



Hoe Mill Bridge

ECC No. 308

Option Study

March 2021

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Executive Summary

Hoe Mill Bridge carries an unclassified road “Causeway” over a tributary of the River Chelmer in Ulting; approximately 5km west of Maldon, Essex. Refer to the location plan in **Appendix A** for the exact location and the grid reference.

The bridge is a reinforced concrete structure, consisting of 3 spans. Each span is approximately 6.35m long.

In 2019, further signs of distress to the top of the piers were observed during scour protection. A BD79 was completed and concluded that Hoe Mill Bridge is classed as a sub-standard structure according to BD79/13 and identified as an Immediate Risk Structure in accordance with BR79/13 Clause 3.

In consideration of the age and the structural capacity of the bridge, Essex County Council appointed Ringway Jacobs/ Essex Highways in 2020 to investigate the options for the reconstruction or strengthening of Hoe Mill Bridge to the current loading standards.

Following three options have been identified:

Option 1 – Refurbishment of existing structure

Review of the current weight restriction by undertaking a detailed stage 2 structural assessment. This will give an opportunity to refurbish the structure without any changes to the current restrictions. Current weight and width restrictions will be made permanent.

Option 2 – Deck replacement

Deck replacement with precast prestressed beam and infill concrete construction. Only the deck and the cross head beams (above the centre piers) will be replaced. The existing abutments, piers and foundations will remain untouched. The new deck will be supported on both existing abutments.

Option 3 – New Integral Bridge Built Off Line

Construction of a new permanent single span integral bridge off line directly east of Hoe Mill Bridge.

Option 4 – New Integral Bridge Built In Line

Construction of a new permanent integral bridge, in line within the existing footprint of the current structure.

Option 4 – New Integral Bridge Built In Line has been recommended in order to have a structure with 120 year design life and increase the value of the County’s bridge stock. The online construction (Option 4) is preferred over the off line bridge (Option 3) due to the numerous challenges including, but notwithstanding, difficulties re-aligning the carriageway to connect to the existing Hoe Mill Lock Bridge (ECC no. 307) directly north of Hoe Mill Bridge (ECC no. 308) and historical impact to Hoe Mill Lock Bridge and surrounding area.

1 Introduction

1.1 Description of existing structure

Hoe Mill Bridge carries an unclassified road “Causeway” over a tributary of the River Chelmer in Ulting; approximately 5km west of Maldon, Essex. Refer to the location plan in **Appendix A** for the exact location and the grid reference.

The carriageway over the bridge is 6.09m wide with designated footways of width of 1.57m and 1.635m on the east and west side respectively, giving a total width of 9.295 between the parapets. The road alignment over the bridge is straight and rises on a slight incline to the north.

Hoe Mill Bridge was constructed in 1937, and is a reinforced concrete structure carrying a two lane carriageway with footpaths on either side. The superstructure is formed of a three span continuous reinforced concrete structure. Each span being approximately 6.35m. The reinforced concrete deck is supported by four longitudinal reinforced concrete beams at approximately 3m centres. These beams are in turn supported by four reinforced concrete transverse beams, which span 2.1m between rows of reinforced concrete piers at skew. There are no expansion joints in the structure.

The connections between the deck, longitudinal beams, transverse beams and the piers are monolithic. The bridge has 11.2 degree skew.

The parapets are of reinforced concrete comprising pilasters and three rails, with an exposed aggregate finish, spanning between insitu stub posts. The parapets are in fair condition with minor spalling and exposed reinforcement. The parapets do not comply with the current standard on the Requirement for Road Restraint Systems CD377.

The superstructure is supported via its transverse beams, which in turn are supported by four rows of driven reinforced concrete piles. The two inner rows from the piers and consist of six 356mm square piles spaced at approximately 1.9m centres across the width of the bridge. The two outer rows consist of four 356mm square piles and these have been surrounded with mass concrete to form abutments.



Photo 1. Hoe Mill Bridge – View of the elevation from the East

1.2 Condition of Structure

As part of this option study, visual inspection of the substructure, scour survey, trial holes and utility survey were carried out. The inspection and the surveys have indicated that the structure has almost reached its design life and extensive refurbishment work will be required to maintain the integrity of the structure for future use.

1.2.1 Foundation

Diving survey was completed in 2019 of the southern abutment. Visible structural elements and topographical survey did not reveal any significant settlement to the structure.

Minor scour defects were observed, but the majority of the piled foundations were on firm strata.

1.2.2 Abutments

The existing drawings and previous 2004 scour protection scheme photos showed that the south abutment was constructed with four reinforced concrete piles with a cross beam. The gap between the piles were filled with mass concrete fill and a reinforced concrete base slab.

As part of 2004 scour protection scheme, a steel sheet pile wall was constructed behind the south abutment and the wingwall. The gap between the sheet pile was filled with mass concrete fill.

The wing walls consisted of reinforced concrete, with two counter-forts on the back with a ground beam connecting the counter-forts together.



Photo 2. View of southern abutment construction details (2004)



Photo 3. View of southern abutment sheet piling construction details (2004)

1.2.3 Piers

Generally in poor condition with various localised spalled concrete exposing reinforcement.

Delamination survey was completed in 2019 and showed that the majority of the 12 piers have diagonal cracks forming at the connection with the transverse beams (top end of the piers). There were also large areas of concrete that had been spalled and exposed corroded reinforcement at these location. A localised concrete repairs were completed in 2019.



Photo 4. Localised spalled concrete



Photo 5. Completed concrete repair

During the diving survey of 2017 and 2019, divers confirmed that the piers were founded in firm strata.

1.2.4 Cross heads / diaphragms

Generally in fair condition. No cracks noted. Some calcium deposits on the outer edges.

Green staining (organic material) on the longitudinal beams and cross heads may indicate water penetration from the deck.

1.2.5 Deck

Visual inspection of the deck has concluded that it is in a fair condition. Minor calcium deposits on the edge beams.

No testing or samples were taken from the deck as part of this option study. Only trial holes were taken on the footways to identify any existing underground utilities spanning across the bridge that were exposed during the 2004 scheme.

1.2.6 Parapets System

The parapets are of reinforced concrete comprising pilasters and three rails, with an exposed aggregate finish, spanning between insitu stub posts. The parapets are in fair condition with

minor spalling and exposed reinforcement. The parapets do not comply with the current standard on the Requirement for Road Restraint Systems CD377

1.2.7 Carriageway

Existing road surfacing is in fair condition.

Currently, on the carriageway there is width restriction of 6' 6" to help enforce the 3 tonne weight restriction.

1.3 Traffic Data

The bridge is located in the country side and is directly south of Hoe Mill Lock Bridge ECC 307. It is situated on a route, which carries both through and local traffic.

- Approximately 1.3km south of the bridge is Woodham Walter Church of England Primary School.
- No bus services run over the structure.
- A derestricted speed limit applies to the road.
- 6' 6" width and 3 tonne weight restriction over Hoe Mill Bridge.

Traffic counts were completed directly north of Hoe Mill Bridge on The Causeway, and south on Manor Road 22nd June to 28th June 2020.

Table 1: The Causeway, Ulting traffic count

The Causeway, Ulting	
North Bound	
Total recorded volume (7 day 22/06/20)	3019
Avg weekday volume (Mon-Fri, 24hrs)	454.6
Avg weekday speed (Mon-Fri, 24hrs)	19.3 mph
AM avg peak vol period (Mon-Fri)	11:15 to 11:30
PM avg peak vol period (Mon-Fri)	16:00 to 16:15
Peak volume	42
24hr break down (weekday avg)	Motor cycles: 9% (42.4)
	Cars/ LGV1: 84% (380.8)
	LGV2 / MGV: 6% (28.2)
	HGV rigid: 1% (2.4)
	HGV articulated: 0% (0.8)
Southbound	
Total recorded volume (7 day 22/06/20)	2946
Avg weekday volume (Mon-Fri, 24hrs)	452.2
Avg weekday speed (Mon-Fri, 24hrs)	20.9mph
AM avg peak vol period (Mon-Fri)	11:45 to 12:00
PM avg peak vol period (Mon-Fri)	12:45 to 13:00

Peak volume	42
24hr break down (weekday avg)	Motor cycles: 5% (23.4)
	Cars/ LGV1: 87% (392)
	LGV2 / MGW: 8% (34.8)
	HGV rigid: 0% (1.4)
	HGV articulated: 0% (0.6)

The recent traffic count suggests that the average speed limit at this location is less than 25mph. However, the reduced speed is due to the recent restrictions in place for the existing bridge (6' 6" width and 3 tonne weight restrictions) which is controlled by temporary 2 way traffic lights.

No recorded severe or normal accidents have occurred at this location. Keeping in mind the above observations and considering the planning requirements at this location it may be possible to provide non-standard decorative parapets on both sides, similar to the existing without any safety barriers on the approaches.

A road safety audit shall be undertaken during the feasibility stage with regards to this matter

1.4 Road Restraint Systems

The existing parapets do not comply with current standards, and there are no active physical protection measures in place to protect these substandard parapets from vehicular impact or approaches to the structure. The current height of the concrete parapets is 1000mm.

1.5 Review of existing reports.

In March 1992, the Assessment report concluded that the structure is not capable of carrying 40Te assessment loading to BD21/84 and BD44/90. The capacity of the structure was indicated as 7.5Te and this restriction to be in place until strengthening works could be carried out.

A severe defect report in October 2002 indicated that the structure was severely affected by scouring and as result of this, the rating of the structure was reduced to 3Te.

An Option Study report was completed in 2009 and recommended single span precast concrete beam deck replacement. This was not pursued.

A BD79/13 (CS 470) was completed in 2019 and recommended an additional 2m wide width restriction to enforce the existing 3Te weight restriction (that was imposed in 2003). Below is an extract from the report.

BD79/13 – Appendix D – Substandard Structure Summary**Structure Name:** Hoe Mill Bridge**Structure Ref. No:** ECC No. 308

Assessment / Review	Stage:	Level 2 Assessment	Severe Defect report	Option Study
	Date:	March 1992	October 2003	March 2009
	Report reference:	Assessment Hoe Mill Bridge	Severe Defect Hoe Mill Bridge	Option Study Hoe Mill Bridge
	Assessed capacity:	7.5Te	Suggests a 3Te weigh limit is imposed	Refers to 7.5Te Assessment report capacity
	Sub-standard status:	Sub-standard	Sub-standard	Sub-standard
Interim Measures Feasibility Assessment	Date:	No record available	No record available	No record available
	Is the structure an Immediate Risk Structure or a Low Risk Provisionally Sub-standard Structure?	No record available	No record available	No record available
	Is the structure monitoring - appropriate?	No record available	No record available	No record available
Interim Measures Proposals	Date:	March 1992	October 2003	March 2009
	Recommendations:	7.5Te weight limit imposed until bridge is strengthened.	Impose 3Te until scour scheme works are completed	Full reconstruction of the bridge with a single span precast beams on new substructure
Interim Measures Approval	Date:	No record available	No record available	No record available
	Approval/Rejection:	No record available	No record available	No record available
Actions	Implementation date:	N/A	January 2011	N/A
	Details/ref:	No IM implemented	3Te weight limit imposed	No IM implemented
	Provisional finish date for monitoring:	N/A	N/A	N/A
	Removal date:	N/A	N/A	N/A
Documentation	Date:	No record available	No record available	No record available
	Form used:	No record available	No record available	No record available
Additional Notes		Basic data unchanged from BD79-06 Summary Sheet.	Basic data unchanged from BD79-06 Summary Sheet.	This report column was not on the BD79-06 Summary Sheet.

1.6 Purpose of Report

Essex County Council have commissioned Ringway Jacobs to prepare an option study to provide a structure at this location that is compliant with current standards. The report investigates the site and environmental constraints, and evaluates possible options providing recommendations on structural form to meet the project requirements.

The main technical criteria to be met by the proposed solution are listed below:-

- Provision for a structure to support live traffic loading in accordance with Eurocodes through the application of CG 300 (formally known as BD2/12) and CD 350 (formally known as BD100/16).
- Provision of a containment barrier to meeting minimum N2 containment level (refer to 2.2 of this report for further information).
- There is currently no recent information available on the existing ground conditions: a Ground Investigation is recommended in due course.
- Surveys to be completed as part of full Planning (refer to 2.5 of this report for further information).
- Additional hydrology survey is required as part of the submission of the Environment Agency bespoke permit.

2 Constraints on the Options

2.1 Land Requirements

For some options, access and compulsory purchase to the surrounding grassland will be required. A land search has been undertaken identifying all surrounding land owners. The HM Land Registry record indicate the land on the south side of the structure is own by private owners. The land on the north side is owned by Essex Waterways Limited. Consultation will be required to agree any land use and purchase for the permanent structure.

The registered tile owners in the vicinity were contacted as part of this option study and their land they occupy are summarised in the table below;

Table 2. Land owners identified

Land owner	Location
[REDACTED]	[REDACTED]

2.1 Nearby schools and Infrastructure

2.1.1.1 Schools

Woodham Walter Church of England Voluntary Controlled Primary School, 1.5 km / 0.9miles south of Hoe Mill Bridge

2.1.1.2 Bus routes

None

2.1.1.3 Public Rights of Way

There are few Public Rights of Way located in the vicinity of the bridge structure. Their exact locations and the route details are included below. Access to all foot paths shall be maintained during any bridge improvement works and prior consultation with Essex County Council PRow team is necessary to obtain permission for any temporary or permanent amendments to the existing PRow network.

Table 3: Public Rights of Way identified

North
PROW 267_13
PROW 267_14
South
PROW 270_24

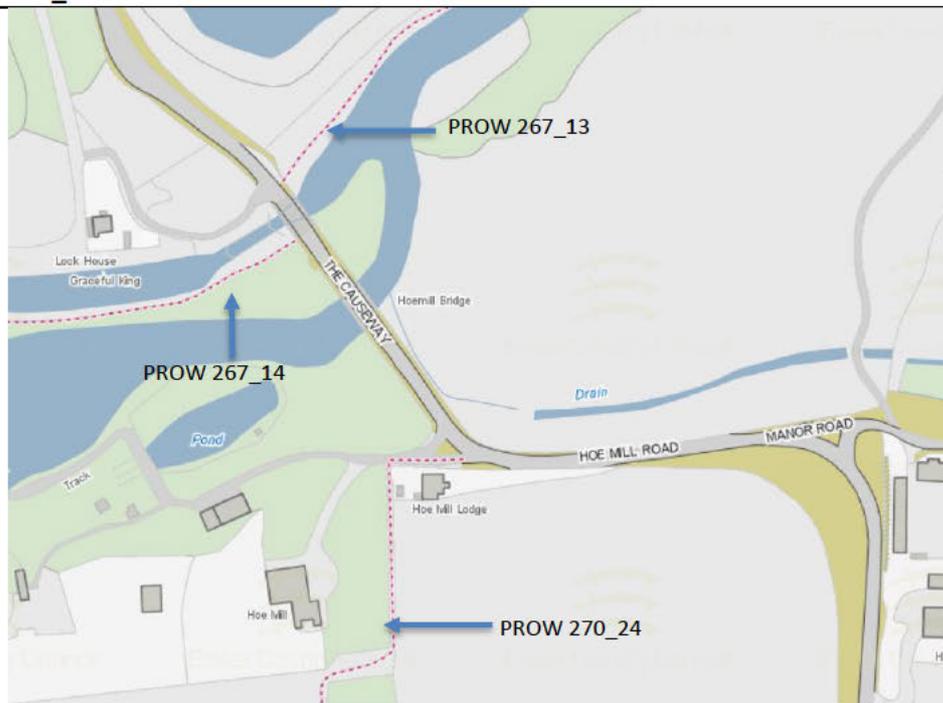


Fig 1. Public Rights of Way locations

2.2 Road Restraint System

The existing parapets do not comply with current standards, and there are no active physical protection measures in place to protect these substandard parapets from vehicular impact.

The parapets are of reinforced concrete comprising pilasters and three rails, with an exposed aggregate finish, spanning between insitu stub posts. The parapets are in fair condition with minor spalling and exposed reinforcement. The parapets do not comply with the current standard on the Requirement for Road Restraint Systems CD377.

Currently the parapets are protected by temporary bolt down bollards to enforce a width restriction over the bridge.

It is recommended that both parapets are replaced and be in compliance with current standards (CD 377).

As The Causeway and Manor Road is a derestricted road, this needs to be considered when selecting the new parapet for the new bridge.

2.3 Departures from Standard

Depending on the outcome of the Landscape and Visual Impact assessment, departures from standards to any new bridge parapets and approach and departure safety barriers will need to be considered. This has also been highlighted by the Heritage Statement and Archaeological Desk Based Assessment, with emphasis on the new structure having a similar in design and form to the existing structure. It has been recommended that the design is undertaken in consultation with the local planning authority and their heritage advisors. This is taken as the 'design and form' of the aesthetic look of the new structure.

Further consideration should be considered in keeping the current carriageway width on any new constructed bridge to be maintained at 6m and not to 7.3m (as per CD 127). This is to stop any bottle necks developing when the new carriageway connects to the existing carriageway over Hoe Mill Lock Bridge (ECC 307).

2.4 Utility companies

The relevant utilities have been identified in the vicinity of the bridge. Further consultations with the utility companies must be carried out to discuss potential diversions or protective measures to their apparatus once the proposed solution is taken through the detailed design stage.

Table 5. Utilities identified and their approximate location.

Company	Location
British Telecommunication	Overhead cable running parallel to existing structure, west side. Sharing UKPN pole.
UKPN	Overhead cable running parallel to the existing structure, west side. BT telecommunication cable sharing same poles.
Northumbrian Water	Across field within title [REDACTED]
Private water	Not shown on any C2 returns, a private main sits within the west footpath of the existing structure.
Surface Water	No gullies on the existing structure. Off structure (southern end), 1no. north bound carriageway, 2no. south bound carriageway. Within farmer's field there is a drainage ditch

2.5 Access

Access to Hoe Mill is largely open. The bridge is in a rural setting and the land owners have been identified. Consultation to the southern land owners will be required for:-

- Work access to all four corners to the bridge
- Site compound licence within the farmer's field to the South East, and
- Compulsory purchase minor parcel of land South West.

There are 3 Public Right of Ways, 2 immediately to the north of the structure, beyond Hoe Mill Lock Bridge, and a second south of the structure (refer to 2.1.1.3). Pedestrians mainly use the routes to the north to walk along the river canal. However, as there is no alternative to cross the River Chelmer and Hoe Mill Bridge is the only viable route for pedestrians to cross the river, a temporary footbridge will be required to be installed or construction of the options must be phased to allow pedestrians across the river.

