NSW Public Works

Department of Regional NSW

Review of Environmental Factors

Holbrook Flood Mitigation Works

3 September 2024

Prepared for Greater Hume Council

Document Control

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Rasha Haymour / Sarah Clarke

Environmental Scientist/Planner

4 Parramatta Square, 12 Darcy Street,

Parramatta, NSW 2150

m: 02 9769 9906

e: rasha.a.haymour@pwa.nsw.gov.au | w: www.publicworksadvisory.nsw.gov.au

Cover Image: SIA Ecological and Environmental Planning Pty Ltd, 2024

Acknowledgements

The NSW Department of Primary Industries and Regional Development stands on Country that always was and always will be Aboriginal land.

From creation, all generations have been caring for Country and sharing with each other, surviving, and living in harmony as one. Today, we show our respect by acknowledging the ancient protocols and traditions of the First Nations peoples. We recognise the elders for continuing dreamtime lore, protecting the knowledge of all things sacred and spiritual, sustaining all living species that called this place home, and preserving the oldest living culture in the world.

We acknowledge the Traditional Custodians of the land and waters, and we pay respect to Elders past, present and emerging. We are committed to providing places in which Aboriginal people are included socially, culturally, and economically through thoughtful and collaborative approaches to our work.

Certification

This Review of Environmental Factors (REF) has been prepared by NSW Public Works (a division of the NSW Department of Primary Industries and Regional Development (DPIRD) on behalf of Greater Hume Council. The report presents the investigations undertaken into proposed flood mitigation works in Holbrook, NSW, which would involve the construction of a flood levee and associated works (hereafter referred to as the Proposal).

Greater Hume Council is a public authority and determining authority as defined in Division 5.1 of the *Environmental Planning & Assessment Act 1979* (EP&A Act). The Proposal satisfies the definition of an activity under the EP&A Act, and as such Greater Hume Council must assess and consider the environmental impacts of the Proposal before determining whether to proceed.

The Proposal is permitted without consent pursuant to the *State Environmental Planning Policy (SEPP) (Transport and Infrastructure) 2021*. Activities permitted without consent still require Environmental Assessment pursuant to Division 5.1 of the EP&A Act. This REF assesses any potential significant environmental impacts expected as part of the Proposal. Based on the information presented in this REF it is concluded that:

1) The proposed activity is not likely to have a significant impact on the environment and therefore an Environmental Impact Statement is not required.
2) The proposed activity is not likely to significantly affect threatened species, populations, ecological communities, or critical habitat. Therefore, a Species Impact Statement (SIS) / Biodiversity Development Assessment Report (BDAR) is not required.
3) The proposed activity is not likely to affect any Commonwealth land, is not being carried out on Commonwealth land, or significantly affect any matters of national environmental significance.

Subject to implementation of the measures to avoid, minimise or manage environmental impacts listed in this REF, the proposed activity is recommended to proceed.

Author & Qualifications	Rasha Haymour. G.Cer.EnvPl
Designation	Environmental Scientist/Planner
I certify that I have reviewed and endorsed the contents of this REF document and, to the best of my knowledge, it is in accordance with the EP&A Act, the EP&A Regulation and the	

Author & Qualifications	Rasha Haymour. G.Cer.EnvPl
Guidelines approved under Section 170 of the EP&A Regulation, and the information it contains is neither false nor misleading.	
Reviewer & Qualifications	Liz Mathieson, B.Sc.
Designation	Principal Scientist- Team Leader
Organisation	NSW Public Works, Department of Regional NSW
Signature	
Date	03/09/2024

Verification

I have examined this Review of Environmental Factors and the Certification and accept the report on behalf of Greater Hume Shire Council.

Name	
Designation	
Organisation	Greater Hume Shire Council
Signature	

Decision Statement

I, (------------------------------), as an authorised person on behalf of Greater Hume Shire Council, have examined and considered the REF for the Holbrook flood mitigation works, prepared in accordance with Section 5.5 of the *Environmental Planning and Assessment Act 1979*.

The proposed activity comprises the construction of three new levee banks within the southern portion of Holbrook as well as ancillary works including six new culverts, establishment of a new borrow pit, removal of an existing stockpile and lowering of a hillside to improve flood conveyance. Some temporary construction related impacts associated with noise and traffic are anticipated however these impacts can be suitably managed by implementing appropriate mitigation measures.

The Proposal will impact on trees and vegetation within the vicinity of the levees; however, a Biodiversity Assessment has confirmed that these impacts will not be significant. Similarly, impacts to Aboriginal and non-Aboriginal heritage items are unlikely provided the mitigation measures identified in the REF are adhered to.

Overall, based on a review of the contents of the REF and an understanding of the impacts of the proposed activity, it is considered that:

- The proposed Activity is not likely to have a significant impact on the environment and therefore an Environmental Impact Statement is not required.
- The proposed Activity will not be carried out in a declared area of outstanding biodiversity value and is not likely to significantly affect threatened species, populations or ecological communities, or their habitats or impact biodiversity values, meaning a Species Impact Statement and/or Biodiversity Development Assessment Report is not required.
- The proposed Activity is not likely to affect any Commonwealth land, is not being carried out on Commonwealth land, or significantly affect any matters of national environmental significance.
- By adopting the identified safeguards, it is unlikely that the proposal would result in significant adverse environmental impacts, and therefore the proposed Activity may proceed subject to the implementation of the mitigation measures identified in Section 5 of the REF.

Authorised Representative	
Designation	
Organisation	
Signature	
Date	

Abbreviations

AHIMS	Aboriginal Heritage Information Management System
ADDA	Aboriginal Due Diligence Assessment
ASS	Acid Sulphate Soils
BC Act	Biodiversity Conservation Act 2016
NSW E&H	NSW Environment and Heritage (part of the NSW Department of Planning and Environment)
CEMP	Construction Environmental Management Plan
DBH	Diameter at Breast Heights
DCCEEW	Department of Climate Change, Energy, the Environment and Water.
DPHI	Department of Planning, Housing and Infrastructure
DPIRD	Department of Primary Industries and Regional Development
EMP	Environmental Management Plan
EP&A Act	Environmental Planning and Assessment Act 1979
EP&A Regulation	Environmental Planning and Assessment Regulation 20
EPA	Environment Protection Authority
EPBC Act	Environment Protection and Biodiversity Conservation Act 1999
GHC	Greater Hume Council
HAC	Heritage Conservation Area
HIS	Heritage Impact Statement
ICNG	Interim Construction Noise Guideline
LEP	Local Environmental Plan
LGA	Local Government Area
NCC	National Construction Code

NPW Act	National Parks and Wildlife Act 1974
POEO Act	Protection of the Environment Operations Act 1997
REF	Review of Environmental Factors
SEPP	State Environmental Planning Policy
TMP	Traffic Management Plan
WHS	Work Health and Safety
WMP	Waste Management Plan

Executive Summary

Greater Hume Council (GHC) is proposing to undertake flood mitigation works through the construction of new levee banks within the southern portion of Holbrook, NSW (hereafter referred to as the Proposal).

Following the 2010 and 2012 flood events, a F*lood Study and a Floodplain Risk Management Study* was prepared by WMA Water in 2017. GHC has adopted the associated floodplain risk management plans for Holbrook township, which recommended the construction of new levee banks within the southern portion of the Holbrook township along Ten Mile Creek.

Scope of Works

The Proposal would involve the following works:

- The construction of three new levee banks within the southern portion of the Holbrook township.
- The installation of six new culverts to transfer floodwaters downstream of Albury Street.
- The removal of a stockpile near the Holbrook bypass off-ramp for use in the levee construction.
- The establishment of a borrow pit to gain suitable fill material to utilise in the construction of the levee banks.
- Lowering of a hillside in the south-eastern portion of the southern levee.

Planning Framework

The applicable environmental planning instrument for the Proposal is *State Environmental Planning Policy (Transport and Infrastructure)* 2021 (SEPP (Transport and Infrastructure) 2021).

Division 7, Section 2.56 of SEPP (Transport and Infrastructure) 2021 allows development for the purpose of ‘flood mitigation works’ to be carried out by or on behalf of a public authority without consent on any land. GHC is a public authority for the purposes of the SEPP (Transport and Infrastructure) 2021 and the Proposal meets the definition of ‘flood mitigation work’ under the SEPP.

Therefore, the Proposal would be permissible without development consent under Section 2.56 of SEPP (Transport and Infrastructure) 2021.

Works permitted without consent require an assessment under Part 5 of the *Environmental Planning and Assessment Act 1979* (EP&A Act). A Review of Environmental Factors (REF) has been prepared for the Proposal and GHC is the determining authority.

Approvals

- Compulsory acquisition of Crown land under the *Land Acquisition (Just Terms Compensation) Act* 1991.
- Dredging and Reclamation permit for undertaking works within the banks of a Key Fish Habitat (i.e., Ten Mile Creek) under Part 7 of the *Fisheries Management Act* 1994.
- Concurrence/approval from Transport for NSW to undertake works in Hume Highway under Section 138 of *the Roads Act* 1993.
- Consultation and consent to the use and potential reservation of the Crown Land parcels that may be subject to registered Aboriginal Land Claims (ALC), agreement to excise the affected areas from the ALCs under the *Aboriginal Land Rights Act* 1983.
- Aquifer Interference Licence (if more than 3ML of groundwater is likely to be extracted per annum during construction works) under Section 91 of *Water Management Act* 2000.
- Acquisition of easements on privately owned lands under the *Land Acquisition (Just Terms Compensation) Act* 1991.

Impacts and Mitigation

The REF has identified that the Proposal would result in a number of temporary construction-related impacts. This includes impacts to land use, amenity, elevated noise, dust, traffic and access and waste generation/management. Given the implementation of appropriate mitigation measures, the Proposal is not expected to result in a significant impact to the community or the surrounding environment.

<u>Biodiversity</u>

A specialist biodiversity impact assessment undertaken for the Proposal (SIA, 2024) indicated that the Proposal would not have significant terrestrial and aquatic biodiversity impacts. This was supported by a Test of Significance under the *Biodiversity Assessment Act* 2016. Therefore, a Species Impact Statement and/or Biodiversity Development Assessment Report are not required for the Proposal.

<u>Aboriginal Heritage</u>

A specialist Aboriginal Heritage Due Diligence Assessment undertaken for the Proposal (NSW PW, 2023) concluded that the Proposal is unlikely to impact Aboriginal objects and will not impact on any known places or sites of cultural significance to the Aboriginal community. No Aboriginal sites or objects were identified inside the Proposal area, and the Proposal area has a low potential for archaeological deposits to be present. Therefore, further archaeological assessments and/or an Aboriginal Heritage Impact Permit are not required, and the Proposal can proceed with caution.

Historic Heritage Impacts

A specialist heritage impact statement undertaken for the Proposal (NSW PW, 2023) indicated that the impacts of the proposal can be partially mitigated by the recommendations contained within this report, including a thorough approach to the landscape design process, to produce a detailed landscape (re) design of Ten Mile Creek Gardens.

Operational Impacts

Once constructed, the Proposal would result in an overall positive long-term impact to the Holbrook community by reducing flooding risks and reducing associated environmental, cultural and social impacts.

Visual impacts are anticipated due to the elevated levee banks during operation. However, the public safety benefits (i.e., reduced flooding risks) associated with the construction of the levee banks are anticipated to outweigh the negative visual impacts during operation.

Conclusion and Recommendations

Subject to the findings of the REF and associated specialist assessments, it is predicted that all environmental impacts associated with the Proposal could be managed through the implementation of suitable mitigation measures, and the Proposal can be implemented without resulting in a significant environmental impact. The works will require a Construction Environmental Management Plan (CEMP) which must be reviewed and approved by GHC prior to the commencement of construction.

Contents

Figures

Tables

1. Introduction

1.1. Background and Description of the Proposal

Greater Hume Council (GHC) is proposing to undertake flood mitigation works through the construction of new levee banks within the southern portion of Holbrook, NSW (hereafter referred to as the Proposal).

Following the 2010 and 2012 flood events, a *Flood Study and a Floodplain Risk Management Study* was prepared by WMA water in 2017. GHC has adopted the associated floodplain risk management plans for Holbrook township, which recommended the construction of new levee banks, within the southern portion of the Holbrook township along Ten Mile Creek. The floods that occurred in October 2010 are believed to be the highest Ten Mile Creek flood since at least December 1887, with multiple houses along the creek flooded over floor level and two homes built at least 120 years ago being flooded for the first time (WMA, 2017). During this flood event, waters covered the majority of the land to the south of the Creek and flowed over Albury Street before re-joining the creek to the west of the town (WMA, 2017).

The proposed levee would be located within the southern portion of Holbrook, with one section on the southern side of Ten Mile Creek along Hay Street, and the other further south, parallel to MacInnes Street from the Holbrook Bypass off-ramp to Ten Mile Creek near the eastern end of Barwell Street. In addition, it is proposed to install six culverts to transfer floodwater through the Holbrook Bypass off-ramp to downstream of Albury Street.

1.2. Proposal Objective and Description

The objective of the works is to mitigate the flood impacts at Holbrook township through the provision of a flood levee in Holbrook township. The proposed levee would provide protection to the southern portion of the town from inundation due to flooding of the Ten Mile Creek.

The Proposal involves the following:

- The construction of three new levee banks within the southern portion of the Holbrook township.
- The installation of six new culverts to transfer floodwaters downstream of Albury Street.
- The removal of a stockpile near the Holbrook bypass off-ramp.
- The establishment of a borrow pit to gain suitable fill material to utilise in the construction of the levee banks.

- Lowering of a hillside in the south-eastern portion of the southern levee.

1.3. Site Description

The Proposal is in the town of Holbrook, NSW. Holbrook is a small town, located approximately 52km north-west of Albury, surrounded by agricultural land (Cardno, 2019).

Ten Mile Creek has a catchment area of approximately 140km^2 near Albury Street, Holbrook, NSW. Land use in the catchment is predominantly rural with a mixture of both pastoral and cropping land uses. The creek crosses the township at its southern end (Cardno, 2019).

Location maps and aerial images of the Proposal site are provided in Figure 1-1 to Figure 1-3 and the concept design plans for the Proposal are provided in Figure 4-1 to Figure 4-12.

Figure 1-1 Location Map of Holbrook Township

Source: NSW ePlanning Portal March 2023

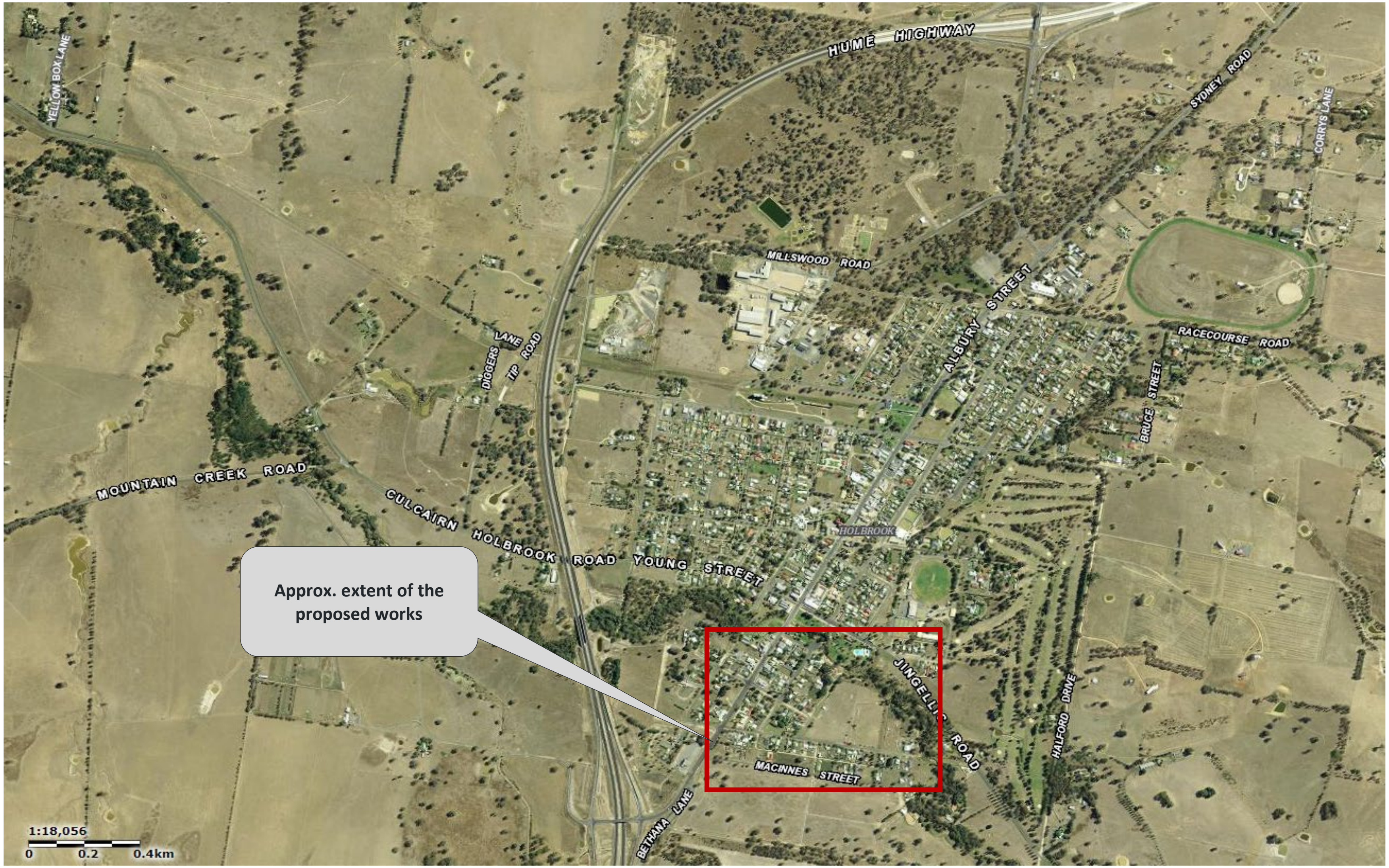


Figure 1-2 Aerial Map of Holbrook Township and Approximate Extent of Proposed Works

Source: NSW ePlanning Portal, March 2023

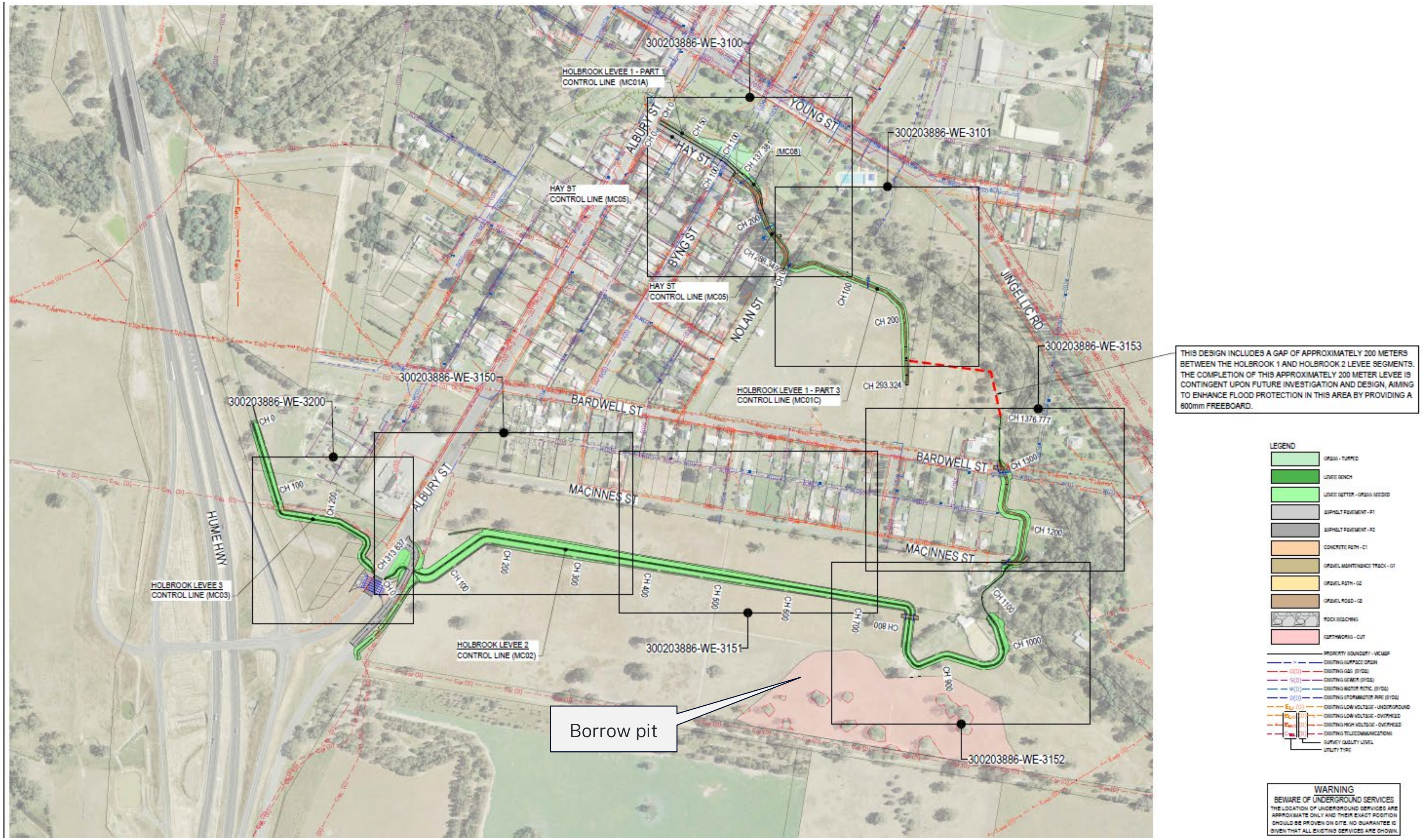


Figure 1-3 layout of proposed works in Holbrook Township

Source: GHC, Stantec Australia Pty Ltd, April 2024

1.4. Land Ownership

Land tenure along the levee alignment includes Crown Land, Crown Land reserves and privately owned land. A detailed list of all land tenures is provided in Appendix B.

Crown Land and Crown Land Reserves

The proposed levee and associated works would traverse Crown Land reserves managed by GHC as well as Crown Land administered by the Department of Planning, Housing and Infrastructure – Crown Land (DPHI- Crown Land). Council will be required to compulsorily acquire the crown lands on which the flood mitigation works are constructed.

A number of these Crown Land parcels are subject to Aboriginal Land Claims (ALCs). Table 1-1 provides a description of Crown land ownership, ALCs and action required to overcome associated land tenure risks. GHC should investigate ALCs with the Local Aboriginal Land Council (LALC) prior to the commencement of proposed works.

Privately Owned Land

Parts of the proposed levee and associated works would traverse private landholdings. GHC should obtain concurrence/approval from all property owners prior to the commencement of construction works. GHC should also seek to acquire easements from the landowners for the proposed flood mitigation works. Council may wish to establish early access agreements with landowners to enable construction works to proceed whilst finalising easements.

Table 1-1 Land Tenure in the Proposal Area

Land Parcel/Address	Owner on Title	Management Control	Aboriginal Land Claim (ALC)	Land Use and Land Zoning	Action Required
Holbrook 1					
Lot 7303 DP1155827 Young Street, Holbrook	The State of NSW	Council CLM Reserve no. 78325 Purpose: Public Recreation	To be confirmed	Carpark Zoned as RU5 Village.	No approval from Crown Lands is required. Consultation with Crown land indicated that GHC will need to acquire under the *Land Acquisition (Just Terms Compensation) Act* 1991 (LAJTC Act) (refer to Sections 2.5. and 2.6). The works are inconsistent with the purpose of the reserve. Therefore, a Plan of Management is deemed necessary. ALC to be investigated by GHC. If the lot is subject to undetermined ALC, approval would need to be granted by LALC or agreement to excise the affected area from the ALC.
Lot 2 Section 42 DP758522 Bardwell Street, Holbrook	The State of NSW	Council CLM/ Holbrook	To be confirmed	Paddock and public recreation.	No approval from Crown Lands is required. Consultation with Crown land indicated that GHC will need to acquire under the

Land Parcel/Address	Owner on Title	Management Control	Aboriginal Land Claim (ALC)	Land Use and Land Zoning	Action Required
		Recreation Ground Reserve no. 37798 Purpose: Public Recreation		Zoned as RU5 Village.	*Land Acquisition (Just Terms Compensation) Act* 1991 (LAJTC Act) (refer to Sections 2.5. and 2.6). The works are inconsistent with the purpose of the reserve. Therefore, a Plan of Management is deemed necessary. ALC to be investigated by GHC. If the lot is subject to undetermined ALC, approval would need to be granted by LALC or agreement to excise the affected area from the ALC.
Lot 1 DP909093 Albury Street, Holbrook	The State of NSW	Council CLM Reserve no. 620023 Purpose: Botanic Gardens	To be confirmed	Miniature Train track and public open space. Zoned as RU5 Village.	No approval from Crown Lands is required. Consultation with Crown land indicated that GHC will need to acquire under the *Land Acquisition (Just Terms Compensation) Act* 1991 (LAJTC Act) (refer to Sections 2.5. and 2.6). The works are inconsistent with the purpose of the reserve. Therefore, a Plan of Management is deemed necessary.

Land Parcel/Address	Owner on Title	Management Control	Aboriginal Land Claim (ALC)	Land Use and Land Zoning	Action Required
					ALC to be investigated by GHC. If the lot is subject to undetermined ALC, approval would need to be granted by LALC or agreement to excise the affected area from the ALC.

2. Statutory Planning Framework

2.1. Environmental Planning Instruments

The following Environmental Planning Instruments are relevant to the Proposal.

2.1.1. Greater Hume Local Environmental Plan 2012

Land Zoning

The Proposal site is located within the Greater Hume Local Government Area (LGA). *The Greater Hume Local Environmental Plan* 2012 (LEP) identifies the land use zones relevant to the Proposal site. The proposed levee and associated works traverse a number of land zones identified by Greater Hume LEP 2012 (refer to Figure 2-1), with these land zones and permissibility under the LEP demonstrated in Table 2-1.

Table 2-1 Land Zoning

Zoning	LEP Permissibility
R5- Large Lot Residential	Permitted with consent
RU1- Primary Production	Permitted with consent
RU5 – Village	Permitted with consent
SP2- Infrastructure-Classified Road	Prohibited

As discussed in Section 2.1.2 below, *State Environmental Planning Policy (Transport and Infrastructure)* 2021 is the relevant environmental planning instrument for the Proposal. Clause 5.12 (1) of the Greater Hume LEP 2012 states that the LEP does not restrict or prohibit, or enable the restriction or prohibition of, the carrying out of any development, by or on behalf of a public authority, that is permitted to be carried out with or without development consent, or that is exempt development, under *State Environmental Planning Policy (Transport and Infrastructure)* 2021.

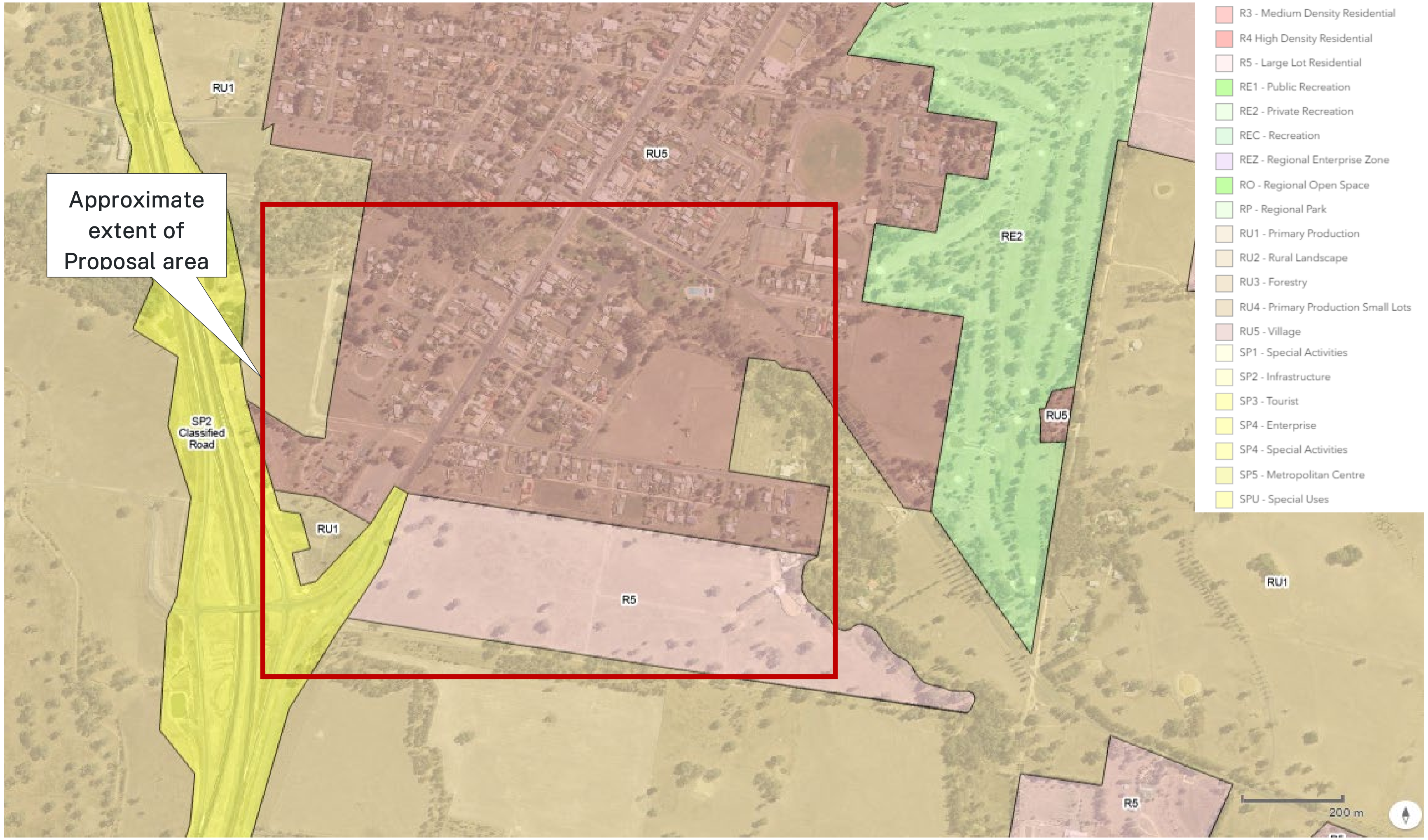


Figure 2-1 Land Zoning Map of the Proposal Area

Source: NSW ePlanning Portal Greater Hume LEP, land zoning map layer, accessed June 2023

Riparian Lands and Watercourses

The Greater Hume LEP 2012 lists parts of the Proposal area as Riparian Lands and Watercourses (refer to Figure 2-2). The objective of Clause 6.3 of Greater Hume LEP is to maintain the water quality of the watercourses, maintain the stability of the bed and banks of the watercourses, maintain aquatic and riparians habitats and ecological processes within and between the waterways and riparian areas. Potential impacts on riparian lands and watercourses are discussed in Section 5.4.

Figure 2-2 Riparian Lands and Watercourses Map

Source: NSW ePlanning Portal Greater Hume LEP, Riparian Lands and Watercourses map layer, April 2023

Terrestrial Biodiversity

The Greater Hume LEP 2012 lists parts of the Proposal area as Terrestrial Biodiversity sensitive areas (refer to Figure 2-3). A specialist Biodiversity Assessment was prepared by SIA Ecological and Environmental Planning in 2024 (Appendix C). Terrestrial biodiversity impacts associated with the Proposal are discussed in Section 5.9.

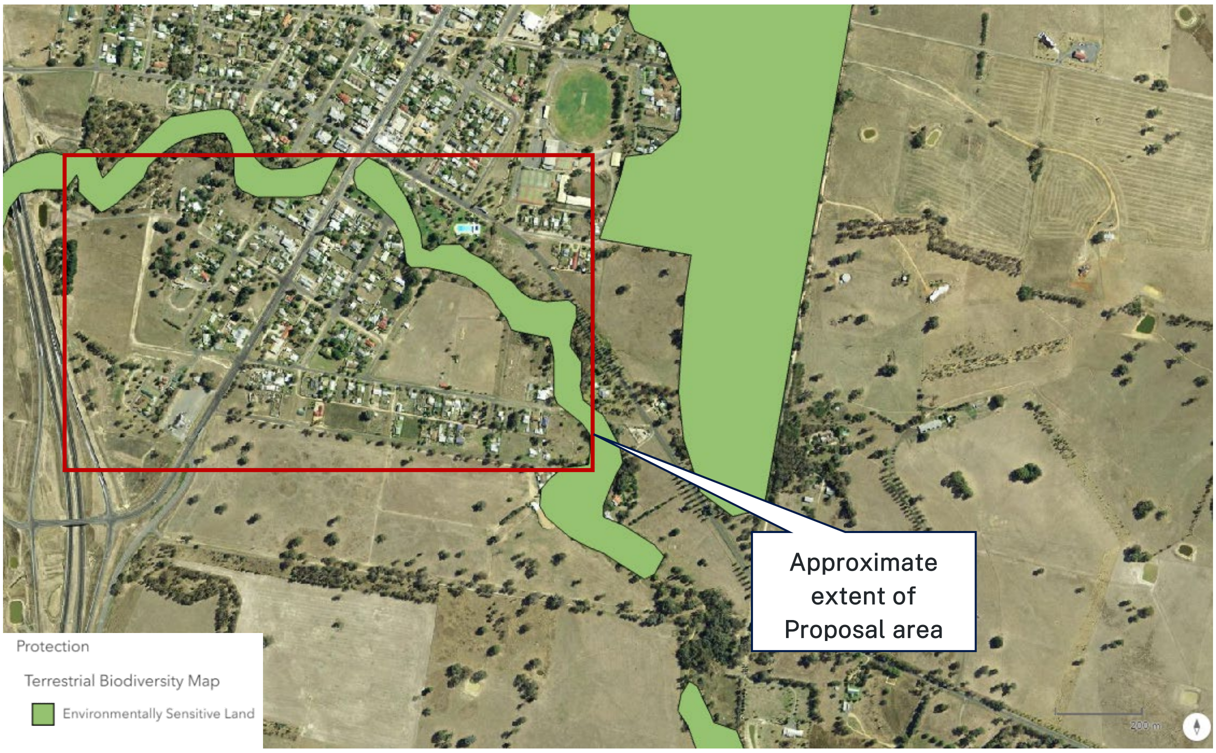


Figure 2-3 Terrestrial Biodiversity Map

Source: NSW ePlanning Portal Greater Hume LEP, Terrestrial Biodiversity map layer, April 2023

Heritage

The proposed levee banks are proposed in close proximity to a number of heritage items listed under the Greater Hume LEP 2012 (refer to Figure 2-4). A Heritage Impact Statement (HIS) was prepared for the Proposal by NSW PW in 2023 (refer to Section 5.10 and Appendix D). Heritage impacts associated with the Proposal are discussed in Section 5.10.

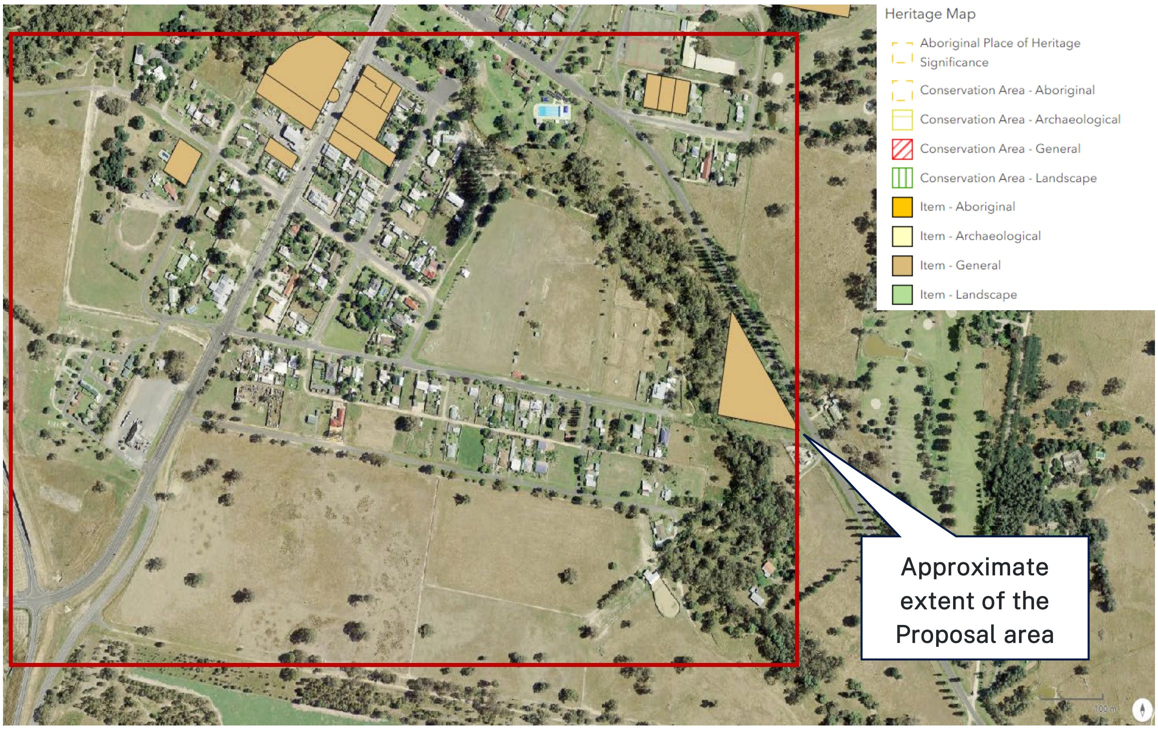


Figure 2-4 Heritage Map

Source: NSW ePlanning Portal Greater Hume LEP, Heritage map layer, June 2023

2.1.2. State Environmental Planning Policy (Transport and Infrastructure) 2021

The applicable environmental planning instrument for the Proposal is *State Environmental Planning Policy (Transport and Infrastructure) 2021 (*SEPP (Transport and Infrastructure) 2021). Chapter 2 of the SEPP aims to assist in the effective delivery of public infrastructure across the State by improving certainty and regulatory efficiency through consistent planning assessment and approvals regime for public infrastructure and services and through the clear definition of environmental assessment and approval process for public infrastructure and services facilities.

Division 7, Section 2.56 of SEPP (Transport and Infrastructure) 2021 allows development for the purpose of 'flood mitigation works' to be carried out by or on behalf of a public authority without consent on any land. GHC is a public authority for the purposes of the SEPP (Transport and Infrastructure) 2021 and the Proposal meets the definition of 'flood mitigation work' under the SEPP.

Therefore, the Proposal would be permissible without development consent under Section 2.56 of SEPP (Transport and Infrastructure) 2021.

Importantly, Section 5.1 of the *Environmental Planning and Assessment Act* 1979 (EP&A Act) requires that environmental assessment of a development that does not require consent may nevertheless be required to carry out an environmental assessment pursuant to Division 5.1 of the EP&A Act. Further, the Proposal is a development that is an activity requiring environmental assessment under Division 5.1 before it is carried out by a public authority or before a public authority gives approval for the carrying out of the activity, pursuant to the definition in s. 1.5 of the EP&A Act.

This REF is the required environmental assessment of the Proposal under Division 5.1 of the EP&A Act.

2.1.3. State Environmental Planning Policy (Biodiversity and Conservation) 2021

Chapter 4- Koala Habitat Protection 2021 of SEPP (Biodiversity and Conservation) 2021 applies to Part 4 assessments which require development consent. This chapter of the SEPP aims to encourage the proper conservation and management of areas of natural vegetation that provide habitat for koalas by requiring plans of management, identification of core areas and protection zones prior to development consent being issued. Schedule 2 of the SEPP lists LGAs which are required to assess Koala Habitat Protection, which includes GHC.

The Proposal is being assessed under Division 5.1 of the EP&A Act and does not require development consent and therefore the provisions of this chapter of the SEPP do not apply. However, the provisions relating to koala habitat protection have still been considered as best practice. A specialist biodiversity impact assessment was prepared for the Proposal (SIA Ecological and Environmental Planning, 2024). The assessment indicated that the Proposal would not impact on Koalas and their habitat (refer to Section 5.9 and Appendix C).

2.2. NSW Environmental Legislation

2.2.1. Environmental Planning and Assessment Act 1979

The applicable environmental planning instrument for the proposed activity is SEPP (Transport and Infrastructure) 2021 (refer to Section 2.1.2) which removes the requirement to obtain development consent. Therefore, the Proposal has been assessed pursuant to Division 5.1 of the EP&A Act and this REF has been prepared as the required environmental assessment of the Proposal under Division 5.1 of the EP&A Act. GHC is the determining authority for the activity.

This REF has been prepared in accordance with sections 5.5 and 5.7 of the EP&A Act, which requires that the proponent take into account to the fullest extent possible all matters affecting or likely to affect the environment due to the proposed activity. Consideration of the factors listed under Section 171 of the *Environmental Planning and Assessment Regulation 2021* (EP&A Regulation) has been used to assist in assessing the significance of the Proposal, and is provided in Appendix A of this REF.

Ecologically Sustainable Development Principle

The encouragement of ecologically sustainable development (ESD) is one of the objects of the EP&A Act. The principles of ESD are:

The reasons justifying the carrying out of the development or activity in the manner proposed, having regard to biophysical, economic and social considerations, including the following principles of ecologically sustainable development:

(a) the precautionary principle, namely, that if there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.

In the application of the precautionary principle, public and private decisions should be guided by:

- i) careful evaluation to avoid, wherever practicable, serious or irreversible damage to the environment, and
- ii) an assessment of the risk-weighted consequences of various options,

(b) inter-generational equity, namely, that the present generation should ensure that the health, diversity and productivity of the environment are maintained or enhanced for the benefit of future generations,

(c) conservation of biological diversity and ecological integrity, namely, that conservation of biological diversity and ecological integrity should be a fundamental consideration,

(d) improved valuation, pricing and incentive mechanisms, namely, that environmental factors should be included in the valuation of assets and services, such as:

- i) polluter pays, that is, those who generate pollution and waste should bear the cost of containment, avoidance or abatement,
- ii) the users of goods and services should pay prices based on the full life cycle of costs of providing goods and services, including the use of natural resources and assets and the ultimate disposal of any waste,
- iii) environmental goals, having been established, should be pursued in the most cost-effective way, by establishing incentive structures, including market mechanisms that enable those best placed to maximise benefits or minimise costs to develop their own solutions and responses to environmental problems.

The Proposal is consistent with these principles. Environmental safeguards have been proposed to be implemented during the works to prevent long term and irreversible environmental degradation in accordance with the precautionary principle and inter-generational integrity. A Biodiversity Assessment (SIA, 2024) indicated that the Proposal would not have a significant impact on biological diversity and ecological integrity at the Proposal area.

2.2.2. Protection of the Environment Operations Act 1997

The *Protection of the Environment Operations Act* 1997 (POEO Act) regulates air, noise, land and water pollution. The Environment Protection Authority (EPA) is generally responsible for implementing the POEO Act and would be the appropriate regulatory authority for the Proposal.

The Proposal does not constitute a scheduled activity listed under Schedule 1 of the POEO Act and therefore an Environment Protection Licence (EPL) would not be required for the works.

Schedule 1 of the POEO Act identifies certain extractive activities as a scheduled activity. However, this only applies to extraction (by any method, including by excavation, dredging, blasting or tunnelling) or processing of extractive materials for the primary purpose of the sale of extracted material, and does not apply to cut and fill operations, or the excavation of foundations or earthworks, that are ancillary to development that is subject to development consent or approval under the *Environmental Planning and Assessment Act 1979*. The excavations proposed within the borrow pit site are ancillary to the development that is permissible under Part 5 of the EP& A Act. Therefore, an EPL is not required for the Proposal.

It is also noted that the exact quantity of excavated soil is estimated to be approximately 45,000 m^3, which falls below 30,000 tonnes per year, due to the relatively small scale and the length of the proposed levee sections (refer to Section 4.1).

Section 120 of the POEO Act states that it is an offence to pollute waters without a licence. It is considered that the Proposal can be carried out without causing water pollution as appropriate mitigation measures would be implemented to prevent water pollution during the works. Therefore, it is considered unlikely that a licence would be required under Section 120 of the POEO Act for the pollution of waters.

Other relevant provisions of the POEO Act that the Proposal would need to comply with include:

- Section 115 – It is an offence to dispose of waste in a manner that harms or is likely to harm the environment.
- Section 116 – It is an offence to cause any substance to leak, spill or otherwise escape (whether or not from a container) in a manner that harms or is likely to harm the environment.

- Section 124 - The occupier of any premises who operates any plant in or on those premises in such a manner as to cause air pollution from those premises is guilty of an offence if the air pollution so caused, or any part of the air pollution so caused, is caused by the occupier's failure (a) to maintain the plant in an efficient condition, or (b) to operate the plant in a proper and efficient manner.
- Section 139 – The occupier of any premises who operates any plant (other than control equipment) at those premises in such a manner as to cause the emission of noise from those premises is guilty of an offence if the noise so caused, or any part of it, is caused by the occupier's failure: (a) to maintain the plant in an efficient condition, or (b) to operate the plant in a proper and efficient manner.
- Section 167 – The occupier of any premises must maintain any control equipment installed at the premises in an efficient condition. The occupier of any premises must operate any control equipment installed at the premises in a proper and efficient manner.

2.2.3. Protection of the Environment Operations (Waste) Regulation 2014

The *Protection of the Environment Operations (Waste) Regulation* 2014 sets out the provisions with regards to non-licensed waste activities and non-licensed waste transporting, in relation to the way in which waste must be stored, transported, and the reporting and record-keeping requirements. The disposal of construction waste including spoil and operational water by-products would be required to comply with this regulation.

2.2.4. Biodiversity Conservation Act 2016

The *Biodiversity Conservation Act* 2016 (BC Act) protects species of threatened flora and fauna, endangered populations and endangered ecological communities and their habitats in NSW. It also lists Key Threatening Process that adversely affects threatened species, populations or ecological communities or that may cause species, populations or ecological communities that are not threatened to become threatened.

A specialist Biodiversity Assessment (SIA, 2024) undertaken for the Proposal indicated that the Proposal would not have a significant impact on threatened flora and fauna species, habitats and ecological communities listed under the BC Act 2016 (see Section 5.9 and Appendix C). Therefore, a BDAR, SIS or an approval under the BC Act would not be required for the Proposal.

2.2.5. Heritage Act 1977

The *Heritage Act* 1977 protects and aims to conserve the environmental heritage of New South Wales. Environmental heritage is broadly defined under Section 4 of the *Heritage*

Act 1977 as consisting of "those places, buildings, works, relics, moveable objects, and precincts, of State or local heritage significance".

Aboriginal places or objects that are recognised as having high cultural value (potentially of local and State significance) can be listed on the State Heritage Register and protected under the provisions of the *Heritage Act* 1977.

The Proposal is located in close proximity to a number of heritage items listed under the Greater Hume LEP 2012. A HIS was prepared for the Proposal (NSW PW, 2023) to assess the impacts on the heritage significance of those items located in the vicinity of the Proposal area (refer to Section 5.10 and Appendix D).

The HIS concluded that the Heritage items immediately adjacent to the levee will not be directly impacted by the proposal, however there will be moderate indirect impact to them, as the views of and from the listed heritage items will be altered by the proposed works. These impacts can be partially mitigated by the recommendations contained in Section 5.11.3 including a thorough approach to the landscape design process, to produce a detailed landscape (re) design of Ten Mile Creek Gardens.

2.2.6. National Parks and Wildlife Act 1974

The *National Parks and Wildlife Act* 1974 (NPW Act) provides for the statutory protection of Aboriginal cultural heritage places, objects and features. One of the objects of the NPW Act is the conservation of places, objects and features of significance to Aboriginal people (Section 2A). The NPW Act provides for the management of both Aboriginal Objects and Aboriginal Places and is administrated by the Department of Planning and Environment- Heritage NSW.

Aboriginal Objects and Aboriginal Places are protected under Part 6 of the NPW Act and there are legislative penalties if a person harms or desecrates an Aboriginal Place or Object (s. 86). Harm to an Aboriginal Place or Object includes any act or omission that destroys, defaces or damages the object or place, or, in relation to an Aboriginal object, moves the object from the land on which it had been situated.

However, harm to an Aboriginal Object that is 'trivial or negligible' does not constitute an offence. Also, it is a defence against prosecution for unintentionally harming Aboriginal Objects if due diligence had been exercised to determine that no Aboriginal object would be harmed, or the harm or desecration was authorised by an Aboriginal Heritage Impact Permit (AHIP).

A specialist Aboriginal Heritage Due Diligence Assessment (AHDDA) undertaken by NSW PW in 2023 concluded that the Proposal is unlikely to impact Aboriginal objects and will not impact on any known places or sites of cultural significance to the Aboriginal community (see Section 5.10 and Appendix E). Accordingly, no impact to Aboriginal heritage is expected as a result of this Proposal and therefore archaeological investigations and/or an AHIP are not required for the Proposal and the works can proceed with caution.

2.2.7. Fisheries Management Act 1994

The objects of the *Fisheries Management Act* 1994 (FM Act) are to conserve, develop and share the fishery resources of the State for the benefit of present and future generations. In particular, the objects of this Act include:

- To conserve fish stocks and key fish habitats, and
- To conserve threatened species, populations and ecological communities of fish and marine vegetation, and
- To promote ecologically sustainable development, including the conservation of biological diversity.

The Act includes schedules of threatened aquatic species, populations and ecological communities, which must be considered in accordance with Section 5A of the EP&A Act.

The Proposal would not impact on any nearby watercourses or waterland (i.e. Ten Mile Creek). A Biodiversity Assessment (SIA, 2024) confirmed that the Proposal would not have a significant impact on any threatened aquatic species, populations and ecological communities protected under the FM Act and the Proposal does not constitute any Key Threatening Processes listed under this Act. Consultation with the DPIRD- Fisheries; however, indicated that a permit under Part 7 of the FM Act is required for the proposal as the works will occur within the banks of the Ten Mile Creek, which is a Type 1 Class 1 Key Fish Habitat (see Section 2.5).

2.2.8. Water Management Act 2000

The objects of the *Water Management Act* 2000 (WM Act) are to provide for the sustainable and integrated management of the water sources of the State for the benefit of both present and future generations.

Section 91D(1) of the WM Act states that a person who constructs or uses a flood work, and who does not hold a flood work approval for that work, is guilty of an offence. Although the Proposal meets the definition of flood work under the WM Act, Clause 41C(1) of the *Water Management (General) Regulation* 2018 states that Local Councils are exempt in relation to the construction or use of a flood work if the construction or use of the work is carried out under a development authorisation granted by a council, and the work is situated in or on a place that is located within a managed designated high risk flood area, or any other place (unless it is located within an unmanaged designated high risk flood area). As the works are being undertaken by a Local Council within a managed high risk flood area, a flood work approval is therefore not required.

Section 91E of the WM Act states that a person must not carry out a controlled activity in, on or under waterfront land otherwise than in accordance with a controlled activity approval. Although the Proposal could meet the definition of a controlled activity under the Act, Clause 38 of the *Water Management (General) Regulation* 2018 states that Public Authorities are exempt in relation to all controlled activities that they carry out in, on or under waterfront land. As the works are being undertaken by a public authority, a controlled activity approval is therefore not required. The works however would need to be consistent with relevant Department of Climate Change, Energy, the Environment and Water (DCCEEW) - Water guidelines (see Section 2.4 below).

Section 91(F) of the WM Act states that an aquifer interference activity cannot be carried out without, or otherwise than as authorised by, an aquifer interference approval.

When groundwater is encountered and dewatering is required during construction works, consultation should be undertaken with the DCCEEW– Water to confirm whether an aquifer interference approval is required for these works. Consultation with DCCEEW - Water is recommended to be undertaken prior to the commencement of works to confirm whether an aquifer interference approval is required.

A Geotechnical investigation undertaken for the Proposal by Cardno in April 2020 encountered groundwater at approximate depths of 1.5 m and 3.2 m below ground level in BH 6 and BH 12 respectively. Therefore, groundwater may be encountered during construction.

2.2.9. Crown Land Management Act 2016

The *Crown Lands Management Act* 2016 (CLM Act) consolidated eight pieces of legislation into one, including the *Crown Lands Act 1989*. The objectives of the CLM Act are to provide for the consistent and transparent management of Crown land and provide for the appropriate management of Crown land.

DPHI – Crown Lands was consulted as part of the REF and advised that Council will need to compulsorily acquire any crown land on which the flood mitigation works will be sited. A licence under Section 5.21 of the CLM Act will be required to undertake the construction works.

Section 1.4 lists those Crown land parcels which would require acquisition and a license under the CLM Act.

2.2.10. Aboriginal Land Rights Act 1983

The *Aboriginal Land Rights (*ALR*) Act 1983* aims to provide for land rights for Aboriginal persons in NSW. The purposes of the ALR Act are set out in section 3, namely:

- To provide land rights for Aboriginal persons in New South Wales.
- To provide for representative Aboriginal Land Councils in New South Wales.
- To vest land in those Councils.
- To provide for the acquisition of land, and the management of land and other assets and investments, by or for those Councils and the allocation of funds to and by those Councils
- To provide for the provision of community benefit schemes by or on behalf of those Councils.

The ALR Act was principally established to return land in NSW to Aboriginal peoples through a process of lodging claims for certain Crown lands. A successful determination of a land claim delivers freehold title to land which includes rights to certain minerals in the freehold land. This freehold can be dealt with via sale, lease, etc and the owner of the freehold land (the Aboriginal Land Council) has the same rights as other freehold owners, subject to compliance with the ALR Act; however, the powers of an acquiring authority to compulsorily acquire the land do not apply. Aboriginal Land Councils may also negotiate Aboriginal Land Agreements which may deal with a range of matters, including land swaps, joint management of land and compensation.

The Proposal would traverse a number of land parcels which may be subject to undetermined ALCs (refer to Section 1.4). Works proposed within ALCs areas would require approval to be obtained from the LALCs or agreement to excise the affected areas from the ALCs (refer to Sections 1.4 and 2.5)

2.2.11. Roads Act 1993

Section 138 of the *Roads Act* 1993 states that a person must not erect a structure or carry out a work in, on or over a public road, unless the appropriate roads authority has given consent.

The Proposal would traverse local roads and road reserves for which GHC is the relevant roads authority. Schedule 2, clause 5(1) of the *Roads Act* 1993 states that a public authority does not need to obtain road's authority consent under Section 138 to exercise the public authority's functions in, on or over an unclassified road other than Crown Road. Therefore, a consent under Section 138 of the *Roads Act* is not required for the Proposal for those works occurring on local roads.

Parts of the Proposal would traverse Hume Highway/ Hume Highway Road reserve (i.e. culverts proposed along Albury Street will extend underneath Hume Highway) for which Transport for NSW (TfNSW) is the appropriate roads authority. Section 138 of the *Roads Act* 1993 states that a person must not erect a structure or carry out a work in, on or over a public road, unless the appropriate roads authority has given consent. Accordingly, approval from TfNSW is required for the Proposal. Consultation with TfNSW confirmed that an approval under Section 138 of the Roads Act is required (refer to Section 2.5).

2.2.12. Rural Fires Act 1997

Parts of the Proposal area would traverse land identified as bushfire prone land (Vegetation Category 1 and Vegetation Buffer) as identified on the Bushfire Prone Land Map, certified by the NSW Rural Fire Service (NSW RFS) (see Appendix G).

Section 100B of the *Rural Fires Act* 1997 requires RFS approval for development on bush fire prone land for a special fire protection purpose. The Proposal is not categorised as a special fire protection purpose; therefore, an approval from the NSW RFS is not required for the Proposal.

2.2.13. Biosecurity Act 2015

The *Biosecurity Act 2015* repeals the *Noxious Weeds Act 1993*, which previously provided regulatory controls and powers to manage noxious weeds in NSW. The *Biosecurity Act* 2015 guides the management of weeds at the regional level throughout NSW. Under the Act, all plants are regulated with a general biosecurity duty to prevent, eliminate or minimise any biosecurity risk they may pose. Any person who deals with any plant who knows or ought to know of any biosecurity risk, has a duty to ensure the risk is prevented, eliminated or minimised, so far as is reasonably practicable. Individual land holders and managers are required under the Act to control priority weeds for their area according to the relevant biosecurity toolset.

No priority weed species were identified within the works areas (refer to Section 5.9).

2.3. Commonwealth legislation

2.3.1. Environment Protection and Biodiversity Conservation Act 1999

The *Commonwealth Environment Protection and Biodiversity Conservation Act* 1999 (EPBC Act) provides for Commonwealth involvement in development assessment and approval in circumstances where there exist ‘matters of national environmental significance’. Matters of national environmental significance include:

- World heritage properties.
- National heritage places.

- Wetlands of international importance.
- Nationally threatened species and ecological communities.
- Migratory species.
- Commonwealth marine areas.
- The Great Barrier Reef Marine Park.
- Nuclear actions (including uranium mining); and
- A water resource, in relation to coal seam gas development and large coal mining development.

A specialist biodiversity impact assessment (SIA, 2024) undertaken for the Proposal indicated that the Proposal would not have a significant impact on threatened flora and fauna species, habitats and ecological communities listed under the EPBC Act (see Section 5.9 and Appendix C). Therefore, a referral/ approval under the EPBC Act would not be required for the Proposal

2.3.2. Native Title Act 1993

The *Native Title Act* 1993 sets up processes to determine where native title exists, how future activities impacting upon native title may be undertaken, and to provide compensation where native title is impaired or extinguished. The Act gives Indigenous Australians who hold native title rights and interests or who have made a native title claim, the right to be consulted and, in some cases, to participate in decisions about activities proposed to be undertaken on the land.

A desktop survey showed that there are no native title determinations applicable to the Proposal area.

2.4. Other Relevant Policies and Guidelines

The following policies and guidelines are of relevance to the Proposal:

Relevant Guidelines

2.4.1. NSW Guidelines for Controlled Activities on Waterfront Land

DCCEEW - Water has developed guidelines for controlled activities listed under the WM Act. Although the Proposal is exempt from the need to obtain a controlled activity approval under the WM Act (see Section 2.2.8), consideration has been given to these guidelines as relevant to the works.

The *Natural Resources Access Regulator Act 2017* commenced partly in December 2017 and partly in April 2018. It establishes a body corporate known as the Natural Resources Access Regulator to ensure effective, efficient, transparent and accountable compliance and enforcement measures for the natural resources management legislation. Their responsibilities include preparing policies, procedures and strategies for natural resource legislation (including the WM Act. They have updated the guideline for controlled activities on waterfront land in riparian corridors. The below guidelines are considered be applicable to the Proposal:

- *Guidelines for Controlled Activities on Waterfront Land - riparian corridors* (DoI – Natural Resources Access Regulator, 2018).

2.4.2. NSW Government's Flood Prone Land Policy

The primary objective of the *NSW Government's Flood Prone Land Policy* is to reduce the impact of flooding and flood liability on individual owners and occupiers of flood prone property, and to reduce private and public losses resulting from floods, utilising ecologically positive methods wherever possible.

The Floodplain Development Manual: the management of flood liable land (NSW Government 2005) (the Manual) is provided to assist councils to meet their obligations through the preparation of floodplain risk management plans. The Manual also documents the process for plan preparation, implementation and review. It is considered that the proposed Aberdeen levee upgrade works are consistent with this policy and manual.

GHC has adopted the Holbrook Floodplain Risk Management Plans (WMA water, 2017), which recommended the construction of new levee banks, within the southern portion of the Holbrook township along Ten Mile Creek.

The proposed levee will provide protection to the southern part of Holbrook township in a 1% Annual Exceedance Probability (AEP) flood event.

2.5. Summary of Approvals

The approvals required to undertake the Proposal are listed in **Table 2-2**.

Table 2-2: Required Approvals

Approval Authority/Entity	Approval/ Licence/ Permit	Reference
GHC	Determination of the Proposal	Part 5 of the EP&A Act
DPHI-Crown Lands	Compulsory acquisition of crown land	Land Acquisition (Just Terms Compensation) Act 1991
DCCEEW -Water	Aquifer Interference Licence (if more than 3ML of groundwater is likely to be extracted per annum during construction works) (highly unlikely)	Section 91 of WM Act
DPIRD- Fisheries	Dredging and Reclamation permit for undertaking works within the banks of a Key Fish Habitat (i.e., Ten Mile Creek)	Part 7 of the FM Act
TfNSW	Concurrence/approval to undertake works in Hume Highway	Section 138 of the Roads Act
NSW ALC and LALC	Consultation and consent to the use and potential reservation of the Crown Land parcels that may be subject to registered Aboriginal Land Claims. OR Agreement to excise the affected areas from the ALCs. (Lot 2, Section 42, DP 758522, Lot 1 DP 909093 and Lot 7303, DP 1155827)	NSW ALR Act 1983
Private Landowners	Acquisition of easements on privately owned lands	Land Acquisition (Just Terms

		Compensation) Act 1991

2.6. Consultation

2.6.1. Statutory Consultation

Chapter 2- Part 2, Division 1 of the SEPP (Transport and Infrastructure) specifies consultation requirements for development permitted without consent under the SEPP, including consultation with Council and other public authorities. In accordance with Sections 2.10, 2.11, 2.12 and 2.14, consultation is required with Councils where the development will have specified impacts upon council-related infrastructure or services, locally listed heritage items, flood liable land or on certain land within the coastal zone. As GHC is the proponent of the activity, consultation under these sections is not required as per Section 2.17(1)(b) of the SEPP.

