Do not scale from this drawing.

SAFETY HEALTH AND ENVIRONMENTAL INFORMATION

IN ADDITION TO THE HAZARD/RISKS NORMALLY ASSOCIATED WITH THE TYPES OF WORK DETAILED ON THIS DRAWING, NOTE THE FOLLOWING RISKS AND INFORMATION.

RISKS LISTED HERE ARE NOT EXHAUSTIVE. REFER TO DESIGN ASSESSMENT FORM NO.

CONSTRUCTION
NO SIGNIFICANT RESIDUAL HAZARDS WERE IDENTIFIED THAT A COMPETENT CONTRACTOR WOULD NOT BE AWARE OF.

DEMOLITION
NOT APPLICABLE.

FOR INFORMATION RELATING TO USE, CLEANING AND MAINTENANCE SEE THE HEALTH AND SAFETY FILE

IT IS ASSUMED THAT ALL WORKS WILL BE CARRIED OUT BY A COMPETENT CONTRACTOR WORKING, WHERE APPROPRIATE, TO AN APPROVED METHOD STATEMENT.

1. ALL MAIN FOUL AND SURFACE WATER SEWERS, AND ALL ASSOCIATED MANHOLES TO BE ADOPTED BY SCOTTISH WATER. FOUL AND SURFACE WATER TAILS FROM EACH INDIVIDUAL PLOT ALSO TO BE ADOPTED BY SCOTTISH WATER.
2. ROAD DRAINS WITHIN ADOPTED ROADS TO BE ADOPTED BY ABERDEEN CITY COUNCIL.
3. DRAINAGE MEASURES WITHIN INDIVIDUAL CURTILAGES TO REMAIN PRIVATE AND BE THE RESPONSIBILITY OF THE INDIVIDUAL HOUSE OWNER/OCCUPIER. THIS INCLUDES FOUL AND SURFACE WATER DISCONNECTING CHAMBERS. PRIVATE ROAD DRAINS TO REMAIN PRIVATE AND BE MAINTAINED BY A FACTOR. THE CULVERTED ROUTING OF AN EXISTING WATERCOURSE TO REMAIN IN PRIVATE OWNERSHIP.

Rev.	Date	Description	Drawn	Checked	Approved

This is the plan / drawing / specification referred to in the application

Signed ....

Dated ....

For Fairhurst

Client:

BARRATT HOMES

Project Title:

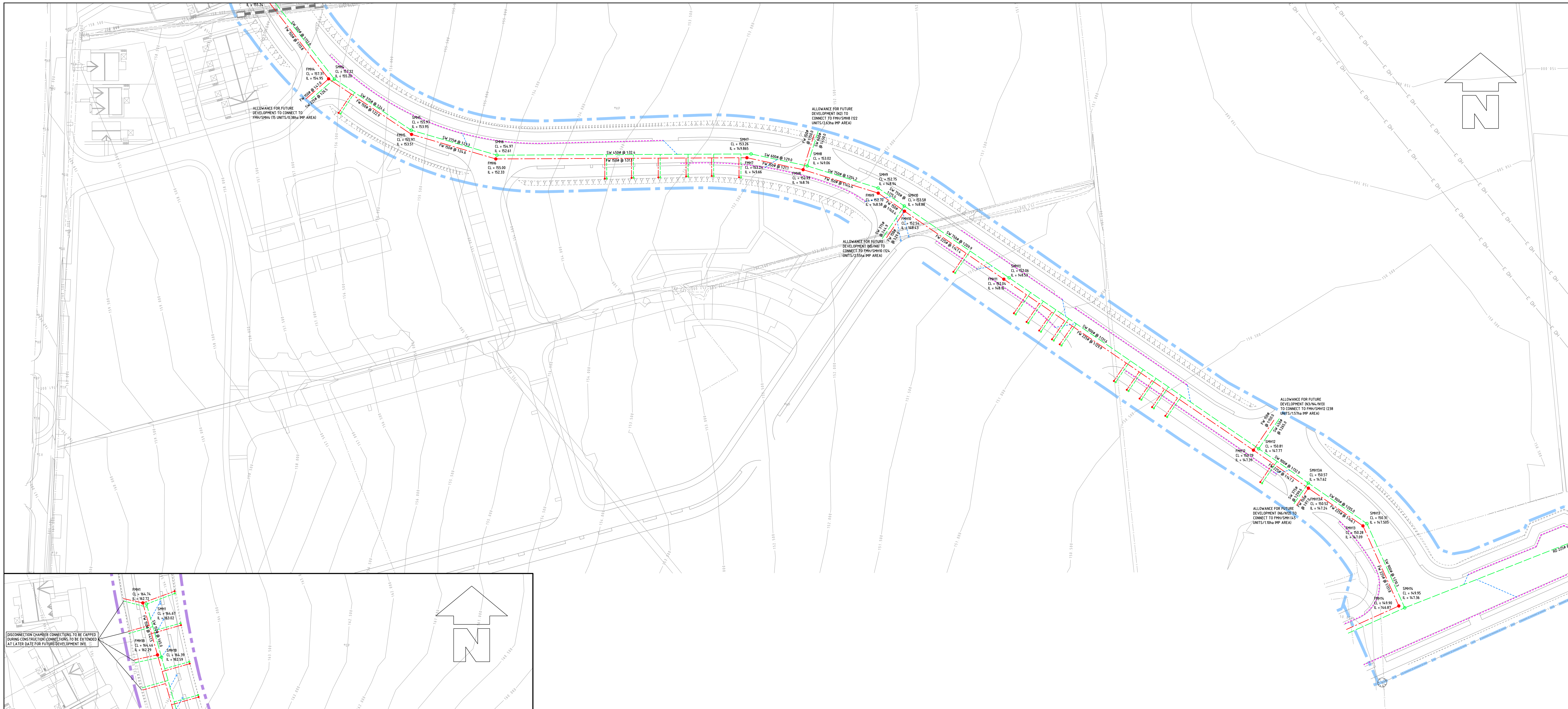
PROPOSED DEVELOPMENT AT AREA N2 COUNTESSWELLS

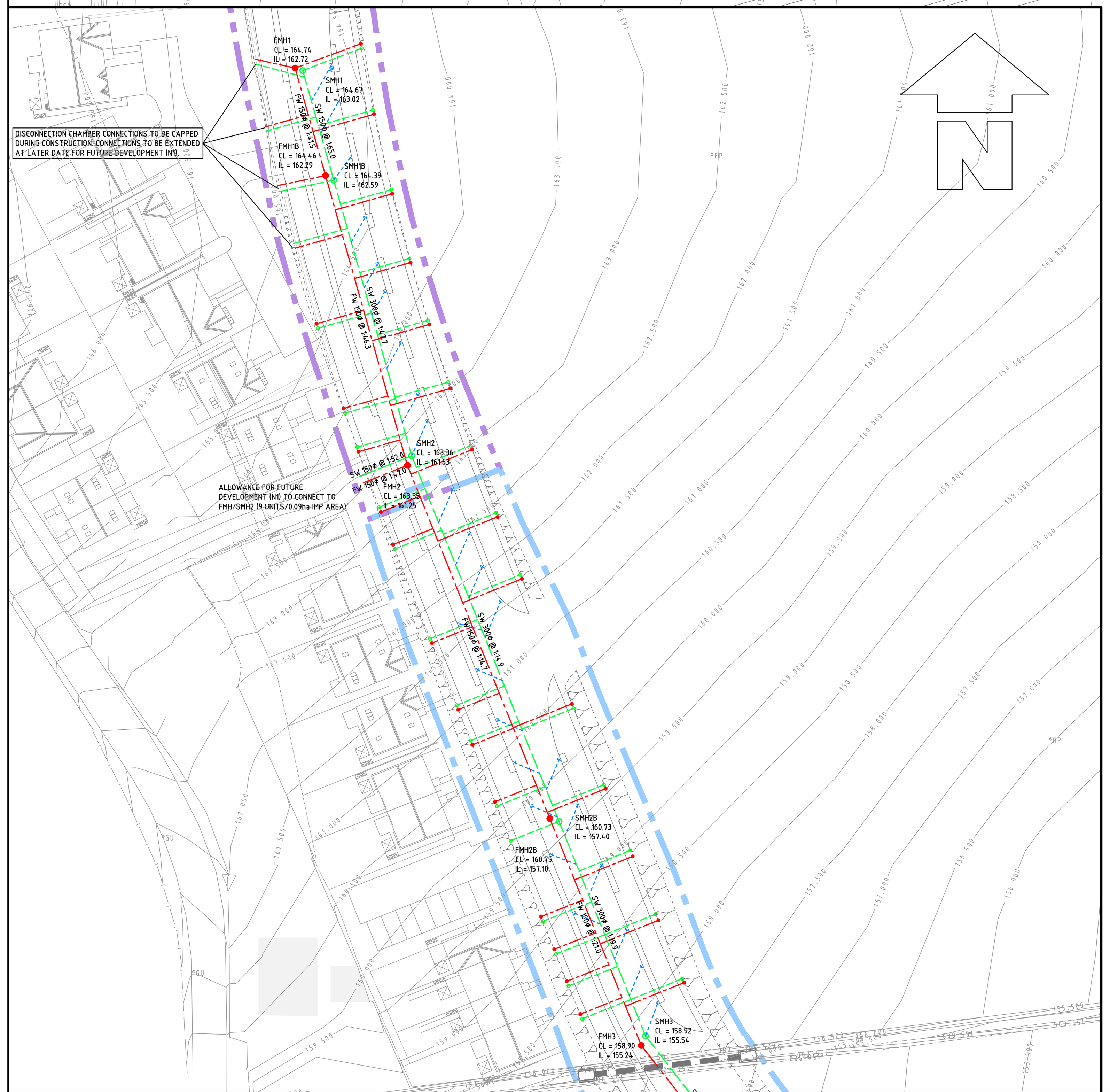
Drawing Title:

DRAINAGE STRATEGY ADOPTION PLAN

FAIRHURST
88 Queens Road,
ABERDEEN, AB15 4YQ
Tel: 01224 321 222 Fax: 01224 323 201

Scale at A0:	Status:	
1:500	For Information	
Drawn: CW	Checked: MC	Approved: DA
Date: 30/03/21	Date: 30/03/21	Date: 30/03/21
Drawing No.: 134783/2205		Revision: –





Do not scale from this drawing.