Transport of the beams must be taken into consideration as the only suitable route to the bridge for the delivery of the beams would from the south.

2.6 Temporary traffic management requirements

The bridge is one of 5 crossings of the River Chelmer and sits between the crossing at:-

- Paper Mill Bridge ECC 303; &
- Maldon bypass (A414) [Chelmer Viaduct ECC 939].

Currently Hoe Mill Bridge is categorised as a sub-standard highway structure under CS470. The bridge has a 3Tonne structural weight and a 6' 6" width restriction.

All Options require full road closures but the severity will depend on the works required.

As such, the signed diversion route shall be given as:-

The Causeway, Crouchman's Farm Road, Ulting Road, The Green, Maldon Road (B1019), Hatfield Road, Maldon Road, Langford Road, Heybridge Approach, Maldon bypass (A414), Spital Road (A414), Wycke Hill (A414), Maldon Road (A414), Chelmsford Road (A414), London Road, Old London Road, Herbage Park Road, Church Hill, The Street, Rectory Road, Hoe Mill Road, The Causeway and vice versa.

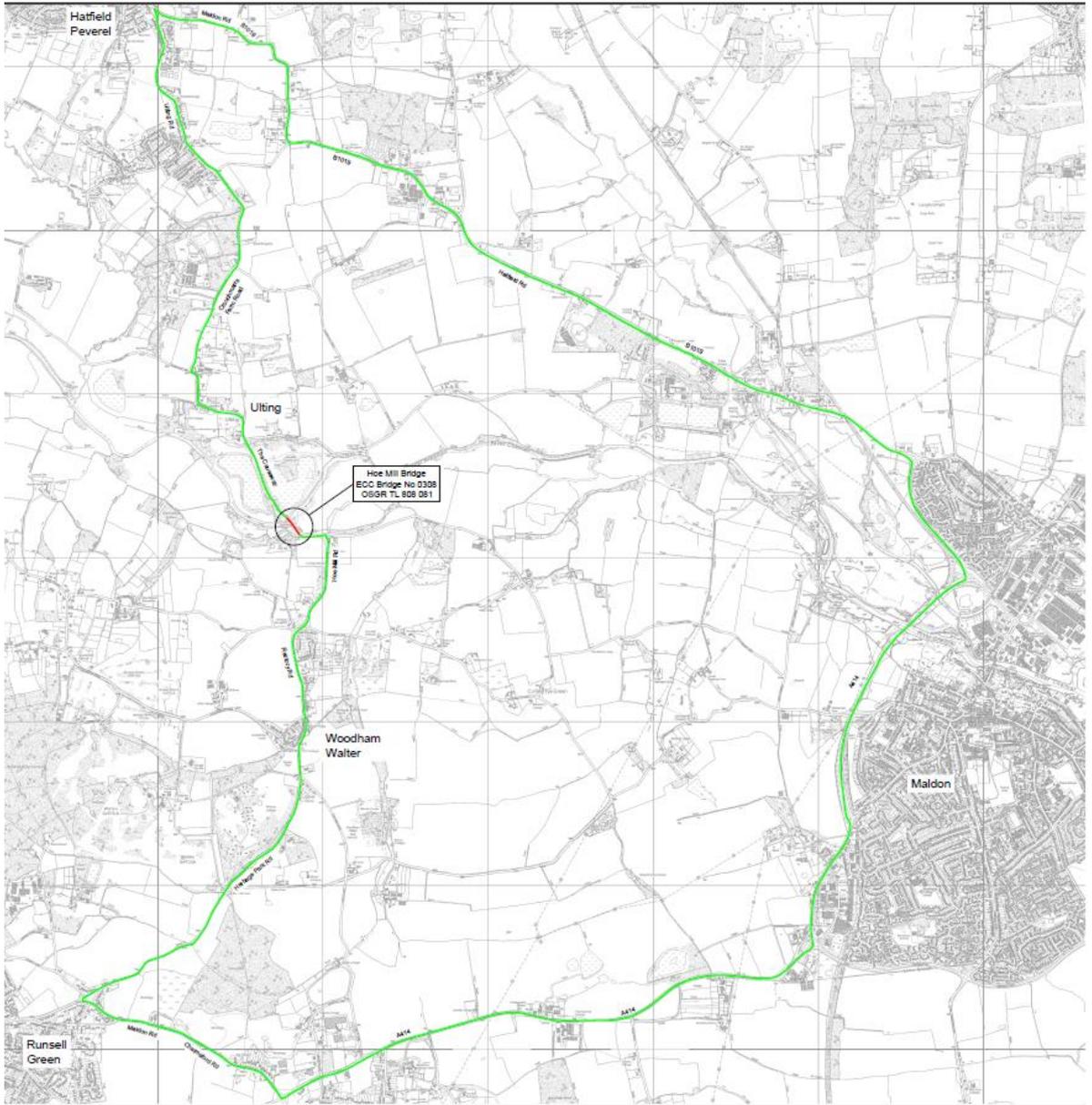


Fig 2 Diversion Route Required – Approx. 21.5 km (13.3 miles)

2.7 Health and safety / CDM

2.7.1 Health and Safety

The risks associated with the potential works have been identified and have been reduced or eliminated where practicable.

For residual risks of the proposed options, refer to **Appendix B**. The main risks associated with the construction works will be:-

- Construction close to the live traffic and farm live stock (cattle);
- Working in and near a deep water;
- Farm land susceptible to flooding; and
- Underground and overhead utilities.

2.7.2 CDM Regulations

CDM 2015 Regulations requires Designers to eliminate, reduce or control foreseeable risks at an early stage of the project as far as reasonably practicable. This process shall be continued throughout the entire design phase to ensure that health and safety issues are avoided. Any unavoidable issues can be effectively addressed.

No major health and safety issues other than those usually associated with construction work have been identified as part of this project.

The key hazards are:-

- Working near deep water;
- Working in and over deep water;
- Working from height;
- Working adjacent to live services;
- Crane lifting of heavy elements;
- Working near live traffic;
- Working adjacent live stock;
- Controlled demolition of the structure;
- Complex temporary works;
- Ecological constraints; and
- Archaeological constraints.

2.8 Ecology

Place Services were commissioned by Essex Highways Structures Team to complete a Preliminary Ecological Appraisal Report (November 2020) to inform our submission of a planning application to the preferred Option for the replacement structure of Hoe Mill Bridge.

Summary of the impacts and recommendations can be found in the table below.

Table 6: Summary of impacts and recommendations

Feature	Impacts	Measures	Enhancements
Locally and Legally Protected Sites	Potential pollution impacts to Locally and Legally Protected Sites	Pollution prevention measures adhered to.	N/A
Priority Habitats	Potential pollution impacts to River and Semi-improved neutral grassland (Floodplain Grazing Marsh)	Precautionary site management measures. Pollution prevention measures adhered to. Rubber grass mats should be used to protect the grassland areas subject to impact from heavy machinery and traffic.	N/A
Bats	Potential impact to trees with potential roost features via felling /pruning. Potential impact to foraging and commuting bats via the provision of lighting during the construction phase.	Further preliminary bat roost assessment should be conducted on any trees identified for removal in the Tree Survey Report. Trees with low potential will need to be soft felled / pruned between late August and early October or between March and April.	A number of bat boxes erected on trees within

		No lighting during the construction phase.	
Reptiles	Killing and injury if habitat is allowed to become suitable prior to work commencing.	Ecological Clerk of Works to provide ecological supervision during site clearance of vegetation, to search any suitable habitat and move any reptiles that are found.	Provision of hibernacula
Badgers	Potential disturbance to badgers, foraging habitat.	If any Badger sets are found within the immediate area of the works, the project ecologist must be contacted for advice.	Planting of native species post-construction
Nesting Birds	Potential disturbance to nesting birds. Loss of nesting habitat	Site clearance undertaken outside the bird nesting season (March to end of August) or immediately after an ecologist has confirmed the absence of nesting birds. Provision of alternative nesting habitat (i.e. boxes / planting)	Provision of bird boxes erected on retained trees within the site.
Otters	Potential disturbance to Otters foraging and commuting.	The development should not involve any night-time working and no night-time illumination of the watercourse, to ensure that otters are not prevented	

		<p>from using their territory. There should also be no barriers to animals travelling up and down the watercourse overnight.</p> <p>An additional survey for otter field signs, and holts, should be completed prior to the works commencing.</p>	
Water Voles	Potential disturbance to Water Voles foraging and commuting.	An additional survey for Water Vole field signs should be completed prior to the works	
Species	<p>Killing and injury of Hedgehogs during vegetation clearance and / or disturbance of hibernating hedgehog.</p> <p>Killing and injury of Toads</p>	<p>Brush piles removed between March and early November by hand unless checked by a competent ecologist</p> <p>Ecological Clerk of Works to provide ecological supervision during site clearance of vegetation, to search any suitable habitat and move any Toads that are found.</p>	Planting of native species post-construction
Invasive and Non-native Species	Causing spread to the wider environment and lack of control leading to reduced biodiversity (Floating Pennywort)	Appropriate removal of the Floating Pennywort on site.	N/A

2.9 Arboriculture Impact Assessment

Place Services were commissioned by Essex Highways Structures Team to complete an Arboricultural Impact Assessment and a preliminary Arboricultural Method Statement (March 2021) to inform our submission of a planning application to the preferred Option for the replacement structure of Hoe Mill Bridge.

It has been identified that:-

- Only one tree, T10 (Category C) will need to be removed to facilitate the development.
- The proposed development will be within the Root Protection Areas (RPA) of five trees. The demolition works are likely to impact three trees of low quality, T8, T9 and T10 (Category C) and will have a slight incursion into the (RPA) of two category B trees (T11 and T12).
- The proposed site compound is situated within the RPAs of T12, T13, G14 and G15. Protective fencing will be required to ensure access is not permitted within these areas during the course of the development.
- The tree protection measures recommended in this report and illustrated on the Tree Protection Plan (TPP) in appendix 3, should be implemented to protect all trees on site from construction activity and root disturbance during any excavation works.
- It is strongly recommended that the arboricultural protection measures are clearly communicated to the entire construction team prior to commencement. This process is most effectively managed by monitoring the development on a regular basis, checking tree protection measures in relation to the TPP and the AMS and reporting to the Local Planning Authority (LPA) on a monthly basis where required.

2.10 Environment Agency

Hoe Mill Bridge carries an unclassified road “The Causeway” over the River Chelmer and is one of five crossings.

The Environment Agency (EA) have been consulted (September 2020) for their initial thoughts on the proposed options. Depending on the option to be constructed, the involvement of the Environment Agency will be determined.

Below are the recommendations from the EA:-

- Road bridge soffit levels and flood spans must normally be 600 mm or more above the design flood level (or the maximum known flood level on minor watercourses) in order to allow floating debris to pass freely through the structure. The soffit level may be further influenced by what is in the vicinity, particularly upstream of the proposed bridge.
- The soffit must be no lower than 300 mm above either of the upstream bank tops. If a lower soffit is required on technical grounds, we may require a wider span to compensate.
- Soffit levels on navigable rivers will need to take account of the clearance level required for boats legally using the river. You must ensure you the developer consults the relevant navigation authority (British Waterways, ourselves as navigation authority, the county council, or a private company, as appropriate) if bridge works are proposed where they operate.
- We would ask for a minimal soffit level 100+25%CC including a 600mm freeboard.
- You must show that there will be no worsening of flooding as a result of the changes and ideally an overall benefit.
- The new bridge must produce no difference in water levels between the upstream and downstream sides (afflux) since this would increase flood risk upstream of the bridge.
- You the developer must adequately consider local scour to piers and abutments.

Comments from the EA’s fisheries and biodiversity team indicated the following requirements:-

- The development of Sustainable Drainage System (SuDS) to be incorporated into the bridge drainage design as to not ‘exacerbate any runoff from the road into the river or its tributaries’.
- Ecology report required.
- Otters have been recorded nearby and therefore ‘depending on the bridge design and surrounding bank gradient, an otter ledge may be an apt and necessary consideration’.
- Water Framework Directive (WFD) assessment to be carried out to determine the work impacts on the river as well as the surrounding biodiversity.
- Consultation with Essex Wildlife Trust will be necessary as the river is designated a Local Wildlife Site (LWS). River Chelmer LWS.

2.11 Planning

Essex County Council planning department have been consulted for Pre-Planning advice with regards to the proposed options. Due to the size of worked area it is considered to be a Major Development.

Planning requirements are as follows:-

- Principle of Development and Need;
- Landscape and Visual Impact;
- Ecological Impact;
- Flood Risk;
- Arboricultural Impact;
- Highways Impact;
- Historic Environment Impact; and
- Archaeological Impact.

2.12 Heritage Statement and Archaeological Desk Based Assessment

Place Services were commissioned by Essex Highways Structures Team to complete a Heritage Statement and Archaeological Desk Based Assessment (November 2020) to inform our submission of a planning application to the preferred Option for the replacement structure of Hoe Mill Bridge.

It has been identified that the potential for paleo environmental remains within the existing footprint of the bridge is likely and that it could be directly impacted or destroyed dependent on the foundations of the new structure.

Any new structure would have a low potential impact to Prehistoric, Roman, Medieval and Post-Medieval periods if the new structure sits within the existing footprint of the structure. However, if the area of site extends beyond the existing footprint than the potential impact on these materials will be to medium –high.

Due to Place Service’s concerns of paleo environmental remains, it has been recommended that a scheme of geotechnical investigation is undertaken within the location of the proposed bridge piers and the road across the flood plain.

It is also highlighted that due to the structure being within a Conservation Area and the listed status of the Lock Bridge and Gate associated with the Navigation, the new bridge should be similar in design and form to the existing structure. It is recommended that the design is undertaken in consultation with the local planning authority and their heritage advisors.

2.13 Geology

Previous bore holes in the vicinity of the existing bridge have been identified via British Geology Society (BGS). See **Appendix D** for details:-

- TL80NW100
- TL80NW103
- TL80NW140

Deep piles will be required to bypass the blue clay layers as shown on the historical bore holes.

Geological Investigation shall be completed during Feasibility stage to confirm the historical BGS boreholes results.



Fig 4. BGS bore hole locations

3 Options Considered

3.1 General

Essex Highways have been commissioned to undertake an option study to investigate the possible options to provide a structure at the location which is compliant with current design standards.

Currently, the structure is in fair to poor condition, with a BCI critical score of 58.0. However, the recent defects to the top of the piers have forced the County into installing a width and weight restriction over the structure.

An option study has been carried out to investigate the possible methods for rehabilitation of the structure. The main aim of this study is for Essex Highways to consider options for providing a structure which is compliant with current standards.

The options considered in this report are:-

Option 1 – **Refurbishment of existing structure**

Review of the current weight restriction by undertaking a detailed stage 2 structural assessment. This will give an opportunity refurbish the structure without any changes to the current restrictions. Current weight restriction and the width restriction will be permanent.

Option 2 – **Deck replacement**

Deck replacement with precast prestressed beam and infill concrete construction.

Only the deck and the cross head beams (above the centre piers) will be replaced. The existing abutments, piers and foundations will remain untouched. The new deck will be supported on both existing abutments.

Option 3 – **New Integral Bridge Built Off Line**

Construction of new permanent single span integral bridge off line directly east of Hoe Mill Bridge.

Option 4 – **New Integral Bridge Built In Line**

Construction of new permanent integral bridge, in line within the existing footprint of the current structure.

3.2 Options Considered

3.2.1 OPTION 1 - Refurbishment of existing structure:

The bridge is currently subject to a 3T weight restriction and 6'6" width restriction. Option 1 suggests a Principal Inspection and a follow-up detailed level 2 structural re-assessment for the existing bridge deck and the substructure in order to review the current restrictions. If the structure passes the current restriction, then the refurbishment works identified below will be undertaken to preserve the structure.

Option 1 suggests a refurbishment scheme that includes:-

- Full delamination survey of the structure;
- Localised concrete repairs to the deck, beams, pier heads and parapets;
- Re-water proofing;
- Re-surfacing; and
- An underwater inspection to determine the condition of intermediate pier foundations and the abutments.

As of this option, the existing 3 Tonne weight restriction and the 6'6" width restriction are to be made permanent. This option will require regular maintenance and on going monitoring of the structure.

3.2.1.1 *Advantage of Option 1*

- Relatively low cost.
- Prolonging the life of the existing bridge.
- No stats diversion.
- No land purchase required.
- Existing Aesthetic view of the bridge will be maintained.
- No planning or archology permission will be required.
- Minimal disturbance to the surrounding area.

3.2.1.2 *Disadvantage of Option 1*

- No improvements will be made to the existing road network due to sub-standard bridge (the 3Tonne weight and 6' 6" width restriction will be maintained).
- There is high probability that the concrete cracks and spalling will re-appear in the future.
- The current structure is already over 100 years old and coming to the end of its design life. It will be difficult to specify the future life of the structure.
- Legacy sub-standard parapet will require maintenance.

3.2.1.3 *Estimated cost and duration*

Estimated cost:- £500k

(Assessment, Design fees and 3rd party consultation are not included.)

Estimated duration:- 14 weeks

3.2.2 OPTION 2 - Deck Replacement:

Proposed Option 2 consists of a full deck replacement by a single span structure using the existing abutment. The existing intermediate piers will either be made shorter or completely removed so that the single beams can span over the existing piers and supported on existing abutments. The existing deck will be replaced with Y2 and YE2 precast prestressed beams with insitu infill concrete. The deck will have a similar clear span as the existing deck. The total construction depth of the proposed deck will be approximately 1115mm (Y2 800mm deep, 200mm concrete slab and 115mm surfacing).

Once the deck is removed the condition of both existing abutments are to be assessed for the new deck loading. If the existing abutments fail supporting the deck loading, then the abutment will be strengthened by building an additional reinforced concrete wall behind the existing abutment walls.

The existing carriageway and footway dimensions will be maintained. The parapets will be replaced. However, due to the location of the existing structure within a conservation area, and as per the Heritage Statement and Archaeological Impact assessment, the new parapet will be an ornamental reinforced concrete design to the time period of the original structure's construction.

Refer to drawing **BR0308-01-1201** for the general arrangement of Option 2.

3.2.2.1 *Advantage of Option 2*

- Use of existing substructure will reduce the construction cost, construction waste and disturbance to the surrounding area.
- Relative low cost compared to full reconstruction.
- Similar appearance to existing structure.
- Road levels remain as existing.
- No additional land purchase required.

3.2.2.2 *Disadvantage of Option 2*

- Overall design life of the structure will be limited by the residual life of the substructure.
- Condition of existing abutment foundations are unknown.
- Extensive investigation works are required to determine load carrying capacity of the existing sub-structure.
- Extensive temporary works within the watercourse required for removal of existing deck, piers and abutment preparations.

