

Iesis Civils
20 Ironmonger Lane
London
EC2V 8EP

t: +44 (0)207 600 2912
w: www.iesisgroup.com
e: iss@iesisgroup.com



Our ref: SE1877-ISS-XX-00-TN-C-3101

Hertfordshire County Council

Address: Farnham and Robertson House,
Six Hills Way,
Stevenage, SG1 2ST

23th July 2026

Dear LLFA Team,

RE: TECHNICAL NOTE Culvert Design

This document is in response to David Uncle's email received 15.07.2026, see below;

From: David Uncle <david.uncle@hertfordshire.gov.uk>
Sent: 15 July 2026 08:25
To: STEFANONI, Fabrizio (LPLON) <Fabrizio.Stefanoni@lovell.co.uk>; garethwilby <garethwilby@iesiscivils.com>
Cc: FRMConsultations <FRMConsultations@hertfordshire.gov.uk>; Elaine Simpson <Elaine.Simpson@wsp.com>; matthewjones <matthewjones@iesisstructures.com>; GREEN, Martin (LPLON) <Martin.Green@lovell.co.uk>; Roger Jack <rogerjack@iesiscivils.com>; glenkeary <glenkeary@iesiscivils.com>; KHAN, Neelima (LPLON) <Neelima.Khan@lovell.co.uk>
Subject: RE: 21/01882/FP Rhee Spring - Conditions (6,7,8)

Hi Fabrizio

Apologies for delay in responding to Gareth's email of 01 July and your email of 03 July.

Thank you for the justification for the box culvert. We're happy with the approach Gareth describes. Would it be possible to run a 1% AEP + CC event through the culvert and check the calcs, or to receive equivalent supporting info that the sizing is appropriate?

Best wishes,



David Uncle
Principal Flood Risk Officer
Lead Local Flood Authority | Growth and Environment
Hertfordshire County Council
Address: Farnham and Robertson House, Six Hills Way, Stevenage, SG1 2ST
Postal Point: CHN215
T: 01992 555839 E: david.uncle@hertfordshire.gov.uk



IESISGROUP

Technical Summary

The existing culvert has a cross-sectional area of approximately 0.30 m², which is equivalent to the proposed open watercourse cross-sectional area.

The replacement culvert beneath the new road crossing will provide a clear flow area of 0.50 m². This has been achieved by selecting a standard precast culvert unit to provide both hydraulic capacity and ease of construction.

To maintain the natural characteristics of the watercourse, the culvert has been intentionally oversized to allow the invert to be buried by approximately 0.30 m. This enables the reinstatement of a natural channel bed within the culvert, promoting ecological continuity and preserving existing flow conditions. The proposed culvert unit is therefore 0.8 m high × 1.0 m wide, providing a clear hydraulic flow area of 0.50 m², which exceeds that of the existing culvert.

The proposed arrangement has been assessed using industry-standard hydraulic modelling software, with the modelling results included in **Appendix A**.

A bespoke setting-out and construction detail is provided in **Appendix B**, while the proposed culvert, headwall and mammal shelf details are included in **Appendix C**.

We trust the information provided demonstrates that the proposed culvert has been appropriately designed and that the requirements of the planning condition have been satisfactorily addressed. We therefore respectfully request that the associated planning condition be discharged.



Gareth Wilby
BSc (Hons) FIHE MCIHT AMICE
Director

Appendix A

Proposed culvert calculations

Design Settings

Rainfall Methodology	FEH-13	Maximum Time of Concentration (mins)	30.00	Preferred Cover Depth (m)	1.200
Return Period (years)	100	Maximum Rainfall (mm/hr)	50.0	Include Intermediate Ground	✓
Additional Flow (%)	0	Minimum Velocity (m/s)	1.00	Enforce best practice design rules	✓
CV	0.750	Connection Type	Level Soffits		
Time of Entry (mins)	10.00	Minimum Backdrop Height (m)	0.200		

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
1	0.480	14.00	70.000	600	525838.718	234036.369	0.300
2			69.618	600	525836.643	234117.994	0.300
3			69.240	600	525832.771	234196.842	0.300
4	0.080	12.00	68.952	600	525810.805	234248.920	0.300
5	0.120	10.00	68.073	600	525779.926	234313.613	0.300
6	0.120	8.00	68.100	300	525752.838	234373.775	0.800
7			68.100	300	525748.565	234383.013	0.850

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.000	1	2	81.651	0.030	69.700	69.318	0.382	213.7	300	16.02	50.0
1.001	2	3	78.943	0.030	69.318	68.940	0.378	208.8	300	17.95	50.0
1.002	3	4	56.521	0.030	68.940	68.652	0.288	196.3	300	19.29	50.0
1.003	4	5	71.685	0.030	68.652	67.773	0.879	81.6	300	20.38	50.0

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
1.000	0.674	232.5	65.1	0.000	0.000	0.480	0.0	173	0.488
1.001	0.682	235.2	65.1	0.000	0.000	0.480	0.0	173	0.493
1.002	0.703	242.6	65.1	0.000	0.000	0.480	0.0	170	0.503
1.003	1.091	376.3	75.9	0.000	0.000	0.560	0.0	150	0.727



Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.004	5	6	65.979	0.030	67.773	67.300	0.473	139.5	300	21.70	50.0
1.005	6	7	10.178	0.030	67.300	67.250	0.050	203.6	500	21.94	50.0

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
1.004	0.834	287.8	92.2	0.000	0.500	0.680	0.0	184	0.625
1.005	0.708	353.8	108.4	0.300	0.350	0.800	0.0	179	0.605

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)
1.000	81.651	213.7	300	Swale	70.000	69.700	0.000	69.618	69.318	0.000
1.001	78.943	208.8	300	Swale	69.618	69.318	0.000	69.240	68.940	0.000
1.002	56.521	196.3	300	Swale	69.240	68.940	0.000	68.952	68.652	0.000
1.003	71.685	81.6	300	Swale	68.952	68.652	0.000	68.073	67.773	0.000
1.004	65.979	139.5	300	Swale	68.073	67.773	0.000	68.100	67.300	0.500
1.005	10.178	203.6	500	Box Culvert	68.100	67.300	0.300	68.100	67.250	0.350

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.000	1	600	Manhole	Adoptable	2	600	Manhole	Adoptable
1.001	2	600	Manhole	Adoptable	3	600	Manhole	Adoptable
1.002	3	600	Manhole	Adoptable	4	600	Manhole	Adoptable
1.003	4	600	Manhole	Adoptable	5	600	Manhole	Adoptable
1.004	5	600	Manhole	Adoptable	6	300	Manhole	Adoptable
1.005	6	300	Manhole	Adoptable	7	300	Manhole	Adoptable

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
1	525838.718	234036.369	70.000	0.300	600				
						0	1.000	69.700	300
2	525836.643	234117.994	69.618	0.300	600		1	1.000	69.318
						0	1.001	69.318	300
3	525832.771	234196.842	69.240	0.300	600		1	1.001	68.940
						0	1.002	68.940	300
4	525810.805	234248.920	68.952	0.300	600		1	1.002	68.652
						0	1.003	68.652	300
5	525779.926	234313.613	68.073	0.300	600		1	1.003	67.773
						0	1.004	67.773	300
6	525752.838	234373.775	68.100	0.800	300		1	1.004	67.300
						0	1.005	67.300	500
7	525748.565	234383.013	68.100	0.850	300		1	1.005	67.250
									500



Simulation Settings

Rainfall Methodology	FEH-13	Analysis Speed	Normal	Additional Storage (m³/ha)	20.0	100 year 360 minute (m³)
Summer CV	0.750	Skip Steady State	✓	Check Discharge Rate(s)	✓	
Winter CV	0.840	Drain Down Time (mins)	240	Check Discharge Volume	✓	

Storm Durations

15	60	180	360	600	960	2160	4320	7200	10080
30	120	240	480	720	1440	2880	5760	8640	

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)	Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
2	0	0	0	100	0	0	0
30	0	0	0	100	40	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)	

Results for 2 year Critical Storm Duration. Lowest mass balance: 98.92%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	1	14	69.850	0.150	35.9	4.8301	0.0000	OK
15 minute winter	2	18	69.475	0.157	42.5	0.0445	0.0000	OK
15 minute winter	3	22	69.093	0.153	43.7	0.0434	0.0000	OK
30 minute winter	4	31	68.762	0.110	40.7	0.6153	0.0000	OK
30 minute winter	5	32	67.917	0.144	41.3	1.1890	0.0000	OK
30 minute winter	6	33	67.397	0.097	40.7	0.2964	0.0000	OK
30 minute winter	7	33	67.344	0.094	40.2	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 winter	1	1.000	2	42.5	0.437	0.183	8.2417	
15 minute winter	2	1.001	3	43.7	0.447	0.186	7.8787	
15 minute winter	3	1.002	4	36.7	0.455	0.151	4.6595	
30 minute winter	4	1.003	5	38.7	0.501	0.103	5.7340	
30 minute winter	5	1.004	6	39.4	0.541	0.137	4.9221	
30 minute winter	6	1.005	7	40.2	0.423	0.114	0.9677	64.6

Results for 30 year Critical Storm Duration. Lowest mass balance: 98.92%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	1	12	69.917	0.217	89.6	6.9955	0.0000	OK
15 minute winter	2	15	69.546	0.228	99.2	0.0645	0.0000	OK
15 minute winter	3	19	69.165	0.225	107.2	0.0636	0.0000	OK
30 minute winter	4	27	68.823	0.171	104.9	0.9586	0.0000	OK
30 minute winter	5	28	67.978	0.205	117.3	1.6964	0.0000	OK
30 minute winter	6	29	67.500	0.200	121.8	0.6142	0.0000	OK
30 minute winter	7	29	67.442	0.192	120.1	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 winter	1	1.000	2	99.2	0.542	0.427	15.8549	
15 minute winter	2	1.001	3	107.2	0.566	0.456	15.3762	
15 minute winter	3	1.002	4	97.2	0.592	0.401	9.4492	
30 minute winter	4	1.003	5	101.9	0.669	0.271	10.9879	
30 minute winter	5	1.004	6	113.7	0.659	0.395	11.3918	
30 minute winter	6	1.005	7	120.1	0.613	0.339	1.9945	162.6

