ENGINEERING
CONSULTANCY

Sandown Quarry Landfill Restoration

Stubbers Green Road, Aldridge, Walsall

Surface Water Management Plan

Addendum

Date: Aug 2023

Revision: 01

Status: Permitting

Project No. 07200

Report Ref. 07200/SWMP/R02

Revision	Description	Issued by	Issue Date
00	Addendum issue	TJG	28.07.2023
01	Updated addendum with additional survey	TJG	25.08.2023

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Contents

1. Introduction

Byrne Looby Partners (UK) Ltd have been commissioned for the restoration design and have commissioned 7 Engineering Consultancy Ltd as sub-consultant, to produce a surface water design and surface water management plan for runoff from the restored surface to support an environmental permit application for the restoration of the Sandown Quarry Landfill.

This addendum is to accompany the Surface Water Management Plan submitted with the planning application and is to provide additional information in response to comments.

2. Site Outfall

Further survey work has been undertaken on site in response to the comments related to the outfall.

The location, levels and size of the existing outfall have been confirmed and included within the proposed restoration scheme. The updated topographical survey is included within the appendices to this addendum.

The outfall was inspected in August 2023, and the existing condition was found to be good with the pipe flowing freely and the headwalls in good condition. Photographs of the existing outfall from the condition inspection are included in the appendices.

No works are proposed to the existing outfall in the Vigo Brook and an ordinary watercourse consent is not required. Further inspections will be carried out at the time of restoration and if works in the brook are considered necessary at that time, an ordinary watercourse consent application will be made.

3. Drawing and calculation updates

The details of the outfall from the updated topographical survey have been included within the drawings, and the scheme adjusted to tie into the surveyed position of the outfall.

The hydraulic model has also been updated to include the surveyed details of the outfall. A new chamber is to be built onto the existing outfall pipe within the site and a further chamber with the flow control constructed to connect to the second basin. The final discharge rate is unchanged from the previous calculations.

The model has also been updated to include the culvert sections used to form the crossing points for the public right of way and proposed permissive path across the drainage channels. The tops of the culverts are set slightly above the bank level to not impede the flow and used standard culvert sections. In the model, these are included as open topped U channels rather than closed culverts. Microdrainage cannot model culverts with negative cover and hence they are included as open U channels with the bank level to match the actual drainage channel bank levels. From inspection of the top water levels in the channels, it can be seen that the water level in the channels is below the soffit level of the proposed culvert, hence hydraulically, they are open channels with a free top water surface.

The updated drawings and calculation pack are included in the appendices to this addendum.

4. Management and Maintenance of the drainage systems

A management and maintenance plan setting out the inspection and maintenance tasks has been produced and is included as an appendix to this addendum.

The plan notes that the site owner, Wienerberger Ltd, will be responsible for all management and maintenance following completion of the restoration.

The plan notes the periodic cutting of the reed in the two basin areas to maintain the through flow of water and attenuation volumes. This cutting is noted as being carried out at appropriate times of the year to not interfere with the use of the reed by roosting migratory birds.

Management and maintenance of surface water runoff during the operational filling and restoration of the site will be dealt with by a separate operational management plan.

4.1. Sediment control in the proposed ponds

The existing sedimentation basin associated with the existing quarrying works is to be retained, modified and used as part of the surface water attenuation in the proposed final restoration scheme.

Sediment forebays are to be created at each of the inlet points from the swales formed of a permeable barrier between the inlet and the main basin area. The purpose of these forebays is to slow the incoming flow and allow sediment to drop out within the forebay area where it can be removed without disturbing the remainder of the pond area. Accumulated sediment is to be removed from the forebays using either a long reach excavator or manual methods at a time of year to cause least disturbance to the roosting migratory birds. The sediment removal will not affect the remainder of the pond area.

Sediment removal across the whole area of the two basins is not expected to be required.

4.2. Basin lining

The basin areas are not proposed as being lined but left as natural ponds relying on the relatively impermeable subsoils to maintain water levels.

4.3. Water quality and pollution

The final restored site will be a vegetated surface rooted into clean soils. The runoff from this clean soil and vegetation will pass into the swales and the attenuation ponds. Passage of flow across a vegetated surface and through a swale system is recognised as improving runoff water quality in the Ciria C753 SUDS Manual. A water quality assessment using the SUDS Manual Simple Index approach has been carried out and shows the SUDS treatments provided are sufficient to deliver good water quality.

The quality of the water entering the first attenuation basin will be markedly better than the current inflow of water from live quarrying operations into the current basin.

There is to be water quality monitoring at locations agreed with the Environment Agency during the operation and restoration of the site in accordance with the environmental permit for the site. This monitoring will continue after the restoration is complete until it is confirmed that the site is stable and there is no pollution, and the permit is surrendered. The frequency of the monitoring is likely to reduce over time, post restoration, but this will not be confirmed until the agreed Closure Plan in place (usually a condition of the permit).

The surface water runoff from the final restored surface to the attenuation basin system within the SSSI area will have low potential for pollution. The restoration surface is to be formed from clean soils with no interaction between waste infill materials and surface water runoff. There will be very limited vehicle movements on the site once restoration is complete, again limiting the risks of a pollution incident.

5. Exceedance flow routes

In the event of rainfall beyond the design storm, exceedance flows could be generated on the site in the form of additional surface water runoff from the restoration surface.

The drainage system on the site has been modelled for storms up to the 1:100 year (1% annual exceedance probability) plus 40% climate change allowance, and a conservative runoff rate from the restored surface has been used. No surface flooding is expected in all storms up to the 1:100 year plus climate change allowance.

In the event of exceedance flows beyond the design storms, the topography of the restored site will direct these exceedance flows across the site and via the swale corridors to the south west toward the attenuation basins, and the outflow to the Vigo Brook. The perimeter of the site on the eastern, western and majority of the southern boundary is significantly above the proposed swale bank levels, and exceedance flows would not be expected to escape the site along these boundaries.

Exceedance flows would escape from the site in the south-west corner to the Vigo Brook via the outfall, and along the southern boundary of the attenuation basins into the Swan Pool if water levels rose to sufficient height to overtop the bank between the site and the Swan Pool. On-site flooding in an exceedance event would be limited to the area around the attenuation basins.

The public right of way (PROW) crossing the site from the southern boundary, across between the two basins and up the north- western side of the site is located outside the restoration filling area and outside the proposed surface water drainage channels. Water from the restoration surface does not flow across the PROW to reach the drainage channels. Where the PROW runs along the north-western side of the site, it is on existing ground and the risks of exceedance flows crossing the PROW are as they are in the existing conditions.

The exceedance flow routes have been marked onto the proposed restoration surface and this plan is included in the appendices to this addendum.

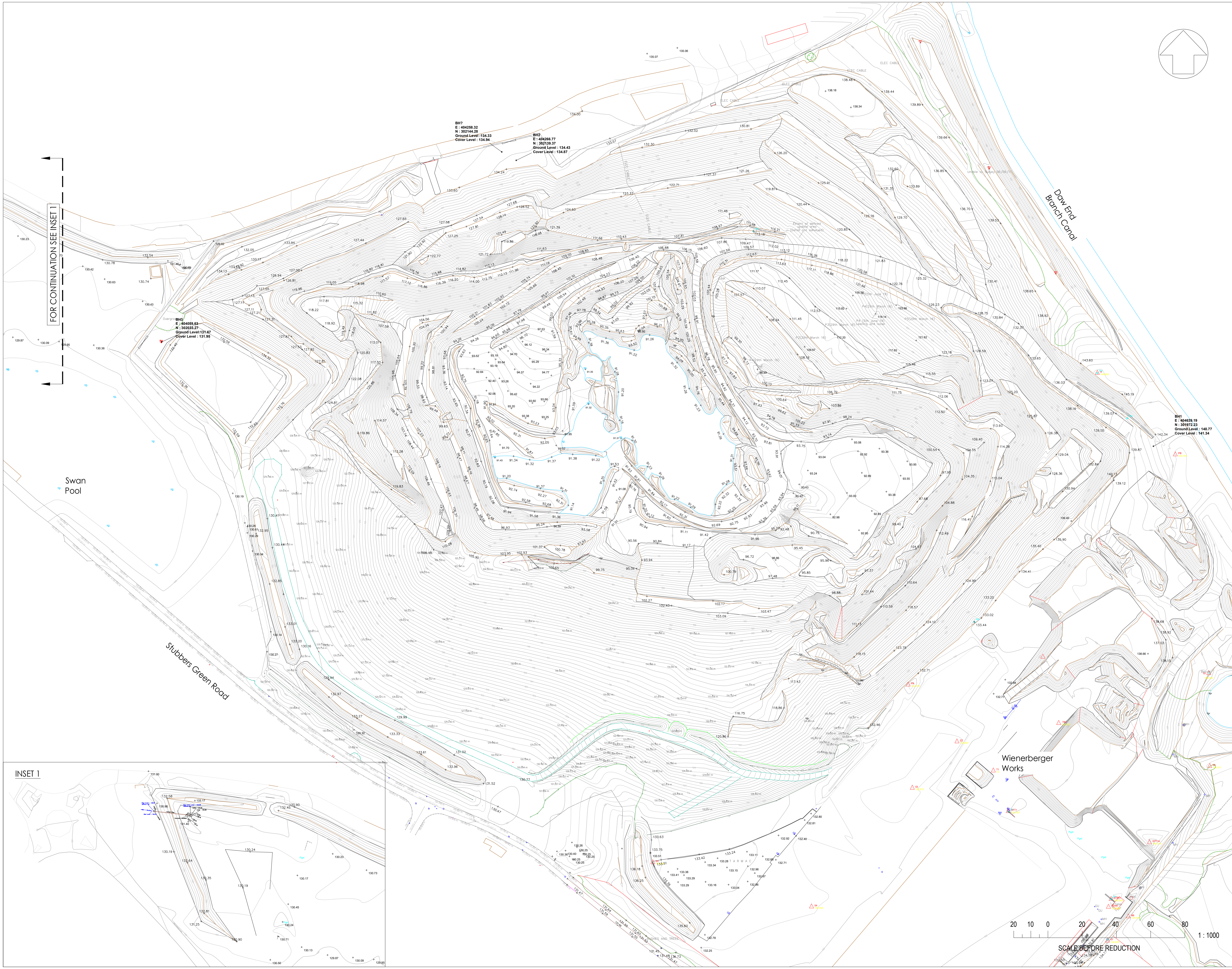
Appendices

The following appendices are included

Addendum Appendix 1:	Updated Topographical survey
Addendum Appendix 2:	Updated General arrangement & details sheet 1.
Addendum Appendix 3:	Exceedance Flow Routes drawing
Addendum Appendix 4:	Management and Maintenance Plan
Addendum Appendix 5:	Updated hydraulic modelling calculations

Addendum Appendix 1: Updated Topographical survey

07200 - 010 - Existing topographical survey Rev 01



DO NOT SCALE THIS DRAWING.