- Temporary footbridge required for pedestrian to cross the River Chelmer.
- EA bespoke permit required in the removal or shortening of the existing.
- Bearings will need to be introduced to allow effective movement of the single span deck. This could be a maintenance liability in an area that is susceptible to flooding.
- Existing water way area cannot be increased due to the use of existing sub-structure.
- Movement joint is required within the carriageway which will introduce another maintenance liability.
- Departure from standard for sub-standard parapets due to conservation area.
- Departure from standard for a reduced carriageway width due to the reuse of the sub-structure.
- Utility diversion required for the private main running within the west footway.
- Full road closure required.
- Land licence required for site compound

3.2.2.3 *Estimated cost and duration*

Estimated cost:- £800k

(Design fees, 3rd party consultation and utility diversion cost are not included)

Estimated duration:- 24 weeks

3.2.3 **OPTION 3 - New Integral Bridge Built Off Line:**

Option 3 consists of a full replacement of the entire structure (including the substructure) with an off line new integral bridge approximately 2m east from the existing bridge.

The new structure will be a precast prestressed concrete integral bridge supported by reinforced concrete piles on both sides of the river.

It is proposed to use Y5 and YE5 precast prestressed beams with a clear span 28m (26m over the river and 1m each end). The construction depth of the deck will be approximately 1415mm (Y5 beam 1100mm deep, 200mm concrete slab and 115mm surfacing).

It is proposed to increase the soffit level by 185mm above the existing lowest level of 9.005m.

Due to the location of the existing structure within a conservation area, and as per the Heritage Statement and Archaeological Impact assessment, the new parapet will be an ornamental reinforced concrete design to the time period of the original structure's construction.

A significant area of land will need to be purchased to accommodate the new structure and for the realignment of the carriageway. Additional land will need to be leased to accommodate the site compound and work access to the bridge on all sides.

Additionally, for the construction of the new carriageway, significant amount of imported fill material is required to facilitate re-levelling of land. The new carriageway will require a full road safety audit to review the new carriageway alignment.

A full road closure is required for the works; however, the closure period will be minimal and will only be required for merging the new carriageway with existing carriageway.

Once the existing structure is demolished, the existing underground water main will need to be diverted over the river permanently.

The existing structure is proposed to be demolished (including the piers), leaving only the abutments in place and to be converted into viewing platforms of the river.

Refer to drawing **BR0308-01-1202** for the general arrangement of Option 3.

3.2.3.1 *Advantage of Option 3*

- Full 120 year design life on new structure.
- Low maintenance cost.
- New bridge can be designed for full Eurocode loading (including full SV loading).
- Using precast prestressed beams will be relatively quick construction method and minimum formwork required.
- Removal of the existing bridge will remove any existing maintenance liability to a sub-standard structure.
- The proposed carriageway width can be widened to current standards (CD 127).
- Minimal disruption to the network as the majority of the construction works will be off line. Existing structure can be left open during construction of the new structure. Traffic can be switched onto the new structure once completed and demolition of the old structure can take place after.
- Land between the existing The Causeway and new carriageway could be used for possible carpark.

3.2.3.2 *Disadvantage of Option 3*

- Significantly large area of land purchase required.
- Planning consent required.
- EA bespoke permit required.
- Due to the proximity of an ancient archaeological site, archaeologist will have to be consulted and be present during geological investigation and construction.
- Hydrology analysis needed with regards to the location of the new structure.
- Significant larger cranes required for lifting the larger beams in place.
- Utility diversion required for the private main within the western footpath.
- Alignment of the new carriageway will need to be designed.

- Large amount of imported material to raise farmer's field to the correct levels for the new carriageway and structure.
- New highway drainage system needs to be designed to take field run off from farmer's field including, but not limited to additional designs for sustainable drainage systems
- Proximity of Hoe Mill Lock Bridge will constrain the alignment of any new carriageway.
- Proximity of Grade II listed assets (Hoe Mill Lock and Lock keepers house) will factor into the design and construction.
- Departure from standards to the parapets due to the structure being within a conservation area.
- Road closure required to complete the works.
- Most expensive option.
- Temporary crash deck required during the demolition of the existing bridge.
- A temporary footbridge crossing the River Chelmer for pedestrians.

3.2.3.3 *Estimate cost and duration*

Estimated cost:-	£2m (including new carriageway) <i>(Design fees, 3rd party consultation and utility diversion cost are not included)</i>
Estimated duration:-	52 weeks

3.2.4 **OPTION 4 - New Integral Bridge Built In Line:**

Option 4 consists of the full replacement of entire structure (including the substructure), built in line within the footprint of the existing structure.

The new structure will be a precast prestressed concrete integral deck supported by reinforced concrete piles on both sides of the river.

It is proposed to use Y3 and YE3 precast prestressed beams with a clear span of 24m (20m over the river and 2m each end). The construction depth of the deck will be approximately 1215mm (Y3 beam 900mm deep, 200mm concrete slab and 115mm surfacing).

The new soffit level will be increased by 185mm above the existing lowest soffit level of 9.005m

The existing abutment walls will be retained to minimise the disturbance to the river. The new bridge deck will be supported by new piled foundations which are located behind the existing abutment walls.

The vertical alignment of the carriageway will be designed to tie-in with Hoe Mill Lock Bridge ECC no. 307 on the northern approach to the new structure.

Due to the location of the existing structure within a conservation area, and as per the Heritage Statement and Archaeological Impact assessment, the new parapet will be an ornamental reinforced concrete design to the time period of the original structure's construction.

Refer to drawing **BR0308-01-1203** for the general arrangement of Option 4.

3.2.4.1 *Advantage of Option 4*

- Full 120 year design life on new structure.
- Low maintenance cost.
- New bridge can be designed for full Eurocode loading (including full SV loading).
- Using precast prestressed beams will be relatively quick construction method and minimum formwork required.
- Current horizontal alignment of the carriageway can be maintained.
- Current carriageway drainage can be reused and incorporated into the design.
- No impact on the existing river flow.
- Minimum area of land purchase required.
- Cheaper option to Option 3

3.2.4.2 *Disadvantage of Option 4*

- Planning consent required.
- EA bespoke permit required.
- Due to the proximity of an ancient archaeological site, archaeologist will have to be consulted and be present during geological investigation and construction.
- Hydrology analysis required.
- Larger cranes required in lifting the larger beams in place.
- Utility diversion required for the private main within the western footpath.
- Due to presence of the existing sheet piling and mass concrete fill within the southern abutment, construction of the piles could be a challenge.
- Departure from standards to the parapets due to conservation area.
- Departure from standards required for the reduced carriageway width over the structure to eliminate the bottle neck with Hoe Mill Lock Bridge (ECC 307).
- Land purchase and land licence will be required for site compound and working areas.
- Road closure required for the full duration of the construction works.
- Temporary crash deck required during the demolition of the existing bridge and piers.
- Temporary pedestrian footbridge will be required across the river.

3.2.4.3 *Estimate cost and duration*

Estimated cost:- £1.5m

(Design fees, 3rd party consultation and utility diversion cost are not included)

Estimated duration:- 30-36 weeks

4 Discussions & Conclusions

Following the 1996 assessment, recent inspections and scour protection works at Hoe Mill Bridge, have indicated that Hoe Mill Bridge is in a poor condition and requires urgent attention to maintain the network and safety of the road users.

Option 1 (Refurbishment of existing structure) would rectify the concrete defects observed in the September 2019 concrete delamination survey; however, the structure would not be strengthened and would still require a width and weight restriction. This is not an economically sustainable solution in the long term.

Option 2 (Deck replacement) would provide a new deck element and remove the structural issues at the deck and piers connection. However, using the existing substructure would require further intrusive investigations to confirm the integrity of the abutments. If the existing abutments are found to be insufficient to take the new deck loading, then the abutments will require strengthening and hence longer beams are required to spread the load onto the new sections. This will result in additional cost and construction time. Options 2, will cost less compared to Options 3 & 4; however, uncertainties surrounding the existing abutments strength will undermine the design life of Option 2.

Option 3 (New integral bridge built off line) will provide a long term, sustainable solution with 120 year design life. However, this option requires significant area of land purchase and planning permissions. This option also affects a larger area both visually and physically. Since the new bridge is proposed to be built off line and proximity location of Hoe Mill Lock Bridge (ECC 307), the new reconnection of the proposed carriageway will introduce a very sharp S bend. This will introduce a new road safety hazard and may increase the likelihood of road accidents.

Option 4 (New integral bridge built online) will provide a long term, sustainable solution with 120 year design life. The majority of the disadvantages with Option 3 are discounted apart from obtaining EA permit and Planning is required. Although we proposed to maintain the existing carriageway width, the new structure will be constructed slightly wider to allow any future carriageway widening. Trief kerbs will be proposed to eliminate the risk of vehicles colliding with the sub-standard parapets.

Having assessed all the proposed options, the preferred option would be **Option 4 (New integral bridge built online)**. This will provide a suitable solution that meets the brief of the structure compliant with current standards, at relatively low cost, it is durable and can be constructed in a reasonable short time. This will also provide 120 year design life.

5 Recommendations

It is recommended that Option 4 is the suitable solution that meets the Client's requirements and this option is to be considered for the feasibility study stage of this scheme.

The key tasks to undertake during the feasibility study are:-

- Finalise the vertical road layout to help drainage design.
- Identify the exact land requirement & start land negotiations for acquisition.
- Obtain a detailed topographical survey (include the river bed profile)
- Geological investigations, including paleo geological survey, of the ground conditions at the proposed bridge abutment locations for the design of pile foundations
- Undertake conceptual design to finalise the type of bridge construction based on the design constraints.
- Prepare drawings for consultations.
- Undertake flood modelling if required by the EA.
- Obtain EA Flood Defence permit for the proposed permanent & temporary works.
- Obtain planning permission for the proposed works.
- Ensure completion of the various impact studies as detailed from the Pre-Planning advice letter.
- Undertake stage 2 Road Safety Audit for the proposed road layout.
- Identify any STATS in the vicinity and obtain C3/C4 estimates for any diversion required.
- Consultation with land owners, businesses, Parish Councils and District Councils.

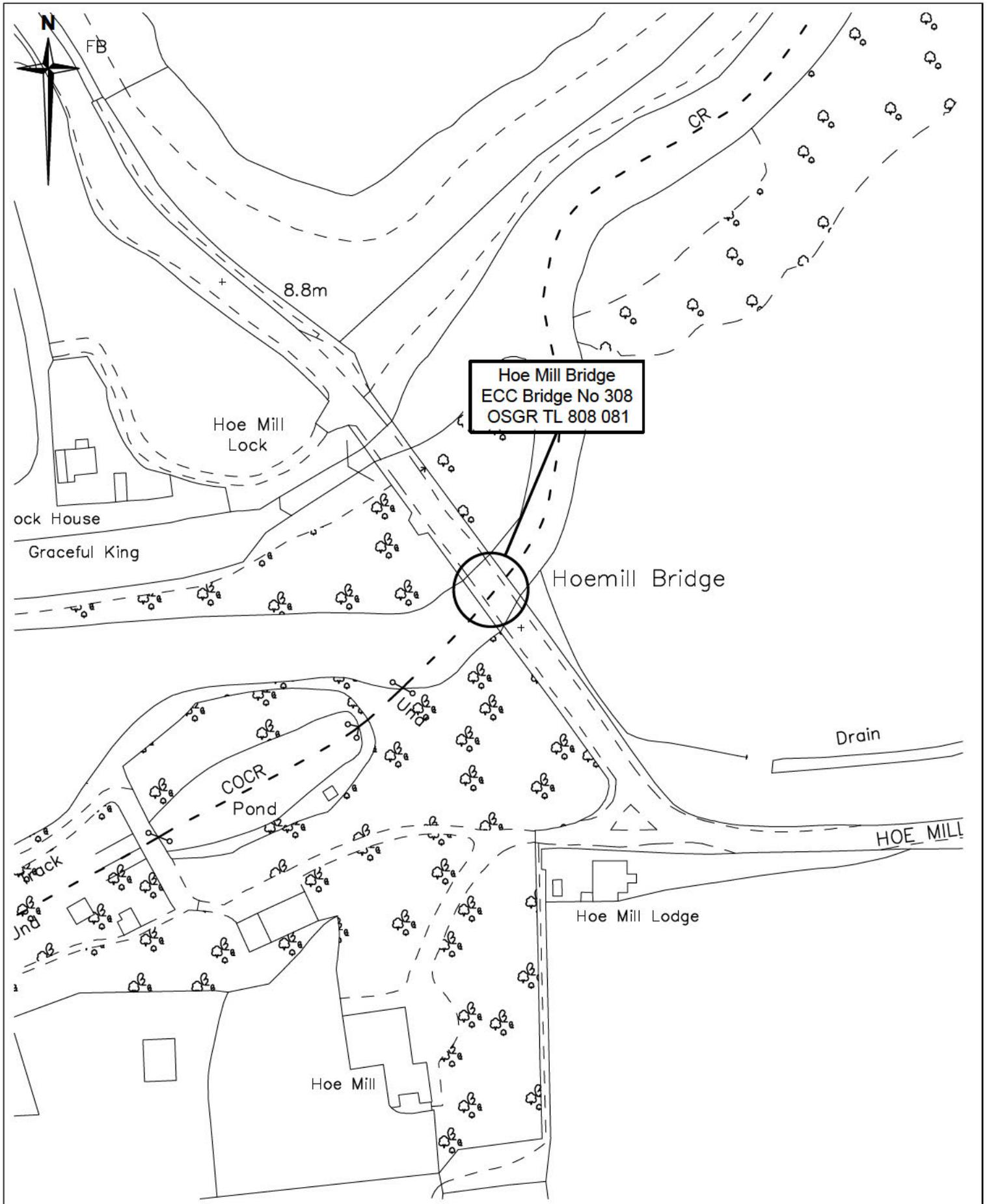
Table 6: Option Summary				
	Option 1: Refurbishment of existing structure	Option 2: Deck replacement	Option 3: New integral bridge built off line	Option 4: New integral bridge built in line
Environment	Low impact on the watercourse hydraulics and ecology.	Low impact on the watercourse hydraulics and ecology.	Highest impact on the watercourse hydraulics, ecology, large amount of imported soil for new carriageway construction.	Medium impact on the watercourse, hydraulics and ecology.
Waterway area	Minimal temporary works required for pier and deck repairs.	Temporary works required for demolition of the existing deck,	Temporary works required for construction of the new foundations, wingwalls and retaining walls.	Temporary works required for demolition of the existing deck, Piers and construction of the substructure.
Appearance	Minimum Existing structure will be maintained	Medium Existing deck will be replaced with a new deck. Existing substructure will be maintained	Maximum. Totally a new structure approximately 2m east of existing bridge will change the existing appearance of the site.	Medium Totally a new structure but in the same location.
Road Network & TM	Full road closure and temporary diversion required for full duration of the works. Pedestrian diversion can be maintained over the bridge	Full road closure and temporary diversion required for full duration of the works. Temporary pedestrian footbridge required	Full road closure and temporary diversion only required during the carriageway tie-in and traffic switch over from the old to new structures.	Full road closure and temporary diversion required for full duration of the works. Temporary pedestrian footbridge required
Parapet	Existing parapet will be maintained. Substandard to CD377	Replace with a new ornate precast concrete balustrade parapet Substandard to CD377	Replace with a new ornate precast concrete balustrade parapet. Substandard to CD377	Replace with a new ornate precast concrete balustrade parapet Substandard to CD377
Services	Utility services can be Protected during the works.	Utility services to be diverted during the works.	Utility services to be diverted during the works.	Utility services to be diverted during the works.
Maintenance	High maintenance and regular inspection required. Current width and weight restrictions to be maintained.	Regular maintenance required for the existing substructure.	No additional maintenance required than the standard inspection.	No additional maintenance required than the standard inspection.
Cost	£500k	£800k	£2m	£1.5m
Duration	14 weeks	24 weeks	52 weeks	30 weeks (36 weeks)

6 Appendix

Appendix A Drawings	43
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Appendix A Drawings