SAFETY HEALTH AND ENVIRONMENTAL INFORMATION

IN ADDITION TO THE HAZARD/RISKS NORMALLY ASSOCIATED WITH THE TYPES OF WORK DETAILED ON THIS DRAWING, NOTE THE FOLLOWING RISKS AND INFORMATION.

RISKS LISTED HERE ARE NOT EXHAUSTIVE. REFER TO DESIGN ASSESSMENT FORM NO.

CONSTRUCTION
EXISTING UTILITIES SERVICES – REFER TO UTILITIES RECORDS AND LOCATE SERVICES ON SITE.

DEMOLITION
NOT APPLICABLE

FOR INFORMATION RELATING TO USE, CLEANING AND MAINTENANCE SEE THE HEALTH AND SAFETY FILE

IT IS ASSUMED THAT ALL WORKS WILL BE CARRIED OUT BY A COMPETENT CONTRACTOR WORKING, WHERE APPROPRIATE, TO AN APPROVED METHOD STATEMENT.

LEGEND

- EXISTING FOUL SEWER
- EXISTING SURFACE WATER SEWER
- PROPOSED FOUL SEWER
- PROPOSED SURFACE WATER SEWER
- PROPOSED PIPE CULVERT (WATERCOURSE DIVERSION)
- PROPOSED GULLY CONNECTION
- PROPOSED MARSHALLS BEANY BLOCK CHANNEL DRAINAGE
- PROPOSED GULLY
- PROPOSED DISCONNECTION CHAMBERS

This is the plan / drawing / specification referred to in the application

Signed ....

Dated ....

For Fairhurst

Rev.	Date	Description	Drawn	Checked	Approved
H	15/11/18	ADDITIONAL MANHOLES (MH13A) ADDED TO TAKE FLOWS FROM N12.	MC	DA	ZLH
G	11/10/18	CULVERT TEXT ADDED IN CLOUDED AREA. BEANY BLOCK ADDED TO REPLACE GULLIES ALONG RT3A.	DG	ZLH	ZLH
F	13/09/18	BASIN 6 CONTROL MH RELOCATED.	MC	ZLH	ZLH
E	28/05/18	INVERT LEVELS ADDED TO PROPOSED 600mm CULVERT.	MC	DA	ZLH
D	26/04/18	BASIN UPDATED.	MC	DA	ZLH
C	21/02/18	GULLIES REPOSITIONED.	MC	DA	ZLH
B	05/02/18	375MM CULVERT UPSIZED TO 600MM AT KINGSHILL ROAD CROSSING.	MC	DA	ZLH
A	02/02/18	CULVERT ALONG WEST LINK ROAD REMOVED. BASIN 06 RE-LOCATED AND ACCESS TRACK ADDED.	MC	DA	ZLH

Rev.	Date	Description	Drawn	Checked	Approved
P	24/04/19	DISCONNECTION CHAMBERS ADDED FOR N2 DEVELOPMENT AS CLOUDED. GULLY CONNECTIONS AMENDED BETWEEN CH 7+00 & 8+50.	CF	MC	ZLH
O	20/03/19	HIGHWAY BOUNDARY FENCE REMOVED WITHIN DEVELOPMENT FRONTAGES.	CA	CF	ZLH
N	27/02/19	EXTENT OF BEANY BLOCK AMENDED AS CLOUDED.	CF	MC	ZLH
M	13/02/19	SEWER INVERT LEVELS AS PER REVISION CLOUDS TWEAKED. DC CHAMBERS AS PER REVISION CLOUDS RELOCATED SLIGHTLY.	MC	DA	ZLH
L	06/02/19	BEANY BLOCK CONNECTION AMENDED AS CLOUDED.	CF	ZLH	ZLH
K	16/01/19	DRAINAGE LAYOUT REVISED TO REMOVE ROAD RP1 FROM CHAINAGE 1+15 WESTWARDS.	CF	ZLH	ZLH
J	19/12/18	BEANY BLOCK AMENDED AS PER ROADS LAYOUT DRAWING.	MC	DA	ZLH
I	03/12/18	GRADIENT OF SEWERS FROM N12 AMENDED.	MC	DA	ZLH

Rev.	Date	Description	Drawn	Checked	Approved
V	21/08/20	AT THE FRONTAGE OF THE FUTURE HOUSING WHICH IS NOW SHOWN, GULLIES AND MOST DC'S REVERTED BACK TO REVISION T.	ZLH	MC	ZLH
U	23/07/20	DISCONNECTION CHAMBERS AND GULLY CONNECTIONS AMENDED WITHIN CLOUDED AREAS FOR N1 LAYOUT. SEWER TAILS ADDED TO FMH/SMH2.	MC	DA	ZLH
T	30/09/19	FMH1 LEVELS AMENDED. DISCONNECTION CHAMBERS AND GULLY CONNECTIONS AMENDED WITHIN CLOUDED AREAS FOR N1 & N2 LAYOUT.	CF	MC	ZLH
S	20/09/19	DISCONNECTION CHAMBERS ADDED AND REPOSITIONED. ADDITIONAL LEGS OF SEWERS/MH'S ADDED – SEE REV CLOUD.	MC	DA	ZLH
R	23/07/19	DRAWING STATUS AMENDED TO CONSTRUCTION.	RD	CF	ZLH
Q	29/04/19	DISCONNECTION CHAMBERS REMOVED FROM AREA N2 TERRACED UNITS.	ZLH	MC	ZLH

CONTRACT LEGEND

- WORKS CARRIED OUT BY HERON BROS LTD.
- WORKS CARRIED OUT BY COUNTESSWELLS DEVELOPMENT LTD.

Client:

Countesswells

Project Title:

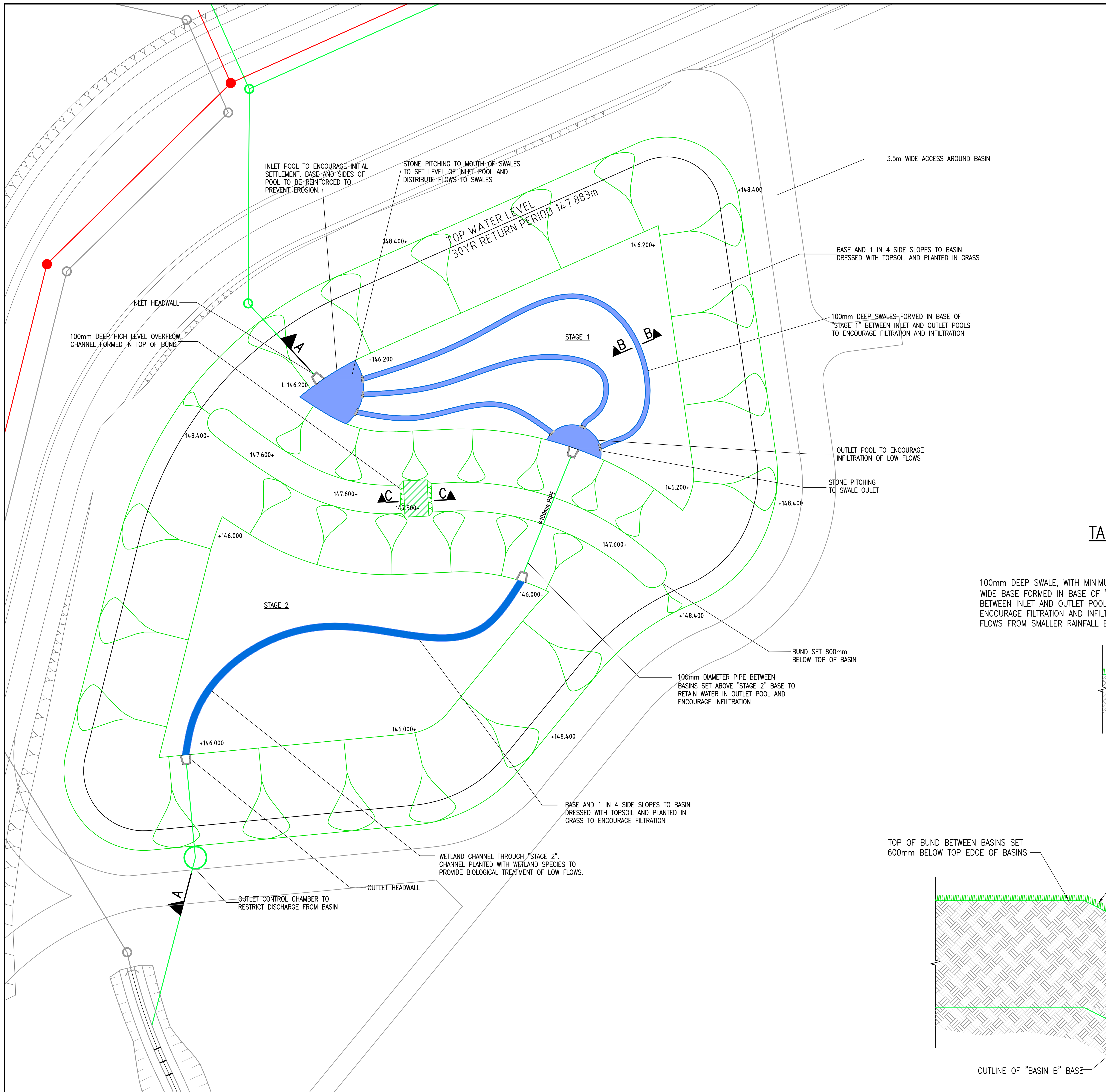
PROPOSED MIXED COMMUNITY DEVELOPMENT AT COUNTESSWELLS, ABERDEEN LINK ACCESS ROADS

Drawing Title:

WEST LINK TO KINGSWELLS ROUNDABOUT DRAINAGE LAYOUT SHEET 3 OF 3

FAIRHURST
88 Queens Road,
ABERDEEN, AB15 4YQ
Tel: 01224 321 222 Fax: 01224 323 201

Scale at A0:	Status:	
1:500	Construction	
Drawn: MC	Checked: ZLH	Approved: PMcM
Date: 30/11/17	Date: 30/11/17	Date: 30/11/17
Drawing No.: 112614/2003	Revision: V	



NOTES

EXTENDED DOUBLE DETENTION BASIN CONSTRUCTION NOTES

ALL FEATURES OF THE EXTENDED DETENTION BASIN ARE TO BE CONSTRUCTED IN ACCORDANCE WITH THE GUIDANCE INCLUDED WITHIN SEWERS FOR SCOTLAND, 3RD EDITION, MAY 2015.

