that the discharge limit from the site (Qbar) has been taken as a conservative 29 l/s which is less than those noted above. The runoff rate for each catchment is set out in table 2.3 (BMCE report) and repeated below;

Table 2.3: Runoff rate per catchment

Catchment	Area (m^2)	Drained Area (m^2)	Calculated Qbar (l/s)	Proposed Qbar (l/s)
Catchment A	28 593	14 029	6.911	7.0
Catchment B1	47 962	40 499	19.951	18.0
Catchment B2	17 319	10 146	4.998	4.0
Total	93 874*	64 674	31.86	29.0

Drg. 1020/PL4 identifies the hydrobrakes that control the flow from the site as;

Catchment A: Node S1.19 = 7 l/s

Catchment B1: Node S10.8 = 14l/s and Node S7.1 = 2l/s and node S9.1 = 2.0l/s – Total 18 l/s

Catchment B2: Node S4.7 = 4l/s

The total pass forward flow (29 l/s) is deemed to satisfy the site greenfield runoff.

The runoff coefficient has been set to 1.0 from the default Flow hydraulic model values of 0.75 (summer) and 0.84 (winter) and designer Cv applied to different surfaces as shown below in Table 2.1 repeated below;

The runoff coefficients used are as prescribed in the DLR Draft Development plan for 2022:

Table 2.1: Runoff Coefficients

Type of areas	CV
Landscaping (Grass / Soft)	0.3
Intensive Green Roof / Podium	0.8
Extensive Green Roof	0.8
Permeable Paving	0.8
Impermeable Surface (incl tree pits)	0.9
Standard Roof (impermeable)	0.95

BMCE state that these values are taken from the Draft Development Plan 2022-2028 and would generally seem reasonable (JBA do not have access to this draft document). However, the landscaping (grass) value of 0.3 might seem low for a SPR value of 0.47 and it could be expected that the SPR value would be applied to contributing grassed areas.

BMCE to confirm if Cv value of 0.3 for grassed areas is adequate for this site with SPR of 0.47.

2.3 Surface Water Drainage Strategy

The development is split into three catchments which are attenuated separately to the combined value of 29 l/s, which is less than Qbar for the site.

A fairly comprehensive SuDS management system has been proposed by BMCE which is generally clearly laid out and should achieve the general principles and aims of SUDS. A pollutant analysis has also been undertaken. A review of the proposals is considered in more detail below.

A FLOW model has been used for the drainage analysis. Pipe design calculations are not provided but simulation runs for the three catchments are provided for the 5-, 30- and 100-year storm return periods.

No infiltration has been allowed for in the design except for the detention basin.

2.3.1 SuDS Measures Considered

SuDS Technology	Comments
Green/Blue Roofs	Blue/Green roofs are proposed, both intensive and extensive. The coverage exceeds the DLRCC requirement of 60%
Swale, Filter Drain, Infiltration Trench	Some filter drains are proposed to drain some roads.
Tree Pits, Bioretention Areas, Rain Gardens	Extensive tree pits and bio areas are proposed to take roof and road
Permeable Paving	Permeable paving is proposed around the site but not designed for any infiltration. Typical detail drawings are provided but it is not clear if the pavements to be provided are lined or unlined.
Soakaways	None proposed. SOIL type 4 would indicate very poor infiltration but some areas of Catchment B2 would be considered suitable for soakaways/infilttration
Detention Basins, Retention Ponds, Stormwater	A detention basin is proposed in catchment B2

Wetlands	
Rainwater Harvesting	None proposed
Petrol Interceptor	The report refers to basement car park drainage and use of a PI to pump to the sw network. No details are provided. It is also queried if the basement drainage should connect to the foul system.
Attenuation	RC tanks, stormtech units and geocellular tanks are proposed. The use of RC tanks outside of buildings is queried and alternatives may be possible.
Other	N/A

2.3.2 Review of drainage drawing 1020/PL4 and SuDS drawing 1030/PL3;

A number of storage tanks are concrete tanks which are not normally considered acceptable. For those under or within building structures then no other alternative may be available. However, tanks H, J are not located under buildings and there could be more suitable alternatives. Use of concrete tanks is also subject to Planning Authority approval.

BMCE to clarify the use of concrete tanks and consider alternatives outside building footprints.

The majority of RG's are connected to tree pits, bio areas, filter drains or permeable paved areas. A small number of RG's appear to be connected directly to the sw network e.g.;

- Adjacent to s12.2.
- Two road gullies at the BM-Road 2 entrance are connected directly to the to the sw network. Although only a small area could these be connected to a filter drain or tree pit?