1. BR0308-00-0101 Location Plan

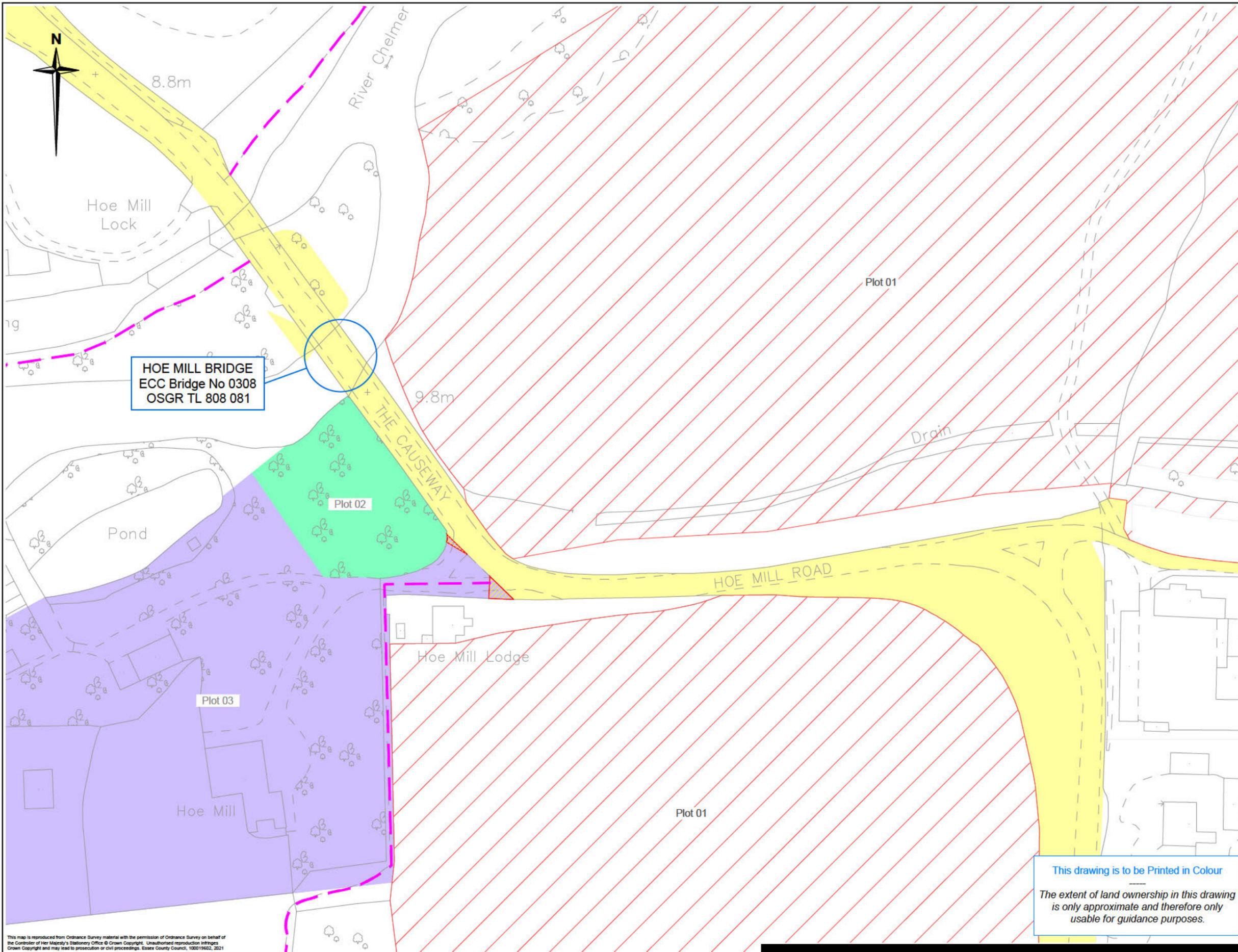


 <p>Essex Highways Seax House, Victoria Road South, Chelmsford, CM1 1QH. Tel: 0345 8037831 © Essex County Council</p>	<p>HOE MILL BRIDGE ECC BRIDGE No. 0308 LOCATION PLAN</p>	<p>DRAWING STATUS FOR INFORMATION</p>																											
	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>Rev.</th> <th>Date</th> <th>Description of revision</th> <th>Drawn</th> <th>Checked</th> <th>Reviewed</th> <th>Approved</th> </tr> </thead> <tbody> <tr> <td>A</td> <td>AUG 18</td> <td>Issued For Tender</td> <td>JEB</td> <td>TP</td> <td>NC</td> <td>RDBH</td> </tr> <tr> <td>B</td> <td>MAY 19</td> <td>Issued For Construction (Scour)</td> <td>JEB</td> <td>TP</td> <td>NC</td> <td>NP</td> </tr> <tr> <td>C</td> <td>MAR 20</td> <td>Frame Updated</td> <td>RS</td> <td>NP</td> <td>NC</td> <td>NP</td> </tr> </tbody> </table>	Rev.	Date	Description of revision	Drawn	Checked	Reviewed	Approved	A	AUG 18	Issued For Tender	JEB	TP	NC	RDBH	B	MAY 19	Issued For Construction (Scour)	JEB	TP	NC	NP	C	MAR 20	Frame Updated	RS	NP	NC	NP
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2. BR0308-00-0201 OS Land Ownership Plan



KEY to TITLEHOLDERS

- [Redacted]
- [Redacted]
- [Redacted]
- [Redacted]
- [Redacted]

KEY

- Footpaths

NOTES

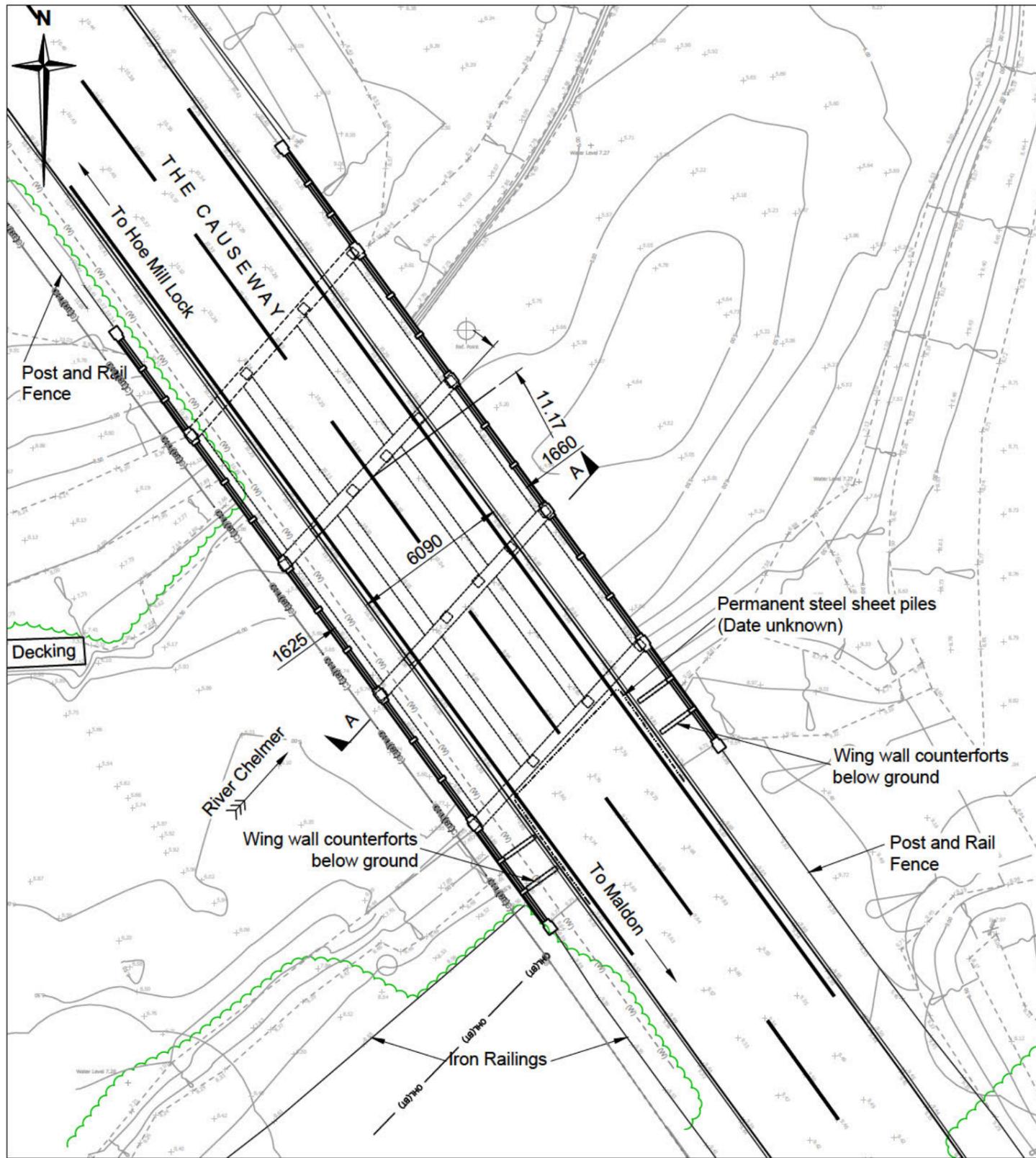
1. The full extent of title [Redacted] and [Redacted] is not shown.
2. This drawing is to be read in conjunction with all other drawings and the specification.

This drawing is to be Printed in Colour
 The extent of land ownership in this drawing is only approximate and therefore only usable for guidance purposes.

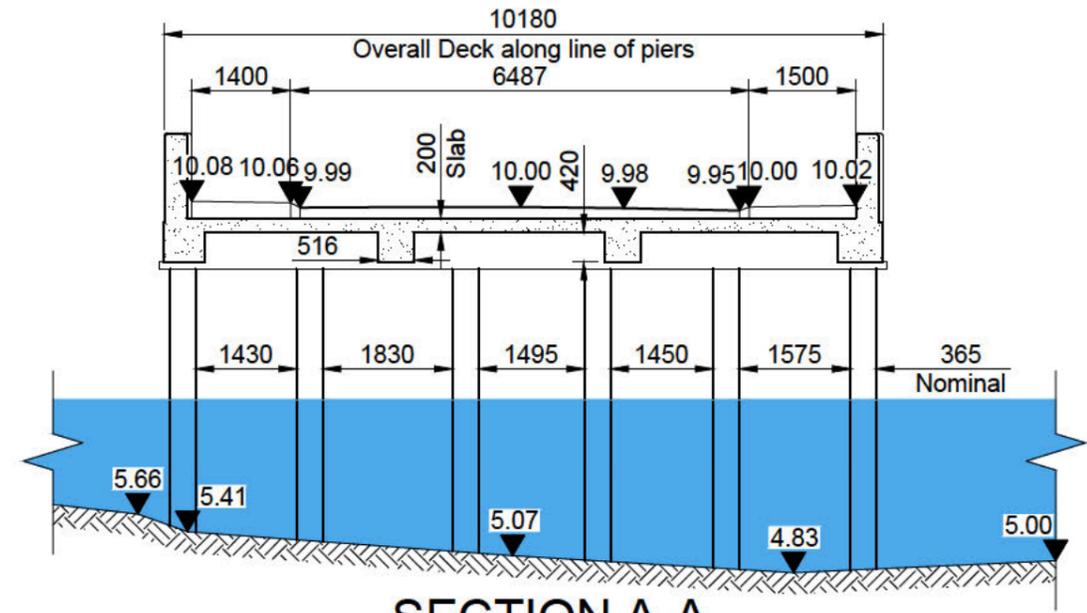
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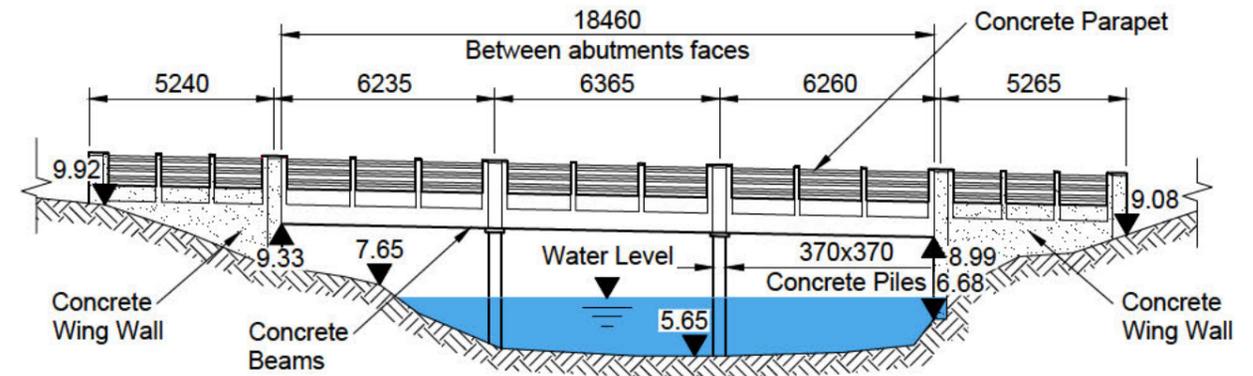
3. BR0308-00-1101 Existing General Arrangement



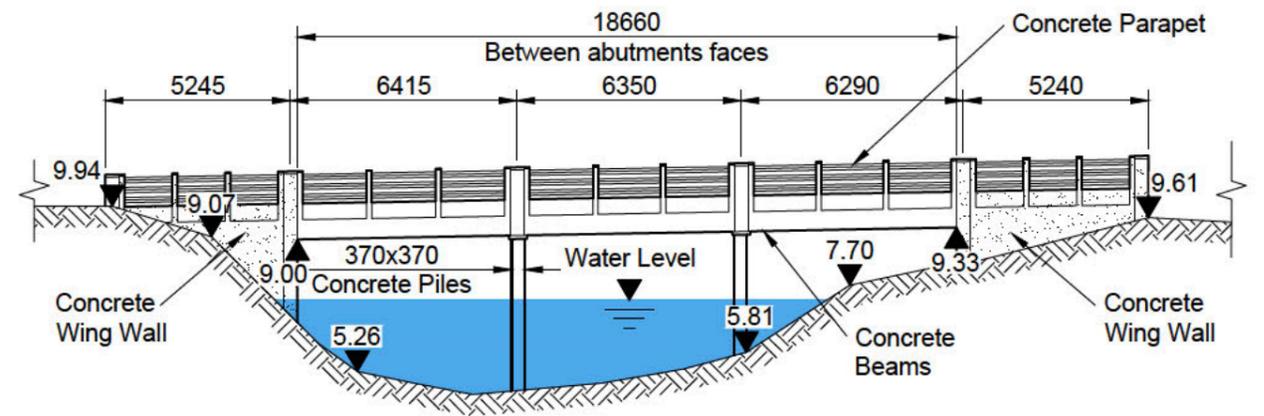
PLAN
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SECTION A-A
Scale 1:100



SOUTH WEST ELEVATION
Scale 1:200



NORTH EAST ELEVATION
Scale 1:200

NOTES

1. Topographical information shown on this drawing is from a recent survey dated January 2008 and from historical drawings dated February 1992.
2. All dimensions are in millimetres and levels in metres.
3. Options A to F for strengthening proposals for this bridge are shown on drawings BR308/P102 to 107 inclusive.

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A	AUG 18	Issued For Tender	JEB	NC	TP	RDBH
B	JUN 19	Issued For Construction (sour)	NC	NP	NC	NP
C	MAR 21	Sheet piles & counterforts added.	RS	NP	NC	NP

SCHEME TITLE
HOE MILL BRIDGE
ECC BRIDGE No. 0308

DRAWING TITLE
EXISTING GENERAL
ARRANGEMENT

DRAWING STATUS
FOR INFORMATION

DESIGNED	DRAWN	CHECKED	REVIEWED	APPROVED
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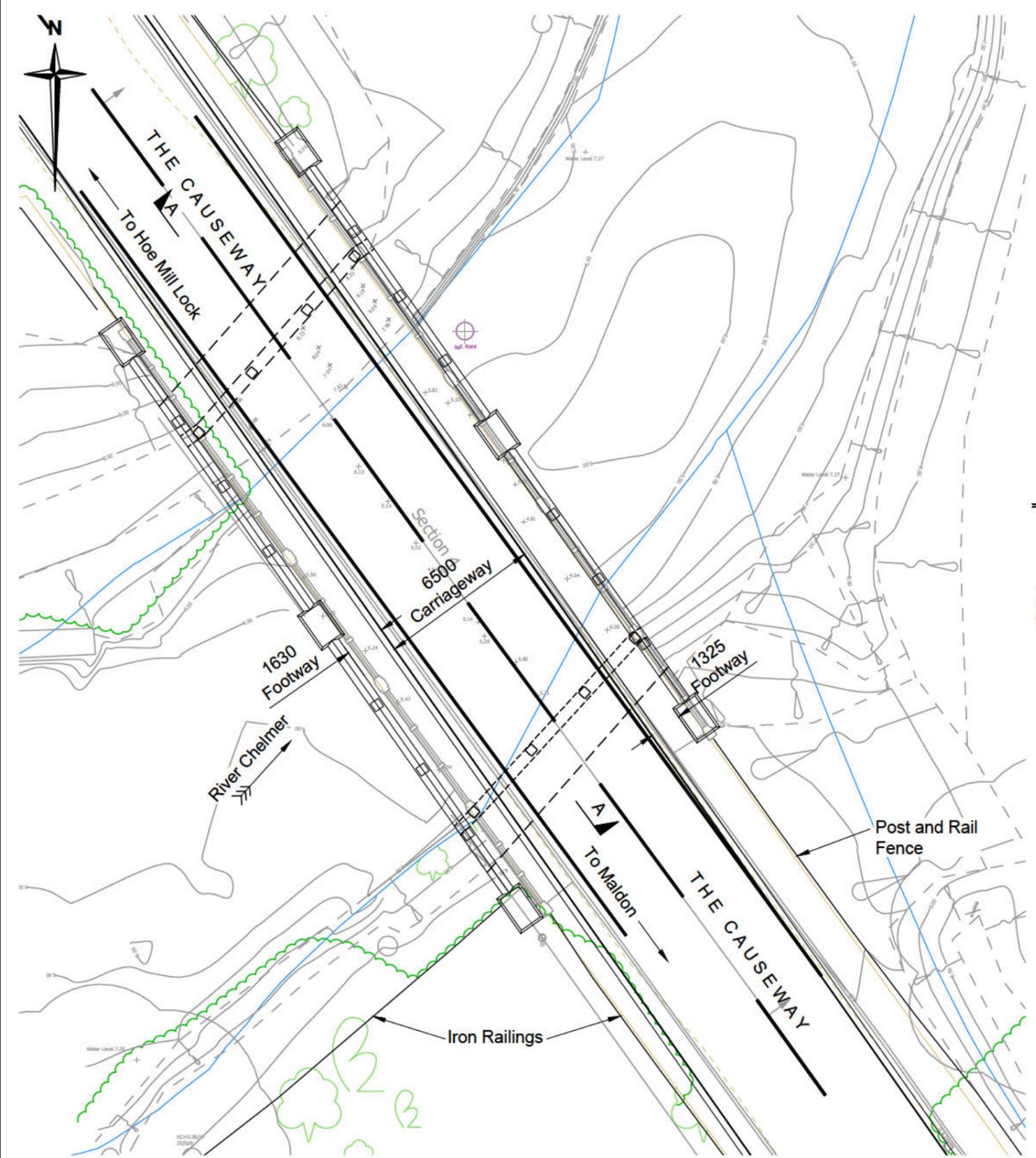
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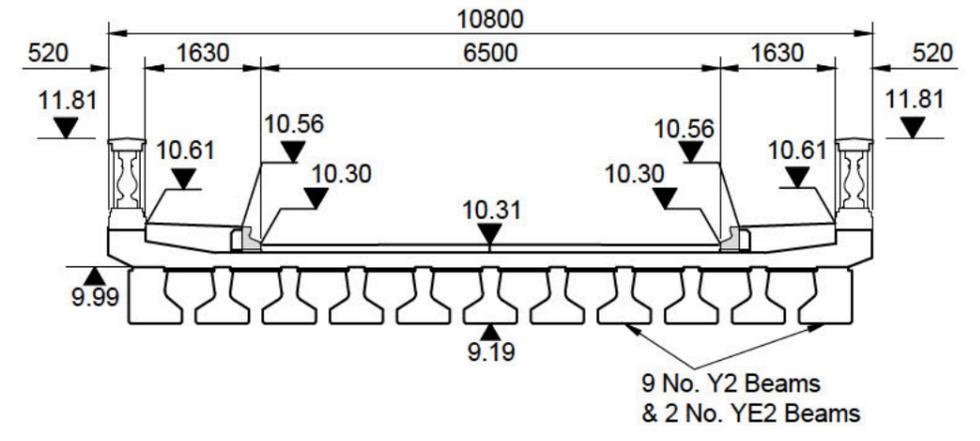
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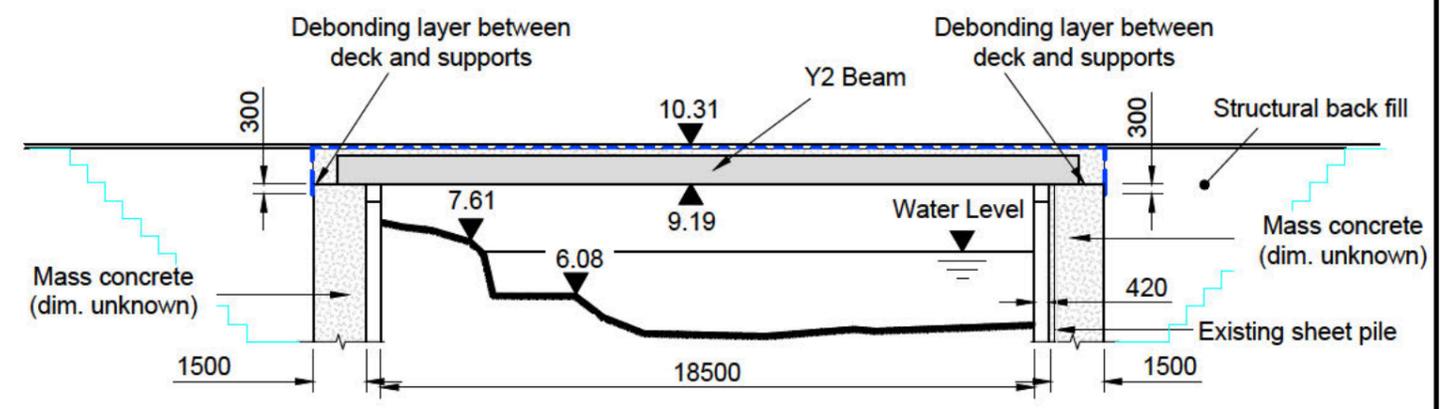
4. BR0308-01-1201 OS A Option 2 – Deck Replacement