ALL BASIN SIDE SLOPES TO BE A MAXIMUM GRADIENT OF 1 IN 4.

ALL INTERNAL BASIN SLOPES AND THE BASE TO HAVE 150mm OF TOPSOIL AND TO BE SEEDED WITH GRASS SEED TO FINISH. GRASS SEED MIX TO BE APPROVED BY THE LANDSCAPE ARCHITECT PRIOR TO SEEDING, THE FOLLOWING MIX, SEEDED AT A RATE OF $30g/m^2$ SHOULD BE USED AS A GUIDE/

- PERENNIAL RYEGRASS 10%
- SLENDER CREEPING RED FESCUE 40%
- ROUGH STALKED MEADOW GRASS 25%
- CREEPING BENT 15%
- "HIGHLAND" BROWNTOP BENT 10%

ANY UP-MADE EMBANKMENTS TO BE FORMED WITH UNIFORM READILY COMPACTED MATERIAL, FREE FROM CLAY LUMPS AND STONES, AND DEPOSITED AND COMPACTED IN APPROPRIATE LAYERS.

INLET AND OUTLET HEADWALLS TO BE CONSTRUCTED OF C35 GRADE CONCRETE.

STONE PITCHING, SET IN 150mm THICK GRADE C35 CONCRETE TO PREVENT SCOURING OF BASIN BASE.

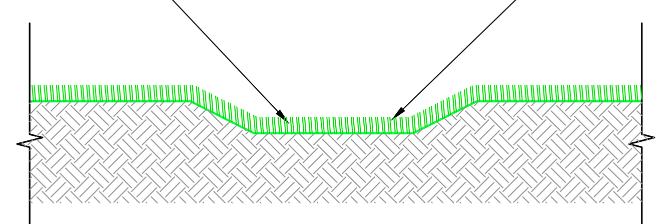
IF INLET OR OUTLET PIPE IS GREATER THAN 300mm DIAMETER, A SQUARE GALVANISED STEEL GRATING, 200mm LARGER THAN THE PIPE DIAMETER IS TO BE FITTED TO THE HEADWALL OVER THE END OF THE PIPE.

GRATING TO HAVE 50mm x 12mm FLAT BARS FIXED VERTICALLY AT 100mm CENTRES TO HINGED FRAME WITH A PADLOCK HASP.

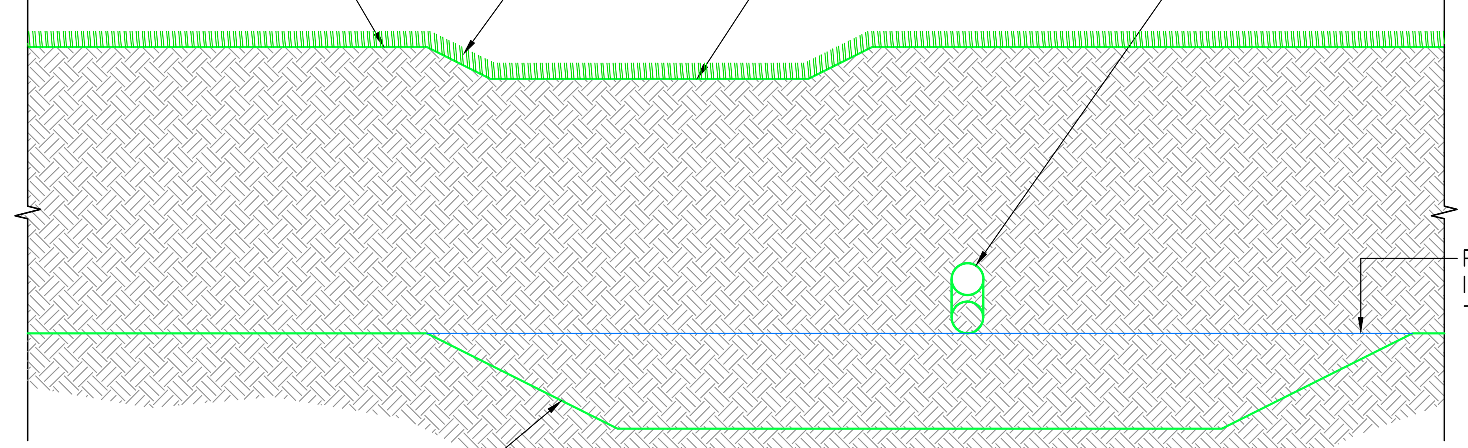
MAINTENANCE ACCESS TO BE PROVIDED TO ALL INLETS AND OUTLETS, REFERENCE TO BE MADE TO ARCHITECTS DETAILS.

DESCRIPTION	TOP WATER LEVEL (m)
TOP WATER LEVEL 10 YEAR PLUS 30% CLIMATE CHANGE ALLOWANCE	147.547
TOP WATER LEVEL 30 YEAR PLUS 30% CLIMATE CHANGE ALLOWANCE	147.883
TOP WATER LEVEL 100 YEAR PLUS 30% CLIMATE CHANGE ALLOWANCE	148.205
TOP WATER LEVEL 200 YEAR PLUS 30% CLIMATE CHANGE ALLOWANCE	148.397

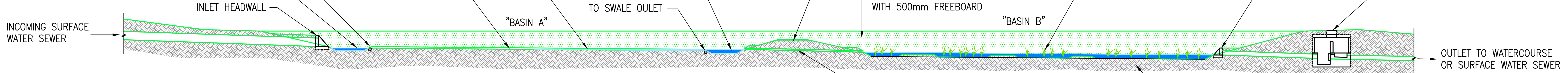
TABLE SHOWING MAXIMUM WATER LEVELS FOR DIFFERENT RETURN PERIODS



SECTION B–B
Scale 1:20



SECTION C–C
Scale 1:20



SECTION A–A
Scale 1:200

NOTES/

PURPOSE

THE TWO STAGE SUDS FACILITY IS INTENDED TO PROVIDE A MINIMUM OF TWO LEVELS OF SURFACE WATER TREATMENT FOR RUN-OFF WHILST FOLLOWING THE GUIDANCE GIVEN IN THE FOLLOWING DOCUMENTS/-

- THE SUDS MANUAL – (CIRIA C753)
- SEPA'S REGULATORY METHOD (WAT-RM-08) SUSTAINABLE URBAN DRAINAGE SYSTEMS
- SUDS FOR ROADS
- SEWERS FOR SCOTLAND, THIRD EDITION, MAY 2015 PUBLISHED BY WRC PLC

THE PROVISION OF A TWO STAGE SUDS FACILITY DOES NOT NEGATE THE REQUIREMENT TO CONSIDER SOURCE CONTROL MEASURES IN ACCORDANCE WITH THE SUDS MANAGEMENT TRAIN.

THE SUDS WILL MIMIC THE NATURAL DRAINAGE OF THE CATCHMENT AND MITIGATE MANY OF THE ADVERSE EFFECTS OF SURFACE WATER RUN-OFF FROM URBAN DEVELOPMENT ON THE ENVIRONMENT BY/-

- MANAGING AND RESTRICTING RUN-OFF RATES TO REDUCE THE RISK OF DOWNSTREAM FLOODING;
- ENCOURAGING NATURAL GROUNDWATER RECHARGE (WHERE APPROPRIATE);
- REDUCING POLLUTANT CONCENTRATIONS IN THE RUN-OFF AND ACTING AS PROTECTION TO THE RECEIVING WATERS;
- CONTRIBUTING TO THE ENHANCED AMENITY AND AESTHETIC VALUE OF DEVELOPED AREAS;
- PROVIDING HABITATS FOR WILDLIFE IN URBAN AREAS AND OPPORTUNITIES FOR BIODIVERSITY ENHANCEMENT.

FUNCTION

FLOWS INTO "STAGE 1" WILL DISCHARGE TO A SHALLOW INLET POOL TO ENCOURAGE INITIAL SETTLEMENT OF SILTS AND PREVENT EROSION.

MULTIPLE EQUAL LEVEL OUTLETS WILL BE PROVIDED TO SHALLOW (100mm DEEP) SWALES FORMED IN THE BASE OF "STAGE 1" WHICH WILL RUN THE LENGTH OF "STAGE 1" AND DISCHARGE TO THE OUTLET POOL. THE SWALES WILL PROVIDE FILTRATION OF THE FLOWS AND ENCOURAGE INFILTRATION TO THE SUBSOILS.

A SHALLOW OUTLET POOL WILL BE PROVIDED AT THE DOWNSTREAM END OF BASIN.

