

# PENRITH CITY COUNCIL

## WATER SENSITIVE URBAN DESIGN (WSUD) STANDARD DRAWINGS

DRAWING SHEET	DRAWING TITLE
001	COVER SHEET & GENERAL NOTES
100	BIORETENTION NOTES - SHEET 1
101	BIORETENTION NOTES - SHEET 2
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106	BIORETENTION - CONSTRUCTION WORKS STAGING - 2
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112	BIORETENTION GENERAL ARRANGEMENT - 100 - 200 SQM
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120	BIORETENTION DETAILS - TYPICAL PROFILES
121	BIORETENTION DETAILS
122	BIORETENTION DETAILS - INLET DIVERSION STRUCTURES
124	BIORETENTION DETAILS - INLET SEDIMENT FOREBAY
125	BIORETENTION DETAILS - OUTLET STRUCTURES
126	BIORETENTION DETAILS - OUTLET TO CHANNEL/CREEK
127	BIORETENTION DETAILS - ACCESS TRACKS
130	BIORETENTION PLANTING
140	BIORETENTION STREETSCAPE - IN ROADWAY < 30 SQM
141	BIORETENTION STREETSCAPE - TOWN CENTRES
142	BIORETENTION STREETSCAPE - TREE PIT

### GENERAL NOTES

- A. THE PURPOSE OF THESE DRAWINGS IS TO PROVIDE GENERAL DESIGN GUIDANCE ON KEY DETAILS HOWEVER THEY ARE NOT A STAND ALONE DESIGN RESOURCE. THEY SHOULD BE READ IN CONJUNCTION WITH OTHER DESIGN GUIDELINES INCLUDING:
  - PENRITH WSUD TECHNICAL GUIDELINES (INCLUDING DEEMED TO COMPLY TOOLKIT)
  - PENRITH STORMWATER DRAINAGE GUIDELINE FOR BUILDING DEVELOPMENTS (POLICY ES 002)
  - PENRITH DESIGN GUIDELINES FOR ENGINEERING WORKS FOR SUBDIVISIONS AND DEVELOPMENTS
  - OTHER RELEVANT GUIDELINES AS REFERENCED.
- B. THESE DRAWINGS ARE INTENDED TO PROVIDE A LIST OF COMPLYING SOLUTIONS THAT COUNCIL ACCEPTS. THEY SHALL NOT BE USED TO STIFLE INNOVATION OR REPLACE SOUND ENGINEERING JUDGEMENT. ALTERNATIVE SOLUTIONS WILL BE ADDRESSED BY COUNCIL ON A MERITS BASED APPROACH.
- C. WHERE THERE IS A CLASH BETWEEN THESE DRAWINGS AND COUNCIL'S BIORETENTION SPECIFICATION, THE DESIGNER/CONTRACTOR SHALL SEEK CLARIFICATION FROM COUNCIL.
- D. THE STANDARD DRAWINGS SHOWN HEREIN MAY REQUIRE MODIFICATION TO SUIT LOCAL TOPOGRAPHY, SOILS, LANDSCAPE, SERVICES & SITE CONDITIONS. DESIGNS SHOULD INTEGRATE TREATMENT SYSTEMS INTO THE SURROUNDING LANDSCAPE.
- E. WSUD SYSTEMS WITH STRUCTURAL ELEMENTS (e.g. RETAINING WALLS) REQUIRE SITE SPECIFIC STRUCTURAL DESIGN INPUT.
- F. ALL WATER QUALITY AND QUANTITY MANAGEMENT MEASURES SHALL BE DESIGNED TO ENSURE:
  - EASE OF MAINTENANCE
  - ACCESS FOR MAINTENANCE
  - SAFE WORK PRACTICES
  - PUBLIC SAFETY AND HEALTH
  - COMPLIANCE WITH DESIGN CRITERIA

### REFERENCES

- BLACKTOWN CITY COUNCIL WSUD STANDARD DRAWINGS (2017, REV C)
- ADOPTION GUIDELINES FOR STORMWATER BIOFILTRATION SYSTEMS (CRCWSC, 2015)
- WATER BY DESIGN 2014 "BIORETENTION TECHNICAL DESIGN GUIDE"
- CATCHMENTS & CREEKS, FACT SHEETS (VARIOUS)

### ABBREVIATIONS

NSL	-NATURAL SURFACE LEVEL	CL	-COVER LEVEL
FSL	-FINISHED SURFACE LEVEL	RL	-REDUCED LEVEL
U/S	-UPSTREAM	RCP	-REINFORCED CONCRETE PIPE
D/S	-DOWNSTREAM	NTS	-NOT TO SCALE
IL	-INVERT LEVEL	EDD	-EXTENDED DETENTION DEPTH
RRJ	-RUBBER RING JOINT	HGL	-HYDRAULIC GRADE LINE
UNO	-UNLESS NOTED OTHERWISE	NOM	-NOMINAL
TYP	-TYPICAL	TWL	-TOP WATER LEVEL
EY	-EXCEEDANCES PER YEAR	K <sub>SAT</sub>	-SATURATED HYDRAULIC CONDUCTIVITY RATE
HDPE	-HIGH DENSITY POLYETHYLENE	GCL	- GEOSYNTHETIC CLAY LINER
PSD	-PARTICLE SIZE DISTRIBUTION		

REV	DESCRIPTION	DATE	APPROVED
B	FOR COUNCIL REVIEW	26/7/19	TN
A	PRELIM DRAFT FOR COUNCIL REVIEW	09/1/19	AM

SCALE (at A1)

A
B
C
D



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WSUD STANDARD DRAWINGS	
PROJECT TITLE:	WSUD STANDARD DRAWINGS
SHEET TITLE:	COVER SHEET & GENERAL NOTES
Drawing No.	Revision
001	A



**INSPECTION/HOLD POINTS**

DURING CONSTRUCTION, IT IS CRITICAL THAT THE DESIGNER UNDERTAKES INSPECTIONS AT KEY POINTS, TO ENSURE THAT BIORETENTION SYSTEMS ARE INSTALLED ACCORDING TO THEIR DESIGN INTENT. THE MINIMUM HOLD POINTS ARE OUTLINED IN THE TABLE AT RIGHT.

AT EACH STAGE, CHECK THE FINISHED LEVELS (TO BE WITHIN 25mm TOLERANCE) AS WELL AS THE QUALITY OF COMPLETED WORK. THE SUPERINTENDENT SHALL PROVIDE CERTIFICATION VERIFYING INSTALLATION AND COMPLIANCE AT EACH STAGE.

REGISTER OF INSPECTIONS AND HOLD POINTS											
PROJECT				Role/Stakeholder		Company		Contact Name		Contact Details	
BIORETENTION SYSTEM ID				Developer							
SITE ADDRESS				Site superintendent (civil)							
				Site superintendent (landscape)							
				Bioretention designer							
				Civil engineer							
				Landscape architect							
				Civil contractor							
				Landscape contractor							
				Council compliance Officer							
STAGE	INSPECTION AND HOLD POINT <small>(ALL INSPECTIONS TO DEMONSTRATE COMPLIANCE WITH THE 'FOR CONSTRUCTION' DRAWINGS AND DESIGN INTENT OF PCC WSUD STANDARD DRAWINGS)</small>	SIGN-OFF BY DEVELOPER (DESIGNER/PROJECT ENGINEER)				SIGN-OFF BY COUNCIL'S REPRESENTATIVE				NOTES	
		NAME	COMPANY	SIGNATURE	DATE	SURVEYED LEVELS PROVIDED?	NAME	POSITION	SIGNATURE		DATE
1 (SEDIMENT BASIN)	SEDIMENT BASIN EXCAVATED TO REQUIRED VOLUME										
	INSTALLATION OF INLET SURCHARGE PIT										
	INSTALLATION OF CONTROLLED OUTLET										
2 (BIORETENTION SYSTEM PARTIALLY COMPLETED, WITH SACRIFICIAL SURFACE LAYER, IF APPLICABLE)	PRIOR TO PROCUREMENT, TEST RESULTS FOR DRAINAGE LAYER, TRANSITION LAYER AND FILTER MEDIA.										
	COMPLETION OF BASIN BULK EARTHWORKS AND INSPECTION OF SUBGRADE, INCLUDING SURVEYED LEVELS.										
	INSTALLATION OF GEOTEXTILE AND LINER										
	INSTALLATION OF GPT OR PRE-TREATMENT DEVICE, INCLUDING INTERNAL INSPECTION										
	INSTALLATION OF INLET PITS AND PIPES, INCLUDING SURVEYED LEVELS										
	INSTALLATION OF OUTLET PITS WITH WEIR/VALVES FOR SATURATED ZONES, AND PIPES, INCLUDING SURVEYED LEVELS										
	INSTALLATION OF OUTLET TO WATERWAY OR DOWNSTREAM DRAINAGE SYSTEM										
	INSTALLATION OF SLOTTED PIPES AND FLUSHING POINTS, PRIOR TO INSTALLATION OF DRAINAGE LAYER										
	INSTALLATION OF DRAINAGE LAYER, INCLUDING SURVEYED LEVELS										
	INSTALLATION OF TRANSITION LAYER (250MM), INCLUDING SURVEYED LEVELS										
	INSTALLATION OF TEMPORARY GEOTEXTILE										
INSTALLATION OF FILTER MEDIA (200MM) AND WASHED TURF											
3 (BIORETENTION SYSTEM COMPLETED, ONLY AFTER 90% OF DEVELOPMENT IN CATCHMENT IS COMPLETED)	PRIOR TO PROCUREMENT, TEST RESULTS FOR TRANSITION LAYER AND FILTER MEDIA										
	INSTALLATION OF TEMPORARY BLOCKING PLATE AT DIVERSION PIT, TO DIRECT ALL STORMWATER TO HIGH FLOW BYPASS										
	REMOVAL OF SACRIFICIAL FILTER MEDIA AND GEOTEXTILE (ONLY CLEAN TRANSITION LAYER REMAINING)										
	INSTALLATION OF COMPLETED TRANSITION LAYER, INCLUDING SURVEYED LEVELS										
	INSTALLATION OF COMPLETED FILTER MEDIA LAYER, INCLUDING SURVEYED LEVELS										
	IN-SITU TESTING OF HYDRAULIC CONDUCTIVITY										
	INSTALLATION OF TEMPORARY IRRIGATION SYSTEM										
	INSTALLATION OF LANDSCAPE FEATURES										
	INSTALLATION OF JUTE MESH (ON BATTERS)										
	INSTALLATION OF ALL PLANTING, INCLUDING CONFIRMATION OF PLANT SPECIES, AND PLANTS ARE OF ACCEPTABLE SIZE AND CONDITION										
	PROVISION OF WORK-AS-EXECUTED DRAWINGS										
4 (BIORETENTION ESTABLISHMENT - 12 MONTHS AFTER COMPLETION OF STAGE 3)	PLANT DENSITY MEASURED AND IN ACCORDANCE WITH DESIGN DENSITY										
	INSTALLATION OF ADDITIONAL PLANTS IN AREAS WHERE DESIGN PLANT DENSITY HAS NOT BEEN ACHIEVED (WHERE REQUIRED)										
	BIORETENTION AND ALL SURROUNDING NATIVE PLANTING AREAS TO HAVE MAXIMUM AVERAGE WEED DENSITY OF 1/20 SQM, WITH SIGN-OFF BY ECOLOGIST.										
	REMOVAL OF TEMPORARY IRRIGATION SYSTEM										
	REMOVE TEMPORARY BLOCKING PLATE IN DIVERSION PIT TO ALLOW STORMWATER FLOWS INTO BIORETENTION										
	CLEANOUT OF DIVERSION PIT, AND REMOVAL OF TEMPORARY BLOCKING PLATE SO AS TO ALLOW STORMWATER TO FLOW INTO THE BIORETENTION SYSTEM										
	CLEANOUT OF GPT OR PRE-TREATMENT DEVICE										
	FLUSHING OF UNDERDRAINAGE PIPES										
	MAINTENANCE REPORT AT 3 MONTHS										
	MAINTENANCE REPORT AT 6 MONTHS										
	MAINTENANCE REPORT AT 9 MONTHS										
MAINTENANCE REPORT AT 12 MONTHS											
HANDOVER INSPECTION											

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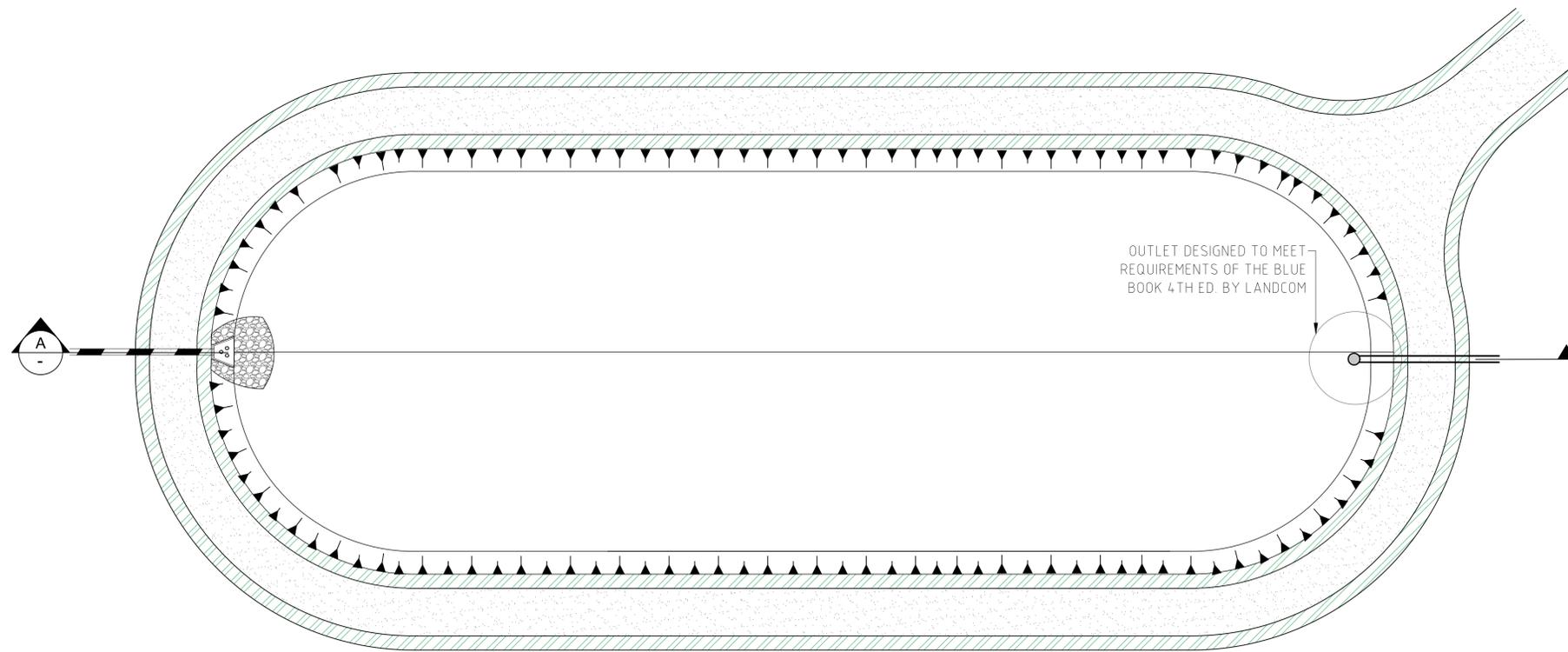
**WSUD STANDARD DRAWINGS**

PROJECT TITLE: WSUD STANDARD DRAWINGS  
SHEET TITLE: BIORETENTION NOTES - SHEET 2

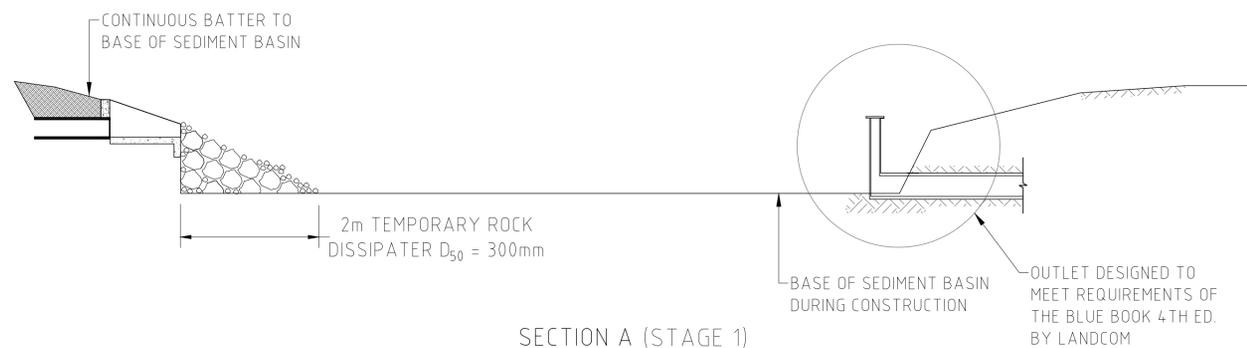


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Drawing No. **101**  
Revision **A**



PLAN 105-1  
STAGE 1  
NTS



SECTION A (STAGE 1)  
NTS

STAGING OF BIORETENTION CONSTRUCTION WORKS

DESIGN NOTES

- WHERE THE UPSTREAM CATCHMENT HAS NOT ACHIEVED 90% OF FINAL CONSTRUCTION, INCLUDING LANDSCAPING, THE BIORETENTION SYSTEM IS TO BE CONSTRUCTED WITH A SACRIFICIAL LAYER.
- ONCE THE 90% TARGET HAS BEEN ACHIEVED, THE BIORETENTION SYSTEM IS TO BE CONSTRUCTED WITHIN 6 MONTHS. CAPTURED SEDIMENT AND SATURATED SOIL IS TO BE REMOVED AND THE BIORETENTION SYSTEM CONSTRUCTED AS PER THE DESIGN.
- THE MAINTENANCE PERIOD OF THE SYSTEM IS TO EXTEND FOR MINIMUM 36 MONTHS FROM WHEN THE BIORETENTION SYSTEM IS FULLY PLANTED BEFORE HANDOVER TO ANY FINAL CUSTODIAN.
- BIORETENTION SYSTEMS SHALL ACHIEVE A MINIMUM DENSITY OF 8 PLANTS PER  $m^2$  AT 36 MONTHS AND BE VIGOROUS, HEALTHY AND FREE OF WEEDS. IT IS THE CONTRACTOR'S RESPONSIBILITY TO ADVISE COUNCIL IF THIS DENSITY IS NOT ACHIEVED AT 26 MONTHS AND TO REPLANT SO THAT ALL PLANTS HAVE BEEN GROWING A MINIMUM OF 12 MONTHS AT THE SPECIFIED DENSITY AT HAND OVER.
- ANY REQUIREMENT OF FENCING OR OTHER MEASURE TO ENSURE PUBLIC SAFETY IS THE RESPONSIBILITY OF THE CONTRACTOR AND MUST BE MAINTAINED IN ACCORDANCE WITH COUNCIL OR OTHER REQUIREMENTS FOR THE DURATION OF THE CONSTRUCTION AND ESTABLISHMENT PERIOD.

REFER TO HOLD AND INSPECTION POINTS ON SHEET 101.  
CONSTRUCTION ACTIVITIES CAN GENERATE LARGE SEDIMENT LOADS IN RUNOFF WHICH CAN SMOTHER VEGETATION AND CLOG BIORETENTION FILTER MEDIA. BIORETENTION BASINS ARE BEST CONSTRUCTED IN STAGES, IN CONJUNCTION WITH OTHER DEVELOPMENT ACTIVITIES:

STAGE 1

TEMPORARY SEDIMENT BASIN - EXCAVATE BULK EARTHWORKS, INSTALLATION OF OUTLET TO MEET REQUIREMENTS OF BLUE BOOK, INSTALLATION OF SYSTEM INLET HEADWALL, SURROUNDED EACH SIDE BY TEMPORARY ROCK DISSIPATOR. DISSIPATOR SHALL EXTEND A MINIMUM OF 2m AROUND THE INLET HEADWALL AND HAVE A  $D_{50} = 300mm$ .

STAGE 2

FUNCTIONAL INSTALLATION OF SACRIFICIAL BIORETENTION - ONCE UPSTREAM CATCHMENTS BULK EARTHWORKS ARE COMPLETE AND ROADS AND TRUNK DRAINAGE COMPLETED A SACRIFICIAL FILTER SYSTEM SHALL BE CONSTRUCTED. THIS INCLUDES:

- REMOVAL OF TEMPORARY ROCK DISSIPATOR AT SYSTEM INLET HEADWALL.
- REMOVAL OF ALL SEDIMENT
- INSTALLATION OF GEOTEXTILE AND LINERS UNDER
- INSTALLATION OF SUBSOIL DRAINS AND DRAINAGE LAYERS. TEMPORARY SUPPORT FLUSHING POINTS
- INSTALLATION OF 250mm OF TRANSITION LAYER
- INSTALLATION OF TEMPORARY GEOTEXTILE AND 150mm MEDIA OR COARSE SAND LAYER. INSTALLATION OF WASHED TURF OVER THE SACRIFICIAL MEDIA LAYER

STAGE 3

COMPLETION OF BIORETENTION ONCE 90% DEVELOPMENT HAS OCCURRED- REMOVAL OF TURF, SACRIFICIAL MEDIA LAYER AND TEMPORARY GEOTEXTILE INSTALLATION OF:

- SEDIMENT FOREBAY
- UPPER 200mm OF TRANSITION LAYER
- FILTER MEDIA LAYER
- PLANTING
- REMOVAL OF ALL SEDIMENT FROM PIPES, INLETS AND OUTLETS.

STAGE 4

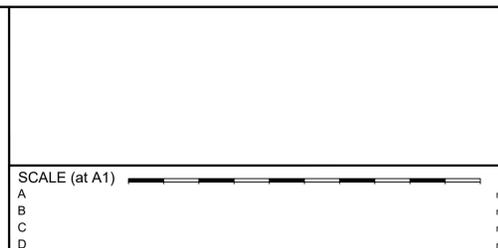
ESTABLISHMENT OF BIORETENTION SYSTEM FOR MONTHS 0 - 12 AFTER COMPLETION:

- OPERATION OF AUTOMATIC IRRIGATION SYSTEM
- TEMPORARY BLOCKAGE OF DIVERSION

ESTABLISHMENT OF BIORETENTION SYSTEM FOR MONTHS 13 - 36 AFTER COMPLETION:

- WEEDING
- PLANT REPLACEMENT AS REQUIRED.

