

	Wallingford UK SuDS Greenfield runoff rate estimation tool to estimate Qbar for their site: https://www.uksuds.com/drainage-calculation-tools/greenfield-runoff-rate-estimation	
2.1.14	Attenuation: If an attenuation system is proposed it should, where possible, not be located under the internal roads but in/under open space or parking areas. Attenuation systems must be inline. The preference is for attenuation systems that allow for infiltration and/or treatment within the site. The Scheme Designer should note that certain landscaping items, such as trees, may not be compatible with attenuation systems. The Scheme Designer must provide fully dimensioned plans and sections of the attenuation storage system. All relevant inlet and outlet levels, dimensioned clearances between other utilities, and actual depths of cover to the system should be provided. Details of the proposed inlet and outlet manholes and arrangements to facilitate draw down and maintenance should also be provided. Scheme Designers are recommended to use the HR Wallingford UK SuDS Surface water storage volume estimation tool to estimate the attenuation storage required for their site: https://www.uksuds.com/drainage-calculation-tools/surface-water-storage .	Highlighted as part of Section 2.9 of this audit.
2.1.15	Green Roof: The proposal must meet the requirements of Appendix 7.2: Green Roof Policy of the County Development Plan 2022-2028.	Y
2.1.16	Interception and Treatment: The Scheme Designer must demonstrate that required interception and/or treatment of surface water run-off is achieved in accordance with GDSDS policy. To be in compliance with GDSDS Volume 2 Section 6.3.3 Table 6.3 Criterion 1, interception of the first 5-10mm is required. If interception of first 5-10mm can't be achieved, then treatment of first 15mm is required.	Y
2.1.17	Maintenance: Scheme Designers must submit a post-construction maintenance specification and schedule for the drainage system, including SuDS measures and attenuation system to dlrc for approval. This maintenance specification and schedule must be included in the Safety File.	Y
2.1.18	New Connections: Prior to submission of the planning application, the Scheme Designer must obtain the sewer network records from DLRCC and assess if a new connection to the public sewer is technically feasible.	Highlighted as part of Section 2.4 of this audit

2.2 Surface Cover Type Table

Table 2-2 Surface Cover Type – Completed by Scheme Designer

Surface Cover Type	Area (m ²)
Wetland or open water (semi-natural; not chlorinated) maintained or established on site.	1,318m ²
Semi-natural vegetation (e.g. hedgerows, trees, woodland, species-rich grassland) maintained or established on site.	3,631 m ²
Reuse of existing soils and seed source to develop vegetation cover	4,625 m ²
Standard trees planted in connected tree pits with a minimum soil volume equivalent to at least two thirds of the projected canopy area of the mature tree.	103no.
Standard trees planted in pits with soil volumes less than two thirds of the projected canopy area of the mature tree.	77no.
Intensive green roof or vegetation over structure. Substrate minimum settled depth of 150mm.	201 m ²
Non intensive Brown Roof (Biodiversity Roof). Substrate minimum settled depth of 150mm. Design will be site specific and developed by a suitably qualified ecologist.	N/A
Extensive green roof with substrate of minimum settled depth of 80mm (or 60mm beneath vegetation blanket)	N/A
Extensive green roof of sedum mat or other lightweight systems	3,107 m ²
Green wall –modular system or climbers rooted in soil.	N/A
Rain gardens and other vegetated sustainable drainage elements.	5,848 m ²
Flower-rich perennial planting.	4,130 m ²
Hedges (line of mature shrubs one or two shrubs wide).	61 m ²
Hedgerows or double hedgerow of native species (may have an associated ditch and bank)	431 m ²
Groundcover planting.	N/A
Amenity grassland entire area or sections managed for lesser mowing frequencies for pollinators (e.g. six week meadow)	8,152 m ²
Amenity grassland (species-poor, regularly mown lawn).	4,799 m ²
Water features (chlorinated) or unplanted detention basins.	1,318 m ²
Permeable paving.	2,981 m ²
Sealed surfaces (e.g. concrete, asphalt, waterproofing, stone)	17,845 m ²
Blue roof	N/A

2.3 Utility Clash Checks

Problem: The Scheme Designer must undertake a utilities clash check to ensure all utilities' vertical and horizontal separation distances can be provided throughout the scheme. The Scheme Designer should demonstrate this with cross-sections at critical locations such as junctions, site thresholds and connection points to public utilities.

Recommendation: Scheme designer to ensure minimum separation distances (i.e. between storm and foul sewer and/or watermains) are in accordance with the Uisce Eireann Code of Practice.

2.4 New Connections / Modifications to Existing Storm Channel

Problem: It is noted that the surface water generated within the development is proposed to outfall to the existing culvert under the M11 Motorway. Additionally, a new culvert is proposed to convey runoff within the existing open drain under the new carriageway

Recommendation: It is recommended that the Scheme Designer confirms the ownership of the existing culvert and open drain. In addition, the Scheme Designer shall obtain all necessary permissions and approvals for any proposed discharge to, or modification of, the existing drainage infrastructure.

2.5 SUDS – Catchpit/Silt Trap Manhole

Problem: It is noted that there is no catchpit/silt trap within the manhole immediately upstream of the Regional Attenuation Pond. Catchpit manholes serve as a pre-treatment device to trap silt, grit, and debris before they can enter and clog the storage system and the flow control devices located downstream.

Recommendation: It is recommended that the scheme designer considers providing a catchpit manhole upstream of the Regional Attenuation Pond.

2.6 SUDS – Network Connectivity

Problem: From the 'Proposed Storm Drainage Overall Plan', some tree pits appear to be standalone drainage systems with no connectivity to the surface water network. However, the Typical SuDS Details drawing indicates these features with overflow systems/outlet pipes.

Recommendation: Scheme designer to clarify and/or rectify where necessary.

2.7 Infiltration

Problem: From the provided documentation, it is noted that the SuDS measures will discharge to ground. The Site Investigation Report indicates that groundwater levels of 0.9–2.2 m were encountered which make infiltration not suitable. Furthermore, the CIRIA C753 SuDS Manual stipulates that the formation level of SuDS features shall not be within 1000mm of the ground water table.

Recommendation: The scheme designer must ensure that an impermeable liner shall be installed at the base and sides of the build-up of the SuDS measures to prevent groundwater ingress or egress.

2.8 Discharge Rate

Problem: It is noted on the 'Proposed Storm Drainage Overall Plan' that the Proposed Flow Control Manhole S-51 shows a controlled discharge rate (Q_{max}) of 24.8l/s. However, Table 2-1 from the SWIA Report indicates the controlled outflow as 27.1 l/s.

Recommendation: Scheme designer to clarify and/or rectify where necessary.

2.9 Document Coordination

Problem: The 'Standard Construction Details' drawing shows manholes S40 and S41 as the inlet and outlet points of the proposed Attenuation Tank A. However, these manholes are shown as part of the future development network in the 'Proposed Storm Drainage Overall Plan'.

Recommendation: Scheme designer to clarify and/or rectify where necessary.

2.10 Petrol Interceptor

Problem: Typical details for a Petrol Interceptor have been provided in the 'Standard Construction Details' drawing. However, this feature is not indicated on the 'Proposed Storm Drainage Overall Plan'.

Recommendation: The Scheme designer to clarify and/or rectify. If the petrol Interceptor is proposed, the scheme designer is to verify that the Petrol Interceptor is sized to accommodate the contributing catchment areas and anticipated peak flow rates. Furthermore, the required drop across the Petrol Interceptor must be allowed for in the surface water long-section.

2.11 Drainage Layout Arrangement

Problem: It is noted that some stormwater pipes are connected in a direction opposing the primary flow of the main drainage line, which may hinder hydraulic efficiency. i.e. angle between inlet pipe and direction of flow is less than 90 degrees.

Recommendation: It is recommended that the scheme designer ensures that the drainage network layout is in accordance with the Uisce Eireann Wastewater Code of Practice (3.5.13) throughout the scheme.

"The angle between any inlet pipe to a Manhole and the outlet pipe from the Manhole shall not be less than 90 degrees, i.e., the inlet flow from any inlet pipe should not run counter to the outlet flow direction and suitably profiled benching shall be provided to ensure smooth flow conditions".

2.12 Undefined Line Types

Problem: It is noted on the 'Proposed Storm Drainage Overall Plan' that some line types which show connections to the main line storm drainage system are not defined.

Recommendation: It is recommended that the scheme designer ensures that all line types are defined in the legend of the drainage plan.

Appendix A Stage 1 Stormwater Audit Feedback Form

Scheme Title: Old Connaught Phase 1

Audit Stage: 1

Audit Completed: 21/07/2026

Project Ref: 262197

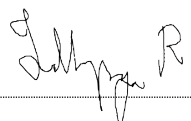
Paragraph No. in Surface Water Audit Report	Issue Accepted (Yes/No)	Recommended Measure Accepted (Yes/No)	Alternative Measures (described) [or reason problem not accepted]	Alternative Measures Accepted by Auditors (Yes/No)
2.3	Yes	Yes	Utility clash and separation checks have been completed as part of the design process and comply with the Uisce Éireann Code of Practice. The design has been submitted to Uisce Éireann for Design Conformance review, which includes an independent assessment of utility separations and clashes. A Statement of Design Acceptance (SoDA) Letter will accompany the planning application to confirm compliance with and acceptability of the design.	Yes
2.4	Yes	Yes	The ownership of the existing culvert and open drain has been identified as part of the design development process. The open drain is within the land owners and DLRCC ownership. Any required permissions, consents, and approvals associated with discharge to, or modification of, the existing drainage infrastructure will be obtained from the relevant asset owners and statutory authorities prior to construction. The proposed works will be carried out in accordance with the requirements of the approving authorities. Section 50 application will be lodged following grant of planning	Yes
2.5	Yes	Yes	The recommendation has been incorporated into the design. A catchpit/Silt trap manhole has now been provided upstream of the Regional Attenuation Pond, and this amendment is reflected in the updated drawings issued as part of the resubmission. Please refer to drawing ATK-ZZ-ZZ-DR-CE-900501 Proposed Storm Drainage Layout - Sheet 1.	Yes
2.6	Yes	Yes	The recommendation has been incorporated into the design, and the tree pit drainage connectivity and overflow arrangements are now clearly shown on the revised drawings issued with the resubmission. Please refer to drawings ATK-ZZ-ZZ-DR-CE-900501 Proposed Storm Drainage Layout - Sheet 1 ATK-ZZ-ZZ-DR-CE-900502 Proposed Storm Drainage Layout - Sheet 2	Yes

Paragraph No. in Surface Water Audit Report	Issue Accepted (Yes/No)	Recommended Measure Accepted (Yes/No)	Alternative Measures (described) [or reason problem not accepted]	Alternative Measures Accepted by Auditors (Yes/No)
2.7	Yes	Yes	The recommendation has been considered within the design. It should be noted that infiltration-based SuDS measures are proposed only in specific areas of the site that have been identified as suitable for infiltration. Within these areas, where groundwater levels are found to be such that the required separation distance cannot be achieved, impermeable liners will be provided to the base and sides of the affected SuDS features to prevent groundwater ingress or egress and ensure compliance with relevant guidance. This clarification has been incorporated into Section 5.5.2 of the Stormwater Impact Assessment Report.	Yes
2.8	Yes	Yes	The discrepancy between the Qmax value shown on the <i>Proposed Storm Drainage Overall Plan</i> and Table 2-1 of the SWIA Report has now been resolved. Drawing ATK-ZZ-ZZ-DR-CE-900501 Proposed Storm Drainage Layout - Sheet 1 has been updated to ensure consistency across all project information.	Yes
2.9	Yes	Yes	The recommendation has been taken on board. The drawings have been updated to ensure consistency between the <i>Standard Construction Details</i> drawing and the <i>Proposed Storm Drainage Overall Plan</i> . The revised drawings ATK-ZZ-ZZ-DR-CE-900501 Proposed Storm Drainage Layout - Sheet 1 ATK-ZZ-ZZ-DR-CE-900502 Proposed Storm Drainage Layout - Sheet 2, ATK-ZZ-ZZ-DR-CE-909008 Standard Construction Details Sheet 8 reflect these updates have been submitted as part of the updated design package.	Yes
2.10	Yes	Yes	Comment noted. The recommendation has been accepted. There is no Petrol Interceptor proposed as part of the surface water drainage scheme. Accordingly, the Petrol Interceptor detail has been removed from the ATK-ZZ-ZZ-DR-CE-909002 <i>Standard Construction Details Sheet 2</i> drawing to ensure consistency with the <i>Proposed Storm Drainage Overall Plan</i> .	Yes

STORMWATER AUDIT FEEDBACK FORM

Paragraph No. in Surface Water Audit Report	Issue Accepted (Yes/No)	Recommended Measure Accepted (Yes/No)	Alternative Measures (described) [or reason problem not accepted]	Alternative Measures Accepted by Auditors (Yes/No)
2.11	Yes	Yes	Comment noted. The recommendation has been reviewed and addressed. The storm drainage network layout has been revised, where necessary, to ensure compliance with Section 3.5.13. These amendments are reflected in the updated <i>Proposed Storm Drainage Overall Plan</i> , ATK-ZZ-ZZ-DR-CE-900500 Proposed Storm Drainage - Overall Layout Plan which has been submitted as part of this revised submission package,	Yes
2.12	Yes	Yes	The drainage drawings have been reviewed and the undefined line types identified on the <i>Proposed Storm Drainage Overall Plan</i> have now been clarified. The legend has been updated to ensure that all line types and drainage connections are clearly defined and accurately represented. This issue has been rectified and is reflected in the updated drawings submitted as part of this revised submission package. Refer to drawings ATK-ZZ-ZZ-DR-CE-900500 Proposed Storm Drainage - Overall Layout Plan, ATK-ZZ-ZZ-DR-CE-900501 Proposed Storm Drainage Layout - Sheet 1, ATK-ZZ-ZZ-DR-CE-900502 Proposed Storm Drainage Layout - Sheet 2 for the amendments made.	Yes

Signed:


INDHU PRIYA RAJAVADIVELU

(Design Team Project Manager)

Date:

21/07/2026

Please complete and return to the auditor

Auditor Signed Off:

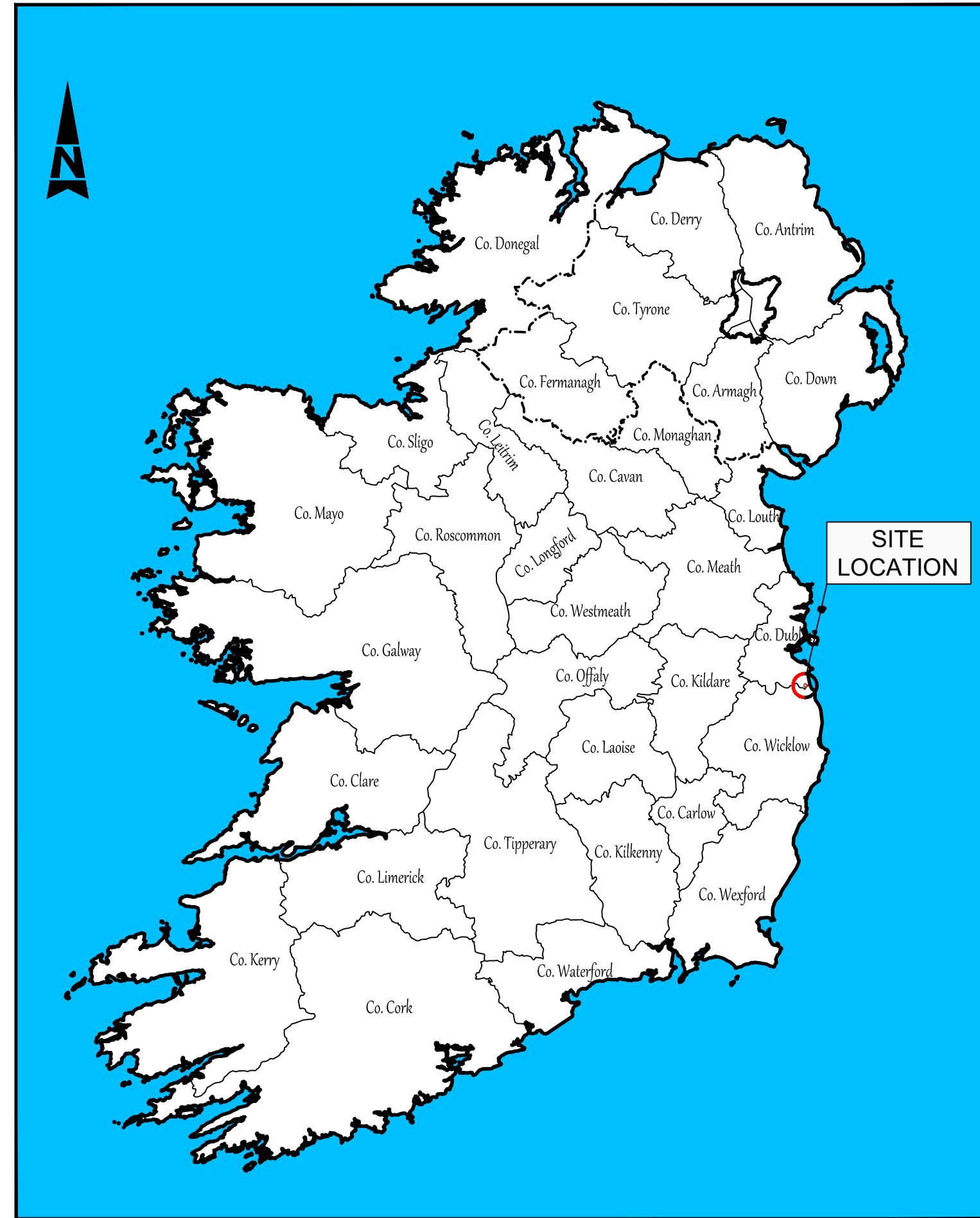

Jennings Chikomba

(Auditor)

Date:

17/07/2026

Appendix B Drawings and Documents Examined by the Author

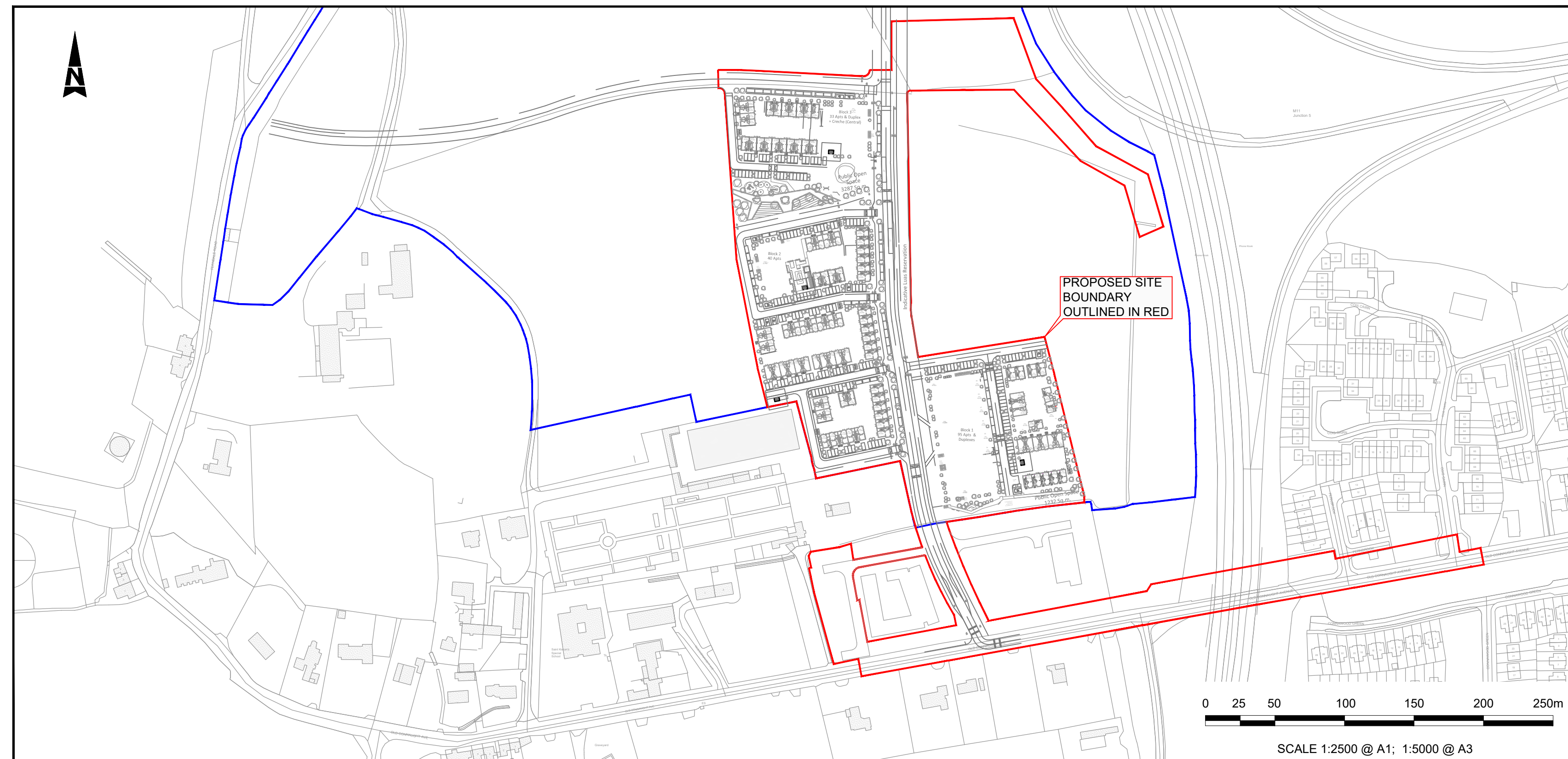


IRELAND LOCATION MAP

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Scale at A3 1:4,000,000



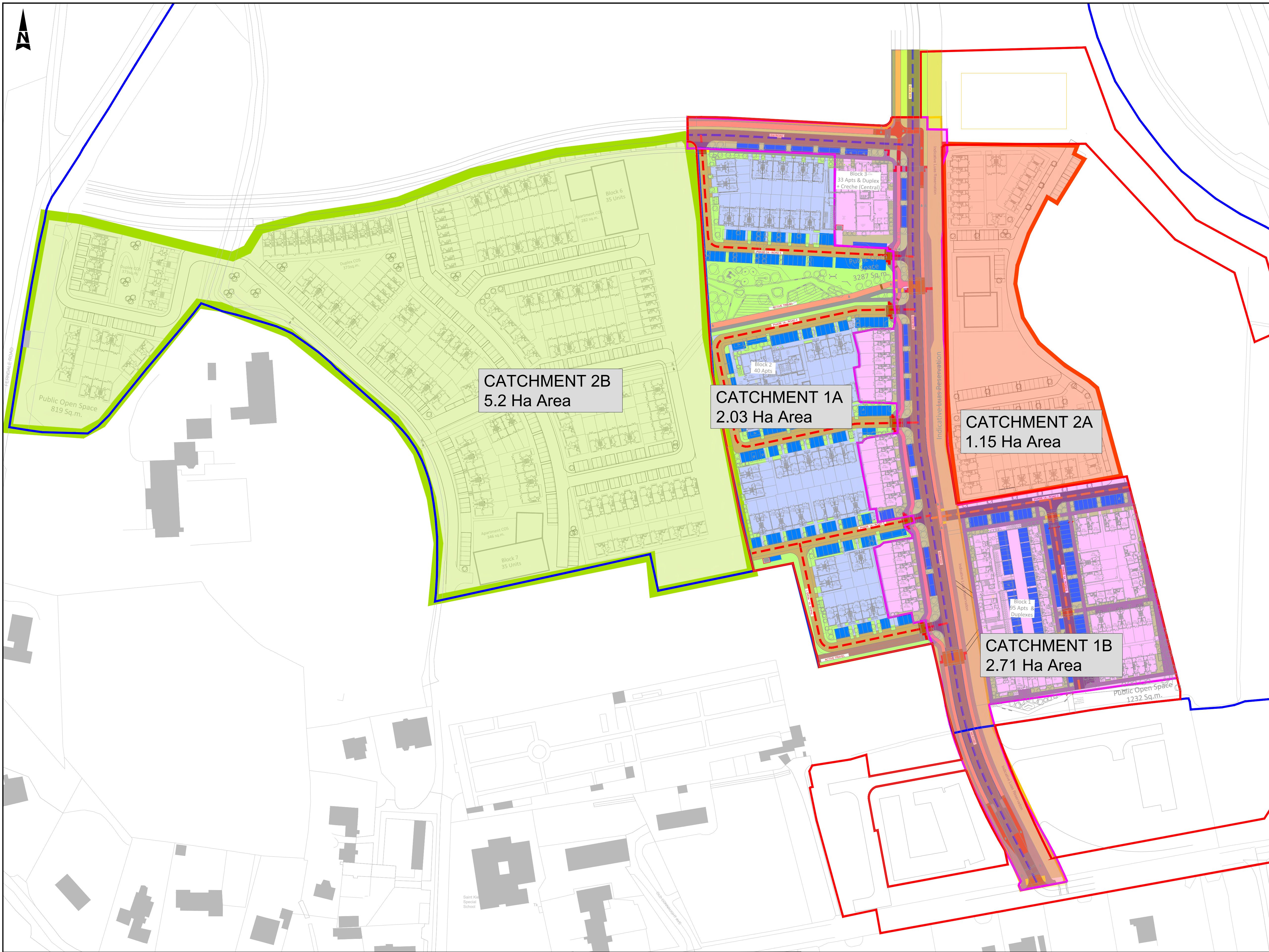
SITE AREA MAP



SITE LOCATION PLAN

- GENERAL NOTES
1. ALL DIMENSIONS ARE IN METRES UNLESS NOTED OTHERWISE
 2. ONLY WRITTEN DIMENSIONS SHALL BE USED. NO DIMENSIONS SHALL BE SCALED FROM THE DRAWINGS
 3. ALL LEVELS ARE IN METRES AND ARE TO MALIN HEAD DATUM
 4. ALL COORDINATES ARE IN METRES AND ARE TO IRISH TRANSVERSE MERCATOR
 5. DRAWINGS ARE TO BE READ IN CONJUNCTION WITH THE SPECIFICATION

Purpose		FOR PLANNING			
Title					
SITE LOCATION MAPS					
Original Scale		Drawn	Checked	Reviewed	Authorised
AS SHOWN		PM	IPR	IPR	GH
		Date 20.11.25	Date 20.11.25	Date 20.11.25	Date 20.11.25
Status	Drawing Number				Rev
S4	ATK-ZZ-ZZ-DR-CE-900100				P01



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Purpose FOR PLANNING									
Title SUB-CATCHMENT AREAS LAYOUT PLAN									
Original Scale 1:1000 at A1 1:2000 at A3		Drawn PM Date 02.07.26	Checked IPR Date 02.07.26	Reviewed GH Date 02.07.26	Authorised GH Date 02.07.26				
Status S4	Drawing Number ATK-ZZ-ZZ-DR-CE-900103								Rev P01

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Risk Level

Atkins Base Line - Low Risk

Atkins Sensitive - Medium Risk

Atkins Private - High Risk

Client Critical - Already Marked

Rev					Description				
P01					ISSUED FOR PLANNING				
By					Date				
10.07.26					IPR				
GH					Rev'd				
GH					Auth				

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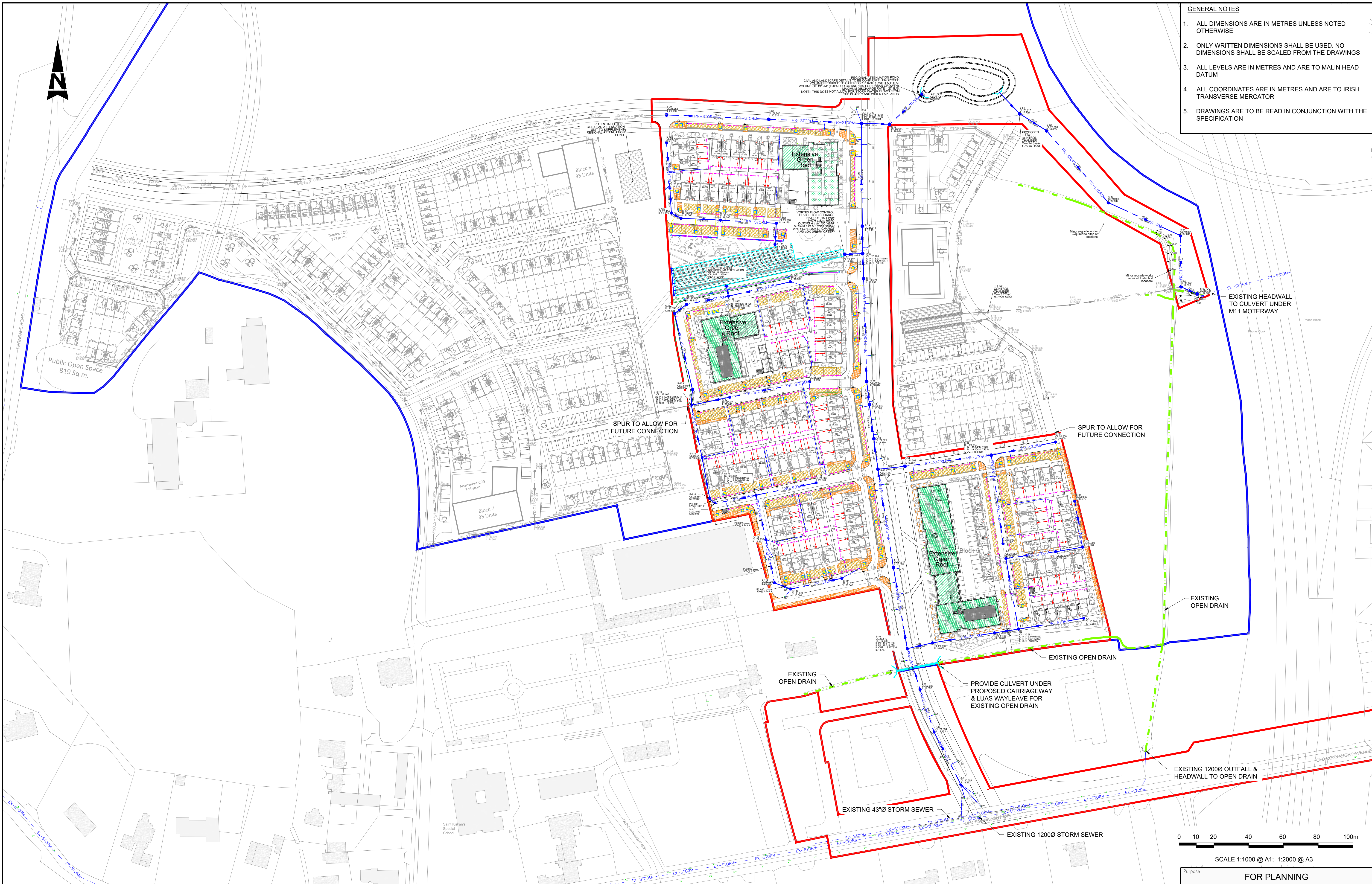
1st Floor Technology House Parkmore Technology Park, Galway
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Fax (+353) 091 779 830

Client CASTLETHORN OLD CONNAUGHT UCL		Project OLD CONNAUGHT PHASE A1 LRD	
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A1

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Plotted by: MUR7315



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Risk Level
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Atkins Sensitive - Medium Risk
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Client Critical - Already Marked

LEGEND			
	STAGE 1A - SITE BOUNDARY		PROPOSED TREE PIT
	EXISTING STORM DRAINAGE		PROPOSED SWALE C/W UNDER DRAIN
	EXISTING OPEN DRAIN		PROPOSED POROUS PAVING; FILTER DRAIN & GRATED ACCESS CHAMBER
	PROPOSED STORM DRAINAGE FOR FUTURE DEVELOPMENT		PROPOSED EXTENSIVE GREEN ROOF
	PROPOSED ROAD GULLY		

P01	ISSUED FOR PLANNING	PM	09.07.26	IPR	GH	GH
Rev	Description	By	Date	Chk'd	Rev'd	Auth

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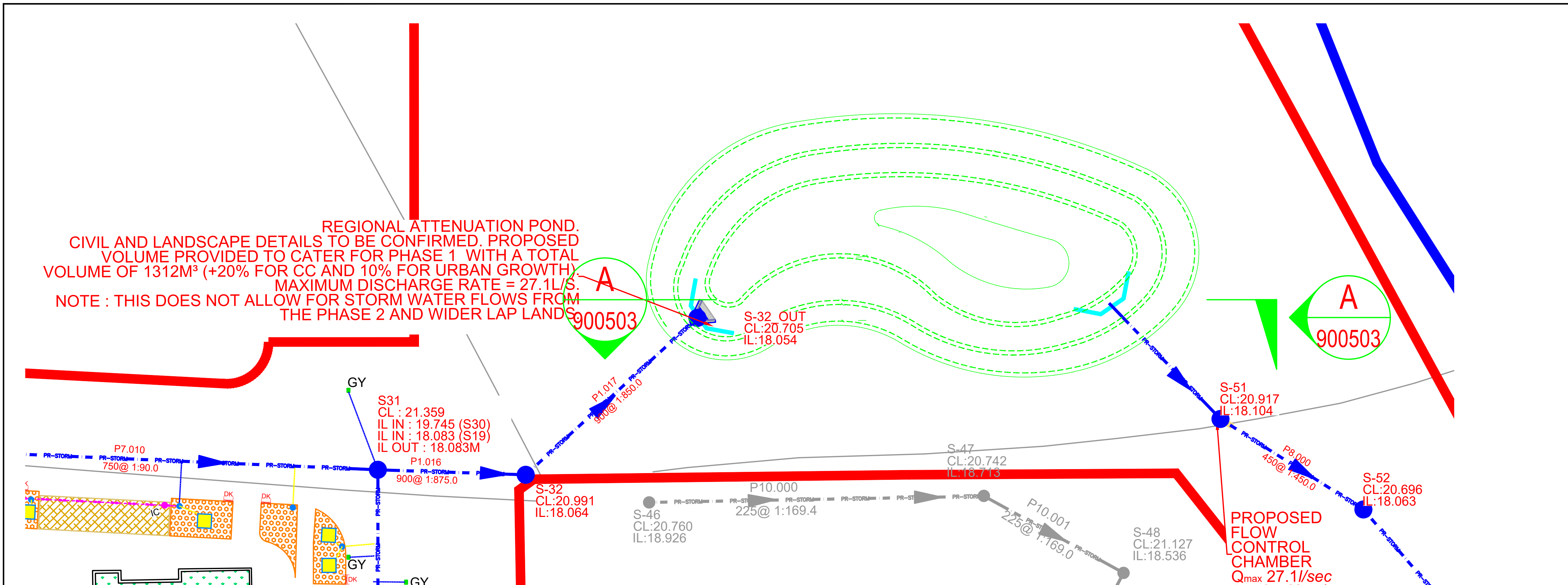
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Project	OLD CONNAUGHT PHASE A1 LRD

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Drawn	PM
Checked	IPR
Reviewed	IPR
Authorised	GH
Status	S4
Drawing Number	ATK-ZZ-ZZ-DR-CE-900500
Rev	P01

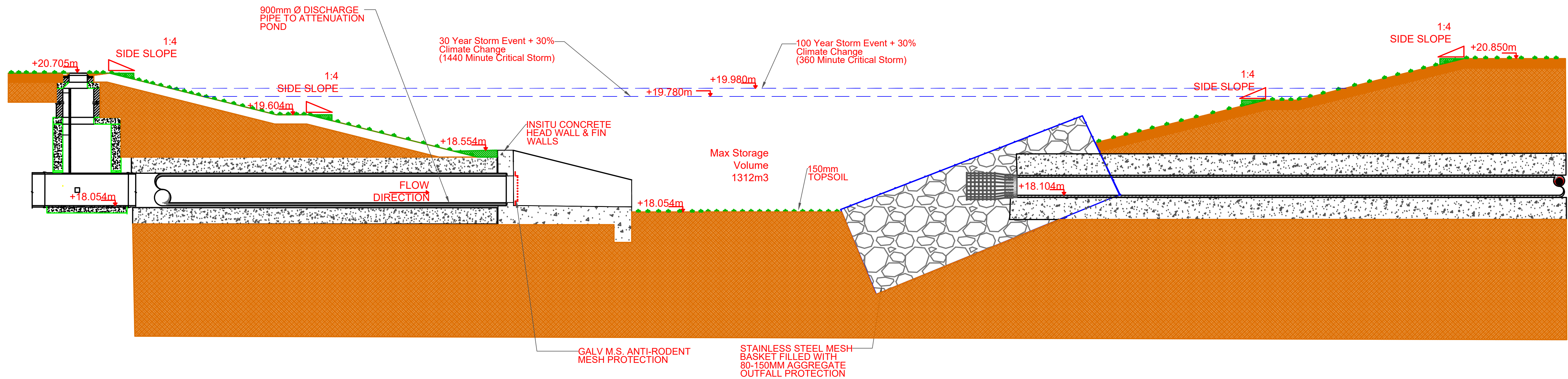
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SECTION A-A OF THE REGIONAL ATTENUATION POND

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	Atkins Private - High Risk
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Rev	Description	By	Date	Chk'd	Rev'd	Auth
P01	ISSUED FOR PLANNING	PM	09.07.26	IPR	GH	GH

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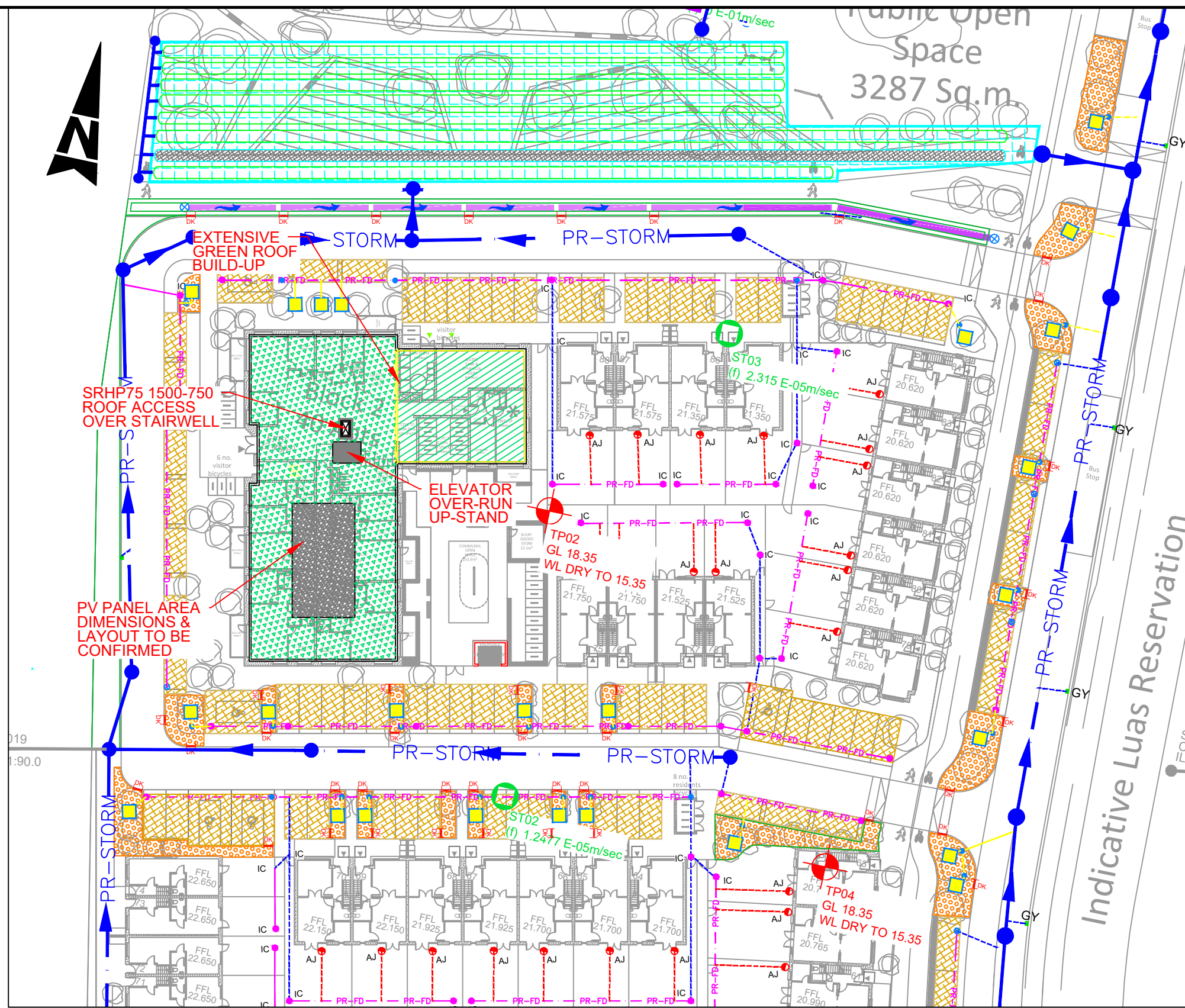
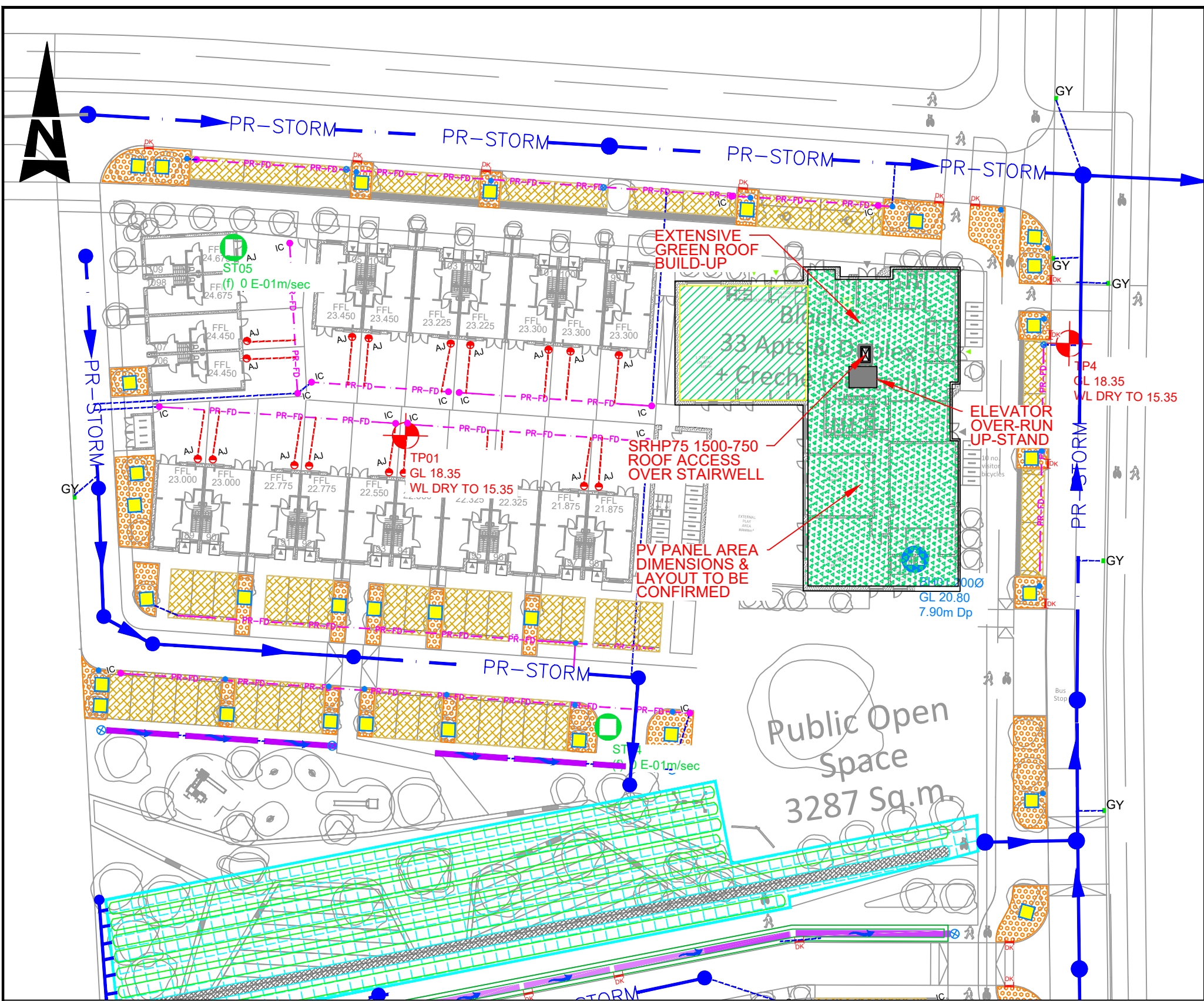
Client
CASTLETHORN OLD CONNAUGHT UCL

Project
OLD CONNAUGHT PHASE A1 LRD

Purpose		FOR PLANNING				
Title		PROPOSED REGIONAL ATTENUATION POND - SECTIONS & DETAILS				
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1:2000 at A3		Date	Date	Date	Date	
		23.02.26	23.02.26	23.02.26	23.02.26	
Status	Drawing Number					Rev
S4	ATK-ZZ-ZZ-DR-CE-900503					P01