"STAGE 1" WILL HAVE A 100mm ø OUTLET PIPE DISCHARGING TO "STAGE 2" THROUGH THE CENTRAL BUND FORMED BETWEEN STAGES 1 & 2. THE INLET TO THE PIPE PIPE WILL BE SET ABOVE THE LEVEL OF THE BASE OF "STAGE 1" TO ENSURE THE DETENTION OF FLOWS IN THE OUTLET POOL AND ENCOURAGE INFILTRATION.

DURING AND IMMEDIATELY FOLLOWING LARGE RAINFALL EVENTS THE LIMITED CAPACITY OF THE 100mm ø PIPE WILL CAUSE RUN-OFF TO ATTENUATE IN "STAGE 1", DETAINING THE TREATMENT VOLUME (Vt) FOR AN EXTENDED PERIOD OF TIME.

IN EXTREME RAINFALL EVENTS, RUN-OFF WILL ATTENUATE TO A LEVEL WHERE IT WILL ALSO DISCHARGE TO "STAGE 2" VIA AN OVERFLOW WEIR SET AT THE TOP EDGE OF THE CENTRAL BUND.

FLOWS ENTERING "STAGE 2" VIA THE 100mm ø PIPE FROM "STAGE 1" WILL DISCHARGE TO THE WETLAND CHANNEL WHICH RUNS THE LENGTH OF "STAGE 2". THE WETLAND CHANNEL WILL PROVIDE BIOLOGICAL TREATMENT OF LOW FLOWS AND FURTHER OPPORTUNITY FOR SEDIMENT REMOVAL.

THE DISCHARGE RATE FROM "STAGE 2" WILL BE REGULATED WITHIN THE OUTLET CONTROL CHAMBER TO THE AGREED GREENFIELD RUN-OFF.

DURING AND IMMEDIATELY FOLLOWING LARGE RAINFALL EVENTS THE OUTLET CONTROL CHAMBER WILL REGULATE THE DISCHARGE AND CAUSE THE RUN-OFF TO ATTENUATE IN "STAGE 2", DETAINING THE TREATMENT VOLUME (Vt) FOR AN EXTENDED PERIOD OF TIME.

PLANTING

THE BASIN SIDE SLOPES AND CENTRAL BUND WILL BE PLANTED IN GRASS.

THE BASIN BASE AND SHALLOW SWALES WILL BE PLANTED WITH A MEADOW GRASS TYPE MIX TO PROVIDE MAXIMUM FILTRATION.

THE WETLAND CHANNEL WILL BE PLANTED WITH WETLAND SPECIES AND WHERE POSSIBLE THE WETLAND WILL BE SET WITHIN 500mm OF GROUNDWATER TABLE IN ORDER TO SUSTAIN THE WETLAND PLANTING.

DETAILS OF PLANTING TO BE AGREED WITH ADOPTING AUTHORITY.

TREATMENT

TREATMENT OF RUN-OFF AT SOURCE WILL BE PROVIDED FOR DEVELOPMENT AREAS WHERE IT IS PRACTICABLE.

SEDIMENT SETTLEMENT WILL BE PROVIDED IN THE INLET AND OUTLET POOLS OF "STAGE 1".

THE TWO STAGE SUDS FACILITY WILL ENCOURAGE THE INFILTRATION OF THE INITIAL 5mm OF RAINFALL TO THE SUBSOIL SO THAT THESE FLOWS DO NOT REACH THE OUTLET.

FILTRATION OF FLOWS WILL BE PROVIDED BY THE GRASS IN THE SHALLOW SWALES AND BASIN BASE.

"STAGE 1" WILL BE SIZED TO ACCOMMODATE THE TREATMENT VOLUME (Vt) SO THAT DURING LARGE RAINFALL EVENTS Vt WILL BE DETAINED FOR AN EXTENDED PERIOD OF TIME TO ENCOURAGE SEDIMENTATION.

THE WETLAND WILL PROVIDE PERMANENT STORAGE AND BIOLOGICAL TREATMENT OF LOW FLOWS.

"STAGE 2" WILL BE SIZED TO ACCOMMODATE THE TREATMENT VOLUME (Vt) AND DURING LARGE RAINFALL EVENTS Vt WILL BE DETAINED FOR AN EXTENDED PERIOD OF TIME TO ENCOURAGE SEDIMENTATION.

Rev.	Date	Description	Drwn.	Chkd.	Appd.
B	26/04/18	BASIN DETAILS UPDATED.	MC	DA	ZLH
A	06/02/18	DRAWING UPDATED TO REFERENCE BASIN 06.	MC	DA	ZLH

FAIRHURST
88 Queens Road
ABERDEEN
AB15 4YQ
Tel: 01224 321222
Fax: 01224 323201

Client: Countesswells

Project Title:
PROPOSED MIXED COMMUNITY DEVELOPMENT AT COUNTESSWELLS, ABERDEEN: LINK ACCESS ROADS

Drawing Title:
TWO STAGE SUDS PROVISION TYPICAL DETAILS

Scale at A1:	Status:	
AS SHOWN	For Information	
Drawn: MC	Checked: LAM	Approved: ZLH
Date: 19/12/17	Date: 19/12/17	Date: 19/12/17

Drawing No.: 112614/2052 Revision: B

Appendix B – Simple Index Approach

- Table 1 Pollution Hazard Indices (CIRIA: The SUDS Manual).
- Table 2 Mitigation Indices for Discharges to Surface Water (CIRIA: The SUDS Manual).
- Summary of Simple Index Approach Results (HR Wallingford SIA: Tool)

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

Table 1 - Pollution Hazard Indices (CIRIA: The SUDS Manual)

NB. All applicable land uses relevant to this application highlighted, but only the worst case one to be used to progress SUDS selection.

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

Table 2 - Mitigation Indices for Discharges to Surface Water (CIRIA: The SUDS Manual)

NB. Proposed SUDS measures to be used in Simple Index Approach highlighted.

SUMMARY TABLE		DESIGN CONDITIONS 1	2	3	4
Land Use Type	Low traffic roads (e.g. residential roads and general access roads, < 300 traffic movements/day)				
Pollution Hazard Level	Low				
Pollution Hazard Indices					
TSS	0.5				
Metals	0.4				
Hydrocarbons	0.4				
SuDS components proposed					
Component 1	Detention basin	SuDS components can only be assumed to deliver these indices if they follow design guidance with respect to hydraulics and treatment set out in the relevant technical component chapters of the SuDS Manual. See also checklists in Appendix B	Detention basins should be designed to ensure the effective retention and management of sediment, such that the sediment will not be re-suspended and washed out in subsequent events		
Component 2	None				
Component 3	None				
SuDS Pollution Mitigation Indices					
TSS	0.5				
Metals	0.5				
Hydrocarbons	0.6				
Groundwater protection type	None				
Groundwater protection Pollution Mitigation Indices					
TSS	0				
Metals	0				
Hydrocarbons	0				
Combined Pollution Mitigation Indices		**Note: In order to meet both Water Quality criteria set out in the SuDS Manual (Chapter 4), Interception should be delivered for all impermeable areas wherever possible. Interception delivery and treatment may be met by the same components, but Interception requires separate evaluation.**	Reference to local planning documents should also be made to identify any additional protection required for sites due to habitat conservation (see Chapter 7 The SuDS design process). The implications of developments on or within close proximity to an area with an environmental designation, such as a Site of Special Scientific Interest (SSSI), should be considered via consultation with relevant conservation bodies such as Natural England		
TSS	0.5				
Metals	0.5				
Hydrocarbons	0.6				
Acceptability of Pollution Mitigation					
TSS	Sufficient				
Metals	Sufficient				
Hydrocarbons	Sufficient				

SUMMARY TABLE		DESIGN CONDITIONS			
		1	2	3	4
Land Use Type	Residential parking				
Pollution Hazard Level	Low				
Pollution Hazard Indices					
TSS	0.5				
Metals	0.4				
Hydrocarbons	0.4				
SuDS components proposed					
Component 1	Detention basin	SuDS components can only be assumed to deliver these indices if they follow design guidance with respect to hydraulics and treatment set out in the relevant technical component chapters of the SuDS Manual. See also checklists in Appendix B	Detention basins should be designed to ensure the effective retention and management of sediment, such that the sediment will not be re-suspended and washed out in subsequent events		
Component 2	None				
Component 3	None				
SuDS Pollution Mitigation Indices					
TSS	0.5				
Metals	0.5				
Hydrocarbons	0.6				
Groundwater protection type	None				
Groundwater protection Pollution Mitigation Indices					
TSS	0				
Metals	0				
Hydrocarbons	0				
Combined Pollution Mitigation Indices		**Note: In order to meet both Water Quality criteria set out in the SuDS Manual (Chapter 4), Interception should be delivered for all impermeable areas wherever possible. Interception delivery and treatment may be met by the same components, but Interception requires separate evaluation.**	Reference to local planning documents should also be made to identify any additional protection required for sites due to habitat conservation (see Chapter 7 The SuDS design process). The implications of developments on or within close proximity to an area with an environmental designation, such as a Site of Special Scientific Interest (SSSI), should be considered via consultation with relevant conservation bodies such as Natural England		
TSS	0.5				
Metals	0.5				
Hydrocarbons	0.6				
Acceptability of Pollution Mitigation					
TSS	Sufficient				
Metals	Sufficient				
Hydrocarbons	Sufficient				

<table>
<tr><th>SUMMARY TABLE</th><th></th><th colspan="4">DESIGN CONDITIONS</th></tr>
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<tr><td>Land Use Type
Pollution Hazard Level
Pollution Hazard Indices
TSS
Metals
Hydrocarbons</td><td>Residential roofing
Very low

