

AtkinsRéalis



Cavan Bridge Culvert NIS

Transport Infrastructure Ireland

16/12/2024

5219387DG0065

TO 332 NORTHWEST BRIDGES TERM MAINTENANCE

Notice

This document and its contents have been prepared and are intended solely as information for Transport Infrastructure Ireland and use in relation to Cavan Bridge Culvert NIS.

AtkinsRéalis assumes no responsibility to any other party in respect of or arising out of or in connection with this document and/or its contents.

Document history

Document title: Cavan Bridge Culvert NIS

Document reference: 5219387DG0065

Revision	Purpose description	Originated	Checked	Reviewed	Authorised	Date
0.0	Draft for Comment	SK	SK	POD	POD	29-11-24
1.0	Final	SK	SK	POD	POD	16-12-24

Client signoff

Client	Transport Infrastructure Ireland
Project	TO 332 NORTHWEST BRIDGES TERM MAINTENANCE
Job number	5219387

Client signature/date



Contents

1.	Introduction.....	6
1.1	Proposed Works.....	8
1.1.1	Project Description.....	8
2.	Scope of Study	20
2.1	Legislative Context.....	20
2.1.1	Natura 2000	20
2.1.2	Appropriate Assessment.....	20
2.1.3	Competent authority.....	21
2.2	Appropriate Assessment Process.....	21
3.	Methods.....	23
3.1	Legislation and Guidance	23
3.2	Desk Study.....	24
3.3	Site Visit	24
3.4	Statement of Authority.....	25
4.	Existing Environment	26
4.1	Desktop Review	26
4.2	Site Visit	28
5.	Connectivity to Natura 2000 sites.....	36
5.1	Zone of Influence	36
5.2	Identification of Sites	37
5.2.1	Direct Impacts	37
5.2.2	Disturbance to habitats	37
5.2.3	Disturbance to fauna.....	37
5.2.4	Potential impacts on water quality	37
5.2.5	Invasive alien species	38
5.2.6	Summary.....	38
5.3	Description of Natura 2000 Sites	41
5.3.1	River Finn SAC (site code: 002301)	41
5.3.2	River Foyle and Tributaries SAC (UK0030320).....	43
6.	Assessment of Adverse Effects.....	48
6.1	Identification of Potential Impacts	48
6.1.1	River Finn SAC	48
6.1.2	River Foyle and Tributaries SAC	49
6.1.3	Summary.....	49
6.2	Analysis and Evaluation of Effects.....	49
6.2.1	Summary.....	54
7.	Mitigation.....	55
7.1	Requirement and Approach	55

7.2	Mitigation Measures	55
7.2.1	Construction Phase	55
7.2.2	Operational Phase	63
7.3	Assessment of Residual Effects	63
7.4	Potential In-combination Effects	64
7.4.1	Requirement for Assessment.....	64
7.4.2	Approach and Methodology	64
7.4.3	Geographical Scope.....	64
7.4.4	Timescale	64
7.4.5	Plans / Projects	65
7.4.6	Conclusion	65
8.	Conclusion	66
9.	References	67
Appendix A.	Section 50 Application.....	72

Tables

Table 5-1 - Designated sites within the Zol of the proposed works.	39
Table 5-2 - Threats, pressures, and activities with negative impacts on the River Barrow and River Nore SAC (Eionet 2022).	42
Table 5-3 - Threats, pressures, and activities with negative impacts on the River Foyle and Tributaries SAC (JNCC, 2024).	47
Table 6-1 - Qualifying Interests of the River Finn SAC within the Zol of the proposed works.	48
Table 6-2 - Qualifying Interests of the River Foyle and Tributaries SAC within the Zol of the proposed works.	49
Table 6-3 - Evaluation of effects on the River Finn SAC (LSE-likely significant effect).	50
Table 6-4 - Evaluation of effects on the River Foyle and Tributaries SAC (LSE-likely significant effect).	52

Figures

Figure 1.1 - Location of the Proposed Works on the Cavan Bridge Culvert (red cross) (Source: EPA Map Viewer)...	6
Figure 1.2 - Location of the proposed works (red cross) in relation to the surrounding river network (blue) (Source: EPA Map Viewer).	7
Figure 1.3 - Aerial image of Cavan Bridge Culvert (highlighted in red) with the Cavan Stream running from south to north (Source: Google Map [accessed 05/11/2024]).	7
Figure 1.4 - Site Location Plan for Cavan Bridge Culvert.....	15

Figure 1.5 - Site Location Plan for Cavan Bridge Culvert, the proposed VRS and site compound.	16
Figure 1.6 - Overall Layout Plan.	17
Figure 1.7 - Proposed Culvert Layout Plan.	18
Figure 1.8 - Proposed traffic diversion plan.	19
Figure 2.1 - Stages of the Appropriate Assessment process (EC, 2021a).	22
Figure 5.1 - Location of the proposed works on Cavan Bridge Culvert (red circle) in relation to the River Finn SAC (orange area) (Source: Bing Aerial Map).....	40

Plates

Plate 1.1 - The stream channel flowing beneath Cavan Bridge, large boulders present. There is also a fibre optic cable running under the bridge.

Plate 1.2 - View of Cavan Bridge (culvert).

Plate 1.3 - Contamination within the stream, possibly due to the high agriculture presence / slurry.

Plate 1.4 - Dense vegetation surrounding Cavan Bridge and the stream/ ditch - mainly grass and bramble.

Plate 1.5 - Improved agricultural grassland and the stream / ditch to the right.

Plate 1.6 - Cavan Bridge Culvert and stream/ditch to the left and the N14 to the right.

Plate 1.7 - Upstream face of masonry section heavily overgrown with vegetation. Some arch facing stones have collapsed.

Plate 1.8 - Downstream face of bridge with shallow concrete arch extension to original masonry structure.

Plate 1.9 - Watercourse downstream of bridge with Himalayan Balsam.

Plate 1.10 - Himalayan Balsam at Cavan Bridge Culvert.

Plate 1.11 - Himalayan Balsam at Cavan Bridge Culvert.

Plate 1.12 - Himalayan Balsam along the road.



1. Introduction

AtkinsRéalis was commissioned by Transport Infrastructure Ireland (TII) to prepare a Screening for Appropriate Assessment report to provide ecological advice with respect to the demolition of the existing structure and the construction of a new box culvert at the same location, Cavan Bridge (culvert) (DL-N14-011.50) under the Northwest Term Maintenance Contract (TMC4) (“the proposed works”). The location of the proposed works on Cavan Bridge Culvert is illustrated in Figure 1.1 below. The location of the proposed works in relation to the surrounding watercourses is illustrated in Figure 1.2 below. Figure 1.3 below shows an aerial view of the proposed works.

This report comprises the Appropriate Assessment Screening Report and the Natura Impact Statement in respect of the proposed works and is intended to assist TII, in its capacity as the competent authority in this case, by providing it with sufficient evidence to make a properly informed determination in respect of the proposed works.

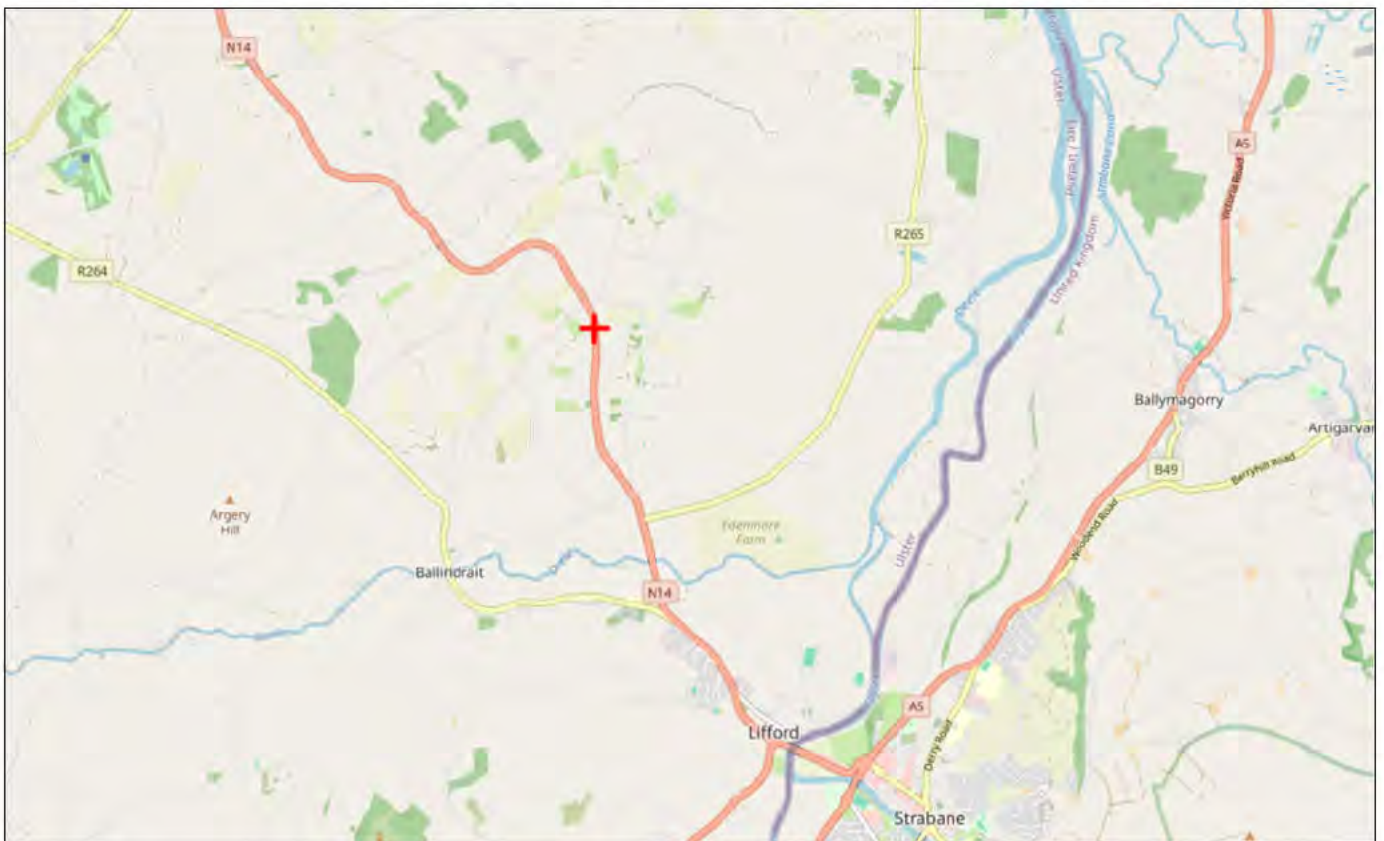


Figure 1.1 - Location of the Proposed Works on the Cavan Bridge Culvert (red cross) (Source: EPA Map Viewer).

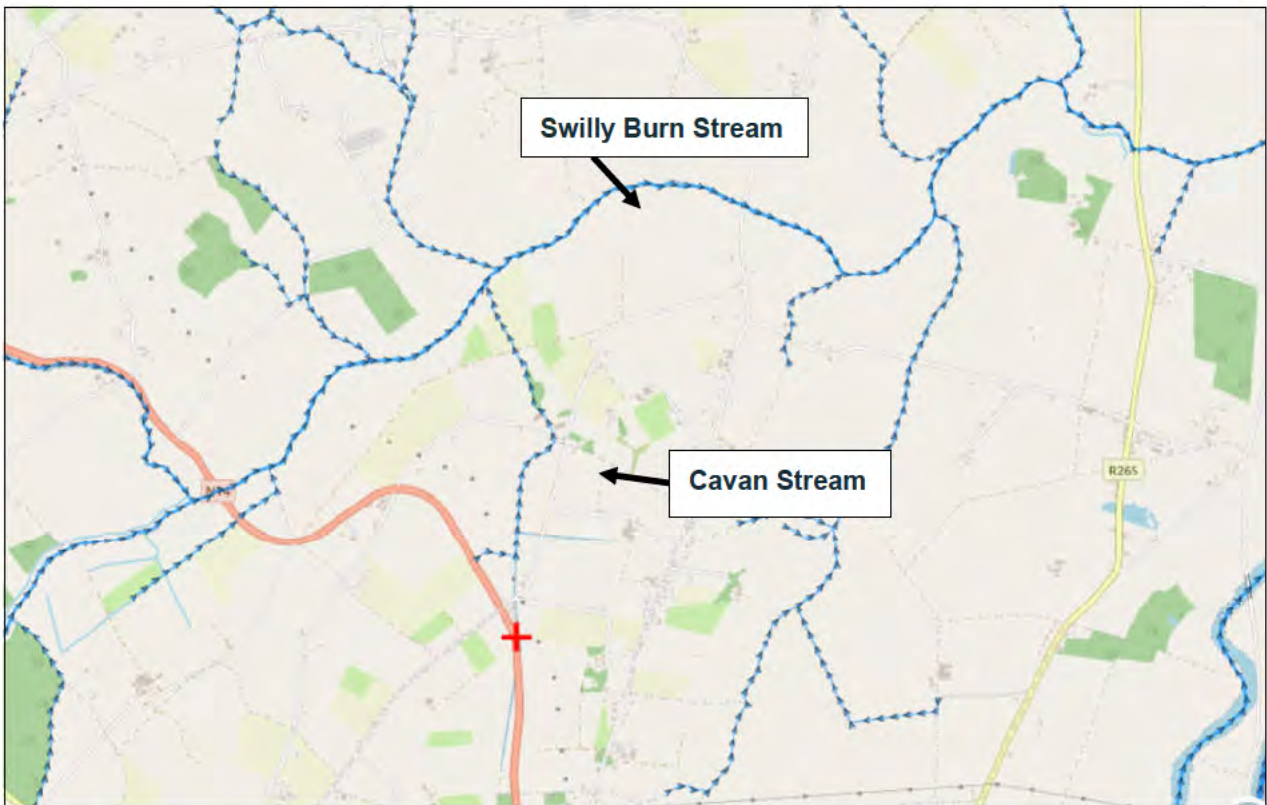


Figure 1.2 - Location of the proposed works (red cross) in relation to the surrounding river network (blue) (Source: EPA Map Viewer).



Figure 1.3 - Aerial image of Cavan Bridge Culvert (highlighted in red) with the Cavan Stream running from south to north (Source: Google Map [accessed 05/11/2024]).



1.1 Proposed Works

The Cavan Bridge Culvert (DL-N14-11.50) is located on the national road N14 within the townlands of Cavan, Donegal, approximately 3.8 km northwest of Lifford. The culvert spans the Cavan Stream, a first-order tributary of the Swilly Burn Stream, positioned around 480 meters downstream. As it continues downstream, the stream converges with the River Foyle, approximately 5.7 km away, eventually joining the River Finn SAC (site code: 002301) approximately 6.6km downstream and the River Foyle and Tributaries SAC (UK0030320) which is located across the border in Northern Ireland also ca. 6.6km downstream of the proposed works.

The current culvert is in a state of disrepair, prompting Transport Infrastructure Ireland (TII) to undertake the demolition of the existing structure and the construction of a new box culvert at the same location.

1.1.1 Project Description

The current culvert is in a state of disrepair, prompting Transport Infrastructure Ireland (TII) to undertake the demolition of the existing structure and the construction of a new box culvert at the same location.

The following text (taken from the Contractor's method statement) outlines the program of works for the construction of Cavan Bridge Culvert, including the scheduling of activities to be carried out during complete road closure, lane closures, and normal working hours. The program shall be designed to ensure efficient project execution while minimizing disruptions to traffic and nearby stakeholders and the project duration shall not exceed 8 weeks.

The Contractor is also required to work to the specification for the works shall be read in conjunction with the Lot 1 North West Bridges Term Maintenance Contract No. 4.

1.1.1.1 Establishment of Site Compound

- A site compound of circa 66m x 100m will be established on the western side of the culvert as per Figure 1.5 below.
- The soil excavation and preparation of the ground for the crane platform and construction vehicle paths will be formed within the site compound.
- Excavated materials will be stacked in the designated area in the southern part of the site compound, ensuring organized storage and efficient use of space.
- Materials stacking within the site compound shall be allowed to provide a sufficient buffer zone and prevent contamination of the stream.

1.1.1.2 Water Management

- The construction is expected to be carried out in dry conditions, as the stream is anticipated to be dry for most of the year.
- If water is present, it will be necessary to redirect water away from the works area.
- The stream will be dammed upstream while maintaining buffer zones to the construction sites, using appropriate methods such as sealed sandbags; with waters flumed to pumped around the works area in order to prevent any local deterioration in water quality.
- The stream will be dammed downstream near the outlet of the culvert to allow the flow of the stream on the eastern side and prevent contamination.
- Access across the stream to the southern part of the site compound shall be prepared in the dry region created by pumping.

- Prior to mobilisation on site the appointed Contractor is to consult with their Ecologist, with respect to agreed approach to works.

1.1.1.3 Delivery and Storage of Backfill Material

- All backfill granular material will be delivered to the site before main works and stored in the northern part of the site compound.

1.1.1.4 Excavation and Material Disposal

- Excavated material will be stacked in the southern part of the site compound, requiring a temporary path crossing the river to the southwest of the culvert.

1.1.1.5 Ground Improvement

- If areas of soft ground are identified, these will require excavation and replacement when located beneath foundations.
- Excavation of soft soils/made ground and replacement with Class 6N1 or 6N2 will be used to form the foundation for embankments and the sub formations of structures.
- The outlines for excavation and replacement shown on the drawings reflect the permanent works requirement only, based on available Site Investigation data. If and where additionally made ground is encountered and over-excavation is required, the revised extent of required excavation shall be recorded and confirmed on site by the ER following removal of soft soils/made ground and measurement of the shear strength of the underlying strata. The final extent of material to be excavated before the placement of the fill shall be agreed upon with the ER.
- The Contractor shall submit specific method statements for these areas which address excavation methodology, stability of adjacent land and safety issues. Excavation of soft soils/made ground by the Contractor shall not impede/undermine the stability of the existing embankments/structures/roads.
- Extreme care will be required when excavating adjacent to the watercourses. The Contractor shall submit specific method statements for these areas which address excavation methodology, stability of adjacent land and safety issues.
- Extreme care will also be required when working in the vicinity of overhead cables, pole supports and buried services.
- An exclusion zone should be established to ensure that traffic loading from the construction plant does not affect the excavation.

1.1.1.6 Materials

- The excavation shall be backfilled with Class 6N1 or 6N2 selected granular fill. A secure source of acceptable Class 6N1 or 6N2 shall be required as well as a continuous supply to on-site stockpiles. Where required works shall be sequenced to ensure there are no delays between excavation and backfilling
- On-site supplies as required shall be stored near the excavation before commencing work to allow the whole excavation to be backfilled quickly in the event of instability adjacent to the excavation.

1.1.1.7 Methodology

- The depth of soft soils/made ground excavated is to be recorded either by survey where safely practical, or by estimation of depth to hard ground by observation of excavator bucket where survey is not practical e.g. underwater excavation.

- The length and width of excavation bays shall be maintained at a size to minimise the amount of disturbed ground in front and to the sides of the excavation. The excavation operation should be monitored by the ER
- Should the extent of the soft soils/made ground vary across the site, from that shown in the GI information, the Contractor should immediately report to the ER.
- Should any signs of instability be observed or occur within or beyond the excavated area, the excavation sides should be immediately backfilled.
- If instability continues or complete failure occurs, Excavation and Replacement works shall halt immediately, and the ER notified. The Contractor shall undertake appropriate temporary works to support the excavation.
- If the Contractor is unable to progress excavations due to an obstruction, he shall inform the Employer's Representative immediately.
- The Contractor and the ER shall agree in advance the minimum setback distances between excavations and disposal areas.
- Where groundwater is encountered the following will apply: Groundwater will be controlled by pumping. Under no circumstances should any groundwater be pumped directly into water courses.

1.1.1.8 Excavation for Culvert

- Excavation for the culvert will be carried out with a standard 1:2 slope, with steps. While all works will take place over an 8-week period, the actual replacement of the culvert will take place over a long weekend, starting on Friday at 18:00 hrs.
- During the excavation of Cavan Bridge Culvert, the existing structure is required to be demolished.
- The existing masonry arch/slab concrete bridge must be completely demolished. Before initiating this work, the contractor should provide a method statement that accounts for all risks involved, including risk mitigation measures, which must be approved by the Employer representative. While the arch bridge is stable in its entirety, it becomes unstable when parts of it are demolished or damaged. This aspect needs to be incorporated into the demolition process. If necessary, the contractor should conduct structural analysis based on their methodology for demolition.
- Throughout the demolition process, ensure compliance with all applicable regulations, permits, and contractual agreements. Demolition equipment should only be operated by qualified personnel trained in safe demolition practices. Identify utilities passing through or adjacent to the bridge and undertake relevant precautions and approvals before commencing work.
- Utilize appropriate demolition equipment to dismantle and remove all remaining bridge components, including arches and abutments. Transport demolished materials to designated disposal sites in compliance with environmental regulations.
- Implement measures to minimize environmental impact, including erosion control and dust suppression. Dispose of hazardous materials according to regulatory requirements to mitigate environmental risks. Personal protective equipment (PPE) must be worn at all times during demolition activities.
- Keep detailed records of demolition activities, including logs, photographs, and safety reports. Prepare a final demolition report documenting all work performed and any deviations from the specifications.
- Construction vehicles are not permitted to operate in the stream except at the designated crossing point upstream as described in Item 2. During riverbed excavation, the excavator and tipper trucks will be positioned on the stream bank. The excavated material will be loaded onto tipper trucks positioned on the river banks and delivered to a designated stacking area in the site compound using only the designated crossing point in the stream upstream.

1.1.1.9 Protection of EXA Service Line

- The EXA fibre duct shall be adequately protected and supported during construction activities to prevent damage or disruption to telecommunications infrastructure. The duct shall be surrounded by concrete over the extent of the excavation.

1.1.1.10 Culvert Invert Level and Excavation in Riverbed

- The new culvert invert level will be placed 300mm below the existing riverbed.
- A minimum of 650mm (300mm embedment + 200mm foundation slab + 150mm Class 6N Granular material) will be excavated in the existing riverbed.

1.1.1.11 Geotextile Installation

- Geotextile will be installed to separate the existing riverbed and a minimum 150mm Class 6N material.
- Once the excavation is completed, the formation is covered with geotextile to prevent contamination.

1.1.1.12 Placement of Class 6N Granular Material

- A minimum 150mm thick layer of Class 6N granular material will be placed in the excavated riverbed.

1.1.1.13 Placement of Precast Box Segments

- 1.5m x 1.5m clear opening 2m long box segments (6 no.) will be placed along the riverbed using a 160 T mobile crane located in the western side of the site compound.
- The use of precast culverts ensures speedy construction with minimal disturbance to the stream bed and surrounding habitat.

1.1.1.14 Waterproofing of Precast Segments

- All precast concrete segments will be waterproofed in the manufactured yard prior to placement for speedy construction.

Preamble

- The waterproofing system is to be installed in accordance appropriate technical specifications.
- Should there be any contradiction between the requirements of appropriate technical specifications, the Specification requirement shall take precedence unless otherwise agreed by the Employers Representative.
- All materials of the waterproofing system are to be as stated on the PWS (Proprietary Waterproofing System) Data Sheet.
- No substitution of any of the stated materials is permitted.

General Requirements

- Immediately before the application of the primer or laying of the waterproofing system or protective layer, the concrete surface or primed surface shall be clean, dry and free from ice, frost, laitance, loose aggregate, dust and other debris and also where the adhesion of the concrete would not be impaired, free from curing liquids, compounds and membranes.

- On any structure, providing no damage results, plant and equipment all fitted only with rubber tyres may stand or travel on the waterproofing system solely for the purposes of laying an additional protective layer or surfacing material on the surface. All such plant and equipment shall have its tyre threads regularly inspected and any embedded stones removed.
- The permission of the Employers Representative shall be obtained before the plant, equipment and traffic is permitted onto the waterproofing system.
- Rollers shall not be permitted to stand or travel directly on the waterproofing system.
- Where it is necessary for plant, equipment or traffic to stand or travel on the waterproofing system, suitable temporary protection is to be provided to the satisfaction of the Employers Representative.

Particular Requirements

- Non-destructive tests shall be carried out in accordance with the Specification
- Concrete deck surfaces shall be waterproofed with a proprietary two coat sprayed bridge deck waterproofing with system BBA Certificate or equivalent certificate. An approved system is:
 - a. The Eliminator system supplied by Stirling Lloyd Polychem Limited.
- At all joints, edges and laps in the waterproofing system due to either the phasing of the works or to features encountered on site, the Contractor shall provide an additional stripe coat, which shall be a minimum of 300mm wide.

Buried Concrete Surfaces

- All structural concrete surfaces in contact with the ground shall be waterproofed with a proprietary below ground waterproofing system except where noted otherwise on the drawings.
- All buried concrete surfaces shall be treated (by brushing, rolling or airless spray) with two coats of MC-DUR 1680 as manufactured by MC Building Chemicals Castleblayney, Co. Monaghan or equivalent. First coat shall be thinned with 7% to 10% maximum MC Thinner EP and shall be red brown in colour. Second coat shall be similarly thinned but shall be black in colour. Application of the second coat must be carried out within 8 to 48 hours after the solvents have evaporated. At lower temperatures, a drying period of 24 hours is required before overcoating.
- Immediately before the application of the primer or laying of the waterproofing system or protective layer, the concrete surface or primed surface shall be clean, dry and free from ice, frost, laitance, loose aggregate, dust and other debris and also where the adhesion of the concrete would not be impaired, free from curing liquids, compounds and membranes.

1.1.1.15 Back Wall Drainage and Backfilling

- Box culvert back wall drainage will be provided, followed by backfilling of the structure using Class 6N Granular material.
- The extent of fill above structural foundations is shown on the structural drawings (refer to full set of Design Drawings). Backfill to structures is subject to the contractor's chosen temporary works (which will take place within the footprint being considered).
- The formation shall be investigated and witnessed by the ER (using shear vane or DCP as appropriate and at a frequency determined by the ER) to confirm that the formation strength meets the design requirements.
- The investigation shall identify the presence and extent of any 'soft spots' (i.e., strength below that required by the design). Where soft spots are encountered beneath the formation level of proposed structures, soft

spots shall be excavated and backfilled with a minimum of 300mm of compacted Class 6N granular material. The method of backfill shall be agreed with the Employer's Representative.

1.1.1.16 Protection of EXA Live Fibre Duct

- Once the box segments are placed, backfilled, the EXA live fibre duct will be protected using a 150mm x 150mm concrete encasement.

1.1.1.17 Reconstruction of the pavement

- Pavement construction will be carried out to allow motor traffic on the following Monday morning at 06.00 hours.

1.1.1.18 Construction of Western Verge Wingwalls

- Western verge wingwalls will be made from cast-in-situ concrete, with excavation for foundation carried out approximately 650mm from existing bed level. Reinforcement, formwork, and concrete pouring will follow similar procedures as precast box culverts.

1.1.1.19 Construction of Eastern Side Spalled Wingwalls

- Eastern side spalled wingwalls will be provided with precast segments, with the foundation bed prepared similarly to the western side.

1.1.1.20 Rock Armouring Protection

- Rock armouring protection using DN 50 will be provided to protect the inlet and outlet riverbed of the culvert.

1.1.1.21 Reinstating the Riverbed

- The river is under the jurisdiction of the Loughs Agency (not Inland Fisheries Ireland). Engineers met with them on site and determined that the river is not of fisheries importance.
- The riverbed in the culvert and wing wall areas shall be reinstated to previous levels using the new or old riverbed material, as suitable.
- Careful attention will be given to ensure grading matches the surrounding natural conditions and maintains the hydraulic function of the watercourse.
- Any excess material shall be removed, and the area shall be restored to its original state to minimize environmental impact and ensure long-term stability.

1.1.1.22 Traffic Signs: Reflective Markers

- The safety barrier reflectors to be installed on the steel safety barriers shall be in accordance with TII CC-SCD-01203 and clause 6.22.9 of the Traffic Signs Manual.
- The reflectors shall be spaced 24m apart in accordance with Chapter 6 of the Traffic Signs Manual, with 1no. reflector to be installed at each end of the barrier at a minimum.

1.1.1.23 Reinstating the ground of site compound and Site Clean-up

- All construction debris shall be disposed of out of the site under the Environmental Management Plan and relevant regulations.

- Careful attention will be given to proper waste segregation and disposal practices to minimize environmental impact and maintain compliance with regulatory requirements.
- The ground of the site compound will be reinstated to its previous status.

The Site Location Plan, Overall Site Layout Plan and the Proposed Culvert Layout Plan are illustrated in Figures 1.4 to 1.6 below. Full scale drawings accompany this submission.



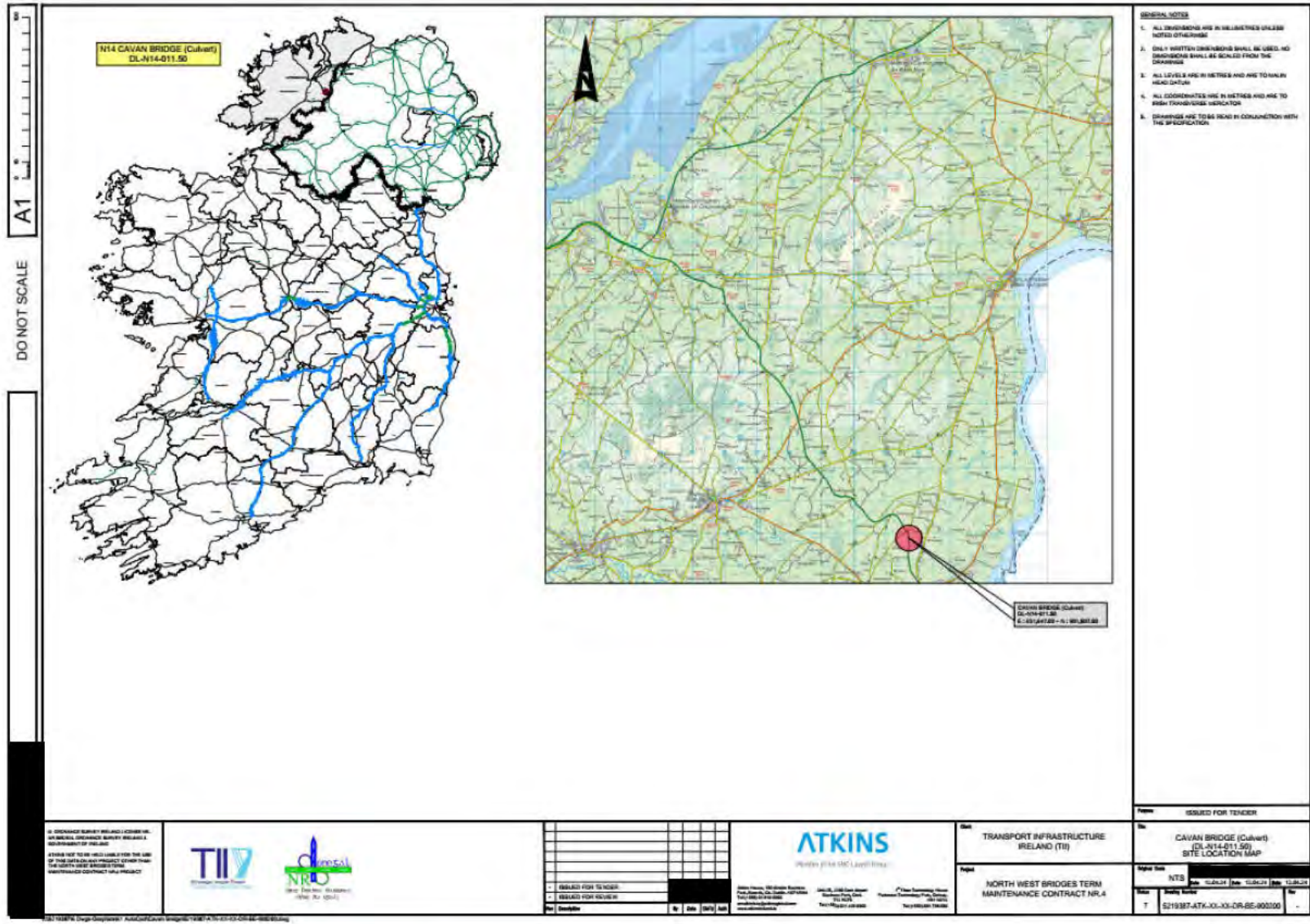


Figure 1.4 - Site Location Plan for Cavan Bridge Culvert.



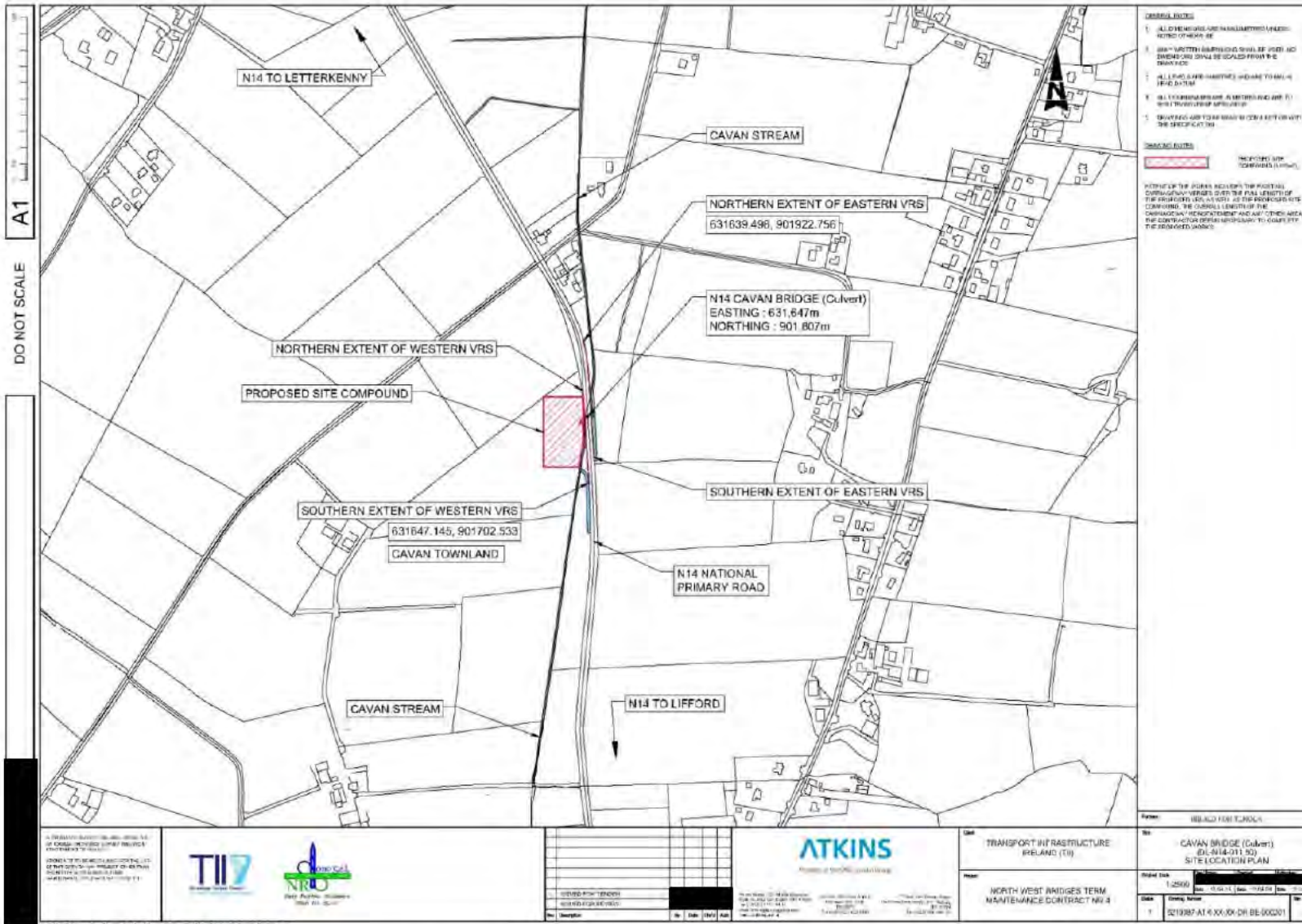


Figure 1.5 - Site Location Plan for Cavan Bridge Culvert, the proposed VRS and site compound.