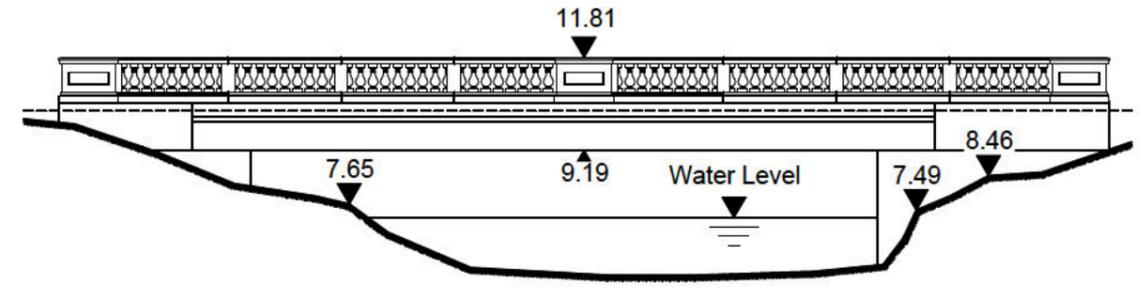
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TYPICAL CROSS-SECTION
Scale 1:100



TYPICAL LONGITUDINAL CROSS-SECTION
SECTION A-A
Scale 1:200



SOUTH WEST ELEVATION
Scale 1:200

- NOTES
1. Topographical information shown on this drawing is from a recent survey dated January 2008 and from historical drawings dated February 1992.
 2. All dimensions are in millimetres and levels in metres.
 3. The substructure will require further intrusive investigation.
 4. Existing piers to be removed/cut below water level.

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Rev.	Date	Description of revision	Drawn	Checked	Reviewed	Approved
A	MAR 21	Issued For Information	OC	NC	NP	NP

SCHEME TITLE
**HOE MILL BRIDGE
ECC BRIDGE No. 0308**

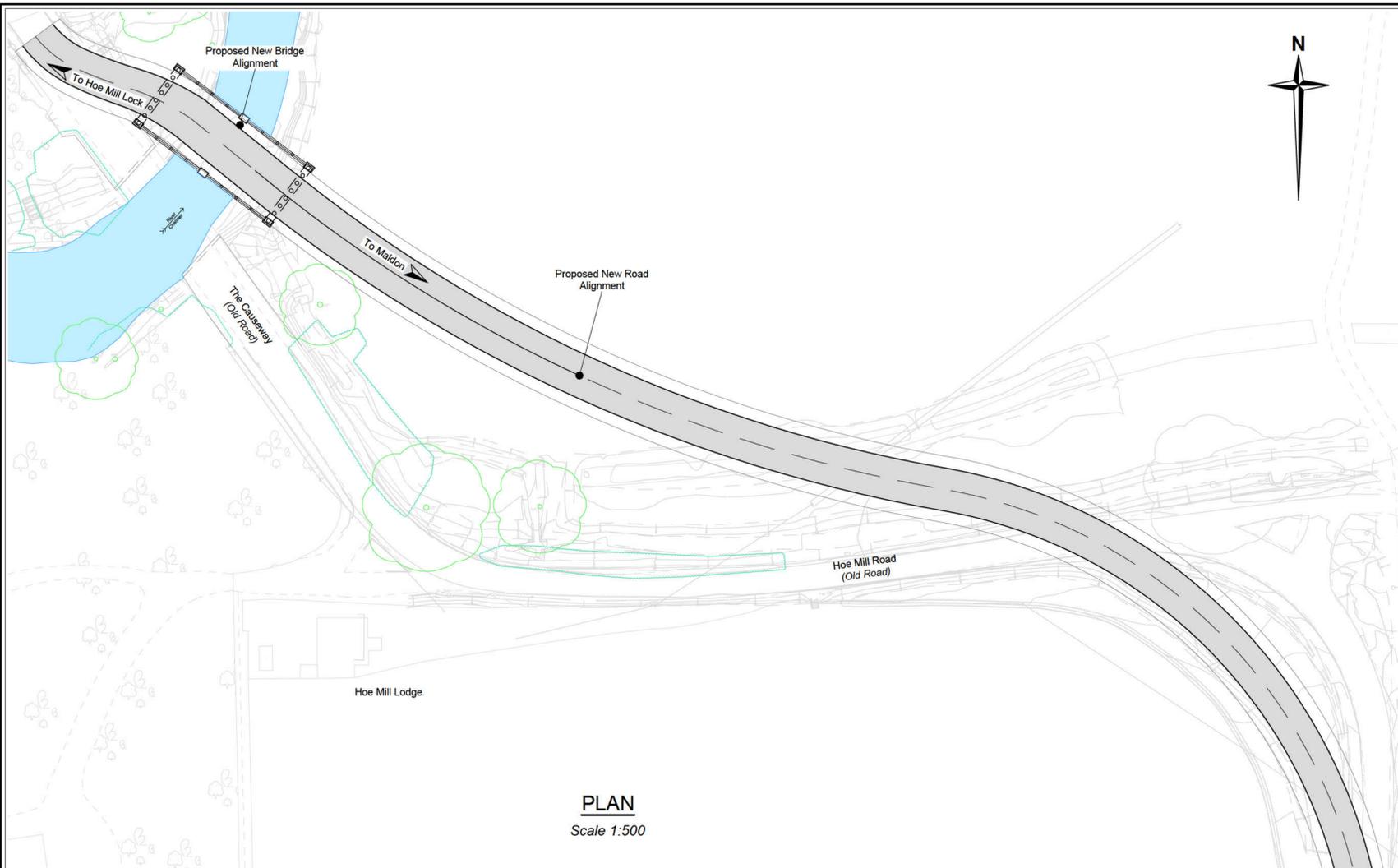
DRAWING TITLE
**OPTION 2
DECK REPLACEMENT**

DRAWING STATUS
FOR INFORMATION

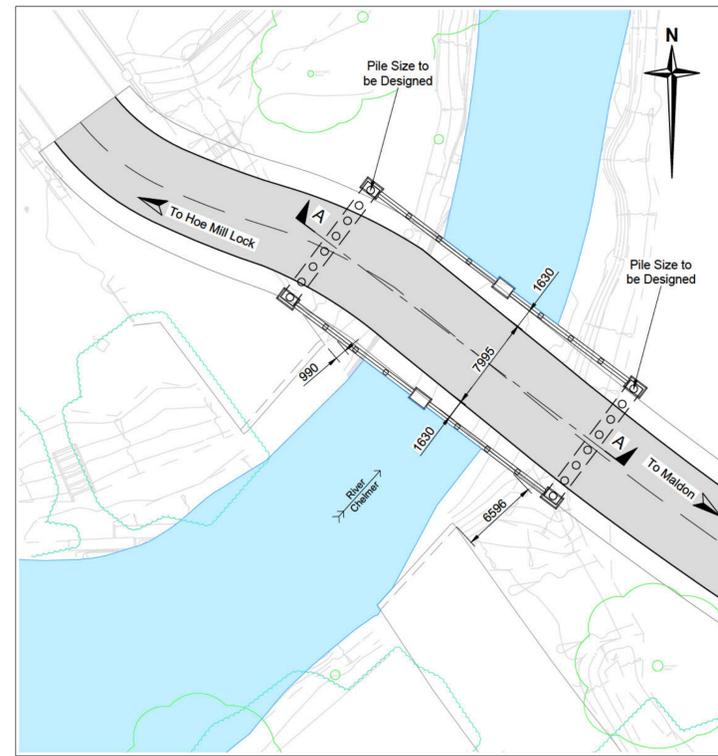
DESIGNED	DRAWN	CHECKED	REVIEWED	APPROVED
NC	OC	NP	NC	NP
DATE DEC 20				

DRAWING UNITS U.N.O.
DIMENSIONS IN MILLIMETRES
LEVELS IN METRES
As Shown
DRAWING No. **BR0308-01-1201-OS**
REV. **A**

5. BR0308-01-1202 OS A Option 3 – New Integral Bridge Built Off Line



PLAN
Scale 1:500

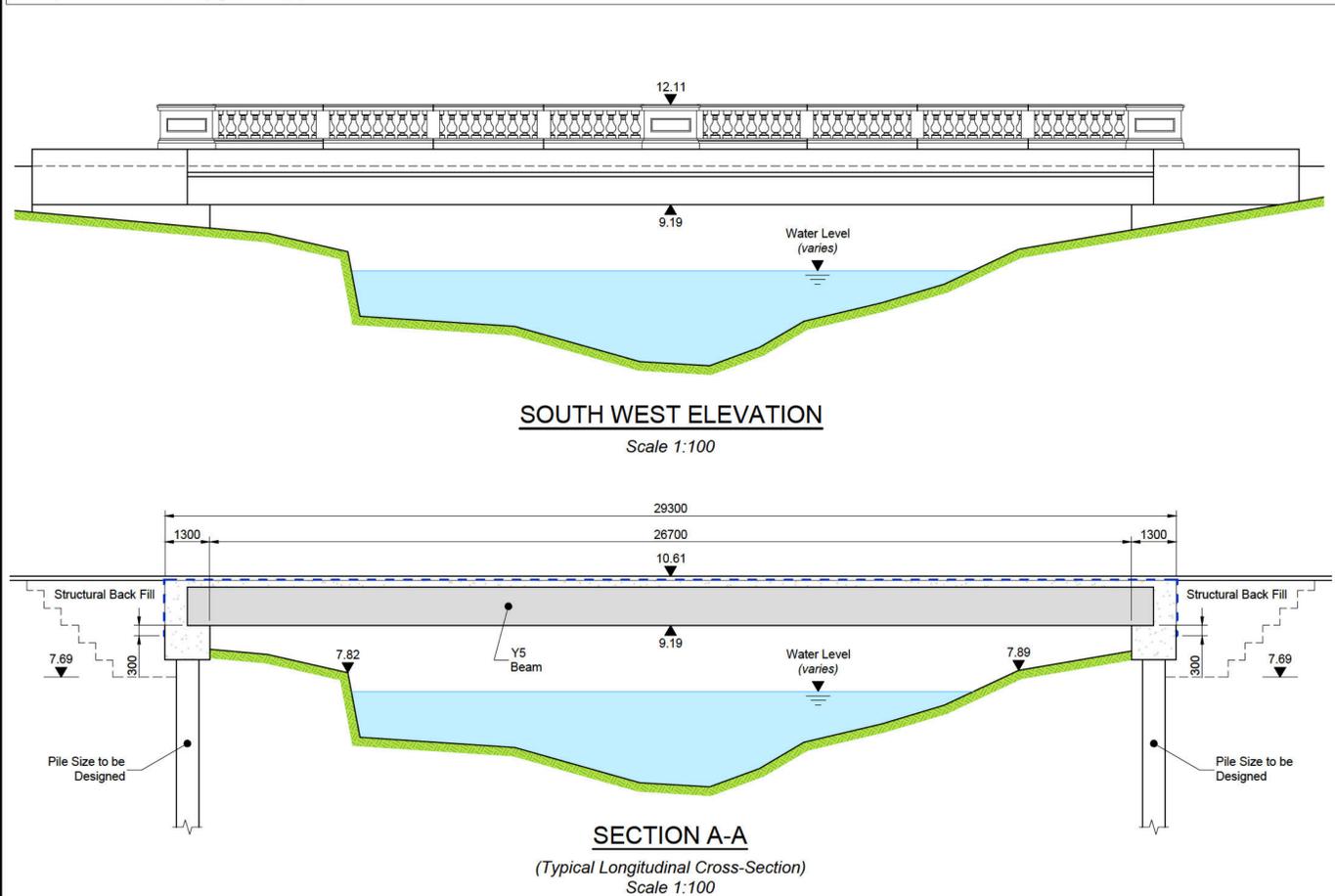


PLAN
Scale 1:300

NOTES

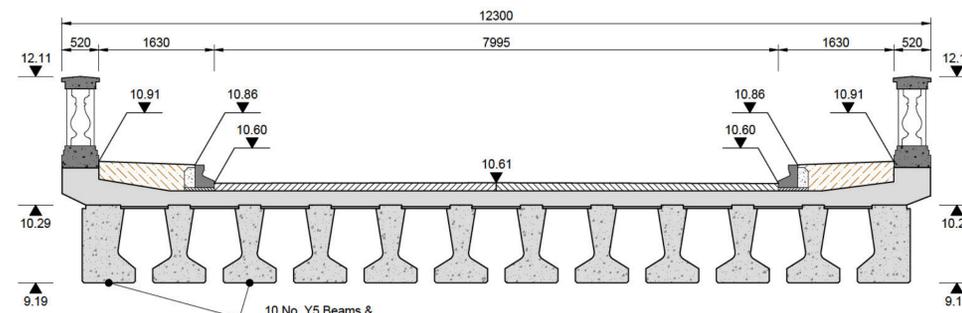
1. All dimensions are in millimetres unless stated otherwise.
2. All levels are in metres above Ordnance Datum unless stated otherwise.
3. Topographical information shown on this drawing is from a recent survey dated *January 2008* and from historical drawings dated *February 1992*.
4. Pile depth to be designed and Geology Investigation is required.
5. Concrete surface for ornate parapet to be exposed aggregate finish.

This drawing is to be Printed in Colour



SOUTH WEST ELEVATION
Scale 1:100

SECTION A-A
(Typical Longitudinal Cross-Section)
Scale 1:100



TYPICAL CROSS-SECTION
Scale 1:50

Rev	Date	Description of revision	Drawn	Checked	Reviewed	Approved
A	03/21	Amends and issued 'For Information'.	VL	NC	NP	NP

FOR INFORMATION



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SCHEME TITLE
HOE MILL BRIDGE
ECC BRIDGE No. 0308
(Woodham Walter)

DRAWING TITLE
OPTION 3
NEW INTEGRAL BRIDGE
BUILT OFF LINE

DESIGNED	DRAWN	CHECKED	REVIEWED	APPROVED
NC	OC	NP	NC	NP
DATE	DATE	DATE	DATE	DATE
DEC 21	DEC 21	DEC 21	DEC 21	DEC 21

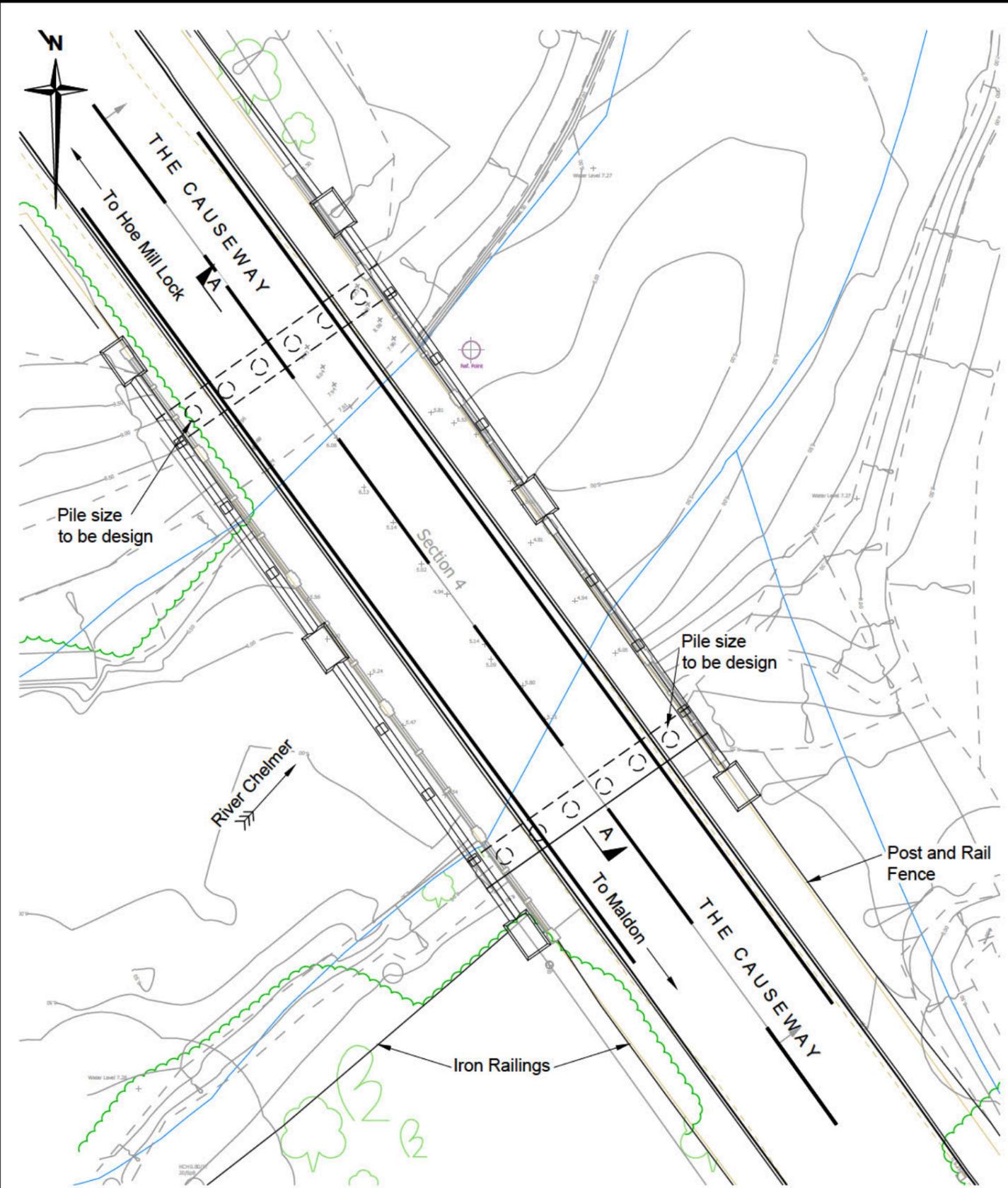
DRAWING UNITS U.N.O. SCALE AT A1 (841x594mm)
DIMENSIONS IN MILLIMETRES As Shown
LEVELS IN METRES