A1

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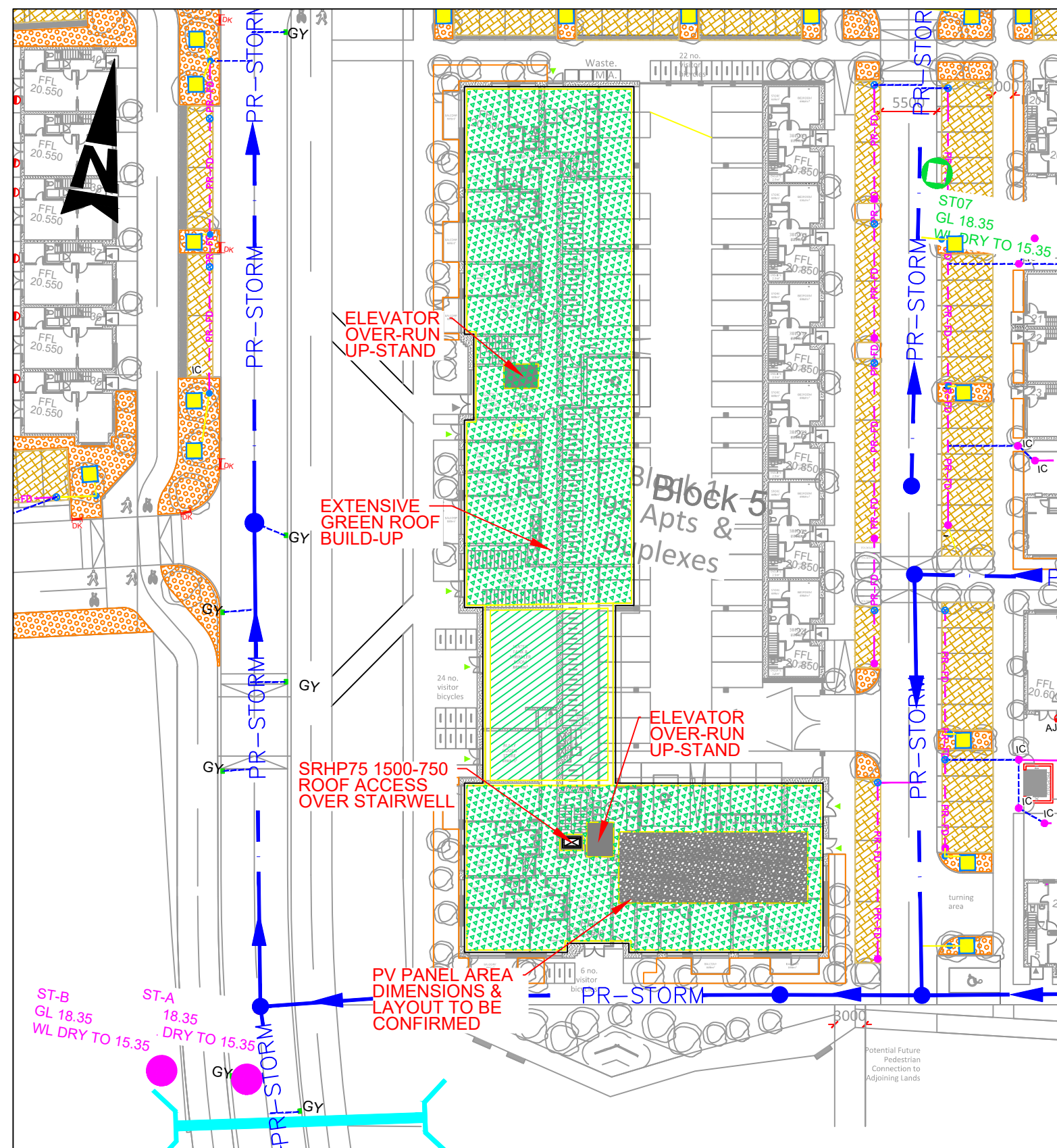
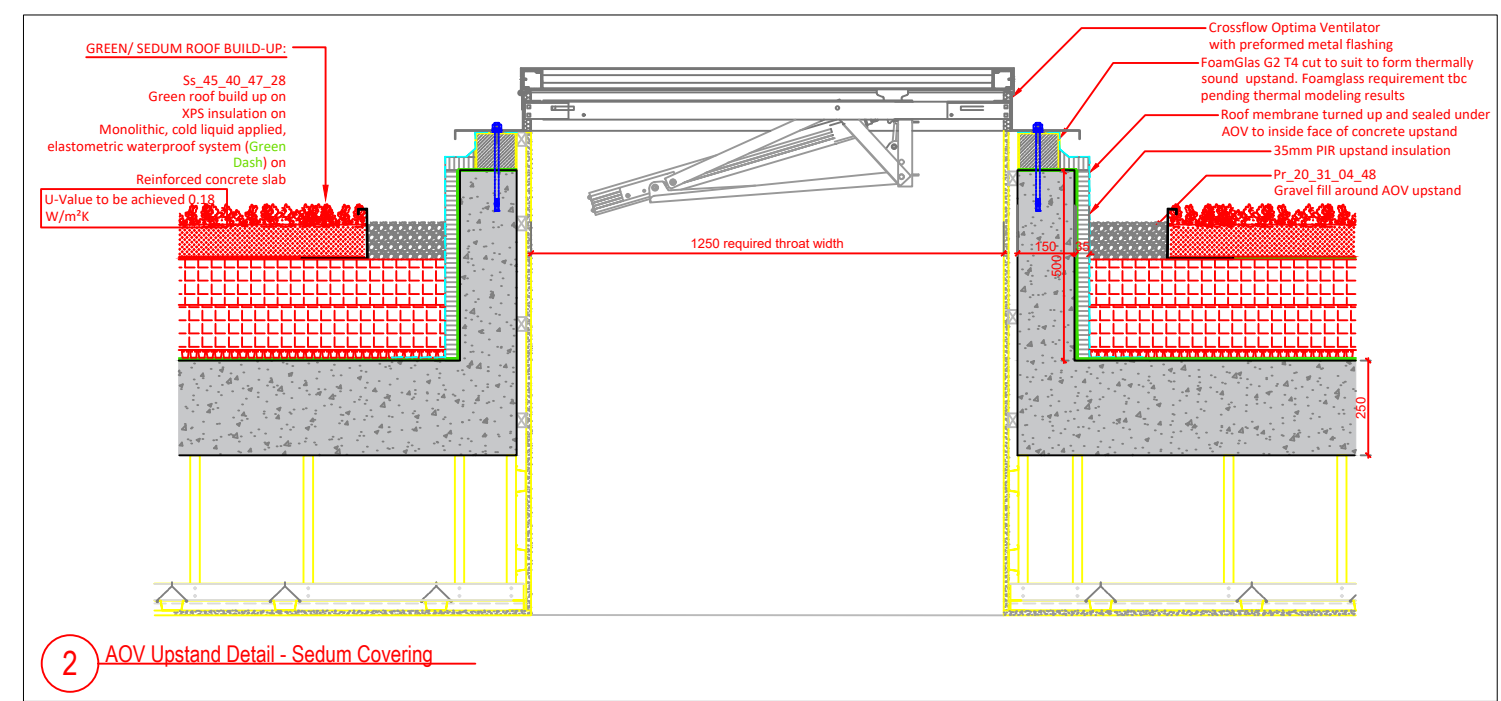
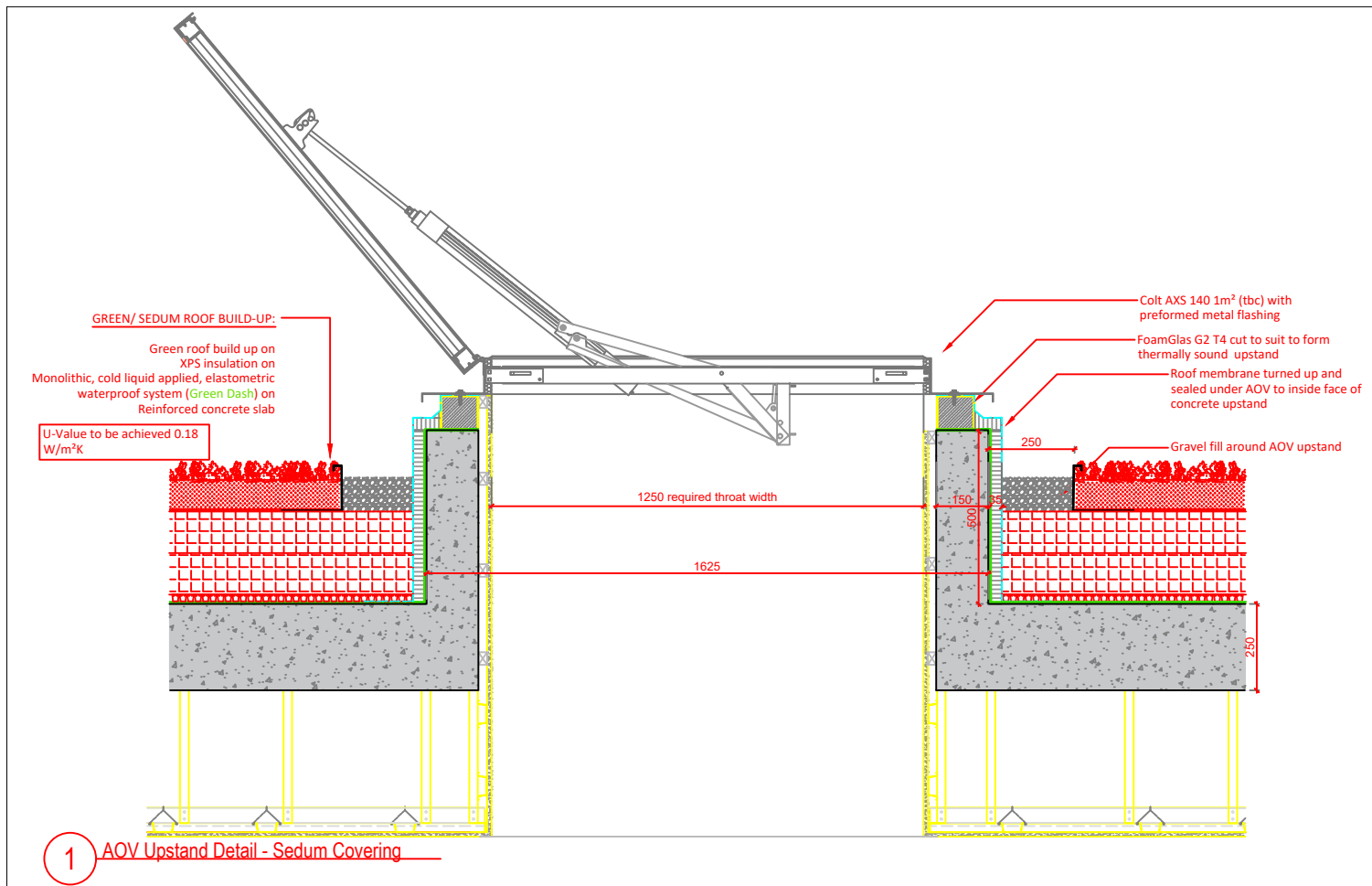


GREEN ROOF AREAS BLOCK 01

Scale at A1 1:500 at A1
Scale at A3 1:1000 at A3

GREEN ROOF AREAS BLOCK 02

Scale at A1 1:500 at A1
Scale at A3 1:1000 at A3



GREEN ROOF AREAS BLOCK 03

Scale at A1 1:500 at A1
Scale at A3 1:1000 at A3

LEGEND

BLOCK 1
TOTAL ROOF AREA = 750 M²
MINIMUM SEDUM ROOF AREA REQUIRED (60%) = 450 M²
TOTAL SEDUM ROOF AREA PROVIDED = 578 M² (77%)

BLOCK 2
TOTAL ROOF AREA = 752 M²
MINIMUM SEDUM ROOF AREA REQUIRED (60%) = 451 M²
TOTAL SEDUM ROOF AREA PROVIDED = 463 M² (63%)

BLOCK 3
TOTAL ROOF AREA = 1636 M²
MINIMUM SEDUM ROOF AREA REQUIRED (60%) = 982 M²
TOTAL SEDUM ROOF AREA PROVIDED = 1216 M² (88%)

- GENERAL NOTES**
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- LEGEND**
- EXTENSIVE GREEN ROOF
 - INTENSIVE GREEN COURTYARD
 - PROPOSED RAIN GARDEN
 - GRAVEL

- EXTENSIVE GREEN ROOF BUILD UP**
- PRE CULTIVATED SEDUM BLANKET
 - EXTENSIVE ROOF GARDEN SOIL MIX 150mm
 - VLF150 FILTRATION FLEECE 1.5mm THICK
 - DEC25 DRAINAGE & RESERVOIR LAYER 25mm THICK
 - ULU300 PROTECTIVE/RESERVOIR FLEECE 2.5mm
 - 4mm UNOSINT ROOT RESISTANT CAP SHEET
 - 4mm TOP/S BASE SHEET
 - 100mm PARATORCH INSULATION BOARD
 - 2mm VAPOBAR VAPOUR CONTROL LAYER

IMPORTANT NOTE:
THE COMBINED THICKNESS OF ALL THE ELEMENTS USED IN GREEN ROOF BUILD UP FROM TOP DECKING IS 315mm,
SEDUM PLANTS WILL TYPICALLY REACH HEIGHTS OF 100-150mm

- COURTYARD BUILD UP (INTENSIVE)**
- INTENSIVE VEGETATION
 - DIADEM SIM INTENSIVE SUBSTRATE
 - DIADEM VLF200 FILTER GEOTEXTILE
 - DIADEM DIADRAIN-60H DRAINAGE BOARD FILLED
 - DIADEM VLF-110 SEPERATION GEOTEXTILE CLOSED CELL THERMAL INSULATION
 - DIADEM VLU-500 PROTECTION GEOTEXTILE ROOT RESISTANT WATERPROOFING MEMBRANE ADDITIONAL LAYERS

IMPORTANT NOTE:
THE COMBINED THICKNESS OF ALL THE ELEMENTS USED IN COURTYARD ROOF BUILD UP IS > 500mm,
PLANTING TO LANDSCAPE ARCHITECTS DETAILS

NOTE:
PROPOSED GREEN ROOF AND GREEN COURTYARD DESIGNED IN ACCORDANCE WITH SECTION 7.2 GREEN ROOF POLICY 2022 DLRCC COUNTY DEVELOPMENT PLAN 2022-2028



PV PANEL ON GREEN ROOF

Scale at A1 NTS
Scale at A3 NTS

File: ATK-ZZ-ZZ-DR-CE-900504.dwg
Date: Jul 14, 2026 - 13:09pm
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Atkins Sensitive - Medium Risk	
Atkins Private - High Risk	
Client Critical - Already Marked	

- LEGEND**
- PR-STORM
 - PR-STORM
 - PROPOSED STORM DRAINAGE
 - PROPOSED STORM WATER MANHOLE
 - PROPOSED UNDERGROUND ATTENUATION SYSTEM
 - SXX
 - SITE INVESTIGATION BORE HOLE LOCATION
 - SITE INVESTIGATION SOAKWAY LOCATION
 - SITE INVESTIGATION SLIT TRENCH LOCATION
 - PROPOSED PERMEABLE PAVING
 - BIO RETENTION RAIN GARDEN
 - SITE INVESTIGATION TRIAL PIT LOCATION

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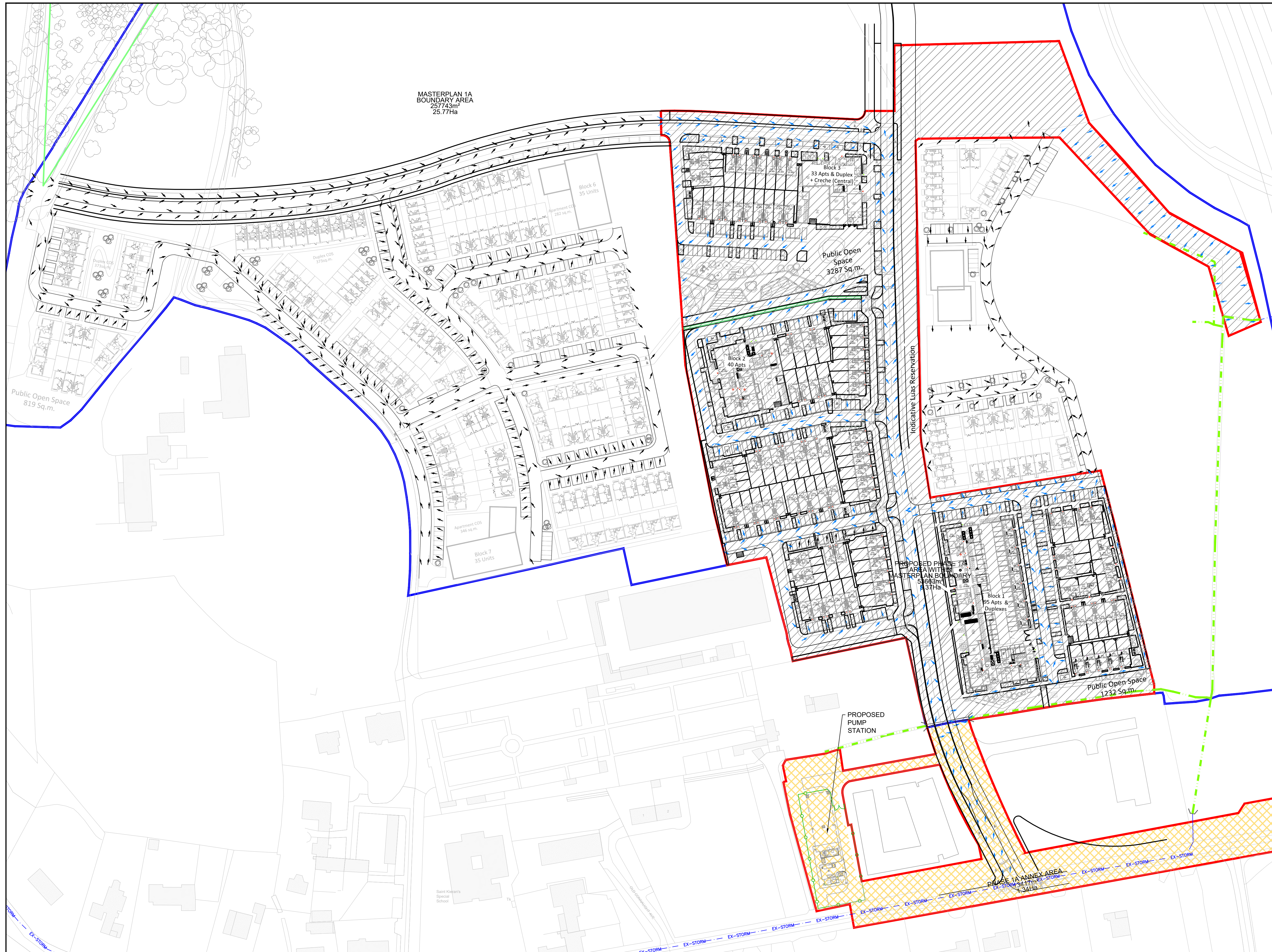
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Client
CASTLETHORN OLD CONNAUGHT UCL

Project
OLD CONNAUGHT PHASE A1 LRD

Purpose		FOR PLANNING					
Title		PROPOSED GREEN INTENSIVE ROOF LAYOUT PLANS & DETAILS					
Original Scale	1:500 at A1 1:1000 at A3	Drawn	Checked	Reviewed	Authorised		
		PM	IPR	IPR	GH	Date	Rev
Status	Drawing Number	ATK-ZZ-ZZ-DR-CE-900504					
S4		P01					



- | GENERAL NOTES | |
|---------------|--|
| 1. | ALL DIMENSIONS ARE IN METRES UNLESS NOTED OTHERWISE |
| 2. | ONLY WRITTEN DIMENSIONS SHALL BE USED. NO DIMENSIONS SHALL BE SCALED FROM THE DRAWINGS |
| 3. | ALL LEVELS ARE IN METRES AND ARE TO MALIN HEAD DATUM |
| 4. | ALL COORDINATES ARE IN METRES AND ARE TO IRISH TRANSVERSE MERCATOR |
| 5. | DRAWINGS ARE TO BE READ IN CONJUNCTION WITH THE SPECIFICATION |

Purpose	FOR PLANNING
---------	--------------

PROPOSED OVERGROUND FLOOD PATH LAYOUT PLAN

Original Scale		Drawn	Checked	Reviewed	Authorised
1:1000 at A1		PM	IPR	IPR	GH
1:2000 at A3		Date: 09.03.26	Date: 09.03.26	Date: 09.03.26	Date: 09.03.26
Status	Drawing Number				Rev
S4	ATK-ZZ-ZZ-DR-CE-900505				P01

P01	ISSUED FOR PLANNING				PM	09.07.28	IPR	GH	GH
Rev	Description				By	Date	Chk'd	Rev'd	Auth



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Client

CASTLETHORN OLD CONNAUGHT UCL

OLD CONNAUGHT PHASE A1 LRD

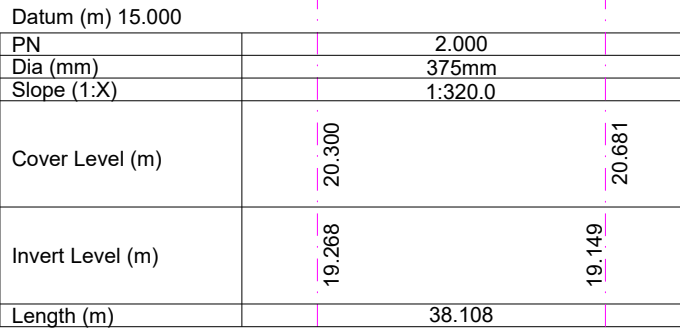
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	Client Critical - Already Marked

LEGEND

-
- PHASE 1A BOUNDARY
 MASTERPLAN BOUNDARY
 OVERLAND FLOOD FLOW PATH
 EXISTING OPEN DRAIN
 EXISTING STORM SEWER
 PROPOSED CULVERT & HEADWALLS



Longitudinal Section S3 - S4

Scale 1:1000 (Horizontally), 1:100 (Vertically)



Longitudinal Section S7 - S10
 Scale: 1:1000 (Horizontally), 1:100 (Vertically)

Longitudinal Section S33 - S12
Scale 1:1000 (Horizontally), 1:100 (Vertically)

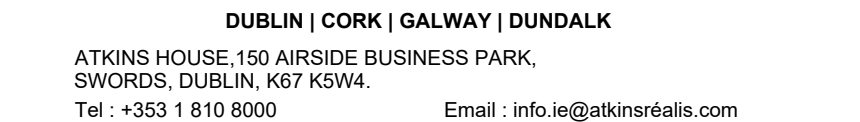
Longitudinal Section S33 - S45_OUT
Scale 1:1000 (Horizontally), 1:100 (Vertically)

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P01	ISSUED FOR PLANNING				PM	09.07.26	IPR	GH	GH
Rev	Description				By	Date	Chk'd	Rev'd	Auth



Client	CATLETHORN OLD CONNAUGHT UCL
Project	OLD CONNAUGHT PHASE A1 LRD

GENERAL NOTES

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4. ALL COORDINATES ARE IN METRES AND ARE TO IRISH TRANSVERSE MERCATOR
5. DRAWINGS ARE TO BE READ IN CONJUNCTION WITH THE SPECIFICATION

Purpose		FOR PLANNING					
Title		PROPOSED STORM DRAINAGE LONG-SECTIONS SHEET 1					
Original Scale 1:1000 H 1: 100 V		Drawn PM Date 26.02.26	Checked IPR Date 26.02.26	Reviewed IPR Date 26.02.26	Authorised GH Date 26.02.26		
Status	Drawing Number					Rev	
S4	ATK-ZZ-ZZ-DR-CE-900510					P01	



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P01	ISSUED FOR PLANNING				PM	09.07.26	IPR	GH	GH
Rev	Description				By	Date	Chk'd	Rev'd	Auth



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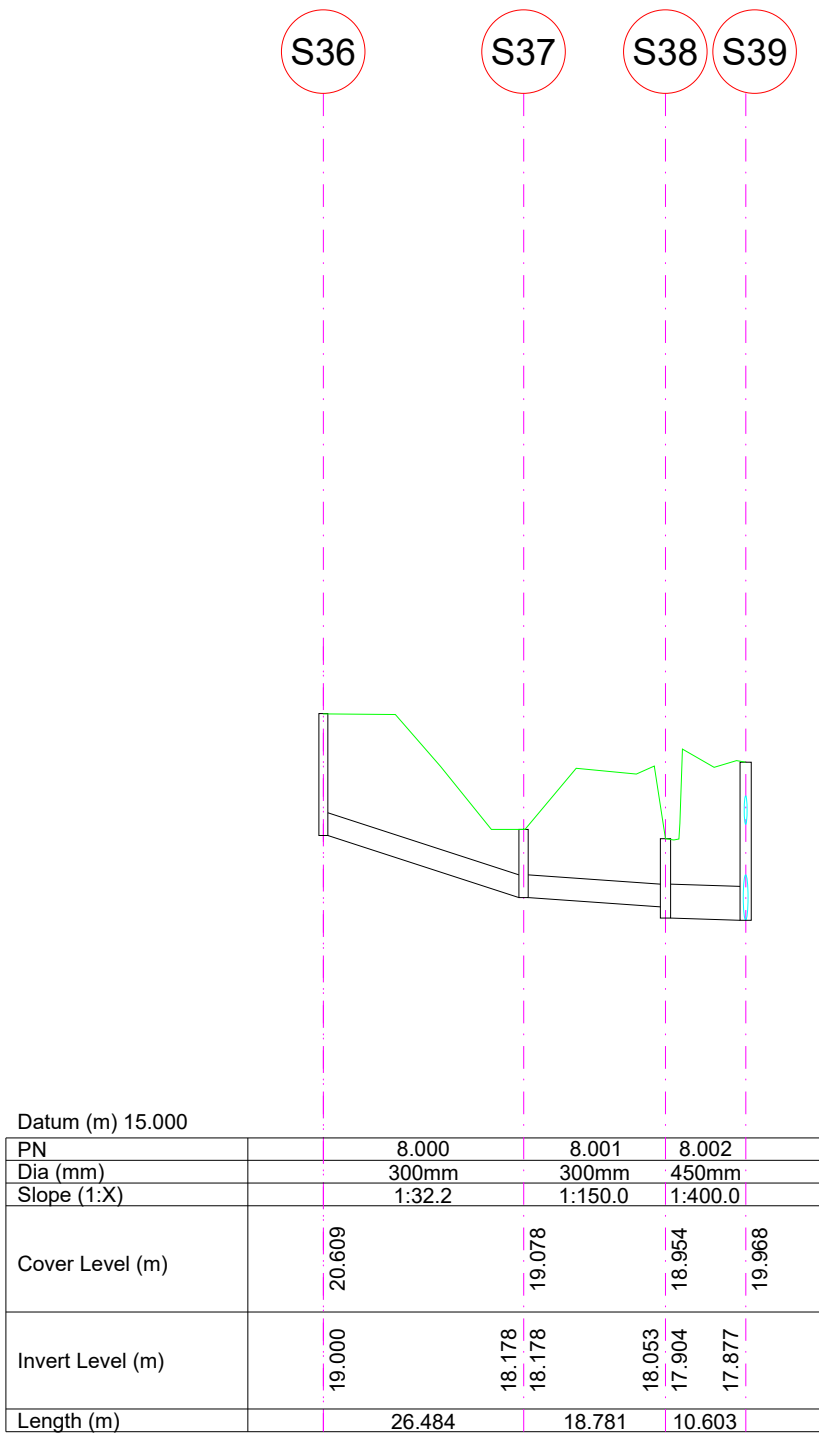
Client	CASCADE
Project	OLD CONNAUGHT PHASE A1 LRD

Purpose		FOR PLANNING				
Title		PROPOSED STORM DRAINAGE LONG-SECTIONS SHEET 2				
Original Scale 1:1000 H 1: 100 V	Drawn	Checked	Reviewed	Authorised		
	PM	IPR	IPR	GH		
	Date 26.02.26	Date 26.02.26	Date 26.02.26	Date 26.02.26		
Status	Drawing Number				Rev	
S4	ATK-ZZ-ZZ-DR-CE-900511				P01	

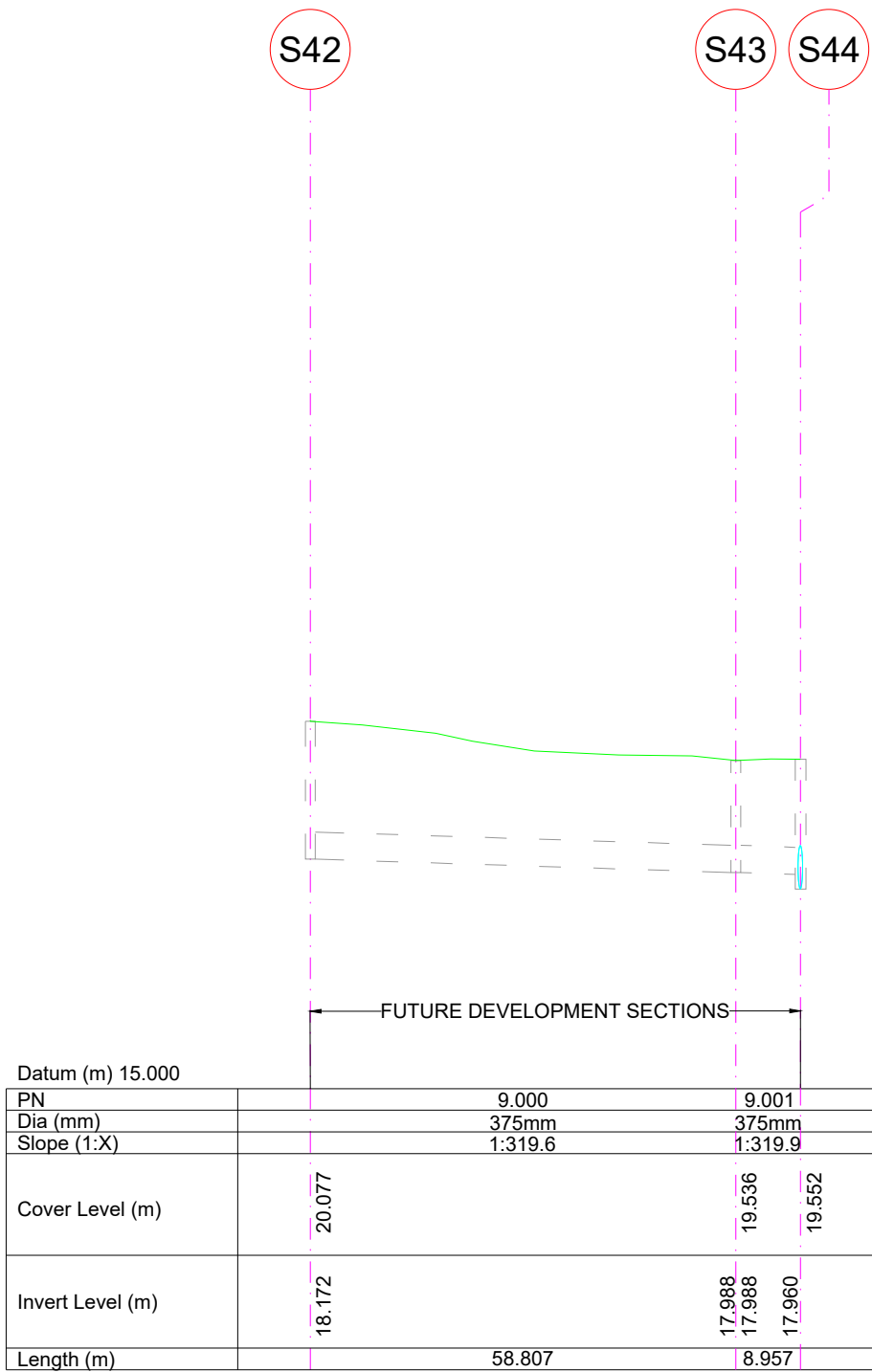
A1

DO NOT SCALE

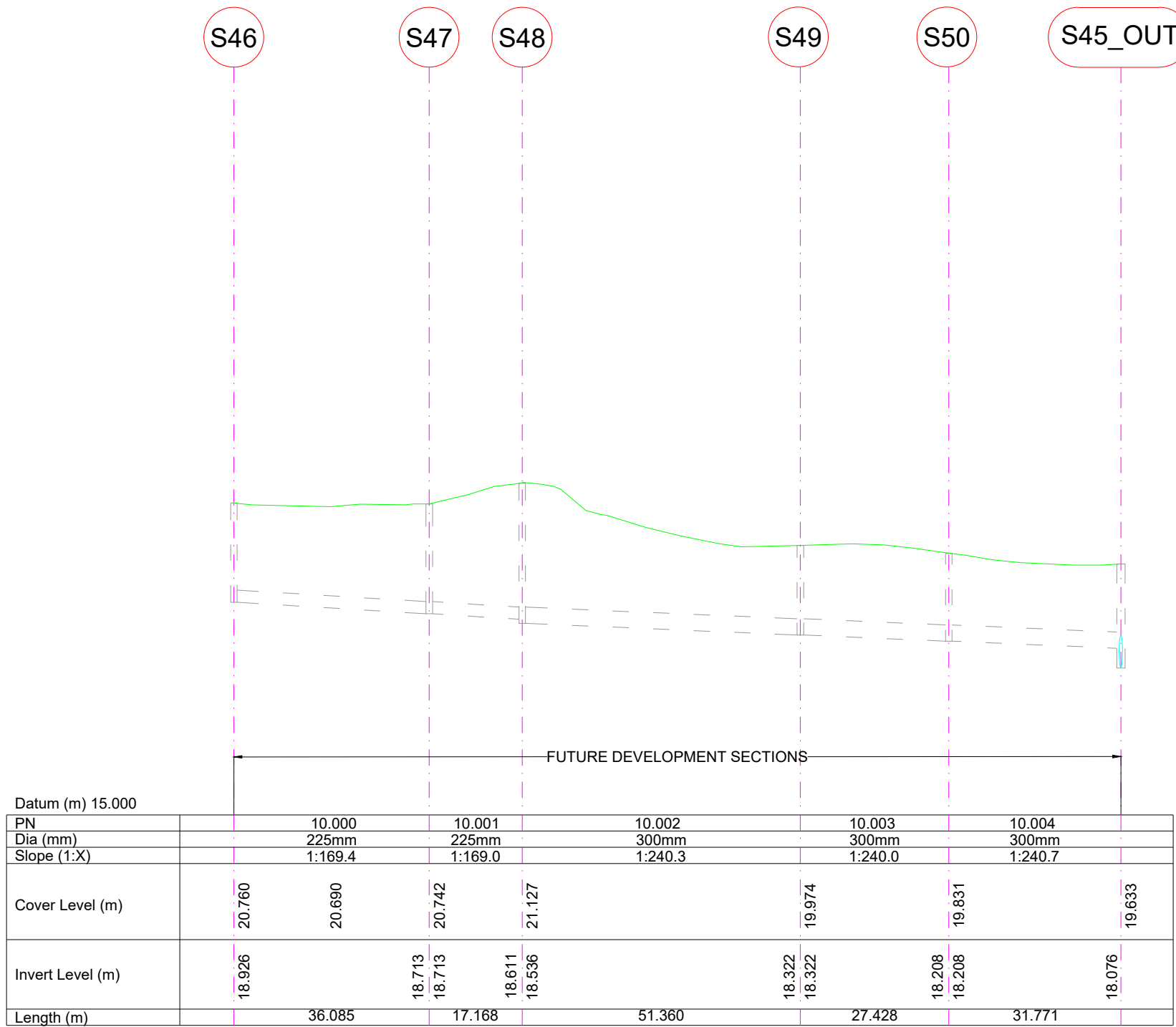
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Plotted by: MUR07315



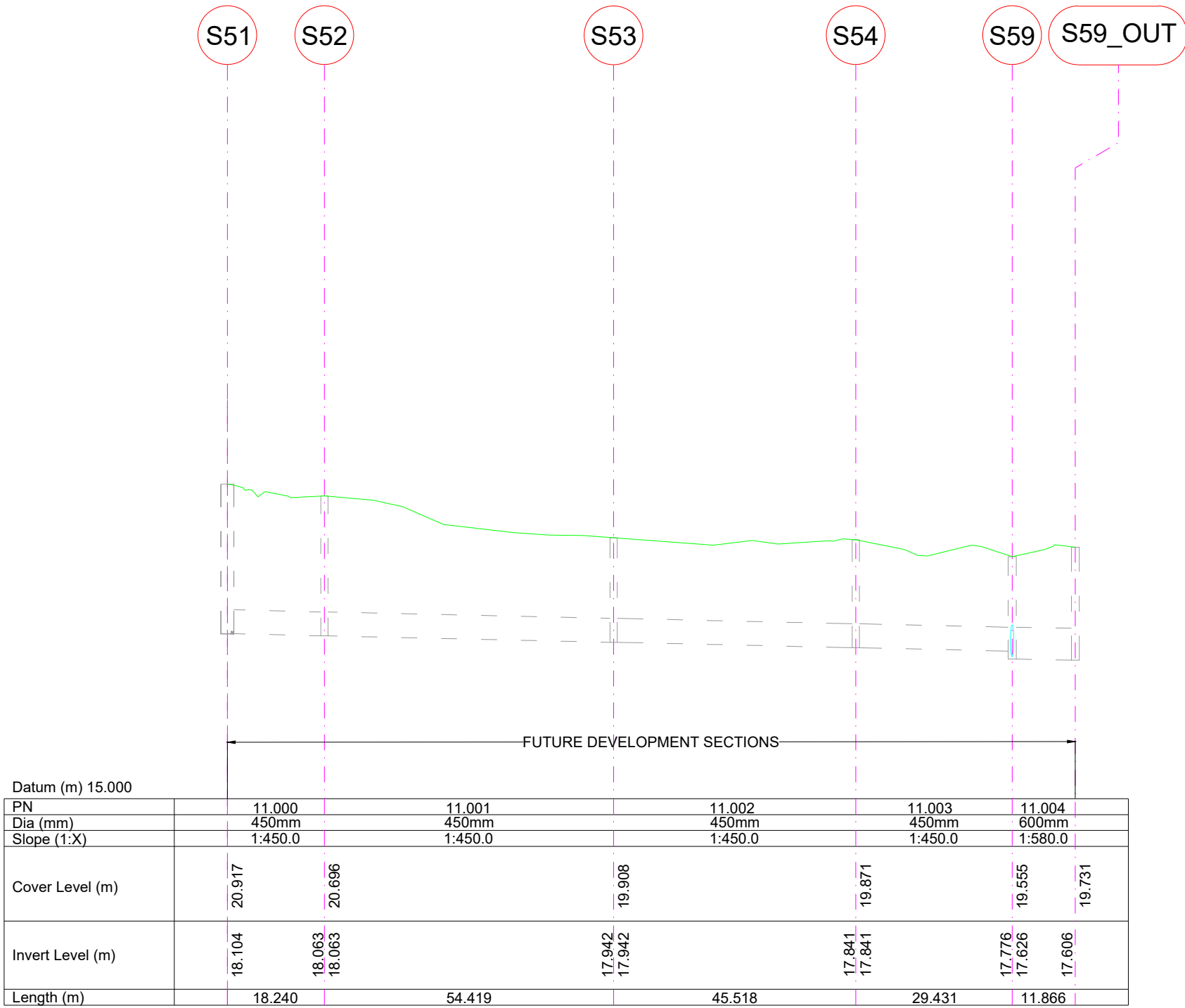
Longitudinal Section S36 - S39
Scale 1:1000 (Horizontally), 1:100 (Vertically)



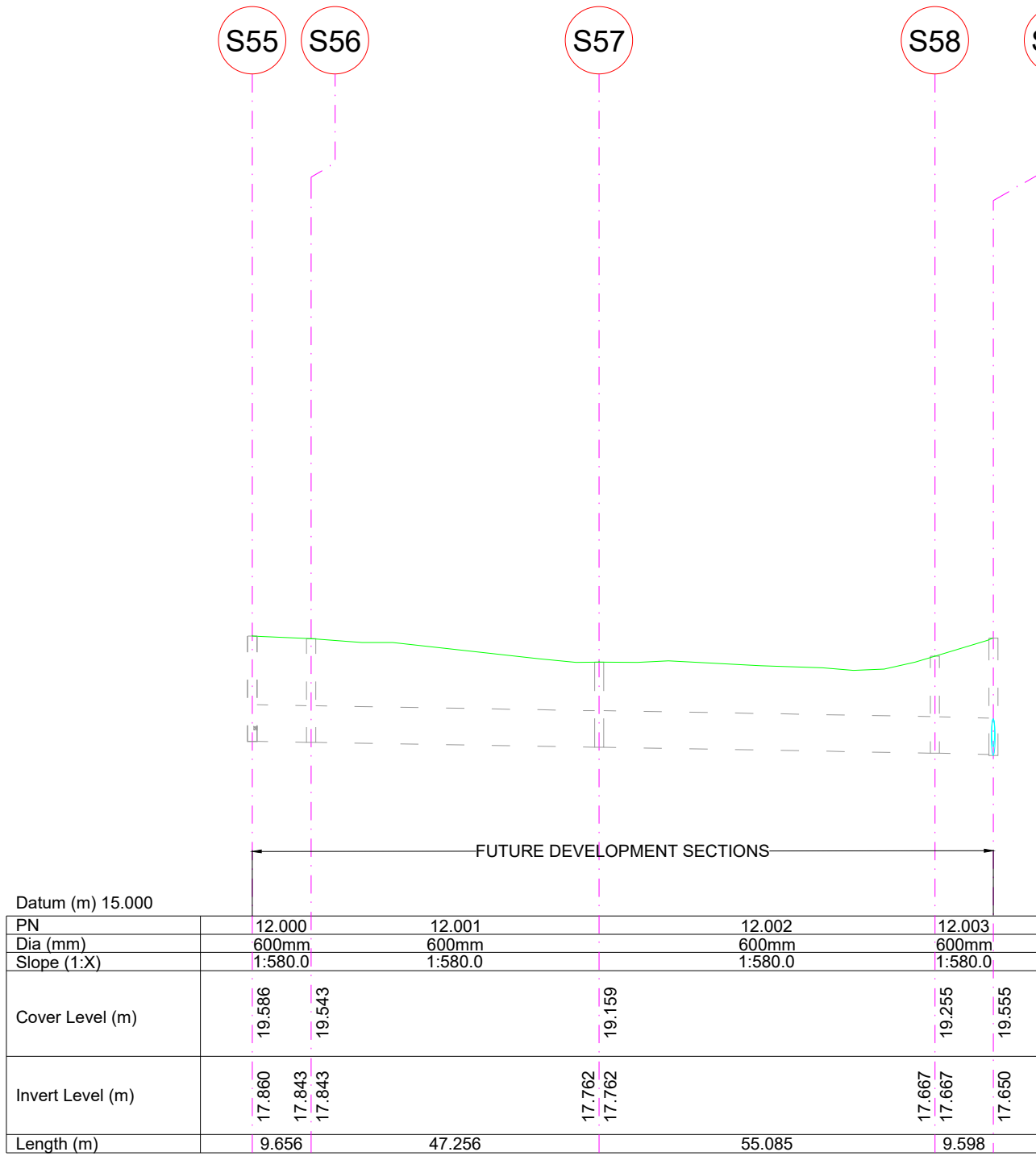
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Scale 1:1000 (Horizontally), 1:100 (Vertically)



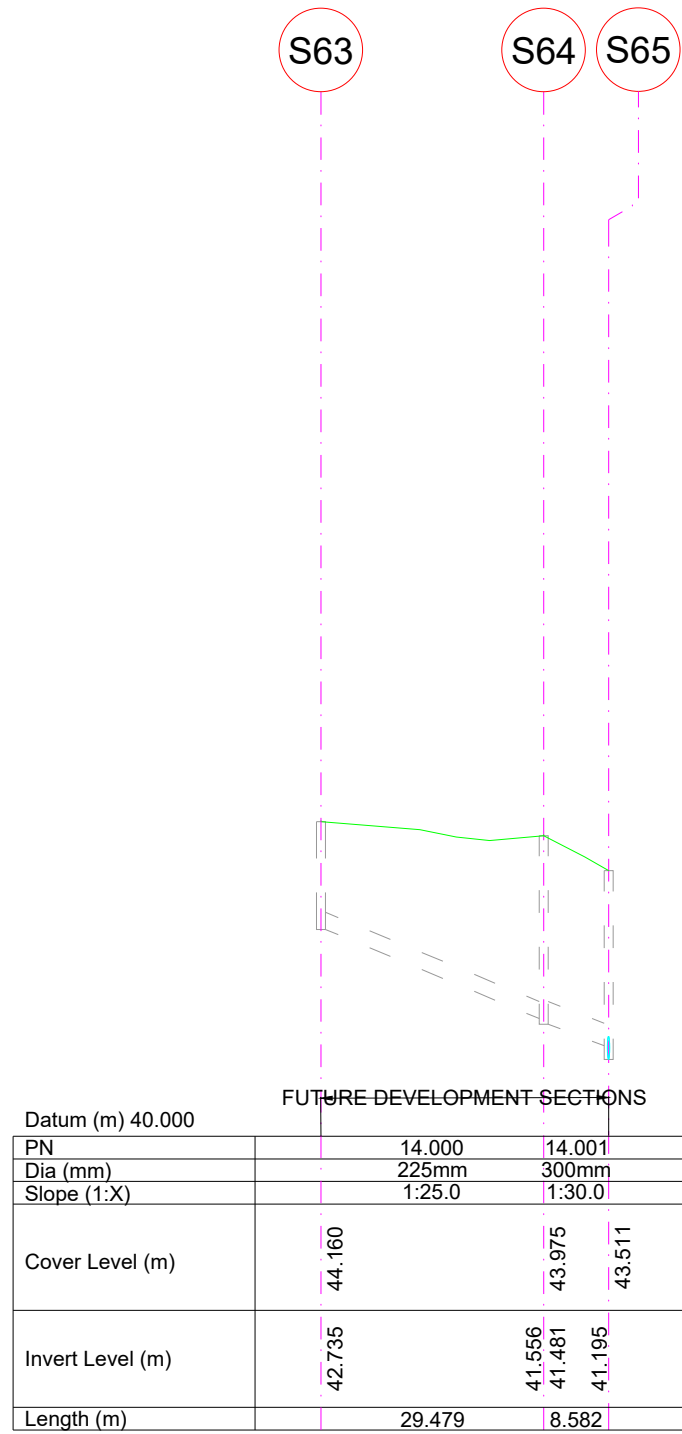
Longitudinal Section S46 - S45_OUT
Scale 1:1000 (Horizontally), 1:100 (Vertically)



Longitudinal Section S51 - S59_OUT
Scale 1:1000 (Horizontally), 1:100 (Vertically)



Longitudinal Section S55 - S59
Scale 1:1000 (Horizontally), 1:100 (Vertically)



Longitudinal Section S63 - S65
Scale 1:1000 (Horizontally), 1:100 (Vertically)

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	Atkins Private - High Risk
	Client Critical - Already Marked

Rev	Description	By	Date	Chk'd	Rev'd	Auth
P01	ISSUED FOR PLANNING	PM	09.07.26	IPR	GH	GH

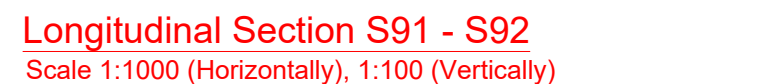
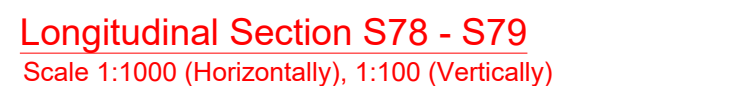
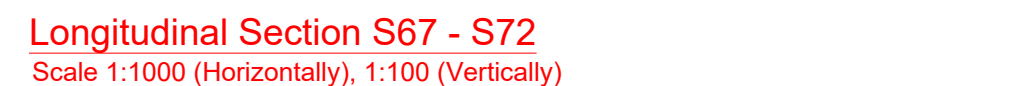


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Client
CASTLETHORN OLD CONNAUGHT UCL

Project
OLD CONNAUGHT PHASE A1 LRD

Purpose	FOR PLANNING				
Title	PROPOSED STORM DRAINAGE LONG-SECTIONS SHEET 3				
Original Scale	1:1000 H	Drawn	PM	Checked	IPR
1: 100 V		Date	26.02.26	Date	26.02.26
Status	S4	Drawing Number	ATK-ZZ-ZZ-DR-CE-900512		Rev
					P01