All dimensions and levels to be checked on site and any discrepancies reported to the Engineers.

HEALTH AND SAFETY INFORMATION

IN ADDITION TO THE HAZARDS/RISKS NORMALLY ASSOCIATED WITH THE TYPES OF WORK DETAILED ON THIS DRAWING, NOTE THE FOLLOWING

CONSTRUCTION.

MAINTENANCE/CLEANING/OPERATION.

DECOMMISSIONING/DEMOLITION.

NOTES.

1. Booth Ventures topographic survey updated with detailed of site outfall added August 2023

Rev	Description	Date	Dm	Ch'd
01	Updated Topographical survey	21.08.23	JC	TG
00	FIRST ISSUE	08.08.22	JC	TG

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Client	Byrne Looby
Project	Sandown Quarry Restoration WS9 8BL
Drawing title	Existing Topographical Survey
Scales @A1	1:1000
Date	August 2022

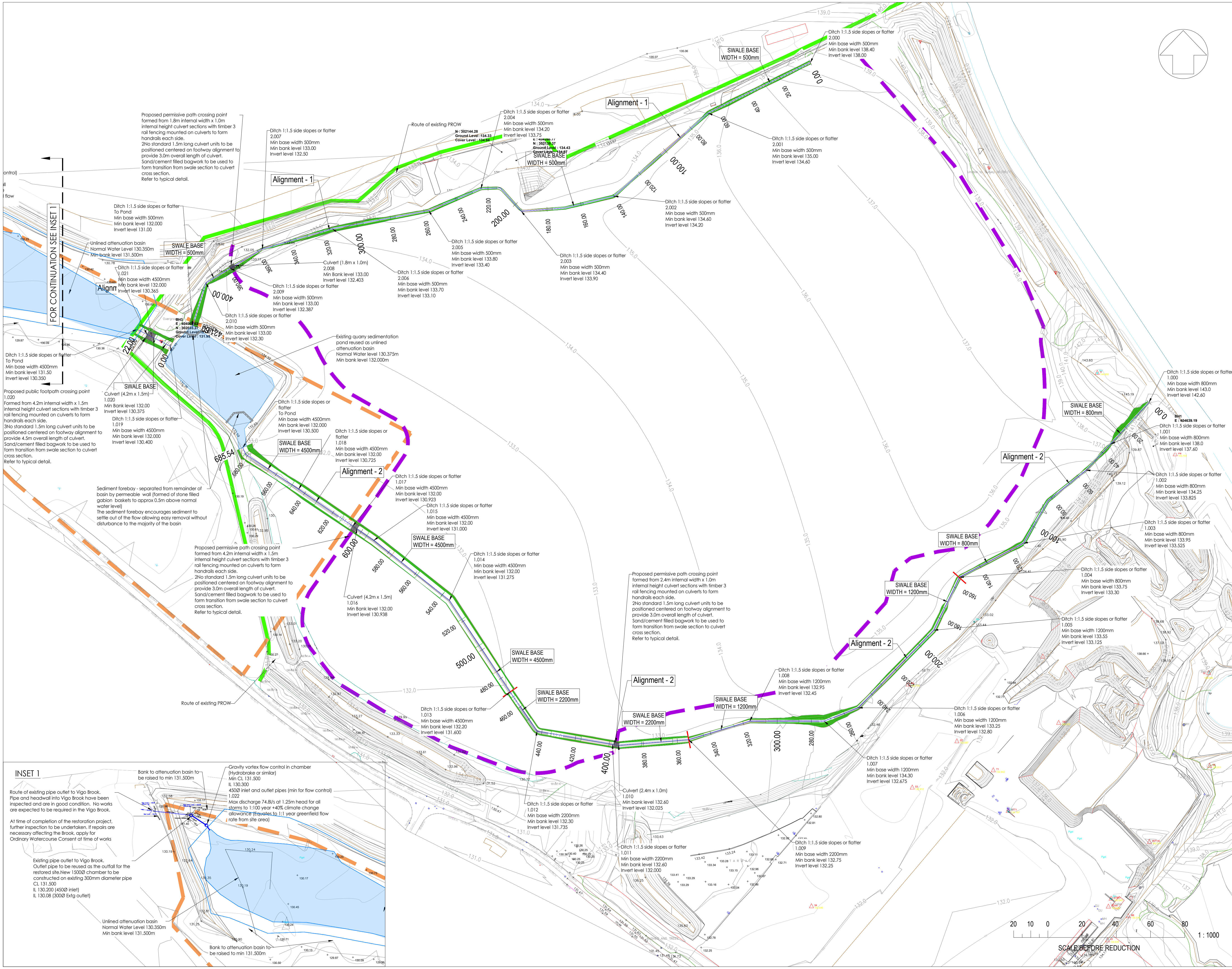
Status: Information

Drg No.: 07200 - 010 | Rev.: 01

Addendum Appendix 2: Updated General arrangement & details sheet 1

07200 - 100 - general arrangement - Rev 05

07200 - 301 - Typical drainage details - Sht 1- Rev 02



DO NOT SCALE THIS DRAWING.

All dimensions and levels to be checked on site and any discrepancies reported to the Engineers.

HEALTH AND SAFETY INFORMATION

IN ADDITION TO THE HAZARDS/RISKS NORMALLY ASSOCIATED WITH THE TYPES OF WORK DETAILED ON THIS DRAWING, NOTE THE FOLLOWING

CONSTRUCTION.

- Site for drainage works will be a capped landfill site. Potential for contamination exists
- Existing unknown services may exist
- Works to pond and outfall in proximity to open water
- Part of site is within and abuts SSSI. Particular care required for any works that may affect SSSI

MAINTENANCE/CLEANING/OPERATION.

- Part of site is within and abuts SSSI. Particular care required for any maintenance works including vegetation clearance that may affect SSSI. Specialist advice may be required
- Works to pond and outfall in proximity to open water

DECOMMISSIONING/DEMOLITION.

NOTES.

1. FOR SWALE CROSS SECTIONS REFER TO DRAWINGS:
   - 07200-121 CROSS SECTIONS SH.1
   - 07200-122 CROSS SECTIONS SH.2
   - 07200-123 CROSS SECTIONS SH.3
2. FOR DETAILS OF EXISTING PROW AND PROPOSED PERMISSIVE PATHS, REFER TO AXIS LANDSCAPE DRAWINGS

EXTG PUBLIC RIGHT OF WAY (PROW)

PROPOSED PERMISSIVE PATH ON SITE

APPROX. BOUNDARY OF SSS1

PROPOSED SWALE MAJOR CONTOUR SET @ 1m

PROPOSED SWALE MINOR CONTOUR SET @ 0.2m

Rev	Description	Date	Drn	Ch'd
05	OUTFALL SURVEY ADDED & OUTFALL DETAIL UPDATED. MINOR DRAINAGE UPDATES	24.08.23	JC	TG
04	PATHS AND SSSI SHOWN, PATH CROSSINGS AND OUTFALL NOTES ADDED	26.07.23	JC	TG
03	INFORMATION ISSUE	05.08.22	JC	TG
02	MINOR UPDATES TO TEXT	04.08.22	JC	TG
01	MD REFERENCES ADDED	01.08.22	JC	TG
00	DRAFT ISSUE	26.07.22	JC	TG

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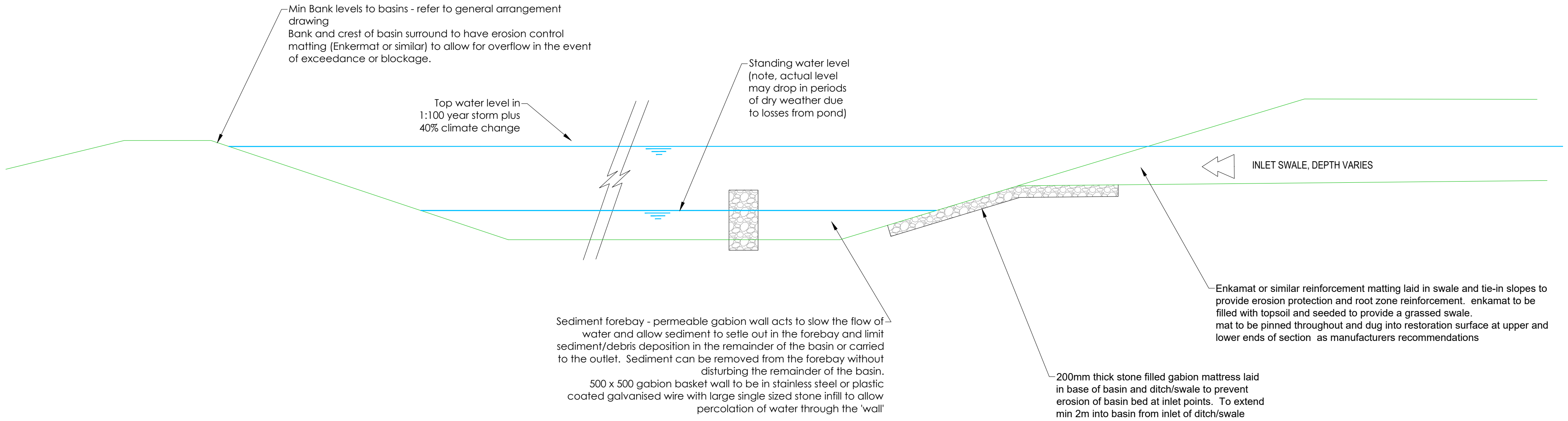
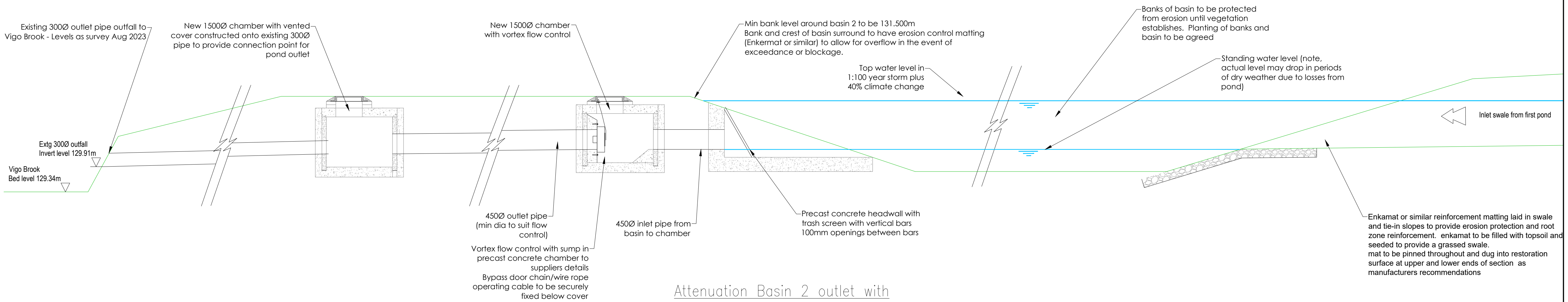
Client	Byrne Looby
Project	Sandown Quarry Restoration WS9 8BL
Drawing title	General Arrangement
Scales @A1	1:1000
Date	July 2022