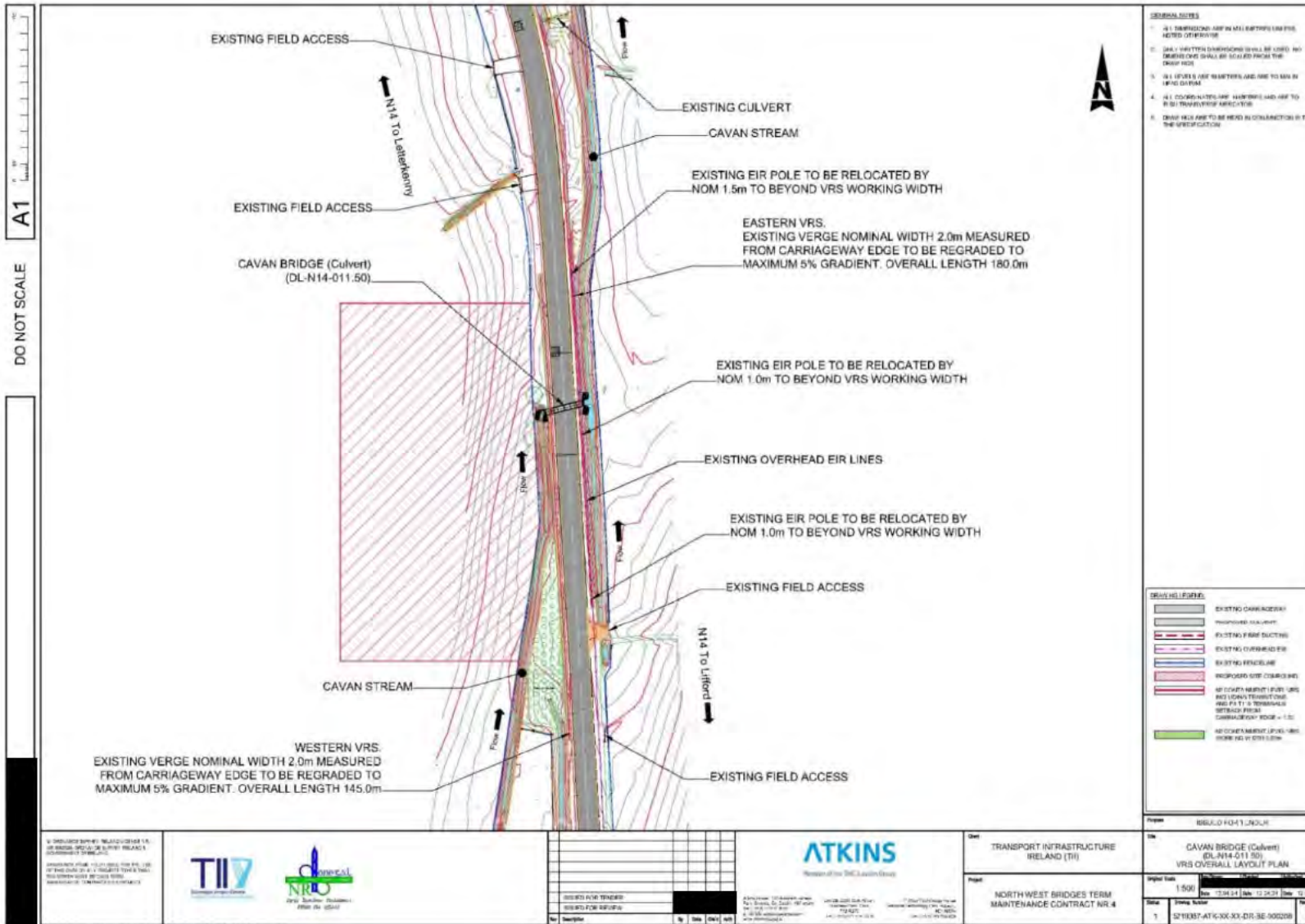


Figure 1.6 - Overall Layout Plan.

5219387DG0065 rev 1.0 - Cavan
 Culvert NIS.docx
 5219387DG0065
 1.0 | 16/12/2024



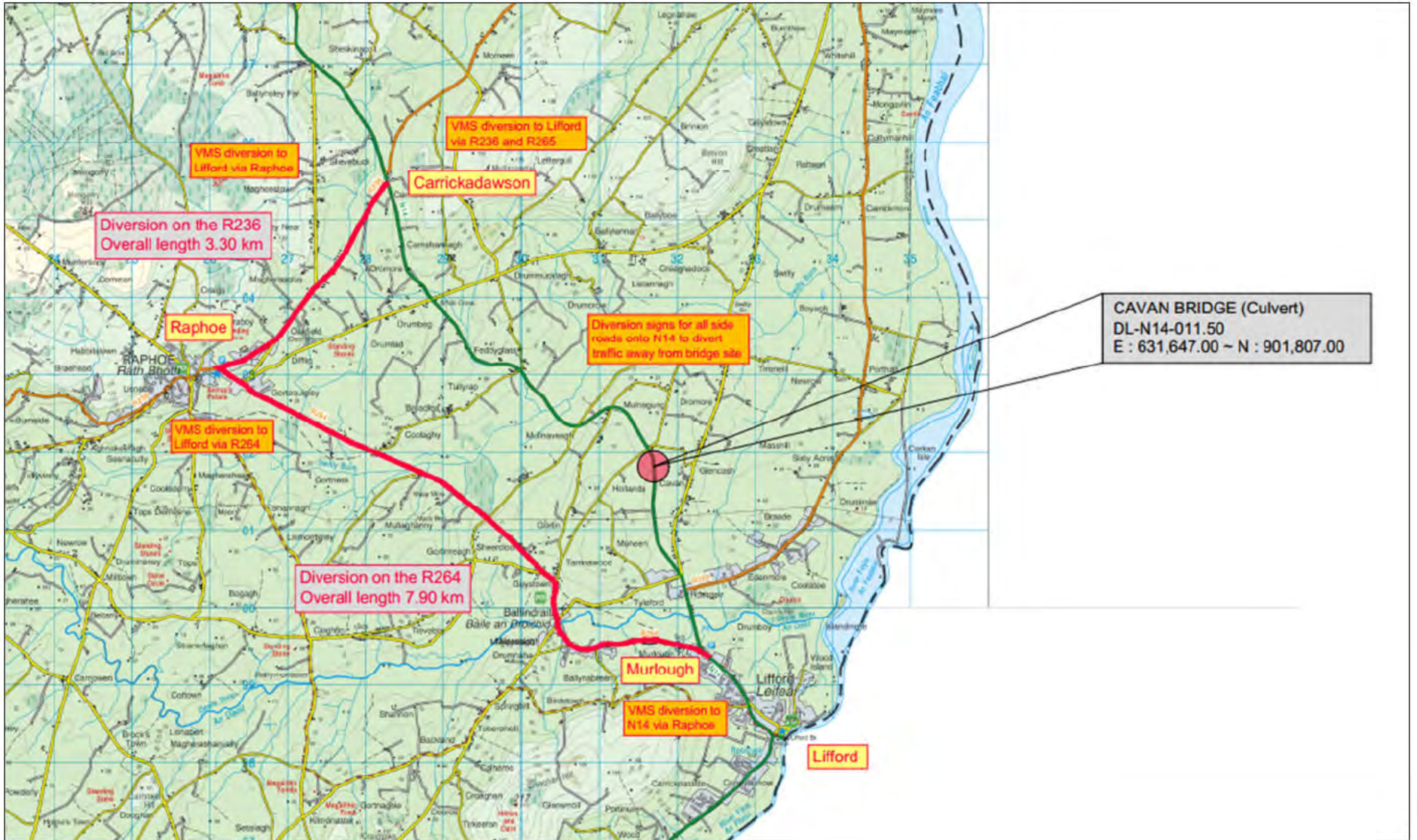


Figure 1.8 - Proposed traffic diversion plan.

2. Scope of Study

This report comprises the Natura Impact Statement in respect of the proposed works intended to provide supporting information to assist TII, in its capacity as the competent authority, in making its Appropriate Assessment Screening Determination in respect of the proposed works.

2.1 Legislative Context

2.1.1 Natura 2000

Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora (“the Habitats Directive”) is a legislative instrument of the European Union (EU) which provides legal protection for habitats and species of Community interest. Article 2 of the Directive requires the maintenance or restoration of such habitats and species at a favourable conservation status, while Articles 3 to 9, inclusive, provide for the establishment and conservation of an EU-wide network of special areas of conservation (SACs), known as Natura 2000, which also includes special protection areas (SPAs) designated under Article 4 of Directive 2009/147/EC of the European Parliament and of the Council of 30 November 2009 on the conservation of wild birds (“the Birds Directive”). Both SACs and SPAs are commonly referred to as “European sites” or “Natura 2000 sites”.

SACs are selected for natural habitat types listed on Annex I to the Habitats Directive and the habitats of species listed on Annex II to the Habitats Directive. SPAs are selected for species listed on Annex I to the Birds Directive and other regularly occurring migratory species. The habitats and species for which a Natura 2000 site is selected are referred to as the “qualifying interests” of that site and each is assigned a “conservation objective” aimed at maintaining or restoring its “favourable conservation condition” at the site, which contributes to the maintenance or restoration of its “favourable conservation status” at national and European levels.

2.1.2 Appropriate Assessment

Article 6 of the Habitats Directive deals with the management and protection of Natura 2000 sites. Articles 6(3) and (4) set out the decision-making process, known as “Appropriate Assessment” (AA), for plans or projects in relation to Natura 2000 sites. Article 6(3) states: -

“Any plan or project not directly connected with or necessary to the management of the site but likely to have a significant effect thereon, either individually or in combination with other plans or projects, shall be subject to appropriate assessment of its implications for the site in view of the site's conservation objectives. In the light of the conclusions of the assessment of the implications for the site and subject to the provisions of paragraph 4, the competent national authorities shall agree to the plan or project only after having ascertained that it will not adversely affect the integrity of the site concerned and, if appropriate, after having obtained the opinion of the general public.”

The first sentence of Article 6(3) provides a basis for determining which plans and projects require AA, i.e., those “*not directly connected with or necessary to the management of [one or more Natura 2000 sites] but likely to have a significant effect thereon, either individually or in combination with other plans or projects*”. In *Waddenzee* (C-127/02), the Court of Justice of the European Union (CJEU) ruled that significant effects must be considered “likely” if “*it cannot be excluded, on the basis of objective information*”, that they would occur. This clearly sets a low threshold, such that AA is required wherever there is a reasonable possibility of significant effects on a Natura 2000 site. In the same judgment, the CJEU established that the test of significance relates specifically to the conservation objectives of the site concerned, i.e., “significant effects” are those which, “*in the light, inter alia, of the characteristics and specific environmental conditions of the site*”, could undermine the site’s conservation objectives. In addition to the effects of the plan or project on its own, the combined effects arising from the plan or project under consideration and other plans and projects must also be assessed (see Section 7 for more details).

The last part of the first sentence of Article 6(3) defines AA as an assessment of the “*implications [of the plan or project] for the site in view of the site's conservation objectives*”. In the second sentence, Article 6(3) requires that,

prior to agreeing to a plan or project, the competent authority must “ascertain” that “*it will not adversely affect the integrity of the site concerned*”. In *Sweetman v. An Bord Pleanála* (C-258/11), the CJEU ruled that a plan or project “*will adversely affect the integrity of that site if it is liable to prevent the lasting preservation of the constitutive characteristics of the site that are connected to the presence of a priority natural habitat whose conservation was the objective justifying the designation of the site in the list of sites*”. On that basis, EC (2018) described the “integrity of the site” as “*the coherent sum of the site’s ecological structure, function and ecological processes, across its whole area, which enables it to sustain the habitats, complex of habitats and/or populations of species for which the site is designated*”. As such, the “integrity” of a specific site is defined by its conservation objectives and is “adversely affected” when those objectives are undermined. In *Waddenzee*, the CJEU ruled that the absence of adverse effects can only be ascertained “*where no reasonable scientific doubt remains*”.

The “precautionary principle” applies to all of the legal tests in AA, i.e., in the absence of objective information to demonstrate otherwise, the worst-case scenario is assumed. Where the tests established by Article 6(3) cannot be satisfied, Article 6(4) applies (see explanation in Section 2.2, below).

2.1.3 Competent authority

The requirements of Articles 6(3) and (4) are transposed into Irish law by, inter alia, Part 5 of the European Communities (Birds and Natura Habitats) Regulations, 2011 (as amended) (“the Habitats Regulations”) and Part XAB of the Planning and Development Act, 2000 (as amended) (“the Planning and Development Acts”). As per the second sentence of Article 6(3), it is the “competent national authorities” who are responsible for carrying out AA and, by extension, for determining which plans and projects require AA. The competent authority in each case is the authority responsible for consenting to or licensing a plan or project. In all cases, it is the competent authority who is ultimately responsible for determining whether or not a plan or project requires AA and for carrying out the AA, where required.

2.2 Appropriate Assessment Process

The AA process can be described as being made up of three distinct stages, as described below, the need to progress to each stage being determined by the outcome of the preceding stage.

Stage 1: Screening – This stage involves a determination by the competent authority as to whether or not a given plan or project required AA. As explained in Section 2.1, AA is required in respect of any plan or project not directly connected with or necessary to the management of a Natura 2000 site, but for which the possibility of likely significant effects on one or more Natura 2000 sites cannot be excluded. In *People Over Wind* (C-323/17), the CJEU ruled that measures intended to avoid or minimise harmful effects on a Natura 2000 site cannot be considered in making this determination. Consideration of the potential for in-combination effects is also required at this stage.

Stage 2: Appropriate Assessment – This stage involves a detailed assessment of the implications of the plan or project, individually and in combination with other plans and projects, for the integrity of the Natura 2000 site(s) concerned. This stage also involves the development of appropriate mitigation to address any adverse effects and an assessment of the significance of any residual impacts following the inclusion of mitigation. In *Kelly v. An Bord Pleanála* (IEHC 400), the High Court ruled that a lawful AA must contain complete, precise, and definitive findings based on examination and analysis, and conclusions and a final determination based on an evaluation of the findings. In the same judgment, the High Court stressed that, in order for the findings to be complete, precise, and definitive, the AA must be carried out in light of best scientific knowledge in the field and cannot have gaps or lacunae. In *Holohan v. An Bord Pleanála* (C-461/17), the CJEU clarified that AA must “*catalogue the entirety of habitat types and species for which a site is protected*” (i.e. the qualifying interests of the site) and assess the implications of the plan or project for the qualifying interests, both within and outside the site boundaries, and other, non-qualifying interest habitats and species, whether inside or outside the site boundaries, “*provided that those implications are liable to affect the conservation objectives of the site*”. The proposer of a plan or project requiring AA is furnishes the competent authority with the scientific evidence upon which to base its AA by way of a Natura Impact Statement (NIS) or Natura Impact Report (NIR). If it is not possible to ascertain that the plan or project will not adversely affect one or more Natura 2000 sites, authorisation can only be granted subject to Article 6(4).

Stage 3: Article 6(4) – If a plan or project does not pass the legal test at Stage 2, alternative solutions to achieve its aims must be considered and themselves subject to Article 6(3). If no feasible alternatives exist, authorisation can only be granted where it can be demonstrated that there are imperative reasons of overriding public interest (IROPI)

justifying its implementation. Where this is the case, all compensatory measures must be taken to protect the overall coherence of Natura 2000.

The three stages described above are illustrated in Figure 2.1.

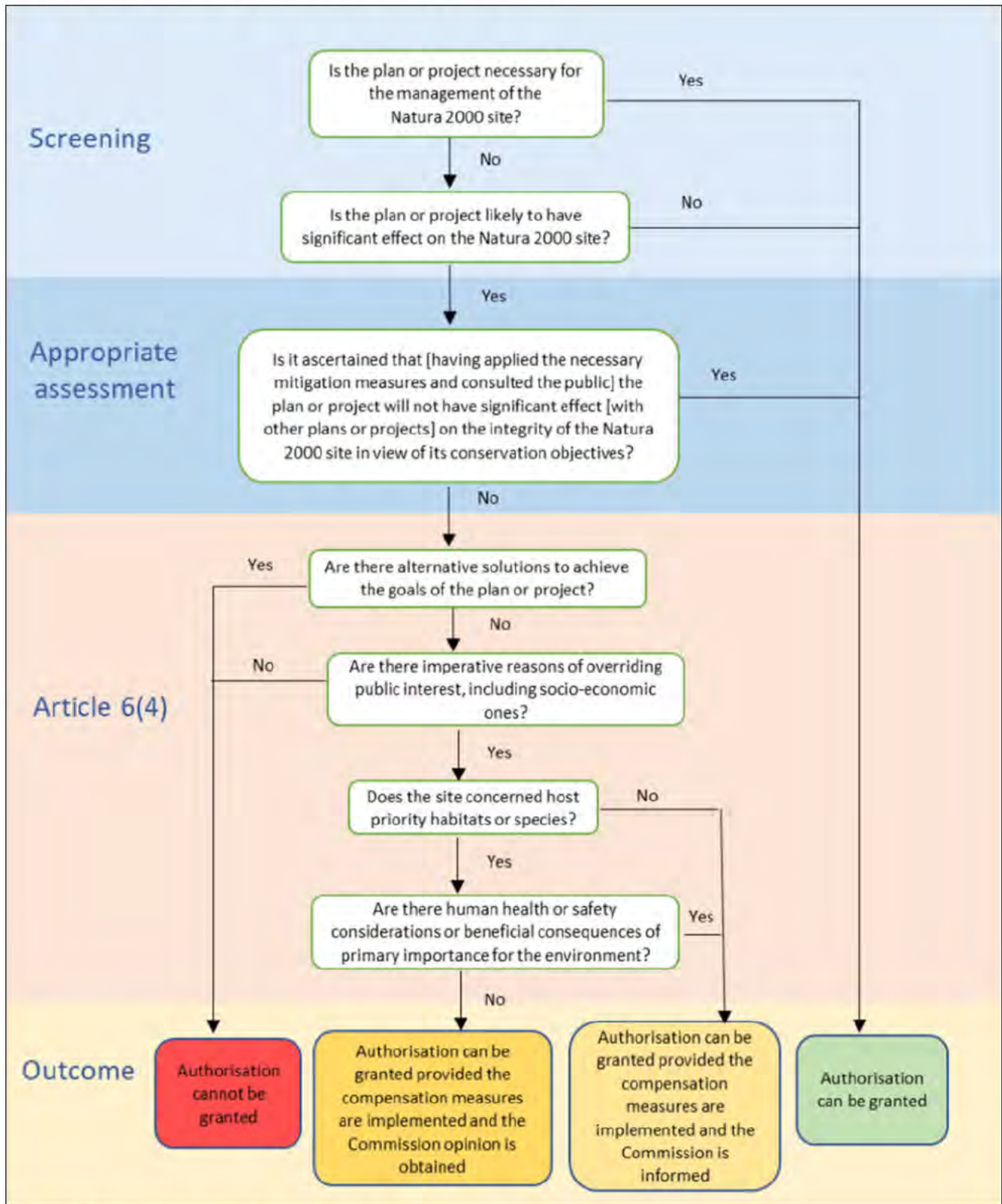


Figure 2.1 - Stages of the Appropriate Assessment process (EC, 2021a).

3. Methods

3.1 Legislation and Guidance

This report was prepared with due regard to the relevant European and Irish legislation, case law and guidance, including but not limited to: -

- Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild flora and fauna. *Official Journal of the European Communities* L 206/7-50.
- Directive 2009/147/EC of the European Parliament and of the Council of 30 November 2009 on the conservation of wild birds. *Official Journal of the European Union* L 207-25.
- European Communities (Birds and Natural Habitats) Regulations, 2011. *S.I. No. 77/2011* (as amended) (“the Habitats Regulations”).
- Planning and Development Act, 2000. *No. 30 of 2000* (as amended) (“the Planning and Development Acts”).
- Planning and Development Regulations, 2001. *S.I. No. 600/2001* (as amended) (“the Planning Regulations”).
- EC (2018) *Managing Natura 2000 sites: The provisions of Article 6 of the ‘Habitats’ Directive 92/43/EEC*. European Commission, Brussels.
- EC (2021a) *Assessment of plans and projects in relation to Natura 2000 sites: Methodological guidance on the provisions of Articles 6(3) and (4) of the Habitats Directive 92/43/EEC*. C(2021) 6913. European Commission, Brussels.
- EC (2021b) *Guidance document on the strict protection of animal species of Community interest under the Habitats Directive*. C(2021) 7301. European Commission, Brussels.
- DEHLG (2010a) *Appropriate Assessment of Plans and Projects in Ireland: Guidance for Planning Authorities. Revised 11/02/2010*. Department of the Environment, Heritage and Local Government, Dublin.
- DEHLG (2010b) *Circular NPW 1/10 & PSSP 2/10. Dated 11/03/2010*. Department of the Environment, Heritage and Local Government, Dublin.
- NPWS (2012a) *Marine Natura Impact Statements in Irish Special Areas of Conservation. A Working Document. April 2012*. National Parks & Wildlife Service, Department of Arts, Heritage and the Gaeltacht, Dublin.
- NPWS (2021) *Guidance on the Strict Protection of Certain Animal and Plant Species under the Habitats Directive in Ireland. National Parks & Wildlife Service Guidance Series 1*, Department of Housing, Local Government and Heritage, Dublin.
- Mullen, E., Marnell, F. and Nelson, B. (2021) *Strict Protection of Animal Species – Guidance for Public authorities on the Application of Articles 12 and 16 of the EU Habitats Directive to development/works undertaken by or on behalf of a Public authority. National Parks & Wildlife Service Guidance Series 2*, Department of Housing, Local Government and Heritage, Dublin.
- OPR (2021) *Appropriate Assessment Screening for Development Management. OPR Practice Note PN01*. Office of the Planning Regulator, Dublin.
- *Applications for Approval for Local Authority Developments made to An Bord Pleanála under 177AE of the Planning and Development Act, 2000, as amended (Appropriate Assessment) – Guidelines for Local Authorities*
- <<https://www.pleanala.ie/getmedia/0f385f48-7e84-43e3-b405-1201e490740a/Applications-for-approval-for-LA-Developments-S177AE-EN.pdf>>. An Bord Pleanála, Dublin.

- Case law, including *Waddenzee* (C-127/02), *Sweetman v. An Bord Pleanála* (C-258/11), *Kelly v. An Bord Pleanála* (IEHC 400), *Commission v. Germany* (C-142/16), *People Over Wind* (C-323/17), *Holohan v. An Bord Pleanála* (C-461/17), *Eoin Kelly v. An Bord Pleanála* (IEHC 84) and *Heather Hill* (IEHC 450).
- Sundseth, K. and Roth, P. (2014) *Article 6 of the Habitats Directive – Rulings of the European Court of Justice*. Ecosystems LTD (N2K Group), Brussels.

3.2 Desk Study

A desktop study was carried out to collate information available on European sites in the vicinity of the proposed project. These areas were viewed using Google Earth, Google maps¹ and Bing maps² (last accessed on the 5th of November 2024).

The National Parks and Wildlife Service (NPWS) and National Biodiversity Data Centre (NBDC) online databases were reviewed concerning European sites and their features of interest in the vicinity of the proposed project.

The locations and boundaries of Natura 2000 sites in relation to the proposed works were reviewed on the *NPWS Designations Viewer* (NPWS, 2023c). Information on the qualifying interests and the structures and functions of the relevant Natura 2000 sites was found in the Site Synopsis, Natura 2000 Standard Data Form, Conservation Objectives and supporting documents for each site. Reporting under Article 17 of the Habitats Directive (NPWS, 2019a-c; ETC/DB, 2023a) and Article 12 of the Birds Directive (NPWS, 2023d; ETC/BD, 2023b) provided further information on the habitats and species concerned at the national level.

Spatial and other data regarding rivers and other waterbodies were obtained from the Environmental Protection Agency (EPA) using its online facility *EPA Maps: Water* (EPA, 2024). Other sources consulted included the National Biodiversity Data Centre (NBDC) *Biodiversity Maps* (NBDC, 2024), the Ordnance Survey Ireland (OSi) *GeoHive Map Viewer* (OSi, 2024) and the *Environmental Sensitivity Mapping Tool* (ESM Webtool, 2024).

Other plans and projects in the surrounding area were identified using the Donegal County Council planning enquiry system. Search criteria were implemented to identify other plans and project with potential, in combination with the proposed works, to adversely affect the integrity of European sites.

3.3 Site Visit

An ecology survey was conducted at Cavan Bridge Culvert on 4th September 2022 and was revisited in July 2024. The structure is situated on the N14, approximately 4km northwest of Lifford, in Co. Donegal. Cavan Bridge Culvert spans a small stream that was very low on the date of the survey. Ecological survey methods were in general accordance with those outlined in the following documents: -

- *A Guide to Habitats in Ireland* (Fossitt, 2000).
- *Best Practice Guidance for Habitat Survey and Mapping* (Smith et al., 2011).

¹ <https://www.google.ie/maps>

² <http://www.bing.com/maps/>

3.4 Statement of Authority

This report was prepared by Sinéad Kinsella. This report was peer reviewed and authorised by Paul O'Donoghue.

Sinéad Kinsella has a BSc in Applied Freshwater and Marine Biology. She has experience in preparing Appropriate Assessment Screening Reports, Natura Impact Statements and prepares Ecological Impact Assessment Reports and undertakes a range of ecological surveys (e.g. mammal and bat surveys) for a range of proposed developments.

Paul O'Donoghue is an Associate Director at Atkins. Paul holds a BSc (Zoology), MSc (Behavioural Ecology) and a PhD (Avian Ecology and Genetics). Paul is a Chartered member of the Society for the Environment (CEnv) and a Full Member of the Chartered Institute of Ecology and Environmental Management (MCIEEM). Paul has over 26 years' experience in ecology; including extensive experience in the preparation of Habitat Directive Assessments / Natura Impact Statements (i.e., Appropriate Assessment under Article 6(3) of the EU Habitats Directive).

4. Existing Environment

4.1 Desktop Review

Cavan Stream, which the Cavan Bridge Culvert is over, is a 1st order tributary of the Swilly Burn Stream which is ca. 480m downstream, and subsequently, the River Foyle ca. 5.7km downstream, and ultimately the River Finn SAC (site code: 002301) ca. 6.6km downstream, and the River Foyle and Tributaries SAC (UK0030320) which is located across the border to Northern Ireland also ca. 6.6km downstream of the proposed works. In Northern Ireland, Natura 2000 sites are usually underpinned by The Conservation (Natural Habitats, etc.) Regulations 1995 (Northern Ireland) (as amended), as well as by designation of an Area of Special Scientific Interest (ASSI) under the Environment (NI) Order 2002 (as amended).

Cavan Stream is located in Hydrometric Area no. 01 – the Foyle catchment and the sub catchment JohnstonSteam_SC_010. The section of the Cavan Stream is fringed on both banks by improved agricultural grassland (GA1)³.

Q-values, a biological water quality metric based on the composition of a river's macroinvertebrates community, detail the Swilly Burn Stream, ca. 3.2km downstream of the proposed works, as being of 'Poor' (Q3) ecological condition at an EPA sampling station 'Swilly Burn' in 1997. There are no other recorded Q-values for the watercourses in the vicinity of the proposed works in more recent years. The Cavan Stream and the Swilly Burn Stream in the vicinity of the proposed works is categorised as 'Poor' status under the Water Framework Directive (WFD).

In relation to Northern Ireland, there is little information available in relation to the water quality of the River Foyle⁴. However, just south of the location where the Swilly Burn Stream conjoins with the River Foyle, the Burn Dennet River also conjoins with the River Foyle and is classified as being of 'Moderate' ecological condition (Northern Ireland Water Framework Directive Statistics Report 2021)⁵.

According to the River Waterbodies Ecological Status 2021 (Northern Ireland), the waterbodies in the vicinity of the River Foyle, ca. 6.6km downstream of the proposed works across the Northern Ireland border, range from 'Moderate' to 'Good' ecological condition. The Groundwater Body (Bedrock Chemical Status 2021) is classified as being of 'Poor' condition along the Northern Ireland side of the River Foyle.

The Northern Ireland border is aligned down the middle of the River Foyle. The River Finn SAC consists of the westerly side of the River Foyle. The easterly side of the River Foyle is within Northern Ireland and this side of the River Foyle is also designated as Natura 2000 site: River Foyle and Tributaries SAC (UK0030320). The two adjacent SACs within the River Foyle realistically make one coherent site.

The qualifying interests of the River Finn SAC are as follows: -

- Oligotrophic waters containing very few minerals of sandy plains (*Littorelletalia uniflorae*) [3110]
- Northern Atlantic wet heaths with *Erica tetralix* [4010]
- Blanket bogs (* if active bog) [7130]
- Transition mires and quaking bogs [7140]
- *Salmo salar* (Salmon) [1106]

³ Alphanumeric codes in accordance with classifications described for Fossitt (2000) 'A Guide to Habitats in Ireland'.

⁴ [NIEA Water Information Request Viewer \(daera-ni.gov.uk\)](#)

⁵ [NI Water Framework Directive Statistics Report 2021.pdf \(daera-ni.gov.uk\)](#)

- *Lutra lutra* (Otter) [1355]

The qualifying interests of the River Foyle and Tributaries SAC (Northern Ireland site) are as follows: -

- *Salmo salar* (Salmon) [1106]
- *Lutra* (Otter) [1355]
- Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation [3260]

According to Article 17 data downloaded from the NPWS (last downloaded 30/04/2024), Oligotrophic waters containing very few minerals of sandy plains (*Littorelletalia uniflorae*) [3110] is not located within 10km of the proposed works site (Grid Reference: C30). According to the River Finn SAC Site Synopsis (NPWS, 2014), lowland oligotrophic lakes are found at Loughs Finn, Belshade and Derg, as well as in many of the smaller lakes within the site, which are all upstream of the proposed works. Northern Atlantic wet heaths with *Erica tetralix* [4010] has also not been recorded within 10km of the proposed works on Cavan Bridge Culvert Grid Reference: C30) according to Article 17. Wet heath is associated with the blanket bog throughout the site and is found on the shallow peats and better drained slopes (NPWS, 2014). Blanket bogs (* if active bog) [7130] and Transition mires and quaking bogs [7140] have also not been recorded within the 10km grid square. These habitats are not considered to be in the vicinity of the proposed works.

Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation relates to rivers that support characteristic communities of water-crowfoot *Ranunculus* species, which often dominate the plant community in the river channel. This vegetation occurs in relatively unpolluted waters, in a diverse range of river types. This species was not recorded in the vicinity of the proposed works (Section 4.2). However, it cannot be ruled out as this habitat may be present immediately downstream of the proposed works.

Otter (*Lutra lutra*) are widespread within the Foyle catchment. NBDC data notes otter records within the 10km grid square (C30). Otter have been recorded ca. 3km downstream of the proposed works along the Swilly Burn Stream in 2010. Otter use watercourses as commuting routes and foraging areas, with their banks offering places of shelter and breeding.

The Cavan Stream watercourse at the proposed works site is subject to seasonal flow, during the summer months the watercourse runs dry. Therefore, the stream does not offer suitable habitat for Freshwater Pearl Mussel and is not located within a "*Margaritifera Sensitive Area*" (nor is pearl mussel a QI species of any of the relevant Natural 2000 sites). The nearest suitable habitat for Freshwater Pearl Mussel is the River Foyle.

proposed works [Source: NPWS pearl mussel records]. Furthermore, the lower part of the Swilly Burn and the Foyle at the point where it discharges are subject to tidal influence.

It is estimated that the number of returning salmon entering the river system included within the River Foyle and Tributaries SAC is in excess of 40,000, making the River Foyle and Tributaries one of the most important salmon rivers in the British Isles. The majority of the salmon returning are grilse (single wintering salmon), with a smaller but important number of spring⁶. In relation to the River Finn SAC, the Finn system is one of Ireland's premier salmon waters. Although the Atlantic Salmon (*Salmo salar*) is still fished commercially in Ireland, it is considered to be endangered or locally threatened elsewhere in Europe and is listed on Annex II of the E.U. Habitats Directive. Commercial netting on the Foyle does not begin until June and this gives spring fish a good opportunity to get into the Finn. The Finn is important in an international context in that its populations of spring salmon appear to be stable, while they are declining in many areas of Ireland and Europe (NPWS, 2014).

All bat species present in Ireland, along with their roosts, are protected under the Wildlife Act, 1976 (as amended) and are similarly afforded strict protection under Article 12 of the Habitats Directive (as they are listed on Annex IV).

⁶ [River Foyle & Tributaries ASSI citation documents and map \(daera-ni.gov.uk\)](#)

Lesser Noctule (*Nyctalus leisleri*), Soprano Pipistrelle (*Pipistrellus pygmaeus*), Brown Long-eared Bat (*Plecotus auritus*) were recorded in the 2km grid square (C30A) in 2018. The masonry section of the bridge was surveyed for roosting bats and nesting birds (Section 4.2). None were recorded (nor were any of these bats QI species for the Natura 2000 sites of relevance). The arch height is approximately 0.6m. The structure floods to just below the top of the arch, rendering it unsuitable as a roosting site for bats. [Note: The estimated 100-year design flood level, plus 20% uplift for climate change is 230mm lower than the soffit of culvert level. OPW have approved the Section 50 Application which is included in Appendix A; this includes a full set of Design Drawings]. A section of the facing stones on the upstream elevation has collapsed into the watercourse. Overall, the masonry arch section of the structure is in poor structural repair with many stones slipped out of position and much loss of mortar. Therefore, there will be no significant loss of bat roosting habitat due to the proposed works being carried out.

Eurasian Badger (*Meles meles*), American Mink (*Mustela vison*), European Rabbit (*Oryctolagus cuniculus*) and West European Hedgehog (*Erinaceus europaeus*) have been recorded in the 2km grid squares C30A and C30B in which the proposed works are located.

As indicated on the NBDC's Biodiversity Maps (accessed 30/04/2024), invasive plant species on the Third Schedule List of the European Communities (Birds and Natural Habitats) Regulations 2011 [S.I.477/2011] that have been recorded within the vicinity of the proposed site (2km grid squares C30A and C30B) of the project include Canadian Waterweed (*Elodea canadensis*), Red Oak (*Quercus rubra*), Sycamore (*Acer pseudoplatanus*) and Himalayan Balsam (*Impatiens glandulifera*). The invasive species records listed above were not in the immediate environs of the proposed works on the NBDC mapviewer.

There are several nationally designated sites, specifically, proposed Natural Heritage Areas (pNHAs), in the vicinity of the proposed works area. These include the Feddyglass Woods pNHA (001129) ca. 1.5 km and the River Foyle, Mongavlin to Carrigans pNHA (002067) ca. 5.9 km. There is a hydrological connection from the site to the River Foyle, Mongavlin to Carrigans pNHA. However, given that the distance via the hydrological connection to the River Foyle pNHA is ca. 8.9 km and considering the small scale nature of the proposed works, no significant effects are anticipated on this site or any other nationally designated site.

4.2 Site Visit

An ecology survey was conducted by Caroline Shiel on behalf of Atkins at Cavan Bridge Culvert on 4th September 2022. The structure is situated on the N14, approximately 4km northwest of Lifford, in Co. Donegal. Cavan Bridge Culvert spans a small stream that was very low on the date of the survey. The watercourse is heavily overgrown with vegetation, and especially with Himalayan Balsam (*Impatiens glandulifera*) both upstream and downstream of the bridge (Himalayan Balsam confirmed to present during site survey 3rd of July 2024). The watercourse flows in an easterly direction under the structure. The purpose of the survey was to characterise and record the habitats and sensitive ecological receptors within and immediately adjacent to the channels included in the study area.

Mammals and birds were surveyed based on incidental sightings, signs of activity during the survey and the identification of possible suitable habitats to support these species. During the ecological survey the field ecologist checked the location for records of commonly occurring riparian invasive plant species such as Japanese knotweed (*Fallopia japonica*), Himalayan balsam (*Impatiens glandulifera*) and Giant Hogweed (*Heracleum mantegazzianum*).

Aerial photos and site maps assisted the ecological walkover survey. The location of the proposed project and the surrounding areas were viewed using Google Earth, Google maps⁷ and Bing maps⁸. The EPA online mapviewer was used to locate watercourse networks and identify hydrological connectivity to larger rivers such as the River Foyle.

Locations and boundaries of all European sites were identified using the National Parks and Wildlife Service (NPWS) online map viewer. Shapefiles were also downloaded from the NPWS and EPA sites to facilitate the preparation of project graphics. The EPA online mapping system and Google Maps were used to complement the information available from the NPWS system.

⁷ <https://www.google.co.in/maps>

⁸ <https://www.bing.com/maps>

The original structure is a low masonry arch with span of approximately 2m. A concrete deck extension was added on to the downstream face of the masonry arch to widen the structure. The concrete extension is in the form of a shallow arch. There are no parapets or safety barriers on Cavan Bridge Culvert.

The masonry section of the bridge was surveyed for roosting bats and nesting birds. None were recorded. The arch height is approximately 0.6m. As noted above, the structure floods to the top of the arch, rendering it unsuitable as a roosting site for bats. A section of the facing stones on the upstream elevation has collapsed into the watercourse. Overall, the masonry arch section of the structure is in poor structural repair with many stones slipped out of position and much loss of mortar.

A search was conducted for signs of otters (*Lutra lutra*) from ca. 50m upstream to 100m downstream of the bridge. No signs of otters were recorded. No otter spraints were recorded on rocks under the arch.

Plates 4.1 to 4.9 below show the pictures taken at the site survey of the bridge in 2022.



Plate 4.1 - The stream channel flowing beneath Cavan Bridge Culvert, large boulders present. There is also a fibre optic cable running under the bridge.



Plate 4.2 - View of Cavan Bridge (culvert).



Plate 4.3 - Contamination within the stream, possibly due to the high agriculture presence / slurry.





Plate 4.4 - Dense vegetation surrounding Cavan Bridge Culvert and the stream/ ditch - mainly grass and bramble.



Plate 4.5 - Improved agricultural grassland and the stream / ditch to the right.





Plate 4.6 - Cavan Bridge Culvert and stream/ditch to the left and the N14 to the right.



Plate 4.7 - Upstream face of masonry section heavily overgrown with vegetation. Some arch facing stones have collapsed.



Plate 4.8 - Downstream face of bridge with shallow concrete arch extension to original masonry structure.