0.2
0.2
0.05</td><td></td><td></td><td></td><td></td></tr>
<tr><td>SuDS components proposed
Component 1</td><td>Detention basin</td><td rowspan="4">SuDS components can only be assumed to deliver these indices if they follow design guidance with respect to hydraulics and treatment set out in the relevant technical component chapters of the SuDS Manual. See also checklists in Appendix B</td><td rowspan="4">Detention basins should be designed to ensure the effective retention and management of sediment, such that the sediment will not be re-suspended and washed out in subsequent events</td><td rowspan="4"></td><td></td></tr>
<tr><td>Component 2</td><td>None</td><td></td></tr>
<tr><td>Component 3</td><td>None</td><td></td></tr>
<tr><td>SuDS Pollution Mitigation Indices
TSS
Metals
Hydrocarbons</td><td>
0.5
0.5
0.6</td><td></td></tr>
<tr><td>Groundwater protection type
Groundwater protection Pollution Mitigation Indices
TSS
Metals
Hydrocarbons</td><td>None

0
0
0</td><td></td><td></td><td></td><td></td></tr>
<tr><td>Combined Pollution Mitigation Indices
TSS
Metals
Hydrocarbons
Acceptability of Pollution Mitigation
TSS
Metals
Hydrocarbons</td><td>
0.5
0.5
0.6

Sufficient
Sufficient
Sufficient</td><td>Note: In order to meet both Water Quality criteria set out in the SuDS Manual (Chapter 4), Interception should be delivered for all impermeable areas wherever possible. Interception delivery and treatment may be met by the same components, but Interception requires separate evaluation.</td><td>Reference to local planning documents should also be made to identify any additional protection required for sites due to habitat conservation (see Chapter 7 The SuDS design process). The implications of developments on or within close proximity to an area with an environmental designation, such as a Site of Special Scientific Interest (SSSI), should be considered via consultation with relevant conservation bodies such as Natural England</td><td></td><td></td></tr>
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Appendix C – Calculations

- Countesswells Greenfield Run-off Rates - 10, 30 and 200 year rainfall return event.
- Two-Stage Detention Basin Calculations - 10, 30 and 200 year rainfall return event.

DESCRIPTION	AREA (ha)	GREENFIELD RUNOFF RATE (l/s)		
		10 YEAR	30 YEAR	200 YEAR
BASIN 1	4.024	23.22	30.42	45.31
BASIN 2	4.962	28.63	37.51	55.87
BASIN 3	10.057	58.03	76.03	113.24
BASIN 4	6.530	37.68	49.37	73.53
BASIN 5 TEMP	3.875	22.36	29.30	43.63
BASIN 6	16.100	92.90	121.72	181.29
BASIN 7	1.118	6.45	8.45	12.59

Table 3 - Countesswells Phase 1 Basins - Greenfield Run-off Rates

NB. Basin and associated run-off rates pertinent to this drainage assessment highlighted, 10 year rate based on agreed 5.77l/s/ha with Aberdeen City Council.

Summary of Results for 10 year Return Period (+30%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Overflow (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	146.740	0.740	92.9	0.0	92.9	1025.2	O K
30 min Summer	146.937	0.937	92.9	0.0	92.9	1406.5	O K
60 min Summer	147.118	1.118	92.9	0.0	92.9	1792.9	O K
120 min Summer	147.248	1.248	92.9	0.0	92.9	2095.8	O K
180 min Summer	147.313	1.313	92.9	0.0	92.9	2253.3	O K
240 min Summer	147.345	1.345	92.9	0.0	92.9	2333.1	O K
360 min Summer	147.380	1.380	92.9	0.0	92.9	2421.6	O K
480 min Summer	147.397	1.397	92.9	0.0	92.9	2466.1	O K
600 min Summer	147.405	1.405	92.9	0.0	92.9	2485.6	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)
15 min Summer	57.200	0.0	1126.4	0.0	29
30 min Summer	39.780	0.0	1566.8	0.0	42
60 min Summer	26.390	0.0	2079.1	0.0	70
120 min Summer	16.705	0.0	2632.7	0.0	128
180 min Summer	12.850	0.0	3037.7	0.0	186
240 min Summer	10.693	0.0	3369.4	0.0	238
360 min Summer	8.277	0.0	3913.0	0.0	300
480 min Summer	6.907	0.0	4354.4	0.0	366
600 min Summer	6.003	0.0	4730.3	0.0	436

Summary of Results for 10 year Return Period (+30%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Overflow (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
720 min Summer	147.406	1.406	92.9	0.0	92.9	2488.5	O K
960 min Summer	147.395	1.395	92.9	0.0	92.9	2460.1	O K
1440 min Summer	147.337	1.337	92.9	0.0	92.9	2313.9	O K
2160 min Summer	147.190	1.190	92.9	0.0	92.9	1957.9	O K
2880 min Summer	147.022	1.022	92.9	0.0	92.9	1584.0	O K
4320 min Summer	146.709	0.709	92.9	0.0	92.9	968.1	O K
5760 min Summer	146.480	0.480	92.5	0.0	92.5	584.4	O K
7200 min Summer	146.342	0.342	90.0	0.0	90.0	378.3	O K
8640 min Summer	146.278	0.278	86.4	0.0	86.4	290.3	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)
720 min Summer	5.352	0.0	5060.6	0.0	506
960 min Summer	4.461	0.0	5624.5	0.0	648
1440 min Summer	3.434	0.0	6494.3	0.0	928
2160 min Summer	2.627	0.0	7449.8	0.0	1328
2880 min Summer	2.164	0.0	8185.1	0.0	1704
4320 min Summer	1.636	0.0	9283.6	0.0	2388
5760 min Summer	1.343	0.0	10160.4	0.0	3064
7200 min Summer	1.156	0.0	10931.8	0.0	3744
8640 min Summer	1.025	0.0	11635.4	0.0	4408

Summary of Results for 10 year Return Period (+30%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Overflow (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
10080 min Summer	146.250	0.250	79.0	0.0	79.0	252.0	O K
15 min Winter	146.812	0.812	92.9	0.0	92.9	1159.0	O K
30 min Winter	147.027	1.027	92.9	0.0	92.9	1593.5	O K
60 min Winter	147.227	1.227	92.9	0.0	92.9	2045.1	O K
120 min Winter	147.377	1.377	92.9	0.0	92.9	2415.7	O K
180 min Winter	147.452	1.452	92.9	0.0	92.9	2609.2	O K
240 min Winter	147.494	1.494	92.9	0.0	92.9	2720.8	O K
360 min Winter	147.529	1.529	92.9	0.0	92.9	2818.1	O K
480 min Winter	147.544	1.544	92.9	0.0	92.9	2858.4	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)
10080 min Summer	0.929	0.0	12295.5	0.0	5144
15 min Winter	57.200	0.0	1261.5	0.0	29
30 min Winter	39.780	0.0	1754.8	0.0	43
60 min Winter	26.390	0.0	2328.9	0.0	70
120 min Winter	16.705	0.0	2948.3	0.0	126
180 min Winter	12.850	0.0	3402.2	0.0	184
240 min Winter	10.693	0.0	3774.2	0.0	238
360 min Winter	8.277	0.0	4382.6	0.0	340
480 min Winter	6.907	0.0	4876.2	0.0	388

Summary of Results for 10 year Return Period (+30%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Overflow (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
600 min Winter	147.547	1.547	92.9	0.0	92.9	2867.2	O K
720 min Winter	147.541	1.541	92.9	0.0	92.9	2850.2	O K
960 min Winter	147.510	1.510	92.9	0.0	92.9	2766.5	O K
1440 min Winter	147.402	1.402	92.9	0.0	92.9	2479.7	O K
2160 min Winter	147.143	1.143	92.9	0.0	92.9	1849.4	O K
2880 min Winter	146.860	0.860	92.9	0.0	92.9	1252.1	O K
4320 min Winter	146.413	0.413	91.7	0.0	91.7	482.3	O K
5760 min Winter	146.263	0.263	82.5	0.0	82.5	269.8	O K
7200 min Winter	146.224	0.224	71.5	0.0	71.5	217.6	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)
600 min Winter	6.003	0.0	5297.2	0.0	466
720 min Winter	5.352	0.0	5667.5	0.0	546
960 min Winter	4.461	0.0	6299.0	0.0	702
1440 min Winter	3.434	0.0	7273.6	0.0	1006
2160 min Winter	2.627	0.0	8343.6	0.0	1416
2880 min Winter	2.164	0.0	9167.4	0.0	1768
4320 min Winter	1.636	0.0	10397.3	0.0	2384
5760 min Winter	1.343	0.0	11381.0	0.0	2952
7200 min Winter	1.156	0.0	12243.8	0.0	3680

Summary of Results for 10 year Return Period (+30%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Overflow (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
8640 min Winter	146.200	0.200	63.6	0.0	63.6	185.6	O K
10080 min Winter	146.182	0.182	57.6	0.0	57.6	163.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)
8640 min Winter	1.025	0.0	13031.5	0.0	4408
10080 min Winter	0.929	0.0	13770.9	0.0	5136

Rainfall Details

Rainfall Model	FEH	Winter Storms	Yes
Return Period (years)	10	Cv (Summer)	0.750
FEH Rainfall Version	2013	Cv (Winter)	0.840
Site Location	GB 387600 804400 NJ 87600 04400	Shortest Storm (mins)	15
Data Type	Catchment	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+30

Time Area Diagram

Total Area (ha) 10.506

Time From:	**(mins) To:**	**Area (ha)**	**Time From:**	**(mins) To:**	**Area (ha)**	**Time From:**	**(mins) To:**	**Area (ha)**	**Time From:**	**(mins) To:**	**Area (ha)**
0	4	0.000	4	8	3.502	8	12	3.502	12	16	3.502