Status: Information

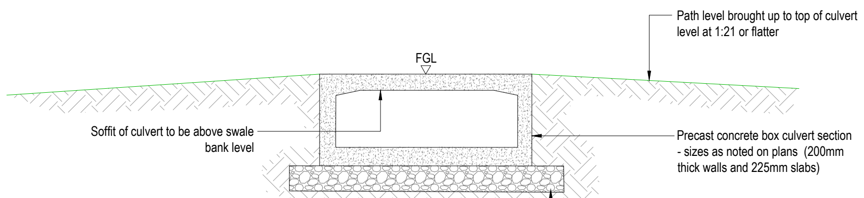
Drg No.: 07200 - 100 | Rev.: 05



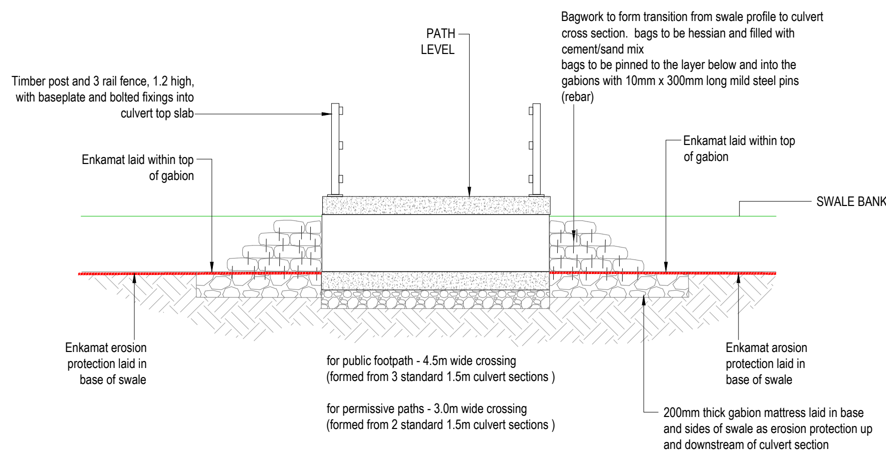
Typical Attenuation Pond with Sediment forebay
Scale NTS



Attenuation Basin 2 outlet with Vortex Flow Control
Scale NTS



CROSS SECTION THROUGH CULVERT



SECTION ALONG CENTRELINE OF SWALE

Typical Culvert Detail for Footpath Crossing of Swale
Scale NTS

DO NOT SCALE THIS DRAWING.

All dimensions and levels to be checked on site and any discrepancies reported to the Engineers.

HEALTH AND SAFETY INFORMATION

IN ADDITION TO THE HAZARDS/RISKS NORMALLY ASSOCIATED WITH THE TYPES OF WORK DETAILED ON THIS DRAWING, NOTE THE FOLLOWING

CONSTRUCTION.

MAINTENANCE/CLEANING/OPERATION.

DECOMMISSIONING/DEMOLITION.

NOTES.

- FOR DETAILS OF THE PROPOSED RESTORATION SURFACE, REFER TO BYRNE LOOBY DRAWINGS
- FOR PROPOSED SURFACE WATER DRAINAGE PLAN AND SECTIONS, REFER TO DRAWINGS 07200/100 TO 123

Rev	Description	Date	Drn	Ch'd
02	SURVEYED OUTFALL LEVELS ADDED DETAIL UPDATED TO MATCH GA	25.08.23		TG
01	CULVERT DETAIL ADDED, OUTFALL DETAIL CLARIFIED	26.07.23		TG
00	ISSUED FOR INFORMATION	04.08.22	JC	TG

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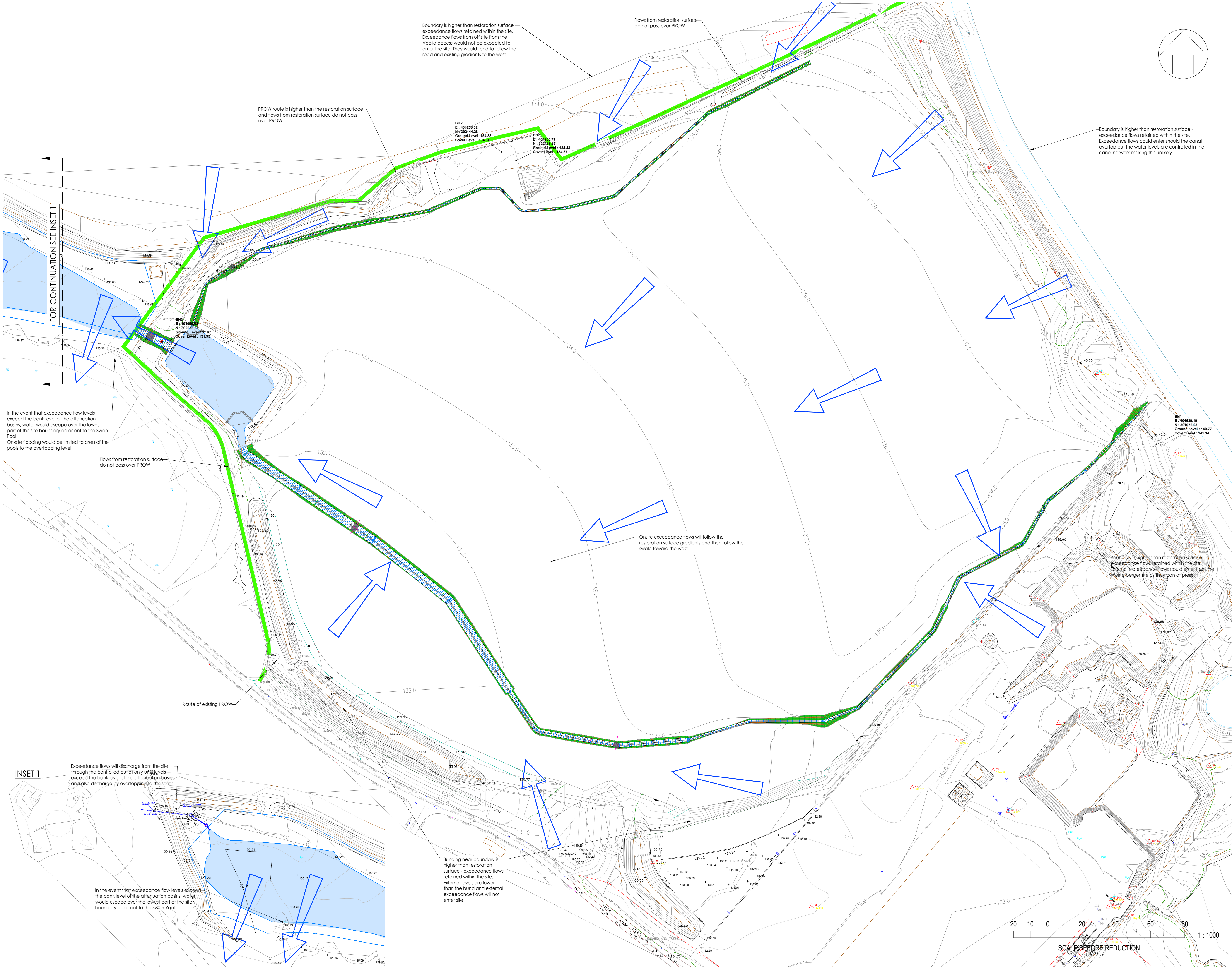
Client	Byrne Looby
Project	Sandown Quarry Restoration WS9 8BL
Drawing title	Surface Water Drainage Typical Details Sheet 1
Scales @A1	1:1000
Date	Aug 2022

Status: Information

Drg No.: 07200 - 301 Rev.: 02

Addendum Appendix 3: Exceedance Flow Routes drawing

07200 - 101 - Exceedance flow routes - Rev 01



DO NOT SCALE THIS DRAWING.

All dimensions and levels to be checked on site and any discrepancies reported to the Engineers.

HEALTH AND SAFETY INFORMATION

IN ADDITION TO THE HAZARDS/RISKS NORMALLY ASSOCIATED WITH THE TYPES OF WORK DETAILED ON THIS DRAWING, NOTE THE FOLLOWING

CONSTRUCTION.
- Site for drainage works will be a capped landfill site. Potential for contamination exists
- Existing unknown services may exist
- Works to pond and outfall in proximity to open water
- Part of site is within and abuts SSSI. Particular care required for any works that may affect SSSI

MAINTENANCE/CLEANING/OPERATION.
- Part of site is within and abuts SSSI. Particular care required for any maintenance works including vegetation clearance that may affect SSSI. Specialist advice may be required
- Works to pond and outfall in proximity to open water

DECOMMISSIONING/DEMOLITION.