Results for 100 year Critical Storm Duration. Lowest mass balance: 98.92%

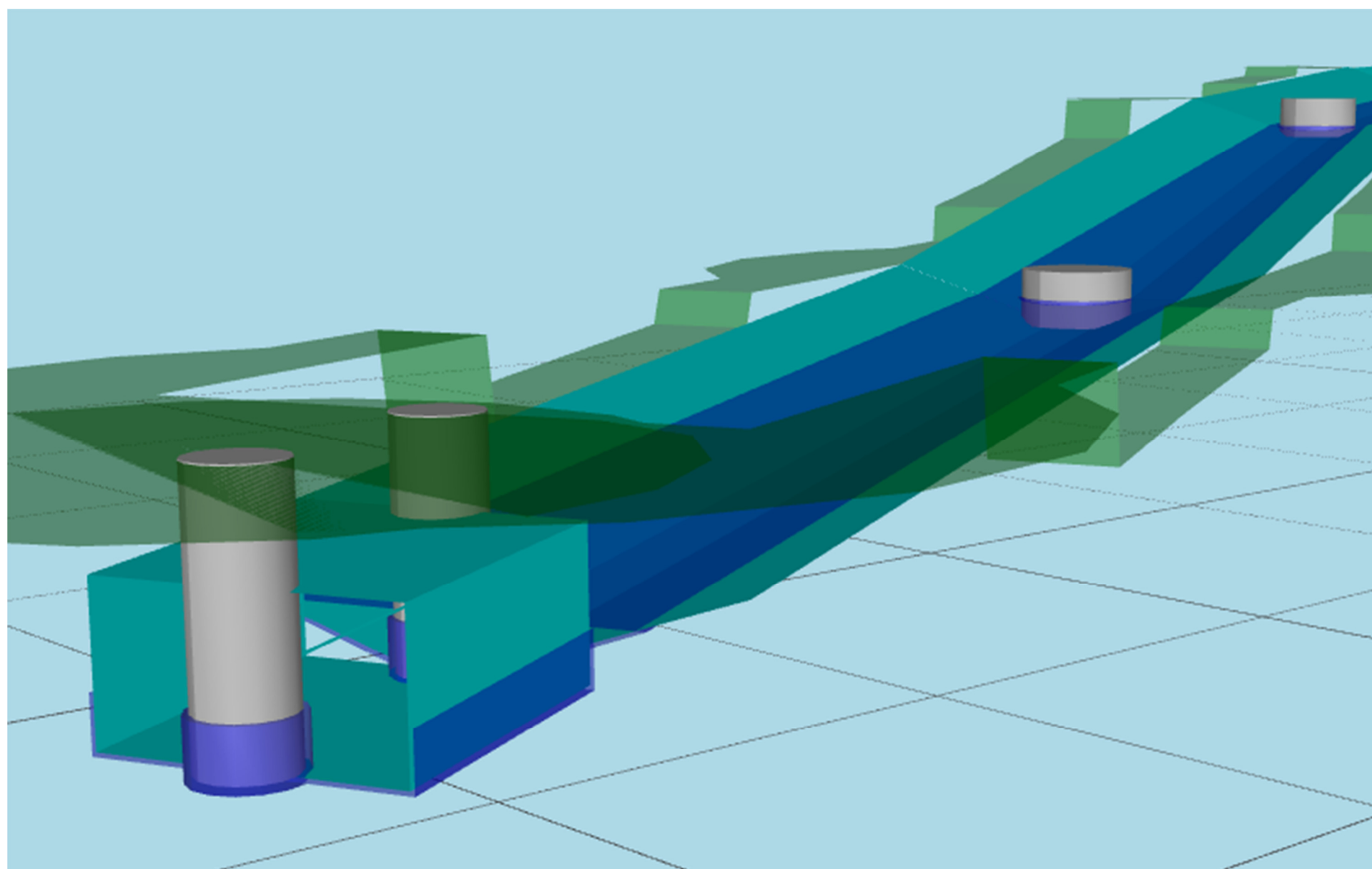
Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	1	12	69.938	0.238	115.8	7.6744	0.0000	OK
15 minute winter	2	15	69.568	0.250	124.9	0.0708	0.0000	OK
15 minute winter	3	18	69.188	0.248	134.1	0.0701	0.0000	OK
15 minute winter	4	20	68.845	0.193	140.2	1.0813	0.0000	OK
30 minute winter	5	27	68.000	0.227	155.5	1.8791	0.0000	OK
30 minute winter	6	27	67.544	0.244	165.9	0.7491	0.0000	OK
30 minute winter	7	27	67.484	0.234	160.3	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 winter	1	1.000	2	124.9	0.574	0.537	18.7107	
15 minute winter	2	1.001	3	134.1	0.601	0.570	18.2886	
15 minute winter	3	1.002	4	124.6	0.631	0.513	11.3516	
15 minute winter	4	1.003	5	133.9	0.741	0.356	13.1209	
30 minute winter	5	1.004	6	149.2	0.665	0.519	14.8668	
30 minute winter	6	1.005	7	160.3	0.671	0.453	2.4297	212.9

Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 98.92%

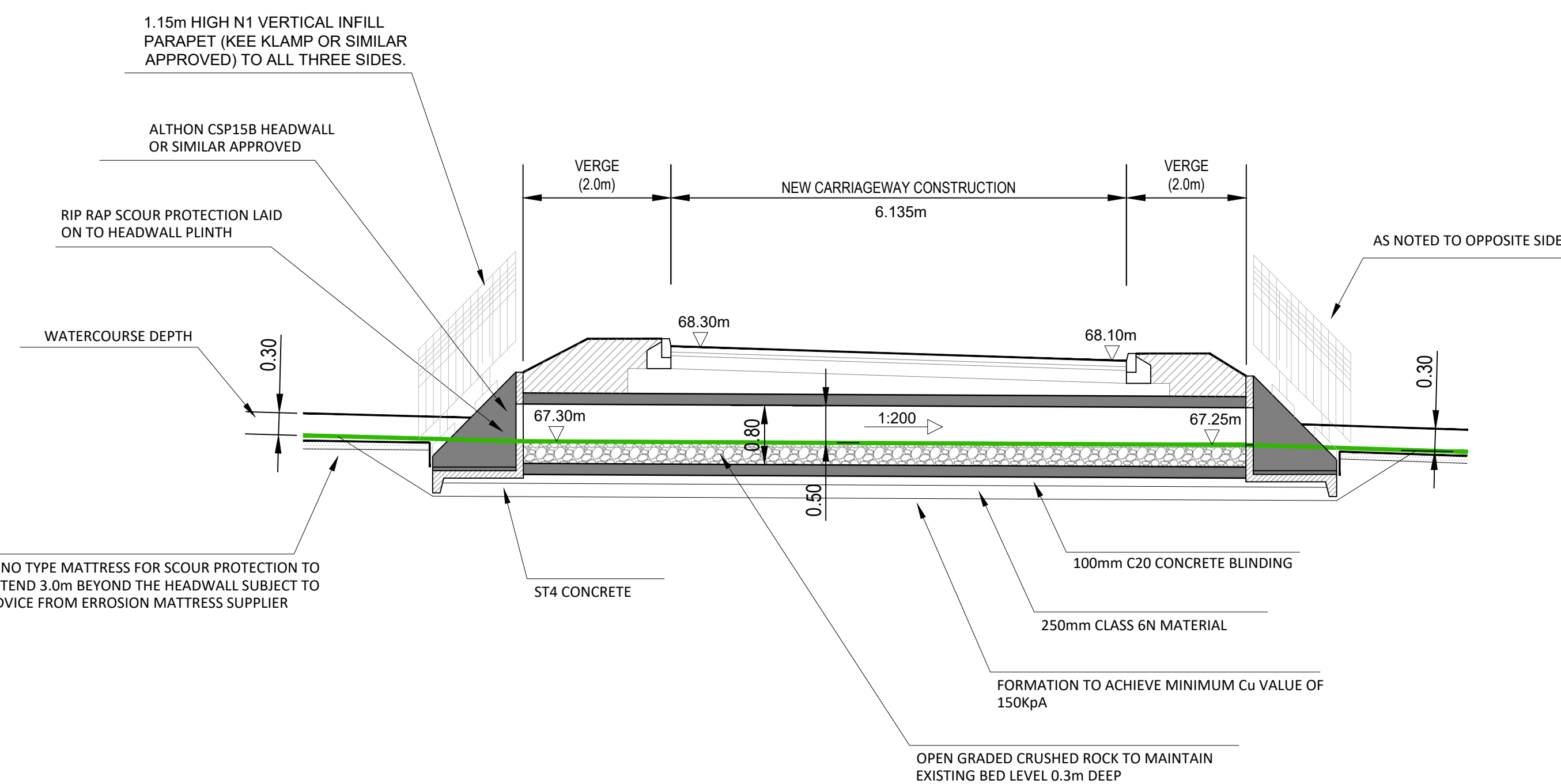
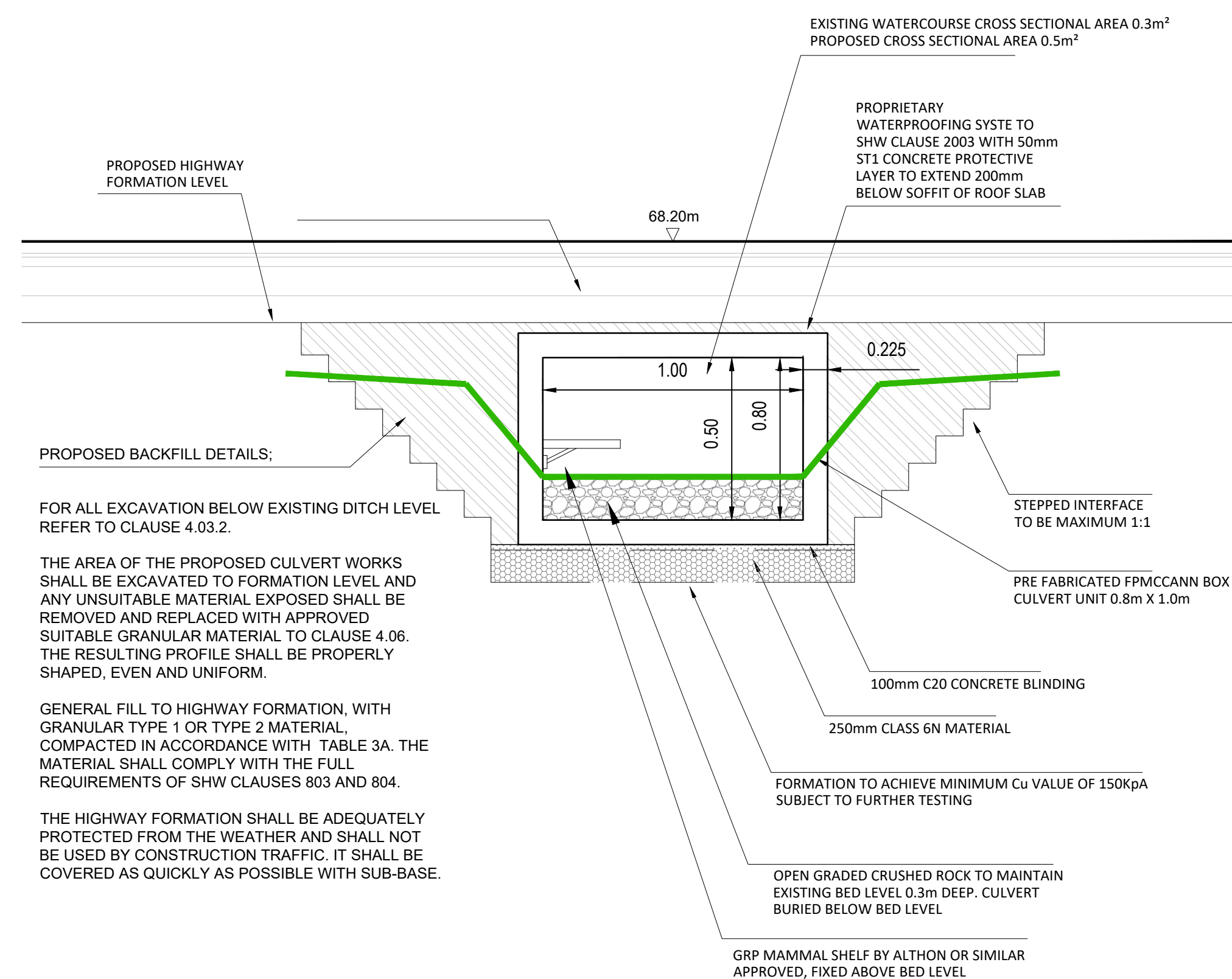
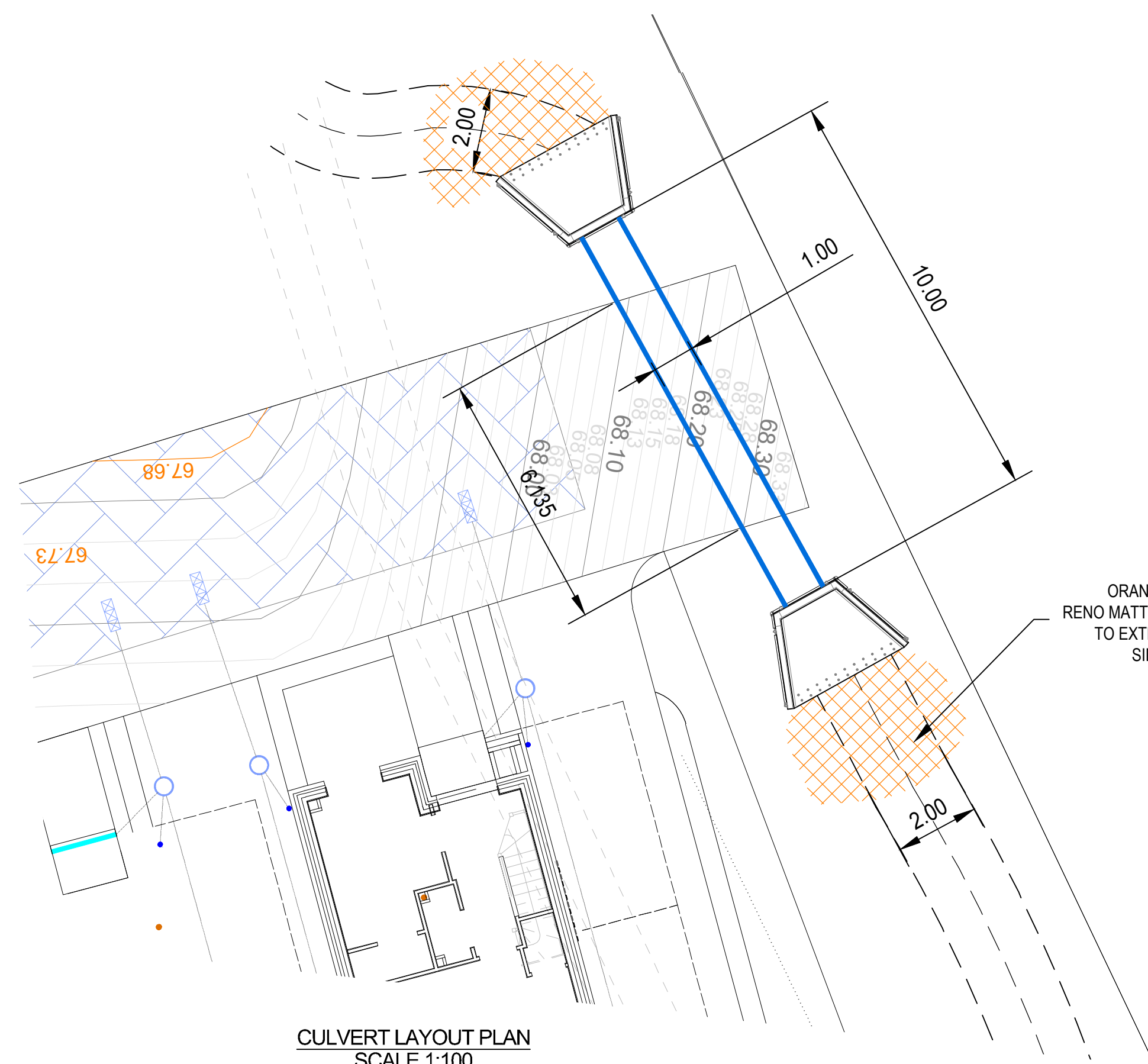
Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	1	11	69.967	0.267	162.1	8.6048	0.0000	OK
15 minute winter	2	14	69.598	0.280	164.2	0.0794	0.0000	OK
15 minute winter	3	17	69.220	0.280	182.3	0.0793	0.0000	OK
15 minute winter	4	19	68.876	0.224	195.8	1.2582	0.0000	OK
30 minute winter	5	26	68.037	0.264	218.4	2.1851	0.0000	OK
30 minute winter	6	26	67.616	0.316	239.8	0.9693	0.0000	OK
30 minute winter	7	26	67.552	0.302	231.6	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 winter	1	1.000	2	164.2	0.617	0.706	23.2388	
15 minute winter	2	1.001	3	182.3	0.649	0.775	22.8209	
15 minute winter	3	1.002	4	171.1	0.684	0.705	14.3640	
15 minute winter	4	1.003	5	189.6	0.812	0.504	16.8345	
30 minute winter	5	1.004	6	212.3	0.658	0.738	21.5271	
30 minute winter	6	1.005	7	231.6	0.750	0.655	3.1420	298.2



Appendix B

Proposed culvert detail drawing



- # NOTES
1. **DO NOT SCALE THIS DRAWING ON PRINT OR ELECTRONICALLY. WORK FROM FIGURED DIMENSIONS ONLY.**
2. No deviation from the details shown on this drawing is allowed without IESi's prior permission in writing.
3. Read this drawing with all Architects, Service Engineers and IESi's relevant details and drawings. **NB.** Setting-out dimensions as per the Architect's drawings take precedence.
4. All work is to be in accordance with the relevant specifications issued by IESi, British Standard Codes of Practice, Statutory requirements and the Contract Documents.
5. **DRAWING STATUS**
- P - PRELIMINARY** - Evolving drawings for approvals, Tenders, Billings, etc.
- C - CONSTRUCTION** - Fully developed drawings issued under instruction for construction.
- ONLY STATUS C DRAWINGS TO BE USED FOR CONSTRUCTION.**
6. **SUITABILITY CODE**
- WORK IN PROGRESS:**
- S0** - Work in progress
- SHARED (NON-CONTRACTUAL):**
- S1** - For coordination, **S2** - For information, **S3** - For internal review and comment, **S4** - For construction approval
- DOCUMENTATION (FOR CONTRACTOR PURPOSES):**
- D1** - For costing, **D2** - Tender, **D3** - For contractor design, **D4** - For manufacture / procurement.
- CONSTRUCTION:**
- A** - For construction, **B** - For construction but with comments (i.e. areas in awaybone),
C - Comprehensive revisions required.

P1	ISSUED FOR APPROVAL	23.07.26	KW
Status/Rev	Description	Date	By

IESISCIVILS

20 IRONMONGER LANE | LONDON | EC2V 8EP | UK
0207 600 2912
www.iesisgroup.com

Job Title
ROYSTON ROAD (SITE 13), BALDOCK
Client
CHALKDENE DEVELOPMENTS

CULVERT DETAILS

drawn	date	scale @ A1	C1 checked	ISIS Project No.
GW	JULY'26	VARIES	-	SE1877

Drq No.	Suitability	Status/Revision
RR-ISS-XX-XX-DR-C-3860	D2	P1

Appendix C

Supporting suppliers details



v2.5



OUR COMPANY

FP McCann is the UK's largest manufacturer and supplier of precast concrete solutions. We are committed to high quality, cost-effective and sustainable solutions tailored to meet clients' requirements.