Plate 4.9 - Watercourse downstream of bridge with Himalayan Balsam.

The site was revisited on the 22nd of July 2024 in order to take pictures of the Himalayan Balsam at the site. Plates 4.10 to 4.12 show the photos taken during this site visit.



Plate 4.10 - Himalayan Balsam at Cavan Bridge Culvert.



Plate 4.11 - Himalayan Balsam at Cavan Bridge Culvert.





Plate 4.12 - Himalayan Balsam along the road.



5. Connectivity to Natura 2000 sites

5.1 Zone of Influence

The “Zone of Influence” of a plan or project is the area which may experience ecological effects as a result of its implementation, including any ancillary activities. The various impacts of a plan or project will each have their own characteristics, e.g. nature, extent, magnitude, duration etc. Accordingly, the area subject to each impact (“zone of impact”) will vary depending on characteristics of the impact and the presence of pathways for its propagation. Ecological features within or connected to one or more zones of impact could, depending on their sensitivities, be affected by the plan or project under consideration. The area containing such features may be regarded as the Zone of Influence. As such, in establishing the Zone of Influence for a plan or project, regard must be had to the characteristics of its potential impacts, potential pathways for impacts and the sensitivities of ecological features in the receiving environment.

In its guidance on selecting Natura 2000 sites to include in AA, *Appropriate Assessment of Plans and Projects in Ireland: Guidance for Planning Authorities* (DEHLG, 2010a) recommends inclusion of sites in the following three categories: -

- Any Natura 2000 sites within or adjacent to the plan or project area,
- Any Natura 2000 sites within the Zone of Influence of the plan or project (to be established on a case-by-case basis for projects, having regard to the nature, scale and location of the project, the sensitivities of the ecological receptors and the potential for in-combination effects), and
- Following the precautionary principle, any other Natura 2000 sites for which the possibility of significant effects cannot be excluded, e.g. for a project with hydrological impacts, it may be necessary to check the full extent of the catchment for Natura 2000 sites with water-dependent qualifying interests.

In addition, *Assessment of plans and projects in relation to Natura 2000 sites: Methodological guidance on the provisions of Articles 6(3) and (4) of the Habitats Directive 92/43/EEC* (EC, 2021a) recommends consideration of Natura 2000 sites hosting fauna which could move to the plan or project area or its zone(s) of impact, and the potential for the plan or project to sever ecological connectivity within or between Natura 2000 sites. *Appropriate Assessment Screening for Development Management* (OPR, 2021) emphasises the importance of employing the source-pathway-receptor model (rather than arbitrary distances such as 15km) when selecting Natura 2000 sites for inclusion in AA.

Based on the above considerations, the Zone of Influence for the proposed works was defined as the combination of the following zones of impact: -

- For direct impacts, all areas within and immediately adjoining the works area.
- For temporary disturbance to birds and other fauna, as well as effects associated with the spread of invasive alien species, all areas within a precautionary buffer of 500m from the works area.
- For water quality impacts, the Swilly Burn Stream (i.e. within the Foyle river catchment) which connects to the River Foyle, further downstream and ultimately the River Finn SAC and the River Foyle and Tributaries SAC (Northern Ireland).
- For indirect effects, all other areas with potential ecological connectivity to the above zones of impact, i.e. Swilly Burn Stream (i.e. within the Foyle river catchment) which connects to the River Foyle.

Using QGIS3, spatial data for waterbodies and catchments from *EPA Geoportal* were viewed in conjunction with aerial imagery from *Bing Maps* to identify pathways and zones of impact from the proposed works, and other potential ecological connections to the wider landscape were considered.

5.2 Identification of Sites

5.2.1 Direct Impacts

The proposed works on the Cavan Bridge Culvert over the Cavan Stream are not located within any designated European sites or designated protected Northern Ireland sites. Given this, there is no risk of direct impacts on the River Finn SAC or the River Foyle and Tributaries SAC or any other designated sites, e.g. loss of fragmentation, degradation, pollution or disturbance of habitats or species this European site as a result of the proposed works.

5.2.2 Disturbance to habitats

During the proposed works, there will be some disturbance to habitats along the Cavan Stream associated with the main works items and access and egress by vehicles, plant and personnel. This disturbance will include noise and visual disturbance and possibly some minor damage to vegetation. As previously mentioned in Section 4.1, the works do not overlap with the SAC and any habitats which are qualifying interests of the River Finn SAC; nor were any of these habitat types noted near the culvert / works area. Any disturbance impacts to habitats of this SAC can therefore be ruled out at this stage.

Water courses of plain to montane levels with the *Ranunculus fluitans* and *Callitriche-Batrachion* vegetation, which is a qualifying interest of the River Foyle and Tributaries SAC is not located within the immediate vicinity of the proposed works. No direct impacts to this habitat are therefore predicted. However, as this habitat could be present in waters downstream of the proposed works, impacts through deterioration in water quality cannot be discounted. Therefore, impacts on this habitat, which is a qualifying interest of the SAC cannot be ruled out at this stage.

5.2.3 Disturbance to fauna

Due to the nature of the proposed works, they will involve some noise and visual impacts to fauna in the receiving environment. The River Finn SAC is designated for both Otter and Atlantic salmon. As noted above, a search was conducted for signs of otters (*Lutra lutra*) from ca. 50m upstream to 100m downstream of the bridge during survey work in 2022. No signs of otters were recorded. No otter spraints were recorded on rocks under the arch. No direct impacts to otter holt sites are anticipated. However, the proposed works could result in localised disturbance. As mentioned, the zone of impact is considered to be 500m for mobile species, such as otter. Although evidence of otter was not recorded during the site survey (see Section 4.2), otter is a qualifying interest of the downstream River Finn SAC and River Foyle and Tributaries SAC. Therefore, disturbance impacts on this species as a result of the proposed works are considered further.

Atlantic salmon is a qualifying interest of both the River Finn SAC and River Foyle SAC. As previously mentioned in section 4.1, salmon is widespread within these designated sites. The River Foyle and Tributaries is an important salmon river (see Section 4.1). As in-stream works will occur during the demolition and construction works on Cavan Bridge Culvert, impacts on these species through deterioration in water quality must be considered further as a result of the proposed works. The river in the immediate environs of the culvert and works area does not support suitable salmon spawning areas (redds) and water quality in the stretch of river is poor (see plates in Section 4.2).

5.2.4 Potential impacts on water quality

Due to the nature of the proposed works and that in-stream works will occur during the proposed works, they give rise to potential impacts on water quality through the input or resuspension of fine sediment during the demolition of the existing culvert, and input of hydrocarbons, as follows: -

- Sources of potential fine sediment input include release of soil from the riverbanks due to disturbance of trees or presence of heavy machinery near the bank. Sources of fine sediment resuspension include disturbance of accumulated silt and other fine sediment during the in-stream works which involve the demolition and construction of a box culvert. Plumes of silt or fine sediment can directly affect aquatic fauna, e.g. by clogging their gills, and can also reduce habitat quality, e.g. by smothering of spawning

gravels for salmonid species. Suspended sediment can also interact with other pollutants, magnifying their effects.

- Sources of hydrocarbon input include leaks of substances such as fuel, e.g. petrol or diesel, or lubricating oil from vehicles, plant or equipment. Hydrocarbons can have direct toxic effects on the flora and fauna of contaminated waters and soils.

The proposed works are located ca. 6.6km upstream from both the River Finn SAC and the River Foyle and Tributaries SAC, therefore, there is a hydrological connection (risk of deterioration in water quality) to the proposed works area. Given that, in-stream works will be carried out, both of these designated sites are considered to be within the zone of impact of the proposed works. Given the nature of the proposed works, there will be temporary physical change on the banks and channel of the river during the proposed works and the access of machinery along the riverbanks.

5.2.5 Invasive alien species

Any works in and adjacent to rivers carry a risk of the introduction or spread of invasive alien species, which can negatively affect native ecosystems. As noted Himalayan Balsam (*Impatiens glandulifera*) has been recorded at the works location. There are no records of Japanese Knotweed (*Fallopia japonica*) from this location. While there are no records of White-clawed crayfish (*Austropotamobius pallipes*) from watercourses in the environs of Lifford, Co. Donegal, due care will still be taken to avoid the spread of aphanomycosis (“crayfish plague”) (furthermore, White-clawed crayfish is not a QI species of any of the relevant Natura 2000 sites).

Given the results of the site visits which identified Himalayan balsam at the site of proposed works, preventing the spread of balsam is a key consideration. Proposals to address balsam are outlined below.

5.2.6 Summary

Given the extents of the potential impacts from the proposed works (as described above), the Zone of Influence for the proposed works is taken as the Cavan Stream, the Swilly Burn stream and the Foyle catchment. This stream flows to the Swilly Burn stream and ultimately the River Foyle, the River Finn SAC and the adjacent River Foyle and Tributaries SAC (in Northern Ireland). There are no other Natura 2000 sites in the immediate vicinity of the proposed works. Lough Swilly SAC/SPA is located ca. 12.1 km to the northwest of the proposed works area and there is no ecological link between the proposed works area and these sites or any other designated sites. There are no other designated sites within the Zone of Influence of the proposed works.

Based on the above examination of the Zone of Influence, one European site has been selected for inclusion in the Appropriate Assessment: –

- River Finn SAC (site code: 002301)
- River Foyle and Tributaries SAC (UK0030320)

Table 5.1 below outlines the qualifying interests of these designated sites and discusses whether further consideration is necessary in relation to the potential for likely significant effects on these sites as a result of the proposed works

Figure 5.1 below shows the location of the proposed works on the Cavan Bridge Culvert in relation to the River Finn SAC and the River Foyle and Tributaries SAC.

Table 5-1 - Designated sites within the Zol of the proposed works.

Natura 2000 Site	Site Code	Distance	Qualifying Interests	Within Zone of Influence (Zol)
River Finn SAC ⁹	IE002301	6.6km downstream of the proposed works	<ul style="list-style-type: none"> ➤ Oligotrophic waters containing very few minerals of sandy plains (<i>Littorelletalia uniflorae</i>) [3110] ➤ Northern Atlantic wet heaths with <i>Erica tetralix</i> [4010] ➤ Blanket bogs (* if active bog) [7130] ➤ Transition mires and quaking bogs [7140] ➤ <i>Salmo salar</i> (Salmon) [1106] ➤ <i>Lutra lutra</i> (Otter) [1355] 	Yes – There is hydrological connectivity from the proposed works to this SAC via the Cavan Stream, the Swilly Burn Stream and the River Foyle.
River Foyle and Tributaries SAC (Northern Ireland site) ¹⁰	UK0030320	6.6km downstream of proposed works	<ul style="list-style-type: none"> ➤ <i>Lutra lutra</i> (Otter) ➤ <i>Salmo salar</i> (Salmon) ➤ Water courses of plain to montane levels with the <i>Ranunculion fluitantis</i> and <i>Callitricho-Batrachion</i> vegetation 	Yes – There is hydrological connectivity from the proposed works to this SAC via the Cavan Stream, the Swilly Burn Stream and the River Foyle.

⁹ NPWS (2017). *Conservation Objectives: River Finn SAC 002301. Version 1*. National Parks and Wildlife Service, Department of Arts, Heritage, Regional, Rural and Gaeltacht Affairs.

¹⁰ [River Foyle & Tributaries SAC Conservation Objectives 2015 \(daera-ni.gov.uk\)](https://www.daera-ni.gov.uk/sites/default/files/2015-05/River-Foyle-Tributaries-SAC-Conservation-Objectives-2015.pdf).

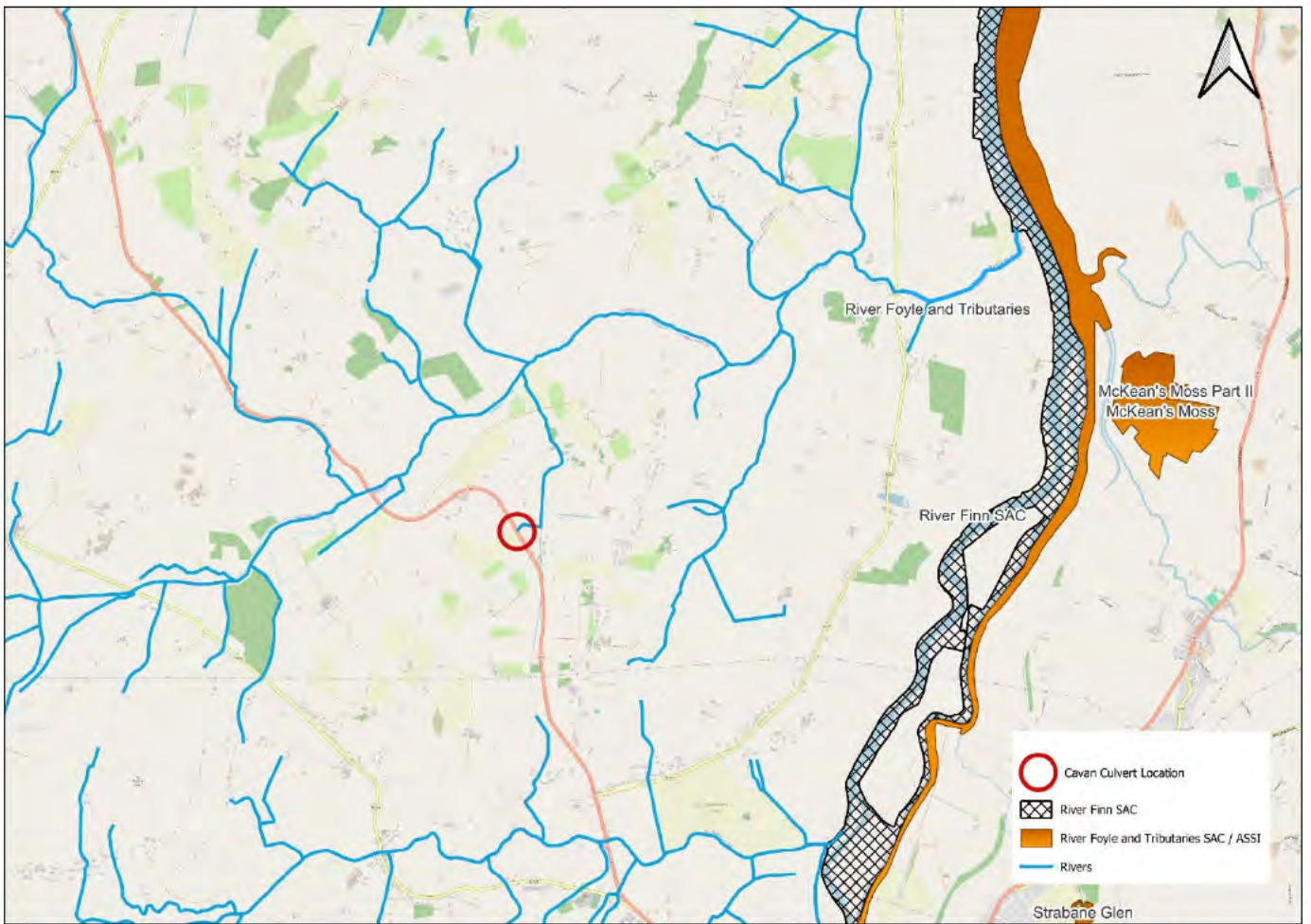


Figure 5.1 - Location of the proposed works on Cavan Bridge Culvert (red circle) in relation to the River Finn SAC (orange area) (Source: Bing Aerial Map).

5.3 Description of Natura 2000 Sites

5.3.1 River Finn SAC (site code: 002301)

The River Finn SAC is described as follows: -

“This site comprises almost the entire freshwater element of the River Finn and its tributaries the Corlacky, the Reelan sub-catchment, the Sruhamboy, Elatagh, Cummirk and Glashagh, and also includes Lough Finn, where the river rises. The spawning grounds at the headwaters of the Mourne and Derg Rivers, Loughs Derg and Belshade and the tidal stretch of the Foyle north of Lifford to the border are also part of the site. The Finn and Reelan, rising in the Bluestack Mountains, drain a catchment area of 195 square miles. All of the site is in Co. Donegal. The underlying geology is Dalradian Schists and Gneiss for the most part though quartzites and Carboniferous Limestones are present in the vicinity of Castlefinn. The hills around Lough Finn are also on quartzite. The mountains of Owendoo and Cloghervaddy are of granite felsite and other intrusive rocks rich in silica. There are many towns along the river but not within the site, including Lifford, Castlefinn, Stranolar and Ballybofey.

*The Finn system is one of Ireland’s premier salmon waters. Although the Atlantic Salmon (*Salmo salar*) is still fished commercially in Ireland, it is considered to be endangered or locally threatened elsewhere in Europe and is listed on Annex II of the E.U. Habitats Directive. Commercial netting on the Foyle does not begin until June and this gives spring fish a good opportunity to get into the Finn. The Finn is important in an international context in that its populations of spring salmon appear to be stable, while they are declining in many areas of Ireland and Europe. The salmon fishing season is 1st March to 15th September. Fishing for spring salmon is best east of Stranolar while the grilse run through to the upper reaches. The grilse run peaks here, depending on water, usually in mid-June. The estimated rod catch from the Finn is approximately 500-800 spring salmon and 4,000 grilse annually, producing about 40% of the total Foyle count. The Loughs Agency has a management regime in place called the ‘control of fishing regulations’. If enough salmon are not past the counter at Killygordon at a certain key date then both the angling and commercial fishing can be closed for set periods.”*

5.3.1.1 Qualifying Interests

The River Finn SAC is designated for the following habitats and species. An asterisk (*) denotes a priority habitat under the Habitats Directive: -

- Oligotrophic waters containing very few minerals of sandy plains (*Littorelletalia uniflorae*) [3110]
- Northern Atlantic wet heaths with *Erica tetralix* [4010]
- Blanket bogs (* if active bog) [7130]
- Transition mires and quaking bogs [7140]
- *Salmo salar* (Salmon) [1106]
- *Lutra lutra* (Otter) [1355]

As discussed previously in Section 4.1, due to the size and geographic range of the SAC, not all qualifying interests of the SAC are within the ZoI of the proposed works on the Cavan Bridge Culvert. Table 5.3 details the identification of qualifying interests of the SAC that are within the ZoI of the proposed works.

Thus, the qualifying interests of the SAC that are within the ZoI of the proposed project are: -

- *Salmo salar* (Salmon) [1106]
- *Lutra lutra* (Otter) [1355]

5.3.1.2 Conservation Objectives

The site-specific conservation objectives for the River Finn SAC and the specific attributes and targets defining the objectives for each qualifying interest are detailed in NPWS (2017). The overall aim is to maintain or restore the favourable conservation status of the habitats and species of community interest, i.e., the habitats and species for which the SAC is designated.

The site-specific conservation objectives of the qualifying interests of the SAC within the Zol of the proposed works are as follows and the attributes for these conservation objectives are detailed further in Table 6-3: -

- To maintain the favourable conservation condition of Atlantic Salmon in River Finn SAC.
- To maintain the favourable conservation condition of Otter in River Finn SAC.

5.3.1.3 Threats and Pressures

The potential threats, as identified by NPWS, for the River Finn SAC are given in Table 5.2 below. The Site Synopsis (NPWS, 2014) describes the land use and management within the site as follows: -

“Agriculture, with particular emphasis on grazing, is the main land use along the Finn and its tributaries. Much of the grassland is unimproved but improved grassland and silage are also present, particularly east of Ballybofey. The spreading of slurry and fertiliser poses a threat to the water quality of this salmonid river, particularly in this region as the river is subject to extensive flooding. Fishing is a main tourist attraction on the Finn and there are a large number of Angler Associations, some with a number of beats. Fishing stands and styles have been erected in places. The River Finn is a designated Salmonid Water under the E.U. Freshwater Fish Directive. Other aspects of tourism such as boating are concentrated around Lough Finn.

Afforestation is ongoing, particularly along the western sections of the site adjacent to the headwaters and around the shores of Lough Derg. Recent planting has been carried out along the Cronamuck River. Forestry poses a threat in that sedimentation and acidification occurs. Sedimentation can cover the gravel beds resulting in a loss of suitable spawning grounds”.

Table 5-2 - Threats, pressures, and activities with negative impacts on the River Barrow and River Nore SAC (Eionet 2022).

Rank	Threats and pressures [code]	Threats and pressures [type]	Location
Low	E04	Structures, buildings in the landscape	inside
Medium	K01.01	Erosion	inside
High	B02.02	forestry clearance	inside
Medium	H01.05	diffuse pollution to surface waters due to agricultural and forestry activities	inside
Low	F05.04	poaching	inside
High	A04.01	intensive grazing	inside
High	C01.03.01	hand cutting of peat	inside
Medium	E03.01	disposal of household / recreational facility waste	inside

5.3.2 River Foyle and Tributaries SAC (UK0030320)

The River Foyle and Tributaries SAC (UK) is described as follows¹¹: -

“This area has been designated as a Special Area of Conservation (SAC) because it contains habitat types and/or species which are rare or threatened within a European context. The ASSI citation describes the special interests for which the site was notified in the Northern Ireland context. [NB: not for marine interests below mean low water mark]. The interests for which the site was selected as ASSI may differ from the interests selected in a European context.

The habitats and/or species for which this area has been designated as a SAC are listed below. The reasons for their selection are listed, together with a brief description of the habitats and species as they typically occur across the UK. This area contains the interests described although it may not contain all the typical features.”

Further, in the River Foyle & Tributaries SAC Conservation Objectives¹² the site is described as follows: -

*“The SAC includes the River Foyle and its tributaries i.e. that part of the River Finn which lies within Northern Ireland, the River Mourne and its tributary the River Strule (up to its confluence with the Owenkillew River) and the River Derg, along with two of its sub-tributaries, the Mourne Beg River and the Glendergan River. In total, the area encompasses 120km of watercourse and is notable for the physical diversity and naturalness of the banks and channels, especially in the upper reaches, and the richness and naturalness of its plant and animal communities. Of particular importance is the population of Atlantic Salmon *Salmo salar*, which is one of the largest in Europe. Research has indicated that each sub-catchment within the system supports genetically distinct populations.*

*The area is also important as a river habitat. In their upper catchments, the rivers are all fast-flowing spate rivers with dynamic flow regimes characterised by sequences of rapid, riffle and run. Although the banks may have been modified in the past, the channels are natural and composed of large cobble substrate with scattered boulders and sandy marginal deposits, while cobble side and point bars Page 5 of 26 and discrete sand deposits are common features. At the top end of the River Derg and its two tributaries, the aquatic flora reflect the highly acidic character of the water, with mosses and liverworts dominant. Beds of Stream Water Crowfoot *Ranunculus penicillatus* var. *penicillatus* occur where the flow is less dynamic. The River Foyle below Strabane is slow-flowing and is influenced by a tidal regime, rising and falling with the tidal cycle. Aquatic plants in the channel are extremely limited, particularly in the more saline areas; here, fucoids make up the main component.*

*Otter *Lutra lutra* is found throughout the system.*

*A small population of the now rare Freshwater Pearl Mussel *Margaritifera margaritifera* was still present in the Mourne River in the mid-nineties.”*

5.3.2.1 Qualifying Interests

- European Otter (*Lutra lutra*)
- Atlantic Salmon (*Salmo salar*)
- Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitriche-Batrachion* vegetation

¹¹ https://www.daera-ni.gov.uk/sites/default/files/publications/doe/land-information-reasons-for-designation-special-area-of-conservation-river-foyle-and-tributaries-2006_0.pdf.

¹² [River Foyle & Tributaries SAC Conservation Objectives 2015 \(daera-ni.gov.uk\)](#).

5.3.2.2 Conservation Objectives

The site-specific conservation objectives for the River Foyle and Tributaries SAC and the specific attributes and targets defining the objectives for each qualifying interest are detailed on the DAERA website (2015)¹³. The overall aim is to maintain or restore the favourable conservation status of the habitats and species of community interest, i.e., the habitats and species for which the SAC is designated.

The site-specific conservation objectives of the qualifying interests of the SAC within the Zol of the proposed works are as follows and the attributes relating to these conservation objectives are detailed further in Table 6-4: -

- Atlantic Salmon (*Salmo salar*)
 - Maintain and if possible expand existing population numbers and distribution (preferably through natural recruitment), and improve age structure of population.
 - Maintain and if possible enhance the extent and quality of suitable Salmon habitat - particularly the chemical and biological quality of the water and the condition of the river channel and substrate.
- Water courses of plain to montane levels with the *Ranunculus fluitans* and *Callitriche-Batrachion* vegetation
 - Maintain and if possible enhance extent and composition of community.
 - Improve water quality.
 - Improve channel substrate quality by reducing siltation.
 - Maintain and if feasible enhance the river morphology
- Otter (*Lutra lutra*)
 - Maintain and if possible enhance extent and composition of communities.
 - Maintain the extent and quality of suitable Otter habitat, in particular the chemical and biological quality of the water and all associated wetland habitats

The following objectives are the River Foyle and Tributaries SAC / ASSI Feature Objective Requirements: -

- Series of river types present with corresponding macrophyte assemblages, ranging from ultraoligotrophic to eutrophic and brackish types
 - Improve water quality.
 - Improve channel substrate quality by reducing siltation.
 - Maintain and if possible, enhance the river morphology.
 - Maintain the diversity and quality of habitats associated with the river, e.g. bog, wet grasslands, scrub and oak woodland.

5.3.2.3 Threats and Pressures

The following threats and pressures for the River Foyle and Tributaries SAC are listed in the Conservation Objectives Document: -

¹³ [River Foyle & Tributaries SAC Conservation Objectives 2015 \(daera-ni.gov.uk\)](https://www.daera-ni.gov.uk/river-foyle-tributaries-sac-conservation-objectives-2015)

“Both on-site and off-site activities can potentially affect SAC/ASSI features. The list below is not exhaustive but deals with the most likely factors that are either affecting River Foyle & Tributaries, or could affect it in the future.

*Although Atlantic Salmon (*Salmo salar*), Water courses of plain to montane levels with the *Ranunculus fluitans* and *Callitriche-Batrachion* vegetation and Otter (*Lutra lutra*) are the qualifying SAC features, factors affecting ASSI features are also considered.*

NOTE - Carrying out any of the Notifiable Operations listed in the ASSI schedule could affect the site.

Water Quality/Eutrophication

Water quality is probably the most important single factor for the SAC and ASSI selection features, with both point and diffuse sources of pollution potentially damaging. These are dependent on human activities throughout the catchment, the majority of which are largely beyond the direct control of the current designation. The total catchment area feeding into the river system is 300,000ha, 78,000ha of which fall within the Republic of Ireland and consists of 27 sub-catchment areas in Northern Ireland. The designation only includes the main channels of the Strule, Mourne, Derg, Mourne Beg, Glendergan, Finn and Foyle rivers and has excluded several tributaries.

Analysis of biological water quality monitoring data from 1991 to 1998 indicates that water quality is good to very good on all rivers and there has been no deterioration in quality over this period. Chemical water quality monitoring data indicates that water quality is moderate in the Derg and its tributaries but varies from moderate to poor in the Mourne and Strule.

A significant portion of the upper catchments of the tributaries are afforested; there is a potential for enrichment of the river during forestry operations (planting and fertiliser application).

Stock have open access to the channel in many sections and have caused poaching of the bank and channel. This represents another possible source of enrichment.

ACTION: Reduce enrichment of the water column by minimising point source pollution and through a catchment-wide campaign, encourage landowners to avoid excessive fertiliser inputs, thus reducing diffuse pollution. Restrict stock access to less sensitive watering points.

Channel & Bank Modification

A number of sections of the river channels have been extensively altered by man in the past. These modifications have changed the natural flow regime of the river, resulting in a reduction of the natural channel area available to aquatic vegetation or for spawning Atlantic Salmon. However, the river continues to recover from the effects of re-sectioning.

ACTION: Future in-river works should be minimised as they reduce habitat and species diversity. Due to the dynamic nature of rivers, work carried out at any point on the river may have a significant impact on the catchment as a whole. Initiate discussions with Rivers Agency to co-ordinate action.

Habitat enhancement schemes, such as the ‘Salmonid Enhancement Programme’ should be thoughtfully planned. Properly executed enhancement schemes can significantly improve the wildlife potential of rivers, but it is important to effectively manage the installation of structures such as weirs, as they may have a negative effect on species diversity by causing excessive damming of the channel. In the past, the construction of weirs by fishing clubs Page 11 of 26 as part of the programme has locally altered the morphology of the river. Enhancement work should be limited to areas of river that have been extensively modified by past drainage schemes and which have lost much of their natural dynamic character.

ACTION: Initiate discussions with DARD Fisheries Division and Environmental Protection to co-ordinate action.

Substrate Siltation A significant portion of the area is afforested (especially the upper catchments), with a potential risk of sediment release during forestry operations, especially clear-felling.

ACTION: Liaise with Forest Service during felling and re-stocking programmes to minimise potential impacts (including potential eutrophication from planting and fertiliser application).

Sand wash from a number of commercial sandpits in the upper reaches of the tributary rivers has resulted in siltation of the riverbed downstream.

ACTION: Monitor and control sediment input levels in tributaries and immediately downstream of sandpits.

Where the bank and channel of the river are accessible to stock, damage to both the Atlantic Salmon spawning grounds and the macrophyte community may occur. Trampling has an obvious direct impact but in some sections of the river, trampling and poaching of the river bank and channel have caused erosion, resulting in siltation of the riverbed downstream. ACTION: Restrict livestock access to drinking areas only.

Sand Extraction Small-scale sand extraction from the riverbed has been an ongoing practice by farmers, particularly in the lower reaches of the river. This disturbance results in damage to the river morphology and increase in sediment loading, thus directly and indirectly affecting spawning beds and the macrophyte community. ACTION: Under the Notifiable Operations, this activity is prohibited - ensure compliance with the ASSI Schedule.

Fish Farms

Fish farms can have a very serious impact on rivers. Fish farms normally abstract water from the river and release effluent downstream. Where the abstraction is large relative to streamflow, the channel between points of abstraction and release may have a much-reduced discharge and water velocity. The effect can be so extreme that the upstream movement of migrating fish and other waterborne wildlife is obstructed. In addition, effluents from intensive fish farms may have a modified temperature and pH, may be contaminated with toxic materials and may carry waste and partly decomposed food and the metabolic products of the fish. This can lead to increased oxygen demand (and hence a low oxygen Page 12 of 26 concentration in the water), increased suspended solids and enrichment of the recipient stream.

NIEA is aware of two fish farms in the area, but they do not appear to be having any damaging effects on the river or the Atlantic Salmon population. Proposals for any further fish farms in the area will require very careful environmental assessment. In particular, it is imperative to ensure that an adequate compensatory flow is maintained and that the effluent is adequately treated. ACTION: Review existing Water Act consents.

Water Extraction

A natural flow regime is essential for the maintenance of many of the selection features. There are several extraction sites along the river. Proposals for further water extraction in the area will require very careful environmental assessment.

ACTION: Review existing Water Act consents.

Fly-tipping

Small-scale fly tipping has occurred in places along the river banks and in the river channel, as well as in adjacent woodland. ACTION: Where practical, remove dumped material from the banks, channel and adjoining woodland to prevent the build-up of debris and discourage further tipping.

Alien species

Japanese Knotweed (*Fallopia japonica*), Giant Hogweed (*Heracleum mantegazzianum*) and Indian Balsam (*Impatiens glandulifera*) are present along the riverbanks of the major rivers.

ACTION: Monitor and if necessary, control the spread of alien species.

Nitrogen Deposition

Excess nitrogen deposition can favour the growth of competitive plants and lead to changes in ecosystem structure or function and to a reduction in biodiversity. National scale studies show the potential adverse effects of excess nitrogen on natural and semi-natural habitats to be widespread across the UK. Lower and upper critical loads have been calculated for the River Foyle & Tributaries SAC.

ACTION: Seek to maintain or where necessary, restore concentrations and deposition of air pollutants to at or below the site-relevant critical load.

Changes to surrounding land use

Any changes in local land-use e.g. agricultural intensification, drainage works and development) may be detrimental to the SAC.

ACTION: Reduce the risk of surrounding agricultural intensification by encouraging the adjacent owner/occupiers to enter into agri-environment schemes. Use Habitats Regulations Assessments (HRAs), through the planning process, to minimise any development risks adjacent to the SAC.

Climate Change

Northern Ireland faces changes to its climate over the next century. Indications are that we will face hotter, drier summers, warmer winters and more frequent extreme weather events.

Table 5.3 shows the threats and pressures for the River Foyle and Tributaries ASSI¹⁴.

¹⁴ <https://jncc.gov.uk/jncc-assets/SAC-N2K/UK0030320.pdf>

Table 5-3 - Threats, pressures, and activities with negative impacts on the River Foyle and Tributaries SAC (JNCC, 2024).

Rank	Threats and pressures [code]	Threats and pressures [type]	Location
High	B02	Forest and Plantation management & use	inside
High	M01	Changes in abiotic conditions	outside
Medium	C03	Renewable abiotic energy use	inside
Medium	C01	Mining and quarrying	inside
High	H01	Pollution to surface waters (limnic & terrestrial, marine & brackish)	outside
High	I01	invasive non-native species	Inside
High	J02	human induced changes in hydraulic conditions	inside
Medium	F02	Fishing and harvesting aquatic resources	inside

Tables 5.4 and 5.5 below, show the Qualifying Interests of the River Finn SAC and the River Foyle and Tributaries SAC (Northern Ireland) within the ZoI of the proposed works.



6. Assessment of Adverse Effects

6.1 Identification of Potential Impacts

This section identifies potential impacts on the qualifying interests of the Natura 2000 sites concerned following the source-pathway-receptor model, i.e. by identifying the impacts from the proposed works (sources) to which the qualifying interests (receptors) are sensitive and establishing whether there are pathways for those impacts.

6.1.1 River Finn SAC

Table 6-1 - Qualifying Interests of the River Finn SAC within the Zol of the proposed works.

Qualifying Interest	Comment	Within Zol
Oligotrophic waters containing very few minerals of sandy plains (<i>Littorelletalia uniflorae</i>) [3110] Northern Atlantic wet heaths with <i>Erica tetralix</i> [4010] Blanket bogs (* if active bog) [7130] Transition mires and quaking bogs [7140]	These habitats are not present in the immediate vicinity of the proposed works, as confirmed by the site visits. These habitats are also not recorded within the 10km grid square (C30) that the proposed works are located within. Therefore, these habitats are not considered to be within the Zol of the proposed works.	No
<i>Salmo salar</i> (Salmon) [1106]	Salmon are present in almost all rivers in Ireland. Salmon also travel upstream each year to spawn. It is, therefore, highly likely that this species will travel in the vicinity of the proposed works. This species is considered to be within the Zol of the proposed works.	Yes
<i>Lutra lutra</i> (Otter) [1355]	Otters are widely distributed across freshwater habitats and are well documented by the NBDC within the Foyle catchment. Although no signs of otter were recorded during the site visit, otter use water channels to commute and forage. Therefore, this species is considered to be within the Zol of the proposed works.	Yes

6.1.2 River Foyle and Tributaries SAC

Table 6-2 - Qualifying Interests of the River Foyle and Tributaries SAC within the Zol of the proposed works.

Qualifying Interest	Comment	Within Zol
Water courses of plain to montane levels with the <i>Ranunculus fluitans</i> and <i>Callitricho-Batrachion</i> vegetation [3260]	The proposed works are located on the Cavan Bridge Culvert, over the Cavan Stream which ultimately flows to the River Foyle. Although this habitat was not recorded in the immediate environs of the proposed work, there is potential for this habitat to exist immediately downstream of the works along the Swilly Burn Stream or the River Foyle. Therefore, this habitat is considered to be within the Zol of the proposed works.	Yes
<i>Salmo salar</i> (Salmon) [1106]	Salmon are present in almost all rivers in Ireland. Salmon also travel upstream each year to spawn. It is, therefore, highly likely that this species will travel in the vicinity of the proposed works. This species is considered to be within the Zol of the proposed works.	Yes
<i>Lutra lutra</i> (Otter) [1355]	Otters are widely distributed across freshwater habitats and are well documented by the NBDC within the Foyle catchment. Although no signs of otter were recorded during the site visit, otter use water channels to commute and forage. Therefore, this species is considered to be within the Zol of the proposed works.	Yes

6.1.3 Summary

As explained in Table 6-1 (River Finn SAC) and 6-2 (River Foyle and Tributaries SAC) potential impacts on the following qualifying interests could not be ruled out: -

- Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation
- Otter
- Atlantic Salmon

The potential impacts on these qualifying interests are analysed and the significance of their effects evaluated, in view of their conservation objectives, in Section 6.2.

6.2 Analysis and Evaluation of Effects

This section analyses the potential impacts identified in Table 6-1 and 6-2 and evaluates the significance of their effects in view of the relevant conservation objectives, as defined by their specific attributes and targets.

Table 6-3 - Evaluation of effects on the River Finn SAC (LSE-likely significant effect).