Consultation with State Emergency Service (SES) is required in accordance with Section 2.13 if the development can be carried out without development consent under a relevant provision of the SEPP. The proposed development is not listed under those relevant provisions and therefore it is considered that GHC is not required to give written notice of the intention to carry out the Proposal to the SES.

2.6.2. Non-Statutory Consultation

Relevant government agencies were consulted during the preparation of the REF. A list of those agencies contacted, and a summary of their response is provided in Table 2-3 below. Copies of the responses received are contained in Appendix F.

2.6.3. Community Consultation

GHC will undertake consultation with the affected community regarding the Proposal. Concurrence/approval and easements from private property owners will be obtained prior to the commencement of construction works.

Table 2-3 Agency Consultation

Agency	Agency comment summary	How addressed
DPHI- Crown Land 1 May 2023	DPHI- Crown Land advised that Crown Land reserves are contained within the Holbrook Flood Mitigation Works footprint, the identified land parcels are: • Lot 1, Section 42, DP 758522 • Lot 7016, DP 1025874 • Lot 1, DP 909093 • Lot 7303, DP 1155827 If the proposed Holbrook Flood Mitigation works are to be implemented on any parcels of Crown land, they will need to be acquired under the Land Acquisition (Just Terms Compensation) Act 1991 (LAJTC Act). Further information regarding Crown land and the LATJC Act is located at the following link: https://www.industry.nsw.gov.au/lands/access/compulsory-acquisition. Additionally, the proposed levee should incorporate design features to ensure people with disabilities or restricted mobility are not excluded from using parcels of Crown land such as the Botanical Gardens and the Recreation Grounds.	Noted. Refer to Sections 1.4, 2.2.9, 2.5 and 5.3. The levee would not restrict access to people with disability.

<table>
<tr><th>Agency</th><th>Agency comment summary</th><th>How addressed</th></tr>
<tr><td>DPHI- Crown Land

17 May 2023</td><td>DPHI- Crown Land advised that a licence under Section 5.2.1 authorises the use or occupation of Crown Land. However, as GHS is the Crown Land Manager for the land parcels discussed they already have occupancy of the land.

When Local Government Agencies are proposing to undertake works to implement public infrastructure on Crown land, the Compulsory Acquisition process is the identified process.

Compulsory Acquisition of Crown land may be an extensive process, but it does not necessarily mean a delay of works.</td><td>Noted. See above.</td></tr>
<tr><td>DPIRD- Fisheries</td><td>The aquatic ecological environmental assessment should be as per Policy and Guidelines for Fish Habitat Conservation and Management (Update 2013) and include the following information.

Waterways that may be affected either directly or indirectly by the development or activity should be clearly identified.

• Description of aquatic and riparian vegetation should be presented and mapped.

• The extent of aquatic habitat removal or modification which may result from the proposed development,</td><td>Noted.

Refer to Sections 5.4, 5.9, 5.14 and 6.</td></tr>
</table>

Agency	Agency comment summary	How addressed
	• Details of the location of all waterway crossings, including any access tracks, timetable for construction of the proposal with details of various phases of construction • Details of the methodology (for example directional drilling, trenching, boring) for any works within or adjacent to waterways. • Aspects of the management of the proposal, both during construction and after completion, that relate to impact minimisation e.g. Environment Management Plans. • A description of how the site will be rehabilitated post-construction including site stabilisation, native vegetation planting and any proposed post works habitat enhancement.	
	Waterway crossings Construction of waterway crossings should be in accordance with section 4.2 – 4.5 of the *DPI Fisheries Policy & Guideline document: Policy and Guidelines for Fish Habitat Conservation and Management (Update 2013).*	There are no waterway crossing associated with the Proposal.
	Riparian buffer zones	

Agency	Agency comment summary	How addressed
	The “degradation of native riparian vegetation” has been listed as a Key Threatening Process under the provisions of the FM Act 1994. DPI Fisheries policy advocates the use of terrestrial buffer zones as per the *Policy and Guidelines for Fish Habitat Conservation and Management (Update 2013)* in order to maintain the riparian buffer zone and limit disturbance and susceptibility to bed or bank erosion. The proposal should include a threatened aquatic species assessment (as per part 7A FM Act 1994) to address whether there are likely to be any significant impacts on listed threatened species, populations or ecological communities listed under the Act. It should be noted that Ten Mile Creek is habitat for Southern Pygmy Perch, Murray Crayfish, and the Lower Murray River Aquatic Ecological Community which are listed under provisions of the Act.	The Proposal would not significantly impact Riparian buffer zones (refer to Section 5.9).
Follow- up consultation June 2024	As some of the works are within the banks of the Ten Mile Creek, which is considered TYPE 1 CLASS 1 Key Fish Habitat, due to the presence of Southern Pygmy Perch; therefore, Council will require a permit under the *Fisheries Management Act*.	Noted (refer to Section 2.2.7 and 2.5)
TfNSW	**Proximity to the Hume Highway**	Noted. GHC was provided with TfNSW enquiry.

Agency	Agency comment summary	How addressed
	Regarding the proximity of the levee to the Hume Highway, have flood impact assessments been conducted that confirm the installation of the levees shown on AWE200028-WE-3050 (close to the Hume Highway) does not increase the risk of water flowing over or ponding on the Highway? TfNSW would like to review these assessments. **Approval under the Act** TfNSW would be required to provide approval (concurrence) under Section 138 of *Roads Act* 1993 No 33 for works that occur on classified roads. In this instance, it is proposed that five box culverts are placed on Albury Street, which is MR211, a classified regional road. **Adverse impacts in the event of natural disasters** TfNSW proposes the REF should consider impacts as a result of the construction of the levees such that resident's homes, access and evacuation routes, and any other essential elements of the transport network are not adversely impacted in the event of natural disasters such as storms, heavy rainfall and flooding.	GHC will follow up TfNSW enquiry and provide relevant information. Noted. Refer to Sections 2.2.11 and 2.5. Noted. Refer to Sections 5.5, 5.6 and 5.16.
DCCEEW - Water	Flood Work Approvals	Noted.

Agency	Agency comment summary	How addressed
	Flood Works Approvals are required for works located within the vicinity of a water course or water body, which are likely to have an effect on the flow of water to or from that water course or water body, or an effect on the distribution of floodwater. Exemptions from the requirement to hold a flood work approval are provided in Clause 47 (2) of the Water Management Regulation (General) 2018. Where exemptions are not applicable applications for Flood Work Approvals should be made to the department. Should a Flood Work Approval be required, more information including how to apply can be found: https://water.dpie.nsw.gov.au/our-work/licensing-and-trade/flood-works-approvals	As the works are being undertaken by a Local Council within a managed high risk flood area, a flood work approval is therefore not required as per Clause 41C(1) of the *Water Management (General) Regulation* 2018 (refer to Section 2.2.8).
	<u>Works on Waterfront Land</u> Controlled Activity Approvals are required for works on waterfront land unless an exemption applies. The Water Management Regulation (General) 2018 (clause 38) provides a Controlled Activity Approvals exemption where works are to be undertaken by a public authority, which will apply in the case as NSW Public Works will be responsible for undertaking construction works. Despite this exemption, works undertaken on	Noted. Refer to Sections 2.2.8 and 2.4.1.

Agency	Agency comment summary	How addressed
	waterfront land must still give consideration to the requirements outlined in the Guidelines for Controlled Activities. In this case proposed culverts and stormwater outlets must be designed and constructed in accordance with the Guidelines for Controlled Activities on Waterfront Land. The Guideline for Controlled Activities on Waterfront Land can be found: https://water.dpie.nsw.gov.au/our-work/licensing-and-trade/controlled-activity- Water take and works approvals As there is a possibility of intercepting groundwater during excavation, the volume should be quantified to maximum potential take per year. A water supply work approval may be required for temporary dewatering and a water access licence may be required to account for this take unless an exemption applies. Site water demands do not appear to be quantified or sources identified. An adequate and secure water supply should be identified for the project. Should this require new or amended water supply works approvals or additional Water Access License the department should be contacted and relevant approvals obtained prior to take or construction occurring.	When groundwater is encountered and dewatering is required during construction works, additional consultation should be undertaken by GHC with the DCCEEW– Water to confirm whether an aquifer interference approval is required for these works. Noted. If a new or amended water supply or access is required for the works, water works approvals or additional Water Access License should be obtained from the DCCEEW-Water prior to the

Agency	Agency comment summary	How addressed
	More information including how to apply for water supply works approvals or Water Access Licences can be found: https://water.dpie.nsw.gov.au/our-work/licensing-and-trade/water-access-licences-and-approvals The department recommends consultation with Crown Lands as the proposed development appears to be partially within Crown Land.	commencement of construction works. Consultation with Crown Lands has been undertaken.
DCCEEW – Biodiversity Conservation and Science- Heritage and Environment EPA	No response received	-

3. Need for the Proposal and Option Evaluation

3.1. Need for The Proposal

This Section provides a summary of the need for the Proposal and Options evaluation as provided in the Preliminary Environmental and Planning Overview- Holbrook Flood Mitigation Works prepared by in Cardno, 2019.

The floods that occurred in October 2010 are believed to be the highest Ten Mile Creek floods since at least December 1887, with multiple houses along the creek flooded over floor level with two homes, built at least 120 years ago, being flooded for the first time (WMA, 2017). During this flood event, waters covered the majority of the land to the south of the Creek and flowed over Albury Street before re-joining the creek to the west of the town (WMA, 2017).

Following the 2010 and 2012 flood events, GHC has adopted the Holbrook Floodplain Risk Management Plans (WMA water, 2017), which recommended the construction of new levee banks, within the southern portion of the Holbrook township along Ten Mile Creek.

Therefore, the Proposal is required to mitigate flooding risks in Holbrook township. The proposed levee would provide protection to the southern portion of the town from inundation due to the 1% AEP flood event of the Ten Mile Creek. The Proposal will consequently minimise environmental, social and cultural impacts associated with flooding events.

3.2. Option Evaluation

3.2.1. Option A: Do Nothing

The do nothing' option does not meet the Proposal objectives and would not achieve the flood mitigation design height to provide a 1% AEP flood level protection for the township of Holbrook. Therefore, this option was considered unacceptable and would not address the flood risk of the town.

3.2.2. Option B: Construction of Levee Banks at the Southern Portion of Holbrook

This option includes the construction of four levee banks in the southern portion of Holbrook township, which are:

- Holbrook 1 levee- which will run parallel to Hay Street to protect the Holbrook Southern Floodplain from Ten Mile Creek flooding, eliminating property flood affection. A key feature of the implementation of this levee is that residents are able to evacuate during a Ten Mile Creek flood event, either via the Holbrook Bypass on-ramp or via the Albury Street Bridge.

- Holbrook 2 levee- which will run parallel to MacInnes Street (within the existing paddock).
- Holbrook 3 levee- which will run to the south and southwest of those properties located at Albury Street (adjacent to Hume Highway); and
- Holbrook 4 levee- which will run parallel to those properties located to the south of Young Street near Albury Street intersection.

It is noted that only two levee bank sections were proposed by GHC in 2019; however, two additional levee bank sections were investigated by GHC during the development of the concept design.

3.2.3. Preferred Option

The preferred option is Option B as it will achieve the objective of the Proposal.

4. The Proposal

4.1. Scope of Works

The Proposal involves the following works:

- The construction of three new levee banks within the southern portion of the Holbrook township (approximately 2,272m long). The height of the levees will vary along the various sections (up to 2.4 m). Those new levee banks are:
  - Holbrook Levee 1: on the north side of Hay Street, Nolan Street and the Holbrook Football Ground and south of Ten Mile Creek,
  - Holbrook Levee 2: South of MacInnes Street and west of Ten Mile Creek at the extent of residential properties along the eastern extent of Bardwell Street and MacInnes Street,
  - Holbrook Levee 3: south of the Holbrook Motor Village and businesses, west of Albury Street and east of Hume Highway off-ramp, and
- The installation of six new culverts to transfer floodwaters downstream of Albury Street.
- The removal of a stockpile near the Holbrook bypass off-ramp for use in levee construction.
- The establishment of the borrow pit to gain suitable fill material to utilise in the construction of the levee banks.
- Lowering of a hillside in the south-eastern portion of the southern levee.

Further details about the proposed levee are provided in Table 4-1 below. Concept design plans are provided in Figure 4-1 to Figure 4-12 and a full set of plans is provided in Appendix H.

Table 4-1 Holbrook Levee Details

Levee	Properties /Lot numbers	Levee Details
Holbrook 1	Lot 1 DP909093, Lot 7303 DP1155827, Road reserve of Hay- Nolan Street Lot 2 Section 42 DP758522,	Holbrook 1 (Part 1&2) levee from chainage (CH) 0.0 to CH 288.349 Holbrook 1 (Part 3) levee from CH 0.0 to Ch 293.324 Earthen levee with 1:3 batter slopes, 2 m bench and 3 m base with clay core. Works in this section involve:

Levee	Properties /Lot numbers	Levee Details
		• Construct levee bank. • Construct levee wall- to be concrete panel flood barrier. • Construct new concrete pathways. • Remove gravel parking area and reinstate with topsoil and grass seeds. • Construct new grated pits over existing pipes. • Construct stairs over flood barrier levee. • Construct new grated catch pit. • Construct gully pit. • Raise a section of Hay Street and tie in with top of levee. • Construct access tracks (informal gravel track). • Construct outfall through proposed levee and install a one-way 'duck bill' valve in the outlet headwall, along with rock scour protection measures. • Install 2.4 m farm gate for access to the levee (Levee 1 part 2). • Install 3.6 m farm gate for access to the levee (Levee 1 part 3 near Nolan Street). • Install 4.2 m farm gate for access to the levee (Levee 1 part 3 north of Bradwell Street). • Other associated works tree removal, removal of fences and removal of gates, relocation of signposts and light poles etc and installation of new wire fence,

Levee	Properties /Lot numbers	Levee Details
		park benches, new pedestrian ramps and pavements. Refer to Drawing 300203886-WE-3061 to 300203886-WE-3063 in Appendix H.
Holbrook 2	Lot 10 DP753340 Bradwell Street Road Reserve Lot 7 DP4512 Lot 8 DP4512 MacInnes Street Road reserve Lot 9 Section D DP5364, Lot 10 Section D DP5364, Lot 5 DP1156130, Lot 6 DP1156130, Albury Street and Bethana Lane road reserves	Holbrook 2 levee from chainage (CH) 0.0 to CH 1376.777 Earthen levee with 1:3 batter slopes, 2m bench and 3m base with clay core. Works would involve: • Construct levee bank. • Construct levee wall- to be concrete panel flood barrier that extends 5m into clay core of earthen levee. • Install rock scour protection over proposed batter. • Construct access over levee with private access gates (2.4 m, 4.2m and 4.8m) to farms. • Install Swale drains. • Install new fencing and posts. • Provide access over levee (ramp/crossing). • Tie levee into existing Albury Road embankment. • Other associated works (i.e. tree removal, removal of existing fencing, bollards, posts and concrete paths demolition). Refer to Drawing 300203886-WE-3065 to 300203886-WE-3067 and 300203886-WE-30151 to 300203886-WE-3153 in Appendix H.

Levee	Properties /Lot numbers	Levee Details
Holbrook 3	Albury Street and Bethana Lane road reserve Lot 7 DP1156130, Lot 8 DP1156130, Lot 9 DP1156130, Lot 17 DP1156130, Lot 18 DP1156130 Lot 19 DP1156130 Lot 1 DP1198264	Holbrook 3 levee from chainage (CH) 0.0 to CH 313.637. Earthen levee with 1:3 batter slopes, 2m bench and 3m base with clay core. Works would involve: • Construct levee bank. • Construct levee wall- to be concrete panel flood barrier that extends 5m into clay core of earthen levee. • Install rock scour protection over proposed batter. • Install swale drains. • Install new fencing and posts. • Install 2m granite gravel access track to informal gravel track. • Other associated works (i.e. tree removal, removal of existing fencing, bollards and posts). Culvert and drainage work: • Lower hillside and install rock beaching in the south-western portion of the Holbrook levee 3 across Albury Road and southwestern portion of Holbrook levee 2 to allow flood migration. • Reinstate existing barrier and channel in accordance with TfNSW requirements. • Divert swale drain to new levee swale drain. • Lower existing service road. • Construct six new culverts along Albury Road, culverts to extend underneath Hume Highway.

Levee	Properties /Lot numbers	Levee Details
		• Reinstate existing guardrails, road posts and signs. Refer to Drawing 300203886-WE-3064, 300203886-WE-3150, 300203886-WE-3200 and 300203886-WE-3500 in Appendix H.
Earthwork - cut area	Lot 5 & 6 DP1156130 60 MacInnes Street, Holbrook	Works would involve the following: • Level hillside to improve flood conveyance. • Undertake cut and fill earthworks as specified on drawing 300203886-WE-3550 (refer to appendix H).

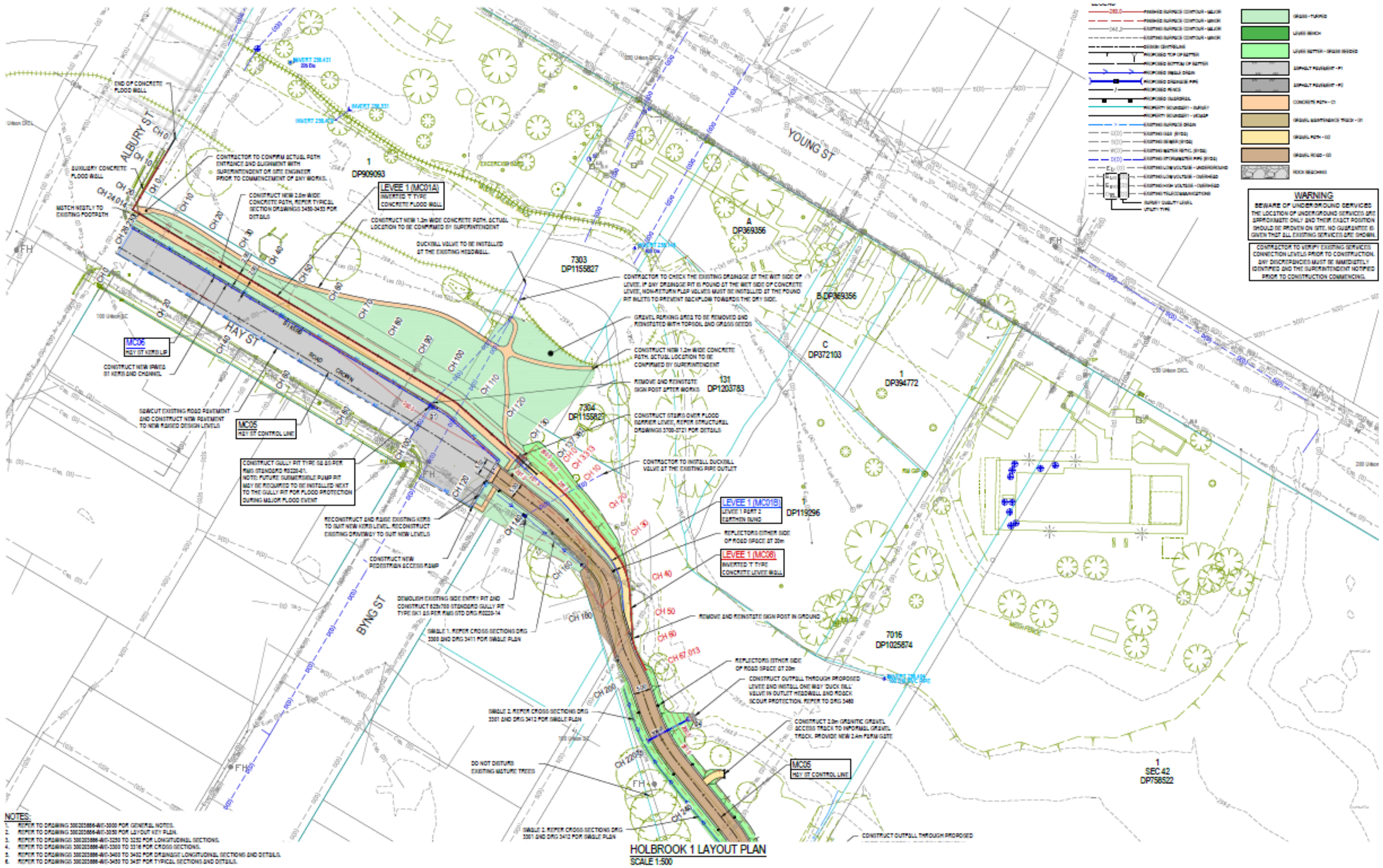


Figure 4-1 Holbrook Levee 1 Site Layout Plan (1)

Source: GHC, Stantec Australia, April 2024

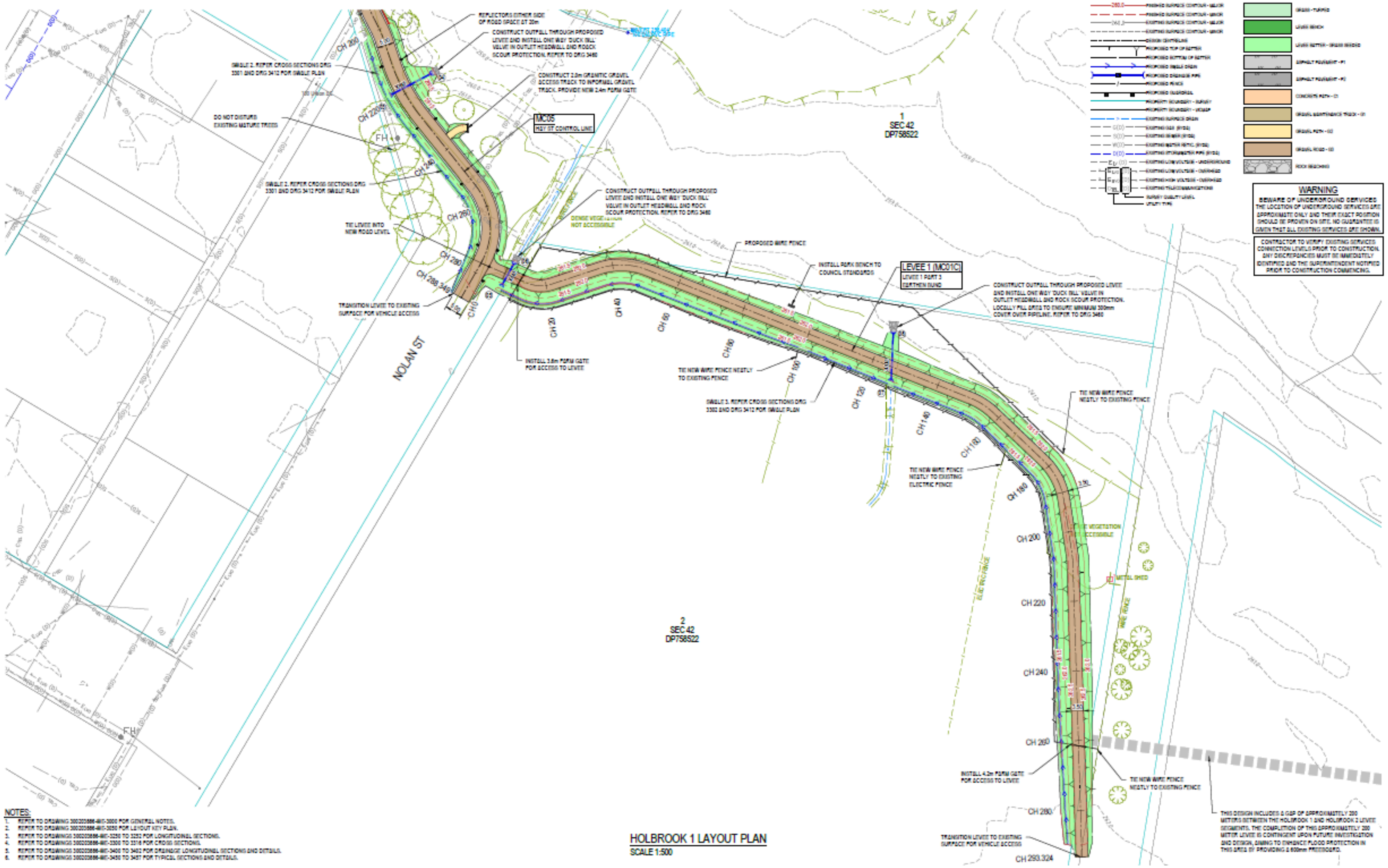


Figure 4-2 Holbrook Levee 1 Site Layout Plan (2)

Source: GHC, Stantec Australia, April 2024

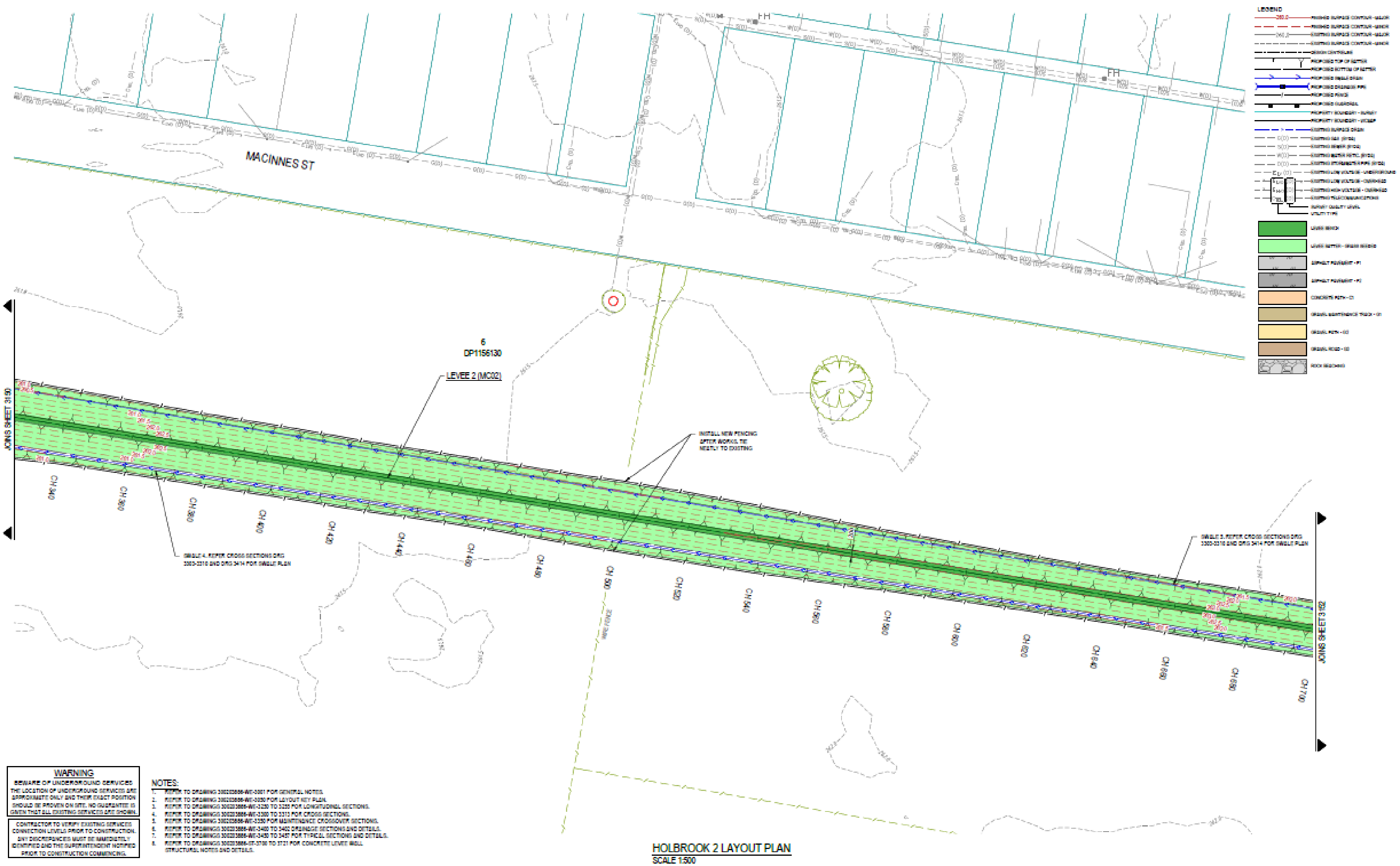


Figure 4-3 Holbrook Levee 2 Site Layout Plan – Section south of MacInnes Street

Source: GHC, Stantec Australia, April 2024

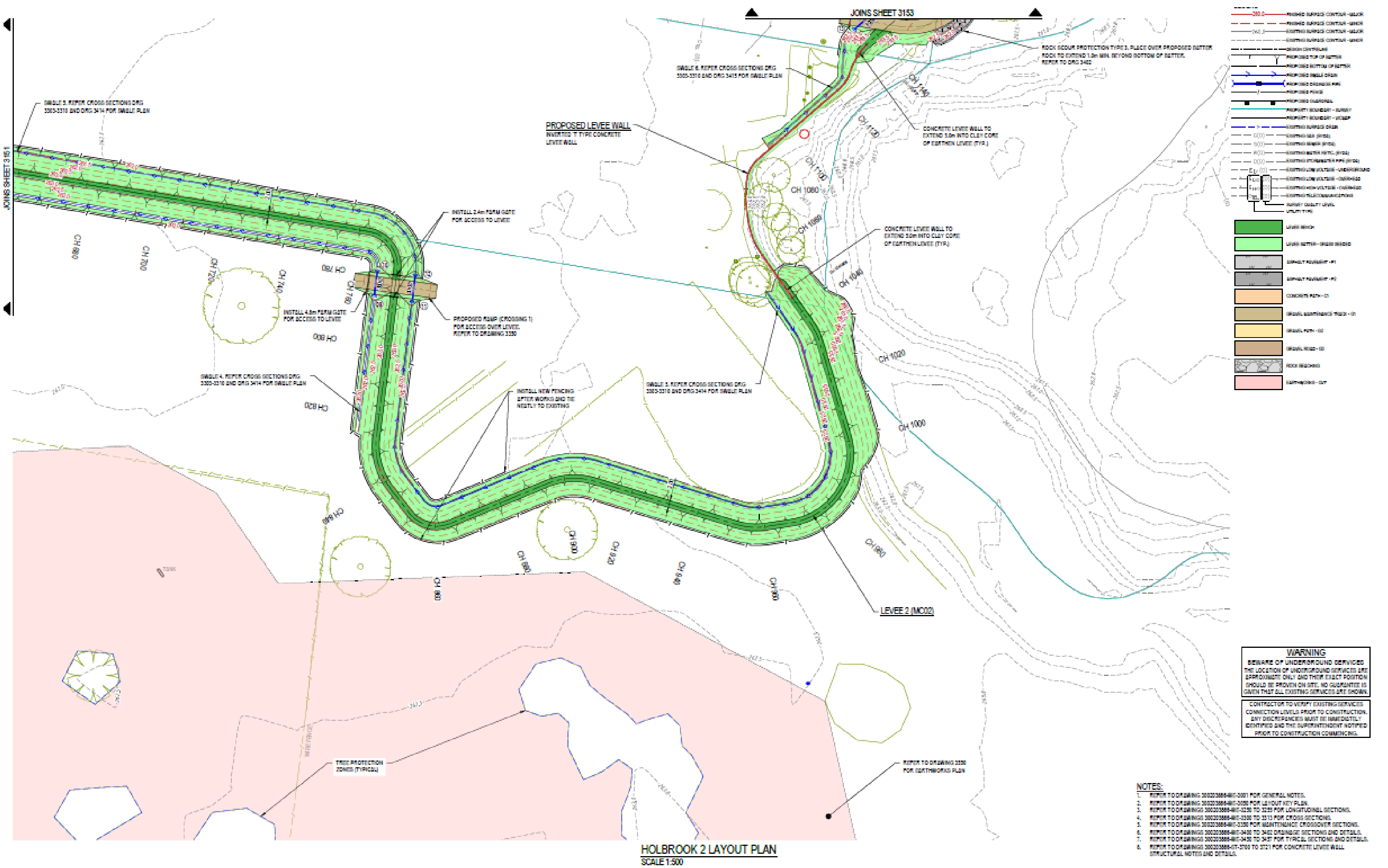


Figure 4-4 Holbrook Levee 2 Site Layout Plan - Section east of MacInnes Street

Source: GHC, Stantec Australia, April 2024

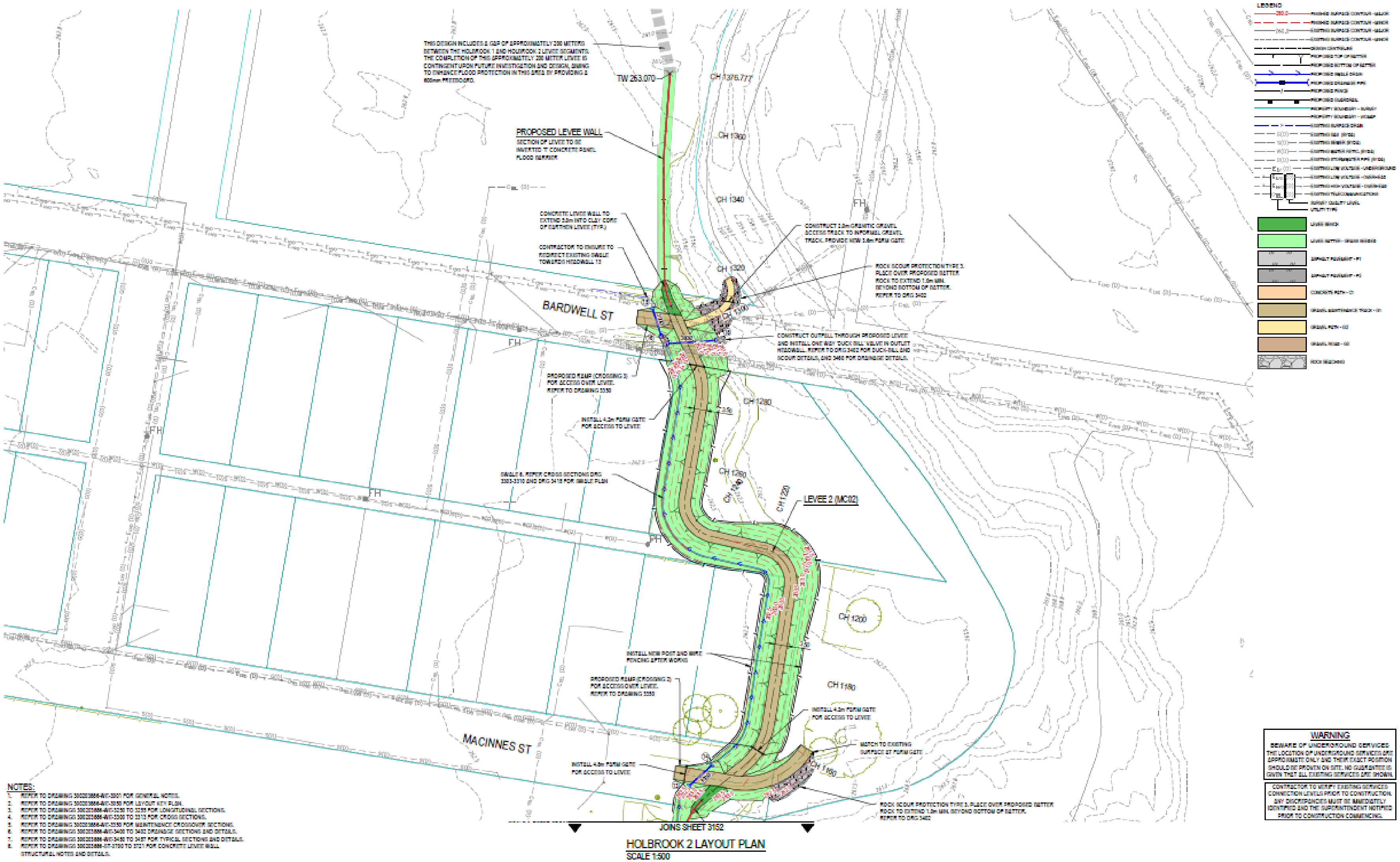


Figure 4-5 Holbrook Levee 2 Site Layout Plan- Section northeast of MacInnes Street

Source: GHC, Stantec Australia, April 2024

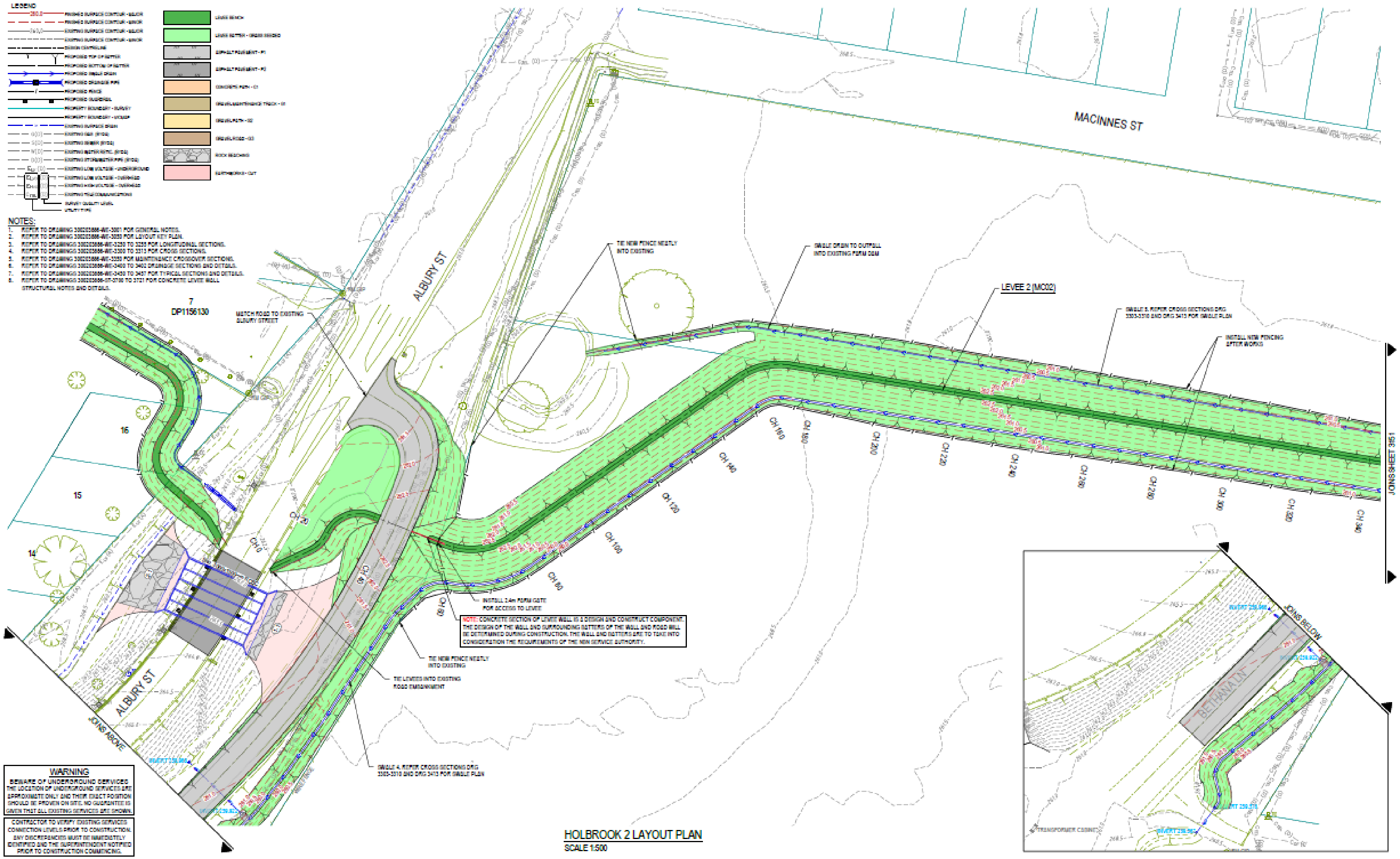


Figure 4-6 Holbrook Levee 2 – East of Albury Street and Section of Holbrook Levee 3

Source: GHC, Stantec Australia, April 2024

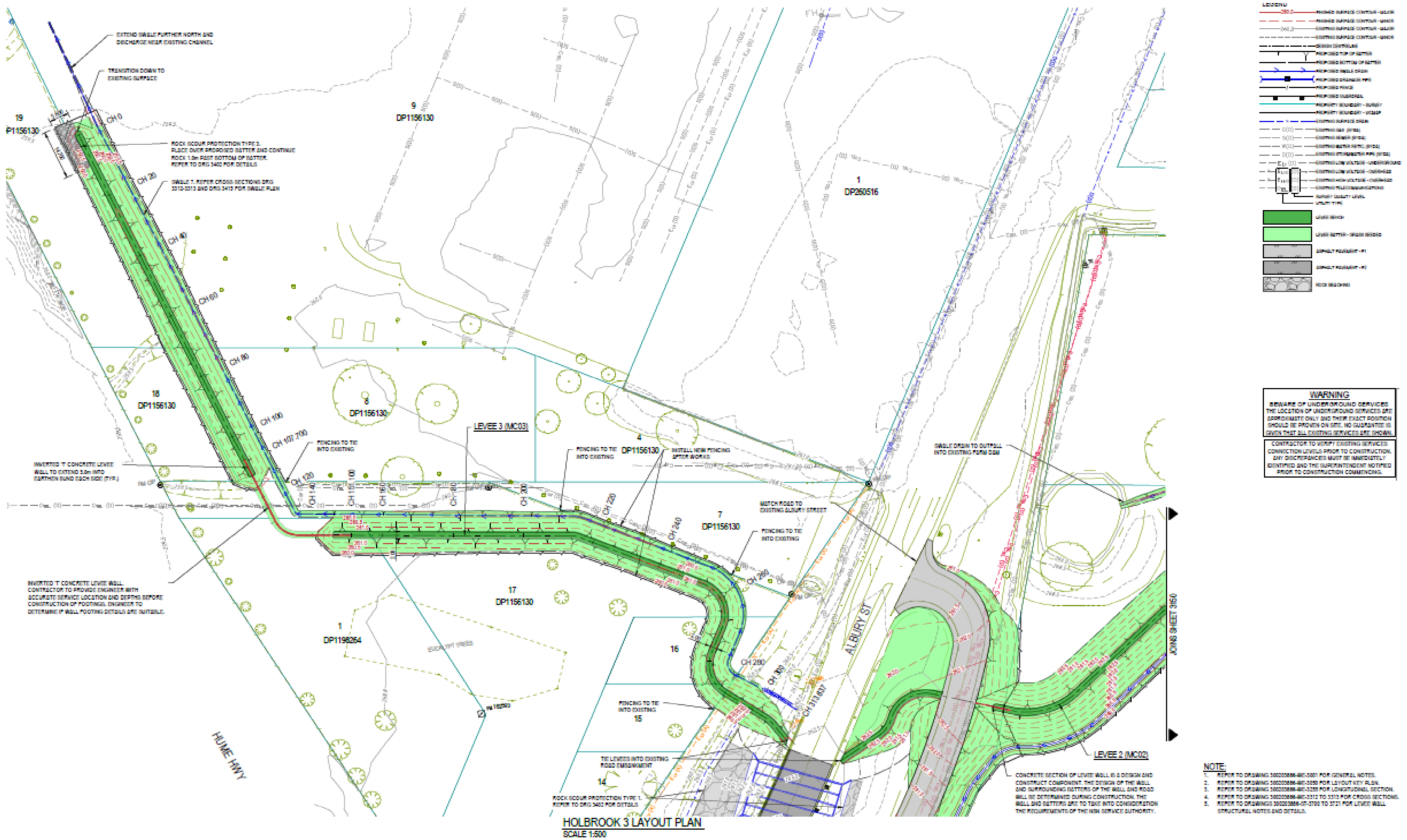
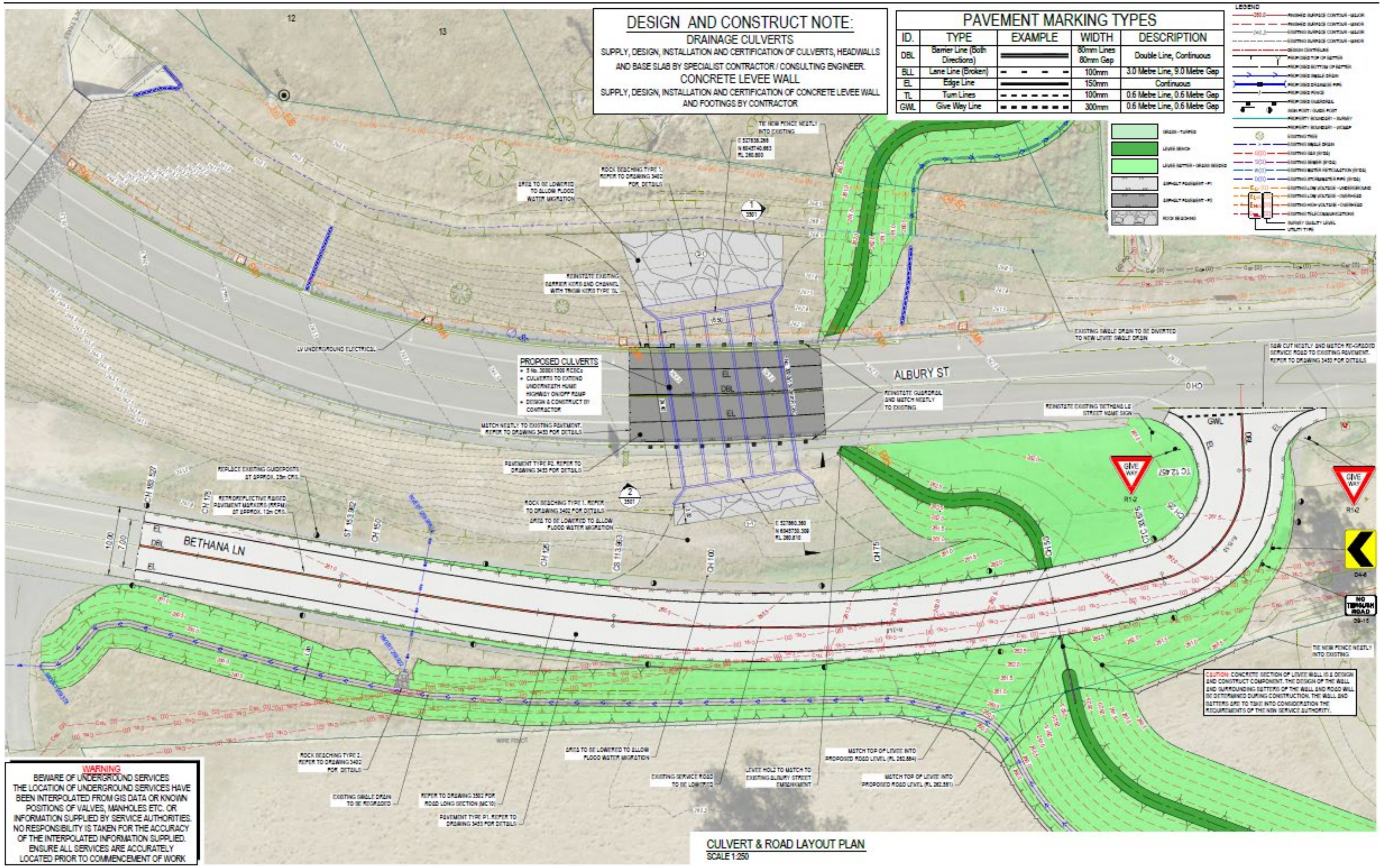


Figure 4-7 Holbrook Levee 3 Site Layout Plan

Source: GHC, Stantec Australia, April 2024



ID.	TYPE	EXAMPLE	WIDTH	DESCRIPTION
DBL	Barrier Line (Both Directions)		80mm Lines 80mm Gap	Double Line, Continuous
BLL	Lane Line (Broken)		100mm	3.0 Metre Line, 9.0 Metre Gap
EL	Edge Line		150mm	Continuous
TL	Turn Lines		100mm	0.6 Metre Line, 0.6 Metre Gap
GWL	Give Way Line		300mm	0.6 Metre Line, 0.6 Metre Gap

Figure 4-8 Culvert and Road Works Site Layout Plan

Source: GHC, Stantec Australia, April 2024

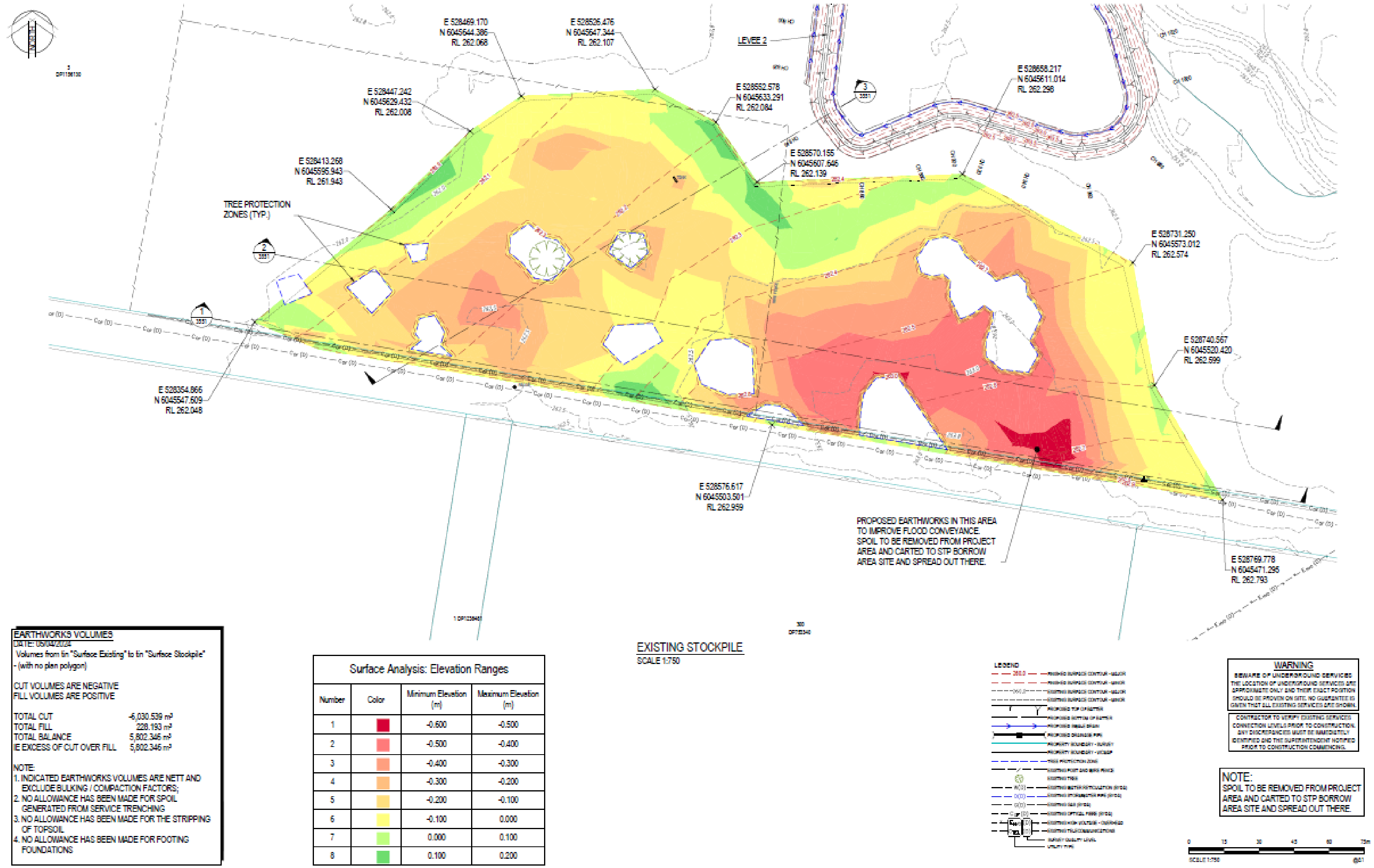


Figure 4-9 Earthworks Plan

Source: GHC, Stantec Australia, April 2024

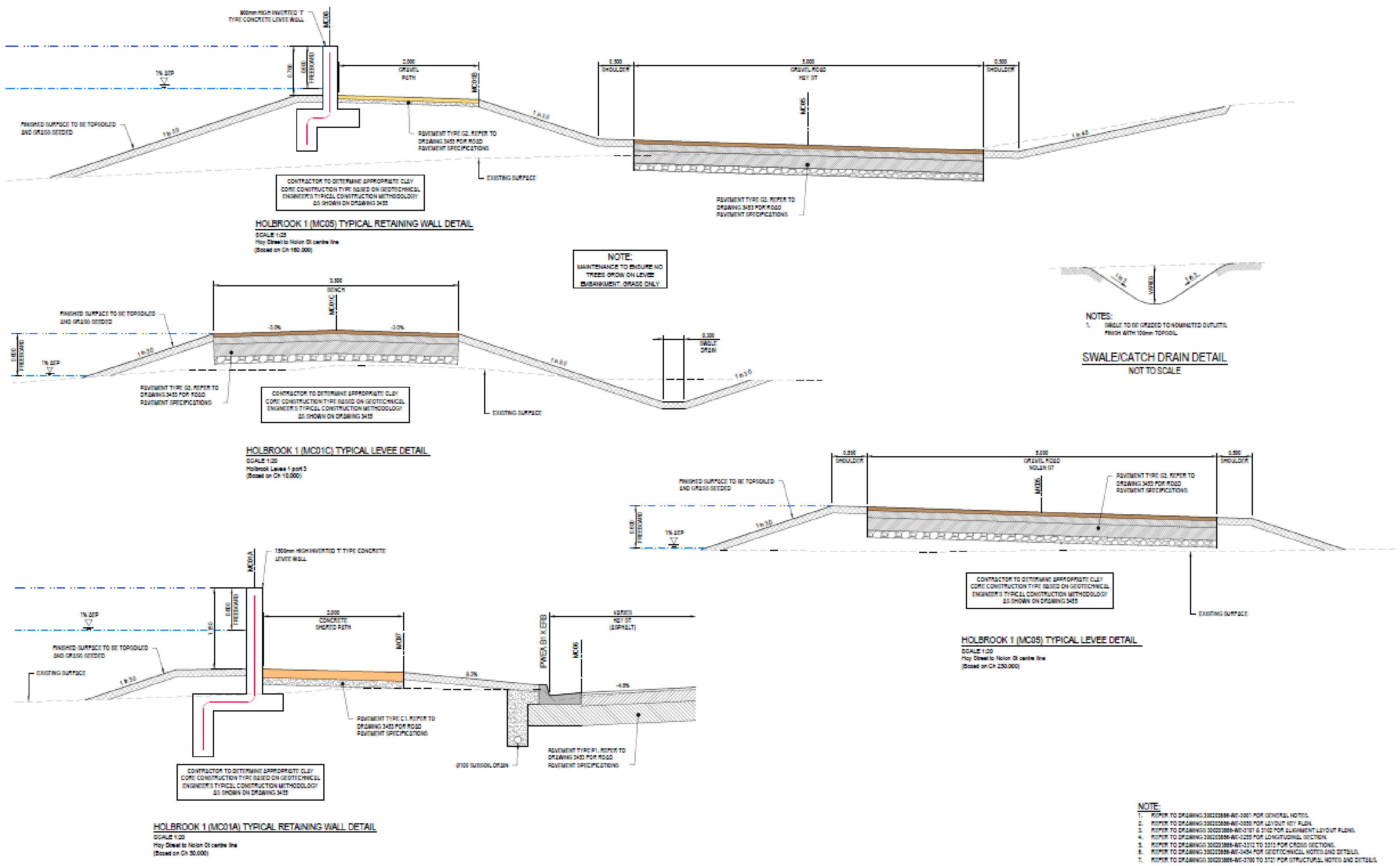


Figure 4-10 Holbrook Levee 1 Typical Section Plan

Source: Source: GHC, Stantec Australia, April 2024

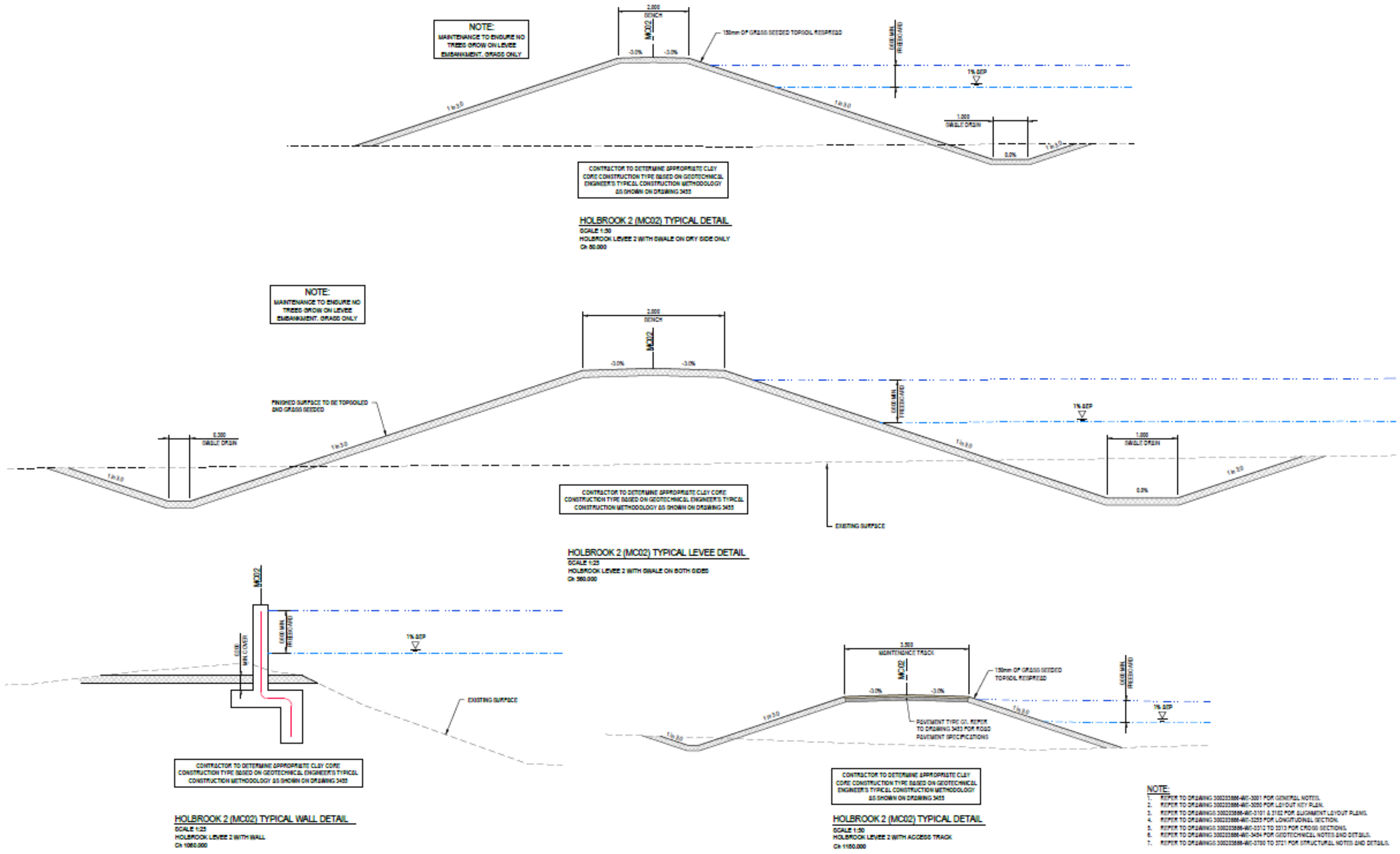


Figure 4-11 Holbrook Levee 2 Typical Section Plan

Source: GHC, Stantec Australia, April 2024

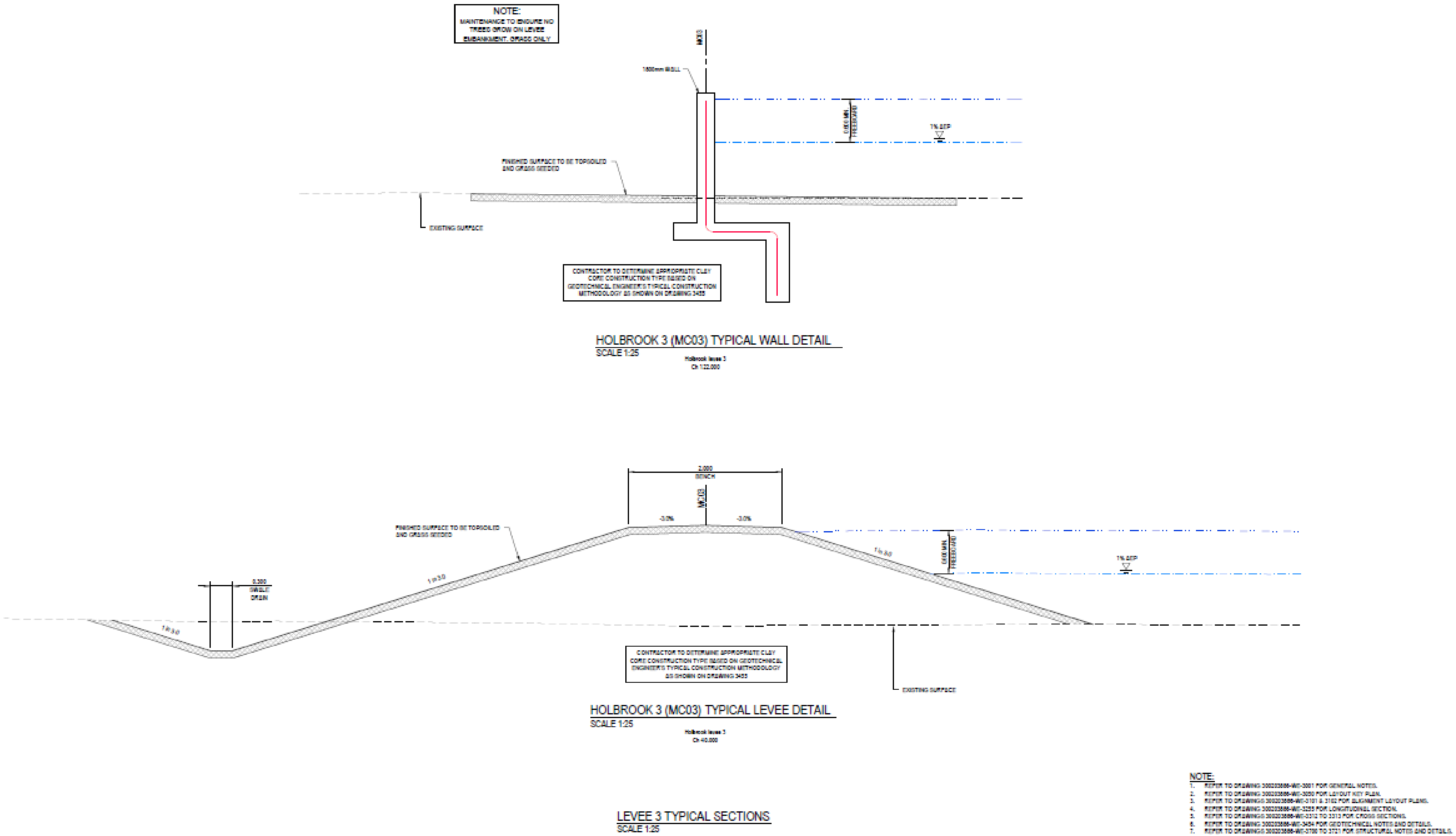


Figure 4-12 Holbrook Levee 3 Typical Section Plan

Source: GHC, Stantec Australia, April 2024

4.2. Construction Methodology

It is anticipated that the proposed works would be undertaken in stages over a 40-week period. The length of each segment and duration of construction works at each segment are unknown at this stage.