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P01	ISSUED FOR PLANNING				PM	09.07.28	IPR	GH	GH
Rev	Description				By	Date	Chk'd	Rev'd	Auth



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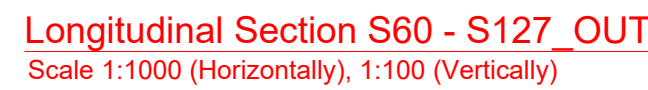
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Client	CASCADE
Project	OLD CONNAUGHT PHASE A1 LRD

Purpose					
FOR PLANNING					
Title					
PROPOSED STORM DRAINAGE LONG-SECTIONS SHEET 4					
Original Scale		Drawn	Checked	Reviewed	Authorised
1:1000 H		PM	IPR	IPR	GH
1:100 V		Date 26.02.26	Date 26.02.26	Date 26.02.26	Date 26.02.26
Status	Drawing Number				Rev
S4	ATK-ZZ-ZZ-DR-CE-900513				P01



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	Atkins Private - High Risk
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P01	ISSUED FOR PLANNING				PM	09.07.28	IPR	GH	GH
Rev	Description				By	Date	Chk'd	Rev'd	Auth

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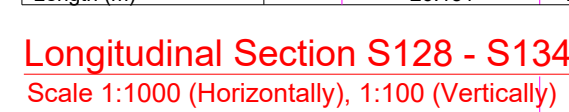
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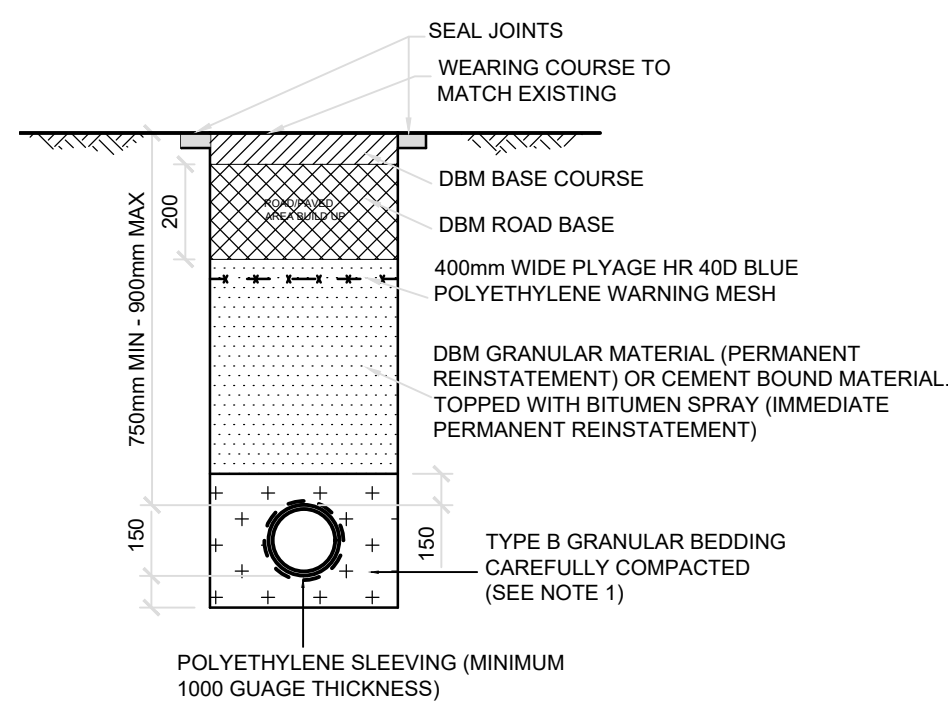
Client	CASCADE
Project	OLD CONNAUGHT PHASE A1 LRD

Purpose		FOR PLANNING			
Title					
PROPOSED STORM DRAINAGE LONG-SECTIONS SHEET 5					
Original Scale		Drawn	Checked	Reviewed	Authorised
1:1000 H		PM	IPR	IPR	GH
1:100 V		Date 26.02.26	Date 26.02.26	Date 26.02.26	Date 26.02.26
Status	Drawing Number				Rev
S4	ATK-ZZ-ZZ-DR-CE-900514				P01

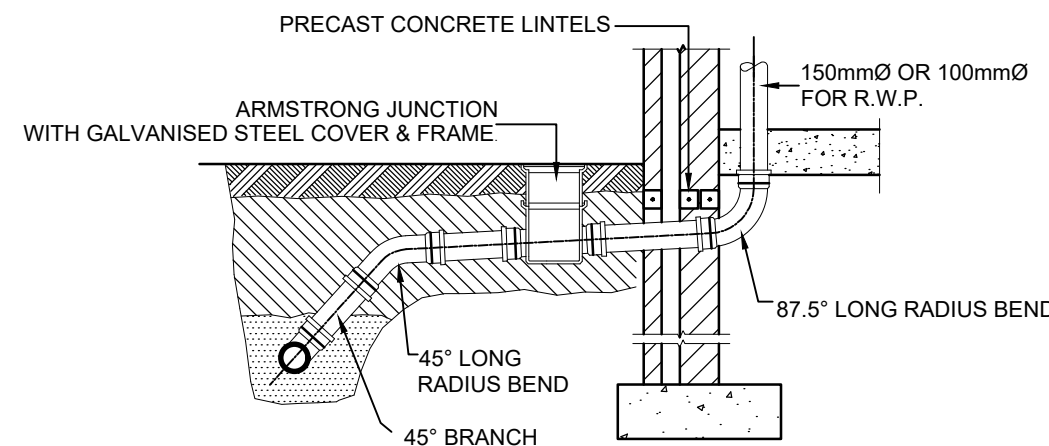


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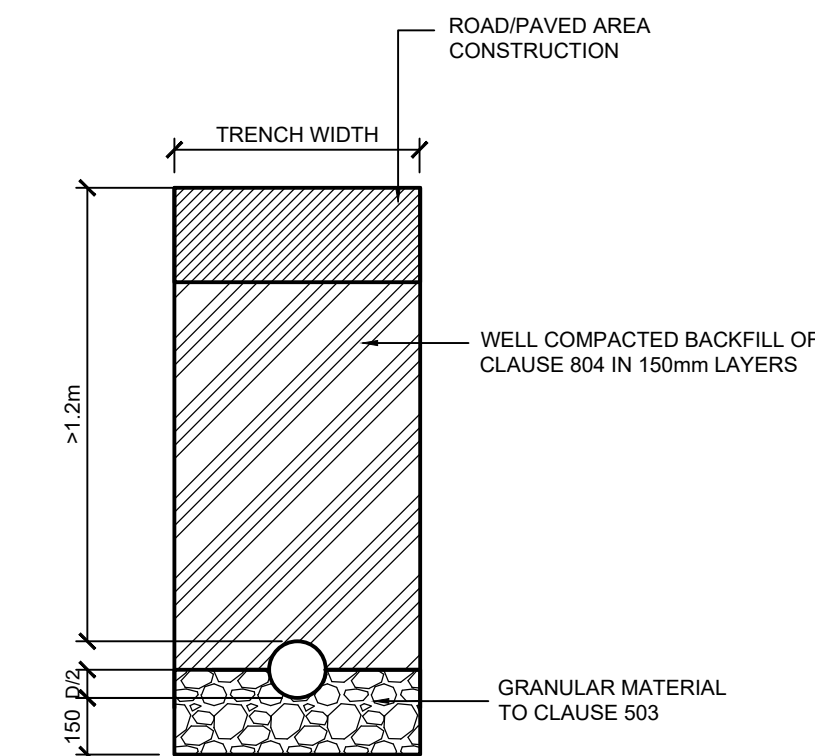
Purpose						FOR PLANNING					
Title											
PROPOSED STORM DRAINAGE LONG-SECTIONS SHEET 6											
Original Scale				Drawn		Checked		Reviewed		Authorised	
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1:100 V				Date		Date		Date		Date	
18.03.26				18.03.26		18.03.26		18.03.26		18.03.26	
Status		Drawing Number								Rev	
S4		ATK-ZZ-ZZ-DR-CE-900515								P01	



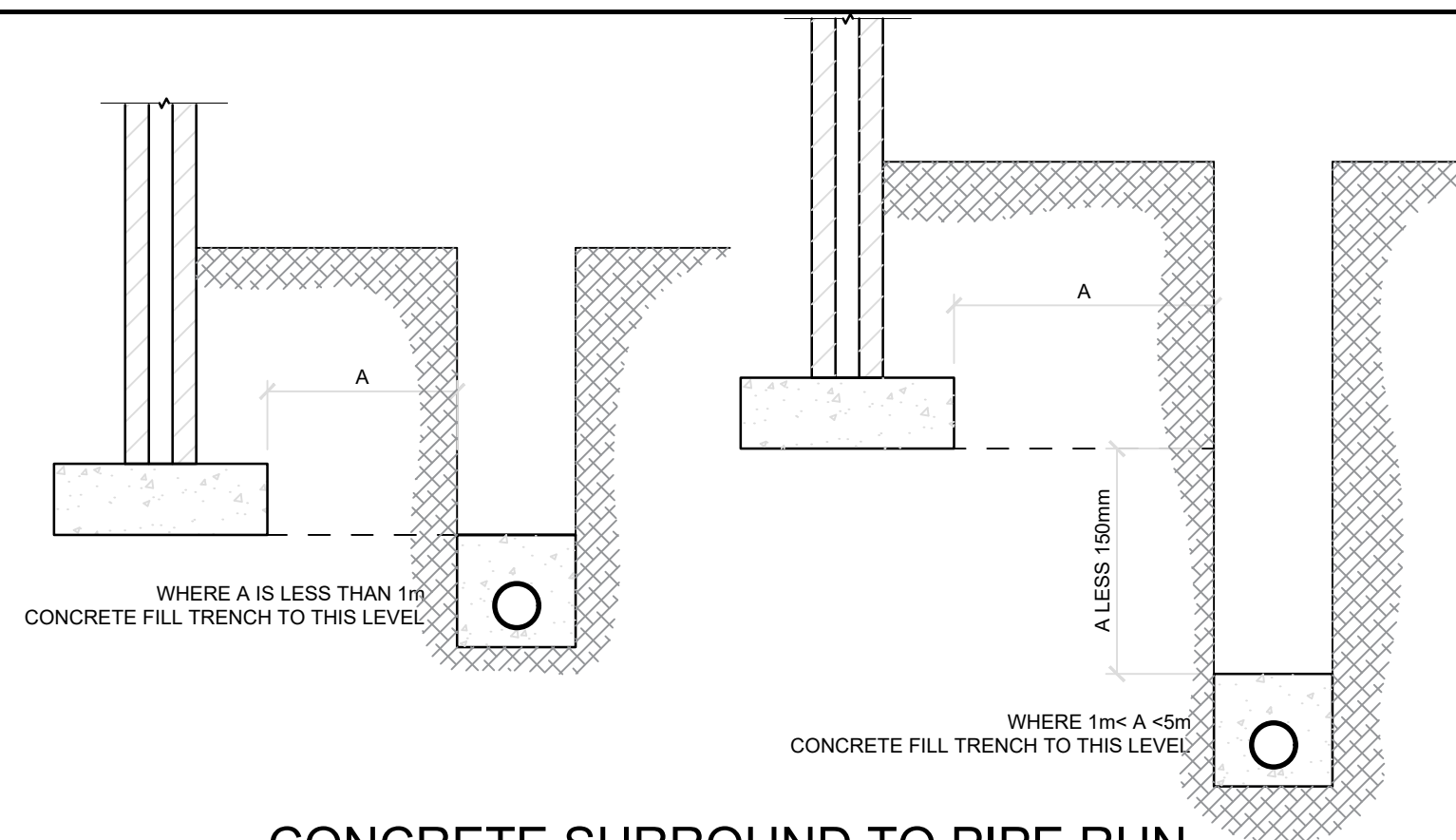
1. ALL EDGES TO BE SAW CUT TO A SUFFICIENT DEPTH THAT THE INTEGRITY OF ADJACENT PAVEMENT SHALL NOT BE DAMAGED DURING SUBSEQUENT WORKS.
2. IF THE OPENING IS TO BE TEMPORARILY DRESSED, IT SHALL BE TOPPED WITH 60mm OF COMPACTED 10mm Or 14mm DELAYED SET BITUMAC TO B.S. 4387
3. HOT ROLLED ASPHALT (HRA) WEARING COURSE TO CL 905 EITHER 55% COURSE AGGREGATE OR 30% COURSE AGGREGATE WITH 20mm (NOMINAL SIZE) PRE COATED CHIPS TO CL 907
4. DBM BASE COURSE SHALL BE 28mm NOMINAL SIZE CL 902
5. PRIOR TO REINSTATEMENT, SAW CUT THE ROAD A SECOND TIME, THE DEPTH OF CUT SHALL BE, AT MINIMUM, TO THE TOP OF THE BASE COURSE, WHERE ALL TRIM LINES ARE EXTENDED 400mm OF THE ROAD EDGE. JOINT, OTHER REINSTATEMENT OR IRONWORK, THE TRIM LINE SHALL BE WITHIN 400mm THAT THAT SITUATION.
6. 100 DCG C HOT BITUMEN BINDER 50 PEN OR COLD THIXOTROPIC BITUMEN 50, 70 PEN TO BE APPLIED TO ALL VERTICAL CURTS IN ACCORDANCE WITH B.S. 594, PRIOR TO APPLICATION OF BLACK TOP.
7. JOINTS SEALED WITH HOT BITUMEN AND TOPPED WITH FINE SAND / GRIT TO GIVE A MINIMUM 55 SKID RESISTANCE VALUE AND SHALL NOT EXCEED 3mm THICKNESS OR 40mm WIDTH.
8. DBM ROAD BASE SHALL BE CL.812
9. LEANMIX CONCRETE IN ACCORDANCE WITH CL.809
10. LEANMIX SURFACE TO BE SPRAYED PER CL. 909 PRIOR TO APPLICATION OF BITUMINOUS LAYER.
11. CL.804 GRANULAR MATERIAL, TYPE B, COMPACTED IN LAYERS IN ACCORDANCE WITH CL.802
12. DEPENDING ON COMPOSITION OF THE ROAD, THE OVER BREAK MAY EXTEND TO THE TOP OF THE GRANULAR OR CEMENT BOUND MATERIAL.



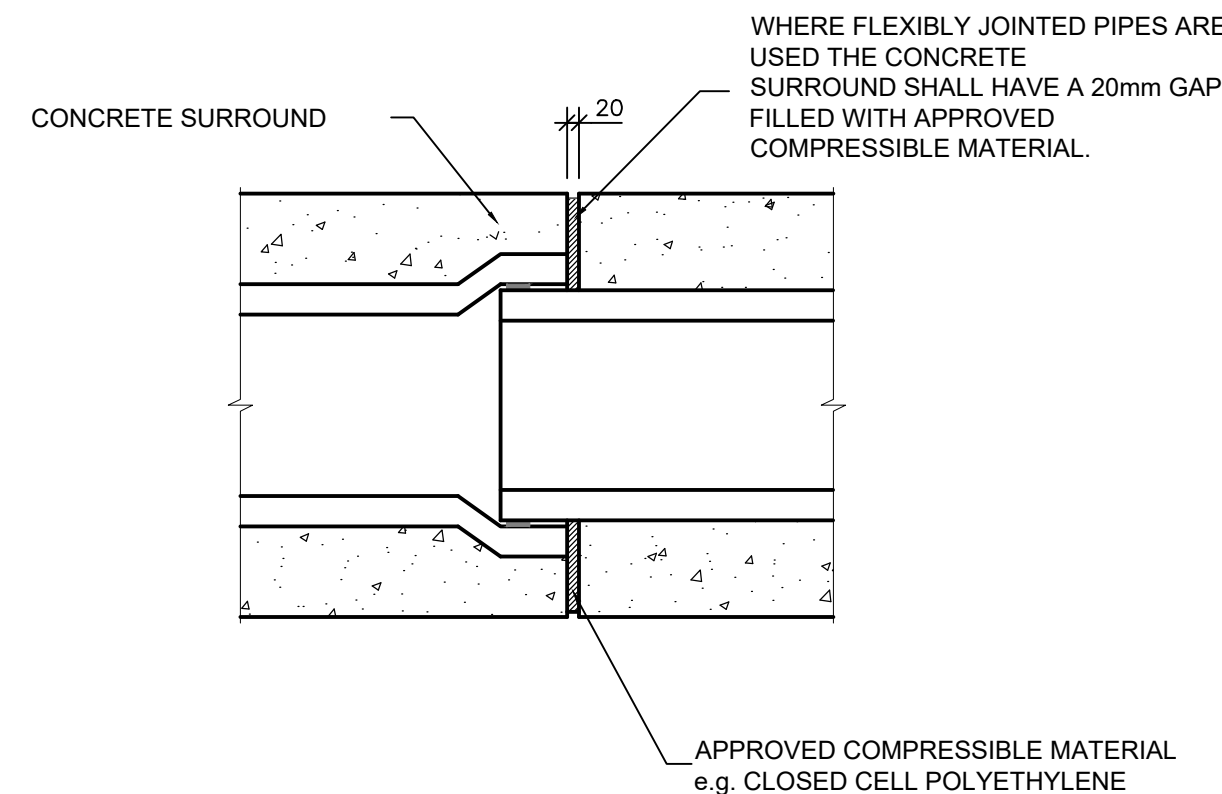
CONNECTION OF INTERNAL DRAINAGE TO DRAIN TYPE 1



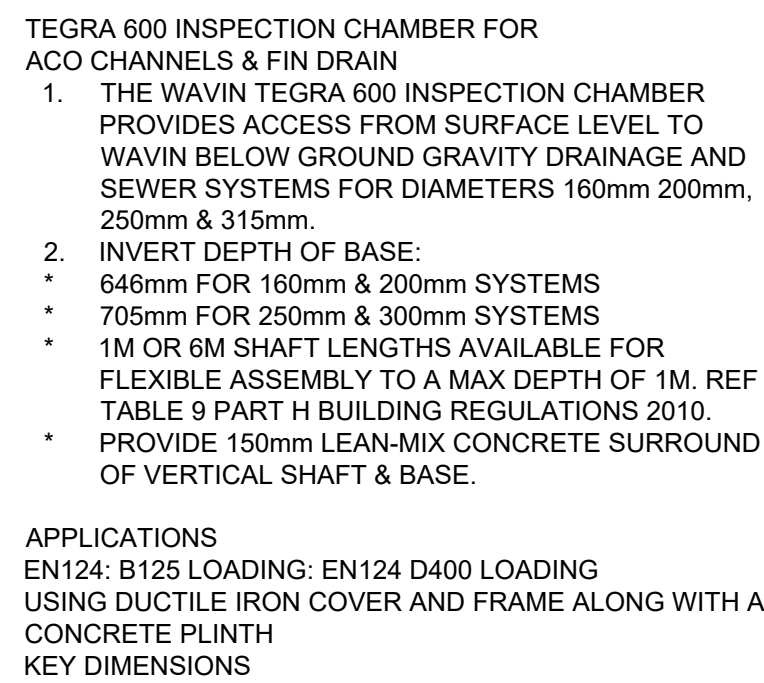
PIPE BEDDING TYPE 1
IF DEPTH OF COVER >1.2M



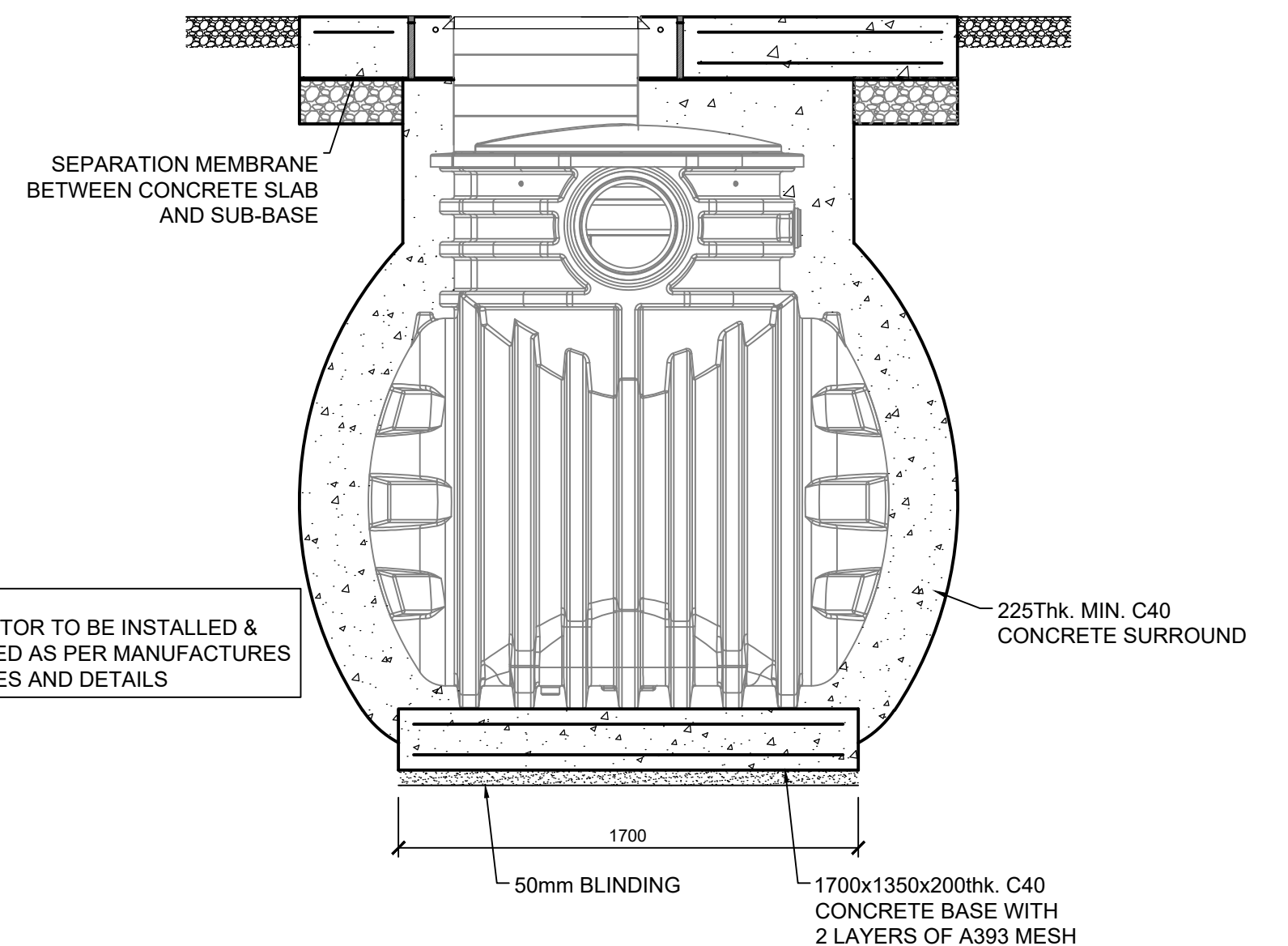
CONCRETE SURROUND TO PIPE RUN NEAR BUILDINGS / FOUNDATIONS



JOINT IN CONCRETE SURROUND



MAXI MANHOLE DETAIL
SCALE 1:20



TYPICAL PETROL INTERCEPTOR DETAILS

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OLD CONNAUGHT PHASE A1 LRD

Risk Level	
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	Atkins Sensitive - Medium Risk
	Atkins Private - High Risk
	Client Critical - Already Marked

P01	ISSUED FOR PLANNING	PM	09.07.26	IPR	GH	GH			
Rev	Description	By	Date	Chk'd	Rev'd	Auth			



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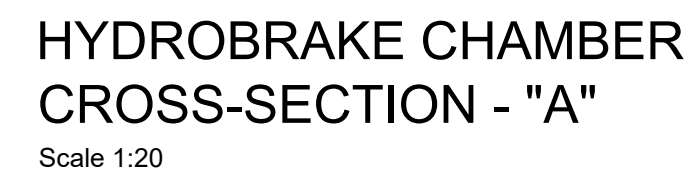
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Fax: (+353) 091 779 830

		Purpose					
		FOR PLANNING					
Client		Title					
CASTLETHORN OLD CONNAUGHT UCL		STANDARD CONSTRUCTION DETAILS SHEET 2					
Project		Original Scale		Drawn	Checked	Reviewed	Authorised
OLD CONNAUGHT PHASE A1 LRD		AS		PM	IPR	GH	GH
		SHOWN		Date 24.11.25	Date 24.11.25	Date 24.11.25	Date 24.11.25
		Status	Drawing Number				Rev
		S4	ATK-ZZ-ZZ-DR-CE-909002				P01



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	Atkins Private - High Risk
	Critical Critical - Already Marked

P01	ISSUED FOR PLANNING			PM	09.07.26	IPR	GH	GH
Rev	Description			By	Date	Chk'd	Rev'd	Auth

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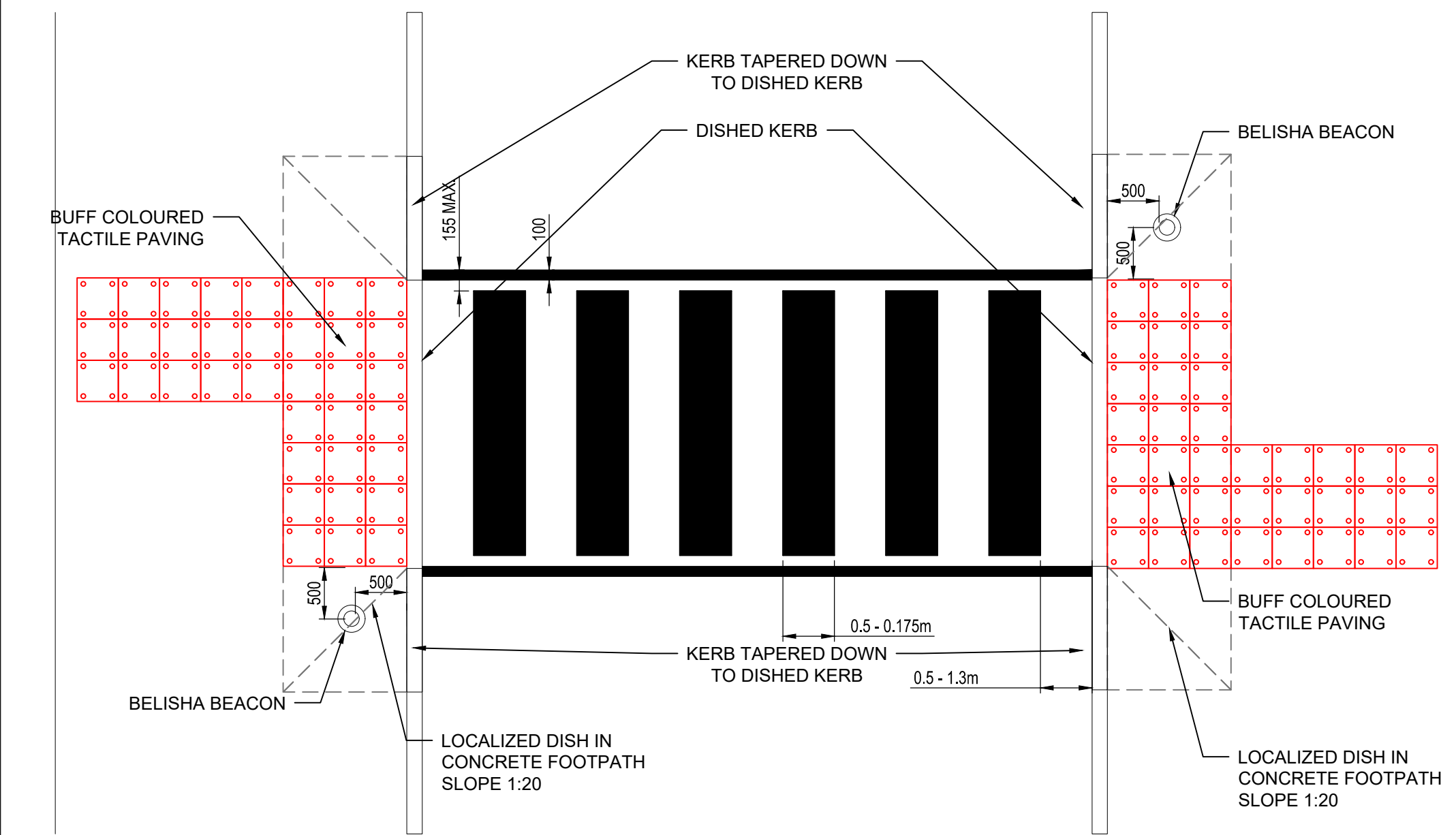
Client		Title					
CASTLETHORN OLD CONNAUGHT UCL		STANDARD CONSTRUCTION DETAILS SHEET 3					
Project		Original Scale		Drawn	Checked	Reviewed	Authorised
OLD CONNAUGHT PHASE A1 LRD		AS		PM	IPR	GH	GH
		SHOWN		Date 24.11.25	Date 24.11.25	Date 24.11.25	Date 24.11.25
		Status	Drawing Number				Rev
		S4	ATK-ZZ-ZZ-DR-CE-909003				P01

A1

DO NOT SCALE

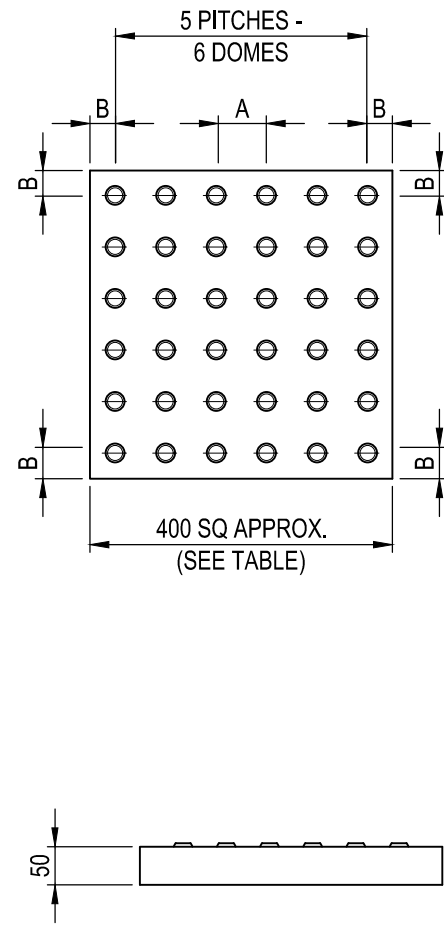
MURR7315

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Date: Jul 13, 2026 - 4:24pm
Plotted by:



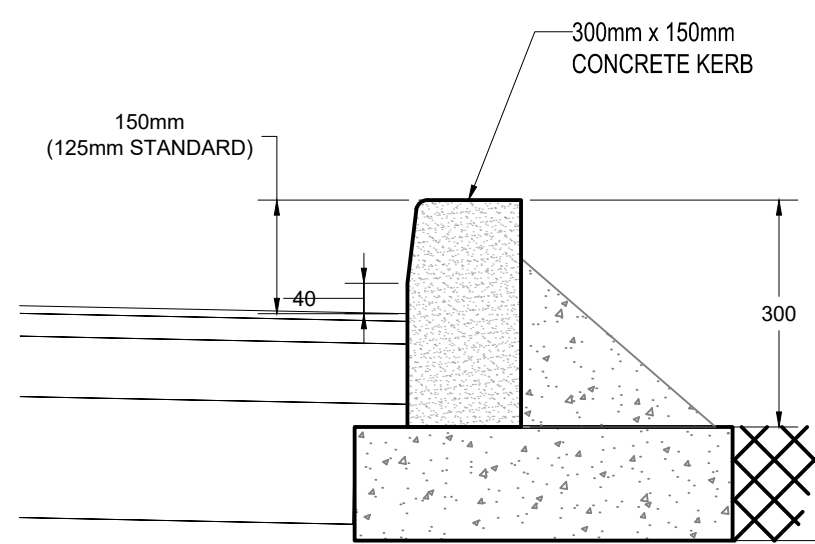
TYPICAL ZEBRA CROSSING LAYOUT

Scale at A1 1:50
Scale at A3 1:100



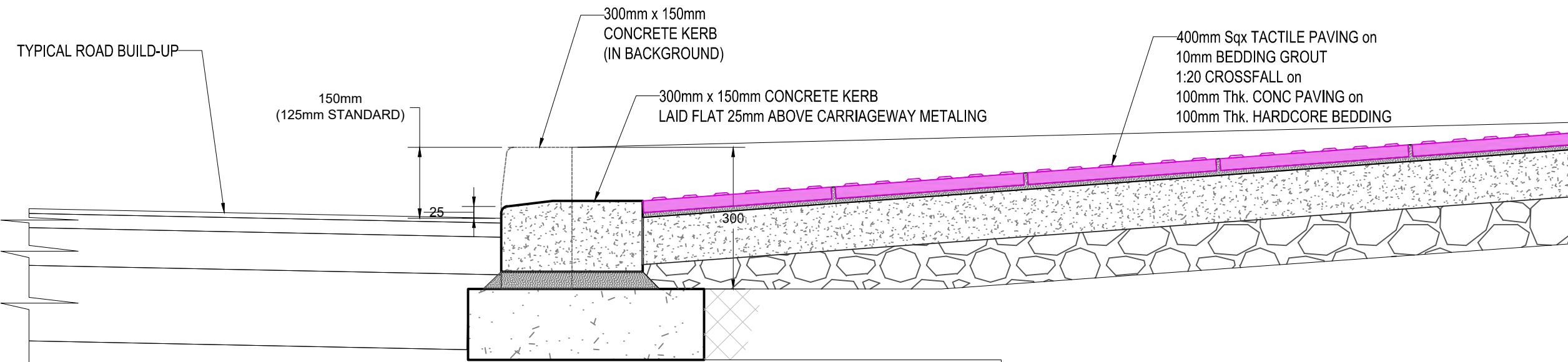
BUFF COLOURED TACTILE PAVING UNCONTROLLED JUNCTION

Scale at A1 1:10
Scale at A3 1:20



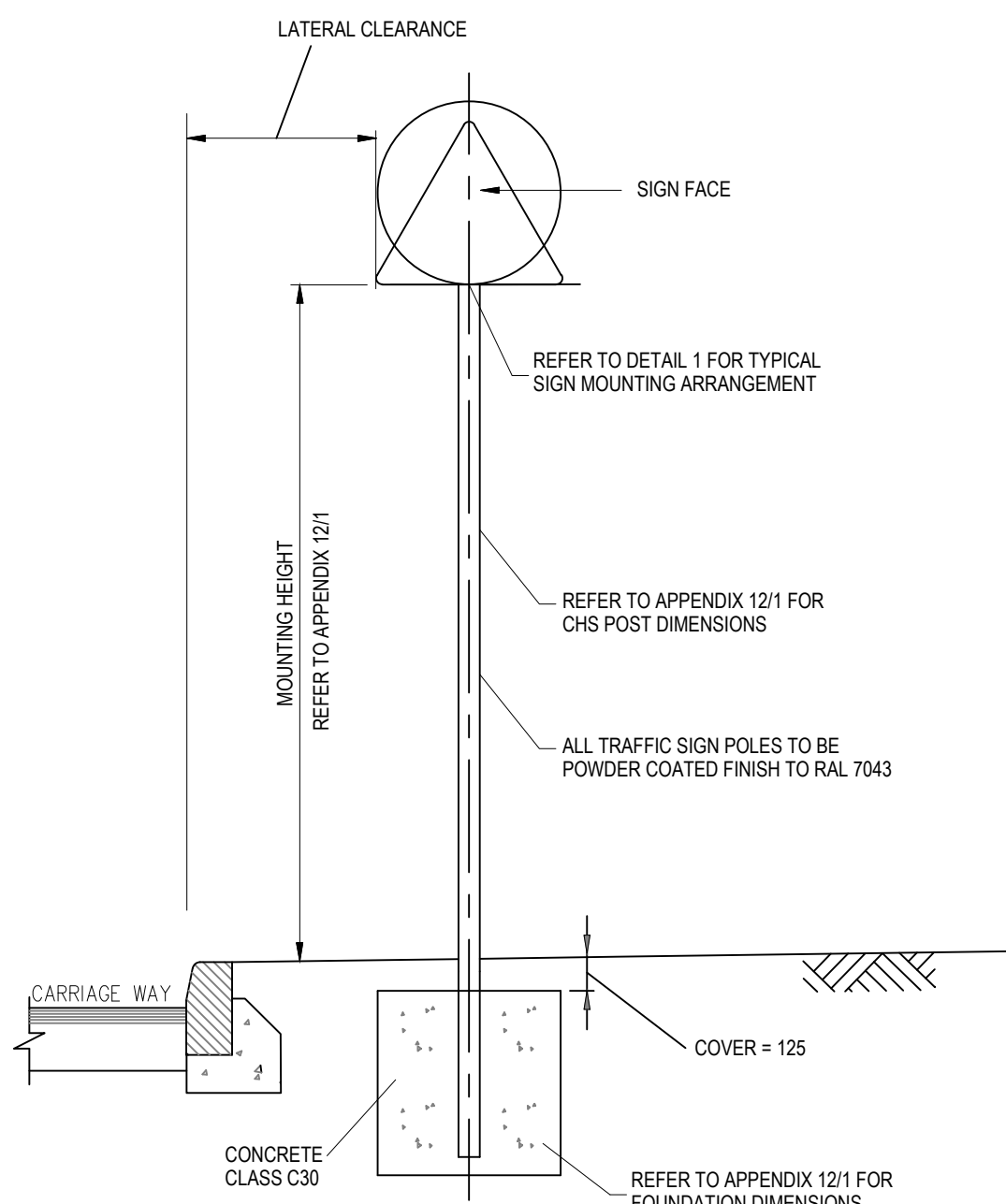
CONCRETE KERB DETAIL

NOT TO SCALE



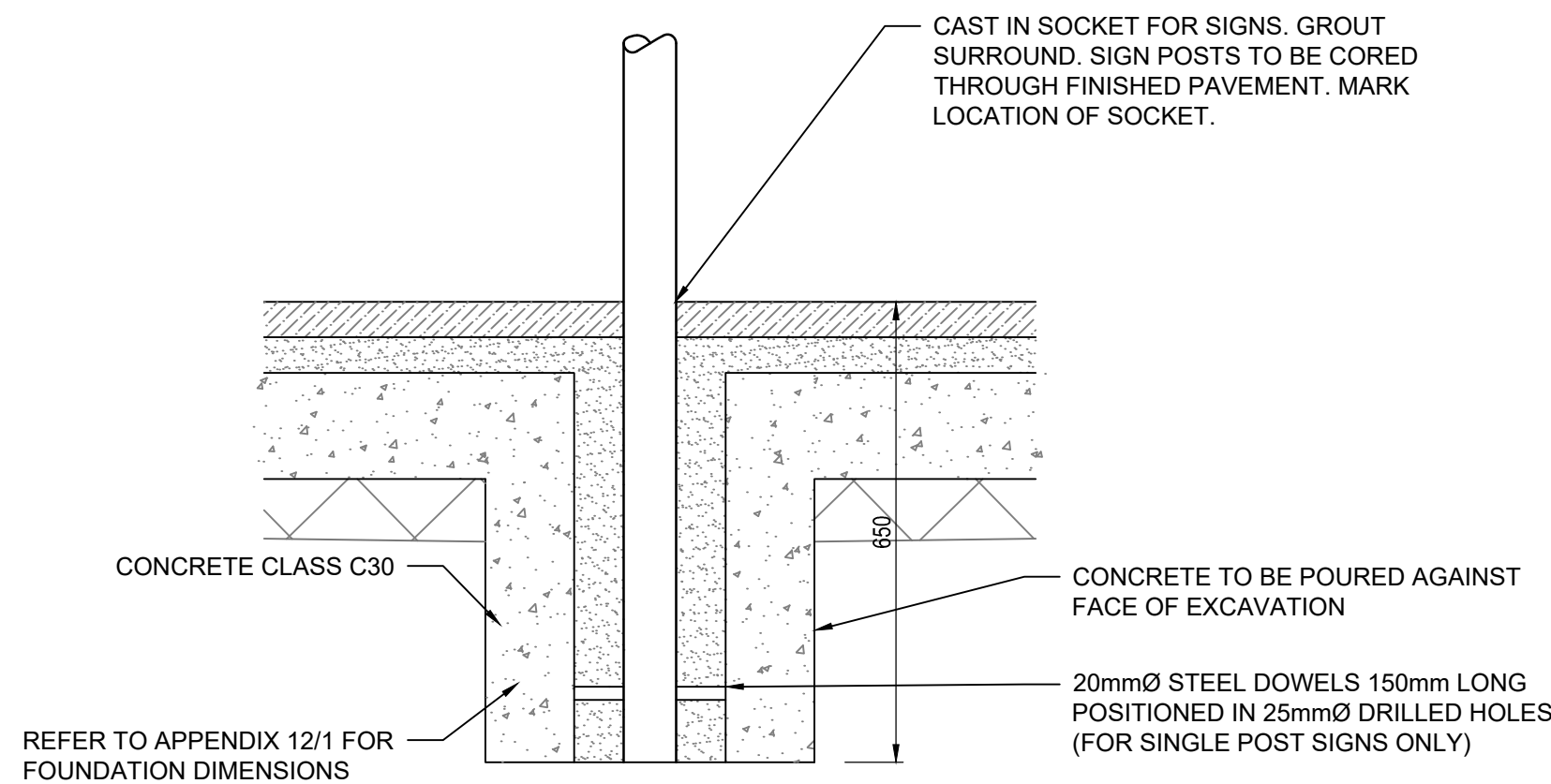
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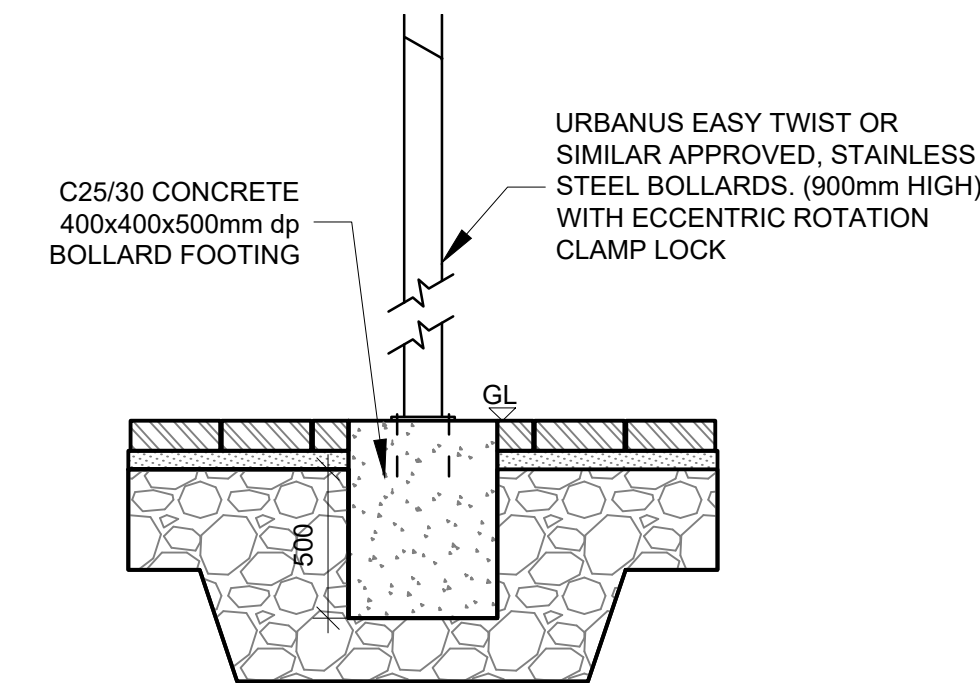
TYPICAL WARNING / REGULATORY SIGN POST ARRANGEMENT

Scale at A1 1:10
Scale at A3 1:20



TYPICAL FOUNDATION DETAIL FOR SIGN POSTS IN PAVED AREAS

Scale at A1 1:10
Scale at A3 1:20



TYPICAL BOLLARD DETAIL

Scale at A1 1:20
Scale at A3 1:40

- GENERAL NOTES
1. ALL DIMENSIONS ARE IN METRES UNLESS NOTED OTHERWISE
 2. ONLY WRITTEN DIMENSIONS SHALL BE USED. NO DIMENSIONS SHALL BE SCALED FROM THE DRAWINGS
 3. ALL LEVELS ARE IN METRES AND ARE TO MALIN HEAD DATUM
 4. ALL COORDINATES ARE IN METRES AND ARE TO IRISH TRANSVERSE MERCATOR
 5. DRAWINGS ARE TO BE READ IN CONJUNCTION WITH THE SPECIFICATION

Purpose FOR PLANNING

Title						
STANDARD CONSTRUCTION DETAILS SHEET 4						
Original Scale AS SHOWN		Drawn	Checked	Reviewed	Authorised	
		PM	IPR	GH	GH	
		Date 24.11.25	Date 24.11.25	Date 24.11.25	Date 24.11.25	
Status	Drawing Number					Rev
S4	ATK-ZZ-ZZ-DR-CE-909004					P01

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OLD CONNAUGHT PHASE A1 LRD

Risk Level - Atkins Base Line - Low Risk
Atkins Sensitive - Medium Risk
Atkins Private - High Risk
Client Critical - Already Marked

Rev	Description	By	Date	Chk'd	Rev'd	Auth
P01	ISSUED FOR PLANNING	PM	09.07.26	IPR	GH	GH

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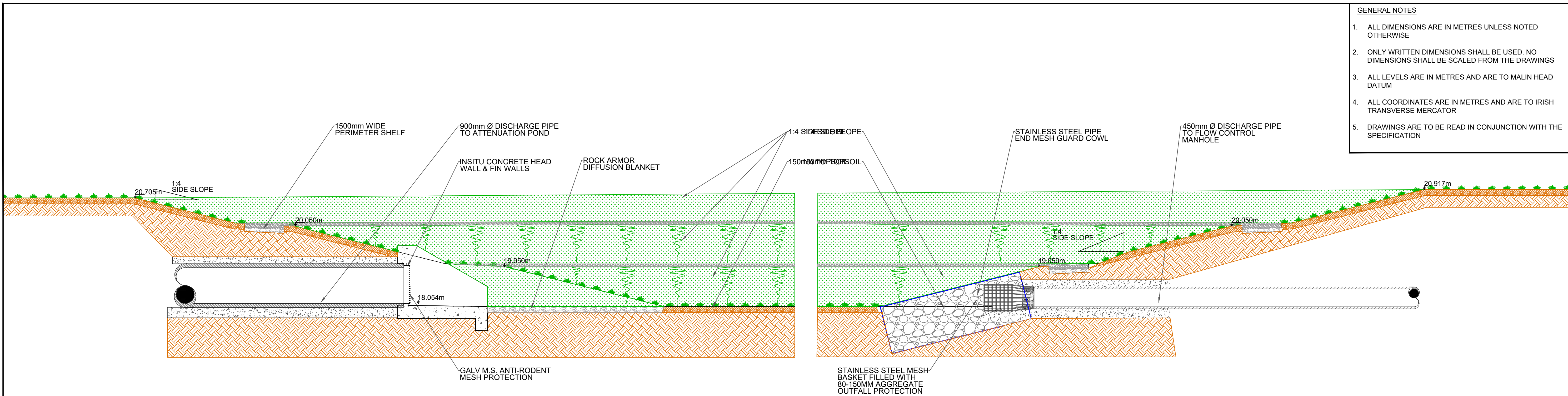
Client
CASTLETHORN OLD CONNAUGHT UCL