NOTES.

1. FOR SWALE GENERAL ARRANGEMENT REFER TO DRAWIING 07200-100
2. FOR SWALE CROSS SECTIONS REFER TO DRAWINGS:
   - 07200-121 CROSS SECTIONS SH.1
   - 07200-122 CROSS SECTIONS SH.2
   - 07200-123 CROSS SECTIONS SH.3

KEY:

Exceedance flow routes

EXTG PUBLIC RIGHT OF WAY (PROW)

Rev	Description	Date	Drn	Ch'd
01	OUTFALL SURVEY ADDED & OUTFALL DETAIL UPDATED. MINOR DRAINAGE UPDATES	24.08.23	JC	TG TG
00	REPORT ADDENDUM ISSUE	28.07.23	JC	TG

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Client	Byrne Looby
Project	Sandown Quarry Restoration WS9 8BL
Drawing title	Exceedance Flow Routes
Scales @A1	1:1000
Date	July 2023

Status: Information

Drg No.: 07200 - 101 Rev.:01

Addendum Appendix 4: Management and Maintenance Plan

07200/DN01 Rev 00

ENGINEERING CONSULTANCY

Design Note Ref: 07200/DN01

Project: Sandown Quarry Landfill Restoration
Stubbers Green Road, Aldridge, Walsall

Title: SUDS management and maintenance plan

Date: July 2023 Rev: 00

1. Introduction

This maintenance plan is designed to give the site management company information on the recommended maintenance of the surface water SUDS drainage elements on the final restoration surface to ensure that the systems remain functioning efficiently for the life of the restoration.

This plan does not cover management and maintenance during the operational life of the site, filling or restoration works. Those elements are covered by the operational plans.

2. Description of the proposed drainage scheme

The proposed surface water drainage scheme is based around collection of surface water runoff from the final vegetated restoration surface using swales, attenuation in basins and discharge at a controlled rate via a gravity flow to the Vigo Brook in the west of the site.

There is a Site of Special Scientific Interest (SSSI) close to the restoration site. The SSSI covers the Swan Pool to the south of the site and part of The Swag, a further waterbody to the south of Stubbers Green Road. The citation for the SSSI notes that it is for the protection of reed bed areas that provide an important roost for migratory birds (Swallows and Sand Martins). The SSSI designation extends into the restoration site boundary in the area of the existing pond, but it understood that the reuse of this pond and the creation of new pond areas is not in conflict with the aims of the SSSI. The management and maintenance plan is to take account of the requirements of the SSSI.

3. Maintenance

Maintenance responsibility

The site owner, Wienerberger Ltd, will be responsible for the management and maintenance of the restored site.

No adoption is proposed for any element on site.

Maintenance Plan

To be read in conjunction with recommendations of Ciria C753 The SUDS Manual, Environment Agency guidance, manufacturers requirements and advice in relation to the SSSI area.

Drainage Element	Inspection requirements	Frequency of inspection	Maintenance requirements	Frequency of maintenance	Comments
Ditches/Swales	Erosion and damage to erosion protection matting, sediment build up, vegetation establishment and growth.	Monthly for 3 months after installation, then every 3 months or after larger storms for 1 year, then annually and after significant storms	If erosion or damage to erosion protection matting is noted, areas to be repaired to prevent further erosion. Significant sediment buildup in ditches/swales to be carefully removed to avoid damage to vegetation layer and disposed of appropriately. If areas of poor vegetation establishment are noted, additional seeding or laying of seed impregnated matting is to be undertaken.	As required following inspections	Responsibility of the site owner Note, lower section of swale system is within the SSSI area. Maintenance operations to be times to minimise disruption to the SSSI

Drainage Element	Inspection requirements	Frequency of inspection	Maintenance requirements	Frequency of maintenance	Comments
Ditches/swales(cont)	Cutting of vegetation in swales/ditches, removal of trees or shrub growth in swales/ditches	Annually	Where vegetation is posing a risk to the capacity of the swale, particularly if scrub plants establish that could form a blockage, they should be cut and cleared.	Annually or as required.	Note, lower section of swale system is within the SSSI area. Maintenance operations to be times to minimise disruption to the SSSI

Drainage Element	Inspection requirements	Frequency of inspection	Maintenance requirements	Frequency of maintenance	Comments
Attenuation basins	Inspect inlets, and outlets for blockages. Inspect trash screen for blockage or damage	Monthly for 3 months, then annually and after significant storms	Clear as necessary	As required	Responsibility of site owner **WITHIN SSSI area** – All maintenance operations to be undertaken with care and in coordination with the requirements of the SSSI
	Sediment build up, vegetation establishment and growth.	Monthly for 3 months after installation, then annually	Remove sediment from sediment forebays when sediment builds up to more than 25 to 50mm depth either manually or using long reach excavator.	As required	**Note**, timing of any work within SSSI area to be coordinated to minimise disruption to roosting migratory birds.
			Periodic cutting of reed and other vegetation in the sediment basins to maintain flow routes for water through the basins.	As required	Only part of the reed area is to be cut each year to maintain habitat – Exact timings and extent to be agreed with Natural England and others.

Drainage Element	Inspection requirements	Frequency of inspection	Maintenance requirements	Frequency of maintenance	Comments
Chambers and piped networks	Inspect chambers for integrity, detritus and silt accumulation	Monthly for 3 months then annually or as required	Empty collected silts from chambers Remove debris and clear for good operation	Annually, adjust to more or less frequently as needed depending on silt build up.	Responsibility of the site owner.
	Inspect pipe network by CCTV inspection for blockages or structural issues	As required when performanc e is reduced or damage suspected	Jet or rod pipes when performance is affected	As needed	
Vortex flow control	Inspect flow control chamber for integrity, silt and detritus accumulation	Monthly for 3 months then 6 monthly or annually as required	Debris should be cleared and sediment removed either manually from the surface or using a 'gully sucker' lorry	Immediately if there is any evidence of blockage, especially following heavy rain. Otherwise, annually, adjust to more or less frequently as needed depending on silt build up.	Do **not** enter below ground chambers without the correct safety equipment and procedures
	Check operation of bypass door in the flow control	6 monthly or annually	If the bypass door has become jammed or stiff, it should be freed off and lubricated in accordance with the manufacturers literature	As required	

Design Note 07200/DN01 SUDS Management & Maintenance Plan

Revision	Description	Issued by	Issue Date
00	First issue	TJG	28.07.2023

Addendum Appendix 5: Updated hydraulic modelling calculations

Updated hydraulic model input and output – Rev 01

Updated hydraulic modelling key plan – Rev 01

STORM SEWER DESIGN by the Modified Rational Method

Network Design Table for Storm

« - Indicates pipe capacity < flow

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	n	HYD SECT	DIA (mm)	Section Type	Auto Design
1.000	33.000	5.000	6.6	0.112	10.00	0.0		0.045	1.5 _/	800	1:1.5 Ditch	
1.001	21.000	3.775	5.6	0.077	0.00	0.0		0.045	1.5 _/	800	1:1.5 Ditch	
1.002	56.000	0.300	186.7	0.462	0.00	0.0		0.045	1.5 _/	800	1:1.5 Ditch	
1.003	42.000	0.225	186.7	0.212	0.00	0.0		0.045	1.5 _/	800	1:1.5 Ditch	
1.004	35.000	0.175	200.0	0.183	0.00	0.0		0.045	1.5 _/	800	1:1.5 Ditch	
1.005	63.000	0.325	193.8	0.301	0.00	0.0		0.045	1.5 _/	1200	1:1.5 Ditch	
1.006	22.000	0.125	176.0	0.083	0.00	0.0		0.045	1.5 _/	1200	1:1.5 Ditch	
1.007	43.000	0.225	191.1	0.509	0.00	0.0		0.045	1.5 _/	1200	1:1.5 Ditch	
1.008	38.000	0.200	190.0	0.475	0.00	0.0		0.045	1.5 _/	1200	1:1.5 Ditch	
1.009	41.000	0.225	182.2	0.745	0.00	0.0		0.045	1.5 _/	2200	1:1.5 Ditch	
1.010	3.000	0.025	120.0	0.000	0.00	0.0	0.600		|_|	-1	Pipe/Conduit	
1.011	46.000	0.265	173.6	0.540	0.00	0.0		0.045	1.5 _/	2200	1:1.5 Ditch	
1.012	28.000	0.135	207.4	0.223	0.00	0.0		0.045	1.5 _/	2200	1:1.5 Ditch	
1.013	65.000	0.325	200.0	2.848	0.00	0.0		0.045	1.5 _/	4500	1:1.5 Ditch	
1.014	56.000	0.275	203.6	7.167	0.00	0.0		0.045	1.5 _/	4500	1:1.5 Ditch	
1.015	12.000	0.062	193.5	0.254	0.00	0.0		0.045	1.5 _/	4500	1:1.5 Ditch	
1.016	3.000	0.015	200.0	0.000	0.00	0.0	0.600		|_|	-2	Pipe/Conduit	
1.017	38.000	0.198	191.9	1.015	0.00	0.0		0.045	1.5 _/	4500	1:1.5 Ditch	
1.018	41.000	0.225	182.2	0.672	0.00	0.0		0.045	1.5 _/	4500	1:1.5 Ditch	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.000	50.00	10.19	142.600	0.112	0.0	0.0	0.0	2.95	1106.7	14.6
1.001	50.00	10.30	137.600	0.189	0.0	0.0	0.0	3.21	1205.5	24.6
1.002	50.00	11.98	133.825	0.651	0.0	0.0	0.0	0.55	208.1	84.6
1.003	50.00	13.24	133.525	0.863	0.0	0.0	0.0	0.55	208.1	112.2
1.004	50.00	14.33	133.300	1.046	0.0	0.0	0.0	0.54	201.0	136.0
1.005	50.00	16.15	133.125	1.347	0.0	0.0	0.0	0.58	285.3	175.1
1.006	50.00	16.75	132.800	1.430	0.0	0.0	0.0	0.60	299.4	185.9
1.007	50.00	17.99	132.675	1.939	0.0	0.0	0.0	0.58	287.3	252.1
1.008	49.16	19.08	132.450	2.414	0.0	0.0	0.0	0.58	288.1«	308.6
1.009	47.52	20.15	132.250	3.159	0.0	0.0	0.0	0.64	508.6	390.3
1.010	47.50	20.16	132.025	3.159	0.0	0.0	0.0	4.07	5864.5	390.3
1.011	45.85	21.33	132.000	3.699	0.0	0.0	0.0	0.66	521.1	440.9
1.012	44.82	22.11	131.735	3.922	0.0	0.0	0.0	0.60	476.7	457.0
1.013	42.78	23.77	131.600	6.770	0.0	0.0	0.0	0.65	965.2	753.0
1.014	41.18	25.22	131.275	13.937	0.0	0.0	0.0	0.64	956.6«	1492.1
1.015	40.86	25.52	131.000	14.191	0.0	0.0	0.0	0.66	981.2«	1507.6
1.016	40.85	25.54	130.938	14.191	0.0	0.0	0.0	4.34	18233.4	1507.6
1.017	39.88	26.49	130.923	15.206	0.0	0.0	0.0	0.66	985.4«	1576.8
1.018	38.92	27.49	130.725	15.878	0.0	0.0	0.0	0.68	1011.2«	1606.8