From our fourteen UK manufacturing facilities, FP McCann offers solutions that include architectural and structural solutions, rooms, flooring, fencing, walling, shafts, tunnels, drainage, rail, power and agricultural products. FP McCann has worked on a large range of Design for Manufacture and Assembly (DfMA) projects across the UK. Our in-house Digital Engineering capability has grown in line with government and client expectations.

OUR COMPREHENSIVE PRECAST CONCRETE BUSINESS EXTENDS TO INCLUDE:

**AGRICULTURE | BOX CULVERTS | BUILDING PRODUCTS | CONCRETE ROOF TILES
DOCK LEVELLER PITS | DRAINAGE | FENCING | FILTER BED SYSTEMS
FLOORING | POWER & INFRASTRUCTURE | PRECAST OFF-SITE BUILDING SOLUTIONS
RAIL | SPECIALIST PRECAST | TANKS & CHAMBERS | TUNNELS & SHAFTS | WALLING**

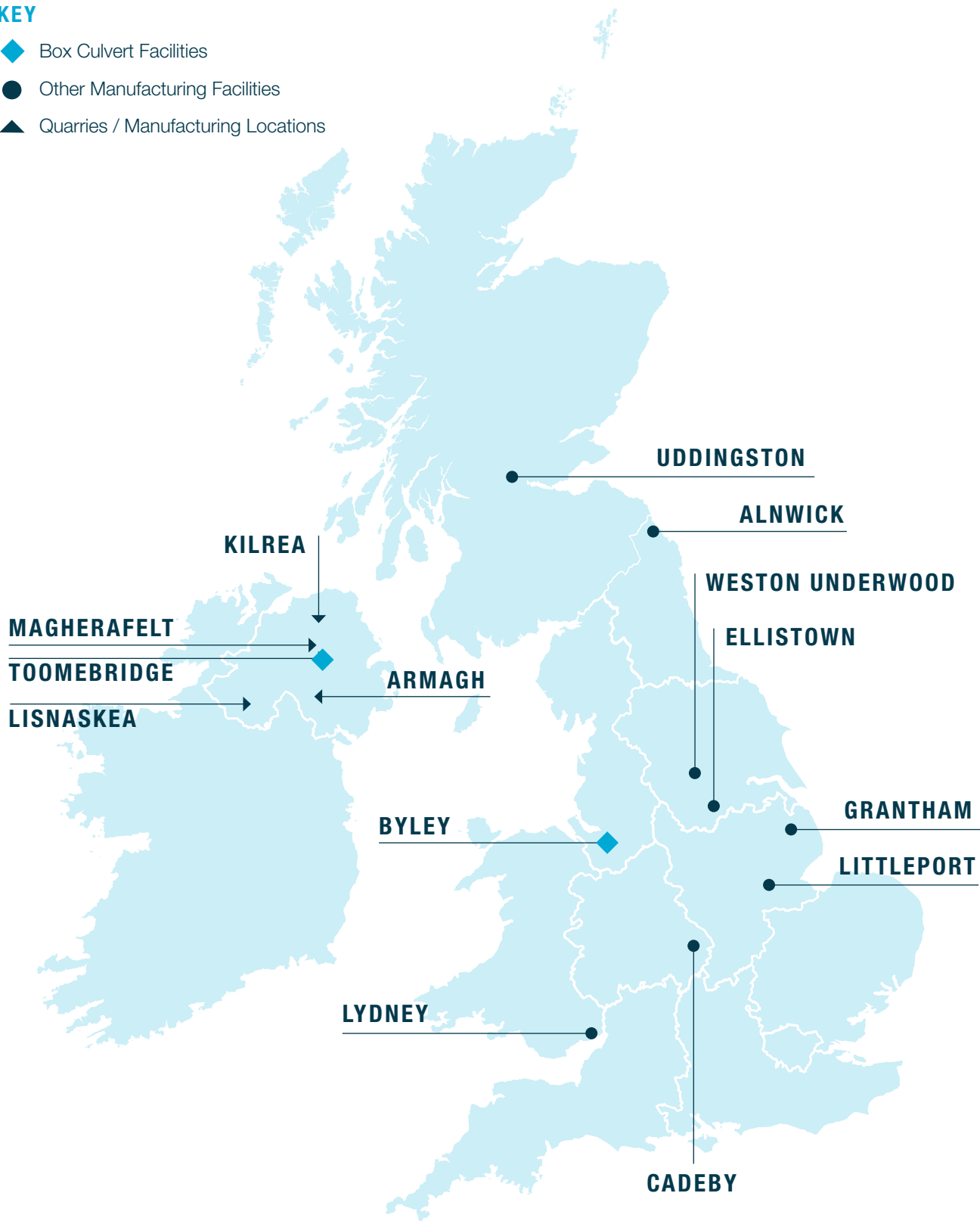
Modern manufacturing plants at Alnwick (Northumberland), Armagh (Northern Ireland), Byley (Cheshire), Cadeby (Leicestershire), Ellistown (Leicestershire), Grantham (Lincolnshire), Lisnaskea (Northern Ireland), Littleport (Cambridgeshire), Lydney (Gloucestershire), Magherafelt (Northern Ireland), Toomebridge (Northern Ireland), Uddingston (Lanarkshire) and Weston Underwood (Derbyshire) incorporate the latest computerised batching, distribution, casting, curing and handling systems and are operated by skilled and experienced workforces to ensure consistency of quality. Their geographical spread gives us an unrivalled ability to serve the construction industry throughout the UK and Ireland.

By applying the DFMA principles, FP McCann's design engineers are able to evaluate individual precast concrete products part by part, in addition to documenting the assembly process step by step. This allows them to generate the cost, part count and assembly time to provide a benchmark to measure its success and identify the parts and process improvement opportunities. In turn, this has allowed FP McCann to design and manufacture more cost-effective and efficient high-quality precast concrete products with less wastage and greater on-site recycling. As a result, increased productivity, combined with a reduction in production time and costs, allows FP McCann to be more competitive within the marketplace.

OUR COMPANY

KEY

- ◆ Box Culvert Facilities
- Other Manufacturing Facilities
- ▲ Quarries / Manufacturing Locations





ADDITIONAL FEATURES

These are varied and can be added to any culvert, as per requirement. For example, end walls, access points, vent holes, inlets, outlets, angles and splayed ends. Starter bars and sockets can be added to facilitate any additional casting on-site, which may be required as part of the finished work.

BOX CULVERT APPLICATIONS

- Attenuation and storage tanks
- Water course diversion
- Open channels
- Road crossings
- Pedestrian and vehicle subways
- Shafts
- Service tunnels and ducts
- Conveyor protection

Designed and manufactured in accordance with all current design specifications and relevant standards, FP McCann's box culverts are available in span sizes from 1000mm to 6000mm and internal heights from 500mm to 3600mm.

With our extensive range of moulds, we also strive to accommodate non standard variances, along with any other internal features requested by the client.

Based in a modern production facility at Byley, Cheshire, FP McCann's experienced engineers and detailing team have the flexibility to quickly respond to meet any design criteria and deliver nationally to just-in-time requirements.

Supplied in either single or multiple runs, the use of precast concrete box sections in civil engineering projects is wide-ranging, from their use for directing/diverting watercourses to the provision of attenuation tanks and underpasses.

FP McCann is a member of the British Precast Drainage Association (BPDA) and their products comply with all relevant standards, as set out in accordance with ISO 9001 and ISO 14001.



BOX CULVERTS

TYPICAL CULVERT

Units are available in internal span sizes from 1000mm to 6000mm and internal heights from 500mm to 3600mm, with unit lengths to a maximum of 2000mm, dependent on final mould configuration (please refer to internal dimensions chart opposite).



DRY WEATHER FLOW CHANNELS

Half round (or equivalent) channels can be cast into the floor of the units at any position, we offer a choice of equivalent half round diameters.



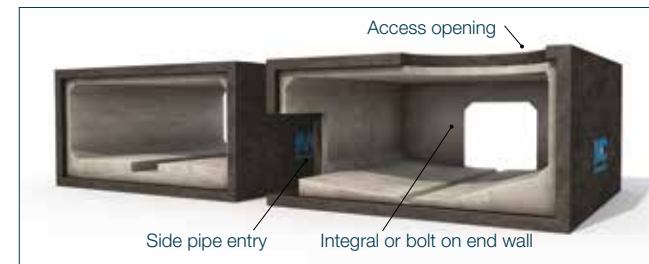
BENCHING

Combined with either a channel or cast as a "vee", benching improves self-cleansing flow rates.



MAMMAL LEDGES

Cast-in mammal ledges allow access through the culvert to wildlife without the requirement for extra site provisions.



SPECIALS

Bespoke units accommodating a variety of features can be manufactured to our customers' design requirements.

The proven strength and performance characteristics of precast concrete box culverts, together with their excellent service life, make them ideal for a wide variety of civil engineering and construction applications. Box culvert sections can be manufactured in a variety of internal profiles and sizes, offering exceptional versatility in the uses to which they can be applied.

In addition to the more common use for diverting water courses, box culverts have been used in an array of applications including balancing tanks, pedestrian subways, access shafts, service tunnels, sea outfalls, road crossings and many other situations where the whole life costing consideration requires strength, durability and economy to be of paramount importance.

Unlike other materials such as steel, precast concrete box culverts do not require additional treatments to prolong their life or improve performance. The concrete surface will not rust and the smooth internal finish of the box culvert ensures optimum flow of water through the concrete structure.

Precast concrete box culverts fulfil the current design life requirements for buried structures. With minimum maintenance and the ability to provide many years of service, precast concrete box culverts are the most cost-effective means of diverting water courses, especially with the ever present risk of corrosive elements in the water or soil.

Whilst the methods and procedures for the installation of precast concrete box culverts are familiar to contractors, careful attention to detail will lead to safer working, a smoother flow of operations and a higher standard of finished culvert. Box Culvert installation and jointing details can be downloaded from www.fpmccann.co.uk/box-culverts

This guide provides a reliable checklist for anyone engaged in the installation of box culverts. It is published to encourage good practice in the use of precast box culverts.