Project
OLD CONNAUGHT PHASE A1 LRD

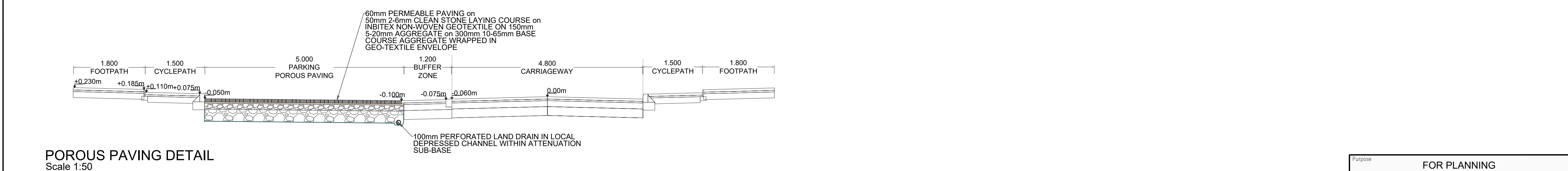
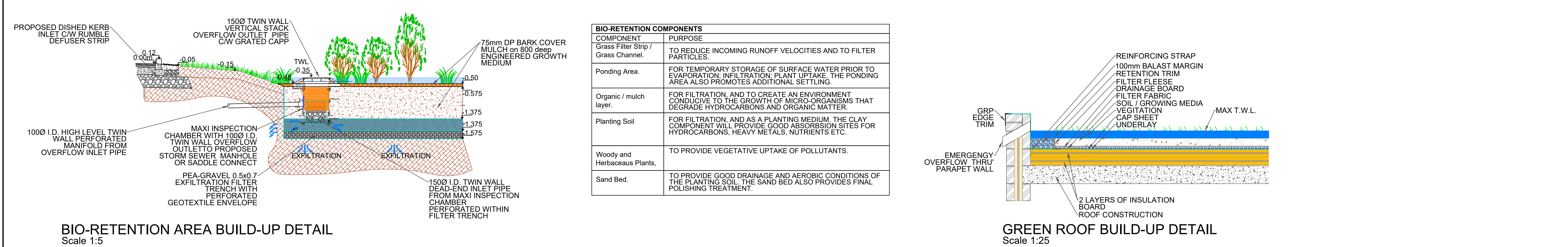
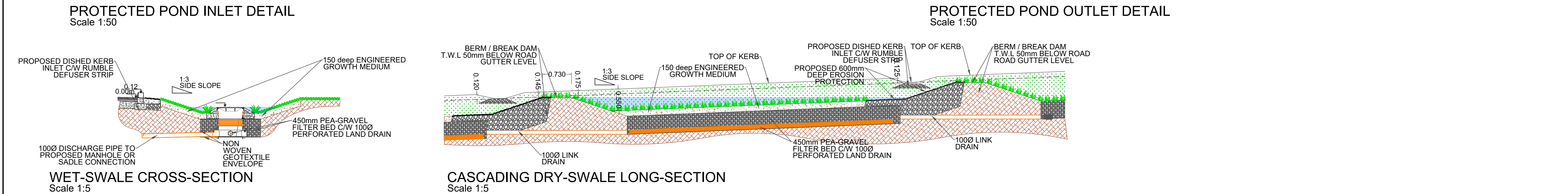
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DO NOT SCALE

File: ATK-ZZ-ZZ-DR-CE-909005.dwg
Date: Jul 13, 2026 - 4:25pm
Plotted by: MURR7315



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 2. ONLY WRITTEN DIMENSIONS SHALL BE USED. NO DIMENSIONS SHALL BE SCALED FROM THE DRAWINGS
 3. ALL LEVELS ARE IN METRES AND ARE TO MALIN HEAD DATUM
 4. ALL COORDINATES ARE IN METRES AND ARE TO IRISH TRANSVERSE MERCATOR
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Risk Level	Atkins Base Line - Low Risk
Atkins Sensitive - Medium Risk	
Atkins Private - High Risk	
Client Critical - Already Marked	

Rev	Description	By	Date	Chk'd	Rev'd	Auth
P01	ISSUED FOR PLANNING	PM	09.07.26	IPR	GH	GH

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Client: CASTLETHORN OLD CONNAUGHT UCL

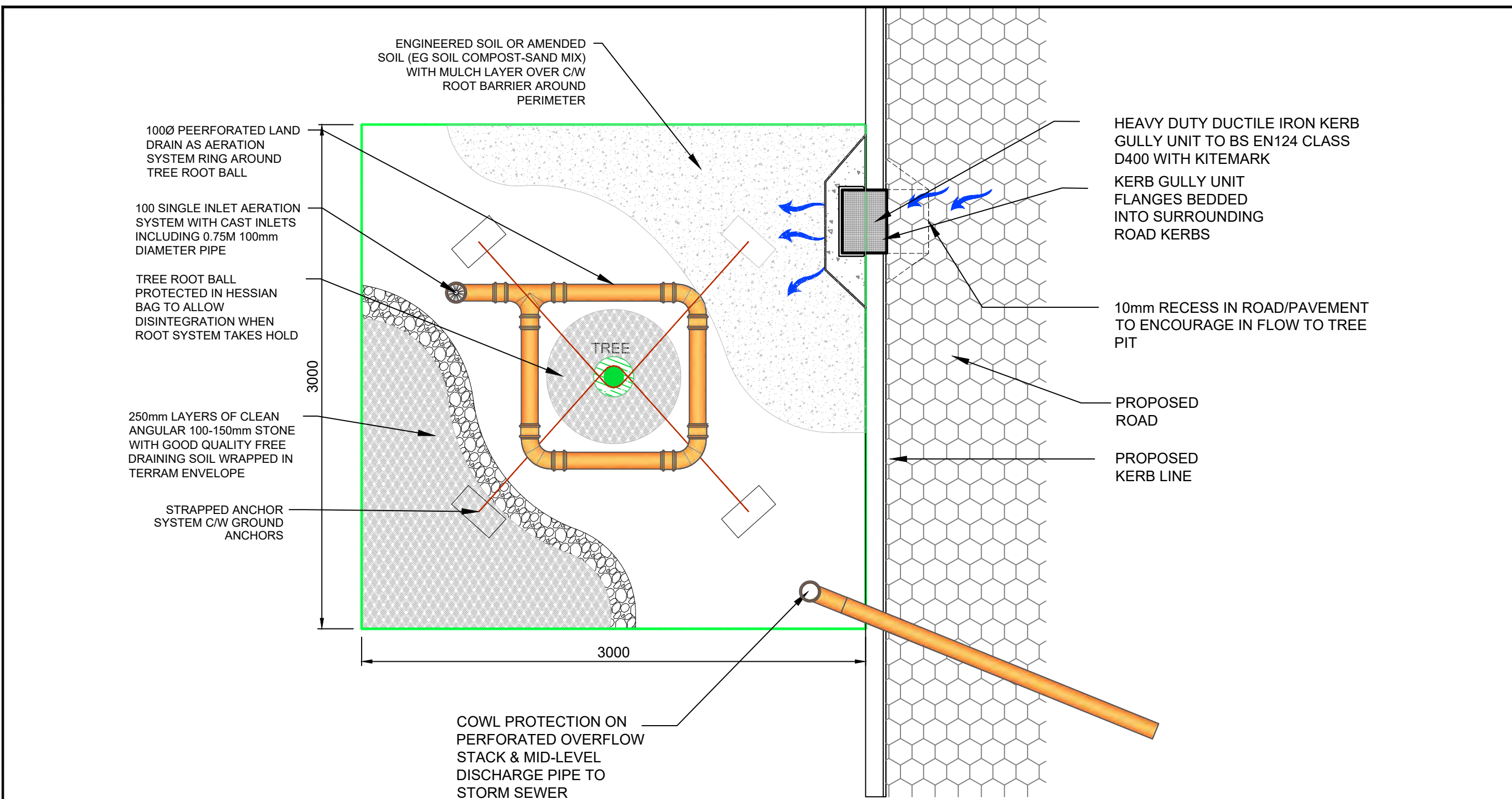
Project: OLD CONNAUGHT PHASE A1 LRD

Purpose: FOR PLANNING					
Title: STANDARD CONSTRUCTION DETAILS SHEET 5					
Original	Scale	Drawn	Checked	Reviewed	Authorised
AS SHOWN		PM	IPR	GH	GH
Date	20.01.26	Date	20.01.26	Date	20.01.26
Status	Drawing Number				Rev
S4	ATK-ZZ-ZZ-DR-CE-909005				P01

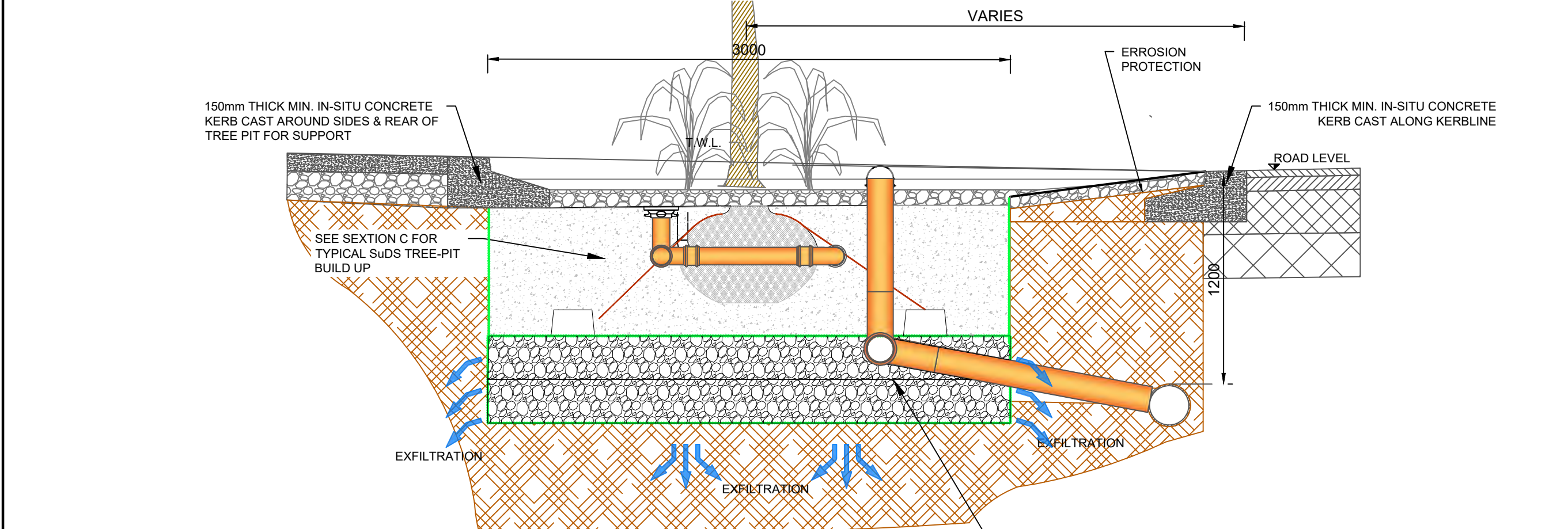
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DO NOT SCALE

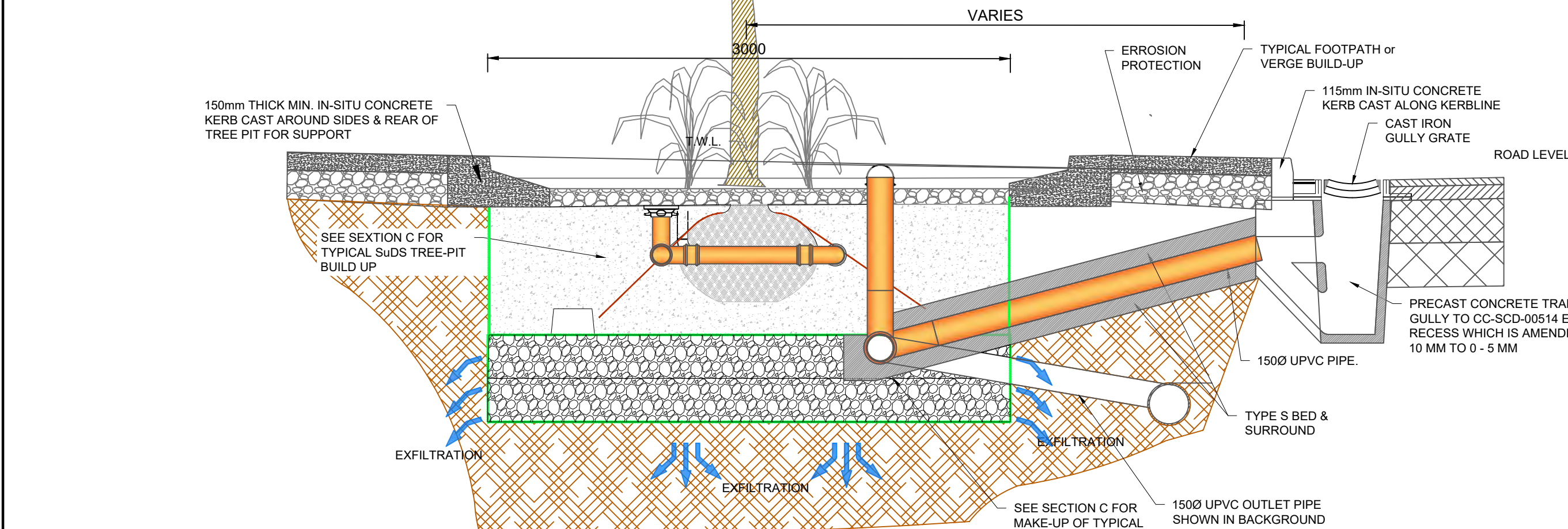
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Date: Jul 13, 2026 - 4:25pm
Plotted by: MURR7315



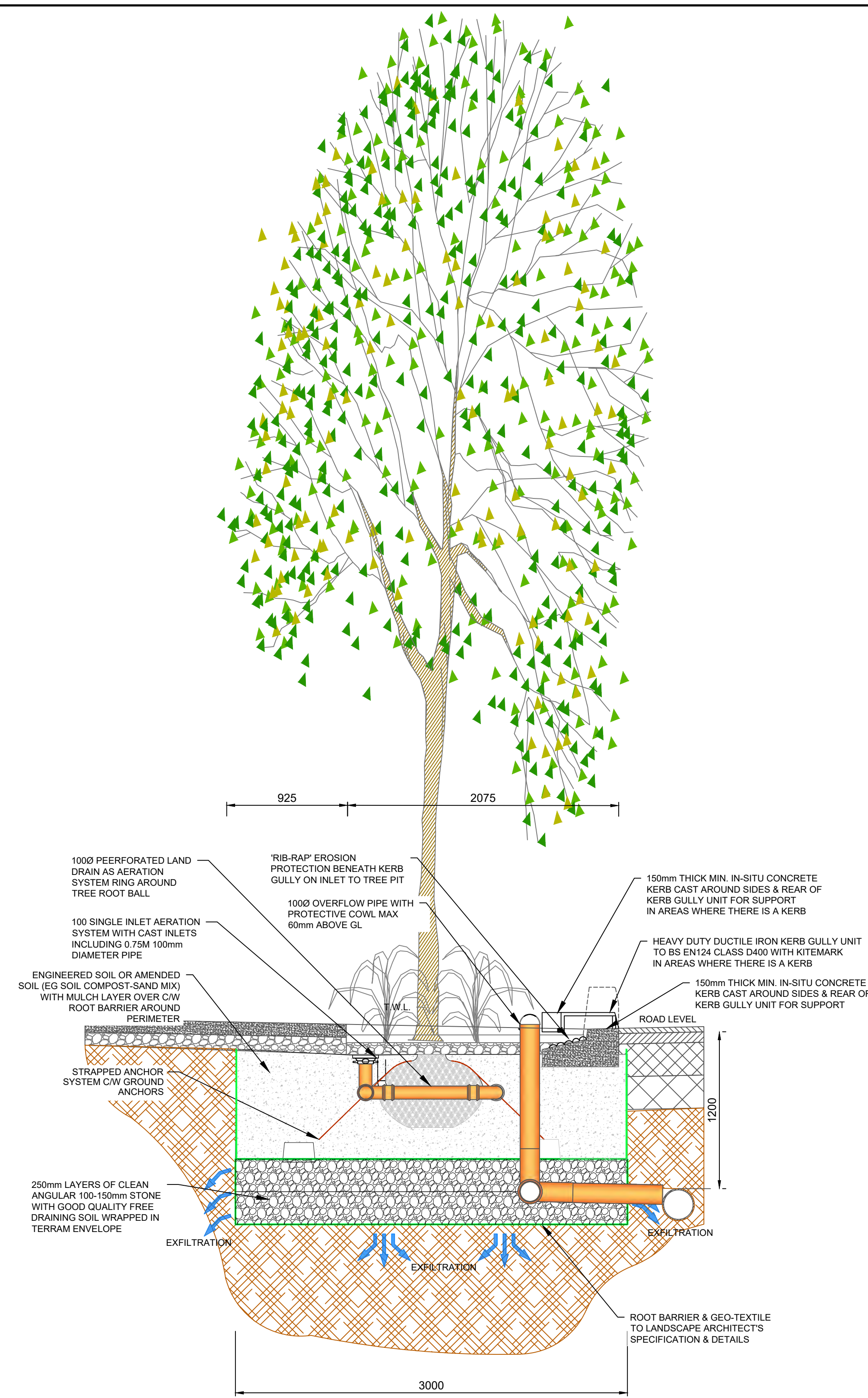
TREE PIT - TYPICAL PLAN
Scale at A1 1:25
Scale at A3 1:50



WHERE TREE PIT SETBACK FURTHER FROM CARRIAGEWAY
Scale at A1 1:25
Scale at A3 1:50



WHERE TREE PIT SETBACK BEHIND RAISED PATH OR VERGE
Scale at A1 1:25
Scale at A3 1:50



TYPICAL SuDS TREE PIT CROSS-SECTION
SECTION C
Scale at A1 1:25
Scale at A3 1:50

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OLD CONNAUGHT PHASE A1 LRD

Risk Level - Atkins Base Line - Low Risk
Atkins Sensitive - Medium Risk
Atkins Private - High Risk
Client Critical - Already Marked

Rev	Description	By	Date	Chk'd	Rev'd	Auth
P01	ISSUED FOR PLANNING	PM	09.07.26	IPR	GH	GH

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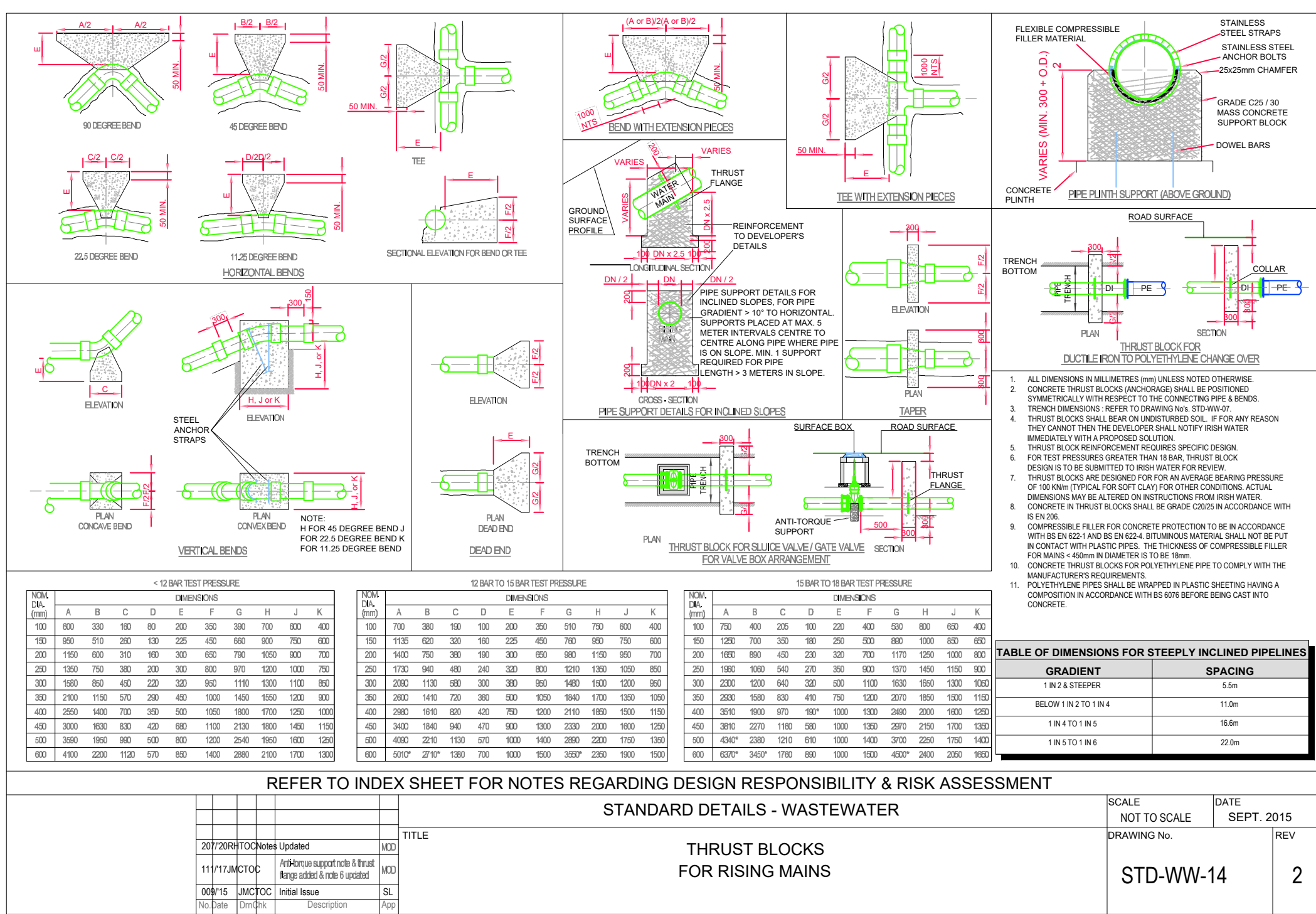
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Client
CASTLETHORN OLD CONNAUGHT UCL

Project
OLD CONNAUGHT PHASE A1 LRD

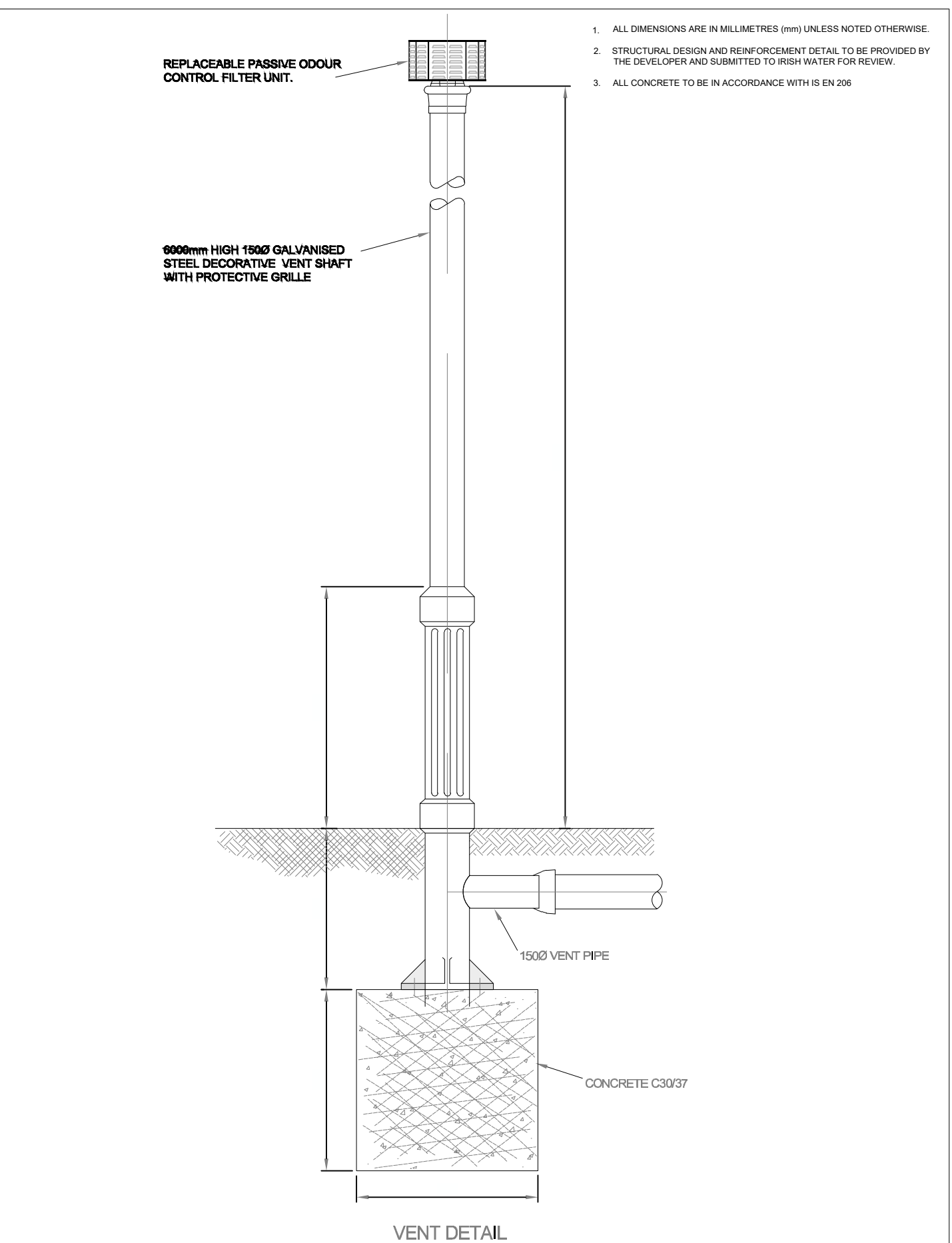
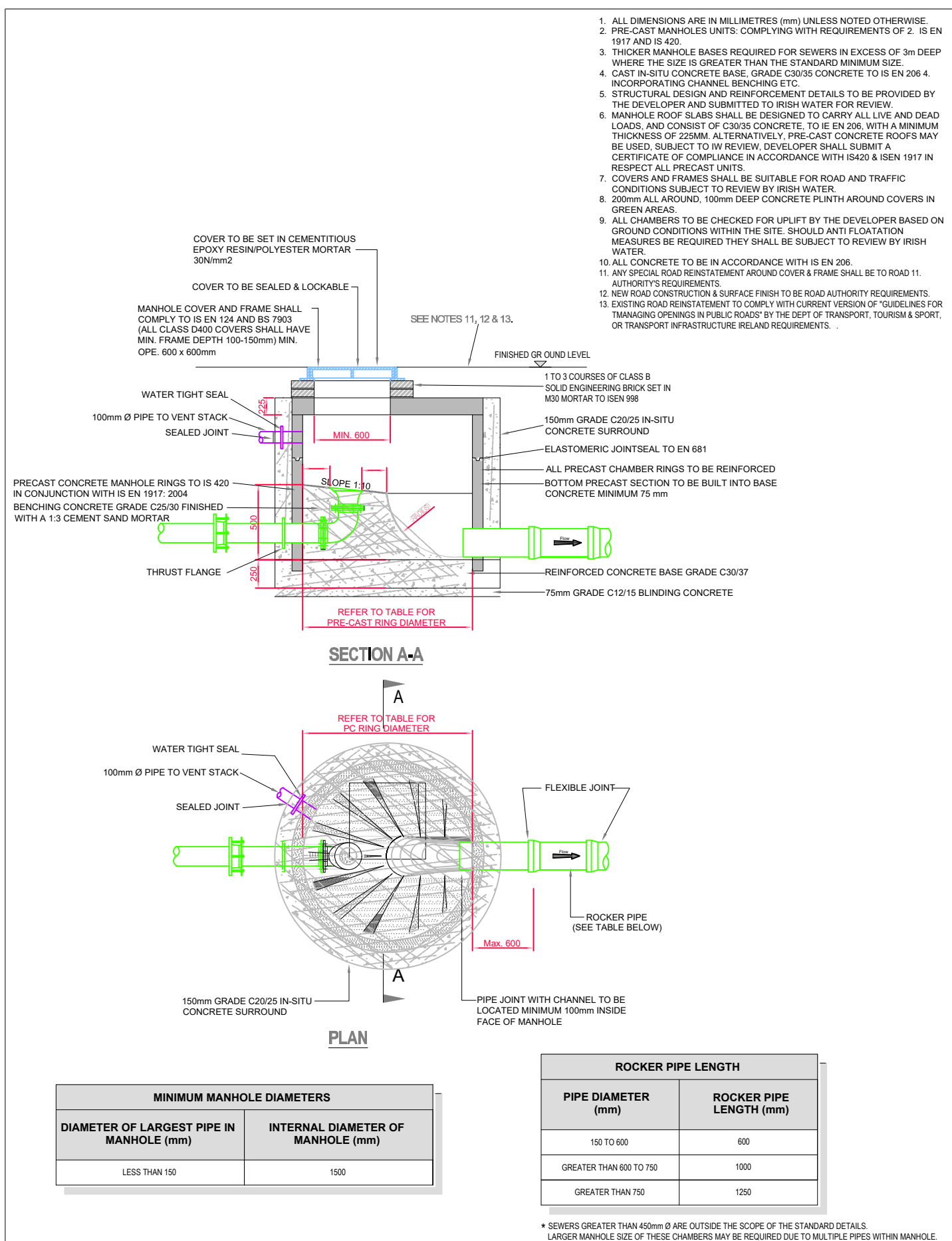
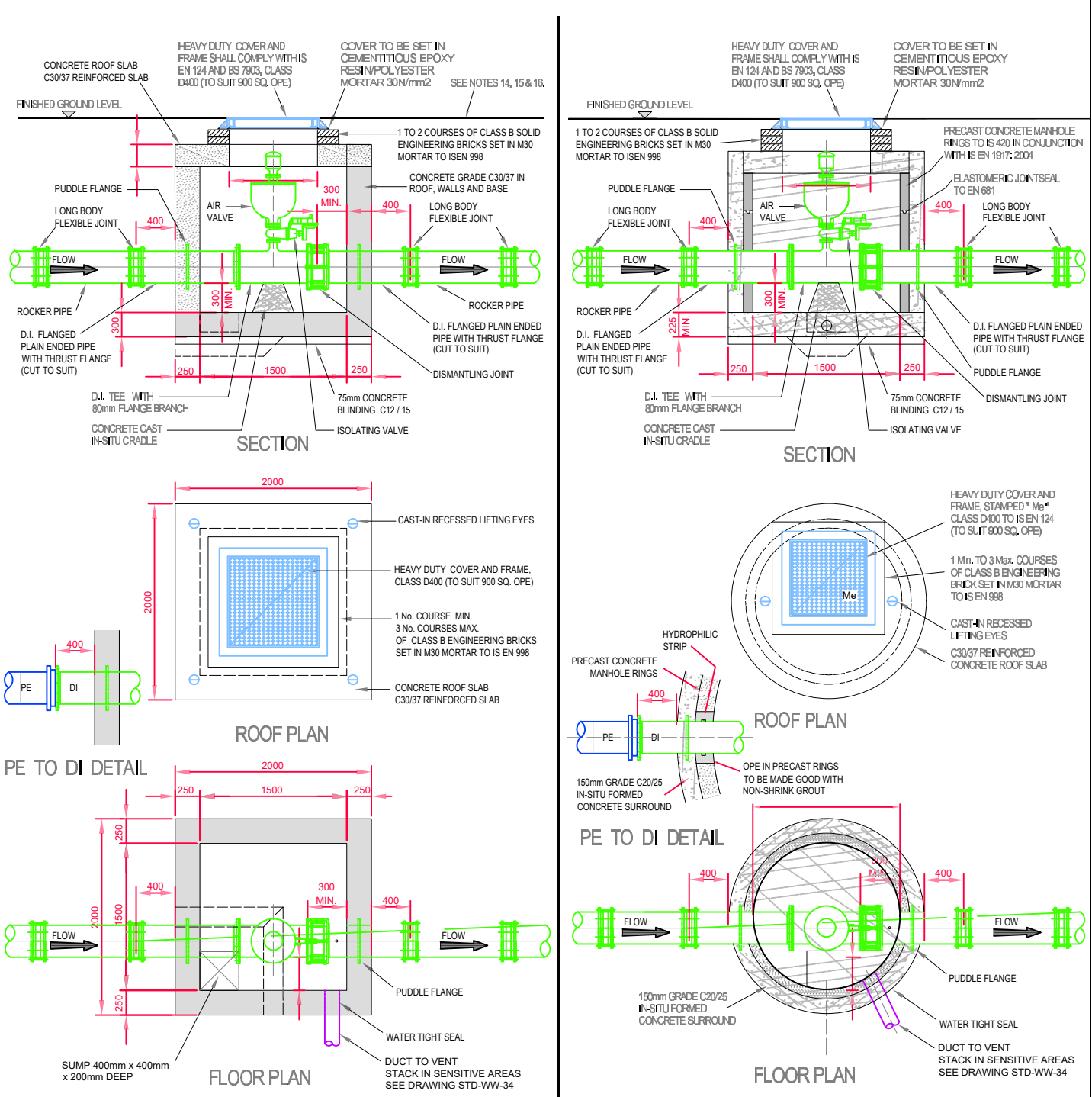
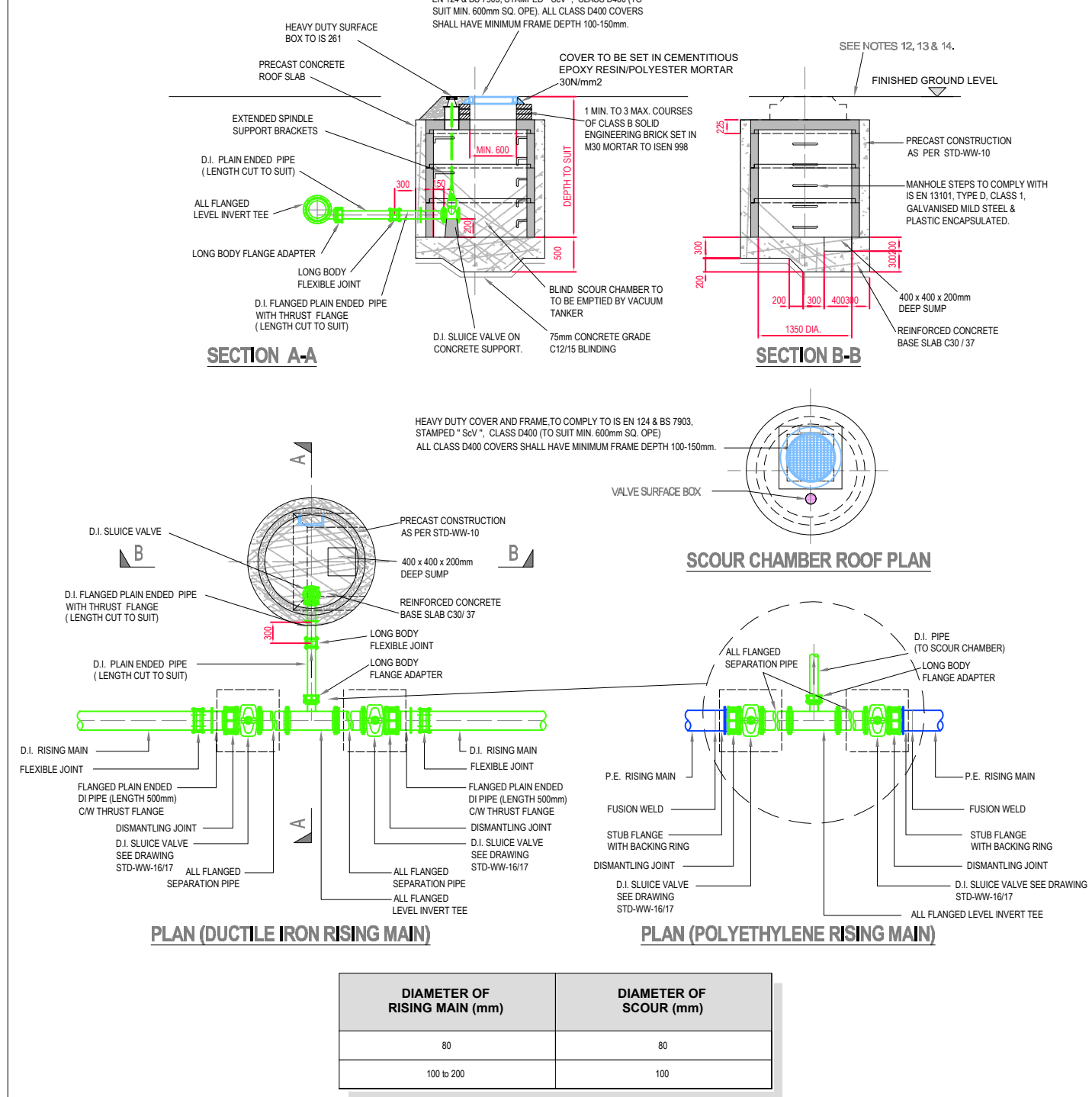
Purpose FOR PLANNING		Title STANDARD CONSTRUCTION DETAILS SHEET 6			
Original Scale AS SHOWN	Drawn PM Date 20.01.26	Checked IPR Date 20.01.26	Reviewed GH Date 20.01.26	Authorised GH Date 20.01.26	
Status S4	Drawing Number ATK-ZZ-ZZ-DR-CE-909006				Rev P01



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1. ALL DIMENSIONS ARE IN METRES UNLESS NOTED OTHERWISE
 2. ONLY WRITTEN DIMENSIONS SHALL BE USED. NO DIMENSIONS SHALL BE SCALED FROM THE DRAWINGS
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 4. ALL COORDINATES ARE IN METRES AND ARE TO IRISH TRANSVERSE MERCATOR
 5. DRAWINGS ARE TO BE READ IN CONJUNCTION WITH THE SPECIFICATION

1. ALL DIMENSIONS ARE IN MILLIMETRES (mm) UNLESS NOTED OTHERWISE.
2. VALVE SURFACE FINISH TO BE IN ACCORDANCE WITH IS 201 OR BS 884:04. SCOUR CHAMBERS SHALL BE COVERED WITH APPROVED HEAVY DUTY BY IRISH WATER.
3. SLURGE VALVE SHALL BE 150mm FLANGED WITH DUCTILE IRON RISING MAIN COVER AND FRAMES SHALL BE SUITABLE FOR ROAD AND TRAFFIC CONDITIONS SUBJECT TO REVIEW BY IRISH WATER.
4. SLURGE VALVE SHALL BE 150mm FLANGED WITH DUCTILE IRON RISING MAIN COVER AND FRAMES SHALL BE SUITABLE FOR ROAD AND TRAFFIC CONDITIONS SUBJECT TO REVIEW BY IRISH WATER.
5. STRUCTURAL DESIGN AND REINFORCEMENT DETAILS TO BE PROVIDED BY THE DEVELOPER AND SUBMITTED TO IRISH WATER FOR REVIEW.
6. ROOF SLAB SHALL BE DESIGNED TO CARRY ALL LIVE LOADS & DEAD LOADS. A CONSIST OF A REINFORCED CONCRETE SLAB OF PLASTIC CONCRETE, GRADE C30/37 WITH A MINIMUM THICKNESS OF 200mm. ALTERNATIVELY, PRE-CAST CONCRETE ROOFS MAY BE USED, SUBJECT TO IRISH WATER REVIEW. A COMPLIANCE WITH BS 811 Part 4.
7. THRUST BLOCKS (NOT SHOWN ON DRAWING) TO BE PROVIDED AS PER STANDARD DRAWING STD-WW-14 AT ALL TEES, BENDS, TAPERS, DEAD ENDS AND PRESS IN STEEP SLOPES.
8. 200mm ALL AROUND 150mm DEEP. COVER CONCRETE PLINTH COMPLETE WITH BULL NOSE FINISH AND TO BE PROVIDED COMPLETE WITH MILD STEEL REINFORCEMENT LING AROUND COVERS IN STEEP AREAS.
9. ALL CHAMBERS TO BE CONCRETE BASED ON GROUND AND CONDITIONS WITHIN THE SITE.
10. ALL DUCTILE IRON PIPEWORK AND FITTINGS TO BE IN ACCORDANCE WITH IS EN 1024.
11. SHOULD ANTI FLOUTATION MEASURES BE REQUIRED THEY SHALL BE SUBJECT TO REVIEW BY IRISH WATER.
12. ANY SPECIAL ROAD REQUIREMENTS AROUND COVER & FRAME SHALL BE TO ROAD AUTHORITY'S REQUIREMENTS.
13. NEW ROAD CONSTRUCTION & SURFACE FINISH TO BE TO ROAD AUTHORITY REQUIREMENTS. EXISTING ROAD RENOVATION TO COMPLY WITH CURRENT VERSION OF GUIDELINES FOR MANAGING OPENINGS IN PUBLIC ROADWAY BY THE DEPT. OF TRANSPORT, TOURISM & SPORT, OR TRANSPORT INFRASTRUCTURE IRELAND REQUIREMENTS.
14. SCOUR VALVE REQUIRED ONLY AT LOW POINTS FOR UNLOADING RISING MAINS.

1. ALL DIMENSIONS ARE IN MILLIMETRES (mm) UNLESS NOTED OTHERWISE.
2. VALVE SURFACE FINISH TO BE PROVIDED IN SCOUR SENSITIVE AREAS AND ODOUR TREATMENT UNIT MAY BE REQUIRED DEPENDING ON LOCATION.
3. ISOLATING VALVE TO BE IN ACCORDANCE WITH IS EN 1024. STRUCTURAL DESIGN AND REINFORCEMENT DETAILS TO BE PROVIDED BY THE DEVELOPER AND SUBMITTED TO IRISH WATER FOR REVIEW.
4. ROOF SLAB SHALL BE DESIGNED TO CARRY ALL LIVE LOADS & DEAD LOADS. A CONSIST OF A REINFORCED CONCRETE SLAB OF IN-SITU CONCRETE, GRADE C30/37 WITH A MINIMUM THICKNESS OF 200mm. ALTERNATIVELY, PRE-CAST CONCRETE ROOFS MAY BE USED, SUBJECT TO IRISH WATER REVIEW. A COMPLIANCE WITH BS 811 Part 4.
5. DOUBLE ANGLE 150mm DEEP. COVER CONCRETE PLINTH COMPLETE WITH BULL NOSE FINISH AND TO BE PROVIDED COMPLETE WITH MILD STEEL REINFORCEMENT LING AROUND COVERS IN GREEN AREAS.
6. THRUST BLOCKS AND 150mm DEEP. COVER CONCRETE PLINTH COMPLETE WITH BULL NOSE FINISH AND TO BE PROVIDED COMPLETE WITH MILD STEEL REINFORCEMENT LING AROUND COVERS IN GREEN AREAS.
7. THRUST BLOCKS AND 150mm DEEP. COVER CONCRETE PLINTH COMPLETE WITH BULL NOSE FINISH AND TO BE PROVIDED COMPLETE WITH MILD STEEL REINFORCEMENT LING AROUND COVERS IN GREEN AREAS.
8. PRE-CAST UNITS MAY BE USED SUBJECT TO REVIEW BY IRISH WATER.
9. THRUST BLOCKS AND 150mm DEEP. COVER CONCRETE PLINTH COMPLETE WITH BULL NOSE FINISH AND TO BE PROVIDED COMPLETE WITH MILD STEEL REINFORCEMENT LING AROUND COVERS IN GREEN AREAS.
10. ALL CONCRETE TO BE IN ACCORDANCE WITH IS EN 206.
11. ALL DUCTILE IRON PIPEWORK AND FITTINGS TO BE IN ACCORDANCE WITH IS EN 1024.
12. ALL PIPE AND FITTINGS TO BE IN ACCORDANCE WITH IS EN 12201:2011.
13. ALL SPECIAL ROAD REQUIREMENTS AROUND COVER & FRAME SHALL BE TO ROAD AUTHORITY'S REQUIREMENTS.
14. ANY SPECIAL ROAD REQUIREMENTS AROUND COVER & FRAME SHALL BE TO ROAD AUTHORITY'S REQUIREMENTS.
15. NEW ROAD CONSTRUCTION & SURFACE FINISH TO BE TO ROAD AUTHORITY REQUIREMENTS.
16. EXISTING ROAD RENOVATION TO COMPLY WITH CURRENT VERSION OF GUIDELINES FOR MANAGING OPENINGS IN PUBLIC ROADWAY BY THE DEPT. OF TRANSPORT, TOURISM & SPORT, OR TRANSPORT INFRASTRUCTURE IRELAND REQUIREMENTS.



REFER TO INDEX SHEET FOR NOTES REGARDING DESIGN RESPONSIBILITY & RISK ASSESSMENT

SCALE	DATE	REV
NOT TO SCALE	SEPT. 2015	
DRAWING No.	STD-WW-15	3

STANDARD DETAILS - WASTEWATER

SCOUR VALVE CHAMBER

FOUL RISING MAIN (≤ 200mm DIA.)

REFER TO INDEX SHEET FOR NOTES REGARDING DESIGN RESPONSIBILITY & RISK ASSESSMENT

SCALE	DATE	REV
NOT TO SCALE	SEPT. 2015	
DRAWING No.	STD-WW-18	3

STANDARD DETAILS - WASTEWATER

AIR VALVE CHAMBER

FOUL RISING MAIN (≤ 200mm DIA.)