The proposed construction method would depend on a number of factors including the contractor's method, equipment and program. The construction methodology would be confirmed by the contractor and detailed in the Construction Environmental Management Plan (CEMP). However, it is anticipated that the works would include the following construction methodology:

Preliminary - General

- Contractor to determine / confirm the staging of works.
- Develop a CEMP and associated plans including Soil and Water Management Plan, Traffic Management Plan, Flood Contingency Plan.
- Implement community consultation plan as necessary.

Levee Construction Works

Works associated with the construction of the levee are likely to involve:

- The establishment of entry/exit points, erosion and sediment controls, stormwater management controls, temporary protection fencing, etc.
- Clearing and stripping for levee construction. This would involve removal of trees and vegetation as illustrated on the concept design plans.
- Stockpiling of levee materials if necessary.
- Levee preparation works including removal of signposts, light poles and foundation works etc.
- Construction of Holbrook 1, 2, 3 and 4 levee banks and other associated works, including levee walls, retaining walls, grated pits, culverts, leveling of hillsides, gates, fencing etc, as detailed on the design plans, the construction of the levee would involve the following:
  - Establishment of a cut off foundation trench at the outside base of the proposed levee to reduce seepage under the levee.
  - Compaction of foundation.
  - Excavation of fill material (i.e. clay) from borrow pit 1 and 2,
  - Deposition of fill in trench and compaction to 98% or in accordance with relevant Australian Standards.

- Stabilisation of fill in accordance with relevant Australian Standards.
- Deposition of as fill on the levee up to the design crest elevation, compaction (to 98%) and stabilisation.
- Shaping and benching batter slopes as detailed on the design plans.
- Landscaping of the levee.
- Gravel pavement supply, placement and consolidation on levee crest and ramps.

- Establishment of access tracks to the top of the levee (topping the ramps with clay, soil and rolling to consolidate and extending where necessary, and finishing with either gravel and/or bitumen).
- Site clean -up.
- Surface stabilisation, landscaping and fencing etc.

Retaining Walls

The areas of the proposed retaining walls would be excavated in preparation for clay core to safe batter slope inside property boundary in accordance with the recommendations of the Geotechnical Investigation (Cardno, 2020). Compacted clay would be placed 600mm - 1000mm deep in 200mm layers. Bored pier hole sizes would be drilled as required to ensure that holes are clean of loose soil and debris.

Galvanised posts will be casted to the appropriate depth. Footings would be poured up to 100mm below finish cut level and the area between two posts would be carefully excavated to insert the concrete panel.

Borrow Area

A borrow pit area would be established to gain clay material for use in the raising and construction of the levee. Figure 1-3 shows the location of the borrow pit site.

It is proposed to excavate up to 2 m from the borrow pit and retain mature trees.

It is anticipated that the excavation of the borrow pit would yield approximately 5,802 m^3 of clay. Excavation may exceed 2 m in depth. Excavated material from the borrow pit will be minimal and would be used as topsoil to avoid the removal of existing vegetation within the borrow pit.

The excavated material will be then transported to the proposed levee sites. Trucks will transport spoil and deposit it immediately on the levee, and stockpiling along the levee alignment will not be required.

Once the levee is constructed and no further clay material is required, the borrow pit will be rehabilitated and landscaped.

4.2.1. Construction Materials and Truck Movements

The following construction materials mainly impacting the number of truck movements (to and from site) would be required for the levee construction works. These quantities are approximate and would be confirmed by the construction contractor.

Table 4-2 shows the total volume of construction materials required for the levee upgrade works.

Table 4-2 Total Predicted Construction Materials

Work Component	Unit	Quantity
Earthworks		
Borrow Pit	m^3	5,803
Imported material	m^3	45,000

All reshaping material would be generally reused on site and therefore minimal excess fill material is anticipated to result. Truck movements would be confirmed by the construction contractor, however; based on the construction materials considered likely to be required (refer to Table 4-2), the delivery of construction material has been calculated assuming an average of 15 tonne of materials per truck. However, it is assumed that during an eight-hour day, there will be approximately 50 truck movements per day (which would include the return journey) per construction stage (refer to Section 4.3.4).

4.3. Construction Considerations

4.3.1. Construction Environmental Management Plan

The proposed works would be undertaken in accordance with a CEMP prepared by the construction contractor and endorsed by the GHC prior to the commencement of works. The CEMP would incorporate site specific management plans and would reflect the environmental safeguards identified in the REF, additional mitigation measures identified as a result of the contractor's risk assessment and construction methodology and any conditions of the project determination and other licences/approvals.

4.3.2. Construction Site Layout/Compound

The contractor would establish a compound area to accommodate construction facilities for the duration of the construction period. The compound area would be established in a previously cleared area close to the work sites and will accommodate the following facilities.

- Toilets.
- Materials storage area.
- Site Office.
- Fuel storage.
- Stockpiled materials.

4.3.3. Construction Equipment

The following construction equipment is likely to be required to undertake the works:

- Haul truck / dump truck.
- Excavator.
- Dozer.
- Water cart.
- Compactors.
- Vibratory rammer.
- Vibratory roller.
- Grader.
- Front end loader.
- Scraper.
- Spreader.
- Light vehicles.
- Generator.

4.3.4. Construction Timeframe and Working Hours

Construction of the levee banks are expected to be staged; however, the length of each segment and the duration of construction works at each segment are unknown at this stage and would be up to the methodology of the contractor.

The total duration of construction works is approximately 40 weeks. Construction works are proposed to start in September 2024 and completed by April 2025.

The I*nterim Construction Noise Guidelines* (DECC 2009) outlines recommended standard construction working hours as:

- Monday to Friday 7am to 6pm,
- Saturdays 8am to 1pm, and

- No work on Sundays or public holidays.

The construction would comply with these recommended hours.

4.4. Operational Maintenance Program

It is expected that GHC will implement a levee maintenance program comprising annual inspections, watering and repair as necessary.

5. Environmental Assessment

5.1. Introduction

This section describes the potential construction and operational impacts of the Proposal and provides mitigation measures to manage identified impacts.

5.2. Assessment Methodology

The environmental assessment methodology for the Proposal involves the following:

(a) Identifying potential environmental risks/impacts associated with the construction and operational phases of the Proposal,

(b) Evaluating identified risks/impacts to determine the potential for occurrence and degree of severity, and

(c) Identifying and determining suitable environmental management procedures and control measures appropriate for planned works.

The Proposal has been evaluated in the context of Section 171 of the EP&A Regulation. A table addressing the factors requiring consideration under Section 171 is contained in Appendix A of this REF.

A CEMP would need to be prepared incorporating applicable environmental management procedures and control measures, which are listed under each environmental factor in this Section and summarised in Section 6.

Environmental issues of potential relevance to the Proposal include:

- Land use.
- Soils and water quality.
- Flooding.
- Traffic and access.
- Air quality.
- Noise and vibration.
- Biodiversity.
- Heritage (Aboriginal and historic).
- Waste management.
- Visual amenity.
- Utilities and services.

- Bushfire.
- Public Safety.

5.3. Land Use

5.3.1. Existing Environment

Land use of the Proposal area is described in Section 1.3 and is not repeated here.

5.3.2. Construction Impacts

The proposed levee banks and associated works will be predominantly located on vacant rural land, road reserves and public reserves. Land tenure is varied and includes freehold (private properties), Council land, Crown reserves and roadways.

The Proposal would result in permanent alteration of land surrounding Lot 1 Section 10 758522 (18 Byng Street, Holbrook), which may limit the existing use of the land.

GHC will need to obtain a Crown Lands licence to construct the flood mitigation works on crown land parcels. Easements will need to be sought from private landowners for the proposed works and Early Access Agreements should be arranged to enable construction works to commence whilst easements are being finalised. Appropriate approval from TfNSW will also be required prior to works commencing. Refer to Section 1.4 and Section 2.5 for further information.

In consultation with the relevant agencies, the works have been designed so as to have minimal interference with the provision of services (such as water, wastewater, electricity supply and telecommunications). Consultation with service providers was undertaken during the concept design development to ensure that their requirements are taken into consideration.

Overall, the construction works associated with the proposed levee works may cause some temporary disruption to adjoining private landowners, to local roads and to the residents of the township. However, due to the temporary nature of the works (at each segment of the proposed levee) and the location of the levee, these impacts are not anticipated to be significant, assuming implementation of the mitigation measures listed in Section 5.3.4. Mitigation measures to minimise impacts from traffic, noise, air quality and waste generation are also provided in Sections 5.6, 5.7 and 5.8 of this REF.

5.3.3. Operational Impacts

Once constructed, the levees will have a permanent impact on surrounding land uses through the reduction in land available for use and restricted access to sections of land outside the levee bank. Informal access tracks and gates will be provided to maintain access to private properties (i.e. existing farms) and current land use practices will continue with limited impacts. The operation of the levee will address the existing flood risk in Holbrook and will likely improve the land use practices in the proposal area due to the reduced flooding risks associated with the construction of the levee.

GHC will need to compulsorily acquire crown lands on which the flood mitigation works are to be established and permanent easements should be acquired, under the Land Acquisition (Just Terms Compensation) Act 1991, across private land.

5.3.4. Mitigation Measures

- All required approvals and licences would be obtained prior to construction activities commencing (i.e. TfNSW and DPIRD- Fisheries).
- GHC will need to acquire Crown Land reserves managed by Council under the *Land Acquisition (Just Terms Compensation) Act* 1991 (as per Crown Land advice during consultation) (refer to Sections 2.5. and 2.6 of this REF).
- Consultation and consent to the use and potential reservation of the Crown Land parcels that may be subject to registered Aboriginal Land Claims, or agreement to excise the affected areas from the ALCs (affected lots are Lot 2, Section 42, DP 758522, Lot 1 DP 909093 and Lot 7303, DP 1155827).
- If the project requires new or amended water supply, water supply works approvals or additional Water Access License, these should be obtained from DCCEEW- Water prior to commencement of construction works.
- Easements are to be obtained over private freehold land in accordance with *the Land Acquisition (Just Terms Compensation) Act* 1991. Early Access Agreements should be established with each landowner to enable access for construction purposes.
- Negotiations would be undertaken with private landowners where access through private land is required. The outcomes of any access arrangements would be documented in a CEMP prior to construction commencing.
- Consultation would be undertaken with all affected landowners with regard to the potential impact on land uses during construction and any safeguards or mitigation measures that need to be implemented during the works.
- The contractor would be required to take all necessary steps to prevent damage to private property and Council facilities and operations including fences and gates. Should damage occur to property it would be restored to a condition equivalent to the original condition.
- Temporary fencing and gates would be installed where necessary to exclude the public and animals from the work sites. Any temporary fencing or gates no

longer required would be removed at the completion of the construction works.

- Restoration of the areas disturbed during construction would be undertaken post-works.

5.4. Topography, Soils and Water Quality

5.4.1. Existing Environment

Topography

The Proposal area is in the NSW Southwestern Slopes bioregion. This bioregion consists of an extensive area of foothills and isolated ranges extending west and southwest of the Great Dividing Range into western Victoria. The bioregion includes part of the Murray, Murrumbidgee, Lachlan and Macquarie River catchments (NPWS 2003: 119). The study area in the lower slopes sub-bioregion and is characterised by undulating and hilly ranges with isolated peaks set in wide valleys at the apices of Riverina alluvial flats (NPWS 2003: 124).

Most of the Proposal area is located either on flat or gently sloping banks adjacent to Ten Mile Creek, or on alluvial flats. Ten Mile Creek is directly adjacent to parts of the Proposal area, and there are several unnamed drainage lines which feed into the creek also in the vicinity. Ten Mile Creek originates near Mount Jergyle in the Woomargama National Park approximately 15 kilometres (km) southeast of Holbrook (Cardno, 2019).

Topography, Soils and Geology

This section is summarised from Holbrook Levee Geotechnical Assessment report prepared by Cardno in 2020 (refer to Appendix I). This investigation only covered Holbrook levee 1 and 2 areas. GHC would undertake further geotechnical investigation at Holbrook levee 3 area.

The geological map of the area (Wagga Wagga, 1:250,000), indicates that all three sites are predominantly underlain by Quaternary aged Alluvium consisting of gravels, sand, silt and clay. Ordovician and Silurian aged igneous intrusive and metamorphic rock are indicated to be present in the vicinity of the sites. The fieldwork observations were consistent with the published geological indications with clays, silts, sands and gravel encountered in the boreholes.

The topography across Holbrook levee 1 alignment varies from a relatively low-lying portion along Hay Street that raises gradually on to a raised terrace along Nolan Street. However, the site generally has a slight fall to the north (towards the creek).

The topography across Holbrook levee 2 alignment is generally flat with local undulation and steepened areas near the creek.

Ten boreholes identified as BH06 to BH15 were drilled using a 6WD mounted drilling rig. The boreholes were drilled to depths of between 2.7 m and 6.0 m below ground level. The primary purpose of the boreholes was to identify the levee construction material and the ground stratigraphy, including any fill, potential erodible layers or sand/gravel lenses. The records of the boreholes accompanied by a Unified Soil Classification System (USCS) are presented in Appendix B. The generalised subsurface profile encountered in the boreholes is provided in Figure 5-1 and Figure 5-2 below.

TOPSOIL/GRASSMATTER encountered to depths of 0.1 m to 0.2 m,

Or;

FILL, Sandy Silty CLAY (CI)/ Silty SAND (SM), moderate plasticity, fine to medium grained, brown, grey, orange, medium dense and very stiff, moist, near plastic limit, encountered to a depth of 1.5 m, only encountered in BH06,

Overlying;

Clayey SILT/ Sandy SILT with clay/ SILT (ML) with sand, low plasticity, soft to friable, brown, orange, grey, moist, dry of plastic limit to wet, wet of liquid limit, fine grained sand, encountered to depths of between 0.5 m to 2.5 m,

Overlying;

Silty CLAY (CL - CI) with or trace sand, low to moderate plasticity, stiff to hard, brown, orange, grey, moist, dry of plastic limit to near plastic limit, fine to medium sand, encountered to depths of 1.2 m to 2.7 m, not encountered in BH06;

Overlying;

Silty Clayey SAND/ Clayey SAND (SM - SC), fine to medium grained, poorly graded, grey, brown, loose to very dense, moist, wet, encountered to depths of 2.7 m to 5.5 m, not encountered in BH09,

Overlying;

Sandy CLAY (CH), high plasticity, orange, grey, firm, moist, wet of plastic limit encountered to a maximum borehole depth of 5.7 m, encountered in BH06 only.

Figure 5-1: Generalised subsurface Profile - BH06 to BH09

Source: Cardno, 2020

TOPSOIL/GRASSMATTER encountered to depths of between 0.20 m to 0.2 m,

Or;

FILL, Silty SAND (SM) with gravel, fine grained, brown, loose, subrounded, dry, encountered to a depth of 0.3m, only encountered in BH14,

Overlying;

Sandy Clayey SILT/ Sandy SILT (ML) low plasticity, friable, brown, orange, white, moist, dry of plastic limit, fine grained sand, encountered to depths of between 0.4 m to 0.9 m and not encountered in BH14,

Overlying;

Silty CLAY/Silty Sandy CLAY (CL - CH) with sand, low to high plasticity, stiff to hard, red, brown, grey, moist, dry of plastic limit, moist, near plastic limit, fine sand, encountered to depths of 1.3 m to 3.2 m,

Overlying;

Silty Clayey SAND/ Silty SAND (SM – SC), fine to coarse grained, poorly graded, subrounded, brown, medium dense to very dense, moist and wet, encountered to depths of 2.3 m to 4.2 m in BH10, BH11, BH12, BH13,

Overlying;

Silty CLAY/ Silty Sandy CLAY (CL - CH), low to high plasticity, brown, grey, stiff to hard, moist near plastic limit and moist, dry of plastic limit, fine sand, encountered to a maximum borehole depth of 2.7 m in BH10, BH11, BH14 and BH15.

Figure 5-2: Generalised Subsurface Profile – BH10 to BH15

Source: Cardno, 2020

The results of the laboratory and field tests are summarised in Table 7-8 of the geotechnical report. The results confirm the presence of variable materials across the site including silts, sands and clays and gravels. The clay material tested were found to be dry to slightly dry (-4.7% to -1.7%) of the Optimum Moisture Content (OMC). The clays and silts were between low and high plasticity with liquid limits in the range of 21% - 70% and plasticity indices in the range of 8% to 53%. The Emerson Class tests were conducted using distilled water and indicated the on-site clays are dispersive to non-dispersive with Emerson Class Numbers between 1 and 7. The majority of samples returned an Emerson Class number of 1 – 3 indicating the clays are highly dispersive to moderately dispersive.

The clays were found to have shrink swell index values of between 0.8 and 4.8 indicating low to high potential reactivity. Noting, the successfully recovered shrink swell samples were collected from the Holbrook Levee sites. Attempts were made to collect samples from the other site but due to the hard condition of the clay soils sufficient material could not be recovered. In any case the clays soils across the townships and the climate conditions are commensurate and equivalent results are anticipated.

Groundwater

Groundwater was encountered in BH06 and BH12. The groundwater was encountered during drilling at approximate depths of 1.5 m and 3.2 m below ground level, respectively.

Rapid groundwater ingress was encountered in BH06 and BH12 and appeared to coincide with the intersection of sand and gravel zones. The boreholes were not left open for sufficient time to allow the groundwater table to equalise and therefore accurate groundwater depths were not recorded. Further field investigation and monitoring is required to accurately assess the depth to the groundwater table.

Surface Water

Holbrook is located within the Murray Catchment. Ten Mile Creek is a fifth order stream that flows north-west through Holbrook to Billabong Creek.

In the area to the north-east of Holbrook, the tributary of Morgan's Ridge Creek (catchment area of 11 km^2) flows south-west before joining Ten Mile Creek approximately 300 m upstream of Albury Street Bridge. A section of Morgan's Ridge Creek from Bowler Street to Ten Mile Creek is a man-made diversion channel. Historically, the creek travelled along Bowler Street and into an unnamed flow path to Holbrook's west. This unnamed flowpath still collects overland flow (and in larger floods overflow from Morgan's Ridge Creek) and flows north-west until it joins Ten Mile Creek approximately 1.5 km west of the existing Hume Highway crossing (Cardno, 2019).

Acid Sulfate Soils

Acid Sulfate Soils (ASS) are unlikely to occur in the Proposal area and are not mapped within the Greater Hume LEP ASS maps.

5.4.2. Construction Impacts

Given the location of the Proposal site in proximity of Ten Miles Creek, there is an elevated risk of water quality impacts arising from the construction works, particularly as a result of rain and wind action. The risk of water quality impacts needs to be diligently managed.

The main construction activities with the potential to cause water quality impacts include:

- Ground excavation (for levee banks construction, informal access tracks, culverts, drainage works, excavation in borrow pit area etc).
- Temporary stockpiling of construction materials and equipment.
- Vegetation removal.
- Onsite vehicle movements.
- Installation and maintenance of the cofferdam.

Erosion and sediment controls would be required during construction works, with these controls be prepared in accordance with "*The Blue Book" (NSW Landcom, 2004)* to detail management measures to prevent soil erosion and water quality issues during the works. These measures will be documented in the Soil and Water Management Plan (SWMP) to be prepared as part of the CEMP. Stabilisation would be required following the works to prevent any adverse impacts, such as sedimentation of waterways (i.e. Ten Mile Creek), following completion of construction works. A number of mitigation measures to protect water quality have been listed in this REF; however, further site- specific plans and construction details would be included in the CEMP for the works when further detail regarding the construction methodology is known. It is noted that no works are proposed within the Ten Mile Creek.

Any temporary works such as stockpiles, equipment and material storage and the like would be located away from waterways and drainage lines.

The fill materials will dominantly comprise clayey sandy silts of low plasticity (CL type) and clayey silty sands (SC type). Relatively clean sands (SP or SP/SM types) were not detected within the fill. All fill materials will be taken from borrow pit 1 and 2.

The materials are potentially erosive; however, providing that the batters are well grassed post construction, then erosion of the batters would not be a major issue.

The *Guidelines for Controlled Activities on Waterfront Land - riparian corridors* (NRAR, 2018) are considered relevant to the Proposal. The guidelines state that the design and construction of works or activities within a watercourse or adjoining waterfront land should protect and enhance water flow, water quality, stream ecology and existing riparian vegetation and establish and preserve the integrity of riparian corridors. Impacts on the hydrologic, hydraulic and geomorphic functions of a watercourse should also be minimised. With the implementation of mitigation measure provided in Section 5.4.3, it is considered that the Proposal would be consistent with this guideline.

As discussed above, the Proposal does not involve works in waterways, and with the proper implementation of mitigation measures provided in this REF, the Proposal is not anticipated to have a significant impact on water quality of the adjacent Ten Mile Creek, which would have the potential to increase the risk of water contamination after rainfall events. Therefore, no impact on the riparian ecosystem health, recreational activities along Ten Mile Creek, and the quality or production of aquatic food is anticipated as a result of the Proposal in accordance with the *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (ANZECC & ARMCANZ 2000).

Accidental spillage of fuels, hydraulic fluids and lubricating oils used in the operation of construction equipment could result in the release of hydrocarbons and metals which may be transported to nearby watercourses. The significance of the impact would depend on the type of fuel or oil used, the quantity spilt, the prevailing weather conditions and rate of flow of the watercourse. Several mitigation measures are recommended below to manage and mitigate potential spill incidents.

If groundwater is encountered during the construction works, it would need to be managed so that it does not result in pollution, including sedimentation. Groundwater devoid of sediment or contaminants would be disposed of in a way that does not cause erosion.

Groundwater was observed at depths of 1.5 m and 3.2 m below ground level (approximate creek level) in BH06 and BH12 conducted along Ten Mile Creek, Holbrook, and in BH02 at a depth of 2.9 m below the base of the Billabong Creek Anabranch, Culcairn.

Groundwater is expected to impact the construction of the levees, between approximate chainage Ch0.0 and Ch150.0 (within the Hay Street Park area). The contractor should make provision for dewatering should the excavations encounter groundwater ingress. The proposed construction of a deep foundation system for a portion of levee may encounter groundwater ingress and the contractor will need to make allowances for dewatering of the excavation should it be encountered during construction.

The presence of perched water in the soils overlying the clays in the wetter months cannot be precluded.

Overall, it is assessed that the impacts of ground disturbance associated with the levee construction works can be adequately managed through the implementation of appropriate soil and water management mitigation measures provided in Section 5.4.3. Therefore, the overall water quality impact is assessed to be low.

5.4.3. Operational Impacts

The levee will be inspected post-construction to ensure all areas of disturbance are appropriately stabilised and erosion and sediment loss is not occurring. Provided the site is stabilised and re-grassed, no impacts to soil and water are expected post construction.

5.4.4. Mitigation Measures

- A detailed Soil and Water Management Plan (SWMP) shall be prepared as part of the CEMP. The SWMP would describe the site-specific measures to be implemented for all works areas, in accordance with the guidelines outlined in the 2004 *Landcom publication Managing Urban Stormwater: Soils and Construction, 4th edition ("The Blue Book")*. The SWMP would need to be site specific and would need to address the following issues to prevent erosion, sediment loss and water quality impacts:

- – Minimisation of disturbance to soil adjacent to all watercourses in the works area (i.e. Ten Mile Creek).
- – Identification of site-specific sediment and erosion control measures wherever erosion is likely to occur.
- – Identification of any environmentally sensitive areas on or near construction sites to ensure runoff is diverted away from sensitive areas.
- – Retention of all surface runoff on-site and where possible stormwater from off site would be diverted around the construction site.
- – Location of construction compounds (at least 50m from any drainage lines).
- – Location and management of stockpiles, such as locating stockpiles away from any drainage lines near the works areas.
- – Regular inspection of all erosion and sediment controls, especially when rain is expected and directly after any rain events.

- Any excess spoil would be reused onsite or removed off site for disposal in accordance with EPA requirements
- Works should not be scheduled when heavy rainfall is forecast and works involving soil disturbance should not take place during heavy rainfall periods, other than work necessary to stabilise the site.
- A site-specific spill management plan would be prepared and include the following requirements:
- Emergency spill kits are to be kept at the site (vehicle kits).
- Refuelling of machinery to be undertaken in a dedicated area within the construction compound appropriately protected as outlined in the spill management plan.
- Any chemicals and fuels are to be stored in a bunded area at least 50 metres from any waterway or drainage line.
- Any hazardous materials stored on site would be stored in the compounds and within impervious and bunded enclosures capable of storing 120% of the volume of material stored there.
- Workers would be trained in the spill management plan and the use of the spill kits.
- The CEMP would incorporate a pollution incident response management plan that defines appropriate procedures for notification of pollution incidents to

the required authorities in accordance with s. 147 to 153 of the POEO Act and requires response actions to be implemented in order to address any risks such as incidents posed to the environment, property or surrounding communities.

- Adequate procedures would be established and detailed in the CEMP, including notification requirements to the EPA, for incidents that cause material harm to the environment.
- Workers are to be made aware of the provisions of Section 120 of the POEO Act with regards to water pollution.
- Mitigation measures to manage groundwater (should it be encountered during construction) would be incorporated into the CEMP which is to address the following issues in relation to groundwater:
  - Dewatering techniques during excavation.
  - Measures to ensure groundwater quality is not impacted during construction.
  - Techniques to settle, treat or filter groundwater encountered during excavation works i.e. diverting groundwater through baffle tanks or filter membranes.
  - Appropriate treatment and monitoring regimes should be established in the event that groundwater flows come to the surface, including disposal of groundwater in such a way as to prevent adverse impacts (such as erosion and water pollution). Groundwater should not be discharged to a waterway during construction.
- All areas where ground disturbance has occurred would be stabilised following completion of works to ensure there is no erosion hazard and restored to their pre-construction condition. This would involve, where required, reshaping the ground surface, covering it with topsoil excavated from the site and re-establishing an appropriate vegetation cover.

5.5. Flooding

5.5.1. Existing Environment

The Holbrook Flood Plain Risk Management Study and Plan (wmawater, 2017) indicated that the that numerous properties in Holbrook will suffer some degree of inundation during a 1% AEP event. Properties on the southern floodplain of Ten Mile Creek, particularly along MacInnes and Bardwell Streets become inundated by events as small as the 5% AEP event. For the 1% AEP flood, as many as 30 homes and 8 commercial lots are likely to become inundated above floor and many more will experience significant flooding of property lots (not necessarily over floor level inundation).

In terms of flood risk, the southern floodplain is particularly notable. Flood depths and velocities are the highest in the flood study area which when combined with the number of properties that are affected and a lack of egress produces significant flood risk. As does the tendency for flood levels to increase significantly for larger and rarer flood events. During a 1% AEP flood event, access to the township of Holbrook will be restricted by flooding in these regions. The PMF is found to inundate much of the town and in many locations will be 2 m higher than the 1% AEP event and up to 4 m higher proximate to the Holbrook Bypass. This is indicative of a high-risk flood situation.

Therefore, flood liability for the 1% AEP event in Holbrook is predominately located on the Ten Mile Creek left floodplain upstream of Albury Street. The majority of residences affected during the 2010 event were located in this region. Flooding in this area occurs when flood waters break out of Ten Mile Creek on the left bank south of MacInnes Street.

5.5.2. Construction Impacts

The Holbrook Flood Plain Risk Management Study and Plan (wmawater, 2017) recommended flood modification measures to modify the behaviour of the flood itself by reducing flood levels or velocities by excluding water from areas under threat. The measure recommended the construction of levee banks to modify the flood behaviour at the southern portion of Holbrook township. The levee options provided within the *Holbrook Flood Plain Risk Management Study and Plan* (wmawater, 2017) were further d*eveloped by Council and resulted with the proposed four levee banks, which was later reduced to three levee banks as well as other associated works (refer to Section 4.1).*

The works are anticipated to occur over an approximate of 40 weeks period and as such works will occur over the wetter season during which floods are possible. During construction, weather forecasts would be checked regularly so that in the event of flooding, construction works in affected areas will cease and equipment will be stored in a safe location. Works will not recommence until floodwaters have receded.

5.5.3. Operational Impacts

Positive impact is anticipated post construction. The levees will modify the behaviour of the floods by reducing flood levels or velocities through excluding water from areas under threat. Therefore, the Proposal would provide protection to the southern portion of the town from inundation due to the 1% AEP flood event of the Ten Mile Creek. The Proposal will also minimise environmental, social and cultural impacts associated with flooding events in Holbrook.

5.5.4. Mitigation Measures

- The contractor would develop a monitoring and flood response plan to detail procedures for monitoring rainfall (stormwater) and waterway flows and to identify subsequent response actions that would be taken to ensure the protection of personnel, equipment and water quality during the construction works.
- The contractor would develop a flood contingency plan and have provisions in place to reinstate any excavated section of levee using concrete bollards or similar should a flood occur during construction.
- In the event of flooding, construction works in affected areas would cease and would not commence until floodwaters have receded. Weather forecasts would be checked regularly so that equipment and materials in flood areas can be secured prior to heavy rainfall events.

5.6. Traffic and Access

5.6.1. Existing Environment

Existing traffic levels in the surrounding road network are low to moderate and typically associated with local residential traffic. Access to the worksites would be via surrounding local streets in Holbrook. The works sites are accessible from Young Street, Hay Street, Nolan Street, Albury Street, Byng Street, Bradwell Street, MacInnes Street, Bethana Lane and via private properties or tracks through open public land.

5.6.2. Impact Assessment

The majority of the works areas would be accessed using existing local roads and existing tracks in Holbrook. New informal (gravel) access tracks would be constructed to allow access to the proposed works area and the levee.

The levee banks and associated works are likely to cause some minor inconvenience for pedestrian access to the works area and to private property access (i.e. farms/paddocks). For the duration of the proposed works (40 weeks) there would be an increase in vehicle movements using local road networks for delivery of materials, transporting excavated fill, the arrival and departure of construction workers, equipment delivery and the removal of waste.

Access to individual properties would be maintained and alternative access provided where impacts are likely. The community and affected landholders would be notified in advance of the proposed construction work program and advised of any issues, including where works affect access to individual properties and public recreation areas.

Works would progress along the proposed levee banks alignment; therefore, there would not be impacts in the same area for the entire construction duration. The duration of works at each segment of the levee banks and associated works would be confirmed by the construction contractor.

Once construction plant and equipment, such as excavators are delivered to the works sites, they would remain there for the duration of the construction period of each section of the levee works. Therefore, their impact on the adjoining road network would be minimal.

Transport of fill to the levee works area (excavated from borrow pit area and other fill material transported to the site) would generate truck movements through the Holbrook township. The volume of truck movements for each construction phase would be confirmed by the construction contractor. However, an estimation of truck movements has been undertaken based on the construction material requirements provided in Table 4-2. It is an anticipated that during an eight- hour day, there would be an average of 50 truck movements per day (which would include the return journey). Given the predicted high volume of truck and vehicle movements, there is likely to be some inconvenience to the adjacent landowners and users of the local road system. It is noted that truck movements would occur over a short distance as the fill would be transferred from the nearby borrow pit or sourced locally (note: source is unknown at this stage). It is predicted that through consultation with affected landowners, the proper implementation of mitigation measures such as restricted working hours, placing curfews on truck movements (respite periods etc), the anticipated increased traffic movements would be short term and are not expected to result in a significant impact on the road network.

The construction vehicles movements may impact on road surfaces. A dilapidation report of traffic routes would be undertaken to ensure that all road surfaces are returned to a condition equivalent to pre-construction condition. Given the duration of the proposed works, periodic patching / repair of road surfaces and tracks may be required during the works.

It is anticipated that a partial closure of Hay Street, Albury Street and McInnes Street would potentially occur during the construction works (due to levee construction and delivery of construction materials and fill). However, it is anticipated that one lane of these roads would remain open at all times and that traffic control and management measures would be implemented on these roads to manage traffic flow during the works.

The removal of the small gravel car parking area along Hay Street, as part of Holbrook 1 levee works, is not anticipated to significantly impact on the availability of vehicle parking in Holbrook, as on street parking and other car parking areas are available within the Proposal area.

Whilst some inconvenience to local residences would be expected during construction of the Proposal, works would be carried out so as to minimise interruption to access for adjoining landowners in Holbrook and surrounding area. The limited duration of the works in any one area would also assist in reducing localised impacts. Traffic related impacts would be mitigated through the development of a Traffic Management Plan (TMP), which would include traffic controls and community consultation to minimise impacts to other road users, as well as access arrangements for residents and pedestrians.

Given the proper implementation of mitigation measures provided below and temporary nature of the Proposal, it is assessed that the Proposal would not have a significant impact on pedestrian access in the surrounding area or access to individual private properties. Increased traffic in the Proposal area is not predicted to have a significant impact on traffic flow to local roads and adjoining road network.

5.6.3. Operational Impacts

Post-construction, access to the levee crest area by unauthorised vehicles would be prevented through the installation of man-proof fencing along the levee alignment. Pedestrian access to the levee area would be maintained for properties located adjacent to the levee, as secure gates will be installed at each individual lot (i.e. farms).

5.6.4. Mitigation Measures

- The contractor would prepare a Traffic Management Plan (TMP) as part of the CEMP, to be reviewed by GHC prior to commencement of works. The TMP would include measures to minimise traffic impacts ensure public safety and would be prepared in accordance with:
  - *RMS's Traffic Control at Work Sites Manual, Issued July 2018; and*
  - *Australian Standard 1742.3 - 2009 Traffic Control for Works on Roads.*
- The TMP would detail mitigation measures to manage traffic related issues associated with the construction works including:
  - All materials deliveries are to avoid school zones during school bus hours, i.e. 7.30am to 9.30am and 3pm to 5pm, and
  - Appropriate and site-specific pedestrian management.
- Prior to the commencement of construction works the contractor shall consult with residential premises likely to be affected by truck movements, or in the immediate vicinity of the proposed works to determine any community

concerns and provide advice as to where concerns can be directed. If during consultation community concerns are not readily resolved by agreement, council staff are to be contacted who will endeavour to assist in resolving any outstanding issues of concern.

- Any disturbance to landowners as a result of vehicle movements and noise would be minimised by adhering to the working hours outlined in Section 4.3.4 of the REF. The contractor would avoid any inconvenience to residences/landowners.
- Where driveways or pedestrian access are to be obstructed, affected property owners/nearby residents to be provide at least 2 days' notice.
- Any temporary compounds and their access roads required for the works would be located so as to minimise disturbance to the existing environment. Following completion of the works the temporary compounds and roads would be removed, topsoil provided and re-grassed. Existing tracks and paths would be restored to their condition prior to works.
- Roads must be re-instated in accordance with Council's Construction Manual or as directed by council staff.
- Trucks would not access the sites in weather conditions that would cause damage to properties or the environment.
- All sealed roads would be kept clean and free of dust and mud at all times. Where material is tracked onto sealed roads at any time, it would be removed immediately so that road pavements are kept safe and trafficable.
- Any temporary access tracks required for the works would be located so as to minimise disturbance to the existing environment. Following completion of the works the temporary tracks would be removed, topsoil provided and re-grassed.
- A dilapidation report of traffic routes would be undertaken to ensure that all road surfaces are returned to a condition equivalent to pre-construction condition.
- All construction traffic would comply with all applicable traffic laws and regulations. All construction vehicles would comply with the speed limits set for the roads accessing the sites.

5.7. Air Quality

5.7.1. Existing Environment

Air quality is expected to be good due to the semi-rural location, with the main influence on air quality in the area being vehicle emissions associated with moderate to low traffic volumes within Holbrook. There are no registered point sources of air pollution in the vicinity of the Proposal site. In high wind events, dust can be a major source of air particulates.

While industry, commercial and residential emissions can be a source of pollution it is unlikely that these sources are significantly impacting on the ambient air quality levels at the Proposal site.

5.7.2. Construction Impacts

The main impact to air quality during construction would be expected to arise from the generation of airborne localised dust associated with earthworks and from trucks transporting materials to and from the works site. Given the close proximity of the work area to nearby residents, any dust generated as part of the levee construction works could result in temporary impacts to neighbouring landowners. Dust suppression methods would be applied where required to prevent dust being transported off site.

Local air quality may be affected by emissions from construction traffic. These emissions would, however, occur only intermittently, and are expected to be minor and temporary. It would be unlikely that they would contribute to a permanent detectable reduction in local air quality.

With implementation of the recommended mitigation measures, potential air quality impacts during construction are considered minor and unlikely to be significant.

5.7.3. Operational Impacts

No operational phase impacts on air quality are anticipated.

5.7.4. Mitigation Measures

- Construction vehicles and equipment would be suitably serviced within the six-month period prior to commencement of construction activities and all necessary maintenance undertaken during the construction period to meet EPA air quality requirements.
- The excessive use of vehicles and powered construction equipment would be avoided.
- All construction machinery would be turned off when not in use to minimise emissions.

- Construction contractors would monitor dust generation potential.
- Dust suppression methods including the use of water carts would be applied where required (i.e. on windy days when earthworks and vehicle movements are generating dust).
- Any stockpiled spoil/fill would be protected to minimise dust generation to avoid sediment moving offsite.
- Vehicles transporting fill/spoil to and from the works sites would be covered.
- Bare surfaces are to be vegetated or stabilised as soon as possible.

5.8. Noise and Vibration

5.8.1. Existing Environment

The area surrounding the levee works is a mixture of low-density residential properties within a rural township, grassed paddocks and open public recreational areas. Noise monitoring was not undertaken as part of the REF, however background noise levels along the levee alignment are likely to range from 40 - 50 dB(A) in the township and surrounding rural area.

There are a number of residential properties located in close proximity (within 10 m, 30 m, 100 m and 500 m) to the proposed levee banks an associated works.

5.8.2. Construction Impacts

Construction

The typical A-weighted sound power levels for equipment which may be required to undertake the proposed construction works are listed in Table 5-1 below (it is noted that this list is not definitive and these levels are taken from the *Australian Standard AS2436-2010 Guide to Noise and Vibration Control on Construction, Demolition and Maintenance Sites*).

Table 5-1 Construction Equipment Sound Power Levels

Equipment	Typical Sound Power Levels (dB)	Sound Pressure Level at 10m distance (dB(A))	Sound Pressure Level at 30m distance (dB(A))	Sound Pressure Level at 100m distance (dB(A))	Sound Pressure Level at 500m distance (dB(A))
Haul truck	110	82	72	62	48
Excavator	112	84	74	64	50

Equipment	Typical Sound Power Levels (dB)	Sound Pressure Level at 10m distance (dB(A))	Sound Pressure Level at 30m distance (dB(A))	Sound Pressure Level at 100m distance (dB(A))	Sound Pressure Level at 500m distance (dB(A))
Dozer	116	88	78	68	54
Water cart	107	79	69	59	45
Compactor	113	85	75	65	51
Vibratory rammer	108	80	70	60	46
Vibratory roller 1	109	81	71	61	47
Grader	110	82	72	62	48
Front end loader	112	84	74	64	50
Scraper	110	82	72	62	48
Spreader	95	67	57	47	33
Light vehicle	103	75	65	55	41
Generator	103	75	65	55	41

As discussed in Section 4.3.4, the works are anticipated to be undertaken in stages; however, the number of stages and duration of each stage are unknown at this stage. The total construction duration is approximately 40 weeks.

It is noted that construction of the levee and associated works would progress relatively rapidly along the levee alignment and would thereby minimise noise and vibration impacts at any one location. Therefore, the works are not anticipated to result in significant noise impacts to surrounding sensitive noise receivers for an extended duration.

Under the *Interim Construction Noise Guideline* (DECCW, 2009) construction noise criteria for residences where the construction duration is greater than three weeks is the rating background noise plus 10dB(A); therefore, the noise management level for the Holbrook township would be 50-60dB(A). Based on the typical sound power levels provided in Table 5-1 above and using the methodology in the *Australian Standard Guide to Noise and Vibration Control on Construction, Demolition and Maintenance Sites* and the *Interim Noise Construction Guideline*, the maximum predicted noise levels at the closest residences during construction may exceed the recommended noise affected level as well as the highly affected noise level (75 dB(A)) above which there may be strong community reaction to noise (DECCW, 2009).

It is noted however that these levels are considered to be a conservative estimate, as they are based on maximum noise levels assuming that all machinery/construction equipment would be used simultaneously. It is anticipated that this would occur rarely, if at all during the construction of the proposed development, and furthermore the actual noise levels experienced would vary depending on the nature of the activities being undertaken. Construction impacts would be temporary and construction hours would be restricted to the normal daytime construction hours as specified by the EPA. It is noted that construction machinery accessing the Proposal works area would be a source of intermittent noise for the majority of the construction period.

The use of the construction equipment listed in Table 5-1 also has the potential to cause some vibration impacts, although it should be noted that no blasting would be undertaken during the works.

The *Interim Construction Noise Guideline* states that, where the predicted noise level is greater than the noise affected level, all feasible and reasonable work practices should be applied to meet the noise affected level. Furthermore, all potentially impacted adjoining properties should be informed of the nature of the works, the expected noise levels and duration, as well as contact details. Where the noise level is above the highly affected noise level, respite periods by restricting the hours that the very noisy activities can occur, taking into account:

- Excavation or removal of any materials using machinery of any kind (noisy works), including compressors, must be limited to between 7.30am and 5.00pm Monday to Friday, with a respite break of 45 minutes between 12pm and 1pm.
- Times identified by the community when they are less sensitive to noise (such as before and after school for when located near schools, or mid-morning or mid-afternoon when located near residences); and

- If the community is prepared to accept a longer period of works in exchange for restrictions on construction times.

Control measures to minimise noise and vibration impacts would be implemented during construction as part of the contractor's CEMP, which would be required to be submitted for approval prior to commencement of works. This should include consideration of Tables 4-10 of the *Interim Construction Noise Guideline*, which present a summary of options for work practices with lower noise impact.

Construction Vibration

The use of a vibratory roller as part of the levee compaction works may result in offsite vibration impacts. The *British Standard (BS) 6472 – 2008, Guide to Evaluation of Human Exposure to Vibration in Buildings (1 Hz to 80 Hz)* is recognised as the preferred standard for assessing the 'human comfort criteria'. There is no Australian Standard that sets criteria for the assessment of building damage caused by vibration. Guidance of limiting vibration values is attained from reference to *German Standard DIN 4150-3: 1999 Structural Vibration – Part 3: Effects of vibration on structures*. Table 5-2 provides a summary of the relevant criteria.

Table 5-2 Summary of Relevant Vibration Criteria

Human comfort intermittent vibration limits (BS 6472-2008)			
Receiver Type	Time of Day	Preferred Value	Recommended Max
Residential	Day	0.2 $m^{-s1.75}$	0.4 $m^{-s1.75}$
Guideline values for short term vibration on structures (DIN 4150-3: 1999)			
Receiver Type	1 Hz to 10 Hz	10 Hz to 50 Hz	50 Hz to 100 Hz
Dwellings and buildings of similar design and/or occupancy.	5 mm/s	5 – 15 mm/s	15 – 20 mm/s
Buildings used for commercial purposes, industrial buildings and buildings of similar design	3 mm/s	3 – 8 mm/s	8 – 10 mm/s

The equipment used during construction are expected to produce levels of vibration that are unlikely to exceed the above criteria.

Furthermore, the CEMP for the works would address site specific issues, including noise and vibration reduction practices, so as to minimise impacts to adjoining properties. All feasible and reasonable works practices would be implemented to reduce construction noise and vibration levels. A pre- and post-construction dilapidation assessment should be undertaken of any structures or buildings within close proximity to the works area and which may be impacted from vibration sources.

All potentially impacted residents would be informed of the nature of the works, the expected noise levels and duration, as well as contact details for the contractor's representative. Therefore, it is concluded that given the proper implementation of mitigation measures provided below, the noise and vibration impacts associated with the Proposal is unlikely to be significant.

5.8.3. Operational Impacts

No noise and vibration impacts are anticipated post construction.

5.8.4. Mitigation Measures

- Prior to the commencement of construction works the contractor shall consult with residential premises likely to be affected by, or in the immediate vicinity of, the proposed works to determine any community concerns and provide advice as to where concerns can be directed. If during consultation community concerns are not readily resolved by agreement, The Department/ council staff are to be contacted who will endeavour to assist in resolving any outstanding issues of concern.
- A Noise and Vibration Management Plan (NVMP) must be prepared as part of the CEMP, to be reviewed by GHC prior to commencement of works. The NVMP would address site specific issues, including limited work hours and noise and vibration reduction practices, taking into consideration DECCW's *Interim Construction Noise Guideline (in particular Tables 4 – 10) and Assessing Vibration: A Technical Guideline (in particular mitigation measures in Section 3)*. Mitigation measures to minimise noise and vibration impacts would include:
  - Optimum siting of work areas, vehicle and plant parking areas, materials stockpiles and equipment storage areas in locations where potential acoustic and vibration impacts would be minimised,
  - Regular maintenance of all plant and machinery used for the project, and
  - Identify locations where construction noise and vibration is most intrusive and develop strategies to reduce impacts for these areas.

- A pre- and post-construction dilapidation assessment should be undertaken of any structures or buildings within close proximity to the works area and which may be impacted from vibration sources.
- Construction works would be undertaken during normal work hours i.e., 7am to 6pm Monday to Friday; 8am to 1pm Saturdays; and no work would be undertaken on Sundays, Public Holidays or outside these work hours without notification to the affected community and EPA. However, due to proximity of the houses to the levee work sites, hours may be reduced to limit the impact to residents. Notification to EPA and affected community would provide the following details:
  - The locations and types of surrounding receivers likely to be affected.
  - The nature of the proposed works.
  - The noise characteristics of any powered equipment likely to be used.
  - Measures to be taken to reduce noise emissions.
  - Any other information EPA may request.
  - All reasonable practical steps shall be undertaken to reduce noise and vibration from the site.
- All plant and machinery used for the project would be well maintained.
- All possible measures would be taken to ensure construction equipment is operated to manufacturer's specifications.
- Any noise complaint received would be investigated as soon as practicable. Any practicable and feasible measures to minimise noise would be identified. The complainant would be advised of the outcome.
- Consideration is to be given to respite periods by restricting the hours that the very noisy activities can occur, taking into account:
  - Excavation or removal of any materials using machinery of any kind, including compressors, must be limited to between 7.30am and 5.00pm Monday to Friday, with a respite break of 45 minutes between 12pm and 1pm.
  - Times identified by the community when they are less sensitive to noise (such as before and after school for when located near schools, or mid-morning or mid-afternoon when located near residences); and
  - If the community is prepared to accept a longer period of works in exchange for restrictions on construction times.

5.9. Biodiversity

A specialist Biodiversity Assessment was undertaken for the Proposal (SIA, 2024). This section is a summary of the assessment's results, with the full report provided in Appendix C.

5.9.1. Existing Environment

Flora

Approximately half of Levee 1 (western side) comprises non-native vegetation. It includes approximately 160m of parkland belonging to the Ten Mile Creek Gardens. This section comprises a Kikuyu (*Cenchrus clandestinus**) lawn with various species of planted, introduced, ornamental trees including, for example, European Ash (*Fraxinus excelsior**), Chinese Tallow Tree (*Triadica sebifera**), Oak (*Quercus sp.**) and London Plane Tree (*Platanus × acerifolia**). Another approximately 140m follows the alignment of a dirt road with numerous planted Elm (*Ulmus sp.**) trees on both sides and a lawn of mainly Kikuyu beneath. The eastern half of Levee 1 comprises a paddock where the native shrubs and trees have been cleared. This area now comprises a grassland with a mixture of native and introduced grasses and forbs. Native species include, for example, Windmill Grass (*Chloris truncata*), Wiry Panic (*Entolasia stricta*), Small St John's Wort (*Hypericum gramineum*), and the Rush Juncus australis. At the far eastern end of Levee 1 there is a thicket of the weed Tree-of-Heaven (*Ailanthus altissima**).

The eastern quarter of Levee 2, that sits alongside Ten Mile Creek, comprises a mixture of entirely cleared, partly cleared and remnant riparian forest all with a high proportion of weeds, as well as various planted ornamental trees and shrubs, both native and introduced. Weeds include, for example, Oats (*Avena sativa**), Perennial Ryegrass (*Lolium perenne**), Large-leaf Privet (*Ligustrum lucidum**), Blackberry (*Rubus fruticosus sp. agg*.*) and Sweet Briar (*Rosa rubiginosa**). Native species include, for example, Blakely's Red Gum (*Eucalyptus blakelyi*), Kurrajong (*Brachychiton populneus*) and Native Sorrel (*Oxalis perennans*).

The remaining approximately 1,000m of Levee 2 comprises grassland pasture with a high proportion of introduced grasses and weeds. The main grasses being the introduced Phalaris (*Phalaris aquatica**), Barnyard Grass (*Echinochloa crusgalli**), Oats and Common Paspalum (*Paspalum dilatatum**). Weeds include, for example, Catsear (*Hypochaeris radicata**), Common Plantain (Plantago lanceolata*), St John's Wort (*Hypericum perforatum**), Curled Dock (Rumex crispus*), and Umbrella Sedge (*Cyperus eragrostis**). Several large old Yellow Box (*Eucalyptus melliodora*) and Blakely's Red Gum occur beside the alignment at the western end and a young, planted street tree (Eucalyptus sp.) occurs on the alignment beside Albury St.

Levee 3 comprises grassland of mostly introduced species and weeds with many of the species described above. In addition, four large old trees of Blakely's Red Gum occur along the alignment, as well as numerous young saplings of Apple Box (*Eucalyptus bridgesiana*) and Blakely's Red Gum.

The stockpile/borrow pit site, covering an area of approximately 3.5 ha, comprises pasture as described above for Levee 2 with scattered, isolated, old, remnant trees of Blakely's Red Gum and Yellow Box.

The complete list of species observed on site is provided in the full biodiversity assessment report (refer to Appendix C).

The State Vegetation Type Map - NSW Extant PCT vC2 identifies most of the proposal site as 'non-native' vegetation. Parts of the project site alongside Ten Mile Creek and on the far western edge of the project site are mapped as Plant Community Type (PCT) PCT 277 '*Blakely's Red Gum - Yellow Box grassy tall woodland*' and PCT 278 '*Riparian Blakely's Red Gum - box - shrub - sedge - grass tall open forest'*. The vegetation mapping is shown below in Figure 5-3.

The two PCTs identified by the DCCEEW (formerly DPE) mapping as occurring on the project site is correct. However, the DCCEEW mapping has incorrectly identified the introduced Elm trees along Levee 2 as native trees. The DCCEEW mapping appears also to be based on older aerial imagery because the extent of native vegetation along Levee 1 alongside Ten Mile Creek is less than is mapped by DCCEEW. More accurate and ground-truthed vegetation mapping is provided below in Figure 5-4 based on the current site assessment and recent aerial imagery (Google Satellite).

Both PCTs that occur on the proposal site form part of the ecological community '*White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland'* listed as Critically Endangered under both the BC Act and EPBC Act.

<u>Threatened Species</u>

A search of the Bionet Atlas of NSW Wildlife database (on 05/04/2023 and 21/06/2024) indicated that no species of flora listed under the BC Act and/ or EPBC Act have been recorded within a 10km x 10km square centred on the proposal site.

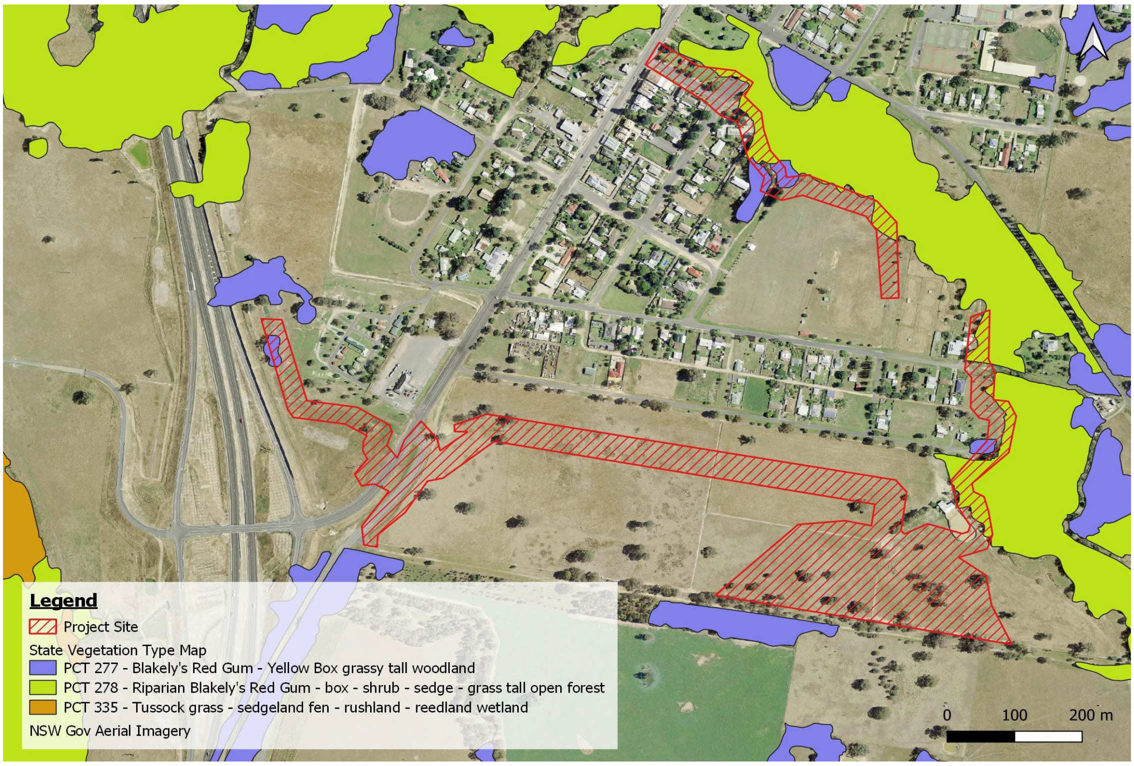


Figure 5-3 State vegetation Types Mapping- Proposal Area Outlined in Red.

Source: SIA Ecological and Environmental Planning, 2024

Figure 5-4 Updated Vegetation Mapping Based on the Site Assessment - Proposal Area Outlined in Red.

Source: SIA Ecological and Environmental Planning, 2024

Fauna

The vegetation over most of the site comprises grassland with a high proportion of introduced grasses and weeds. These areas provide little habitat for native fauna. Parts of the proposal site adjoining Ten Mile Creek provide habitat for native fauna where there are trees and/ or shrubs and/ or a dense groundcover (i.e., not grazed). These areas would provide habitat mainly for invertebrates, reptiles, birds, and mammals such as possums, gliders, wombats, wallabies, flying foxes and microbats. These sections of creek would also provide habitat for native fish. The old trees at the proposed Borrow Site and along the alignment of Levee 3 provide habitat for some of the native fauna mentioned above, particularly the hollow-bearing trees as these provide important roosting and nesting habitat.

During the site assessment three native species of frog, twelve native species of bird and two native species of butterfly were incidentally observed. The species are listed in the full biodiversity report provided in Appendix C.

Threatened Species

A search of the BioNet Atlas of NSW Wildlife database (on 05/04/2023 and 21/06/2024) indicated that nine (9) species of fauna listed under the BC Act and/ or EPBC Act have been recorded within a 10km x 10km square centred on the project site. The species are presented in Appendix C, which indicates the likelihood of a species being present on site and the reason for the stated likelihood. No species of threatened fauna was observed during the site assessment.

The 'Fish communities and threatened species distributions of NSW' (DPI, 2016) identifies Ten Mile Creek at Holbrook as being within the indicative distribution for the Murray Crayfish (*Euastacus armatus*) listed as Vulnerable under the FM Act and for the Southern Pygmy Perch (*Nannoperca australis*) listed as Endangered under the FM Act.

There are no records of either species within the Greater Hume Local Government Area on the BioNet Atlas of NSW Wildlife database.

The Fisheries Scientific Committee Final Determinations for these two species (FSC (2008) and FSC (2013)) indicates that section of Ten Mile Creek immediately adjoining the proposed levee wall along Levee 2 (chainages 1020 to 1160) provides potential habitat for both species.

5.9.2. Construction Impacts

Flora

Almost the entire lengths of the levee alignments (approx. 2km or 87%) are on non-native vegetation (although scattered isolated native trees do occur either within the proposal footprint, or immediately adjoining it). In these areas there would be no impact to native vegetation (the impact on the isolated trees is discussed further below) other than small numbers of scattered native grasses and forbs that occur amongst the non-native vegetation. All of these native grasses and forbs are common species.

Approximately 200m of Levee 2 is either through or immediately next to highly disturbed PCT 278 - *Riparian Blakely's Red Gum – box – shrub – sedge – grass tall open forest*. The creek line suffers from many of the typical ecological impacts such as soil erosion, nutrient enrichment, and weed invasion. Additionally, being the very edge of a narrow strip of remnant vegetation the forest within the levee alignment is subjected to many edge effects from the adjoining urban and agricultural land uses. The main effects would be altered micro-environment/climate, invasion of non-native plants, and nutrient enrichment. Consequently, the two short sections of native forest that would be impacted by the proposal are already heavily impacted and degraded. One section, near Bardwell Street, is approx. 70m of proposed levee wall. At the time of the site assessment, the only native vegetation along the wall alignment was a small clump of young Eucalypt saplings, the dense native vegetation occurring on the opposite side of Ten Mile Creek. Some of the trees on the opposite bank may overhand the levee alignment. Also, the angle of the aerial imagery gives the impression that trees occur along the alignment, although this is not the case, therefore, it is assessed that impact to native vegetation in this area is minor.

The next section is approx. 130m long near MacInnes Street, with approx. 75m of this being a proposed levee wall. At the end of MacInnes Street six mature trees would be removed, being three (3) Blakely's Red Gum with Diameter at Breast Heights (DBH) of approx. 40 to 50 cm and three smaller Eucalyptus with DBH of approx. 20-30cm of unknown species that have been planted in the adjoining, residential gardens. One of the Blakely's Red Gums could potentially have small tree hollows in the ends of dead branches. Another four (4) smaller Blakely's Red Gums with DBHs of approx. 20-40cm would be removed near the end of this section. The trees are relatively young and have no tree hollows. The plan drawings indicate that further tree clearing may be required in this area, presumably to be determined during construction. It is recommended that an arborist be engaged to advise on which trees can be retained and which need to be removed during the construction stage of the project. The arborist should also advice on appropriate tree protection measures for those trees to be retained. The other vegetation to be removed in this section comprises planted ornamental, small trees and shrubs of non-native species, and weeds. In places along this section of the proposed levee it is close to the creek. Where this is the case Council should consider, and particularly where the creek bank and adjoining riparian areas are cleared of vegetation for construction, removing the problem weeds that occur there and replanting the riparian area with native species.