Model Details

Storage is Online Cover Level (m) 148.400

Tank or Pond Structure

Invert Level (m) 146.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	615.1	1.000	2112.8	2.000	3343.4	3.000	3715.2	4.000	3715.2	5.000	3715.2
0.200	1288.7	1.200	2342.6	2.200	3527.3	3.200	3715.2	4.200	3715.2		
0.400	1480.0	1.400	2581.8	2.400	3715.2	3.400	3715.2	4.400	3715.2		
0.600	1681.4	1.600	2830.1	2.600	3715.2	3.600	3715.2	4.600	3715.2		
0.800	1892.4	1.800	3163.6	2.800	3715.2	3.800	3715.2	4.800	3715.2		

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0372-9290-1900-9290
Design Head (m)	1.900
Design Flow (l/s)	92.9
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	372
Invert Level (m)	145.920
Minimum Outlet Pipe Diameter (mm)	450
Suggested Manhole Diameter (mm)	Site Specific Design (Contact Hydro International)

Hydro-Brake® Optimum Outflow Control

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.900	92.9	Kick-Flo®	1.359	79.0
Flush-Flo™	0.649	92.9	Mean Flow over Head Range	-	78.4

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)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	10.5	0.600	92.8	1.600	85.5	2.600	108.2	5.000	148.8	7.500	181.4
0.200	37.2	0.800	92.2	1.800	90.5	3.000	116.0	5.500	155.9	8.000	187.2
0.300	70.2	1.000	90.1	2.000	95.2	3.500	125.0	6.000	162.6	8.500	192.9
0.400	89.3	1.200	86.1	2.200	99.7	4.000	133.4	6.500	169.1	9.000	198.3
0.500	91.8	1.400	80.1	2.400	104.0	4.500	141.3	7.000	175.4	9.500	203.7

Orifice Overflow Control

Diameter (m) 0.205 Discharge Coefficient 0.600 Invert Level (m) 147.650

Summary of Results for 30 year Return Period (+30%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Overflow (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	146.933	0.933	92.9	0.0	92.9	1398.0	O K
30 min Summer	147.181	1.181	92.9	0.0	92.9	1937.9	O K
60 min Summer	147.411	1.411	92.9	0.0	92.9	2502.0	O K
120 min Summer	147.555	1.555	92.9	0.0	92.9	2890.2	O K
180 min Summer	147.628	1.628	92.9	0.0	92.9	3094.9	O K
240 min Summer	147.669	1.669	92.9	0.3	92.9	3213.7	O K
360 min Summer	147.708	1.708	92.9	2.3	92.9	3329.1	O K
480 min Summer	147.727	1.727	92.9	4.0	94.7	3388.9	O K
600 min Summer	147.737	1.737	92.9	5.0	95.9	3419.3	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)
15 min Summer	76.338	0.0	1503.6	0.0	29
30 min Summer	53.377	0.0	2102.9	0.0	43
60 min Summer	35.456	0.0	2793.9	0.0	72
120 min Summer	21.933	0.0	3456.0	0.0	130
180 min Summer	16.675	0.0	3941.4	0.0	188
240 min Summer	13.778	0.0	4342.4	0.5	246
360 min Summer	10.586	0.0	5004.7	13.2	318
480 min Summer	8.790	0.0	5540.9	29.7	382
600 min Summer	7.608	0.0	5994.9	39.2	446

Summary of Results for 30 year Return Period (+30%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Overflow (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
720 min Summer	147.742	1.742	92.9	5.4	96.4	3432.2	O K
960 min Summer	147.737	1.737	92.9	5.0	95.9	3419.3	O K
1440 min Summer	147.701	1.701	92.9	1.8	92.9	3309.2	O K
2160 min Summer	147.598	1.598	92.9	0.0	92.9	3009.9	O K
2880 min Summer	147.472	1.472	92.9	0.0	92.9	2662.9	O K
4320 min Summer	147.142	1.142	92.9	0.0	92.9	1847.8	O K
5760 min Summer	146.832	0.832	92.9	0.0	92.9	1196.5	O K
7200 min Summer	146.595	0.595	92.9	0.0	92.9	770.9	O K
8640 min Summer	146.435	0.435	92.0	0.0	92.0	516.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)
720 min Summer	6.760	0.0	6391.5	42.7	516
960 min Summer	5.600	0.0	7060.2	38.1	658
1440 min Summer	4.281	0.0	8095.0	11.1	942
2160 min Summer	3.244	0.0	9203.0	0.0	1356
2880 min Summer	2.656	0.0	10043.8	0.0	1768
4320 min Summer	1.994	0.0	11314.2	0.0	2516
5760 min Summer	1.630	0.0	12329.6	0.0	3184
7200 min Summer	1.398	0.0	13219.7	0.0	3832
8640 min Summer	1.237	0.0	14033.7	0.0	4504

Summary of Results for 30 year Return Period (+30%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Overflow (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
10080 min Summer	146.335	0.335	89.8	0.0	89.8	369.0	O K
15 min Winter	147.019	1.019	92.9	0.0	92.9	1577.6	O K
30 min Winter	147.288	1.288	92.9	0.0	92.9	2192.9	O K
60 min Winter	147.535	1.535	92.9	0.0	92.9	2834.7	O K
120 min Winter	147.698	1.698	92.9	1.6	92.9	3300.9	O K
180 min Winter	147.778	1.778	92.9	11.0	102.8	3545.3	O K
240 min Winter	147.820	1.820	92.9	16.6	109.4	3678.5	O K
360 min Winter	147.855	1.855	93.7	22.5	116.2	3788.8	O K
480 min Winter	147.876	1.876	94.2	26.3	120.5	3857.7	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)
10080 min Summer	1.118	0.0	14801.1	0.0	5152
15 min Winter	76.338	0.0	1683.8	0.0	29
30 min Winter	53.377	0.0	2355.3	0.0	43
60 min Winter	35.456	0.0	3128.7	0.0	72
120 min Winter	21.933	0.0	3871.0	2.1	128
180 min Winter	16.675	0.0	4414.7	35.7	184
240 min Winter	13.778	0.0	4863.4	87.6	238
360 min Winter	10.586	0.0	5605.5	190.5	312
480 min Winter	8.790	0.0	6205.8	263.5	378

Summary of Results for 30 year Return Period (+30%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Overflow (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
600 min Winter	147.883	1.883	94.4	27.6	121.9	3880.9	O K
720 min Winter	147.882	1.882	94.3	27.3	121.6	3875.8	O K
960 min Winter	147.864	1.864	93.9	24.1	118.0	3816.8	O K
1440 min Winter	147.800	1.800	92.9	13.7	106.1	3613.4	O K
2160 min Winter	147.650	1.650	92.9	0.0	92.9	3159.2	O K
2880 min Winter	147.441	1.441	92.9	0.0	92.9	2579.6	O K
4320 min Winter	146.860	0.860	92.9	0.0	92.9	1251.5	O K
5760 min Winter	146.441	0.441	92.1	0.0	92.1	525.2	O K
7200 min Winter	146.277	0.277	86.1	0.0	86.1	288.9	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)
600 min Winter	7.608	0.0	6714.7	304.8	456
720 min Winter	6.760	0.0	7158.6	320.9	534
960 min Winter	5.600	0.0	7907.5	294.9	690
1440 min Winter	4.281	0.0	9066.2	160.5	1000
2160 min Winter	3.244	0.0	10307.4	0.0	1464
2880 min Winter	2.656	0.0	11249.6	0.0	1904
4320 min Winter	1.994	0.0	12672.1	0.0	2600
5760 min Winter	1.630	0.0	13810.7	0.0	3176
7200 min Winter	1.398	0.0	14807.7	0.0	3680

Summary of Results for 30 year Return Period (+30%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Overflow (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
8640 min Winter	146.241	0.241	76.5	0.0	76.5	240.3	O K
10080 min Winter	146.217	0.217	69.3	0.0	69.3	208.4	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)
8640 min Winter	1.237	0.0	15719.8	0.0	4408
10080 min Winter	1.118	0.0	16575.9	0.0	5136

Rainfall Details

Rainfall Model	FEH	Winter Storms	Yes
Return Period (years)	30	Cv (Summer)	0.750
FEH Rainfall Version	2013	Cv (Winter)	0.840
Site Location	GB 387600 804400 NJ 87600 04400	Shortest Storm (mins)	15
Data Type	Catchment	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+30

Time Area Diagram

Total Area (ha) 10.506

Time From:	**(mins) To:**	**Area (ha)**	**Time From:**	**(mins) To:**	**Area (ha)**	**Time From:**	**(mins) To:**	**Area (ha)**	**Time From:**	**(mins) To:**	**Area (ha)**
0	4	0.000	4	8	3.502	8	12	3.502	12	16	3.502

Model Details

Storage is Online Cover Level (m) 148.400

Tank or Pond Structure

Invert Level (m) 146.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	615.1	1.000	2112.8	2.000	3343.4	3.000	3715.2	4.000	3715.2	5.000	3715.2
0.200	1288.7	1.200	2342.6	2.200	3527.3	3.200	3715.2	4.200	3715.2		
0.400	1480.0	1.400	2581.8	2.400	3715.2	3.400	3715.2	4.400	3715.2		
0.600	1681.4	1.600	2830.1	2.600	3715.2	3.600	3715.2	4.600	3715.2		
0.800	1892.4	1.800	3163.6	2.800	3715.2	3.800	3715.2	4.800	3715.2		

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0372-9290-1900-9290
Design Head (m)	1.900
Design Flow (l/s)	92.9
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	372
Invert Level (m)	145.920
Minimum Outlet Pipe Diameter (mm)	450
Suggested Manhole Diameter (mm)	Site Specific Design (Contact Hydro International)

Hydro-Brake® Optimum Outflow Control

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.900	92.9	Kick-Flo®	1.359	79.0
Flush-Flo™	0.649	92.9	Mean Flow over Head Range	-	78.4