REFER TO INDEX SHEET FOR NOTES REGARDING DESIGN RESPONSIBILITY & RISK ASSESSMENT

SCALE	DATE	REV
NOT TO SCALE	SEPT. 2015	
DRAWING No.	STD-WW-29	3

STANDARD DETAILS - WASTEWATER

RISING MAIN DISCHARGE

STAND OFF MANHOLE

REFER TO INDEX SHEET FOR NOTES REGARDING DESIGN RESPONSIBILITY & RISK ASSESSMENT

SCALE	DATE	REV
NOT TO SCALE	SEPT. 2015	
DRAWING No.	STD-WW-34	2

STANDARD DETAILS - WASTEWATER

VENT STACK

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Risk Level	Atkins Base Line - Low Risk
	Atkins Sensitive - Medium Risk
	Atkins Private - High Risk
	Client Critical - Already Marked

Rev	Description	By	Date	Chk'd	Rev'd	Auth
P01	ISSUED FOR PLANNING		PM 09.07.26	PS	GH	GH

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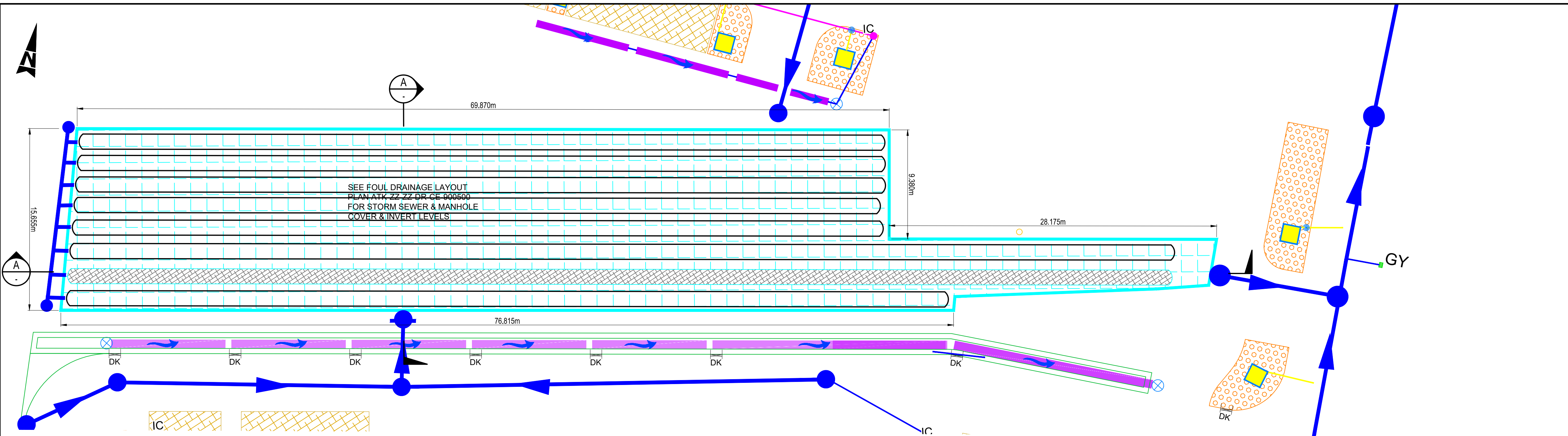
1st Floor Technology House Parkmore Technology Park, Galway
Tel: +353 (0) 91 786 050 Fax: +353 (0) 91 779 830

Client	CASTLETHORN OLD CONNAUGHT UCL
Project	OLD CONNAUGHT PHASE A1 LRD
Purpose	FOR PLANNING
Title	STANDARD CONSTRUCTION DETAILS SHEET 7
Original Scale	AS SHOWN
Drawn	PM
Checked	IPR
Reviewed	IPR
Authorised	GH
Status	S5
Drawing Number	ATK-ZZ-ZZ-DR-CE-909007
Date	23.06.26
Rev	P01

A1

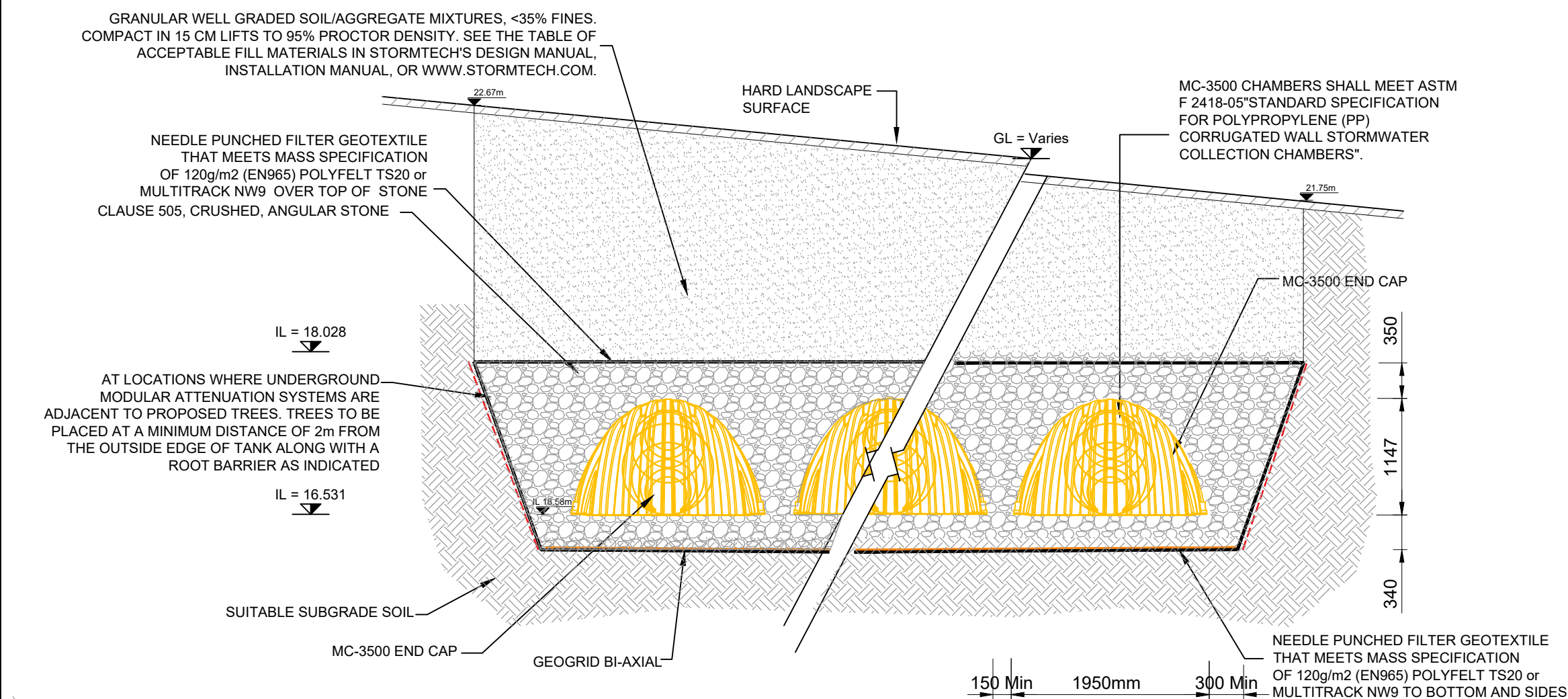
DO NOT SCALE

File: ATK-ZZ-ZZ-DR-CE-909008-909008.dwg
Date: Jul 13, 2026 - 4:26pm
Plotted by: MURR7315

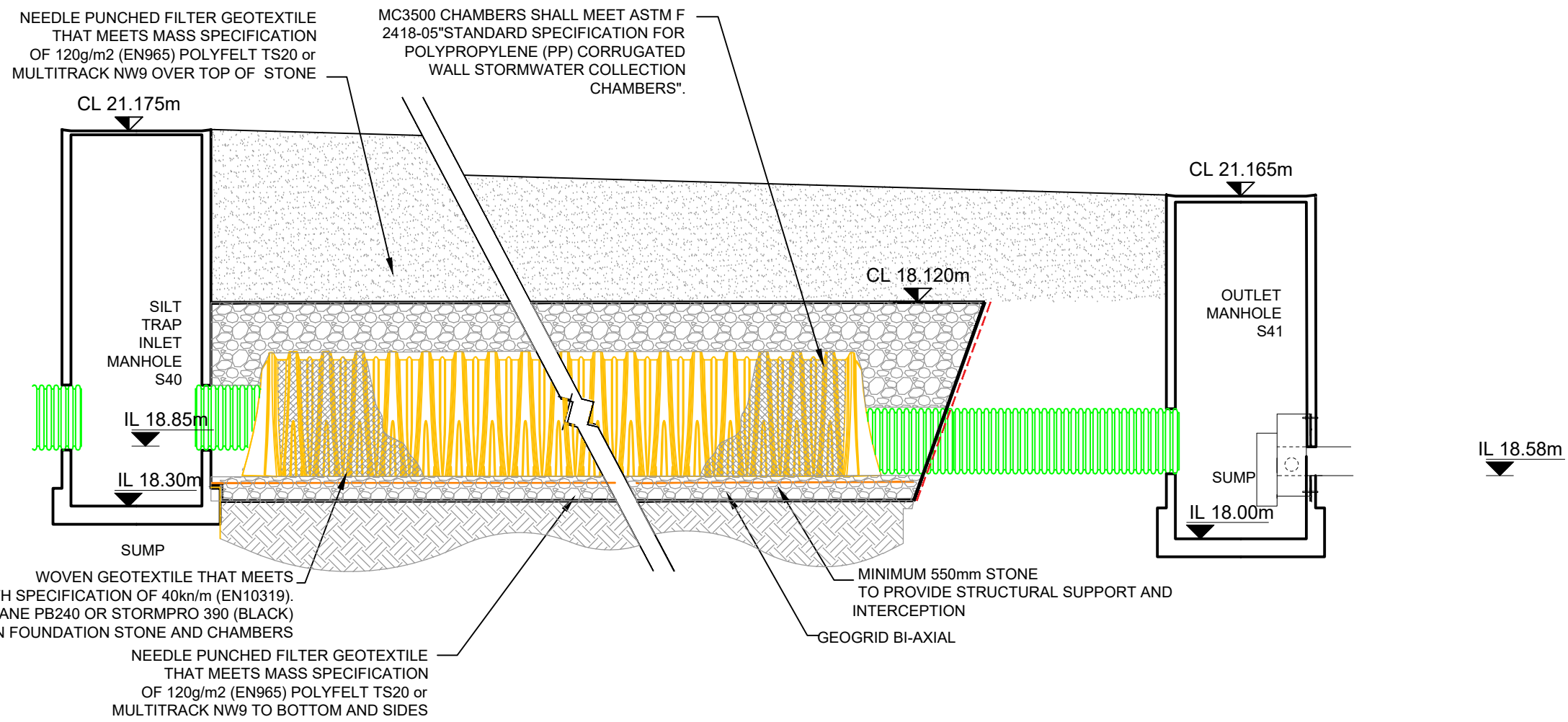


PROPOSED TANK A 1350M³ CHAMBER LAYOUT PLAN

Scale at A1 1:200
Scale at A3 1:400



SECTION A
1:50



SECTION B
1:50

MATERIAL LOCATION		DESCRIPTION	AASHTO MATERIAL CLASSIFICATIONS	COMPACTION / DENSITY REQUIREMENT
D	FINAL FILL: FILL MATERIAL FOR LAYER 'D' STARTS FROM THE TOP OF THE 'C' LAYER TO THE BOTTOM OF FLEXIBLE PAVEMENT OR UNPAVED FINISHED GRADE ABOVE. NOTE THAT PAVEMENT SUBBASE MAY BE PART OF THE 'D' LAYER	ANY SOIL/ROCK MATERIALS, NATIVE SOILS, OR PER ENGINEER'S PLANS. CHECK PLANS FOR PAVEMENT SUBGRADE REQUIREMENTS.	N/A	PREPARE PER SITE DESIGN ENGINEER'S PLANS. PAVED INSTALLATIONS MAY HAVE STRINGENT MATERIAL AND PREPARATION REQUIREMENTS.
C	INITIAL FILL: FILL MATERIAL FOR LAYER 'C' STARTS FROM THE TOP OF THE EMBEDMENT STONE ('B' LAYER) TO 18" (450 mm) ABOVE THE TOP OF THE CHAMBER. NOTE THAT PAVEMENT SUBBASE MAY BE A PART OF THE 'C' LAYER.	GRANULAR WELL-GRADED SOIL/AGGREGATE MIXTURES, <35% FINES OR PROCESSED AGGREGATE. MOST PAVEMENT SUBBASE MATERIALS CAN BE USED IN LIEU OF THIS LAYER.	AASHTO M145 ¹ A-1, A-2-4, A-3 OR AASHTO M43 ¹ 3, 357, 4, 467, 5, 56, 57, 6, 67, 68, 7, 78, 8, 89, 9, 10	BEGIN COMPACTIONS AFTER 12" (300 mm) OF MATERIAL OVER THE CHAMBERS IS REACHED. COMPACT ADDITIONAL LAYERS IN 6" (150 mm) MAX LIFTS TO A MIN. 95% PROCTOR DENSITY FOR WELL GRADED MATERIAL AND 95% RELATIVE DENSITY FOR PROCESSED AGGREGATE MATERIALS. ROLLER GROSS VEHICLE WEIGHT NOT TO EXCEED 12,000 lbs (53 kN). DYNAMIC FORCE NOT TO EXCEED 20,000 lbs (89 kN).
B	EMBEDMENT STONE: FILL SURROUNDING THE CHAMBERS FROM THE FOUNDATION STONE ('A' LAYER) TO THE 'C' LAYER ABOVE.	CLEAN, CRUSHED, ANGULAR STONE OR RECYCLED CONCRETE ⁵	AASHTO M43 ¹ 3, 357, 4, 467, 5, 56, 57	NO COMPACTION REQUIRED.
A	FOUNDATION STONE: FILL BELOW CHAMBERS FROM THE SUBGRADE UP TO THE FOOT (BOTTOM) OF THE CHAMBER.	CLEAN, CRUSHED, ANGULAR STONE OR RECYCLED CONCRETE ⁵	AASHTO M43 ¹ 3, 357, 4, 467, 5, 56, 57	PLATE COMPACT OR ROLL TO ACHIEVE A FLAT SURFACE. ^{2,3}

PLEASE NOTE:
1. THE LISTED AASHTO DESIGNATIONS ARE FOR GRADATIONS ONLY. THE STONE MUST ALSO BE CLEAN, CRUSHED, ANGULAR. FOR EXAMPLE, A SPECIFICATION FOR #4 STONE WOULD STATE: "CLEAN, CRUSHED, ANGULAR NO. 4 (AASHTO M43) STONE".
2. STORMTECH COMPACTION REQUIREMENTS ARE MET FOR 'A' LOCATION MATERIALS WHEN PLACED AND COMPACTED IN 9" (230 mm) (MAX) LIFTS USING TWO FULL COVERAGES WITH A VIBRATORY COMPACTOR.
3. WHERE INFILTRATION SURFACES MAY BE COMPROMISED BY COMPACTION, FOR STANDARD DESIGN LOAD CONDITIONS, A FLAT SURFACE MAY BE ACHIEVED BY RAKING OR DRAGGING WITHOUT COMPACTION EQUIPMENT. FOR SPECIAL LOAD DESIGNS, CONTACT STORMTECH FOR COMPACTION REQUIREMENTS.
4. ONCE LAYER 'C' IS PLACED, ANY SOIL/MATERIAL CAN BE PLACED IN LAYER 'D' UP TO THE FINISHED GRADE. MOST PAVEMENT SUBBASE SOILS CAN BE USED TO REPLACE THE MATERIAL REQUIREMENTS OF LAYER 'C' OR 'D' AT THE SITE DESIGN ENGINEER'S DISCRETION.
5. WHERE RECYCLED CONCRETE AGGREGATE IS USED IN LAYERS 'A' OR 'B' THE MATERIAL SHOULD ALSO MEET THE ACCEPTABILITY CRITERIA OUTLINED IN TECHNICAL NOTE 6.20 "RECYCLED CONCRETE STRUCTURAL BACKFILL".

User Inputs
Chamber Model: MC-3500
Outlet Control Structure: Yes
Project Name: Indhu Rajavadivelu
Engineer:
Project Location: Metric
Measurement Type: 1350.00 cubic meters.
Required Storage Volume: 40%
Stone Porosity: 339 mm.
Stone Foundation Depth: 351 mm.
Stone Above Chambers: (18.01 m. x 71.01 m.)
Design Constraint Dimensions:

Results:-
System Volume and Bed Size
INSTALLED STORAGE VOLUME: 362.56 CUBIC METERS.
STORAGE VOLUME PER CHAMBER: 3.12 CUBIC METERS.
NUMBER OF CHAMBERS REQUIRED: 247
NUMBER OF END CAPS REQUIRED: 16
CHAMBER ROWS: 8
MAXIMUM LENGTH: 70.72 M.
APPROX. BED SIZE REQUIRED: 17.51 M.
AVERAGE COVER OVER CHAMBERS: 1226.35 SQUARE METERS.
N/A .
SYSTEM COMPONENTS
AMOUNT OF STONE REQUIRED(0% OVERAGE): 1471 CUBIC METERS
(CUBIC YARD TO TON FACTOR:1.4): 2692.01 TONS
VOLUME OF EXCAVATION (NOT INCLUDING FILL): 2246 CUBIC METERS
TOTAL NON-WOVEN GEOTEXTILE REQUIRED: 3331 SQUARE METERS
WOVEN GEOTEXTILE REQUIRED (EXCLUDING ISOLATOR ROW): 122 SQUARE METERS
WOVEN GEOTEXTILE REQUIRED (ISOLATOR ROW): 221 SQUARE METERS
TOTAL WOVEN GEOTEXTILE REQUIRED: 343 SQUARE METERS
IMPERVIOUS LINER REQUIRED: 0 SQUARE METERS

- GENERAL NOTES
1. ALL DIMENSIONS ARE IN METRES UNLESS NOTED OTHERWISE
 2. ONLY WRITTEN DIMENSIONS SHALL BE USED. NO DIMENSIONS SHALL BE SCALED FROM THE DRAWINGS
 3. ALL LEVELS ARE IN METRES AND ARE TO MALIN HEAD DATUM
 4. ALL COORDINATES ARE IN METRES AND ARE TO IRISH TRANSVERSE MERCATOR
 5. DRAWINGS ARE TO BE READ IN CONJUNCTION WITH THE SPECIFICATION

CHAMBERS SHALL MEET THE REQUIREMENTS OF ASTM F2418, "STANDARD SPECIFICATION FOR POLYPROPYLENE (PP) CORRUGATED WALL STORMWATER COLLECTION CHAMBERS".

1. MC-3500 CHAMBERS SHALL BE DESIGNED IN ACCORDANCE WITH ASTM F2787 "STANDARD PRACTICE FOR STRUCTURAL DESIGN OF THERMOPLASTIC CORRUGATED WALL STORMWATER COLLECTION CHAMBERS".
2. THE SITE DESIGN ENGINEER IS RESPONSIBLE FOR ASSESSING THE BEARING RESISTANCE (ALLOWABLE BEARING CAPACITY) OF THE SUBGRADE SOILS AND THE DEPTH OF FOUNDATION STONE WITH CONSIDERATION FOR THE RANGE OF EXPECTED SOIL MOISTURE CONDITIONS. REFERENCE STORMTECH DESIGN MANUAL FOR BEARING CAPACITY GUIDANCE.
3. PERIMETER STONE MUST BE EXTENDED HORIZONTALLY TO THE EXCAVATION WALL FOR BOTH VERTICAL AND SLOPED EXCAVATION WALLS.
4. REQUIREMENTS FOR HANDLING AND INSTALLATION:
 - TO MAINTAIN THE WIDTH OF CHAMBERS DURING SHIPPING AND HANDLING, CHAMBERS SHALL HAVE INTEGRAL, INTERLOCKING STACKING LUGS.
 - TO ENSURE A SECURE JOINT DURING INSTALLATION AND BACKFILL, THE HEIGHT OF THE CHAMBER JOINT SHALL NOT BE LESS THAN 2" (50 mm).
 - TO ENSURE THE INTEGRITY OF THE ARCH SHAPE DURING INSTALLATION, a) THE ARCH STIFFNESS CONSTANT AS DEFINED IN SECTION 6.2.8 OF ASTM F2418 SHALL BE GREATER THAN OR EQUAL TO 500 LBS/FT³. AND b) TO RESIST CHAMBER DEFORMATION DURING INSTALLATION AT ELEVATED TEMPERATURES (ABOVE 73° F / 23° C), CHAMBERS SHALL BE PRODUCED FROM REFLECTIVE GOLD OR YELLOW COLORS.

Purpose		FOR PLANNING	
Client		Title	
CASTLETHORN OLD CONNAUGHT UCL		STANDARD CONSTRUCTION DETAILS SHEET 8	
Project		Original Scale	
OLD CONNAUGHT PHASE A1 LRD		AS SHOWN	
Status	Drawing Number	Drawn	Checked
S6	ATK-ZZ-ZZ-DR-CE-909008	PM	IPR
Rev	Rev	Rev	Rev
P01			

AtkinsRéalis



Stormwater Impact Assessment Report

Castlethorn Old Connaught UCL

13 July 2026

0126446DG0009

OLD CONNAUGHT PHASE 1

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Client signoff

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1. Introduction

The purpose of the Stormwater Impact Assessment Report is to provide details of the Storm water elements associated with the proposed development at Lands at Allies River Road, Old Connaught, Co. Dublin.

For the purposes of Planning, the Old Conna Development lands have been split into two phases; Phase 1 (to which this planning application applies) and Phase 2 which will be delivered at a later stage. The storm water drainage design has been undertaken for the overall Old Conna Masterplan Development site including Phase 1 and allowance for the Future Phase 2 to ensure that there is adequate capacity and connectivity within the proposed storm system.

The proposed development comprises 271no. dwellings in a mix of houses and duplex / apartment units, including 103no. 2 to 3-storey houses (22no. 4-bedroom, 68 no. 3-bedroom and 13no. 2-bedroom), 162no. apartments (113no. 2-bedroom and 49no. 1-bedroom) across 4 no.blocks ranging from 1-4 storeys in building height and 6 no. 3-bedroom duplex units; 1 no. creche (c. 574 sqm) at ground floor of Apartment Block 3; and all associated and ancillary site development and infrastructural works including on site attenuation, hard and soft landscaping and boundary treatment works, including: public open space; communal open space; components of the regional attenuation pond; public lighting; surface car parking spaces; bicycle parking spaces/stores for houses and duplex / apartment units; 4no. ESB substations; bin stores; vehicular access via existing Old Connaught Avenue and a proposed new primary north-south street into the eastern portion of the Central Character Area. The proposed development also includes the construction of a new pumping station, twin rising mains extending circa 400m along Old Connaught Avenue under the M11 connecting to the existing Gravity foul network on Old Connaught Avenue 125m east of the M11 bridge and associated storage, together with all ancillary site development and reinstatement works required to facilitate these elements. The report deals with the following aspects associated within this development.

- Existing Site and Hydrological Features
- Site Investigation Testing
- Soil Type Classification
- Storm Water Drainage Design
- Sustainable Urban Drainage System (SuDS)
- Flood Risk Assessment and Exceedance Flows
- SuDS Maintenance

1.1 Site Location

The proposed site is located within the client land ownership within the Old Connaught LAP. The land is bounded to the west of the M11 corridor, North of Old Connaught Avenue, and east of existing residential areas in Old Connaught. Figure 1-1 below indicates the extents of the site within the redline boundary. The site extends across the central and eastern fields of Old Connaught and includes frontage onto Old Connaught Avenue to the south.

The map highlights several features that help show the site's position within the surrounding areas. The M11 forms a clear landmark to the east, and Old Connaught Avenue defines the Southern Edge of the surrounding area. The wider setting comprises a combination of suburban neighbourhoods, community facilities and open green spaces, reflecting the mixed residential and semi-rural character typical of Old Connaught.





Figure 1-1 - Site Location

1.2 Existing Site Description

The existing topographical levels within the proposed site range from approximately 24.23mOD at the North-West Boundary, which is the highest point to around 18.89mOD at the lowest point in the southwest . Overall, the ground levels fall gradually across the site, sloping from the North-west area towards the South-West.

1.3 Principle Design Considerations

During the design of the storm Drainage for the proposed site, including SuDS, the following key documents / standards were taken into consideration.

- Dun Laoghaire Rathdown County Development Plan, 2022-2028
- Old Connaught Local Area Plan (LAP)
- Greater Dublin Strategic Drainage Study (GDSDS)
- CIRIA Report C753 The SuDS Manual -v6

The proposed stormwater drainage has been developed in consultation with the relevant authorities including Dun Laoghaire Rathdown County Council (DLRCC) Municipal services Department and will be further discussed prior to the final planning submission.



2. Surface Water Design

The storm drainage system has been designed in accordance with the key documents and standards listed in Section 1.3 above.

Surface water generated from the proposed residential development will be conveyed through a proposed surface water network including SuDS and attenuated / managed on site prior to final discharge at QBar greenfield run-off rates. The restricted discharge from the proposed site will be conveyed via a new surface water sewer proposed from the attenuation pond and discharged to the existing culvert located east of the proposed site which then discharges to the receiving Crinken Stream. The proposed Storm drainage Network for the development is as indicated on the planning drawings ATK-ZZ-ZZ-DR-CE-900500 - ATK-ZZ-ZZ-DR-CE-900504.

The principles behind the proposed design were discussed and agreed with DLRCC Municipal services department at multiple stages in advance of making this application. . Aspects of the proposed development that were discussed and agreed have been incorporated within this design.

The proposed measures included within the design proposal are as follows:

- Swales within Open Space / Park areas adjacent to roads
- Permeable Paving in light traffic areas (Parking Bays)
- Green Roofs to suitable Apartment Block
- Potential for use of Modular underground attenuation Systems within Park Areas
- Filter Drains in rear Gardens
- Tree Pits
- Flow Control Devices including Vortex and orifice Plates as required.
- A regional overground attenuation Pond

2.1 Proposed Sustainable Urban Drainage (SuDS) Strategy

For the proposed development a SuDS Triangle was utilized to ensure all three functions are provided for within the SuDS strategy.

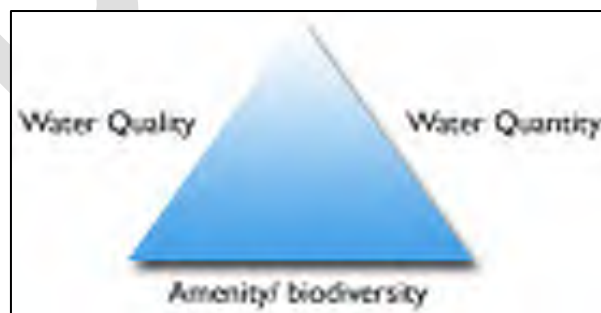


Figure 2-1 - SuDS Triangle

By considering the three functions of the triangle, a SuDS system will allow for water quality treatment through natural processes by;

- Encouraging infiltration (where appropriate) and attenuation peak flows.
- Improving Water Quality by providing treatment to storm water prior to discharge
- Providing Habitat and function were possible for those using the area (including wildlife)

The principles of a SuDS Treatment train were used during the design of the surface water drainage system. The treatment train as illustrated in the image below provides an understanding of prevention and source control to reduced water runoff from a site and improve water Quality.

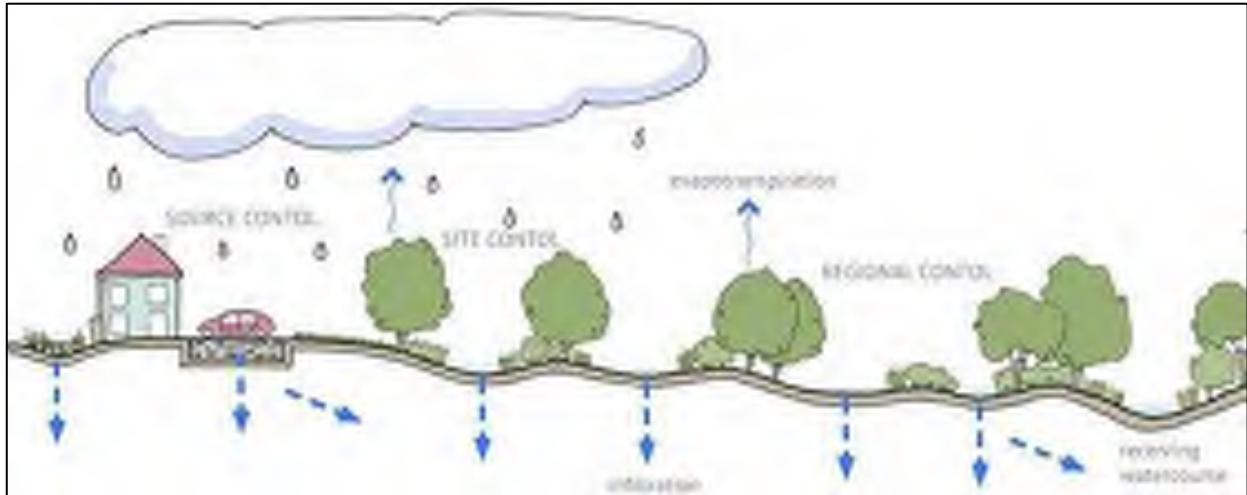


Figure 2-2 - SuDS Treatment Train

The treatment train principles include;

- Prevention of surface water run-off from the proposed site by use of filter drains, swales, permeable paving, tree pits, extensive green roofs, and modular attenuation systems with a permeable base. (where appropriate)
- Minimising impermeable paved areas using permeable paving, and extensive green roofs.
- Infiltration by use of Filter drains, swales, permeable paving and tree pits.
- Site control using underground modular attenuation storage and vortex flow control devices to manage flows and agreed final Qbar Run off rate.

Each of the items outlined above will help to improve water quality, reduce storm runoff quantity from the proposed site and ensure that there is no increased risk to downstream flooding where discharging to the existing culvert.

To facilitate the design of the Phase 1 stormwater drainage network, the full development extent (Phases 1 and 2) has been considered in the hydraulic assessment. The Phase 1 drainage layout has been developed using the proposed finished levels, while the Phase 2 lands have been assessed based on existing ground levels. Considering the overall development extent at this stage ensures that adequate drainage gradients and satisfactory invert levels can be achieved for the internal network, including the discharge to the proposed regional attenuation tank. The total area considered in the assessment is 11.538 ha, as illustrated in Figure 2-3.

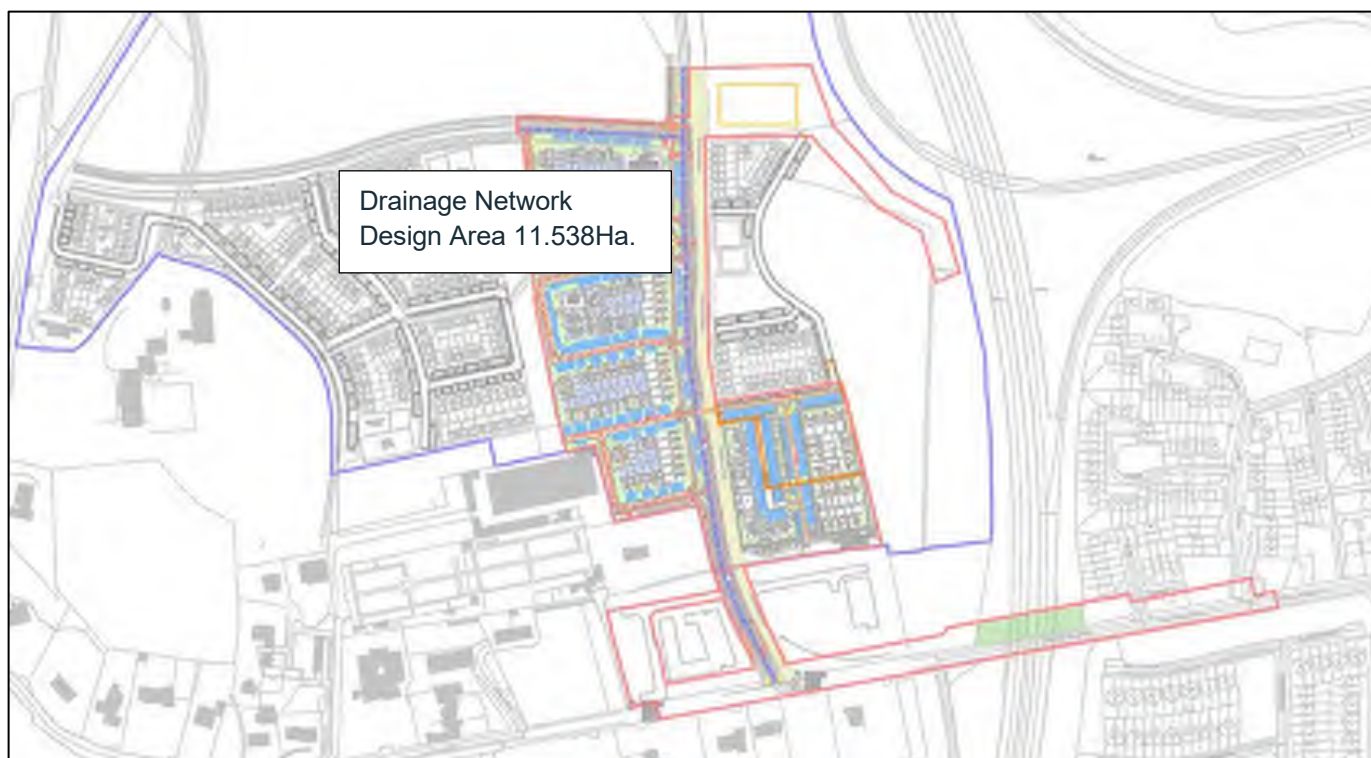


Figure 2-3 - Overall Catchment Area Considered for Drainage Network Design

There are 4 No proposed drainage Sub-catchment Areas (Catchment 1A, 1B, 2A, and 2B) Within the proposed development for the purpose of site control as outlined on planning drawing ATK-ZZ-ZZ-DR-CE-900103 Sub Catchment Areas Layout Plan.. The catchments are segregated by use of a vortex control device to limit / Manage discharge from each catchment. Section 7 provides further details on Catchment areas.

The SuDS techniques proposed within the development are outlined below:

- Swales are to be used within the site as conveyance systems for surface water runoff from sections of road, footpaths, or shared surfaces. Discharge into the swale will be via drop kerbs/ side inlet gullies or over edge flows.
- Permeable Paving will be used in light traffic areas to the front of residential units, courtyards and carparks, The permeable paving will allow for attenuation, infiltration to ground, reduction of peak flow rates and improved water quality. Roof Run-off from the front roof area of residential housing units will discharge directly into the Subbase below each permeable paving area allowing for reduced run off from these roof areas.
- Extensive Green roofs will be provided on suitable buildings as indicated on drawing ATK-ZZ-ZZ-DR-CE-900504 in accordance with Dun Laoghaire Rathdown County Development Plan, 2022-2028 and Old Connaught LAP. The green roofs will provide reduced peak flow rates, attenuation, evaporation and improved water quality.
- Filter drains within rear gardens of the housing units will allow for infiltration to ground, reduced peak flow rates and improved water quality. Only roof run off from the rear roof of the residential unit will discharge into the filter drain. The filter drain will allow for infiltration to ground and reduce the overall site runoff.
- Underground modular systems will be used within public green corridors / Park areas . The modular systems will allow for storm water attenuation underground for storm events up to 1 in 100 year events. The modular systems will also allow for infiltration to ground were suitable.
- Vortex flow control devices will be used throughout the site to allow for storm water control and reduce peak run-off.

The storm water drainage network will be assessed for compliance with Key design parameter as set out in Table 2-1 below.

Table 2-1 - Storm Drainage Design Parameters

Parameter	Value/Requirement
Minimum Depth	1.2m cover under highways 0.9m elsewhere*
Maximum Depth	5m
Minimum Sewer Size for Main Drainage	225mm
DLRCC Municipal services agreed coefficient runoff factors for pipe sizing and storage requirements	100% Roads / Cycletrack / Footpath / Roofs (when discharging directly to the proposed Storm drainage Network). 75% - Roads / Cycle tracks / Footpath / Roofs when discharging directly to swales, tree pits and filter drains. 60% - Roads / Cycle tracks / Footpaths / Roofs when discharging directly to permeable paving 85% - Extensive Green Roofs
Max velocity at Pipe full	3.0m/s
Min Velocity in	0.75m/s (1.0m/s used where achievable)
Roughness	0.6mm
Maximum discharge rate	A discharge rate of 15.1 l/s is controlled at the flow control manhole located at the final outfall from the local attenuation tank serving Catchment 1A. A discharge rate of 27.1 l/s is controlled at the final discharge point from the regional attenuation pond serving Catchments 1A and 1B.
Level of Service Critical Storm 1 in 2 year return period	No Surcharge within the pipe network, no flooding
Level of service Critical Storm 1 in 30 year return period	Surcharge allowed, No flooding
Level of service Critical Storm 1 in 100 year return period	No Flooding unless planned and contained on site.

**Without recourse to concrete, absolute minimum cover in roads is 0.9m. Pipes with cover between 0.9m and 1.2m shall be bedded and surrounded in concrete, 150mm thick, Class E, in accordance with Clause 1502 of the Specification for Roadworks.*

***Overall catchment area for storm water design purposes is 11.538Ha as discussed in Section 2.1 above.*

Causeway Flow which is an industry standard tool for the design and assessment of gravity sewer drainage networks, has been used to simulate the proposed storm drainage network including flow controls and attenuation requirements. Outputs from the model for the proposed storm network are contained in Appendix A-F of this report.



3. Site Investigations

Site Investigations were carried out by Ground Investigations Ireland Ltd in March 2026. Refer to Appendix G for a copy of the Ground Investigations Report.

The purpose of the site investigation was to investigate subsurface conditions utilising a variety of investigative methods. The scope of the site investigation works undertaken for this project included the following.

- 3 no. cable percussive boreholes
- 3 no. rotary coreholes at borehole locations
- 5 no. mechanically excavated trial pits
- 2 no. window samples
- 2 no. dynamic probes at window sample locations
- 7 no. plate bearing tests
- 7 no. infiltration tests
- 1 no. inspection (slit) trench
- Groundwater monitoring of standpipes
- A programme of geotechnical, chemical and environmental laboratory testing

The locations for the site investigation testing including soakaways and ground water monitoring wells were discussed and agreed with DLRCC Municipal services prior to works commencing on site. Refer to Figure 3-1 below for borehole and trial pit locations. The locations for the site investigation testing are indicated in the image below:

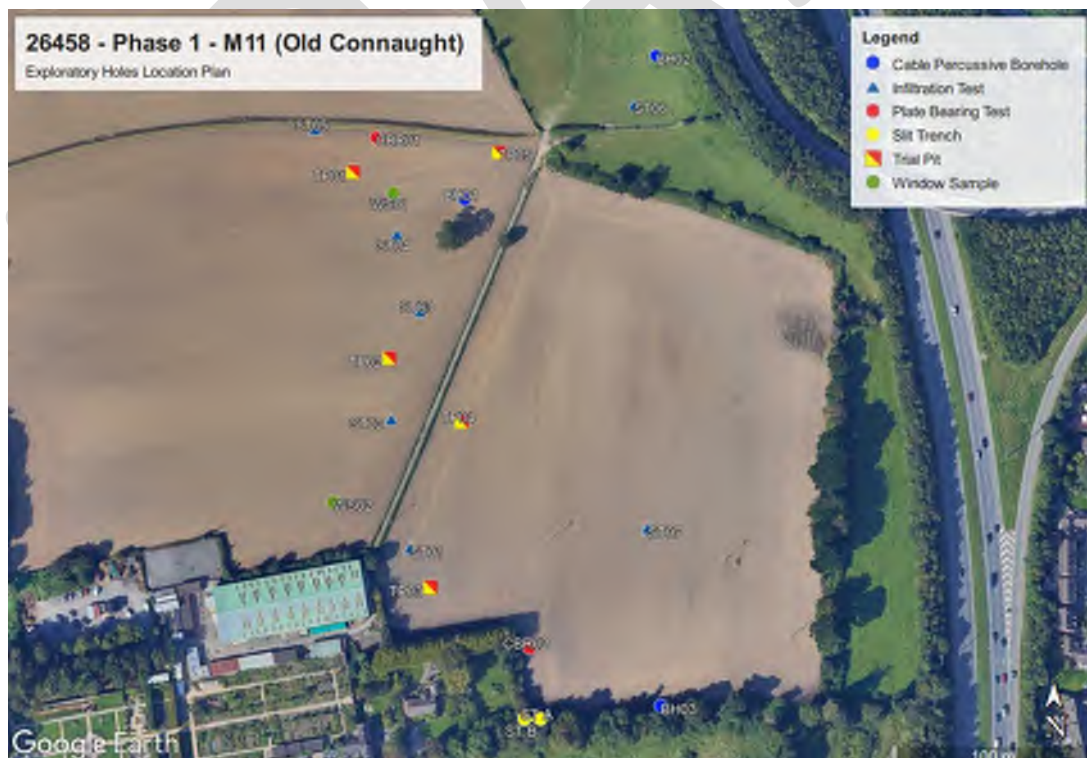


Figure 3-1 - Site Investigation Testing Locations



Review of the SI results including Trial Pit (TP) logs indicate that out of the 12No. TP (including 7No. soakaways), ground water was encountered within 11No. TP's. The ground water levels within the TP logs varied between 0.9m – 2.20m in depth.

The location of the trial pits, ground levels, and ground water levels are indicated on the storm water Layout Drawings ATK-ZZ-ZZ-DR-CE-900500-900502.

DRAFT



4. Existing Site Hydrology

4.1 EPA Based Assessment

The environmental Protection Agency (EPA) geoportal was consulted in relation to the proposed site to identify nearby waterbodies. The water bodies close to the proposed site are: Crinken Stream (EPA Code : 10R18) c. 326m to the North – East of the proposed site, Dargle Stream (EPA Code: 10D01) c.780m South – East of the proposed site, and the Irish Sea C1.5km East of the proposed site as shown in Figure Below.

The Dargle stream flows in a south – easterly direction and joins the Irish Sea. The Dargle stream flows in a North – Easterly manner into the Dargle Estuary C.1.3km East of the proposed site. The Old Connaught Local Area Plan 2025 identifies a primary watercourse relevant to the proposed site – a tributary of Crinken stream known as the Old Connaught Stream (also known as Ballyman Tributary) as shown in Figure 4-1, which flows through the site. The tributary rises from Carrickgollogan Hill on the eastern edge of the Dublin Mountains and flows down to Old Connaught where it enters a culvert upon converging with Ferndale Road. From here, the tributary runs in an Easterly direction in a series of culverts and open channels, diverted from its original route, before finally discharging to the Crinken Stream again on the eastern side of M11.



Figure 4-1 - Site Hydrology

4.2 Old Conna Local Area Plan Based Assessment

The Old Connaught Local Area Plan (LAP) identified four distinct character areas within the plan lands, namely the Northern, Central, Southern and Western Character Areas. As part of the LAP-wide drainage strategy, a Primary Regional Attenuation Pond and a Secondary Regional Attenuation Pond were identified to facilitate the management of surface water runoff across the overall development area. A review of the stormwater network strategy for the wider LAP lands has been undertaken to assess the feasibility of the drainage proposals and to confirm the continued functionality of the integrated surface water management strategy envisaged under the LAP.

The Central Character Area presents particular drainage challenges due to the existing site topography and the relatively flat gradients across portions of the lands. Notwithstanding these constraints, the drainage analysis has demonstrated that the majority of the Old Connaught Castlethorn lands within the Central Character Area can be conveyed to the Primary Regional Attenuation Pond identified in the LAP. This has been achieved through a carefully developed drainage strategy that accommodates the adverse gradients across the catchment, resulting in a relatively deep regional attenuation pond. In addition, surface water runoff from the proposed highway link connecting the Northern Character Area to the Central Character Area will also be directed to the Primary Regional Attenuation Pond.

A small portion of the Old Connaught Castlethorn lands, comprising approximately 0.5 ha, is located within an area where the existing ground gradients are insufficient to feasibly convey runoff to the Primary Regional Attenuation Pond. The lowest ground level within this area is approximately 18.975 mOD, which would not allow drainage to the regional attenuation facility. Consequently, runoff from this portion of the site will be attenuated locally and discharged to the final outfall location identified within the LAP, in accordance with the overall drainage strategy.

Surface water runoff from the Southern Character Area will be managed through localised attenuation measures within the respective development sites before being conveyed through the Secondary Regional Attenuation Pond. Similarly, runoff from the Western Character Area will be attenuated within the respective development sites and subsequently discharged via the proposed stormwater pipe network within Old Connaught Avenue. The outfalls from the Southern and Western Character Areas will combine and discharge to the existing ditch located south of the Old Connaught Castlethorn lands within the Central Character Area, at an indicative invert level of 18.6 mOD. This ditch subsequently conveys flows towards the same culvert that receives discharge from the Central Character Area, thereby maintaining the integrated surface water management strategy proposed under the Old Connaught LAP.

The proposed drainage arrangement is as shown below in fig 4-2, showing the relationship between the Northern, Central, Southern and Western Character Areas, the regional attenuation ponds, and the proposed discharge routes. The overall surface water management strategy described above is illustrated on Drawing, included in **Appendix H**.



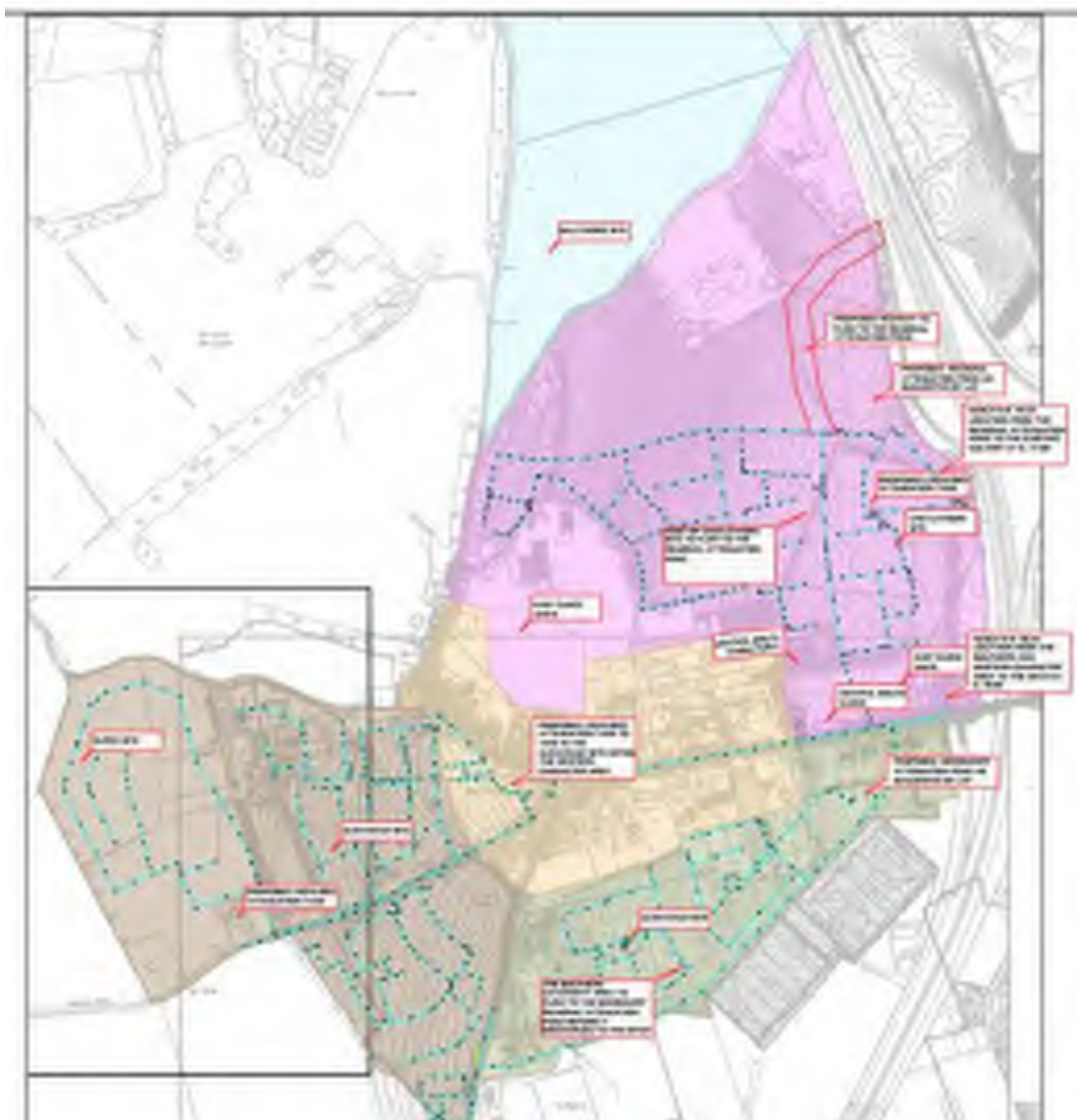


Figure 4-2 - Old Conna LAP - Proposed Storm Network

5. Soil Type Classification

To determine the allowable QBar discharge rate from the proposed site, the SOIL value for the existing site was classified using the Winter Rain Acceptance Potential Classification . Table 2-1 from the Institute of Hydrology Report No.126 , See Figure 5-1 below.