Section types -1, -2, -3 - Refer to notes on Conduit sections on page 3 of these calculations

STORM SEWER DESIGN by the Modified Rational Method

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	n	HYD SECT	DIA (mm)	Section Type	Auto Design
2.000	67.000	3.400	19.7	0.153	10.00	0.0		0.045	1.5 _/	500	1:1.5 Ditch	
2.001	73.000	0.400	182.5	0.245	0.00	0.0		0.045	1.5 _/	500	1:1.5 Ditch	
2.002	55.000	0.300	183.3	0.098	0.00	0.0		0.045	1.5 _/	500	1:1.5 Ditch	
2.003	28.000	0.150	186.7	0.067	0.00	0.0		0.045	1.5 _/	500	1:1.5 Ditch	
2.004	33.000	0.350	94.3	0.065	0.00	0.0		0.045	1.5 _/	500	1:1.5 Ditch	
2.005	57.000	0.300	190.0	0.069	0.00	0.0		0.045	1.5 _/	500	1:1.5 Ditch	
2.006	43.000	0.600	71.7	0.070	0.00	0.0		0.045	1.5 _/	500	1:1.5 Ditch	
2.007	19.000	0.097	195.9	0.049	0.00	0.0		0.045	1.5 _/	500	1:1.5 Ditch	
2.008	3.000	0.016	187.5	0.000	0.00	0.0	0.600		|_|	-3	Pipe/Conduit	
2.009	17.000	0.087	195.4	0.050	0.00	0.0		0.045	1.5 _/	500	1:1.5 Ditch	
2.010	26.000	1.300	20.0	0.083	0.00	0.0		0.045	1.5 _/	500	1:1.5 Ditch	
1.019	12.000	0.025	480.0	1.360	0.00	0.0		0.045	1.5 _/	4500	1:1.5 Ditch	
1.020	4.500	0.010	450.0	0.000	0.00	0.0	0.600		|_|	-2	Pipe/Conduit	
1.021	6.500	0.015	433.3	0.000	0.00	0.0		0.045	1.5 _/	4500	1:1.5 Ditch	
1.022	10.000	0.100	100.0	0.860	0.00	0.0	0.600		o	450	Pipe/Conduit	
1.023	21.300	0.170	125.3	0.000	0.00	0.0	0.600		o	300	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
2.000	50.00	10.70	138.000	0.153	0.0	0.0	0.0	1.60	455.1	19.9
2.001	50.00	13.02	134.600	0.398	0.0	0.0	0.0	0.52	149.6	51.7
2.002	50.00	14.77	134.200	0.496	0.0	0.0	0.0	0.52	149.2	64.5
2.003	50.00	15.67	133.900	0.563	0.0	0.0	0.0	0.52	147.9	73.2
2.004	50.00	16.42	133.750	0.628	0.0	0.0	0.0	0.73	208.1	81.6
2.005	50.00	18.27	133.400	0.697	0.0	0.0	0.0	0.51	146.6	90.6
2.006	49.09	19.12	133.100	0.767	0.0	0.0	0.0	0.84	238.7	97.9
2.007	48.12	19.75	132.500	0.816	0.0	0.0	0.0	0.51	144.4	102.1
2.008	48.09	19.77	132.403	0.816	0.0	0.0	0.0	3.05	3296.4	102.1
2.009	47.26	20.32	132.387	0.866	0.0	0.0	0.0	0.51	144.5	106.4
2.010	46.87	20.60	132.300	0.949	0.0	0.0	0.0	1.59	451.8	115.6
1.019	38.49	27.97	130.400	18.187	0.0	0.0	0.0	0.42	623.1«	1819.8
1.020	38.46	28.00	130.375	18.187	0.0	0.0	0.0	2.89	12137.4	1819.8
1.021	38.24	28.24	130.365	18.187	0.0	0.0	0.0	0.44	655.8«	1819.8
1.022	38.17	28.32	130.300	19.047	0.0	0.0	0.0	2.03	323.4«	1890.2
1.023	37.95	28.58	130.080	19.047	0.0	0.0	0.0	1.40	99.2«	1890.2

Section types -1, -2, -3 - Refer to notes on Conduit sections on page 3 of these calculations

Conduit Sections for Storm

NOTE: Diameters less than 66 refer to section numbers of hydraulic conduits. These conduits are marked by the symbols:- [] box culvert, \/ open channel, oo dual pipe, ooo triple pipe, O egg.

Section numbers < 0 are taken from user conduit table

Section Number	Conduit Type	Major Dimn. (mm)	Minor Dimn. (mm)	Side Slope (Deg)	Corner Splay (mm)	4*Hyd Radius (m)	XSect Area (m^2)
-1	|_|	2400	600	90.0		1.600	1.440
-2	|_|	4200	1000	90.0		2.710	4.200
-3	|_|	1800	600	90.0		1.440	1.080

Note: Culverts for crossing of footpath over the drainage channels are modelled as open topped U sections

Microdrainage cannot accept closed topped culvert sections where the top of the culvert is above ground level as we have in our case where the top of the culvert is set above bank level so as not to impede the flow in the channel. The use of an open topped section allows the actual bank levels to be used.

By inspection of the top water levels in the channels, the water levels are below the soffit of the culvert section, and the water has a free surface. Hydraulically, a culvert section with water level below the soffit performs as an open top section

Manhole Schedules for Storm

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	PN	Pipe Out Invert Level (m)	Diameter (mm)	PN	Pipes In Invert Level (m)	Diameter (mm)
1	143.000	0.400	Junction		1.000	142.600	800			
2	138.000	0.400	Junction		1.001	137.600	800	1.000	137.600	800
3	134.250	0.425	Junction		1.002	133.825	800	1.001	133.825	800
4	133.950	0.425	Junction		1.003	133.525	800	1.002	133.525	800
5	133.750	0.450	Junction		1.004	133.300	800	1.003	133.300	800
6	133.550	0.425	Junction		1.005	133.125	1200	1.004	133.125	800
7	133.250	0.450	Junction		1.006	132.800	1200	1.005	132.800	1200
8	134.300	1.625	Junction		1.007	132.675	1200	1.006	132.675	1200
9	132.950	0.500	Junction		1.008	132.450	1200	1.007	132.450	1200
10	132.750	0.500	Junction		1.009	132.250	2200	1.008	132.250	1200
11	132.600	0.575	Junction		1.010	132.025	-1	1.009	132.025	2200
12	132.600	0.600	Junction		1.011	132.000	2200	1.010	132.000	-1
13	132.300	0.565	Junction		1.012	131.735	2200	1.011	131.735	2200
14	132.200	0.600	Junction		1.013	131.600	4500	1.012	131.600	2200
15	132.000	0.725	Junction		1.014	131.275	4500	1.013	131.275	4500
16	132.000	1.000	Junction		1.015	131.000	4500	1.014	131.000	4500
17	132.000	1.062	Junction		1.016	130.938	-2	1.015	130.938	4500
18	132.000	1.077	Junction		1.017	130.923	4500	1.016	130.923	-2
17	132.000	1.275	Junction		1.018	130.725	4500	1.017	130.725	4500
18	138.400	0.400	Junction		2.000	138.000	500			
19	135.000	0.400	Junction		2.001	134.600	500	2.000	134.600	500
20	134.600	0.400	Junction		2.002	134.200	500	2.001	134.200	500
21	134.400	0.500	Junction		2.003	133.900	500	2.002	133.900	500
22	134.200	0.450	Junction		2.004	133.750	500	2.003	133.750	500
23	133.800	0.400	Junction		2.005	133.400	500	2.004	133.400	500
24	133.700	0.600	Junction		2.006	133.100	500	2.005	133.100	500
25	133.000	0.500	Junction		2.007	132.500	500	2.006	132.500	500
26	133.000	0.597	Junction		2.008	132.403	-3	2.007	132.403	500
27	133.000	0.613	Junction		2.009	132.387	500	2.008	132.387	-3
28	133.000	0.700	Junction		2.010	132.300	500	2.009	132.300	500
29	132.000	1.600	Junction		1.019	130.400	4500	1.018	130.500	4500
								2.010	131.000	500
30	132.000	1.625	Junction		1.020	130.375	-2	1.019	130.375	4500
31	132.000	1.635	Junction		1.021	130.365	4500	1.020	130.365	-2
MH Flow Cont	131.500	1.200	Open Manhole	1500	1.022	130.300	450	1.021	130.350	4500
MH on Extg pipe	131.600	1.520	Open Manhole	1500	1.023	130.080	300	1.022	130.200	450
	131.000	1.090	Open Manhole	0		OUTFALL		1.023	129.910	300

Manhole Schedules for Storm

No coordinates have been specified, layout information cannot be produced.

PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.000	1.5 _/	800	1	143.000	142.600	0.100	Junction	
1.001	1.5 _/	800	2	138.000	137.600	0.100	Junction	
1.002	1.5 _/	800	3	134.250	133.825	0.125	Junction	
1.003	1.5 _/	800	4	133.950	133.525	0.125	Junction	
1.004	1.5 _/	800	5	133.750	133.300	0.150	Junction	
1.005	1.5 _/	1200	6	133.550	133.125	0.125	Junction	
1.006	1.5 _/	1200	7	133.250	132.800	0.150	Junction	
1.007	1.5 _/	1200	8	134.300	132.675	1.325	Junction	
1.008	1.5 _/	1200	9	132.950	132.450	0.200	Junction	
1.009	1.5 _/	2200	10	132.750	132.250	0.200	Junction	
1.010	|_|	-1	11	132.600	132.025	-0.025	Junction	
1.011	1.5 _/	2200	12	132.600	132.000	0.300	Junction	
1.012	1.5 _/	2200	13	132.300	131.735	0.265	Junction	
1.013	1.5 _/	4500	14	132.200	131.600	0.300	Junction	
1.014	1.5 _/	4500	15	132.000	131.275	0.425	Junction	
1.015	1.5 _/	4500	16	132.000	131.000	0.700	Junction	
1.016	|_|	-2	17	132.000	130.938	0.062	Junction	
1.017	1.5 _/	4500	18	132.000	130.923	0.777	Junction	
1.018	1.5 _/	4500	17	132.000	130.725	0.975	Junction	
2.000	1.5 _/	500	18	138.400	138.000	0.100	Junction	

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.000	33.000	6.6	2	138.000	137.600	0.100	Junction	
1.001	21.000	5.6	3	134.250	133.825	0.125	Junction	
1.002	56.000	186.7	4	133.950	133.525	0.125	Junction	
1.003	42.000	186.7	5	133.750	133.300	0.150	Junction	
1.004	35.000	200.0	6	133.550	133.125	0.125	Junction	
1.005	63.000	193.8	7	133.250	132.800	0.150	Junction	
1.006	22.000	176.0	8	134.300	132.675	1.325	Junction	
1.007	43.000	191.1	9	132.950	132.450	0.200	Junction	
1.008	38.000	190.0	10	132.750	132.250	0.200	Junction	
1.009	41.000	182.2	11	132.600	132.025	0.275	Junction	
1.010	3.000	120.0	12	132.600	132.000	0.000	Junction	
1.011	46.000	173.6	13	132.300	131.735	0.265	Junction	
1.012	28.000	207.4	14	132.200	131.600	0.300	Junction	
1.013	65.000	200.0	15	132.000	131.275	0.425	Junction	
1.014	56.000	203.6	16	132.000	131.000	0.700	Junction	
1.015	12.000	193.5	17	132.000	130.938	0.762	Junction	
1.016	3.000	200.0	18	132.000	130.923	0.077	Junction	
1.017	38.000	191.9	17	132.000	130.725	0.975	Junction	
1.018	41.000	182.2	29	132.000	130.500	1.200	Junction	
2.000	67.000	19.7	19	135.000	134.600	0.100	Junction	

PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
2.001	1.5 _/	500	19	135.000	134.600	0.100	Junction	
2.002	1.5 _/	500	20	134.600	134.200	0.100	Junction	
2.003	1.5 _/	500	21	134.400	133.900	0.200	Junction	
2.004	1.5 _/	500	22	134.200	133.750	0.150	Junction	
2.005	1.5 _/	500	23	133.800	133.400	0.100	Junction	
2.006	1.5 _/	500	24	133.700	133.100	0.300	Junction	
2.007	1.5 _/	500	25	133.000	132.500	0.200	Junction	
2.008	|_|	-3	26	133.000	132.403	0.297	Junction	
2.009	1.5 _/	500	27	133.000	132.387	0.313	Junction	
2.010	1.5 _/	500	28	133.000	132.300	0.400	Junction	
1.019	1.5 _/	4500	29	132.000	130.400	1.300	Junction	
1.020	|_|	-2	30	132.000	130.375	0.125	Junction	
1.021	1.5 _/	4500	31	132.000	130.365	1.335	Junction	
1.022	o	450	MH Flow Cont	131.500	130.300	0.750	Open Manhole	1500
1.023	o	300	MH on Extg pipe	131.600	130.080	1.070	Open Manhole	1500

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
2.001	73.000	182.5	20	134.600	134.200	0.100	Junction	
2.002	55.000	183.3	21	134.400	133.900	0.200	Junction	
2.003	28.000	186.7	22	134.200	133.750	0.150	Junction	
2.004	33.000	94.3	23	133.800	133.400	0.100	Junction	
2.005	57.000	190.0	24	133.700	133.100	0.300	Junction	
2.006	43.000	71.7	25	133.000	132.500	0.200	Junction	
2.007	19.000	195.9	26	133.000	132.403	0.297	Junction	
2.008	3.000	187.5	27	133.000	132.387	0.313	Junction	
2.009	17.000	195.4	28	133.000	132.300	0.400	Junction	
2.010	26.000	20.0	29	132.000	131.000	0.700	Junction	
1.019	12.000	480.0	30	132.000	130.375	1.325	Junction	
1.020	4.500	450.0	31	132.000	130.365	0.135	Junction	
1.021	6.500	433.3	MH Flow Cont	131.500	130.350	0.850	Open Manhole	1500
1.022	10.000	100.0	MH on Extg pipe	131.600	130.200	0.950	Open Manhole	1500
1.023	21.300	125.3		131.000	129.910	0.640	Open Manhole	0

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
1.023		131.000	129.910	0.000	0	0

Online Controls for Storm

Hydro-Brake® Optimum Manhole: MH Flow Cont, DS/PN: 1.022, Volume (m³): 67.5

Unit Reference	MD-SHE-0346-7480-1250-7480
Design Head (m)	1.250
Design Flow (l/s)	74.8
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	346
Invert Level (m)	130.300
Minimum Outlet Pipe Diameter (mm)	375
Suggested Manhole Diameter (mm)	2100

Control Points	**Head (m)**	**Flow (l/s)**
Design Point (Calculated)	1.250	74.8
Flush-Flo™	0.531	74.5
Kick-Flo®	0.960	65.8
Mean Flow over Head Range	-	60.5

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	**Flow (l/s)**	**Depth (m)**	**Flow (l/s)**	**Depth (m)**	**Flow (l/s)**	**Depth (m)**	**Flow (l/s)**
0.100	10.1	1.200	73.3	3.000	114.4	7.000	173.1
0.200	35.0	1.400	79.0	3.500	123.3	7.500	179.0
0.300	64.0	1.600	84.3	4.000	131.6	8.000	184.8
0.400	73.3	1.800	89.3	4.500	139.4	8.500	190.4
0.500	74.5	2.000	93.9	5.000	146.8	9.000	195.8
0.600	74.3	2.200	98.4	5.500	153.8	9.500	201.0
0.800	71.6	2.400	102.6	6.000	160.5		
1.000	67.1	2.600	106.7	6.500	166.9		

Storage Structures for Storm

Tank or Pond Manhole: 29, DS/PN: 1.019

Invert Level (m) 130.400

Depth (m)	**Area (m²)**	**Depth (m)**	**Area (m²)**
0.000	1750.0	0.600	2000.0

Tank or Pond Manhole: MH Flow Cont, DS/PN: 1.022

Invert Level (m) 130.350

Depth (m)	**Area (m²)**	**Depth (m)**	**Area (m²)**
0.000	4960.0	1.150	8600.0

1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 0.000
Hot Start (mins) 0 MADD Factor * 10m³/ha Storage 2.000
Hot Start Level (mm) 0 Inlet Coeffiecient 0.800
Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (l/per/day) 0.000
Foul Sewage per hectare (l/s) 0.000

Number of Input Hydrographs 0 Number of Storage Structures 2
Number of Online Controls 1 Number of Time/Area Diagrams 0
Number of Offline Controls 0 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR Ratio R 0.400
Region England and Wales Cv (Summer) 0.690
M5-60 (mm) 19.000 Cv (Winter) 0.690

Refer to Runoff Coefficents from restored landfill surface calculation in SWMP

Margin for Flood Risk Warning (mm) 300.0
Analysis Timestep 2.5 Second Increment (Extended)
DTS Status ON
DVD Status ON
Inertia Status ON

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years) 1, 30, 100
Climate Change (%) 35, 35, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	1	30 Summer	1	+35%					142.621
1.001	2	15 Summer	1	+35%					137.629
1.002	3	15 Summer	1	+35%					134.004
1.003	4	15 Summer	1	+35%					133.722
1.004	5	15 Summer	1	+35%					133.513
1.005	6	30 Summer	1	+35%					133.316
1.006	7	30 Summer	1	+35%					132.986
1.007	8	30 Summer	1	+35%					132.889
1.008	9	30 Summer	1	+35%					132.690
1.009	10	30 Summer	1	+35%					132.452
1.010	11	30 Summer	1	+35%					132.222
1.011	12	30 Summer	1	+35%					132.217
1.012	13	30 Summer	1	+35%					131.966
1.013	14	30 Summer	1	+35%					131.816
1.014	15	30 Summer	1	+35%					131.625
1.015	16	30 Summer	1	+35%					131.342
1.016	17	30 Summer	1	+35%					131.280

1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	1	-0.379	0.000	0.01		11.5	OK	
1.001	2	-0.371	0.000	0.01		20.8	OK	
1.002	3	-0.246	0.000	0.18		74.8	FLOOD RISK*	
1.003	4	-0.228	0.000	0.23		92.3	FLOOD RISK*	
1.004	5	-0.237	0.000	0.24		105.5	FLOOD RISK*	
1.005	6	-0.234	0.000	0.23		123.8	FLOOD RISK*	
1.006	7	-0.264	0.000	0.20		127.4	FLOOD RISK*	
1.007	8	-1.411	0.000	0.02		162.3	OK	
1.008	9	-0.260	0.000	0.26		191.7	FLOOD RISK*	
1.009	10	-0.298	0.000	0.20		254.5	FLOOD RISK*	
1.010	11	-0.403	0.000	0.09		256.1	OK	
1.011	12	-0.383	0.000	0.17		295.6	OK	
1.012	13	-0.334	0.000	0.21		303.6	OK	
1.013	14	-0.384	0.000	0.17		539.2	OK	
1.014	15	-0.375	0.000	0.28		1215.2	OK	
1.015	16	-0.658	0.000	0.16		1224.3	OK	
1.016	17	-0.658	0.000	0.11		1225.6	OK	