BOX CULVERTS

INTERNAL DIMENSIONS

(Based on flat invert culvert units)
Key: Flow area m² / Discharge rate m³/sec

		Width mm (internal span)															
Internal height mm		1000	1200	1500	1800	2100	2400	2700	3000	3300	3600	3900	4200	4500	4800	5100	5400
	500	0.46 0.40	0.56 0.51	0.71 0.67	0.86 0.84	1.01 1.00	-	-	-	-	-	-	-	-	-	-	-
	600	0.56 0.53	0.68 0.67	0.86 0.89	1.04 1.11	1.22 1.33	-	-	-	-	-	-	-	-	-	-	-
	650	0.61 0.60	0.74 0.76	0.93 1.00	1.13 1.25	1.32 1.50	1.52 1.75	1.71 2.00	-	-	-	-	-	-	-	-	-
	800	0.76 0.81	0.92 1.03	1.13 1.33	1.37 1.67	1.61 2.01	1.85 2.36	2.09 2.71	2.33 3.06	2.57 3.42	2.81 3.77	3.05 4.12	-	-	-	-	-
	1000	0.96 1.10	1.16 1.40	1.43 1.84	1.73 2.32	2.03 2.80	2.33 3.29	2.63 3.79	2.93 4.29	3.23 4.79	3.53 5.30	3.83 5.80	4.13 6.30	4.43 6.81	4.73 7.32	-	-
	1200	-	1.37 1.76	1.73 2.37	2.09 3.00	2.45 3.64	2.81 4.29	3.17 4.95	3.53 5.61	3.89 6.28	4.25 6.95	4.61 7.62	4.97 8.29	5.33 8.97	5.69 9.64	6.05 10.32	6.41 11.00
	1500	-	-	2.18 3.21	2.63 4.09	3.08 4.98	3.53 5.89	3.98 6.81	4.43 7.74	4.88 8.68	5.33 9.62	5.78 10.57	6.23 11.52	6.68 12.48	7.13 13.44	7.58 14.40	8.03 15.37
	1800	-	-	-	3.17 5.21	3.71 6.38	4.25 7.57	4.79 8.78	5.33 10.00	5.87 11.24	6.41 12.48	6.95 13.74	7.49 15.00	8.03 16.27	8.57 17.54	9.11 18.82	9.65 20.10
	2100	-	-	-	-	4.34 7.83	4.97 9.31	5.60 10.83	6.23 12.36	6.86 13.92	7.49 15.49	8.12 17.07	8.75 18.67	9.38 20.27	10.01 21.89	10.64 23.50	11.27 25.13
	2400	-	-	-	-	-	5.69 11.11	6.41 12.94	7.13 14.81	7.85 16.70	8.57 18.62	9.29 20.55	10.01 22.50	10.73 24.46	11.45 26.44	12.17 28.42	12.89 30.41
	2700	-	-	-	-	-	-	7.22 15.11	8.03 17.32	8.84 19.57	9.65 21.84	10.46 24.14	11.27 26.46	12.08 28.80	12.89 31.16	13.70 33.53	14.51 35.91
	3000	-	-	-	-	-	-	-	8.93 19.89	9.83 22.50	10.73 25.15	11.63 27.83	12.53 30.54	13.43 33.27	14.33 36.03	15.23 38.80	16.13 41.59
	3300	-	-	-	-	-	-	-	-	10.82 25.49	11.81 28.52	12.80 31.60	13.79 34.71	14.78 37.86	15.77 41.03	16.76 44.22	17.75 47.43
	3600	-	-	-	-	-	-	-	-	-	12.89 31.96	13.97 35.44	15.05 38.97	16.13 42.53	17.21 46.13	18.29 49.76	19.37 53.42

Please note: These figures are a guide only and will be dependent on the mould configuration used in manufacture. Discharge rates are calculated using Colebrooke-White equation for a fully wetted perimeter under uniform flow conditions and assuming a flat invert culvert unit. The assumed laying gradient (s) is 1:1000 with a roughness co-efficient (k) of 0.3. The hydraulic design of a box culvert should always be undertaken by the overall scheme designer, as they are able to take into account the upstream and downstream conditions and other parameters such as freeboard, restriction due to silt build-up and need for the culvert to be free flowing at all times. Due to the lack of this information, FP McCann will only give discharge rates for an idealised culvert, which may not suit the local conditions.

PORTAL FRAMES



Portal frames either consist up of an n-shaped upper unit and two L-shaped footings per ring, or simply just an n-section. The portal frame system offers a quicker and more economical alternative to bridge beams and abutments that are cast in-situ. Units can be designed for specified loadings, and fulfill Eurocode requirements.

KEY FEATURES

- Alternative to bridge beam construction
- Ball and socket joint between wall and roof
- Designed per project requirements
- Reduced insitu works
- Used for road infrastructure
- Bitumen coating can be factory applied if required



UAN culverts consist of two U-shaped sections, which can then be assembled on-site. A ball and socket joint is used between the two parts of the finished section. This option can be offered for larger box culverts that are unsuitable for transport as a monolithic structure or if there are any site specific weight constraints.

The popularity of UAN culverts is growing, largely due to their immediate stability, quick installation, and the flexibility in being able to manufacture culverts for a wider range of applications. Key uses include as an underbridge for road or rail, and in other road infrastructure projects.

KEY FEATURES

- Adjustable moulds mean the product can be made to accommodate a range of projects
- Instant stability
- Mammal ledges can be added to allow wildlife to safely pass through the culvert
- The ball and socket joint is typically located mid-height.
- Used for road infrastructure
- Bitumen coating can be factory applied if required

UAN CULVERTS



Box Culverts

installation guide

Whilst the methods and procedures for the installation of precast concrete box culverts may be familiar to contractors, careful attention to detail will lead to safer working, a smoother flow of operations and a higher standard of finished culvert installation.

This guide provides an overview for anyone engaged in the installation of box culverts and is published to encourage good practice in the installation of precast box culverts.

Taking Delivery

1. The contractor is responsible for offloading box culverts and should:

- Agree the delivery date and laying sequence, ideally 5 working days in advance of the proposed installation date
- Provide a suitable access and vehicle hard standing which can be used safely by standard delivery vehicles
- Provide a suitable crane and plant of adequate capacity to safely off load and install the culvert units
- Upon arrival on-site, the contractor must take responsibility for the safety of the driver whilst the products are offloaded
- The load recipient should be aware that to be on the back of a lorry during the offloading process constitutes “working at height” and as such, the requirements of the current Working at Height Regulations (2005) must be satisfied. It is the contractor's responsibility to carry out a risk assessment of the operation and to provide all suitable measures to access the vehicle trailer safely with fall protection provisions provided, as deemed necessary

2. Lifting methods may occasionally differ, but generally all FP McCann units are lifted using a pin and clutch system, details of which can be forwarded upon request. The contractor should:

- Confirm details of the lifting method being used
- Undertake all risk assessments in addition to providing all handling equipment necessary to safely operate the lifting method on site

3. Where other methods, such as lifting forks, beams or slings are to be used, the contractor should:

- Consult with our technical department to ensure that the proposed method is acceptable
- Protect the box culvert and particularly the joining surfaces from damage while lifting
- Ensure complete safety of operatives

4. Generally, box culverts are transported as laid, but for safety reasons of load stability, or economy, the box culverts may be transported on end. The contractor should:

- Check in which orientation the box culverts will be delivered
- Where box culverts are delivered on end, establish a safe method of turning the units to the as laid orientation. (Further guidance can be seen on the separate lifting and turning data sheet)
- Provide any equipment necessary for the operation

5. The box culverts may be offloaded into a storage area or they may be placed in line alongside the trench in which they are to be laid. In either situation:

- Before offloading, check the box culverts for any damage which may have occurred in transit and report any defects promptly
- Lower them carefully on to a firm level base away from the edge of the trench



- Box culvert units should be moved by lifting and never by dragging
- In cold weather, protect open lifting sockets from freezing and bursting

Preparing the Trench

1. Bedding is intended to level out any remaining irregularities in the trench bottom and ensure uniform support under the full width and length of the box culvert.
 - Lay well-compacted granular material over the full width of the trench to a minimum depth of 200mm, having first removed any protective layer
 - Blind the surface with fine material to assist levelling
2. Having achieved a flat, well prepared base, it should not be allowed to deteriorate.
 - Lay the bedding only a minimum distance ahead of the laying of box culverts
 - Keep off the prepared base so far as practicable
3. As an alternative to granular bedding, a concrete blinding layer is sometimes preferred to protect the formation or to allow faster laying of box culverts.
 - Lay a thin flat apron of unreinforced lean mix concrete about 75mm thick on a trench bottom which has been well prepared to a uniform firmness

Jointing Material

FP McCann can supply jointing material, if required, and this will usually be delivered on the first load to site. If, however, it is not supplied, the jointing material should be ordered in good time. In either case, the jointing material manufacturers storage instruction and application guides should be followed. Joints may be left open in certain cases but a preformed strip compressed within the joint is commonly used. The strip should be applied to the box culvert just before it is laid in the trench.

- Where necessary, clean and prime the inner and sloping faces both spigot and socket and allow to dry
- Place the strip in the internal corner of the socket or where otherwise directed
- Cut mitred ends and join the strip at corners and do not bend the strip
- Check all the joints in the strip to ensure that the strip is continuous
- Always follow the recommendations of the manufacturer of the jointing material

Laying the Culverts

A box culvert line is usually laid from the downstream end with sockets facing upstream to receive the next box culvert to be laid.

- Inspect the box culvert before laying to ensure that the jointing surfaces are clean and that no damage has occurred in handling and storage on-site
- Lower the box culvert carefully on to the prepared base, aligning the spigot with the socket of the unit already laid



- Prevent loose surface bedding material from entering the joint space during positioning of the unit by placing a hardboard strip beneath the base joint or by any other means
- If any adjustment to level is necessary, remove the box culvert and adjust the surface level of the bedding
- Do not use local packing to adjust the level

Making the Joint

When a preformed strip is used, joints are closed by pulling against the box culverts previously laid.