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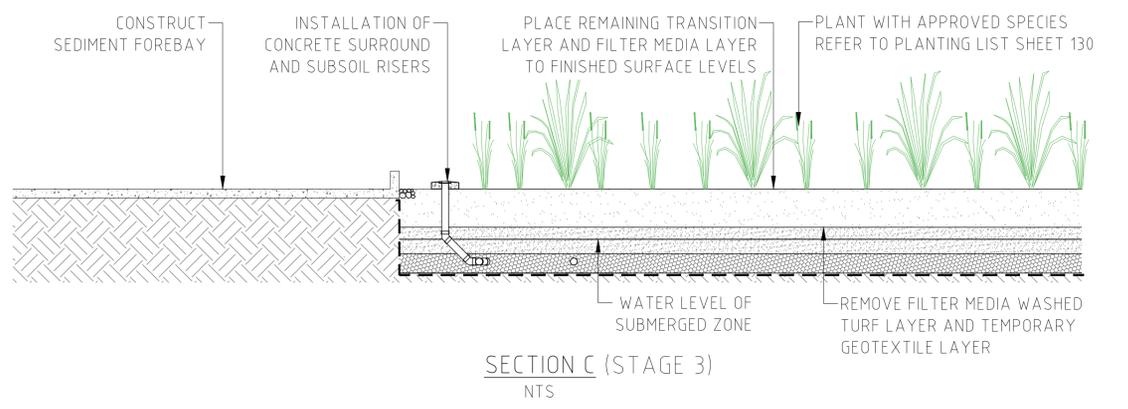
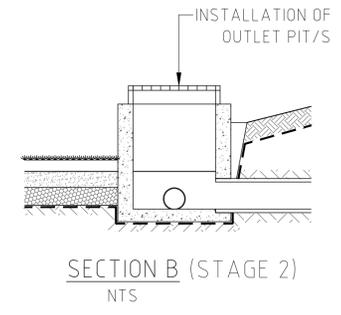
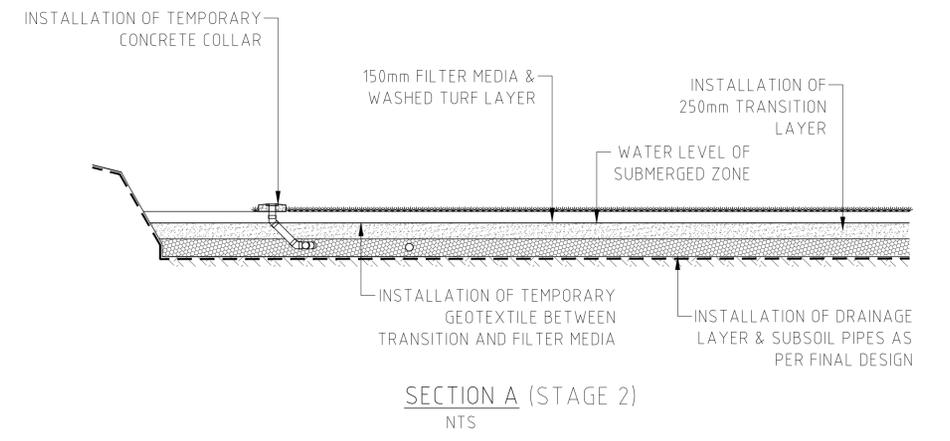
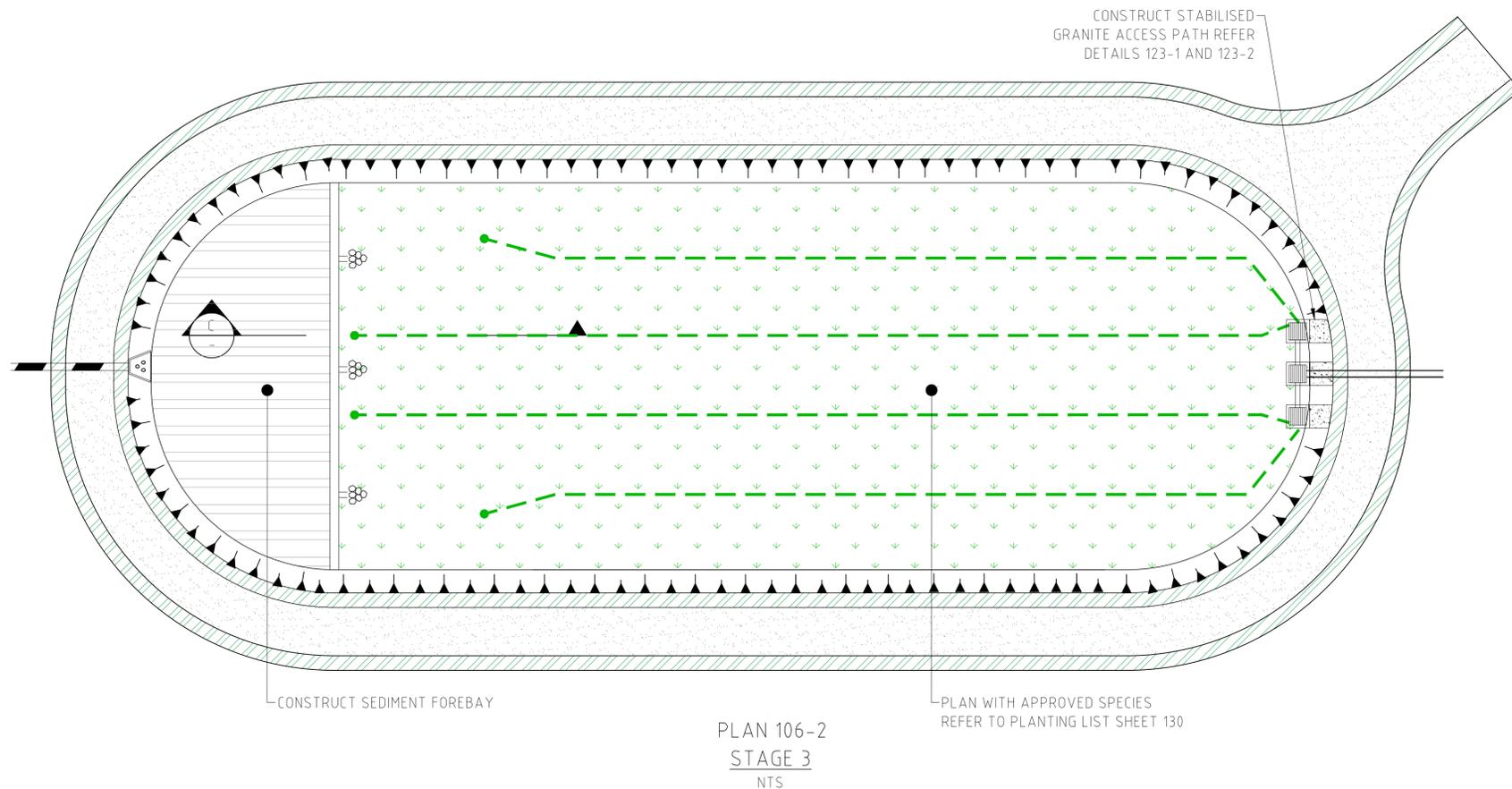
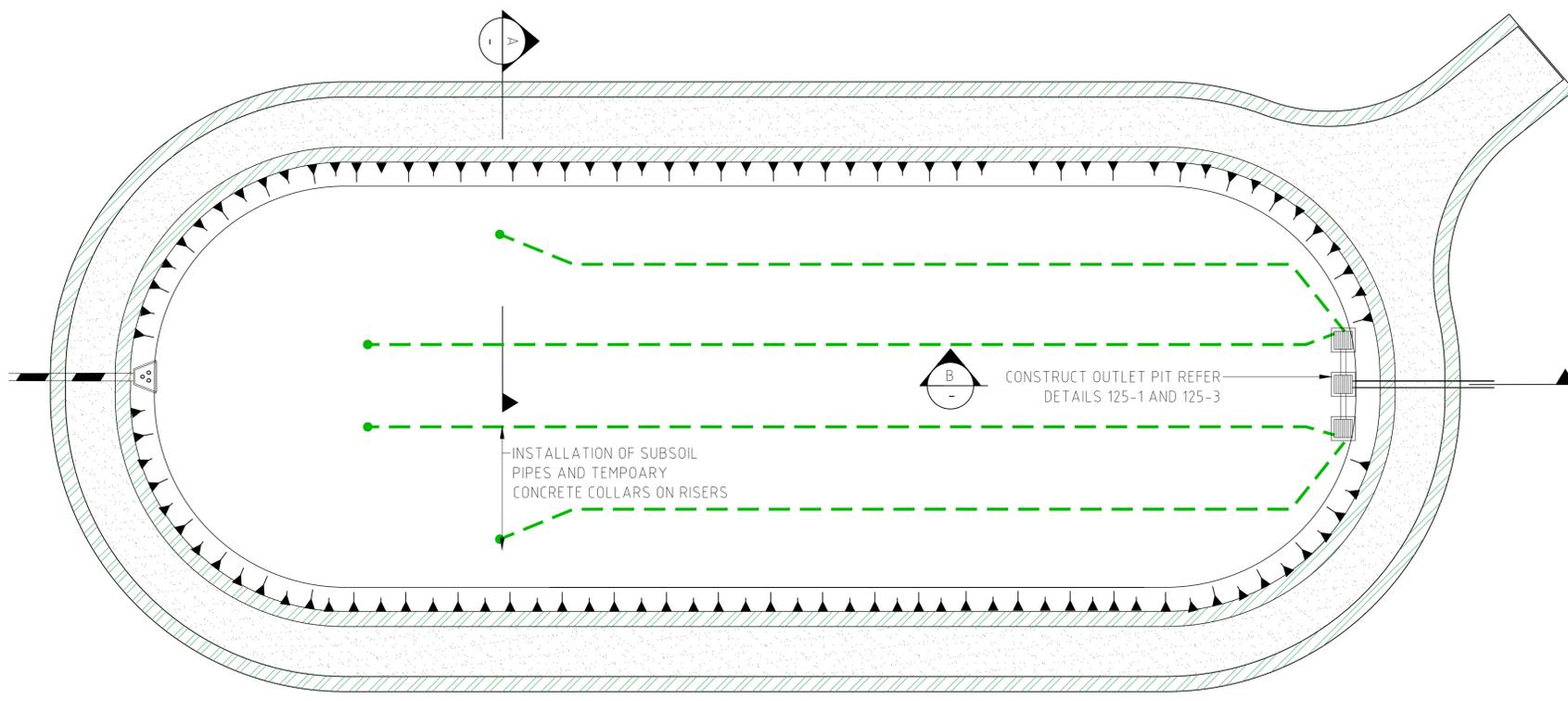
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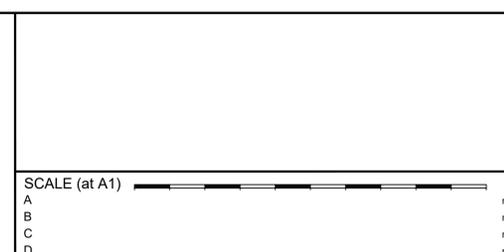
**WSUD STANDARD DRAWINGS**

PROJECT TITLE: WSUD STANDARD DRAWINGS  
SHEET TITLE: BIORETENTION - CONSTRUCTION WORKS STAGING - 1

Drawing No. **105**      Revision **A**



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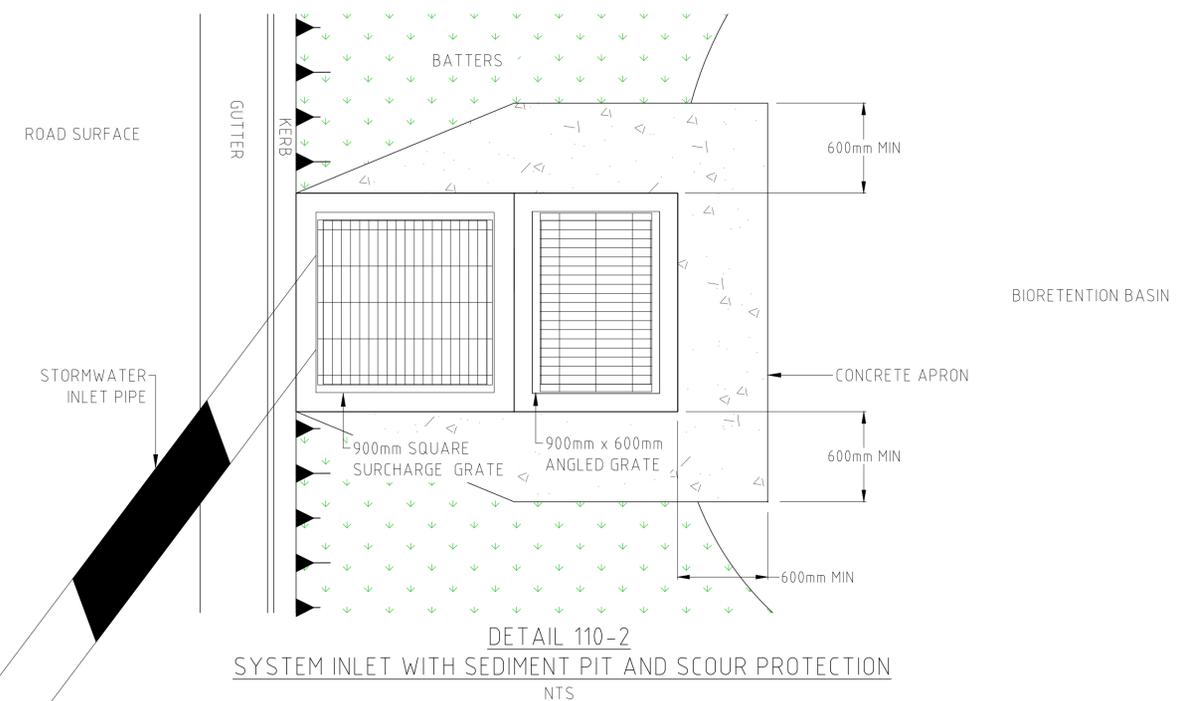
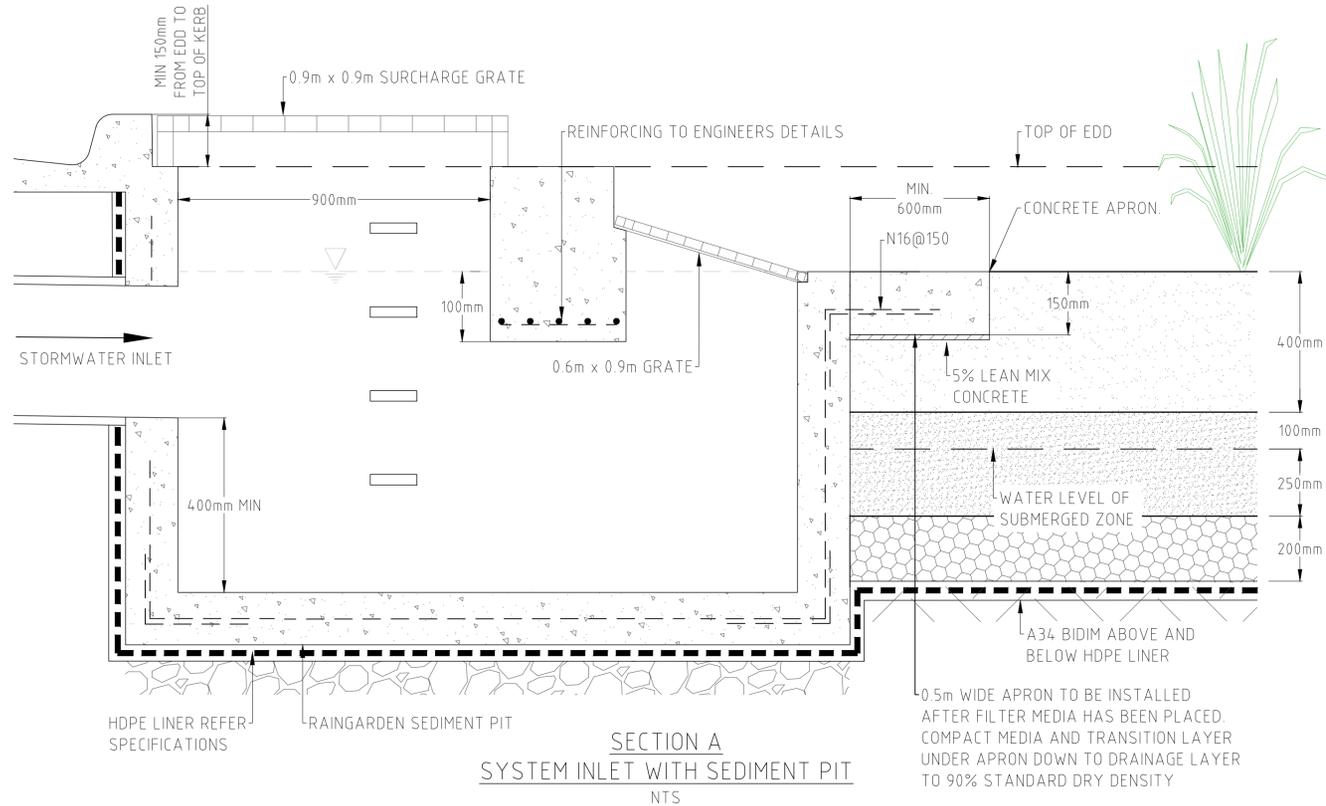
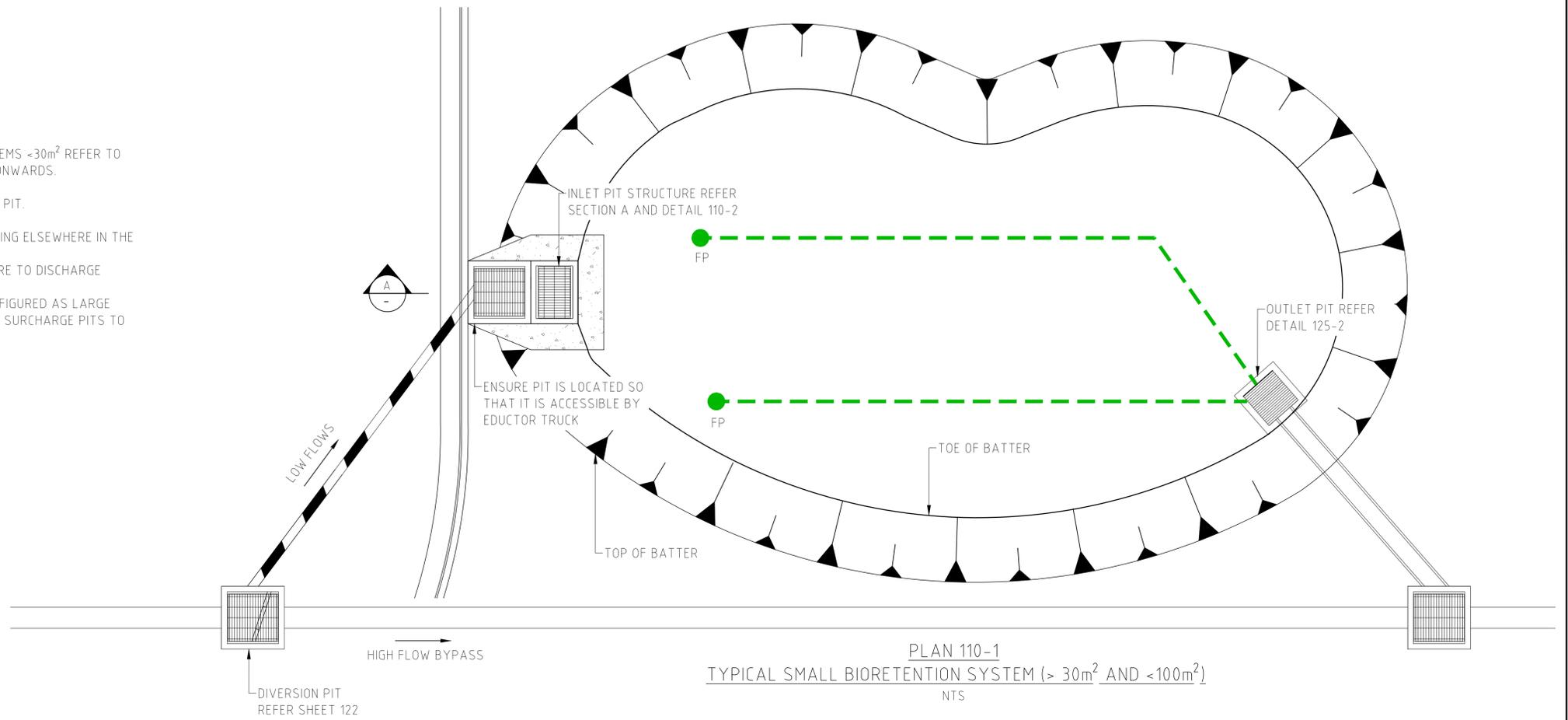
SHEET TITLE: BIORETENTION - CONSTRUCTION WORKS STAGING - 2

Drawing No. **106**

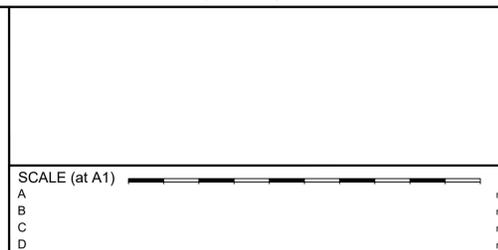
Revision **A**

**DESIGN NOTES**

1. THIS APPROACH IS TO BE USED FOR BIORETENTION SYSTEMS  $>30m^2$  AND  $<100m$  FOR SYSTEMS  $<30m^2$  REFER TO SHEET 140. FOR SYSTEMS LARGER THAN  $100m^2$  REFER TO DETAILS SHOWN ON SHEET 112 ONWARDS.
2. MAXIMUM LENGTH TO BE 20m.
3. FOR CATCHMENTS UP TO  $1ha$  THE MINIMUM REQUIREMENT IS FOR A RAINGARDEN SEDIMENT PIT.
4. FOR CATCHMENTS GREATER THAN  $1ha$ , A GPT IS TO BE INSTALLED
5. ENSURE THE HGL IN ALL UPSTREAM PITS IS ABOVE THE EDD HEIGHT TO PREVENT UPWELLING ELSEWHERE IN THE SYSTEM & DIRECT ALL OVERLAND FLOWS TOWARDS THE BASIN
6. WHERE THE BIORETENTION FORMS PART OF A DETENTION SYSTEM THE SUBSOIL FLOWS ARE TO DISCHARGE DOWNSTREAM OF THE DISCHARGE CONTROL PIT.
7. AS AN ALTERNATIVE TO THE ARRANGEMENT SHOWN HERE, SMALL SYSTEMS MAY BE CONFIGURED AS LARGE SYSTEMS (REFER SHEETS 112,113) USING A SEDIMENT FOREBAY OR PERMEABLE PIPES AND SURCHARGE PITS TO DISTRIBUTE THE FLOW.