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)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	10.5	0.600	92.8	1.600	85.5	2.600	108.2	5.000	148.8	7.500	181.4
0.200	37.2	0.800	92.2	1.800	90.5	3.000	116.0	5.500	155.9	8.000	187.2
0.300	70.2	1.000	90.1	2.000	95.2	3.500	125.0	6.000	162.6	8.500	192.9
0.400	89.3	1.200	86.1	2.200	99.7	4.000	133.4	6.500	169.1	9.000	198.3
0.500	91.8	1.400	80.1	2.400	104.0	4.500	141.3	7.000	175.4	9.500	203.7

Orifice Overflow Control

Diameter (m) 0.205 Discharge Coefficient 0.600 Invert Level (m) 147.650

Summary of Results for 200 year Return Period (+30%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Overflow (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	147.304	1.304	92.9	0.0	92.9	2232.1	O K
30 min Summer	147.643	1.643	92.9	0.0	92.9	3139.5	O K
60 min Summer	147.919	1.919	95.2	34.0	129.2	3998.2	O K
120 min Summer	148.061	2.061	98.4	48.7	147.2	4471.2	O K
180 min Summer	148.124	2.124	99.8	53.4	153.3	4685.5	O K
240 min Summer	148.151	2.151	100.4	55.4	155.8	4780.0	O K
360 min Summer	148.182	2.182	101.1	57.5	158.6	4887.9	O K
480 min Summer	148.195	2.195	101.4	58.3	159.7	4932.9	O K
600 min Summer	148.197	2.197	101.4	58.5	159.9	4939.5	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)
15 min Summer	118.740	0.0	2339.0	0.0	30
30 min Summer	84.137	0.0	3314.7	0.0	44
60 min Summer	55.339	0.0	4360.6	136.1	72
120 min Summer	33.192	0.0	5230.5	372.4	128
180 min Summer	24.761	0.0	5852.7	542.8	186
240 min Summer	20.171	0.0	6357.8	675.3	234
360 min Summer	15.174	0.0	7173.6	871.9	292
480 min Summer	12.411	0.0	7823.8	1005.2	358
600 min Summer	10.622	0.0	8369.4	1098.1	426

Summary of Results for 200 year Return Period (+30%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Overflow (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
720 min Summer	148.192	2.192	101.3	58.1	159.4	4923.0	O K
960 min Summer	148.173	2.173	100.9	56.9	157.8	4856.6	O K
1440 min Summer	148.114	2.114	99.6	52.7	152.3	4650.9	O K
2160 min Summer	148.013	2.013	97.3	44.8	142.1	4307.1	O K
2880 min Summer	147.923	1.923	95.3	34.8	130.1	4009.9	O K
4320 min Summer	147.763	1.763	92.9	8.8	100.3	3498.7	O K
5760 min Summer	147.550	1.550	92.9	0.0	92.9	2874.9	O K
7200 min Summer	147.304	1.304	92.9	0.0	92.9	2231.9	O K
8640 min Summer	146.999	0.999	92.9	0.0	92.9	1534.6	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)
720 min Summer	9.355	0.0	8844.8	1163.7	496
960 min Summer	7.657	0.0	9653.0	1226.2	636
1440 min Summer	5.747	0.0	10867.6	1145.8	912
2160 min Summer	4.290	0.0	12169.3	923.7	1320
2880 min Summer	3.482	0.0	13168.1	654.2	1716
4320 min Summer	2.589	0.0	14688.7	122.6	2560
5760 min Summer	2.104	0.0	15917.7	0.0	3400
7200 min Summer	1.799	0.0	17011.3	0.0	4184
8640 min Summer	1.588	0.0	18017.2	0.0	4768

Summary of Results for 200 year Return Period (+30%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Overflow (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
10080 min Summer	146.774	0.774	92.9	0.0	92.9	1087.7	O K
15 min Winter	147.414	1.414	92.9	0.0	92.9	2511.4	O K
30 min Winter	147.774	1.774	92.9	10.4	102.2	3531.3	O K
60 min Winter	148.068	2.068	98.6	49.3	147.9	4495.6	O K
120 min Winter	148.233	2.233	102.2	60.8	163.0	5070.2	O K
180 min Winter	148.312	2.312	103.9	65.6	169.5	5351.3	Flood Risk
240 min Winter	148.351	2.351	104.7	67.9	172.6	5495.5	Flood Risk
360 min Winter	148.382	2.382	105.3	69.6	174.9	5608.5	Flood Risk
480 min Winter	148.397	2.397	105.7	70.4	176.1	5664.6	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)
10080 min Summer	1.433	0.0	18968.8	0.0	5448
15 min Winter	118.740	0.0	2619.6	0.0	30
30 min Winter	84.137	0.0	3712.7	18.0	44
60 min Winter	55.339	0.0	4883.6	314.2	72
120 min Winter	33.192	0.0	5858.0	617.3	126
180 min Winter	24.761	0.0	6555.3	832.7	182
240 min Winter	20.171	0.0	7120.6	1000.9	236
360 min Winter	15.174	0.0	8035.1	1254.3	300
480 min Winter	12.411	0.0	8762.0	1430.6	376

Summary of Results for 200 year Return Period (+30%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Overflow (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
600 min Winter	148.395	2.395	105.6	70.3	175.9	5656.1	Flood Risk
720 min Winter	148.382	2.382	105.3	69.6	175.0	5609.3	Flood Risk
960 min Winter	148.342	2.342	104.5	67.4	171.9	5462.5	Flood Risk
1440 min Winter	148.237	2.237	102.3	61.0	163.3	5081.8	O K
2160 min Winter	148.077	2.077	98.8	50.0	148.8	4525.2	O K
2880 min Winter	147.944	1.944	95.8	38.4	134.2	4080.4	O K
4320 min Winter	147.721	1.721	92.9	3.4	93.9	3368.0	O K
5760 min Winter	147.315	1.315	92.9	0.0	92.9	2258.8	O K
7200 min Winter	146.766	0.766	92.9	0.0	92.9	1071.9	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)
600 min Winter	10.622	0.0	9373.7	1557.0	454
720 min Winter	9.355	0.0	9906.7	1649.1	532
960 min Winter	7.657	0.0	10811.5	1764.8	682
1440 min Winter	5.747	0.0	12171.0	1753.4	974
2160 min Winter	4.290	0.0	13630.4	1390.7	1396
2880 min Winter	3.482	0.0	14748.3	947.2	1820
4320 min Winter	2.589	0.0	16450.6	49.0	2768
5760 min Winter	2.104	0.0	17829.2	0.0	3632
7200 min Winter	1.799	0.0	19053.4	0.0	4120

Summary of Results for 200 year Return Period (+30%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Overflow (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
8640 min Winter	146.439	0.439	92.1	0.0	92.1	520.9	O K
10080 min Winter	146.289	0.289	88.1	0.0	88.1	304.4	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)
8640 min Winter	1.588	0.0	20179.9	0.0	4672
10080 min Winter	1.433	0.0	21244.3	0.0	5152

Rainfall Details

Rainfall Model	FEH	Winter Storms	Yes
Return Period (years)	200	Cv (Summer)	0.750
FEH Rainfall Version	2013	Cv (Winter)	0.840
Site Location	GB 387600 804400 NJ 87600 04400	Shortest Storm (mins)	15
Data Type	Catchment	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+30

Time Area Diagram

Total Area (ha) 10.506

Time From:	**(mins) To:**	**Area (ha)**	**Time From:**	**(mins) To:**	**Area (ha)**	**Time From:**	**(mins) To:**	**Area (ha)**	**Time From:**	**(mins) To:**	**Area (ha)**
0	4	0.000	4	8	3.502	8	12	3.502	12	16	3.502

Model Details

Storage is Online Cover Level (m) 148.400

Tank or Pond Structure

Invert Level (m) 146.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	615.1	1.000	2112.8	2.000	3343.4	3.000	3715.2	4.000	3715.2	5.000	3715.2
0.200	1288.7	1.200	2342.6	2.200	3527.3	3.200	3715.2	4.200	3715.2		
0.400	1480.0	1.400	2581.8	2.400	3715.2	3.400	3715.2	4.400	3715.2		
0.600	1681.4	1.600	2830.1	2.600	3715.2	3.600	3715.2	4.600	3715.2		
0.800	1892.4	1.800	3163.6	2.800	3715.2	3.800	3715.2	4.800	3715.2		

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0372-9290-1900-9290
Design Head (m)	1.900
Design Flow (l/s)	92.9
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	372
Invert Level (m)	145.920
Minimum Outlet Pipe Diameter (mm)	450
Suggested Manhole Diameter (mm)	Site Specific Design (Contact Hydro International)

Hydro-Brake® Optimum Outflow Control

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.900	92.9	Kick-Flo®	1.359	79.0
Flush-Flo™	0.649	92.9	Mean Flow over Head Range	-	78.4

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)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	10.5	0.600	92.8	1.600	85.5	2.600	108.2	5.000	148.8	7.500	181.4
0.200	37.2	0.800	92.2	1.800	90.5	3.000	116.0	5.500	155.9	8.000	187.2
0.300	70.2	1.000	90.1	2.000	95.2	3.500	125.0	6.000	162.6	8.500	192.9
0.400	89.3	1.200	86.1	2.200	99.7	4.000	133.4	6.500	169.1	9.000	198.3
0.500	91.8	1.400	80.1	2.400	104.0	4.500	141.3	7.000	175.4	9.500	203.7

Orifice Overflow Control

Diameter (m) 0.205 Discharge Coefficient 0.600 Invert Level (m) 147.650

Appendix D – Approval Letters

- Aberdeen City Council – Agreed Greenfield Run-off Rates.