- Establish a suitable anchor position which will be dependent on the type of winch device being used
- Ideally, take the weight of the culvert unit to be jointed on the crane to reduce frictional resistance at the base of the box culverts
- Allow for a pulling/compression load of approximately one tonne per metre of strip to compress the jointing material
- Apply heat, as recommended, to soften bitumen based strip when the weather is very cold
- Close the joint to the specified nominal gap
- On completion, make good any holes used for lifting and laying

To provide an internal seal or to improve hydraulic flow, joints in box culverts of sufficient size may be pointed internally. This can take the form of an elastomeric or bitumen based material with a suitable primer or bond break material, if required. Not all methods and types of jointing, however, should be expected to be completely watertight.

Backfilling

Backfilling should commence as soon as possible after the box culverts have been laid.

- Fill the trench to the level of the top of the box culvert working evenly on each side
- Use selected backfill material well compacted in layers not exceeding 200mm
- Do not use heavy vibratory equipment
- Continue filling over the box culvert and compact in layers
- Do not run heavy rollers or construction plant over the box culvert without protection

Care must be taken since site traffic and construction equipment over shallow fill depths can impose loadings greater than those for which the finished box culvert has been designed. In such cases protective measures will be required.

Disclaimer:

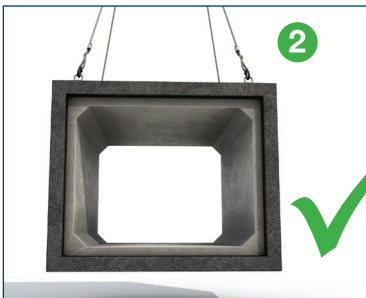
This document is produced as a guideline document to assist contractors with the proper handling and installation of box culverts and is not intended to be a substitute for site and product specific handling procedures lifting plans, and procedures and relevant safe systems of work. FP McCann bear no responsibility or any liability which may arise as the result of incorrect handling of the box culverts or as a result of any unapproved modification to the units. It is the responsibility of the contractor to ensure correct offloading equipment is available and that correct offloading procedures are adhered too. In addition, it is the responsibility of the contractor to ensure that the installation of box culverts is carried out in accordance with relevant health and safety procedures and in accordance with any specific site conditions. No part of this publication may be reproduced by any means without the permission of FP McCann.



Lifting in the 'as-laid' condition

Correct Method

1. Use a two or four leg sling or chain sets with hooks and safety catches to correspond with the number of available lifting points.
2. Only lift from the top face in the 'as laid' condition.



Incorrect Method

1. NEVER lift from the sides in the 'as laid' condition.
2. UNDER NO CIRCUMSTANCES should a unit be lifted on one side only.



Lifting in the 'as-cast' condition

Correct Method

1. Use a four leg sling with hooks and safety catches.
2. Use the lowest lifting points available when lifting in the 'as cast' condition.
3. Protect top edges.



Incorrect Method

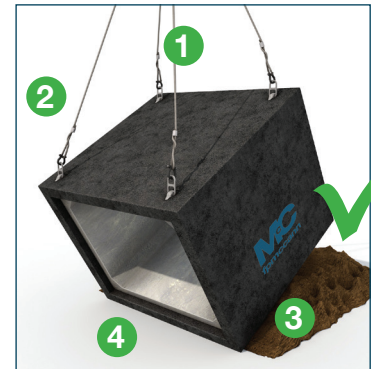
1. NEVER lift using top lifting points in the 'as-cast' condition.



Turning from the 'as-cast' condition to the 'as-laid' condition

Correct Method

1. Use a four or two leg sling with hooks and safety catches to correspond with the number of available lifting points.
2. Stand well clear
3. Provide soft landing material.
4. Cradle bottom edges.



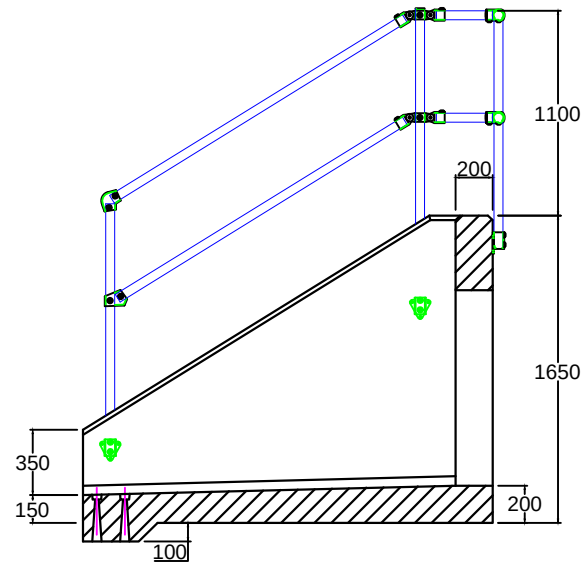
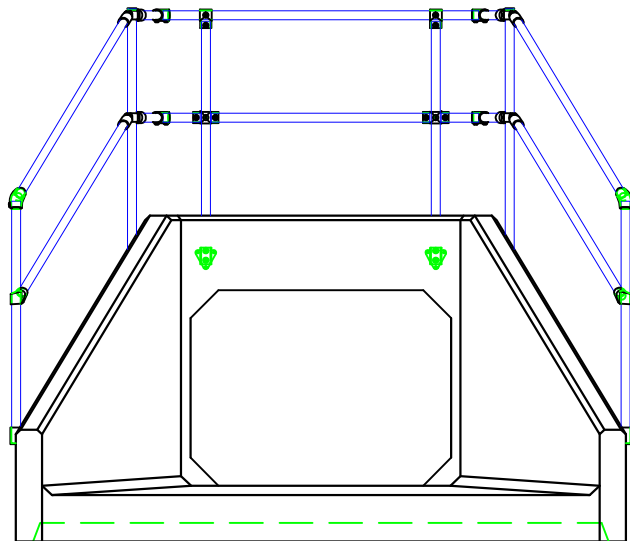
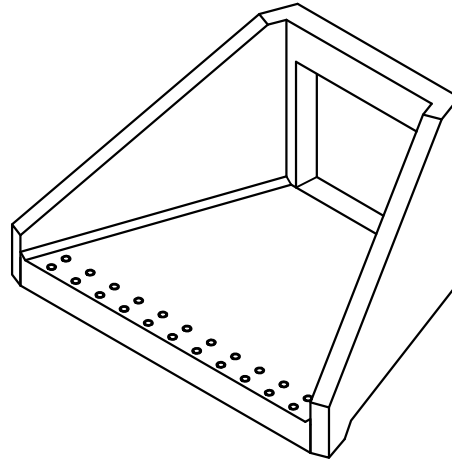
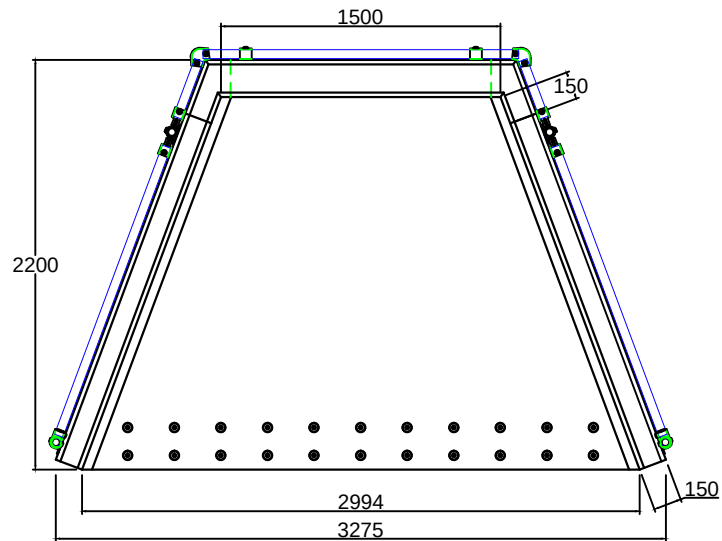
Incorrect Method

1. NEVER turn with lifting points remaining on the side.
2. NEVER turn without soft landing material.



CSP15B Specification Information

- Opening in back wall cast to mirror the internal profile of the Pcc box culvert its being used with
- Invert level of PCC box culvert can be set to your specification
- There is a 50mm fall from the back wall of the headwall to the front of the spillway
- Max internal dimensions of a PCC box culvert 1400mm wide and 1050mm high
- Culvert headwalls can include a variety of accessories including low flow channels, mammal shelves, handrails and gratings.



Kee Klamp Specification Information

- Galvanised steel kee klamp handrail
- 1100mm high above back wall
- GRP / FRP hand rails also available

Althon CSP15B Headwall Installation

Units should be bedded on minimum 150mm of well compacted selected, uniformly graded granular fill.
Material: Reinforced concrete
Weight approximately 5210kg
All dimensions in mm