Conservation objective	Habitat	Description of effects	LSE
<i>To restore the favourable conservation condition of Salmon in the River Finn SAC</i>	Salmon	<p>The attributes of this conservation objective relate to distribution (extent of anadromy), adult spawning fish, fry and out-migrating smolt abundance, number and distribution of redds, and water quality. Given the nature of the proposed works, the only attribute potentially affected is water quality.</p> <p>The use of machinery gives rise to a risk of water quality impacts, particularly hydrocarbon contamination. Given the location of the works (ca. 6.6km upstream of this SAC) and that the works are to be undertaken in the dry (Section 1.1.2), the probability of any such impact occurring is low and, if they were to occur, the magnitude would also be low. The construction is expected to be carried out in dry conditions, where the stream is anticipated to be dry for most of the year. In case of water flow during construction, the stream will be dammed upstream and downstream near the outlet of the culvert to allow the flow of the stream to be flumed or pumped around the works area. Access across the upstream to the southern part of the site compound shall be prepared in the dry region created by pumping. Given the extent of the proposed works and that the stream will be dammed in the case of water flow, downstream impacts as a result of the proposed works, cannot be ruled out at this stage.</p>	Yes
<i>To restore the favourable conservation condition of Otter in the River Finn SAC</i>	Otter	<p>The attributes of this conservation objective relate to distribution, extent of terrestrial, marine and freshwater habitats, couching sites and holts, and fish biomass available. During the site survey, there was no evidence of otter holts or couches recorded and there will be no effect on the distribution of otters along the proposed works site.</p> <p>Otters are sensitive to noise and visual disturbance, which can form an effective barrier to connectivity along watercourses. The proposed works will give rise to some noise and visual disturbance within otter habitat; however, the proposed works are ca. 6.6km from the SAC on a small non EPA stream which provides lower quality habitat for otter. No evidence of otters along the proposed works was recorded during the site visit. The small size of the stream, together with its tendency to dry out is such that it is of limited ecological value to otter. Any impacts will be highly localised and of a brief duration. Therefore, they will not give rise to any significant disturbance effect on otters.</p>	Yes



Conservation objective	Habitat	Description of effects	LSE
		<p>Otters have a broad diet that varies locally and seasonally, but dominated by fish, in particular salmonids, eels and sticklebacks in fresh water (Bailey & Rochford, 2006). As noted above, impacts on salmon as a result of the proposed works, cannot be ruled out at this stage. It can be concluded that there is potential for a significant decline in the availability of fish or other prey for otters in downstream waters. Given this, likely significant effects on otter, as a result of the proposed works, cannot be ruled out at this stage.</p>	



Table 6-4 - Evaluation of effects on the River Foyle and Tributaries SAC (LSE-likely significant effect).

Conservation objective	Habitat	Description of effects	LSE
<p><i>To restore the favourable conservation condition of Salmon in the River Foyle and Tributaries SAC</i></p> <p><i>Maintain and if possible, expand existing population numbers and distribution (preferably through natural recruitment), and improve age structure of population.</i></p> <p><i>Maintain and if possible, enhance the extent and quality of suitable Salmon habitat - particularly the chemical and biological quality of the water and the condition of the river channel and substrate.</i></p>	Salmon	<p>The attributes of this conservation objective relate to distribution (extent of anadromy), adult spawning fish, fry and out-migrating smolt abundance, number and distribution of redds, and water quality (NPWS 2017). Given the nature of the proposed works, the only attribute potentially affected is water quality.</p> <p>As mentioned above, the use of machinery gives rise to a risk of water quality impacts, particularly hydrocarbon contamination. Given the location of the works (ca. 6.6km upstream of this SAC) and that the works are to be undertaken in the dry (Section 1.1.2), the probability of any such impact occurring is low and, if they were to occur, the magnitude would also be low. The construction is expected to be carried out in dry conditions, where the stream is anticipated to be dry for most of the year. In case of water flow during construction, the stream will be dammed upstream and downstream near the outlet of the culvert to allow the flow of the stream to be flumed or pumped around the works area. Access across the upstream to the southern part of the site compound shall be prepared in the dry region created by pumping. Given the extent of the proposed works and that the stream will be dammed in the case of water flow, downstream impacts as a result of the proposed works, cannot be ruled out at this stage.</p>	Yes
<p><i>To restore the favourable conservation condition of Otter in the River Foyle and Tributaries SAC</i></p> <p><i>Maintain and if possible increase population numbers and distribution</i></p> <p><i>Maintain the extent and quality of suitable Otter</i></p>	Otter	<p>The attributes of this conservation objective relate to distribution, extent of terrestrial, marine and freshwater habitats, couching sites and holts, and fish biomass available. During the site survey, there was no evidence of otter holts or couches recorded and there will be no effect on the distribution of otters along the proposed works site.</p> <p>As mentioned above, otters are sensitive to noise and visual disturbance, which can form an effective barrier to connectivity along watercourses. The proposed works will give rise to some noise and visual disturbance within otter habitat; however, the proposed works are ca. 6.6km from the SAC on a small non EPA stream which provides lower quality habitat for otter. No evidence of otters along the proposed works was recorded during the site visit.</p>	Yes



Conservation objective	Habitat	Description of effects	LSE
<i>habitat, in particular the chemical and biological quality of the water and all associated wetland habitats</i>		<p>The small size of the stream, together with its tendency to dry out is such that it is of limited ecological value to otter. Any impacts will be highly localised and of a brief duration. Therefore, they will not give rise to any significant disturbance effect on otters.</p> <p>Otters have a broad diet that varies locally and seasonally, but dominated by fish, in particular salmonids, eels and sticklebacks in fresh water (Bailey & Rochford, 2006). As noted above, impacts on salmon as a result of the proposed works, cannot be ruled out at this stage. It can be concluded that there is potential for a significant decline in the availability of fish or other prey for otters in downstream waters. Given this, likely significant effects on otter, as a result of the proposed works, cannot be ruled out at this stage.</p>	
<p><i>Maintain and if possible, enhance extent and composition of communities</i></p> <p><i>Improve water quality</i></p> <p><i>Improve channel substrate quality by reducing siltation.</i></p> <p><i>Maintain and if possible enhance the river morphology</i></p>	Water courses of plain to montane levels with the <i>Ranunculion fluitantis</i> and <i>Callitriche-Batrachion</i> vegetation	<p>The proposed works will not have a significant impact on the channel substrate quality and the river morphology as the works will be carried out in the dry.</p> <p>As mentioned above, there is potential for the proposed works to have a significant impact on the water quality as a result of the proposed works.</p> <p>In case of water flow during construction, the stream will be dammed upstream and downstream near the outlet of the culvert to allow the flow of the stream to be flumed or pumped around the works area. Access across the upstream to the southern part of the site compound shall be prepared in the dry region created by pumping. Given the extent of the proposed works, downstream impacts as a result of the proposed works cannot be ruled out at this stage and are considered further below.</p>	Yes



6.2.1 Summary

With regard to the River Finn SAC and the River Foyle and Tributaries SAC, potential impacts on the following qualifying interests could not be ruled out: -

- Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation
- Atlantic Salmon
- Otter

As the possibility of adverse effects on the above qualifying interests could not be ruled out, appropriate mitigation is required in order to avoid or reduce the impacts of the proposed works on those qualifying interests such that they no longer represent adverse effects in view of the relevant conservation objectives.



7. Mitigation

7.1 Requirement and Approach

Section 6 of this NIS found that, in the absence of appropriate mitigation, the proposed works have the potential to adversely affect the conservation objectives for 'Water courses of plain to montane levels with the *Ranunculus fluitantis* and *Callitriche-Batrachion* vegetation', Atlantic Salmon and Otter in the River Finn SAC and the River Foyle and Tributaries SAC. The potential for such effects arises due to the risk of water quality impacts. This section prescribes mitigation measures to address these impacts and, thereby, eliminate the possibility of adverse effects.

The development of the mitigation measures prescribed in this section has followed the "mitigation hierarchy", which prioritises avoidance over reduction, and actions at source over pathway over receptor, as follows: -

1. Eliminate the source of the impact,
2. Minimise or reduce the impact at its source,
3. Block or weaken the pathway for effects, and
4. Abate effects at the receptor.

This approach assists with more complete removal of the effects, minimises the risk of effects occurring by less obvious pathways, also protects non-target receptors, and minimises the risks of unintended harm associated with measures focussed at or near the receptors.

7.2 Mitigation Measures

7.2.1 Construction Phase

This section details the mitigation measures which will be implemented by the Contractor during the construction phase. These measures have been developed in consultation with the Contractor and shall be incorporated into the Contractor's Risk Assessment Method Statement (RAMS).

7.2.1.1 General Precautions

The following overarching measures shall apply to the construction phase: -

1. All works shall be undertaken within the agreed works area. No works shall be undertaken outside the works area.
2. As part of site induction, all persons entering the works area shall receive a 'tool-box talk' covering the environmental and ecological sensitivities of the site and the measures being implemented to avoid and minimise impacts on those sensitivities, as well as the responsibilities of persons on site in implementing those measures.
3. All in-stream and bankside works shall be carried out within the period beginning on 1st July and ending on 30th September. This includes all of the temporary enabling works, i.e. water management.
4. No works shall be undertaken before sunrise or after sunset.



7.2.1.2 Ecological Supervision

The Contractor shall retain the services of a suitably qualified and experienced ecologist (“Contractor’s ecologist”) for the duration of the works.

The qualifications and experience of the Contractor’s ecologist shall include, as a minimum: -

- BSc (Hons) or above in Ecology or a related environmental discipline,
- Full membership of the CIEEM or equivalent membership of a similar professional body,
- Demonstrable experience in providing ecological/environmental oversight on construction sites, including sites where sensitive watercourses are present.

The main duties of the Contractor’s ecologist shall include the following: -

1. Assist the Contractor in ensuring that the measures in this NIS, any conditions of consents/licences and relevant TII guidelines are fully and properly implemented during construction.
2. Undertake pre-construction surveys for legally restricted IAS, any breeding or resting places of species listed on Annex IV to the Habitats Directive, and nesting birds.
3. Advise the Contractor on any requirement for a derogation licence under Regulation 54 of the Habitats Regulations due to the presence of breeding or resting places of species listed on Annex IV to the Habitats Directive, as identified during the pre-construction surveys.¹⁵
4. Directly supervise and record key activities on site, including: -
 - a. Set-up of water management measures,
 - b. Dewatering of the works area and fish rescue,
 - c. Pouring of concrete scour protection,
 - d. Rearrangement and removal of water management measures.
5. Carry out weekly inspections of the site and document the implementation of the measures in this NIS, any conditions of consents/licences and relevant TII guidelines. The Contractor’s ecologist’s records shall be available to TII or TII’s Representative, the NPWS and Loughs Agency, on request.
6. Provide monthly updates to TII or TII’s Representative on the implementation of the mitigation measures detailed in this NIS and any ecological/environmental incidents on site.

7.2.1.3 Protection of Watercourse / Water Management

In-stream works shall only begin once the working area is fully isolated and dewatered. The following measures apply specifically to the water management for in-stream works: -

- When working in watercourses including the erection of scaffolding and the like, the Contractor shall comply with Loughs Agency published guidance on working close to watercourses¹⁶. Loughs Agency were consulted prior to the works and the watercourse is not of fisheries value.

¹⁵ The Contractor, assisted by the Contractor’s ecologist, shall be responsible for applying for the licence and observing its conditions.

¹⁶ (Lough Agency. 2011. *Guidelines for Fisheries Protection during Development Works (Foyle and Carlingford areas)*. Environmental Guideline Series No. 1). This can be downloaded from the Lough Agency webpage.



- The Contractor shall, as appropriate, notify in writing to the Office of Public Works, National Parks and Wildlife Service, Loughs Agency etc. and/or any other relevant body at least 1 month in advance of any proposed works in or over the river channel for approval to commence work.
- It will be necessary to isolate the works area from the watercourse for the duration of works. The stream is to be dammed upstream and downstream of the existing bridge using double sealed sandbags to be placed spanning the width of the stream. If required hay bales can also be used in combination with sandbags. Their set up is to be supervised by the Contractor's ecologist.
- During the summer the stream is often dry – however, it is prone to re-establishment of flow during heavy rainfall. Thus, even if dry, the system of sandbag barriers is to be set up upstream and downstream of the works area.
- If the intervening areas does hold water, any fish present in the isolated area shall be rescued by electrofishing. This shall be carried out by Loughs Agency staff or another person authorised under Section 14 of the Fisheries (Consolidation) Act, 1959 (as amended). The Contractor's ecologist will advise on the need for electrofishing to salvage fish. Any fish captured are to be relocated to suitable nearby waters.
- All water removed from the works area shall be pumped to a mobile settlement tank with a hydrocarbon interceptor, which shall be placed in vegetated area at least 25m from the river and surrounded by a silt fence.
 - This system shall be checked on a daily basis by the Contractor and weekly by the Contractor's ecologist and any issues identified shall be addressed immediately and recorded.
 - Sediment and hydrocarbons built up in this system shall be removed as and when necessary and sent off-site for appropriate disposal and recorded.
- Following dewatering, any water that seeps through the dams or the riverbed will flow to a low point or sump at the downstream end and can then be pumped out as described above.
- A secondary 4-inch pump shall be stored on site as a back-up.

7.2.1.4 Water Quality

In addition to the water management mitigation detailed above, the following measures shall also apply to prevent water quality impacts generally: -

- During all stages of construction, site management shall ensure that good housekeeping is maintained at all times and that all site personnel are made aware of the importance of the freshwater environments and the requirement to avoid pollution.
- Safe handling of all potentially hazardous materials will be emphasised to all site personnel.
- Tools and equipment shall not be cleaned in any watercourse and wash water shall not be discharged directly into any watercourse or road drains without appropriate treatment.
- The Contractor's RAMS shall include an Emergency Response Procedure (ERP) as follows: -
 - Prior to the commencement of works, the Contractor, assisted by the Contractor's ecologist, shall elaborate a detailed, project-specific ERP on the basis of the outline ERP and the mitigation in this NIS. The final ERP shall be agreed with TII.
 - The ERP shall be adhered to in order to address any pollution incidents on site, including from flooding, and in that regard shall pay particular attention to water management.



- Notwithstanding that the proposed works will be carried out within the period beginning on 1st July and ending on 30th September, when there is a reduced risk of heavy rainfall, the Contractor shall make daily checks for elevated water levels/flows in the river and weather warnings or flood alerts from Met Éireann.
 - Should water levels in the river or overland flows pose a risk of overwhelming water quality control measures, or a weather warning for extreme rainfall or a flood alert covering County Donegal be in place.
 - i. All areas of exposed soil shall be securely covered with hessian matting,
 - ii. All stockpiles shall also be securely covered, and
 - iii. Works with a pollution risk, e.g. in-stream works, excavations, flow diversion, and works involving wet concrete, other cementitious materials or lime, shall be suspended and all vehicles, plant, equipment, construction materials and personnel shall be removed from the flood zone.
 - Works may resume once any flood waters have receded, and any warning/alert been lifted.

In addition, the measures in the following sub-sections shall apply to control the risk of water quality impacts from specific sources.

7.2.1.5 Run-off

The following shall be implemented to minimise the quantity of any run-off entering the river and to minimise any contamination of run-off by fine sediment or other deleterious matter: -

- Where possible, run-off from outside of the works area shall be intercepted before entering the works area and diverted around it.
- Run-off from the dry (bankside) and dewatered works areas will generally drain to the low point or sump at the downstream end of the dewatered area and pumped to the settlement tank, as described above, where sediment and hydrocarbons will be trapped before the water is allowed to slowly filter back to the river.
- Any stockpiles shall not be located within 25m of the river and shall be covered overnight.

7.2.1.6 Hydrocarbons

The following shall be implemented to control the risk of pollution from hydrocarbons, including fuels, hydraulic oils etc. on site: -

- Storage of any fuels, oils and other hydrocarbons on site shall be in secure tanks/containers banded to 110% capacity.
- Refuelling shall not be permitted within 50m of any watercourse.
- All vehicles, plant, equipment etc. shall: -
 - Be free of any mechanical defects, and be well maintained so as to prevent fuel or oil leaks,
 - Be mechanically sound and checked before arriving on site,
 - Not be left idling when not in use, and
 - Be parked/stored on drip trays overnight.



- Driving on the riverbed and banks shall be kept to a minimum.
- All site personnel shall be familiar with their responsibilities in the event of spills. In particular: -
 - All construction personnel shall be trained in the use of the spill containment/pollution control kits which will be kept on site.
 - Any spillage of fuels, lubricants or hydraulic oils shall be immediately contained, and a pollution control kit used. The contaminated soil shall be removed off site and properly disposed of.
 - Any spillage of fuels, lubricants or hydraulic oils, shall be reported immediately to the Contractor and the Contractor's ecologist.
- Additional drip trays and spill kits shall be accessible from the site compound.

7.2.1.7 Use of Concrete

The following shall be implemented to prevent contamination of the river by concrete, other cementitious materials or lime: -

- Shuttering shall be used to contain the wet concrete and blinding, and the shuttering shall be surrounded with hessian sandbags to prevent any contamination of any water in the works area.
- Ready-mix concrete shall be delivered to site in a volumetric lorry, which shall set up at road level. A concrete pump shall be used to deliver concrete from the lorry into the works area.
- Concrete lorries shall not be permitted to wash out on site.

7.2.1.8 Maintenance of Connectivity for Otter

The following shall be implemented to ensure permeability of the works area for Otter during the works: -

- All works activities shall be restricted to daylight hours, avoiding the hours during which otters are most likely to move through the works area.
- There shall be no artificial lighting of the works area outside of the permitted working hours.
- Outside of working hours, excavations shall either be securely covered or have sloped sides/a ramp to allow any otters or any other mammals which may fall in to escape.
- For the full duration of the works, when leaving each evening, the Contractor shall ensure that passage for otters is maintained along the northern riverbank through the works area. The Contractor's ecologist shall assist the Contractor in providing adequate and safe passage for otters while maintaining the safety and security of the site.

7.2.1.9 Terrestrial Habitat Loss/Disturbance

The following shall be implemented to minimise the effects of loss or disturbance of terrestrial habitats associated with the works: -

- Site clearance and removal of vegetation shall be limited to the area required for the works. Vegetation outside of the agreed works area shall not be cleared or disturbed.
- As the construction programme necessitates minor vegetation clearance during the bird nesting season, the Contractor's ecologist shall inspect vegetation to be cleared and identify any active nests. These shall be protected, and surrounding cover not cleared until such time as they are no longer active, as advised by the Contractor's ecologist.



- As part of the pre-construction survey, the Contractor's ecologist shall identify any breeding or resting places of species listed on Annex IV to the Habitats Directive, e.g. bat roosts in the bridge¹⁷ or otter holts near the works area and assist the Contractor in applying any derogation licences under Regulation 54 of the Habitats Regulations which might be required. Where any such licence is granted, the works to which it relates shall be carried out in strict accordance with its conditions and the Contractor's ecologist shall assist the Contractor in this regard. [*This is required due to the time that may elapse between completion of this assessment and mobilisation to site*].

7.2.1.10 Invasive Alien Species

Terrestrial

This section outlines the biosecurity measures which shall be implemented to control the risks associated with Invasive Alien Plant Species (IAPS). As noted Himalayan balsam has been recorded at the works location.

The following shall be implemented prior to mobilisation and before any works commence on site (including advance works): -

1. While Donegal County Council are currently engaged in a programme of invasive plant species management, this currently focuses on knotweed species and *Gunnera tinctoria* (Giant rhubarb), which are treated in September/October. In the case of Himalayan balsam treatment would normally take place in the Spring.
2. A invasive species management specialist will be commissioned by the appointed Contractor to provide advice on Himalayan balsam and develop an Invasive Species Management Plan. This will be done in advance of works.
3. The preferred option is that works would be undertaken early in 2025. Consultation has been undertaken with the Lough Agency; they have identified the stream as not being of fisheries importance and have no objection to works in February/March 2025. Further consultation will be undertaken as the project progresses.
4. The Contractor will be clearing ca. 10m upstream and downstream of the culvert location. Due to the proposed timing of works, it will not be possible to undertake a full survey of the extent of Himalayan balsam along the Cavan Stream. However, based on field observations, the full length of the stream within the works area is known to contain Himalayan balsam.
5. As Himalayan balsam disperses by seed, any arising within the works footprint, where balsam has been growing, potentially contain seeds from balsam and must be treated as contaminated with propagules of an invasive plant species which is listed on Schedule 3 of the Natural Habitats Regulations (S.I. 477 of 2011). There are two options that could be considered when preparing the proposed Invasive Species Management Plan, as follows: -
 - a. Remove all arising from the site under licence for disposal at an appropriately licenced waste facility; or
 - b. Store arising in a dedicated area on site until it can be reused when infilling following construction of the new culvert.
6. The Contractor will import granular material to construct a large site compound to the west of the Cavan Stream (see Figure 1-5), and for use in construction of the proposed culvert. The granular material used to construct the site compound will be removed on completion of the job. It will therefore be necessary to create a clear divide between the site compound; the works area along the river where Himalayan

¹⁷ Inspections, e.g. for potential bat roosts, of the central and southern arch barrels may only be possible following dewatering of these spans. As dewatering will not cause any significant disturbance to such features, there will be no adverse effect of the inspections being deferred until post-dewatering.



balsam is present (biosecure area); and parking / movement of any machinery being used that could potentially be contaminated with seed containing material (biosecure area). This is to be addressed in full in the Invasive Species Management Plan.

7. Between the works / biosecure area and the site compound, it will be necessary to place a washdown area. All vehicles and equipment that have been used in a contaminated zone shall be thoroughly pressure-washed in the wash-down area each time they leave this zone and once work in that zone is complete. This includes footwear, personal protective equipment (PPE), tools, and other light equipment. This is to be addressed in full in the Invasive Species Management Plan. The Washdown area should be placed on a concrete plinth (see further comments below).
8. In either case, sequencing of works, area of storage of material to be used etc. are to be set out in detail in the proposed Invasive Species Management Plan. Also, any waste material or arising generated on site must be assessed for risk of containing balsam and must be disposed of accordingly. This will be considered in full in the proposed Invasive Species Management Plan.
9. Following completion of site works, the full extent of the works area is to be resurveyed for any regrowth of Himalayan balsam. As above, manual and / or herbicide treatment is then to be implemented.
10. This programme of survey and treatment is to be repeated in Spring / early summer of 2026. Any treatment thereafter will be addressed by Donegal County Council as part of their IAPS treatment programme.
11. The IAPS Management Plan shall be prepared in agreement with the Contractor and TII or TII's Representative and in accordance with the following: -
 - TII (2017) *The Management of Waste from National Road Construction Projects. GE-ENV-01101. December 2017.* Transport Infrastructure Ireland, Dublin.
 - TII (2020a) *The Management of Invasive Alien Plant Species on National Roads – Standard. GE-ENV-01104. December 2020.* Transport Infrastructure Ireland, Dublin.
 - TII (2020b) *The Management of Invasive Alien Plant Species on National Roads – Technical Guidance. GE-ENV-01105. December 2020.* Transport Infrastructure Ireland, Dublin.

The following shall be implemented during the construction stage (including advance works): -

1. The IAPS Management Plan shall be implemented by the Contractor with the advice and assistance of the Contractor's ecologist.
2. The 'toolbox talk' for all persons entering the site shall include an overview of the IAPS present on site, their identification, the importance of controlling them/preventing their spread, and the responsibilities of site staff in avoiding any spread of IAPS.
3. The Contractor shall ensure that all vehicles, plant, equipment and PPE intended for use on site are dry, clean and free from debris and plant material prior to being brought to site.
4. A dedicated and clearly marked cleaning facility/wash-down area shall be strategically placed in a contained area on site for use by staff, vehicles and machinery.
 - a. All vehicles and equipment that have been used in a contaminated zone shall be thoroughly pressure-washed in the wash-down area each time they leave site and once work in that zone is complete. This includes footwear, personal protective equipment (PPE), tools, and other light equipment.
 - b. This facility shall be located at least 25m from any watercourse and be appropriately bunded to prevent run-off.



- c. Material gathered in this area shall be appropriately stockpiled and treated along with other contaminated material.
- 5. Soil management during the works shall be in accordance with Section 5.5 of TII (2006).
- 6. All imported materials shall be sourced from licensed suppliers who shall certify that in advance of delivery that any such materials are free from IAPS material, especially propagules such as seeds or rhizome fragments.
- 7. The Contractor shall implement appropriate controls on the movement of machinery and materials in IAPS-contaminated zones.
 - a. Where it is necessary to work in contaminated zones, every effort shall be made not to use vehicles with caterpillar tracks.
 - b. Vehicles leaving contaminated zones shall be confined to marked haulage routes protected by root barrier membranes or be pressure-washed before leaving the zone.
- 8. Any further measures required in relation to any additional species which may be identified on site during the Contractor's ecologist's pre-construction survey shall be included in the IAPS Management Plan.
- 9. In relation to stockpiling of IAPS-contaminated material: -
 - a. Any such material shall be stockpiled separately from other material and clearly marked as contaminated.
 - b. The length of time for which such material is stored on site shall be kept to a minimum.
 - c. Any stockpiles containing IAPS material shall be secured to prevent any run-off which could convey IAPS propagules to the river.
- 10. Where materials are to be removed from site, only vehicles that are deemed to be biosecure (i.e. sealed so that no soil can escape) shall be used to transport IAPS-contaminated material.
- 11. The Contractor shall oversee and keep a record of the implementation of the IAPS Management Plan and all works relating to IAPS, as per TII (2020a,b). In particular, the Contractor's ecologist shall: -
 - a. Inspect the demarcation and signage of contaminated zones, the cleaning/wash-down area and IAPS material stockpiling area prior to their use.
 - b. Directly supervise and document all IAPS removal works.
 - c. Carry out weekly inspections of the site for compliance with the biosecurity measures detailed in the IAPS Management Plan.
 - d. Provide monthly updates to TII or TII's Representative on the implementation of the IAPS Management Plan.

Aquatic

The following biosecurity protocol shall be implemented to control risks from aquatic invasive alien species and pathogens: -

- 1. In-stream works shall be restricted to those described in this NIS. No other access into the river shall be permitted for plant, equipment or personnel.



2. The 'toolbox talk' for all persons entering the site shall include an overview of aquatic invasive alien species and pathogens, the importance of preventing their spread, and the responsibilities of site staff in avoiding any such spread.
3. Equipment, tools or PPE shall be treated using Virkon Aquatic or equivalent disinfectant before and after contact with the river. This shall be undertaken at least 25m from the river.
4. The Contractor's ecologist shall carry out weekly checks for compliance with the aquatic biosecurity measures.

7.2.2 Operational Phase

During the defects period and during future routine inspections as part of the EIRSPAN bridge management programme, the works area will be monitored for any growth of Himalayan balsam (or other invasive alien plant species). Any such infestation shall be treated in accordance with the following guidance: -

- TII (2020a). *The Management of Invasive Alien Plant Species on National Roads – Standard. GE-ENV-01104. December 2020.* Transport Infrastructure Ireland, Dublin.
- TII (2020b). *The Management of Invasive Alien Plant Species on National Roads – Technical Guidance. GE-ENV-01105. December 2020.* Transport Infrastructure Ireland, Dublin.

7.3 Assessment of Residual Effects

Given the full and proper implementation of the mitigation prescribed in this section, the potential for residual impacts and effects from the proposed works can be summarised as follows: -

- The probability and likely magnitude, extent and duration of any water quality impacts from the proposed works have been reduced such that they will not result in adverse effects on 'Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation' or Salmon or Otter.
- In particular the likely magnitude of any water quality impacts has been reduced to low, while the likely extent of any such impacts has been reduced to the river within and immediately adjoining the works area and their likely duration has been reduced to brief or temporary.
- The works methods now ensure that there will be no permanent or temporary barrier to connectivity for Otter moving along the river or riparian corridor through the works area.

Thus, the mitigation prescribed in Section 6.2 has successfully addressed all of the potential impacts from the proposed works such that they no longer represent a risk of adverse effects on any of the qualifying interests concerned, in view of their conservation objectives.



7.4 Potential In-combination Effects

7.4.1 Requirement for Assessment

The requirement for AA arising out of Article 6(3) of the Habitats Directive covers plans and projects that, “*either individually or in combination with other plans or projects*”, are likely to have a significant effect on one or more Natura 2000 sites. This means that AA is required for any plan or project that, in combination with other plans or projects, would have a significant effect on one or more Natura 2000 sites, irrespective of the presence or absence of such effects from that plan or project on its own. Therefore, regardless of the significance of the effects of the plan or project individually, the potential for significant effects in combination with other plans and projects must be considered in all cases.

7.4.2 Approach and Methodology

The objective of this requirement is to capture significant effects potentially arising from the cumulation or other interaction of non-significant effects from multiple plans and projects. Consequently, the assessment of potential in-combination effects is not a pair-wise assessment, rather, it considers the totality of the effects arising from all plans and projects affecting the Natura 2000 site(s) in question. In identifying the plans and projects to be included in this assessment, it is important to define an appropriate geographical scope and timescale over which potential in-combination effects are to be considered and the sources of information to be consulted, as described below. It is also important to consider the nature of the interactions between effects, which may be additive, antagonistic, synergistic or complex.

For practical reasons, the effects from the proposed works which are considered in the assessment of potential in-combination effects are the residual effects described in Section 7.3 above, rather than the potential effects in the absence of any mitigation. For this reason, this assessment is documented following the description of the mitigation measures and residual effects.

7.4.3 Geographical Scope

In defining the geographical scope for identifying potential in-combination effects, it is important to remember that effects are evaluated in view of the conservation objectives of the Natura 2000 site(s) concerned. As such, two or more effects relating to the same conservation objective for a given Natura 2000 site would combine even if their geographical extents did not overlap. For example, the loss of a small area of an Annex I habitat type listed as a qualifying interest of a Natura 2000 site would combine with the loss of an entirely unconnected area of the same habitat type from a remote part of the same site to produce an in-combination effect, the significance of which would need to be evaluated in view of the relevant conservation objective. On that basis, the scope of the assessment of in-combination effects extends to all plans and projects affecting the same conservation objectives as the plan or project under consideration, irrespective of whether those effects are significant or not.

However, given the small scale of the proposed works and localised extents of their residual impacts (which are limited to possible water quality impacts), it was deemed sufficient in this case to include only areas in close proximity to the proposed works and their zone of impact (for residual water quality impacts) in the geographical scope for identifying potential in-combination effects. For larger-scale plans and projects, this was extended to the full Zone of Influence of the proposed works.

7.4.4 Timescale

The proposed works will be completed during the fishery open season in 2025. Given the nature and magnitude of their residual effects, there will be complete recovery of the habitats close to the works area within a short period following their completion, with no effects whatsoever remaining beyond the end of 2025. On that basis, there are no effects from the proposed works which could act in combination with effects from other plans and projects beyond the end of 2025. Therefore, other plans and projects considered in this assessment included those with potential effects between now and the end of 2025.



7.4.5 Plans / Projects

Potential in-combination effects with the following plans and projects were considered during the preparation of this report. The search of Donegal County was based on a map-based search (Donegalcoco.ie¹⁸ and Myplan.ie).

The Donegal County Development Plan 2018 to 2024¹⁹ sets out strategies and objectives to provide sustainable development within Co. Donegal. The aims and objectives of the Donegal County Development Plan include the aim to support the development and implementation of a sustainable economic model for County Donegal embracing growth in areas such as innovation, research and development, County Donegal Development Plan 2018-2024 Part A: The Strategic Plan Chapter 1: Introduction and Vision Page 9 rural diversification, tourism initiatives, energy advances and the promotion of sustainable start up enterprises and as an integral component of accelerating the socio-economic growth in the North West and to protect, enhance and appropriately harness the unique quality and diversity of the environment in the County, through a wide range of measures, supported by proper planning and sustainable development.

Farmers and landowners may also undertake general agricultural operations in areas adjacent to the proposed works and along the river, which could potentially give rise to impacts of a similar nature to those arising from the proposed works. This could potentially result in additional an increased risk to water quality. Many agricultural operations are periodic, not continuous in nature, and qualify as Activities Requiring Consent (ARCs) that require consultation with the NPWS in advance of the works, e.g., reclamation, infilling or land drainage within 30m of the river, removal of trees or any aquatic vegetation within 30m of the river, and harvesting or burning of reed or willow (NPWS, 2022a). Agricultural operations must also comply with the European Communities (Environmental Impact Assessment) (Agriculture) Regulations, 2011 (as amended) in relation to: -

- Restructuring of rural land holdings,
- Commencing use of uncultivated land or semi-natural areas for intensive, and
- Land drainage works on lands used for agriculture.

A Natura Impact Statement (NIS) is required under Regulation 9 if it is likely to have a significant effect on a Natura 2000 site. The drainage or reclamation of wetlands is controlled under the Planning and Development (Amendment) (No. 2) Regulations, 2011 and the European Communities (Amendment to Planning and Development) Regulations, 2011. Therefore, the in-combination effects of agricultural operations and the proposed works are not likely to be significant.

Near the proposed works, projects that have been granted planning permission include retention of existing developments, typically extensions to domestic dwellings, or the construction of new domestic dwellings or extensions to such dwellings. Regarding potential impacts to water quality, these projects will have to comply with the EPA's Code of Practice for Wastewater Treatment Systems for Single Houses (EPA, 2009, 2018). These developments have conditions attached to their planning permission relating to sustainable development, such as siting of septic tanks, foul surface water and effluent drainage facilities, and clean surface water run-off drainage facilities. Therefore, it is not anticipated that the developments that have been granted permission will have any significant effects in combination with the proposed works.

7.4.6 Conclusion

As detailed in the preceding sections, it can be concluded that, based on the small scale of the proposed works and the duration of the works themselves and any impacts arising from them, they will not give rise to adverse effects on any Natura 2000 site or ASSI, in combination with other plans or projects.

¹⁸ [Planning Application Locator \(arcgis.com\)](https://arcgis.com).

¹⁹ [Part A The Strategic Plan and Part B Objectives and Policies.pdf \(donegalcoco.ie\)](https://donegalcoco.ie).

8. Conclusion

This NIS has examined the details of the proposed works on the Cavan Bridge Culvert and the Natura 2000 sites and the designated Northern Ireland sites (ASS) in their Zone of Influence. It has analysed the potential impacts of the proposed works on the receiving natural environment and evaluated their effects, both individually and in combination with other plans and projects, in view of the conservation objectives of the relevant Natura 2000 sites and ASSI sites. This report has been prepared in line with the Habitats Directive, as transposed into Irish law by the Habitats Regulations, relevant case law and guidance from the European Commission, the Department of the Environment, Heritage and Local Government and the Office of the Planning Regulator, on the basis of objective information and adhering to the precautionary principle.

Given the mitigation measures detailed in Section 6 of this NIS, it can be concluded beyond reasonable scientific doubt that the proposed works will not, either individually or in combination with other plans or projects, give rise to any impacts which would constitute adverse effects on the River Finn SAC, the River Foyle and Tributaries ASSI or any other Natura 2000 site or ASSI site, in view of their conservation objectives. Therefore, it is the recommendation of the authors of this report that TII, as the competent authority in this case, may determine that the proposed works, either individually or in combination with other plans or projects, will not adversely affect the integrity of any Natura 2000 site or ASSI site, provided that the mitigation prescribed in this NIS is fully and properly implemented.



9. References

- Bailey, M., and Rochford J. (2006) Otter Survey of Ireland 2004/2005. Irish Wildlife Manuals 23. National Parks & Wildlife Service, Department of the Environment, Heritage and Local Government, Dublin.
- Brian Holohan and Others v. An Bord Pleanála* [2018] CJEU C-461/17.
- CAAS (2022). *Appropriate Assessment Conclusion Statement. In Support of the Appropriate Assessment of the Laois County Development Plan 2021-2027 in accordance with the requirements of Article 6(3) of the EU Habitats Directive*. Report for Laois County Council.
- CIEEM (2022). *Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater, Coastal and Marine. Version 1.2*. Chartered Institute of Ecology and Environmental Management, Winchester.
- Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild flora and fauna. *Official Journal of the European Communities* L 206/7-50.
- DAERA (2017). *River Foyle & Tributaries SAC Conservation Objectives (UK0030320) Version: 27/07/2017*
- DEHLG (2010a). *Appropriate Assessment of Plans and Projects in Ireland: Guidance for Planning Authorities. Revised 11/02/2010*. Department of the Environment, Heritage and Local Government, Dublin.
- DEHLG (2010b). *Circular NPW 1/10 & PSSP 2/10. Dated 11/03/2010*. Department of the Environment, Heritage and Local Government, Dublin.
- DG Env (2013). *Interpretation Manual of European Union Habitats – EUR28. April 2013*. Directorate-General for the Environment, European Commission, Brussels.
- Directive 2009/147/EC of the European Parliament and of the Council of 30 November 2009 on the conservation of wild birds. *Official Journal of the European Union* L 20/7-25.
- Eamon (Ted) Kelly v. An Bord Pleanála and Others* [2014] IEHC 400.
- EC (2018). *Managing Natura 2000 sites: The provisions of Article 6 of the ‘Habitats’ Directive 92/43/EEC*. European Commission, Brussels.
- EC (2021). *Assessment of plans and projects in relation to Natura 2000 sites: Methodological guidance on the provisions of Articles 6(3) and (4) of the Habitats Directive 92/43/EEC*. European Commission, Brussels.
- Eionet (2022). *Reference Portal for Natura 2000* <<https://cdr.eionet.europa.eu/help/natura2000>> [accessed 19/07/2023]. European Environment Information and Observation Network, European Environment Agency, Copenhagen.
- Eoin Kelly v. An Bord Pleanála* [2019] IEHC 84.
- EPA (2009). *Code of Practice: Wastewater Treatment Systems and Disposal Systems serving Single Houses (p.e. ≤10)*. Environmental Protection Agency, Wexford.
- EPA (2018). *Code of Practice: Domestic Waste Water Treatment Systems (Population Equivalent ≤10) Draft 26 November 2018*. Environmental Protection Agency, Wexford.
- EPA (2022). *EPA Maps: Water* <<https://gis.epa.ie/EPAMaps/Water>> [accessed 02/05/2024]. Environmental Protection Agency, Wexford.
- ESM Webtool (2024). *Environmental Sensitivity Mapping Tool* <<https://airomaps.geohive.ie/ESM/>> [accessed 19/07/2023]. Collaborative project between the School of Geography, University College Dublin and the All-Island Research Observatory, National University of Ireland, Maynooth.