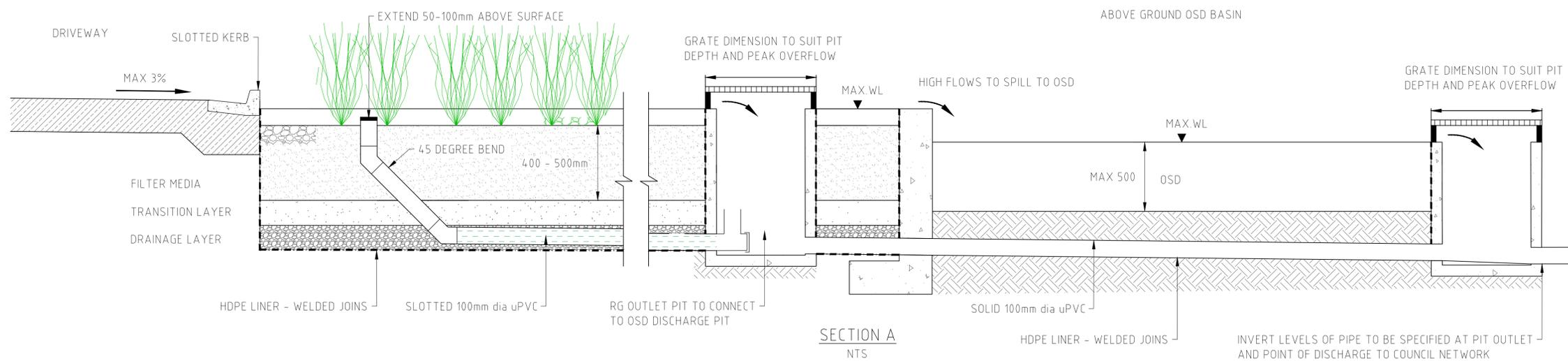
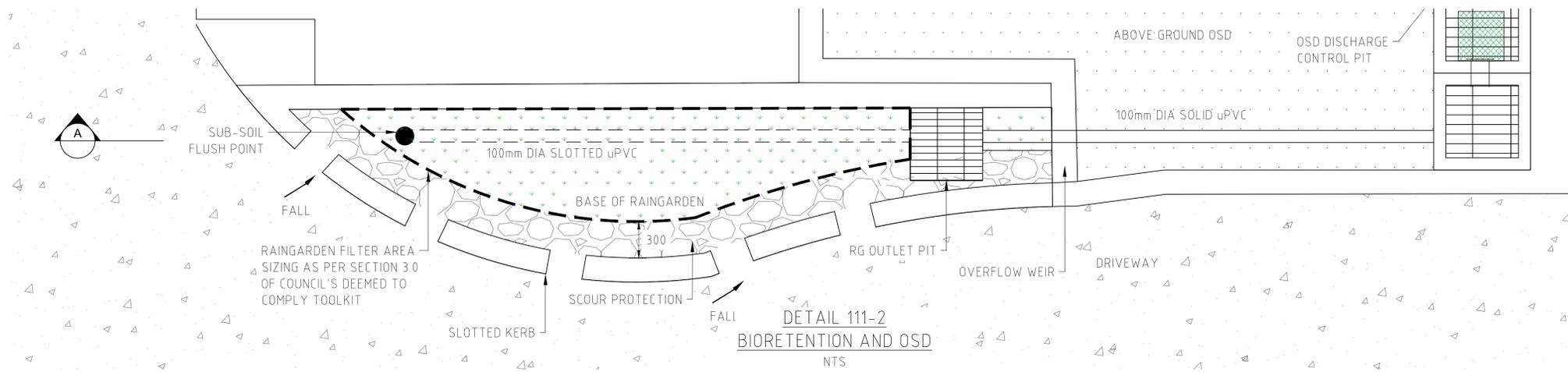
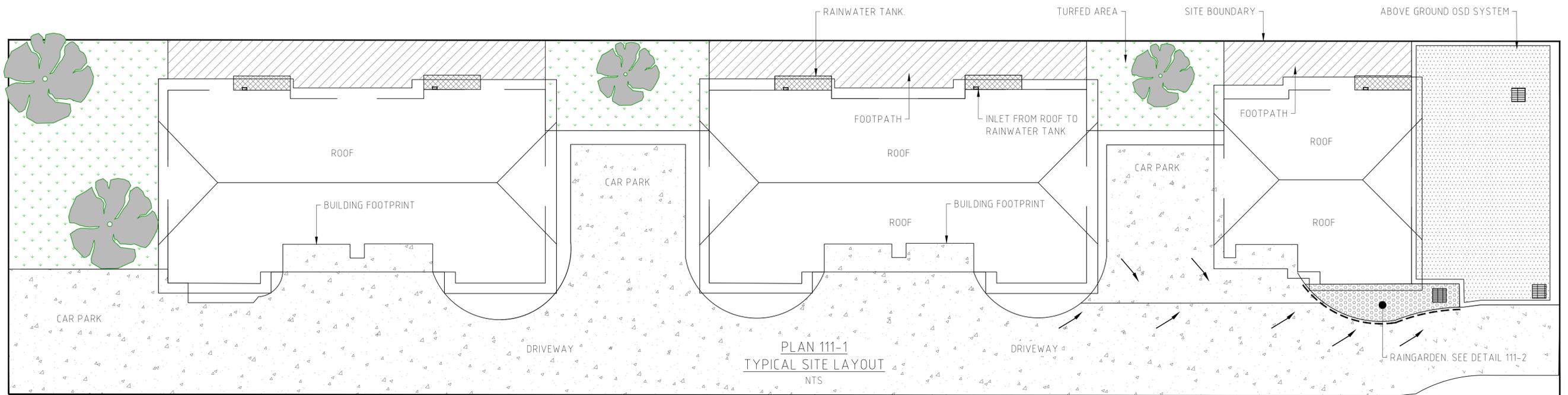
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WSUD STANDARD DRAWINGS	
PROJECT TITLE:	WSUD STANDARD DRAWINGS
SHEET TITLE:	BIORETENTION GENERAL ARRANGEMENT 30 - 100 SQM
Drawing No.	110
Revision	A



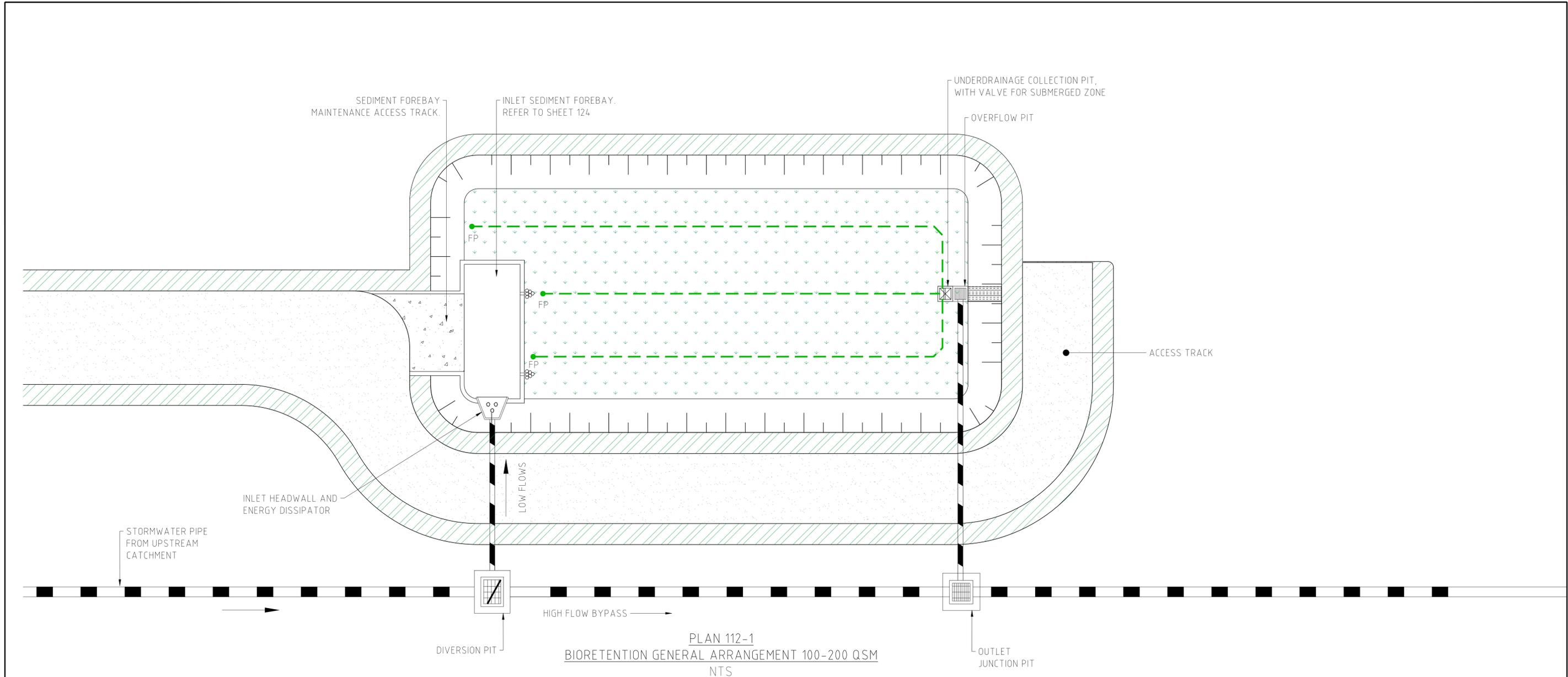
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SCALE (at A1)	
A	0m
B	1m
C	2m
D	3m

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<b>WSUD STANDARD DRAWINGS</b>	
PROJECT TITLE:	WSUD STANDARD DRAWINGS
SHEET TITLE:	BIORETENTION GENERAL ARRANGEMENT - VILLA EXAMPLE
Drawing No.	111
Revision	A



PLAN 112-1  
 BIORETENTION GENERAL ARRANGEMENT 100-200 QSM  
 NTS

- LEGEND
-  DIVERSION PIT REFER TO SHEET 122
  -  STORMWATER PIPE
  -  SUBSOIL DRAINAGE PIPE
  -  SUBSOIL FLUSHING POINT REFER DETAIL 120-5

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SCALE (at A1)



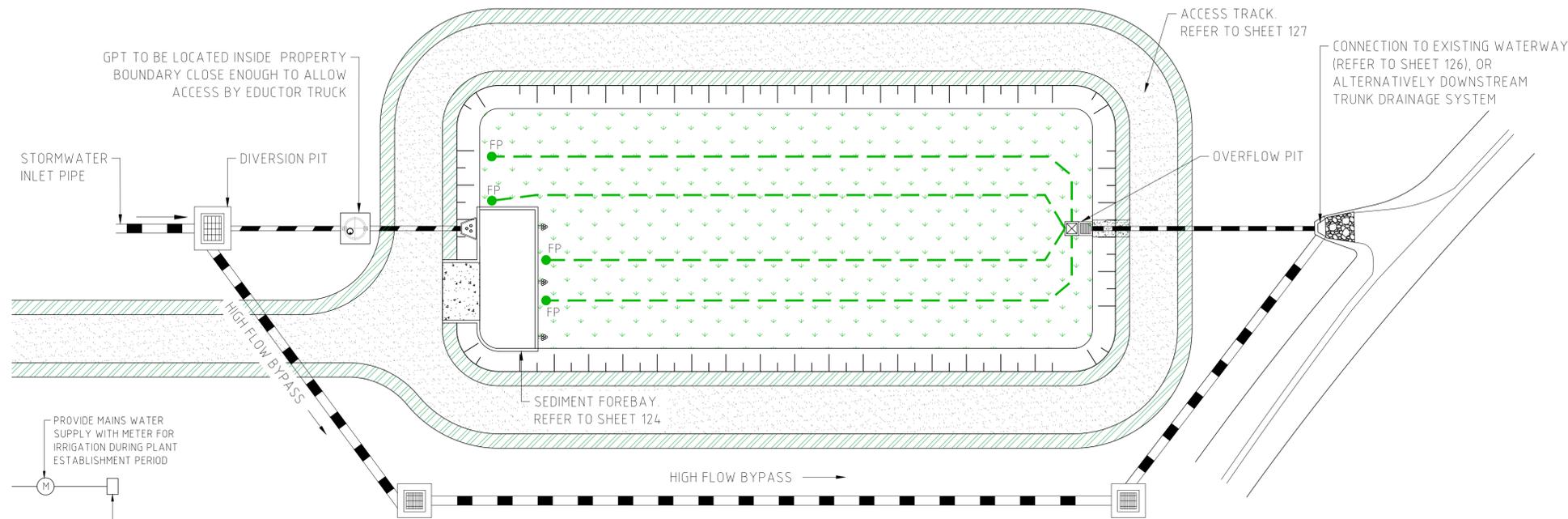
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**WSUD STANDARD DRAWINGS**

PROJECT TITLE: WSUD STANDARD DRAWINGS  
 SHEET TITLE: BIORETENTION GENERAL ARRANGEMENT  
 100 - 200 SQM

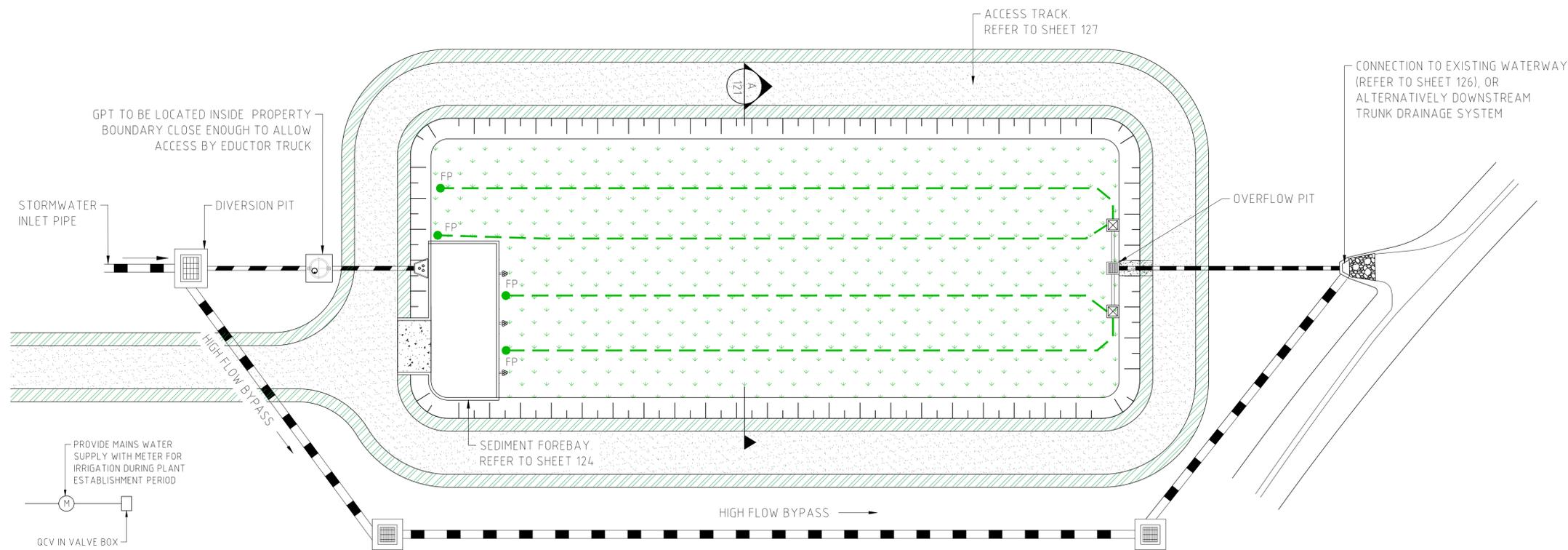
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PLAN 113-1  
 BIORETENTION GENERAL ARRANGEMENT 200-400 QSM  
 NTS

LEGEND

- OUTLET PIT AND PIPE REFER TO SHEET 125
- STORMWATER PIPE
- SUBSOIL DRAINAGE PIPE
- SUBSOIL FLUSHING POINT REFER DETAIL 120-5



PLAN 113-2  
 BIORETENTION GENERAL ARRANGEMENT 400-600 QSM  
 NTS

DESIGN NOTES

1. BIORETENTION SYSTEMS SHALL BE DESIGNED TO ACCEPT ONLY LOW FLOWS WITH A HIGH FLOW BYPASS DIVERTED AROUND THE BIORETENTION SYSTEM.
2. GENERALLY BIORETENTION SYSTEMS ARE DESIGNED TO TREAT THE 6 MONTH PEAK FLOW BEING APPROXIMATELY THE 0.75 x 1 YEAR ARI.
3. THE ACCESS TRACK SHALL BE 4m WIDE AND GRADED WITH A 3% CROSSFALL REFER SHEET 127. ACCESS TRACKS SHALL BE DESIGNED FOR ACCESS BY A 9m SERVICE VEHICLE. EVERY PART OF THE BASIN SHALL BE REACHABLE BY AN EXCAVATOR WITH A 9m REACH.
4. SUBSOIL PIPES SHALL BE LAID HORIZONTAL.
5. DESIGNERS SHALL CONSIDER DEPTH OF PIPES & SPECIFY APPROPRIATE PIPE CLASSES.
6. OUTLET PIPES SHALL BE DESIGNED TO HAVE THE SAME CAPACITY AS INLET PIPES.
7. THE OVERFLOW/OUTLET PIT SHALL BE SIZED TO CONVEY THE DESIGN INFLOW SUCH THAT THE DEPTH OF FLOW, H, ABOVE THE PIT INLET LEVEL IS LIMITED TO LESS THAN 100mm USING THE WEIR EQUATION. THE DESIGNER SHALL ASSUME THAT ONLY 50% OF THE WEIR LENGTH IS AVAILABLE AND THE REMAINING 50% IS BLOCKED.
8. UPFLOW PITS SHALL BE LOCATED ON EDGE OF FILTER MEDIA AS SHOWN AND SPACED TO ALLOW AN EVEN DISTRIBUTION OF WATER INTO THE BIORETENTION SYSTEM WITH A MAXIMUM SPACING OF 20m.
9. LINER TO BE IN ACCORDANCE WITH DETAIL 121.

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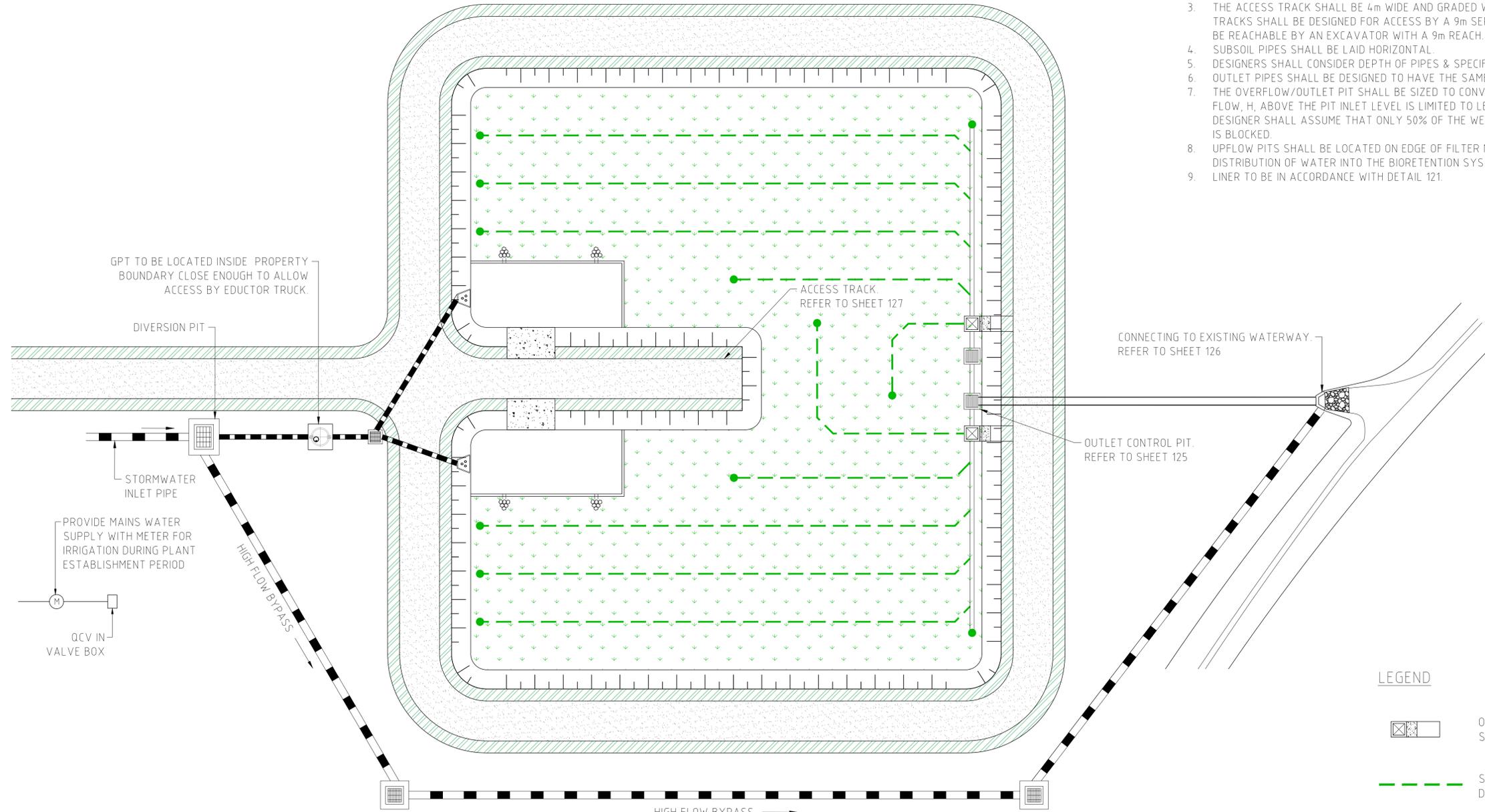
WSUD STANDARD DRAWINGS

PROJECT TITLE: WSUD STANDARD DRAWINGS  
 SHEET TITLE: BIORETENTION GENERAL ARRANGEMENT  
 200 - 600 SQM

Drawing No. **113** Revision **A**

DESIGN NOTES

1. BIORETENTION SYSTEMS SHALL BE DESIGNED TO ACCEPT ONLY LOW FLOWS WITH A HIGH FLOW BYPASS DIVERTED AROUND THE BIORETENTION SYSTEM.
2. GENERALLY BIORETENTION SYSTEMS ARE DESIGNED TO TREAT THE 6 MONTH PEAK FLOW BEING APPROXIMATELY THE 0.75 x 1 YEAR ARI.
3. THE ACCESS TRACK SHALL BE 4m WIDE AND GRADED WITH A 3% CROSSFALL REFER SHEET 127. ACCESS TRACKS SHALL BE DESIGNED FOR ACCESS BY A 9m SERVICE VEHICLE. EVERY PART OF THE BASIN SHALL BE REACHABLE BY AN EXCAVATOR WITH A 9m REACH.
4. SUBSOIL PIPES SHALL BE LAID HORIZONTAL.
5. DESIGNERS SHALL CONSIDER DEPTH OF PIPES & SPECIFY APPROPRIATE PIPE CLASSES.
6. OUTLET PIPES SHALL BE DESIGNED TO HAVE THE SAME CAPACITY AS INLET PIPES.
7. THE OVERFLOW/OUTLET PIT SHALL BE SIZED TO CONVEY THE DESIGN INFLOW SUCH THAT THE DEPTH OF FLOW, H, ABOVE THE PIT INLET LEVEL IS LIMITED TO LESS THAN 100mm USING THE WEIR EQUATION. THE DESIGNER SHALL ASSUME THAT ONLY 50% OF THE WEIR LENGTH IS AVAILABLE AND THE REMAINING 50% IS BLOCKED.
8. UPFLOW PITS SHALL BE LOCATED ON EDGE OF FILTER MEDIA AS SHOWN AND SPACED TO ALLOW AN EVEN DISTRIBUTION OF WATER INTO THE BIORETENTION SYSTEM WITH A MAXIMUM SPACING OF 20m.
9. LINER TO BE IN ACCORDANCE WITH DETAIL 121.