DRAWING No.	REV.
BR0308-01-1202-OS	A

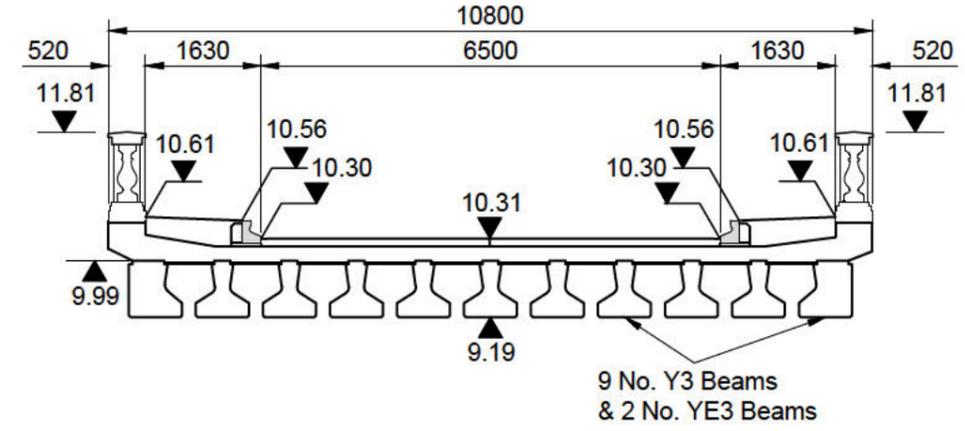


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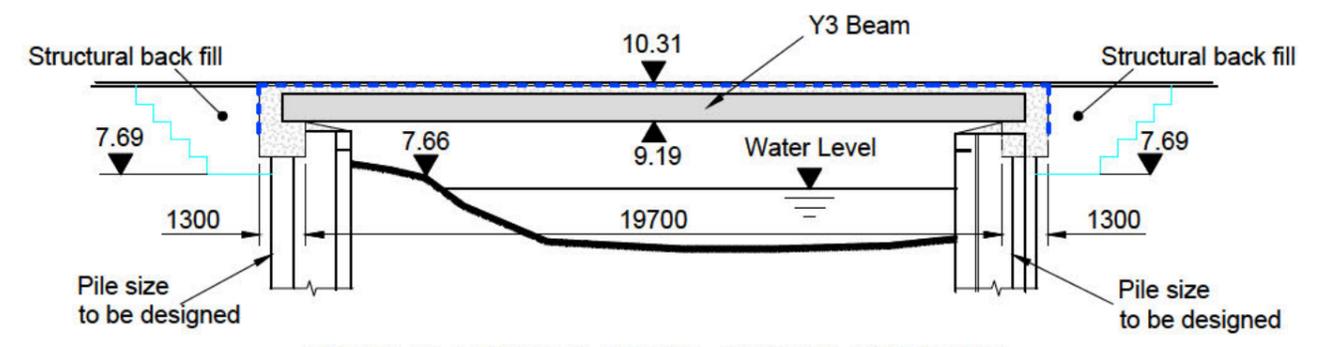
6. BR0308-01-1203 OS A Option 4 – New Integral bridge Built In Line



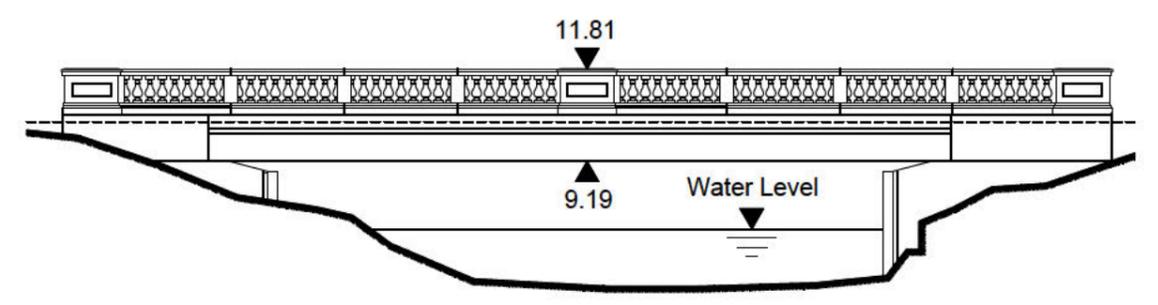
PLAN
Scale 1:200



TYPICAL CROSS-SECTION
Scale 1:100



TYPICAL LONGITUDINAL CROSS-SECTION
SECTION A-A
Scale 1:200



WEST ELEVATION
Scale 1:200

NOTES

1. Topographical information shown on this drawing is from a recent survey dated January 2008 and from historical drawings dated February 1992.
2. All dimensions are in millimetres and levels in metres.
3. Pile depth to be designed and Geology Investigation is required.
4. Concrete surface for ornate parapet to be exposed aggregate finish.
5. Existing piers to be removed/cut below water level.
6. New piles to be installed behind the existing abutment and sheet piles on the south abutment.

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A	MAR 21	Issued For Information	OC	NC	NP	NP

SCHEME TITLE
**HOE MILL BRIDGE
ECC BRIDGE No. 0308**

DRAWING TITLE
**OPTION 4
NEW INTEGRAL BRIDGE
BUILT IN LINE**

DRAWING STATUS
FOR INFORMATION

DESIGNED	DRAWN	CHECKED	REVIEWED	APPROVED
NC	OC	NP	NC	NP
DATE DEC 20				

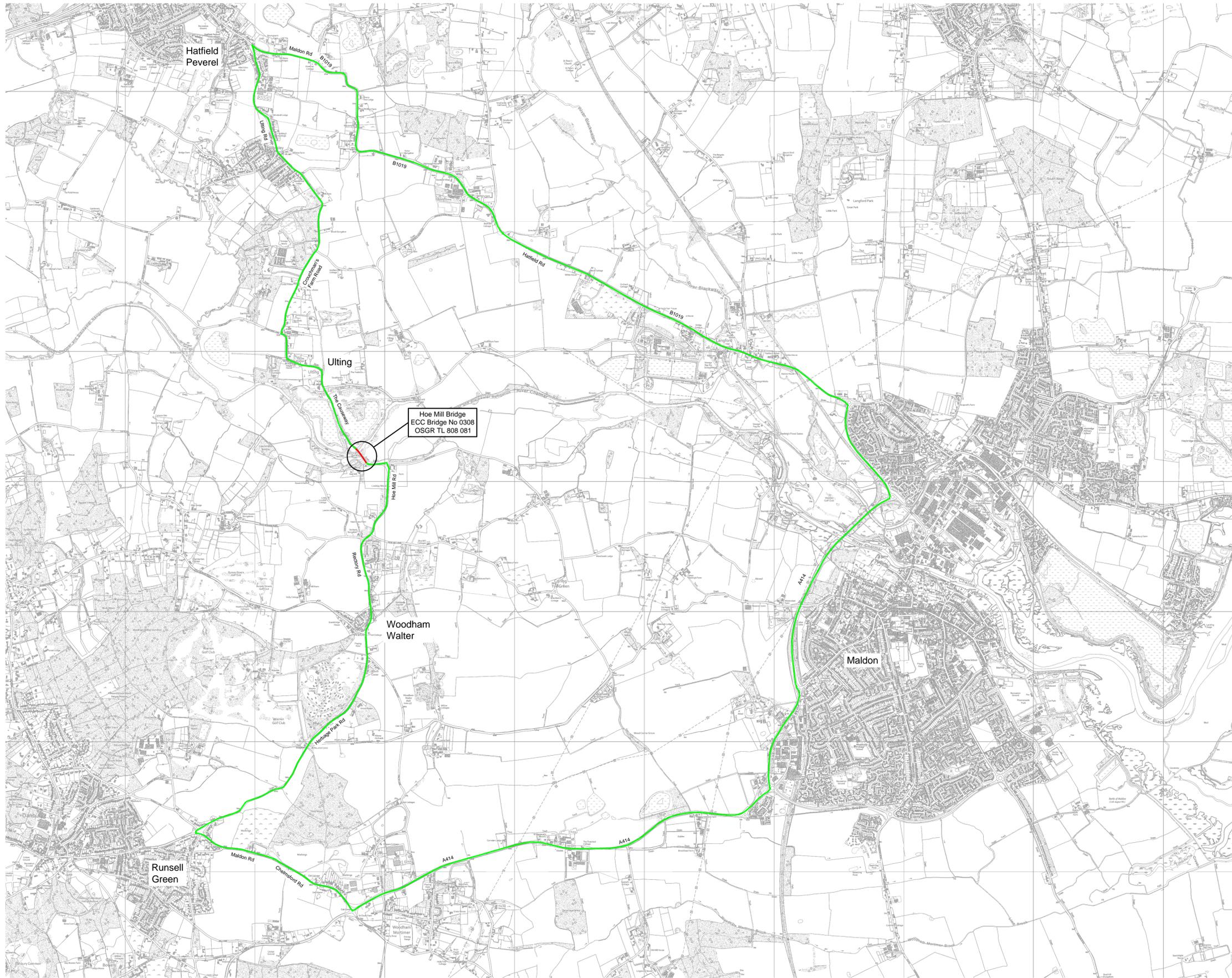
DRAWING UNITS U.N.O.
DIMENSIONS IN MILLIMETRES
LEVELS IN METRES

SCALE AT A3 (420x297mm)
As Shown

DRAWING NO.
BR0308-01-1203-OS

REV.
A

7. BR0308-01-1401 OS Diversion Route



NOTES

1. Do not scale.
2. All works to be in accordance with the Department for Transport's Specification for Highway Works, Traffic Signs Manual - Chapter 8.
3. Consideration should be given as to the expected duration of the road closure, and whether it's preferable to install some diversion signs on post, dependant on their location.

- = Diversion route
- = Road closure

Diversion distance = 21.5km (13.3 miles)

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Rev.	Date	Description of revision	Drawn	Checked	Review'd	Approv'd

SCHEME TITLE
HOE MILL BRIDGE ECC BRIDGE No. 308

DRAWING TITLE
DIVERSION ROUTE

DRAWING STATUS				
FOR INFORMATION				
DESIGNED	DRAWN	CHECKED	REVIEWED	APPROVED
NC	JEB	NP	NC	NP
DATE	DATE	DATE	DATE	DATE
MAR 21	MAR 21	MAR 21	MAR 21	APR 21

DRAWING UNITS U.N.O.	SCALE AT A1 (841x594mm)
DIMENSIONS IN MILLIMETRES LEVELS IN METRES	NTS
DRAWING No. BR0308-01-1401-OS	
REV.	B

Appendix B Designer's Hazard List & Hazard Elimination and Risk Reduction

Project: Hoe Mill ECC 308OS

Principal Designer / Designer: [REDACTED]

Date of Assessment: 21/12/2020

HAZARD LIST

This form is to be used by the Principal Designer to identify project specific hazards that may give rise to a foreseeable risk to the health or safety of any person carrying out construction work on the project.

PART 1: ROAD LAYOUT AND TRAFFIC CONSIDERATIONS				
Ref	Hazard/activity	Hazard Identified (Yes / No / Data required)	Significance (High / Med / Low)	Comments – Especially required where Med or High Is selected. Add actions to be taken by designers as appropriate.
Traffic Management assessment required to determine if the works can be undertaken in accordance with "Safety at Street Works and Road Works" – a Code of Practice. (Measure road widths, footway widths, traffic flows, pedestrian flows etc.). Also consider additional hazards associated with:-				
1.1	High speed dual carriageway 50mph or more	Yes	High	De-restricted road. Full road closure
1.2	Rural lane <6m wide	No	N/A	N/A
1.3	Urban street <6m wide, Cul-de-sac, mews courts, footpath area	No	N/A	N/A
1.4	Driver and pedestrian visibility Issues – bends, hills, private accesses etc.	Yes	Med	Bend on the south approach to structure, and Hoe Mill Lock bridge is humped. Full road closure.
1.5	Any known speeding issues.	No	N/A	N/A
1.6	Significant number of HGV's	No	N/A	3T weight restriction; however, there has been instances of HGV, farm tractors going over the structure. Full road closure. Engineer to arrange.
1.7	Bus routes and bus stops	No	N/A	N/A
1.8	High traffic flows (>42 / 3 min)	No	N/A	N/A
1.9	High pedestrian flows	Yes	Med	During summer, Hoe Mill Lock is a busy tourist attraction. Works to be completed outside summer holidays (dependent on EA permit and if reasonably practicable). Full road closure (where practicable pedestrian crossing to be maintained; cyclists to dismount).

PART 1: ROAD LAYOUT AND TRAFFIC CONSIDERATIONS				
Ref	Hazard/activity	Hazard Identified (Yes / No / Data required)	Significance (High / Med / Low)	Comments – Especially required where Med or High Is selected. Add actions to be taken by designers as appropriate.
1.10	High cyclist or equestrian flows	No	N/A	See above 1.9
1.11	Major / Minor Junction	No	N/A	N/A
1.12	Traffic signal junction	No	N/A	N/A
1.13	Roundabout Junction	No	N/A	N/A
1.14	Grade separated or other complex junction	No	N/A	N/A
1.15	Signalised crossing facilities, incl. school crossing patrols in works area.	No	N/A	N/A
1.16	On street parking / residents parking / permit parking / loading areas / disabled parking	No	N/A	N/A
1.17	Traffic sensitive street i.e. consider restricted working hours.	No	N/A	N/A
1.18	Refuse collection	Yes	Med	Every Wednesday. Full road closure. Engineer to liaise with Maldon DC.
1.19	Railways level crossings within 500m of works.	No	N/A	N/A

* Add further relevant hazards as identified

PART 2: UNDERGROUND & OVERHEAD SERVICES				
Ref	Hazard/activity	Hazard Identified (Yes / No / Data required)	Significance (High / Med / Low)	Comments – Especially required where Med or High Is selected Add actions to be taken by designers as appropriate.
Statutory undertaker drawings must be obtained and be less than 3 months old at the point of work being commenced. Consider hazards associated with:-				
2.1	Underground high voltage electric (11kVa and above)	No	N/A	N/A
2.2	Other underground electric cables	No	N/A	N/A
2.3	Overhead electricity (incl. railway). Need for GS6 survey.	Yes	High	Overhead UK Power Network cable running parallel to the bridge on the west side. Utility Technician Survey 13/03/2018 confirmed GS6 height.
2.4	Gas Mains - Medium / Intermediate / High pressure	No	N/A	N/A
2.5	Other gas mains	No	N/A	N/A
2.6	Presence of shallow services <100mm	No	N/A	N/A
2.7	Significant Water Mains	Yes	High	Small dia. water main located within western footpath. Unknown owner.
2.8	Major communications cables / ducting / other infrastructure	Yes	High	Overhead BT cables. Engineer to liaise with BT Open Reach and organise site visit. Site briefing to highlight overhead cable. No lifting operations to take place on the west side of the structure where reasonably practicable. Utility Technician Survey 13/03/2018 confirmed GS6 height.
2.9	Oil pipelines	No	N/A	N/A
2.10	Gas pipelines	No	N/A	N/A
2.11	Street Lighting	No	N/A	N/A
2.12	Sewerage / Surface Water drainage	No	N/A	N/A
2.13	Signal detector loops, traffic counter loops and the like	No	N/A	N/A
2.14	Private Apparatus	Yes	Med	Possible private water main. See above 2.7.
2.15	Other major stats apparatus	No	N/A	N/A

* Add further relevant hazards as identified

PART 3: SURROUNDING ENVIRONMENT / LAND USES				
Ref	Hazard/activity	Hazard Identified (Yes / No / Data required)	Significance (High / Med / Low)	Comments – Especially required where Med or High Is selected Add actions to be taken by designers as appropriate.
Details of adjacent land use and constraints that may impact on the work are to be considered as follows:-				
3.1	Rural area	Yes	High	Farmers field South East corner of the structure. Grazing cattle in the field. Proposed site compound and working access to be agreed to via Land Licence.
3.2	Urban area	No	N/A	N/A
3.3	Industrial area	No	N/A	N/A
3.4	Tourist routes / attraction	Yes	High	Hoe Mill lock and the canal is a tourist area for walkers, canalists and canoeists. Works to try and programme around summer time; however, due to working over and in deep water it might be prudent to work during the Spring / summer time. Road closure and TM to not interfere with Hoe Mill lock entrance.
3.5	Works adjacent to railways	No	N/A	N/A
3.6	Interface with public rights of way	Yes	Low	Either side of structure, PROW 267_13 (north side) and PROW 267_14 (south side). PROW officer to be informed of the works. Due to the structure being the only crossing point, temporary footbridge to be designed and installed by contractor.
3.7	Schools, playgroups, children's homes,	No	N/A	Woodham Walter Church of England Voluntary Controlled Primary School 1.5km south of Hoe Mill Bridge. Letters
3.8	Playgrounds, open spaces, village greens and the like	Yes	High	Hoe Mill Lock grounds.
3.9	Shopping centres.	No	N/A	N/A
3.10	Shops, banks, takeaways, libraries, post offices and the like.	No	N/A	N/A
3.11	Petrol stations	No	N/A	N/A
3.12	Fire stations, police station, ambulance station, other emergency access routes	No	N/A	N/A
3.13	Hospitals / Minor Injury Units	No	N/A	N/A

PART 3: SURROUNDING ENVIRONMENT / LAND USES				
Ref	Hazard/activity	Hazard Identified (Yes / No / Data required)	Significance (High / Med / Low)	Comments – Especially required where Med or High Is selected Add actions to be taken by designers as appropriate.
3.14	Doctors surgeries, health centres	No	N/A	N/A
3.15	Leisure facilities, Health clubs, swimming pools	No	N/A	N/A
3.16	Elderly people homes, hospices, sheltered accommodation	No	N/A	N/A
3.17	Churches, village Halls, meeting halls, church halls	No	N/A	N/A
3.18	Car parks, accesses to car parks	No	N/A	N/A
3.19	Large office buildings	No	N/A	N/A
3.20	Retail parks, industrial areas	No	N/A	N/A
3.21	Densely populated residential area	No	N/A	N/A
3.22	Rural / farms accesses	Yes	Low	Access to the farmers' field in the south east corner can be found on the j/w Hoe Mill Road and Manor Road (210m south from the bridge).
3.23	Works near rivers / watercourse – has the EA been consulted?	Yes	High	River Chelmer is main river. EA bespoke permit is required.
3.24	Works adjacent to / in ditches	Yes	High	Highway ditch / farmers' ditch located on the South East farmers field running parallel to the carriageway.
3.25	Surrounding area susceptible to flooding	Yes	High	Farmers field to the South East and also north of the structure, The Causeway floods. However, the Hoe Mill Lock Bridge and Hoe Mill Bridge does not flood.
3.26	Carriageway susceptible to flooding	No	N/A	N/A
3.27	Existing on site contamination - asbestos	No	N/A	N/A
3.28	Existing on site contamination - tar	No	N/A	N/A
3.29	Archaeological finds	Yes	High	Due to the findings of the Heritage assessment, there is a high change of disturbing paleo environment. Archaeologists required during GI and construction.