- ETC/BD (2022a). *Article 17 web tool* <<https://nature-art17.eionet.europa.eu/article17/>> [accessed 02/05/2024]. European Topic Centre on Biological Diversity, European Environment Agency, Copenhagen.
- ETC/BD (2022b). *Article 12 web tool* <<https://nature-art12.eionet.europa.eu/article12/>> [accessed 02/05/2024]. European Topic Centre on Biological Diversity, European Environment Agency, Copenhagen.
- European Commission v. Federal Republic of Germany* [2017] CJEU C-142/16.
- European Communities (Birds and Natural Habitats) (Amendment) Regulations, 2013. *S.I. No. 499/2013*.
- European Communities (Birds and Natural Habitats) (Amendment) Regulations, 2015. *S.I. No. 355/2015*.
- European Communities (Birds and Natural Habitats) Regulations, 2011. *S.I. No. 477/2011*.
- European Communities (Environmental Impact Assessment) (Agriculture) Regulations, 2011. *S.I. No. 456/2011*.
- European Communities (Environmental Impact Assessment) (Agriculture) (Amendment) Regulations 2017. *S.I. No. 407/2017*.
- European Communities (Quality of Salmonid Waters) Regulations, 1988. *S.I. No. 293/1988*.
- European Union (Birds and Natural Habitats) (Amendment) Regulations, 2021. *S.I. No. 293/2021*.
- Fossitt, J.A (2000). *A Guide to Habitats in Ireland*. The Heritage Council, Kilkenny.
- Heather Hill Management Company CLG v. An Bord Pleanála* [2019] IEHC 450.
- Landelijke Vereniging tot Behoud van de Waddenzee and Nederlandse Vereniging tot Bescherming van Vogels v. Staatssecretaris van Landbouw, Natuurbeheer en Visserij* [2004] CJEU C-127/02.
- NBDC (2024). *Biodiversity Maps* <<https://maps.biodiversityireland.ie/Map>> [accessed 02/05/2024]. National Biodiversity Data Centre, Waterford.
- NPWS (2016). *Site Synopsis: River Finn (002301). Version 03/01/2014*. National Parks & Wildlife Service, Department of Arts, Heritage and the Gaeltacht, Dublin.
- NPWS (2017) *Conservation Objectives: River Finn SAC 002301*. Version 1. National Parks and Wildlife Service, Department of Arts, Heritage, Regional, Rural and Gaeltacht Affairs.
- NPWS (2019a). *The Status of EU Protected Habitats and Species in Ireland. Volume 1: Summary Overview*. National Parks & Wildlife Service, Department of Culture, Heritage and the Gaeltacht, Dublin.
- NPWS (2019b). *The Status of EU Protected Habitats and Species in Ireland. Volume 2: Habitat Assessments*. National Parks & Wildlife Service, Department of Culture, Heritage and the Gaeltacht, Dublin.
- NPWS (2019c). *The Status of EU Protected Habitats and Species in Ireland. Volume 3: Species Assessments*. National Parks & Wildlife Service, Department of Culture, Heritage and the Gaeltacht, Dublin.
- NPWS (2020a). *Natura 2000 Standard Data Form: River Finn SAC (002302). Update October 2020*. National Parks & Wildlife Service, Department of Housing, Local Government and Heritage, Dublin.
- NPWS (2020b). *Natura 2000 Standard Data Form: River Foyle and Tributaries (UK00303200). Update October 2020*. National Parks & Wildlife Service, Department of Housing, Local Government and Heritage, Dublin.
- NPWS (2023a). *Activities Requiring Consent* <<https://www.npws.ie/farmers-and-landowners/activities-requiring-consent>> [accessed 02/05/2024]. National Parks & Wildlife Service, Department of Housing, Local Government and Heritage, Dublin.
- NPWS (2023b). *Development Consultations* <<https://www.npws.ie/development-consultations>> [accessed 02/05/2024]. National Parks & Wildlife Service, Department of Housing, Local Government and Heritage, Dublin.



- NPWS (2023c). *NPWS Designations Viewer* <<https://dahg.maps.arcgis.com/apps/webappviewer/index.html?id=8f7060450de3485fa1c1085536d477ba>> [accessed 02/05/2024]. National Parks & Wildlife Service, Department of Housing, Local Government and Heritage, Dublin.
- NPWS (2023d). *The status and trends of Ireland's bird species – Article 12 Reporting* <<https://www.npws.ie/status-and-trends-ireland%E2%80%99s-bird-species-%E2%80%93-article-12-reporting>> [accessed 02/05/2024]. National Parks & Wildlife Service, Department of Housing, Local Government and Heritage, Dublin.
- NPWS (2023e). *Historic Environment Viewer* < <https://maps.archaeology.ie/HistoricEnvironment> > [accessed 02/05/2024]. National Parks & Wildlife Service, Department of Housing, Local Government and Heritage, Dublin.
- OPR (2021). *Appropriate Assessment Screening for Development Management. OPR Practice Note PN01*. Office of the Planning Regulator, Dublin.
- OSi (2022). *GeoHive Map Viewer* <<https://webapps.geohive.ie/mapviewer/index.html>> [accessed 02/05/2024]. Ordnance Survey Ireland, Dublin.
- People Over Wind and Peter Sweetman v. Coillte Teoranta* [2018] CJEU C-323/17.
- Peter Sweetman and Others v. An Bord Pleanála* [2013] CJEU C-258/11.
- Planning and Development Act, 2000. *No. 30 of 2000* (as amended). In: *Revised Acts* <<http://revisedacts.lawreform.ie/eli/2000/act/30/revised/en/html>> [accessed 02/05/2024]. Law Reform Commission, Dublin.
- Scott Wilson, Levett-Therivel Sustainability Consultants, Treweek Environmental Consultants and Land Use Consultants (2006). *Appropriate Assessment of Plans*.
- Smith, G.F., O'Donoghue, P., O'Hora, K. and Delaney, E. (2011). *Best Practice Guidance for Habitat Survey and Mapping*. The Heritage Council, Kilkenny.





APPENDICES

Appendix A. Section 50 Application



**Construction, Replacement or Alteration of Bridges and Culverts
Application for Consent under Section 50 of the Arterial Drainage Act, 1945 & EU (Assessment
and Management of Flood Risks) Regulations SI 122 of 2010**

Project Name		Structure Ref No.	
Applicant (Correspondence will issue to agent)			
Company or Organisation Name:			
Postal Address:			
[Redacted]			
			Fax:

Agent (Correspondence will issue to agent)			
Company or Organisation Name:			
Postal Address:			
[Redacted]			
			Fax:

Location and Parameters of crossing			
Watercourse:		Catchment:	
Address (Townland – County):			
Grid Reference	X:	Y:	
Hydrometric Station(s) utilized (including reference number):			
Area of Contributing Catchment:	Km ²	Road Reference:	
Design Flood Flow:	m ³ /s	Annual Exceedance Probability (AEP):	%

Statement of Authenticity	
I hereby certify that the information contained in this application form, along with all appended supporting information, has been checked by me and that all statements are true and accurate.	
[Redacted]	
Company/Organisation:	
Signature:	[Redacted]
Date:	

Application Check List	
COMPLETED APPLICATION FORM	<input type="checkbox"/>
SUPPORTING HYDROLOGICAL AND HYDRAULIC INFORMATION	<input type="checkbox"/>
PHOTOGRAPHS COVERING SITE OF ALL PROPOSED WORKS	<input type="checkbox"/>
SCALED PLAN OF BRIDGE/CULVERT/ APPROACH EARTHWORKS	<input type="checkbox"/>
SCALED CROSS SECTION OF BRIDGE/CULVERT/ APPROACH EARTHWORKS	<input type="checkbox"/>
SCALED LONG SECTION OF CHANNEL THROUGH BRIDGE/CULVERT	<input type="checkbox"/>
DETAILS OF RELEVANT EXISTING STRUCTURES	<input type="checkbox"/>
COMPLETED STATEMENT OF AUTHENTICITY	<input type="checkbox"/>
PLAN OF CATCHMENT AREA	<input type="checkbox"/>
COPY OF NOTICE OF GRANT OF PLANNING PERMISSION WITH CONDITIONS *1	<input type="checkbox"/>

For OPW use only	Date of Receipt							
OPW Drainage Maintenance Region	East	<input type="checkbox"/>	South East	<input type="checkbox"/>	South West	<input type="checkbox"/>	West	<input type="checkbox"/>

If the application form is not completed correctly, and in its entirety, the application may be deemed invalid and returned for correction.

Correspondence Number	OPW Register No:	
	Consent Issued	<input type="checkbox"/>

ADDITIONAL INFORMATION

Hydrological Analysis			Factors Applied	
Methodology Applied			Type of Factor	Value Used
Method Used	Tick box if used or state other	Flow *2 (m ³ /sec)		
6 – Variable Catchment characteristics			Climate Change	
			Irish Growth Curve	
			Factor for Standard Error	
3 – Variable Catchment Characteristics			Drained Channel	
			Other	
IH 124	<input type="checkbox"/>			
Gauged Flow	<input type="checkbox"/>			
Unit Hydrograph	<input type="checkbox"/>			
Other	<input type="checkbox"/>			
Other	<input type="checkbox"/>			
FSR <input type="checkbox"/>	FSU <input type="checkbox"/>	Other <input type="checkbox"/>	Tidal <input type="checkbox"/>	
Comments			Comments	

Hydraulic/Structure Details			
Description of Structure *3			
Effective Conveyance Area *4		m ²	
Upstream Invert Level	mOD	Downstream Invert Level	mOD
Upstream Soffit Level	mOD	Downstream Soffit Level	mOD
Upstream Design Flood Level	mOD	Downstream Design Flood Level	mOD

NOTES :

- In line with OPW policy, section 50 approvals should be sought for bridges and culverts that are necessary for access or deemed acceptable by the planning authority. A copy of the notice of grant of planning permission with all conditions should be enclosed with all applications, that are not exempt development under the Planning and Development Act, 2000, as evidence that these factors have been considered.
- Flow is the estimated flow from the catchment, without any factors applied.
- The following details are to be included: the channel bed level, invert and soffit levels of the structure along with the width, length and total conveyance area. Any environmental considerations such as bed depression, baffles, mammal walkways etc. should be described.
- Effective conveyance area is from channel bed level to design flood level.
- All levels must be given to Ordnance Datum, Malin Head.

If the application form is not completed correctly, and in its entirety, the application may be deemed invalid and returned for correction.

BASELINE

AtkinsRéalis



Cavan Culvert - Hydraulic Assessment

Transport Infrastructure Ireland TII

03/04/2024

TO 332 NORTHWEST BRIDGES TERM MAINTENANCE

AtkinsRéalis - Baseline / Référence
BASELINE

Notice

This document and its contents have been prepared and are intended solely as information for Transport Infrastructure Ireland TII and use in relation to Final Submission

WS Atkins Ireland Limited assumes no responsibility to any other party in respect of or arising out of or in connection with this document and/or its contents.

This document has 19 pages including the cover.

Document history

Document title: Cavan Culvert - Hydraulic Assessment

Document reference: 5219387DG0048

Revision	Purpose description	Originated	Checked	Reviewed	Authorised	Date
0.0	Final Submission					10/04/2024

Client signoff

Client	Transport Infrastructure Ireland TII
Project	TO 332 NORTHWEST BRIDGES TERM MAINTENANCE
Job number	5219387

Client signature/date



Contents

1.	Introduction	6
2.	Site Location	6
3.	Existing Culvert Description	6
4.	Proposed Works	8
5.	Hydrology assessment	8
5.1	Catchment Assessment	8
5.2	Flow Assessment	10
6.	Hydraulic assessment	11
7.	Conclusion	14
Appendix A.	Previous hydrology assessment for culvert rehabilitation	16
Appendix B.	Detail hydraulic design for Cavan Culvert 1.5m x 1.5m single cell box	17
Appendix C.	Drawings	18

Tables

Table 5-1 - Physical catchment descriptors of the ungauged catchment from FSU portal	9
Table 5-2 - Design flow estimates - FSSR 6 method	10
Table 5-3 – Design flow estimates IH 124	10
Table 5-4 - Comparison of Q100 and Q100CC estimates	10
Table 5-5 - Design flow estimates for hydraulic modelling	11
Table 6-1 - Summary of culvert hydraulic assessment	13

Figures

Figure 2-1 - Cavan Culvert location	6
Figure 3-1 - Downstream of the Culvert	7
Figure 3-2 - Upstream of the culvert.....	8
Figure 5-1 - Catchment of the Cavan Bridge.....	9
Figure 6-1 - Hydraulics of culvert flowing full under outlet control.....	11



BASELINE

Figure 6-2 - Determination of h_o for tailwater below the top of opening..... 12

Figure 6-3 - Determination of h_o for high tailwater 13

Figure 6-4 - Typical condition in which culvert operate 13

Figure 7-1 - Proposed longitudinal section of the culvert 14



1. Introduction

AtkinsRealis was commissioned by Transport Infrastructure Ireland (TII) to design the replacement works of the Cavan Culvert DL-N14-011.50 under the Northwest Term Maintenance Contract T4. This report contains the hydrology and hydraulic assessment of the Cavan stream through the proposed box culvert.

2. Site Location

The Cavan culvert DL-N14-011.50 is situated on the national road N14, within the townlands of Cavan, Donegal, roughly 3.8 km northwest of Lifford, as depicted in the figure below. The grid reference for the culvert location is (ITM) 631647.0, 901806.6.

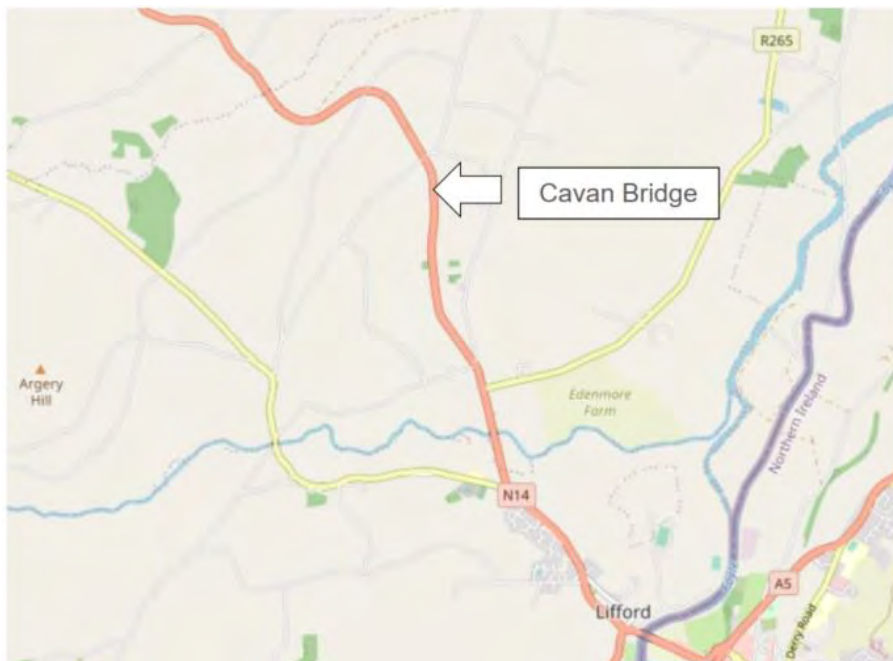


Figure 2-1 - Cavan Culvert location

The Cavan Stream is a first-order tributary of the Swilly Burn Stream, situated approximately 480 meters downstream. Further downstream, it flows into the River Foyle, around 5.7 km away, and eventually joins the River Finn SAC, located approximately 6.6 km downstream. Additionally, it contributes to the River Foyle and Tributaries SAC (UK0030320), which spans across the border into Northern Ireland.

3. Existing Culvert Description

The existing structure comprises the following:

- Section 1 - 1.93m span masonry arch 4.3 m long on the west side and
- Section 2 - 2.04m span 7.7 m long in-situ concrete slab on masonry abutments on the east side.

BASELINE

Section 1, - The masonry arch bridge is in poor condition with extensive loss of mortar. The arch ring at the west elevation has partially collapsed over a 1m length. There is also an approximate 2m² hole in the masonry arch at the interface with the concrete slab.

Section 2 - The concrete slab on masonry abutments is in fair condition with algae present.

The riverbed is overgrown on upstream and downstream approaches to the bridge. There is debris in the riverbed below the structure and there is a strong odour from the watercourse.

The overall length of the culvert is approximately 12 m and its depth varies from 900 mm to 500 mm over 3300 mm from the inlet (upstream side) and between 3300 and 4300 from the outlet (downstream side) it increases to 900 mm depth. Debris from the material loss on the culvert roof has accumulated on the invert and partially obstructs the free flow.

The stream cross-section downstream of the culvert has a similar width to the culvert. The edge of the roadway is approximately 2m above the culvert invert on the upstream side and 2.20m on the downstream side. The surrounding area to the culvert is heavily covered with vegetation. Figures 3-1 and 3-2 show the downstream and upstream edges of the culvert, respectively.



Figure 3-1 - Downstream of the Culvert



Figure 3-2 - Upstream of the culvert

4. Proposed Works

Due to the poor condition of the existing masonry arch bridge, it was proposed to demolish the existing masonry arch bridge and extension. However, due to the challenges posed by heavy traffic on N14 Lifford to Letterkenny, an extended period of road closure is not feasible. Therefore, considering the need for speedy construction, precast concrete pipes and precast concrete box culverts were considered as alternatives.

The following options were considered for the reconstruction of the bridge:

- 1500 mm diameter concrete pipe culvert
- Three rows of 600 mm diameter concrete pipe culvert
- 1m x 1m single-cell box culvert
- 1.5m x 1.5m single-cell box culvert

A detailed analysis of each option was conducted. Based on the analysis, the 1.5m x 1.5m single-cell precast box culvert was chosen as the feasible solution.

5. Hydrology assessment

Previously, AtkinsRealis undertook a hydrology assessment for the same culvert as part of a proposal to rehabilitate/line the existing culvert. The catchment and flow assessment from the previous study are being utilized in this report, and the previous report is included in Annex A for reference.

5.1 Catchment Assessment

The Cavan culvert is a tributary to the river Swilly (Burn), and approximately 5.1 km upstream of the confluence with River Folye. The catchment has an area of 1.535 km² and is mainly rural with small urban settlements. The outlet

node of the ungauged catchment is slightly downstream of the Cavan culvert (Location Number: 01_1894_1, FSU Portal). The Cavan culvert drainage catchment upstream of the culvert location is shown in Figure 5-1.

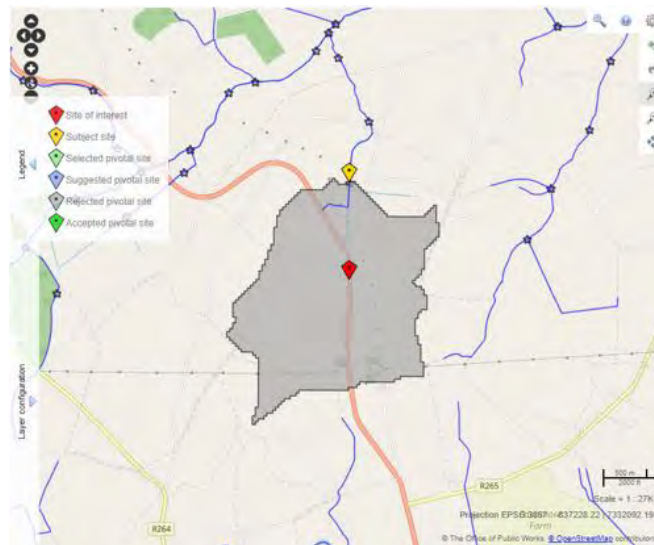


Figure 5-1 - Catchment of the Cavan Bridge

The catchment descriptors from the FSU Portal for the subject site are tabulated in Table 5-1. The mainstream is almost flat as can be noted from a value of mainstream slope given by S1085 (0.1 m/km). The catchment can be considered somewhat flashy as it is moderately impermeable (BFISOIL = 0.562), and there is no attenuation due to lakes/reservoirs (FARL = 1). This indicates that the catchment has a moderate quick response to the rainfall events.

No existing flood risk from the studied stream to the properties of interest has been identified based on surface and groundwater flood maps from the floodinfo.ie web portal.

Table 5-1 - Physical catchment descriptors of the ungauged catchment from FSU portal

Location number	01_1894_1
Contributing Catchment Area	1.535 km ²
BFISOIL	0.562
SAAR	1043.74 mm
FARL	1
DRAIN2	0.237 km/m ²
S1085	0.1 m/km
ARTDRAIN2	0.0825
URBEXT	0
Centroid distance	1160.1531 km

5.2 Flow Assessment

For the assessment of inflows to the hydraulic model, the catchment was assessed by two methods follows.

- FSSR 6
- IH124.

Since the catchment area is small (<25 km²), the FSU method is not applicable. However, the three-term equation and the four-term equation of the FSSR 6 method were utilized for comparative purposes.

The FSSR 6 provides Q_{BAR} with two equations that can be utilized on catchments of less than 20km², and the results are summarized as follows:

Table 5-2 - Design flow estimates - FSSR 6 method

Event	Three-term equation (m ³ /s)	Four-term equation (m ³ /s)
Q_{BAR}	0.766	0.746
Q_{100} (1% AEP)	1.495	1.454
Q_{100CC} (1% AEP + climate change 20%)	1.794	1.745

The Institute of Hydrology (IH) Report 124 method was used for comparative purposes to determine the mean annual flow (Q_{BAR}), hence Q_{100} and Q_{100CC} for the Cavan culvert catchment. The results are summarized as follows:

Table 5-3 – Design flow estimates IH 124

Event	Flow (m ³ /s)
Q_{BAR}	0.741
Q_{100} (1% AEP)	1.445
Q_{100CC} (1% AEP climate change 20%)	1.734

The comparison of Q_{100CC} estimates (Table 5-6) from different methods are comparable, thereby indicate the robustness and reliability of estimates for the study area. The FSSR 6 and IH124 methods are well suited for the subject catchment size.

Table 5-4 - Comparison of Q_{100} and Q_{100CC} estimates

Event	Q_{100} (m ³ /s)	Q_{100CC} (m ³ /s)
FSSR 6 – three-term equation	1.495	1.794
FSSR 6 – four-term equation	1.454	1.745
IH 124	1.445	1.734



The flows computed using the FSSR 6 three-term methodology was taken forward for hydraulic modelling, as these flows are more conservative and presented in Table 5-5.

Table 5-5 - Design flow estimates for hydraulic modelling

Event	Flow (m ³ /s)
Q ₁₀₀	1.495
Q _{100CC}	1.794

6. Hydraulic assessment

The hydraulic performance of the culvert is subject to either inlet or outlet control. Inlet control occurs when the capacity of the culvert barrel exceeds that of the inlet. Factors such as the cross-sectional area of the culvert barrel, the depth of headwater, entrance conditions including entrance type, the existence and angle of wingwalls, and the projection of the culvert into the headwater pond are important for inlet control culverts.

Outlet control occurs when the flow exiting the culvert is restricted by the hydraulic conditions at the outlet, such as the downstream channel geometry, tailwater elevation, and flow capacity of the receiving water body. While outlet control primarily focuses on conditions at the outlet, the geometry of the inlet edge can still affect the culvert's capacity.

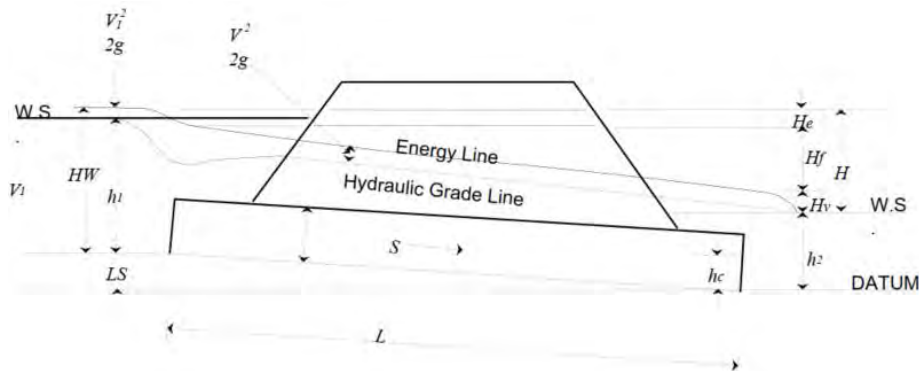


Figure 6-1 - Hydraulics of culvert flowing full under outlet control

Flow under outlet control can be calculated from the formulae below, the parameters for which are illustrated in Figure 6-1. The total head (H) required to pass water through a culvert flowing under outlet control is determined by:

$$H = H_v + H_e + H_f$$

$$H_v = \text{velocity head (m)} = V^2/2g$$

$$H_e = \text{entrance loss} = k_e * V^2/2g$$

$$H_f = \text{friction loss} = 19.6n^2L/R^{1.33} * V^2/2g$$

And

V = mean velocity of flow in the culvert barrel (m/s)

K_e = entrance loss coefficient

n = Manning's friction factor



L – length of the barrel (m)
 g= acceleration due to gravity
 R = Hydraulic Radius

Substituting in the first equation above and simplifying

$$H = (1+K_e + 19.6 \frac{n^2 L}{R^{1.33}}) * V^2 / 2g$$

This equation is solved for H by the use of nomographs.

Headwater depth under outlet control is calculated according to the equation:

$$HW = H + h_0 - LS_0$$

where:

H_0 = tailwater depth (m)

L = length of the culvert, (m)

S_0 = slope of culvert barrel, (m/m).

The tailwater level (h_0) is to be adopted when the tailwater elevation (TW) is below the obvert of the culvert at the outlet is the greater of the two values:

TW, or $(h_c + D)/2$

where:

H_c = tailwater depth (m)

D = length of culvert, (m).

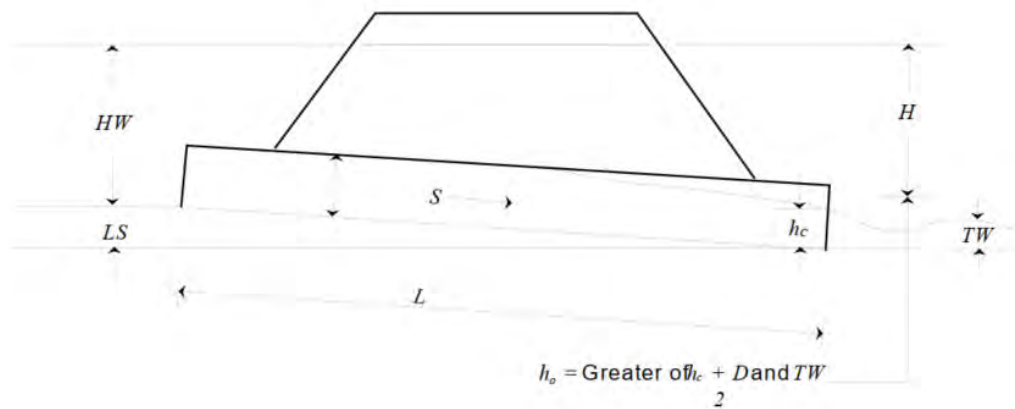


Figure 6-2 - Determination of h_0 for tailwater below the top of opening

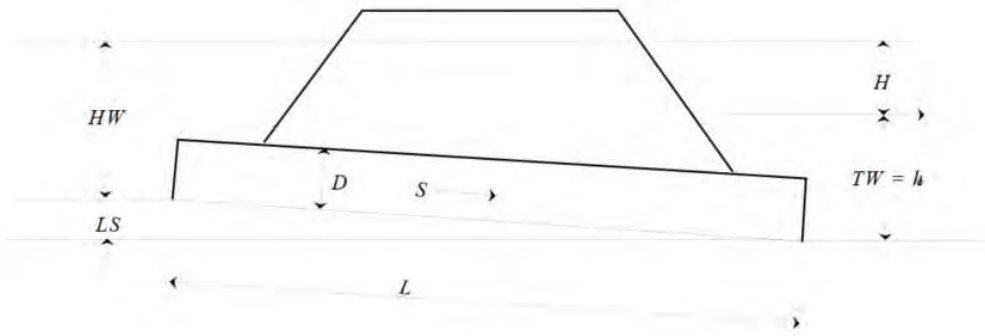


Figure 6-3 - Determination of h_o for high tailwater

The determination of whether a culvert operates under inlet or outlet control involves checking the headwater level for both cases and adopting the higher result.

Based on the hydraulic model for the culvert and referenced nomographs from the OPW guidelines, Table 6-1 provides a summary of the detailed hydraulic assessment output of the culvert. The detailed calculations are provided in Annex B

Table 6-1 - Summary of culvert hydraulic assessment

Culvert Description	Design Discharge (m ³ /s)	Allowable Head Water depth (m)	INLET CONTROL		OUTLET CONTROL HW = H+h ₀ -LS ₀										Controlling HW(m)	OUTLET velocity (m/s)
			Hw/D (ref graph) (m)	Hw (m)	Ke	H (head Loss Through Pipe) (m)	Critical Depth h (m)	hc = (dc+D)/2 (m)	Tw (Tail Water ht) (m)	h _o (m)	L (m)	s ₀	LS ₀ (m)	H _{wo} (m)		
Cavan Culvert	1.794	1.5	0.69	0.828	0.5	0.097	0.48	0.84	1.05	1.05	12	0.015	0.18	0.97	0.97	1.14m/s

Based on the calculations, it is observed that the tailwater height of the culvert is greater than the critical depth of the flow, yet less than the culvert opening. Therefore, the culvert functions as an outlet-controlled type 2 condition, as depicted below

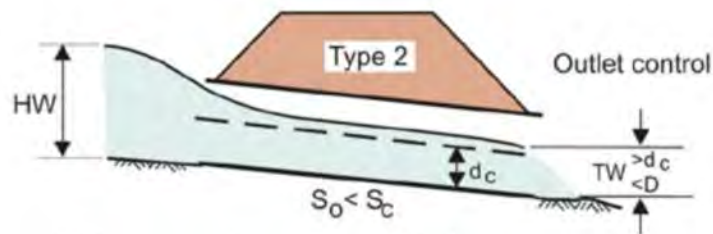


Figure 6-4 - Typical condition in which culvert operate

7. Conclusion

This hydraulic capacity assessment has been prepared in consideration of the requirements under Section 50 of the Arterial Drainage Act 1945

Based on the hydrology & hydraulic assessment of the Cavan culvert, the following conclusions are drawn:

- In the hydraulic assessment of the culvert, the Q_{100cc} flow derived from the FSSR6 - three-term equation has been utilized. The values for Q_{med} , Q_{100} , and Q_{100cc} are respectively $0.716 \text{ m}^3/\text{s}$, $1.495 \text{ m}^3/\text{s}$, and $1.794 \text{ m}^3/\text{s}$.
- The existing masonry arch bridge is proposed to be replaced with a $1.5 \text{ m} \times 1.5 \text{ m}$ box culvert with a 300mm embedment for additional safety against scouring, while also maintaining the minimum soil cover for the precast section.
- The $1.5 \text{ m} \times 1.5 \text{ m}$ single-cell box culvert meets the hydraulic requirements of Cavan stream. The culvert operates under outlet control conditions, and a minimum freeboard of 230mm for the culvert soffit is expected for Q_{100cc} . The outlet velocity is approximately 1.1 m/s

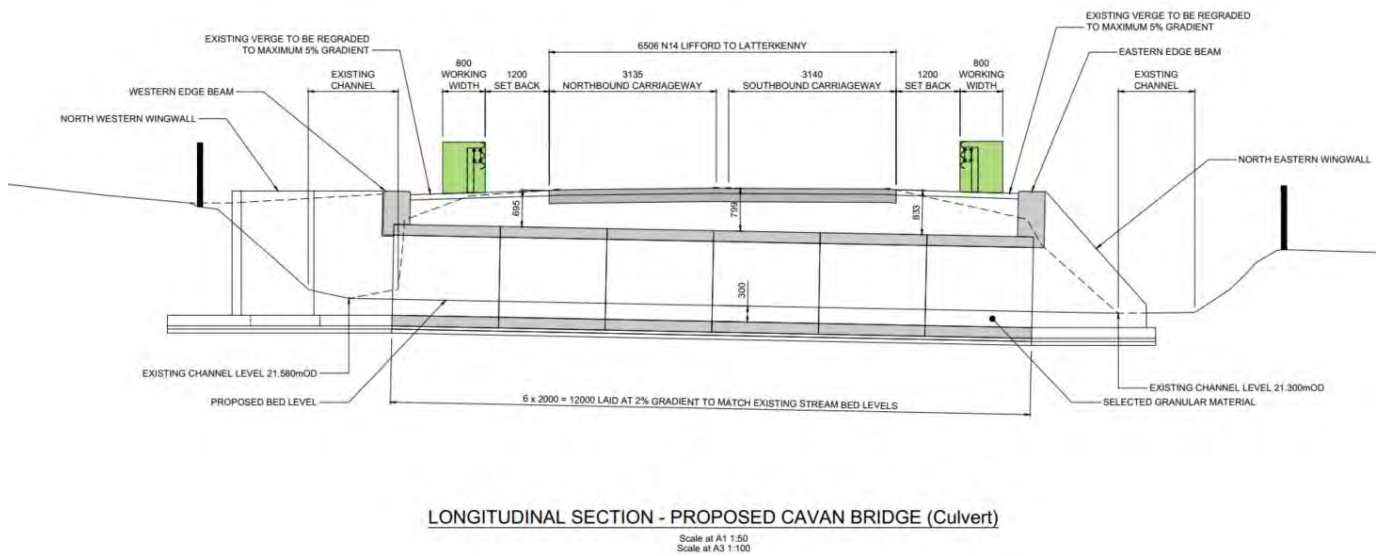


Figure 7-1 - Proposed longitudinal section of the culvert

BASELINE

APPENDICES

Appendix A. Previous hydrology assessment for culvert rehabilitation



NW Term Maintenance Contract 3

Hydraulic Assessment Report

Transport Infrastructure Ireland

26/11/2021



Notice

This document and its contents have been prepared and are intended solely as information for Transport Infrastructure Ireland and use in relation to NW Term Maintenance Contract 3

WS Atkins Ireland Limited assumes no responsibility to any other party in respect of or arising out of or in connection with this document and/or its contents.

This document has 18 pages including the cover.

Document history

Revision	Purpose description	Originated	Checked	Reviewed	Author-ised	Date
Rev 0	Submitted for revision					<date>

Client signoff

Client	Donegal County Council
Project	NW Term Maintenance Contract 3
Job number	5162160
Client signature / date	

Contents

Chapter	Page
1. Introduction	4
2. Site Location	4
3. Existing Culvert Description	4
4. Proposed Works	5
5. Catchment Description	5
5.1. Flow Assessment	6
6. Development of Hydraulic Model	9
6.1. Hydraulic Model Selection	9
6.2. Hydraulic Modelling Assumptions	9
6.3. Topographical Survey Data	9
6.4. Channel & Associated Bank Roughness Values	9
6.5. Boundary Conditions	10
6.6. Hydraulic Model Development	10
7. Analysis of Model Simulations	12
8. Conclusions	15
Appendices	17

1. Introduction

Atkins were commissioned by Transport Infrastructure Ireland (TII) in respect of National Roads bridges maintenance for North West region. TII propose to rehabilitate Cavan Bridge as reactive maintenance under this Contract.

This assessment is being undertaken for Cavan Bridge (DL-N14-011.50) to analyse its existing and proposed conditions.

2. Site Location

Cavan Bridge is located on the nation road N14 approximately 3.8 km northwest of Lifford as indicated in Figure 2-1 below.

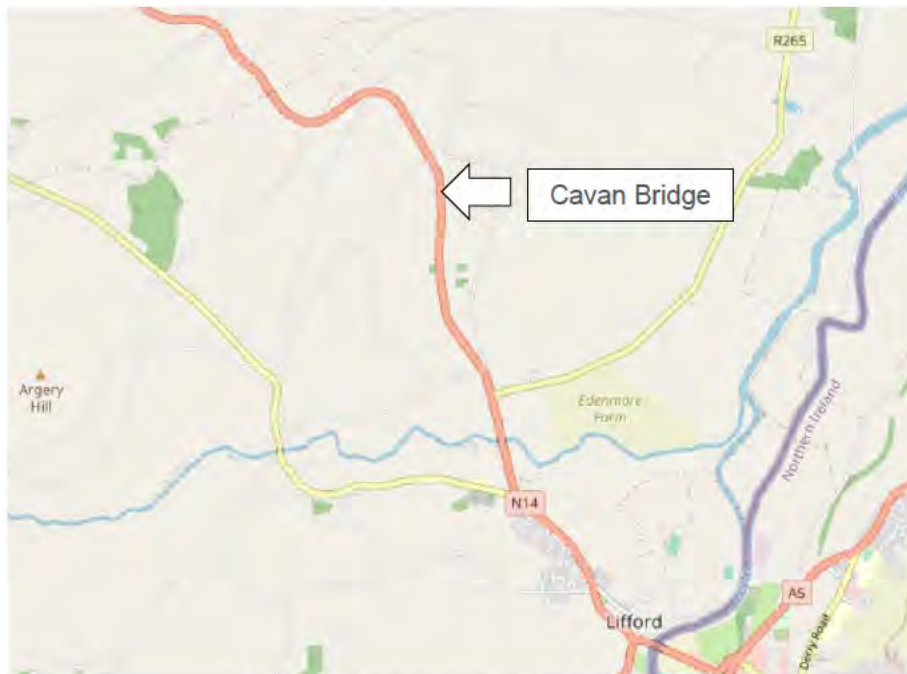


Figure 2-1 – Cavan Bridge location

3. Existing Culvert Description

The existing structure comprises the following:

- Section 1 - 1.93m span masonry arch 4.3m long on the west side and
- Section 2 - 2.04m span 7.7m long in-situ concrete slab on masonry abutments on the east side.