PLAN 114-1  
BIORETENTION GENERAL ARRANGEMENT 600-1000 SQM  
NTS

LEGEND

-  OUTLET PIT AND PIPE REFER TO SHEET 124
-  SUBSOIL DRAINAGE PIPE REFER DETAIL 120-4
-  SUBSOIL FLUSHING POINT REFER DETAIL 120-7

REV	DESCRIPTION	DATE	APPROVED
B	FOR COUNCIL REVIEW	26/7/19	TN
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WSUD STANDARD DRAWINGS

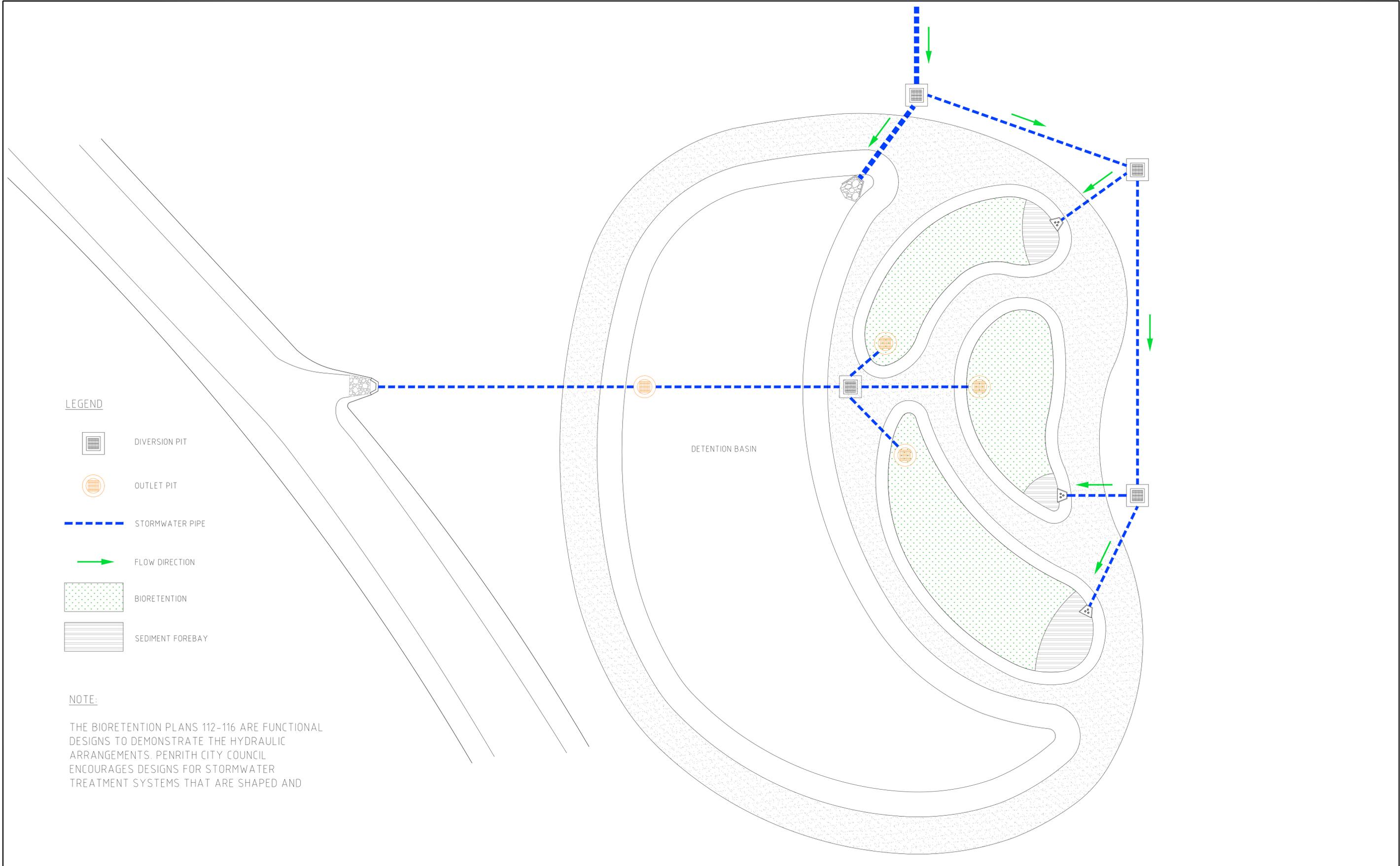
PROJECT TITLE: WSUD STANDARD DRAWINGS  
SHEET TITLE: BIORETENTION GENERAL ARRANGEMENT  
600 - 1000 SQM

Drawing No.  
**114**

Revision  
**A**







**LEGEND**

-  DIVERSION PIT
-  OUTLET PIT
-  STORMWATER PIPE
-  FLOW DIRECTION
-  BIORETENTION
-  SEDIMENT FOREBAY

**NOTE:**

THE BIORETENTION PLANS 112-116 ARE FUNCTIONAL DESIGNS TO DEMONSTRATE THE HYDRAULIC ARRANGEMENTS. PENRITH CITY COUNCIL ENCOURAGES DESIGNS FOR STORMWATER TREATMENT SYSTEMS THAT ARE SHAPED AND

REV	DESCRIPTION	DATE	APPROVED
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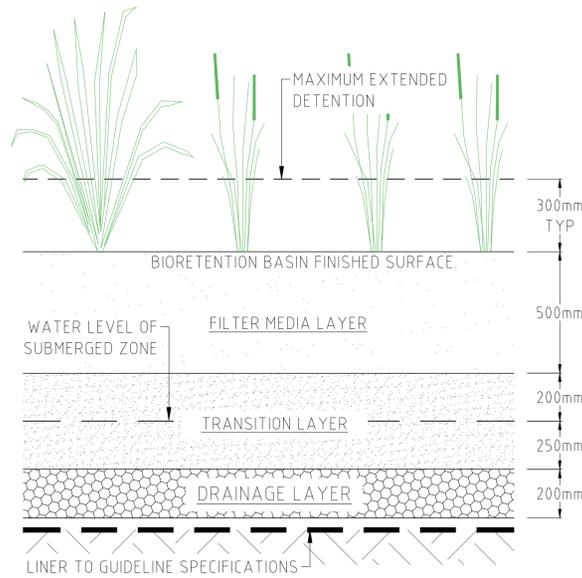
SCALE (at A1) 

A  
B  
C  
D

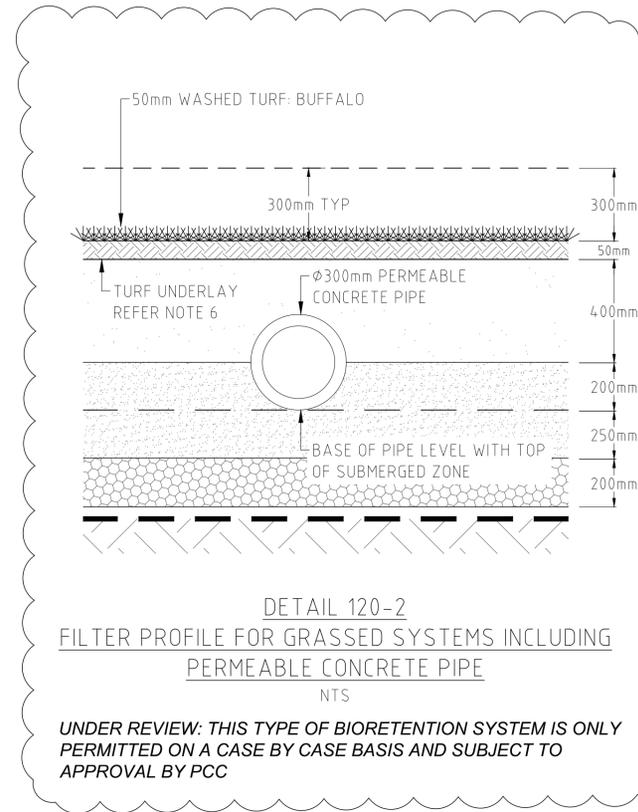


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WSUD STANDARD DRAWINGS	
PROJECT TITLE:	WSUD STANDARD DRAWINGS
SHEET TITLE:	MULTI-CELL BIORETENTION LAYOUT
Drawing No.	Revision
<b>118</b>	<b>A</b>

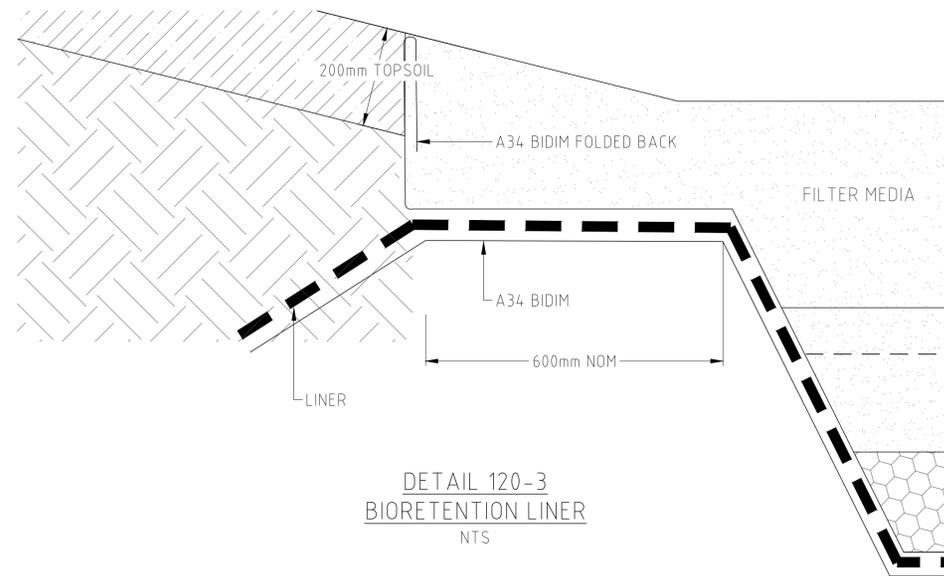


DETAIL 120-1  
TYPICAL BIORETENTION FILTER PROFILE  
NTS

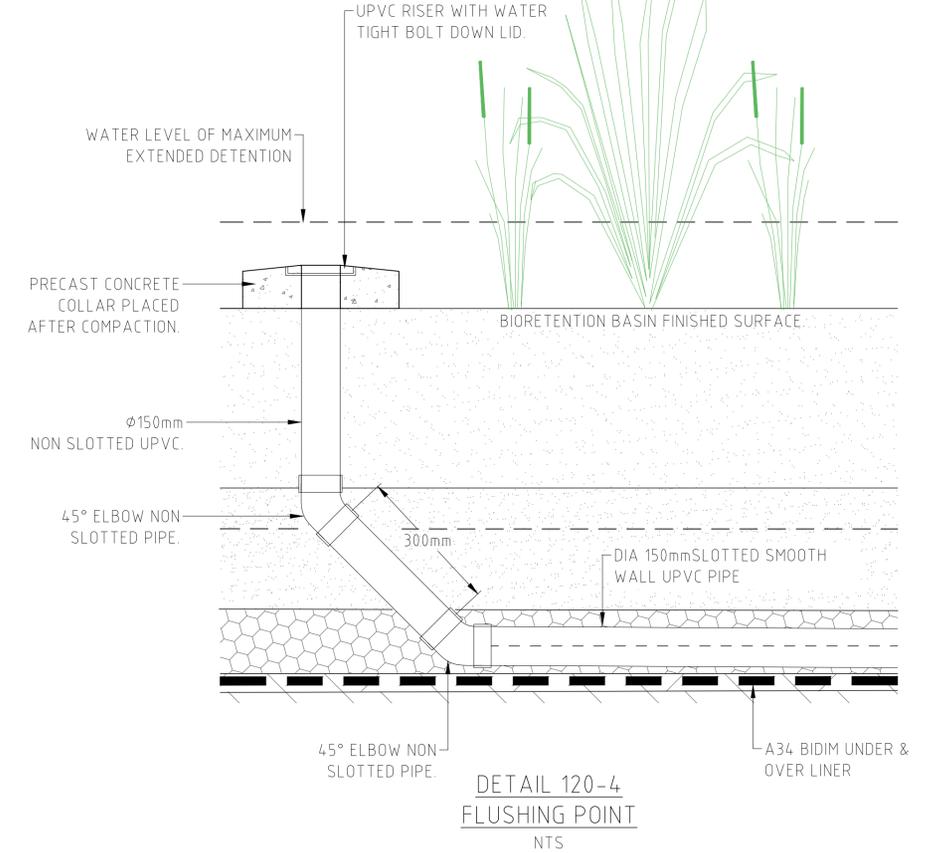


DETAIL 120-2  
FILTER PROFILE FOR GRASSED SYSTEMS INCLUDING  
PERMEABLE CONCRETE PIPE  
NTS

UNDER REVIEW: THIS TYPE OF BIORETENTION SYSTEM IS ONLY PERMITTED ON A CASE BY CASE BASIS AND SUBJECT TO APPROVAL BY PCC



DETAIL 120-3  
BIORETENTION LINER  
NTS



DETAIL 120-4  
FLUSHING POINT  
NTS

DESIGN NOTES

1. EDD MAY BE INCREASED TO 500MM WHERE REQUIRED.
2. GEOTEXTILE FABRICS MUST NOT BE USED BETWEEN THE FILTER MEDIA, TRANSITION AND DRAINAGE LAYERS IN BIORETENTION SYSTEMS DUE TO THE RISK OF CLOGGING. THE SOIL SPECIFICATIONS ARE DESIGNED TO LIMIT THE MIGRATION OF PARTICLES THROUGH THE SYSTEM.
3. NO GEOTEXTILE SOCKS TO BE INSTALLED ON THE SLOTTED DRAINAGE PIPES.
4. THE TOP LEVEL OF THE SATURATED ZONE MUST BE LOCATED WITHIN THE TRANSITION LAYER 200mm BELOW THE FILTER MEDIA. THE HEIGHT OF THE SATURATED ZONE IS CONTROLLED BY THE OUTLET LEVEL. REFER SHEET 124.
5. FILTER MEDIA, TRANSITION AND DRAINAGE LAYERS SHALL BE PROVIDED IN ACCORDANCE WITH THE SPECIFICATION ON SHEET 100.
6. TURF UNDERLAY SHALL BE A 70:30 SAND:TOPSOIL MIX. SAND SHALL COMPLY WITH THE TRANSITION LAYER SPECIFICATION ON SHEET 100.
7. TOPSOIL SHALL COMPLY WITH AS4419. SITE TOPSOILS MAY BE REUSED PROVIDED THEY HAVE BEEN ASSESSED BY A QUALIFIED HORTICULTURIST OR SOIL SCIENTIST AND AMELIORATED ACCORDING TO THEIR RECOMMENDATIONS.
8. TURF SHALL BE WATERED IMMEDIATELY AFTER LAYING UNTIL UNDERLAY IS MOISTENED TO FULL DEPTH. CONTINUE WATERING AS REQUIRED TO MAINTAIN GROWTH RATES FREE OF STRESS FOR 6 WEEKS.
9. ONCE TURF HAS ESTABLISHED (4-6 WEEKS TYP.) TOP DRESS WITH FILTER MEDIA TO CREATE A LEVEL FINISH, TWO OR MORE ADDITIONAL TOP DRESSES MAY BE REQUIRED DEPENDING ON THE EXTENT OF SETTLEMENT.

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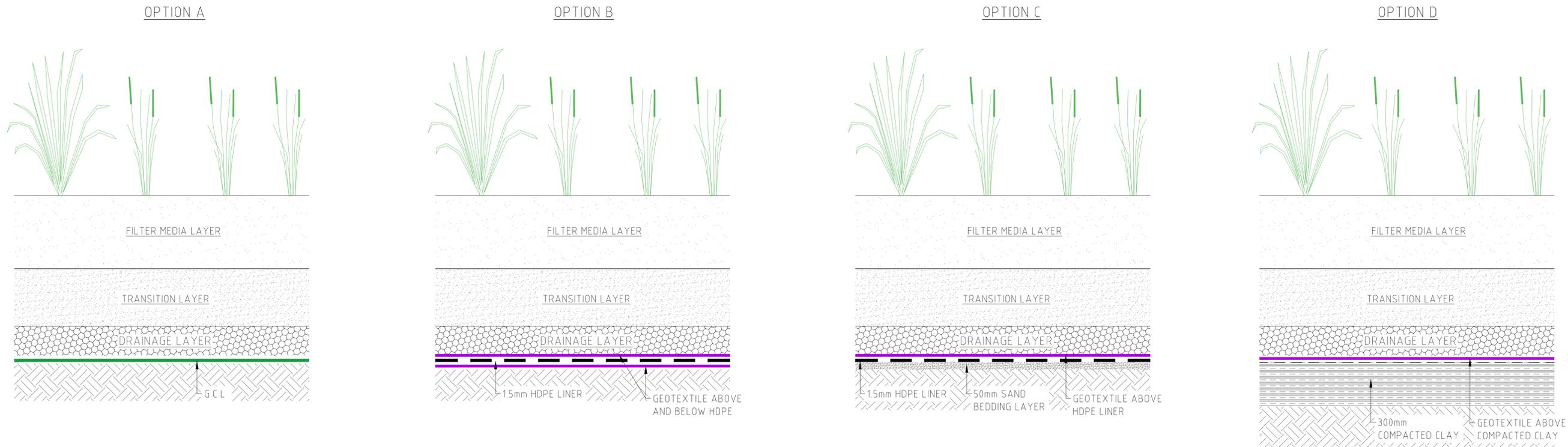
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WSUD STANDARD DRAWINGS

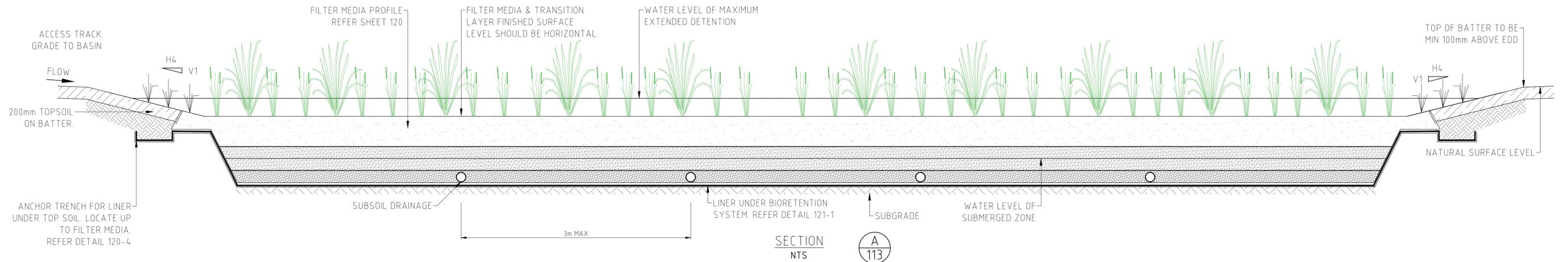
PROJECT TITLE: WSUD STANDARD DRAWINGS  
SHEET TITLE: BIORETENTION DETAILS - TYPICAL PROFILES

Drawing No. 120

Revision A



DETAIL 121-1  
LINER OPTIONS  
NTS



SECTION  
NTS  
A  
113

REV	DESCRIPTION	DATE	APPROVED
B	FOR COUNCIL REVIEW	26/7/19	TN
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SCALE (at A1)

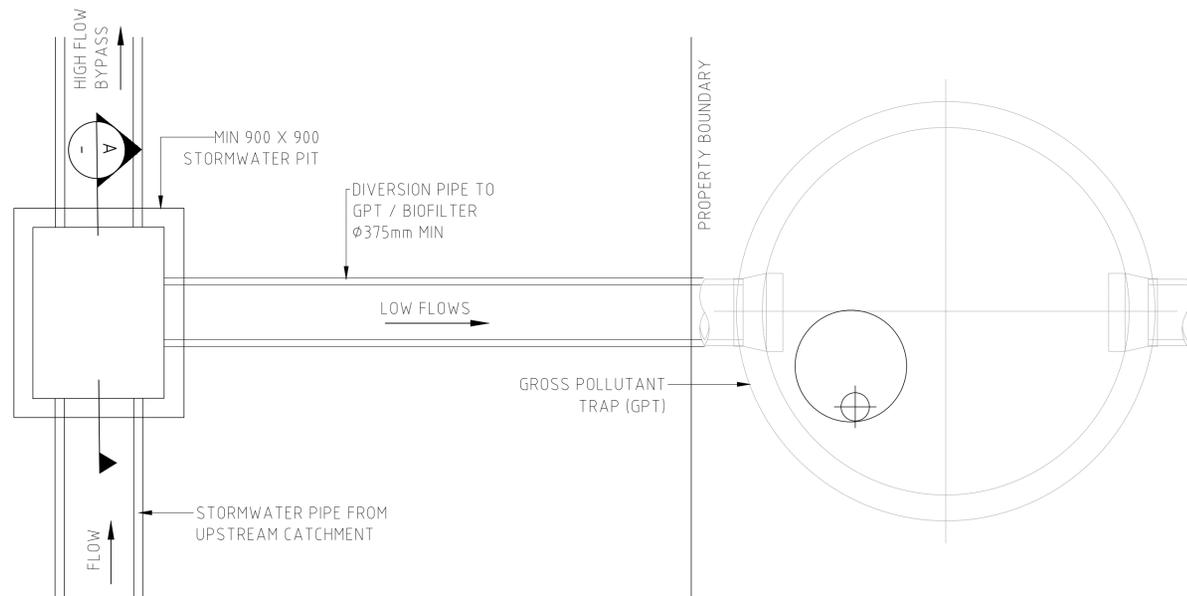
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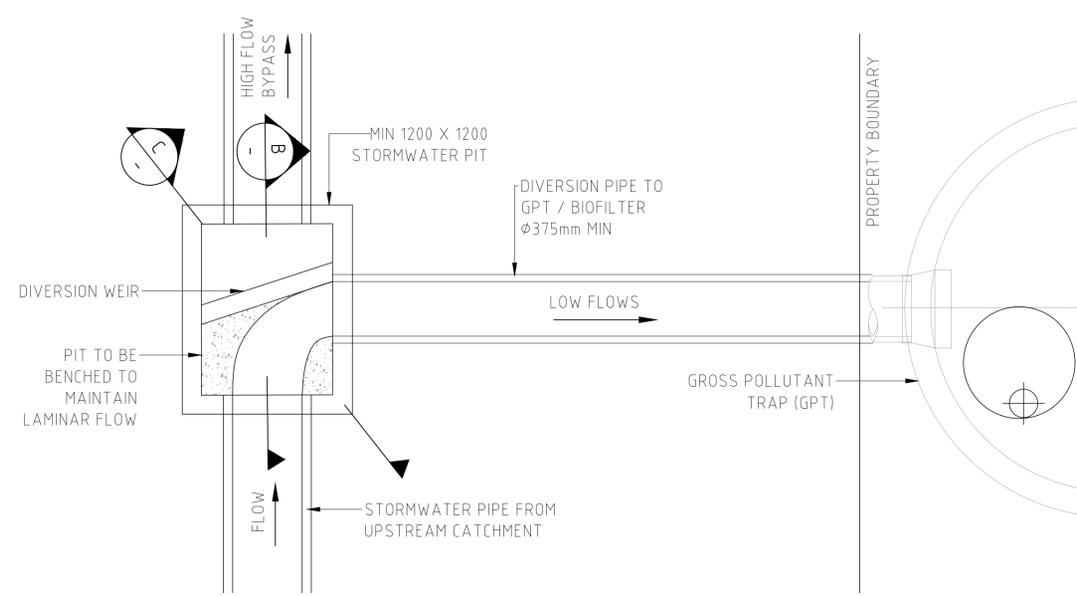
**WSUD STANDARD DRAWINGS**