ADDRESS: ALTHON LIMITED
VULCAN ROAD SOUTH
NORWICH
NR6 6AF

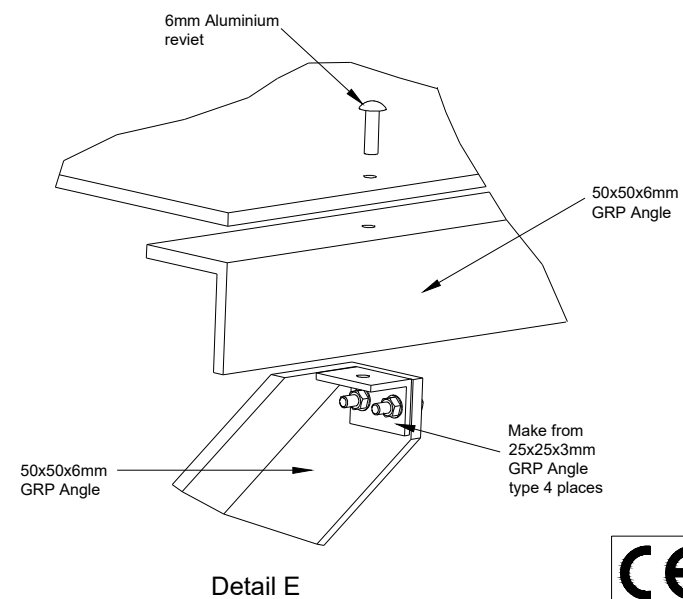
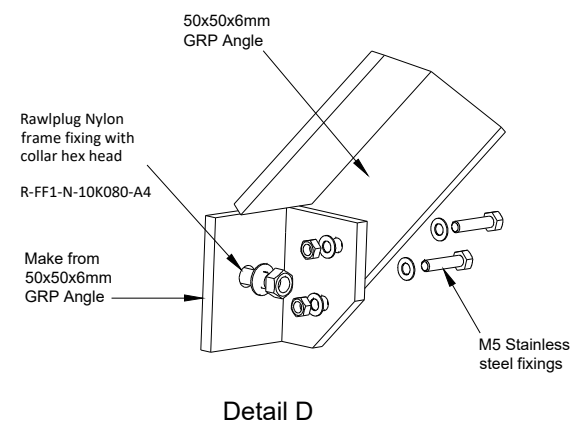
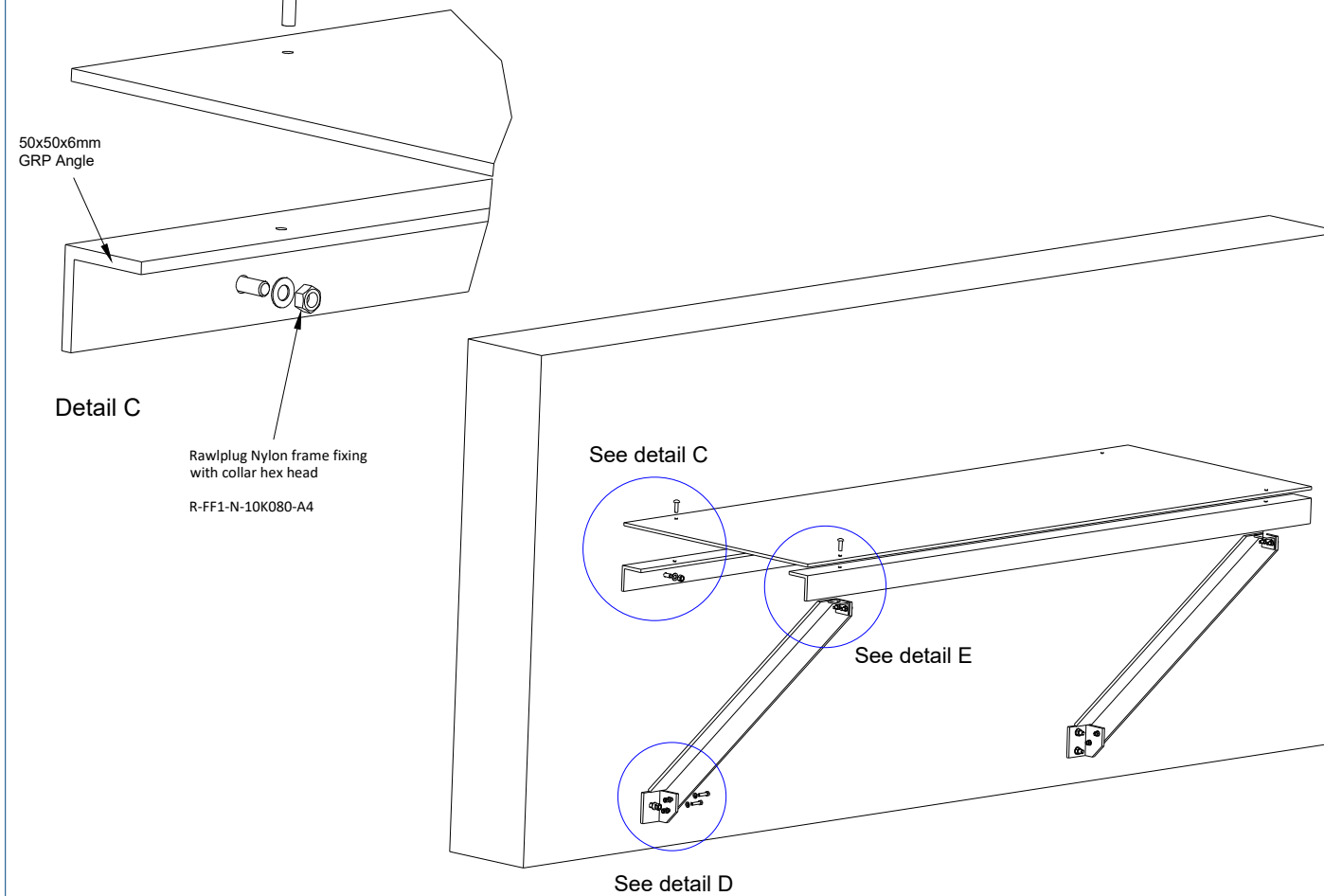
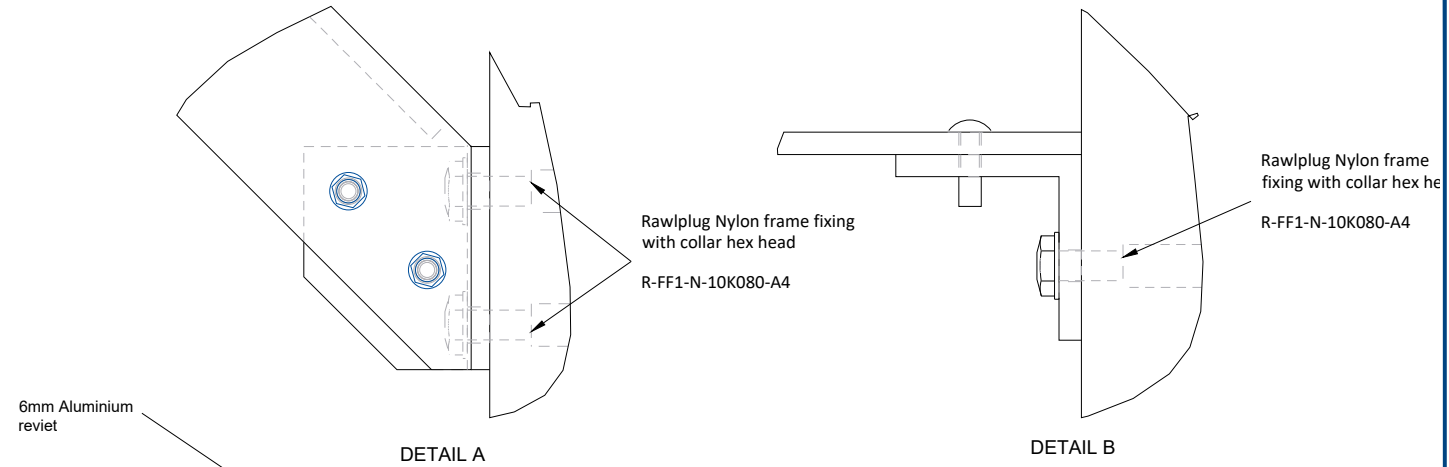
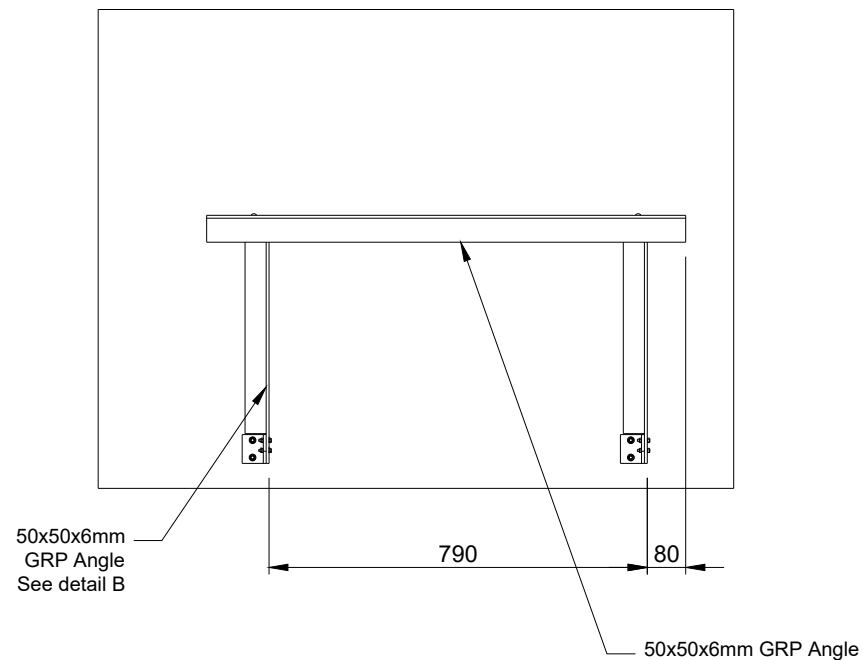
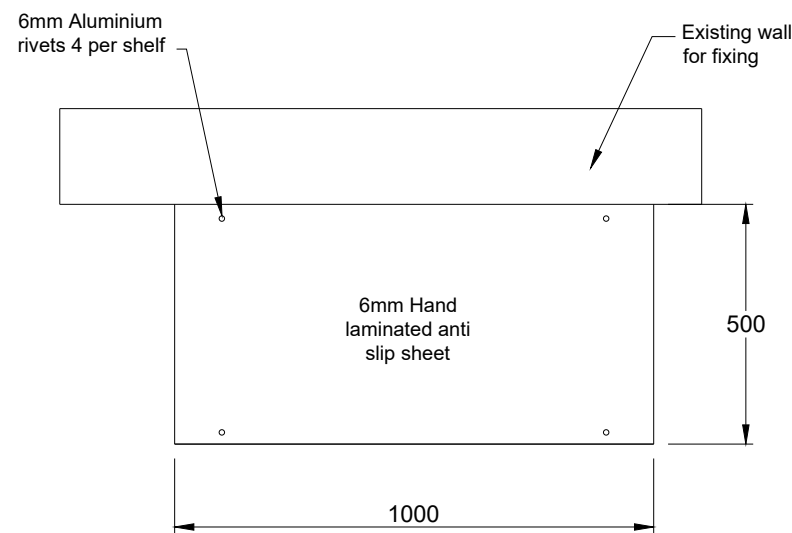
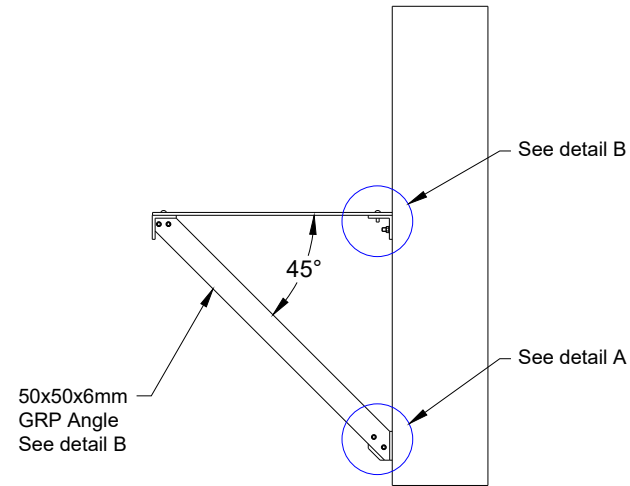
TEL: 01603 488700
FAX: 01603 488598
EMAIL: sales@althon.co.uk
WEBSITE: www.althon.co.uk