Road 2: from S1.8A to S1.11 - how is this road drained? No RG's or filter drain is shown. Also, there is a junction table which might interfere with the flow path. Raised speed tables are located in other areas.

It is not clear how all road sections are to be drained and how speed tables/junction tables might interfere with flow paths. All gullies, if possible, should be connected to a SuDs feature. BMCE to clarify.

2.3.3 Review of BMCE report

S2.4.6.2 refers to drainage of the basement car park pumped to the storm network via a PI. It is more usual to pump highly contaminated underground car park drainage (created from washdown rather than rainfall) to the foul system as per the GDSDS CoP s3.18. It is not clear what the DLRCC policy is on this.

BMCE to justify disposal of u/g car park drawing to the storm network rather than pumped to foul, subject to Planning Authority requirements.

S2.4.-Catchment A refers to pumping Block 1 and eastern side of Block 2 to catchment B but this does not make sense with the layout shown on the drawing. Is pumping of storm water still proposed? Pumping is also referred to in the legend of drg. 1020/PL4

BMCE to clarify if pumping of storm water is still proposed and update the report and drawings if not. It should be noted that pumping of storm water is not preferred by the Planning Authority.

S2.3.4.4 refers to provision of a raised drainage pipe in the paving substrata by 100mm to give interception storage. It is queried if there is no infiltration if this could be provided. Also, the typical detail provided shows a land drain below the pavement substrata.

BMCE to justify their assumption that interception storage is provided in the undrained pavement substrata and amend the typical detail to suit if appropriate.

2.3.4 Review of Hydraulic Model

FLOW hydraulic model has been used for the design. A Detailed Area Summary is provided in Appendix 7 of the BMCE report which includes for surface type breakdown with Cv factor applied. A spot check would indicate that the aeras in the model are complimentary to those in the summary sheet for each node.

- 20% climate change allowed for in the simulation for 5-, 30- and 100-year storms which are analysed for the range of durations and is satisfactory.
- Hydrobrakes have min.50mm orifice except for tank K (42mm dia) but all contributing areas would appear to connect to a SuDS element first which would help to mitigate blockage
- No TWL within 500mm of adjacent FFL of buildings
- Drained area breakdown provided in Appendix 7

Some queries for BMCE to address are listed below

- Pipe design calculations are not provided. The summary calculations for simulation runs indicate no flooding for the 100-year event.
- In Catchment B1 hydrobrake flow controls are provided at s7.1, s9.1, s11.4 and s10.5 with two tank structures allocated to them. One of these is related to the tank as shown on the drawing, the other is a depth of 0.06 and varying area to give volumes of 119m3, 66m3 129m3 and 66m3 respectively with porosity set at 0.95. It is not clear what these storage structures relate to.
- No infiltration has been allowed for except for the detention basin (node s6.4) with a rate of 7.3x10-5 m/s, based on the lower of the two soakage tests undertaken. However, no soakage test was undertaken in the vicinity of the proposed detention basin and BMCE and details of nearby TH's and BH's nor provided. BMCE should justify the rationale.
- JBA would recommend that BMCE put head + pass forward flow on drawings for hydrobrake controls
- Stormtech storage units are proposed for tanks A & D. The type of stormtech unit proposed is not clear but the typical detail provided (drg. 1208/PL3) is a SC740 with a typical available head of 0.9m. Manufacturer's design details of the actual units to be provided to match the volume of storage required should be provided at detailed design stage if acceptable to the Planning Authority.
- Tank A (S14.7) has a design head in the Model of 0.6m which would be more suitable for a SC310 stormtech unit. The head on drg is shown as 1.06m.
- Tank D (S10.5) has a design head in the Model of 1.6m which would be more appropriate for a MC3500 type unit. The head on the drg. Is shown as 1.06m
- Detention basin tank (S6.4) is in the Model but no hydrobrake control is indicated as shown on the drawing.

Catchment B2

- Tank G (S4.7) has a volume of 260m3 in the Model but only 171m3 is indicated on the drawing.
- Drg 1205/PL4 provides typical details of permeable paving, both unlined and lined, but it is not clear whether the units proposed will be lined or unlined. The type to be adopted would make a difference in the assessment of interception as per Table 24.6 of the CIRIA manual.