In summary, some isolated native trees along the levee alignments will need to be removed. This includes a young Kurrajong (*Brachychiton populneus*) and two small

Eucalyptus sp. saplings along Levee 2 near Bardwell Street and a planted, young Eucalyptus sp. street tree beside Albury Street. It is recommended that these trees be replaced with the same or similar species of native trees along the levee alignments or elsewhere in town where such planting would most benefit biodiversity. In addition, the construction footprint beside the levee alignment includes several large, old Eucalypts that immediately adjoin the levee alignments. It is recommended that an Arborist assist during the construction stage by implementing appropriate protection measures to ensure these trees are not damaged by the proposal.

The Levee 3 alignment would result in the removal of one large, old Blakely's Red Gum and numerous saplings beside Albury Street. The Red Gum does not appear to have any tree hollows that are likely to be used by fauna. It is recommended that Blakely's Red Gum trees be planted alongside the levee alignment, but away from existing mature trees, to offset this impact. Approaching the northern end of Levee 3, three very large, old Blakely's Red Gum trees are located within the levee alignment and would most likely, therefore, need to be removed. A number of species of native bird were observed in the tree at the time of the site assessment and one of these trees at least contains trees hollows that are likely to be used by fauna, including, potentially, the threatened Super Parrot. The trees are likely to be several hundreds of years old and should be retained. It is recommended that the levee be re-aligned to avoid impact these three trees unless a Level 5 AQF Arborist advises that the trees would not be adversely impacted by the project.

Some native species of flora impacted by the proposal form part of the *White Box – Yellow Box – Blakely's Red Gum Woodland* ecological community that is listed as Critically Endangered under both the BC Act and EPBC Act. The impact to this ecological community from the proposal would be relatively minor and would not constitute a significant impact if the mitigation measures listed in Section 5.9.4 are properly implemented. This is confirmed in a Test of Significance (5-part test) provided in Appendix C.

Fauna

With the effective implementation of the recommendations of this report the proposal would have little direct impact on native fauna. It would remove a small number of native trees only one of which contains small hollows that could potentially be used by microbats. Nine species of microbat have been recorded within a 10km x 10km square centred on the project site. Only one of these is listed under the BC Act and/ or EPBC Act and there is only one record of that species, approximately 3km north of the tree being removed. Therefore, the probability of this species utilising the tree hollow is low. To minimise the risk of harming any native fauna it is recommended that this tree be removed carefully and under the direction of an ecologist who can care for any fauna found to be inhabiting a tree hollow. The impact on other native fauna from removal of a small number of native trees would be mainly the removal of foraging habitat for birds and habitat for invertebrates. It is recommended that locally occurring species of Eucalypt be replanted to compensate for the loss of trees from the project.

With effective the implementation of sediment and erosion control measures as well as risk management and clean up procedures for accidental spills of chemicals and other hazardous materials, the project is unlikely to directly impact the fish habitat that occurs within Ten Mile Creek. However, the opportunity exists following completion of construction to rehabilitate the riparian zone, where this has been disturbed, by removing problem weeds and replanting these areas of native plants. This would improve the condition of the riparian and aquatic habitat there for native biodiversity, potentially including the threatened Murray Crayfish and Southern Pygmy Perch that may occur there.

There may be some indirect impacts on fauna from noise during construction of the project. However, construction activities would only be undertaken during normal daytime construction hours when existing background noise levels are higher. Furthermore, the fauna that could potentially be impacted by construction noise is likely to be common species of native fauna typically found within a mostly cleared rural environment.

With effective implementation of the recommendations of this report there would be no significant impact on fauna from the proposal

5.9.3. Operational Impacts

No biodiversity impacts are anticipated post construction.

5.9.4. Mitigation Measures

- A comprehensive weed management plan is to be implemented for the site during and after construction.
- Vegetation clearing should be limited to the minimum required to successfully complete the proposal.
- Limits of clearing should be provided to the construction contractor and identified both on site maps/plans and on site.
- Carry out erosion & sediment control around the disturbance area.
- Turf used on the levee shall be free of weeds.
- Only lay turf free of weeds onto the levee structure.
- Vehicles and machinery should be stored and parked in treeless areas.
- Any animals injured during the clearing works should be collected and taken to a local veterinarian or wildlife carer.

- In accordance with the *Biosecurity Act* 2015, those weeds identified on site must be controlled to result in their suppression.
- Levee 3 from chainage 0 to chainage 80 should be re-aligned to avoid impacting the three large, old Blakely's Red Gum trees that occur along that section of levee alignment, unless a Level 5 AQF Arborist advises that the trees would not be adversely impacted by the proposal.
- A Level 5 AQF Arborist should also advise on appropriate protection measures for all native trees that immediately adjoin the alignments for all three proposed levees to ensure they are not damaged during construction. The Arborist should be engaged on completion of the proposal, to confirm that the recommended tree protection measures were properly implemented.
- To minimise the risk of harming native fauna the three mature Blakely's Red Gums at the end of MacInnes Street should only be removed under the direction of an appropriately qualified ecologist who can also care for any fauna that may be injured during the removal these trees.
- Thirty (30) Eucalyptus trees of either Blakely's Red Gum or Yellow Box are recommended to planted alongside the levee alignments, preferably in areas where Eucalyptus trees presently do not occur.
- Council should consider removing the problem weeds that occur at Levee 2 (between chainages 1020 to 1160, particularly where the creek bank and adjoining riparian areas are cleared of vegetation). Replanting this area with native species and stabilising the creek bank are recommended to improve the condition of habitat for the threatened Murray Crayfish and Southern Pygmy Perch that potentially occur there.
- Periodic weed control is to be undertaken within areas of remaining native vegetation.

5.10. Aboriginal Heritage

5.10.1. Existing Environment

A specialist Aboriginal Due Diligence Assessment (ADDA) was undertaken for the proposal (NSW PW, October 2023). This section is a summary of the assessment's results, with the full report provided in Appendix E.

An extensive search of the Aboriginal Heritage Information Management System (AHIMS) was conducted on 27 March 2023. A total of 89 previously recorded sites were identified within the AHIMS search area which covered approximately 15 km zone around the study area. The majority of the recorded sites were artefact scatters (60%), followed by modified trees (21%) and isolated finds (11%). Other site types such as artefact scatters with potential archaeological deposit (PAD) (2%), restricted sites (2%), artefact scatters and modified trees (1%), ceremony and dreaming location (1%) and PAD (1%) are also present in the general area though to a lesser frequency. The closest recorded AHIMS site was located approximately 470 m southwest of the western extent of the study area (was identified during Kelleher Nightingale Consulting survey). There are no sites registered on the AHIMS in the study area.

A visual survey of the study area was conducted as part of the assessment. No Aboriginal sites or areas of potential archaeological deposits were identified during the survey. Much of the study area is in the lower lying flood plain of Ten Mile Creek or has been developed over the past seventy years. The soils present at the surface inside the study area, in particular the southern area, indicate that the soils are related to current floodplain alluvial as opposed to the older or younger terraces which are more likely retain Aboriginal sites.

No Aboriginal sites or objects have been recorded inside the study area. The study area has a low potential for archaeological deposits to be present due to prior disturbances across the area. Based on the results of this assessment, no further archaeological assessments are necessary.

5.10.2. Construction Impacts

The results of the Aboriginal due diligence assessment have determined the Proposal is unlikely to impact Aboriginal objects and will not impact on any known places or sites of cultural significance to the Aboriginal community.

The Proposal area has a low potential for archaeological deposits to be present due to prior disturbances across the area. The undertaking of the Aboriginal due diligence process has resulted in the conclusion that the Proposal would have an impact on the ground surface, but no Aboriginal objects or intact archaeological deposits will be harmed. Therefore, no further archaeological assessment is required.

5.10.3. Operational Impacts

No Aboriginal heritage impacts are anticipated post construction.

5.10.4. Mitigation Measures

- All workers (including contractors) should be made aware that it is illegal to harm an Aboriginal object or historic relics, and if a potential Aboriginal object or historic relic is encountered during activities, then all work at the site will cease and Heritage NSW, Department of Premier and Cabinet will be contacted.

- All workers (including contractors) should be inducted concerning Aboriginal cultural heritage values and basic training should be provided for identifying Aboriginal objects.
- In the event that known or suspected Aboriginal objects, artefacts or skeletal remains are encountered during the activity, the following unexpected finds protocol will be followed:
  - All work in the immediate vicinity will cease.
  - The find will be immediately reported to the work supervisor who will immediately advise the Environment Manager or other nominated senior staff member.
  - The Environment Manager or other nominated senior staff member will promptly notify the police and the state coroner (as required for all human remains discoveries).
  - The Environment Manager or other nominated senior staff member will contact Heritage NSW, Department of Premier and Cabinet for advice on identification of the skeletal material as Aboriginal and management of the material.
  - If the skeletal material is of Aboriginal ancestral remains, the Local Aboriginal Land Council will be contacted and consultative arrangements will be made to discuss ongoing care of the remains.
- All staff and contractors involved in the proposed work should be made aware of legislative protection under the NPW Act for all Aboriginal sites and objects, and the contents of the Unanticipated Finds Protocols
- All land and ground disturbance activities must be confined to inside the study area.

5.11. Historic Heritage

5.11.1. Existing Environment

A specialist Heritage Impact Statement (HIS) was undertaken for the proposal (NSW PW, May 2023). This section is a summary of the assessment's results, with the full report provided in Appendix D.

The Holbrook district is rural in character and includes some of the best grazing land in the state, producing cattle and sheep as well as wool, lucerne, wheat and other grains.

Being situated half-way between Sydney and Melbourne on the Old Hume Highway (Albury Street), Holbrook has historic importance as a staging post from the mid-19th century, and the National Trust previously identified Holbrook as being significant as a town typical of Australian towns from that time.

The built fabric of the main street townscape consists of single or double storey buildings, several of which date to the late 1800s. Building scale, form, setback, materials, and finishes are largely harmonious and combine to create a cohesive streetscape.

The Old Hume Highway, which is straight and flat, forms the artery of the town, and most of the listed heritage items in Holbrook are located along it. It is central to the Holbrook Heritage Conservation Area (HCA), a non-statutory nominated area included in the Greater Hume Development Control Plan (DCP), as shown in Figure 5-5.

The flood mitigation works are proposed within part of the HCA, as well as into areas of low density residential, open, cleared land and sportsgrounds.

Holbrook Heritage Conservation Area

The Greater Hume Development Control Plan 2013 (GHDCP) was adopted by Council on 26th June 2013 and came into effect on 5th July 2013. While this is not a statutory document, it provides additional planning guidance for development within the boundaries of a specified area, known as the Holbrook Heritage Conservation Area (HCA), as shown in Figure 5-5, and states that:

> *The Conservation Area is a very good piece of urban townscape combining buildings, tree, and space, which still very successfully conveys the atmosphere of a nineteenth century highway town from the 1860s to the 1910s. It includes the two main entry points into the historic centre of the town along the Highway.*
>
> *Some of the Conservation Area at its outer edges contains more scattered building groups. Enough remains, however, of an early typical country townscape to protect and enhance as a Conservation Area.*
>
> *The core of the Conservation Area, half-way through the town, contains many fine buildings, including Woolpack Inn Museum (former Criterion Hotel); Knox Presbyterian Church, Mackie Bros Shop (National Museum of Australian Pottery); Ross Buildings; CBC Bank; Police Station; Courthouse, groups of old shops and hotels. These have significance individually and collectively and the entire streetscape is an essential component of the historic cultural landscape of Holbrook.*

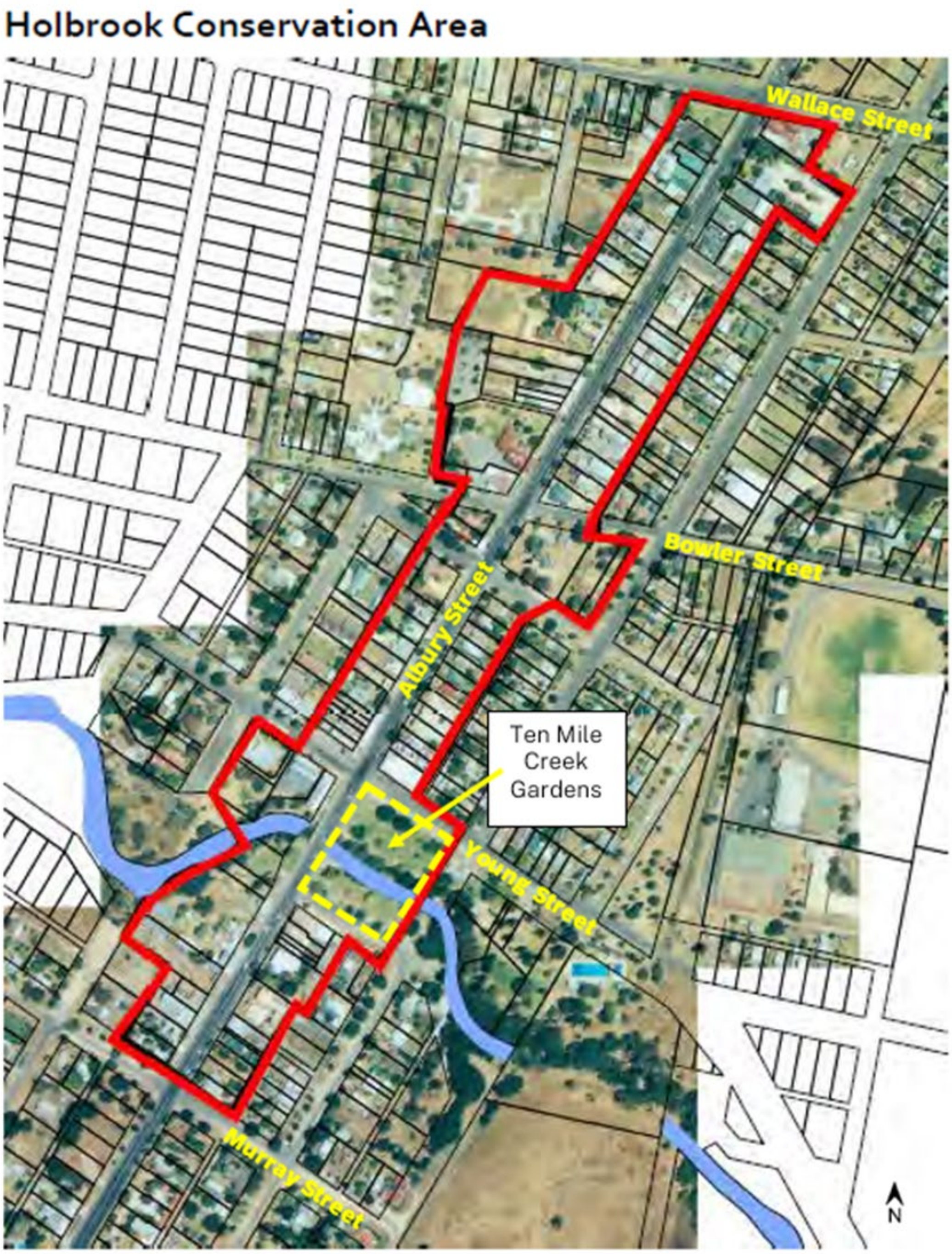


Figure 5-5 Holbrook Heritage Conservation Area, shown within the red line. Ten Mile Creek Gardens in the vicinity of the proposed works is shown within the dashed yellow line.

Ten Mile Creek Gardens

The HCA includes Ten Mile Creek Gardens, an area of public open space below the Ten Mile Creek Bridge. As Ten Mile Creek runs through the park, this land is susceptible to flooding. Levees are proposed to both the northern and southern banks of the creek within Ten Mile Creek Gardens.

The park has areas of open lawn to both sides of the creek. The lawns and northern and southern boundaries of the park have been planted with trees.

Other elements within the park include public toilets, 3 (not listed) memorials, a gazebo and a miniature railway. The railway loops around the park, including under the bridge, and is complimented by a small station, which is located towards the centre of the eastern side of the park.

Heritage items adjacent to Ten Mile Creek Gardens

Of the listed heritage items within the HCA, 4 are immediately adjacent to the park, and will be considered in the impact assessment. They are:

- I95 Germanton Courier,
- I99 Shire Hall,
- I104 Mackie & Son Stores, and
- Ten Mile Creek Bridge.

Items listed by State government instrumentalities

Ten Mile Creek Bridge is listed under the *Heritage Act 1977* - on the s. 170 heritage register for Transport for NSW. 62 and 64 Albury Street are listed under the *Heritage Act 1977* - on the s. 170 heritage register of NSW Police as items of local significance. The courthouse is also listed on the s. 170 heritage register of the NSW DCJ (see Table 5-3 below).

Table 5-3 s.170 heritage register listings

Item no	Name	Address
n/a	Ten Mile Creek Bridge	Albury Street
4180198	Holbrook Court House & Police Office	62 Albury Street
4180197	Holbrook Police Station & Lockup Keeper’s Residence	64 Albury Street
3080069	Holbrook Courthouse and Residence	62 Albury Street

Items listed by Greater Hume Council

The town of Holbrook has many items of local heritage significance, listed in the *Greater Hume Local Environment Plan 2012* (GHLEP).

Items most likely to be impacted by the Proposal are:

I95 Germanton Courier

I99 Holbrook Shire Hall

I104 Mackie & Son stores

Non-listed items

In addition to the above listed items, there are several non-listed items within Ten Mile Creek Gardens, a key component of the HCA, that may have cultural and/ or social significance to the community, such as the miniature railway.

The memorials located within Ten Mile Creek Gardens may hold historical significance, and two are listed on the NSW War Memorial register, the Holbrook First and Second World Wars Memorial and the Trooper A. Richards Memorial.

5.11.2. Impact Assessment

Removal of 32 trees along the alignment of the levees

Heritage Items Affected	Impact
I95	Moderate indirect impact to views of and from the item and the HCA context
I99	Moderate indirect impact to views of and from the item and the HCA context
I104	Moderate indirect impact to views of and from the item and the HCA context
Ten Mile Creek Bridge (no number)	Moderate indirect impact to views of and from the item and the HCA context
Non-listed items affected: Ten Mile Creek Gardens including the miniature railway and memorials.	Moderate direct and indirect impact to setting, views, patterns of use, shade cover, and habitat.

Depending on the findings of the arborist report (to be prepared by Council), the removal of at least 32 trees will result in moderate direct and indirect impact to the above items, including to existing views to and from listed heritage items and within the HCA. Replanting of selected species at appropriate locations will partially mitigate this impact.

Bulk earthworks

Heritage Items Affected	Impact

I95	Moderate indirect impact to views of and from the item and the HCA context
I99	Moderate indirect impact to views of and from the item and the HCA context
I104	Moderate indirect impact to views of and from the item and the HCA context
Ten Mile Creek Bridge (no number)	Moderate indirect impact to views of and from the item and the HCA context
Non-listed items affected: Ten Mile Creek Gardens including the miniature railway and memorials.	Moderate direct and indirect impact to setting, views, patterns of use, and habitat.

Bulk earthworks will result in moderate direct and indirect impacts to the above items, including to existing views to and from listed heritage items. Thoughtful detailed design guidelines may partially mitigate this impact.

Levee Construction

The Proposal will involve the importation and compaction of clay soil to build the levee core and clay rich engineered fill to create the embankments, heights will vary along the length of each levee, from approximately 800 – 2500mm.

Heritage Items Affected	Impact
I95	Moderate indirect impact to views of and from the item and the HCA context
I99	Moderate indirect impact to views of and from the item and the HCA context
I104	Moderate indirect impact to views of and from the item and the HCA context
Ten Mile Creek Bridge (no number)	Moderate indirect impact to views of and from the item and the HCA context

Non-listed items affected: Ten Mile Creek Gardens including the miniature railway, and memorials.	Moderate direct and indirect impact to setting, views, patterns of use, and habitat.
NOTE: Impact will be greater from below the levee and will be dependent on final levee height, it may be considered **major in certain locations.**	

Levee construction will result in moderate direct and indirect impact to the above items, including to existing views to and from listed heritage items. Thoughtful detailed design informed by a visual impact assessment may partially mitigate this impact.

Levee and swale topsoil and seeding

The Proposal involves the Importation and spreading of 100mm topsoil seeded with native grass seed to the embankments, and engineered swales.

Heritage Items Affected	Impact
I95	Moderate indirect impact to views of and from the item and the HCA context
I99	Moderate indirect impact to views of and from the item and the HCA context
I104	Moderate indirect impact to views of and from the item and the HCA context
Ten Mile Creek Bridge (no number)	Moderate indirect impact to views of and from the item and the HCA context
Non-listed items affected: Ten Mile Creek Gardens including the miniature railway, and memorials.	Moderate direct and indirect impact to setting, views, patterns of use, and habitat.

Levee and swale topsoil and seeding will result in moderate direct and indirect impact to the above items, including to existing views to and from listed heritage items. Appropriate specified seed species may partially mitigate this impact.

Levee bench access roads and paths

The Proposal involves the importation of materials and construction of roads, maintenance tracks, and pedestrian paths on the levee bench where shown, materials include asphalt, crushed rock, and granitic sand.

Heritage Items Affected	Impact
I95	Moderate indirect impact to views of and from the item and the HCA context
I99	Moderate indirect impact to views of and from the item and the HCA context
I104	Moderate indirect impact to views of and from the item and the HCA context
Ten Mile Creek Bridge (no number)	Moderate indirect impact to views of and from the item and the HCA context
Non-listed items affected: Ten Mile Creek Gardens including the miniature railway, and memorials.	Moderate direct and indirect impact to setting, views, patterns of use, and habitat.
NOTE: Impact will be greater from below the levee and will be dependent on final levee height, it may be considered **major in certain locations.**	

Levee bench access roads and paths will result in moderate direct and indirect impact to the above items, including to existing views to and from listed heritage items. Thoughtful selection of materials may partially mitigate impact.

Levee Fixtures

The Proposal involves the installation of fences, gates, handrails, and other fixtures.

Heritage Items Affected	Impact
I95	Moderate indirect impact to views of and from the item and the HCA context

I99	Moderate indirect impact to views of and from the item and the HCA context
I104	Moderate indirect impact to views of and from the item and the HCA context
Ten Mile Creek Bridge (no number)	Moderate indirect impact to views of and from the item and the HCA context
Non-listed items affected: Ten Mile Creek Gardens including the miniature railway, and memorials.	Moderate direct and indirect impact to setting, views, patterns of use, shade cover, and habitat. Impact will be greater from below the levee and will be dependent on final levee height, it may be considered major in certain locations.

Installation of levee fixtures will result in moderate direct and indirect impact to the above items, including to existing views to and from listed heritage items. Thoughtful selection of materials may partially mitigate impact.

Retaining walls

The Proposal involves the installation of concrete panel retaining walls, the height of the panels is 900 mm – 1200mm and 1200 - 1600mm at 14 locations along the levee bench.

Heritage Items Affected	Impact
I95	Major indirect impact to views of and from the item and the HCA context
I99	Major indirect impact to views of and from the item and the HCA context
I104	Major indirect impact to views of and from the item and the HCA context
Ten Mile Creek Bridge (no number)	Major indirect impact to views of and from the item and the HCA context
Non-listed items affected: Ten Mile Creek Gardens including the	Moderate direct and indirect impact to setting, views, patterns of use, shade cover, and habitat.

miniature railway, and memorials.	Impact will be greater from within Ten Mile Creek Gardens, it may be considered **major in certain locations**

Installation of retaining walls will result in moderate direct and indirect impact to the above items, including to existing views to and from listed heritage items. This impact can be partially mitigated by appropriate colour and finishes selection.

5.11.3. Mitigation Measures

- All relevant construction staff, contractors and subcontractors must be made aware of their statutory obligations for heritage under the NSW *Heritage Act* 1977 and best practice as outlined in The Burra Charter (Australia ICOMOS 2013) to ensure no archaeological remains or heritage fabric are impacted during the proposed works without appropriate mitigation measures in place. This will be implemented through a heritage induction carried out prior to works commencing and throughout the works program.
- As the existing street trees along Hay Street (in the vicinity of Ten Mile Creek Gardens) are proposed to be removed, replacement trees within Ten Mile Creek Gardens are recommended following the works, to enhance the setting of the heritage items and regain valuable tree canopy in Ten Mile Creek Gardens.
- All proposed built elements should be selected to be harmonious with the surrounding built and natural environment, respect the heritage values of the town's historic core, and to reduce impacts on views to and from listed heritage items where possible.
- Site topsoil should be stockpiled wherever possible for reuse on site during the seeding work to minimise impact on the natural environment and retain the existing landscape character.
- Imported soil should be inspected prior to spreading to ensure it is weed free and of appropriate structure to advance seed germination.

5.12. Waste Management

5.12.1. Construction Impacts

The construction of the Proposal would result in waste in the form of excess spoil, cleared vegetation and general building wastes such as packaging, off cuts, excess materials and workers' wastes such as drinks containers, food scraps, etc. Portable toilets would be provided for workers. Spoil excavated from the proposed borrow pit/stockpile area will be used as engineered fill and would be reused for construction of the levee. Any spoil not able to be re-used as engineered fill would be disposed off-site, although this is considered unlikely.

All weeds are to be managed in accordance with site specific weed management measures to be included in the CEMP. All other waste material generated by the works would be removed from site post construction.

To ensure that environmental harm does not occur as a result of uncontrolled or inappropriate collection, transport and disposal the relevant provisions of the following Acts would be implemented:

- *Waste Avoidance and Resource Recovery Act 2001.*
- *Protection of the Environment Operations Act 1997.*
- *Protection of the Environment Operations (Waste) Regulation 2014.*

Given the proper implementation of waste management and contamination control procedures and/or measures listed below, waste and contamination impacts associated with the Proposal are not expected to be significant.

5.12.2. Operational Impacts

Ongoing vegetation and weed removal would be required post construction along the levee alignment and would be undertaken in accordance with Council's Vegetation Management Plan.

5.12.3. Mitigation Measures

- The contractor undertaking the works would detail waste management procedures in a Waste Management Plan (WMP) to be incorporated into the CEMP. The contractor is to assume responsibility for the appropriate disposal of any waste generated. Adequate procedures should be established and detailed in the CEMP, including notification requirements to EPA, for incidents that cause material harm to the environment. The WMP would also follow the resource management hierarchy principles embodied in the *Waste Avoidance and Resource Recovery Act* 2001. Namely, to:
  - avoid unnecessary resource consumption,
  - recover resources (including reuse, reprocessing, recycling and energy recovery), and
  - dispose (as a last resort).
- The construction contractor is to ensure that waste generated by the works is transported to a place that can lawfully accept it as per Section 143 of the *Protection of the Environment Operations Act* 1997.
- If any contaminated material is encountered during earthworks, work shall cease, the site secured and a safe work method statement(s) and appropriate

practices shall be implemented. Any contaminated material would be classified first and then stored, transported and disposed of in accordance with EPA requirements at an EPA licensed waste facility.

- The EPA is to be notified immediately of any pollution incidents or harm to the environment (as defined under Part 5.7 of the POEO Act).
- The WMP would adopt the objectives of the *Waste Avoidance and Resource Recovery Act*, namely, to encourage the most efficient use of resources, to reduce environmental harm, and to provide for the continual reduction in waste generation in line with the principles of environmentally sustainable development (ESD).
- The reuse of spoil would need to comply with the EPA's *Resource Recovery Exemption and Resource Recovery Order for Excavated Natural Material or disposed in accordance with the Waste Classification Guidelines* (EPA, 2014).
- Accurate written records are to be kept such as:
  - who transported the waste (company name, ABN, vehicle registration and driver details, date and time of transport, description of waste)
  - copies of waste dockets/receipts for the waste facility (date and time of delivery, name and address of the facility, it's ABN, contact person).
- The WMP is to be regularly updated to record how waste is managed and audit where waste is taken.
- Adequate supervision is to be provided to ensure the WMP is implemented and complied with.
- The construction contractor is to ensure that waste generated by the works is transported to a place that can lawfully accept it as per Section 143 of the *Protection of the Environment Operations Act* 1997.
- All waste debris etc ,must be contained within the site and steps taken to ensure this material does not enter nearby waterways.
- Cleared vegetative (exclusive of weeds) is to be returned to nearby suitable locations that are not in the constructible footprint early in the construction process rather than disposed of off-site.
- All weeds are to be removed from site and disposed of appropriately.
- All waste, including excess spoil be recycled if practicable or alternatively taken to a licensed waste disposal facility.

- Solid waste materials including garbage would be collected in steel containers and transported off the site to an approved waste disposal facility.
- Waste receptacles for recyclable and non-recyclable waste are to be provided for personnel waste.
- Trucks used for the transport of excavated materials and imported materials shall be loaded in such a manner and fitted with suitable tarpaulins as to prevent materials dropping from the truck during transportation along the foreshore and public roads.
- The EPA is to be notified immediately of any pollution incidents or harm to the environment (as defined under Part 5.7 of the POEO Act).

If practicable, surplus excavated materials/fill would be reused onsite as part of levee rehabilitation works. Any surplus spoil disposed of in this manner would be seeded to minimise the likelihood of it being transported offsite through wind or water action.

5.13. Bushfire

5.13.1. Existing Environment

Parts of Proposal area would traverse land identified as bushfire prone land (Vegetation Category 1 and Vegetation Buffer) as identified on the Bushfire Prone Land Map, certified by the NSW Rural Fire Service (NSW RFS) (See Figure 5-6).

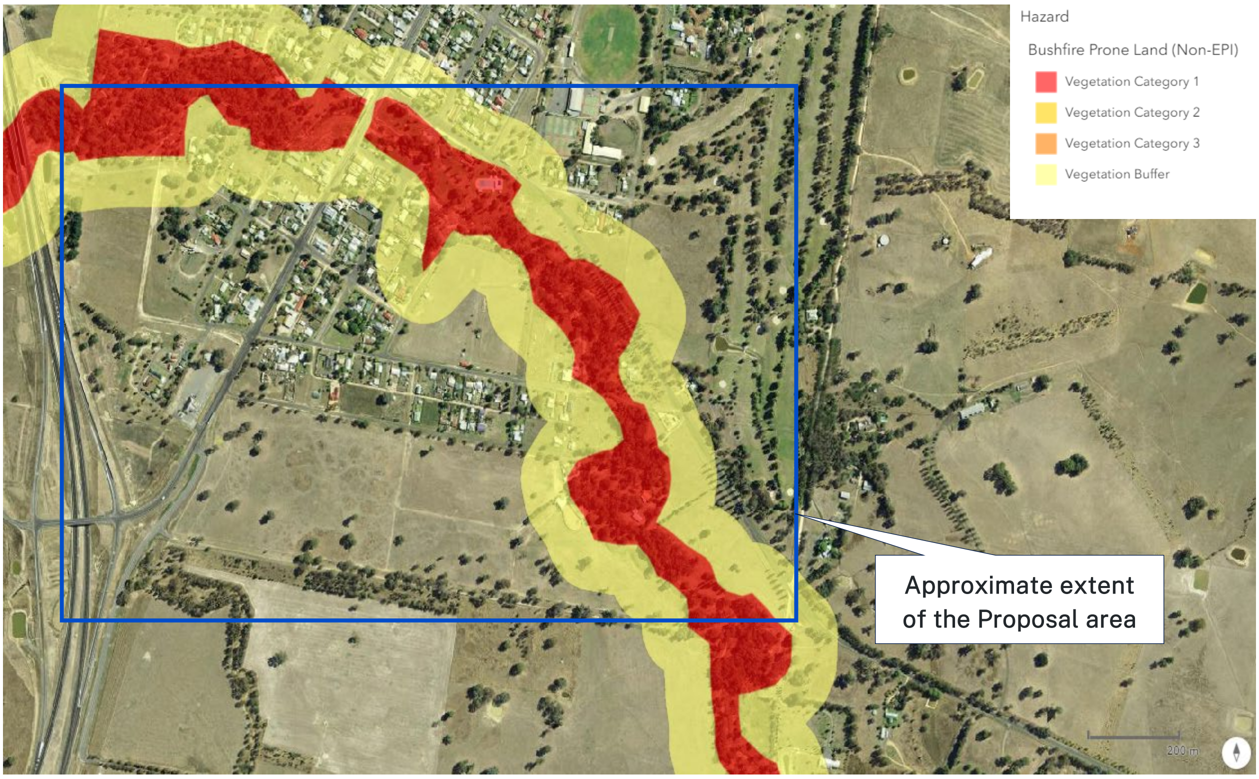


Figure 5-6 Bushfire Prone Land Map

Source: NSW ePlanning Portal, accessed June 2023

5.13.2. Construction Impacts

Construction works at the Proposal site are not anticipated to pose a bushfire risk. Any fire risks associated with works (such as welding) should be incorporated into safe work method statements or similar. The design of the above ground structures should take into consideration the potential bushfire risk at the site, in accordance with the relevant principles of the NSW RFS publication *Planning for Bushfire Protection Guideline 2019*.

5.13.3. Operational Impacts

There would be no operational phase implications for management of bushfire risk at the Proposal area post construction of the levee.

5.13.4. Mitigation Measures

- Construction personnel are to be made aware of the location of the proposed works in bushfire prone land and the potential for bushfire risk.
- No hot works would be undertaken on Total Fire Ban days.

5.14. Visual Amenity

5.14.1. Construction Impacts

Construction activities such as stockpiling and machinery will be visible from residential properties, recreational areas (i.e. Botanic Gardens and Holbrook War Memorial Swimming Pool) and roads/car parks located in the Proposal area. The presence of site fencing, stockpiling, machinery and ongoing excavation to construct the levee banks would detract from the visual amenity and landscape character of the Proposal area, especially the recreational areas (Botanic Gardens and Holbrook War Memorial Swimming Pool). However, as the works would be staged /temporary at each segment of the levee, the visual amenity impacts during construction are considered to be minor.

The proposed levee banks would be adjacent to residential properties, so the construction of the levee and associated works is anticipated to cause a minor disruption to the neighbouring properties, due to noise generation, visual disturbance as well as minor loss of privacy (especially those residences which do not have boundary fences). However, GHC will keep the residents informed of the design and construction works and would investigate any options proposed by the community to reduce potential visual impact/loss of privacy, such as landscaping/ revegetation to improve the visual amenity associated with the Proposal.

The Proposal would require clearing of native vegetation at some locations of the proposed works (i.e. constructing of the levee banks, borrow pit excavation etc); however, vegetation removal is not anticipated to have a significant visual impact on the Proposal area, as this impact will be temporary, vegetation will naturally re-establish and disturbed areas will be rehabilitated and landscaped post the construction of the Proposal. It is noted that the landscaping details for impacted properties will be negotiated between council and the land holders. GHC will prepare a landscape plan based on the results of their discussions with the affected community.

5.14.2. Operational Impacts

Post-construction visual impacts are anticipated due to the construction of the levee banks, concrete levee wall panels and retaining walls in the Proposal area. The increase in height of the surrounding land is anticipated to obscure views to the surrounding area for residents. Some sections of the levee (Holbrook 2 and 3) will be located within existing paddock areas and are not anticipated to have a significant visual impact during operation, as it will be a subsurface gradient grassed feature within the paddock.

Holbrook 2 levee has an approximate length of 1,377 m. This levee is likely to have the greatest visual impact due to its length and location. This levee will be able to be observed from Albury Street after exiting the Hume Highway to the south.

Holbrook 1 and 2 levee banks involve the construction of concrete levee flood wall barriers, which would be within the visual range of the commercial properties located along Hay Street and residential properties located along Bradwell Street and McInnes Street.

All levees may require some form of ongoing maintenance which may include mowing, maintenance of access, or stability assessments.

Overall, the public safety impacts (i.e. reduced flooding risks) associated with the construction of the levee banks are anticipated to outweigh the negative visual impacts during operation.

Visual impacts on heritage items located in the vicinity of the Proposal area are discussed in Section 5.11 above.

5.14.3. Mitigation Measures

- Prepare a landscape plan which incorporates landscaping and revegetation details provided/suggested by the affected community.
- The clearing of groundcover vegetation would be kept to the minimum required for the works.
- Construction compounds and areas for the parking of vehicles and storing of equipment would be located in cleared areas wherever possible.
- Revegetation and landscaping of disturbed areas and the levee to be undertaken as soon as practicable according to the landscaping plan prepared by GHC.

5.15. Utilities and Services

5.15.1. Existing Environment

The Proposal area has access to existing infrastructure services (i.e. water mains, sewer mains and stormwater drainage, electricity and telecommunications).

5.15.2. Construction Impacts

Relevant authorities (i.e., Essential Energy, Telstra and Water NSW) would be consulted further regarding the detailed design requirements, where works are in close proximity to or have the potential to impact on existing services and infrastructure (relocation of light poles, sewer or water mains etc). Those requirements would be incorporated into the detailed design of the Proposal.

5.15.3. Operational Impacts

There would be no operational phase impacts on utilities and services post construction.

5.15.4. Mitigation Measures

- Accurately locate any services near the Site which may be impacted by the construction activities prior to the commencement of construction. This may include contacting 'Dial Before You Dig' if relevant.
- Utility and service providers would be consulted prior to the commencement of and during construction works in the event that impacts on any utilities and services by the Proposal are likely.

5.16. Amenity and Public Safety

5.16.1. Construction Impacts

Any reduction in the quality of the environment during construction will be of a short term and temporary nature, with minor disruption and disturbance to local residents and surrounding businesses during construction. The construction works would not block access to residential properties or affect evacuation routes during flooding events. Appropriate measures would be implemented during construction to ensure the safety of construction staff, occupants of adjoining land and the general public. Assuming the appropriate safeguards are implemented during construction as identified in Section 6. It is concluded that the Proposal would not have an adverse impact on the community.

5.16.2. Operational Impacts

Positive impact is anticipated post construction. The Proposal will minimise environmental, social and cultural impacts associated with flooding events in Holbrook and improve public safety. Bridges, gravel roads and gates will be provided along the levee banks to maintain access to the surrounding public and private areas.

5.16.3. Mitigation Measures

- The construction area would be cordoned off and out of bounds to the general public for the duration of the construction activities.
- In accordance with SafeWork NSW requirements, all plant and equipment used in construction work must comply with the relevant Australian Standards and manufacturer specifications.
- Community complaints received as a result of construction would be recorded and attended to promptly. On receiving a complaint, works would be reviewed to determine whether issues relating to the complaint can be avoided or minimised. Feedback would be provided to the complainant explaining what remedial actions were taken.

6. Environmental Management

6.1. Construction Environmental Management Plan

Preparation of a CEMP is mandatory for all projects undertaken by or on behalf of government agencies or where funding is being provided by the government.

The CEMP would be developed to ensure that appropriate environmental management practices are followed during a project's construction and/or operation. GHC would review the CEMP for this proposal, which should include the following elements, as described in the Guideline for the *Preparation of Environmental Management Plans* (DIPNR, 2004):

Table 6 Construction Environmental Management Plan Structure

Background	Introduction to the document Description of the proposal and project details The context for the CEMP in regard to the overall project The CEMP objectives The contractor's environmental policy
Environmental Management	Environmental management structure of the organisation and specific team responsibilities with respect to the CEMP and its implementation Approval and licensing requirements relevant to the project Reporting requirements Environmental training Emergency contacts and response
Implementation	A project specific risk assessment A detailed list of environmental management safeguards and controls CEMP sub plans for specific environmental controls A detailed schedule assigning responsibility to each environmental management activity and control
Monitor and Review	Environmental monitoring Environmental auditing Corrective action CEMP review and document control procedures

The CEMP would include a risk assessment which ensures that the safeguards identified in this REF, as well as any others that are considered relevant, are effectively translated into actual construction techniques and environmental management activities, controls and monitoring/verification to prevent or minimise environmental impacts. The CEMP should also identify the requirements for compliance with relevant legislation and any other regulatory requirements to ensure environmental safeguards described throughout this REF are implemented. The environmental management objectives and supporting actions presented in this section are intended to assist in this process.

The following details the environmental objectives during construction and the proposed mitigation to be included in the CEMP. This list is not definitive, and additional measures detailed as part of the determination of the project and conditions of any other approvals must also be included.

Safeguards for ongoing management are also listed below and are to be implemented by the GHC and/or the Contractor.

6.2. Environmental Management Measures

Implementation of the mitigation measures outlined below would be undertaken during a number of phases of the project. These phases comprise:

- Detailed design – refinement of the design details
- Pre-construction – prior to the contractor arriving on site to carry out the works
- Construction – during construction phase
- Operation – post construction

6.2.1. Land Use

Objective

- Minimise impacts to surrounding land users during construction and operation of the project

Actions

Action/Phase	Responsibility
Pre-construction	
All required approvals and licences would be obtained prior to construction activities commencing (i.e. TfNSW and DPIRD-Fisheries).	GHC/ Contractor
GHC will need to acquire Crown Land reserves managed by Council under the *Land Acquisition (Just Terms Compensation) Act*	GHC

Action/Phase	Responsibility
1991 (as per Crown Land advice during consultation) (refer to Sections 2.5. and 2.6 of this REF).	
Consultation and consent to the use and potential reservation of the Crown Land parcels that may be subject to registered Aboriginal Land Claims, or agreement to excise the affected areas from the ALCs (affected lots are Lot 2, Section 42, DP 758522, Lot 1 DP 909093 and Lot 7303, DP 1155827).	GHC
If the project requires new or amended water supply, water supply works approvals or additional Water Access License should be obtained from DCCEEW prior to commencement of construction works.	GHC/ Contractor
Easements are to be obtained over private freehold land in accordance with the Land Acquisition (Just Terms Compensation) Act 1991. Early Access Agreements should be established with each landowner to enable access for construction purposes.	GHC
Landowner consent would be obtained from private landowners for works on private freehold land, prior to construction works commencing.	GHC/ Contractor
Negotiations would be undertaken with private landowners where access through private land is required. The outcomes of any access arrangements would be documented in a CEMP prior to construction commencing.	GHC/ Contractor
Consultation would be undertaken with all affected landowners with regard to the potential impact on land uses during construction and any safeguards or mitigation measures that need to be implemented during the works.	GHC/ Contractor
Construction	
The contractor would be required to take all necessary steps to prevent damage to private property and Council facilities and operations including fences and gates. Should damage occur to property it would be restored to a condition equivalent to the original condition.	Contractor
Temporary fencing and gates would be installed where necessary to exclude the public and animals from the work	Contractor

Action/Phase	Responsibility
sites. Any temporary fencing or gates no longer required would be removed at the completion of the construction works.	
Restoration of the areas disturbed during construction would be undertaken post-works.	Contractor

6.2.2. Water Quality and Flooding

Objective

- To effectively manage sediment and erosion control during the construction stage of the project.
- Prevention/minimisation of impacts to the waterways during the construction works.
- To effectively manage flooding during the construction stage of the project.

Actions

Action/Phase	Responsibility
Pre-construction	
A detailed Soil and Water Management Plan (SWMP) shall be prepared as part of the CEMP. The SWMP would describe the site specific measures to be implemented for all works areas, in accordance with the guidelines outlined in the 2004 Landcom publication *Managing Urban Stormwater: Soils and Construction*, 4th edition ("The Blue Book"). The SWMP would need to be site specific and would need to address the following issues to prevent erosion, sediment loss and water quality impacts: • Minimisation of disturbance to soil and water adjacent to all watercourses in the works area. • Identification of site specific sediment and erosion control measures wherever erosion is likely to occur. • Identification of any environmentally sensitive areas on or near construction sites to ensure runoff is diverted away from sensitive areas.	Contractor

Action/Phase	Responsibility
• Retention of all surface runoff on-site and where stormwater from off site would be diverted around the construction site. • Location of construction compounds (at least 50m from any drainage lines). • Location and management of stockpiles, such as locating stockpiles away from any drainage lines near the works areas. • Regular inspection of all erosion and sediment controls, especially when rain is expected and directly after any rain events.	
A site-specific spill management plan would be prepared and include the following requirements: • Emergency spill kits are to be kept at the site (vehicle kits). • Refueling of machinery to be undertaken in a dedicated area within the construction compound appropriately protected as outlined in the spill management plan. • Any chemicals and fuels are to be stored in a bunded area at least 50 metres from any waterway or drainage line. • Any hazardous materials stored on site would be stored in the compounds and within impervious and bunded enclosures capable of storing 120% of the volume of material stored there. • Workers would be trained in the spill management plan and the use of the spill kits.	Contractor
The CEMP would incorporate a pollution incident response management plan that defines appropriate procedures for notification of pollution incidents to the required authorities in accordance with s. 147 to 153 of the POEO Act and requires response actions to be implemented in order to address any risks such as incidents posed to the environment, property or surrounding communities.	Contractor

Action/Phase	Responsibility
Adequate procedures would be established and detailed in the CEMP, including notification requirements to the EPA, for incidents that cause material harm to the environment.	Contractor
Mitigation measures to manage groundwater (should it be encountered during construction) would be incorporated into the CEMP which is to address the following issues in relation to groundwater: • Dewatering techniques during excavation. • Measures to ensure groundwater quality is not impacted during construction. • Techniques to settle, treat or filter groundwater encountered during excavation works i.e., diverting groundwater through baffle tanks or filter membranes. • Appropriate treatment and monitoring regimes should be established in the event that groundwater flows come to the surface, including disposal of groundwater in such a way as to prevent adverse impacts (such as erosion and water pollution). Groundwater should not be discharged to a waterway during construction.	Contractor
Ideally the works would be scheduled to occur during winter-spring to avoid the wetter seasons, however there is the potential that may occur within this period and additional measures shall be developed.	GHC/ Contractor
The contractor would develop a monitoring and flood response plan to detail procedures for monitoring rainfall (stormwater) and waterway flows and to identify subsequent response actions that would be taken to ensure the protection of personnel, equipment and water quality during the construction works.	Contractor
Construction	
The contractor's compound is to be located within cleared land and not within the riparian corridor.	Contractor
Any excess spoil would be reused onsite or removed off site for disposal in accordance with EPA requirements	Contractor

Action/Phase	Responsibility
Works should not be scheduled when heavy rainfall is forecast and works involving soil disturbance should not take place during heavy rainfall periods, other than work necessary to stabilise the site.	Contractor
Workers are to be made aware of the provisions of Section 120 of the POEO Act with regards to water pollution.	Contractor
All areas where ground disturbance has occurred would be stabilised following completion of works to ensure there is no erosion hazard and restored to their pre-construction condition. This would involve, where required, reshaping the ground surface, covering it with topsoil excavated from the site and re-establishing an appropriate vegetation cover.	Contractor
The contractor would develop a flood contingency plan have provisions in place to reinstate any excavated section of levee using concrete bollards or similar should a flood occur during construction.	Contractor
In the event of flooding, construction works in affected areas would cease and would not commence until floodwaters have receded. Weather forecasts would be checked regularly so that equipment and materials in flood areas can be secured prior to heavy rainfall events.	Contractor

6.2.3. Traffic and Access

Objective

- Ensure that construction vehicles do not cause excessive inconvenience to road and pedestrian users.
- Ensure the safety of road users and construction personnel for the duration of the works.
- Minimise the pollution impacts resulting from the use of vehicles during construction.

Actions

Action/Phase	Responsibility
Pre-construction	

Action/Phase	Responsibility
The contractor would prepare a Traffic Management Plan (TMP) as part of the CEMP, to be reviewed by GHC prior to commencement of works. The TMP would include measures to minimise traffic impacts ensure public safety and would be prepared in accordance with: • *RMS's Traffic Control at Work Sites Manual, Issued July 2018; and* • *Australian Standard 1742.3 - 2009 Traffic Control for Works on Roads.*	Contractor
The TMP would detail mitigation measures to manage traffic related issues associated with the construction works including: • All materials deliveries are to avoid school zones during school bus hours, i.e. 7.30am to 9.30am and 3pm to 5pm, and • Appropriate and site-specific pedestrian management.	Contractor
Prior to the commencement of construction works the contractor shall consult with residential premises likely to be affected by truck movements, or in the immediate vicinity of the proposed works to determine any community concerns and provide advice as to where concerns can be directed. If during consultation community concerns are not readily resolved by agreement, The Department/council staff are to be contacted who will endeavour to assist in resolving any outstanding issues of concern.	GHC/ Contractor
Construction	
Any disturbance to landowners as a result of vehicle movements and noise would be minimised by adhering to the working hours outlined in Section 4.3.4 of the REF. The contractor would avoid any inconvenience to residences/landowners.	Contractor
Where driveways or pedestrian access are to be obstructed, affected property owners/nearby residents to be provide at least 2 days' notice.	Contractor

Action/Phase	Responsibility
Any temporary compounds and their access roads required for the works would be located so as to minimise disturbance to the existing environment. Following completion of the works the temporary compounds and roads would be removed, topsoil provided and re-grassed. Existing tracks and paths would be restored to their condition prior to works.	Contractor
Roads must be re-instated in accordance with Council's Construction Manual or as directed by Council's staff.	Contractor
Trucks would not access the sites in weather conditions that would cause damage to properties or the environment.	Contractor
All sealed roads would be kept clean and free of dust and mud at all times. Where material is tracked onto sealed roads at any time, it would be removed immediately so that road pavements are kept safe and trafficable.	Contractor
Any temporary access tracks required for the works would be located so as to minimise disturbance to the existing environment. Following completion of the works the temporary tracks would be removed, topsoil provided and re-grassed.	Contractor
A dilapidation report of traffic routes would be undertaken to ensure that all road surfaces are returned to a condition equivalent to pre-construction condition.	Contractor
All construction traffic would comply with all applicable traffic laws and regulations. All construction vehicles would comply with the speed limits set for the roads accessing the sites.	Contractor

6.2.4. Air Quality

Objective

- Avoidance/minimisation of off-site dust nuisance to neighboring residences and the community.
- Minimisation of air quality impacts resulting from machinery and vehicle emissions.

Actions

Action/Phase	Responsibility
Pre-construction	
Construction vehicles and equipment would be suitably serviced within the six-month period prior to commencement of construction activities and all necessary maintenance undertaken during the construction period to meet EPA air quality requirements.	Contractor
Construction	
The excessive use of vehicles and powered construction equipment would be avoided.	Contractor
All construction machinery would be turned off when not in use to minimise emissions.	Contractor
Construction contractors would monitor dust generation potential.	Contractor
Dust suppression methods including the use of water carts would be applied where required (i.e., on windy days when earthworks and vehicle movements are generating dust).	Contractor
Any stockpiled spoil/fill would be protected to minimise dust generation to avoid sediment moving offsite.	Contractor
Vehicles transporting fill/spoil to and from the works sites would be covered.	Contractor
Bare surfaces are to be vegetated or stabilised as soon as possible.	Contractor

6.2.5. Noise and Vibration

Objective

- Compliance with relevant recommendations specified in the *Interim Construction Noise Guideline* (DECC, 2009).
- Avoidance/minimisation of noise impacts on nearby sensitive noise receivers.

Actions

Action/Phase	Responsibility
Pre-construction	
Prior to the commencement of construction works , the contractor shall consult with residential premises likely to be affected by, or in the immediate vicinity of, the proposed works to determine any community concerns and provide advice as to where concerns can be directed. If during consultation community concerns are not readily resolved by agreement, Council staff are to be contacted who will endeavour to assist in resolving any outstanding issues of concern.	GHC/ Contractor
A Noise and Vibration Management Plan (NVMP) must be prepared as part of the CEMP, to be reviewed by GHC prior to commencement of works. The NVMP would address site specific issues, including limited work hours and noise and vibration reduction practices, taking into consideration DECCW's *Interim Construction Noise Guideline* (in particular Tables 4 – 10) and *Assessing Vibration: A Technical Guideline* (in particular mitigation measures in Section 3). Mitigation measures to minimise noise and vibration impacts would include: • Optimum siting of work areas, vehicle and plant parking areas, materials stockpiles and equipment storage areas in locations where potential acoustic and vibration impacts would be minimised. • Regular maintenance of all plant and machinery used for the project. • Identify locations where construction noise and vibration is most intrusive and develop strategies to reduce impacts for these areas.	Contractor
A pre- construction dilapidation assessment should be undertaken of any structures or buildings within close proximity to the works area and which may be impacted from vibration sources.	Contractor
Construction	
Construction works would be undertaken during normal work hours i.e., 7am to 6pm Monday to Friday; 8am to 1pm Saturdays; and no work would be undertaken on Sundays, Public Holidays	Contractor

Action/Phase	Responsibility
or outside these work hours without notification to the affected community and EPA. However, due to proximity of the houses to the levee work sites, hours may be reduced to limit the impact to residents. Notification to EPA and affected community would provide the following details: • The locations and types of surrounding receivers likely to be affected. • The nature of the proposed works. • The noise characteristics of any powered equipment likely to be used. • Measures to be taken to reduce noise emissions; and • Any other information EPA may request. • All reasonable practical steps shall be undertaken to reduce noise and vibration from the site.	
Consideration is to be given to respite periods by restricting the hours that the very noisy activities can occur, taking into account: - Excavation or removal of any materials using machinery of any kind, including compressors, must be limited to between 7.30am and 5.00pm Monday to Friday, with a respite break of 45 minutes between 12pm and 1pm. - Times identified by the community when they are less sensitive to noise (such as before and after school for when located near schools, or mid-morning or mid-afternoon when located near residences); and - If the community is prepared to accept a longer period of works in exchange for restrictions on construction times.	Contractor
All plant and machinery used for the project would be well maintained.	Contractor

Action/Phase	Responsibility
All possible measures would be taken to ensure construction equipment is operated to manufacturer's specifications.	Contractor
Any noise complaint received would be investigated as soon as practicable. Any practicable and feasible measures to minimise noise would be identified. The complainant would be advised of the outcome.	Contractor
A post-construction dilapidation assessment should be undertaken of any structures or buildings within close proximity to the works area and which may be impacted from vibration sources.	Contractor

6.2.6. Biodiversity

Objective

- Avoidance/minimisation of impacts to flora and fauna
- Minimise unnecessary clearing of vegetation
- Avoid weed invasion

Actions

Action/Phase	Responsibility
Construction	
A comprehensive weed management plan is to be implemented for the site both during and after construction.	Contractor
Vegetation clearing should be limited to the minimum required to successfully complete the proposal.	Contractor
Limits of clearing should be provided to the construction contractor and identified both on site maps/plans and on site.	Contractor
Carry out erosion & sediment control around the disturbance area.	Contractor
Turf used on the levee shall be free of weeds	Contractor
Only lay turf free of weeds onto the levee structure;	Contractor

Action/Phase	Responsibility
Vehicles and machinery should be stored and parked in treeless areas.	Contractor
Any animals injured during the clearing works should be collected and taken to a local veterinarian or wildlife carer.	Contractor
In accordance with the *Biosecurity Act 2015*, those weeds identified on site must be controlled to result in their suppression.	Contractor
Levee 3 from chainage 0 to chainage 80 should be re-aligned to avoid impacting the three large, old Blakely's Red Gum trees that occur along that section of levee alignment, unless a Level 5 AQF Arborist advises that the trees would not be adversely impacted by the proposal.	Contractor
A Level 5 AQF Arborist should also advise on appropriate protection measures for all native trees that immediately adjoin the alignments for all three proposed levees to ensure they are not damaged during construction. The Arborist should be engaged on completion of the proposal, to confirm that the recommended tree protection measures were properly implemented.	Contractor
To minimise the risk of harming native fauna the three mature Blakely's Red Gums at the end of MacInnes Street should only be removed under the direction of an appropriately qualified ecologist who can also care for any fauna that may be injured during the removal these trees.	Contractor
Thirty (30) Eucalyptus trees of either Blakely's Red Gum or Yellow Box are recommended to planted alongside the levee alignments, preferably in areas where Eucalyptus trees presently do not occur.	Council
Council should consider removing the problem weeds that occur at Levee 2 (between chainages 1020 to 1160, particularly where the creek bank and adjoining riparian areas are cleared of vegetation). Replanting this area with native species and stabilising the creek bank are recommended to improve the	Council

Action/Phase	Responsibility
condition of habitat for the threatened Murray Crayfish and Southern Pygmy Perch that potentially occur there.	
Operation	
Periodic weed control is to be undertaken within areas of remaining native vegetation.	Contractor

6.2.7. Aboriginal Cultural Heritage

Objective

- Minimise potential impacts to items and places of Aboriginal cultural heritage due to the works

Actions

Action/Phase	Responsibility
Construction	
All workers (including contractors) should be made aware that it is illegal to harm an Aboriginal object or historic relics, and if a potential Aboriginal object or historic relic is encountered during activities, then all work at the site will cease and Heritage NSW, Department of Premier and Cabinet will be contacted.	Contractor
All workers (including contractors) should be inducted concerning Aboriginal cultural heritage values and basic training should be provided for identifying Aboriginal objects.	Contractor
In the event that known or suspected Aboriginal objects, artefacts or skeletal remains are encountered during the activity, the following unexpected finds protocol will be followed: – All work in the immediate vicinity will cease. – The find will be immediately reported to the work supervisor who will immediately advise the Environment Manager or other nominated senior staff member.	Contractor

Action/Phase	Responsibility
– The Environment Manager or other nominated senior staff member will promptly notify the police and the state coroner (as required for all human remains discoveries). – The Environment Manager or other nominated senior staff member will contact Heritage NSW, Department of Premier and Cabinet for advice on identification of the skeletal material as Aboriginal and management of the material. – If the skeletal material is of Aboriginal ancestral remains, the Local Aboriginal Land Council will be contacted and consultative arrangements will be made to discuss ongoing care of the remains.	
All staff and contractors involved in the proposed work should be made aware of legislative protection under the NPW Act for all Aboriginal sites and objects, and the contents of the Unanticipated Finds Protocols	Contractor
All land and ground disturbance activities must be confined to inside the study area.	Contractor

6.2.8. Historic Heritage

Objective

- Minimise potential impacts to items and places of historic heritage due to the works

Actions

Action/Phase	Responsibility
Pre-Construction	
All relevant construction staff, contractors and subcontractors must be made aware of their statutory obligations for heritage under the NSW *Heritage Act* 1977 and best practice as outlined in The Burra Charter (Australia ICOMOS 2013) to ensure no archaeological remains or heritage fabric are impacted during the proposed works without appropriate mitigation measures in place. This will be implemented through a heritage induction	Contractor

Action/Phase	Responsibility
carried out prior to works commencing and throughout the works program.	
All proposed built elements should be selected to be harmonious with the surrounding built and natural environment, respect the heritage values of the town's historic core, and to reduce impacts on views to and from listed heritage items where possible.	GHC
Construction	
Site topsoil should be stockpiled wherever possible for reuse on site during the seeding work to minimise impact on the natural environment and retain the existing landscape character.	Contractor
Imported soil should be inspected prior to spreading to ensure it is weed free and of appropriate structure to advance seed germination.	Contractor
Post-Construction	
As the existing street trees along Hay Street (in the vicinity of Ten Mile Creek Gardens) are proposed to be removed, replacement trees within Ten Mile Creek Gardens are recommended following the works, to enhance the setting of the heritage items and regain valuable tree canopy in Ten Mile Creek Gardens.	GHC

6.2.9. Waste Management

Objective

- Compliance the provisions of the *Protection of the Environment Operations (Waste) Regulation 2014*.
- Maximise reuse/recycling of waste material and minimise waste disposed of to landfill.

Actions

Action/Phase	Responsibility
Pre- Construction	

Action/Phase	Responsibility
The contractor undertaking the works would detail waste management procedures in a Waste Management Plan (WMP) to be incorporated into the CEMP. The contractor is to assume responsibility for the appropriate disposal of any waste generated. Adequate procedures should be established and detailed in the CEMP, including notification requirements to EPA, for incidents that cause material harm to the environment. The WMP would also follow the resource management hierarchy principles embodied in the *Waste Avoidance and Resource Recovery Act 2001*. Namely, to: • avoid unnecessary resource consumption, • recover resources (including reuse, reprocessing, recycling and energy recovery), and • dispose (as a last resort).	Contractor
Construction	
The construction contractor is to ensure that waste generated by the works is transported to a place that can lawfully accept it as per Section 143 of the *Protection of the Environment Operations Act* 1997.	Contractor
If any contaminated material is encountered during earthworks, work shall cease, the site secured, and a safe work method statement(s) and appropriate practices shall be implemented. Any contaminated material would be classified first and then stored, transported and disposed of in accordance with EPA requirements at an EPA licensed waste facility.	Contractor
The EPA is to be notified immediately of any pollution incidents or harm to the environment (as defined under Part 5.7 of the POEO Act).	Contractor
The WMP would adopt the objectives of the *Waste Avoidance and Resource Recovery Act*, namely, to encourage the most efficient use of resources, to reduce environmental harm, and to provide for the continual reduction in waste generation in line with the principles of environmentally sustainable development (ESD).	Contractor

Action/Phase	Responsibility
The reuse of spoil would need to comply with the EPA's *Resource Recovery Exemption and Resource Recovery Order for Excavated Natural Material or disposed in accordance with the Waste Classification Guidelines* (EPA, 2014).	Contractor
Accurate written records are to be kept such as: • who transported the waste (company name, ABN, vehicle registration and driver details, date and time of transport, description of waste) • copies of waste dockets/receipts for the waste facility (date and time of delivery, name and address of the facility, it's ABN, contact person).	Contractor
The WMP is to be regularly updated to record how waste is managed and audit where waste is taken.	Contractor
Adequate supervision is to be provided to ensure the WMP is implemented and complied with.	Contractor
The construction contractor is to ensure that waste generated by the works is transported to a place that can lawfully accept it as per Section 143 of the *Protection of the Environment Operations Act* 1997.	Contractor
All waste debris etc , must be contained within the site and steps taken to ensure this material does not enter nearby waterways.	Contractor
Cleared vegetative (exclusive of weeds) is to be returned to nearby suitable locations that are not in the constructible footprint early in the construction process rather than disposed of off-site.	Contractor
All weeds are to be removed from site and disposed of appropriately.	Contractor
All waste, including excess spoil be recycled if practicable or alternatively taken to a licensed waste disposal facility.	Contractor
Solid waste materials including garbage would be collected in steel containers and transported off the site to an approved waste disposal facility.	Contractor
Waste receptacles for recyclable and non-recyclable waste are to be provided for personnel waste.	Contractor

Action/Phase	Responsibility
Trucks used for the transport of excavated materials and imported materials shall be loaded in such a manner and fitted with suitable tarpaulins as to prevent materials dropping from the truck during transportation along the foreshore and public roads.	Contractor
The EPA is to be notified immediately of any pollution incidents or harm to the environment (as defined under Part 5.7 of the POEO Act).	Contractor
If practicable, surplus excavated materials/fill would be reused onsite as part of levee rehabilitation works. Any surplus spoil disposed of in this manner would be seeded to minimise the likelihood of it being transported offsite through wind or water action.	Contractor

6.2.10. Bushfire

Objective

- To protect the public and the construction personnel during the construction works from bushfire risks.