* Add further relevant hazards as identified

PART 4: CONSTRUCTION CONSIDERATIONS				
Ref	Hazard/activity	Hazard Identified (Yes / No / Data required)	Significance (High / Med / Low)	Comments – Especially required where Med or High Is selected Add actions to be taken by designers as appropriate.
Does the proposed design result in any of the following issues:-				
4.1	Deep excavations	Yes	High	Options 2, especially 3 and 4 will require deep excavations for piling, piling cap, excavations behind the abutments and construction of the run on slabs. Temporary works to be designed.
4.2	Working at Height	Yes	High	Options 2, 3 and 4 with regards to lifting long prestressed precast beams, form work, construction of the deck over main river and construction of wingwalls.
4.3	Impact on structures (bridges, retaining walls, culverts etc.)	Yes	High	Options 2 and 4. Due to the 2 options being within the current footprint of the bridge and Option 2 reusing the existing substructure, care must be taken during construction to maintain stability of the abutments.
4.4	Impact on other highway infrastructure (lighting columns, signs, detector loops etc.)	Yes	High	Options 2, 3 and 4. Options 2 and 4 will require feathering of the new carriageway into the existing. Option 3 will require tie in from the proposed new carriageway to the existing to the south and north.
4.5	Potential impact on buildings, walls or other structures abutting the works? Consider stability etc.	No	N/A	N/A
4.6	Slope / ground stability	Yes	Mid	Options 3 and 4 during construction of the wingwalls, abutments and
4.7	Ground water / water courses	Yes	High	All options will be working over main river. Options 2, 3 and 4 will require construction of the deck over a main river. Options 3 and 4. GI will need to be completed to ascertain ground water levels for piled foundations.
4.8	Interface with services in the excavation	Yes	Mid	2 over head cables running parallel but off structure on the west side of the bridge. 1 water main running under west footway.
4.9	Dealing with excavated materials / contaminated materials	Yes	High	Options 2, 3 and especially 4.
4.10	Access difficulties	Yes	Mid	Land licence required and possible CP of land to the four corners of the structure to allow for construction of the new bridge in Options 2, 3 and 4.
4.11	Potential confined space working	No	N/A	N/A

* Add further relevant hazards as identified

PART 5: Ecological & Environmental Considerations				
Ref	Hazard/activity	Hazard Identified (Yes / No / Data required)	Significance (High / Med / Low)	Comments – Especially required where Med or High Is selected Add actions to be taken by designers as appropriate.
The following environmental issues are to be considered:-				
5.1	Impact on trees or hedgerows (consider nesting birds; beginning of March to end of August)	Yes	High	Arboriculture survey to be completed in Jan 2021.
5.2	Evidence of protected species – badgers Dec to June; closed season for development work	No	Low	Ecologist report 27/11/20. Bat habitat is considered negligible.
5.3	Evidence of protected species – bats Nov to Feb; no work, hibernation June to Aug; no work, breeding roosts	No	Low	Ecologist report 27/11/20. Bat habitat is considered negligible.
5.4	Evidence of protected species – birds Mar to Aug; no work in nesting habitats	Yes	Mid	Ecologist report 27/11/20. Probable impact of nesting birds during works. Ecologist to complete visual inspections for nesting birds. Bird Nest boxes and native species to be replanted to compensate for any suitable bird nesting habitat lost.
5.5	Evidence of protected species – great crested newts Oct to Feb, no work, hibernation period	No	N/A	Ecologist report 27/11/20. Extremely unlikely to be affected by the proposed works.
5.6	Evidence of protected species – otters Licence normally required	Yes	High	Ecologist report 27/11/20. River channel is considered suitable for commuting Otters. No night time working and no night-time illumination of the watercourse. Additional survey for otter field signs before works commences.
5.7	Evidence of protected species – water voles Best time for work, April and Sept	Yes	Mid	Ecologist report 27/11/20. Moderate suitability for Water Voles with some section some of the banks of the river suitable for the creation of Water Vole burrows. No night time working and no night-time illumination of the watercourse. Additional survey for otter field signs before works commences.
5.8	Environmentally sensitive areas (SSSI, Conservation area, Listed Buildings etc.)	No	N/A	Ecologist report 27/11/20. Woodham Walter Common SSSI 1.8km south-west, Blakes Wood and Lingwood Common SSSI 3.4km south-west, Danbury Common SSSI 3.9km south-west, Maldon Cutting SSSI 3.7km south-east and Blackwater Estuary 4.5km east.
5.9	Works within 10m of a watercourse	Yes	High	Ecologist report 27/11/20. Main River, River Chelmer LoWS.

PART 5: Ecological & Environmental Considerations				
Ref	Hazard/activity	Hazard Identified (Yes / No / Data required)	Significance (High / Med / Low)	Comments – Especially required where Med or High Is selected Add actions to be taken by designers as appropriate.
5.10	Consideration of waste issues (re-cycling / re-use of material, existing on-site contamination such as ditch arising's or tar etc.)	Yes	Mid	Re-use of excavated soil where possible.
5.11	Any excessively noisy operations particularly at night	No	N/A	N/A
5.12	Generation of excessive amounts of dust or use of "fine" construction materials	No	N/A	N/A
5.13	Are works near any known archaeological remains	Yes	High	Heritage Statement and Archaeological Assessment 12/11/20. Potential paleo environmental remains within site. Archaeologists to be on site during GI and excavation works.
5.14	Are works planned near any significant trees (girth of 300mm or more) and likely to cause root damage TPO????	Yes	Mid	Waiting for Arboriculture report to be completed Jan 2021. Sycamore tree to north west to be removed as part of the works.
*				
*				
*				

* Add further relevant hazards as identified

Notes:

1. This form includes a list of significant potential hazards pertaining to a wide range of situations that may occur across common highways activities.
2. All items considered by the principal designer as having a potential medium or high risk must be addressed by the designer. Low risk activities can also be included if considered appropriate.

Project No:		Project Name: Hoe Mill Bridge ECC 308 OS							
Design Stage: Option Study					Prepared by: [REDACTED]		Date: 04/01/2020		
Ref.	Phase C/M/D /UaW	Activity	Potential Hazards	Person(s) at Risk	Initial RR H/M/L	Design Measures to Eliminate Hazards	Design Measures to Reduce Risk	Final RR H/M/L	Significant Residual Risk to be incorporated into Construction Drawings / PCI
1.1	C / D / UaW	Working area	High speed dual carriageway 50mph or more	Operatives and MoP	H	N/A	Full road closure	M	
2.3	C / D / UaW	Demolition, Construction	Overhead electricity (incl. railway). Need for GS6 survey.	Operatives and MoP	H	N/A	Utility Technician Survey 13/03/2018 confirmed GS6 height.	M	Additional GS6 required (update). LOLER required for non-standard lifts from Contractor
2.7	C / D / UaW	Demolition, Construction	Unknown owner of small diameter private water main under west footpath.	Operatives, Apparatus owner and MoP	H	N/A	Previous trial holes have positively located water main. C3 and C4 discussion with water company to see whether main can be supporter in situ or whether it needs to be diverted.	M	
2.8	C / D / UaW	Demolition, Construction	Overhead BT cables crossing river, off structure directly west of structure	Operatives, Apparatus owner and MoP	H	N/A	C3 and C4 discussion with water company to see whether main can be supporter in situ or whether it needs to be diverted.	M	Additional GS6 required (update). LOLER required for non-standard lifts from Contractor.
3.1	C / D / UaW	Demolition, Construction	Farmers field South East corner of the structure. Grazing cattle in the field.	Operatives and farmer	H	N/A	Land licence for site compound to be sort. Appropriate fencing to be used to stop cattle entering site.	M	

Project No:		Project Name: Hoe Mill Bridge ECC 308 OS							
Design Stage: Option Study					Prepared by: [REDACTED]		Date: 04/01/2020		
3.4	C / D / UaW	Demolition, Construction	Hoe Mill lock and the canal is a tourist area for walkers, canalists and canoeists	Operatives and MoP	H	N/A	Full road closures to be applied for and installed. Clear fencing around site.	M	Additional temporary footbridge will need to be designed and installed by Contractor to allow pedestrian passage over the river.
3.8	C / D / UaW	Demolition, Construction	Hoe Mill Lock area	MoP	H	N/A	See above point 3.4	M	
3.23	C / D / UaW	Demolition, Construction	Works near rivers / watercourse	Operatives	H	N/A	EA bespoke permit to be applied for and accepted before AIP is submitted to TAA	M	Close liaison with EA to ensure that the propose design of the structure during Feasibility and Detailed Design is acceptable.
3.24	C / D / UaW	Demolition, Construction	Highway / farmer's ditch running parallel with The Causeway SE.	Land owner, Operatives	H	Outfall to be incorporated into the final proposed design.	PCI to highlight location of highway ditch.	M	Liaise with land owner with regards to any proposed work on the highway ditch.
3.25	C / D / UaW	Demolition, Construction	Surrounding area susceptible to flooding. Farmer's field for the proposed site compound, The Causeway to the north of the structure. Hoe Mill does not flood.	Operatives	H	N/A	PCI and drawings to highlight area susceptible to flooding. Contractors to provide adequate RAMs and mitigation against their temporary site compound being flooded.	M	Where possible main works to start during Spring / Summer. Contractor register with the Environment Agency's flood warning system. All deliveries to come from the south.
3.29	C / D	Construction	Archaeological finds. Due to the findings of the Heritage assessment, there is a high change of disturbing paleo environment.	Environment	H	N/A	GI works and proposed piling works shall be undertaken with Archeologically supervision.	M	Place services to be commissioned to supply Supervising Archaeologist.

Project No:		Project Name: Hoe Mill Bridge ECC 308 OS							
Design Stage: Option Study					Prepared by: [REDACTED]			Date: 04/01/2020	
4.1	C / D / UaW	Demolition, Construction	Deep excavations. Options 2, especially 3 and 4 will require deep excavations for piling, piling cap, excavations behind the abutments and construction of the run on slabs.	Operatives	H	N/A	Temporary works design to be completed by Contractor. Both Type P and S certificate to be supplied by Contractor	M	
4.2	C / D / UaW	Demolition, Construction	Working at height. Options 2, 3 and 4 with regards to demolishing and removing existing deck above water level. Lifting long prestressed precast beams, form work, construction of the deck over main river and construction of wingwalls	Operatives	H	N/A	Contractor to supply adequate RAMS and LOLER plans for non- standard lifting procedures.	M	
4.3	C / D / UaW	Demolition, Construction	Impact on structures (bridges, retaining walls, culverts etc.). Options 2 and 4. Due to the 2 options being within the current footprint of the bridge and Option 2 reusing the existing substructure,	Operatives and MoP	H	Where possible, during Feasibility Stage for Option 2 and 4, maximising the retainment of the substructure would be beneficial.	Appointed contractor to supply adequate RAMS, LOLWER and temporary works designer certificates.	M	

Project No:		Project Name: Hoe Mill Bridge ECC 308 OS							
Design Stage: Option Study					Prepared by: [REDACTED]		Date: 04/01/2020		
4.7	C / D / UaW	Demolition, Construction	Ground water / water courses. All options will be working over main river. Options 2, 3 and 4 will require construction of the deck over a main river.	Operatives, Environment	H	During Feasibility Stage for Option 2 and 4, Designer to go through buildability challenges. GI works	Contractor to supply adequate RAMs to mitigate flooding to proposed site compound.	M	
4.9	C / D / UaW	Demolition, Construction	Dealing with excavated materials / contaminated materials Options 2, 3 and especially 4 will require high volume of imported material to build up the proposed carriageway.	Operatives & Environment	H	During feasibility study, Designer to see whether any excavated material can be reused and limit amount of imported material for Option 4	Deliveries and removal of material shall follow The Causeway to the South. Contractor to provide detailed accounts to where imported materials are located.	M	
5.1	C / D	Demolition, Construction	Impact on trees or hedgerows.	Environment	H	Aboriculture survey to be completed Jan 2021. Options to consider impacts on TPO trees.	N/A	M	
5.6	C / D / UaW	Demolition, Construction	Evidence of protected species – otters Licence normally required	Environment	H	N/A	No night works allowed.	M	
5.9	C / D / UaW	Demolition, Construction	Works within 10m of a watercourse	Operatives and Environment	H	Environment Agency to be consulted and permit	Contractor to supply adequate RAMs to mitigate flooding to proposed site compound.	M	

Project No:			Project Name: Hoe Mill Bridge ECC 308 OS						
Design Stage: Option Study					Prepared by: [REDACTED]		Date: 04/01/2020		
5.13	C / D	Demolition, Construction	Are works near any known archaeological remains. Heritage Statement and Archaeological Assessment highlighted the potential of paleo environmental remains within site confines.	Environment	H	N/A	Places Services' Archaeologist to be present during GI and piling works.	L	

Phase
C = Construct
M = Maintain / Clean
D = Demolish and/or Adapt
UaW = Use as Workplace

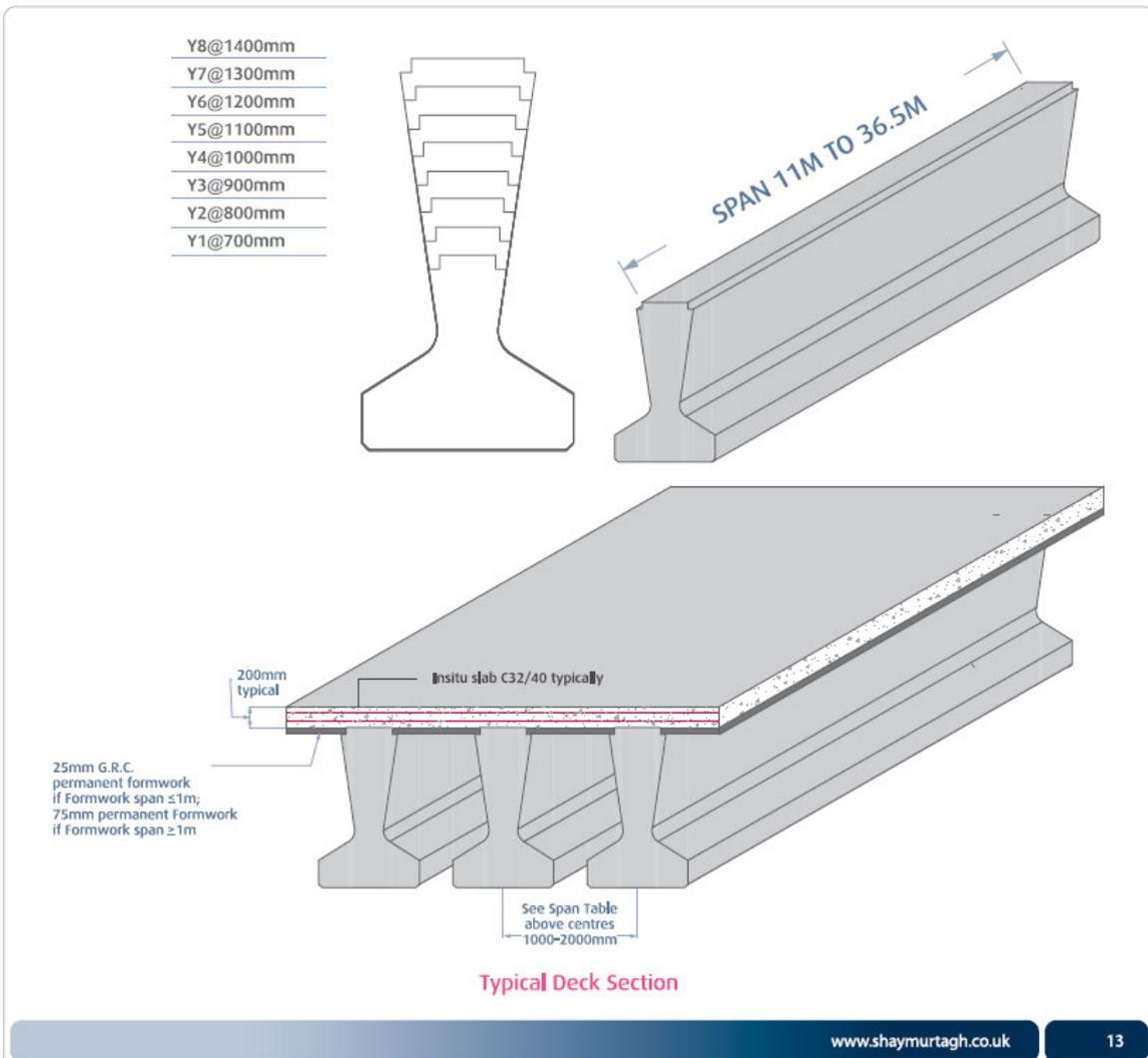
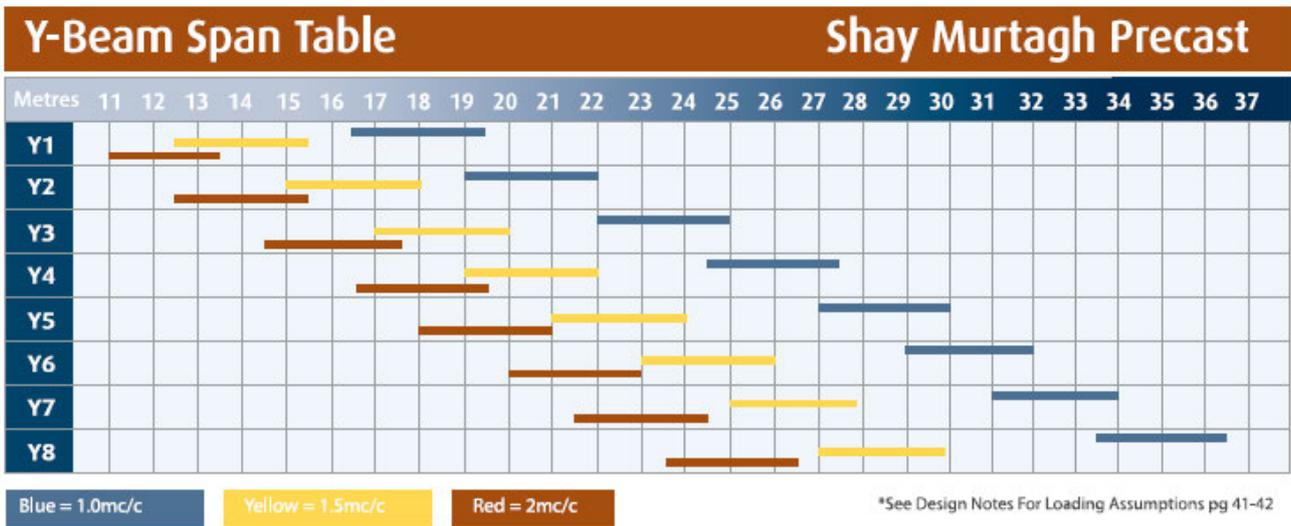
Severity of Injury
H: Major, Fatal or long term disabling injury or illness.
M: Moderate injury or illness
L: Minor injury/ illness