1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow
1.017	18	30 Summer	1	+35%			
1.018	17	30 Summer	1	+35%			
2.000	18	30 Summer	1	+35%			
2.001	19	15 Summer	1	+35%			
2.002	20	30 Summer	1	+35%			
2.003	21	30 Summer	1	+35%			
2.004	22	30 Summer	1	+35%			
2.005	23	30 Summer	1	+35%			
2.006	24	30 Summer	1	+35%			
2.007	25	30 Summer	1	+35%			
2.008	26	30 Summer	1	+35%			
2.009	27	30 Summer	1	+35%			
2.010	28	30 Summer	1	+35%			
1.019	29	60 Summer	1	+35%			
1.020	30	720 Summer	1	+35%	100/240 Summer		
1.021	31	720 Summer	1	+35%			
1.022	MH Flow Cont	720 Summer	1	+35%	30/15 Summer		
1.023	MH on Extg pipe	720 Summer	1	+35%			

PN	US/MH Name	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)
1.017	18		131.276	-0.724	0.000	0.14		1291.2
1.018	17		131.076	-0.924	0.000	0.11		1320.1
2.000	18		138.046	-0.354	0.000	0.02		15.6
2.001	19		134.761	-0.239	0.000	0.15		40.9
2.002	20		134.370	-0.230	0.000	0.18		48.5
2.003	21		134.076	-0.324	0.000	0.12		52.9
2.004	22		133.902	-0.298	0.000	0.12		56.5
2.005	23		133.589	-0.211	0.000	0.22		58.7
2.006	24		133.246	-0.454	0.000	0.06		61.0
2.007	25		132.695	-0.305	0.000	0.15		62.5
2.008	26		132.587	-0.416	0.000	0.03		62.3
2.009	27		132.583	-0.417	0.000	0.10		63.6
2.010	28		132.405	-0.595	0.000	0.02		65.8
1.019	29		130.784	-1.216	0.000	0.10		954.7
1.020	30		130.747	-0.628	0.000	0.03		307.8
1.021	31		130.743	-1.257	0.000	0.02		307.0
1.022	MH Flow Cont		130.742	-0.008	0.000	0.41		73.8
1.023	MH on Extg pipe		130.292	-0.088	0.000	0.85		73.8

1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Status	Level Exceeded
1.017	18	OK	
1.018	17	OK	
2.000	18	OK	
2.001	19	FLOOD RISK*	
2.002	20	FLOOD RISK*	
2.003	21	OK	
2.004	22	FLOOD RISK*	
2.005	23	FLOOD RISK*	
2.006	24	OK	
2.007	25	OK	
2.008	26	OK	
2.009	27	OK	
2.010	28	OK	
1.019	29	OK	
1.020	30	OK	
1.021	31	OK	
1.022	MH Flow Cont	OK	
1.023	MH on Extg pipe	OK	

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 0.000
Hot Start (mins) 0 MADD Factor * 10m³/ha Storage 2.000
Hot Start Level (mm) 0 Inlet Coeffiecient 0.800
Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (l/per/day) 0.000
Foul Sewage per hectare (l/s) 0.000

Number of Input Hydrographs 0 Number of Storage Structures 2
Number of Online Controls 1 Number of Time/Area Diagrams 0
Number of Offline Controls 0 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR Ratio R 0.400
Region England and Wales Cv (Summer) 0.690
M5-60 (mm) 19.000 Cv (Winter) 0.690

Refer to Runoff Coefficents from restored landfill surface calculation in SWMP

Margin for Flood Risk Warning (mm) 300.0
Analysis Timestep 2.5 Second Increment (Extended)
DTS Status ON
DVD Status ON
Inertia Status ON

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years) 1, 30, 100
Climate Change (%) 35, 35, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	1	30 Summer	30	+35%					142.637
1.001	2	15 Summer	30	+35%					137.654
1.002	3	15 Summer	30	+35%					134.161
1.003	4	15 Summer	30	+35%					133.885
1.004	5	15 Summer	30	+35%					133.675
1.005	6	30 Summer	30	+35%					133.457
1.006	7	30 Summer	30	+35%					133.120
1.007	8	30 Summer	30	+35%					133.046
1.008	9	30 Summer	30	+35%					132.854
1.009	10	30 Summer	30	+35%					132.601
1.010	11	30 Summer	30	+35%					132.383
1.011	12	30 Summer	30	+35%					132.376
1.012	13	30 Summer	30	+35%					132.133
1.013	14	30 Summer	30	+35%					131.994
1.014	15	30 Summer	30	+35%					131.878
1.015	16	30 Summer	30	+35%					131.592
1.016	17	30 Summer	30	+35%					131.542

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	1	-0.363	0.000	0.01		28.2	OK	
1.001	2	-0.346	0.000	0.03		58.6	OK	
1.002	3	-0.089	0.000	0.57		232.6	FLOOD RISK*	
1.003	4	-0.065	0.000	0.68		274.7	FLOOD RISK*	
1.004	5	-0.075	0.000	0.68		298.5	FLOOD RISK*	
1.005	6	-0.093	0.000	0.61		328.6	FLOOD RISK*	
1.006	7	-0.130	0.000	0.53		334.7	FLOOD RISK*	
1.007	8	-1.254	0.000	0.05		427.9	OK	
1.008	9	-0.096	0.000	0.66		490.1	FLOOD RISK*	
1.009	10	-0.149	0.000	0.53		656.6	FLOOD RISK*	
1.010	11	-0.242	0.000	0.23		660.2	FLOOD RISK*	
1.011	12	-0.224	0.000	0.43		759.3	FLOOD RISK*	
1.012	13	-0.167	0.000	0.53		774.6	FLOOD RISK*	
1.013	14	-0.206	0.000	0.43		1357.1	FLOOD RISK*	
1.014	15	-0.122	0.000	0.72		3098.7	FLOOD RISK*	
1.015	16	-0.408	0.000	0.40		3115.0	OK	
1.016	17	-0.396	0.000	0.28		3122.4	OK	

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow
1.017	18	30 Summer	30	+35%			
1.018	17	30 Summer	30	+35%			
2.000	18	30 Summer	30	+35%			
2.001	19	15 Summer	30	+35%			
2.002	20	15 Summer	30	+35%			
2.003	21	15 Summer	30	+35%			
2.004	22	30 Summer	30	+35%			
2.005	23	30 Summer	30	+35%			
2.006	24	30 Summer	30	+35%			
2.007	25	30 Summer	30	+35%			
2.008	26	30 Summer	30	+35%			
2.009	27	30 Summer	30	+35%			
2.010	28	30 Summer	30	+35%			
1.019	29	720 Winter	30	+35%			
1.020	30	720 Winter	30	+35%	100/240 Summer		
1.021	31	720 Winter	30	+35%			
1.022	MH Flow Cont	720 Winter	30	+35%	30/15 Summer		
1.023	MH on Extg pipe	960 Winter	30	+35%			

PN	US/MH Name	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)
1.017	18		131.536	-0.464	0.000	0.37		3315.0
1.018	17		131.339	-0.661	0.000	0.27		3421.4
2.000	18		138.079	-0.321	0.000	0.05		38.4
2.001	19		134.889	-0.111	0.000	0.43		116.4
2.002	20		134.496	-0.104	0.000	0.50		133.1
2.003	21		134.192	-0.208	0.000	0.32		138.4
2.004	22		134.001	-0.199	0.000	0.30		145.0
2.005	23		133.706	-0.094	0.000	0.56		148.6
2.006	24		133.340	-0.360	0.000	0.15		153.1
2.007	25		132.812	-0.188	0.000	0.38		156.3
2.008	26		132.707	-0.296	0.000	0.08		155.7
2.009	27		132.701	-0.299	0.000	0.24		158.8
2.010	28		132.475	-0.525	0.000	0.06		163.5
1.019	29		131.252	-0.748	0.000	0.12		1110.8
1.020	30		131.252	-0.123	0.000	0.10		1043.7
1.021	31		131.220	-0.780	0.000	0.07		960.4
1.022	MH Flow Cont		131.217	0.467	0.000	0.42		74.4
1.023	MH on Extg pipe		130.294	-0.086	0.000	0.85		74.4

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Status	Level Exceeded
1.017	18	OK	
1.018	17	OK	
2.000	18	OK	
2.001	19	FLOOD RISK*	
2.002	20	FLOOD RISK*	
2.003	21	FLOOD RISK*	
2.004	22	FLOOD RISK*	
2.005	23	FLOOD RISK*	
2.006	24	OK	
2.007	25	FLOOD RISK*	
2.008	26	FLOOD RISK*	
2.009	27	FLOOD RISK*	
2.010	28	OK	
1.019	29	OK	
1.020	30	OK	
1.021	31	OK	
1.022	MH Flow Cont	FLOOD RISK	
1.023	MH on Extg pipe	OK	

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 0.000
Hot Start (mins) 0 MADD Factor * 10m³/ha Storage 2.000
Hot Start Level (mm) 0 Inlet Coeffiecient 0.800
Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (l/per/day) 0.000
Foul Sewage per hectare (l/s) 0.000

Number of Input Hydrographs 0 Number of Storage Structures 2
Number of Online Controls 1 Number of Time/Area Diagrams 0
Number of Offline Controls 0 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR Ratio R 0.400
Region England and Wales Cv (Summer) 0.690
M5-60 (mm) 19.000 Cv (Winter) 0.690

Refer to Runoff Coefficents from restored landfill surface calculation in SWMP

Margin for Flood Risk Warning (mm) 300.0
Analysis Timestep 2.5 Second Increment (Extended)
DTS Status ON
DVD Status ON
Inertia Status ON