Section 1, - The masonry arch bridge is in poor condition with extensive loss mortar. The arch ring at the west elevation has partially collapsed over a 1m length. There is also an approximate 2m² hole in the masonry arch at the connection with the concrete slab.

Section 2 - The concrete slab on masonry abutments is in fair condition with algae present.

The riverbed is overgrown on upstream and downstream approaches to the bridge . There is debris to the riverbed below the structure and there is a strong odour from the watercourse.

The overall length of culvert is approximately 12 m and its depth vary from 900 mm to 500 mm over 3300 mm from the inlet (upstream side) and between 3300 and 4300 from the outlet (downstream side) it increases to 900 mm depth. Debris from the material loss on culvert roof has accumulated on the invert and partially obstructs the free flow.

For hydraulic modelling purposes, the culvert is assumed as a rectangular box with a span of 1.93 m and a rise of 0.50 m. A weighted roughness coefficient is considered to account for the masonry and concrete slab sections at the culvert roof. An increased roughness coefficient was utilized to simulate the resistance in the flow due to the obstructions present in the culvert invert.

The stream cross section downstream of the culvert have a similar width to the culvert. The edge of the roadway is approximately 2m above the culvert invert on upstream side and 2.20m on the downstream side. The surrounding area to the culvert is heavily covered with vegetation. Figures 3-1 and 3-2 show the downstream and upstream edges of the culvert, respectively.



Figure 3-1 - Cavan culvert downstream



Figure 3-2 – Cavan culvert upstream

4. Proposed Works

Four scenarios are considered to remediate the existing culvert conditions. For all scenarios, a clearing of debris and vegetation on channel bed and repointing of masonry is assumed to be undertaken. The proposed scenarios are as follows:

1. Piping the stream flow through culvert with grout infill to arch barrel above
2. Install preformed GRP lining, to smoothen the roughness and thus improve the flow conveying capacity of the culvert by increasing the velocity
3. Full culvert replacement
4. Guniting to arch soffit

The height clearance inside the culvert remains at 0.50m for proposed works scenarios number 1, 2, and 4. However, if a minimum layer of 75 mm thick gunnite is applied in scenario four, the height clearance reduces significantly to 0.425 m, which makes it impractical to installation. Therefore, alternative four is discarded.

5. Catchment Description

The existing culvert is on an un-named tributary to the River Swilly (Burn), and approximately 5.1 km upstream of the confluence with River Folye. The catchment has an area of 1.535 km² and is mainly rural with small urban settlements. The outlet node of the ungauged catchment is slightly downstream of the Cavan culvert (Location Number: 01_1894_1, FSU Portal). The Cavan culvert drainage catchment upstream of culvert location are shown in Figure 5-1.

The catchment descriptors from the FSU Portal for the subject site are tabulated in Table 5-1. The main stream is almost flat as can be noted from a value of main stream slope given by S1085 (0.1 m/km). The catchment can be considered as somewhat flashy as it is moderately impermeable (BFISOIL = 0.562), and there is no attenuation due to lakes/reservoirs (FARL = 1). This indicates that the catchment has a moderate quick response to the rainfall events.

No existing flood risk from the studied stream to the properties of interest has been identified based on surface and groundwater flood maps from the floodinfo.ie web portal.

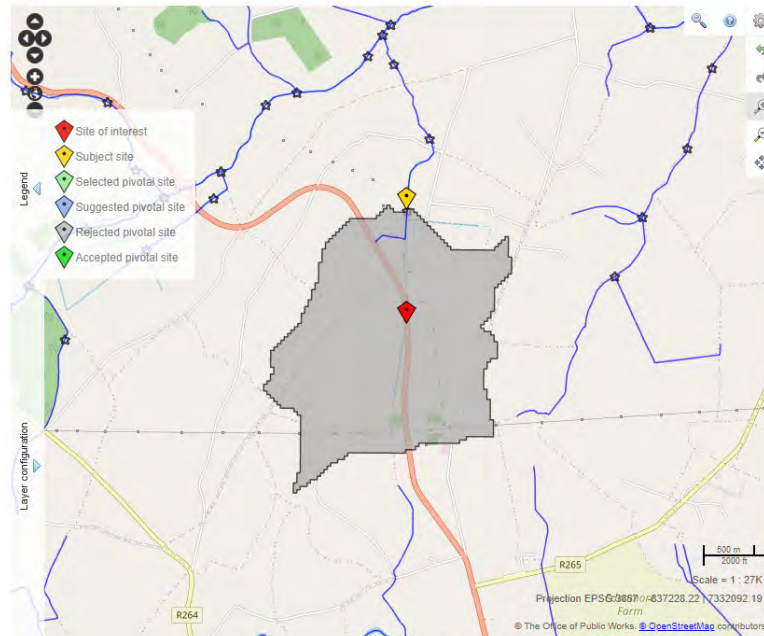


Figure 5-1 - Catchment of Cavan culvert

Table 5-1 - Physical catchment descriptors of the ungauged catchment from FSU portal

Location number	01_1894_1
Contributing Catchment Area	1.535 km ²
BFISOIL	0.562
SAAR	1043.74 mm
FARL	1
DRAIN2	0.237 km/m ²
S1085	0.1 m/km
ARTDRAIN2	0.0825
URBEXT	0
Centroid distance	1160.1531 km

5.1. Flow Assessment

For the assessment of inflows to the hydraulic model, the catchment was assessed by two methods such as the FSSR 6 and IH124. Since the catchment area is small (<25 km²), the FSU method is not applicable. However, the three-term equation and the four-term equation of the FSSR 6 method were utilized for comparative purposes.

5.1.1. FSSR 6 Analysis for Cavan Culvert

The FSSR 6 provides QBAR two equations that can be utilized on catchments of less than 20km²

$$QBAR = 0.00066 AREA^{0.92} SAAR^{1.22} SOIL^{2.0}$$

or

$$QBAR = 0.0288 AREA^{0.90} RSMD^{1.23} SOIL^{1.77} STMFRQ^{0.23}$$

A desktop study was carried out to determine the values of the parameters for Cavan culvert catchment. The soil for the catchment was classified into Class 2 based on maps from the UKSUDS website. The description of parameters of the FSSR 6 method and the determined values for catchment are listed in Table 5-2.

Table 5-2 - FSSR 6 Parameters

Parameter	Description	Value
AREA	Catchment area (km ²)	1.535
SAAR	Standard Average Annual Rainfall (mm)	1165
SOIL	Soil index (no units)	0.3
RSMD*	Residual soil moisture deficit (mm)	44.6
STMFRQ**	Stream Frequency	0.651

* $RSMD = (2.48 * SAAR^{1/2}) - 40 = (2.48 * 1165^{1/2}) - 40 = 44.6$

** $STMFRQ = (no. of junctions) / (catchment area) = 1 / (1.535) = 0.651$

SOIL factor is derived from UKSUDS website

Based on the above values of the parameters, the QBAR was calculated. Further, the standard factorial error of 1.58 and 1.53 (for 68% confidence interval) was applied to the three-term equation and the four-term equation, respectively. For FSSR 6 method, the growth factor for the 1% AEP (1 in 100-year) flood is 1.95. Also, a 20% increase factor was applied to account for climate change, as indicated in the CFRAM General Map User Guidance Notes. The estimated flows are listed in Table 5-3.

Table 5-3 - Design flow estimates - FSSR 6 method

Event	Three – term equation (m ³ /s)	Four – term equation (m ³ /s)
QBAR	0.766	0.746
Q ₁₀₀ (1% AEP)	1.495	1.454
Q _{100CC} (1% AEP + climate change)	1.794	1.745

5.1.2. Institute of Hydrology Report No. 124 Method

The Institute of Hydrology (IH) Report 124 method was used for comparative purposes to determine the mean annual flow (QBAR), hence Q₁₀₀ and Q_{100CC} for Cavan culvert catchment. The Institute of Hydrology Report No.124 (IH 124) 3 parameter equation to determine mean annual flow (QBAR) is shown below:

$$QBAR_{rural} = 0.00108 Area^{0.89} SAAR^{1.17} SOIL^{2.17}$$

A desktop study was carried out to determine the values of the parameters for Cavan culvert catchment. The soil for the catchment was classified into Class 2 based on the UKSUDS website. The description of parameters of the IH 124 3-variable equation and the determined values for the catchment are listed in Table 5-4.

Table 5-4 - IH 124 parameters

Parameter	Description	Value
AREA	Catchment area (km ²)	1.535
SAAR	Standard Average Annual Rainfall (mm)	1165
SOIL	Soil index (no units)	0.3

The values listed above were applied to the calculations, and the QBAR was calculated. Further, the standard factorial error of 1.65 (for 68% confidence interval) was applied. For the IH 124 method, the growth factor for the 1% AEP (1 in 100-year) flood is 1.95, and the aforementioned 20% climate change factor was applied. Thus, the flows estimated are listed in Table 5-5.

Table 5-5 - Design flow estimates - IH 124 method

Event	Flow (m ³ /s)
QBAR	0.741
Q ₁₀₀ (1% AEP)	1.445
Q _{100CC} (1% AEP climate change)	1.734

5.1.3. Comparison of flow estimates

The comparison of Q_{100CC} estimates (Table 5-6) from different methods are comparable, thereby indicate the robustness and reliability of estimates for the study area. The FSSR 6 and IH124 methods are well suited for the subject catchment size. The flows computed using FSSR 6 three-term methodology was taken forward for hydraulic modelling, as these flows are more conservative.

Table 5-6 - Comparison of Q100 and Q100CC estimates

Event	Q ₁₀₀ (m ³ /s)	Q _{100CC} (m ³ /s)
FSSR 6 – three-term equation	1.495	1.794
FSSR 6 – four-term equation	1.454	1.745
IH 124	1.445	1.734

The QMED event corresponds to the median flood flow (1 in 2-year return period) and is a reasonable estimate for low flows as there is 50% exceedance probability. The QMED flow for IH 124 method is estimated as:

$$Q_{MED} = Q_{BAR} / 1.07$$

Thus, QMED is computed as (0.766/1.07) = **0.716 m³/s**. The summary of flows taken forward for hydraulic modelling is listed in Table 5-6.

Table 5-7 - Design flow estimates for hydraulic modelling

Event	Flow (m ³ /s)
Q _{med}	0.716
Q ₁₀₀	1.495
Q _{100CC}	1.794

6. Development of Hydraulic Model

A 1D hydraulic model was developed for the stream with Cavan culvert added. The purpose is to estimate the existing conditions of the culvert, to estimate the impacts of the proposed scenarios and to evaluate estimated water levels and velocities upstream and downstream.

Due to the uncertainty and limitations in hydrologic and hydraulic modelling along with assumptions as listed in Section 6.2, the reader is advised to exercise caution when interpreting the results. The results should not be used for any direct assessment of flood risk in the region.

6.1. Hydraulic Model Selection

HEC-RAS v6.1 was used to construct the 1D hydraulic model for the study area.

6.2. Hydraulic Modelling Assumptions

The main assumptions in developing the hydraulic model are as follows:

1. A HEC-RAS geometry file based on survey data was provided by Murphy Geospatial LTD (dated 21 September 2021). The geometry file was checked for accuracy against the CAD file provided also with the survey and necessary adjustments were made. A new cross section, measured from the provided CAD survey data, was added downstream of the culvert to replace the one provided in the survey in order to compensate for model limitations regarding cross section location upstream and downstream of a bridge or culvert.
2. For model simplification, the shape of the culvert is assumed to be a rectangular box with a span of 1.93 m and a rise of 0.50 m.
3. The culvert inlet unit was assumed to have square edges and a vertical headwall and the terrain above slopes 2H:1V to match existing road embankment elevations
4. A blockage in the roof of the culvert was considered to account for the varying depth inside the culvert as described in Section 3. The minimal surveyed depth (0.50 m) was used, as it is assumed that the flow is forced into the reduced opening. A weighted roughness coefficient was considered for the roof of the culvert.
5. A weighted Manning's coefficient was applied to account for the masonry and concrete slab material present at the culvert's roof at the existing conditions.
6. Abrupt contraction and expansion factors were utilised at the cross sections adjacent to the culvert to account for the sharp turns in the channel in this area (0.6 contraction upstream, 0.8 expansion downstream).

6.3. Topographical Survey Data

Topographical survey data from Murphy Geospatial LTD (2021) has been used to develop the hydraulic model. The data includes river cross sections and the stream layout. The survey covers the watercourse for an approximate length of 152 m upstream of the culvert, and 148 m downstream of the culvert. The extent of the survey and the survey data received are shown in Appendix A of the report.

6.4. Channel & Associated Bank Roughness Values

Manning's roughness values were also provided along with the survey data Murphy Geospatial LTD (2021). The channel and overbanks are assigned Manning's 'n' values of 0.04 and 0.06 respectively. The high value of 0.06 of the Manning's coefficient is intended to represent the heavily vegetated stream banks and floodplain. The value 0.04 was adopted for the channel bed only, representing the less dense vegetation cover. These values are used for the existing culvert conditions analysis and they prevail in the proposed works study, except at the culvert, where different materials are being proposed, as indicated in Table 6-1.

Table 6-1 - Roughness values for the watercourse and Cavan culvert

Watercourse Features	Manning's Roughness
River bed	0.040
River banks	0.060
Culvert bottom (existing)	0.050
Culvert top (existing)	0.024
Proposed work 1 (PVC pipe)	0.009
Proposed work 2 (GRP lining)	0.009
Proposed work 3 (Concrete box)	0.013

6.5. Boundary Conditions

A critical depth boundary was applied upstream, and a normal depth boundary was applied as the downstream boundary condition. For comparison purposes, the model was run for mixed scenario (sub and supercritical) in order to compare the results. The latter run was chosen, as it is more appropriate to the flow and site conditions.

6.6. Hydraulic Model Development

The modelled channel has a total length of 310.69 m along the unnamed tributary to the River Swilly (Burn).

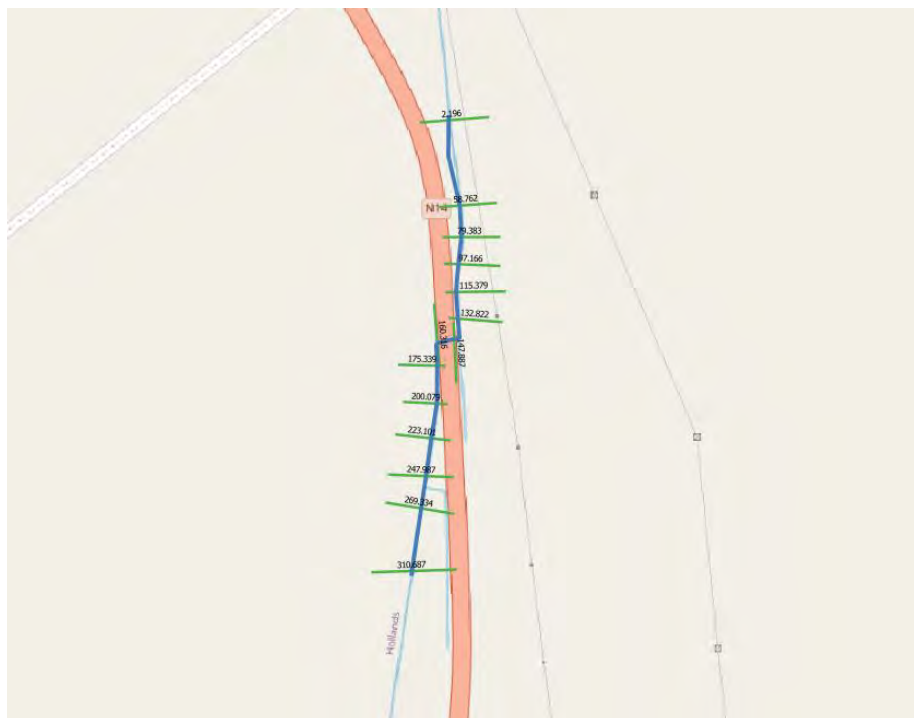


Figure 6-1 – Location of cross sections

The cross sections station and their relative positions to the culvert is tabulated in Table 6-2.

Table 6-2 - Cross section locations

Cross Section	Station	Relative distance to Cavan culvert
14	310.687	150.458
13	269.334	109.105
12	247.987	87.758
11	223.101	62.872
10	200.079	39.85
9	175.339	15.11
8	160.316	0.087
Culvert upstream	160.229	Upstream face of culvert
Culvert downstream	147.949	Downstream face of culvert
7A (replaced cross section 7)	147.887	0.062
6	132.822	15.127
5	115.379	32.57
4	97.166	50.783
3	79.383	68.566
2	58.762	89.187
1	2.196	145.753

The upstream and downstream invert elevations of the existing culvert were obtained from the CAD survey data. Culvert details as modelled are shown in Table 6-3.

Table 6-3 - Culvert details (existing)

	Invert level	Span (m)	Rise (m)
Upstream	21.58	1.93	0.50
Downstream	21.39	1.93	0.50
Culvert length (m)	11.99		

Proposed work scenario (W1)

A series of pipelines are being proposed as the first alternative. Due to available height clearance restrictions, the maximum allowable size was set to 450 mm (inner diameter) accounting for a wall thickness of 25 mm. Along the existing span of 1.93 m, three pipes fit in the available clearance set one next to another. Invert levels and culvert length remain the same as Table 6-3.

Proposed work scenario (W2)

In this scenario a GRP lining is proposed. A 5mm lining thickness is assumed for the GRP lining. Invert levels and culvert length remain the same as Table 6-3.

Proposed work scenario (W3)

A concrete box is proposed. A span of 1.93 m and a rise of 0.90 m with bevelled edges with splayed wingwalls is considered, to replicate the original culvert sizing. Invert levels and culvert length remain the same as Table 6-3. Splayed wing walls should be used in new culvert scenario

7. Analysis of Model Simulations

The model was run under steady state mode for the following scenarios:

- 1% AEP (1 in 100 year) flood (Q_{100})
- 1% AEP (1 in 100 year) flood with climate change (Q_{100CC})

The purpose of the simulation 1% AEP (1 in 100 year) flood with climate change (Q_{100CC}) is to assess the hydraulic conditions of Cavan culvert under existing and future climate change scenario. The maximum stage, depth, and velocity results from hydraulic modelling for Q_{100} and Q_{100CC} are presented in Table 7-1 and Table 7-2, respectively. A long section plot indicating the maximum stages along the watercourse for Q_{100} and Q_{100CC} for associated culvert conditions, W1, W2, and W3 is also shown in Figure 7-1, Figure 7-2, Figure 7-3, and Figure 7-4, respectively.

Table 7-1 - Maximum stage, depth, and velocity for Q100

Station	Stage				Depth (m)				Velocity (m/s)			
	Ex.*	W1	W2	W3	Ex.*	W1	W2	W3	Ex.*	W1	W2	W3
310.69	22.99	23.24	22.91	22.91	1.01	1.26	0.93	0.93	0.64	0.35	0.80	0.80
269.33	22.93	23.22	22.81	22.82	1.31	1.60	1.19	1.20	0.49	0.29	0.66	0.66
247.99	22.92	23.22	22.79	22.79	1.16	1.46	1.03	1.03	0.35	0.21	0.48	0.48
223.10	22.89	23.21	22.72	22.72	1.23	1.55	1.06	1.06	0.58	0.34	0.80	0.80
200.08	22.86	23.20	22.65	22.66	1.19	1.53	0.98	0.99	0.54	0.34	0.76	0.75
175.34	22.82	23.19	22.53	22.54	1.29	1.66	1.00	1.01	0.68	0.43	1.04	1.03
160.32	22.78	23.17	22.37	22.23	1.14	1.53	0.73	0.59	0.83	0.58	1.45	1.97
147.89	22.26	22.26	22.26	22.26	0.9	0.90	0.90	0.90	1.13	1.13	1.13	1.13
132.82	22.18	22.18	22.18	22.18	0.94	0.94	0.94	0.94	0.83	0.83	0.83	0.83
115.38	22.09	22.09	22.09	22.09	0.89	0.89	0.89	0.89	1.05	1.05	1.05	1.05
97.17	22.02	22.02	22.02	22.02	0.87	0.87	0.87	0.87	0.91	0.91	0.91	0.91
79.38	21.94	21.94	21.94	21.94	0.88	0.88	0.88	0.88	0.99	0.99	0.99	0.99
58.76	21.83	21.83	21.83	21.83	0.85	0.85	0.85	0.85	1.02	1.02	1.02	1.02
2.20	21.58	21.58	21.58	21.58	0.89	0.89	0.89	0.89	0.95	0.95	0.95	0.95

* Existing conditions

Table 7-2 - Maximum stage, depth, and velocity for Q100CC

Station	Stage				Depth (m)				Velocity (m/s)			
	Ex.*	W1	W2	W3	Ex.*	W1	W2	W3	Ex.*	W1	W2	W3
310.69	23.21	23.64	23.01	23.00	1.23	1.66	1.03	1.02	0.45	0.16	0.75	0.76
269.33	23.19	23.64	22.91	22.89	1.57	2.02	1.29	1.27	0.36	0.14	0.62	0.64
247.99	23.19	23.64	22.89	22.87	1.43	1.88	1.13	1.11	0.26	0.14	0.46	0.48
223.10	23.17	23.64	22.83	22.80	1.51	1.98	1.17	1.14	0.43	0.21	0.78	0.82
200.08	23.16	23.64	22.77	22.74	1.49	1.97	1.10	1.07	0.43	0.22	0.74	0.79
175.34	23.14	23.63	22.67	22.61	1.61	2.10	1.14	1.08	0.55	0.32	1.00	1.10
160.32	23.11	23.63	22.57	22.28	1.47	1.99	0.93	0.64	0.73	0.23	1.27	2.10
147.89	22.34	22.34	22.34	22.34	0.98	0.98	0.98	0.98	1.24	1.24	1.24	1.24
132.82	22.26	22.26	22.26	22.26	1.02	1.02	1.02	1.02	0.89	0.89	0.89	0.89
115.38	22.16	22.16	22.16	22.16	0.96	0.96	0.96	0.96	1.11	1.11	1.11	1.11
97.17	22.09	22.09	22.09	22.09	0.94	0.94	0.94	0.94	0.97	0.97	0.97	0.97
79.38	22	22.00	22.00	22.00	0.94	0.94	0.94	0.94	1.08	1.08	1.08	1.08
58.76	21.88	21.88	21.88	21.88	0.9	0.90	0.90	0.90	1.14	1.14	1.14	1.14
2.20	21.61	21.61	21.61	21.61	0.92	0.92	0.92	0.92	0.98	0.98	0.98	0.98

* Existing conditions

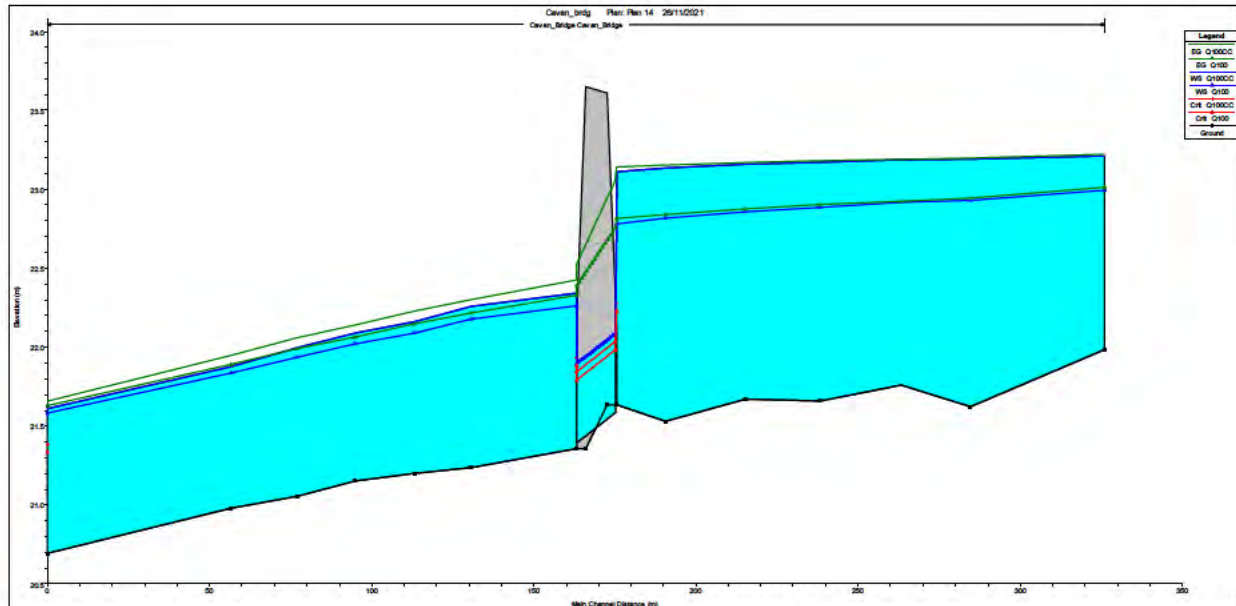


Figure 7-1 – Existing conditions long plot for Q100 and Q100CC

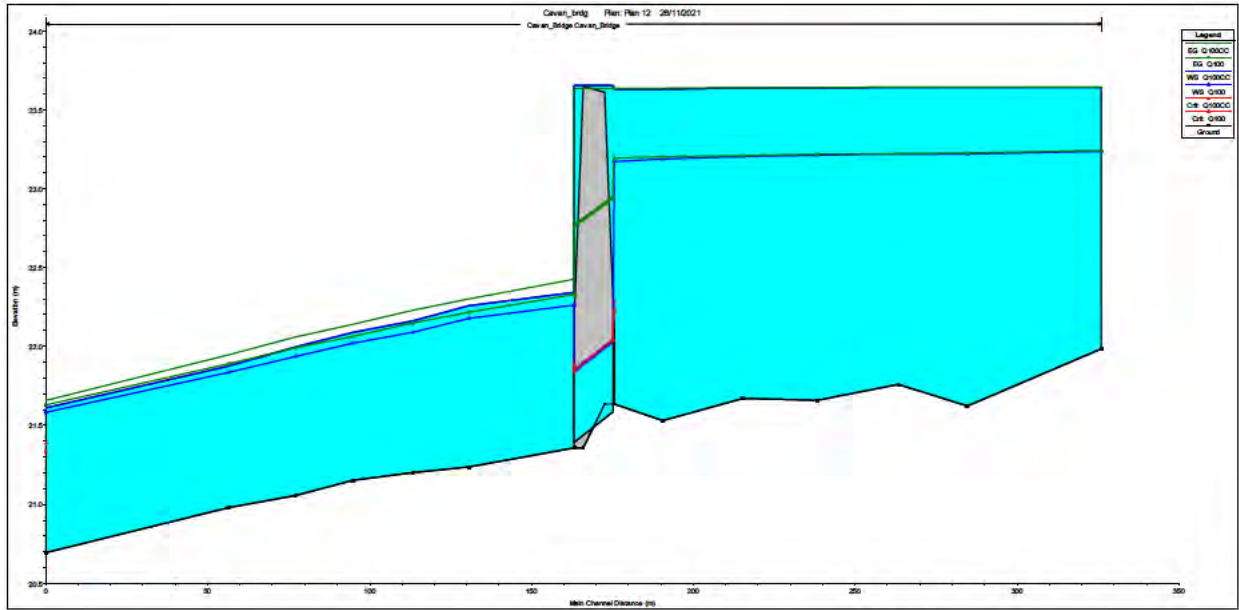


Figure 7-2 – W1 long plot for Q100 and Q100CC

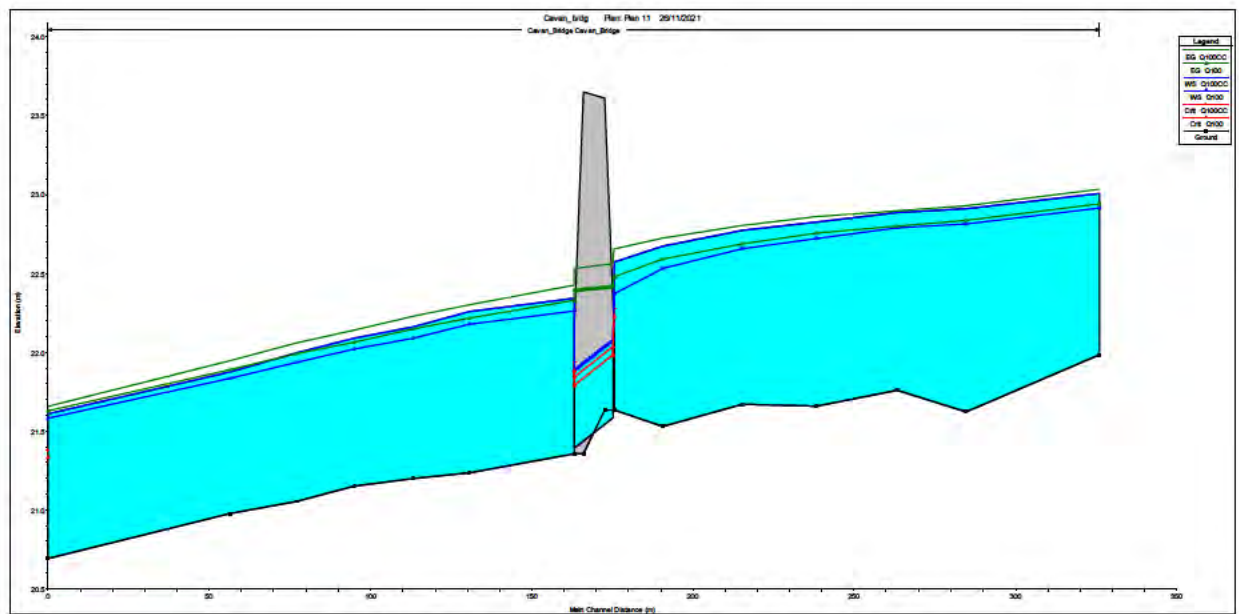


Figure 7-3 – W2 long plot for Q100 and Q100CC

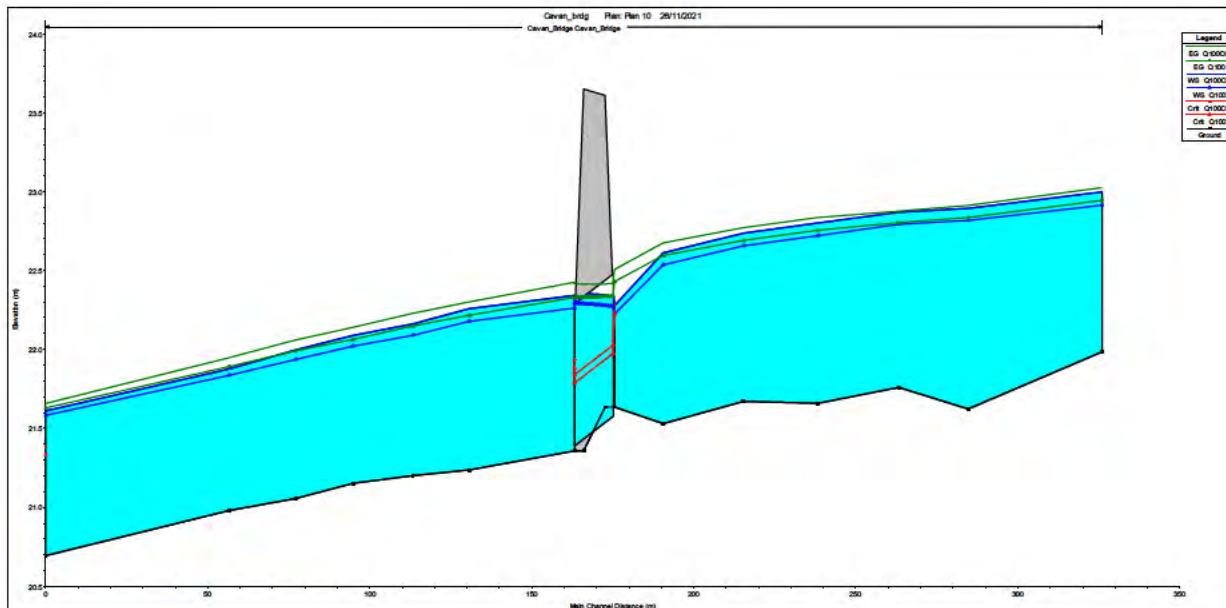


Figure 7-4 - W3 long plot for Q100 and Q100CC

The results of the simulation indicate that scenario (W1) overtops the roadway and thus, it is discarded as a viable solution. Freeboard calculations are presented in Table 7-3 for Q₁₀₀ and Q_{100CC}. A calculated freeboard at the upstream section of the culvert for the existing conditions is observed as 0.83m and 0.50m, for Q₁₀₀ and Q_{100CC}, respectively. Scenario W2 and W3 indicate a minimum freeboard of 1.04 m and a maximum of 1.38 m. Also, a freeboard at the entrance of the culvert between the water surface and the culvert lower cord in W3 was observed as 0.21 m for Q₁₀₀ and 0.14 m for Q_{100CC}.

Table 3-3 - Freeboard Cavan culvert - Q100 - Q100CC

	Q100 (m)			Q100CC (m)		
	Existing	W2	W3	Existing	W2	W3
Upstream	0.83	1.24	1.38	0.50	1.04	1.33
Downstream	1.25	1.25	1.25	1.17	1.17	1.17

The above interpretation of freeboard is incorrect. Freeboard is the divergence between the culvert soffit and top water level so Tables 7-1 and 7-2 must be revised. The max allowable flooding of the upstream lands is subjective but 250mm is often mentioned in OPW publications

8. Conclusions

Based on the hydrology estimations, and further hydraulic model assessment, following conclusions are made:

- This hydraulic capacity assessment has been prepared in consideration of the requirements under Section 50 of the Arterial Drainage Act 1945.
- FSSR 6 three-term equation methodology has been used to derive flows for Q₁₀₀ and Q_{100CC}, their magnitudes being 1.495 m³/s and 1.794 m³/s. QMED values were calculated utilizing the IH 124 methodology, resulting in a 0.716 m³/s discharge.
- Existing conditions convey the Q₁₀₀ or Q_{100CC} discharges, however, only a freeboard of 0.50 m is available at the upstream cross section at the climate change scenario.
- Alternative 1 (W1) for piping the culvert and filling the remaining space with grout has been deemed to be unviable, due to its inability to convey either the Q₁₀₀ or Q_{100CC} without overtopping the existing roadway.
- The minimum freeboard of any scenario for W2 and W3 is 1.04 m, which is well below the existing roadway.

- Lining the culvert with GRP (W2) appears to be the best alternative in terms of construction costs and traffic disturbance in the roadway above the culvert. Although it represents a minor hydraulic conveyance when compared to W3, it still conveys the flow with a minimum freeboard of 1.04 m in any modelled flood scenario.
- For the events analysed in W2, W3, and existing conditions, the N14 road is not expected to be at flood risk with the existing conditions.