2.3.5 Interception/Treatment

Interception of runoff is intended to prevent any runoff for small rainfall events which are less than 5mm (and up to 10mm if possible). Treatment of 15mm is required if interception is not provided.

Table 24.6 of the CIRIA manual provides indication of deemed to satisfy criteria and it is considered that this should be complied with. All sources of runoff should also be intercepted where possible. A high level of Interception provided for some parts of the site is not to be considered as adequate compensation for a low degree of interception provision for other locations. Compliance is required for the whole site, or at least for road/paved areas, for it to be considered effective. Interception mechanisms are based on runoff retention. This can be achieved using rainwater harvesting or using soil storage and evaporation. Either

infiltration or transpiration rates can dispose of the runoff from minor events to enable the next event to be captured.

Interception of flow is dealt with in s2.4.5 of the BMCE report and assumes varying storage rates for different surfaces. Interception is dealt with by volumetrics which is not necessarily applicable. No infiltration is assumed in the design and the SOIL type=4 would typically indicate a clay/ impervious soil. Whilst storage and retention within different surfaces can provide for some interception it can be very subjective as to how much, especially if there is no infiltration.

Impermeable roof areas for Blocks 09 are connected to small permeable paved areas. There is no infiltration in this area and the impermeable area drained should not exceed that of the permeable paved area (if unlined) to comply with table 24.6 of the CIRIA manual.

No RWP are shown draining the impermeable roofs on Blocks 08. BMCE should provide details and if they are draining to permeable paving areas or tree pits they should be in compliance with table 24.6 of the CIRIA manual and indicate if pavements are lined or unlined. It is also noted that tree pits are proposed immediately adjacent to some buildings in Blocks 08 and BMCE should confirm that this is acceptable

The Gate Lodge roof and paved area are drained to a bioretention area which also takes one road gully. Table 24.6 states that unlined components can take up to five times the vegetated surface area. BMCE to provide details of the impermeable area and bioretention area to show compliance

BMCE to clarify that adequate provision for interception for all impermeable surfaces has been made where possible and in compliance with Table 24.6 of the CIRIA manual.

2.3.6 Exceedance Flows

BMCE have provided a drawing 1025/PL3 showing overland flow routes in case of blockage etc. FLOW analysis has been provided assuming 50% blockage of the outlets.

2.4 Health & Safety and Maintenance Issues

The proposed drainage system comprises SuDS devices, traditional road gullies, manholes, attenuation systems, a petrol interceptor and underground pipes. These elements are considered acceptable from a Health & Safety perspective once supplier/manufacturers guides are followed and complied with during the detailed design, construction and operation.

Optimum performance of the SUDs treatment train is subject to the frequency of maintenance provided. At detailed design stage, it is recommended that a maintenance regime be adopted.

Particular consideration is required at detailed design stage to the design, maintenance requirements and whole life plan (and replacement) of the SuDS system as a whole.

Regular maintenance of the hydrobrake will be required to remove any blockages, particularly in the wake of heavy rainfall events or local floods.

It is recommended that the petrol interceptors be fitted with an audible high-level silt and oil alarm for maintenance and safety purposes. Regular inspection and maintenance is recommended for the petrol interceptor.

Please note that silt and debris removed from the petrol interceptor during maintenance will be classified as contaminated material and should only be handled and transported by a suitably licensed contractor and haulier and disposed of at a suitably licensed landfill only.

2.5 Items to be considered at Detailed Design Stage

There are a number of items that require attention at detailed design stage. A summary of same are as follows:

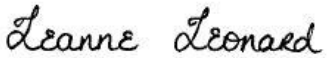
- Proper detail design and construction of SuDS devices is paramount to ensure long term optimum hydraulic performance as well as maximisation of biodiversity opportunity. It is recommended that a collaborated approach to detail design is adopted between engineers, architects, ecologists and Landscape Architects.
- Location, layout and levels of basement vents should be cognisant of exceedance flow routes.
- Operation & Maintenance regime for each of the components on site;
- Hydrobrake selection to be give due consideration to hydraulic performance, actual head behind the unit, maximum potential clear passage size and maintenance requirements.

2.6 Audit Report sign Off

Audit Report Prepared by:

Chris Wason BEng CEng MICE
Principal Engineer

Approved by:



Leanne Leonard BEng (Hons) MIEI
Design Engineer

Note:

JBA Consulting Engineers & Scientists Ltd. role on this project is as an independent reviewer/auditor. JBA Consulting Engineers & Scientists hold no design responsibility on this project. All issues raised and comments made by JBA are for the consideration of the Design Engineer. Final design, construction supervision, with sign-off and/or commissioning of the surface water system so that the final product is fit for purpose with a suitable design, capacity and life-span, remains the responsibility of the Design Engineers.