Action/Phase	Responsibility
Construction	
Construction staff to be made aware of the location of the proposed works in bushfire prone land and the potential for bushfire risk.	Contractor
No hot works to be undertaken on Total Fire Ban days.	Contractor

6.2.11. Visual Amenity

Objective

– Protect the visual amenity of the locality for neighbouring land users and the local community.

Actions

Action/Phase	Responsibility
Pre- Construction	
Prepare a landscape plan which incorporates landscaping and revegetation details provided/suggested by the affected community.	GHC
Construction	
The clearing of groundcover vegetation would be kept to the minimum required for the works	Contractor
Construction compounds and areas for the parking of vehicles and storing of equipment would be located in cleared areas wherever possible.	Contractor
The clearing of groundcover vegetation would be kept to the minimum required for the works.	Contractor
Construction compounds and areas for the parking of vehicles and storing of equipment would be located in cleared areas wherever possible.	Contractor
Revegetation and landscaping of disturbed areas and the levee to be undertaken as soon as practicable according to the landscape plan prepared by GHC.	Contractor

6.2.12. Utilities and Infrastructure

Objective

- Prevention/minimisation of impacts to utilities and services infrastructure during the construction works.

Actions

Action/Phase	Responsibility
Construction	
Utilities and services which may be impacted by the proposal would be accurately located prior to commencement of works using Dial Before You Dig (DYBD).	Contractor

Action/Phase	Responsibility
Utility and service providers would be consulted prior to the commencement of and during construction works in the event that impacts on any utilities and services by the proposal are likely.	Contractor

6.2.13. Amenity and Public Safety

Objective

- Prevention/minimisation of socio economic impacts during the construction works.

Actions

Action/Phase	Responsibility
Construction	
The construction area would be cordoned off and out of bounds to the general public for the duration of the construction activities.	Contractor
In accordance with SafeWork NSW requirements, all plant and equipment used in construction work must comply with the relevant Australian Standards and manufacturer specifications.	Contractor
Community complaints received as a result of construction would be recorded and attended to promptly. On receiving a complaint, works would be reviewed to determine whether issues relating to the complaint can be avoided or minimised. Feedback would be provided to the complainant explaining what remedial actions were taken.	Contractor

7. Conclusions and Recommendations

7.1. Conclusion

The Proposal would mitigate flooding risks in Holbrook township by providing protection to the southern portion of the town from inundation due to the 1% AEP flood event of the Ten Mile Creek. The Proposal will consequently minimise environmental, social and cultural impacts associated with flooding events.

The Proposal would potentially cause short term impacts such as impacts to land use, elevated noise, dust, traffic and access, waste generation/management increased noise and reduction in community amenity for the nearby residents and users of local streets during the construction phase. However, these impacts are considered to be minor and temporary.

Specialist biodiversity impact assessment undertaken for the Proposal (SIA, 2024) indicated that the Proposal would not have significant terrestrial and aquatic biodiversity impacts, this was supported by ToS under the BA Act. Therefore, a SIS and/or BDAR are not required for the Proposal.

Specialist AHDDA undertaken for the Proposal (NSW PW, 2023) concluded that the Proposal is unlikely to impact Aboriginal objects and will not impact on any known places or sites of cultural significance to the Aboriginal community. No Aboriginal sites or objects were identified inside the Proposal area, and the Proposal area has a low potential for archaeological deposits to be present. Therefore, further archaeological assessments and/or an AHIP are not required, and the Proposal can proceed with caution.

Specialist HIS undertaken for the proposal concluded that the greatest impact of the proposed works will be in and around Ten Mile Creek Gardens. While not a listed item, this park is located within the (non-statutory) Holbrook Heritage Conservation Area and is the location of several community assets including the miniature railway and war memorials. The proposed levees will change the way people currently use the park, by altering access, the existing ground plane and tree cover.

Heritage items immediately adjacent to the park will not be directly impacted by the proposal, however there will be moderate indirect impact to them, as the views of and from the listed heritage items will be altered by the proposed works.

These impacts can be partially mitigated by the recommendations contained within this report, including a thorough approach to the landscape design process, to produce a detailed landscape (re) design of Ten Mile Creek Gardens.

Once constructed, the Proposal would result in an overall positive long-term impact to the Holbrook community by reducing flooding risks and reducing associated environmental, cultural and social impacts.

Visual impacts are anticipated due to the elevated levee banks during operation. However, the public safety impacts (i.e. reduced flooding risks) associated with the construction of the levee banks are anticipated to outweigh the negative visual impacts during operation. Therefore, visual impacts associated with the Proposal are not anticipated to be significant.

7.2. Recommendations

Subject to the findings of the REF and associated specialist assessments, it is predicted that all environmental impacts associated with the Proposal could be managed through the implementation of suitable mitigation measures, and the Proposal can be implemented without resulting in a significant environmental impact. The works will require a CEMP which must be reviewed and approved by GHC prior to the commencement of construction.

This REF has been prepared in accordance with Sections 5.5 and 5.7 of the EP&A Act *1979* and Section 171 of the EP&A Reg. It provides a true and fair assessment of the proposed activity in relation to its likely effects on the environment.

On the basis of the information presented in this REF it is concluded that:

1) The proposed activity is not likely to have a significant impact on the environment and therefore an Environmental Impact Statement is not required.

2) The proposed activity is not likely to significantly affect threatened species, populations, ecological communities, or critical habitat. Therefore, a SIS / BDAR is not required.

3) The proposed activity is not likely to affect any Commonwealth land, is not being carried out on Commonwealth land, or significantly affect any matters of national environmental significance.

The Proposal is recommended for approval subject to implementation of the measures to avoid, minimise or manage environmental impacts listed in this REF.

8. References

Australian Standard AS2436-2010. *Guide to Noise and Vibration Control on Construction, Demolition and Maintenance Sites*

Cardno, 2019*, Preliminary Environmental and Planning Overview- Holbrook Flood Mitigation Works*

Department of Energy and Climate Change (DECC). (2009). *NSW Government Interim Construction Noise Guidelines*

Department of Infrastructure, Planning and Natural Resources (DIPNR). (2004). *NSW Government Guideline for the Preparation of Environmental Management Plans*

Department of Energy and Climate Change (DECC). (2010). *Due Diligence Code of Practice for the Protection of Aboriginal Objects in NSW*

Environment Protection Authority, 2017, *Noise Policy for Industry*

Landcom, 2004, Managing Urban Stormwater: Soils and Construction, 4th Edition (The Blue Book)

9. Appendices

Appendix A: Consideration of S171 of the EPA Regulation

Section 171 of the EP&A Regulation details those factors that must be taken into account concerning the impact of an activity on the environment. The following is a summary of the environmental assessment related to the factors that have to be considered under s.171.

The considerations below apply to construction activities covered in this REF. As noted in Section 5, safeguards need to be implemented to ensure these considerations are met.

Table 0-1: Consideration of Section 171 of the EP&A Regulation

Environmental Factor	Impact(s)
a) Any environmental impact on a community?	There is the potential for some minor noise, dust and visual impacts during construction however mitigation measures will be adopted to minimise these impacts.
b) Any transformation of a locality?	Transformation of areas surrounding the proposed elevated levee banks, concrete levee walls and retaining walls is expected. However, as the majority of the levee banks would be consistent/compatible with the adjoining land uses (i.e. paddocks and rural areas) the transformation of the locality is not anticipated to be significant. The public safety impacts (i.e. reduced flooding risks) associated with the construction of the levee banks are anticipated to outweigh the negative impacts associated with the transformation of the locality.
c) Any environmental impact on the ecosystems of the locality?	Specialist biodiversity impact assessment undertaken for the Proposal (SIA, 2024) indicated that the Proposal would not have significant impact on aquatic and terrestrial ecosystems of the locality, this was supported by ToS undertaken under the BA Act.
d) Any reduction of the aesthetic, recreational, scientific or other	Minor visual impacts are anticipated due the construction of the levee banks, concrete levee wall panels and retaining walls in the Proposal area. The

Environmental Factor	Impact(s)
environmental quality or value of a locality?	increase in height of the surrounding land is anticipated to obscure views to the surrounding area for residents. However, as the majority of the levee banks would be consistent/compatible with the adjoining land uses (i.e. paddocks and rural areas) the transformation of the locality is not anticipated to be significant. All levees will require some form of ongoing maintenance which may include mowing, maintenance of access, or stability assessments Overall, the public safety impacts (i.e. reduced flooding risks) associated with the construction of the levee banks are anticipated to outweigh the negative visual impacts during operation.
e) Any effect on a locality, place or building having aesthetic, anthropological, archaeological, architectural, cultural, historical, scientific or social significance or other special value for present or future generations?	A specialist Aboriginal Due Diligence Assessment and Heritage Impact Statement were prepared by NSW PW for the Proposal to assess impacts on historic heritage, including archaeological impacts, and Aboriginal heritage. Copies of these reports are provided in Appendix D and E and a summary of the findings is discussed in Section 5.10 and 5.11. The results of the specialist assessments identified that: – No Aboriginal items are likely and no further archaeological investigations are required. The works can proceed with care. – Impacts to heritage can be partially mitigated by the recommendations in Section 5.11.3, including a thorough approach to the landscape design process, to produce a detailed landscape (re) design of Ten Mile Creek Gardens.
f) Any impact on the habitat of protected animals (within the meaning of the	Specialist biodiversity impact assessment undertaken for the Proposal (SIA, 2024) indicated that the Proposal would not have significant impact

Environmental Factor	Impact(s)
Biodiversity Conservation Act 2016)?	on terrestrial fauna species, this was supported by ToS undertaken under the BA Act.
g) Any endangering of any species of animal, plant or other form of life, whether living on land, in water or in the air?	Specialist biodiversity impact assessment undertaken for the Proposal (SIA, 2024) indicated that the Proposal would not have significant impact on flora and fauna species.
h) Any long-term effects on the environment?	None identified.
i) Any degradation of the quality of the environment?	Minor temporary degradation may occur during the works due to excavation and construction materials placement and associated dust, noise and visual impacts. Such impacts will be managed through the adoption of the proposed mitigation measures.
j) Any risk to the safety of the environment?	Safety of the area will be greatly improved post construction by the flood mitigation works due to the reduced flooding risks.
k) Any reduction in the range of beneficial uses of the environment?	No, the Proposal would provide additional flood protection in Holbrook.
l) Any pollution of the environment?	No, given the proper implementation of mitigation measures provided in this REF and documented in the CEMP.
m) Any environmental problems associated with the disposal of waste?	No, given the proper implementation of mitigation measures provided in this REF and documented in the CEMP.
n) Any increased demands on resources, natural or otherwise which are, or are likely to become, in short supply?	None identified.

Environmental Factor	Impact(s)
o) Any cumulative environmental effect with other existing or likely future activities?	None identified.
p) Any impact on coastal processes and coastal hazards, including those under projected climate change conditions.	None identified.
q) Applicable local strategic planning statements, regional strategic plans or district strategic plans made under the Act, Division 3.1,	None identified.
r) Other relevant environmental factors.	No additional environmental factors identified.

Appendix B: Land Tenure

LOT & DP	FOLIO	OWNER NAME	NOTES FROM TITLE SEARCH	NOTES FROM EPLANNING SPATIAL
1/42/DP758522	1/42/758522	THE STATE OF NEW SOUTH WALES	AJ252526 RESERVE TRUST: HOLBROOK SHIRE COUNCIL RESERVES RESERVE TRUST SEE GOVERNMENT GAZETTE DATED 3/3/1995, FOLIO 1101 AND ERRATUM DATED 15/7/2016, FOLIO 2015 AJ26887 LEASE TO TERRENCE PAUL MELBOURNE OF "HOLBROOK SWIMMING POOL", YOUNG STREET, HOLBROOK SHOWN HATCHED IN PLAN WITH AJ26887. EXPIRES: 31/3/2017. OPTION OF RENEWAL: 1 YEAR.	RESERVE 82247: Manager - Greater Hume Shire Council Purpose - Public Recreation
2/42/DP758522	2/42/758522	THE STATE OF NEW SOUTH WALES	NIL	RESERVE 37798: Manager - Holbrook Recreation Ground Land Manager Purpose - Public Recreation
7/10/DP758522	7/10/758522	HEATHER JEAN JULIAN & PHILIP ANTHONY JULIAN (AS JOINT TENANTS)	NIL	
1/10/DP869633	REFERENCE NOT HELD - PERHAPS TYPO - SHOULD IT BE 1/10/DP758522, WHICH HAS LOCATION OF 18 BYNG ST? (DETAILS IN FOLLOWING ROW)			
	1/10/758522	CARKILT PTY LTD	NIL	

7304/DP1155827	7304/1155827	THE STATE OF NEW SOUTH WALES	NIL	RESERVE 753340: Manager - The Minister Purpose - Future Public Requirements
7303/DP1155827	7303/1155827	THE STATE OF NEW SOUTH WALES	LAND EXCLUDES TEN MILE CREEK SHOWN IN THE TITLE DIAGRAM	RESERVE 78325: Manager - Greater Hume Shire Council Purpose - Public Recreation
1/DP909093	1/909093	THE STATE OF NEW SOUTH WALES	NIL	RESERVE 620023: Manager - Greater Hume Shire Council Purpose - Botanic Gardens
7/DP1156130	7/1156130	STUFF IT PTY LTD	DP610408 EASEMENT FOR WATER SUPPLY APPURTENANT TO THE LAND ABOVE DESCRIBED	
17/DP1156130	17/1156130	ROADS & TRAFFIC AUTHORITY OF NEW SOUTH WALES	W472036 RIGHT OF CARRIAGEWAY AFFECTING THE PART SHOWN DESIGNATED (E2) IN THE TITLE DIAGRAM AH936296 RESTRICTION(S) ON THE USE OF LAND	
5/DP1156130	AUTO CONSOL 8455-80	TREVOR PATRICK BOLAND & ELAINE JOYCE BOLAND (AS JOINT TENANTS)	NIL	
6/DP1156130	AUTO CONSOL 8455-80	TREVOR PATRICK BOLAND & ELAINE JOYCE BOLAND (AS JOINT TENANTS)	NIL	
9/D/DP5364	9/D/5364	BARBARA MAY HICKS	NOTATIONS: NOTE: THIS FOLIO MAY BE ASSOCIATED WITH A CROWN TENURE WHICH	

			IS SUBJECT TO PAYMENT OF AN ANNUAL RENT. FOR FURTHER DETAILS CONTACT CROWN LANDS.
7/D/DP4512	AUTO CONSOL 2107-158	BARBARA MAY HICKS	NOTATIONS: NOTE: THIS FOLIO MAY BE ASSOCIATED WITH A CROWN TENURE WHICH IS SUBJECT TO PAYMENT OF AN ANNUAL RENT. FOR FURTHER DETAILS CONTACT CROWN LANDS.
8/D/DP4512	AUTO CONSOL 2107-158	BARBARA MAY HICKS	NOTATIONS: NOTE: THIS FOLIO MAY BE ASSOCIATED WITH A CROWN TENURE WHICH IS SUBJECT TO PAYMENT OF AN ANNUAL RENT. FOR FURTHER DETAILS CONTACT CROWN LANDS.
10/D/DP5364	10/D/5364	MICHELLE TRACEY DINSDALE & ANTHONY MARK BEAUMONT (AS JOINT TENANTS)	NIL
10/DP753340	10/753340	KELVIN JOHN LYONS & CHRISTINE MAREE LYONS (AS JOINT TENANTS)	LAND EXCLUDES THE ROAD(S) SHOWN IN CROWN PLAN 11704.1603
1/DP1198264	1/1198264	ROADS AND MARITIME SERVICES	AK805811 RESTRICTION(S) ON THE USE OF LAND

Appendix C: Biodiversity Impact Assessment

Biodiversity Impact Assessment

Holbrook Flood Mitigation Works

(Prepared for NSW Public Works and Greater Hume Council)

30 August 2024

SIA Ecological & Environmental Planning Pty Ltd
PO Box 409 Strawberry Hills NSW 2012

SIA Ecological & Environmental Planning Pty Ltd

PO Box 409 Strawberry Hills NSW 2012
ABN: 32 636 794 477
www.siaeep.com.au
Email: mjames@siaeep.com.au
Mob: 0403 233 676

Biodiversity Impact Assessment:
Holbrook Flood Mitigation Works

30 August 2024

SIA Ecological & Environmental Planning operates a quality control system. If this report is not signed below, it is a preliminary draft.

Report prepared by: Martin James

Signed: Date: 30th August 2024

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1 INTRODUCTION

1.1 Site Location and Setting

The project site is situated on the southern side of the town of Holbrook in the Greater Hume Local Government Area. It encompasses the alignments of three proposed new levees and one proposed soil borrow site. It includes the areas adjoining the levee alignments to a distance of approximately 10m in consideration of potential construction impacts.

The project site is entirely on the southern side of Ten Mile Creek. The landform across the project site is generally flat, comprising the Brokong Floodplains Mitchell Landscape. Elevation is approx. 260m AHD. The NSW Government eSPADE database indicates the project site is entirely within the Mountain Creek Soil Landscape. The soils of this landscape are described in the Mountain Creek Soil Landscape Report as:

> "*very deep (>1.5 m), moderately well-drained Brown, Yellow and Grey Sodosols (Soloths) occur on the higher, older terraces, with deep (1.0–1.5 m), moderately well-drained Yellow and Brown Dermosols (Yellow and Brown Earths) occurring on lower younger terraces. Deep (1.0–1.5 m), imperfectly drained Stratic Rudosols (Alluvial Soils) occur in the recent channels*."

Figure 1-1 shows the location of the project site.

1.2 Description of Development Proposal

The proposed activity is to construct three levees. Levee 1 has a length of approx. 600m. It is positioned alongside the left bank of Ten Mile Creek, commencing beside Hay St. Levee 2 is approx. 1.4kms long. It is positioned alongside the left bank of Ten Mile Creek, commencing near Bardel St, for a distance of approx. 400m but then heads west across the adjoining floodplain to end at Albury St. Levee 3 continues the alignment of Levee 2 on the western side of Albury St heading west then north-west for a distance of approx. 300m. A borrow site is proposed to supply soil for the levees. It immediately adjoins Levee 2 in the south-east of the project site. Figure 1-2 below shows the project site. Plan drawings of the proposed levee alignments and borrow site are provided in Appendix A. Photographs of the project site are provided in Appendix B.

1.3 Purpose of this Report

This report provides the biodiversity impact assessment for the proposal. It describes the flora and fauna habitat on the project site and discusses the likely biodiversity impacts of the proposal. The report identifies species, populations or communities listed under the NSW *Biodiversity Conservation Act 2016* (BC Act), *Fisheries Management Act 1994* (FM Act) and/ or the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) that occur or may occur on or adjoining the project site. Where the proposal is likely to impact on these the report includes the required assessments of significance.

1.4 Assessment Methodology

Background information was collated from relevant sources and databases including, but not limited to the NSW Government vegetation mapping, NSW Government SEED website, BioNet Atlas of NSW Wildlife database, DPI (2016) '*Fish communities and threatened species distributions of NSW*', NSW Government Six Viewer website, and Google Maps.

Site assessments were undertaken on the 6th April and 12th September 2023. The site assessments involved inspecting vegetation and fauna habitat over the entire project site and immediately adjoining areas. All observed species of flora were identified, vegetation community types were identified, fauna habitat described, any opportunistic sightings of fauna documented, and any significant flora or fauna features described. A brief examination of the vegetation in the adjoining and surrounding areas was undertaken to establish the local context for vegetation and fauna habitat on the site. Digital photographs and GPS coordinates were taken for later reference and for inclusion in this report.

The results of the site assessment were analysed with reference to relevant information sources and databases including, but not limited to, the NSW Flora Online PlantNET database, NSW Threatened Species Profiles, NSW Scientific Committee Determinations, Commonwealth Listing Advices, and Threatened Species Assessment of Significance Guidelines (DECC, 2007).

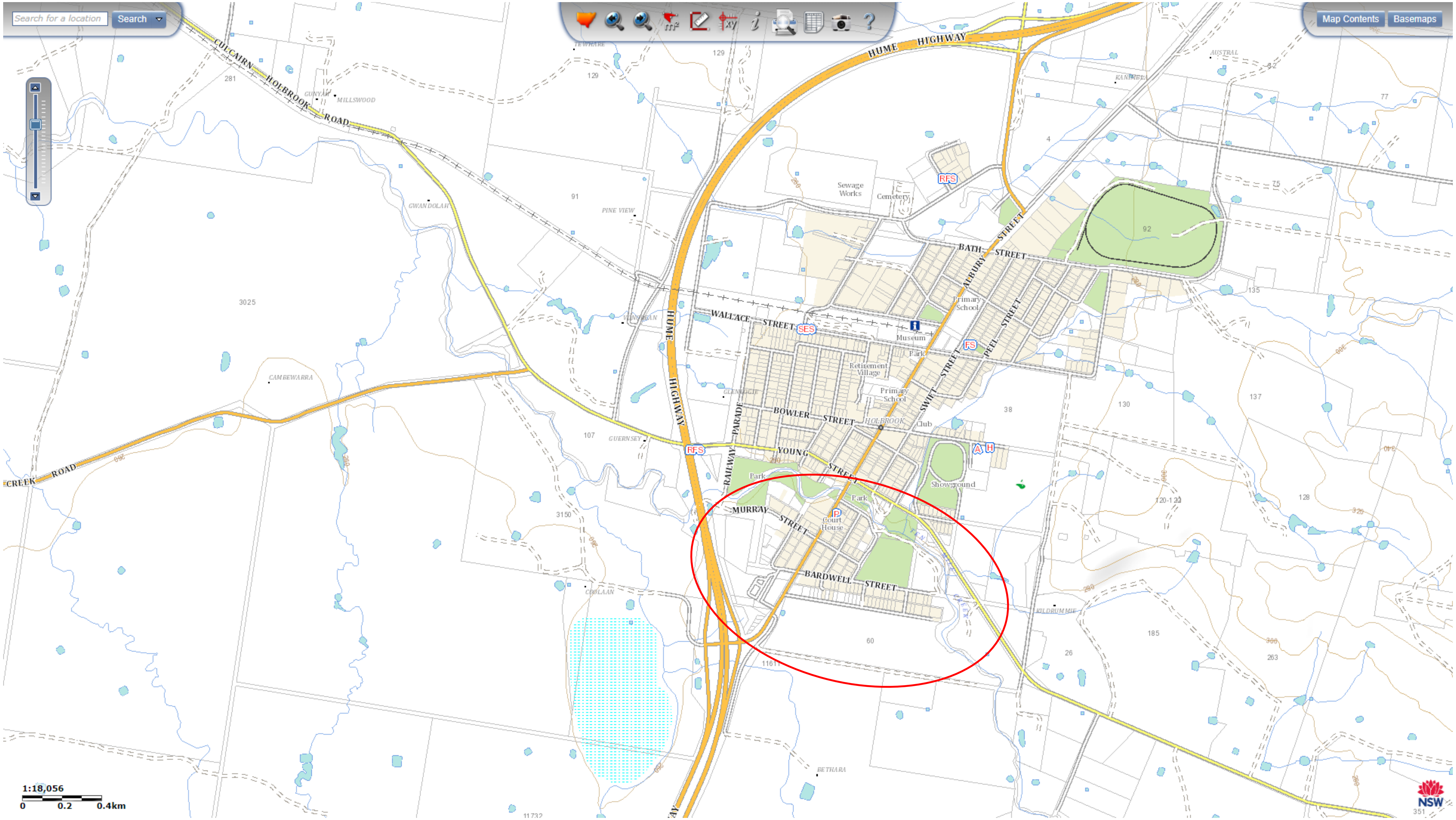


Figure 1-1: Location of project site.

Figure 1-2: The project site.

2 EXISTING FLORA AND FAUNA

2.1 Flora

2.1.1 Flora on the Project Site

The western approximately half of Levee 1 comprises non-native vegetation. It includes approximately 160m of parkland belonging to the Ten Mile Creek Gardens. This section comprises a Kikuyu (*Cenchrus clandestinus**) lawn with various species of planted, introduced, ornamental trees including, for example, European Ash (*Fraxinus excelsior**), Chinese Tallow Tree (*Triadica sebifera**), Oak (*Quercus* sp.*) and London Plane Tree (*Platanus* × *acerifolia**). Another 140m approximately follows the alignment of a dirt road with numerous planted Elm (*Ulmus sp.**) trees on both sides and a lawn of mainly Kikuyu beneath. The eastern approximately half of Levee 1 comprises a paddock where the native shrubs and trees have been cleared. This area now comprise a grassland with a mixture of native and introduced grasses and forbs. Native species include, for example, Windmill Grass (*Chloris truncata*), Wiry Panic (*Entolasia stricta*), Small St John's Wort (*Hypericum gramineum*), and the Rush *Juncus australis*. At the far eastern end of Levee 1 there is a thicket of the weed Tree-of-Heaven (*Ailanthus altissima**).

The eastern approximately quarter of Levee 2, that sits alongside Ten Mile Creek, comprises a mixture of entirely cleared, partly cleared and remnant riparian forest all with a high proportion of weeds, as well as various planted ornamental trees and shrubs, both native and introduced. Weeds include, for example, Oats (*Avena sativa**), Perennial Ryegrass (*Lolium perenne**), Large-leaf Privet (*Ligustrum lucidum**), Blackberry (*Rubus fruticosus* sp. *agg.**) and Sweet Briar (*Rosa rubiginosa**). Native species include, for example, Blakely's Red Gum (*Eucalyptus blakelyi*), Kurrajong (*Brachychiton populneus*) and Native Sorrel (*Oxalis perennans*).

The remaining approximately 1,000m of Levee 2 comprises grassland pasture with a high proportion of introduced grasses and weeds. The main grasses being the introduced Phalaris (*Phalaris aquatica**), Barnyard Grass (*Echinochloa crusgalli**), Oats and Common Paspalum (*Paspalum dilatatum**). Weeds include, for example, Catsear (*Hypochaeris radicata**), Common Plantain (*Plantago lanceolata**), St John's Wort (*Hypericum perforatum**), Curled Dock (*Rumex crispus**), and Umbrella Sedge (*Cyperus eragrostis**). Several large old Yellow Box (*Eucalyptus melliodora*) and Blakely's Red Gum occur beside the alignment at the western end and a young, planted street tree (*Eucalyptus* sp.) occurs on the alignment beside Albury St.

Levee 3 comprises grassland of mostly introduced species and weeds with many of the species described above. In addition four large, old trees of Blakely's Red Gum occur along the alignment, as well as numerous young saplings of Apple Box (*Eucalyptus bridgesiana*) and Blakely's Red Gum.

The stockpile site, covering an area of approximately 3.5 ha, comprises pasture as described above for Levee 2 with scattered, isolated, old, remnant trees of Blakely's Red Gum and Yellow Box.

The complete list of species observed on the site is provided in Appendix C. Photos are provided in Appendix B.

The State Vegetation Type Map - NSW Extant PCT vC2 identifies most of the project site as 'non-native' vegetation. Parts of the project site alongside Ten Mile Creek and on the far western edge of the project site are mapped as PCT 277 '*Blakely's Red Gum - Yellow Box grassy tall woodland*' and PCT 278 '*Riparian Blakely's Red Gum - box - shrub - sedge - grass tall open forest*'. The vegetation mapping is shown below in Figure 2-1.

The two Plant Community Types (PCTs) identified by the OEH mapping as occurring on the project site is correct. However, the OEH mapping has incorrectly identified the introduced Elm trees along Levee 2 as native trees. The OEH mapping appears also to be based on older aerial imagery because the extent of native vegetation along Levee 1 alongside Ten Mile Creek is less than is mapped by OEH. More accurate and ground-truthed vegetation mapping is provided below in Figure 2-2 based on the current site assessment and recent aerial imagery (Google Satelite).

Both PCTs that occur on the project site form part of the ecological community '*White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland*' listed as Critically Endangered under both the BC Act and EPBC Act.

2.1.2 Species Listed under BC Act and EPBC Act

A search of the DPE Atlas of NSW Wildlife database (on 05/04/2023 and 21/06/2024) indicated that no species of flora listed under the BC Act and/ or EPBC Act have been recorded within a 10km x 10km square centred on the project site.

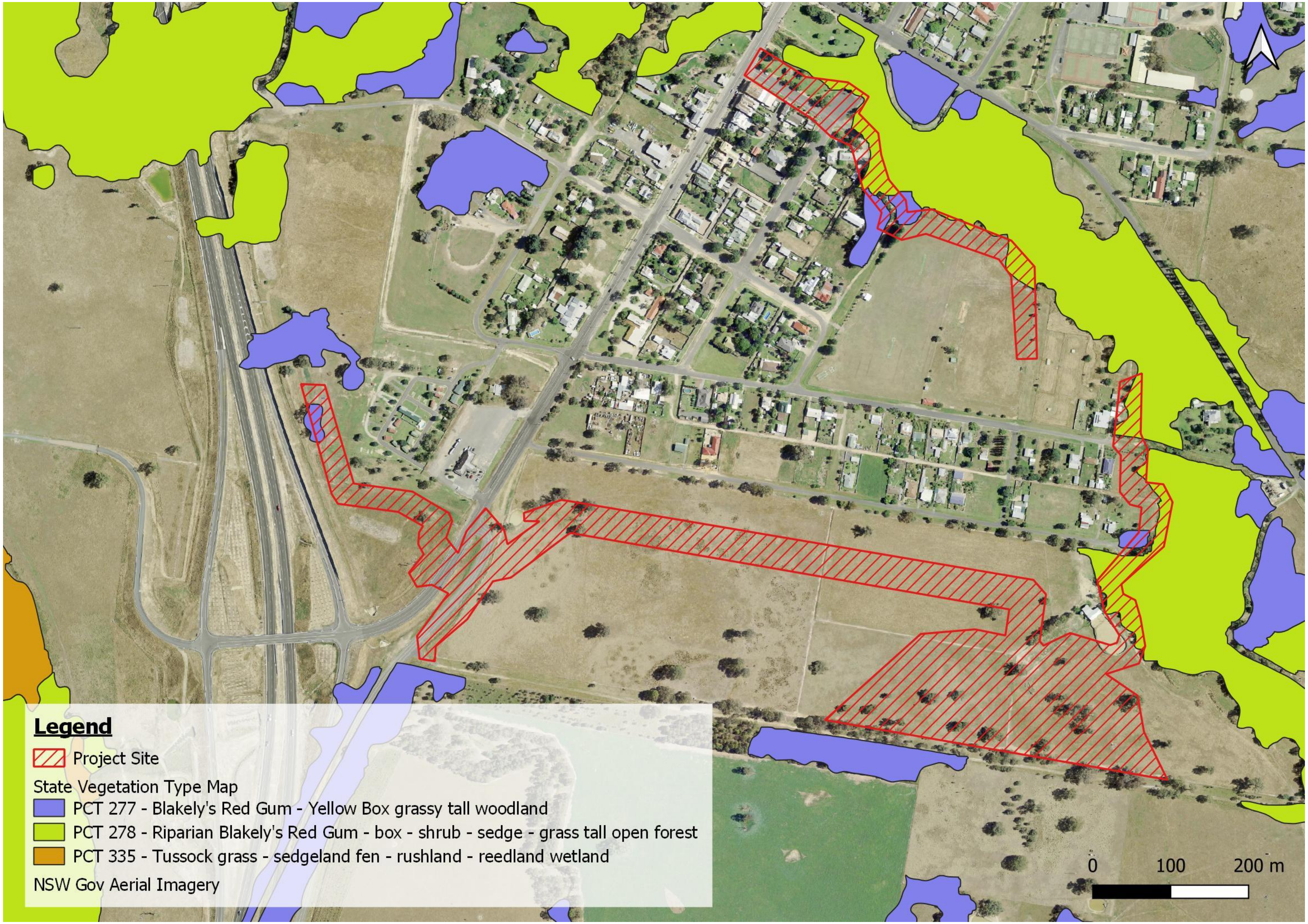


Figure 2-1: State Vegetation Type Mapping with proposal footprint marked.

Figure 2-2: Updated vegetation mapping based on the site assessment.

2.2 Fauna

2.2.1 Fauna Habitat on the Project Site

The vegetation over most of the site comprises grassland with a high proportion of introduced grasses and weeds. These areas provide little habitat for native fauna. Parts of the project site adjoining Ten Mile Creek provide habitat for native fauna where there are trees and/ or shrubs and/ or a dense groundcover (i.e. not grazed). These areas would provide habitat mainly for invertebrates, reptiles, birds, and mammals such as possums, gliders, wombats, wallabies, Flying-foxes and microbats. These sections of creek would also provide habitat for native fish. The old trees at the proposed Borrow Site and along the alignment of Levee 3 provide habitat for some of the native fauna mentioned above, particularly the hollow-bearing trees as these provide important roosting and nesting habitat.

During the site assessment three native species of frog, twelve native species of bird and two native species of butterfly were incidentally observed. The species are listed in Appendix C.

2.2.2 Species Listed under BC Act and EPBC Act

A search of the BioNet Atlas of NSW Wildlife database (on 05/04/2023 and 21/06/2024) indicated that nine (9) species of fauna listed under the BC Act and/ or EPBC Act have been recorded within a 10km x 10km square centred on the project site. The species are presented in Table 2-1 below. The table indicates the likelihood of a species being present on site and the reason for the stated likelihood. No species of threatened fauna was observed during the site assessment.

2.2.3 Species listed under the FM Act 1994

The '*Fish communities and threatened species distributions of NSW*' (DPI, 2016) identifies Ten Mile Creek at Holbrook as being within the indicative distribution for the Murray Crayfish (*Euastacus armatus*) listed as Vulnerable under the FM Act and for the Southern Pygmy Perch (*Nannoperca australis*) listed as Endangered under the FM Act.

There are no records of either species within the Greater Hume Local Government Area on the BioNet Atlas of NSW Wildlife database.

The Fisheries Scientific Committee Final Determinations for these two species (FSC (2008) and FSC (2013)) indicates that section of Ten Mile Creek immediately adjoining the proposed levee wall along Levee 2 (chainages 1020 to 1160) provides potential habitat for both species.

Table 2-1: Species of fauna listed under the BC Act or EPBC Act recorded within a 10km x 10km square centred on the project site.

Scientific Name	Common Name	Habitat	TSC Act/ EPBC Act Status *	Likelihood of the Species Occurring on the Site	Reason for Stated Likelihood
Aves					
Anseranas semipalmata	Magpie Goose	Mainly found in shallow wetlands (less than 1 m deep) with dense growth of rushes or sedges. Equally at home in aquatic or terrestrial habitats; often seen walking and grazing on land; feeds on grasses, bulbs and rhizomes. Activities are centred on wetlands, mainly those on floodplains of rivers and large shallow wetlands formed by run-off; breeding can occur in both summer and winter dominated rainfall areas and is strongly influenced by water level; most breeding now occurs in monsoonal areas; nests are formed in trees over deep water; breeding is unlikely in south-eastern NSW. Often seen in trios or flocks on shallow wetlands, dry ephemeral swamps, wet grasslands and floodplains; roosts in tall vegetation.	V/ -	Low	Not suitable habitat
Ixobrychus flavicollis	Black Bittern	Inhabits both terrestrial and estuarine wetlands, generally in areas of permanent water and dense vegetation. Where permanent water is present, the species may occur in flooded grassland, forest, woodland, rainforest and mangroves. Feeds on frogs, reptiles, fish and invertebrates, including snails, dragonflies, shrimps and crayfish, with most feeding done at dusk and at night. During the day, roosts in trees or on the ground amongst dense reeds. When disturbed, freezes in a characteristic bittern posture (stretched tall, bill pointing up, so that shape and streaked pattern blend with upright stems of reeds), or will fly up to a branch or flush for cover where it will freeze again. Generally solitary, but occurs in pairs during the breeding season, from December to March.	V/ -	Low	Not suitable habitat
Polytelis swainsonii	Superb Parrot	Inhabit Box-Gum, Box-Cypress-pine and Boree Woodlands and River Red Gum Forest. In the Riverina the birds nest in the hollows of large trees (dead or alive) mainly in tall riparian River Red Gum Forest or Woodland. On the South West Slopes nest trees can be in open Box-Gum Woodland or isolated paddock trees. Species known to be used are Blakely's Red Gum, Yellow Box, Apple Box and Red Box.	V/ V	Medium	One of the old, hollow bearing trees on the Levee 3 alignment provides a potential nesting site. It is recommended to avoid impacting this tree.

Scientific Name	Common Name	Habitat	TSC Act/ EPBC Act Status *	Likelihood of the Species Occurring on the Site	Reason for Stated Likelihood
Climacteris picumnus victoriae	Brown Treecreeper (eastern subspecies)	Found in eucalypt woodlands (including Box-Gum Woodland) and dry open forest of the inland slopes and plains inland of the Great Dividing Range; mainly inhabits woodlands dominated by stringybarks or other rough-barked eucalypts, usually with an open grassy understorey, sometimes with one or more shrub species; also found in mallee and River Red Gum (Eucalyptus camaldulensis) Forest bordering wetlands with an open understorey of acacias, saltbush, lignum, cumbungi and grasses; usually not found in woodlands with a dense shrub layer; fallen timber is an important habitat component for foraging; also recorded, though less commonly, in similar woodland habitats on the coastal ranges and plains. Sedentary, considered to be resident in many locations throughout its range; present in all seasons or year-round at many sites; territorial year-round, though some birds may disperse locally after breeding. Gregarious and usually observed in pairs or small groups of 8 to 12 birds; terrestrial and arboreal in about equal proportions; active, noisy and conspicuous while foraging on trunks and branches of trees and amongst fallen timber; spend much more time foraging on the ground and fallen logs than other treecreepers. When foraging in trees and on the ground, they peck and probe for insects, mostly ants, amongst the litter, tussocks and fallen timber, and along trunks and lateral branches; up to 80% of the diet is comprised of ants; other invertebrates (including spiders, insects larvae, moths, beetles, flies, hemipteran bugs, cockroaches, termites and lacewings) make up the remaining percentage; nectar from Mugga Ironbark (Eucalyptus sideroxylon) and paperbarks, and sap from an unidentified eucalypt are also eaten, along with lizards and food scraps; young birds are fed ants, insect larvae, moths, craneflies, spiders and butterfly and moth larvae. Hollows in standing dead or live trees and tree stumps are essential for nesting. The species breeds in pairs or co-operatively in territories which range in size from 1.1 to 10.7 ha (mean = 4.4 ha). Each group is composed of a breeding pair with retained male offspring and, rarely, retained female offspring. Often in pairs or cooperatively breeding groups of two to five birds.	V/ -	Low	Most of the project site provides only marginal habitat. A small area of better quality habitat exists where the project site immediately adjoins along Ten Mile Creek along the Levee 2 levee.

Scientific Name	Common Name	Habitat	TSC Act/ EPBC Act Status *	Likelihood of the Species Occurring on the Site	Reason for Stated Likelihood
Anthochaera phrygia	Regent Honeyeater	The species inhabits dry open forest and woodland, particularly Box-Ironbark woodland, and riparian forests of River Sheoak. Regent Honeyeaters inhabit woodlands that support a significantly high abundance and species richness of bird species. These woodlands have significantly large numbers of mature trees, high canopy cover and abundance of mistletoes. Every few years non-breeding flocks are seen foraging in flowering coastal Swamp Mahogany and Spotted Gum forests, particularly on the central coast and occasionally on the upper north coast. Birds are occasionally seen on the south coast. The Regent Honeyeater is a generalist forager, which mainly feeds on the nectar from a wide range of eucalypts and mistletoes. Nectar and fruit from mistletoes are also eaten during the breeding season. When nectar is scarce lerp and honeydew comprise a large proportion of the diet. Insects make up about 15% of the total diet and are important components of the diet of nestlings. A shrubby understorey is an important source of insects and nesting material. The species can undertake large-scale nomadic movements in the order of hundreds of kilometres. However, the exact nature of these movements is still poorly understood. It is likely that movements are dependent on spatial and temporal flowering and other resource patterns.	E4A/ E	Low	The project site provides only marginal habitat

Scientific Name	Common Name	Habitat	TSC Act/ EPBC Act Status *	Likelihood of the Species Occurring on the Site	Reason for Stated Likelihood
Pomatostomus temporalis temporalis	Grey-crowned Babbler	Inhabits open Box-Gum Woodlands on the slopes, and Box-Cypress-pine and open Box Woodlands on alluvial plains. Flight is laborious so birds prefer to hop to the top of a tree and glide down to the next one. Birds are generally unable to cross large open areas. Live in family groups that consist of a breeding pair and young from previous breeding seasons. A group may consist of up to fifteen birds. All members of the family group remain close to each other when foraging. A soft 'chuck' call is made by all birds as a way of keeping in contact with other group members. Feed on invertebrates, either by foraging on the trunks and branches of eucalypts and other woodland trees or on the ground, digging and probing amongst litter and tussock grasses. Build and maintain several conspicuous, dome-shaped stick nests about the size of a football. A nest is used as a dormitory for roosting each night. Nests are usually located in shrubs or sapling eucalypts, although they may be built in the outermost leaves of low branches of large eucalypts. Nests are maintained year round, and old nests are often dismantled to build new ones. Territories range from one to fifty hectares (usually around ten hectares) and are defended all year. Territorial disputes with neighbouring groups are frequent and may last up to several hours, with much calling, chasing and occasional fighting.	V/ -	Low	There are relatively vast areas of similar habitat in the local area and beyond

Mammalia					
Petaurus norfolcensis	Squirrel Glider	Inhabits mature or old growth Box, Box-Ironbark woodlands and River Red Gum forest west of the Great Dividing Range and Blackbutt-Bloodwood forest with heath understorey in coastal areas. Prefers mixed species stands with a shrub or Acacia midstorey. Require abundant tree hollows for refuge and nest sites. Diet varies seasonally and consists of Acacia gum, eucalypt sap, nectar, honeydew and manna, with invertebrates and pollen providing protein.	V/ -	Low	Although there are many records of this species nearby the project site does not provide good quality habitat. If however, the native vegetation were to regenerate around the large hollow-bearing trees at the northern end of Levee 3, these trees could become important den sites for this species.
Pteropus poliocephalus	Grey-headed Flying-fox	Roosting camps are generally located within 20 km of a regular food source and are commonly found in gullies, close to water, in vegetation with a dense canopy. Can travel up to 50 km from the camp to forage; commuting distances are more often <20 km. Feed on the nectar and pollen of native trees, in particular Eucalyptus, Melaleuca and Banksia, and fruits of rainforest trees and vines.	V/ V	Low	There are relatively vast areas of similar habitat in the local area and beyond
Scoteanax rueppellii	Greater Broad-nosed Bat	Utilises a variety of habitats from woodland through to moist and dry eucalypt forest and rainforest, though it is most commonly found in tall wet forest. Although this species usually roosts in tree hollows, it has also been found in buildings. Forages after sunset, flying slowly and directly along creek and river corridors at an altitude of 3 - 6 m. Open woodland habitat and dry open forest suits the direct flight of this species as it searches for beetles and other large, slow-flying insects; this species has been known to eat other bat species.	V/ -	Low	Marginal habitat although the presence of tree hollows increases the likelihood

* V = Vulnerable; E = Endangered; E4A = Critically Endangered.

3 IMPACT ASSESSMENT

3.1 Flora

Almost the entire lengths of the levee alignments (approx. 2km or 87%) are on non-native vegetation (although scattered isolated native trees do occur either within the proposal footprint, or immediately adjoining it). In these areas there would be no impact to native vegetation (the impact on the isolated trees is discussed further below) other than small numbers of scattered native grasses and forbs that occur amongst the non-native vegetation. All of these native grasses and forbs are common species.

Approximately 200m of Levee 2 is either through or immediately next to highly disturbed PCT 278 - Riparian Blakely's Red Gum – box – shrub – sedge – grass tall open forest. The creek line suffers from many of the typical ecological impacts such as soil erosion, nutrient enrichment, and weed invasion. Additionally, being the very edge of a narrow strip of remnant vegetation the forest within the levee alignment is subjected to many edge effects from the adjoining urban and agricultural land uses. The main effects would be altered micro-environment/climate, invasion of non-native plants, and nutrient enrichment. Consequently, the two short sections of native forest that would be impacted by the proposal are already heavily impacted and degraded. One section, near Bardell St, is approx. 70m of proposed levee wall. At the time of the site assessment the only native vegetation along the wall alignment here was a small clump of young Eucalypt saplings, the dense native vegetation occurring on the opposite side of Ten Mile Creek. Some of the trees on the opposite bank may overhand the levee alignment. Also, the angle of the aerial imagery gives the impression that trees occur along the alignment, although this is not the case. There would be little impact to native vegetation here. The next section is approx. 130m long near Macinnes St, with approx. 75m of this being a proposed levee wall. At the end of Macinnes St six mature trees would be removed, being three (3) Blakely's Red Gum with Diameter at Breast Heights (DBH) of approx. 40 to 50 cm and three smaller Eucalyptus with DBH of approx. 20-30cm of unknown species that have been planted in the adjoining, residential gardens. One of the Blakely's Red Gums could potentially have small tree hollows in the ends of dead branches. Another four (4) smaller Blakely's Red Gums with DBHs of approx. 20-40cm would be removed near the end of this section. The trees are relatively young and have no tree hollows. The plan drawings indicate that further tree clearing may be required in this area, presumably to be determined during construction. It is recommended that an arborist be engaged to advise on which trees can be retained and which need to be removed during the construction stage of the project. The arborist should also advice on appropriate tree protection measures for those trees to be retained. The other vegetation to be removed in this section comprises planted ornamental, small trees and shrubs of non-native species, and weeds. In places along this section of the proposed levee it is close to the creek. Where this is the case Council should consider, and particularly where the creek bank and adjoining riparian areas are cleared of vegetation for construction, removing the problem weeds that occur there and replanting the riparian area with native species.

As mentioned above some isolated native trees along the levee alignments will need to be removed. This includes a young Kurrajong (*Brachychiton populneus*) and two small *Eucalyptus* sp. saplings along Levee 2 near Bardell St and a planted, young *Eucalyptus* sp. street tree beside Albury St. It is recommended that these trees be replaced with the same or similar species of native trees along the levee alignments or elsewhere in town where such planting would most benefit biodiversity. In addition the construction footprint beside the levee alignment includes several large, old Eucalypts that immediately adjoin the levee alignments. It is recommended that an Arborist assist during the construction stage by implementing appropriate protection measures to ensure these trees are not damaged by the project.

The Levee 3 alignment would remove one large, old Blakely's Red Gum and numerous saplings beside Albury St. The Red Gum does not appear to have any tree hollows that are likely to be used by fauna. It is recommended that Blakely's Red Gum trees be planted alongside the levee alignment, but away from existing mature trees, to offset this impact. Approaching the northern end of Levee 3 three very large, old Blakely's Red Gum trees are located within the levee alignment and would most likely, therefore, need to be removed. A number of species of native bird were observed in the tree at the time of the site assessment and one of these trees at least contains trees hollows that are likely to be used by fauna, including, potentially, the threatened Super Parrot. The trees are likely to be several hundreds of years old and should be retained. It is recommended that the levee be re-aligned to avoid impact these three trees, unless a Level 5 AQF Arborist advises that the trees would not be adversely impacted by the project.

All species of native flora impacted by the project are common species. No species of flora listed under either the BC Act or EPBC Act would be impacted. However, the native species of flora impacted by the project form part of the White Box – Yellow Box – Blakely's Red Gum Woodland ecological community that is listed as Critically Endangered under both the BC Act and EPBC Act. The impact to this ecological community from the project would be relatively minor if the above recommendations are properly implemented and would not constitute a significant impact. This is confirmed in a Test of Significance (5-part test) provided in Appendix D.

3.2 Fauna

With the effective implementation of the recommendations of this report the proposal would have little direct impact on native fauna. It would remove a small number of native trees only one of which contains small hollows that could potentially be used by microbats. Nine species of microbat have been recorded within a 10km x 10km square centred on the project site. Only one of these is listed under the BC Act and/ or EPBC Act and there is only one record of that species, approximately 3km north of the tree being removed. Therefore, the probability of this species utilising the tree hollow is low. To minimise the risk of harming any native fauna it is recommended that this tree be removed carefully and under the direction of an ecologist who can care for any fauna found to be inhabiting a tree hollow. The impact on other native fauna from removal of a small number of native trees would be mainly the removal of foraging habitat for birds and habitat for invertebrates. It is recommended that locally occurring species of Eucalypt be replanted to compensate for the loss of trees from the project.

With effective the implementation of sediment and erosion control measures as well as risk management and clean up procedures for accidental spills of chemicals and other hazardous materials, the project is unlikely to directly impact the fish habitat that occurs within Ten Mile Creek. However, the opportunity exists following completion of construction to rehabilitated the riparian zone, where this has been disturbed, by removing problem weeds and replanting these areas of native plants. This would improve the condition of the riparian and aquatic habitat there for native biodiversity, potentially including the threatened Murray Crayfish and Southern Pygmy Perch that may occur there.

There may be some indirect impacts on fauna from noise during construction of the project. However, construction activities would only be undertaken during normal daytime construction hours when existing background noise levels are higher. Furthermore, the fauna that could potentially be impacted by construction noise is likely to be common species of native fauna typically found within a mostly cleared rural environment.

With effective implementation of the recommendations of this report there would be no significant impact on fauna from the proposal.

4 CONCLUSION

The proposal to construct three levees around the town of Holbrook would have little impact on native flora as most of the alignment is on cleared land comprised of mostly non-native vegetation. A small number of native trees and some isolated groundcover vegetation would be removed. The vegetation is part of the White Box – Yellow Box – Blakely's Red Gum Woodland ecological community that is listed as Critically Endangered under both the BC Act and EPBC Act. However, the impact to this ecological community from the project would be minor if the recommendations of this report are properly implemented. There would be no significant impact to the ecological community.

There would be a minor impact on native fauna from removal of mostly foraging habitat for native birds and habitat for invertebrates. One tree would be removed that may contain small tree hollows. To minimise the risk of injury to any fauna that may be utilising the tree hollows an ecologist would be present during the tree removal to guide the operations and care for any fauna found to be present. It is unlikely that any threatened species of fauna would be impacted by the proposal.

There would be no significant impact on native flora or fauna from the proposal.

While there would be no significant impact there would be some adverse impact from the clearing of native vegetation. To mitigate this impact the following recommendations are made.

<u>Recommendations</u>

1. Levee 3 from chainage 0 to chainage 80 should be re-aligned to avoid impacting the three large, old Blakely's Red Gum trees that occur along that section of levee alignment, unless a Level 5 AQF Arborist advises that the trees would not be adversely impacted by the project.
2. A Level 5 AQF Arborist should also advise on appropriate protection measures for all native trees that immediately adjoin the alignments for all three proposed levees to ensure they are not damaged during construction. The Arborist should be engaged to confirm on completion of the project that the recommended tree protection measures were properly implemented.
3. To minimise the risk of harming native fauna the three mature Blakely's Red Gums at the end of Mcinnes St should only be removed under the direction of an appropriately qualified ecologist who can also care for any fauna that may be injured during the removal these trees.
4. Thirty (30) Eucalyptus trees of either Blakely's Red Gum or Yellow Box should be planted alongside the levee alignments, preferably in areas where Eucalyptus trees presently do not occur.
5. Council should consider, between chainages 1020 to 1160 of Levee 2, and particularly where the creek bank and adjoining riparian areas are cleared of vegetation for construction, removing the problem weeds that occur there and replanting the riparian area with native species. in addition to stabilising the creek bank this would improve the condition of habitat for the threatened Murray Crayfish and Southern Pygmy Perch that potentially occur there.

5 REFERENCES

DECC, 2007. *Threatened Species Assessment Guidelines - The Assessment of Significance.* NSW Department of Environment and Climate Change.

DPI, 2016. *Fish communities and threatened species distributions of NSW*. NSW Department of Primary Industries.

FSC, 2008. *Final Determination* Nannoperca australis - *Southern pygmy perch*. Fisheries Scientific Committee. Ref. No. FD34. File No. FSC 00/01.

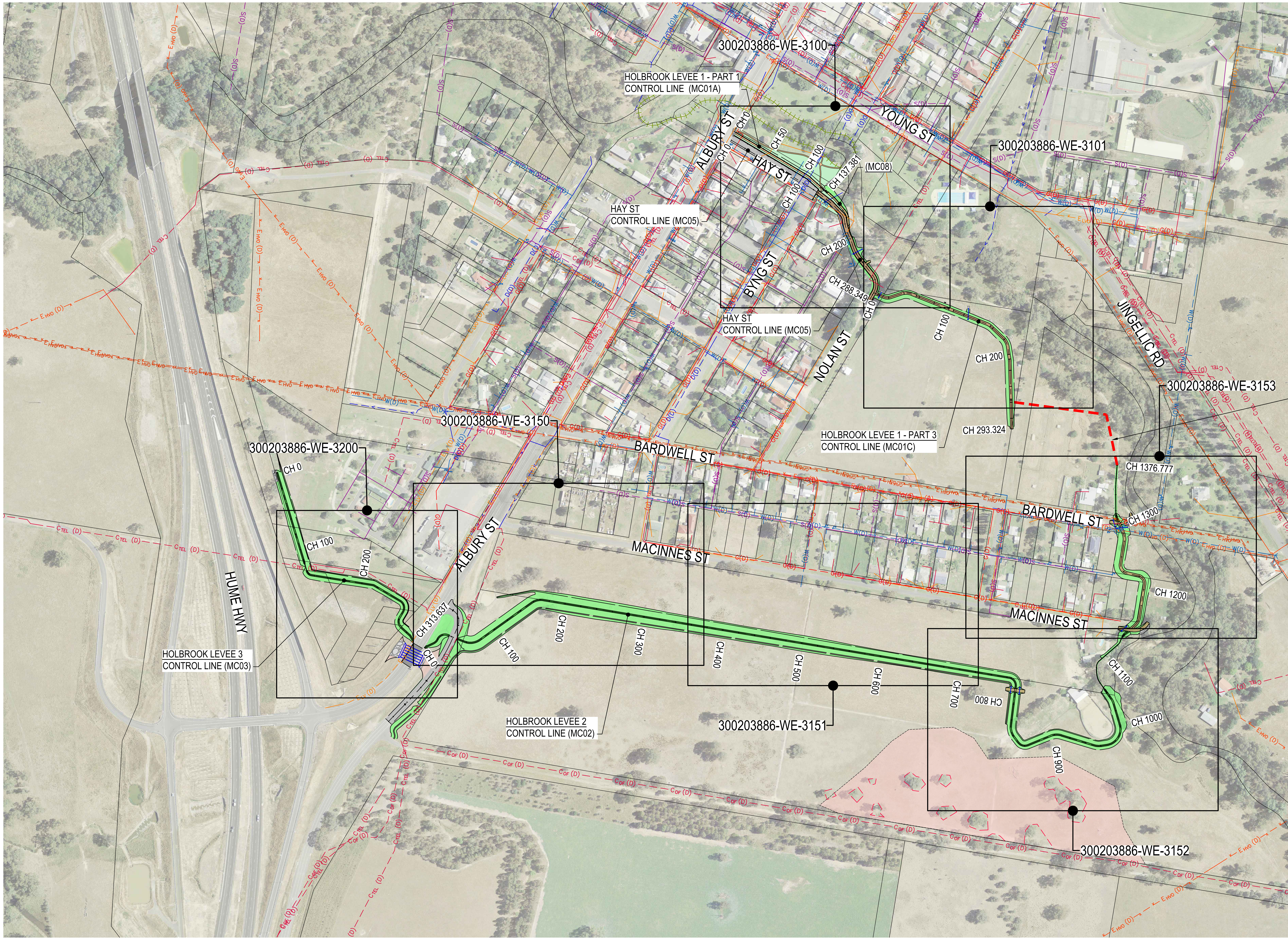
FSC, 2013. *Final Determination The Murray crayfish* – Euastacus armatus *as a Vulnerable Species*. Fisheries Scientific Committee. Ref. No. FD53. File No. FSC 12/04.

Appendices

APPENDIX A

PLAN DRAWING OF PROPOSAL

DATE PLOTTED: 8 May 2024 1:22 PM BY : HAZELGROVE, ADAM
XREF's: XR-03886-VIC-MAP; XR-AWE200028-HOLBROOK-IMAGE; XR-03886-BASE-HOL; XR_03886_SU_BYDA_STRM; XR_03886_SU_BYDA_COMM; XR_03886_SU_BYDA_ELEC; XR_03886_SU_BYDA_SERV; XR-03886-LEGEND; XR-03886-ALGN-CHNG
CAD File: \\au2013-ppfss01\shared_projects\300203886\300 Levee Design\300203886-WE-3050.dwg



THIS DESIGN INCLUDES A GAP OF APPROXIMATELY 200 METERS BETWEEN THE HOLBROOK 1 AND HOLBROOK 2 LEVEE SEGMENTS. THE COMPLETION OF THIS APPROXIMATELY 200 METER LEVEE IS CONTINGENT UPON FUTURE INVESTIGATION AND DESIGN, AIMING TO ENHANCE FLOOD PROTECTION IN THIS AREA BY PROVIDING A 600mm FREEBOARD.

LEGEND

- GRASS - TURFED
- LEVEE BENCH
- LEVEE BATTER - GRASS SEEDED
- ASPHALT PAVEMENT - P1
- ASPHALT PAVEMENT - P2
- CONCRETE PATH - C1
- GRAVEL MAINTENANCE TRACK - G1
- GRAVEL PATH - G2
- GRAVEL ROAD - G3
- ROCK BEACHING
- EARTHWORKS - CUT
- PROPERTY BOUNDARY - VICMAP
- > EXISTING SURFACE DRAIN
- G(D) EXISTING GAS (BYDA)
- S(D) EXISTING SEWER (BYDA)
- W(D) EXISTING WATER RETIC. (BYDA)
- D(D) EXISTING STORMWATER PIPE (BYDA)
- E_{LV} (D) EXISTING LOW VOLTAGE - UNDERGROUND
- E_{LVO} (D) EXISTING LOW VOLTAGE - OVERHEAD
- E_{HVO} (D) EXISTING HIGH VOLTAGE - OVERHEAD
- C_{TEL} (D) EXISTING TELECOMMUNICATIONS
- (D) SURVEY QUALITY LEVEL
- UTILITY TYPE

WARNING

BEWARE OF UNDERGROUND SERVICES

THE LOCATION OF UNDERGROUND SERVICES ARE APPROXIMATE ONLY AND THEIR EXACT POSITION SHOULD BE PROVEN ON SITE. NO GUARANTEE IS GIVEN THAT ALL EXISTING SERVICES ARE SHOWN.

CONTRACTOR TO VERIFY EXISTING SERVICES CONNECTION LEVELS PRIOR TO CONSTRUCTION. ANY DISCREPANCIES MUST BE IMMEDIATELY IDENTIFIED AND THE SUPERINTENDENT NOTIFIED PRIOR TO CONSTRUCTION COMMENCING.

HOLBROOK SITE PLAN

SCALE 1:2500

Rev.	Date	Description	Des.	Verif.	Appd.
A	10/05/2024	TENDER ISSUE	VZ		AS

NORTH

0 50 100m

SCALE 1:2500 @A1

Greater Hume Council

Stantec
Stantec Australia Pty Ltd | ABN 17 007 820 322
Level 4, 501 Swanston Street
Melbourne VIC 3000
Tel: 03 8415 7777
Web: www.stantec.com/au

Drawn SB	Date 15/06/20	
Checked SB	Date 15/06/20	
Designed AW	Date 15/06/20	
Verified	Date	
Approved	Date	

Client: GREATER HUME SHIRE COUNCIL

Project: HHC FLOOD LEVEE DESIGN
HOLBROOK, HENTY
& CULCAIRN

Title: HOLBROOK SITE PLAN

Status: FOR TENDER ONLY
NOT TO BE USED FOR CONSTRUCTION PURPOSES

VERT. DATUM	HORZ. DATUM	Scale	Size
AHD	MGA	AS SHOWN	A1

Drawing Number	Revision
300203886-WE-3050	A

APPENDIX B

PHOTOGRAPHS

Photo 1: The start of Levee 1 would remove these planted introduced species of tree.