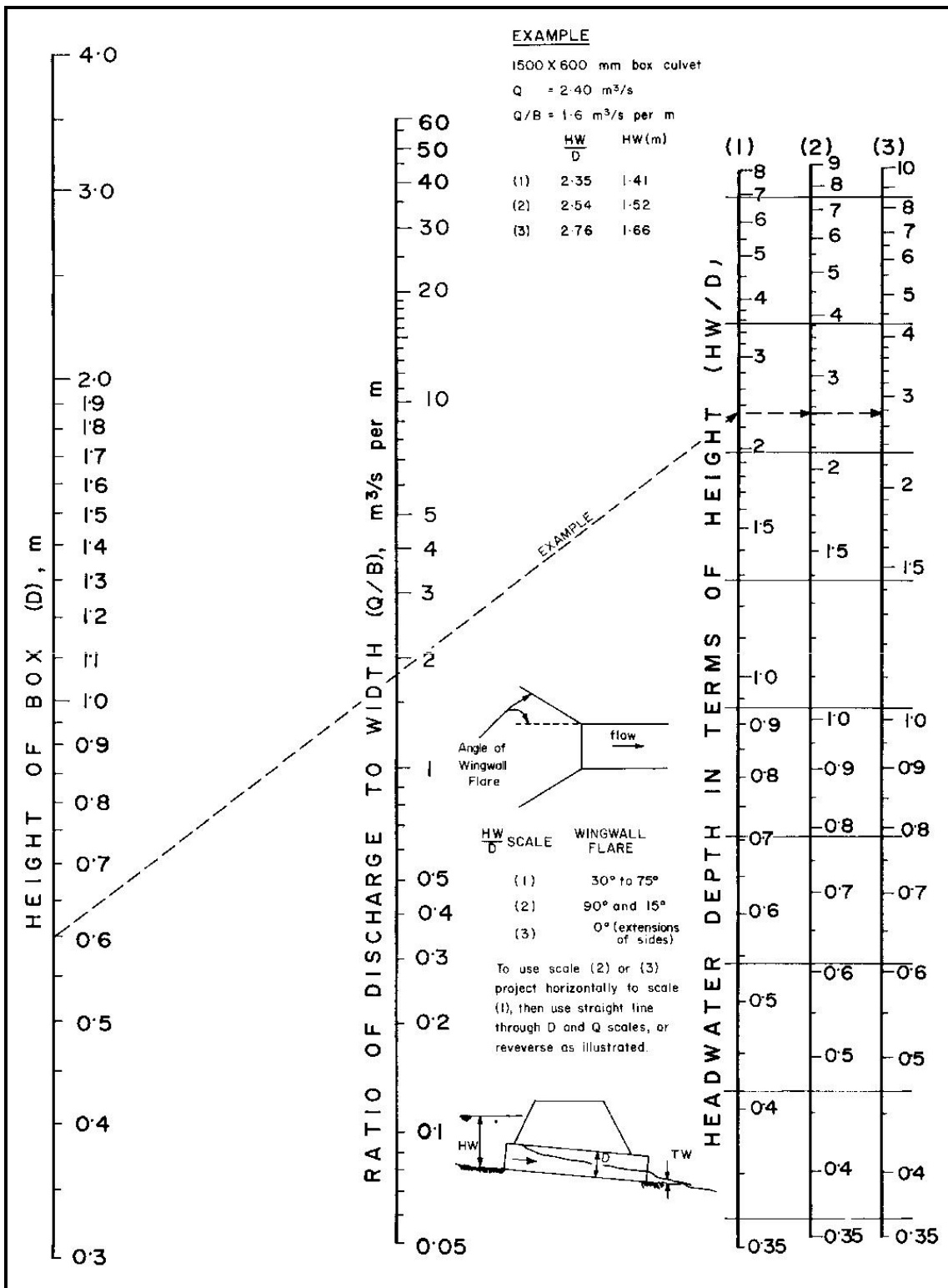
WS Atkins Ireland Limited
Unit 2B
2200 Cork Airport Business Park
Cork
T12 R279

© WS Atkins Ireland Limited except where stated otherwise

Appendix B. Detail hydraulic design for Cavan Culvert 1.5m x 1.5m single cell box



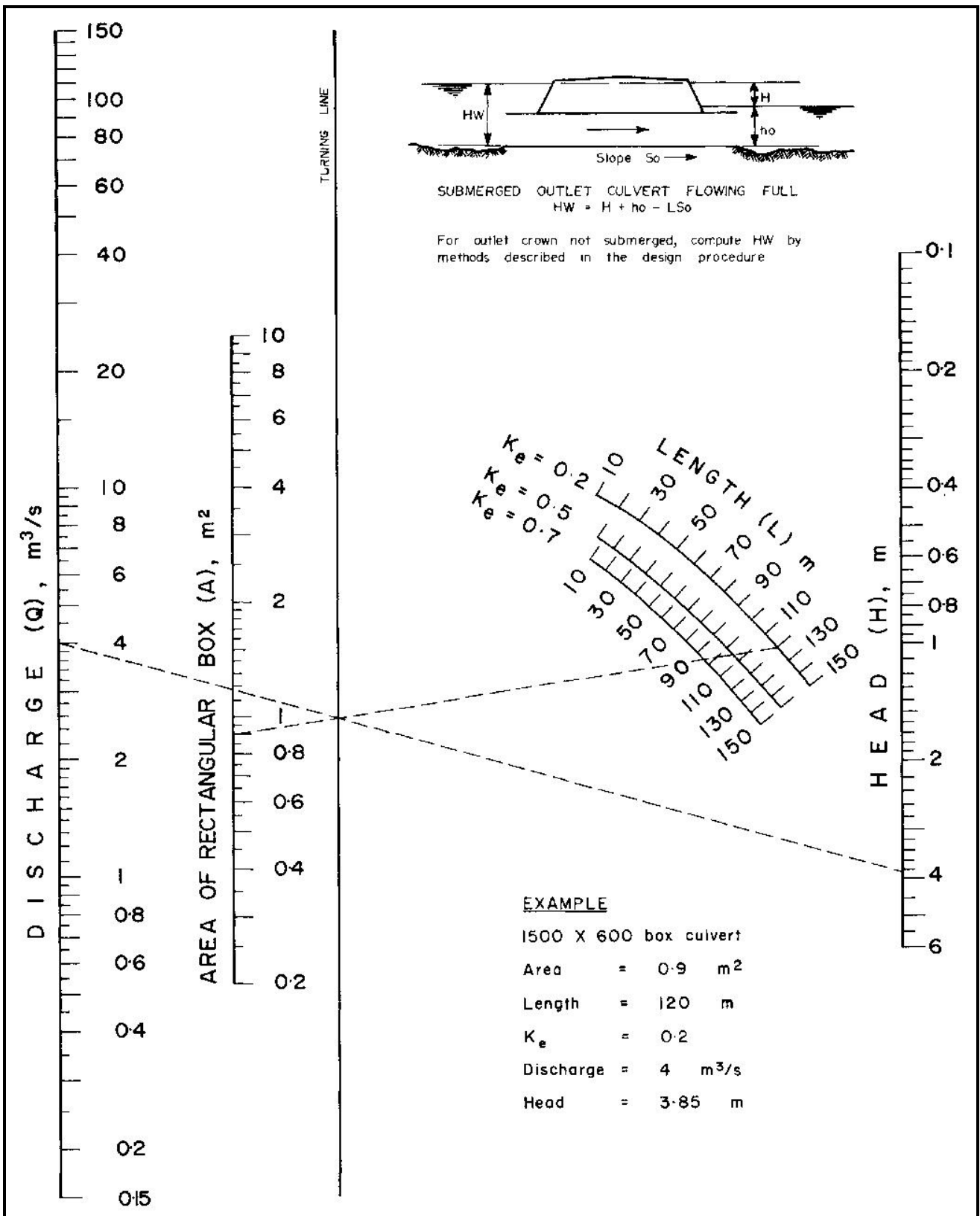
A.2 Inlet Control



Source: DMR QLD (2002)

Figure A 1: Headwater depth for box culvert with inlet control

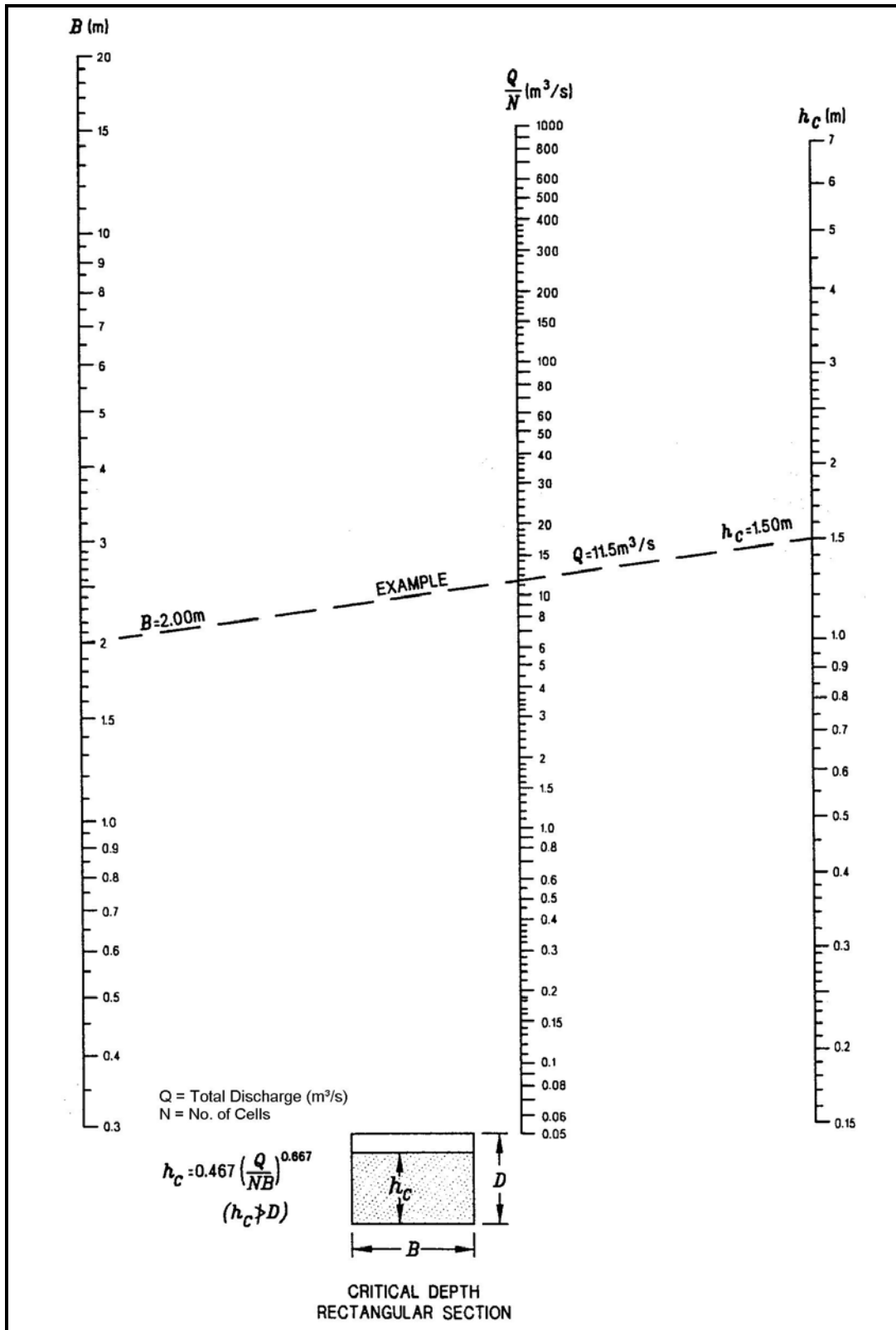
A.3 Outlet Control



Source: DMR QLD (2002)


Figure A 5: Head for concrete box culverts flowing full with outlet control ($n=0.012$)

B.3 Critical Depth



Source: DMR QLD (2002)

Figure B 3: Critical depth in a rectangular section

PROJECT	Location	CULVERT TYPE	SIZE	
	cavan bridge	Box	1500	

INPUT DATA

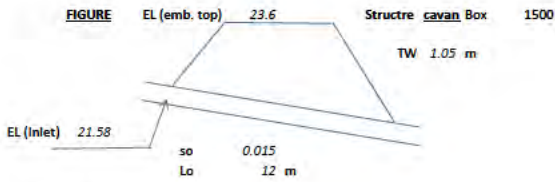
Type BOX
 Breadth (or Diameter) 1.5 m
 Depth (or Diameter) 1.2 m
 No of openings 1
 Discharge 1.794 m³/s
 Legth of Culvert (L0) 12 m
 Slope of the culvert (S0) 0.015
 Allowable HW 1.5 m
 EL (Inlet) 21.58 (optinal)
 EL (embankemt) 23.6 (Optional)

INLET CONTROL DATA

Discharge Throgh Opening 1.794 (read the graph for this discahrge)
 Ratio to discharge to width (Q/B) 1.20 (need only for BOX type)
 Inlet Contro HW/D 0.69 (ref. A1 to A3)

OUTLET CONTROL DATA

Culvert entry loss co efficient (Ke) 0.5
 Area of the opening 1.8
 Head Loss Through Pipe (H) 0.097 (Ref A4 to A10)
 critical depth 0.48 (Ref B3 to B6)
 Tw 1.05



CALCULATION

Culvert Discription	Design Discharge	Allowable Head Water depth	INLET CONTROL		OUTLET CONTROL HW = H+h0-Ls0											Controlling HW	Outlet velocity (m/s)
			Hw/D (ref graph)	Hw	Ke	H (head Loss Through Pipe)	Critical Depth	hc = (dc+D)/2	Tw (Tail Water ht)	h0	L	s0	Ls0	Hw0			
cavan bridge	1.79	1.5	0.69	0.828	0.5	0.097	0.48	0.84	1.05	1.05	12	0.015	0.18	0.967	0.97	1.14 m/s	

Satisfactory

Proposal - 1 nos of 1.5m x 1.5m box culverts with 0.3m embedment. For HFL@Q100cc the inlet water level is 0.97m (approximately 1 m below the road (freeboard to Embankment) level & outlet velocity is 1.14m/s.

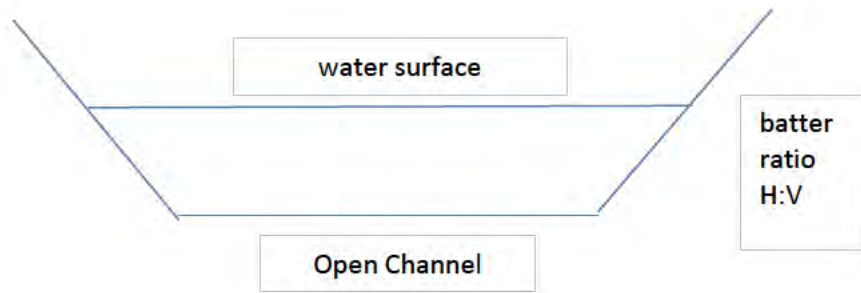
v

Note Velocity
 $V = Q/A$

Inlet Control
 Normal ' Depth (use software)

Outlet control
 hc if hc > TW
 TW if hc < TW < D
 D if D < TW

Project	Cavan Bridge, N14, Co.Donegal	
Culvert No	Canvan Bridge	

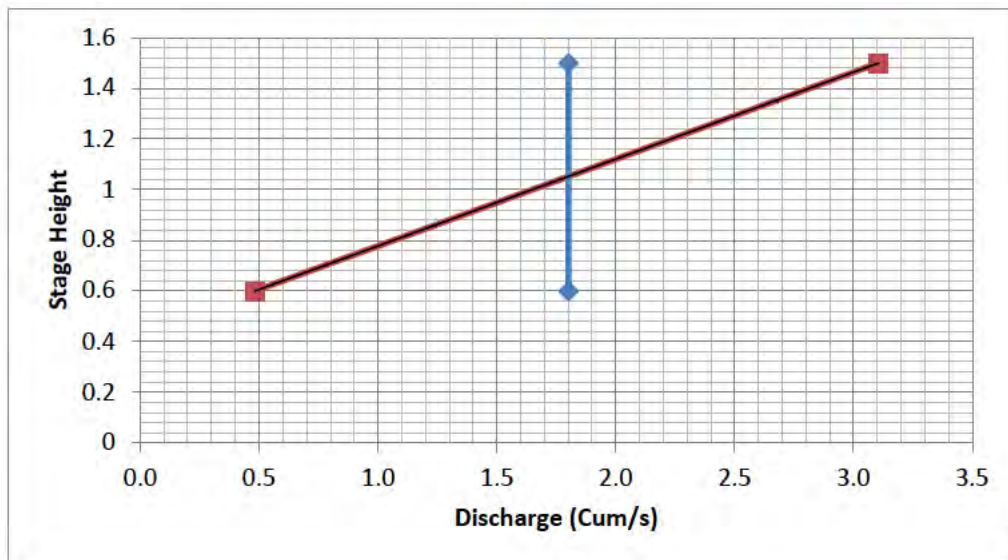


Chanel width = 1.25
 batter ratio (H :V) = 1.35 : 1
 Mannings co effeicient = 0.06
 Slope Gradient = 0.20%
 Degined Q = 1.8

caclucation

1. Determine the Stage Discharge Curve

Trial Depth	Area	wetted perimeter	Hydraulic Radius	R 0.66	Average Velocity	Q
<u>1.5</u>	4.9125	6.290089	0.780991	0.848207	0.632216	3.1
<u>0.6</u>	1.236	3.266036	0.37844	0.523536	0.390221	0.5



2.) Determination of the Tail water height

$$\begin{aligned}
 \text{Tail Water Ht (by Interpolation)} &= \frac{0.6}{1.8} \times 1.8 - 0.45205 \\
 &= \underline{\underline{1.05 \text{ m}}}
 \end{aligned}$$

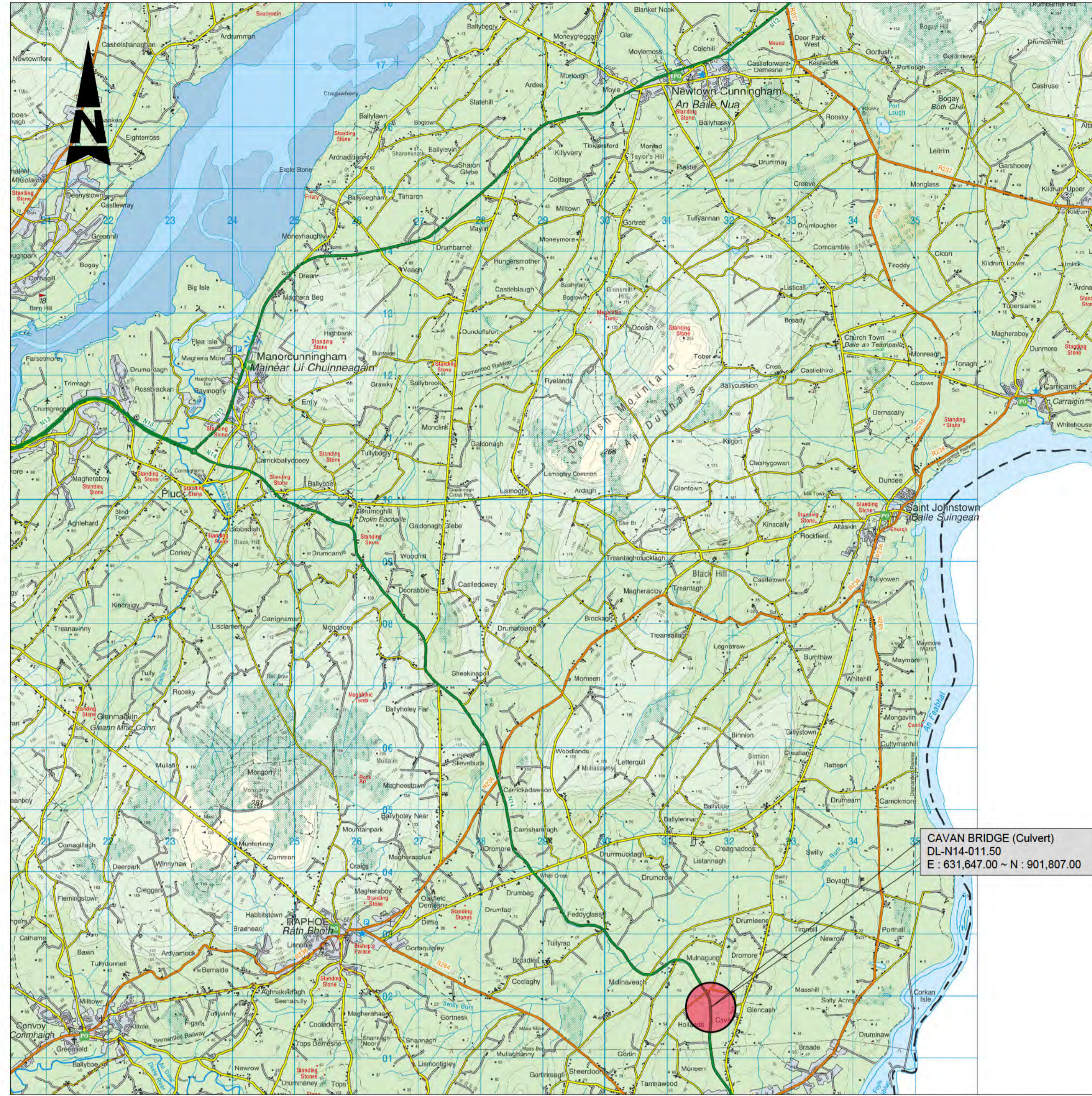
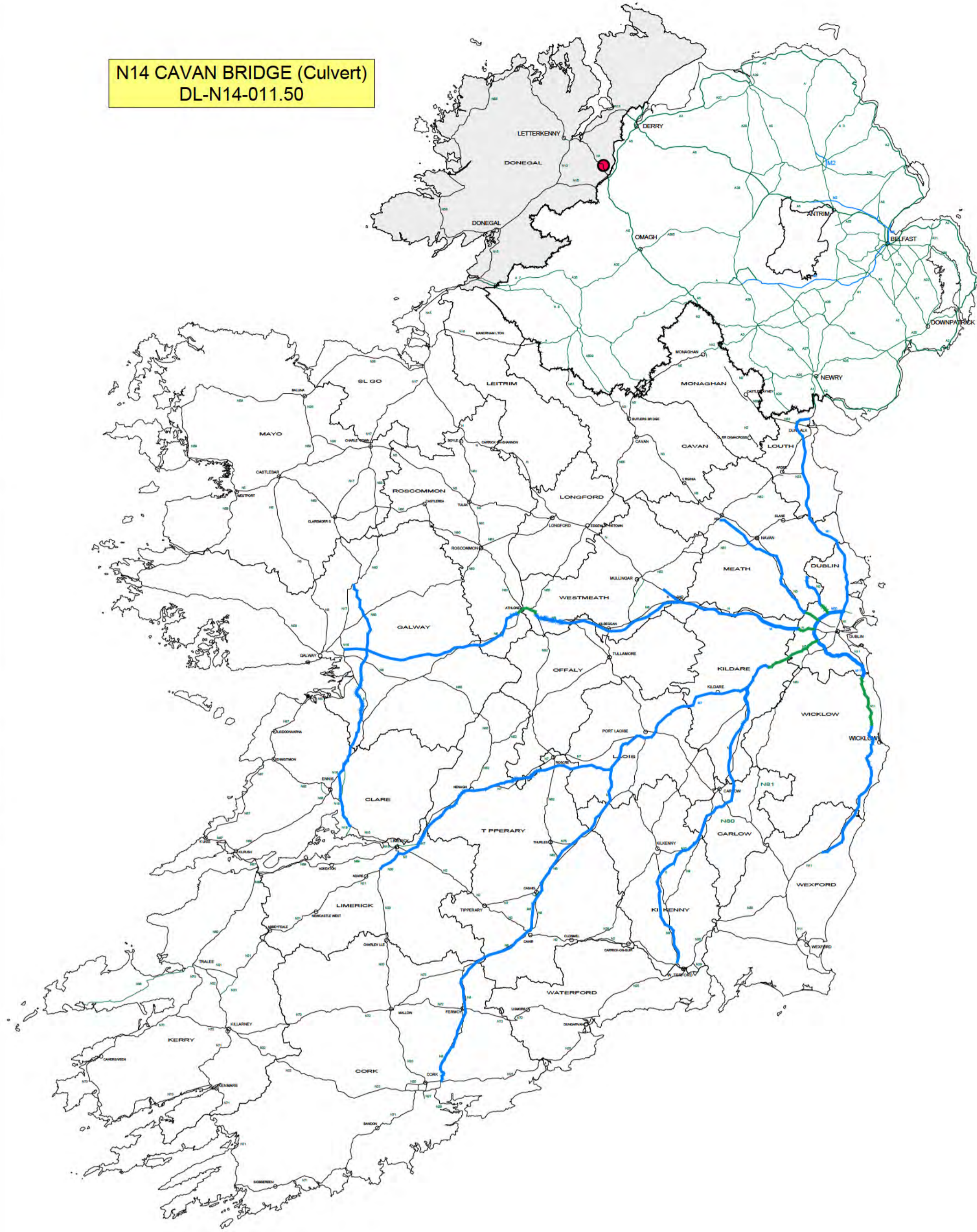
Appendix C. Drawings



100
0 10
A1

DO NOT SCALE

N14 CAVAN BRIDGE (Culvert)
DL-N14-011.50



- GENERAL NOTES**
1. ALL DIMENSIONS ARE IN MILLIMETRES 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

© ORDNANCE SURVEY IRELAND LICENSE NR. AR 0082524. ORDNANCE SURVEY IRELAND & GOVERNMENT OF IRELAND
ATKINS NOT TO BE HELD LIABLE FOR THE USE OF THIS DATA ON ANY PROJECT OTHER THAN THE NORTH WEST BRIDGES TERM MAINTENANCE CONTRACT NR.3 PROJECT



Rev	Description	By	Date	Chk'd	Auth
-	ISSUED FOR REVIEW				

ATKINS
Member of the SNC-Lavalin Group

Atkins House, 150 Airside Business Park, Swords, Co. Dublin, K67 K5W4
Tel (+353) 01 810 8000
email: info.ie@atkinsglobal.com
www.atkinsireland.ie

Unit 2B, 2200 Cork Airport Business Park, Cork, T12 R279
Tel (+353) 021 429 0300

1st Floor Technology House Parkmore Technology Park, Galway, H91 NXV4
Tel (+353) 091 786 050

Client
TRANSPORT INFRASTRUCTURE IRELAND (TII)

Project
NORTH WEST BRIDGES TERM MAINTENANCE CONTRACT NR.3

Purpose ISSUED FOR REVIEW		Title CAVAN BRIDGE (Culvert) (DL-N14-011.50) SITE LOCATION MAP	
Original Scale NTS	Des/Drawn Date 12.04.24	Checked Date 12.04.24	Authorised Date 12.04.24
Status P	Drawing Number 5162160 / HTR / DR / 4010	Rev -	

100
0 10
A1

DO NOT SCALE



- GENERAL NOTES**
1. ALL DIMENSIONS ARE IN MILLIMETRES 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

© ORDNANCE SURVEY IRELAND LICENSE NR. AR 0082524. ORDNANCE SURVEY IRELAND & GOVERNMENT OF IRELAND
 ATKINS NOT TO BE HELD LIABLE FOR THE USE OF THIS DATA ON ANY PROJECT OTHER THAN THE NORTH WEST BRIDGES TERM MAINTENANCE CONTRACT NR.3 PROJECT



Rev	Description	By	Date	Chk'd	Auth
-	ISSUED FOR REVIEW				

ATKINS
 Member of the SNC-Lavalin Group

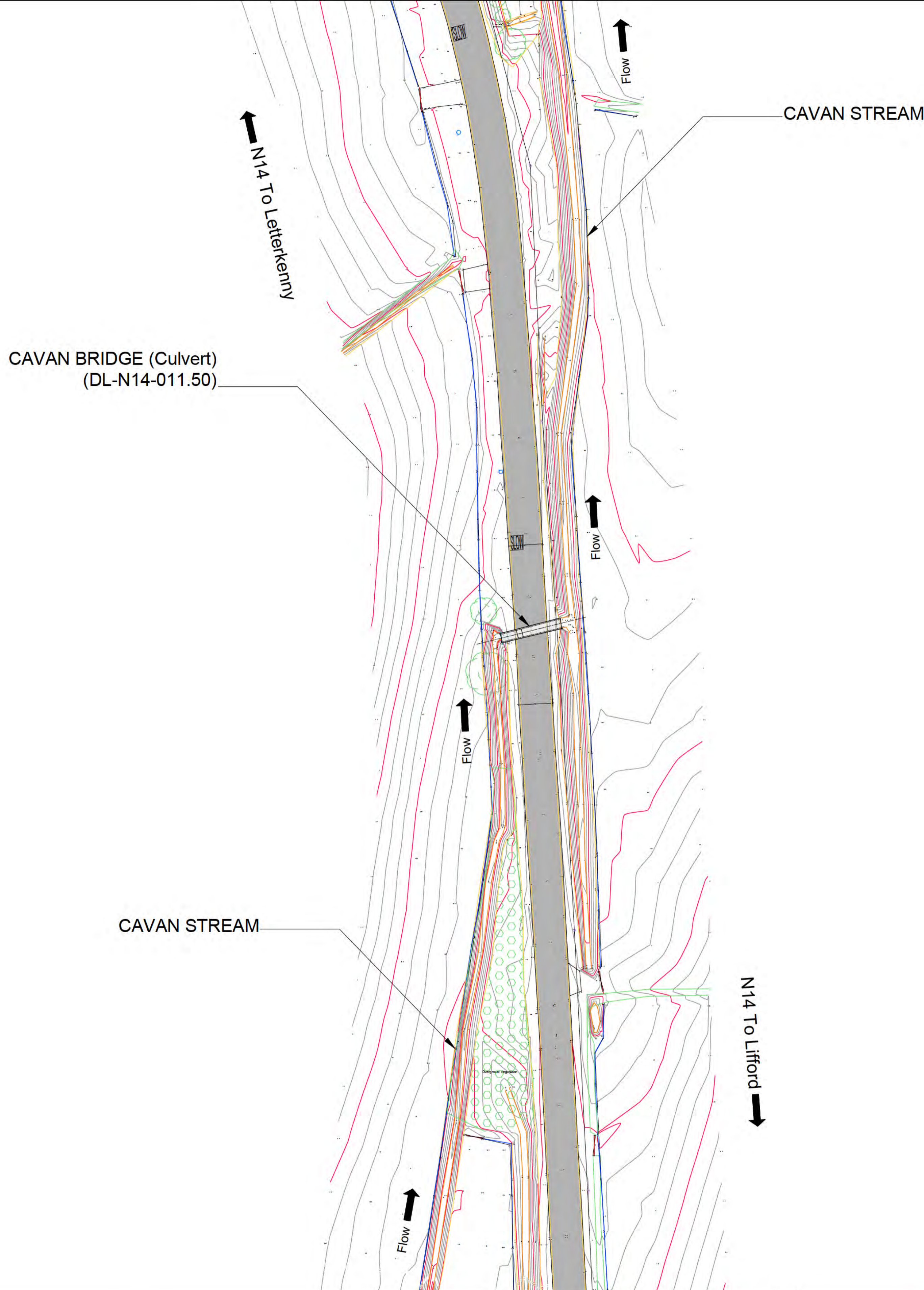
Atkins House, 150 Airside Business Park, Swords, Co. Dublin, K67 K5W4
 Tel (+353) 01 810 8000
 email info.ie@atkinsglobal.com
 www.atkinsireland.ie

Unit 2B, 2200 Cork Airport Business Park, Cork, T12 P279
 Tel (+353) 021 429 0300

1st Floor Technology House Parkmore Technology Park, Galway, H91 NX74
 Tel (+353) 091 786 050

Client	TRANSPORT INFRASTRUCTURE IRELAND (TII)
Project	NORTH WEST BRIDGES TERM MAINTENANCE CONTRACT NR.3

Purpose	ISSUED FOR REVIEW
Title	CAVAN BRIDGE (Culvert) (DL-N14-011.50) SITE LOCATION PLAN
Original Scale	1:2500
Date	12.04.24
Status	P
Drawing Number	5162160 / HTR / DR / 4011



- GENERAL NOTES**
1. ALL DIMENSIONS ARE IN MILLIMETRES 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

© ORDNANCE SURVEY IRELAND LICENSE NR. AR 0082524. ORDNANCE SURVEY IRELAND & GOVERNMENT OF IRELAND
 ATKINS NOT TO BE HELD LIABLE FOR THE USE OF THIS DATA ON ANY PROJECT OTHER THAN THE NORTH WEST BRIDGES TERM MAINTENANCE CONTRACT NR.3 PROJECT



Rev	Description	By	Date	Chk'd	Auth
-	ISSUED FOR REVIEW				

ATKINS
 Member of the SNC-Lavalin Group

Atkins House, 150 Airside Business Park, Swords, Co. Dublin, K67 K5W4
 Tel (+353) 01 810 8000
 email: info.ie@atkinsglobal.com
 www.atkinsireland.ie

Unit 2B, 2200 Cork Airport Business Park, Cork, T12 R279
 Tel (+353) 021 429 0300

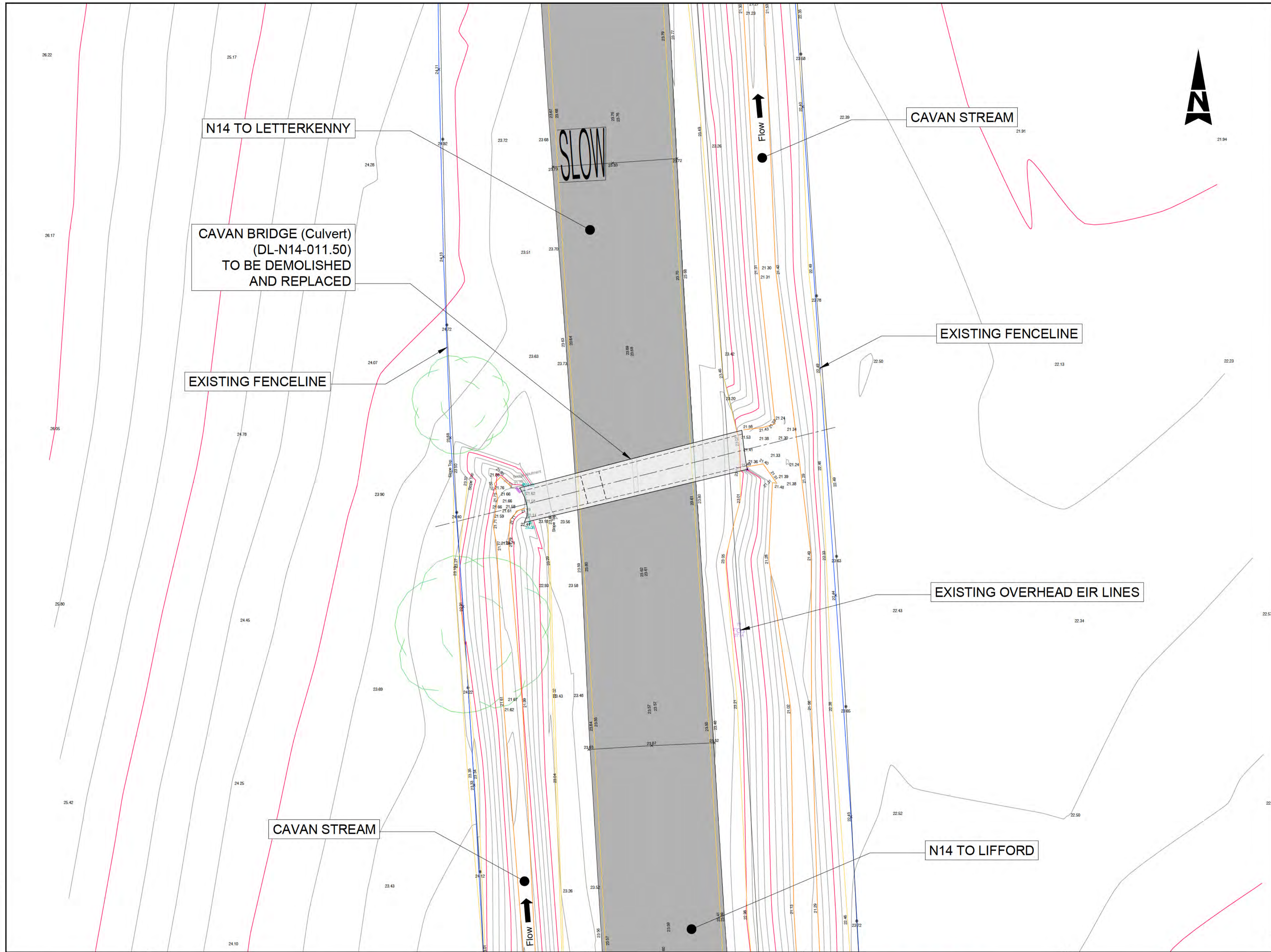
1st Floor Technology House Parkmore Technology Park, Galway, H91 NX14
 Tel (+353) 091 786 050

Client	TRANSPORT INFRASTRUCTURE IRELAND (TII)
Project	NORTH WEST BRIDGES TERM MAINTENANCE CONTRACT NR.3

Purpose	ISSUED FOR REVIEW
Title	CAVAN BRIDGE (Culvert) (DL-N14-011.50) EXISTING OVERALL SITE LAYOUT PLAN
Original Scale	1:500
Date	12.04.24
Status	P
Drawing Number	5162160 / HTR / DR / 4011
Rev	-

100
0 10
A1

DO NOT SCALE



- GENERAL NOTES**
1. ALL DIMENSIONS ARE IN MILLIMETRES 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

DRAWING NOTES

THE EXISTING STRUCTURE COMPRISES THE FOLLOWING:

SECTION 1 - 1.93m SPAN MASONRY ARCH x 4.30m LONG ON THE WEST SIDE AND
SECTION 2 - 2.04m SPAN x 7.70m LONG IN-SITU CONCRETE SLAB ON MASONRY ABUTMENTS ON THE EAST SIDE

SECTION 1 - THE MASONRY ARCH BRIDGE IS IN POOR CONDITION WITH EXTENSIVE LOSS OF MORTAR. THE ARCH RING AT THE WEST ELEVATION HAS PARTIALLY COLLAPSED OVER A 1.00m LENGTH. THERE IS ALSO AN APPROXIMATE 2.00m² HOLE IN THE MASONRY ARCH AT THE INTERFACE WITH THE CONCRETE SLAB.

SECTION 2 - THE CONCRETE SLAB ON MASONRY ABUTMENTS IS IN FAIR CONDITION WITH ALGAE PRESENT.