Water regime class	Depth to impermeable horizon	Slope Classes									
		< 2°			2-8°			> 8°			
		Permeability class (above impermeable horizon)									
		Rapid	Medium	Slow	Rapid	Medium	Slow	Rapid	Medium	Slow	
1	> 80	1		1			2	-	2	3	
	80-40	2			3			4			
	< 40	-			-			-			
2	> 80	2	3			-			-		
	80-40	4			-			-			
	< 40	3	-			-			-		
3	> 80	5			-			-			
	80-40	-			-			-			
	< 40	-			-			-			

Winter Rain Acceptance Class		Winter Run-off Potential	
1	Very high	1	Very Low
2	High	2	Low
3	Moderate	3	Moderate
4	Low	4	High
5	Very low	5	Very high

Figure 5-1 - WRAP Table

The table considers four main soil and site properties which include :

- Soil Water Regime
- Depth to an Impermeable layer
- Slope Class
- Permeability of the Soil Horizons above the impermeable layer.

5.1 Soil Water Regime

The water regime class is taken from the Soil Survey field Handbook. The classes are identified as :

- 1) soils rarely waterlogged within 40 cm depth, and for less than 90 days within 70 cm in most years,
- 2) soils commonly waterlogged within 40 cm, but for less than 335 days within 70 cm in most years, and
- 3) soils waterlogged within 40 cm for more than 180 days, and for more than 335 days within 70 cm in most years.

Figure 5-2 - Water Regime Class



The Site Investigations findings indicated a ranging depth of topsoil for each of the 12No. Trial Pits including the 7 Soakaway Trial Pits from 200mm to 600mm.

Due to the maximum depth of the topsoil (600mm thk.) and the depth to impermeable layer discussed in Section 5.2 below, it was determined that water regime Class 2 “soils commonly waterlogged within 40cm, but for less than 335 days within the 70mm in most years” is the most suitable selection for this site.

5.2 Depth to an Impermeable Layer

Site Investigations were carried out on site as previously discussed in Section 3 of this report. During the Site Investigations 7No. soakaway tests were performed in accordance with BRE digest 365 at specified locations to determine the suitability of the soils for the infiltration of surface water.

The Site Investigations findings indicated a depth of topsoil for each of the 7No. soakaway Trial Pits as 200mm.

Below the topsoil the test medium varied between slightly sandy slightly gravelly CLAY, slightly silty sandy gravelly CLAY, sandy CLAY, slightly gravelly sandy CLAY, and sandy gravelly CLAY with occasional red brick and concrete fragments.

The Institute of Hydrology Report No. 126 outlines that “an impermeable layer is defined as a layer with a hydraulic conductivity of less than 0.1 m/day”.

Based on this information with predominant soil type for each of the soakaway tests being CLAY, the depth to an impermeable layer is determined to be located 200mm below surface level or at the underside of the topsoil or, accordance with the WRAP table a depth to impermeable horizon of <40cm.

5.3 Slope Class

Following a review of the topographical survey a 3D Heatmap model of the existing site gradients was generated. The 3D Model allowed for Identification of the slopes on site between the ranges set out in the winter Rain Acceptance Potential Classification. See Figure 5-3 below for slope classifications.



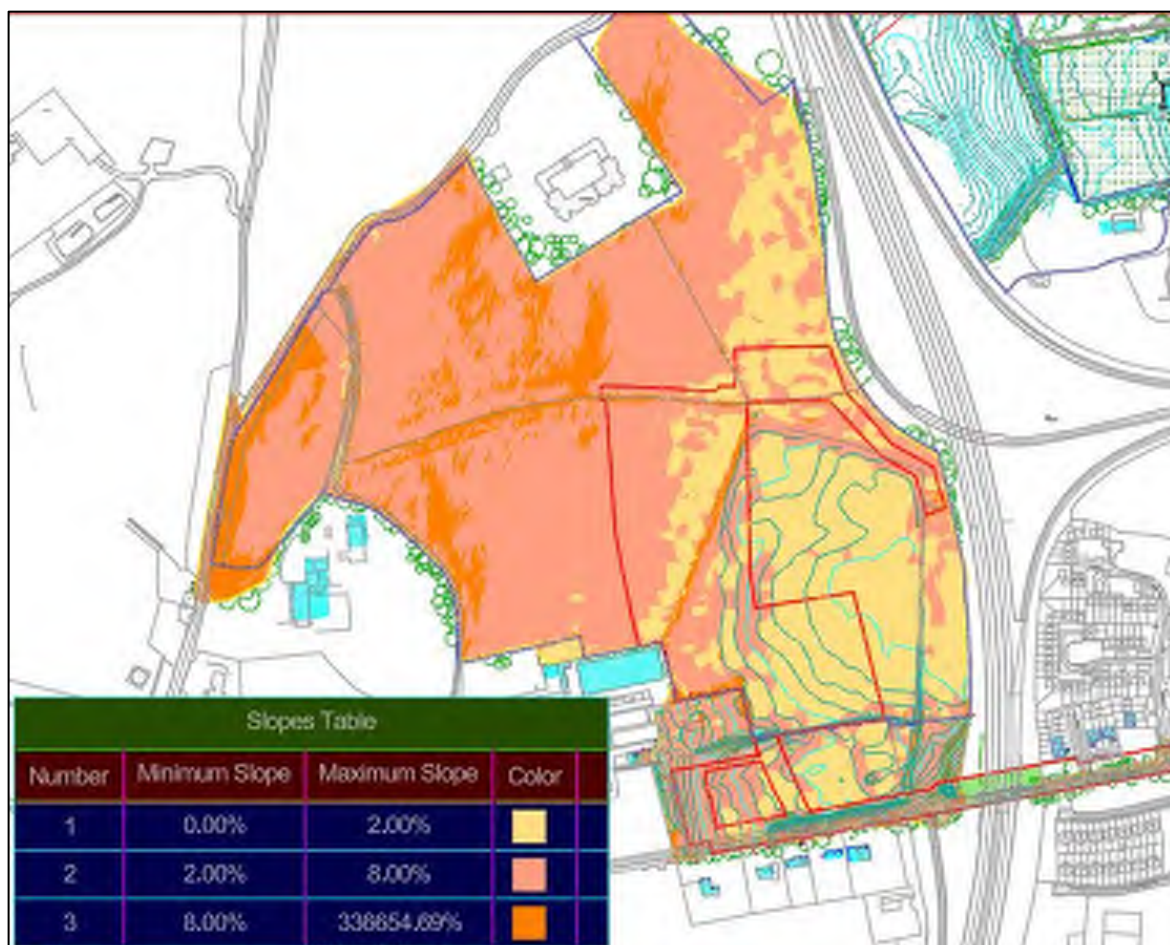


Figure 5-3 - Site Slope

The majority of the site has a slope of < 2 degrees or between 2 and 8 degrees. It is noted however that parts of the site have a slope of > 8 degrees. For this assessment based on the average, a 2-8 degrees slope will therefore be used.

5.4 Permeability Class

The Handbook of Soils for Landscape Architects by Robert F. Keeler Table 6.1 provides a soil characterisation for permeability from slow to rapid as outlined in Figure 5-4 Below:

Table 6.1 Soil Permeability Class Related to Flow of Water through a Saturated Soil	
Permeability Class	Rate of Flow (inches per hour)
Very slow	Less than 0.06
Slow	0.06-0.2
Moderately slow	0.2-0.6
Moderate	0.6-2.0
Moderately rapid	2.0-6.0
Rapid	6.0-20.0
Very rapid	More than 20

Figure 5-4 - Permeability Classifications



From review of the soakaway test results, the site has been subdivided into two areas based on permeability classes as per Figure 5-5 below.

The site investigation results indicate that infiltration across the area A is consistently poor, with water levels observed to fall too slowly to allow reliable determination of infiltration rates in most locations. Based on this it is determined that permeability class is 'Very Slow'.

The site investigation results indicate that infiltration within area B is generally good, with water levels observed to fall readily during testing, allowing for the determination of infiltration rates. In parts of the site, infiltration was notably rapid, demonstrating favourable drainage characteristics. For Area B it is determined that the permeability class is 'Moderately Rapid'.

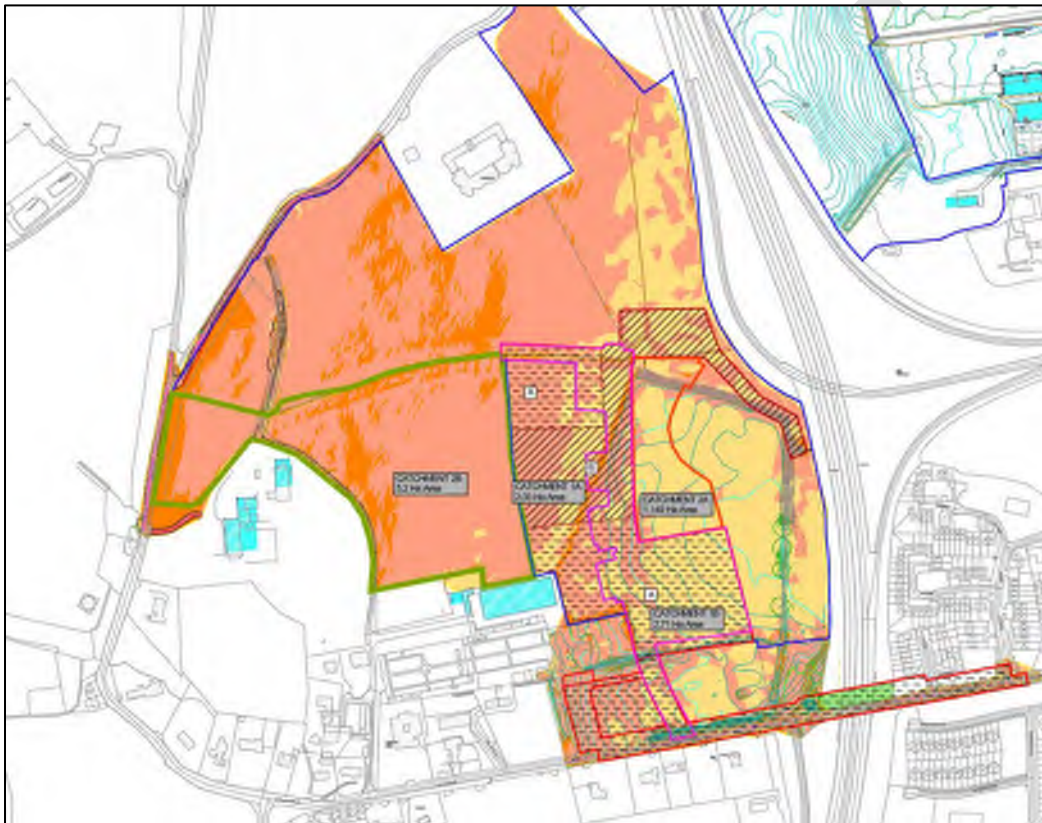


Figure 5-5 - Site Permeability Classification

5.5 Soil Type Classification

5.5.1 Area A

Based on the rational discussed in Sections 5.1 5.4 above, Area A would fall into the Soil Type 4 classification as per Figure 5-6 below.

As indicated in **Figure 5.4**, and when compared against the catchment extents shown in **Figure 5.8**, it is evident that the majority of **Catchment 1A**, and **Catchment 1B** fall within **Area A**. In accordance with the soil classifications presented in Figure 5.4, Area A is characterized by negligible infiltration potential, indicating that infiltration to ground cannot be relied upon as part of the surface water management strategy. Consequently, this assumption has been adopted in the design of the proposed SuDS measures within these catchments, with attenuation tanks and associated drainage infrastructure sized and designed on the basis of providing attenuation only, without any allowance for infiltration losses.

No Site Investigation (SI) information is currently available for **Catchments 2A and 2B**. Therefore, for the purposes of this assessment and to adopt a conservative approach, these catchments have also been assumed to fall within **Area A** and have been classified as **Soil Type 4**. Accordingly, all proposed SuDS features and attenuation areas within Catchments 2A and 2B have been designed on the basis of negligible infiltration potential. This classification may be reviewed should future site investigation data become available.

Figure 5-6 - Area A Soil Type Classification

Water regime class	Depth to impermeable horizon (m)	Slope Classes									
		< 2°			2-8°			> 8°			
		Permeability class (above impermeable horizon)									
		Rapid	Medium	Slow	Rapid	Medium	Slow	Rapid	Medium	Slow	
1	> 80	1			1			2		2	3
	80-40	2			2			3			4
	< 40	3			3			4			
2	> 80	2			3			4			
	80-40	3			4			5			
	< 40	4			5			6			
3	> 80	5			6			7			
	80-40	6			7			8			
	< 40	7			8			9			

Winter Rain Acceptance Class		Winter Run-off Potential	
1	Very high	1	Very Low
2	High	2	Low
3	Moderate	3	Moderate
4	Low	4	High
5	Very low	5	Very high

5.5.2 Area B

Based on the rational discussed in Sections 5.1 5.4 above, Area B would fall into the Soil Type 4 classification as per Figure 5-6 below.



Figure 5-7 - Area B Soil Type Classification

Water regime class	Depth to impermeable horizon	Slope Classes								
		< 2°			2-8°			> 8°		
		Permeability class (above impermeable horizon)								
		Rapid	Medium	Slow	Rapid	Medium	Slow	Rapid	Medium	Slow
1	> 80				1		2		2	3
	80-40	1			2			3		4
	< 40									
2	> 80	2			3					
	80-40						4			
	< 40	3								
3	> 80									
	80-40				5					
	< 40									

Winter Rain Acceptance Class		Winter Run-off Potential	
1	Very high	1	Very Low
2	High	2	Low
3	Moderate	3	Moderate
4	Low	4	High
5	Very low	5	Very high

However, DLRCC Municipal Services has advised that areas with no infiltration potential should be classified as **Soil Type 4**, while areas exhibiting limited infiltration potential should be classified as **Soil Type 3**. On this basis, the portions of the site falling within **Area B** have been reclassified as **Soil Type 3** for the purposes of the QBAR runoff rate calculations. The adoption of Soil Type 3 results in a lower QBAR discharge rate compared to Soil Type 4 and, consequently, increases the attenuation storage requirements within the development. The use of Soil Type 3 is therefore considered a more conservative and onerous approach for the design of the proposed surface water drainage infrastructure.

Based on this classification, a portion of **Catchment 1A** located within Area B, together with the corresponding areas of **Catchment 1B**, have been assigned **Soil Type 3**. Accordingly, the design of the proposed SuDS features, attenuation tanks and attenuation ponds serving these areas has been undertaken using Soil Type 3 parameters. As a result, the QBAR discharge rates adopted for these catchments reflect the runoff characteristics associated with Soil Type 3, ensuring that the sizing of the attenuation measures is based on the more conservative hydraulic assessment.



Figure 5-8 - Catchments

6. Surface Water Storage Requirements

As agreed with DLRCC Municipal services, the www.uksuds.com surface water storage volume estimation tool was used to determine the maximum Qbar discharge rate from the site for a 1 in 100 year storm event. Site specific data was confirmed using Met Eireann Rainfall Data as indicated below.

Met Eireann
Return Period Rainfall Depths for sliding Durations
Irish Grid: Easting: 325110, Northing: 219630,

DURATION	Interval	2,	3,	4,	5,	10,	20,	30,	50,	75,	100,	150,	200,	250,	500,
5 mins	2.8, 3.9,	4.5,	5.3,	5.9,	6.3,	7.8,	9.4,	10.4,	11.9,	13.2,	14.2,	15.8,	17.0,	17.9,	N/A ,
10 mins	3.9, 5.4,	6.2,	7.4,	8.2,	8.8,	10.8,	13.1,	14.5,	16.6,	18.4,	19.8,	22.0,	23.6,	25.0,	N/A ,
15 mins	4.6, 6.4,	7.3,	8.7,	9.6,	10.4,	12.7,	15.4,	17.1,	19.5,	21.7,	23.3,	25.8,	27.8,	29.4,	N/A ,
30 mins	6.1, 8.3,	9.5,	11.2,	12.4,	13.3,	16.1,	19.3,	21.4,	24.3,	26.9,	28.8,	31.8,	34.1,	36.0,	N/A ,
1 hours	8.0, 10.8,	12.3,	14.4,	15.9,	16.9,	20.4,	24.3,	26.8,	30.3,	33.3,	35.6,	39.2,	41.9,	44.1,	N/A ,
2 hours	10.6, 14.1,	15.9,	18.6,	20.3,	21.7,	25.9,	30.6,	33.6,	37.7,	41.3,	44.1,	48.2,	51.4,	54.0,	N/A ,
3 hours	12.5, 16.5,	18.6,	21.5,	23.5,	25.0,	29.8,	35.0,	38.3,	42.9,	46.9,	49.9,	54.5,	58.0,	60.8,	N/A ,
4 hours	14.0, 18.4,	20.7,	23.9,	26.1,	27.7,	32.9,	38.5,	42.0,	47.0,	51.2,	54.5,	59.4,	63.1,	66.2,	N/A ,
6 hours	16.5, 21.5,	24.1,	27.7,	30.1,	32.0,	37.7,	44.0,	48.0,	53.4,	58.1,	61.7,	67.1,	71.1,	74.5,	N/A ,
9 hours	19.5, 25.1,	28.0,	32.2,	34.9,	36.9,	43.4,	50.3,	54.7,	60.7,	65.9,	69.8,	75.7,	80.2,	83.9,	N/A ,
12 hours	21.9, 28.1,	31.2,	35.7,	38.6,	40.9,	47.8,	55.3,	60.1,	66.5,	72.0,	76.2,	82.5,	87.3,	91.2,	N/A ,
18 hours	25.7, 32.8,	36.3,	41.4,	44.7,	47.2,	55.0,	63.3,	68.5,	75.6,	81.7,	86.3,	93.2,	98.4,	102.7,	N/A ,
24 hours	28.9, 36.6,	40.5,	46.0,	49.5,	52.2,	60.6,	69.6,	75.2,	82.8,	89.3,	94.3,	101.6,	107.2,	111.7,	126.9,
2 days	36.4, 45.3,	49.7,	56.0,	60.0,	63.0,	72.4,	82.2,	88.4,	96.6,	103.7,	109.0,	116.8,	122.8,	127.5,	143.6,
3 days	42.5, 52.4,	57.2,	64.1,	68.5,	71.7,	81.9,	92.5,	99.0,	107.9,	115.4,	121.0,	129.3,	135.5,	140.6,	157.4,
4 days	47.8, 58.6,	63.8,	71.1,	75.8,	79.3,	90.1,	101.4,	108.3,	117.7,	125.5,	131.4,	140.2,	146.7,	151.9,	169.5,
5 days	57.2, 69.4,	75.2,	83.5,	88.7,	92.6,	104.5,	116.9,	124.5,	134.6,	143.2,	149.6,	159.0,	166.0,	171.7,	190.5,
8 days	65.6, 78.9,	85.3,	94.3,	100.0,	104.2,	117.1,	130.4,	138.6,	149.5,	158.6,	165.4,	175.4,	182.9,	188.9,	208.7,
10 days	73.2, 87.7,	94.6,	104.2,	110.3,	114.8,	128.6,	142.7,	151.4,	162.9,	172.5,	179.7,	190.3,	198.1,	204.4,	225.2,
12 days	80.4, 95.8,	103.2,	113.4,	119.9,	124.6,	139.2,	154.1,	163.2,	175.3,	185.4,	192.9,	204.0,	212.2,	218.8,	240.5,
16 days	93.8, 110.9,	119.1,	130.4,	137.5,	142.8,	158.7,	175.0,	184.9,	198.1,	209.0,	217.1,	229.0,	237.9,	244.9,	268.2,
20 days	106.2, 124.9,	133.8,	146.1,	153.8,	159.5,	176.7,	194.1,	204.8,	218.8,	230.5,	239.2,	251.8,	261.2,	268.7,	293.4,
25 days	120.8, 141.3,	151.0,	164.3,	172.7,	178.9,	197.5,	216.3,	227.8,	242.8,	255.4,	264.6,	278.1,	288.1,	296.1,	322.3,

NOTES:
N/A Data not available
These values are derived from a Depth Duration Frequency (DDF) Model
For details refer to:
'Fitzgerald D. L. (2007), Estimates of Point Rainfall Frequencies, Technical Note No. 61, Met Eireann, Dublin',
Available for download at www.met.ie/climate/dataproducts/Estimation-of-Point-Rainfall-Frequencies_TN61.pdf

A SAAR Value of 1010mm was utilised to calculate the green field runoff rate.

Refer to Appendix I of this document for the output from the www.uksuds.com surface water storage volume estimation tool and maximum QBar discharge rate.

The Phase 1 drainage design calculations are summarised below and form the basis for the assessment of runoff rates, attenuation storage requirements and the sizing of the proposed surface water management infrastructure:

- Total Site Area (Red line Boundary) : 6.878Ha
- Total area drained (overall Catchment); 4.735ha
- Total Impermeable Area based on reduced coefficient runoff rate: 3.696Ha
- Total % of drainage area impermeable: 78.05%

Significant public open space (public open spaces, rear gardens etc.) has been calculated by subtracting the total site area from the total positively drained area

As outlined in **Section 5.5**, the Phase 1 development area has been divided into **two sub-catchments** based on the applicable soil type classifications. This approach allows the runoff characteristics of each area to be assessed independently and ensures that the QBAR calculations accurately reflect the underlying ground conditions. The resulting **QBAR runoff rates**, including a **20% climate change allowance and 10% Urban Creep allowance**, are summarised in **Table 6-1**, with the detailed UK SuDS calculation outputs provided in **Appendix I**.



Table 6-1 - Qbar Calculation Summary

Area Ref.	Soil Type	Area Size (ha)	% of Total Area (6.878ha)	Resulting Qbar (l/s)
1A	4	2.03	29.5	15.1
1B	3	2.705	39.3	12
(Regional Attenuation Pond)	Catchment 1A+Catchment 1B	4.73	68.77	27.1

The calculated **QBAR discharge rate of 27.1 l/s** has been agreed in principle with **DLRCC Municipal Services** as an appropriate discharge rate for the **Phase 1 Castlethorn lands** included within the current Planning Application. The proposed approach is that the Phase 1 drainage design, including the attenuation requirements and discharge rate assessment, is based solely on the catchment area associated with this phase of development.

It is acknowledged that the wider Old Connaught lands will be developed in subsequent phases and that the ultimate regional attenuation strategy will need to accommodate runoff from these additional catchments. Accordingly, the sizing and configuration of the proposed regional attenuation pond will be reviewed and expanded as necessary during the design of future phases to cater for the increased contributing catchment area and associated runoff volumes.

DLRCC Municipal Services has agreed that it is appropriate for the current application to assess and design the surface water drainage infrastructure based on the Phase 1 lands only, with the wider regional attenuation pond strategy to be refined and developed as future phases progress. Therefore, the QBAR value presented in this report relates exclusively to the Phase 1 development and represents the proposed permissible discharge rate for the current Planning Application.



7. Proposed Site Characteristics

For the purposes of this Phase 1 Planning Application, the overall catchment has been divided into **three sub-catchments (Catchments 1A, and 1B)**, as illustrated on the accompanying drainage drawings. Each sub-catchment incorporates a range of SuDS measures, as outlined in Section 2.1, to provide attenuation and treatment of surface water runoff prior to discharge.



Figure 7-1 - Site Catchment Areas

The proposed **regional attenuation pond forms part of the Phase 1 infrastructure works** and has been designed to accommodate runoff from **Catchments 1A and 1B**. The future development areas within **Phase 2** will be attenuated locally on site prior to discharging to the **Regional Attenuation Pond**. The drainage strategy has been developed to ensure that runoff from the Phase 2 catchments is controlled within the site before being conveyed to the regional attenuation system.

However, the extent of **Catchment 2A** within Phase 2 has been designed to provide local attenuation and discharge directly to the proposed outfall. This approach has been adopted due to the favourable site topography and drainage gradients, which allow runoff to gravitate naturally towards the outfall. Routing flows from Catchment 2A directly to the outfall avoids the need to convey these flows to the Regional Attenuation Pond, thereby reducing the required storage volume and excavation depth of the regional attenuation facility. This results in a more efficient, practical, and sustainable drainage solution for this catchment.

It should be noted that the drainage strategy presented at this stage is indicative of the future Phase 2 development. All design considerations, including drainage, attenuation requirements, network layouts, and supporting infrastructure associated with Phase 2, will be developed and assessed in detail as part of a future planning application for Phase 2.

Table 7-1 - Catchment Area Discharge Rates



Lands draining to attenuation	Area	Volume of attenuation	Discharge Rate	Allowance made for Climate Change + Urban Creep
Catchment 1A	2.03 Ha	1350m ³	15.1 L/s	30%
Regional Attenuation Pond (Catchment 1A + Catchment 1B)	2.7 Ha + Controlled flow from Catchment 1B	1312m ³	27.1 L/s	30%

Two flow control devices are proposed for phase 1 catchments due to the topography and layout of the site, before finally discharging from the overall catchment to the existing culvert in the East via a new storm water network as indicated on the planning drawings ATK-ZZ-ZZ-DR-CE-900500-ATK-ZZ-ZZ-DR-CE-900502.

7.1 Catchment Design Details

Localised attenuation within Catchment 1A will be provided by underground modular attenuation systems. Refer to Drawing ATK-ZZ-ZZ-DR-CE-900501 PROPOSED STORM DRAINAGE LAYOUT - SHEET 1 and ATK-ZZ-ZZ-DR-CE-900502 PROPOSED STORM DRAINAGE LAYOUT - SHEET 2 for further details of the proposed attenuation infrastructure.

A controlled discharge from both catchment 1A and 1B will be achieved by a vortex flow control device located downstream of the underground modular attenuation systems. The flow control devices have been sized based on the maximum design water level within each attenuation system. The design head for each catchment has been established to ensure that the discharge rates presented in Table 7-1 are not exceeded during the 1 in 100-year, 6-hour storm event. Penstocks will be incorporated within the hydrobrake chambers to facilitate maintenance activities when required. In accordance with DLRCC requirements, the flow control devices will not include bypass doors or high-level overflow arrangements.

Catchpit manholes will be provided at the inlet to the underground modular attenuation systems to minimise the ingress of silt and debris and to enhance the long-term performance of the attenuation infrastructure.

Where swales are proposed, they will primarily serve as conveyance features for surface water runoff from adjacent roads and footpaths. Runoff will enter the swales through dropped kerbs and/or side-entry gullies. Discharge from the swales to the stormwater network will be via perforated manhole covers. These covers will be set approximately 50 mm above the swale invert to provide an element of interception and promote water quality treatment prior to discharge.

Porous paving areas will accommodate runoff from the paved surface itself, adjacent roads and footpaths, as well as roof runoff from the front of residential dwellings. The underlying sub-base will provide infiltration, attenuation of peak flows, and approximately 30% storage within the voided aggregate layer. An orifice plate or flow control structure will be installed within the outfall chamber serving each porous paving area to restrict discharge rates and maximise the available storage volume within the sub-base.



Filter drains incorporating perforated carrier pipes will be provided within rear gardens to collect and convey roof runoff from the rear of the proposed dwellings.

Tree pits will be incorporated at the locations indicated on the relevant drawings. Surface water runoff from adjacent roads, footpaths and other impermeable areas will be directed into the tree pits via dropped kerbs. Interception, filtration and infiltration will occur within the identified locations in Area B, as described in Section 5.5.2. An overflow pipe set 50 mm above the finished surface level of the tree pit will provide a controlled overflow route to the stormwater drainage network during higher-intensity rainfall events.

Extensive green roofs will be provided on suitable apartment blocks and retail units. Refer to Drawing ATK-ZZ-ZZ-DR-CE-900504 PROPOSED EXTENSIVE GREEN ROOF LAYOUTS for the proposed green roof extents within Phase 1. For the purposes of the drainage assessment and hydraulic modelling, a runoff coefficient of 80% has been adopted for the green roof areas.

7.2 Catchment 1A- Drainage Design Details

Attenuation is proposed for Catchment 1A using an underground modular attenuation system. It was determined during modelling of the network that based a maximum discharge rate of 15.1l/s via a vortex flow control device that a volume of 1350m³ is required for 1 in 100 – year 6-hour storm event including 20% climate change and 10% urban creep.

Modelling of the 1 in 30 year storm for upto 24-hour event confirmed that the attenuation storage volume of 1350m³ provided was also sufficient.

Table 7-2 - Design Summary - Catchment 1A

Catchment Reference	Maximum Design Flow from Vortex Flow Control	Resulting Maximum Design Flow for 1 in 100 year	Resulting Maximum Design Flow for 1 in 30 year	Minimum Tank Volume
Catchment 1A	15.1 l/s	15.1 l/s	15.1 l/s	1350 m ³

Table 7-3 - Site Impermeable Areas - Catchment 1A

Catchment 1A	Total Site Area	Total Impervious Area
	2.03Ha	1.003Ha

Table 7-4 - Interception Volume Required - Catchment 1A

	Total Paved Site
Paved Surfaces (roads, footpaths, permeable paving & roof areas)	1.003
Volume of Interception Required	10030 x 0.005 x 0.8 = 40.12m ³



Table 7-5 - Interception Volume Provided – Catchment 1A

SuDS	Volume
Permeable Paving	$2328.2\text{m}^2 \times 0.05 = 141.41\text{m}^3$ $141.41 \times 35\% = 49.49\text{m}^3$
Extensive Green Roof (>150mm thk.)	$806.09\text{m}^2 \times 0.005 = 4.03\text{m}^3$
Swales	$22(\text{L}) \times 0.5(\text{W}) \times 0.05(\text{D}) \times 2 = 1.1\text{m}^3$
Underground Modular Attenuation System	$35.14(\text{W}) \times 35.14(\text{L}) = 1235\text{m}^2$ $0.688(\text{D}) \times 1235\text{m}^2 = 849.68\text{m}^3$ $849.68 \times 35\% \text{ Voids} = 297.388\text{m}^3$
Tree pits and Bioretention Gardens	$3926 \times 0.05 = 196.3\text{m}^3$ $65.9 \times 35\% \text{ Voids} = 68.71\text{m}^3$
Total	$420.718\text{m}^3 > 40.12\text{m}^3 \text{ required (OK)}$

7.3 Catchment 1B- Drainage Design Details

Attenuation for **Catchment 1B** is proposed within the Regional Attenuation Pond, as identified in the Old Connaught Local Area Plan (LAP). The controlled discharge from **Catchment 1A** will be directed into Catchment 1B and subsequently conveyed to the Regional Attenuation Pond.

Hydraulic modelling of the proposed drainage network determined that, with a maximum discharge rate of **27.1 l/s** controlled by a vortex flow control device, a minimum attenuation storage volume of **1,312 m³** is required to accommodate the **1 in 100-year, 6-hour storm event**, including allowances for **20% climate change** and **10% urban creep**.

In addition, modelling of the **1 in 30-year storm event** for durations of up to **24 hours** confirmed that the proposed attenuation storage volume of **1,312 m³** provides sufficient capacity to manage runoff without exceeding the design criteria.

Table 7-6 - Design Summary - Catchment 1B

Catchment Reference	Maximum Design Flow from Vortex Flow Control	Resulting Maximum Design Flow for 1 in 100 year	Resulting Maximum Design Flow for 1 in 30 year	Minimum Tank Volume
Catchment 1B	27.1 l/s	27.1 l/s	27.1 l/s	1312 m³

Table 7-7 - Site Impermeable Areas - Catchment 1B

Catchment 1B	Total Site Area	Total Impervious Area
	2.71Ha	2.117Ha

Table 7-8 - Interception Volume Required - Catchment 1B

	Total Paved Site
Paved Surfaces (roads, footpaths, permeable paving & roof areas)	2.117Ha
Volume of Interception Required	$21170 \times 0.005 \times 0.8 = 84.68\text{m}^3$

Table 7-9 - Interception Volume Provided – Catchment 1B

SuDS	Volume
Permeable Paving	$652.9\text{m}^2 \times 0.05 = 32.645\text{m}^3$ $32.645 \times 35\% \text{ Voids} = 11.42\text{m}^3$
Extensive Green Roof (>150mm thk.)	$2,299.05\text{m}^2 \times 0.005 = 11.495\text{m}^3$
Intensive Green Roof (landscape courtyard areas with soil >500mm thk.)	$200.88\text{m}^2 \times 0.005 = 1.004\text{m}^3$
Tree pits and Bioretention Gardens	$1,922.63 \times 0.05 = 96.13\text{m}^3$ $96.13 \times 35\% \text{ Voids} = 33.64\text{m}^3$
Detention Pond (Regional Attenuation)	1,312m ³ of storage provided
Total	1,369.559m ³ provided > 84.68m ³ required (OK)

7.4 Compliance with GDSDS Design Criteria

Outfall section 6.3.4 of the GDSDS Volume 2 New Development sets out four design criterion which are required to be met by the proposed drainage system. Compliance with these criteria are outlined below:

7.4.1 Interception Volume – Criterion 1.1

Criterion 1 is satisfied by providing interception storage and treatment of runoff within SuDS features i.e., petrol interceptor and attenuation systems. Interception volumes are based on 80% runoff from paved areas and 0% runoff from pervious surfaces for the first 5mm rainfall.

	Total Paved Site
Paved surfaces (roads, footpaths, permeable paving & roof areas)	3.12Ha
Volume of Interception Required	$31200 \times 0.005 \times 0.8 = 124.8\text{m}^3$



Interception volume of 1,369.559m³ is being provided for the overall site which is >than 124.8m³ required for the site. Interception volume has been provided on the proposed site using the SuDS features noted below.

- Filter Drains
- Permeable Pavement to Parking Bays
- Conveyance Swales
- Green Roofs (apartment buildings only)
- Green Courtyards (Apartment Buildings only)
- Tree Pits (along Main avenue)
- Underground Modular Systems (within green open spaces)

7.4.2 Treatment Volume – Criterion 1.2

Interception volume is based on 80% runoff from paved areas and 0% runoff from pervious surfaces for the first 15mm rainfall .

Table 7-10 - Treatment Volume

	Total Paved Site
Paved surfaces (roads, footpaths, permeable paving & roof areas)	3.12Ha
Volume of Treatment Storage Required	$31200 \times 0.015 \times 0.8 = 374.4\text{m}^3$

A storage volume of **1312 m³** is provided within the detention pond, which has been identified as the **regional attenuation pond** for the site. The pond receives runoff from the entire development and discharges at a controlled rate of 27.1l/s to the designated outfall. On this basis, it is considered that the required treatment volume is fully achieved. The required treatment volume is **374.4 m³**; however, the detention pond provides **1312m³** of storage, which is approximately **3.5 times greater** than the minimum requirement, providing a significant surplus in treatment and attenuation capacity.

7.4.3 River Regime Protection – Criterion 2

As discussed in Section 7, the site is divided into two drainage catchments, namely Catchments 1A, and 1B, each incorporating attenuation measures as part of the overall surface water management strategy. Catchment 1A is served by a localised underground modular attenuation system providing 1,350 m³ of attenuation storage, with discharge controlled to 15.1 l/s before conveying flows to the regional attenuation pond. Catchment 1B provides 1312 m³ of attenuation storage and drains directly to the regional attenuation pond. The regional attenuation pond therefore receives runoff from the entirety of Catchment 1B together with the controlled discharge from Catchment 1A and acts as the principal attenuation feature for the site. The discharge from the regional attenuation pond is regulated by a flow control device set at 27.1 l/s, ensuring runoff is released to the outfall at the approved controlled rate.



7.4.4 Level of Service - Criterion 3

Criterion 3 is satisfied by majority of the site being outside the 1000-year coastal and fluvial flood levels. The eastern boundary is identified to have flooding, however there is no building proposed along this extent. Pluvial flood risk is addressed by designing the development to accommodate storage for a 100 year storm (plus climate change) as per GDSDS. Planned flood routing for storms upto 100-year level was considered in the design and development run-off contained within the site.

There are 4 criteria for levels of service. These are

- Criterion 3.1 : No external flooding (30-year high intensity rainfall event)
- Criterion 3.2 : No internal Flooding (100 – year high intensity rainfall event)
- Criterion 3.3 : No internal Flooding (100 year river event and critical duration for site storage)
- Criterion 3.4 : No flood routing off site except where specifically planned (100 year high intensity rainfall event)

Criteria 3.1, 3.2, 3.3, 3.4 : All potential flooding has been reviewed and modelled using causeway flow for upto the required 1 in 100 year storm event including 30% uplift for a climate change. Outputs from the model for the proposed storm network are contained in Appendix A-F of this report.

7.4.5 River Flood Protection - Criterion 4

Attenuation for surface water runoff is provided through Sustainable Drainage Systems (SuDS), including attenuation in Detention/Wetland Basins designed to manage post development flows. In accordance with the Greater Dublin Strategic Drainage Study (GDSDS), three methods are available for assessing River Flood Protection – Outline under Criterion 4.1, 4.2 and 4.3

Following a comparative review, Criterion 4.3 has been identified as the most appropriate for application at the proposed site. This criterion focuses on the comparison of pre and post development runoff volumes, ensuring that the post development discharge does not exceed the natural runoff rate. An extract from the GDSDS outlining Criterion 4 is provided below for reference.



Criterion 4 River flood protection (Criterion 4.1, or 4.2 or 4.3 to be applied)	4.1	100	"Long-term" floodwater accommodated on site for development runoff volume which is in excess of the greenfield runoff volume. Temporary flood storage drained by infiltration on a designated flooding area brought into operation by extreme events only. 100 year, 6 hour duration storm to be used for assessment of the additional volume of runoff.
	4.2	100	Infiltration storage provided equal in volume to "long term" storage. Usually designed to operate for all events. 100year, 6-hour duration storm to be used for assessment of the additional volume of runoff.
	4.3	100	Maximum discharge rate of QBAR or 2 l/s/ha, whichever is the greater, for all attenuation storage where separate "long term" storage cannot be provided.

Figure 7-2 - GDSDS River Flood Protection

Criterion 4.3 has been satisfied for the proposed site by providing an agreed Maximum discharge rate of QBar (27.1/s) and on site attenuation for upto the 1 in 100 year storm event (including 30% for Climate Change).

8. Flooding & Exceedance Flows

8.1 Flood Risk Assessment

A Flood risk assessment (FRA) has been undertaken for the site to satisfy the requirements of the Planning System and Flood Risk Management Guidelines. The report Aimed at scoping source of flooding, assessing whether any significant flood risk issues exist and proposing appropriate flood risk management measures as required, The flood risk assessment can be considered to satisfy the Stage 1 Flood Risk Identification as set out in the guidelines. In relation to the proposed Old Connaught development, based on the Stage 1 Flood Risk Identification findings are :

- The eastern boundary of the proposed site is located within Flood Zone A and B and is at a high risk of flooding (i.e. greater than 1 in 100 year / 1% AEP). A historic flood event (ID2030 – Old Connaught Avenue) has been identified C.200M West of the proposed site.
- The old Connaught LAP SFRA hydraulic model clearly shows part of the proposed site boundary is located in the 1% AEP (Flood Zone A) and 0.1% AEP (Flood Zone B) predicted flood extents.
- The DLR county development Plan 2022-2028 Flood Zone Map similarly shows Flood Zone A and B extending into the eastern and southern lower – lying portion of the site, with the remainder of the proposed site located in Flood Zone C.
- Site levels range broadly from C.24.9 mOD (high ground) to C. 16.3 mOD (low ground). The areas of lowest elevation correspond to those overlapping the mapped flood extents and therefore align with the identified risk.

Based on these findings above, a stage 2 flood risk assessment needs to be carried out for the proposed site, to investigate the identified fluvial flood risk in further detail. The assessment must apply the sequential approach within the site, set out appropriate mitigation measures and where necessary, include a development specific Justification Test depending on proposed land – use vulnerability with the flood affected area. Refer 0126446DG0010 - Stage 1 FRA for Stage 1 Flood Risk Assessment.

8.2 Exceedance Flows

Surface water exceedance flows from the site have been considered as part of the drainage design. A modelling exercise was carried out with a 50% blockage within the vortex Flow control units at all 2 attenuation locations.

The table below outlines the Catchments and vortex flow control that had restriction applied. There was no flooding in the 1 in 100 year 360 minute event. However there was flooding in the 1 in 30 year 1440 minute event.

Table 8-1 - Blockage Analysis - Phase 1

Catchment	Vortex Flow Control Restriction	Storm Event	Maximum Flood Volume
Catchment 1A	50%	1 in 30-year 1440-minute event + (30% CC)	No Flooding
Catchment 1B	50%	1 in 30-year 1440-minute event + (30% CC)	No Flooding



Catchment 1A

A review of the hydraulic model outputs confirms that **no flooding occurs during either the 1 in 30-year or the 1 in 100-year storm events**, demonstrating that the proposed drainage system has sufficient capacity to manage the design storm events. An assessment of the site levels indicates that, in the unlikely event of a blockage occurring within the vortex flow control, any exceedance flows would follow natural overland flow routes towards the **north, west and east** of the site. To further manage exceedance flows, **dropped kerbs are provided at regular intervals along the road network**, allowing surface water to discharge safely into adjacent green spaces and reducing the risk of flooding to developed areas. The indicative exceedance flow routes are shown in **Image 8.1** below..

Catchment 1B

A review of the hydraulic model outputs indicates that **no flooding occurs during either the 1 in 30-year or the 1 in 100-year storm events**. An assessment of the site levels further demonstrates that, in the unlikely event of flooding arising from factors outside the design assumptions, such as a blockage of the vortex flow control caused by inadequate maintenance or pipework clogging, any exceedance flows would be directed along a defined overland flow route towards the eastern side of the site. The indicative exceedance flow path is shown in **Image 8.1** below.

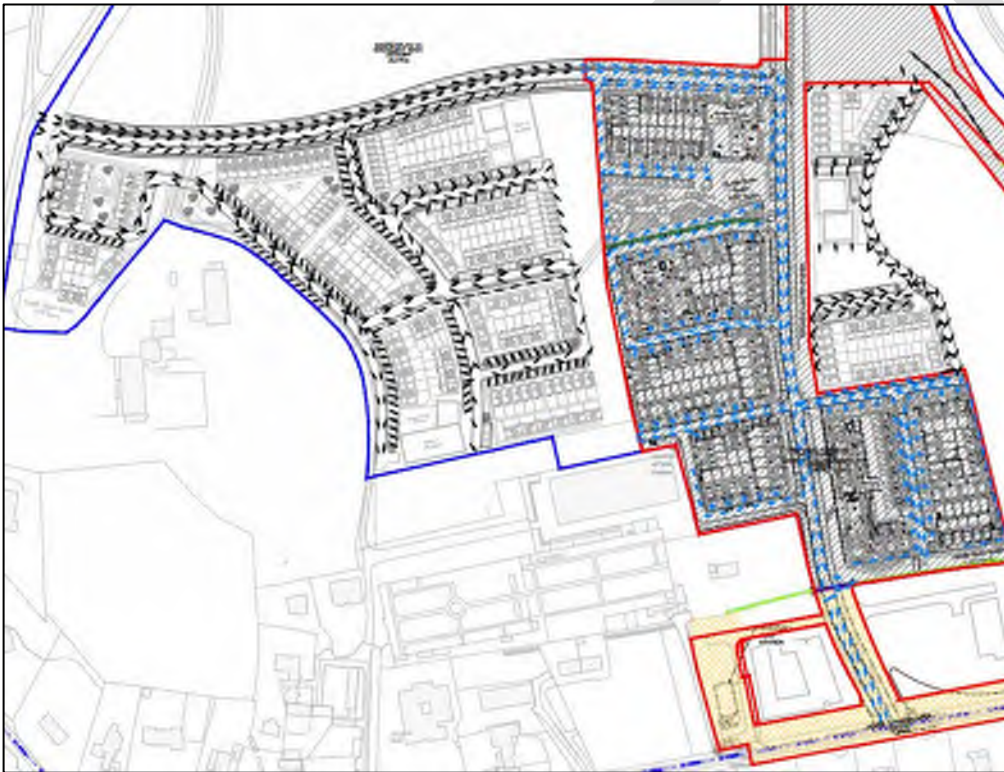


Figure 8-1 - Overland Flow Path

9. SuDS Maintenance

Regular checks and maintenance of the SUDS systems is required and have been considered as part of the overall drainage design for the proposed development. This will ensure both the design life of the SuDS systems, ongoing improved water quality, reduced water runoff and reduce the risk of onsite flooding and exceedance flows.

9.1 Permeable Paving

Paving should be inspected regularly, preferable during and after heavy rainfall to ensure effective operation. Vacuum brushing or jetting of the permeable paving should be carried out once a year. Cleaning is generally carried out after Autumn leaf fall to remove silts and sediments.

9.2 Underground modular attenuation systems

Inspection of the system should be carried out monthly for the first 3 month and then annually to ensure the system is working correctly.

Debris should be removed monthly from the catchment surface where it may cause risk to the performance of the underground attenuation system

As required sediment from Pre- treatment (catchpit) manholes prior to the attenuation system should be removed to ensure on going performance of the system.

The inside of the tank should be surveyed every 5 years or as required if performance is reduced. Sediment build up removed if necessary.

9.3 Green Roofs

All components (Soil substrate, vegetation, drains, membranes and rood structure) should be inspected annually and after severe storms.

Underside of roof should also be inspected annually and after severe storms for evidence of leakage.

Debris, fallen leaves and litter should be regularly removed to prevent clogging of inlet drains.