PROJECT TITLE: WSUD STANDARD DRAWINGS  
SHEET TITLE: BIORETENTION DETAILS

Drawing No. **121**      Revision **A**



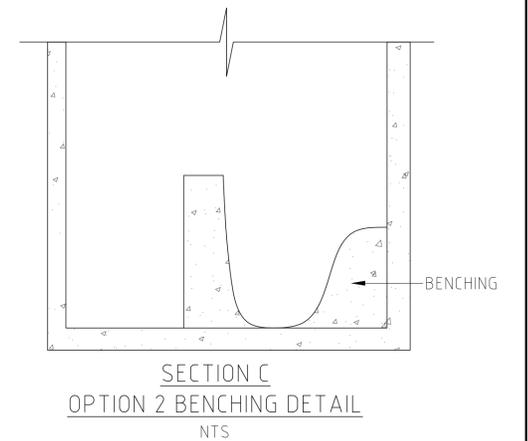
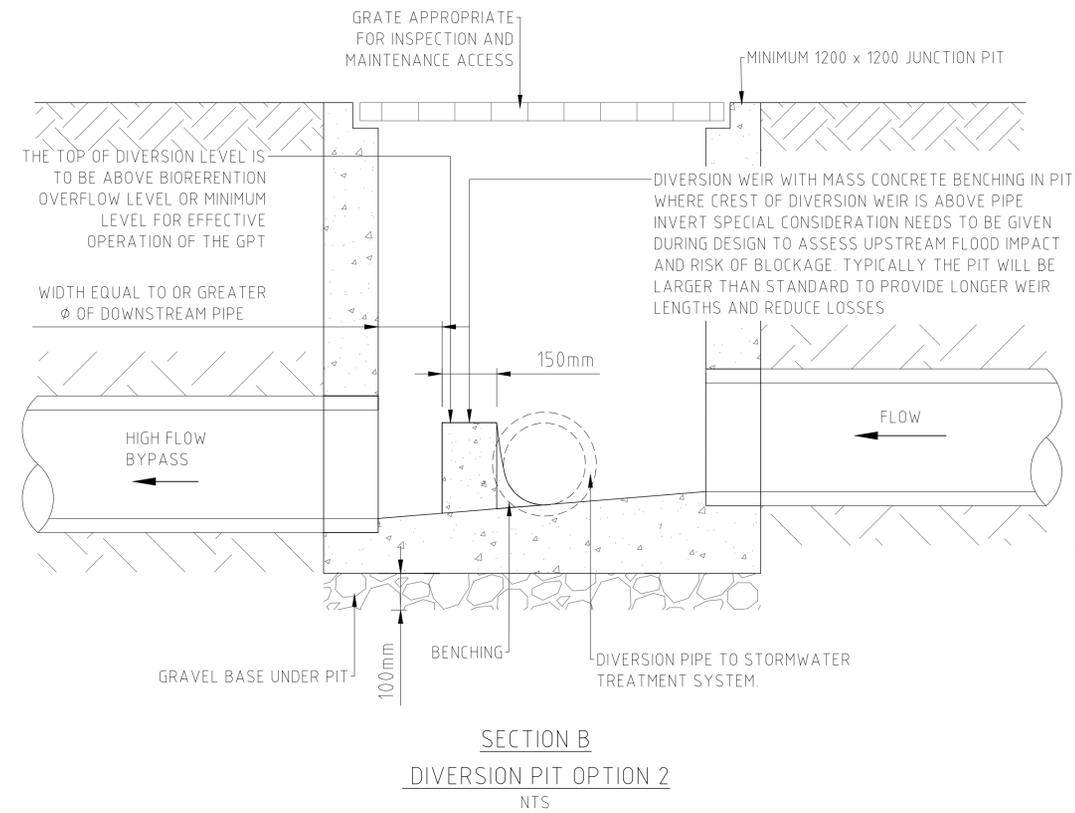
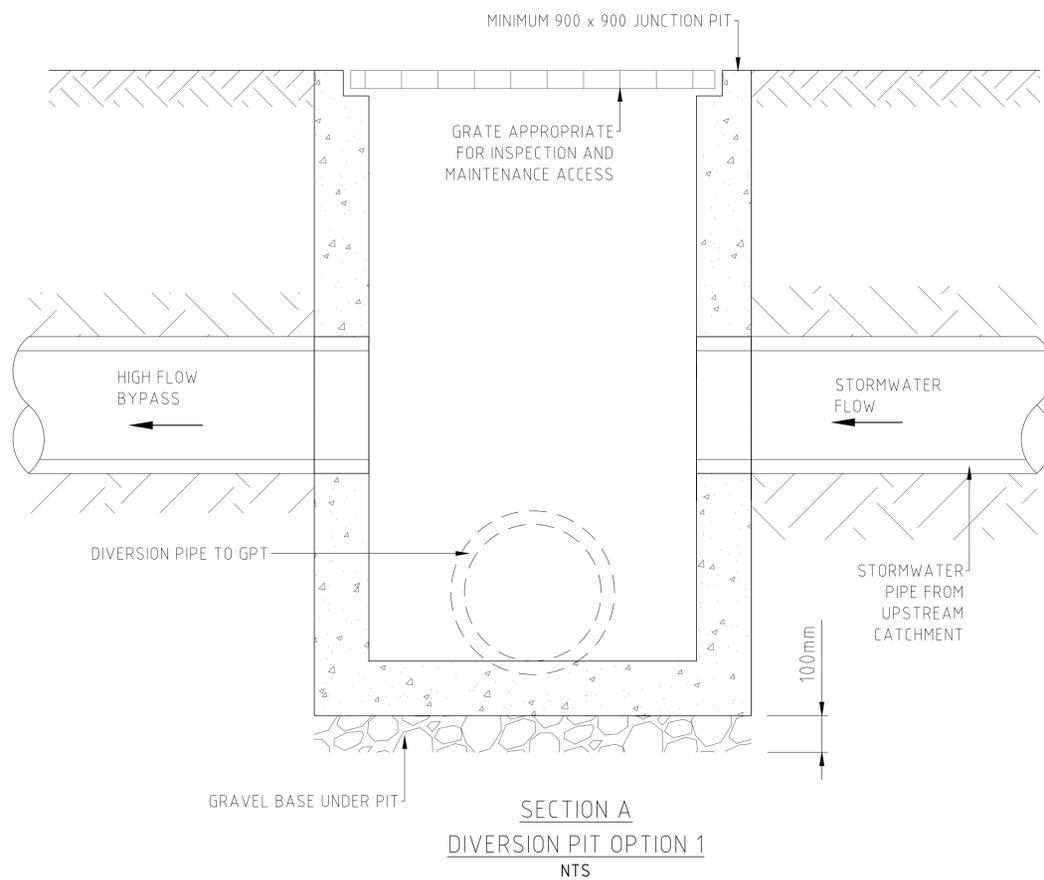
PLAN 122-1  
TYPICAL DIVERSION OPTION 1 - SUMP  
NTS



PLAN 122-2  
TYPICAL DIVERSION OPTION 2- WEIR  
NTS

DESIGN NOTES

1. DIVERSION PITS ARE KEY POINTS WHERE MAINTENANCE IS OFTEN REQUIRED - CONSIDER ACCESS AND MAINTENANCE TECHNIQUES. SUMPS WILL REQUIRE PERIODIC MAINTENANCE TO REMOVE ACCUMULATED MATERIAL.
2. WEIRS CAN ALSO BE USED TO DIVERT FLOWS WITHIN STORMWATER PITS, HOWEVER CHECK THE HYDRAULIC GRADE LINE TO AVOID IMPACTS ON HYDRAULIC GRADES UPSTREAM.
3. THE MINIMUM SIZE OF DIVERSION PIPE SHALL BE Ø375mm TO REDUCE BLOCKAGE RISK.
4. THE GRADE AND LEVEL OF THE DIVERSION PIPE SHALL BE DETERMINED BY HYDRAULIC DESIGN. TYPICALLY SYSTEMS SHOULD BE DESIGNED FOR 6 MONTH PEAK FLOW BEING THE 0.75 x 1 YEAR ARI.
5. GPTs SHALL BE DESIGNED TO TREAT 0.75 x 1YR ARI PEAK FLOW & REMOVE 50% ANNUAL TSS LOAD



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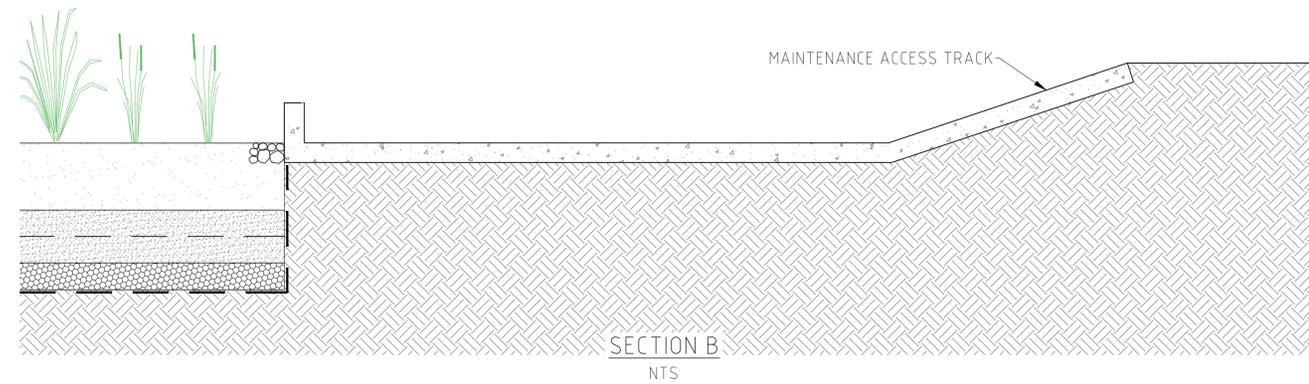
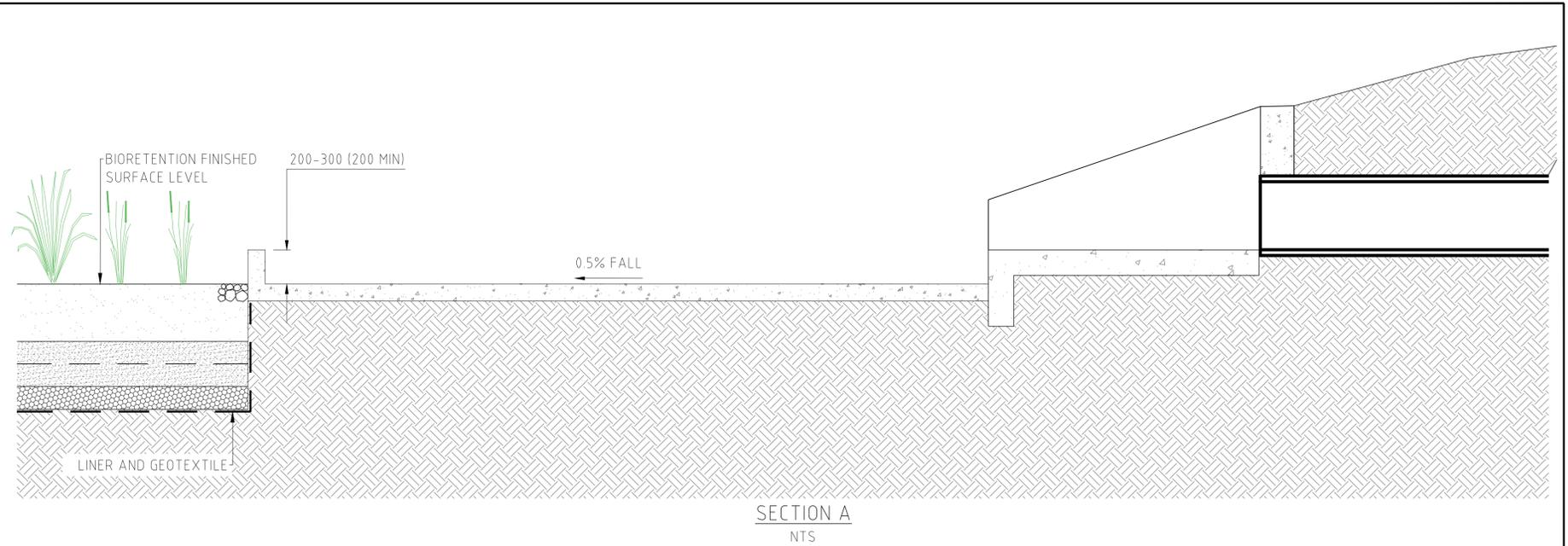
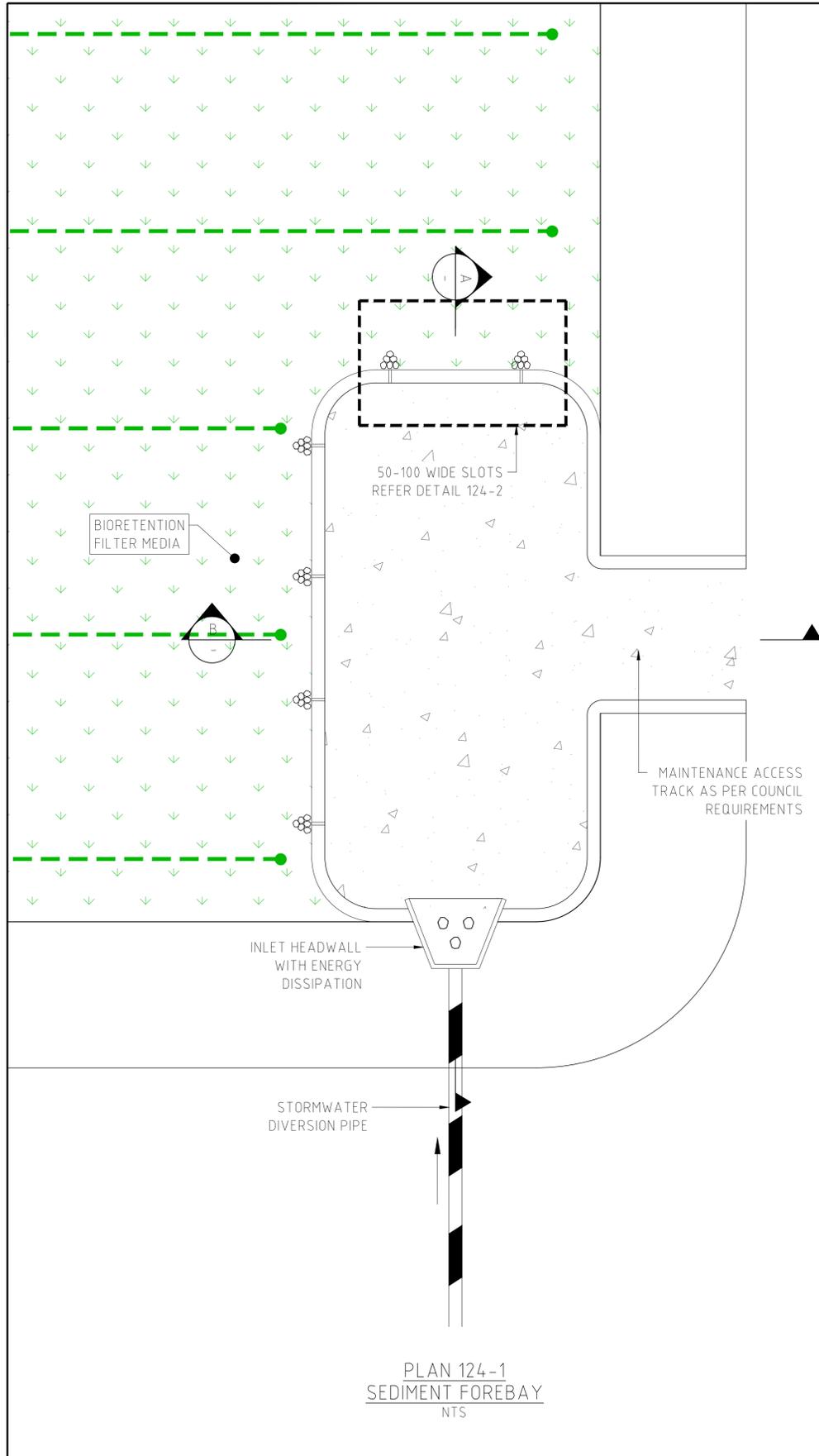
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**PENRITH CITY COUNCIL**

**WSUD STANDARD DRAWINGS**

PROJECT TITLE: WSUD STANDARD DRAWINGS  
SHEET TITLE: BIORETENTION DETAILS - INLET DIVERSION STRUCTURES

Drawing No. **122** Revision **A**



**NOTES**

1. THE SIZE OF THE SEDIMENT FOREBAY IS ESTABLISHED USING THE FOLLOWING: (TAKEN FROM WATER BY DESIGN, 2014, P.71-2)

$$V_s = A_c \times R \times L_0 \times F_c$$

WHERE:  
 $V_s$  = VOLUME OF FOREBAY SEDIMENT STORAGE REQUIRED (m<sup>3</sup>)  
 $A_c$  = CONTRIBUTING CATCHMENT AREA (ha)  
 $R$  = CAPTURE EFFICIENCY (ASSUME 80%)  
 $L_0$  = SEDIMENT LOADING RATE (m<sup>3</sup>/ha/year) - ASSUME 1m<sup>3</sup>/ha/year  
 $F_c$  = DESIRED CLEAN-OUT FREQUENCY (year) - ASSUME 4 CLEAN-OUTS PER YEAR

THE AREA OF THE FOREBAY IS ESTABLISHED BY DIVIDING THE VOLUME BY THE DEPTH. THE DEPTH OF THE FOREBAY SHOULD NOT BE GREATER THAN 0.3M BELOW THE SURFACE OF THE FILTER MEDIA.

$$A_s = V_s / D$$

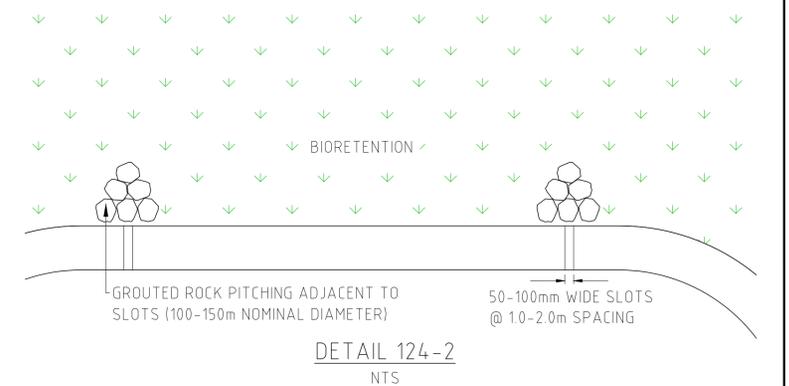
WHERE:  
 $D$  = DEPTH OF SEDIMENT FOREBAY (MAX 0.3 M BELOW FILTER MEDIA SURFACE)  
 THE SEDIMENT FOREBAY AREA SHOULD BE CHECKED TO ENSURE IT CAPTURES THE 1MM AND GREATER PARTICLES USING THE FOLLOWING EXPRESSION (MODIFIED VERSION OF FAIR AND GEYER (1954):

$$R = 1 - [1 + 1/n \cdot V_T / (Q/A)]^{-n}$$

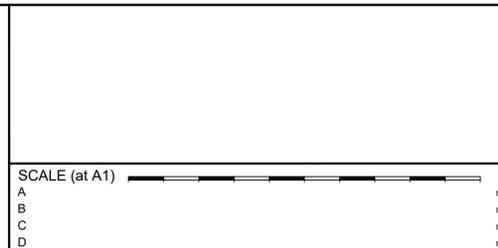
WHERE:  
 $R$  = FRACTION OF TARGET SEDIMENT REMOVED (80%)  
 $V_T$  = SETTLING VELOCITY OF TARGET SEDIMENT (100mm/s OR 0.1m/s FOR 1mm PARTICLE)  
 $Q/A$  = APPLIED FLOW RATE DIVIDED BY BASIN SURFACE AREA (m<sup>3</sup>/s/m<sup>2</sup>)  
 $n$  = TURBULENCE OR SHORT-CIRCUITING PARAMETER (ADOPT 0.5)