Photo 2: More introduced species of tree to be removed for Levee 1.

Photo 3: The end of Levee 1 passes through this cleared paddock.

Photo 4: A cleared paddock that Levee 2 passes through.

Photo 5: Cleared paddock where Levee 2 approached Albury St. Note the two large old Eucalypts the levee would pass between. They will need to be protected from damage during construction.

Photo 6: Cleared paddock Levee 3 passes through.

Photo 7: Cleared paddock with isolated native trees that would be removed near Bardell St.

Photo 8: Two planted Eucalypts and a sapling that would be removed at the end of Mcinnes St.

Photo 9: Three Blakely's Red Gums that would be removed at the end of Mcinnes St.

Photo 10: Ten Mile Creek immediately behind two of the Red Gums from the previous photo. Disturbance here would be very close to the top of the creek bank.

Photo 11: Another planted Eucalypt that would be removed at the end of Mcinnes St.

Photo 12: A Blakely's Red Gum proposed for removal. Some of the other Red Gums in this area may also require removal.

Photo 13: Chainage 1020 of Levee 2 where the levee wall ends and battered embankment commences. Several Red Gums on the left would be removed.

Photo 14: A planted street tree near Albury St that would be removed for Levee 2.

Photo 15: An old Blakely's Red Gum and surrounding saplings that would be removed for Levee 3.

Photo 16: The three large old, hollow-bearing Blakely's Red Gums along the alignment at the start of Levee 3 that should be protected by levee re-alignment if required (arborist to advise).

Photo 17: The three old Blakely's Red Gums of Photo 16 seen up close.

APPENDIX C

SPECIES LISTS

FLORA

Trees

*Acer negundo**	Box Elder
Ailanthus altissima (R)*	Tree-of-heaven
Brachychiton populneus	Kurrajong
Chrysocephalum apiculatum	Common Everlasting
Eucalyptus blakelyi	Blakely's Red Gum
Eucalyptus bridgesiana	Apple Box
Eucalyptus melliodora	Yellow Box
Eucalyptus viminalis	Ribbon Gum
Euchiton sphaericus	Cudweed
*Fraxinus excelsior**	European Ash
*Ligustrum lucidum**	Large-leaf Privet
*Platanus × acerifolia**	London Plane Tree
*Quercus sp.**	Oak
*Schinus molle**	Peppercorn Tree
*Triadica sebifera**	Chinese Tallow Tree
*Ulmus sp.**	Elm

Shrubs and Brambles

Acacia sp.	Wattle
Callistemon sp.	Bottlebrush
Grevillea sp.	
*Rosa rubiginosa**	Sweet Briar
Rubus fruticosus sp. *agg.**	Blackberry

Groundcovers, Climbers and Mistletoes

*Avena sativa**	Oats
*Bromus catharticus**	Prairie Grass
*Cenchrus clandestinus**	Kikuyu
Chloris truncata	Windmill Grass
*Cirsium vulgare**	Spear Thistle
*Conyza bonariensis**	Flaxleaf Fleabane
Cynodon dactylon	Couch
*Cyperus eragrostis**	Umbrella Sedge
*Digitaria sanguinalis**	Summer Grass
*Echinochloa crusgalli**	Barnyard Grass
*Echium plantagineum**	Paterson's Curse
*Ehrharta erecta**	Panic Veldt-grass
*Eleusine tristachya**	Goose Grass
Entolasia stricta	Wiry Panic
*Eragrostis cilianensis**	Stinkgrass
Eragrostis leptostachya	Paddock Lovegrass
Hypericum gramineum	Small St. John's Wort
Hypericum perforatum (R)*	St. John's Wort
*Hypochaeris radicata**	Catsear
Juncus australis	
Lachnagrostis filiformis	Blown Grass
*Lolium perenne**	Perennial Ryegrass
*Medicago polymorpha**	Burr Medic
*Modiola caroliniana**	Red-flowered Mallow
*Oenothera sp.**	
Oxalis perennans	Native Sorrel

*Paspalum dilatatum**	Common Paspalum
*Phalaris aquatica**	Phalaris
*Plantago lanceolata**	Common Plantain
*Poa annua**	Winter Grass
*Polygonum aviculare**	Wireweed
*Romulea rosea var. australis**	Guildford Grass
*Rumex crispus**	Curled Dock
*Setaria pumila**	Pale Pigeon Grass
*Sonchus oleraceus**	Common Sowthistle
*Stellaria media**	Chickweed
*Taraxacum officinale**	Dandelion
*Trifolium repens**	White Clover
*Trifolium subterraneum**	Subterraneum Clover

** = Introduced species; E = Endangered under BC Act.*

FAUNA

Amphibia

Crinia parinsignifera	Eastern Sign-bearing Froglet
Crinia signifera	Common Eastern Froglet
Limnodynastes tasmaniensis	Spotted Grass Frog

Aves

Acanthiza chrysorrhoa	Yellow-rumped Thornbill
Anthochaera carunculata	Red Wattlebird
Ardea pacifica	Pacific Heron
Cacatua galerita	Sulphur-crested Cockatoo
Chenonetta jubata	Australian Wood Duck
Coracina novaehollandiae	Black-faced Cuckooshrike
Eolophus roseicapilla	Galah
Gymnorhina tibicen	Australian Magpie
Psephotus haematonotus	Red-rumped Parrot
Rhipidura leucophrys	Willy Wagtail
Sturnus vulgaris	Common Starling
Threskiornis moluccus	White Ibis

Mammalia

Equus caballus	Horse
Bos taurus	Cow
Capra aegagrus hircus	Goat

Insecta

Heteronympha merope	Common Brown Butterfly
Papilio anactus	Dainty Swallowtail Butterfly

APPENDIX D

TESTS OF SIGNIFICANCE

<u>Test of Significance (5-part test) for 'White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highlands, NSW South Western Slopes, South East Corner and Riverina Bioregions'</u>

(a) in the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,

N/A.

(b) in the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

Figure D-1 below shows the State Vegetation Type Map mapping of PCTs 277 and 278 that are part of the '*White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland*' ecological community within approx. 3kms of the project site. The local occurrence of the ecological community extends beyond the edges of the map. The mapping clearly illustrates that the proposal would impact only a small proportion of the ecological community that exists in the local area. The local occurrence of the ecological community would not be placed at risk of extinction by the proposal.

(i) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,

The proposal would remove a small number of trees and small areas of native groundcover where the proportion of native species is low compared to introduced species. The species impacted are widespread throughout the local area and the composition of the local occurrence of the ecological community would be unaffected by the proposal.

(c) in relation to the habitat of a threatened species, population or ecological community:

(i) the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and

As discussed above the proposal would remove a small area of habitat. It should be noted that the proposal would replant a greater number of native trees that are characteristic of the ecological community than are being removed.

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and

No areas of habitat would become fragmented or isolated as a result of the proposal. The ecological community occurs and is largely continuous over a relative large part of the local area.

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality,

The habitat to be removed is not important for the long-term survival of the local occurrence of the ecological community as there is a relatively vast area of the ecological community in the local area in similar or better condition.

(d) whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly),

Four declared ‘Areas of Outstanding Biodiversity Value’ exist in New South Wales. These are:

- Critical habitat for the Gould’s Petrel at Cabbage Tree Island, and to a lesser extent, Boondelbah Island, off the coast of Port Stephens.
- Little Penguin population in Sydney’s north harbour.
- Mitchell’s Rainforest Snail in Stotts Island Nature Reserve, on the NSW north coast.
- Wollemi Pine in the Wollemi National Park, north-west of Sydney.

The proposal would not affect any declared areas of outstanding biodiversity value.

(e) whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process.

The proposal involves the ‘clearing of native vegetation’ that is identified as a key threatening process. However, only a small number of trees and small areas of highly disturbed groundcover vegetation would be removed. To offset the impact of the proposal thirty (30) Eucalyptus trees would be planted alongside the levee alignments.

Conclusion

Based on the above assessment it is concluded that the proposed development would not have a significant impact on ‘White Box - Yellow Box - Blakely’s Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highlands, NSW South Western Slopes, South East Corner and Riverina Bioregions’.

Figure D-1: State Vegetation Type Map – NSW Extant PCT mapping of '*White Box – Yellow Box – Blakely's Red Gum Woodland*'.

Appendix D: Heritage Impact Statement

NSW Public Works

Holbrook Flood Mitigation Works -

Heritage Impact Statement

Report Number: HEP202311

September 2024

Prepared for:

Greater Hume Council

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Holbrook Flood Mitigation Works – HIS.docx

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Megan Holdsworth

Landscape Architect

Heritage, Environment and Planning

NSW Public Works

L3, 66 Harrington Street, The Rocks, NSW, 2000

Locked Bag 5022, Parramatta NSW 2124

T (02) 9769 9856 | **M** 0477 100 436

E megan.holdsworth@pwa.nsw.gov.au | **W** www.publicworks.nsw.gov.au

Cover photo: Ten Mile Creek Bridge, viewed from Ten Mile Creek Gardens, Holbrook NSW 2644.

Source: NSW Public Works.

Executive Summary

Flood mitigation works are proposed within the town of Holbrook; around Ten Mile Creek where it flows through Ten Mile Creek Gardens and to areas south and east of the town.

As there are numerous heritage items in the town, including the Ten Mile Creek Bridge, this report investigates the impact of the proposed flood mitigation works on these items and surrounds.

There is some potential for heritage impact in and around Ten Mile Creek Gardens. While not a listed item, this park is located within the (non-statutory) Holbrook Heritage Conservation Area (HCA) and is the location of several community assets including war memorials and the miniature railway.

Heritage items immediately adjacent to the park will not be directly impacted by the proposal, however there will be moderate to major indirect impact to them, as the views of and from the listed heritage items and the HCA will be altered by the proposed levees.

It is unlikely that there will be any impact to items beyond those in the immediate vicinity of Ten Mile Creek Gardens.

Contents

Figures (source for all photos is NSW Public Works 2023, unless otherwise noted)

Tables

1. Introduction

1.1 Project Background

NSW Public Works (PW) has been engaged by Greater Hume Council to prepare a Review of Environmental Factors (REF) to assess the impact of proposed flood mitigation works in the town of Holbrook. This Heritage Impact Statement (HIS) is required within the REF to assess the impact the proposal will have on the heritage values of the site and surrounds.

1.2 Subject Site

The subject site is within the small town of Holbrook, located on the traditional lands of the Wiradjuri people, in the Riverina region of southern New South Wales. Holbrook is located within the Greater Hume Local Government Area (LGA) on the Hume Highway, approximately 500km by road south-west of Sydney, and 280km south-west of Canberra. See Figure 1-1 for the Holbrook location map.

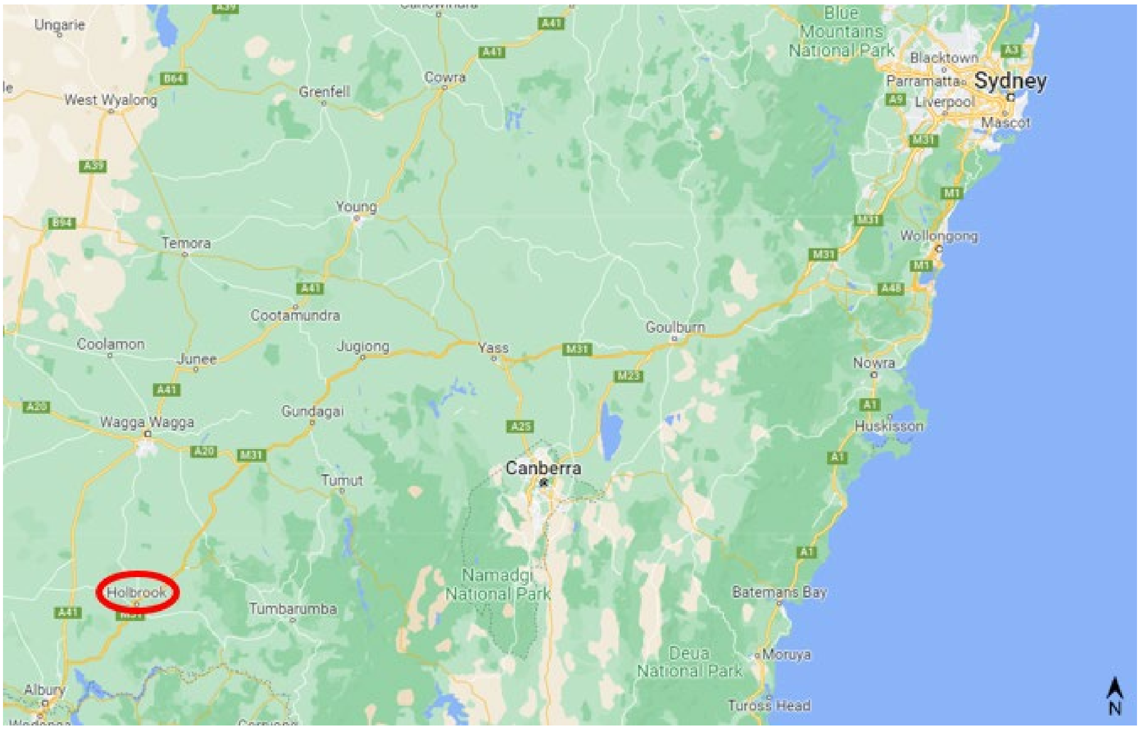


Figure 1-1: Holbrook location map. (Source: Google Maps 2023)

Holbrook straddles Ten Mile Creek, which has a catchment area of approximately 140km^2 at Albury Street. The Creek has experienced several flood events, including in October 2010, which was the highest Ten Mile Creek flood since at least December 1887. During the October 2010 event, flood waters covered most of the land to the south of the Creek and flowed over Albury Street before re-joining the Creek to the west of the town. [1]

[1] WMA Water, 2017, "Holbrook – Floodplain Risk Management Study and Plan." P. 6

Flood mitigation works, including the construction of several levees, are now proposed in the southern part of the town. The affected area is south of Young Street between Albury Street to the west and Ten Mile Creek to the east, and land between the Hume Highway and Albury Street, south of Bardwell Street, as approximately shown within the dashed red line in Figure 1-2.

Figure 1-2: Approximate area to be affected by flood mitigation works, shown within red dashed line. (Source: Nearmap with PW overlay, 2023)

1.3 Methodology and Limitations

This report has been developed following the principles of the Burra Charter, (The Australia ICOMOS charter for the conservation of places of cultural significance), the nationally accepted and adopted standard for heritage conservation practice.

This assessment is based on a desktop analysis of heritage listings and site visit by a built heritage specialist. No additional historical or archaeological research has been undertaken. This report does not consider potential impacts on Aboriginal heritage or ecological communities in the study area.

A site inspection was undertaken by NSW PW heritage staff on 18th April 2023.

1.4 Key Reference Material

This report references material found on The State Heritage Inventory, the Greater Hume Council webpage, the *Greater Hume Local Environment Plan 2012*, and the *Greater Hume Development Control Plan 2013*.

2. Site Description

The Holbrook district is rural in character and includes some of the best grazing land in the state, producing cattle and sheep as well as wool, lucerne, wheat and other grains.[2]

Being situated half-way between Sydney and Melbourne on the Old Hume Highway (Albury Street), Holbrook has historic importance as a staging post from the mid-19th century, and the National Trust previously identified Holbrook as being significant as a town typical of Australian towns from that time.

The built fabric of the main street townscape consists of single or double storey buildings, several of which date to the late 1800s, see Figure 2-1 for example. Building scale, form, setback, materials, and finishes are largely harmonious and combine to create a cohesive streetscape.

Figure 2-1: Holbrook Police Station and Courthouse, items of local heritage that contribute to the streetscape of the town. (Source: Google maps, 2023)

The Old Hume Highway, which is straight and flat, forms the artery of the town, and most of the listed heritage items in Holbrook are located along it. It is central to the Holbrook Heritage Conservation Area (HCA), a non-statutory nominated area included in the Greater Hume Development Control Plan (DCP), as shown in Figure 2-2.

The flood mitigation works are proposed within part of the HCA, as well as into areas of low density residential, open, cleared land and sportsgrounds.

[2] Greater Hume Council webpage.

2.1 Statutory Planning Framework

The *Greater Hume Local Environment Plan 2012* (GHLEP), made under the *Environmental Planning and Assessment Act 1979* (EP&A Act) is the prevailing planning instrument under which the proposed works are being considered.

Items of environmental heritage are listed in the GHLEP, as shown in Table 4-4.

2.2 Holbrook Heritage Conservation Area

The *Greater Hume Development Control Plan* 2013 (GHDCP) was adopted by Council on 26th June 2013 and came into effect on 5th July 2013. While this is not a statutory document, it provides additional planning guidance for development within the boundaries of a specified area, known as the Holbrook Heritage Conservation Area (HCA), as shown in Figure 2-2, and states that:

> *The Conservation Area is a very good piece of urban townscape combining buildings, tree, and space, which still very successfully conveys the atmosphere of a nineteenth century highway town from the 1860s to the 1910s. It includes the two main entry points into the historic centre of the town along the Highway.*
>
> *Some of the Conservation Area at its outer edges contains more scattered building groups. Enough remains, however, of an early typical country townscape to protect and enhance as a Conservation Area.*
>
> *The core of the Conservation Area, half-way through the town, contains many fine buildings, including Woolpack Inn Museum (former Criterion Hotel); Knox Presbyterian Church, Mackie Bros Shop (National Museum of Australian Pottery); Ross Buildings; CBC Bank; Police Station; Courthouse, groups of old shops and hotels. These have significance individually and collectively and the entire streetscape is an essential component of the historic cultural landscape of Holbrook.*

At present, the HCA is not designated on the *Greater Hume Local Environment Plan 2012* (GHLEP), and as such, heritage conservation may not currently be a high priority for Council. This ambiguity may cause future issues with the development approvals process.

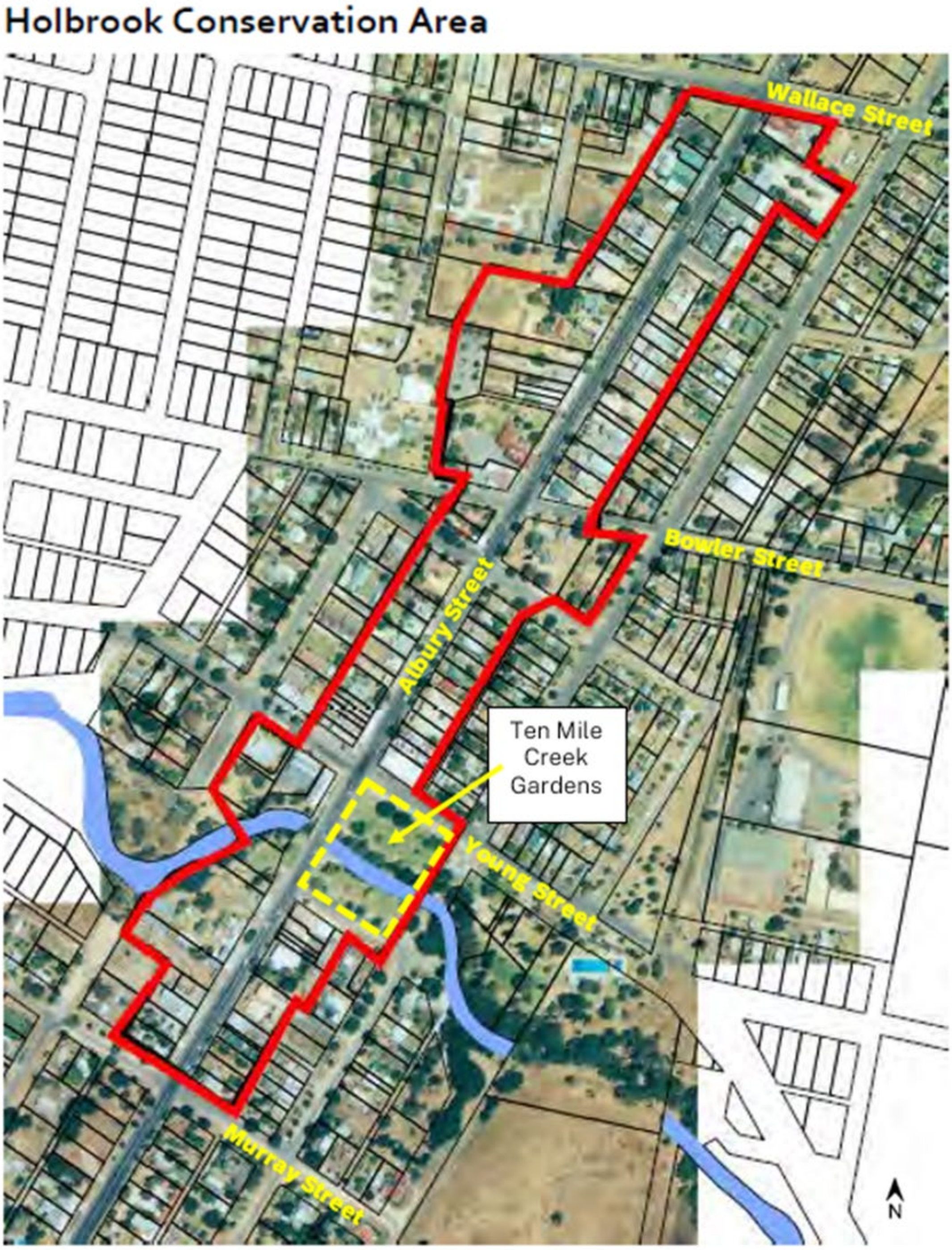


Figure 2-2: Holbrook Heritage Conservation Area, shown within the red line. Ten Mile Creek Gardens in the vicinity of the proposed works is shown within the dashed yellow line. (Source: GHDCP with PW overlay, 2023)

2.2.1 Ten Mile Creek Gardens

The HCA includes Ten Mile Creek Gardens, an area of public open space below the Ten Mile Creek Bridge. As Ten Mile Creek runs through the park, this land is susceptible to flooding. Levees are proposed to the southern bank of the creek within Ten Mile Creek Gardens.

The park has areas of open lawn to both sides of the creek. The lawns and northern and southern boundaries of the park have been planted with trees. Plant material appears to be well maintained and in good condition, as seen in Figures 2-3 through 2-8.

Figure 2-3: View of Ten Mile Creek Gardens, looking east from Ten Mile Creek Bridge.

Figure 2-4: View of Ten Mile Creek Gardens, looking east from Ten Mile Creek Bridge, note miniature railway tracks to the left of the photo.

Figure 2-5: View of Ten Mile Creek Gardens, looking northeast from Ten Mile Creek Bridge.

Figure 2-6: View from within Ten Mile Creek Gardens, looking north.

Figure 2-7: View from within Ten Mile Creek Gardens, looking west from south of the creek.

Figure 2-8: View from within Ten Mile Creek Gardens, looking east from south of the creek, towards the gazebo.

Ten Mile Creek Gardens includes public toilets and 3 memorials. While the memorials are not listed on the GHLEP, 2 of them, as seen in Figures 2-13 & 2-14 are war memorials and they are listed on the NSW War Memorials Register. For more information see https://www.warmemorialsregister.nsw.gov.au/.

There is also a gazebo, seen in Figure 2-8 and a miniature railway. The railway loops around the park, including under the bridge, and is complimented by a small station, seen in Figure 2-10, which is located towards the centre of the eastern side of the park. Train rides are available, as shown in Figure 2-12. The view towards the park from beside I 99, the Shire Hall can be seen in Figure 2-19.

Figure 2-9: View of Ten Mile Creek Gardens looking west from Young Street.

Figure 2-10: Miniature railway station, located within Ten Mile Creek Gardens.

Figure 2-11: Miniature railway tracks crossing Ten Mile Creek within Ten Mile Creek Gardens.

Figure 2-12: Holbrook miniature railway, located in Ten Mile Creek Gardens. (Source: Attractons.net.au website)

Figure 2-13: Trooper A. Richards Memorial located within Ten Mile Creek Gardens.

Figure 2-14: Holbrook War Memorial located within Ten Mile Creek Gardens.

2.2.2 Heritage Items Adjacent to Ten Mile Creek Gardens

Of the listed heritage items within the HCA, 4 are immediately adjacent to the park, and will be considered in the impact assessment. They are:

- I95 Germanton Courier, seen in Figure 2-15,
- I99 Shire Hall, seen in Figure 2-16,
- I104 Mackie & Son Stores, seen in Figure 2-17, and
- Ten Mile Creek Bridge, seen in Figure 2.18.

Figure 2-15: Heritage item 95, Germanton Courier viewed from within Ten Mile Creek Gardens.

Figure 2-16: Heritage item 99, Shire Hall viewed from within Ten Mile Creek Gardens.

Figure 2-17: Heritage item 104, Mackie & Son Stores viewed from within Ten Mile Creek Gardens.

Figure 2-18: Ten Mile Creek Bridge, viewed from within Ten Mile Creek Gardens, the tracks of the miniature railway can be seen bottom right, heading below the bridge. The bridge is significant for its social, historic, and aesthetic values, as described in section 4.2.

Figure 2-19: View of Ten Mile Creek Gardens from the Shire Hall.

3. Historical Context

Holbrook is part of the tribal land of the Wiradjuri Aboriginal people, and was on the direct route to Yellowin, the principal meeting place of the Murray River, Yass, and local Aboriginal peoples.

Hume and Hovell, were the first Europeans to pass through the area. During their overland expedition from Sydney to Victoria in search of prime agricultural land; they arrived in the Holbrook Shire on 10th November 1824. [3] They gave the area the first of the many names it would come to be known by; 'Friday Mount' and/ or 'Camden Forest'.[4]

European settlement of the area began during the 1830s, as stock routes were established towards the Murray River region. The major route south from Gundagai to Port Phillip followed the line of the main Southern Road (later Hume Highway) through Tarcutta, Little Billabong, Holbrook, and Albury.

Around this time the area was known as 'Therry's' or 'Billabong' after the Rev John Therry. In 1838, Holbrook was known as Ten Mile Creek, so named by John Purtell who squatted ten miles from Father John Therry's cattle yards at Billabong. By the 1840s settlers began moving into the area from Victoria as well as from the north and expansive cattle runs were established. Cattle were favoured until the 1860s, when falling beef prices and an outbreak of disease turned attention away from cattle to sheep and wool.

The goldrushes in Victoria and New South Wales during the 1850s increased growth of the region. In the later 19th century pastoralism intensified and agriculture also developed. Towns sprang up to service the growing population, and Holbrook became an agricultural centre with a significant concentration of German born settlers, including John Pabst. This led to the town being known as 'Germanton' by 1858.

Holbrook was an important staging post for horse drawn coaches travelling along the Hume Highway until the railway from Sydney to Melbourne opened in 1883, which diverted traffic away from the town.

During WW1, Holbrook was one of over 90 Australian places to change its name due to its German associations. During the war, many German-Australian communities, including Germanton, found themselves the object of suspicion and animosity, and there was pressure to change the towns name. The Germanton Shire Council considered several new names in 1915, before choosing ‘Holbrook’, in honour of Lieutenant Norman Douglas Holbrook.

Norman Douglas Holbrook was commander of a British submarine which sank a Turkish battleship in the Dardanelles Strait in December 1914. Following the sinking, Holbrook successfully navigated the outmoded 1905 submarine back to the Mediterranean through five rows of mines, scraping along the bottom with a shattered compass while dodging torpedo

[3] Transport for NSW s170 register listing for Ten Mile Creek, as viewed on the State Heritage Inventory. https://www.hms.heritage.nsw.gov.au/App/Item/ViewItem?itemId=4309613

[4] Greater Hume Council webpage.

boats and gunfire. The submarine had been submerged for nine hours, which was a new record. For this remarkable voyage, the 25-year-old Holbrook was awarded the Victoria Cross and the French Legion of Honour. Each of his 13 crew members received the Distinguished Conduct Medal.

Norman Holbrook would visit the town on three occasions. The name change sparked a chain reaction of events, leading to the formation of a unique submariner community that still exists in Holbrook today.[5] Holbrook is locally known as “The Submarine Town”. A decommissioned Australian submarine HMAS OTWAY and a 1/5 scale model of the submarine captained by Norman Holbrook in 1915, are in Submarine Park, on Albury Street between Raymond and Wallace Streets.

By the 1920s, major improvements were being made to the highways across NSW. Upgrade works included widening, line markings, grades, crossings, and re-surfacing to improve road safety. By 1939, 95 percent of the Hume Highway between Sydney and Albury had been surfaced with bitumen. The State’s main roads required constant upgrading due to the increasing use of heavy vehicles including semi-trailers for freight haulage.

Where necessary, dilapidated 19th century timber bridges were upgraded. Concrete was favoured for bridge construction as it was seen as a low maintenance material, and many concrete slab and beam bridges were constructed around this time. It was most likely for these reasons that Ten Mile Creek Bridge, near the intersection of Albury Street (Hume Highway) and Young Street, was built in 1942 to replace an earlier timber bridge.

5 Greater Hume Council webpage.

Figure 3-1: Ten Mile Creek Bridge, indicated by red line. (Source: Nearmap with PW overlay, 2023)

In 1982 Holbrook Shire Council were interested in incorporating a wider footpath on the outside of the railing of the Ten Mile Creek Bridge. At that time the bridge was only 6.7m between kerbs, and the existing footpaths only 1.55m. This arrangement offered little protection from traffic, especially from the large heavy transport vehicles that created draughts sufficient to cause pedestrians to lose their footing.

Plans were made to widen the bridge to carry four traffic lanes and two footways. These plans drew concern from the local community, particularly representatives from the local tourism committee who desired to maintain the character and aesthetic qualities of the existing bridge, including the lanterns on columns at each end. Importantly, they felt that the bridge was in harmony with the Albury Street streetscape, classified by the National Trust as typical of Australian towns at the turn of the century.

The bridge passes over the Ten Mile Creek Gardens, a major attraction for tourists to the town. In the bridge-widening plans, however, only the substructure was to be retained. In the late 1980s Holbrook Shire Council commissioned consultants to report on the character and potential of Albury Street, to assist in planning for Holbrook generally, and at public meetings, the future of the bridge was a key issue.

Another concern for the local community was the increase in heavy vehicle traffic over the bridge and through the town. They argued that such traffic was a threat to safety and to the stability of historic buildings along the main street.

Residents suggested a ‘loop’ road for heavy vehicles that would by-pass the main street. They also suggested that only two lanes of traffic be allowed along the entire length of the town and that the existing two-lane bridge could be widened by removing the footpath. A separate footbridge could then be provided in a different location.

Plans proceeded for a four-lane bridge, though it was noted that the RTA was examining possible routes for the Highway to eventually bypass Holbrook. To accommodate community concerns, an attempt was made to preserve some features of the 1942 bridge by retaining the four lamp standards and the art deco feature on the pier facades. As it was impractical to reproduce the balustrades, a grille railing was considered an appropriate replacement. The widened bridge was completed in July 1991, as indicated by a plaque, shown in Figure 3-2, at a cost of $1.2 million.

The Holbrook bypass to the west of town, opened in 2013. Holbrook was the last town on the Hume Highway to be bypassed and thereby lose many of the freight trucks driving along Albury Street.[6]

Figure 3-2: Plaque on Ten Mile Creek Bridge.

[6] Transport for NSW s170 register listing for Ten Mile Creek, as viewed on the State Heritage Inventory. https://www.hms.heritage.nsw.gov.au/App/Item/ViewItem?itemId=4309613

4. Heritage Significance

4.1 Heritage Items

4.1.1 Items listed by State government instrumentalities

Ten Mile Creek Bridge is listed under the *Heritage Act 1977* - on the s. 170 heritage register for Transport for NSW, as shown in Table 4-1.

The bridge is described on the State Heritage Inventory as follows:

> *Sited in the centre of Holbrook on the Hume Highway, this bridge crosses a waterway of intermittent flow set in parkland to protect the floodway. Besides the creek, it also crosses model railway tracks on each bank, which are part of the park amenities.*
>
> *The bridge is a three-span structure. Originally a narrower two lane, the bridge now carries two lanes, parking or breakdown lanes and footways. To achieve this widened configuration, the original piers have been extended on both sides in style sympathetic to the original, with rectangular columns, headstocks having under beams with haunches, and art-deco style vertical stepping on the upstream and downstream faces. The abutments are of plain wall type and have similarly been widened on both sides. The deck consists of prestressed concrete planks with footways of precast covers over utility ducts. Railings are of modern steel rectangular hollow section design, but frame to end posts into which the original precast concrete lamp standards have been relocated.*

Table 4-1: Excerpt from Transport s.170 Register

Item no	Name	Address
n/a	Ten Mile Creek Bridge	Albury Street

62 and 64 Albury Street are listed under the *Heritage Act 1977* - on the s. 170 heritage register of NSW Police as items of local significance, as shown in Table 4-2. The courthouse is also listed on the s. 170 heritage register of the NSW DCJ, as shown in Table 4-3.

Table 4-2: Excerpt from NSW Police s.170 Register – Vol.1 - 2006

Item no	Name	Address
4180198	Holbrook Court House & Police Office	62 Albury Street
4180197	Holbrook Police Station & Lockup Keeper's Residence	64 Albury Street

Table 4-3: Excerpt from Department of Justice and Attorney General s.170 Register

Item no	Name	Address
3080069	Holbrook Courthouse and Residence	62 Albury Street

4.1.2 Items listed by Greater Hume Council

The town of Holbrook has many items of local heritage significance, listed in the *Greater Hume Local Environment Plan 2012* (GHLEP), as shown in Figure 4-1 and Table 4-4.

Figure 4-1: Holbrook heritage listings (Source: ePlanning Spatial Viewer 2023)

Table 4-4: Holbrook local heritage items

Item no	Name	Address	Lot & DP
I108 *	Police Station also on NSW Police s.170 register, and NSW DCJ s. 170 register	62 Albury Street	Lot 3, Section 2, DP 758522; Lot 12, DP 2325
I94 *	Courthouse (former post office) also on NSW Police s.170 register	64 Albury Street	Lot 3, Section 2, DP 758522
I93 *	CBC Bank (former)	68 Albury Street	Lot 2, DP 560948
I112 *	Ross Buildings	70–74 Albury Street	Lots Z and Y, DP 101975; Lot 32, DP 566695
*I104 **	*Mackie & Son stores*	*76 Albury Street (corner Hay Street)*	*Lot 31, DP 566695*
I96 *	Gold assay office	79 Albury Street	Lot 1, DP 997504
I113 *	Shop	81A Albury Street	Lot 12, DP 551397
I101 *	Horse and dog trough	83 Albury Street (footpath in front of Woolpack Inn)	
I125 *	Woolpack Inn Museum (former Criterion Hotel)	83 Albury Street	Lot 11, DP 551397; Lot 1, DP 971953
I102	Knox Presbyterian Church and Hall	108 Albury Street	Lots 74, 75 and 274, DP 753340
I109	Presbyterian Church (former)	108 Albury Street	Part Lot 74, DP 753340
I119	Timber shop and cottage	113 Albury Street	Lot F, DP 3633
I107	Peter Pan Building	123–129 Albury Street	Lot 2, DP 204191
I111	Riverina Hotel	131–133 Albury Street	Lot 3, DP 716164
I98	Holbrook Hotel	144 Albury Street	Lot 1, DP 543149
I106	Our Lady of Sorrows Catholic Church	145 Albury Street	Lots 1 and 2, Section E, DP 4843; Lot 1, DP 335174
I114	St Clare's Catholic Convent	145 Albury Street	Lots 1 and 2, Section E, DP 4843; Lot 1, DP 335174
I115	St Patrick's Catholic School	145 Albury Street	Lot 1, DP 956575; Lots 7 and 8, DP 4045; Lot 2, DP 500773
I100	Holbrook Stores	155 Albury Street	Part Lot 13, DP 827736
I124	William Bros Saddlery	155 Albury Street	Part Lot 13, DP 827736

Item no	Name	Address	Lot & DP
I117	HMS Otway (submarine display)	159 Albury Street	Lot 2, DP 831081
I118	Submarine, scale model	163 Albury Street	Lot 10, DP 571557
I97	Holbrook General Cemetery	Bath Street	Lots 7008 and 7009, DP 1025562
I110	Presbyterian manse (later public hospital)	Bowler Street	Lot 12, DP 1055714
I103	Log Cabin Scout Hall	63 Bowler Street	Lot B, DP 441663
I95 *	***Germanton Courier***	***2 Hay Street***	***Lot 2, DP 212947***
I91	**Anglican Rectory (former)**	**78 Jingellic Road**	**Lot 1, DP 995361**
I92	“Annandayle”, homestead	590 Jingellic Road	Lot 4, DP 668631
I105	**Masonic Hall (former)**	**19–21 Nyhan Street**	**Lots 1 and 2, Section 14, DP 758522**
I116 *	**St Paul’s Anglican Church**	**38 Young Street**	**Lot 11, DP 736838**
I99 *	***Holbrook Shire Hall***	***40 Young Street***	***Lots 2 and 4, Section 7, DP 758522; Lot 13, DP 736838***
I120	**Weatherboard cottage**	**55 Young Street**	**Lot 227, DP 753340**
I121	**Weatherboard cottage**	**57 Young Street**	**Lot 228, DP 753340**
I122	**Weatherboard cottage**	**59 Young Street**	**Lot 229, DP 753340**

The items shown in **bold** text are located within proximity of the proposed works.

An * beside the item number indicates the item is within the HCA, between Young and Murray Streets.

Items also shown in *italics* are the most likely to be impacted, they are:

I95 * Germanton Courier

I99 * Holbrook Shire Hall

I104 * Mackie & Son stores

4.1.3 Non-listed items

In addition to the above listed items, there are several non-listed items within Ten Mile Creek Gardens, a key component of the HCA, that may have cultural and/ or social significance to the community, such as the miniature railway.

The memorials located within Ten Mile Creek Gardens may hold historical significance, and two are listed on the NSW War Memorial Register, the Holbrook First and Second World Wars Memorial, shown in Figure 2-14 and the Trooper A. Richards Memorial, seen in Figure 2-13.

Works in the area should avoid damage to the memorials and community access to them should not be limited by any development.

4.2 Statements of Significance

The following statements of significance have been taken from the State Heritage Inventory for the items most likely to be impacted by the proposal.

4.2.1 Ten Mile Creek Bridge

> *Ten Mile Creek Bridge has local social, historic, and aesthetic significance. The bridge, a 1942 structure substantially modified in 1990/1, embodies a late twentieth century compromise between the pressure for change to accommodate large volumes of heavy road traffic, and the high value placed on Holbrook's cultural heritage and amenity by the local community. The bridge is highly articulate about the successes and failures of such compromise in a distinctively contemporary dilemma.*

Significance is assessed against the following criteria:

Historical Significance

> *Ten Mile Creek Bridge has local historic significance. The original bridge design reflected both the increasing demands on the Hume Highway in the motor age, and the DMR's preference for concrete bridge designs across the State, as well as civic pride in the provision of public infrastructure. It was a solid and functional structure as well as a stylish modern gateway to Holbrook. The bridge as it stands in 2004, after major modifications in the late twentieth century, reflects the increased demand on local road infrastructure across the century, and also demonstrates both the successes and failures of community lobbying in the late twentieth century to preserve local heritage and a sense of local identity.*

Aesthetic Significance

> *The bridge is visually distinctive and forms a gateway to Holbrook centre. Although the bridge as it stands today presents largely late twentieth century fabric to the viewer, it follows the lead of the original bridge's design style. The details of the original bridge piers are repeated on the new outer piers, and the original art deco lamp posts are incorporated in the modified structure. The detailing aims to reflect the original design style of the bridge and forms a response to contemporary community respect for the original structure.*

Social Significance

> *Ten Mile Creek Bridge has local social significance. The bridge was originally designed to embody a sense of civic pride presumed to reside within inhabitants of Holbrook and surrounding districts. That the community has continued to associate a sense of civic pride with the Ten Mile Creek Bridge is evidenced by community lobbying in the 1980s for retention of the bridge as a gateway to Holbrook and the centrepiece of*

the Ten Mile Creek Gardens. The bridge has been substantially modified, but the structure as it currently stands acknowledges the value placed on the cultural heritage of Holbrook by the local community.

4.2.2 Germanton Courier

Small commercial building with landmark value for its contribution to the street. Locally rare traces of historic signage on exterior.

Significance is assessed against the following criteria:

Aesthetic Significance

Small commercial building with landmark value for its contribution to the street.

Social Significance

Of some social significance to the local community for its role in local news reporting.

Rare Assessment

Locally rare traces of historic signage on exterior.

Integrity/Intactness

Exterior substantially intact.

4.2.3 Holbrook Shire Hall

Historically significant as part of an outstanding group of late nineteenth and early twentieth century buildings which, because of their scale and location in Holbrook, make an important contribution to the vernacular architecture of the main street.

Significance is assessed against the following criteria:

Historical significance

Historically significant as part of an outstanding group of late 19th and early twentieth century buildings which, because of their scale and location in Holbrook, make an important contribution to the vernacular architecture of the main street.

Aesthetic Significance

High. An example of early twentieth century architecture and important landmark of the main street.

Research Significance

Important for the settlement history of the town.

Representative Assessment

Representative of early twentieth century architecture.

Integrity/Intactness

High.

4.2.4 Mackie & Sons Store

> *Good example of an Arts and Crafts style building, externally in original condition.*

Significance is assessed against the following criteria:

Aesthetic Significance

> *Double storey Arts and Crafts style brick shops with residences over. First floor symmetrical verandah featuring two ornate brick arches with rendered frames centrally with brick parapet over.*

Representative Assessment

> *Good example of an Arts and Crafts style building.*

Integrity/Intactness

Externally intact.

5. Proposed Work

5.1 Background

The proposed works are required to mitigate flooding in Holbrook. Following flooding of residential areas in 2010 and 2012, Greater Hume Council completed the Holbrook Floodplain Risk Management Study and Plan. (WMA Water, 2017) to determine the nature and extent of the existing flood problem.

It found that properties on the southern floodplain of Ten Mile Creek, particularly along MacInnes and Bardwell Streets become inundated even by relatively small flood events. For larger floods as many as 30 homes and 8 commercial lots are likely to become inundated above floor and many more will experience significant flooding of property lots (not necessarily over floor level inundation).

In terms of flood risk, the southern floodplain was found to be particularly notable. Flood depths and velocities were highest in the study area, which when combined with the number of properties that are affected and a lack of egress, produces significant flood risk. The tendency for flood levels to increase significantly for larger and rarer flood events, also increases flood risk.[7]

The engineering company Cardno prepared the Holbrook Flood Mitigation Design for Council approval in September 2020. The proposal affected land south of Young Street between Albury Street to the west and Ten Mile Creek to the east, and land between the Hume Highway and Albury Street, south of Bardwell Street, as shown in Figure 1-2.

That design proposed the construction of 4 levees, including one immediately to the north of Ten Mile Creek Gardens, one immediate to the south of the park, one south of MacInnes Street and the fourth west of Albany Street between it and the Hune Highway. That proposal also recommended soil be removed from 2 areas, in the southern part of the town.

By June 2023, Council was re considering the proposal, and revised plans have now been provided.

5.2 Scope of Work

The proposed site plan is provided in Figure 5-1, with additional selected plans from the revised concept by Stantec provided in Appendix A. This proposal involves the construction of three levees, as follows:

- Holbrook Levee 1 – south of Ten Mile Creek Gardens, on the north side of Hay Street, Nolan Street and the Holbrook Football Ground,
- Holbrook Levee 2 – south of MacInnes Street and west of Ten Mile Creek at the eastern extent of residential properties along Bardwell and MacInnes Streets,

[7] WMA Water, 2017, “Holbrook – Floodplain Risk Management Study and Plan.” P. 19.

- Holbrook Levee 3 – south of the Holbrook Motor Village and businesses, west of Albury Street and east of the Hume Highway off-ramp.

Holbrook levee 1 is in the vicinity of I95, I99, I104, Ten Mile Creek Bridge (no number) and the non-listed Ten Mile Creek Gardens.

Associated works include:

- removal of at least 32 trees,
- bulk earthworks to form embankments and swales,
- removal of a stockpile near the Holbrook bypass, soil to be used in levee construction, (Council advises that this mound of earth is left over fill from construction of the highway, and since it is not naturally occurring, is not considered in this assessment),
- establishment of one borrow pit in the southeast of the area, to gain fill material,
- lowering of a hillside in the southeast of the area to improve flood conveyance,
- importation and compaction of additional soil to build the levee core and clay rich engineered fill to create the embankments, heights will vary along the length of each levee, from approximately 800 – 2500mm,
- importation and spreading of 100mm topsoil seeded with native grass seed to the embankments, and engineered swales,
- importation of materials and construction of roads, maintenance tracks, and pedestrian paths on the levee bench where shown, materials include asphalt, crushed rock, and granitic sand,
- installation of culverts, fences, gates and other fixtures,
- installation of concrete panel retaining walls, the height of the panels vary, from 900 mm 1600mm

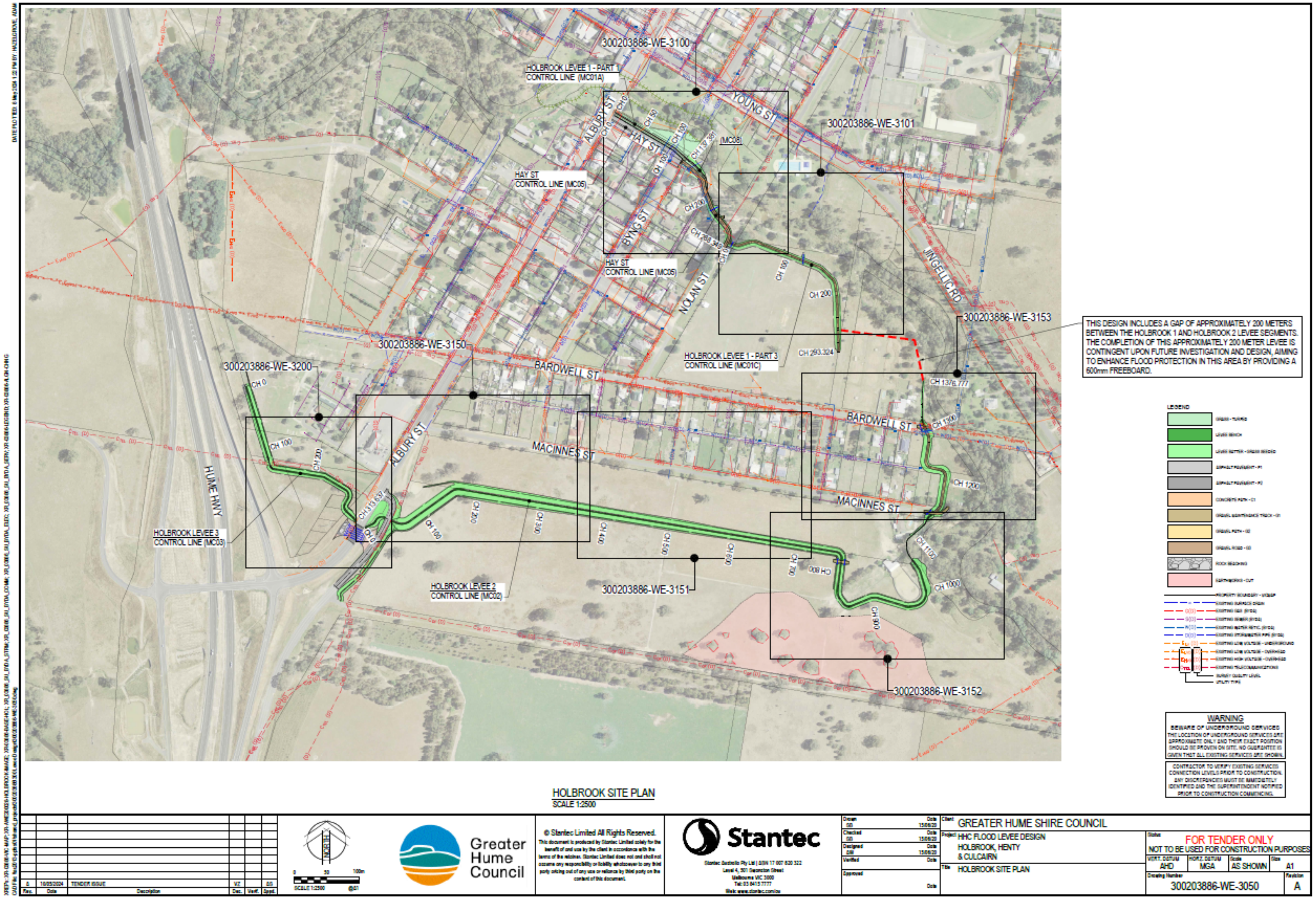


Figure 5-1: Proposed site plan. (Source: Stantec, Holbrook Levee Design, 2024

6. Heritage Impact Assessment

6.1 Methodology

To consistently identify the potential impact of the proposed works, the terminology contained in Table 6-1 has been referenced throughout this document. This terminology, and corresponding definitions, are based on those contained within guidelines produced by the International Council on Monuments and Sites (ICOMOS). The method of assessment has been undertaken in accordance with the 2009 guidelines for Statements of Heritage Impact published by the NSW Heritage Office.

Table 6-1: Impact Definitions

Impact	Definition
Major	Actions that would have a long-term and substantial impact on the significance of a heritage item. Actions that would remove key historic building elements, key historic landscape features, or significant archaeological materials, thereby resulting in a change of historic character, or altering of a historical resource. **These actions cannot be fully mitigated.**
Moderate	This would include actions involving the modification of a heritage item, including altering the setting of a heritage item or landscape, partially removing archaeological resources, or the alteration of significant elements of fabric from historic structures. The impacts arising from such actions may be able to be partially mitigated.
Minor	Actions that would result in the slight alteration of heritage buildings, archaeological resources, or the setting of an historical item. The impacts arising from such actions can usually be mitigated.
Negligible	Actions that would result in very minor changes to heritage items.
Neutral	Actions that would have no heritage impact.

The following assessment considers both direct and indirect impacts. Direct impacts are defined as being physical alterations to fabric arising from the proposed works. Indirect, or visual impacts are impacts to views, vistas and/or the setting of a heritage item resulting from the proposed works.

6.2 Assessment of Heritage Impact

The heritage impact is primarily the indirect impact from the construction of levee 1, on the views and settings of the heritage items described in Section 4. Levees 2 and 3 are some distance away from these items and will not impact views to and from the heritage items.

There are also indirect and direct heritage impacts arising from these major works within the HCA. Although not gazetted in the LEP, this area is important for its landscape and townscape character.

As the *Greater Hume Development Control Plan* 2013 (GHDCP) states, the combination of buildings, trees, and space, including within Ten Mile Creek Gardens, conveys the atmosphere of a 19th century highway town, and is an integral part of the setting of items I95 (Germanton Courier), I99 (Holbrook Shire Hall), I104 (Mackie & Sons Store) and the Ten Mile Creek Bridge.

The following table considers each of the steps required to construct the proposed work and its heritage impact and provides recommendations to mitigate the impact.

Table 6-2: Assessment of Heritage Impacts

PROPOSED WORKS		
1.Tree removal in Ten Mile Creek Gardens		
Task	Heritage Items Affected	Impact
Removal of 7 mature, exotic, ornamental trees along Hay Street	I95	Moderate indirect impact to views of and from the item and the HCA context.
	I99	Moderate indirect impact to views of and from the item and the HCA context.
	I104	Moderate indirect impact to views of and from the item and the HCA context.
	Ten Mile Creek Bridge (no number)	Moderate indirect impact to views of and from the item and the HCA context.
	Non-listed items affected: Ten Mile Creek Gardens	Moderate direct and indirect impact to setting, HCA, views, patterns of use, shade cover, and habitat.
RECOMMENDATIONS: New trees, to Council's specification, could be planted within the park following construction of the levee, to re-define the edge of Ten Mile Creek Gardens, the setting of the heritage items, and reinstate tree canopy to the park, which provides welcome summer shade and habitat.		
MITIGATION: Long term direct and indirect impact can be partially mitigated by implementing the above recommendations.		
IMPACT SUMMARY: Removal of the trees along Hay Street has potential to result in **moderate indirect impact** to the above items, as this will alter existing views to and from listed heritage items and within the HCA. However, additional tree planting in future could mitigate the impacts and enhance amenity value.		

<table>
<tr><td colspan="3">PROPOSED WORKS</td></tr>
<tr><td colspan="3">2. Bulk earthworks</td></tr>
<tr><td>Task</td><td>Heritage Items Affected</td><td>Impact</td></tr>
<tr><td>Earthworks to form the levee and swales.</td><td>I95

I99

I104

Ten Mile Creek Bridge (no number)

Non-listed items affected:

Ten Mile Creek Gardens including the miniature railway and memorials.</td><td>Moderate indirect impact to views of and from the item and the HCA context.

Moderate indirect impact to views of and from the item and the HCA context.

Moderate indirect impact to views of and from the item and the HCA context.

Moderate indirect impact to views of and from the item and the HCA context.

Moderate direct and indirect impact to setting, HCA, views, patterns of use, and habitat.</td></tr>
<tr><td colspan="3">RECOMMENDATIONS:
Remove and stockpile site topsoil as first step in earthworks, stockpile and re-use topsoil where possible.</td></tr>
<tr><td colspan="3">MITIGATION: The impact of bulk earthworks on the views to and from the heritage items cannot be mitigated; however, re-use of site topsoil may improve sustainability outcomes.</td></tr>
<tr><td colspan="3">IMPACT SUMMARY:
Bulk earthworks, as part of levee construction will result in moderate indirect impacts to the above items, as this will alter existing views to and from listed heritage items, and within the HCA. Re-use of site topsoil may improve project sustainability outcomes.</td></tr>
</table>

PROPOSED WORKS		
3. Levee construction		
Task	**Heritage Items Affected**	**Impact**
Importation and compaction of clay soil to build the levee core and clay rich engineered fill to create the embankments, heights will vary along the length of each levee, from approximately 800 – 2500mm.	I95 I99 I104 Ten Mile Creek Bridge (no number) Non-listed items affected: Ten Mile Creek Gardens including the miniature railway, and memorials.	Moderate indirect impact to views of and from the item and the HCA context. Moderate indirect impact to views of and from the item and the HCA context. Moderate indirect impact to views of and from the item and the HCA context. Moderate indirect impact to views of and from the item and the HCA context. Moderate direct and indirect impact to setting, HCA, views, patterns of use, and habitat. NOTE: Impact will be greater from below the levee and will be dependent on final levee height, it may be considered **major in certain locations.**
RECOMMENDATIONS: Nil		
MITIGATION: Nil		
IMPACT SUMMARY: Levee construction will result in **at least moderate indirect impact** to the above items, as this will alter existing views to and from listed heritage items, and within the HCA.		

PROPOSED WORKS		
4. Levee & swale topsoil & seeding		
Task	Heritage Items Affected	Impact
Importation and spreading of 150mm topsoil seeded with unspecified grass seed to the embankments, and engineered swales.	I95 I99 I104 Ten Mile Creek Bridge (no number) Non-listed items affected: Ten Mile Creek Gardens including the miniature railway, and memorials.	Moderate indirect impact to views of and from the item and the HCA context. Moderate indirect impact to views of and from the item and the HCA context. Moderate indirect impact to views of and from the item and the HCA context. Moderate indirect impact to views of and from the item and the HCA context. Moderate direct and indirect impact to setting, HCA, views, patterns of use, and habitat.
RECOMMENDATIONS: Ensure imported topsoil is weed free and of an appropriate free draining structure that allows for seed germination. A hold point should be set up so that imported soil can be inspected prior to spreading. Reserved site topsoil (from bulk earthworks stage) should be incorporated wherever possible. Seed mix must be weed free and species selection should be suitable to the area.		
MITIGATION: Inclusion of previously stockpiled site topsoil that may contain a seed bank of suitable species and use of suitable weed free materials, will partially mitigate impact on the natural environment and this in turn may have a positive outcome in retaining/regenerating the existing landscape character of the site. Long term direct and indirect impact can be partially mitigated by implementing the above recommendations.		
IMPACT SUMMARY: Levee and swale topsoil and seeding will result in **moderate direct and indirect impact** to the above items, as this will alter existing views to and from listed heritage items, and within the HCA. Appropriate specified seed species may partially mitigate this impact.		

<table>
<tr><th colspan="3">PROPOSED WORKS</th></tr>
<tr><th colspan="3">5. Levee bench access roads and paths</th></tr>
<tr><th>Task</th><th>Heritage Items Affected</th><th>Impact</th></tr>
<tr><td>Importation of materials and construction of roads, maintenance tracks, and pedestrian paths on the levee bench where shown, materials include asphalt, crushed rock, and granitic sand.</td><td>I95

I99

I104

Ten Mile Creek Bridge (no number)

Non-listed items affected:
Ten Mile Creek Gardens including the miniature railway, and memorials.</td><td>Moderate indirect impact to views of and from the item and the HCA context.

Moderate indirect impact to views of and from the item and the HCA context.

Moderate indirect impact to views of and from the item and the HCA context.

Moderate indirect impact to views of and from the item and the HCA context.

Moderate direct and indirect impact to setting, views, patterns of use, and habitat.

NOTE: Impact will be greater from below the levee and will be dependent on final levee height, it may be considered major in certain locations.</td></tr>
<tr><td colspan="3">RECOMMENDATIONS:
Selected hardscape material should be weed free and harmonious with the existing landscape.</td></tr>
<tr><td colspan="3">MITIGATION:
Use of suitable, weed free materials, selected to be harmonious with the existing landscape, will partially mitigate impact on the natural environment, this in turn may have a positive outcome in retaining/regenerating existing landscape character of the site.
Long term direct and indirect impact can be partially mitigated by implementing the above recommendations.</td></tr>
<tr><td colspan="3">IMPACT SUMMARY:
Levee bench access roads and paths will result in at least moderate direct and indirect impact to the above items, as this will alter existing access as well as views to and from listed heritage items, and within the HCA. This can be partially mitigated by sensitive landscaping that continues to facilitate access, circulation and enjoyment of the character of the HCA.</td></tr>
</table>

<table>
<tr><th colspan="3">PROPOSED WORKS</th></tr>
<tr><th colspan="3">6. Levee fixtures</th></tr>
<tr><th>Task</th><th>Heritage Items Affected</th><th>Impact</th></tr>
<tr><td rowspan="5">Installation of fences, gates, handrails, and other fixtures as shown.</td><td>I95</td><td>Moderate indirect impact to views of and from the item and the HCA context.</td></tr>
<tr><td>I99</td><td>Moderate indirect impact to views of and from the item and the HCA context.</td></tr>
<tr><td>I104</td><td>Moderate indirect impact to views of and from the item and the HCA context.</td></tr>
<tr><td>Ten Mile Creek Bridge (no number)</td><td>Moderate indirect impact to views of and from the item and the HCA context.</td></tr>
<tr><td>Non-listed items affected:
Ten Mile Creek Gardens including the miniature railway, and memorials.</td><td>Moderate direct and indirect impact to setting, HCA, views, patterns of use, shade cover, and habitat.
NOTE: Impact will be greater from below the levee and will be dependent on final levee height, it may be considered major in certain locations.</td></tr>
<tr><td colspan="3">RECOMMENDATIONS:
Selected hardscape material should be harmonious with the existing landscape.</td></tr>
<tr><td colspan="3">MITIGATION:
Use of fixtures selected to be harmonious with the existing landscape, will partially mitigate impact on the heritage values of the site.
Long term direct and indirect impact can be partially mitigated by implementing the above recommendations.</td></tr>
<tr><td colspan="3">IMPACT SUMMARY:
Installation of levee fixtures will result in at least moderate direct and indirect impact to the above items, as this will alter existing views to and from listed heritage items, and within the HCA. This can be partially mitigated by sensitive landscaping that continues to facilitate access, circulation and enjoyment of the character of the HCA.</td></tr>
</table>

PROPOSED WORKS		
7. Retaining walls		
Task	Heritage Items Affected	Impact
Installation of concrete panel retaining walls, the height of the panels is 900 mm – 1200mm & 1200 - 1600mm along the levee bench.	I95 I99 I104 Ten Mile Creek Bridge (no number) Non-listed items affected: Ten Mile Creek Gardens including the miniature railway, and memorials.	Major indirect impact to views of and from the item and the HCA context. Major indirect impact to views of and from the item and the HCA context. Major indirect impact to views of and from the item and the HCA context. Moderate indirect impact to views of and from the item and the HCA context. Moderate to major direct and indirect impact to setting, HCA, views, patterns of use, shade cover, and habitat. NOTE: Impact will be greater from within Ten Mile Creek Gardens, looking south.
RECOMMENDATIONS: Selected hardscape material should be harmonious with the existing landscape.		
MITIGATION: Use of a concrete colour and finish, selected to be harmonious with the existing landscape, will partially mitigate impact on the heritage values of the site. Long term direct and indirect impact can be partially mitigated by implementing the above recommendations.		
IMPACT SUMMARY: Installation of retaining walls will result in **major to moderate direct and indirect impact,** to the above items, as this will alter existing views to and from listed heritage items, and within the HCA. This impact can be partially mitigated by ensuring the character of the heritage area and views to heritage buildings are retained by appropriate colour and finishes selection.		