Appendix A – Audit Feedback Form

JBA Consulting Stormwater Audit - Stage 1 Feedback Form	
Project:	SHD at CMH Dundrun Road, Dundrum, Dunlin 14
Date:	20/01/2022
JBA Reviewers	Chris Wason
Status	S3/P02
Project Number:	2021s1635

Item No.	JBA Review Comment	Comment/Clarification Request/Suggested Mitigation	Response from Client/Client Representative	Acceptable / Not Acceptable
	21/01/2022	21/01/2022	28/02/2022	28/02/2022
	Reference Documents see SW Audit Report			
1	Site investigation and ground conditions 1 -the site investigation indicates a cohesive natural soil across the site and BMCE have adopted a SOIL type 4 which seems appropriate. However, soakage teets in Catchment B2 indicate that some areas may have good infiltration. 2 - GWL across the site may pose a problem and SuDs elements may need to be lined if the level is within 1m of the base of proposed SuDS features. General details of GWL have been given but no specifics	1 - Would BMCE consider infiltration in the Catchment B2 or at least confirm that SuDs units will be unlined if GWL is suitable. 2 - It is not clear from the information provided if , or where, GW may be an issue and which SuDS elements may be affected and may be need to be lined. BMCE should confirm the GWL across the site and indicate if SuDs elements are to be lined or unlined	1 - Yes, infiltration in Catchment B2 will be considered. SuDS units on this project are generally 'unlined' (they have a high permeablity geotextile lining only). 2 - Based on the SI report and experience in the south Dublin area, the groundwater table is likely to be 3.0-4.0m bgl but with higher level water perched on top of and travelling over the relatively impermeable boulder clays. SuDS devices located below the perched water level will be lined. Further site investigations (trial pits) will be carried out prior to construction to confirm the water table levels in more detail at the locations of the larger buried devices e.g. the attenuation tanks (these are generally unlined & indicated 'Permeable' in the tank details note on BM drg C1020).	Accepted
2	Flow Model (1) 1 - it is noted that the default runoff coefficient in the model has been edited to 1 and that coefficients for different surface types has been applied which generally seem reasonable (and in agreement with draft DLRCC Development Plan). The Cv for grassed lands is 0.3 but he soil investigation indicates cohesive soils. 2 - In Catchment B1 hydrobrake flow controls are provided at s7.1, s9.1, s11.4 and s10.5 with two tank structures allocated to them. One of these is related to the tank as shown on the drawing, the other is a depth of 0.065 and varying area to give volumes of 119m3, 66m3 129m3 and 66m3 respectively with porosity set at 0.95. It is not clear what these storage structures relate to. 3 - No infiltration has been allowed for except for the detention basin (node s6.4) with a rate of 7.3x10-5 m/s, based on the lower of the two soakage tests undertaken. However, no soakage test was undertaken in the vicinity of the proposed detention basin and BMCE and details of nearby TH's and BH's are not provided. BMCE should justify the rationale. 4 - JBA would recommend that BMCE put head + pass forward flow on drawings for hydrobrake controls 5 - Stormtech storage units are proposed for tanks A & D. The type of stormtech unit proposed is not clear but the typical detail provided (drg. 1208/PL3) is a SC740 with a typical available head of 0.9m. Manufacturer's design details of the actual units to be provided to match the volume of storage required should be provided at detailed design stage if acceptable to the Planning Authority.	