2. PREFER L/W OF FOREBAY IS MIN 2:1

3. STORMWATER PIPE TO BE ALIGNED AT A MAXIMUM OF 45° TO THE LONG AXIS OF THE FOREBAY.



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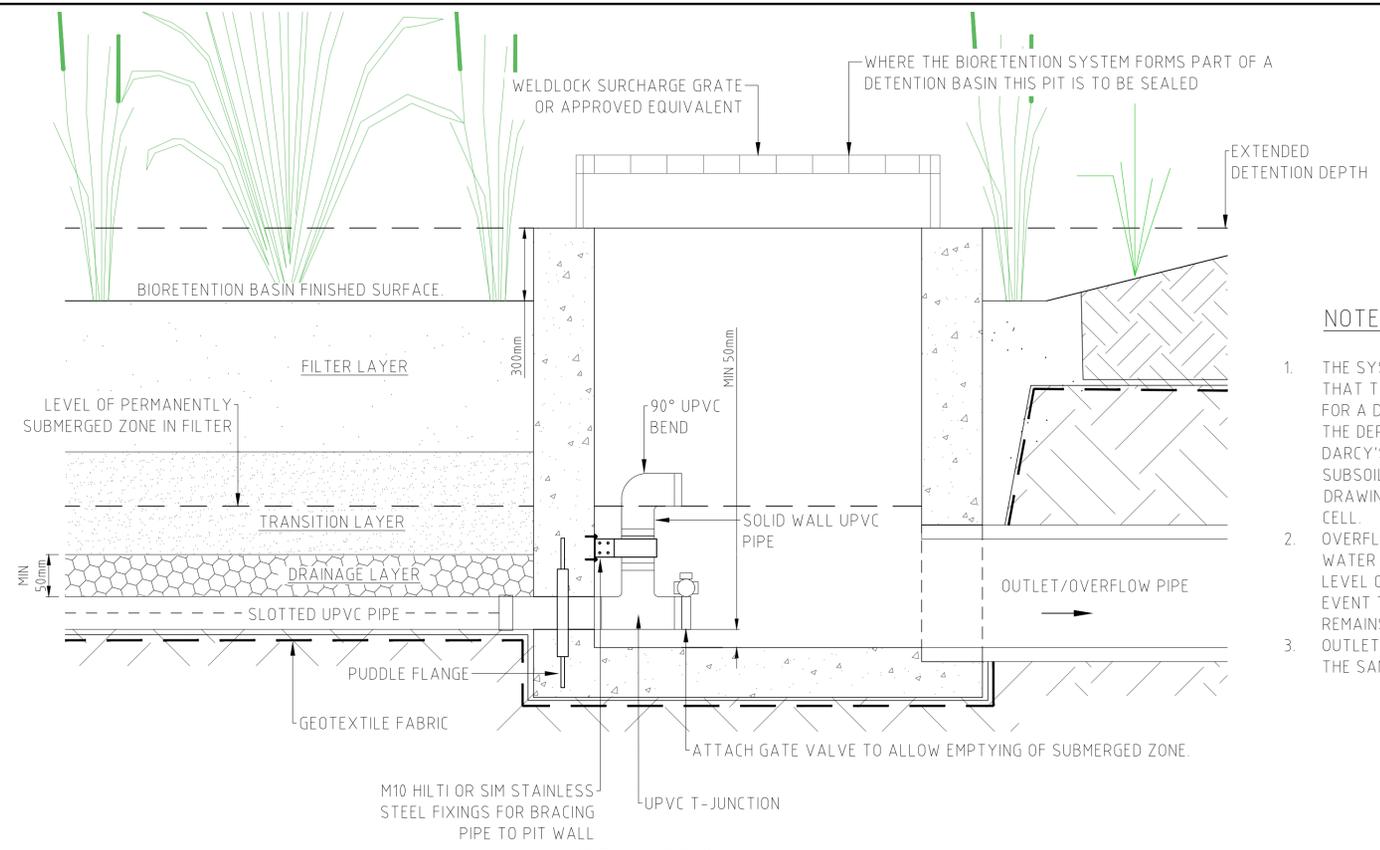
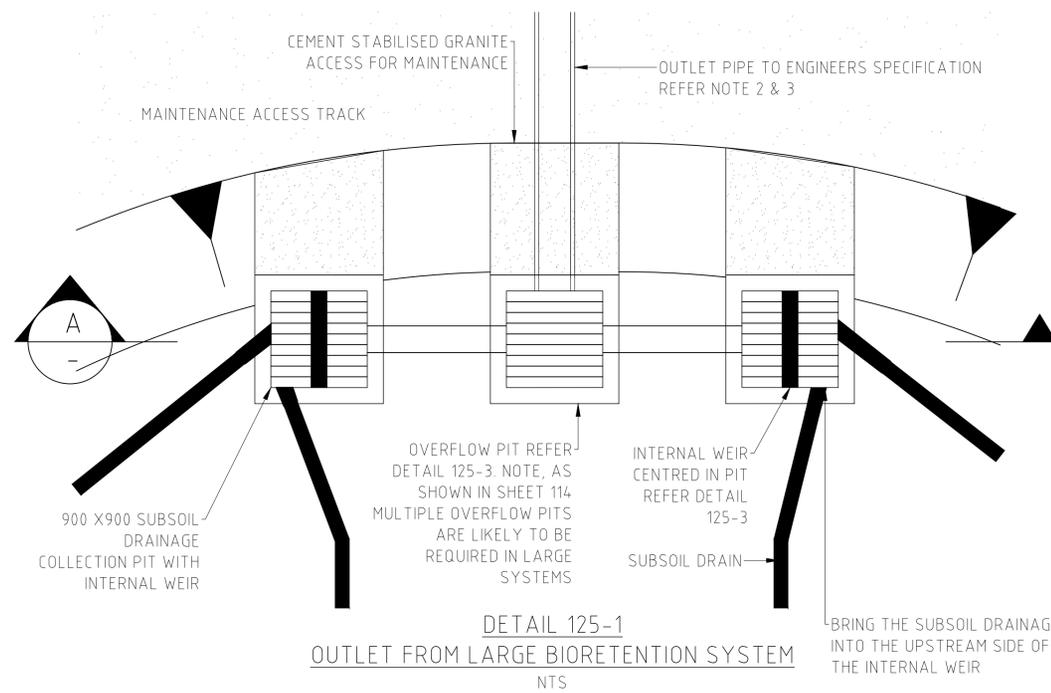
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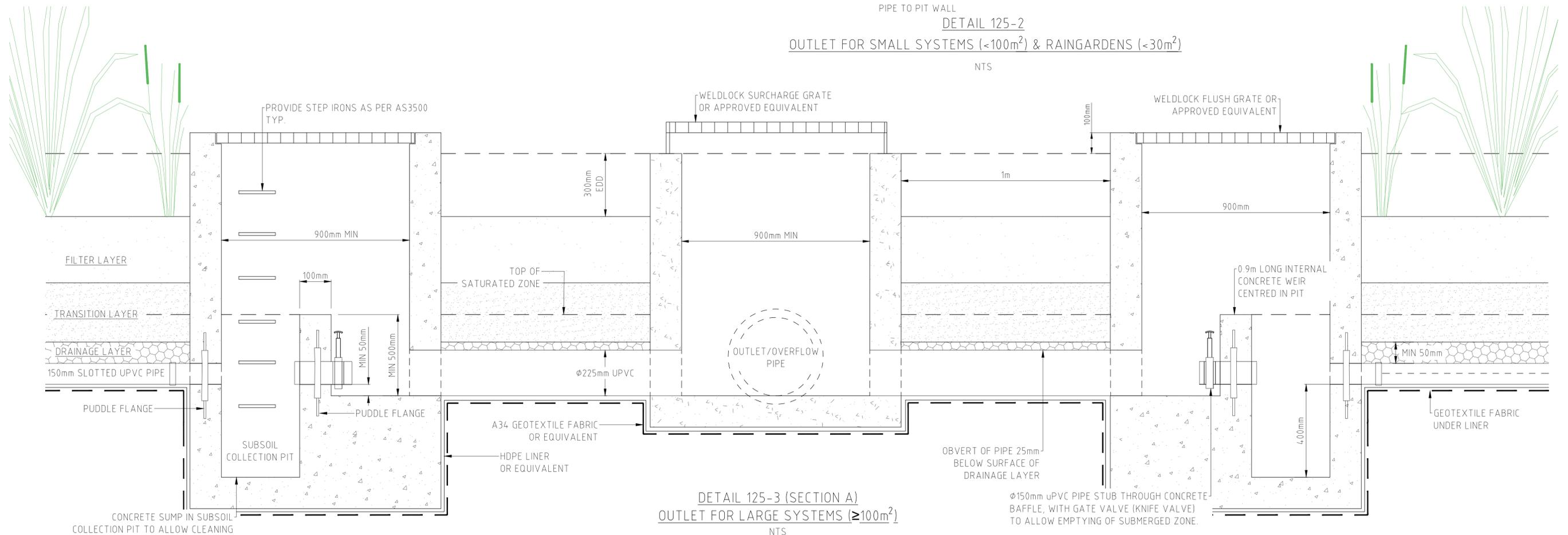
**WSUD STANDARD DRAWINGS**

PROJECT TITLE: WSUD STANDARD DRAWINGS  
SHEET TITLE: BIORETENTION DETAILS - INLET SEDIMENT FOREBAY

Drawing No. **124** Revision **A**



- NOTES**
1. THE SYSTEM SHALL BE DESIGNED TO ENSURE THAT THE HGL DOES NOT RISE TO THE MEDIA FOR A DESIGN FLOW ACHIEVED AT  $K_{SAT}$  WHEN THE DEPTH OF PONDING IS 300mm USING DARCY'S LAW. A 1.8m WIDE (2x900mm) WEIR AND SUBSOIL DRAINAGE AS SHOWN IN THESE DRAWINGS MEETS THIS CRITERIA FOR A 1000m<sup>2</sup> CELL.
  2. OVERFLOW PIT AND PIPE TO BE SIZED SO THAT WATER LEVEL IN PIT DOES NOT EXCEED THE LEVEL OF THE SATURATED ZONE IN 2 YEAR ARI EVENT TO ENSURE THE BIORETENTION SYSTEM REMAINS FUNCTIONAL.
  3. OUTLET PIPES SHALL BE DESIGNED TO HAVE THE SAME CAPACITY AS INLET PIPES.



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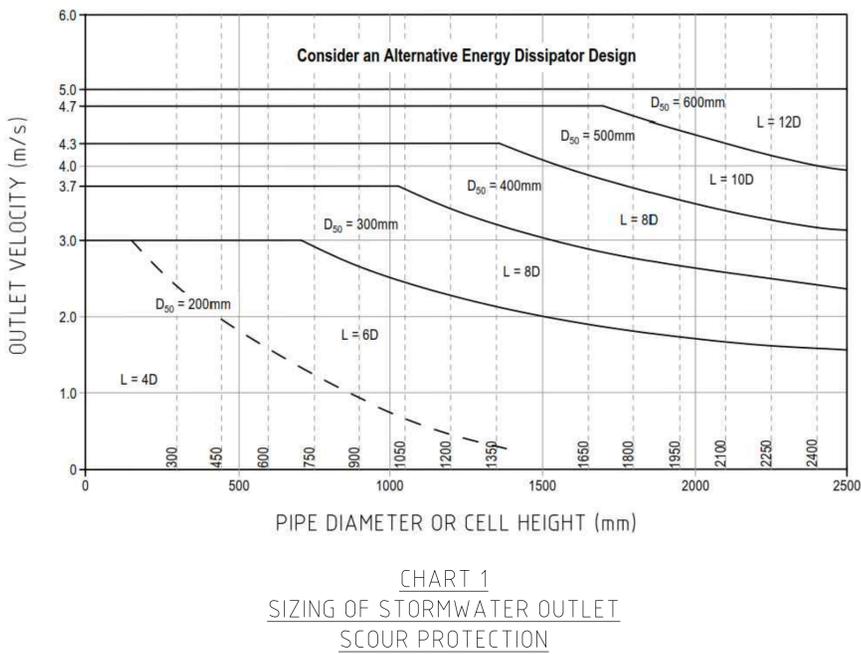
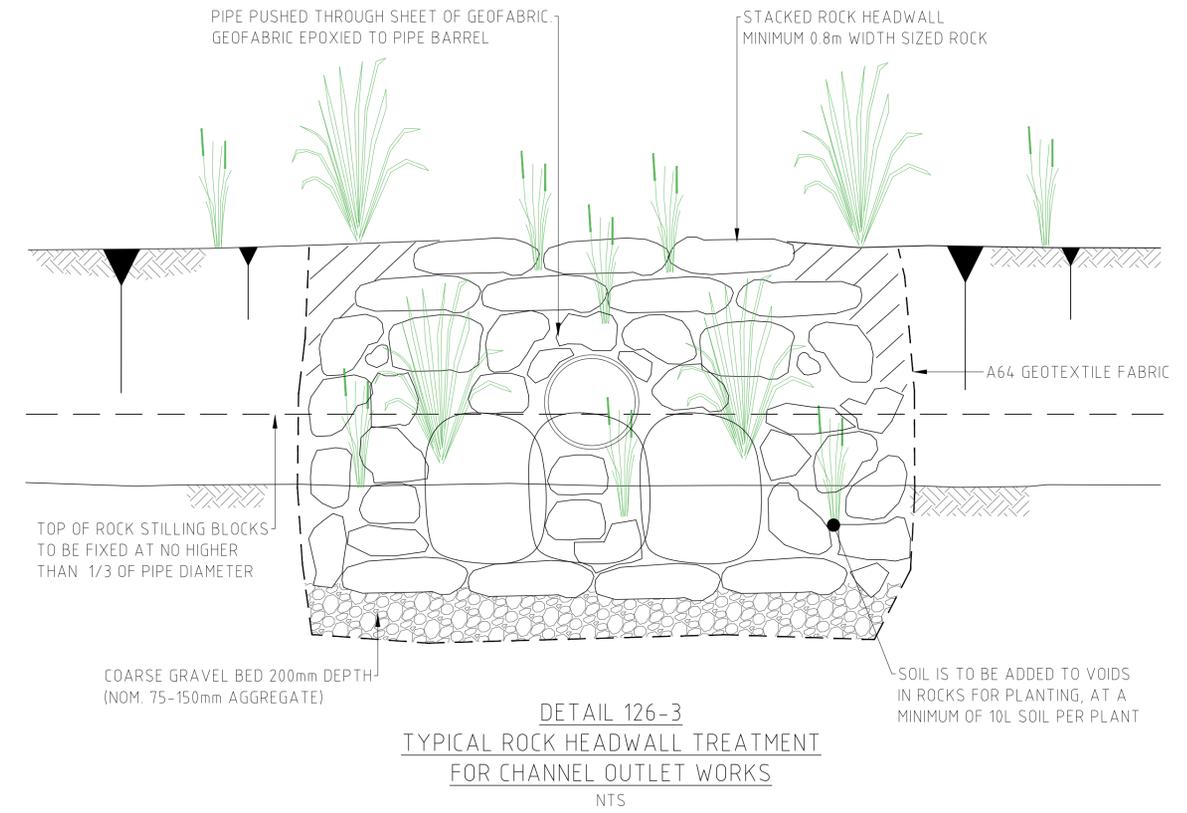
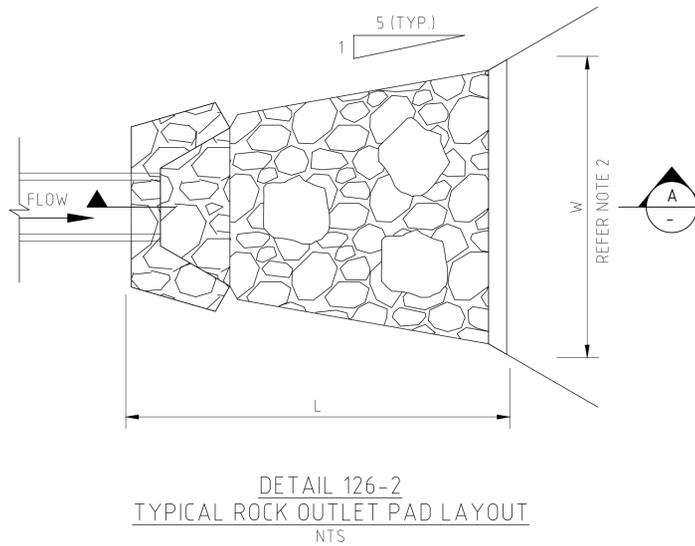
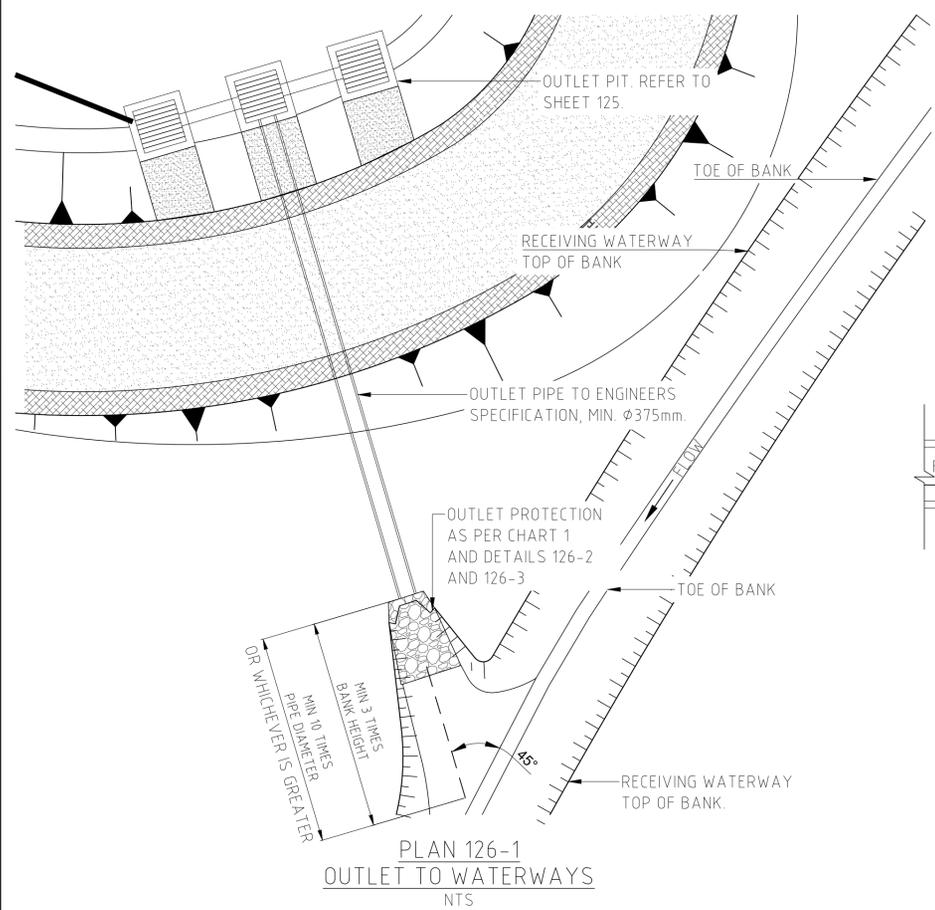
**WSUD STANDARD DRAWINGS**

PROJECT TITLE: WSUD STANDARD DRAWINGS

SHEET TITLE: BIORETENTION DETAILS - OUTLET STRUCTURES

Drawing No. **125**

Revision **A**



**NOTES**

1. READ 'L' FROM CHART 1. LEFT.
2.  $W = 3$  TIMES PIPE DIAMETER 'D'.
3. THE MEDIAN ROCK SIZE  $D_{50}$  AND LENGTH (L) OF ROCK SCOUR PROTECTION DOWNSTREAM OF STORMWATER OUTLETS IS TO BE DETERMINED USING CHART 1. MIN.  $D_{50} = 200$ mm
4. ROCK IS TO BE GRADED IN ACCORDANCE WITH THE ROCK SIZE DISTRIBUTION TABLE AS SHOWN BELOW
5. IN THE EVENT THE WIDTH OF THE OUTLET CHANNEL IS LESS THAN THE DESIGN WIDTH OF THE ROCK APRON, THE ROCK SCOUR PROTECTION SHALL EXTEND UP TO THE BANK TO EITHER THE HEIGHT OF THE OBVERT OF PIPE OR CULVERT OR TO THE DESIGN TAILWATER LEVEL.
6. REFER TO 'BCC ENGINEERING GUIDE FOR DEVELOPMENT' TO ASSESS CHANNEL HYDRAULICS.

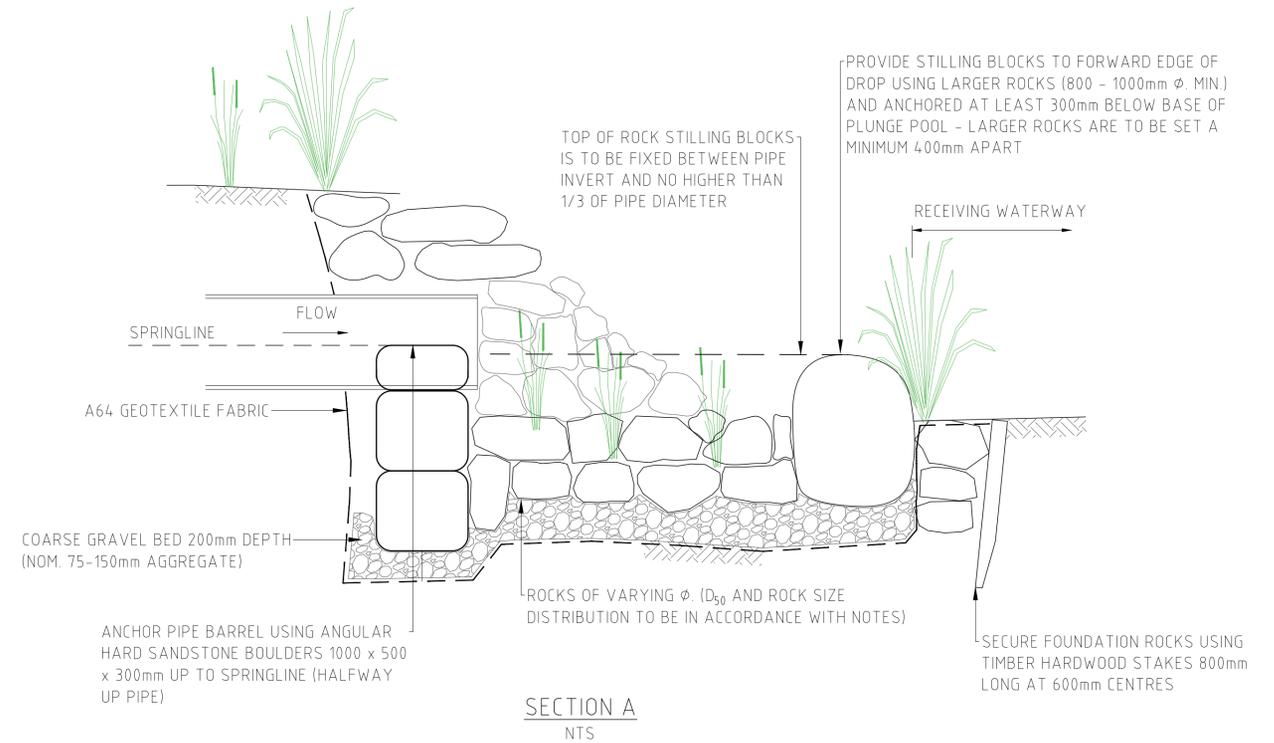
**REFERENCES**

BRISBANE CITY COUNCIL (BCC) 2003 "STORMWATER OUTLETS IN PARKS AND WATERWAYS"  
 NSW OFFICE OF WATER: GUIDELINE FOR OUTLET STRUCTURES ON WATERFRONT LANDS

**ROCK SIZE DISTRIBUTION TABLE**

$D_{100}/D_{50} - 2.0$	$D_{33}/D_{50} - 0.50$
$D_{90}/D_{50} - 1.8$	$D_{25}/D_{50} - 0.45$
$D_{75}/D_{50} - 1.5$	$D_{10}/D_{50} - 0.20$
$D_{65}/D_{50} - 1.3$	
$D_{40}/D_{50} - 0.65$	