MEMO

ABERDEEN CITY COUNCIL

To	Paul Williamson Planning & Infrastructure	Date Your Ref. Our Ref.	28/04/2014 P140435 (ZLJ)
From Email Dial Fax	Flooding seilla@aberdeencity.gov.uk 01224 53 8099		

Flooding
Enterprise, Planning & Infrastructure
Aberdeen City Council
Ground Floor
74 - 76 Spring Garden
Aberdeen AB25 1GN

Planning application no. P140435
Aberdeen Local Dev' Plan Site OP58, Countesswells (Phase 1), West of Hazlehead Park
Provision of infrastructure including access, internal road layout, landscaping and drainage provision for Phase 1 of residential-led mixed use development

I have considered the above planning application and have the following observations:

The proposed rate of discharge (5.77 l/s/h) stays within the usual values range. Once the area starts being developed, each different catchment will have to ensure that this value is taken into account.
The attenuation volume might be provided within the two stages extended detention basins in order to contain the run-off volumes generated by the critical 10 year rainfall return event plus 20% and the run-off volumes generated by critical rainfall events up to 200 year plus 20%.
The basins will be provided with the appropriate flow control device in order to limit the run-off at the greenfield run-off rate.

As the SuDS system will discharge into a SW sewer, all designs and calculations might be also agreed with them.

Regards,

Sergi Illa
Principal Technical Officer

Appendix E – SUDS Function Document

- SUDS Function Document.

92762: Development at Countesswells

Two Stage SuDS Function at Various Rainfall Return Events **22/06/16**

This document has been prepared to further explain the operation of the 2 stage SuDS facility detailed in drawing 92762/sk2001A and should be read in conjunction with this drawing.

The operation of the 2 Stage SuDS provision will vary depending on the rainfall return event being dealt with. The following gives details of how the facility will function during, and immediately following 2 year, 10 year, 30 year, 100 year and 200 year rainfall return events.

1. General operation in all rainfall events

The incoming surface water sewer network is designed in accordance with Scottish water's specification, to accommodate the design flows without any surcharging of the drainage network. Initial flows from any rainfall event will mobilise any pollution and sediment on the drained surfaces. These "first flush" flows will therefore be dealt with as follows:-

a) Flows into Basin A will initially discharge to the shallow inlet pool, which will allow any heavy sediment to settle.

b) The pool will overflow into the shallow grass swales formed in the base of Basin A. The grass in the swales will provide a filtering effect to remove sediment and a degree of infiltration will be possible for the initial flows.

c) The flows from the swales will discharge to the outlet pool. The outlet from Basin A to Basin B is a 100mm diameter pipe set at a level above the base of Basin A. The small diameter and level of this pipe will detain the run-off in Basin A and encourage a degree of infiltration in the wider basin for the initial flows.

d) The limited flow passing from Basin A to Basin B will discharge to the wetland channel running the length of Basin B.

e) The low flows through the wetland will encourage further sediment settlement and the wetland planting will filter and provide biological treatment of the initial flows.

f) The restricted discharge from Basin B will detain the flows to increase the time that the run-off spends within the SuDS facility.

g) For low flows, a combination of settlement, filtration, infiltration, biological treatment and detention provides in excess of 2 levels, and types, of treatment for the "first flush" run-off from the development roads.

2. 2 year rainfall return event

Initial flows will be dealt with as described in 1. above. Beyond the initial flows, the 2 year rainfall return event will be dealt with as follows:-

a) The restricted discharge to Basin B will result in flows being attenuated in Basin A and discharged to Basin B over several hours. In the critical duration event, run-off will be attenuated to depths between 150 & 300mm in Basin A.

b) The discharge from Basin B is also restricted and flows into this basin will also be attenuated and detained for several hours. In the critical duration event, run-off will be attenuated to depths between 450 & 900mm in Basin B.

c) The discharge from Basin B will be restricted to the agreed greenfield run-off rate for the 2 year rainfall return event.

d) As well as the settlement, filtration, infiltration and biological treatment provided for the initial “first flush” flows, the run-off is detained for several hours, giving at least 2 levels, and types, of treatment for run-off from the development roads during, and immediately following, a 2 year rainfall return event.

3. 10 year rainfall return event

Initial flows will be dealt with as described in 1. above. Beyond the initial flows the 10 year rainfall return event will be dealt with as follows:-

a) The restricted discharge to Basin B will result in flows being attenuated in Basin A and discharged to Basin B over an extended period of up to 24 hours. In the critical duration event, the design treatment volume Vt will be attenuated to depths between 350 & 600mm in Basin A.

b) The discharge from Basin B is also restricted and flows into this basin will also be attenuated over an extended period of up to 24 hours. In the critical duration event, the design treatment volume Vt will be attenuated to depths between 650 & 1200mm in Basin B.

c) The discharge from Basin B will be restricted to the agreed greenfield run-off rate for the 10 year rainfall return event.

d) Each basin detains the design treatment run-off volume Vt for an extended period of up to 24 hours. Therefore 2 x Vt is detained. The extended detention time along with the settlement, filtration, infiltration and biological treatment provided for the initial “first flush” flows, gives at least 2 levels and types of treatment for run-off from the development roads during, and immediately following, a 10 year rainfall return event.

4. 30 year rainfall return event

Initial flows will be dealt with as described in 1. above. Beyond the initial flows the 30 year rainfall return event will be dealt with as follows:-

a) The restricted discharge to Basin B will result in flows being attenuated in Basin A and discharged to Basin B over an extended period of up to 24 hours. In the critical duration event, the design treatment volume Vt will be attenuated to depths between 450 & 800mm in Basin A.

b) The overflow weir on the top of the bund between the two basins will allow flows in the most extreme 30 year rainfall return events to overflow from Basin A to Basin B. The volume detained in Basin A below the overflow level will be in excess of the design treatment volume Vt. This volume will discharge at a controlled rate over an extended period through the 100mm diameter pipe to Basin B.

c) The discharge from Basin B is also restricted and flows into this basin will also be attenuated over an extended period of up to 24 hours. In the critical duration event, the design treatment volume Vt will be attenuated to depths between 750 & 1400mm in Basin B.

d) The discharge from Basin B will be restricted to the agreed greenfield run-off rate for the 30 year rainfall return event.

e) Each basin detains the design treatment run-off volume Vt for an extended period of up to 24 hours. Therefore 2 x Vt is detained. The extended detention time along with the settlement, filtration, infiltration and biological treatment provided for the initial "first flush" flows, gives at least 2 levels and types of treatment for run-off from the development roads during, and immediately following, a 30 year rainfall return event.

5. 100 year rainfall return event

Initial flows will be dealt with as described in 1. above. Beyond the initial flows the 100 year rainfall return event will be dealt with as follows:-

a) The restricted discharge to Basin B will result in flows being attenuated in Basin A and discharged to Basin B over an extended period of up to 24 hours. In the critical duration event, the design treatment volume Vt will be attenuated to depths between 600 & 1050mm in Basin A.

b) The overflow weir on the top of the bund between the two basins will allow flows in the most extreme 30 year rainfall return events, and greater, to overflow from Basin A to Basin B. The volume detained in Basin A below the overflow level will be in excess of the design treatment volume Vt. This volume will discharge at a controlled rate over an extended period through the 100mm diameter pipe to Basin B.

c) The discharge from Basin B is also restricted and flows into this basin will also be attenuated over an extended period of up to 24 hours. In the critical duration event, the design treatment volume Vt will be attenuated to depths between 900 & 1650mm in Basin B.

d) The discharge from Basin B will be restricted to the agreed greenfield run-off rate for the 100 year rainfall return event.

e) Each basin detains the design treatment run-off volume Vt for an extended period of up to 24 hours. Therefore 2 x Vt is detained. The extended detention time along with the settlement, filtration, infiltration and biological treatment provided for the initial "first flush" flows, gives at least 2 levels and types of treatment for run-off from the development roads during, and immediately following, a 100 year rainfall return event.

92762: Development at Countesswells

Two Stage SuDS Function at Various Rainfall Return Events **22/06/16**

6. 200 year rainfall return event

Initial flows will be dealt with as described in 1. above. Beyond the initial flows the 200 year rainfall return event will be dealt with as follows:-

a) The restricted discharge to Basin B will result in flows being attenuated in Basin A and discharged to Basin B over an extended period of up to 24 hours. In the critical duration event, the design treatment volume Vt will be attenuated to depths between 700 & 1150mm in Basin A.

b) The overflow weir on the top of the bund between the two basins will allow flows in the most extreme 30 year rainfall return events, and greater, to overflow from Basin A to Basin B. The volume detained in Basin A below the overflow level will be in excess of the design treatment volume Vt. This volume will discharge at a controlled rate over an extended period through the 100mm diameter pipe to Basin B.

c) The discharge from Basin B is also restricted and flows into this basin will also be attenuated over an extended period of up to 24 hours. In the critical duration event, the design treatment volume Vt will be attenuated to depths between 1000 & 1800mm in Basin B.

d) The discharge from Basin B will be restricted to the agreed greenfield run-off rate for the 200 year rainfall return event.

e) Each basin detains the design treatment run-off volume Vt for an extended period of up to 24 hours. Therefore 2 x Vt is detained. The extended detention time along with the settlement, filtration, infiltration and biological treatment provided for the initial “first flush” flows, gives at least 2 levels and types of treatment for run-off from the development roads during, and immediately following, a 200 year rainfall return event.

At the most extreme 30 year rainfall return events and greater, the attenuated volume in Basin A spills over the weir in the central bund and will fill Basin B to the point where the two basins will act as one. This only occurs in extreme rainfall events, where the most polluted “first flush” flows have already been treated and the flows are therefore much cleaner. As the basins discharge and the water level drops below the central bund level, each basin will retain the design treatment volume Vt and deal with this as described above.

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