1 - BMCE to confirm that the Cv for grassed areas of 0.3 is suitable bearing in mind the SPR value is 0.47. 2 - BMCE to clarify the second storage tank inputs wit depth of 0.065mm 3 - BMCE to justify the use of the infiltration rate at the detention basin location 4 - Would BMCE consider putting the head and discharge rate on the drawing for all flow controls 5 - BMCE should indicate the type of Stormtech unit proposed and also provide calculation from Stormtech to confirm the actual size required to suit the volume needed. Flow analysis should be representative of the storage type proposed.	1 - The SOIL Class for the existing undeveloped greenfield site is esimated as Class 4 which has an SPR value of 0.45 (low permeability boulder clay typical of the Dublin area). The development, by its nature will change the topography of the site, and higher quality topsoil for landscaping purposes will be applied to all soft landscape areas to ensure proposed planting can thrive, and to allow for a greater level of natural infiltration through the soil. It is therefore reasonable to use a Cv value of 0.3 bearing in mind the current industry guidance which suggest run-off coefficients from soft landscaping in the region of 0.10-0.25. A run-off coefficient of 0.3 has been used in the design of the proposed development to account for any run-off arising from the areas of soft landscaping. 2 - The storage tanks with a depth of 0.065m represent the various blue roofs on the different blocks (where applicable) 3 - The detention basin will be a dry, landscaped area with the ability to attenuate surface water in high storm events. Due to the fact that the facility will be able to dry out, infiltration will be possible when it fills with water. The infiltration rate used in the calculations is the average result from the two nearby soakaway tests. (0.264m/hr - As per section 6.3 of Site Investigation) 4 - Yes, the head and discharge rate will be put on drawing C-1020 for all controls. 5 - Stormtech type proprietary arch unit 740 deep assumed throughout. Tanks A & D was updated in the Flow model to reflect 60% typical porosity with a depth of 1.1m.	Accepted
3	Flow Model (2) 1 - Tank A (S14.7) has a design head in the Model of 0.6m which would be more suitable for a SC310 Stormtech unit. The head on drg is shown as 1.06m. 2 - Tank D (S10.5) has a design head in the Model of 1.6m which would be more appropriate for an MC3500 type unit. The head on the drg. Is shown as 1.06m 3 - Detention basin tank (S6.4) is in the Model but no hydrobrake control is indicated as shown on the drawing Catchment B2 4 - Tank G (S4.7) has a volume of 260m3 in the Model but only 171m3 is indicated on the drawing.	1 & 2 - BMCE should indicate the type of Stormtech unit proposed and also provide calculation from Stormtech to confirm the actual size required to suit the volume needed. Flow analysis should be representative of the storage type proposed. 3 - Is a hydrobrake proposed at node S6.4 and if so should this be represented in the Flow model. 4 - Please confirm the correct volume for this tank and ensure Mode land drawing are complimentary	1 & 2 - Noted. Calculations will be obtained off Stormtech or an alternative unit provided (if used) at tender preparation stage. BM will re-visit the calculations and update the sw drainage drawing C-1020 to indicate the correct unit type for each Stormtech type tank. 3 - Flow control to the detention basin is provided at manhole S6.4 as noted on BM drg C-1020. 4 - The correct volume is 258 cum. The drawing will be updated to reflect this. The area was shown in the drawing text box - 171m2.	Accepted