9.4 Wetland/Detention Basins

- Remove litter and debris from the basin, inlets, outlets, and overflows on a routine (monthly) basis.
- Inspect and clear inlets/outlets to prevent blockages and ensure correct hydraulic operation.
- Manage vegetation, including grass cutting and removal of nuisance or overgrown plants.
- Remove accumulated sediment annually from inlets, outlets, and forebay areas; undertake larger sediment removal as required.
- Inspect basin structures and embankments, repairing erosion, damaged components, or stability issues as needed.



9.5 Tree Pits

Maintenance of trees will be greatest in the first few years , which will include regular inspection of tree condition including Inlets and outlets , removal of invasive and possibly irrigation during long dry periods.

9.6 Swales

Mowing in the first year is critical to eliminate competition from weeds. Lawn Mowing to an ideal height of 100mm should be maintained as grasses tend to flatten down when water is flowing over them, reducing sedimentation. Maintenance of the swale should include:

- Periodic litter removal with the swale and self-clearing inlet grid.
- Occasional stabilisation of eroded side slopes and base
- Check Removal of sediment buildup
- Ongoing maintenance should form part of the site landscaping proposals.

9.7 Filter Drains

Inspection of the system should be carried out monthly on the inlet / outlet pipework and any control systems for blockages.

Inspection of pre-treatment systems including should be carried out every 6 months for catch pits manholes prior to the filter drain with removal of silt or other build ups. Removal of silt built up may be required more frequent.

Annual cleaning of roof runoff gutters etc should be part of the generally maintenance of the drainage system to ensure debris is removed prior to entering the network.

Perforated pipework should be cleared of blockage if required.



10. SuDS Audit Overview

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APPENDICES

Appendix A. Simulation Criteria



Simulation Settings

Rainfall Methodology	FSR	Winter CV	1.000	Check Discharge Rate(s)	✓
Rainfall Events	Singular	Analysis Speed	Normal	100 year (l/s)	18.8
FSR Region	Scotland and Ireland	Skip Steady State	x	Check Discharge Volume	✓
M5-60 (mm)	16.900	Drain Down Time (mins)	240	100 year 360 minute (m³)	
Ratio-R	0.268	Additional Storage (m³/ha)	20.0		
Summer CV	1.000	Starting Level (m)			

Storm Durations

15 | 30 | 60 | 120 | 180 | 240 | 360 | 480 | 600 | 720 | 960 | 1440

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
30	30	0	0

Pre-development Discharge Rate

Site Makeup	Greenfield	Soil Index	1	Growth Factor 30 year	1.95	Q 1 year (l/s)
Greenfield Method	IH124	SPR	0.10	Growth Factor 100 year	2.48	Q 30 year (l/s)
Positively Drained Area (ha)		Region	1	Betterment (%)	0	Q 100 year (l/s)
SAAR (mm)		Growth Factor 1 year	0.85	QBar		

Pre-development Discharge Volume

Site Makeup	Greenfield	Soil Index	1	Return Period (years)	100	Betterment (%)	0
Greenfield Method	FSR/FEH	SPR	0.10	Climate Change (%)	0	PR	
Positively Drained Area (ha)		CWI		Storm Duration (mins)	360	Runoff Volume (m³)	

Appendix B. Pipeline Schedules



Causeway		Atkins Ltd				File: 10.07.26 Storm Final July 1.pfd				Page 1	
						Network: Storm Indhu Priya Rajavadivelu 13/07/2026					
Pipeline Schedule											
Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)	
1.002	28.837	324.0	375	Circular	20.630	19.123	1.132	21.052	19.034	1.643	
1.003	41.199	400.0	450	Circular	21.052	19.034	1.568	20.681	18.931	1.300	
2.000	38.108	320.0	375	Circular	20.300	19.268	0.657	20.681	19.149	1.157	
1.004	13.912	400.0	450	Circular	20.681	18.931	1.300	21.521	18.896	2.175	
1.005	36.016	400.0	450	Circular	21.521	18.896	2.175	21.830	18.806	2.574	
1.006	16.028	550.0	600	Circular	21.830	18.806	2.424	22.336	18.777	2.959	
3.000	33.709	320.0	375	Circular	20.552	19.277	0.900	21.394	19.172	1.847	
3.001	25.750	320.0	375	Circular	21.394	19.172	1.847	22.038	19.092	2.571	
3.002	24.821	320.0	375	Circular	22.038	19.092	2.571	22.336	19.014	2.947	
1.007	47.363	577.6	600	Circular	22.336	18.777	2.959	21.717	18.695	2.422	
1.008	57.104	432.6	600	Circular	21.717	18.695	2.422	21.317	18.563	2.154	
1.009	17.810	742.1	750	Circular	21.317	18.413	2.154	21.075	18.389	1.936	
1.010	19.814	700.0	750	Circular	21.075	18.389	1.936	20.815	18.361	1.704	
1.011	13.391	700.0	750	Circular	20.815	18.361	1.704	20.627	18.342	1.535	
1.012	59.076	700.0	750	Circular	20.627	18.342	1.535	20.724	18.258	1.716	
1.013	15.033	700.0	750	Circular	20.724	18.258	1.716	20.988	18.237	2.001	
6.000	14.277	240.0	300	Circular	21.157	18.579	2.278	20.988	18.520	2.168	
1.014	15.009	887.4	900	Circular	20.988	18.168	1.920	21.311	18.151	2.260	
1.015	59.219	875.0	900	Circular	21.311	18.151	2.260	21.359	18.083	2.376	
7.000	33.173	21.0	225	Circular	44.368	42.414	1.729	42.375	40.834	1.316	
7.001	29.969	21.0	225	Circular	42.375	40.134	2.016	40.413	38.707	1.481	
7.002	35.543	28.0	300	Circular	40.413	37.200	2.913	38.579	35.931	2.348	
7.003	46.101	28.0	300	Circular	38.579	35.227	3.052	36.023	33.581	2.142	
7.004	29.174	38.0	375	Circular	36.023	32.775	2.873	34.415	32.007	2.033	
7.005	47.653	38.0	375	Circular	34.415	30.967	3.073	32.091	29.713	2.003	
7.006	32.287	47.0	450	Circular	32.091	28.566	3.075	29.974	27.879	1.645	
7.007	36.751	47.0	450	Circular	29.974	27.000	2.524	27.375	26.218	0.707	
7.008	44.489	67.0	600	Circular	27.375	24.700	2.075	25.252	24.036	0.616	
7.009	58.799	90.0	750	Circular	25.252	21.950	2.552	22.643	21.297	0.596	
7.010	53.125	90.0	750	Circular	22.643	20.335	1.558	21.359	19.745	0.864	
1.016	16.218	875.0	900	Circular	21.359	18.083	2.376	20.991	18.064	2.027	
1.017	8.490	850.0	900	Circular	20.991	18.064	2.027	20.705	18.054	1.751	
4.000	51.196	169.0	225	Circular	20.992	19.567	1.200	20.634	19.264	1.145	
4.001	50.059	320.0	375	Circular	20.634	18.843	1.416	21.308	18.687	2.246	
5.000	37.593	240.0	300	Circular	20.200	19.000	0.900	20.634	18.843	1.491	
1.000	26.801	240.0	300	Circular	20.500	19.375	0.825	20.609	19.263	1.046	
12.000	30.215	590.0	600	Circular	18.915	17.834	0.481	19.338	17.783	0.955	
12.001	18.237	590.0	600	Circular	19.338	17.789	0.949	19.552	17.758	1.194	
Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type			
1.002	1	1350	Manhole	Adoptable	2	1350	Manhole	Adoptable			
1.003	2	1350	Manhole	Adoptable	4	1350	Manhole	Adoptable			
2.000	3	1350	Manhole	Adoptable	4	1350	Manhole	Adoptable			
1.004	4	1350	Manhole	Adoptable	5	1350	Manhole	Adoptable			
1.005	5	1350	Manhole	Adoptable	6	1500	Manhole	Adoptable			
1.006	6	1500	Manhole	Adoptable	10	1500	Manhole	Adoptable			
3.000	7	1350	Manhole	Adoptable	8	1350	Manhole	Adoptable			
3.001	8	1350	Manhole	Adoptable	9	1350	Manhole	Adoptable			
3.002	9	1350	Manhole	Adoptable	10	1500	Manhole	Adoptable			
1.007	10	1500	Manhole	Adoptable	11	1500	Manhole	Adoptable			
1.008	11	1500	Manhole	Adoptable	12	1800	Manhole	Adoptable			
1.009	12	1800	Manhole	Adoptable	13	1800	Manhole	Adoptable			
1.010	13	1800	Manhole	Adoptable	14	1800	Manhole	Adoptable			
1.011	14	1800	Manhole	Adoptable	15	1800	Manhole	Adoptable			
1.012	15	1800	Manhole	Adoptable	16	1800	Manhole	Adoptable			
1.013	16	1800	Manhole	Adoptable	18	1800	Manhole	Adoptable			
6.000	17	1800	Manhole	Adoptable	18	1800	Manhole	Adoptable			
1.014	18	1800	Manhole	Adoptable	19	1800	Manhole	Adoptable			
1.015	19	1800	Manhole	Adoptable	31	1800	Manhole	Adoptable			
7.000	20	1200	Manhole	Adoptable	21	1200	Manhole	Adoptable			
7.001	21	1200	Manhole	Adoptable	22	1200	Manhole	Adoptable			
7.002	22	1200	Manhole	Adoptable	23	1200	Manhole	Adoptable			
7.003	23	1200	Manhole	Adoptable	24	1350	Manhole	Adoptable			
7.004	24	1350	Manhole	Adoptable	25	1350	Manhole	Adoptable			
7.005	25	1350	Manhole	Adoptable	26	1350	Manhole	Adoptable			
7.006	26	1350	Manhole	Adoptable	27	1350	Manhole	Adoptable			
7.007	27	1350	Manhole	Adoptable	28	1500	Manhole	Adoptable			
7.008	28	1500	Manhole	Adoptable	29	1800	Manhole	Adoptable			
7.009	29	1800	Manhole	Adoptable	30	1800	Manhole	Adoptable			
7.010	30	1800	Manhole	Adoptable	31	1800	Manhole	Adoptable			
1.016	31	1800	Manhole	Adoptable	32	1800	Manhole	Adoptable			
1.017	32	1800	Manhole	Adoptable	32_OUT	1800	Manhole	Adoptable			
4.000	33	1200	Manhole	Adoptable	35	1350	Manhole	Adoptable			
4.001	35	1350	Manhole	Adoptable	34	1350	Manhole	Adoptable			
5.000	39	1200	Manhole	Adoptable	35	1350	Manhole	Adoptable			
1.000	37	1200	Manhole	Adoptable	36	1200	Manhole	Adoptable			
12.000	40	1500	Manhole	Adoptable	41	1500	Manhole	Adoptable			
12.001	41	1500	Manhole	Adoptable	44	1500	Manhole	Adoptable			

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Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
11.000	58.807	319.6	375	Circular	20.077	18.172	1.530	19.536	17.988	1.173
11.001	8.957	319.9	375	Circular	19.536	17.988	1.173	19.552	17.960	1.217
11.002	13.688	590.0	600	Circular	19.552	17.758	1.194	19.574	17.735	1.239
11.003	14.950	598.0	600	Circular	19.574	17.735	1.239	19.633	17.710	1.323
10.000	36.085	169.4	225	Circular	20.760	18.926	1.609	20.742	18.713	1.804
10.001	17.168	169.0	225	Circular	20.742	18.713	1.804	21.127	18.611	2.291
10.002	51.360	240.3	300	Circular	21.127	18.536	2.291	19.974	18.322	1.352
10.003	27.428	240.0	300	Circular	19.974	18.322	1.352	19.831	18.208	1.323
10.004	31.771	240.7	300	Circular	19.831	18.208	1.323	19.633	18.076	1.257
8.000	18.240	450.0	450	Circular	20.917	18.104	2.363	20.696	18.063	2.183
8.001	54.419	450.0	450	Circular	20.696	18.063	2.183	19.908	17.942	1.516
8.002	45.518	450.0	450	Circular	19.908	17.942	1.516	19.871	17.841	1.580
8.003	29.431	450.0	450	Circular	19.871	17.841	1.580	19.555	17.776	1.329
9.000	9.656	580.0	600	Circular	19.586	17.860	1.126	19.543	17.843	1.100
9.001	47.256	580.0	600	Circular	19.543	17.843	1.100	19.159	17.762	0.797
9.002	55.085	580.0	600	Circular	19.159	17.762	0.797	19.255	17.667	0.988
9.003	9.598	580.0	600	Circular	19.255	17.667	0.988	19.555	17.650	1.305
8.004	11.866	580.0	600	Circular	19.555	17.626	1.329	19.731	17.606	1.525
13.000	18.071	25.0	225	Circular	43.992	42.482	1.285	43.874	41.759	1.890
13.001	18.276	35.0	225	Circular	43.874	41.759	1.890	43.798	41.237	2.336
13.002	5.112	35.0	300	Circular	43.798	41.162	2.336	43.511	41.016	2.195
14.000	29.479	25.0	225	Circular	44.160	42.735	1.200	43.975	41.556	2.194
14.001	8.582	30.0	300	Circular	43.975	41.481	2.194	43.511	41.195	2.016
13.003	24.866	42.6	300	Circular	43.511	41.016	2.195	42.011	40.432	1.279
13.004	23.763	21.0	300	Circular	42.011	40.432	1.279	40.844	39.300	1.244
15.000	16.610	21.0	225	Circular	42.721	41.191	1.305	41.770	40.400	1.145
15.001	17.189	23.6	300	Circular	41.770	40.325	1.145	41.097	39.597	1.200
15.002	26.742	30.0	300	Circular	41.097	39.597	1.200	40.570	38.706	1.564
15.003	5.365	40.0	375	Circular	40.570	38.631	1.564	40.670	38.497	1.798
15.004	5.898	310.4	375	Circular	40.670	38.497	1.798	40.844	38.478	1.991
13.005	8.482	28.0	375	Circular	40.844	38.478	1.991	40.587	38.175	2.037
13.006	30.953	40.0	375	Circular	40.587	37.500	2.712	40.688	36.726	3.587
13.007	4.722	40.0	375	Circular	40.688	36.726	3.587	40.559	36.608	3.576
13.008	31.315	40.0	375	Circular	40.559	35.500	4.684	38.844	34.717	3.752
13.009	37.278	40.0	375	Circular	38.844	34.717	3.752	36.556	33.785	2.396
13.010	35.148	40.0	375	Circular	36.556	33.000	3.181	34.107	32.121	1.611
16.000	46.059	150.0	300	Circular	32.722	31.222	1.200	34.107	30.915	2.892
13.011	33.816	48.0	450	Circular	34.107	30.650	3.007	31.792	29.946	1.396
13.012	21.273	48.0	450	Circular	31.792	29.361	1.981	30.431	28.918	1.063

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
11.000	42	1350	Manhole	Adoptable	43	1350	Manhole	Adoptable
11.001	43	1350	Manhole	Adoptable	44	1500	Manhole	Adoptable
11.002	44	1500	Manhole	Adoptable	45	1500	Manhole	Adoptable
11.003	45	1500	Manhole	Adoptable	45_OUT	1500	Manhole	Adoptable
10.000	46	1200	Manhole	Adoptable	47	1200	Manhole	Adoptable
10.001	47	1200	Manhole	Adoptable	48	1200	Manhole	Adoptable
10.002	48	1200	Manhole	Adoptable	49	1200	Manhole	Adoptable
10.003	49	1200	Manhole	Adoptable	50	1200	Manhole	Adoptable
10.004	50	1200	Manhole	Adoptable	45_OUT	1500	Manhole	Adoptable
8.000	51	2400	Manhole	Adoptable	52	1350	Manhole	Adoptable
8.001	52	1350	Manhole	Adoptable	53	1350	Manhole	Adoptable
8.002	53	1350	Manhole	Adoptable	54	1350	Manhole	Adoptable
8.003	54	1350	Manhole	Adoptable	59	1500	Manhole	Adoptable
9.000	55	1500	Manhole	Adoptable	56	1500	Manhole	Adoptable
9.001	56	1500	Manhole	Adoptable	57	1500	Manhole	Adoptable
9.002	57	1500	Manhole	Adoptable	58	1500	Manhole	Adoptable
9.003	58	1500	Manhole	Adoptable	59	1500	Manhole	Adoptable
8.004	59	1500	Manhole	Adoptable	59_OUT	1500	Manhole	Adoptable
13.000	60	1200	Manhole	Adoptable	61	1200	Manhole	Adoptable
13.001	61	1200	Manhole	Adoptable	62	1200	Manhole	Adoptable
13.002	62	1200	Manhole	Adoptable	65	1200	Manhole	Adoptable
14.000	63	1200	Manhole	Adoptable	64	1200	Manhole	Adoptable
14.001	64	1200	Manhole	Adoptable	65	1200	Manhole	Adoptable
13.003	65	1200	Manhole	Adoptable	66	1200	Manhole	Adoptable
13.004	66	1200	Manhole	Adoptable	72	1350	Manhole	Adoptable
15.000	67	1200	Manhole	Adoptable	68	1200	Manhole	Adoptable
15.001	68	1200	Manhole	Adoptable	69	1200	Manhole	Adoptable
15.002	69	1200	Manhole	Adoptable	70	1350	Manhole	Adoptable
15.003	70	1350	Manhole	Adoptable	71	1350	Manhole	Adoptable
15.004	71	1350	Manhole	Adoptable	72	1350	Manhole	Adoptable
13.005	72	1350	Manhole	Adoptable	73	1350	Manhole	Adoptable
13.006	73	1350	Manhole	Adoptable	74	1350	Manhole	Adoptable
13.007	74	1350	Manhole	Adoptable	75	1350	Manhole	Adoptable
13.008	75	1350	Manhole	Adoptable	76	1350	Manhole	Adoptable
13.009	76	1350	Manhole	Adoptable	77	1350	Manhole	Adoptable
13.010	77	1350	Manhole	Adoptable	79	1350	Manhole	Adoptable
16.000	78	1200	Manhole	Adoptable	79	1350	Manhole	Adoptable
13.011	79	1350	Manhole	Adoptable	80	1350	Manhole	Adoptable
13.012	80	1350	Manhole	Adoptable	81	1350	Manhole	Adoptable

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
13.013	25.460	48.0	450	Circular	30.431	28.399	1.582	28.757	27.869	0.438
13.014	31.903	48.0	450	Circular	28.757	27.344	0.963	27.328	26.679	0.199
17.000	31.439	21.0	225	Circular	33.762	31.250	2.287	32.362	29.753	2.384
17.001	27.978	21.0	225	Circular	32.362	29.753	2.384	30.462	28.421	1.816
17.002	26.055	28.0	300	Circular	30.462	28.346	1.816	28.703	27.415	0.988
17.003	26.109	38.0	375	Circular	28.703	26.000	2.328	27.328	25.313	1.640
13.015	35.120	68.0	600	Circular	27.328	24.890	1.838	25.636	24.374	0.662
13.016	43.705	22.0	600	Circular	25.636	23.819	1.217	23.656	21.832	1.224
18.000	48.875	25.0	225	Circular	29.879	27.200	2.454	26.966	25.245	1.496
18.001	38.091	28.0	300	Circular	26.966	25.170	1.496	24.796	23.810	0.686
19.000	48.714	48.0	375	Circular	26.520	25.026	1.119	24.796	24.011	0.410
18.002	56.754	67.0	600	Circular	24.796	22.996	1.200	23.656	22.149	0.907
13.017	32.341	90.1	750	Circular	23.656	21.682	1.224	23.346	21.323	1.273
13.018	23.269	90.0	750	Circular	23.346	21.323	1.273	23.280	21.064	1.466
20.000	25.947	25.0	225	Circular	29.637	28.395	1.017	28.686	27.357	1.104
20.001	19.588	35.0	225	Circular	28.686	27.357	1.104	28.444	26.797	1.422
20.002	32.246	35.0	300	Circular	28.444	26.722	1.422	28.155	25.801	2.054
20.003	32.536	28.0	300	Circular	28.155	25.801	2.054	26.576	24.639	1.637
20.004	27.189	38.0	375	Circular	26.576	24.564	1.637	25.505	23.849	1.281
21.000	28.931	69.5	225	Circular	25.430	24.417	0.788	25.505	24.001	1.279
20.005	22.446	37.0	375	Circular	25.505	23.849	1.281	24.817	23.242	1.200
20.006	31.097	38.0	375	Circular	24.817	23.242	1.200	24.004	22.424	1.205
20.007	28.102	100.0	450	Circular	24.004	22.150	1.404	23.109	21.869	0.790
20.008	18.584	100.2	600	Circular	23.109	21.309	1.200	23.225	21.124	1.501
20.009	26.680	100.0	600	Circular	23.225	21.124	1.501	23.280	20.857	1.823
22.000	18.371	21.0	225	Circular	26.724	25.074	1.425	26.006	24.200	1.581
22.001	26.884	28.0	300	Circular	26.006	24.125	1.581	25.341	23.165	1.876
22.002	35.895	40.5	375	Circular	25.341	23.090	1.876	24.101	22.203	1.523
22.003	35.629	45.3	450	Circular	24.101	22.128	1.523	23.280	21.342	1.488
13.019	20.322	90.0	750	Circular	23.280	20.707	1.823	22.467	20.481	1.236
23.000	29.980	169.0	225	Circular	21.773	20.348	1.200	21.922	20.171	1.526
23.001	10.015	244.3	300	Circular	21.922	20.096	1.526	22.020	20.055	1.665
23.002	25.242	242.7	300	Circular	22.020	20.055	1.665	22.139	19.951	1.888
23.003	26.277	243.3	300	Circular	22.139	19.951	1.888	22.352	19.843	2.209
24.000	35.191	109.3	225	Circular	21.665	20.240	1.200	22.352	19.918	2.209
23.004	24.210	322.8	375	Circular	22.352	19.768	2.209	22.569	19.693	2.501
23.005	4.176	321.2	375	Circular	22.569	19.693	2.501	22.554	19.680	2.499
23.006	23.731	320.7	375	Circular	22.554	19.680	2.499	22.547	19.606	2.566
23.007	30.863	320.0	375	Circular	22.547	19.606	2.566	22.467	19.510	2.582

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
13.013	81	1350	Manhole	Adoptable	82	1350	Manhole	Adoptable
13.014	82	1350	Manhole	Adoptable	87	1500	Manhole	Adoptable
17.000	83	1200	Manhole	Adoptable	84	1200	Manhole	Adoptable
17.001	84	1200	Manhole	Adoptable	85	1200	Manhole	Adoptable
17.002	85	1200	Manhole	Adoptable	86	1350	Manhole	Adoptable
17.003	86	1350	Manhole	Adoptable	87	1500	Manhole	Adoptable
13.015	87	1500	Manhole	Adoptable	88	1500	Manhole	Adoptable
13.016	88	1500	Manhole	Adoptable	93	1800	Manhole	Adoptable
18.000	89	1200	Manhole	Adoptable	90	1200	Manhole	Adoptable
18.001	90	1200	Manhole	Adoptable	92	1500	Manhole	Adoptable
19.000	91	1350	Manhole	Adoptable	92	1500	Manhole	Adoptable
18.002	92	1500	Manhole	Adoptable	93	1800	Manhole	Adoptable
13.017	93	1800	Manhole	Adoptable	94	1800	Manhole	Adoptable
13.018	94	1800	Manhole	Adoptable	110	1800	Manhole	Adoptable
20.000	95	1200	Manhole	Adoptable	96	1200	Manhole	Adoptable
20.001	96	1200	Manhole	Adoptable	97	1200	Manhole	Adoptable
20.002	97	1200	Manhole	Adoptable	98	1200	Manhole	Adoptable
20.003	98	1200	Manhole	Adoptable	99	1350	Manhole	Adoptable
20.004	99	1350	Manhole	Adoptable	101	1350	Manhole	Adoptable
21.000	100	1200	Manhole	Adoptable	101	1350	Manhole	Adoptable
20.005	101	1350	Manhole	Adoptable	102	1350	Manhole	Adoptable
20.006	102	1350	Manhole	Adoptable	103	1350	Manhole	Adoptable
20.007	103	1350	Manhole	Adoptable	104	1500	Manhole	Adoptable
20.008	104	1500	Manhole	Adoptable	105	1500	Manhole	Adoptable
20.009	105	1500	Manhole	Adoptable	110	1800	Manhole	Adoptable
22.000	106	1200	Manhole	Adoptable	107	1200	Manhole	Adoptable
22.001	107	1200	Manhole	Adoptable	108	1350	Manhole	Adoptable
22.002	108	1350	Manhole	Adoptable	109	1350	Manhole	Adoptable
22.003	109	1350	Manhole	Adoptable	110	1800	Manhole	Adoptable
13.019	110	1800	Manhole	Adoptable	122	1800	Manhole	Adoptable
23.000	111	1200	Manhole	Adoptable	112	1200	Manhole	Adoptable
23.001	112	1200	Manhole	Adoptable	113	1200	Manhole	Adoptable
23.002	113	1200	Manhole	Adoptable	114	1200	Manhole	Adoptable
23.003	114	1200	Manhole	Adoptable	116	1350	Manhole	Adoptable
24.000	115	1200	Manhole	Adoptable	116	1350	Manhole	Adoptable
23.004	116	1350	Manhole	Adoptable	117	1350	Manhole	Adoptable
23.005	117	1350	Manhole	Adoptable	118	1350	Manhole	Adoptable
23.006	118	1350	Manhole	Adoptable	119	1350	Manhole	Adoptable
23.007	119	1350	Manhole	Adoptable	122	1800	Manhole	Adoptable

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
25.000	48.654	169.5	225	Circular	21.328	19.903	1.200	22.401	19.616	2.560
25.001	21.036	244.6	300	Circular	22.401	19.541	2.560	22.467	19.455	2.712
13.020	9.104	700.0	750	Circular	22.467	19.005	2.712	22.549	18.992	2.807
13.021	44.943	700.0	750	Circular	22.549	18.992	2.807	22.743	18.928	3.065
13.022	8.651	700.0	750	Circular	22.743	18.928	3.065	22.837	18.916	3.171
13.023	24.440	700.0	750	Circular	22.837	18.916	3.171	22.562	18.881	2.931
26.000	36.587	243.9	300	Circular	21.489	19.989	1.200	22.562	19.839	2.423
13.024	23.435	700.0	750	Circular	22.562	18.881	2.931	21.743	18.848	2.145
27.000	26.151	169.0	225	Circular	24.798	21.750	2.823	23.922	21.595	2.102
27.001	14.446	240.0	300	Circular	23.922	21.520	2.102	23.484	21.460	1.724
27.002	6.286	320.0	375	Circular	23.484	21.385	1.724	23.243	21.365	1.503
27.003	24.304	320.0	375	Circular	23.243	21.365	1.503	22.501	21.289	0.837
28.000	33.979	244.5	300	Circular	20.617	19.492	0.825	21.795	19.353	2.142
28.001	23.189	322.1	375	Circular	21.795	19.353	2.067	22.501	19.281	2.845
27.004	20.183	320.4	375	Circular	22.501	19.281	2.845	21.743	19.218	2.150
4.002	15.820	322.8	375	Circular	21.308	18.687	2.246	21.317	18.638	2.304
1.001	15.617	240.3	300	Circular	20.609	19.263	1.046	20.630	19.198	1.132

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
25.000	120	1200	Manhole	Adoptable	121	1200	Manhole	Adoptable
25.001	121	1200	Manhole	Adoptable	122	1800	Manhole	Adoptable
13.020	122	1800	Manhole	Adoptable	123	1800	Manhole	Adoptable
13.021	123	1800	Manhole	Adoptable	124	1800	Manhole	Adoptable
13.022	124	1800	Manhole	Adoptable	125	1800	Manhole	Adoptable
13.023	125	1800	Manhole	Adoptable	127	1800	Manhole	Adoptable
26.000	126	1200	Manhole	Adoptable	127	1800	Manhole	Adoptable
13.024	127	1800	Manhole	Adoptable	127_OUT	1800	Manhole	Adoptable
27.000	128	1200	Manhole	Adoptable	129	1200	Manhole	Adoptable
27.001	129	1200	Manhole	Adoptable	130	1350	Manhole	Adoptable
27.002	130	1350	Manhole	Adoptable	131	1350	Manhole	Adoptable
27.003	131	1350	Manhole	Adoptable	134	1350	Manhole	Adoptable
28.000	132	1200	Manhole	Adoptable	133	1350	Manhole	Adoptable
28.001	133	1350	Manhole	Adoptable	134	1350	Manhole	Adoptable
27.004	134	1350	Manhole	Adoptable	127_OUT	1800	Manhole	Adoptable
4.002	34	1350	Manhole	Adoptable	12	1800	Manhole	Adoptable
1.001	36	1200	Manhole	Adoptable	1	1350	Manhole	Adoptable

Appendix C. Storage Structures



Node 51 Pond Storage Structure

Invert Level (m) 18.104 | Time to half empty (mins) | Analyse flow through structure x

Inlets

32_OUT

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	750.0	1.750	750.0	1.751	0.0

Node 55 Tank Storage Structure

Invert Level (m) 17.860 | Time to half empty (mins) | Analyse flow through structure x

Inlets

45_OUT

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	475.0	0.815	475.0	0.816	0.0

Node 17 Tank Storage Structure

Invert Level (m) 18.579 | Time to half empty (mins) | Analyse flow through structure x

Inlets

127_OUT

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	698.5	1.828	698.5	1.829	0.0

Appendix D. Online Controls



Node 51 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	x	Sump Available	✓
Invert Level (m)	18.099	Product Number	CTL-SHE-0216-2710-1750-2710
Design Depth (m)	1.750	Min Outlet Diameter (m)	0.300
Design Flow (l/s)	27.1	Min Node Diameter (mm)	2100

Node 55 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	x	Sump Available	✓
Invert Level (m)	18.050	Product Number	CTL-SHE-0094-3700-0815-3700
Design Depth (m)	0.815	Min Outlet Diameter (m)	0.150
Design Flow (l/s)	3.7	Min Node Diameter (mm)	1200

Node 17 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	x	Sump Available	✓
Invert Level (m)	18.579	Product Number	CTL-SHE-0163-1510-1828-1510
Design Depth (m)	1.828	Min Outlet Diameter (m)	0.225
Design Flow (l/s)	15.1	Min Node Diameter (mm)	1800

Appendix E. Summary of Results

E.1 Results Status Description

E.2 1 in 100 year Outputs

E.3 1 in 30 year Outputs



Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)	Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
30 year +30% CC 15 minute summer	259.564	73.448	30 year +30% CC 360 minute summer	39.547	10.177
30 year +30% CC 15 minute winter	182.150	73.448	30 year +30% CC 360 minute winter	25.706	10.177
30 year +30% CC 30 minute summer	179.080	50.674	30 year +30% CC 480 minute summer	31.681	8.372
30 year +30% CC 30 minute winter	125.670	50.674	30 year +30% CC 480 minute winter	21.048	8.372
30 year +30% CC 60 minute summer	125.576	33.186	30 year +30% CC 600 minute summer	26.298	7.193
30 year +30% CC 60 minute winter	83.430	33.186	30 year +30% CC 600 minute winter	17.968	7.193
30 year +30% CC 120 minute summer	80.290	21.218	30 year +30% CC 720 minute summer	23.702	6.352
30 year +30% CC 120 minute winter	53.343	21.218	30 year +30% CC 720 minute winter	15.929	6.352
30 year +30% CC 180 minute summer	63.030	16.220	30 year +30% CC 960 minute summer	19.822	5.220
30 year +30% CC 180 minute winter	40.971	16.220	30 year +30% CC 960 minute winter	13.131	5.220
30 year +30% CC 240 minute summer	50.622	13.378	30 year +30% CC 1440 minute summer	14.764	3.957
30 year +30% CC 240 minute winter	33.632	13.378	30 year +30% CC 1440 minute winter	9.922	3.957

Results for 100 year +30% CC Critical Storm Duration. Lowest mass balance: 99.40%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
30 minute summer	1	19	19.988	0.865	51.7	1.8683	0.0000	SURCHARGED
30 minute summer	2	19	20.017	0.983	95.6	2.3984	0.0000	SURCHARGED
15 minute summer	3	12	19.991	0.723	33.8	1.0856	0.0000	SURCHARGED
30 minute summer	4	19	19.932	1.001	126.0	2.3201	0.0000	SURCHARGED
30 minute summer	5	19	19.909	1.013	144.0	1.9803	0.0000	SURCHARGED
360 minute summer	6	352	19.859	1.053	43.3	1.8606	0.0000	SURCHARGED
15 minute summer	7	11	19.882	0.605	19.5	1.1674	0.0000	SURCHARGED
360 minute summer	8	360	19.860	0.688	13.6	1.3982	0.0000	SURCHARGED
360 minute summer	9	360	19.860	0.768	23.8	1.4896	0.0000	SURCHARGED
360 minute winter	10	344	19.858	1.081	53.3	2.5513	0.0000	SURCHARGED
360 minute summer	11	360	19.859	1.164	99.2	3.5838	0.0000	SURCHARGED
360 minute summer	1.008:50%	360	19.861	1.232	93.4	0.0000	0.0000	SURCHARGED
360 minute summer	12	360	19.859	1.446	165.7	5.4934	0.0000	SURCHARGED
360 minute summer	13	360	19.861	1.472	168.4	4.3850	0.0000	SURCHARGED
360 minute summer	14	360	19.857	1.496	169.6	4.3031	0.0000	SURCHARGED
360 minute summer	15	360	19.861	1.519	170.1	4.2646	0.0000	SURCHARGED
360 minute summer	16	360	19.859	1.601	200.2	7.3837	0.0000	SURCHARGED
360 minute winter	17	352	20.181	1.602	82.4	1112.4400	0.0000	SURCHARGED
360 minute summer	18	360	19.859	1.691	211.9	4.3039	0.0000	SURCHARGED
360 minute summer	19	360	19.858	1.707	235.2	6.2990	0.0000	SURCHARGED
15 minute summer	20	1	42.414	0.000	0.0	0.0000	0.0000	OK
15 minute summer	21	1	40.134	0.000	0.0	0.0000	0.0000	OK
15 minute summer	22	1	37.200	0.000	0.0	0.0000	0.0000	OK
15 minute summer	23	1	35.227	0.000	0.0	0.0000	0.0000	OK
15 minute summer	24	1	32.775	0.000	0.0	0.0000	0.0000	OK
15 minute summer	25	1	30.967	0.000	0.0	0.0000	0.0000	OK
15 minute summer	26	1	28.566	0.000	0.0	0.0000	0.0000	OK
15 minute summer	27	1	27.000	0.000	0.0	0.0000	0.0000	OK
15 minute summer	28	1	24.700	0.000	0.0	0.0000	0.0000	OK
15 minute summer	29	10	22.016	0.066	21.6	0.1826	0.0000	OK
15 minute summer	30	10	20.471	0.136	91.4	0.4819	0.0000	OK
360 minute winter	31	352	19.856	1.773	181.3	5.4773	0.0000	SURCHARGED
360 minute winter	32	352	19.856	1.792	182.5	4.8120	0.0000	SURCHARGED
360 minute winter	32_OUT	352	19.855	1.801	181.9	0.0000	0.0000	OK
15 minute summer	33	11	20.236	0.669	65.4	1.7615	0.0000	SURCHARGED
30 minute summer	4.000:50%	21	20.020	0.605	67.9	11.1506	0.0000	SURCHARGED
360 minute summer	34	360	19.860	1.173	53.8	1.9723	0.0000	SURCHARGED
30 minute summer	35	20	19.915	1.072	166.5	3.9414	0.0000	SURCHARGED
360 minute summer	4.001:50%	352	19.858	1.093	53.4	11.2123	0.0000	SURCHARGED

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
30 minute summer	1	1.002	2	45.0	0.617	0.407	3.1806	
30 minute summer	2	1.003	4	96.9	0.704	0.603	6.5277	
15 minute summer	3	2.000	4	-31.6	-0.466	-0.284	4.2032	
30 minute summer	4	1.004	5	122.1	0.771	0.760	2.2043	
30 minute summer	5	1.005	6	138.4	0.873	0.861	5.7065	
360 minute summer	6	1.006	10	39.5	0.456	0.135	4.5147	
15 minute summer	7	3.000	8	29.0	0.421	0.261	3.7180	
360 minute summer	8	3.001	9	13.4	0.542	0.121	2.8401	
360 minute summer	9	3.002	10	23.5	0.822	0.212	2.7377	
360 minute winter	10	1.007	11	51.5	0.689	0.181	13.3411	
360 minute summer	11	1.008	1.008:50%	90.8	0.880	0.276	8.0424	
360 minute summer	11	1.008	12	88.7	0.918	0.269	8.0424	
360 minute summer	12	1.009	13	160.3	0.639	0.356	7.8386	
360 minute summer	13	1.010	14	163.9	0.645	0.353	8.7206	
360 minute summer	14	1.011	15	165.9	0.661	0.358	5.8937	
360 minute summer	15	1.012	16	164.8	0.586	0.355	26.0006	
360 minute summer	16	1.013	18	197.4	0.746	0.426	6.6163	
360 minute winter	17	6.000	18	14.8	0.774	0.207	1.0054	
360 minute summer	18	1.014	19	210.1	0.509	0.316	9.5123	
360 minute summer	19	1.015	31	230.5	0.506	0.345	37.5315	
15 minute summer	20	7.000	21	0.0	0.000	0.000	0.0000	
15 minute summer	21	7.001	22	0.0	0.000	0.000	0.0000	
15 minute summer	22	7.002	23	0.0	0.000	0.000	0.0000	
15 minute summer	23	7.003	24	0.0	0.000	0.000	0.0000	
15 minute summer	24	7.004	25	0.0	0.000	0.000	0.0000	
15 minute summer	25	7.005	26	0.0	0.000	0.000	0.0001	
15 minute summer	26	7.006	27	0.0	0.000	0.000	0.0000	
15 minute summer	27	7.007	28	0.0	0.000	0.000	0.0000	
15 minute summer	28	7.008	29	0.0	0.000	0.000	0.0001	
15 minute summer	29	7.009	30	20.9	1.125	0.016	1.0946	
15 minute summer	30	7.010	31	90.6	1.717	0.070	2.8050	
360 minute winter	31	1.016	32	180.7	0.631	0.270	10.2785	
360 minute winter	32	1.017	32_OUT	181.9	0.917	0.268	5.3807	
15 minute summer	33	4.000	4.000:50%	59.3	1.491	1.487	1.0181	
15 minute summer	33	4.000	35	59.0	1.485	1.479	1.0181	
360 minute summer	34	4.002	12	52.4	0.917	0.473	1.7449	
30 minute summer	35	4.001	4.001:50%	155.5	1.410	1.398	2.7607	
30 minute summer	35	4.001	34	163.5	1.483	1.470	2.7607	

Results for 100 year +30% CC Critical Storm Duration. Lowest mass balance: 99.40%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
30 minute summer	36	20	19.971	0.708	44.9	1.2253	0.0000	SURCHARGED
30 minute summer	37	20	20.042	0.667	35.7	0.7539	0.0000	SURCHARGED
30 minute summer	39	19	19.955	0.955	49.0	2.4603	0.0000	FLOOD RISK
30 minute summer	5.000:50%	20	19.936	1.015	45.4	4.5099	0.0000	SURCHARGED
360 minute winter	40	368	17.968	0.134	0.2	0.2366	0.0000	OK
360 minute winter	41	376	17.968	0.185	0.5	0.3266	0.0000	OK
15 minute summer	42	10	18.344	0.172	46.0	0.3811	0.0000	OK
15 minute summer	43	11	18.163	0.175	46.4	0.2503	0.0000	OK
360 minute winter	44	376	17.968	0.210	6.8	0.3708	0.0000	OK
360 minute winter	45	368	17.968	0.233	6.3	0.4115	0.0000	OK
15 minute summer	46	1	18.926	0.000	0.0	0.0000	0.0000	OK
15 minute summer	47	1	18.713	0.000	0.0	0.0000	0.0000	OK
15 minute summer	48	1	18.536	0.000	0.0	0.0000	0.0000	OK
15 minute summer	49	1	18.322	0.000	0.0	0.0000	0.0000	OK
15 minute summer	50	1	18.208	0.000	0.0	0.0000	0.0000	OK
360 minute winter	45_OUT	368	17.968	0.258	6.2	0.0000	0.0000	OK
360 minute winter	51	344	19.834	1.730	103.9	1317.8520	0.0000	SURCHARGED
60 minute winter	52	39	18.193	0.130	27.1	0.1860	0.0000	OK
30 minute summer	53	229	18.073	0.131	27.1	0.1872	0.0000	OK
30 minute summer	54	230	17.972	0.131	27.1	0.1881	0.0000	OK
360 minute winter	55	600	17.968	0.108	3.0	50.5333	0.0000	OK
15 minute summer	56	1	17.843	0.000	0.0	0.0000	0.0000	OK
15 minute summer	57	1	17.762	0.000	0.0	0.0000	0.0000	OK
30 minute winter	58	241	17.750	0.083	4.3	0.1468	0.0000	OK
30 minute winter	59	239	17.750	0.124	27.1	0.2192	0.0000	OK
30 minute winter	59_OUT	238	17.709	0.103	27.1	0.0000	0.0000	OK
15 minute summer	60	1	42.482	0.000	0.0	0.0000	0.0000	OK
15 minute summer	61	1	41.759	0.000	0.0	0.0000	0.0000	OK
15 minute summer	62	1	41.162	0.000	0.0	0.0000	0.0000	OK
15 minute summer	63	1	42.735	0.000	0.0	0.0000	0.0000	OK
15 minute summer	64	1	41.481	0.000	0.0	0.0000	0.0000	OK
15 minute summer	65	1	41.016	0.000	0.0	0.0000	0.0000	OK
15 minute summer	66	1	40.432	0.000	0.0	0.0000	0.0000	OK
15 minute summer	67	1	41.191	0.000	0.0	0.0000	0.0000	OK
15 minute summer	68	1	40.325	0.000	0.0	0.0000	0.0000	OK
15 minute summer	69	1	39.597	0.000	0.0	0.0000	0.0000	OK
15 minute summer	70	1	38.631	0.000	0.0	0.0000	0.0000	OK
15 minute summer	71	1	38.497	0.000	0.0	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
30 minute summer	36	1.001	1	28.1	0.769	0.393	1.0997	
30 minute summer	37	1.000	36	-35.7	-0.667	-0.499	1.8873	
30 minute summer	39	5.000	5.000:50%	41.5	0.634	0.581	1.3236	
30 minute summer	39	5.000	35	38.1	0.541	0.533	1.3236	
360 minute winter	40	12.000	41	0.2	-0.022	0.001	1.8193	
360 minute winter	41	12.001	44	-0.5	-0.047	-0.002	1.4418	
15 minute summer	42	11.000	43	46.4	0.934	0.417	2.9225	
15 minute summer	43	11.001	44	44.8	0.969	0.403	0.4144	
360 minute winter	44	11.002	45	6.3	0.227	0.023	1.2919	
360 minute winter	45	11.003	45_OUT	6.2	0.114	0.022	1.6204	
15 minute summer	46	10.000	47	0.0	0.000	0.000	0.0000	
15 minute summer	47	10.001	48	0.0	0.000	0.000	0.0000	
15 minute summer	48	10.002	49	0.0	0.000	0.000	0.0000	
15 minute summer	49	10.003	50	0.0	0.000	0.000	0.0000	
15 minute summer	50	10.004	45_OUT	0.0	0.000	0.000	0.0000	
360 minute winter	51	8.000	52	27.1	0.695	0.179	0.7113	
60 minute winter	52	8.001	53	27.1	0.712	0.179	2.0698	
30 minute summer	53	8.002	54	27.1	0.728	0.179	1.7458	
30 minute summer	54	8.003	59	27.1	0.785	0.179	1.0165	
360 minute winter	55	9.000	56	0.0	0.000	0.000	0.0000	
15 minute summer	56	9.001	57	0.0	0.000	0.000	0.0001	
15 minute summer	57	9.002	58	0.0	0.000	0.000	0.6446	
30 minute winter	58	9.003	59	-4.3	-0.287	-0.015	0.2606	
30 minute winter	59	8.004	59_OUT	27.1	0.731	0.095	0.4405	401.5
15 minute summer	60	13.000	61	0.0	0.000	0.000	0.0000	
15 minute summer	61	13.001	62	0.0	0.000	0.000	0.0000	
15 minute summer	62	13.002	65	0.0	0.000	0.000	0.0000	
15 minute summer	63	14.000	64	0.0	0.000	0.000	0.0000	
15 minute summer	64	14.001	65	0.0	0.000	0.000	0.0000	
15 minute summer	65	13.003	66	0.0	0.000	0.000	0.0000	
15 minute summer	66	13.004	72	0.0	0.000	0.000	0.0000	
15 minute summer	67	15.000	68	0.0	0.000	0.000	0.0000	
15 minute summer	68	15.001	69	0.0	0.000	0.000	0.0000	
15 minute summer	69	15.002	70	0.0	0.000	0.000	0.0000	
15 minute summer	70	15.003	71	0.0	0.000	0.000	0.0000	
15 minute summer	71	15.004	72	0.0	0.000	0.000	0.0000	