Probability (Prob.)
H: Highly likely
M: Likely event
L: Possible

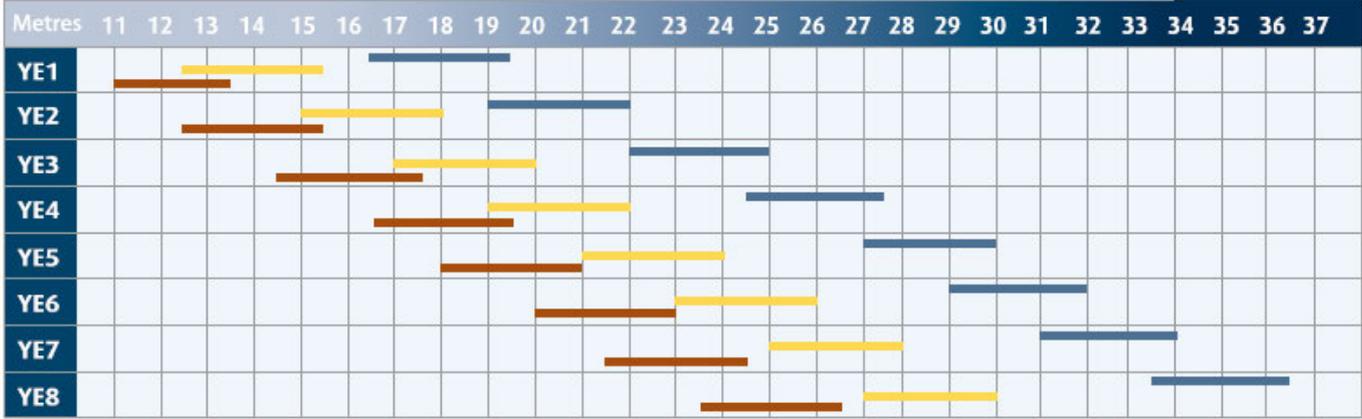
Risk Rating (RR)				
Prob. (LMH)	M	H	H	Note The purpose of Risk Rating is to determine which risks are significant. It is a subjective process, not an absolute or precise determination.
	L	M	H	
	L	L	M	
	Severity (LMH)			

Designers **MUST** follow the general principles of prevention / hierarchy of control to eliminate hazards and to reduce risk. Additional guidance is provided in CDM 2015: Guidance Note 1; General Principles of Prevention available on the RJMS

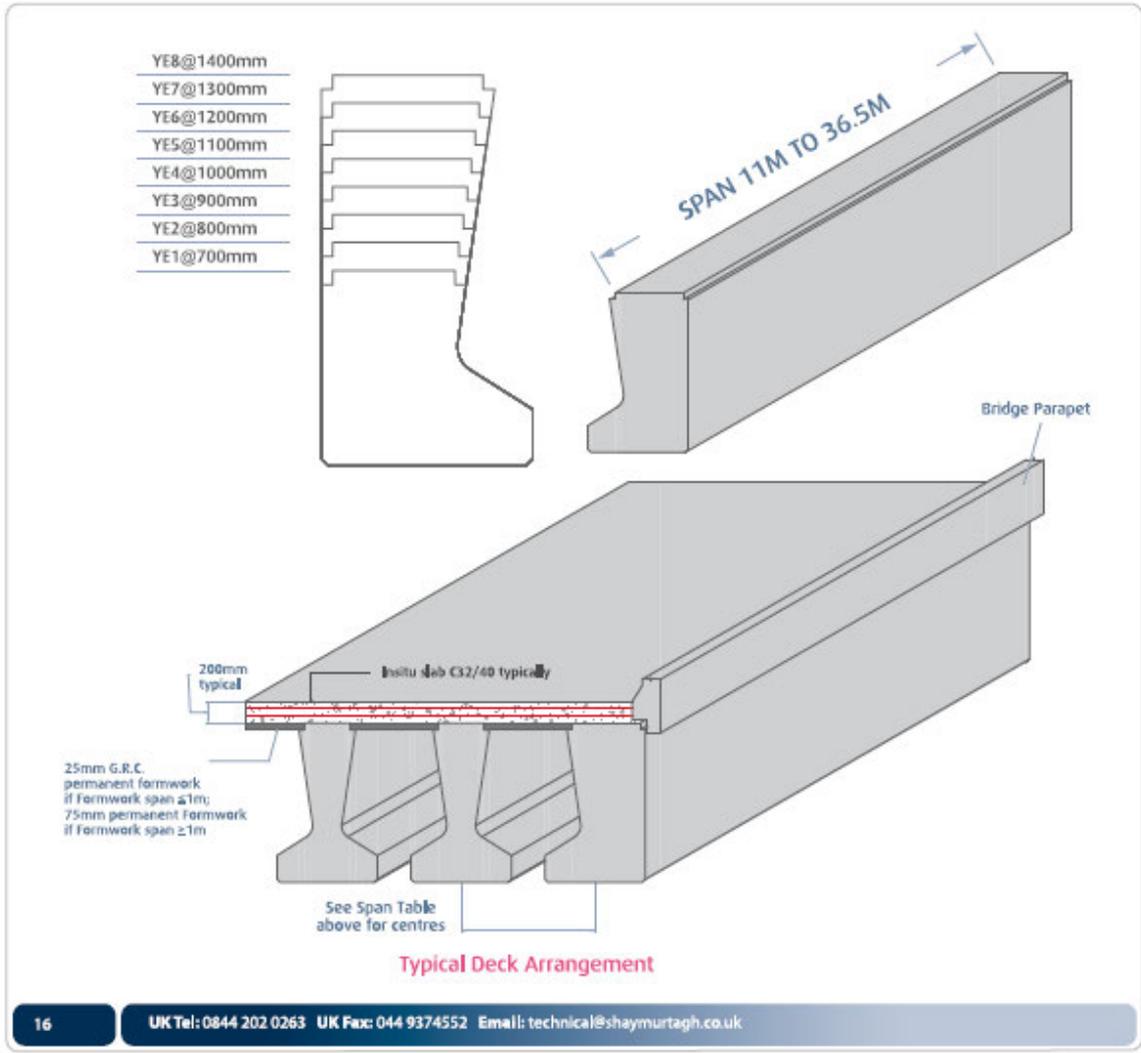
Appendix C Proposed Calculations



YE-Beam Span Table Shay Murtagh Precast



Blue = 1.0mc/c Yellow = 1.5mc/c Red = 2mc/c *See Design Notes For Loading Assumptions pg 41-42



Appendix D Historical Geology

GEOLOGICAL SURVEY OF GREAT BRITAIN
RECORD OF SHAFT OR BORE FOR MINERALS

(For Survey use only)
6-inch Map Registered No.
TL 80NW/100

Name of Shaft or Bore given by Geological Survey: _____

Name and Number given by owner:
Woodham Walter Borehole No. 5

For whom made _____

Town or Village **Uttling** County **Essex**

Exact site _____ *Attach a tracing from a map, or a sketch-map, if possible.*

Purpose for which made _____

Ground Level at ^{shaft}bore relative to O.D. _____ If not ground level give O.D. of beginning of ^{shaft}bore _____

Made by **Carter and Ward Ltd.** Date of sinking _____

Information from _____ Date received _____

Examined by _____

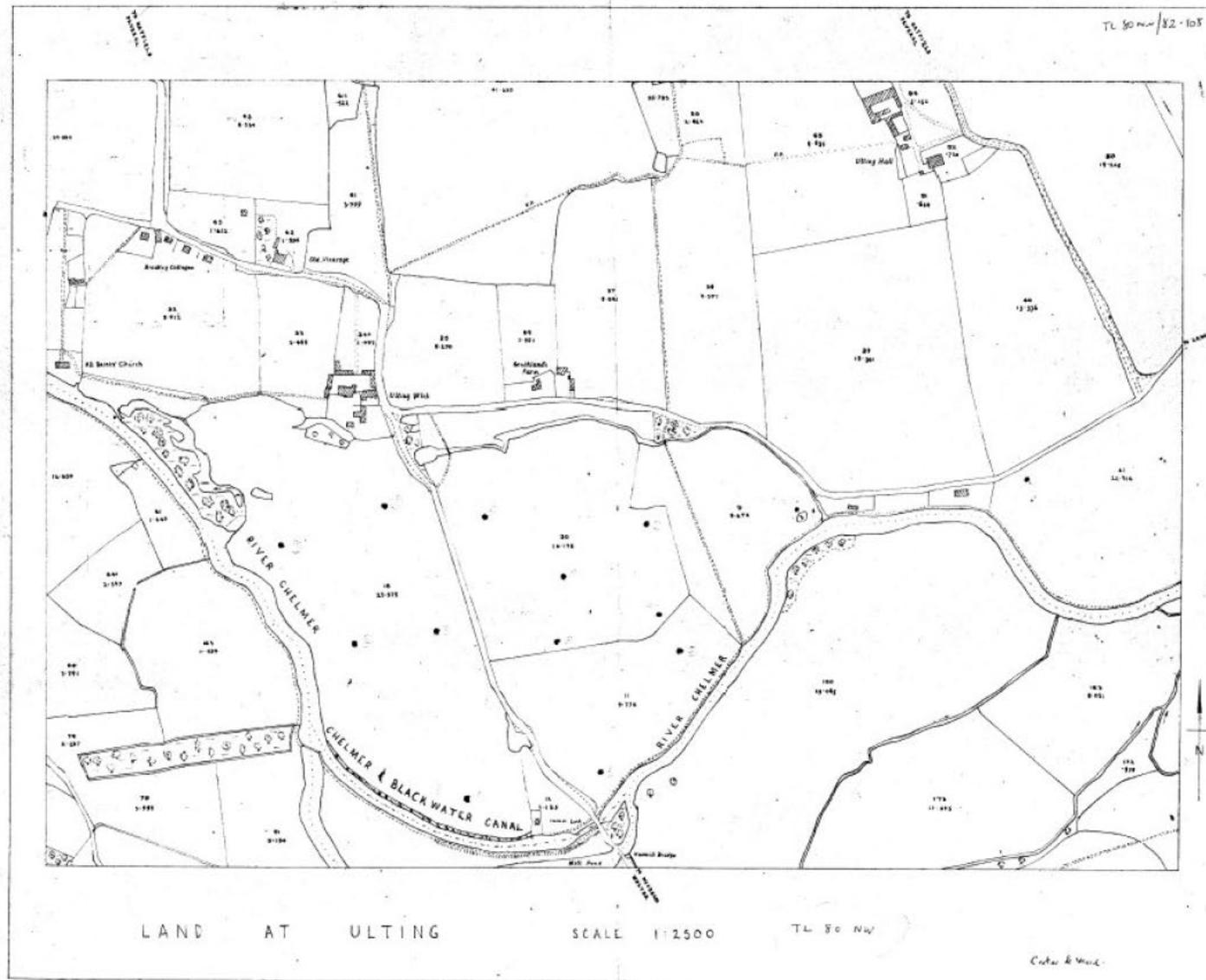
1" N.S. Map No.	1" O.S. Map No.	Confidential or not
241		C

SPECIMEN NUMBERS AND ADDITIONAL NOTES

<i>(For Survey use only)</i> GEOLOGICAL CLASSIFICATION	DESCRIPTION OF STRATA	THICKNESS		DEPTH	
		FT.	IN.	FT.	IN.
Depth (m)					
0.30m	Topsoil	1	0	1	0
1.22m	Yellow clay	3	0	4	0
1.52m	Sandy brown clay	1	0	5	0
2.13m	Blue clay and ballast	2	0	7	0
2.59m	Grey ballast with sand	1	6	8	6
3.05m	Dark blue clay	1	6	10	0

(5412) W.S. 32837/P.S. 154 2m 10/94 G.W.B.Ltd. G.N. 863





TL 80 NW/ 140

British Geological Survey
 Woodham Walter.
 Ordnance Map 241, new ser. (Essex 5d, N.E.). Geologic Map 1, N.E.
 Walter Hoag, Near Hoe Mill, 10 yds. from River Chelmer.
 Information from Capt. the Hon. R. Mountrous.
 About 25 ft. above Ordnance Datum.
 Said to be 112 ft. deep, ending in Thanet Sands.
 Yield sufficient for the premises. Water faintly opalescent. For analysis,
 see p. 465.
 Essex N. 55 SE/W

By Dr. J. C. THRESH.

	In parts per 100,000	
	Woodham Ferrers Hyote Farm on the Marshes 20 Feb., 1898, see p. 319.	Woodham Walter, W. Walter House, near Hoe Mill, 27 March, 1903, see p. 319.
Calcium carbonate	4.25	3.75
Magnesium carbonate	3.15	1.95
Sodium carbonate	31.2	38.9
Sodium sulphate	12.1	16.3
Sodium chloride	58.6	49.8
Sodium nitrate	3	No nitrates
Silica, &c.	9	-
Error	-	-7
Total solids dried at 180° C.	117.6	110.
Hardness: Temporary Total	7°	5.9°
Permanent Total	3°	.7°
Total	10°	6°
Free ammonia ... ..	.000	.1
Organic ammonia ... ..	.005	.004
Oxygen absorbed in 3 hours at 37° C. ... ..	.124	.088
Nitrate	-	nil.

? Old eng
 Visited & analysed on Essex N55 SE
 Feb 1964

1550 yds. N. of St. Michael's Church.

Visited. Shaft 5 3/4 x 3 1/2 x 5, bore 188 yds. Mr. J. Little
 Accessible between 4" and 2" tubing, R.W.L. : Hoe Mill House
 5 7/8 below top of 4" tube = approx. G.L. Woodham Walter
 Elec. pump, 2" pipe, used 3 hrs. ev. per day, 1500 gal storage filled in 7-8 hrs.
 Boldest & yellow clay 19 19 O.D. + 25
 London clay 152 171 883
 Blue sandy clay 2 173 17. 6. 58
 White " " 1/2 175 1/2
 Blue " " 13/4 175 1/4 Published in Diff 19 19
 Sand 13/4 177 'Water Supply of LC }
 'Hard white stone' 2 179 of Essex', Oh } 169 188
 Sand 9 185 page 319 ? WRB }
 above All depths below Datum, about 1'3" Price 26.8.64
 present ground level.

DATA Bank



241 ✓

TL80/29

66

Woodham Walter.

Ordinance Map 241, new ser. (Essex 53, N.E.). Geologic Map 1, N.E.
 Walter House. Near Hoe Mill, 10 yds. from River Chelmer.
 Information from Capt. the Hon. R. Molesworth.
 About 25 ft. above Ordnance Datum.
 Said to be 112 ft. deep, ending in Thanet Sands.
 Yield sufficient for the premises. Water faintly opalescent. For analysis, see p. 465.

Essex N. 55 SE/W.

By Dr. J. C. THRESH.

	In parts per 100,000	
	Woodham Ferrals Hyots Farm on the Marshes 26 Feb., 1898, see p. 319.	Woodham Walter, W. Walter House, near Hoe Mill, 27 March, 1903, see p. 319.
Calcium carbonate	4.25	3.75
Magnesium carbonate	3.15	1.05
Sodium carbonate	31.5	38.9
Sodium sulphate	12.4	18.3
Sodium chloride	58.8	49.8
Sodium nitrate	3	No nitrates
Silica, &c. ... ..	.9	—
Error	—	-.7
Total solids dried at 180° C.	117.5	110.
Hardness: Temporary	7°	5.3°
Permanent	3°	.7°
Total	10°	6°
Free ammonia ... ..	.000	.1
Organic ammonia ... ..	.005	.004
Oxygen absorbed in 3 hours at 37° C. ... ..	.124	.088
Nitrites	—	nil.

? Oil eng
 Visited & lab'd on Essex N55 SE
 Feb
 1964

1550 yds. N. of St. Michael's Church.

Visited. **Slings** 5 3/4 x 3 1/2 x 5, bore 188 x 4 in. Mr. J. Little
 Accessible between 4" and 2" tubing, R.W.L. Hoe Mill House
 5 7/8 below top of 4" tube = approx. G.L. Woodham Walter
 Elec. pump, 2" pipe, used 3 hrs. av. per day, 1500 gal storage filled in 7-8 hrs.
 Ballast & yellow clay 19 19 O.D. + 25
 London Clay 152 171 883
 Blue sandy clay 2 173 17. 6. 58
 White " " 1/2 175 1/2
 Blue " " 13/4 175 1/4 Published in Duff 19 19
 Sand 13/4 177 'Water Supply of LC 169 188
 'Hard white stone' 2 179 of Essex, ?WRB }
 Sand 9 185 page 315 PERI 26.8.64
 All depths below Datum, about 1'3"
 above present ground level.

DATA Bank

Appendix E Photographs of the existing Structure



West Elevation



View of Underside of Structure



East Elevation