JBA Consulting Stormwater Audit - Stage 1 Feedback Form	
Project:	SHD at CMH Dundrun Road, Dundrum, Dunlin 14
Date:	20/01/2022
JBA Reviewers	Chris Wason
Status	S3/P02
Project Number:	2021s1635

Item No.	JBA Review Comment	Comment/Clarification Request/Suggested Mitigation	Response from Client/Client Representative	Acceptable / Not Acceptable
	21/01/2022	21/01/2022	28/02/2022	28/02/2022
4	Interception/Treatment 1 - Drg 1205/PL4 provides typical details of permeable paving, both unlined and lined, but it is not clear whether the units proposed will be lined or unlined. The type to be adopted would make a difference in the assessment of interception as per Table 24.6 of the CIRIA manual 2 - Impermeable roof areas for Blocks 09 are connected to small permeable paved areas. Are these to be lined or unlined? Are they in compliance with table 24.6 of the CIRIA manual 3 - No RWP are shown draining the impermeable roofs on Blocks 08. 4 - It is also noted that tree pits are proposed immediately adjacent to some buildings in Blocks 08 and BMCE should confirm that this is acceptable. 5 - The Gate Lodge roof and paved area are drained to a bioretention area which also takes one road gully. Table 24.6 states that unlined components can take up to five times the vegetated surface area.	1 -What are the type (s) of permeable paving to be used from the typical details provided 2 - BMCE to clarify that adequate provision has been made for all impermeable surfaces 3 - BMCE should provide details and if they are draining to permeable paving areas or tree pits they should be in compliance with table 24.6 of the CIRIA manual and indicate if pavements are lined or unlined. 4 - are tree pits immediately adjacent to building ok? BMCE to confirm. 5 - BMCE to provide details of the impermeable area and bioretention area to show compliance with Table 24.6 of the CIRIA manual.	1 - As noted on BM drg C-1207 a Type B system (partial infiltration) will apply throughout except within 1.5m of building foundations or 1.5m of the site boundary where Type C will apply (=impermeable membrane - no infiltration). We will update the note so that this is clearer. Note 1: During a recent IEI Seminar on Perm Pavements it was stated that the normal rule of 5m separation distance between soakaways and building foundations was unduly onerous for a thin flat soakaway like a permeable pavement. 1.5m or less was suggested unless there are significant additional inflows. Note 2 - On the sw drainage layout drawing, BM drg no C-1020, Attn tank 'F' which is a permeable pavement with a deepened granular base, will have an impermeable membrane up to 5m from the building. 2 - The roof areas of Blocks 08 & 09 will connect to a soakaway in each rear garden. The soakaways will each have a high level overflow to the site sw drainage system. Infiltration tests along these gardens will be carried prior to construction to verify infiltration rates and the required soakaway sizes. 3 - Noted. Drainage will be locally revised if necessary to ensure compliance with Table 24.6. 4 - Yes, tree pits/bio-rention areas beside buildings can take water directly from rainwater downpipes. These pits will be lined with an impermeable lining. This will be noted on the sw drainage layout drg no. C-1020. 5 - Following discussions with the Landscape Architect the large area of paving around the gate lodge with be revised to perm. paving and the bio retention area will be enlarged. These will be sufficient to take the road and road drainage while complying with Table 24.6.	Accepted
5	Review of Drawing 1020/PL4 and 1030/PL3 1 - a number of RC tanks are proposed which would not normally be considered acceptable but no other option may be available. However, H & J do not seem to be located under or within buildings 2 - A small number of RG's appear to be connected directly to the sw network e.g.; • adjacent to s12.2. • Two road gullies at the BM-Road 2 entrance are connected directly to the to the sw network. Although only a small area could these be connected to a filter drain or tree pit? 3 - Road 2: from S1.8A to S1.11 - how is this road drained? No RG's or filter drain is shown. Also, there is a junction table which might interfere with the flow path. Raised speed tables are located in other areas	1 - Use of concrete tanks is subject to Planning Authority approval. BMCE to confirm that no other suitable alternatives are available, particularly with regard to tanks H & J which appear to outside the building lines. 2 - BMCE to review RG connections and connect to a SuDS feature where possible 3 - BMCE to review all sections of road and confirm that adequate provison has been made for their drainage and that any new RG are connected to a SuDS feature.	1 -Conrete tank H is an extension of the Block 10 basement and will need to remain a concrete tank. Tank J will be revised to a tank constructed with proprietary cellular units with a permeable lining. A low infiltration value has been used in the calculations (0.264m/hr - As per section 6.3 of Site Investigation). 2 - All RG locations will be reviewed and addressed. 3 - All RG locations will be reviewed.	Accepted
6	Review of BMCE report 1 - S2.4.6.2 refers to drainage of the basement car park pumped to the storm network via a PI. It is more usual to pump highly contaminated underground car park drainage (created from washdown rather than rainfall) to the foul system as per the GDSDS CoP s3.18. It is not clear what the DLRCC policy is on this. 2 - S2.4.-Catchment A refers to pumping Block 1 and eastern side of Block 2 to catchment B but this does not make sense with the layout shown on the drawing. Is pumping of storm water still proposed? Pumping is also referred to in the legend of drg. 1020/PL4 3 - S2.3.4.4 refers to provision of a raised drainage pipe in the paving substrata by 100mm to give interception storage. It is queried if there is no infiltration if this could be provided. Also, the typical detail provided shows a land drain below the pavement substrata.	1 - BMCE to justify disposal of u/g car park drawing to the storm network rather than pumped to foul, subject to Planning Authority requirements 2 - BMCE to clarify if pumping of storm water is still proposed and update the report and drawings if not. It should be noted that pumping of storm water is not preferred by the Planning Authority. 3 - BMCE to justify their assumption that interception storage is provided in the undrained pavement substrata and amend the typical detail to suit if appropriate.	1 - Basement drainage will be pumped to foul network. 2 - Pumping is not proposed. The note in the Infrastructure Report is an error and will be removed. 3 - The permeable pavements are typically 'unlined' i.e. have a high permeability geotextile lining except in proximity to buildings or the site boundary where an impermeable membrane should be used as noted on BM drg C-1207. Infiltration in the top layers of soil on site/granular fill will be sufficient to ensure that interception storage is achieved. In the case of the permeable paved area taking part of the run-off from Block 06, a shallow soakaway test will be carried out prior to construction to confirm the infiltration rate.	Accepted