THE RIVERBED IS OVERGROWN ON UPSTREAM AND DOWNSTREAM APPROACHES TO THE BRIDGE. THERE IS DEBRIS IN THE RIVERBED BELOW THE STRUCTURE AND THERE IS A STRONG ODOUR FROM THE WATERCOURSE.

THE OVERALL LENGTH OF THE CULVERT IS APPROXIMATELY 12.0m AND ITS DEPTH VARIES FROM 0.90m TO 0.50m OVER 3.3m FROM THE INLET (UPSTREAM SIDE) AND BETWEEN 3.3m AND 4.3m FROM THE OUTLET (DOWNSTREAM SIDE). IT INCREASES TO 0.9m DEPTH. DEBRIS FROM THE MATERIAL LOSS ON THE CULVERT ROOF HAS ACCUMULATED ON THE INVERT AND PARTIALLY OBSTRUCTS THE FREE FLOW.

THE STREAM CROSS-SECTION DOWNSTREAM OF THE CULVERT HAS A SIMILAR WIDTH TO THE CULVERT. THE EDGE OF THE ROADWAY IS APPROXIMATELY 2.0m ABOVE THE CULVERT INVERT ON THE UPSTREAM SIDE AND 2.20m ON THE DOWNSTREAM SIDE. THE SURROUNDING AREA TO THE CULVERT IS HEAVILY COVERED WITH VEGETATION.

© ORDNANCE SURVEY IRELAND LICENSE NR. AR 0082524. ORDNANCE SURVEY IRELAND & GOVERNMENT OF IRELAND

ATKINS NOT TO BE HELD LIABLE FOR THE USE OF THIS DATA ON ANY PROJECT OTHER THAN THE NORTH WEST BRIDGES TERM MAINTENANCE CONTRACT NR.3 PROJECT



Rev	Description	By	Date	Chkd	Auth
-	ISSUED FOR REVIEW				

ATKINS
Member of the SNC-Lavalin Group

Atkins House, 150 Airside Business Park, Swords, Co. Dublin, K67 K5W4
Tel (+353) 01 810 8000
email: info.ie@atkinsglobal.com
www.atkinsireland.ie

Unit 2B, 2200 Cork Airport Business Park, Cork, T12 R279
Tel (+353) 021 429 0300

1st Floor Technology House Parkmore Technology Park, Galway, H91 NKY4
Tel (+353) 091 786 050

Client: TRANSPORT INFRASTRUCTURE IRELAND (TII)

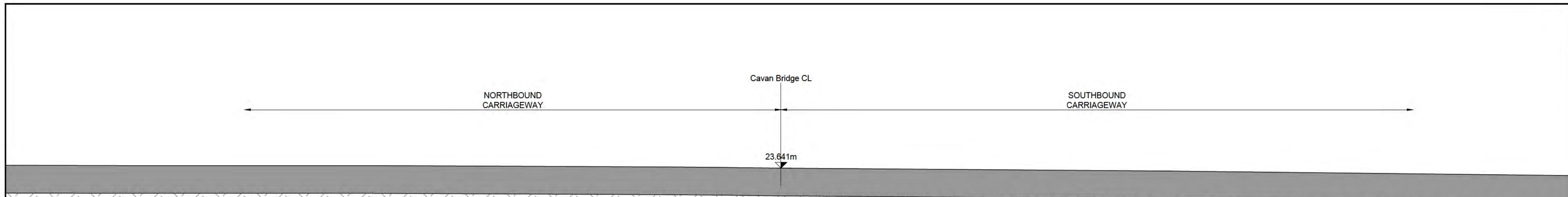
Project: NORTH WEST BRIDGES TERM MAINTENANCE CONTRACT NR.3

Purpose: ISSUED FOR REVIEW		Title: CAVAN BRIDGE (Culvert) (DL-N14-011.50) EXISTING SITE LAYOUT PLAN	
Original Scale: 1:100	Des/Drawn: []	Checked: []	Authorised: []
Status: P	Drawing Number: 5162160 / HTR / DR / 4012	Date: 12.04.24	Date: 12.04.24

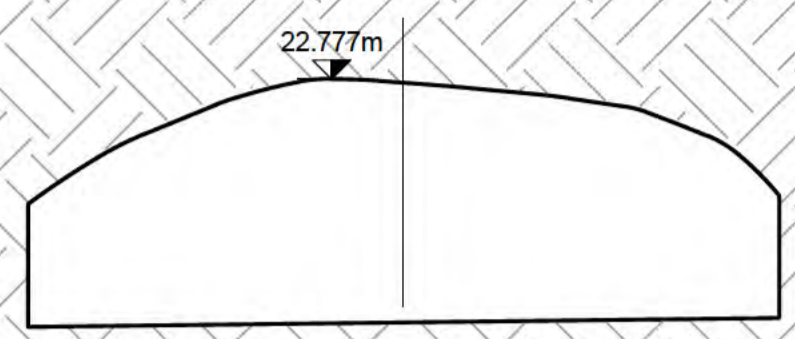
100
10
0
A1

DO NOT SCALE

- GENERAL NOTES**
1. ALL DIMENSIONS ARE IN MILLIMETRES 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



VIEW LOOKING UPSTREAM

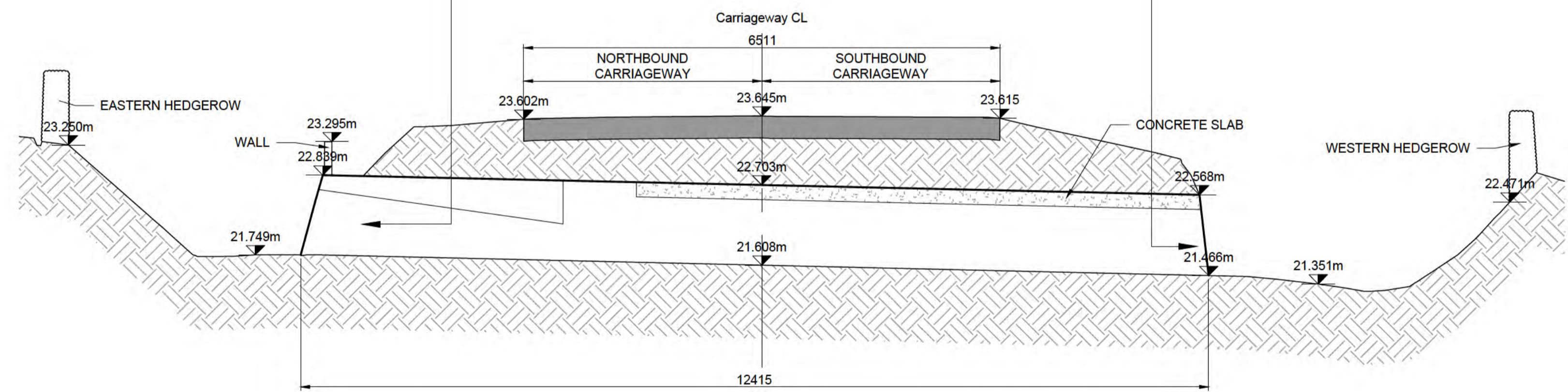


CROSS SECTION - EXISTING CAVAN BRIDGE (Culvert)

Scale at A1 1:25
Scale at A3 1:50



VIEW LOOKING DOWNSTREAM



LONGITUDINAL SECTION - EXISTING CAVAN BRIDGE (Culvert)

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

© ORDNANCE SURVEY IRELAND LICENSE NR. AR 0082524. ORDNANCE SURVEY IRELAND & GOVERNMENT OF IRELAND
ATKINS NOT TO BE HELD LIABLE FOR THE USE OF THIS DATA ON ANY PROJECT OTHER THAN THE NORTH WEST BRIDGES TERM MAINTENANCE CONTRACT NR.3 PROJECT



Rev	Description	By	Date	Chk'd	Auth
-	ISSUED FOR REVIEW				



Atkins House, 150 Airside Business Park, Swords, Co. Dublin, K67 K5W4
Tel (+353) 01 810 8000
email: info.ie@atkinsglobal.com
www.atkinsireland.ie

Unit 2B, 2200 Cork Airport Business Park, Cork, T12 R279
Tel (+353) 021 429 0300

1st Floor Technology House Parkmore Technology Park, Galway, H91 NXV4
Tel (+353) 091 786 050

Client: TRANSPORT INFRASTRUCTURE IRELAND (TII)

Project: NORTH WEST BRIDGES TERM MAINTENANCE CONTRACT NR.3

Purpose: ISSUED FOR REVIEW

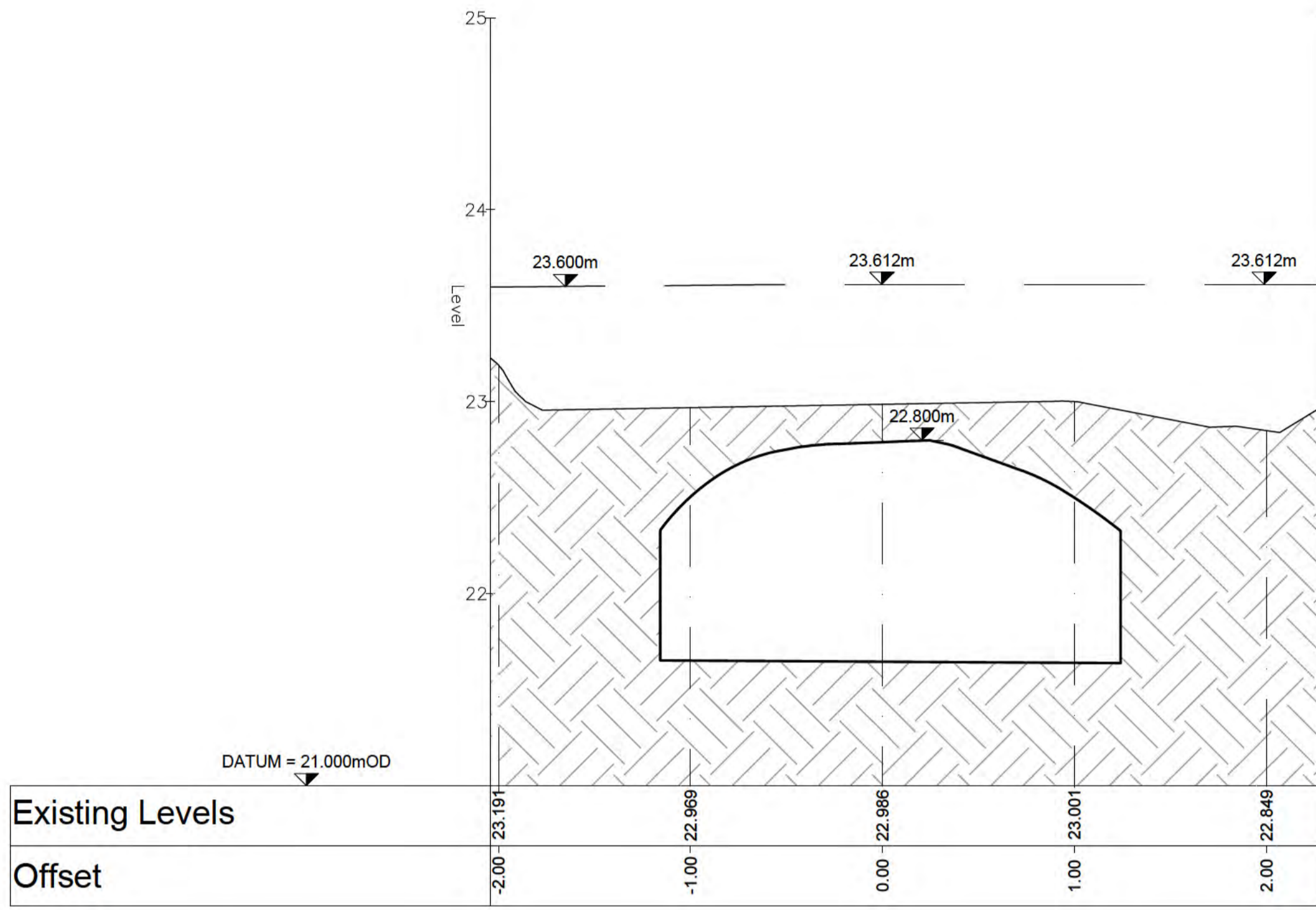
Title: CAVAN BRIDGE (Culvert) (DL-N14-011.50) EXISTING LONGITUDINAL AND CROSS SECTIONS

Original Scale	As Shown	Des/Drawn	Checked	Authorised	
Date	12.04.24	Date	12.04.24	Date	12.04.24

Status	Drawing Number	Rev
P	5162160 / HTR / DR / 4013	-

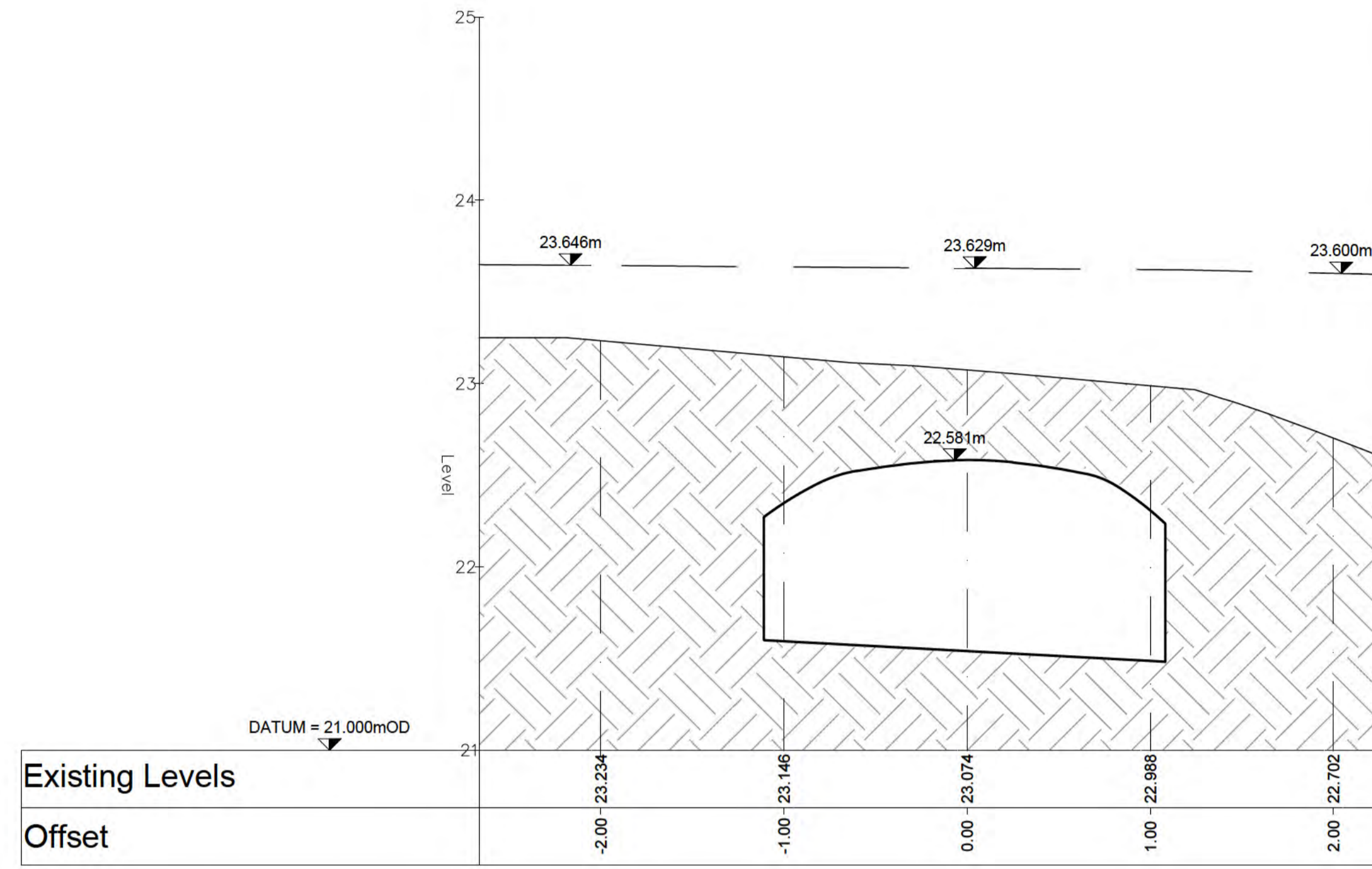
A1

DO NOT SCALE



SECTIONAL ELEVATION - UPSTREAM

Scale at A1 1:25
Scale at A3 1:50



SECTIONAL ELEVATION - DOWNSTREAM

Scale at A1 1:25
Scale at A3 1:50



ELEVATION - UPSTREAM

Scale at A1 1:25
Scale at A3 1:50



ELEVATION - DOWNSTREAM

Scale at A1 1:25
Scale at A3 1:50

- GENERAL NOTES
1. ALL DIMENSIONS ARE IN MILLIMETRES 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

ELEVATION - UPSTREAM

Scale at A1 1:25
Scale at A3 1:50

ELEVATION - DOWNSTREAM

Scale at A1 1:25
Scale at A3 1:50

© ORDNANCE SURVEY IRELAND LICENSE NR. AR 0082524. ORDNANCE SURVEY IRELAND & GOVERNMENT OF IRELAND
ATKINS NOT TO BE HELD LIABLE FOR THE USE OF THIS DATA ON ANY PROJECT OTHER THAN THE NORTH WEST BRIDGES TERM MAINTENANCE CONTRACT NR.3 PROJECT



Rev	Description	By	Date	Chk'd	Auth
-	ISSUED FOR REVIEW				



Member of the SNC-Lavalin Group

Atkins House, 150 Airside Business Park, Swords, Co. Dublin, K67 K5W4
Tel (+353) 01 810 8000
email: info.ie@atkinsglobal.com
www.atkinsireland.ie

Unit 2B, 2200 Cork Airport Business Park, Cork, T12 R279
Tel (+353) 021 429 0300

1st Floor Technology House Parkmore Technology Park, Galway, H91 NXV4
Tel (+353) 091 786 050

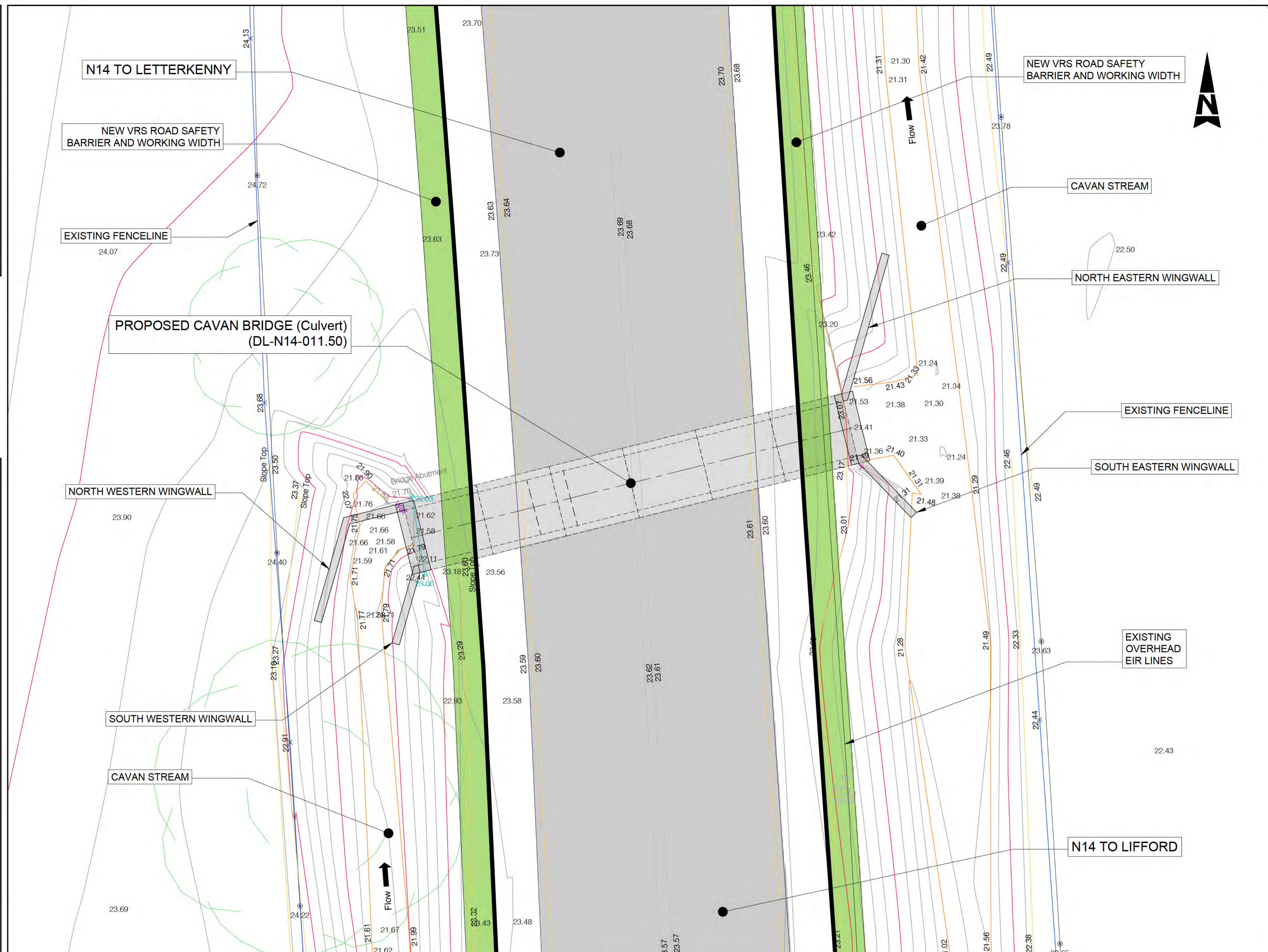
Client
TRANSPORT INFRASTRUCTURE IRELAND (TII)

Project
NORTH WEST BRIDGES TERM MAINTENANCE CONTRACT NR.3

Purpose	ISSUED FOR REVIEW				
Title	CAVAN BRIDGE (Culvert) (DL-N14-011.50) EXISTING LONGITUDINAL AND CROSS SECTIONS				
Original Scale	1:25	Des/Drawn	Checked	Authorised	
Date	12.04.24	Date	12.04.24	Date	12.04.24
Status	P	Drawing Number	5162160 / HTR / DR / 4014	Rev	-

100
0 10
A1

DO NOT SCALE



- GENERAL NOTES
1. ALL DIMENSIONS ARE IN MILLIMETRES 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

© ORDNANCE SURVEY IRELAND LICENSE NR. AR 0082524. ORDNANCE SURVEY IRELAND & GOVERNMENT OF IRELAND
 ATKINS NOT TO BE HELD LIABLE FOR THE USE OF THIS DATA ON ANY PROJECT OTHER THAN THE NORTH WEST BRIDGES TERM MAINTENANCE CONTRACT NR.3 PROJECT



Rev	Description	By	Date	Chk'd	Auth
-	ISSUED FOR REVIEW				

ATKINS
 Member of the SNC-Lavalin Group

Atkins House, 150 Airside Business Park, Swords, Co. Dublin, K67 K5W4
 Tel (+353) 01 810 8000
 email: info.ie@atkinsglobal.com
 www.atkinsireland.ie

Unit 2B, 2200 Cork Airport Business Park, Cork, T12 R279
 Tel (+353) 021 429 0300

1st Floor Technology House Parkmore Technology Park, Galway, H91 NX74
 Tel (+353) 091 788 050

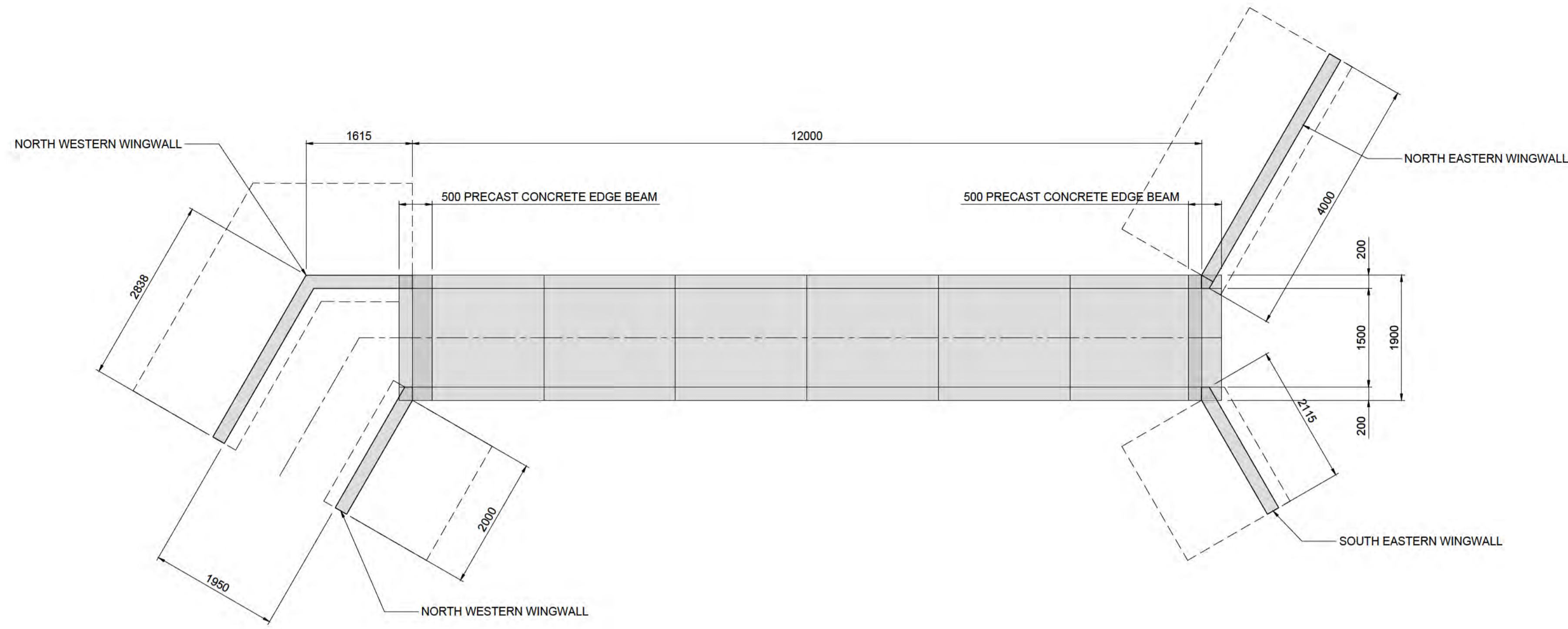
Purpose: TRANSPORT INFRASTRUCTURE IRELAND (TII)

Project: NORTH WEST BRIDGES TERM MAINTENANCE CONTRACT NR.3

Purpose	ISSUED FOR REVIEW		
Title	CAVAN BRIDGE (DL-N14-011.50) PROPOSED CULVERT LAYOUT PLAN		
Original Scale	1:50	Drawn	Checked
Date	12.04.24	Date	12.04.24
Date	12.04.24	Date	12.04.24
Status	P	Drawing Number	5162160 / HTR / DR / 4016
Rev			

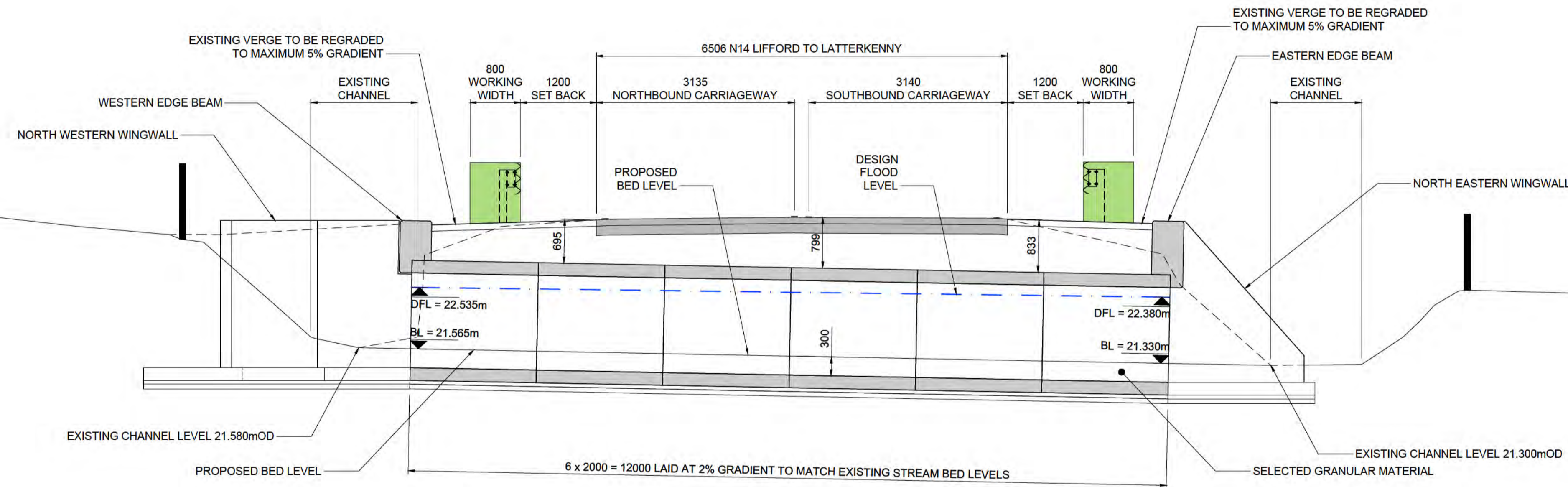
A1

DO NOT SCALE



PLAN - PROPOSED CAVAN BRIDGE (Culvert)

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



LONGITUDINAL SECTION - PROPOSED CAVAN BRIDGE (Culvert)

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

- GENERAL NOTES
1. ALL DIMENSIONS ARE IN MILLIMETRES 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



© ORDNANCE SURVEY IRELAND LICENSE NR. AR 0082524. ORDNANCE SURVEY IRELAND & GOVERNMENT OF IRELAND

ATKINS NOT TO BE HELD LIABLE FOR THE USE OF THIS DATA ON ANY PROJECT OTHER THAN THE NORTH WEST BRIDGES TERM MAINTENANCE CONTRACT NR.3 PROJECT



Rev	Description	By	Date	Chk'd	Auth
-	ISSUED FOR REVIEW				



Atkins House, 150 Airside Business Park, Swords, Co. Dublin, K67 K5W4
Tel (+353) 01 810 8000
email: info.ie@atkinsglobal.com
www.atkinsireland.ie

Unit 2B, 2200 Cork Airport Business Park, Cork, T12 R279
Tel (+353) 021 429 0300

1st Floor Technology House Parkmore Technology Park, Galway, H91 NX74
Tel (+353) 091 786 050

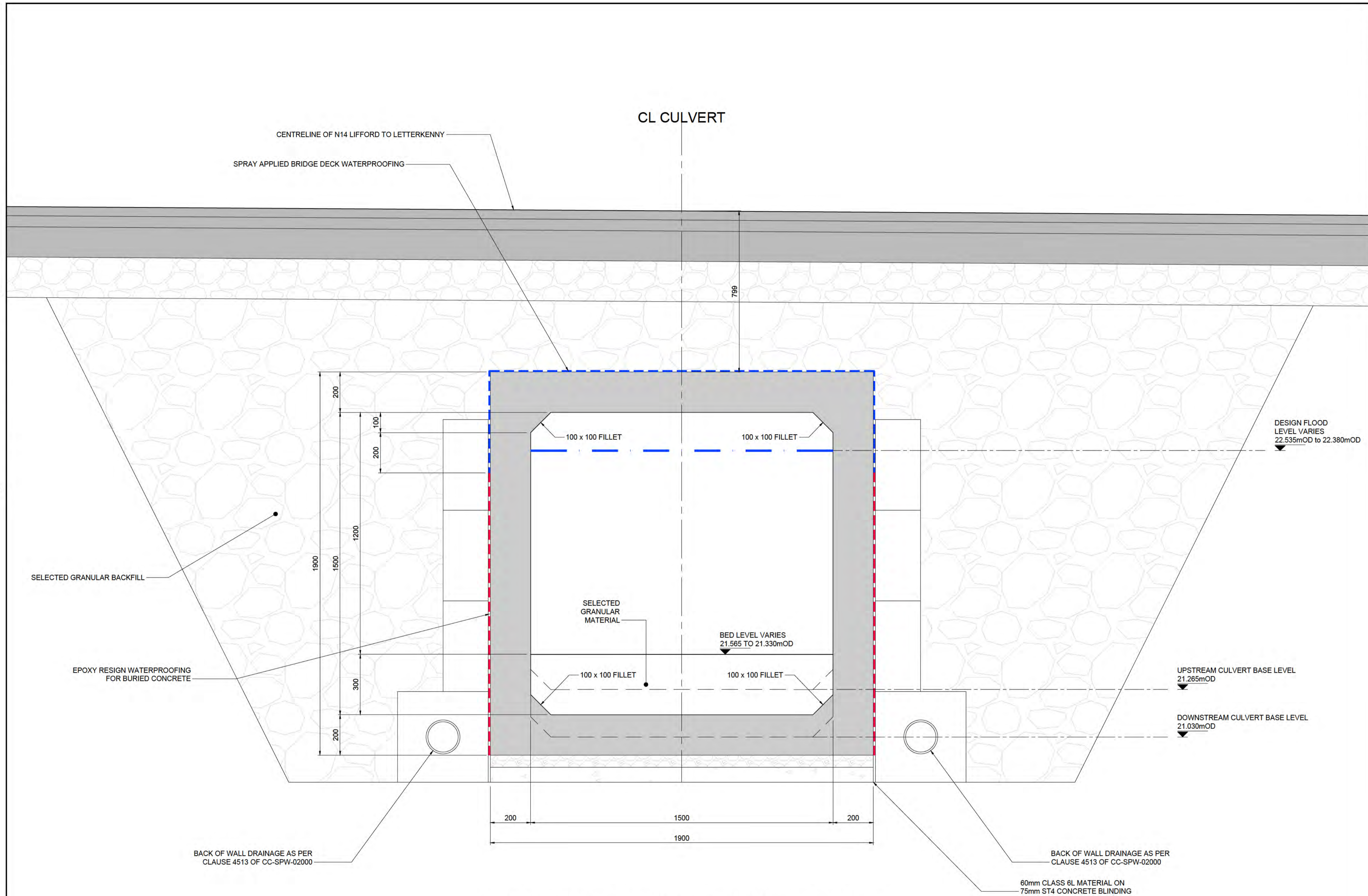
Client: TRANSPORT INFRASTRUCTURE IRELAND (TII)

Project: NORTH WEST BRIDGES TERM MAINTENANCE CONTRACT NR.3

Purpose	ISSUED FOR REVIEW		
Title	CAVAN BRIDGE (DL-N14-011.50) PROPOSED CULVERT GENERAL ARRANGEMENT		
Original Scale	1:50	Des/Drawn	Checked
Date	12.04.24	Date	12.04.24
Date	12.04.24	Date	12.04.24
Status	P	Drawing Number	5162160 / HTR / DR / 4017
Rev	-		

A1

DO NOT SCALE



TYPICAL CROSS SECTION - NEW CAVAN BRIDGE (Culvert)
 Scale at A1 1:10
 Scale at A3 1:20

- GENERAL NOTES**
1. ALL DIMENSIONS ARE IN MILLIMETRES 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

© ORDNANCE SURVEY IRELAND LICENSE NR. AR 0082524. ORDNANCE SURVEY IRELAND & GOVERNMENT OF IRELAND
 ATKINS NOT TO BE HELD LIABLE FOR THE USE OF THIS DATA ON ANY PROJECT OTHER THAN THE NORTH WEST BRIDGES TERM MAINTENANCE CONTRACT NR.3 PROJECT



Rev	Description	By	Date	Chk'd	Auth
-	ISSUED FOR REVIEW				



Atkins House, 150 Airside Business Park, Swords, Co. Dublin, K67 K5W4
 Tel (+353) 01 810 8000
 email: info.ie@atkinsglobal.com
 www.atkinsireland.ie

Unit 2B, 2200 Cork Airport Business Park, Cork, T12 R279
 Tel (+353) 021 429 0300

1st Floor Technology House Parkmore Technology Park, Galway, H91 NX14
 Tel (+353) 091 786 050

Client: TRANSPORT INFRASTRUCTURE IRELAND (TIIV)

Project: NORTH WEST BRIDGES TERM MAINTENANCE CONTRACT NR.3

Purpose	ISSUED FOR REVIEW				
Title	CAVAN BRIDGE (DL-N14-011.50) PROPOSED CULVERT TYPICAL CROSS SECTION				
Original Scale	1:10	Des/Drawn	Checked	Authorised	
Date	12.04.24	Date	12.04.24	Date	12.04.24
Status	P	Drawing Number	5162160 / HTR / DR / 4018	Rev	-

AtkinsRéalis



WS Atkins Ireland Limited
Unit 2B
2200 Cork Airport Business Park
Cork
T12 R279

<contact info>

© WS Atkins Ireland Limited except where stated
otherwise



AtkinsRéalis



WS Atkins Ireland Limited
Unit 2B
2200 Cork Airport Business Park
Cork
T12 R279

████████████████████
© WS Atkins Ireland Limited except where stated
otherwise