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years) 1, 30, 100
Climate Change (%) 35, 35, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	1	30 Summer	100	+40%					142.644
1.001	2	15 Summer	100	+40%					137.664
1.002	3	15 Summer	100	+40%					134.216
1.003	4	15 Summer	100	+40%					133.946
1.004	5	15 Summer	100	+40%					133.741
1.005	6	30 Summer	100	+40%					133.521
1.006	7	30 Summer	100	+40%					133.185
1.007	8	30 Summer	100	+40%					133.116
1.008	9	30 Summer	100	+40%					132.925
1.009	10	30 Summer	100	+40%					132.669
1.010	11	30 Summer	100	+40%					132.484
1.011	12	30 Summer	100	+40%					132.443
1.012	13	30 Summer	100	+40%					132.205
1.013	14	30 Summer	100	+40%					132.115
1.014	15	30 Summer	100	+40%					131.999
1.015	16	30 Summer	100	+40%					131.708
1.016	17	30 Summer	100	+40%					131.668

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	1	-0.356	0.000	0.02		38.2	OK	
1.001	2	-0.336	0.000	0.04		78.7	OK	
1.002	3	-0.034	0.000	0.77		313.6	FLOOD RISK*	
1.003	4	-0.004	0.000	0.92		373.7	FLOOD RISK*	
1.004	5	-0.009	0.000	0.93		409.7	FLOOD RISK*	
1.005	6	-0.029	0.000	0.84		451.7	FLOOD RISK*	
1.006	7	-0.065	0.000	0.73		462.9	FLOOD RISK*	
1.007	8	-1.184	0.000	0.07		587.5	OK	
1.008	9	-0.025	0.000	0.90		668.1	FLOOD RISK*	
1.009	10	-0.081	0.000	0.72		897.9	FLOOD RISK*	
1.010	11	-0.141	0.000	0.30		869.5	FLOOD RISK*	
1.011	12	-0.157	0.000	0.57		1015.0	FLOOD RISK*	
1.012	13	-0.095	0.000	0.72		1045.3	FLOOD RISK*	
1.013	14	-0.085	0.000	0.60		1893.4	FLOOD RISK*	
1.014	15	-0.001	0.000	0.97		4222.7	FLOOD RISK*	
1.015	16	-0.292	0.000	0.54		4267.0	FLOOD RISK*	
1.016	17	-0.270	0.000	0.39		4258.7	OK	

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

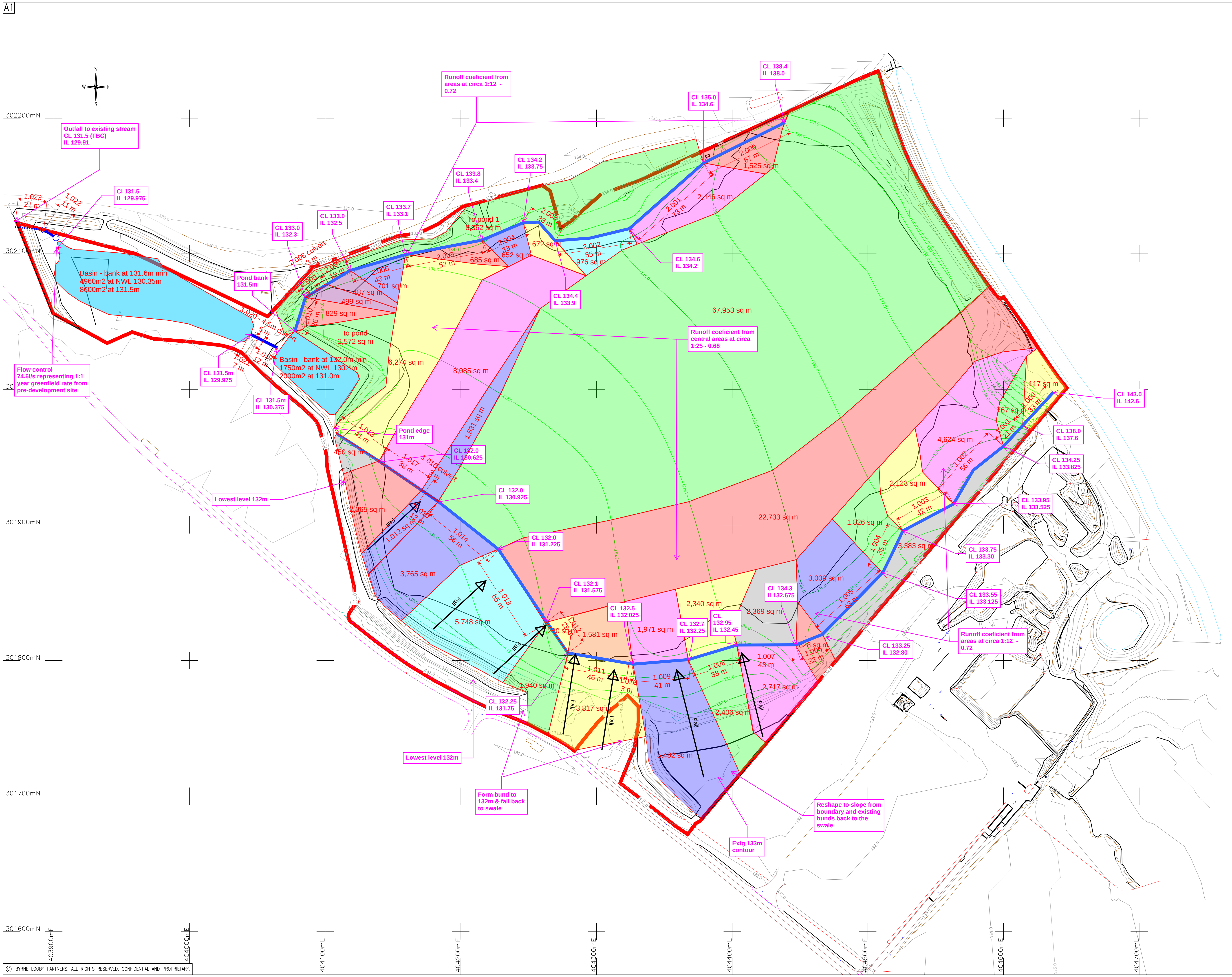
PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow
1.017	18	30 Summer	100	+40%			
1.018	17	720 Winter	100	+40%			
2.000	18	30 Summer	100	+40%			
2.001	19	15 Summer	100	+40%			
2.002	20	15 Summer	100	+40%			
2.003	21	15 Summer	100	+40%			
2.004	22	30 Summer	100	+40%			
2.005	23	30 Summer	100	+40%			
2.006	24	30 Summer	100	+40%			
2.007	25	30 Summer	100	+40%			
2.008	26	30 Summer	100	+40%			
2.009	27	30 Summer	100	+40%			
2.010	28	30 Summer	100	+40%			
1.019	29	720 Winter	100	+40%			
1.020	30	720 Winter	100	+40%	100/240 Summer		
1.021	31	960 Winter	100	+40%			
1.022	MH Flow Cont	720 Winter	100	+40%	30/15 Summer		
1.023	MH on Extg pipe	7200 Winter	100	+40%			

PN	US/MH Name	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)
1.017	18		131.659	-0.341	0.000	0.51		4546.1
1.018	17		131.525	-0.475	0.000	0.05		635.3
2.000	18		138.093	-0.307	0.000	0.06		52.0
2.001	19		134.935	-0.065	0.000	0.58		157.3
2.002	20		134.540	-0.060	0.000	0.67		179.3
2.003	21		134.237	-0.163	0.000	0.44		185.6
2.004	22		134.042	-0.158	0.000	0.41		196.5
2.005	23		133.755	-0.045	0.000	0.77		201.8
2.006	24		133.380	-0.320	0.000	0.20		208.6
2.007	25		132.863	-0.137	0.000	0.51		212.9
2.008	26		132.761	-0.242	0.000	0.10		212.1
2.009	27		132.753	-0.247	0.000	0.33		216.2
2.010	28		132.509	-0.491	0.000	0.08		222.9
1.019	29		131.487	-0.513	0.000	0.15		1381.9
1.020	30		131.490	0.115	0.000	0.12		1355.8
1.021	31		131.496	-0.504	0.000	0.08		1124.2
1.022	MH Flow Cont		131.476	0.726	0.000	0.42		74.4
1.023	MH on Extg pipe		130.294	-0.086	0.000	0.85		74.4

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Status	Level Exceeded
1.017	18	OK	
1.018	17	OK	
2.000	18	OK	
2.001	19	FLOOD RISK*	
2.002	20	FLOOD RISK*	
2.003	21	FLOOD RISK*	
2.004	22	FLOOD RISK*	
2.005	23	FLOOD RISK*	
2.006	24	OK	
2.007	25	FLOOD RISK*	
2.008	26	FLOOD RISK*	
2.009	27	FLOOD RISK*	
2.010	28	OK	
1.019	29	OK	
1.020	30	SURCHARGED*	
1.021	31	OK	
1.022	MH Flow Cont	FLOOD RISK	
1.023	MH on Extg pipe	OK	

A1



GENERAL NOTES

1. SURVEY INFORMATION SUPPLIED BY CLIENT
2. DO NOT SCALE
3. ALL DIMENSIONS ARE IN MILLIMETRES AND ALL LEVELS ARE IN METRES ABOVE ORDNANCE DATUM
4. ANY ANOMALIES ON THIS DRAWING ARE TO BE BROUGHT TO THE ATTENTION OF BYRNE LOOBY LTD

LEGEND

- OWNERSHIP BOUNDARY
- 130.0 / 129.0 EXISTING GROUND CONTOURS
- 150.0 / 149.0 PROPOSED RESTORATION CONTOURS

Rev	Date	Description	By	Chk	App
A	11/05	CLIENT ISSUE	GH	PS	JB
00	11/05	FOR REVIEW	GH	PS	JB

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CLIENT
BOOTH VENTURES

PROJECT
SANDOWN QUARRY LANDFILL

DRAWING TITLE
FINAL RESTORATION

STATUS
CLIENT ISSUE

Date: 09.05.22	Scale: 1:1250	Drawn: GH	Chk: PR	App: JB
Project No: 5430	Drg. No: 5430/1/007			Rev: A

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