7. Recommendations & Conclusion

7.1 Recommendations

There are positive heritage impacts to consider in that Holbrook's important historic building stock will be protected from flood water during any future flood event following these mitigation works.

There is however potential for these works to cause moderate to major heritage impact.

To mitigate the impact of the proposal on the heritage values of the site, recommendations as shown in Table 7-1 could be implemented.

Table 7-1: Recommendations

Mitigation Measure	Description
Replacement trees	The existing street trees along Hay Street in the vicinity of Ten Mile Creek Gardens will be removed under this proposal. Replacement trees within Ten Mile Creek Gardens are recommended following the works, to enhance the setting of the heritage items and regain valuable tree canopy in Ten Mile Creek Gardens.
Stockpiling site topsoil	Site topsoil should be stockpiled wherever possible for reuse on site during the seeding work to minimise impact on the natural environment and retain the existing landscape character.
Hold point to inspect imported soil	Imported soil should be inspected prior to spreading to ensure it is weed free and of appropriate structure to advance seed germination.
Hardscape selection	All proposed built elements should be selected to be harmonious with the surrounding built and natural environment, respect the heritage values of the town's historic core, and to reduce impacts on views to and from listed heritage items where possible.
Heritage induction	All relevant construction staff, contractors and subcontractors must be made aware of their statutory obligations for heritage under the NSW *Heritage Act 1977* and best practice as outlined in The Burra Charter (Australia ICOMOS 2013) to ensure no archaeological remains or heritage fabric are impacted during the proposed works without appropriate mitigation measures in place. This would be implemented through a heritage induction carried out prior to works commencing and throughout the works program.

7.2 Conclusion

There is potential for adverse heritage impact in and around Ten Mile Creek Gardens. While not a listed item, this park is located within the (non-statutory) Holbrook Heritage Conservation Area and is the location of several community assets including the miniature railway and two war memorials. The park is also a partial setting for numerous locally listed heritage listed items (in particular Ten Mile Creek Bridge, Shire Hall, Mackie & Sons and the Germanton Courier building).

Levee 1 will change the way people currently enjoy and use the park, by altering the existing ground plane and thereby access, as well impact the character of the place and extent of tree cover.

Heritage items immediately adjacent to the park will not be directly impacted by the proposal, however there will be moderate to major indirect impact to them, as these items are within the HCA boundary outlined in the *Greater Hume Development Control Plan* 2013 (GHDCP) and the views of and from the listed heritage items and the HCA will be altered by the proposed works.

Levees are however considered necessary to prevent flooding in the area which may cause damage to existing built heritage fabric in the future. There are therefore positive heritage impacts to consider in the form of protection for the town centre’s important historic building stock. Potential heritage impacts to local heritage items can also be partially mitigated by the recommendations contained within this report.

8. References

Cardno, 2020, “Holbrook Levee Design.”

Greater Hume Council various webpages.

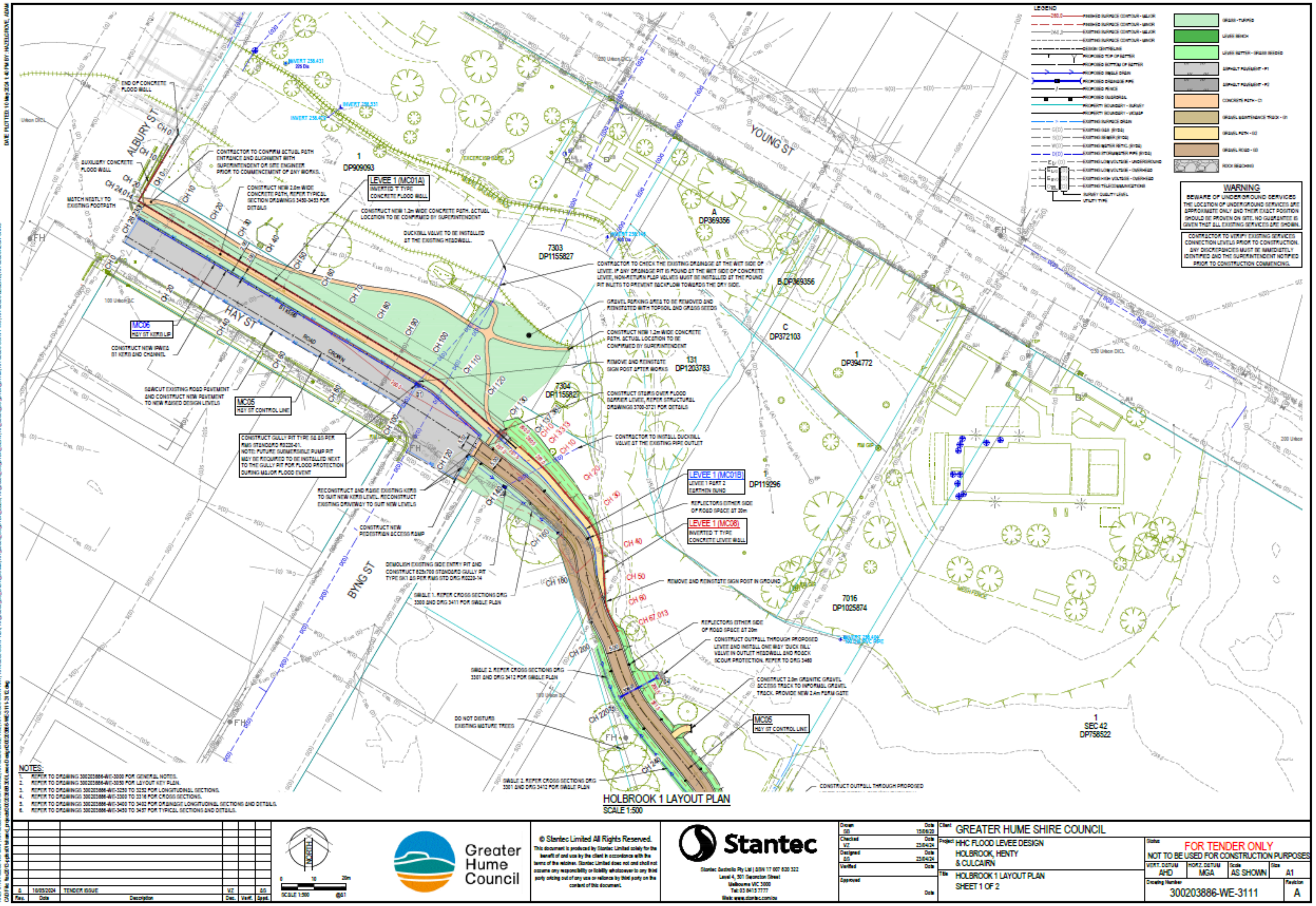
State Heritage Inventory.

WMA Water, 2017, “Holbrook – Floodplain Risk Management Study and Plan.” P. 19.

Stantec, 2024, “Holbrook Flood Mitigation Design.”

Appendix A Stantec, 2024, “Holbrook Flood Mitigation Design.”– Selected Plans

(see full document for further information)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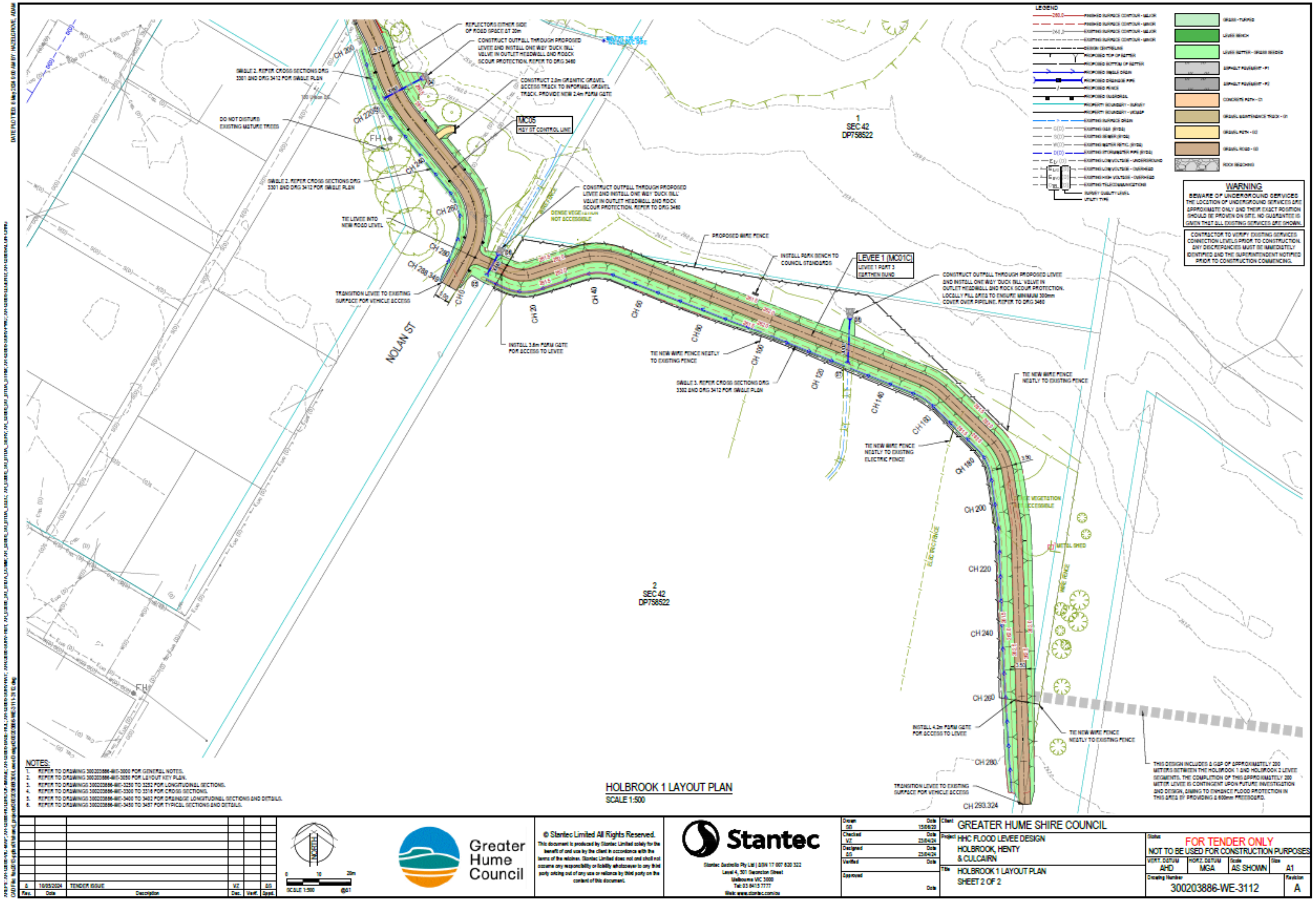
GREATER HUME SHIRE COUNCIL
HHC FLOOD LEVEE DESIGN
HOLBROOK, HENTY & CULCAIRN
HOLBROOK 1 LAYOUT PLAN
SHEET 1 OF 2
FOR TENDER ONLY
NOT TO BE USED FOR CONSTRUCTION PURPOSES
300203886-WE-3111
Stantec
Greater Hume Council
YOUNG ST
HAY ST
ALBURY ST
BYNG ST
LEVEE 1 (MC01A)
LEVEE 1 (MC01B)
LEVEE 1 (MC06)
WARNING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HOLBROOK, HENTY
& CULCAIRN
HOLBROOK 1 LAYOUT PLAN
SHEET 2 OF 2
FOR TENDER ONLY
NOT TO BE USED FOR CONSTRUCTION PURPOSES
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Stantec
Greater Hume Council
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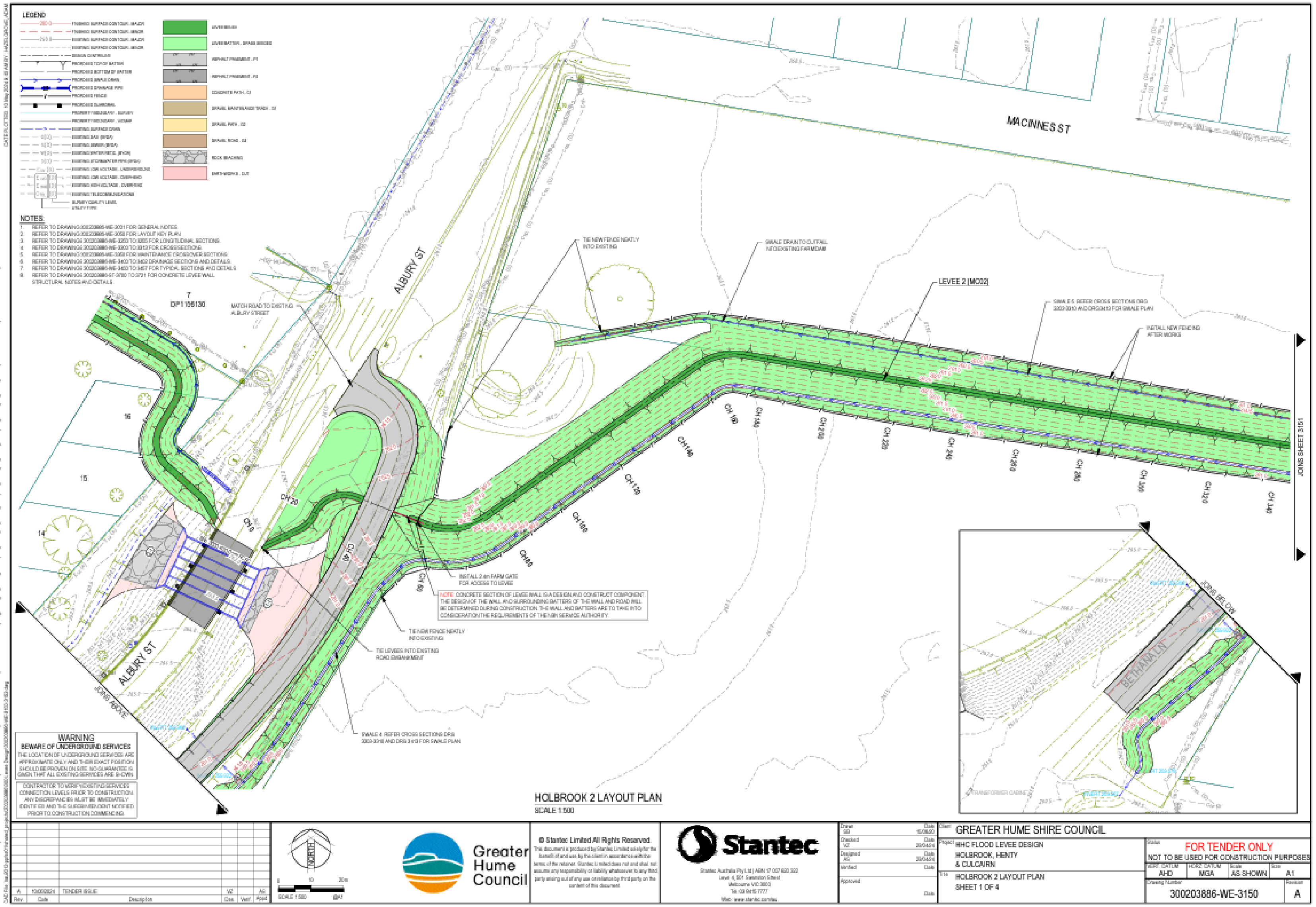
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HOLBROOK, HENTY & CULCAIRN
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SHEET 1 OF 4
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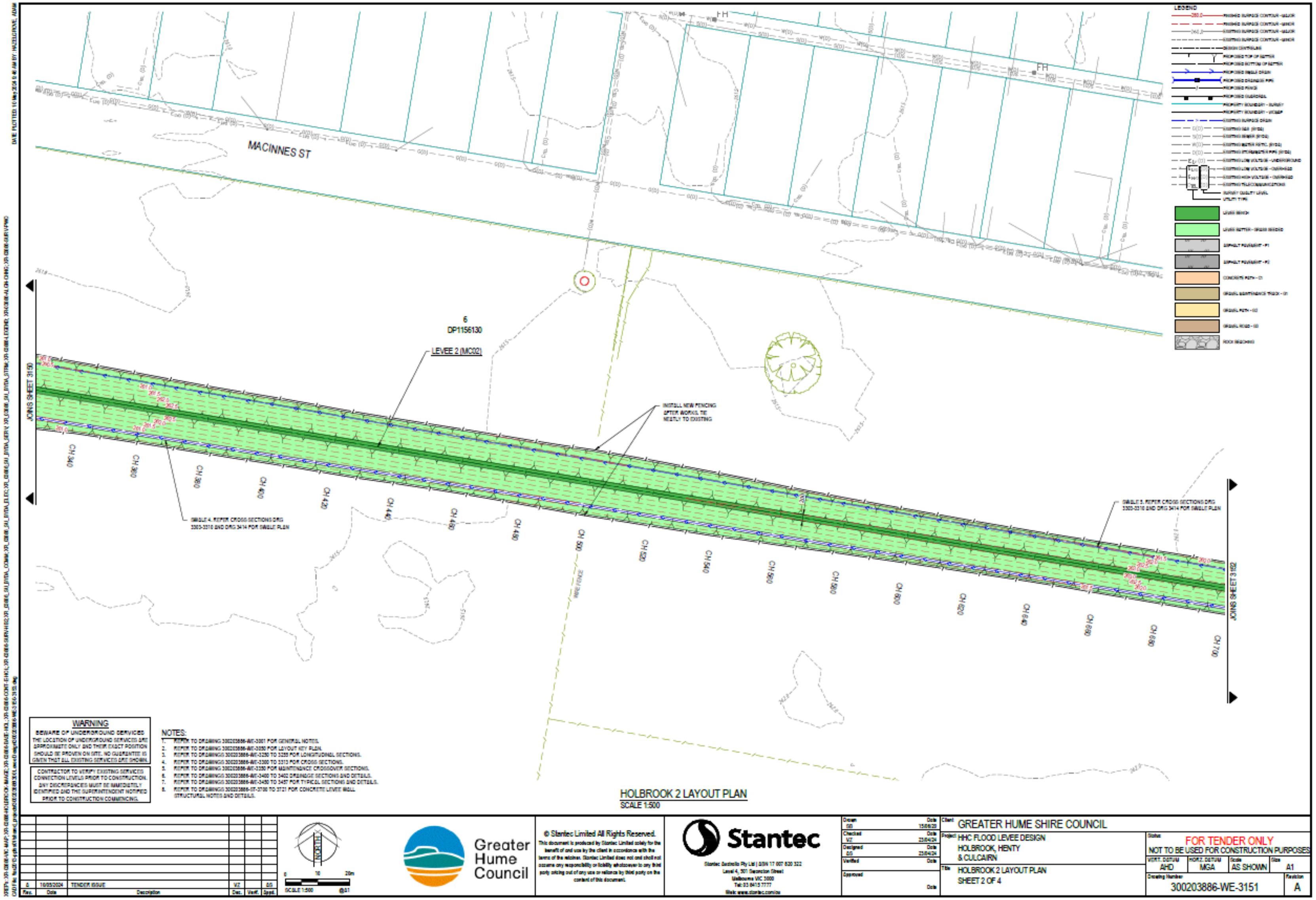
NOT TO BE USED FOR CONSTRUCTION PURPOSES
300203886-WE-3150
MACINNES ST
ALBURY ST
LEVEE 2 (MC02)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DP1156130
LEVEE 2 (MC02)
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JOINS SHEET 3152
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WARNING
BEWARE OF UNDERGROUND SERVICES
NOTES:
Greater Hume Council
Stantec
GREATER HUME SHIRE COUNCIL
HHC FLOOD LEVEE DESIGN
HOLBROOK, HENTY & CULCAIRN
HOLBROOK 2 LAYOUT PLAN
SHEET 2 OF 4
FOR TENDER ONLY
NOT TO BE USED FOR CONSTRUCTION PURPOSES
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MGA
AS SHOWN
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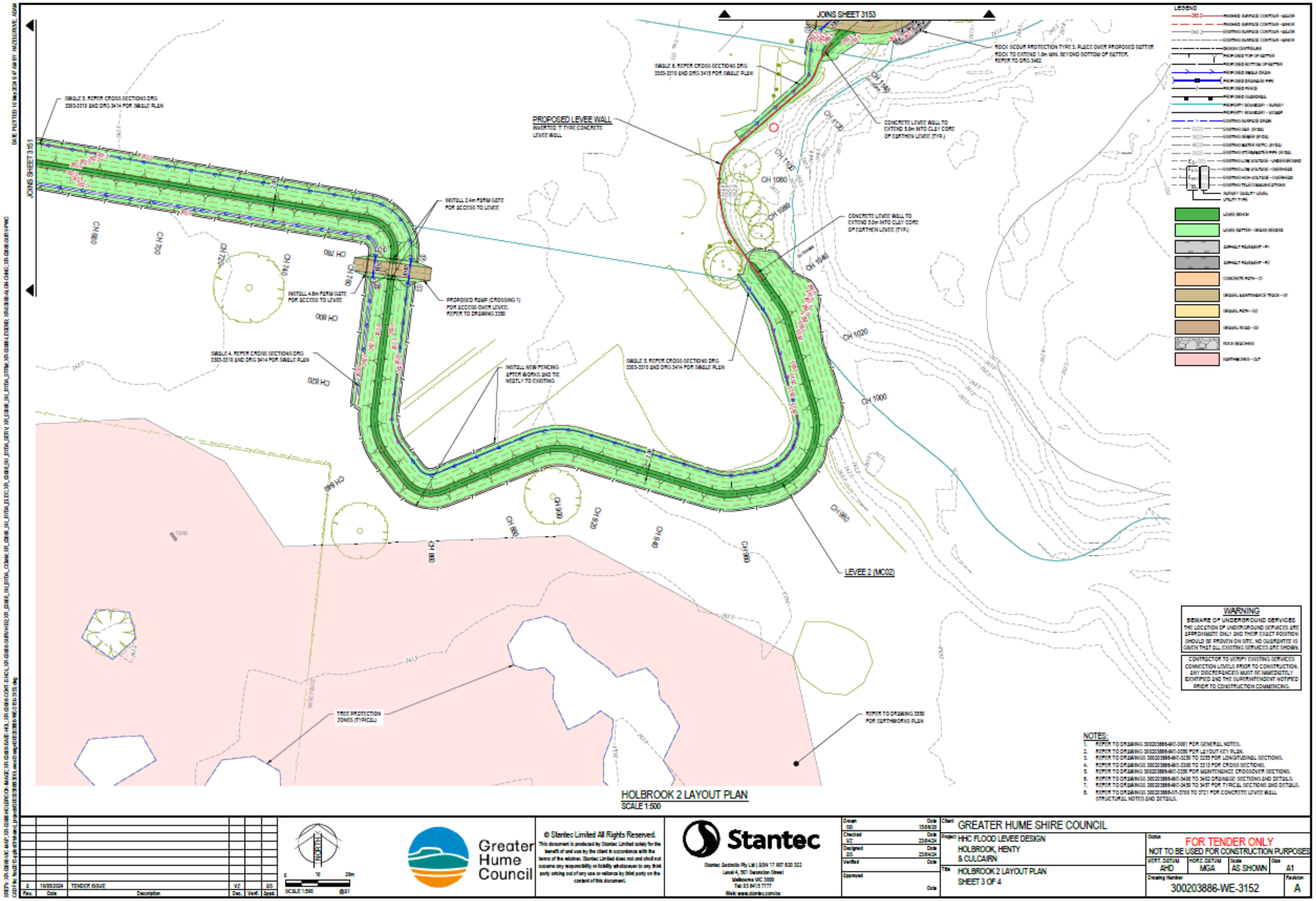
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PROPOSED LEVEE WALL
LEVEE 2 (MC02)
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HHC FLOOD LEVEE DESIGN
HOLBROOK, HENTY & CULCAIRN
HOLBROOK 2 LAYOUT PLAN
SHEET 3 OF 4
FOR TENDER ONLY
NOT TO BE USED FOR CONSTRUCTION PURPOSES
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MGA
AS SHOWN
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300203886-WE-3152
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Greater Hume Council
Stantec
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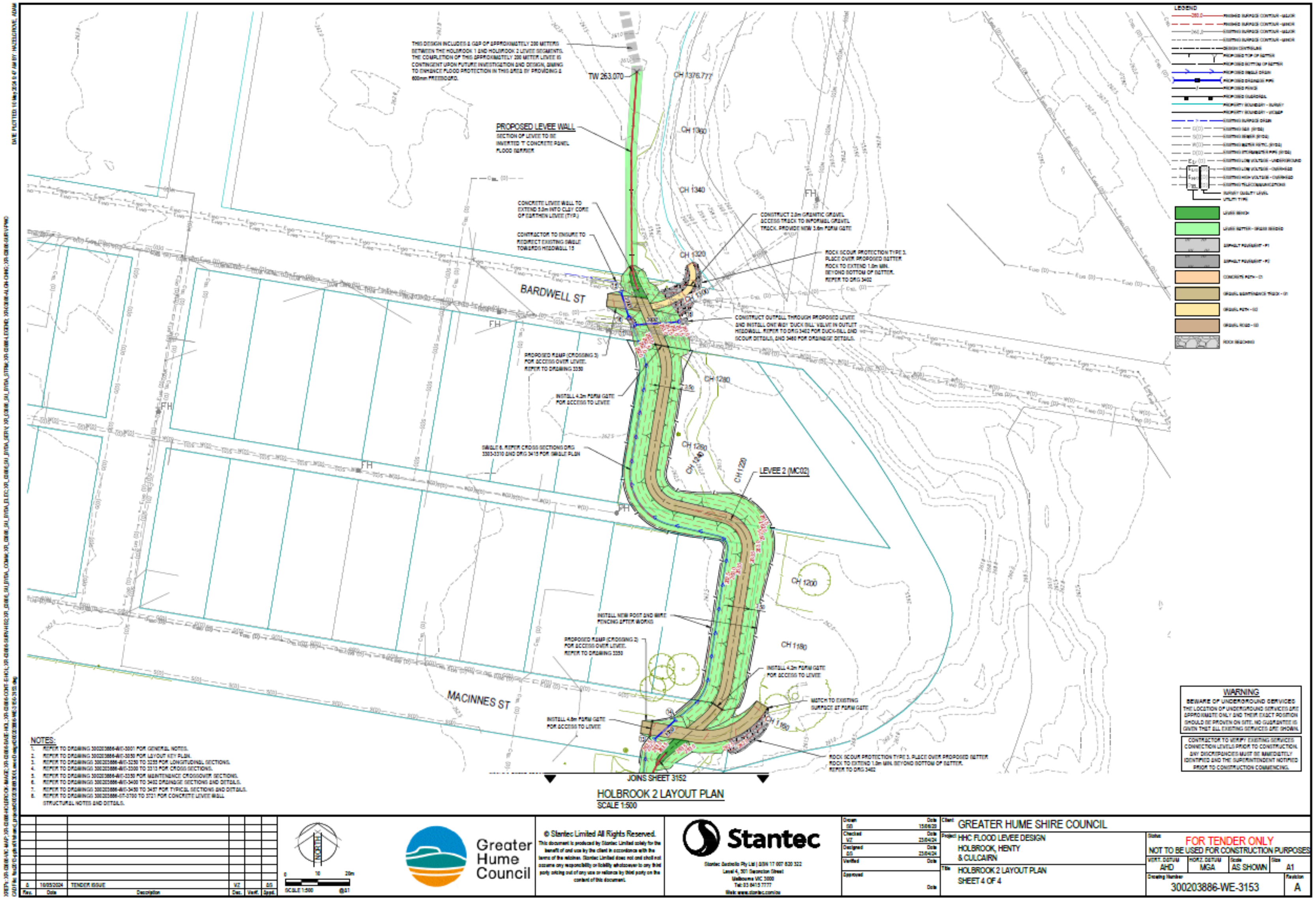
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CH 1340
CH 1320
BARDWELL ST
CH 1280
CH 1260
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CH 1200
CH 1180
MACINNES ST
JOINS SHEET 3152
HOLBROOK 2 LAYOUT PLAN
SCALE 1:500
WARNING
LEGEND
NOTES:
Greater Hume Council
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GREATER HUME SHIRE COUNCIL
HHC FLOOD LEVEE DESIGN
HOLBROOK, HENTY
& CULCAIRN
HOLBROOK 2 LAYOUT PLAN
SHEET 4 OF 4
FOR TENDER ONLY
NOT TO BE USED FOR CONSTRUCTION PURPOSES
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MGA
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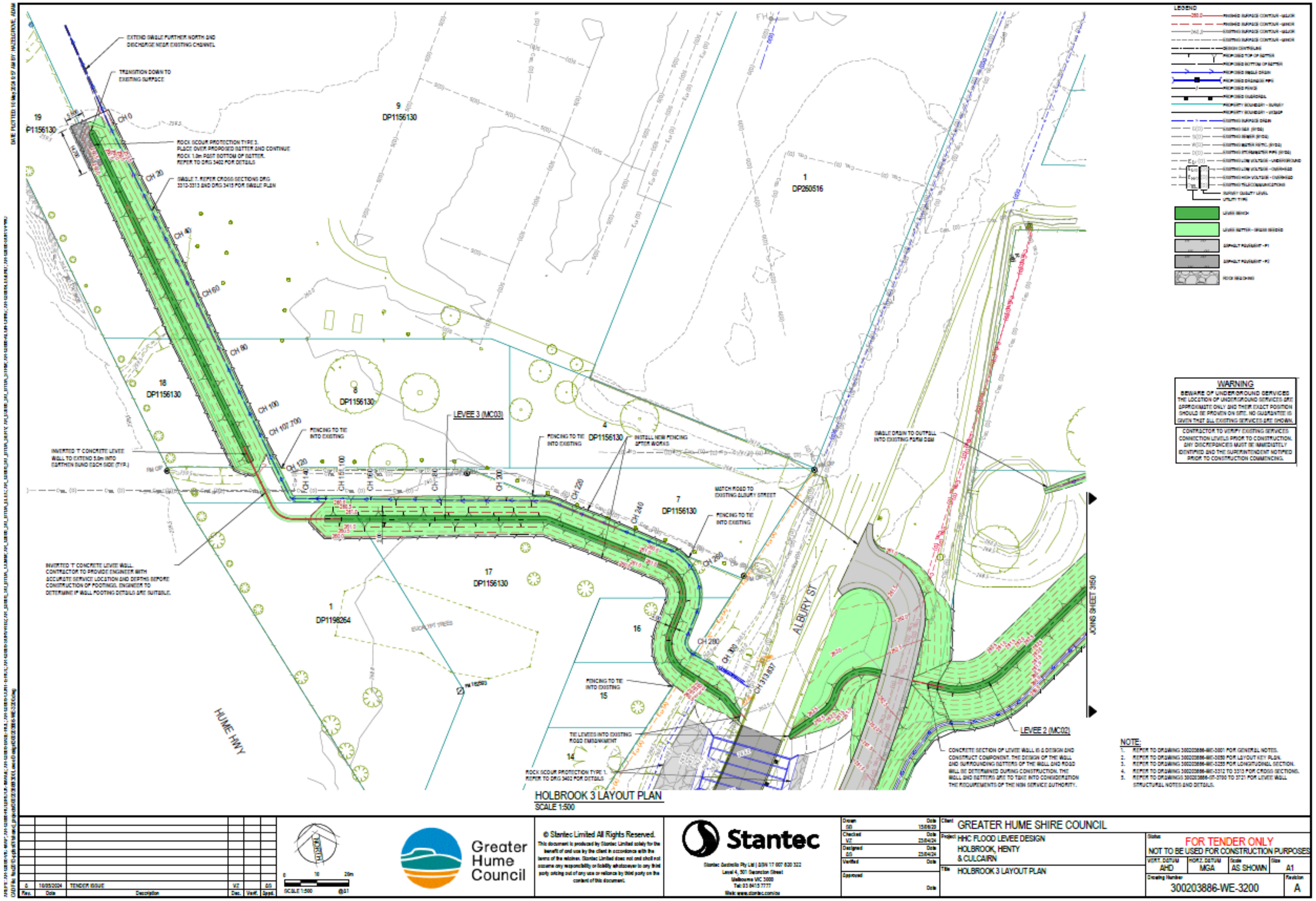
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LEVEE 2 (MC02)
ALBURY ST
HUME HWY
WARNING
BEWARE OF UNDERGROUND SERVICES
GREATER HUME SHIRE COUNCIL
HHC FLOOD LEVEE DESIGN
HOLBROOK, HENTY
& CULCAIRN
HOLBROOK 3 LAYOUT PLAN
FOR TENDER ONLY
NOT TO BE USED FOR CONSTRUCTION PURPOSES
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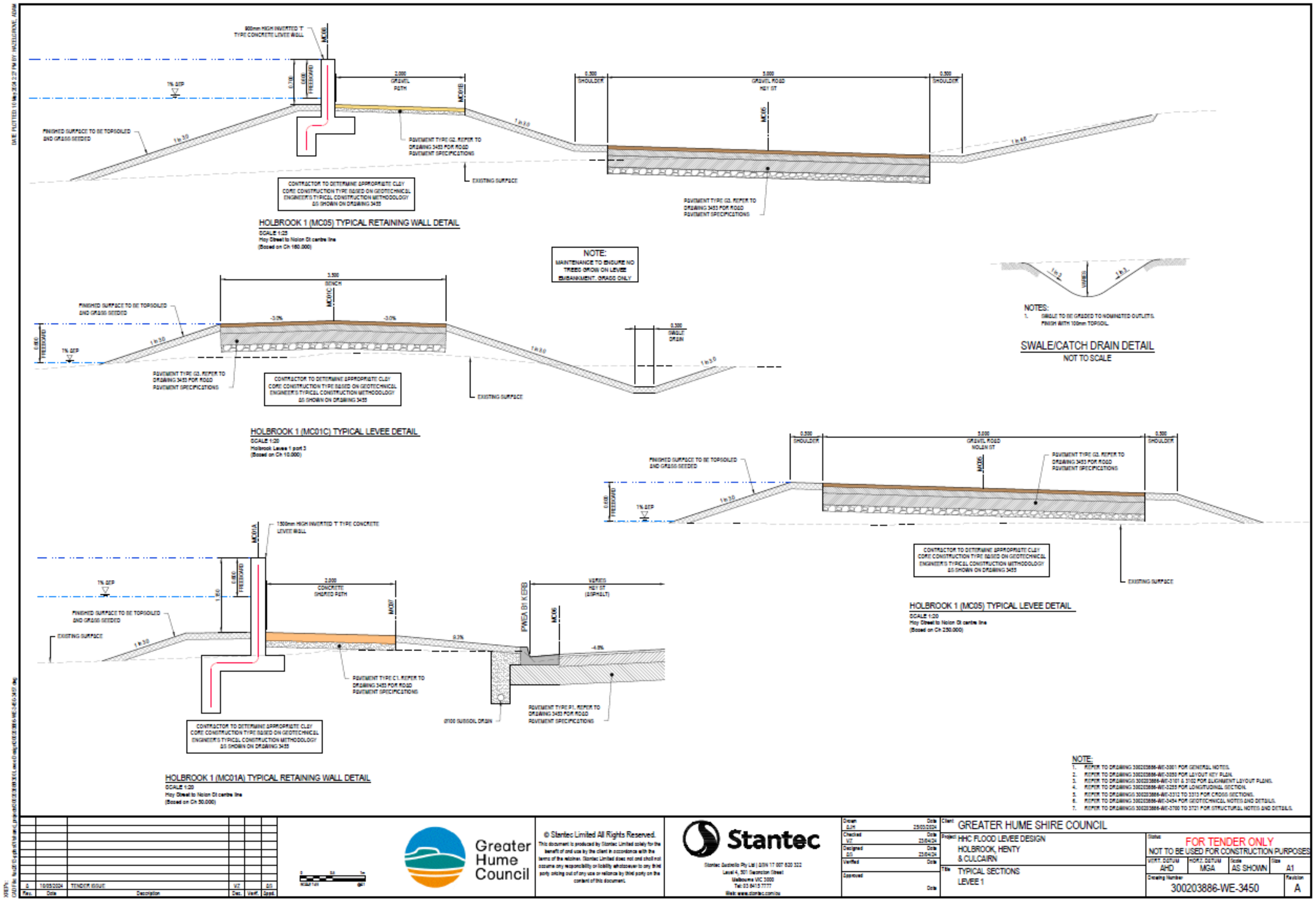
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HOLBROOK 1 (MC01C) TYPICAL LEVEE DETAIL
SWALE/CATCH DRAIN DETAIL
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HOLBROOK 1 (MC05) TYPICAL LEVEE DETAIL
HOLBROOK 1 (MC01A) TYPICAL RETAINING WALL DETAIL
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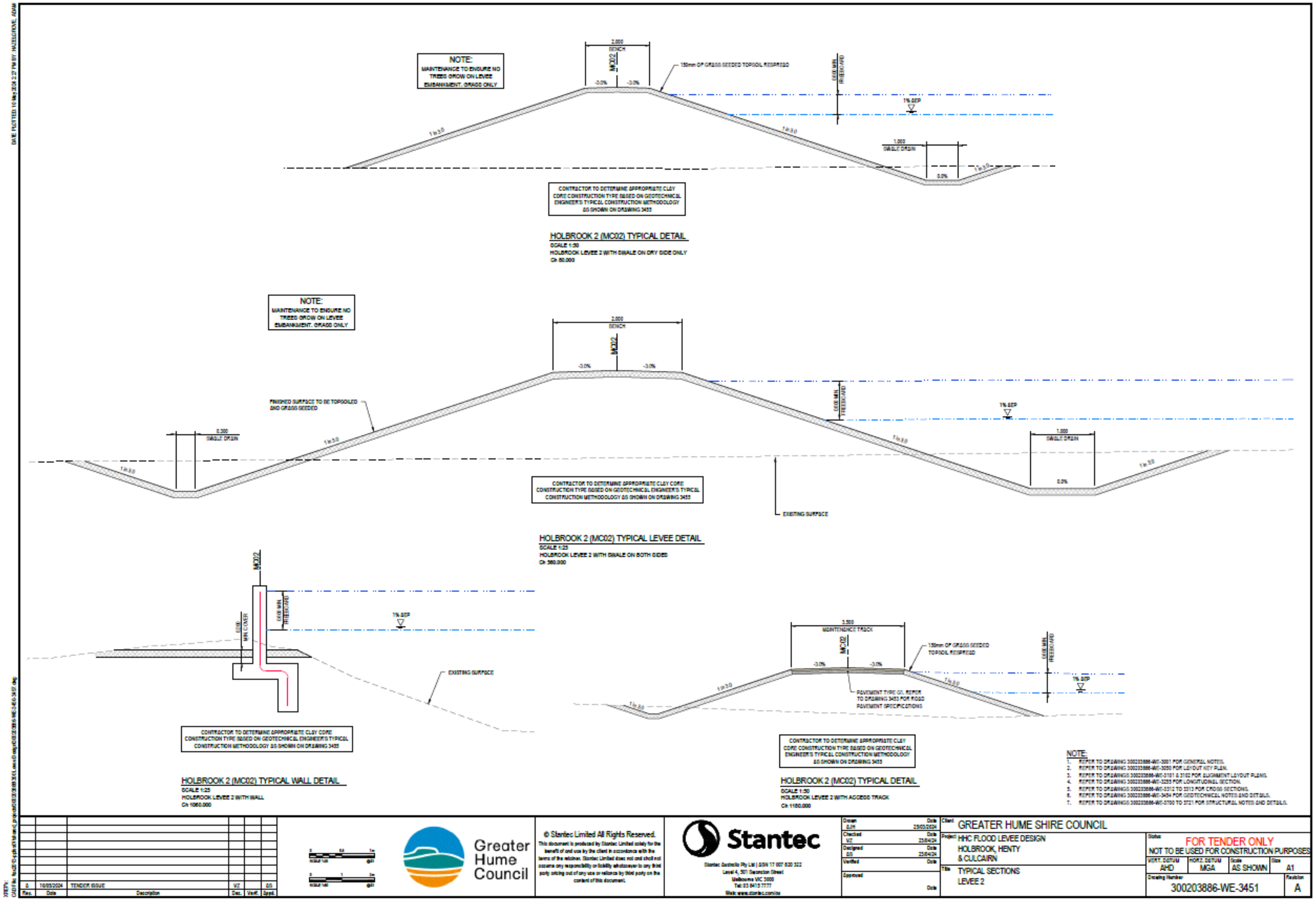
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HOLBROOK 2 (MC02) TYPICAL DETAIL
SCALE 1:50
HOLBROOK LEVEE 2 WITH SWALE ON DRY SIDE ONLY
HOLBROOK 2 (MC02) TYPICAL LEVEE DETAIL
SCALE 1:25
HOLBROOK LEVEE 2 WITH SWALE ON BOTH SIDES
EXISTING SURFACE
HOLBROOK 2 (MC02) TYPICAL WALL DETAIL
SCALE 1:25
HOLBROOK LEVEE 2 WITH WALL
HOLBROOK 2 (MC02) TYPICAL DETAIL
SCALE 1:50
HOLBROOK LEVEE 2 WITH ACCESS TRACK
NOTE:
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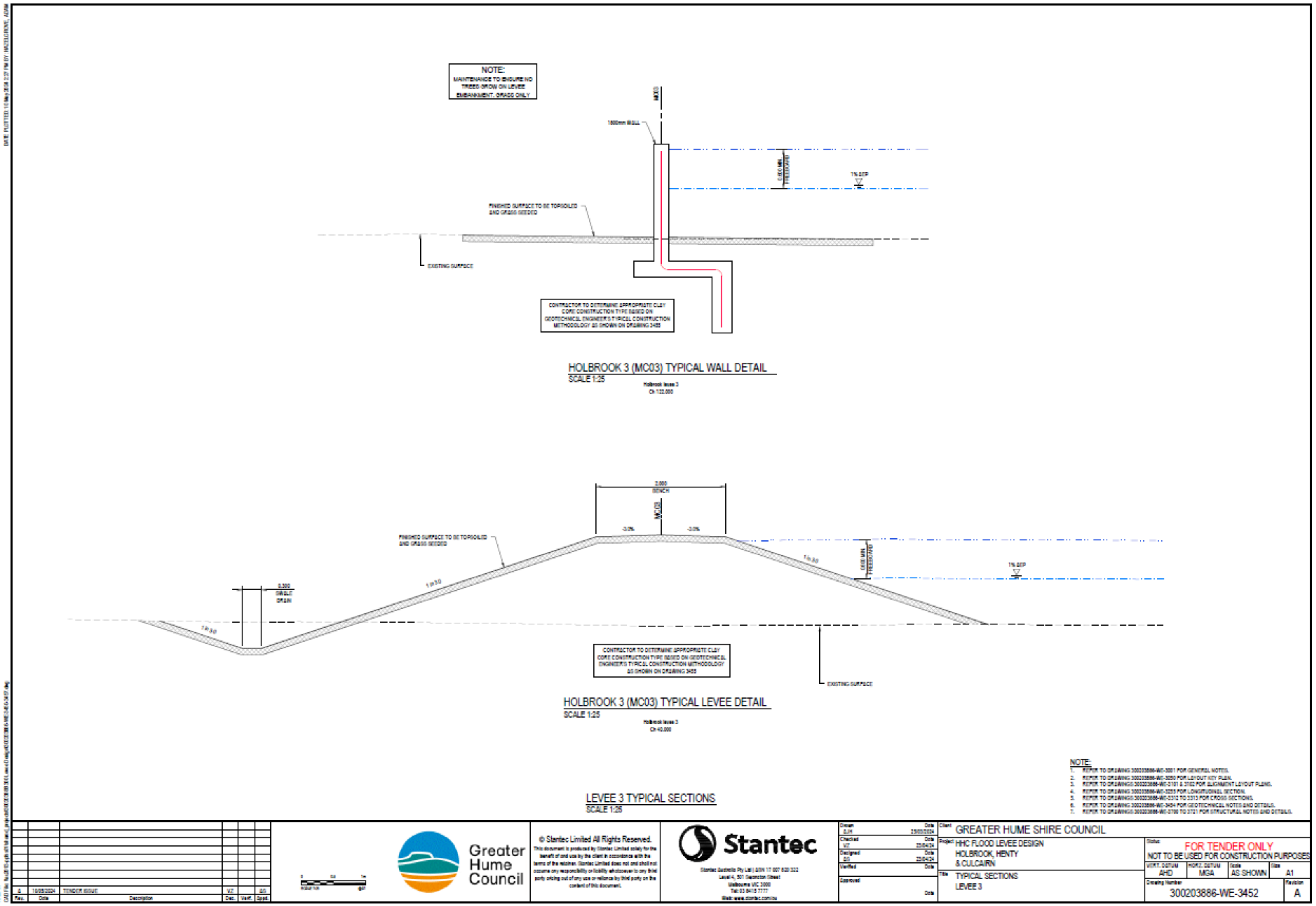
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HOLBROOK 3 (MC03) TYPICAL LEVEE DETAIL
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END OF REPORT

Appendix E Aboriginal Heritage Due Diligence Assessment

NSW Public Works

Aboriginal Heritage Due Diligence Assessment

Holbrook Flood Mitigation Works

Levee banks, culverts, stockpile removals and borrow pits

Report Number: P-FY20231873-PWO-ENV-RP-001-A2

September 2024

Prepared for:

Greater Hume Council

NSW Public Works

Report Number: P-FY20231873-PWO-ENV-RP-001-A2

P-FY20231873-PWO-ENV-RP-001-A2_HolbrookLeveeADDA.docx

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Document control

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A2 (final)	A. Cameron	Rasha Haymour	Liz Mathieson	03/09/2024

Dr Alyce Cameron

Archaeologist

NSW Public Works, 359 Harbour Drive, Coffs Harbour NSW 2450

M 0488 316 037

E alyce.cameron@pwa.nsw.gov.au | **W** www.publicworks.nsw.gov.au

Cover photo: View southeast across proposed location of levee bank adjacent to south bank of Ten Mile Creek.

Source: NSW Public Works, Department of Primary Industries and Regional Development NSW.

Acknowledgements

The Department of Primary Industries and Regional Development NSW stands on Country that always was and always will be Aboriginal land.

From creation, all generations have been caring for Country and sharing with each other, surviving, and living in harmony as one. Today, we show our respect by acknowledging the ancient protocols and traditions of the First Nations peoples. We recognise the elders for continuing dreamtime lore, protecting the knowledge of all things sacred and spiritual, sustaining all living species that called this place home, and preserving the oldest living culture in the world.

We acknowledge the Traditional Custodians of the land and waters, and we pay respect to Elders past, present and emerging. We are committed to providing places in which Aboriginal people are included socially, culturally, and economically through thoughtful and collaborative approaches to our work.

Executive Summary

NSW Public Works (NSW PW) have been engaged by the Greater Hume Council (GHC) to complete an Aboriginal heritage due diligence assessment to support a Review of Environmental Factors (REF) for flood mitigation works at Holbrook, New South Wales (NSW).

Following the 2010 and 2012 flood events, a Flood Study and a Floodplain Risk Management Study was prepared by WMA water in 2017. GHC has adopted the associated floodplain risk management plans for Holbrook township, which recommended the construction of new levee banks, within the southern portion of the Holbrook township along Ten Mile Creek. The floods that occurred in October 2010 are believed to be the highest Ten Mile Creek flood since at least December 1887, with multiple houses along the creek flooded over floor level and two homes built at least 120 years ago being flooded for the first time (WMA, 2017). During this flood event, waters covered most of the land to the south of the Creek and flowed over Albury Street before re-joining the creek to the west of the town (WMA, 2017).

The proposed levee would be located within the southern portion of Holbrook, with one section on the southern side of Ten Mile Creek along Hay Street, and the other further south, parallel to Macinnes Street from the Holbrook Bypass off-ramp to Ten Mile Creek near the eastern end of Barwell Street. In addition, it is proposed to install six culverts to transfer floodwater through the Holbrook Bypass off-ramp to downstream of Albury Street.

A visual inspection of the study area was conducted on the afternoon of Tuesday 11 April and the morning Wednesday 12 April 2023 by Dr Alyce Cameron (archaeologist, NSW PW).

The results of the Aboriginal due diligence assessment have determined the Proposal is unlikely to impact Aboriginal objects. No Aboriginal sites or objects have been recorded inside the study area. The study area has a low potential for archaeological deposits to be present. Based on the results of this assessment, no further archaeological assessments are necessary.

The following recommendations are provided as a precautionary measure to ensure the greatest possible protection to the area’s Aboriginal cultural heritage values:

1. The Proposal may proceed at the study area with no further archaeological investigation. The Proposal and all land and ground disturbance activities must be confined to inside the study area. Should the Proposal extend outside the study area then further archaeological assessment may be required.
2. All staff and contractors involved in the proposed work should be made aware of legislative protection under the NPW Act for all Aboriginal sites and objects, and the contents of the Unanticipated Finds Protocols.
3. This assessment has concluded that Aboriginal objects are unlikely to be harmed by the proposed works. However, if during works, Aboriginal objects, artefacts, or skeletal material are noted the Unanticipated Finds Protocol (Appendix C) should be followed.

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Glossary

Term	Definition
A Horizon	Surface mineral horizon(s) with some organic accumulation; either darker in colour than underlying horizons, or lighter in colour but with a lower silicate clay/sesquioxide content.
Aboriginal object/s	Aboriginal object/s are any deposit, object or material evidence (not being a handicraft made for sale) relating to the Aboriginal habitation of the area that comprises New South Wales, being habitation before or concurrent with (or both) the occupation of that area by persons of non-Aboriginal extraction and includes Aboriginal remains. Defined by the *National Parks and Wildlife Act 1974* (NPW Act).
Aboriginal Place	An Aboriginal Place is a location declared to be an Aboriginal Place under Section 84 of the *National Parks and Wildlife Act* by the Minister administering the NPW Act and by order published in the Gazette. The Aboriginal Place is of special significance with respect to Aboriginal culture and may or may not contain Aboriginal objects.
Aboriginal site	The location of one or more Aboriginal objects and material traces of past Aboriginal land use.
Alluvial landscape	Alluvial soil landscapes are formed by deposition along rivers and streams. Soil parent material is alluvium. Alluvial soil landscapes include floodplains and alluvial deposits. Typical landform elements include those found on meander plains; including bars, back plains, scrolls, scroll plains, flood-outs, oxbows, levees, terraces, prior and current stream channels.
Alluvium	Alluvium is a loose clay, silt, sand or gravel that has been deposited by running water. Alluvium is typically geologically young and not consolidated into solid rock.
Artefact scatter	An artefact scatter consists of two or more stone artefacts located within 50 metres of each other. Artefact scatters can be located on the ground surface or as subsurface deposits. Sometimes recorded in association with other archaeological features such as hearths, modified trees or PADs.
B Horizon	A subsoil horizon(s) characterised by one or more of the following: concentration of silicate clay, iron, aluminium, and/or organic material; different structure and/or consistency to adjacent horizons; and/or stronger colours than adjacent horizons.

Term	Definition
Colluvial landscape	Colluvial soil landscapes are affected by mass movement. Soil parent material mostly consists of colluvial mass movement debris including scree and talus along with other landslide, mudflow and creep deposits. Colluvial soil landscapes usually include alcoves, cliffs, cliff-foot slopes, scarps, landslides, talus, some moderately inclined to precipitous hillslopes and areas of commonplace evidence of mass movement.
Colluvium	Colluvium is a general term for loose unconsolidated sediments that have been deposited at the base of hill slopes by rain wash, sheetwash, downslope creep or a combination of these processes.
Isolated find	A stone artefact located by itself, usually at least 50 metres from any other Aboriginal archaeological feature (i.e., an artefact scatter, modified tree, quarry location, etc.).
Modified tree	A modified tree has been culturally modified through scarring, carving or the deliberate removal by traditional methods of the bark or wood from a tree, or the deliberate modification by traditional methods of the wood of the tree.
National Parks and Wildlife Act (NPW Act):	The NSW legislation which covers the conservation of the natural and cultural heritage of the state of New South Wales; fostering public appreciation, understanding and enjoyment of its natural and cultural heritage; and managing any lands reserved for the purposes of conserving and fostering public appreciation and enjoyment of its natural and/or cultural heritage.
Potential archaeological deposit (PAD)	An area where subsurface stone artefacts and/or other cultural features are likely to occur.
Quaternary	The current and most recent geologic era which began 2.58 million years ago. It is one of three periods of the Cenozoic Era and follows on from the Neogene Period.

Abbreviations and Notations

Item	Description
AHIMS	Aboriginal Heritage Information Management System
AHIP	Aboriginal Heritage Impact Permit
BCD	Biodiversity Conservation Division.
DECCW	Department of Environment, Climate Change and Water
DRNSW	Department of Regional New South Wales
DPIE	Department of Planning, Industry and Environment
EP&A Act	Environmental Planning and Assessment Act 1979
EP&A Regulation	Environmental Planning and Assessment Regulation 2000
EPBC Act	Environment Protection and Biodiversity Conservation Act 1999
HNSW	Heritage NSW. Formerly OEH and BCD.
LEP	Local Environmental Plan
LGA	Local Government Area
NPW Act	National Parks and Wildlife Act 1974
NSW	New South Wales
OEH	Office of Environment and Heritage
REF	Review of Environmental Factors

1. Introduction

This section provides a brief description of the proposal, the background to the proposal and its objectives.

1.1 Purpose of the Proposal

NSW Public Works (NSWPW) has been engaged by the Greater Hume Council (GHC) to complete an Aboriginal heritage due diligence assessment to support a Review of Environmental Factors (REF) for flood mitigation works at Holbrook, New South Wales (NSW).

Following the 2010 and 2012 flood events, a Flood Study and a Floodplain Risk Management Study was prepared by WMA water in 2017. GHC has adopted the associated floodplain risk management plans for Holbrook township, which recommended the construction of new levee banks, within the southern portion of the Holbrook township along Ten Mile Creek. The floods that occurred in October 2010 are believed to be the highest Ten Mile Creek flood since at least December 1887, with multiple houses along the creek flooded over floor level and two homes built at least 120 years ago being flooded for the first time (WMA, 2017). During this flood event, waters covered most of the land to the south of the Creek and flowed over Albury Street before re-joining the creek to the west of the town (WMA, 2017).

The proposed levee would be located within the southern portion of Holbrook, with one section on the southern side of Ten Mile Creek along Hay Street, and the other further south, parallel to Macinnes Street from the Holbrook Bypass off-ramp to Ten Mile Creek near the eastern end of Barwell Street. In addition, it is proposed to install six culverts to transfer floodwater through the Holbrook Bypass off-ramp to downstream of Albury Street.

1.2 The study area

The study area is in the township of Holbrook, NSW, in the local government area (LGA) of the GHC. The study area consists of several locations in south Holbrook:

The objective of the works is to mitigate the flood impacts at Holbrook township through the provision of a flood levee in Holbrook township. The proposed levee would provide protection to the southern portion of the town from inundation due to flooding of the Ten Mile Creek.

The location of the study area is shown in Figure 1-1 and an aerial map is shown in Figure 1-2.

1.3 The proposed works

The proposed works include:

- The construction of three new levee banks within the southern portion of the Holbrook township (approximately 2,272m long). The height of the levees will vary along the various sections (up to 1.09 m). Those new levee banks are located:
  - Holbrook Levee 1: on the north side of Hay Street, Nolan Street, and the Holbrook Football Ground and south of Ten Mile Creek.

  - Holbrook Levee 2: South of MacInnes Street and west of Ten Mile Creek at the extent of residential properties along the eastern extent of Bardwell Street and MacInnes Street.
  - Holbrook Levee 3: south of the Holbrook Motor Village and businesses, west of Albury Street and east of Hume Highway off-ramp.
- The installation of six new culverts to transfer floodwaters downstream of Albury Street.
- The removal of a stockpile near the Holbrook bypass off-ramp for use in levee construction.
- The establishment of one borrow pit to gain suitable fill material to utilise in the construction of the levee banks.
- Lowering of a hillside in the south-eastern portion of the southern levee.

The plans for the proposed flood mitigation works are provided in Appendix A with an overview provided as Figure 1-3.

The study area at the time of the pedestrian survey was larger and included the area north of Ten Mile Creek in Ten Mile Creek Gardens as well as a second borrow pit location adjacent to the location of Levee 3. These locations have since been determined to not be required to be impacted by the proposed works. However, these two locations remain part of the overall study area for completeness of this due diligence assessment.

1.4 Assessment methodology

This Aboriginal Due Diligence assessment has been undertaken in compliance with the following:

- Due Diligence Code of Practice for the Protection of Aboriginal Objects in New South Wales (DECCW 2010).

1.5 Report authorship

This report was authored by Dr Alyce Cameron (archaeologist, NSWPW) who has over 12 years' experience of heritage consulting in Australia (BA Hons (Combined archaeology and biological anthropology, Australian National University) and PhD (Archaeology & Palaeoanthropology, Australian National University). The report was reviewed internally by Liz Mathieson (Principal Scientist, NSWPW).