Results for 100 year +30% CC Critical Storm Duration. Lowest mass balance: 99.40%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	72	1	38.478	0.000	0.0	0.0000	0.0000	OK
15 minute summer	73	1	37.500	0.000	0.0	0.0000	0.0000	OK
15 minute summer	74	1	36.726	0.000	0.0	0.0000	0.0000	OK
15 minute summer	75	1	35.500	0.000	0.0	0.0000	0.0000	OK
15 minute summer	76	1	34.717	0.000	0.0	0.0000	0.0000	OK
15 minute summer	77	1	33.000	0.000	0.0	0.0000	0.0000	OK
15 minute summer	78	1	31.222	0.000	0.0	0.0000	0.0000	OK
15 minute summer	79	1	30.650	0.000	0.0	0.0000	0.0000	OK
15 minute summer	80	1	29.361	0.000	0.0	0.0000	0.0000	OK
15 minute summer	81	1	28.399	0.000	0.0	0.0000	0.0000	OK
15 minute summer	82	1	27.344	0.000	0.0	0.0000	0.0000	OK
15 minute summer	83	1	31.250	0.000	0.0	0.0000	0.0000	OK
15 minute summer	84	1	29.753	0.000	0.0	0.0000	0.0000	OK
15 minute summer	85	1	28.346	0.000	0.0	0.0000	0.0000	OK
15 minute summer	86	1	26.000	0.000	0.0	0.0000	0.0000	OK
15 minute summer	87	1	24.890	0.000	0.0	0.0000	0.0000	OK
15 minute summer	88	1	23.819	0.000	0.0	0.0000	0.0000	OK
15 minute summer	89	1	27.200	0.000	0.0	0.0000	0.0000	OK
15 minute summer	90	1	25.170	0.000	0.0	0.0000	0.0000	OK
15 minute summer	91	1	25.026	0.000	0.0	0.0000	0.0000	OK
15 minute summer	92	1	22.996	0.000	0.0	0.0000	0.0000	OK
15 minute summer	93	1	21.682	0.000	0.0	0.0000	0.0000	OK
15 minute summer	94	1	21.323	0.000	0.0	0.0000	0.0000	OK
15 minute summer	95	1	28.395	0.000	0.0	0.0000	0.0000	OK
15 minute summer	96	1	27.357	0.000	0.0	0.0000	0.0000	OK
15 minute summer	97	1	26.722	0.000	0.0	0.0000	0.0000	OK
15 minute summer	98	1	25.801	0.000	0.0	0.0000	0.0000	OK
15 minute summer	99	1	24.564	0.000	0.0	0.0000	0.0000	OK
15 minute summer	100	1	24.417	0.000	0.0	0.0000	0.0000	OK
15 minute summer	101	1	23.849	0.000	0.0	0.0000	0.0000	OK
15 minute summer	102	1	23.242	0.000	0.0	0.0000	0.0000	OK
15 minute summer	103	1	22.150	0.000	0.0	0.0000	0.0000	OK
15 minute summer	104	1	21.309	0.000	0.0	0.0000	0.0000	OK
15 minute summer	105	1	21.124	0.000	0.0	0.0000	0.0000	OK
15 minute summer	106	1	25.074	0.000	0.0	0.0000	0.0000	OK
15 minute summer	107	1	24.125	0.000	0.0	0.0000	0.0000	OK
15 minute summer	108	1	23.090	0.000	0.0	0.0000	0.0000	OK
15 minute summer	109	1	22.128	0.000	0.0	0.0000	0.0000	OK
15 minute summer	110	1	20.707	0.000	0.0	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	72	13.005	73	0.0	0.000	0.000	0.0000	
15 minute summer	73	13.006	74	0.0	0.000	0.000	0.0000	
15 minute summer	74	13.007	75	0.0	0.000	0.000	0.0000	
15 minute summer	75	13.008	76	0.0	0.000	0.000	0.0000	
15 minute summer	76	13.009	77	0.0	0.000	0.000	0.0000	
15 minute summer	77	13.010	79	0.0	0.000	0.000	0.0000	
15 minute summer	78	16.000	79	0.0	0.000	0.000	0.0000	
15 minute summer	79	13.011	80	0.0	0.000	0.000	0.0000	
15 minute summer	80	13.012	81	0.0	0.000	0.000	0.0000	
15 minute summer	81	13.013	82	0.0	0.000	0.000	0.0000	
15 minute summer	82	13.014	87	0.0	0.000	0.000	0.0000	
15 minute summer	83	17.000	84	0.0	0.000	0.000	0.0000	
15 minute summer	84	17.001	85	0.0	0.000	0.000	0.0000	
15 minute summer	85	17.002	86	0.0	0.000	0.000	0.0000	
15 minute summer	86	17.003	87	0.0	0.000	0.000	0.0000	
15 minute summer	87	13.015	88	0.0	0.000	0.000	0.0001	
15 minute summer	88	13.016	93	0.0	0.000	0.000	0.0001	
15 minute summer	89	18.000	90	0.0	0.000	0.000	0.0000	
15 minute summer	90	18.001	92	0.0	0.000	0.000	0.0000	
15 minute summer	91	19.000	92	0.0	0.000	0.000	0.0001	
15 minute summer	92	18.002	93	0.0	0.000	0.000	0.0001	
15 minute summer	93	13.017	94	0.0	0.000	0.000	0.0001	
15 minute summer	94	13.018	110	0.0	0.000	0.000	0.0000	
15 minute summer	95	20.000	96	0.0	0.000	0.000	0.0000	
15 minute summer	96	20.001	97	0.0	0.000	0.000	0.0000	
15 minute summer	97	20.002	98	0.0	0.000	0.000	0.0000	
15 minute summer	98	20.003	99	0.0	0.000	0.000	0.0000	
15 minute summer	99	20.004	101	0.0	0.000	0.000	0.0000	
15 minute summer	100	21.000	101	0.0	0.000	0.000	0.0000	
15 minute summer	101	20.005	102	0.0	0.000	0.000	0.0000	
15 minute summer	102	20.006	103	0.0	0.000	0.000	0.0000	
15 minute summer	103	20.007	104	0.0	0.000	0.000	0.0000	
15 minute summer	104	20.008	105	0.0	0.000	0.000	0.0000	
15 minute summer	105	20.009	110	0.0	0.000	0.000	0.0000	
15 minute summer	106	22.000	107	0.0	0.000	0.000	0.0000	
15 minute summer	107	22.001	108	0.0	0.000	0.000	0.0000	
15 minute summer	108	22.002	109	0.0	0.000	0.000	0.0000	
15 minute summer	109	22.003	110	0.0	0.000	0.000	0.0000	
15 minute summer	110	13.019	122	0.0	0.000	0.000	0.0000	

Results for 100 year +30% CC Critical Storm Duration. Lowest mass balance: 99.40%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	111	11	21.367	1.019	29.9	1.1530	0.0000	SURCHARGED
15 minute summer	112	11	21.362	1.266	70.7	3.0365	0.0000	SURCHARGED
15 minute summer	113	11	21.325	1.270	52.8	1.4361	0.0000	SURCHARGED
15 minute summer	114	11	21.253	1.302	108.3	2.7624	0.0000	SURCHARGED
15 minute summer	115	11	21.196	0.956	50.4	2.1860	0.0000	SURCHARGED
15 minute summer	116	11	20.953	1.185	189.3	2.5119	0.0000	SURCHARGED
15 minute summer	117	11	20.661	0.968	194.9	1.4866	0.0000	SURCHARGED
15 minute summer	118	11	20.543	0.863	193.4	1.2346	0.0000	SURCHARGED
15 minute summer	119	11	20.238	0.632	206.2	1.0246	0.0000	SURCHARGED
15 minute summer	120	11	21.295	1.392	77.6	4.0541	0.0000	FLOOD RISK
15 minute summer	121	10	20.358	0.817	168.6	1.8986	0.0000	SURCHARGED
360 minute winter	122	352	20.196	1.191	68.9	3.2619	0.0000	SURCHARGED
360 minute winter	123	352	20.196	1.204	74.7	3.5791	0.0000	SURCHARGED
360 minute winter	124	352	20.197	1.269	71.2	3.2868	0.0000	SURCHARGED
360 minute winter	125	352	20.196	1.280	79.3	4.1501	0.0000	SURCHARGED
15 minute summer	126	10	21.129	1.140	180.3	5.7725	0.0000	SURCHARGED
360 minute winter	127	352	20.196	1.315	103.0	3.3473	0.0000	SURCHARGED
15 minute summer	128	10	21.907	0.157	31.1	0.2307	0.0000	OK
15 minute summer	129	10	21.722	0.202	51.2	0.2839	0.0000	OK
15 minute summer	130	10	21.629	0.244	55.2	0.3642	0.0000	OK
15 minute summer	131	10	21.607	0.242	79.5	0.4504	0.0000	OK
15 minute summer	132	10	20.532	1.040	24.6	1.7797	0.0000	FLOOD RISK
15 minute summer	133	10	20.513	1.160	65.3	2.3978	0.0000	SURCHARGED
15 minute summer	134	10	20.480	1.199	361.6	4.4176	0.0000	SURCHARGED
360 minute winter	127_OUT	352	20.197	1.617	152.4	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	111	23.000	112	-29.9	-0.849	-0.751	1.1923	
15 minute summer	112	23.001	113	52.8	0.942	0.746	0.7052	
15 minute summer	113	23.002	114	58.4	0.829	0.822	1.7775	
15 minute summer	114	23.003	116	104.2	1.480	1.469	1.8504	
15 minute summer	115	24.000	116	40.0	1.067	0.804	1.3996	
15 minute summer	116	23.004	117	187.3	1.699	1.691	2.6703	
15 minute summer	117	23.005	118	193.4	1.754	1.742	0.4606	
15 minute summer	118	23.006	119	192.2	1.742	1.729	2.6175	
15 minute summer	119	23.007	122	204.7	1.861	1.840	3.2782	
15 minute summer	120	25.000	121	69.5	1.747	1.745	1.9350	
15 minute summer	121	25.001	122	165.8	2.355	2.344	1.4664	
360 minute winter	122	13.020	123	67.8	0.585	0.146	4.0069	
360 minute winter	123	13.021	124	70.4	0.591	0.152	19.7803	
360 minute winter	124	13.022	125	67.0	0.539	0.145	3.8075	
360 minute winter	125	13.023	127	76.7	0.607	0.165	10.7565	
15 minute summer	126	26.000	127	169.4	2.406	2.392	2.5504	
360 minute winter	127	13.024	127_OUT	100.0	0.881	0.216	10.3142	
15 minute summer	128	27.000	129	31.0	1.085	0.779	0.7480	
15 minute summer	129	27.001	130	51.2	1.097	0.716	0.6731	
15 minute summer	130	27.002	131	54.9	0.727	0.494	0.4750	
15 minute summer	131	27.003	134	78.3	1.148	0.704	1.6614	
15 minute summer	132	28.000	133	23.8	0.339	0.337	2.3928	
15 minute summer	133	28.001	134	69.6	0.631	0.628	2.5577	
15 minute summer	134	27.004	127_OUT	355.2	3.221	3.195	2.2036	

Results for 30 year +30% CC Critical Storm Duration. Lowest mass balance: 99.90%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
1440 minute summer	1	1140	19.729	0.606	4.0	1.3091	0.0000	SURCHARGED
1440 minute summer	2	1140	19.729	0.695	8.2	1.6946	0.0000	SURCHARGED
1440 minute summer	3	1140	19.729	0.461	1.1	0.6919	0.0000	SURCHARGED
1440 minute summer	4	1140	19.729	0.798	11.4	1.8486	0.0000	SURCHARGED
1440 minute summer	5	1140	19.729	0.833	14.2	1.6281	0.0000	SURCHARGED
1440 minute summer	6	1140	19.729	0.923	14.1	1.6306	0.0000	SURCHARGED
1440 minute summer	7	1140	19.729	0.452	1.3	0.8725	0.0000	SURCHARGED
1440 minute summer	8	1140	19.729	0.557	4.0	1.1309	0.0000	SURCHARGED
1440 minute summer	9	1140	19.729	0.637	7.1	1.2354	0.0000	SURCHARGED
1440 minute summer	10	1140	19.729	0.952	24.5	2.2472	0.0000	SURCHARGED
1440 minute summer	11	1140	19.729	1.034	31.1	3.1842	0.0000	SURCHARGED
1440 minute summer	1.008:50%	1140	19.729	1.100	29.8	0.0000	0.0000	SURCHARGED
1440 minute summer	12	1140	19.729	1.316	52.7	4.9999	0.0000	SURCHARGED
1440 minute summer	13	1140	19.729	1.340	53.4	3.9898	0.0000	SURCHARGED
1440 minute summer	14	1140	19.729	1.368	53.8	3.9335	0.0000	SURCHARGED
1440 minute summer	15	1140	19.729	1.387	53.9	3.8925	0.0000	SURCHARGED
1440 minute summer	16	1140	19.729	1.471	62.4	6.7843	0.0000	SURCHARGED
1440 minute summer	17	1050	19.917	1.338	41.7	929.4901	0.0000	SURCHARGED
1440 minute summer	18	1140	19.729	1.561	75.9	3.9719	0.0000	SURCHARGED
1440 minute summer	19	1140	19.729	1.578	83.1	5.8230	0.0000	SURCHARGED
15 minute summer	20	1	42.414	0.000	0.0	0.0000	0.0000	OK
15 minute summer	21	1	40.134	0.000	0.0	0.0000	0.0000	OK
15 minute summer	22	1	37.200	0.000	0.0	0.0000	0.0000	OK
15 minute summer	23	1	35.227	0.000	0.0	0.0000	0.0000	OK
15 minute summer	24	1	32.775	0.000	0.0	0.0000	0.0000	OK
15 minute summer	25	1	30.967	0.000	0.0	0.0000	0.0000	OK
15 minute summer	26	1	28.566	0.000	0.0	0.0000	0.0000	OK
15 minute summer	27	1	27.000	0.000	0.0	0.0000	0.0000	OK
15 minute summer	28	1	24.700	0.000	0.0	0.0000	0.0000	OK
15 minute summer	29	10	22.008	0.058	16.7	0.1609	0.0000	OK
15 minute summer	30	10	20.454	0.119	70.4	0.4212	0.0000	OK
1440 minute summer	31	1140	19.729	1.645	92.6	5.0846	0.0000	SURCHARGED
1440 minute summer	32	1140	19.728	1.664	93.2	4.4690	0.0000	SURCHARGED
1440 minute summer	32_OUT	1140	19.728	1.674	92.9	0.0000	0.0000	OK
15 minute summer	33	11	19.931	0.364	50.4	0.9582	0.0000	SURCHARGED
15 minute summer	4.000:50%	12	19.769	0.353	58.9	3.7894	0.0000	SURCHARGED
1440 minute summer	34	1140	19.729	1.042	17.5	1.7523	0.0000	SURCHARGED
1440 minute summer	35	1140	19.729	0.886	17.4	3.2566	0.0000	SURCHARGED
1440 minute summer	4.001:50%	1140	19.729	0.964	17.3	8.7120	0.0000	SURCHARGED

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
1440 minute summer	1	1.002	2	4.0	0.370	0.036	3.1806	
1440 minute summer	2	1.003	4	8.1	0.458	0.051	6.5277	
1440 minute summer	3	2.000	4	-1.1	0.249	-0.010	4.2032	
1440 minute summer	4	1.004	5	11.4	0.533	0.071	2.2043	
1440 minute summer	5	1.005	6	14.1	0.554	0.088	5.7065	
1440 minute summer	6	1.006	10	13.2	0.380	0.045	4.5147	
1440 minute summer	7	3.000	8	1.4	0.222	0.012	3.7180	
1440 minute summer	8	3.001	9	4.0	0.393	0.036	2.8401	
1440 minute summer	9	3.002	10	7.1	0.593	0.064	2.7377	
1440 minute summer	10	1.007	11	23.0	0.539	0.081	13.3411	
1440 minute summer	11	1.008	1.008:50%	29.0	0.679	0.088	8.0424	
1440 minute summer	11	1.008	12	28.4	0.703	0.086	8.0424	
1440 minute summer	12	1.009	13	51.0	0.460	0.113	7.8386	
1440 minute summer	13	1.010	14	52.1	0.454	0.112	8.7206	
1440 minute summer	14	1.011	15	52.7	0.461	0.114	5.8937	
1440 minute summer	15	1.012	16	51.9	0.393	0.112	26.0006	
1440 minute summer	16	1.013	18	61.5	0.518	0.133	6.6163	
1440 minute summer	17	6.000	18	14.6	0.761	0.204	1.0054	
1440 minute summer	18	1.014	19	75.7	0.367	0.114	9.5123	
1440 minute summer	19	1.015	31	82.7	0.349	0.124	37.5315	
15 minute summer	20	7.000	21	0.0	0.000	0.000	0.0000	
15 minute summer	21	7.001	22	0.0	0.000	0.000	0.0000	
15 minute summer	22	7.002	23	0.0	0.000	0.000	0.0000	
15 minute summer	23	7.003	24	0.0	0.000	0.000	0.0000	
15 minute summer	24	7.004	25	0.0	0.000	0.000	0.0000	
15 minute summer	25	7.005	26	0.0	0.000	0.000	0.0001	
15 minute summer	26	7.006	27	0.0	0.000	0.000	0.0000	
15 minute summer	27	7.007	28	0.0	0.000	0.000	0.0000	
15 minute summer	28	7.008	29	0.0	0.000	0.000	0.0001	
15 minute summer	29	7.009	30	16.1	1.035	0.012	0.9125	
15 minute summer	30	7.010	31	69.4	1.593	0.053	2.3150	
1440 minute summer	31	1.016	32	92.4	0.366	0.138	10.2785	
1440 minute summer	32	1.017	32_OUT	92.9	0.420	0.137	5.3807	
15 minute summer	33	4.000	4.000:50%	47.1	1.186	1.183	1.0181	
15 minute summer	33	4.000	35	46.3	1.196	1.161	1.0181	
1440 minute summer	34	4.002	12	16.8	0.695	0.152	1.7449	
1440 minute summer	35	4.001	4.001:50%	16.7	0.695	0.150	2.7607	
1440 minute summer	35	4.001	34	16.2	0.635	0.146	2.7607	

Results for 30 year +30% CC Critical Storm Duration. Lowest mass balance: 99.90%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
1440 minute summer	36	1140	19.729	0.466	1.7	0.8059	0.0000	SURCHARGED
1440 minute summer	37	1140	19.729	0.354	1.2	0.4004	0.0000	SURCHARGED
1440 minute summer	39	1140	19.729	0.729	3.6	1.8784	0.0000	SURCHARGED
1440 minute summer	5.000:50%	1140	19.728	0.807	3.9	2.8509	0.0000	SURCHARGED
1440 minute winter	40	1470	17.996	0.162	0.1	0.2862	0.0000	OK
1440 minute winter	41	1470	17.996	0.213	0.2	0.3763	0.0000	OK
15 minute summer	42	10	18.320	0.148	35.4	0.3284	0.0000	OK
15 minute summer	43	11	18.140	0.152	35.7	0.2169	0.0000	OK
1440 minute winter	44	1470	17.996	0.238	2.1	0.4205	0.0000	OK
1440 minute winter	45	1470	17.996	0.261	2.0	0.4611	0.0000	OK
15 minute summer	46	1	18.926	0.000	0.0	0.0000	0.0000	OK
15 minute summer	47	1	18.713	0.000	0.0	0.0000	0.0000	OK
15 minute summer	48	1	18.536	0.000	0.0	0.0000	0.0000	OK
15 minute summer	49	1	18.322	0.000	0.0	0.0000	0.0000	OK
15 minute summer	50	1	18.208	0.000	0.0	0.0000	0.0000	OK
1440 minute winter	45_OUT	1470	17.996	0.286	1.9	0.0000	0.0000	OK
1440 minute summer	51	1140	19.709	1.605	59.5	1222.9990	0.0000	SURCHARGED
60 minute winter	52	45	18.193	0.130	27.1	0.1860	0.0000	OK
60 minute winter	53	251	18.073	0.131	27.1	0.1872	0.0000	OK
60 minute summer	54	252	17.972	0.131	27.1	0.1881	0.0000	OK
1440 minute winter	55	1680	17.996	0.136	1.0	63.6685	0.0000	OK
15 minute summer	56	1	17.843	0.000	0.0	0.0000	0.0000	OK
15 minute summer	57	1	17.762	0.000	0.0	0.0000	0.0000	OK
60 minute summer	58	253	17.750	0.083	2.9	0.1468	0.0000	OK
60 minute summer	59	254	17.750	0.124	27.1	0.2192	0.0000	OK
60 minute summer	59_OUT	254	17.709	0.103	27.1	0.0000	0.0000	OK
15 minute summer	60	1	42.482	0.000	0.0	0.0000	0.0000	OK
15 minute summer	61	1	41.759	0.000	0.0	0.0000	0.0000	OK
15 minute summer	62	1	41.162	0.000	0.0	0.0000	0.0000	OK
15 minute summer	63	1	42.735	0.000	0.0	0.0000	0.0000	OK
15 minute summer	64	1	41.481	0.000	0.0	0.0000	0.0000	OK
15 minute summer	65	1	41.016	0.000	0.0	0.0000	0.0000	OK
15 minute summer	66	1	40.432	0.000	0.0	0.0000	0.0000	OK
15 minute summer	67	1	41.191	0.000	0.0	0.0000	0.0000	OK
15 minute summer	68	1	40.325	0.000	0.0	0.0000	0.0000	OK
15 minute summer	69	1	39.597	0.000	0.0	0.0000	0.0000	OK
15 minute summer	70	1	38.631	0.000	0.0	0.0000	0.0000	OK
15 minute summer	71	1	38.497	0.000	0.0	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
1440 minute summer	36	1.001	1	1.7	0.437	0.024	1.0997	
1440 minute summer	37	1.000	36	-1.2	-0.024	-0.017	1.8873	
1440 minute summer	39	5.000	5.000:50%	3.6	0.521	0.050	1.3236	
1440 minute summer	39	5.000	35	3.9	0.270	0.054	1.3236	
1440 minute winter	40	12.000	41	-0.1	-0.007	0.000	2.2781	
1440 minute winter	41	12.001	44	-0.2	-0.013	-0.001	1.7335	
15 minute summer	42	11.000	43	35.7	0.879	0.321	2.3955	
15 minute summer	43	11.001	44	34.6	0.899	0.311	0.3444	
1440 minute winter	44	11.002	45	2.0	0.140	0.007	1.5165	
1440 minute winter	45	11.003	45_OUT	1.9	0.056	0.007	1.8691	
15 minute summer	46	10.000	47	0.0	0.000	0.000	0.0000	
15 minute summer	47	10.001	48	0.0	0.000	0.000	0.0000	
15 minute summer	48	10.002	49	0.0	0.000	0.000	0.0000	
15 minute summer	49	10.003	50	0.0	0.000	0.000	0.0000	
15 minute summer	50	10.004	45_OUT	0.0	0.000	0.000	0.0000	
1440 minute summer	51	8.000	52	27.1	0.695	0.179	0.7112	
60 minute winter	52	8.001	53	27.1	0.712	0.179	2.0705	
60 minute winter	53	8.002	54	27.1	0.706	0.179	1.7458	
60 minute summer	54	8.003	59	27.1	0.785	0.179	1.0165	
1440 minute winter	55	9.000	56	0.0	0.000	0.000	0.0000	
15 minute summer	56	9.001	57	0.0	0.000	0.000	0.0001	
15 minute summer	57	9.002	58	0.0	0.000	0.000	0.6204	
60 minute summer	58	9.003	59	-2.9	-0.220	-0.010	0.2606	
60 minute summer	59	8.004	59_OUT	27.1	0.731	0.095	0.4405	429.5
15 minute summer	60	13.000	61	0.0	0.000	0.000	0.0000	
15 minute summer	61	13.001	62	0.0	0.000	0.000	0.0000	
15 minute summer	62	13.002	65	0.0	0.000	0.000	0.0000	
15 minute summer	63	14.000	64	0.0	0.000	0.000	0.0000	
15 minute summer	64	14.001	65	0.0	0.000	0.000	0.0000	
15 minute summer	65	13.003	66	0.0	0.000	0.000	0.0000	
15 minute summer	66	13.004	72	0.0	0.000	0.000	0.0000	
15 minute summer	67	15.000	68	0.0	0.000	0.000	0.0000	
15 minute summer	68	15.001	69	0.0	0.000	0.000	0.0000	
15 minute summer	69	15.002	70	0.0	0.000	0.000	0.0000	
15 minute summer	70	15.003	71	0.0	0.000	0.000	0.0000	
15 minute summer	71	15.004	72	0.0	0.000	0.000	0.0000	

Results for 30 year +30% CC Critical Storm Duration. Lowest mass balance: 99.90%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	72	1	38.478	0.000	0.0	0.0000	0.0000	OK
15 minute summer	73	1	37.500	0.000	0.0	0.0000	0.0000	OK
15 minute summer	74	1	36.726	0.000	0.0	0.0000	0.0000	OK
15 minute summer	75	1	35.500	0.000	0.0	0.0000	0.0000	OK
15 minute summer	76	1	34.717	0.000	0.0	0.0000	0.0000	OK
15 minute summer	77	1	33.000	0.000	0.0	0.0000	0.0000	OK
15 minute summer	78	1	31.222	0.000	0.0	0.0000	0.0000	OK
15 minute summer	79	1	30.650	0.000	0.0	0.0000	0.0000	OK
15 minute summer	80	1	29.361	0.000	0.0	0.0000	0.0000	OK
15 minute summer	81	1	28.399	0.000	0.0	0.0000	0.0000	OK
15 minute summer	82	1	27.344	0.000	0.0	0.0000	0.0000	OK
15 minute summer	83	1	31.250	0.000	0.0	0.0000	0.0000	OK
15 minute summer	84	1	29.753	0.000	0.0	0.0000	0.0000	OK
15 minute summer	85	1	28.346	0.000	0.0	0.0000	0.0000	OK
15 minute summer	86	1	26.000	0.000	0.0	0.0000	0.0000	OK
15 minute summer	87	1	24.890	0.000	0.0	0.0000	0.0000	OK
15 minute summer	88	1	23.819	0.000	0.0	0.0000	0.0000	OK
15 minute summer	89	1	27.200	0.000	0.0	0.0000	0.0000	OK
15 minute summer	90	1	25.170	0.000	0.0	0.0000	0.0000	OK
15 minute summer	91	1	25.026	0.000	0.0	0.0000	0.0000	OK
15 minute summer	92	1	22.996	0.000	0.0	0.0000	0.0000	OK
15 minute summer	93	1	21.682	0.000	0.0	0.0000	0.0000	OK
15 minute summer	94	1	21.323	0.000	0.0	0.0000	0.0000	OK
15 minute summer	95	1	28.395	0.000	0.0	0.0000	0.0000	OK
15 minute summer	96	1	27.357	0.000	0.0	0.0000	0.0000	OK
15 minute summer	97	1	26.722	0.000	0.0	0.0000	0.0000	OK
15 minute summer	98	1	25.801	0.000	0.0	0.0000	0.0000	OK
15 minute summer	99	1	24.564	0.000	0.0	0.0000	0.0000	OK
15 minute summer	100	1	24.417	0.000	0.0	0.0000	0.0000	OK
15 minute summer	101	1	23.849	0.000	0.0	0.0000	0.0000	OK
15 minute summer	102	1	23.242	0.000	0.0	0.0000	0.0000	OK
15 minute summer	103	1	22.150	0.000	0.0	0.0000	0.0000	OK
15 minute summer	104	1	21.309	0.000	0.0	0.0000	0.0000	OK
15 minute summer	105	1	21.124	0.000	0.0	0.0000	0.0000	OK
15 minute summer	106	1	25.074	0.000	0.0	0.0000	0.0000	OK
15 minute summer	107	1	24.125	0.000	0.0	0.0000	0.0000	OK
15 minute summer	108	1	23.090	0.000	0.0	0.0000	0.0000	OK
15 minute summer	109	1	22.128	0.000	0.0	0.0000	0.0000	OK
15 minute summer	110	1	20.707	0.000	0.0	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	72	13.005	73	0.0	0.000	0.000	0.0000	
15 minute summer	73	13.006	74	0.0	0.000	0.000	0.0000	
15 minute summer	74	13.007	75	0.0	0.000	0.000	0.0000	
15 minute summer	75	13.008	76	0.0	0.000	0.000	0.0000	
15 minute summer	76	13.009	77	0.0	0.000	0.000	0.0000	
15 minute summer	77	13.010	79	0.0	0.000	0.000	0.0000	
15 minute summer	78	16.000	79	0.0	0.000	0.000	0.0000	
15 minute summer	79	13.011	80	0.0	0.000	0.000	0.0000	
15 minute summer	80	13.012	81	0.0	0.000	0.000	0.0000	
15 minute summer	81	13.013	82	0.0	0.000	0.000	0.0000	
15 minute summer	82	13.014	87	0.0	0.000	0.000	0.0000	
15 minute summer	83	17.000	84	0.0	0.000	0.000	0.0000	
15 minute summer	84	17.001	85	0.0	0.000	0.000	0.0000	
15 minute summer	85	17.002	86	0.0	0.000	0.000	0.0000	
15 minute summer	86	17.003	87	0.0	0.000	0.000	0.0000	
15 minute summer	87	13.015	88	0.0	0.000	0.000	0.0001	
15 minute summer	88	13.016	93	0.0	0.000	0.000	0.0001	
15 minute summer	89	18.000	90	0.0	0.000	0.000	0.0000	
15 minute summer	90	18.001	92	0.0	0.000	0.000	0.0000	
15 minute summer	91	19.000	92	0.0	0.000	0.000	0.0001	
15 minute summer	92	18.002	93	0.0	0.000	0.000	0.0001	
15 minute summer	93	13.017	94	0.0	0.000	0.000	0.0001	
15 minute summer	94	13.018	110	0.0	0.000	0.000	0.0000	
15 minute summer	95	20.000	96	0.0	0.000	0.000	0.0000	
15 minute summer	96	20.001	97	0.0	0.000	0.000	0.0000	
15 minute summer	97	20.002	98	0.0	0.000	0.000	0.0000	
15 minute summer	98	20.003	99	0.0	0.000	0.000	0.0000	
15 minute summer	99	20.004	101	0.0	0.000	0.000	0.0000	
15 minute summer	100	21.000	101	0.0	0.000	0.000	0.0000	
15 minute summer	101	20.005	102	0.0	0.000	0.000	0.0000	
15 minute summer	102	20.006	103	0.0	0.000	0.000	0.0000	
15 minute summer	103	20.007	104	0.0	0.000	0.000	0.0000	
15 minute summer	104	20.008	105	0.0	0.000	0.000	0.0000	
15 minute summer	105	20.009	110	0.0	0.000	0.000	0.0000	
15 minute summer	106	22.000	107	0.0	0.000	0.000	0.0000	
15 minute summer	107	22.001	108	0.0	0.000	0.000	0.0000	
15 minute summer	108	22.002	109	0.0	0.000	0.000	0.0000	
15 minute summer	109	22.003	110	0.0	0.000	0.000	0.0000	
15 minute summer	110	13.019	122	0.0	0.000	0.000	0.0000	

Results for 30 year +30% CC Critical Storm Duration. Lowest mass balance: 99.90%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	111	11	20.797	0.449	23.3	0.5080	0.0000	SURCHARGED
15 minute summer	112	11	20.761	0.665	54.5	1.5952	0.0000	SURCHARGED
15 minute summer	113	11	20.742	0.687	40.6	0.7768	0.0000	SURCHARGED
15 minute summer	114	11	20.707	0.756	81.7	1.6039	0.0000	SURCHARGED
15 minute summer	115	11	20.660	0.420	38.8	0.9611	0.0000	SURCHARGED
15 minute summer	116	11	20.519	0.751	149.7	1.5916	0.0000	SURCHARGED
15 minute summer	117	11	20.336	0.643	155.0	0.9864	0.0000	SURCHARGED
15 minute summer	118	11	20.261	0.581	153.6	0.8308	0.0000	SURCHARGED
15 minute summer	119	11	20.067	0.461	163.2	0.7470	0.0000	SURCHARGED
15 minute summer	120	11	20.686	0.783	59.8	2.2789	0.0000	SURCHARGED
15 minute summer	121	10	20.105	0.564	132.4	1.3122	0.0000	SURCHARGED
1440 minute summer	122	1050	19.931	0.926	31.4	2.5350	0.0000	SURCHARGED
1440 minute summer	123	1050	19.931	0.939	34.0	2.7902	0.0000	SURCHARGED
1440 minute summer	124	1050	19.930	1.002	32.7	2.5975	0.0000	SURCHARGED
1440 minute summer	125	1050	19.930	1.014	36.6	3.2890	0.0000	SURCHARGED
15 minute summer	126	10	20.702	0.713	139.0	3.6099	0.0000	SURCHARGED
1440 minute summer	127	1050	19.930	1.049	47.6	2.6709	0.0000	SURCHARGED
15 minute summer	128	10	21.881	0.131	24.0	0.1921	0.0000	OK
15 minute summer	129	10	21.691	0.171	39.6	0.2408	0.0000	OK
15 minute summer	130	10	21.591	0.206	42.6	0.3070	0.0000	OK
15 minute summer	131	10	21.571	0.206	61.3	0.3829	0.0000	OK
15 minute summer	132	10	20.138	0.646	24.9	1.1046	0.0000	SURCHARGED
15 minute summer	133	10	20.143	0.790	50.0	1.6331	0.0000	SURCHARGED
15 minute summer	134	10	20.136	0.855	280.3	3.1512	0.0000	SURCHARGED
1440 minute summer	127_OUT	1050	19.930	1.351	69.9	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	111	23.000	112	-23.3	-0.587	-0.585	1.1923	
15 minute summer	112	23.001	113	40.6	0.953	0.574	0.7052	
15 minute summer	113	23.002	114	45.0	0.729	0.633	1.7775	
15 minute summer	114	23.003	116	83.9	1.192	1.183	1.8504	
15 minute summer	115	24.000	116	33.7	1.066	0.678	1.3996	
15 minute summer	116	23.004	117	149.1	1.352	1.347	2.6703	
15 minute summer	117	23.005	118	153.6	1.393	1.384	0.4606	
15 minute summer	118	23.006	119	152.4	1.382	1.371	2.6175	
15 minute summer	119	23.007	122	160.0	1.485	1.439	3.1348	
15 minute summer	120	25.000	121	55.1	1.386	1.385	1.9350	
15 minute summer	121	25.001	122	130.2	1.850	1.841	1.4453	
1440 minute summer	122	13.020	123	30.9	0.478	0.067	4.0069	
1440 minute summer	123	13.021	124	32.3	0.480	0.070	19.7803	
1440 minute summer	124	13.022	125	31.0	0.430	0.067	3.8075	
1440 minute summer	125	13.023	127	35.5	0.458	0.077	10.7565	
15 minute summer	126	26.000	127	131.1	1.863	1.851	2.5155	
1440 minute summer	127	13.024	127_OUT	46.2	0.660	0.100	10.3142	
15 minute summer	128	27.000	129	24.0	1.031	0.602	0.6082	
15 minute summer	129	27.001	130	39.5	1.017	0.553	0.5614	
15 minute summer	130	27.002	131	42.4	0.685	0.381	0.3891	
15 minute summer	131	27.003	134	60.2	1.066	0.541	1.3801	
15 minute summer	132	28.000	133	16.8	0.282	0.238	2.3928	
15 minute summer	133	28.001	134	52.5	0.476	0.473	2.5577	
15 minute summer	134	27.004	127_OUT	279.3	2.533	2.512	2.2036	

Appendix F. Ground Investigation Report



IGSL Limited

Atkins

**Ground Investigation for
Old Connaught South Dublin
Phase 1**

Factual Report

Report No. 26458

June 2026



Report



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FOREWORD

The following conditions and notes on the geotechnical site investigation procedures should be read in conjunction with this report.

Standards

The ground investigation works for this project have been carried out by IGSL in accordance with Eurocode 7 - Part 2: Ground Investigation & Testing (EN 1997-2:2007). This has been used together with complementary documents such as BS 5930:2015 and BS 1377 (Parts 1 to 9) and the following European Norms:

- EN 1997-2 Eurocode 7: 2007 – Geotechnical Design – Part 2: Ground Investigation & Testing
- EN ISO 22475-1:2006 Geotechnical Investigation and Sampling – Sampling Methods & Groundwater Measurements
- EN ISO 14688-1:2018 Geotechnical Investigation and Testing – Identification and Classification of Soil, Part 1: Identification and Description
- EN ISO 14688-2:2018 Geotechnical Investigation and Testing – Identification and Classification of Soil, Part 2: Classification Principles
- EN ISO 14689-1:2018 Geotechnical Investigation and Testing - Identification & Classification of Rock, Part 1: Identification & Description

Reporting

This report has been prepared for Atkins and the information should not be used without prior written permission of either party. IGSL Ltd accepts no responsibility or liability for this document being used other than for the purposes for which it was intended. No responsibility can be held by IGSL Ltd for ground conditions between exploratory hole locations.

The engineering logs provide ground profiles and configuration of strata relevant to the investigation depths achieved and caution should be taken when extrapolating between exploratory points. No liability is accepted for ground conditions extraneous to the investigation points. Unless specifically stated, no account has been taken of possible subsidence due to mineral extraction, mining works or karstification below or close to the site.

Boring Procedures

Unless otherwise stated, 'shell and auger' or cable percussive boring technique has been employed as defined by Section 6.3 of IS EN ISO 22475-1:2006. The boring operations, sampling and in-situ testing complies with the recommendations of IS EN 1997-2:2007 and BS 1377:1990 and EN ISO 22476-3:2005+A1:2011. The shell and auger boring technique allows for continuous sampling in clay and silt above the water table and sand and gravel below the water table (Table 2 of IS EN ISO 22475-1:2006).

It is highlighted that some disturbance and variations is unavoidable in particular ground (e.g. blowing sands, gravel / cobble dominant glacial deposits etc). Attention is drawn to this condition, whenever it is suspected. Where cobbles and boulders are recorded, no conclusion should be drawn concerning the size, presence, lithological nature, or numbers per unit volume of ground.

Rotary Drilling Procedures

Rotary drilling methods are used to recover very heavily over-consolidated glacial till and bedrock samples in line with Section 3.5 of IS EN 1997-2:2007 and IS EN ISO 22475-1. Open hole drilling methods (odex or symmetrix) are utilized to advance the drillholes through granular dominant superficial deposits, with coring in hard ('cemented') fine grained or cohesive glacial deposits and bedrock.

In-Situ Testing

Standard penetration tests are conducted by IGSL strictly in accordance with Section 4.6 of IS EN 1997-2:2007. The SPT equipment (hammer energy test) has been calibrated in accordance with EN ISO 22476-3:2005+A1:2011 and the Energy Ratio (E_r) is defined as the ratio of the actual energy E_{meas} (measured energy during calibration) delivered to the drive weight assembly into the drive rod below the anvil, to the theoretical energy (E_{theor}) as calculated from the drive weight assembly. The measured number of blows (N) reported on the engineering logs are uncorrected. In sands, the energy losses due to rod length and the effect of the overburden pressure should be taken into account (see IS EN ISO 22476-3:2005+A1:2011).

Groundwater

The depth of entry of any influx of groundwater is recorded during the course of boring or drilling operations. However, the normal rate of boring does not usually permit the recording of an equilibrium level for any one water strike. Where possible drilling is suspended for a period of twenty minutes to monitor the subsequent rise in water level. Groundwater conditions observed in the borings or pits are those appertaining to the period of investigation. It should be noted however, that groundwater levels are subject to diurnal, seasonal and climatic variations and can also be affected by drainage conditions, tidal variations etc.

Soil Sampling

Three categories of sampling methods are outlined in EN ISO 22475-1:2006. The categories are referenced A, B and C for any given ground conditions and are shown in Tables 1 and 2 of EN ISO 22475-1:2006. Reference should be made to EN 1997-2:2007 for guidelines on sample class and quality for strength and compressibility testing. Samples of quality classes 1 or 2 can only be obtained by using Category A sampling methods.

Where appropriate Class 1 thin wall undisturbed tube samples (UT100) are obtained in fine grained soils and strictly meet the requirements of EN 1997-2:2007 and EN ISO 22475-1:2006. Soil samples for laboratory tests are divided into five classes with respect to the soil properties that are assumed to remain unchanged during sampling, handling transport and storage. The minimum sample quality required for testing purposes to Eurocode 7 compatibility (EN 1997-2:2007) is shown in Table A.

Table A – Details of Sample Quality Requirements

EN 1997 Clause	Test	Minimum Sample Quality Class
5.5.3	Water Content	3
5.5.4	Bulk Density	2
5.5.5	Particle Density	N/S
5.5.6	Particle Size Analysis	N/S
5.5.7	Consistency Limits	4
5.5.8	Density Index	N/S
5.5.9	Soil Dispersivity	N/S
5.5.10	Frost Susceptibility	N/S
5.6.2	Organic Content	4
5.6.3	Carbonate Content	3
5.6.4	Sulphate Content	3
5.6.5	pH	3
5.6.6	Chloride Content	3
5.7	Strength Index	1
5.8	Strength Tests	1
5.9	Compressibility Tests	1
5.10	Compaction Tests	N/S
5.11	Permeability	2

N/S – not stated. Presume a representative sample of appropriate size.

Samples recovered from trial pits or trenches meet the requirements of IS EN ISO 22475-1. It is highlighted that unforeseen circumstances such as variations in geological strata may lead to lower quality sample classes being obtained.

Engineering Logging

Soil and rock identification is based on the examination of the samples recovered and conforms with IS EN ISO 14688-1:2018 and IS EN ISO 14689-1:2018. Rock weathering classification conforms to IS EN ISO 14689-1:2018 while discontinuities (bedding planes, joints, cleavages, faults etc) are classified in accordance with 4.3.3 of IS EN ISO 14689-1:2018. Rock mechanical indices (TCR, SCR, RQD) are defined in accordance with IS EN ISO 22475-1:2006.

Retention of Samples

After satisfactory completion of all the scheduled laboratory tests on any sample, the remaining material will be discarded. Unless a period of retention of samples is agreed, it is company policy to discard soil samples one month after submission of our final report.

1.0 Introduction and Objectives

Proposed construction works between Shankill and Bray in Co. Wicklow will include a new overbridge at the M11 motorway and an associated approach road on the western side of the M11. Ground investigation works have been carried out for the project and these have been segregated into two phases as follows:

Phase 1 – Approach Road

Phase 2 – Overbridge at M11

This report relates to the Phase 1 ground investigation that has been undertaken on behalf of Mountclare and Castlethorn in accordance with a technical specification prepared by Atkins. The objectives of the investigation were to ascertain the ground and groundwater conditions, and to produce a report which will assist in the geotechnical design of the project.

The site location is shown in Figure 1 with the area of the Phase 1 investigation approximately outlined in red.



Figure 1 – Site Location

This report presents the fieldwork data and the results of laboratory testing.

2.0 Scope of Works

The programme of exploratory works included the following:

- 3 no. cable percussive boreholes
- 3 no. rotary coreholes at borehole locations
- 5 no. mechanically excavated trial pits
- 2 no. window samples
- 2 no. dynamic probes at window sample locations
- 7 no. plate bearing tests
- 7 no. infiltration tests
- 1 no. inspection (slit) trench
- Groundwater monitoring of standpipes
- A programme of geotechnical, chemical and environmental laboratory testing

The exploratory hole locations are shown on the as-surveyed aerial plan in Appendix 12 of this report.

2.1 Cable Percussive Boreholes

Boreholes were constructed in 3 locations (BH01 to BH03) using a Dando 2000 rig equipped with 200 mm casing. The bored depths ranged from 7.9 to 11.8 metres below existing ground level (m BGL).

A hand dug inspection pit was excavated at each location prior to commencing drilling works and the locations were scanned for services using a CAT detection tool.

During the course of boring, in-situ Standard Penetration Tests (SPT) were undertaken at metre intervals. Samples were also recovered to assist in the visual description of recovered soils and to provide specimens for laboratory testing. In low strength soils, driven tube samples (U100) were obtained. Instances of groundwater ingress were recorded and monitored for a further 20 minutes to permit the water to rise.

The borehole records are presented in Appendix 1 of this report.

2.2 Rotary Coreholes

Rotary drilling was carried out at 3 locations (RC01 to RC03) adjacent to the cable percussive boreholes, using a Beretta T44 tracked rig. Symmetrex drilling was utilized in the soil deposits, with coring techniques used in the bedrock. The rotary drilling produced 78mm diameter cores. The holes extended to depths of 15 to 25 m BGL, with bedrock reached in RC01.

The retrieved cores were placed in 3m capacity timber boxes and transported to IGSL's laboratory in Naas, Co. Kildare.

The cores were then logged by an engineering geologist, including photography of the cores with a digital camera. Where rock is recovered, a graphic fracture log is also presented alongside the mechanical indices. This illustrates the fracture state of the rock cores and allows easy identification of highly fractured / non-intact zones and discontinuity spacings. It should be noted that no correction for dip of the joints has been made and that the spacings shown are successive joint / core intersections within the core.

Groundwater monitoring standpipes were installed in RC02 and RC03. The standpipes consisted of 50mm diameter pipe and incorporated pea gravel filter pack and bentonite seal. Standup covers were concreted in place and timber fence posts were placed around them.

The core log records are presented in Appendix 2, including the engineering geological descriptions, details of the bedding / discontinuities and mechanical indices (TCR, SCR and RQD's) for each core run and details of the installation. Core photographs are also presented in Appendix 2 and they illustrate the structure and fracture state of the bedrock.

2.3 Trial Pits

Trial pitting was performed at 5 locations (TP01 to TP05) using an 8.5-tonne tracked excavator. The trial pits were logged and sampled by an IGSL geotechnical engineer in accordance with BS 5930:2015 +A1:2020.

Hand shear vane tests (set of 3) were performed within the upper soils to permit an assessment of the in-situ shear strengths.

Pit sidewalls were assessed in terms of their short-term stability and any instances of groundwater ingress were recorded. Bulk soil samples were also recovered to provide specimens for laboratory testing.

The samples were placed in heavy duty polyethene bags and sealed before being transported to Naas for laboratory testing. For this project, environmental samples were obtained and placed in appropriate containers (tubs, jars and vials).

The trial pits were backfilled with the as-dug arisings and reinstated to the satisfaction of IGSL's site geotechnical engineer. The trial pit logs in Appendix 3 include descriptions of the soils encountered, groundwater conditions and stability of the pit sidewalls. Photographs of the open pits and spoil are also presented in Appendix 3.

2.4 Window Samples

Window samples were undertaken in 2 locations (WS01 and WS02) in order to obtain undisturbed samples of the upper soils for detailed examination and logging.

Window samples are advanced by driving a steel sampling tube under constant percussive effort. The soils enter the tube within a protective plastic liner, which is withdrawn after every metre of progress. The liners are then placed in wooden channel boxes.

The window sample records and photographs are presented in Appendix 4.

2.5 Dynamic Probes

Dynamic probes DP01 and DP02 were undertaken adjacent to corresponding window samples. The dynamic probe utilised by IGSL Ltd complies with the requirements of BS 1377, Part 9 (1990) and Eurocode 7: Part 3.

The super-heavy probe (DPSH) probe was used, comprising a 63.5 kg drop weight, 500mm drop height and a 45 mm diameter (90°) cone. In accordance with the standards, the number of blows required to drive the probe through each 100mm increment of penetration was recorded. Probing was terminated when blow counts, N_{100} values, exceeded 25, in order to avoid damage to equipment.

Detailed probe records are provided in Appendix 5 on which the blow counts are recorded both numerically and graphically.

2.6 Inspection (Slit) Trenches

Inspection trench ST01 was excavated towards the south of the site to investigate for the presence of buried utilities or services. Excavation comprised a combination of mini-digger and hand digging methods.

A photograph of the open trench and a detailed geological description of the soils encountered are included on the record in Appendix 6, although no buried services or utilities were encountered.

2.7 Plate Bearing Tests

Plate bearing tests were performed in 7 locations to obtain a measure of the moduli of subgrade reaction and equivalent in-situ CBR values. A 450 mm diameter plate was used in 5 locations (adjacent to the trial pits) and tests were performed in accordance with BS 1377 Part 9: 1990. "In-situ Tests". In 2 locations (marked CBR01 and CBR02 on site plan), the test was performed using a 300 mm diameter plate.

The maximum applied load was estimated on the basis of obtaining an accumulative displacement of at least 1.25 mm. The load was then applied in five approximately equal increments to the design load. To measure recovery the load was removed in three increments. A second phase of loading and unloading was performed to assess the benefits of further compaction.

The settlement under each increment was measured against time until movement had effectively ceased and the results are presented as graphs of applied pressure against settlement. Calculation of Modulus of Sub-grade Reaction (k) and CBR values are in accordance with NRA HD25-26/10 Volume7: Pavement Design and Maintenance.

The plate bearing test records are presented in Appendix 7.