$D_x$  = NOMINAL ROCK DIAMETER OF WHICH x% OF THE ROCKS IS SMALLER



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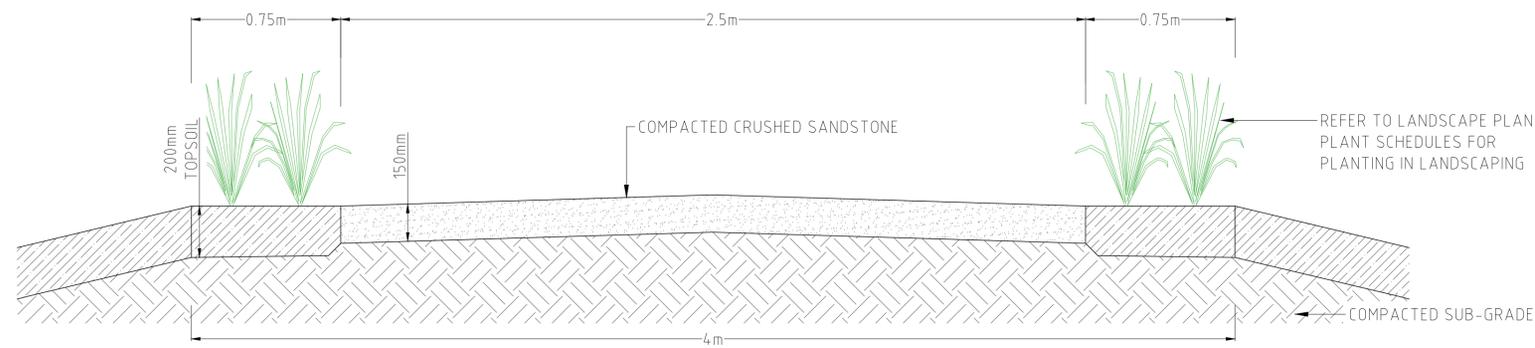
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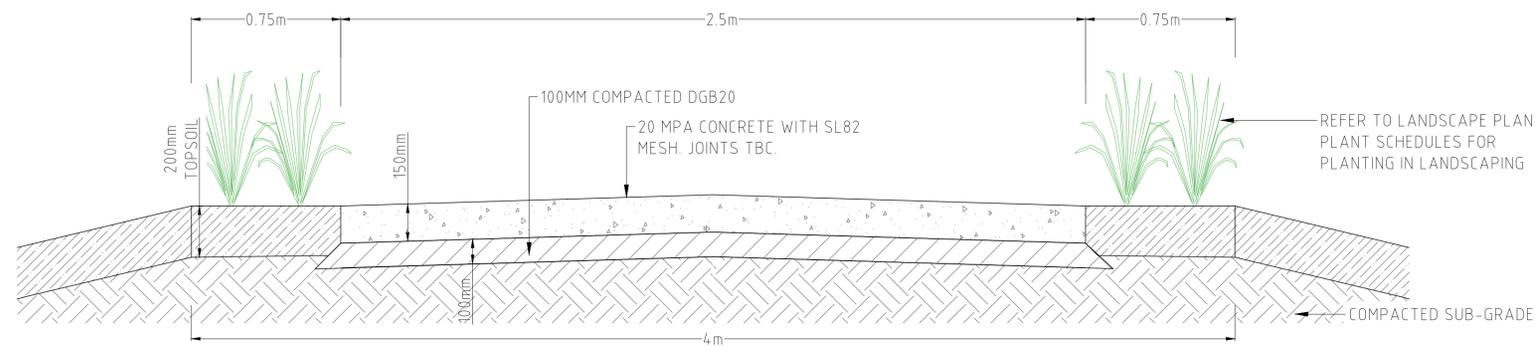
**WSUD STANDARD DRAWINGS**

PROJECT TITLE: WSUD STANDARD DRAWINGS  
 SHEET TITLE: BIORETENTION DETAILS - OUTLET TO CHANNEL/CREEK

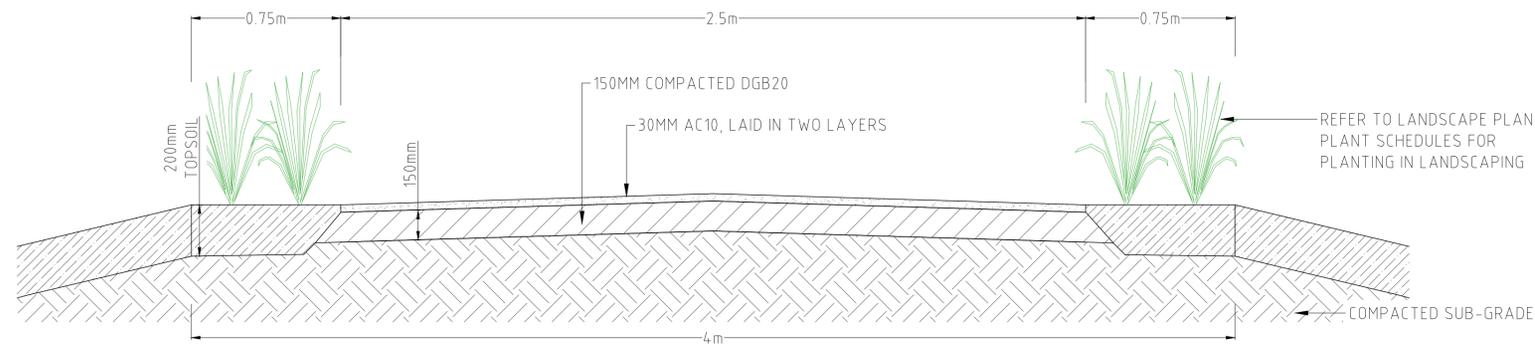
Drawing No. **126** Revision **A**



DETAIL 127-1  
 MAINTENANCE ACCESS TRACK - CRUSHED SANDSTONE  
 NTS

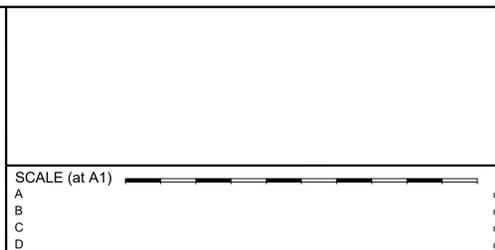


DETAIL 127-2  
 MAINTENANCE ACCESS RAMP - REINFORCED CONCRETE  
 NTS



DETAIL 127-3  
 MAINTENANCE ACCESS TRACK - ASPHALTIC CONCRETE  
 NTS

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A	PRELIM DRAFT FOR COUNCIL REVIEW	09/1/19	AM

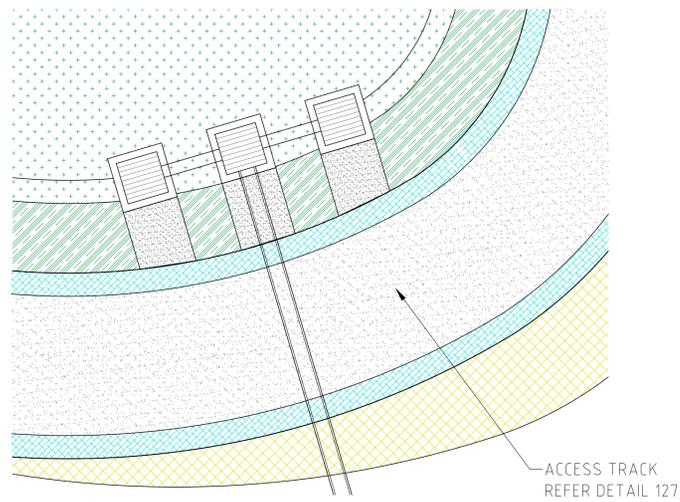


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WSUD STANDARD DRAWINGS	
PROJECT TITLE:	WSUD STANDARD DRAWINGS
SHEET TITLE:	BIORETENTION DETAILS - ACCESS TRACKS
Drawing No.	Revision
127	A

LEGEND

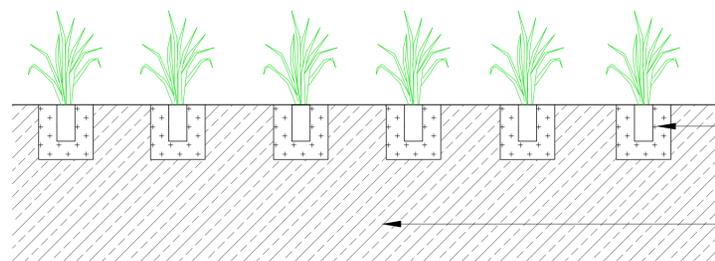
-  P1 - FILTER MEDIA PLANTING AREA
-  P2 - BATTER PLANTING AREA
-  P3 - LANDSCAPING PLANTING AREA
-  P4 - REVEGETATION PLANTING AREA



PLAN 130-1  
BIORETENTION PLANTING ZONES  
NTS



DETAIL 130-2  
BIORETENTION PLANTING EXAMPLE  
NTS



DETAIL 130-3  
TYPICAL PLANTING  
NTS

EXCAVATE PLANTING HOLE 50mm WIDER AND DEEPER THAN ROOTBALL FOR ALL 50mm TUBES TO BE INSTALLED. BACKFILL AND LIGHTLY CONSOLIDATE WITH SPECIFIED FILTER MEDIA

REFER TO ENGINEERING DETAILS FOR SPECIFICATIONS OF BIO-RETENTION SOIL PROFILE

PREFERRED PLANTING LIST

COMMON NAME	SPECIES	TYPE OF VEGETATION	PLANT DENSITY PER SQM	PLANTING ZONE
Tall Sedge ***	<i>Carex appressa</i>	Tufted short rhizomatous, 1.2 h	8-10	P1
Kangaroo Grass ***	<i>Themeda trianda</i> , <i>Themeda australis</i>	Densely tufted leafy perennial, 1.2 h	8-10	P1
Knobby Club Rush ***	<i>Ficinia nodosa</i>	Rhizomatous perennial, 1 h	8-10	P1
Blue Flax-Lily	<i>Dianella revoluta</i>	Tufted perennial herb, 1h	8-10	P1
Wallaby Grass	<i>Rytidosperma tenuior</i> , <i>Austrodanthonia tenuior</i> , <i>Danthonia tenuior</i>	Tufted perennial grass, 1.2 h	8-10	P1
Common Rush	<i>Juncus usitatus</i>	Tufted short rhizomatous, 1 h	8-10	P1
Eskdale Tussock Grass	<i>Poa labillardieri</i>	Densely tufted perennial grass, 0.6 h	8-10	P1
Gorse Bitter Pea	<i>Daviesia ulicifolia</i>	Small shrub, 2 h	1 per 2 sqm	P1; P2
Pink Honey Myrtle	<i>Melaleuca erubescens</i>	Hard, rough barked shrub, 2 m	1 per 2 sqm	P1; P2
Blueberry Lily	<i>Dianella longifolia</i>	Perennial rhizomatous tufted herb, 1 h	8-10	P1; P3; P4
Wattle Mat-rush	<i>Lomandra filiformis</i>	Perennial tussock, 0.5 h	8-10	P1; P3; P4
Tanika, Spiny Mat-rush	<i>Lomandra longifolia</i>	Perennial weeping tussock, 0.7 h	8-10	P1; P3; P4
Weeping Grass	<i>Microlaena stipoides</i>	Slender, tufted perennial grass, 0.7 h	8-10	P1; P3; P4
Pale Rush	<i>Juncus pallidus</i>		8-10	P1
Sea Rush	<i>Juncus kraussii</i>	Tussock, rhizomatous perennial, 1 m	8-10	P1
N/A	<i>Lachnagrostis filiformis</i>	Erect perennial grass, 0.7 h	8-10	P1
N/A	<i>Lachnagrostis billardieri</i>	Erect perennial grass, 0.7 h	8-10	P1
Chaffy Saw-sedge	<i>Gahnia filum</i>	Tussock forming perennial, 1 h	8-10	P1
N/A	<i>Cyperus polystachyos</i>	Tufted perennial, short rhizome, 0.6 h	8-10	P1
N/A	<i>Austrostipa stipoides</i>	Tufted perennial grass, 1.2 h	8-10	P1
Tassel Sedge	<i>Carex fascicularis</i>	Tufted rhizomatous perennial, 1 h	8-10	P1
Swamp Foxtail Grass	<i>Pennisetum alopecuroides</i>	Clumping tussocks perennial, 1.5 h	8-10	P1
N/A	<i>Baloskion / Restio pollens</i>	Dioecious perennial herb, 1 h	8-10	P1
N/A	<i>Schoenoplectus mucronatus</i>	Tufted perennial, 1 h	8-10	P1
Marsh Clubrush	<i>Bolboschoenus fluviatilis</i>	Rhizomatous tufted perennial, 2.5 h	8-10	P1
N/A	<i>Bolboschoenus caldwellii</i>	Rhizomatous tufted perennial, 1 h	8-10	P1

ALTERNATIVE PLANTING LIST

Corkscrew Grass	<i>Austrostipa setacea</i>	Tufted perennial grass, 0.8h	8-10	P1
Barbed Wire Grass	<i>Cymbopogon refractus</i>	Tufted perennial grass, 1 h	8-10	P1
Shorthair Plume Grass	<i>Dichelachne micrantha</i>	Tufted perennial grass, 1.2 h	8-10	P1
Forest Hedgehog Grass	<i>Echinopogon ovatus</i>	Rhizomatous perennial, 1.2 h	8-10	P1
Wiry Panic Grass	<i>Entolasia stricta</i>	Shrubby rhizomatous perennial, 0.8 h	8-10	P1
Paddock Lovegrass	<i>Eragrostis leptostachya</i>	Loosely tufted perennial, 1 h	8-10	P1
Hop Goodenia	<i>Goodenia ovata</i>	Erect, ascending or prostrate shrub, 2 h	1 per 2 sqm	P2; P3; P4
Sticky Hop Bush	<i>Dodonaea viscosa</i>	Small shrub to tree, 8 m	1 per 2 sqm	P2; P3; P4
N/A	<i>Cyperus laevigatus</i>	Rhizomatous perennial, 0.6 h	8-10	P1
Queensland Bluegrass	<i>Dichanthum sericeum</i>	Tufted warm season perennial, 1.2 h	8-10	P1

DESIGN NOTES

- VEGETATION COVER IS AN ESSENTIAL FUNCTIONAL COMPONENT OF THE BIORETENTION BASIN
- PLANTS ARE TO BE 25mm HIKO CELLS OR 50mm TUBESTOCK
- PLANTING SHOULD OCCUR NO LATER THAN 14 DAYS AFTER INSTALLATION OF THE FILTER MEDIA. AFTER PLANTING THE SOIL SHOULD BE RE-INSTATED TO A FLAT SURFACE.
- THE PLANTS SHALL BE PLANTED AS A MATRIX ENSURING A DIVERSE COVERAGE.
- PLANTING SHOULD INCORPORATE SEVERAL TYPES OF VEGETATION INCLUDING SHRUBS AND GRASSES AND TUFTED PLANTS FROM THE PLANTING LIST.
- A MINIMUM OF 4 DIFFERENT SPECIES IS REQUIRED FOR RAINGARDENS (<30m<sup>2</sup>), A MIN OF 6 FOR SMALL SYSTEMS < 100m<sup>2</sup> & 10 OR MORE FOR LARGE SYSTEMS (>100m<sup>2</sup>).
- PLANT ESTABLISHMENT AND WATERING IS REQUIRED FOR 12 MONTHS FROM PLANTING.
- NO SURFACE MULCHING OF BIORETENTION BASINS IS PERMITTED.
- NO WEED MAT OR HYDRO-MULCH IS TO BE APPLIED TO THE SURFACE OF THE BIORETENTION BASIN FOLLOWING THE CONSTRUCTION PHASE (I.E. IN ITS FINAL DESIGN FORM, VEGETATED AS PER PLANTING SCHEDULE), AS THIS WILL HINDER FILTRATION OF STORMWATER THROUGH THE FILTER MEDIA. JUTE MATTING IS PERMITTED.
- 40% OF COVERAGE SHALL COMPRISE OF THE PLANTS MARKED WITH \*\*\*
- PLANTS FROM THE PREFERRED PLANTING LIST SHALL BE PLANTED IN PREFERENCE TO PLANTS FROM THE ALTERNATIVE PLANTING LIST. PLANTS FROM THE ALTERNATIVE PLANTING LIST CAN BE USED WHERE PREFERRED PLANTS ARE COMMERCIALY UNAVAILABLE.
- PLANTING SHALL IDEALLY OCCUR FROM OCTOBER TO MARCH TO IMPROVE VIABILITY OF JUVENILE PLANTS.
- ALL PLANTS SHALL BE HARDENED PRIOR TO PLANTING.
- SOME PLANTS MAY NOT BE AVAILABLE COMMERCIALY & MAY NEED TO BE GROWN FROM SEED. THIS CAN TAKE UP TO 12 MONTHS. PLANNING OF PLANTING STAGE SHALL TAKE LONG LEAD IN TIMES INTO ACCOUNT.
- THE FINAL PLANTING LIST SHALL BE APPROVED BY COUNCIL AT DESIGN STAGE PRIOR TO PRE-ORDER.
- AVOID PLANTING IN SUMMER IF POSSIBLE.

REV	DESCRIPTION	DATE	APPROVED
B	FOR COUNCIL REVIEW	26/7/19	TN
A	PRELIM DRAFT FOR COUNCIL REVIEW	09/1/19	AM

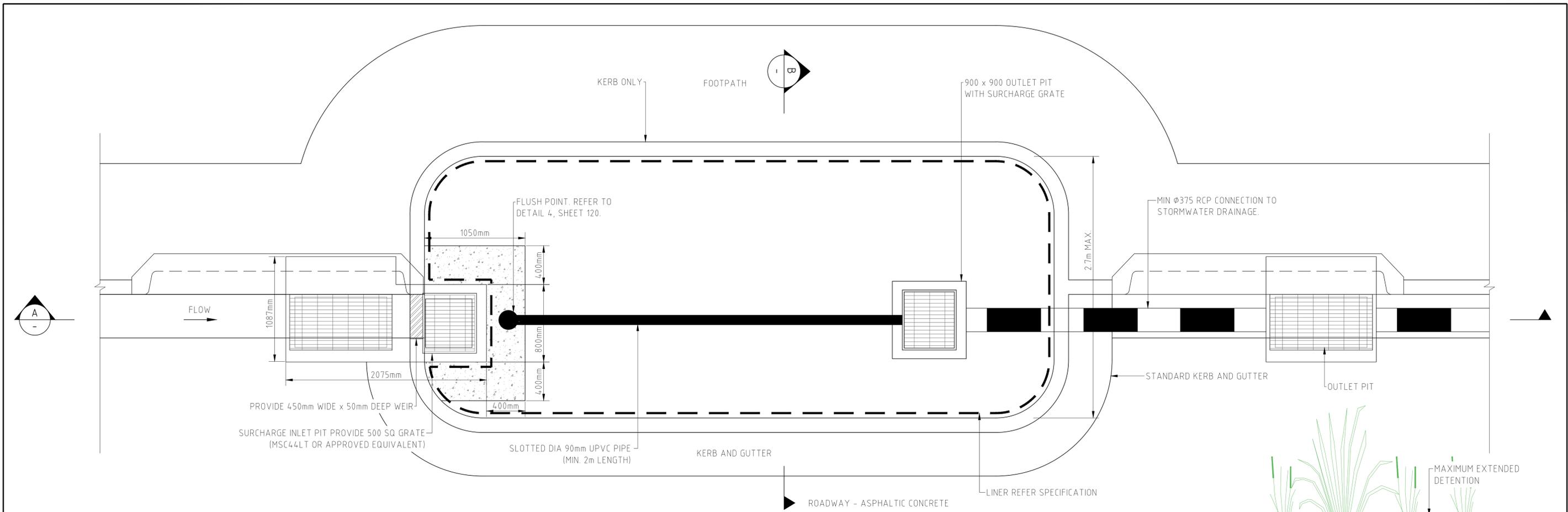
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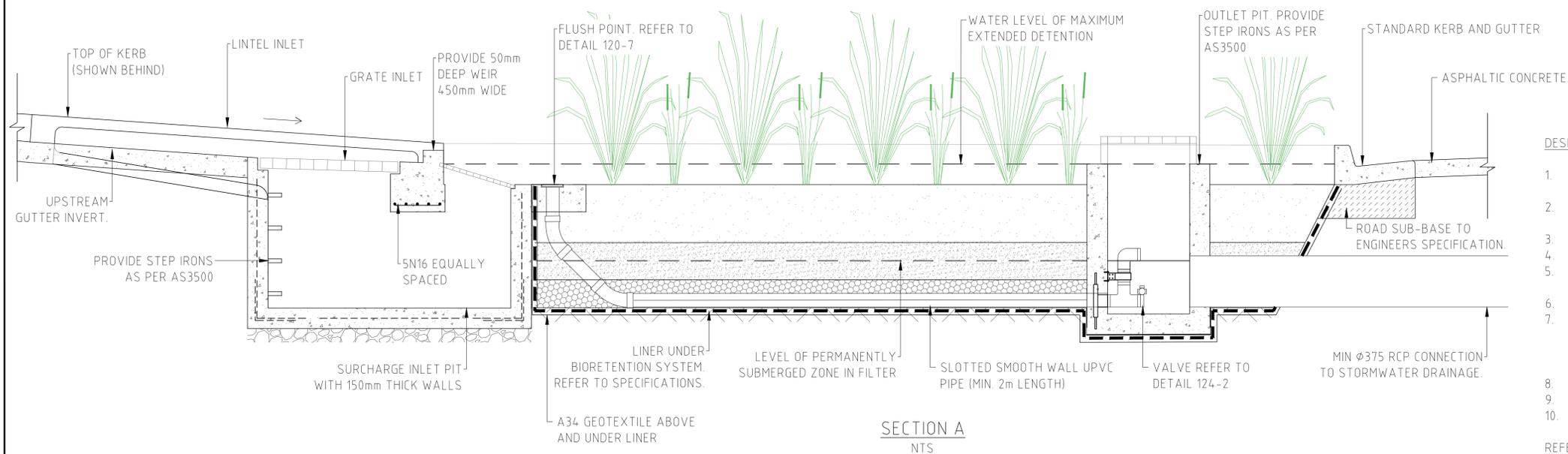
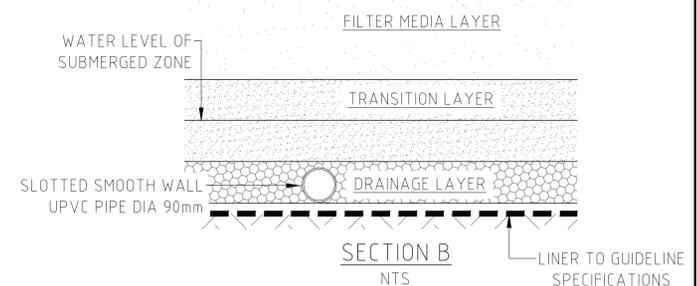
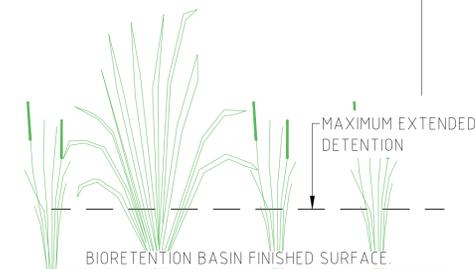
**WSUD STANDARD DRAWINGS**

PROJECT TITLE: WSUD STANDARD DRAWINGS  
SHEET TITLE: BIORETENTION PLANTING

Drawing No. **130**      Revision **A**



PLAN 140-1  
 BIORETENTION SYSTEM - ROADWAY / TRAFFIC CALMING DEVICE  
 NTS

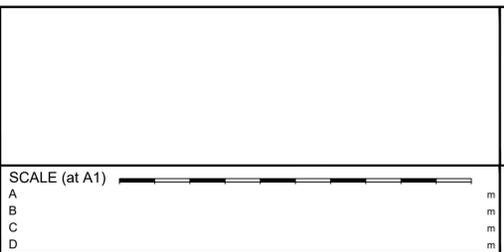


DESIGN NOTES

1. THIS DESIGN APPROACH SHALL BE USED WHERE THE BIORETENTION IS < 30m<sup>2</sup> FOR CATCHMENTS UP TO 1ha
2. FOR APPLICATIONS NOT IN A ROADWAY THE ARRANGEMENT SHALL BE MODIFIED TO SUIT SITE CONDITIONS
3. IN THE ROADWAY THE KEY CONSIDERATIONS ARE TRAFFIC AND DRAINAGE.
4. USE STANDARD KERB & GUTTER TO EXCLUDE VEHICLES.
5. THE ROAD IS OFTEN A MAJOR OVERLAND FLOWPATH. ESTIMATE DESIGN FLOWS AND VELOCITIES AND CONSIDER HOW THESE FLOWS WILL BE ACCOMMODATED.
6. CONSIDER IMPACT OF VEGETATION ON VISUAL SIGHT DISTANCE.
7. THE DRAWINGS SHOW THE TYPICAL LOCATION OF STORMWATER DRAINAGE PIPES WITHIN THE STREET, HOWEVER OTHER SERVICES ARE ALSO OFTEN LOCATED WITHIN THE ROADWAY. CONSIDER EXISTING UTILITY LOCATIONS AND/OR ALLOCATIONS FOR FUTURE WORKS WHEN LOCATING WSUD MEASURES.
8. A LINER IS REQUIRED TO PREVENT EXFILTRATION.
9. EMPLOY BICYCLE FRIENDLY DESIGN PRINCIPLES. REFER RMSI20051.
10. KERBS AND FOOTINGS IN THE ROADWAY MUST BE DESIGNED TO WITHSTAND VEHICLE IMPACT.