DRAWING TITLE:

CSP15B HEADWALL
+ 3 SIDED KEE KLAMP

SCALE: NTS PAPER: A1 DATE: 21 - 03 - 17

DRAWING No:



DO NOT SCALE DRAWING

- NOTES:**
- All dimensions are in millimeters unless noted otherwise
 - All dimensions are to be confirmed on site prior to commencement of works, any deviations found are to be reported to the engineer.
 - All fasteners M10 Stainless steel (unless stated otherwise)
 - All bolted connections to incorporate anti-vibration fittings / locking nuts
 - All pultruded sections produced to E23 quality specified in EN13706-3:2002

B	20/09/2021	Fixing Notes Updated
A	18/08/2021	Notes updated



ADDRESS: ALTHON LIMITED
VULCAN ROAD SOUTH
NORWICH
NR6 6AF

TEL: 01603 488700
FAX: 01603 488598
EMAIL: sales@althon.co.uk
WEBSITE: www.althon.co.uk

PROPRIETARY & CONFIDENTIAL

The information contained in this drawing is the sole property of Althon Limited. Any reproduction in part or as a whole without the written permission of Althon Limited is strictly prohibited.

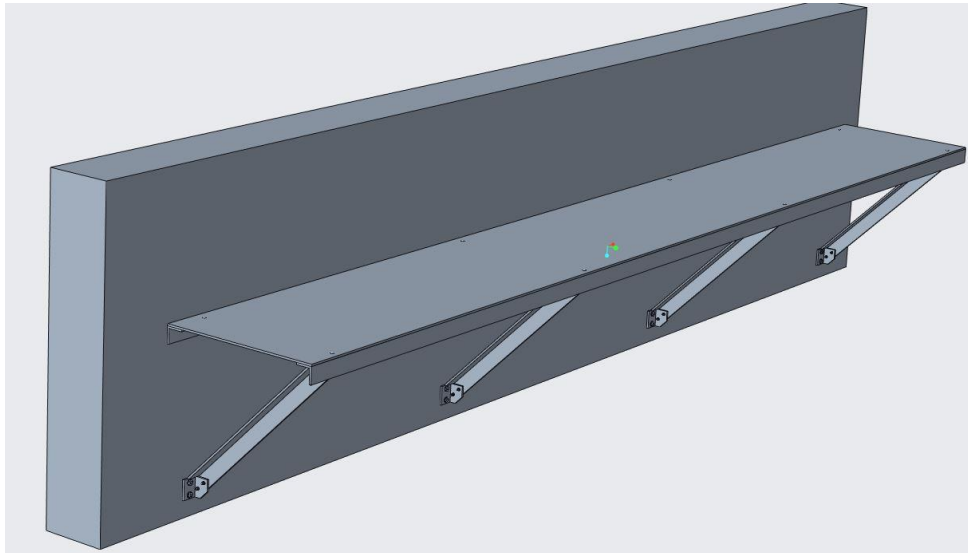
DRAWING TITLE / PROJECT:

Althon GRP Mammal Ledge c/w Support
Brackets 500 x 1000mm

SCALE:	NTS	PAPER:	A3	SHEET NO:	01 OF 01	DATE:	05 - 06 - 20
PRODUCT CODE:	ALTMAMLED	MATERIAL:	see component spec	PROTECTIVE FINISH:	Natural		
PRODUCT NAME:	Althon GRP Mammal Ledge B						



GRP Culvert Mammal Shelf (Ledge or Board) Specification & Design Life



- a) Design Life: 60 years
- b) Serviceability: Components used are:
- Isophthalic Glass Reinforced Plastic pultruded sections & panels
 - Non-corroding fasteners
- The resultant structure is:
- light in weight yet high in strength
 - durable & robust - capable of withstanding light mechanical impacts
 - non-corroding
 - suitable for damp or wet conditions and capable of repeated submersion in water
 - resistant to the following:
 - Freeze thaw cyclical effects
 - Degradation and weakening by UV radiation
 - Degradation by both high and low temperatures within a range of -35°C to + 40°C and concomitant expansion and contraction
 - Modular in design and capable of being easily replaced in the event of heavy impact damage
- c) Slip Resistance: The surface finish of the panel provides a minimum slip resistance value of 45 both 'in the dry' and 'in the wet' for '4S' grade rubber when measured in accordance with the PENDULUM floor friction test as developed by (CERAM) **(test report available on request)**
- d) Loading: The GRP Mammal Shelf is designed for an imposed load of 1kN/m². At 500mm shelf width, 1kN/m² is equivalent to 0.5kN/m or 50kg per metre.
- e) Applied Surface finish:
- The colour of the standard panel surface is black
 - A coating of aluminium oxide is applied to the upper (wearing) surface, which is bound by a vinylester resin and a final a topcoat of polyester resin applied.

		The anti-slip surface meets the following criteria when tested in accordance with the requirements of BS812: • Minimum particle size of 0.8mm • Minimum hardness value of 8 Moh • Maximum aggregate abrasion value 5 • The surface texture is equivalent to grit grade 16
f)	Size	• Surface panels are nominally 6mm thick • Length & depth of the panel section modules are 3000mm x 500mm • Overall height (base of cantilever support to upper surface) = approx. 516mm
g)	Durability	The bond between the panel components is such that it will not be affected by the applied loadings from expected traffic. The supporting frame and cantilever sections are manufactured in accordance with EN 13706 meeting minimum standards for mechanical properties.
h)	Surface Spread of Flame	The product is not especially attributed with fire resistant properties. However, the following can be said: • GRP pultruded sections are manufactured in a fire retardant version and tested to standard EN 13501. • The anti-slip panel surface is made from GRP which is self-extinguishing except under sustained, extreme heat and flame where it will support combustion, emitting dense smoke.
i)	Fixings	The panels modular sections are assembled and installed using a combination of non-corroding blind dome headed rivets, screws/nuts/washers and concrete expansion anchor bolts. Please refer to the design drawing for further information.
j)	Manufacture	All panel modules are prefabricated under factory conditions
k)	Quality & Certification	• All component parts are manufactured by ISO 9001 certified companies • The GRP sections used in this structure are manufactured in accordance with EN 13706 & EN 13501. • Structures are assembled under a QMS structured on the requirements of International Standard ISO 9001. This system addresses the design, development, production, installation and servicing of the company's products. • A Declaration of Performance for the products is available at the Engineer's request.
l)	Supply Portfolio	Commencing in 2015 we have manufactured and supplied this product to between 40-50 project sites, for contractors including: • Staffordshire Alliance JV • Balfour Beatty Vinci JV • Osborne Rail • Volker Fitzpatrick • Skanska Costain Strabag • Buckingham Group • Taylor Wimpey • Story Contracting



Installation

- | | | |
|----|--------------|--|
| 1) | Survey | The contractor shall carry out all necessary survey works to enable the production of manufacturing drawings and the panels themselves. |
| 2) | Drawings | The drawings will be sent prior to manufacture for the Engineer's approval in principle. Dimensional accuracy will remain the responsibility of the contractor. |
| 3) | Installation | All installation works should be carried out in strict accordance with the manufacturer's instructions, in adherence to all local site regulations and Health & Safety law. |
| 4) | Alteration | The alteration of panels on site should only be carried out by suitably trained personnel to ensure that re-sealing of edges is carried out in accordance with the manufacturer's specification. |

Service Life, Routine & Maintenance Inspections

The structural integrity of the product carries a design life of 60 years and is guaranteed to be free from manufacturing defect in both design and construction. GRP materials have been used successfully in building and constructions since the 1950s, with no discernible degradation in performance to the present day. Some fading of colours may take place over time where the product is continually exposed to sunlight.

Unless the product is subject to conditions outside of the design criteria, no extra routine inspection of the structure of the panels would be required, outside of the normal scheduled inspection of the surrounding structures.

Disposal & Environmental Considerations

GRP is an inert product. Presently, scrap and waste material may be either disposed of in approved landfill facilities adhering to local regulatory handling and documentation requirements, or it may be processed by select handlers for the incorporation into solid recovered fuel to provide energy for heavy manufacturing. Please contact Evergrip for further details. The material presents no special hazard to the environment. At present, options for recycling are in development within the EU. It is expected that by the end of life for new products, that these processes will be well established.

Handling, Re-working & Machining of GRP Materials - COSHH Advisory Notes

Operators should observe correct Manual Handling techniques when lifting & moving products to prevent personal injury.

General guidelines are when cutting or machining GRP products with power tools, the material produces a non-toxic, biologically inert dust. The dust levels should be kept as low as is reasonably practicable and must not exceed the Occupational Exposure Limit of 10mg/m³ total inhalable dust and 4mg/m³ respirable dust – 8 hour TWA value. When working out of doors, it is unlikely that these levels will be reached. When working indoors or in confined spaces, adequate ventilation should be provided and when extensive operations are necessary, suitable dust extraction should be provided. Operators should wear suitable dust masks (FFP2) & goggles.

In isolated cases, GRP dust may cause slight, transient skin irritation. Should these effects become prolonged or should any signs of a rash occur, medical advice should be sought. All exposed skin should be thoroughly washed with soap and water. Any eye contamination should be washed out with copious amounts of bottled sterile water or fresh clean water. Do not smoke, eat or drink in working areas.

END OF NOTE