REFERENCES CITY OF SYDNEY'S STANDARD DRAWING 7.2.9 "RAINGARDENS - SURCHARGE INLET PIT"

REV	DESCRIPTION	DATE	APPROVED
B	FOR COUNCIL REVIEW	26/7/19	TN
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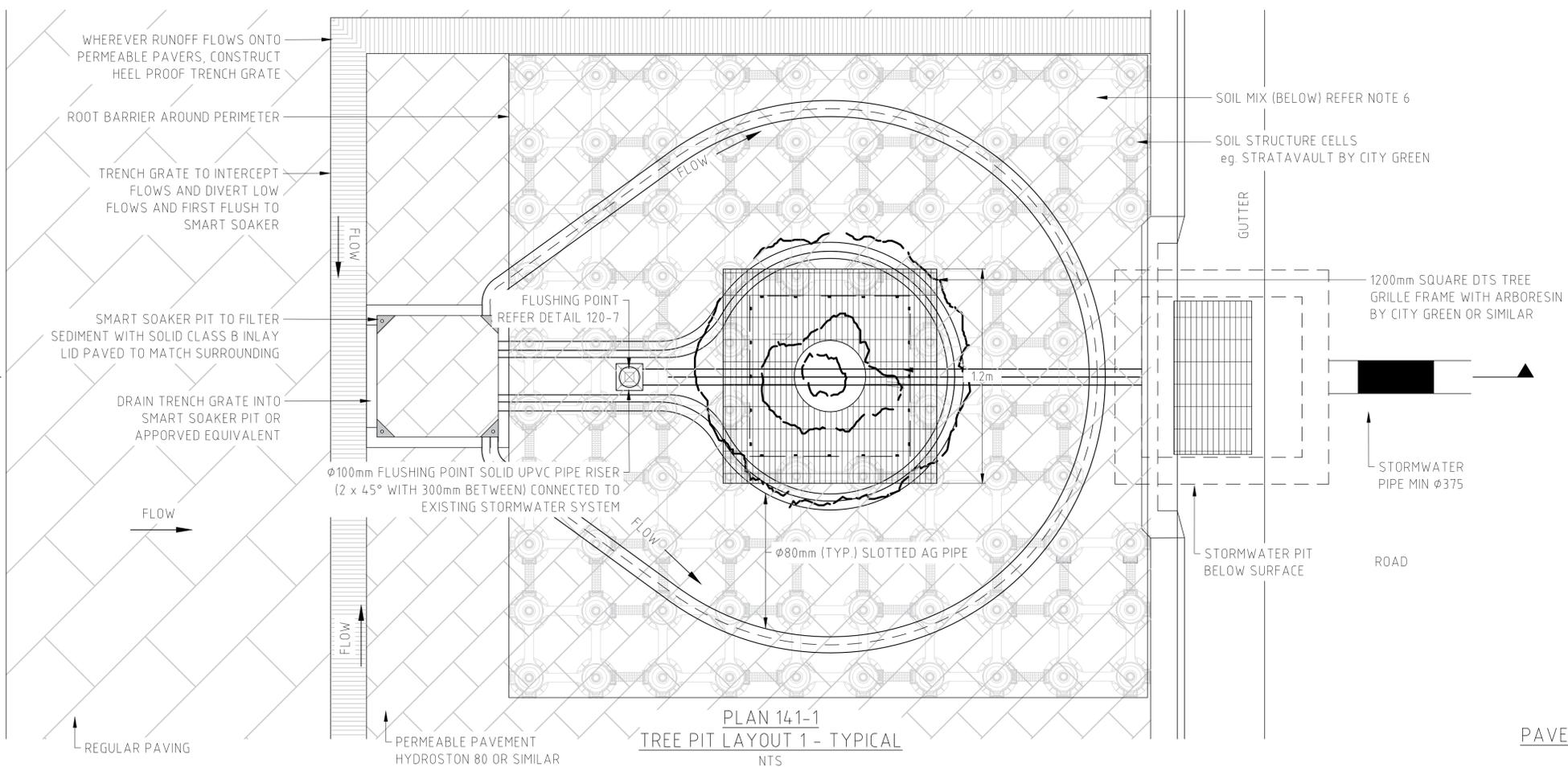
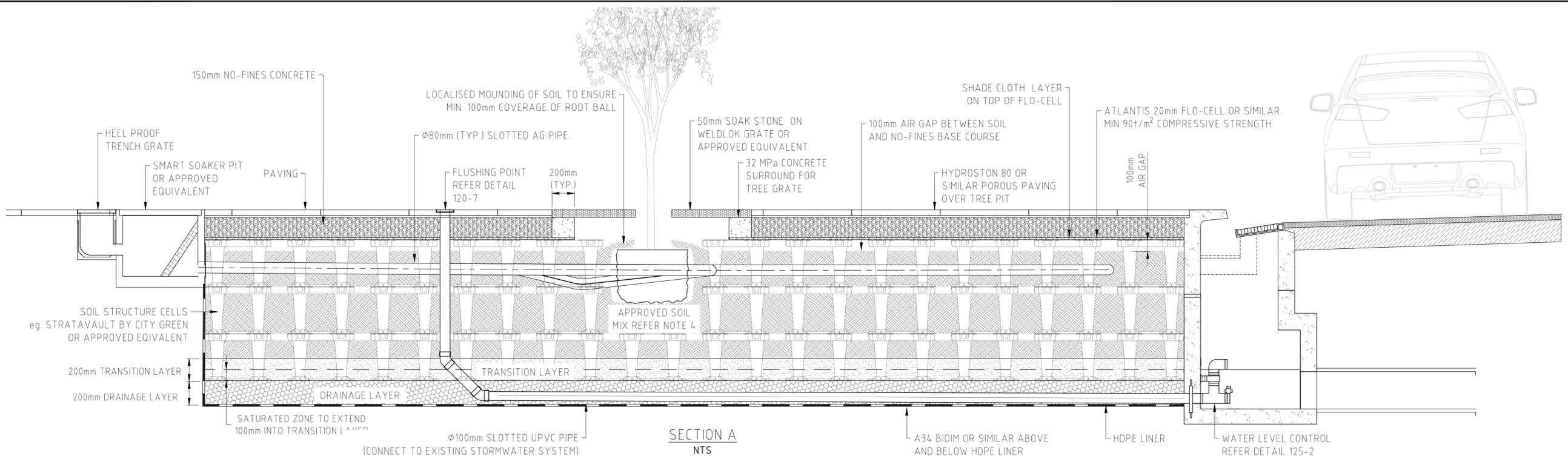
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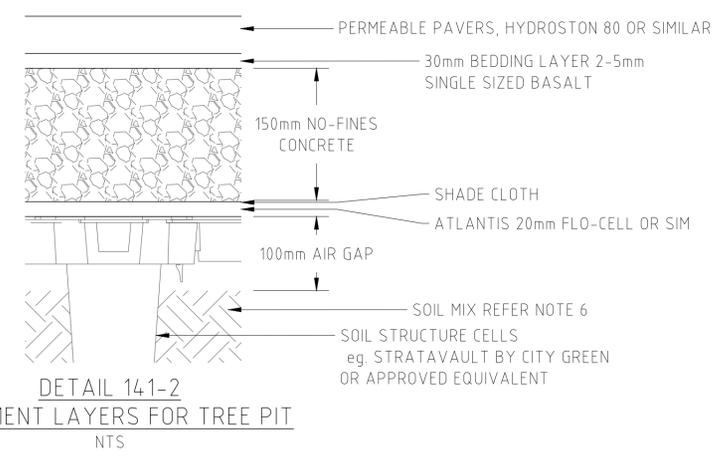
**WSUD STANDARD DRAWINGS**

PROJECT TITLE: WSUD STANDARD DRAWINGS  
 SHEET TITLE: BIORETENTION STREETSCAPE - IN ROADWAY < 30 SQM

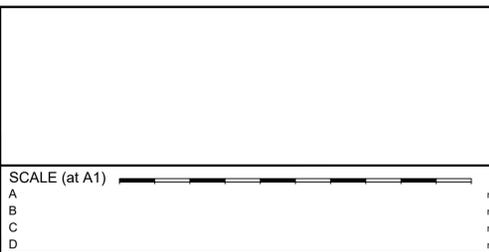
Drawing No. **140**  
 Revision **A**



- DESIGN NOTES**
- IT IS INTENDED THAT THIS TREATMENT IS APPLICABLE TO TOWN CENTRES AND DENSE URBAN AREAS. IT WOULD BE SUITABLE FOR PAVED OPEN SPACE AREAS WHICH CAN BENEFIT FROM EXTENSIVE SHADING AND URBAN COOLING SUCH AS OUTDOOR EATING AREAS. THE LENGTH TO WIDTH RATIO OF THE TREE PIT SHALL NOT EXCEED 2:1.
  - THE STANDARD DETAILS SHOWN ON THIS DRAWING ARE TYPICAL ONLY. THESE DETAILS MAY NEED TO BE RECONFIGURED TO SUIT SITE SPECIFIC CONDITIONS.
  - THE VOLUME OF SOIL TO BE USED IN A TREE PIT SHALL BE A MIN. OF 30m<sup>3</sup>.
  - WHERE POSSIBLE GRADE PAVING TO DIRECT FLOWS TOWARDS THE TREE PITS WITHOUT CREATING A TRAPPED LOW POINT.
  - SOIL MIX SHALL BE AS PER CITY GREEN RECOMMENDATIONS FOR TREE PITS.
  - WHERE TRENCH GRATES OR PERMEABLE PAVERS ARE INAPPROPRIATE OR THE CATCHMENT IS ≤ 100m<sup>2</sup> CONSIDER SUPPLYING WATER FROM ALTERNATIVE SOURCES SUCH AS ROOF RUNOFF AND PROVIDE A HIGH FLOW BYPASS.



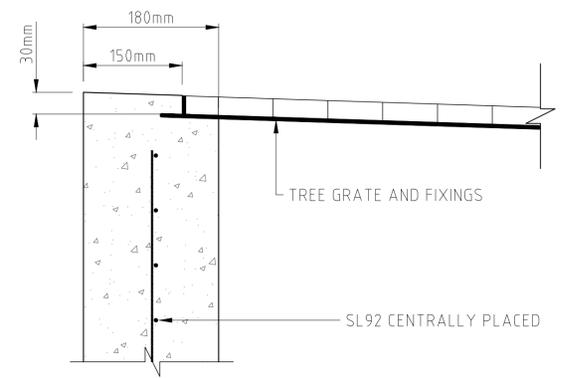
REV	DESCRIPTION	DATE	APPROVED
B	FOR COUNCIL REVIEW	26/7/19	TN
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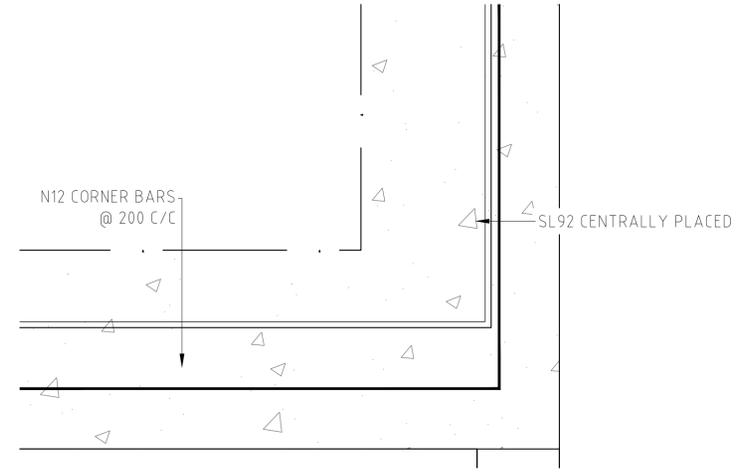
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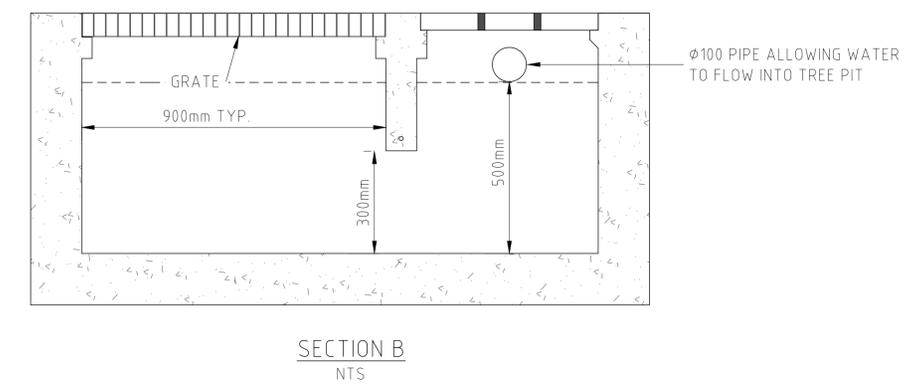
WSUD STANDARD DRAWINGS	
PROJECT TITLE:	WSUD STANDARD DRAWINGS
SHEET TITLE:	BIORETENTION STREETSCAPE - TOWN CENTRES
Drawing No.	141
Revision	A



DETAIL 142-1  
TREE PIT WALL DETAIL



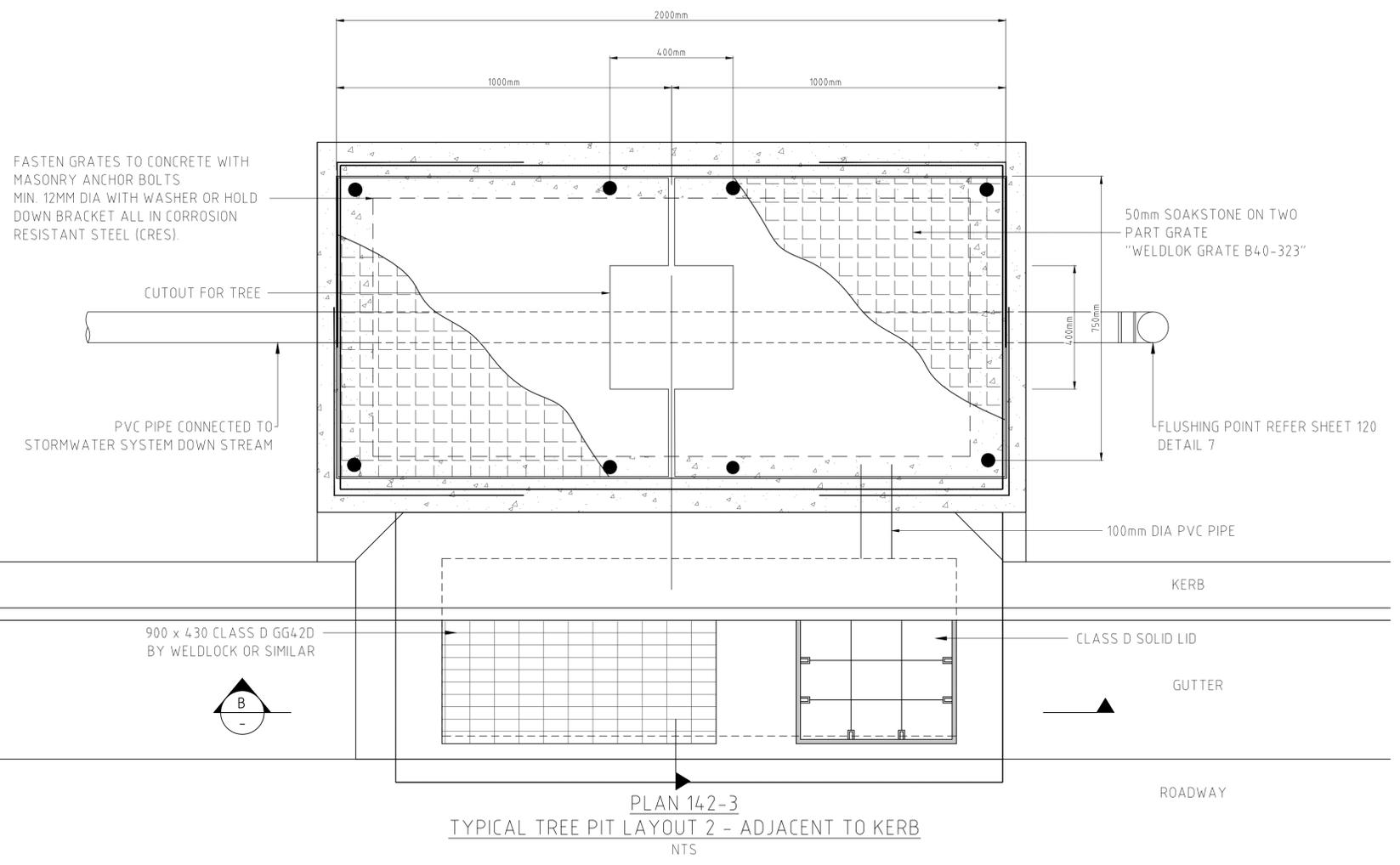
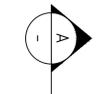
DETAIL 142-2  
TREE PIT CORNER REINFORCEMENT  
NTS



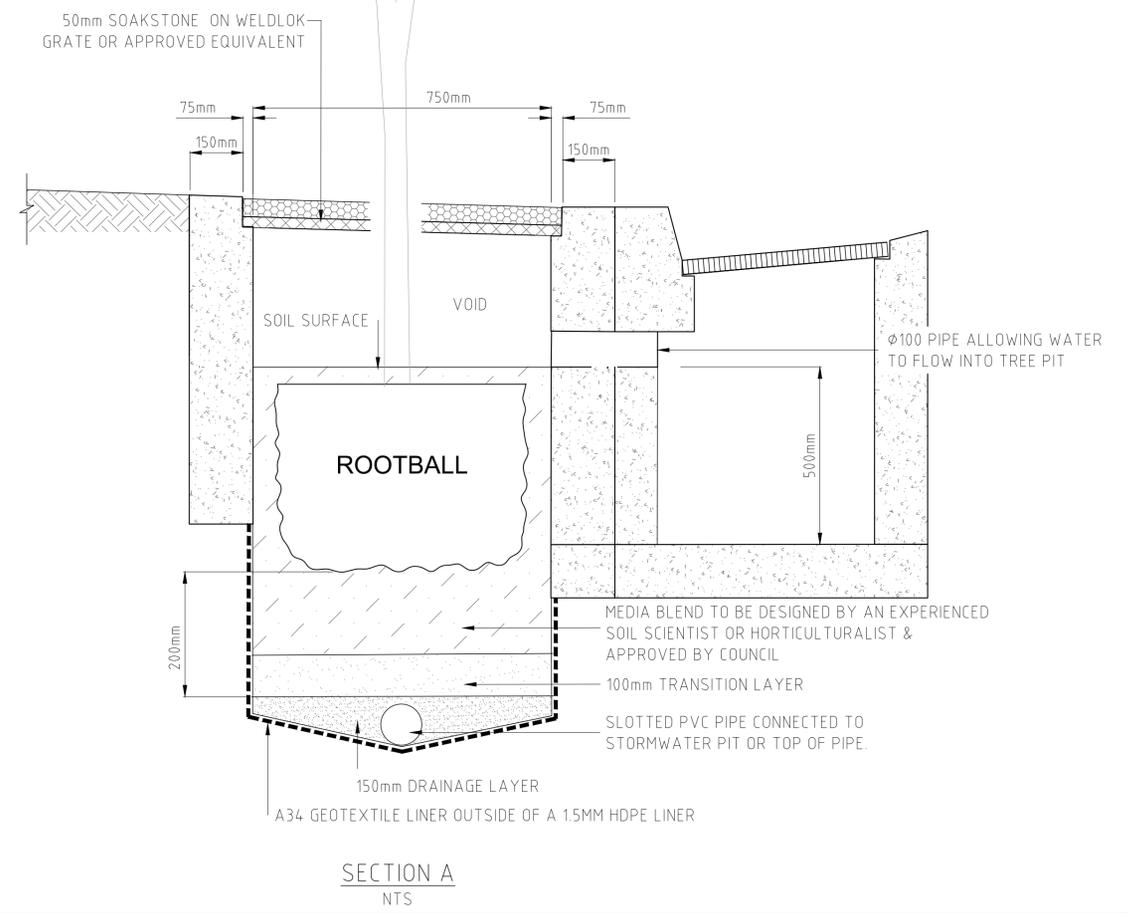
SECTION B  
NTS

DESIGN NOTES

1. ALL CONCRETE KERBS AND GRATES TO BE FLUSH WITH SURROUNDING PAVEMENT AND KERB.
2. FOOTPATHS TO BE REINSTATED AS PER COUNCIL STANDARD (WHERE REQUIRED).
3. BIORETENTION TREE PITS SHOULD NOT BE PLACED ON CRESTS WHERE THEY DO NOT RECEIVED ADEQUATE HYDRAULIC LOADING.
4. CARE SHOULD BE TAKEN WHEN LOCATING PITS IN SAGS. ENSURE THAT:
  - 4.1. THE TREE PIT IS NOT OVERLOADED HYDRAULICALLY
  - 4.2. THE SAG IS NOT TRAPPED WHICH COULD RESULT IN SURFACE PONDING.



PLAN 142-3  
TYPICAL TREE PIT LAYOUT 2 - ADJACENT TO KERB  
NTS



SECTION A  
NTS

REV	DESCRIPTION	DATE	APPROVED
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**WSUD STANDARD DRAWINGS**

PROJECT TITLE: WSUD STANDARD DRAWINGS  
SHEET TITLE: BIORETENTION STREETScape - TREE PIT

Drawing No. **142**      Revision **A**