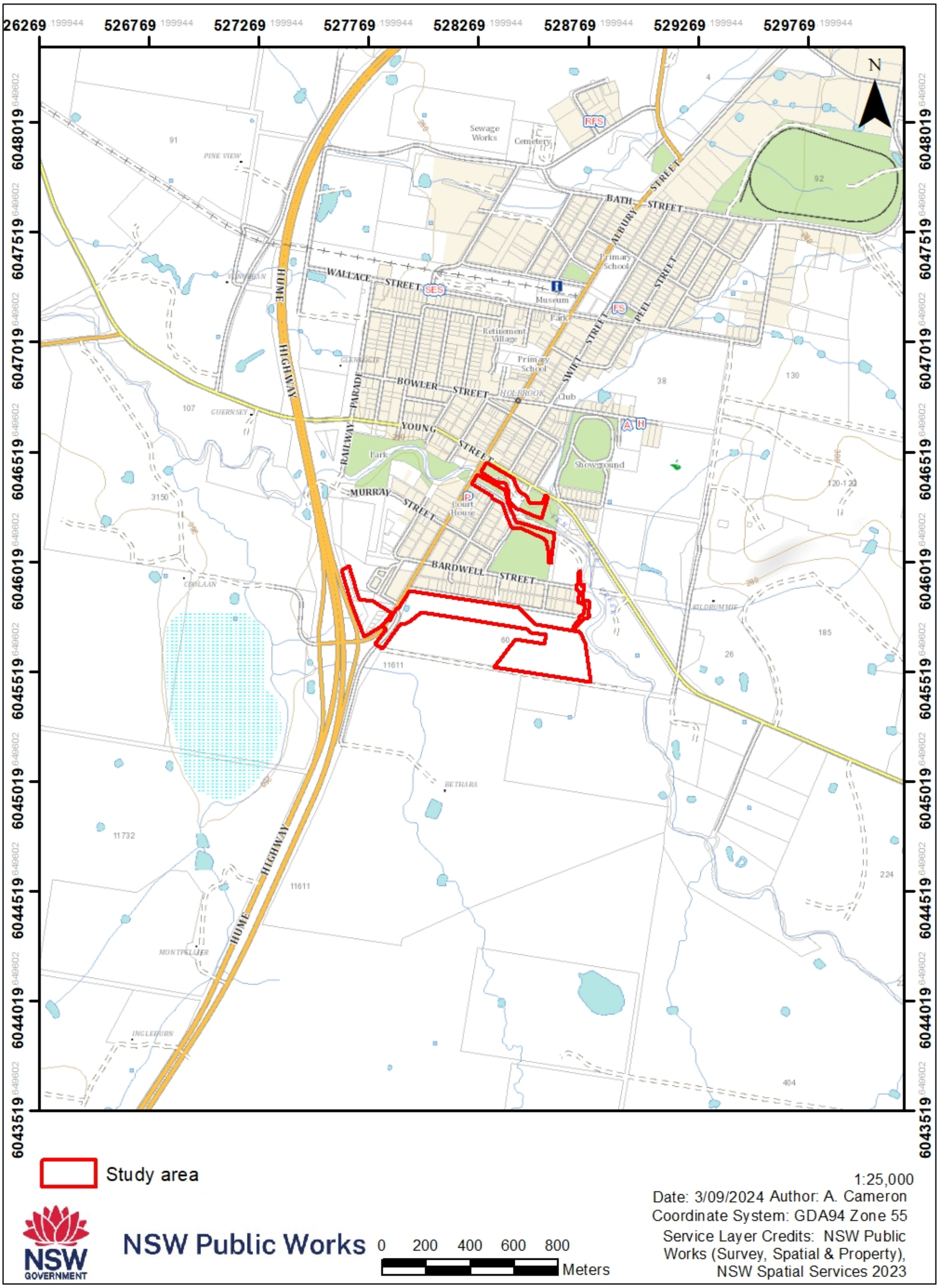

Figure 1-1: Location of study area

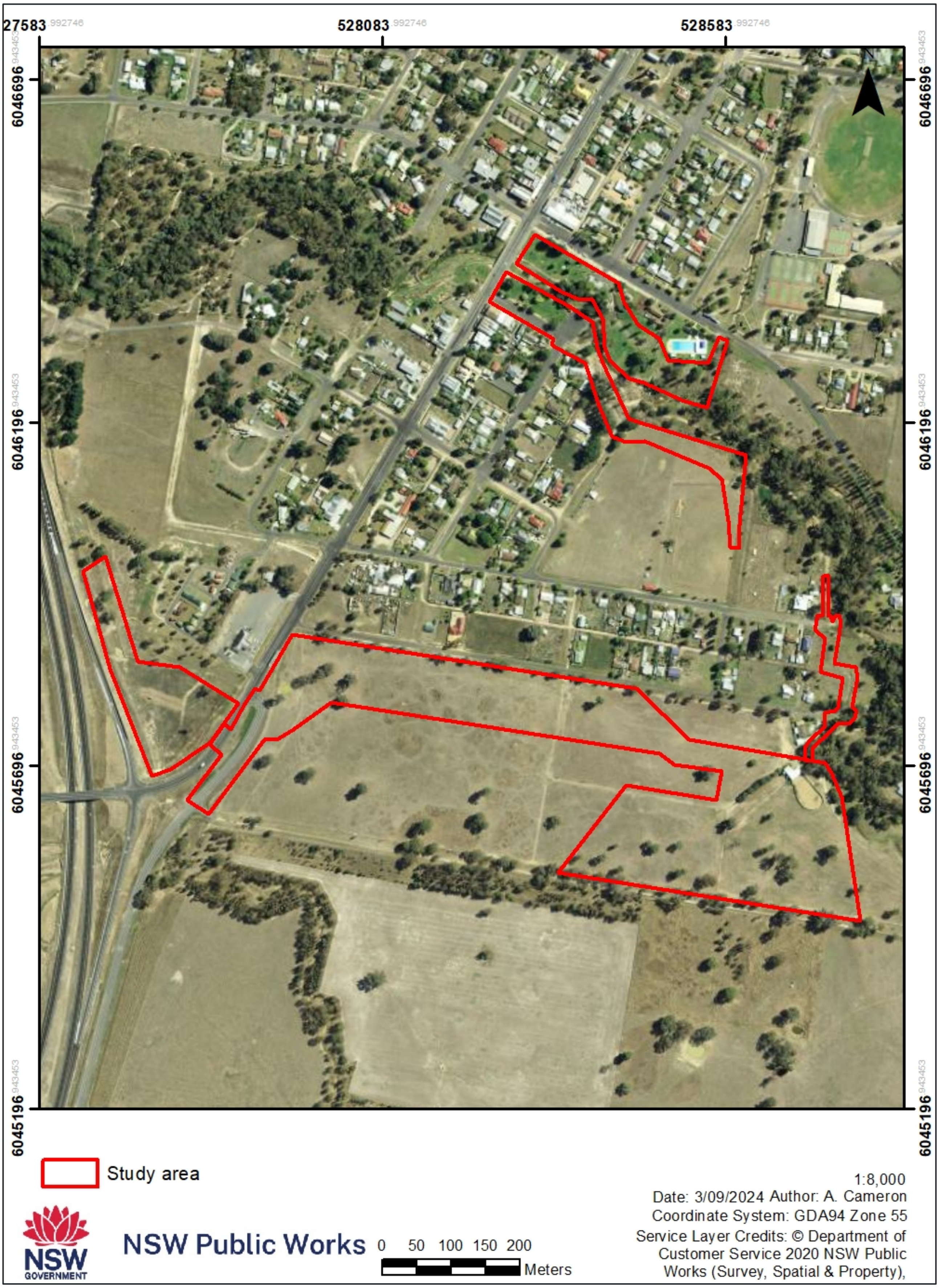

Figure 1-2: Aerial of study area

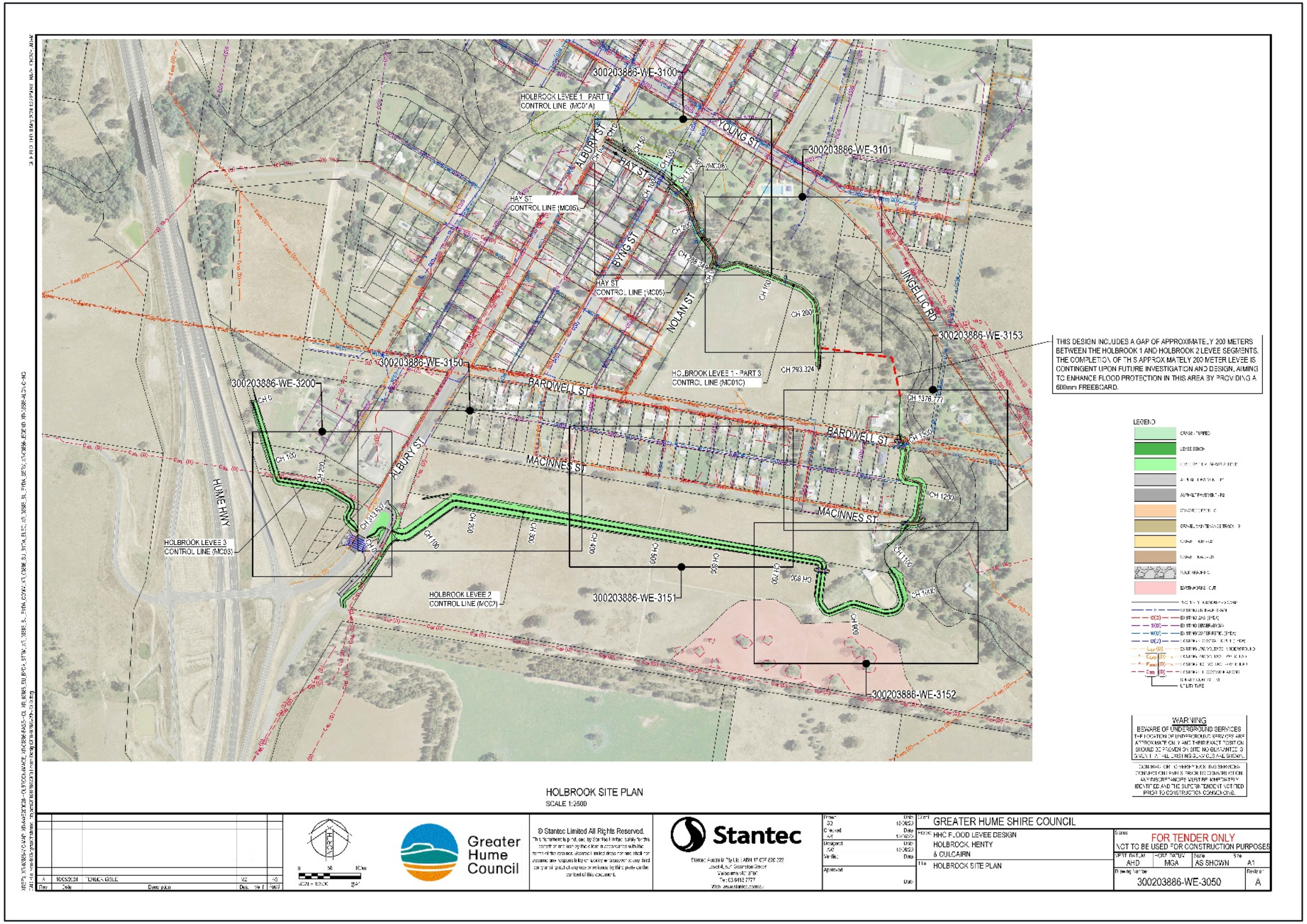

Figure 1-3: Proposed works overview (Stantec 2024)

2. Statutory Considerations

2.1 Heritage Act 1977

The *Heritage Act 1977* protects and aims to conserve the environmental heritage of New South Wales. Environmental heritage is broadly defined under Section 4 of the *Heritage Act 1977* as consisting of “those places, buildings, works, relics, moveable objects, and precincts, of State or local heritage significance” (Heritage Branch, DoP 2009:4). Aboriginal places or objects that are recognised as having high cultural value (potentially of local and State significance) can also be listed on the State Heritage Register and protected under the provisions of the *Heritage Act 1977*.

2.2 National Parks and Wildlife Act 1974

The *National Parks and Wildlife Act 1974* (NPW Act) provides for the statutory protection of Aboriginal cultural heritage places, objects and features. One of the objects of the NPW Act is the conservation of places, objects and features of significance to Aboriginal people (Section 2A). The NPW Act provides for the management of both Aboriginal Objects and Aboriginal Places and is administrated by Heritage NSW within the Department of Planning and Environment.

Aboriginal Objects and Aboriginal Places are protected under Part 6 of the NPW Act and there are legislative penalties if a person harms or desecrates an Aboriginal Place or Object (s. 86). Harm to an Aboriginal Place or Object includes any act or omission that destroys, defaces or damages the object or place, or, in relation to an Aboriginal object, moves the object from the land on which it had been situated. However, harm to an Aboriginal Object that is ‘trivial or negligible’ does not constitute an offence. Also, it is a defence against prosecution for unintentionally harming Aboriginal Objects if due diligence had been exercised to determine that no Aboriginal object would be harmed, or the harm or desecration was authorised by an Aboriginal Heritage Impact Permit (AHIP). The National Parks and Wildlife Regulation *2009* (NPW Regulation) made under the NPW Act advocates a Due Diligence process to determining likely impacts on Aboriginal objects.

The NPW Regulation made under the NPW Act allows a due diligence process in determining potential impacts of proposed works and actions to Aboriginal objects. The Aboriginal due diligence process provides a defence to the offence of harming Aboriginal objects. The Due Diligence Code of Practice for the Protection of Aboriginal Objects in NSW (DECCW, 2010) outlines a series of low impact activities, definitions of disturbed land, and a series of ‘steps’ for the Aboriginal due diligence process.

2.3 Environmental Planning and Assessment Act 1979 (EP&A Act)

The *Environmental Planning and Assessment Act 1979* (EP&A Act) establishes the requirements relating to environmental planning and assessment for NSW. It governs matters such as planning administration, planning instruments, development assessments, building certification, infrastructure finance, appeals and enforcement.

Section 1.3(f) of the EP&A Act is to promote the sustainable management of built and cultural heritage (including Aboriginal cultural heritage).

The parts of the EP&A Act relevant to environmental and heritage assessment are:

- Part 4 Development assessment and consent, including local government schedules of heritage items.
- Part 5 Infrastructure and environmental impact assessment, which includes self-determining authorities.

The proposal will be assessed under Part 5 of EP&A Act.

3. Environmental context

Understanding the landscape is essential to the interpretation of Aboriginal land use across an area. It helps provide context and is required for any archaeological investigation as an understanding of the landscape of a study area guides survey strategies and the detection of archaeological sites. It also allows archaeologists to better understand natural geomorphic processes such as erosion or deposition of soils, which, in turn affects the preservation of archaeological sites and the degree to which past Aboriginal occupation may be preserved and detected (DEECW 2010: 8).

3.1 Topography and hydrology

The study area is in the NSW Southwestern Slopes bioregion. This bioregion consists of an extensive area of foothills and isolated ranges extending west and southwest of the Great Dividing Range into western Victoria. The bioregion includes part of the Murray, Murrumbidgee, Lachlan and Macquarie River catchments (NPWS 2003: 119). The study area in the lower slopes sub-bioregion and is characterised by undulating and hilly ranges with isolated peaks set in wide valleys at the apices of Riverina alluvial flats (NPWS 2003: 124).

Most of the study area is located either on flat or gently sloping banks adjacent to Ten Mile Creek, or on alluvial flats. Ten Mile Creek is directly adjacent to parts of the study area, and there are several unnamed drainage lines which feed into the creek also in the vicinity. Ten Mile Creek originates near Mount Jergyle in the Woomargama National Park approximately 15 kilometres (km) southeast of Holbrook (Cardno 2019). Figure 3-1 shows the topography and hydrology in relation to the study area.

Parts of Holbrook have been flooded recently in 2010 and 2012. The October 2010 floods are thought to be the highest Ten Mile Creek flood since at least December 1887 (WMA 2017). The study area is in a flood planning area (Figure 3-2).

3.2 Geology and soils

The underlying geology of the study area includes Quaternary alluvial deposits adjacent to Ten Mile Creek, with Cenozoic undifferentiated sediments and sedimentary rocks underlying the southwest areas of the study area.

The study area is in the Mountain Creek soil landscape (Figure 3-1). There are three typical soil profiles for this landscape: older terraces which make up approximately 60% of the landscape, younger terraces that make up 30%, and current floodplain alluvial are 10% of the landscape (Doughty 2003: 119). Table 3-1 summarises the three different typical soil profiles.

Cardno (2020) conducted geotechnical analysis of the soils for the project. Ten boreholes were tested throughout the study area. The geotechnical analysis showed that there was variation across the study area in terms of soil profiles, but it can be generalised to topsoil and grass matter overlying a brown or pale brown sandy silt which extends to an approximately depth of 0.5–1 m. Underneath is a silty clay that goes to a depth of 1–2.5 m. The borehole log information tends to match the profile for current floodplain alluvials as summarised in Table 3-1.

Table 3-1: Typical soil profiles for Mountain Creek soil landscape

Type Profile	Layer 1	Layer 2	Layer 3
Older terraces	A1 horizon. 0–45 cm in depth. Dark brown sandy loam with no gravels	A2 horizon. 45–75 cm in depth. Light brown sandy loam.	B horizon. 75–120 cm in depth. Strong brown sandy clay loam with no gravels.
Younger terraces	A horizon. 0–15 cm in depth. Dark yellowish brown sandy clay loam with no gravels.	B1 horizon. 15–90 cm in depth. Strong brown light clay.	B2 horizon. 90–150 cm in depth. Yellowish brown light medium clay with no gravels.
Current floodplain alluvials	A1 horizon. 0–10 cm in depth. Yellowish brown pale brown to grey sand.	A2 horizon. 10–30 cm in depth. Brown pale or brown loamy sandy.	B horizon. 30–150 cm in depth. Pale yellow light sandy clay with frequent gravels.

3.3 Vegetation

The study area is predominately urbanised, and vegetation consists of non-natives. Where native vegetation is present it tends to be associated with either the Blakely’s Red Gum-Yellow Box grassy tall woodland or the Riparian Blakely’s Red Gun-Box-Shrub-Sedge-Grass Tall Open Forest. Both vegetation community types are present through the central NSW Southwestern Slopes Bioregion and tend to be dominated by Blakelys Red Gum, with Yellow Box, and Apple Box trees also present.

3.4 Past land use

The first Europeans in the region were Hamilton Hume and William Hovell in 1824 during their exploration of the land south of the Murrumbidgee River. The area of Holbrook was described by Hume and Hovell as being thinly timbered and named the area Friday Mount and Camden Forest. Upon their return to Gunning, Hume reported to Governor Thomas Brisbane that rich grazing land was present, and it was this grazing land that drew permanent settlers to the Holbrook area (Ryan 2008)).

One of the first European settlers was Father John Therry who arrived in the region in 1836 and leased a run of land. In 1838 another run was taken up by John Purtell which centred on a creek which became known as Ten Mile Creek. Ten Mile Creek was a regular stopping point for mail coaches by 1840 between Albury and Sydney. The Woolpack Inn was established in 1838 where Holbrook now is. The town developed around the Woolpack Inn with a post office opening in 1858, and a school in 1868. The developing town was frequently called either Ten Mile Creek, The Germans or German’s Flat. When the town surveyed in 1858 the problem of the town name was solved when it was gazetted in 1876 as Germanton. Following the start of World War I in 1914, it was decided to change the name of the town from Germanton. Finally, in 1915 the name of Holbrook was chosen, after Lieutenant Norman Holbrook, the first submariner to win the Victoria Cross (Ryan 2008).

The town has been a stopping point for travellers journeying between Sydney and Albury. It also services the surrounding farmlands.

An aerial from 1958 (Figure 3-3) shows that the study area adjacent to Ten Mile Creek had not been developed into a park yet. The eastern and southern parts of the study area is also undeveloped, though extensive vegetation clearing had occurred. By 1965 (Figure 3-4) the swimming pool had been constructed and there are additional residential buildings adjacent to parts of the study area have been constructed. By 1982 (Figure 3-5) the park on either side of Ten Mile Creek has been landscaped, including part of the oval. There are additional residences in proximity to the study area, and there is development at the location where the southern Holbrook service centre and Holbrook Motor Home are now located. Figure 3-6 shows the aerial from 1990 and there have been few developments adjacent to the study area, excepting the highway bypass, since then.

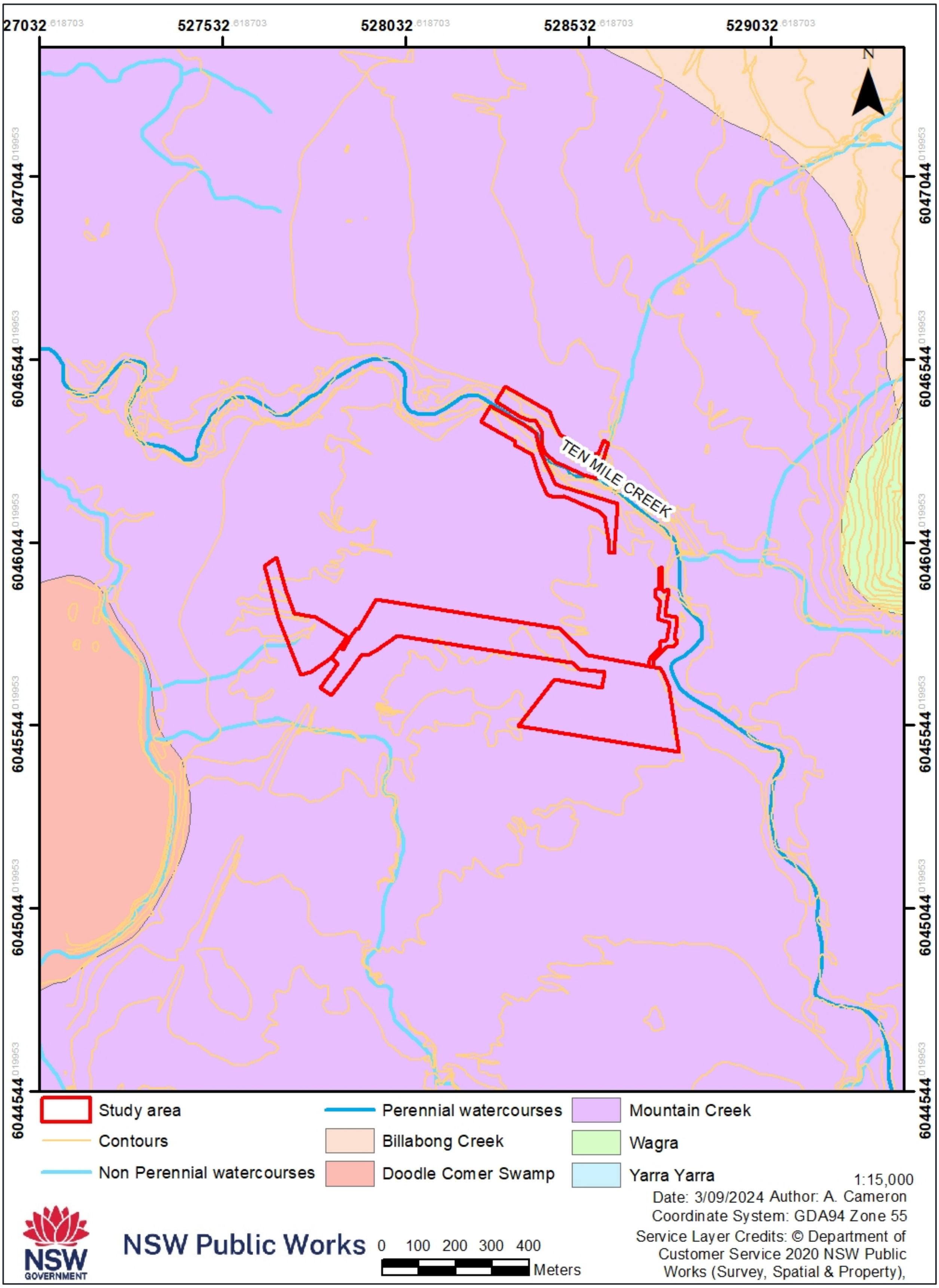

Figure 3-1: Topography, hydrology, and soil landscape of study area.

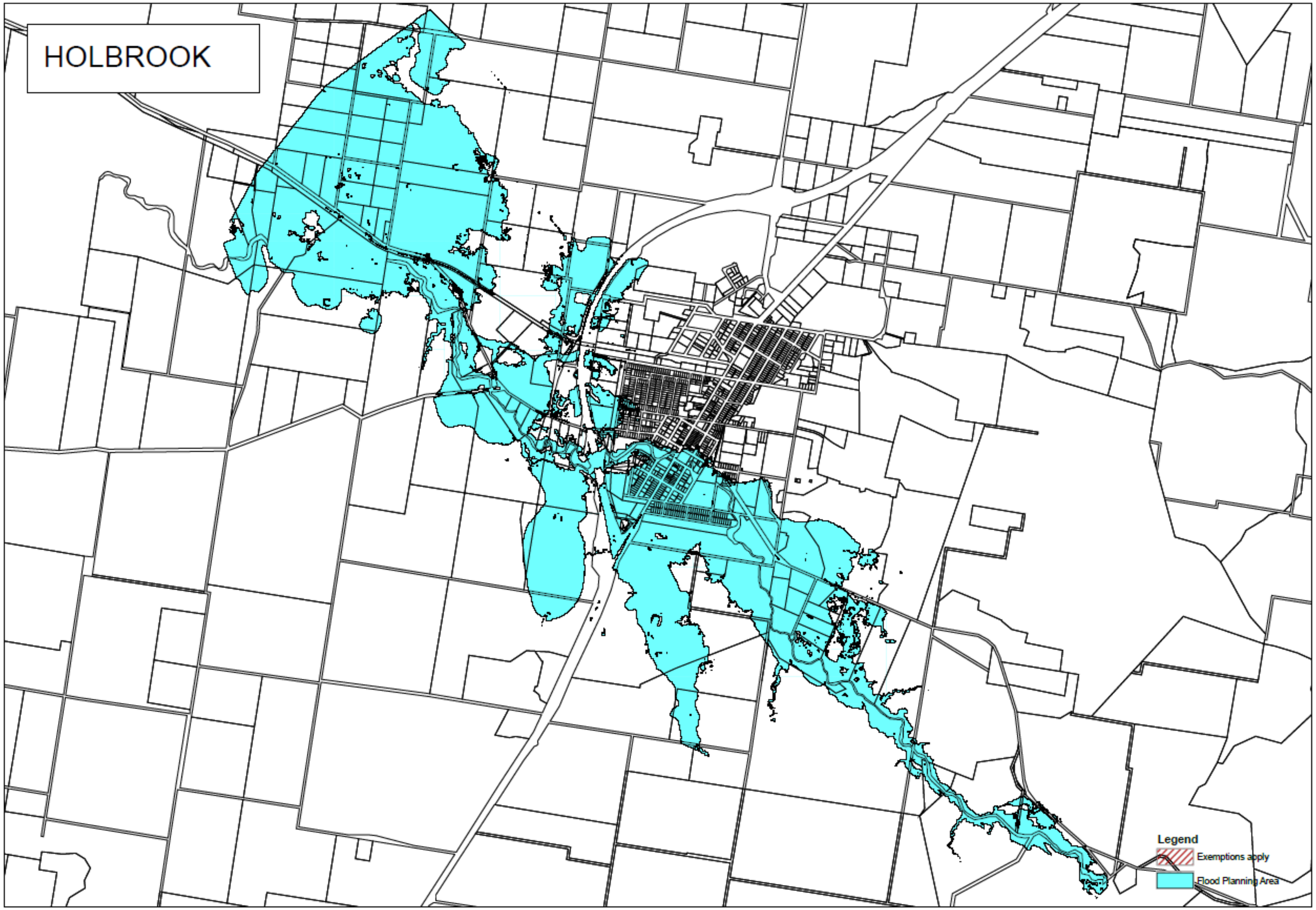

Figure 3-2: Holbrook Flood Planning Area (GHSC 2022).

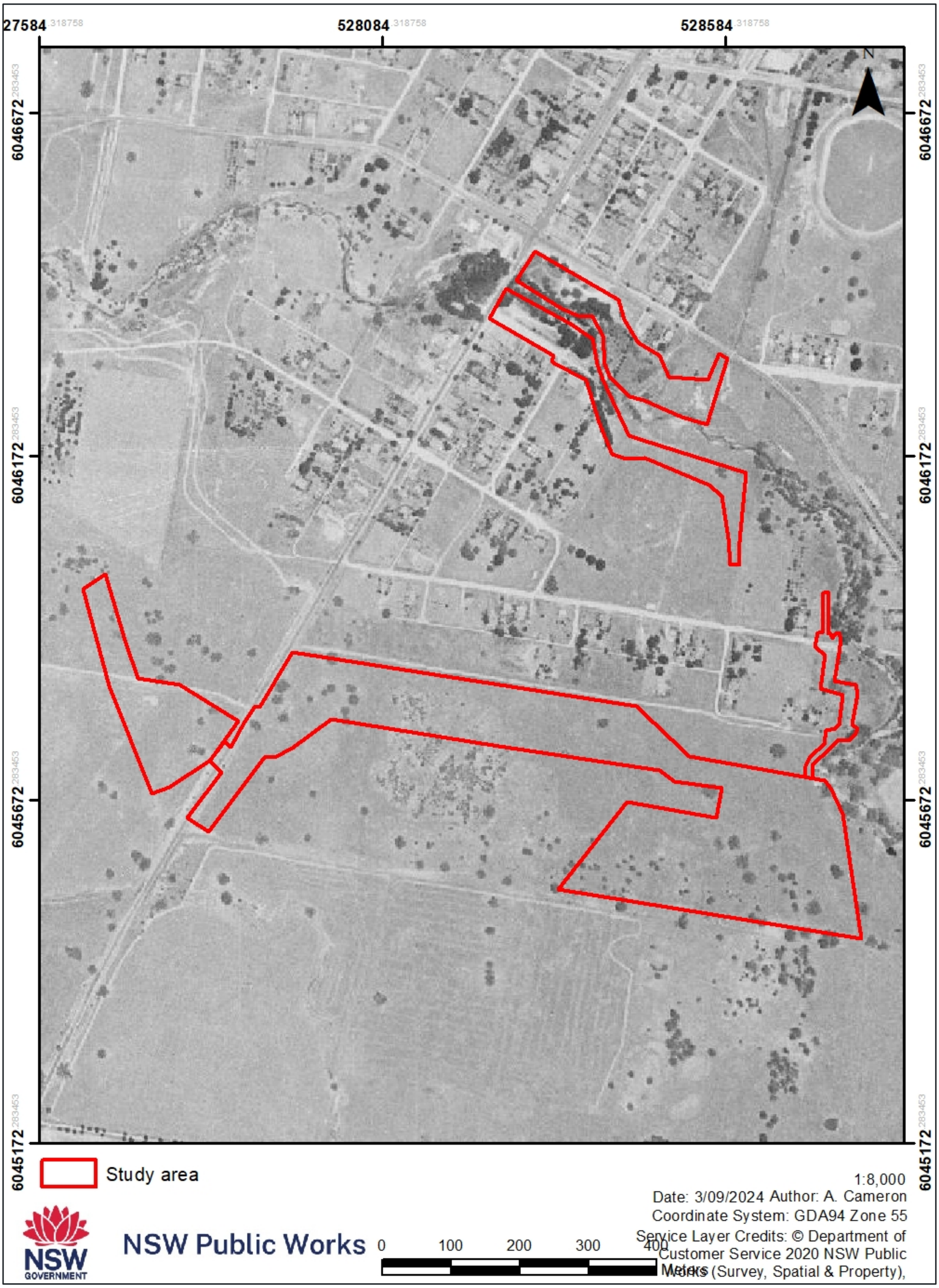

Figure 3-3: Historical aerial from 1958 (NSW SS 2022)

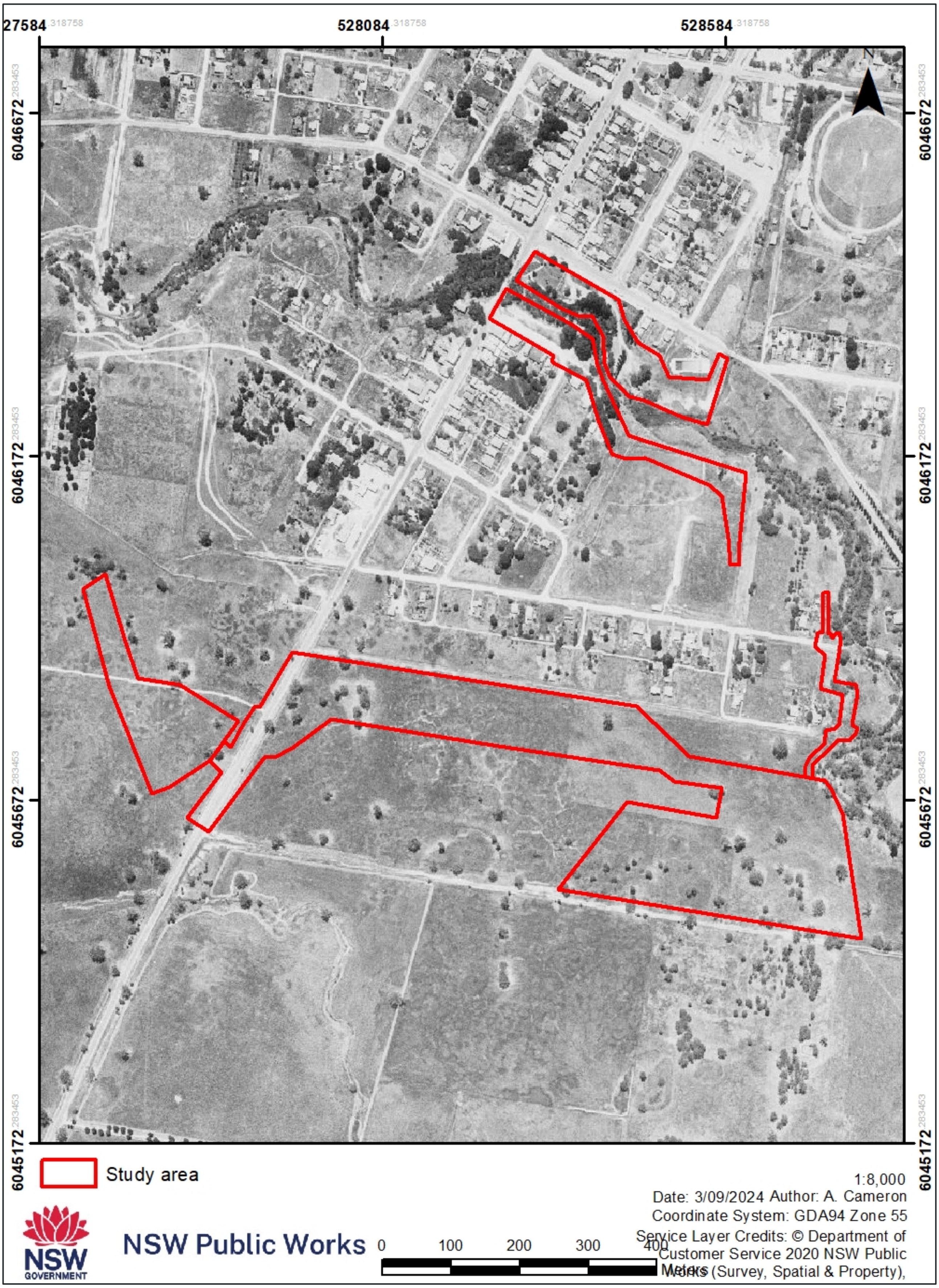

Figure 3-4: Historical aerial from 1965 (NSW SS 2022)

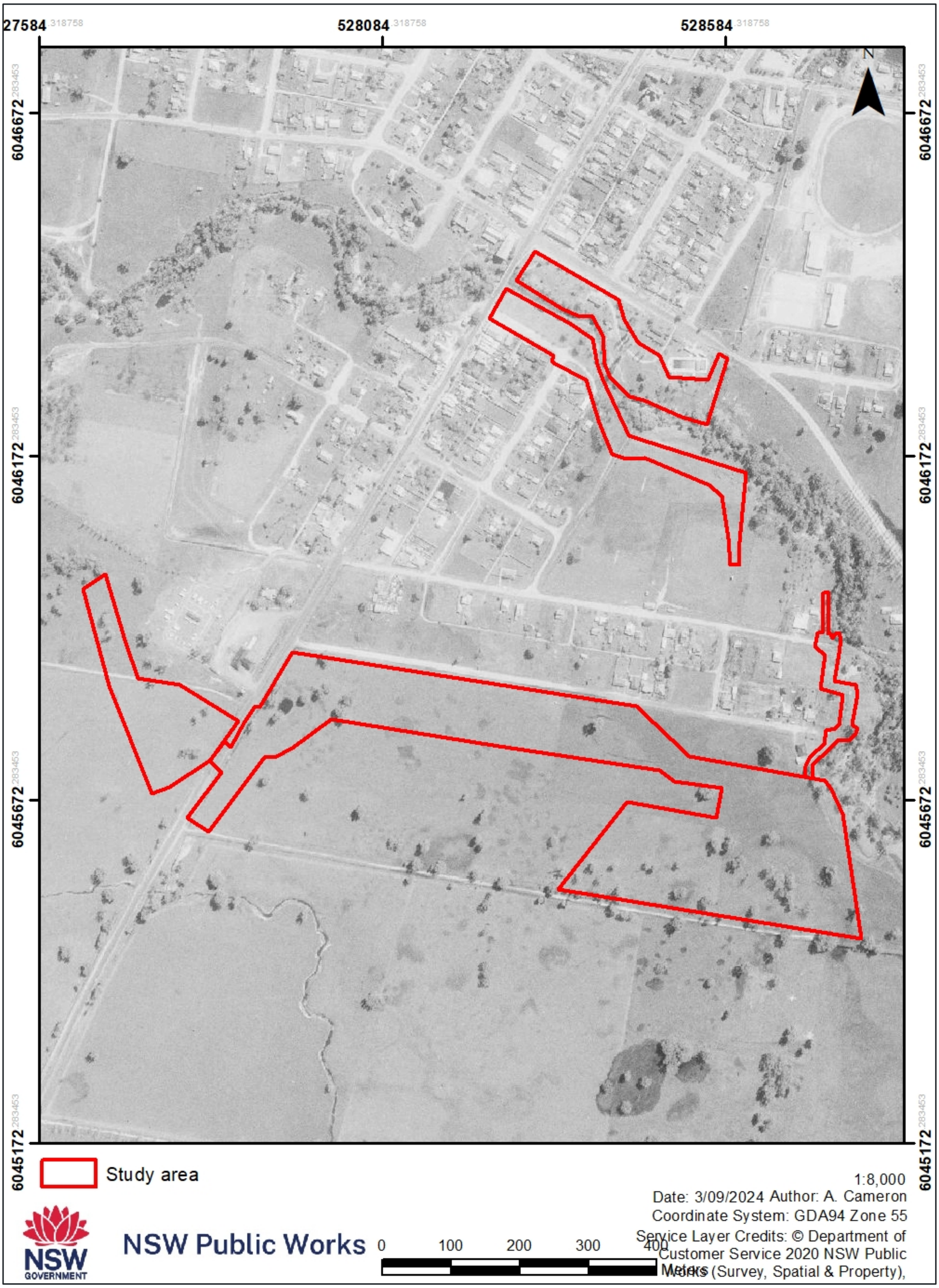

Figure 3-5: Historical aerial from 1982 (NSW SS 2022)

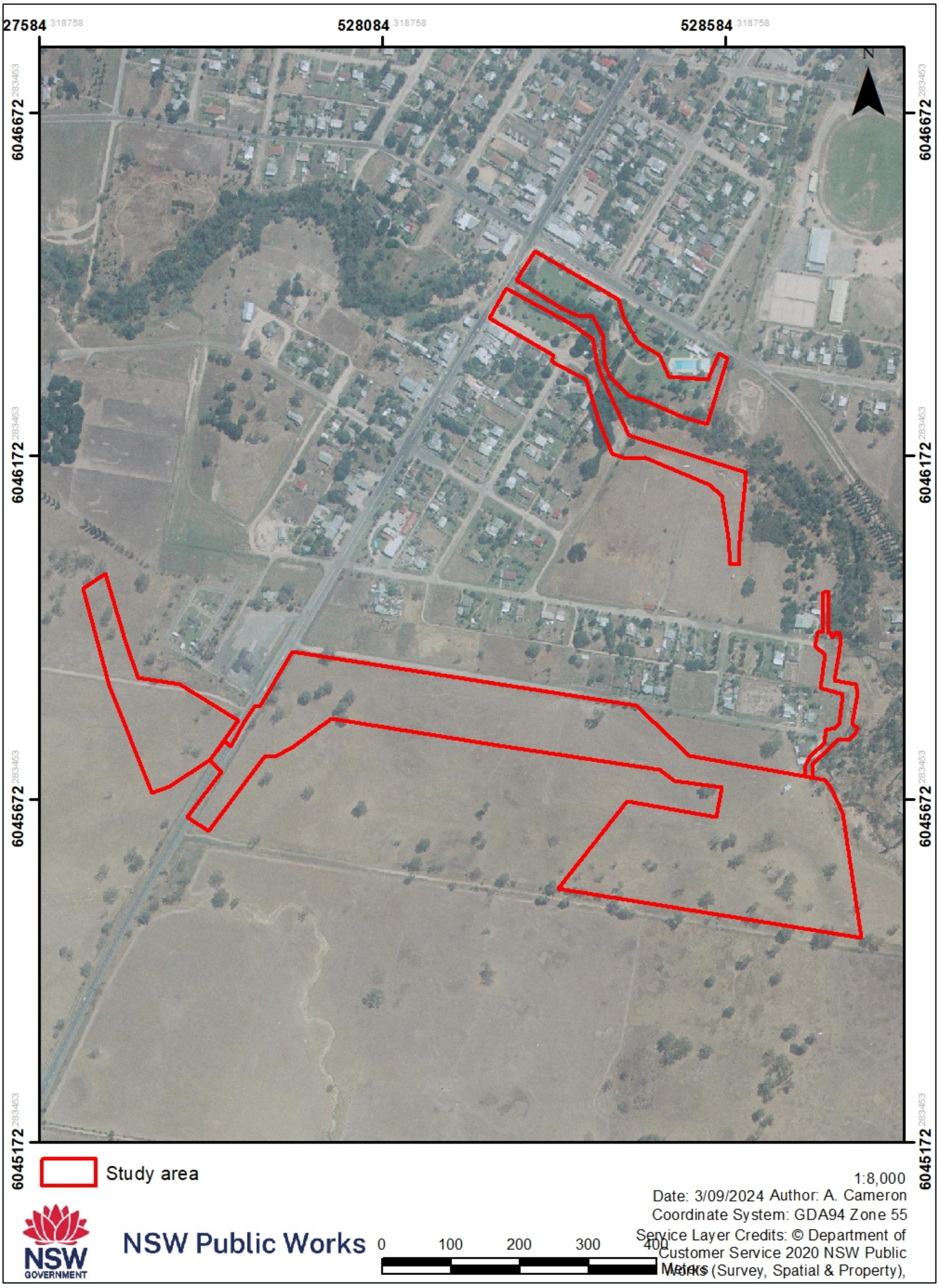

Figure 3-6: Historical aerial from 1990 (NSW SS 2022)

4. Aboriginal due diligence

There are series of questions in the Code used to determine whether it is necessary to follow the Aboriginal due diligence process:

- Is the activity a declared project under Part 3A of the EP&A Act?
  - The activity is not a declared project under Part 3A of the EP&A Act.
- Is the activity an exempt activity listed in the National Parks and Wildlife Act or other legislation?
  - The activity is not an exempt activity.
- Will the activity involve harm that is trivial or negligible?
  - The proposed activity includes disturbance of natural ground surface for the levee banks and culvert works.
- Is the activity in an Aboriginal Place or are you already aware of Aboriginal objects on the land?
  - The activity is not in an Aboriginal Place. There are no recorded Aboriginal objects / sites inside the study area.

4.1 4.1. Low impact activities

The NPW Regulation removes the need to follow the Aboriginal due diligence process provided the proposed works are a specifically defined low impact activity. It is important to note that this does not apply to situations where there are already known Aboriginal object/s and that the defence does not authorise harm to known Aboriginal objects (DEECW 2010: 6–8).

The proposal is not considered a low impact activity as defined by the Due Diligence Code (DECCW 2010a: 6–7) and there are Aboriginal sites recorded in the general vicinity of part of the study area.

4.2 4.2. Disturbed lands

Disturbed lands are defined as (DEECW 2010: 7–8):

> *Land is disturbed if it has been the subject of human activity that has changes the land's surface, being changes that remain clear and observable.*
>
> *Examples of activities that may have disturbed land include the following:*
>
> - *Soil ploughing*
> - *Construction of rural infrastructure (such as dams and fences)*
> - *Construction of roads, trails and tracks (including fire trails and tracks and walking tracks)*
> - *Clearing of vegetation*
> - *Construction of buildings and the erection of other structures*

- *Construction or installation of utilities and other similar services (such as above or below ground electrical infrastructure, water or sewerage pipelines, stormwater drainage and other similar infrastructure*
- *Substantial grazing involving the construction of rural infrastructure*
- *Construction of earthworks associated with anything referred to in paragraphs (a)¬(g).*

Parts of the study area have extensively disturbed. The land adjacent to Ten Mile Creek between Young Street and Hay Street consist of landscaped parkland, including gazebos, a miniature railway line, and miniature railway station, carpark, toilets, child day care centre, swimming pool and war memorial.

The study area adjacent to Nolan Street and the sports oval have been previously cleared of vegetation and used for agricultural purposes. The sports oval is currently used as pasture for sheep and horses. The southern section of the study area has been used extensively for cropping and grazing. There is farm infrastructure, outbuildings and a residence at its eastern extent which has disturbed the area immediately adjacent to Ten Mile Creek.

The southwestern study area has been partially disturbed through construction of the Hume Highway-Holbrook Bypass.

There are also several buried utilities which intersect with the study area including gas, telecommunications and electricity lines.

4.3 The Aboriginal Due Diligence Assessment

4.3.1 Step 1

Will the activity disturb the ground surface?

Yes. The proposed activities will disturb the ground surface. The construction of the levee banks will include foundation trenches, shaping and benching as necessary, landscaping and fencing as required. Ground disturbance will also occur at the borrow areas where soil is proposed to be excavated for use as topsoil elsewhere.

4.3.2 Step 2a

Are there any sites registered on the Aboriginal Heritage Information Management System?

An extensive search of AHIMS was conducted on 27 March 2023 covering a search area between:

- Eastings 512790–543798
- Northings 6030639–6061549

The search area covered approximately 15 km around the study area. The AHIMS search returned 89 sites (Table 4-1). Basic searches were conducted on 24 May 2024 and 29 August 2024 to check whether any sites had been recorded on AHIMS since the extensive search was completed. No additional sites had been recorded in the extensive search area. A copy of the extensive AHIMS search and the basic search update is provided Appendix B.

Figure 4-1 shows the location of recorded AHIMS sites using the GPS coordinates provided by the extensive search. The most frequent site type in the vicinity of the study area are artefact scatters (60%), followed by modified trees (21%) and isolated finds (11%). Other site types such as artefact scatters with potential archaeological deposit (PAD) (2%), restricted sites (2%), artefact scatters and modified trees (1%), ceremony and dreaming location (1%) and PAD (1%) are also present in the general area though to a lesser frequency.

The closest AHIMS site recorded to the study area, 56-4-0274, was identified during KNC's survey is approximately 470 m southwest of the western extent of the study area (Figure 4-2). AHIMS 56-4-0274 (HB4) is located on a broad gently sloping terrace bordered by low-lying areas associated with the floodplain of Ten Mile Creek and a former swamp (KNC 2009: 18). Test excavations were undertaken at this site by KNC. A total of 32 test pits (1 m by 1 m in size) were excavated at the site using 20 cm spit intervals to an average depth of 35 cm. In total 338 artefacts were recorded during the test excavation. Most of these artefacts were quartz (n=330) in terms of raw material type. There were also two quartzite artefacts, three fine grained siliceous artefacts and three artefacts made from 'other' material. Most artefacts were recorded in test pits that were located on the elevated part of the landform.

Table 4-1: AHIMS site types in the vicinity of the study area

Site type	Number	Frequency (%)
Artefact scatter	53	60
Modified tree	19	21
Isolated find	10	11
Artefact scatter & PAD	2	2
Restricted site	2	2
Artefact scatter & modified tree	1	1
Ceremony & dreaming	1	1
PAD	1	1
Total	**89**	**100.0**

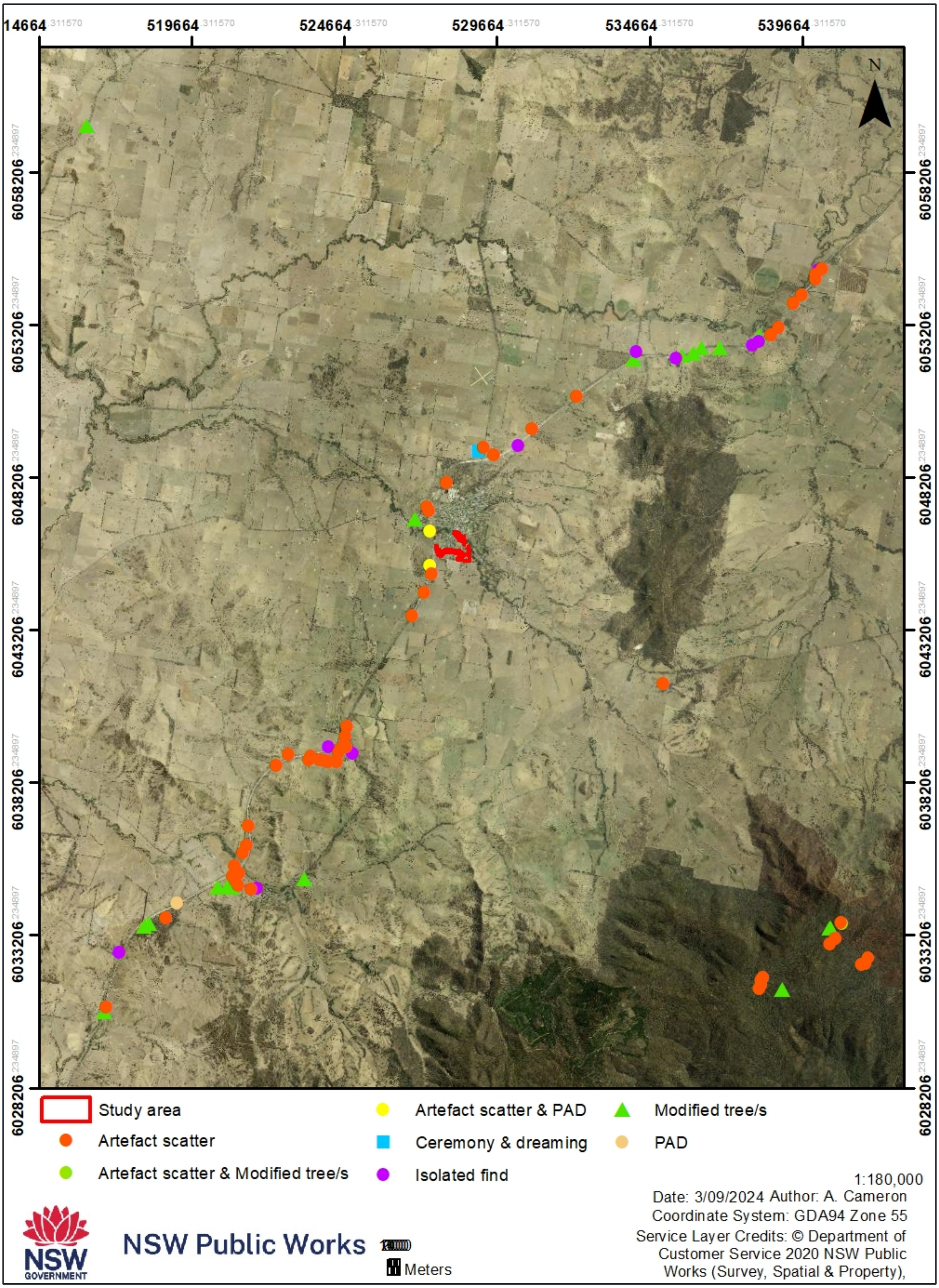

Figure 4-1: AHIMS sites recorded in the vicinity of the study area.

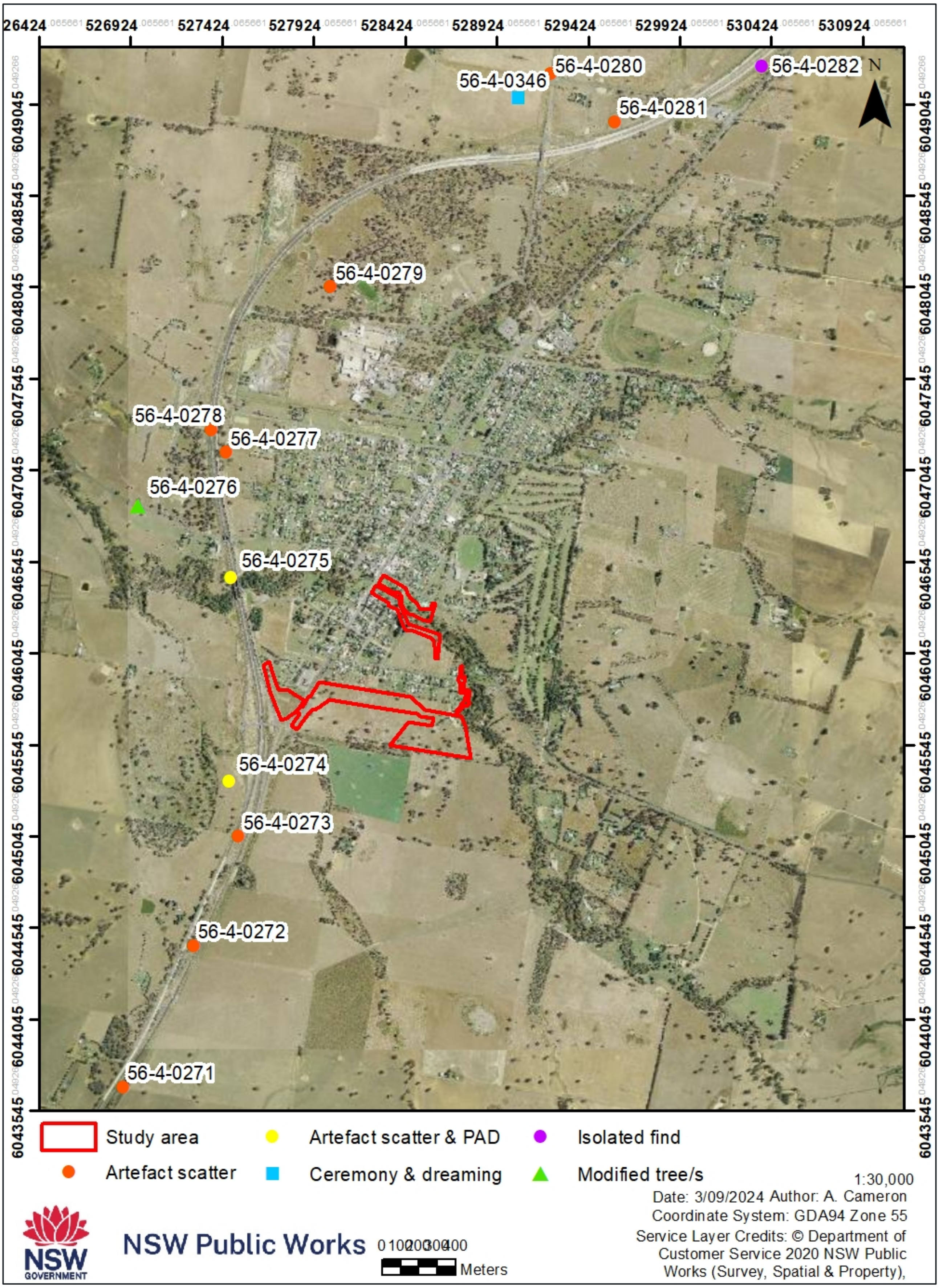

Figure 4-2: Detail of AHIMS sites recorded in the vicinity of the study area.

Table 4-2 summarises the results of searches for items listed on alternative databases and registers, such as the State Heritage Register (SHR) and the Local Environmental Plans (LEP).

Figure 4-3 shows the location of any nearby listed items to the study area. There are no SHR or LEP listed items inside the study area, though there are several LEP listed items in the vicinity of the study area. According to the AHIP public register and AHIP archive provided by Heritage NSW there are no current or former AHIPs for the study area.

Table 4-2: Additional database searches

Name	Comments
State Heritage Register (SHR) and Inventory (SHI)	No SHR or SHI items are within or adjacent to the study area.
Greater Hume Local Environmental Plan (2012)	No LEP listed items are located inside the study area, though there are number of them adjacent including: I91 Anglican Rectory (former) I104 Mackie & Son Stores I95 Germanton Courier I112 Ross Buildings I120, I121 & I122 Weatherboard Cottages I94 Courthouse (former post office) I108 Holbrook Police Station I93 CBC Bank (former) I116 St Paul's Anglican Church I99 Holbrook Shire Hall I125 Woolpack Inn Museum (former Criterion Hotel) I101 Horse and Dog Trough I123 Wedding Dress of Gertrude Pabst I113 Shop
Register of the National Estate	No items are within or adjacent to the study area.
Commonwealth Heritage List	No items are within or adjacent to the study area.
National Heritage List	No items are within or adjacent to the study area.
World Heritage List	No items are within or adjacent to the study area.

Name	Comments
Previous or nearby AHIPs	No AHIPs are listed on the public register or archive in relation to the study area. One AHIP (C00044114) has been issued in relation to a proposed service centre at 565-609 Holbrook-Wagga Road, Holbrook approximately 3 km north of the study area. The AHIP included salvage excavations and harm to certain Aboriginal objects.

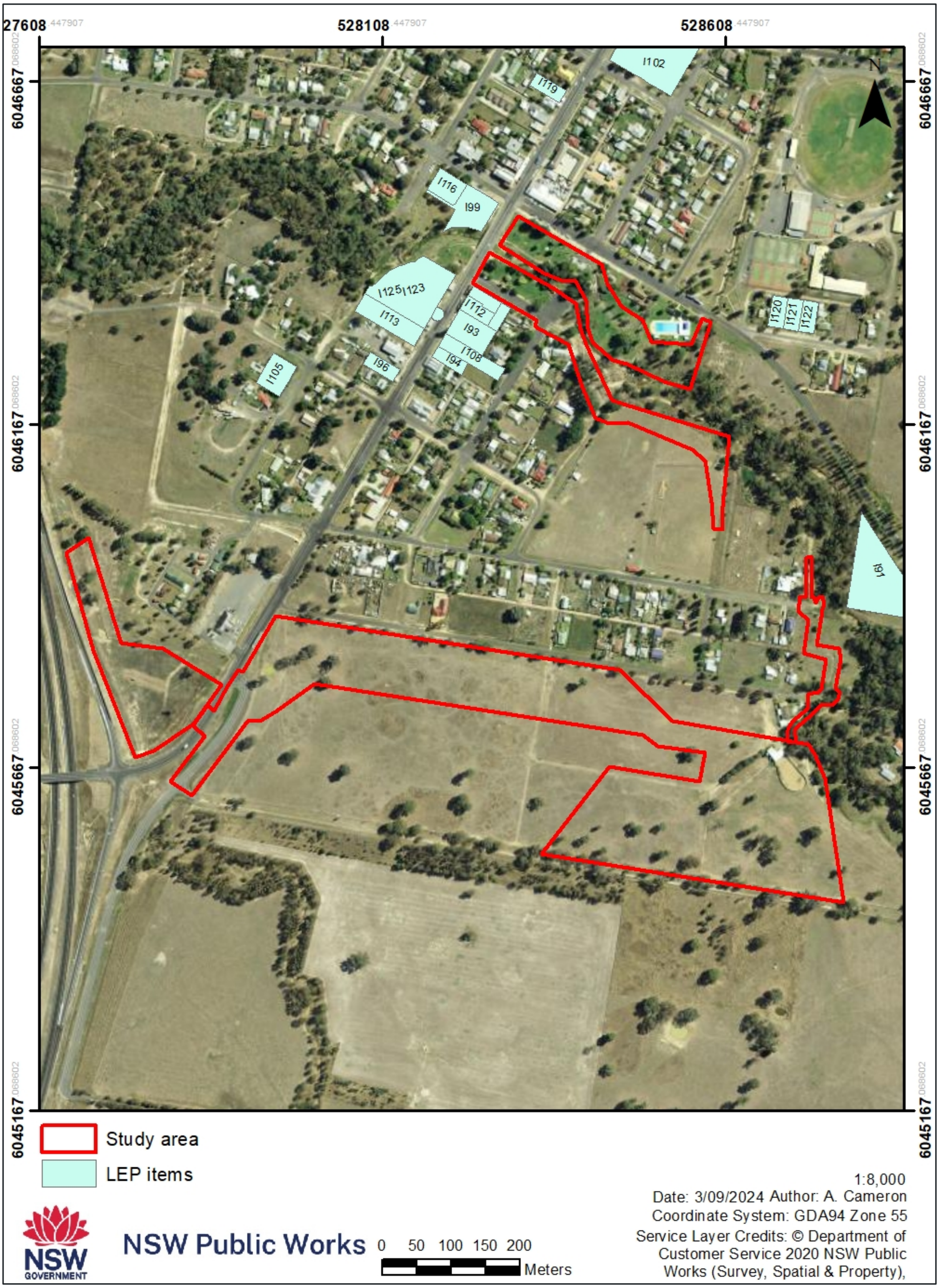

Figure 4-3: LEP listed items in the vicinity of the study area

4.3.3 Step 2b

Are there any other sources of information?

There have been limited archaeological surveys conducted in the vicinity of the study area, all related to either the duplication of the Hume Highway or the Hume Highway–Holbrook Bypass.

In 2007 Kelleher Nightingale Consulting (KNC) Pty Ltd undertook an Aboriginal Cultural Heritage Assessment for the Hume Highway Duplication Project between Sturt Highway to Mullengandra. The assessment included a survey of two teams with 7-8 people in each team, surveying a 100 m wide corridor on either side of the proposed duplication corridor. As a result of the survey, 60 Aboriginal sites were recorded as well as 18 areas of potential archaeological deposits (PADs).

Of relevance to this assessment is the results of KNC's 2007 survey between Yarra Yarra and Holbrook. In this section of the duplication project, there were nine artefact scatters, six scarred trees and four isolated finds identified. The results of the assessment indicated several main points regarding Aboriginal sites in the area:

- The highest density artefact scatters were recorded just off the tops of low rises in erosion prone soils (KNC 2007: 34).
- Modified trees (scarred trees) were the most recorded site type in the highway duplication assessment area, with most of the modified trees being white or grey box trees (KNC 2007: 35).
- Stone artefacts were recorded within many parts of the corridor but tend to form visible scatters when associated with low rises underlaid by metasedimentary rocks (often abutting colluvial formations near creek channels). These locations are considered good camping grounds being near water on dry level land, but also exhibited good surface visibility due to the combination of moderate slope gradient (c. 2% - 10%) and erosion prone soils. Artefact densities exhibited by these scatters vary widely from isolated finds to more than 80 artefacts (KNC 2007: 35).

Kelleher Nightingale Consulting Pty Ltd (KNC) also conducted an Aboriginal Cultural Heritage Assessment Report for the Hume Highway Town Bypass of Holbrook in 2009 for the (then) Roads and Traffic Authority of NSW (RTA). The assessment included pedestrian survey and test excavation.

During KNC's survey thirteen Aboriginal sites were recorded (eleven artefact scatters, one isolated find and one scarred tree) as well as 20 Cultural Places. Quartz was the predominate raw material for stone artefacts, and around 10–15% of the artefacts recorded during the survey showed signs of retouch. Part of the study area (the western most borrow pit and levee bank adjacent to the bypass) was included in KNC's 2009 assessment. No Aboriginal sites or Cultural Locations were recorded inside this area during KNC's assessment. KNC's survey and test excavation concluded that fresh water was a key component regarding site location for the area.

Several archaeological sites were recommended by KNC to be salvaged prior to the bypass works. The salvage was conducted by KNC in 2010 and included salvage excavation of six archaeological sites, surface collection of artefacts from two archaeological sites, and a cultural salvage excavation of one Cultural Place.

Though there has been a lack of systematic archaeological assessment conducted in the vicinity of the study area, the assessments relating to the Hume Highway Duplication and Bypass works which have been done to date provide valuable insights into the Aboriginal use of the area.

4.3.4 Step 2c

Are there any landscape features that are likely to indicate presence of Aboriginal objects?

The Due Diligence Code lists several landscape features that indicate the likely existence of Aboriginal Objects (DEECW 2010a: 12). These include:

- Within 200 metres of waters (including the whole or any part of a river, stream, lake, lagoon, swamp, wetlands, natural watercourse, tidal waters (including the sea).
- Located within a sand dune system.
- Located on a ridge top, ridge line or headland.
- Located within 200 metres below or above a cliff face.
- Within 20 metres of or in a cave, rock shelter, or a cave mouth.

The study area is adjacent to sections of Ten Mile Creek which divides the town of Holbrook into north and south and as such, parts of the study area are in a sensitive landscape. However, these areas have been heavily disturbed through development of the town and recreational facilities such as parks, a miniature rail, swimming pool and football field.

4.3.5 Step 3

Can harm to Aboriginal objects listed on AHIMS or identified by other sources of information and /or can the carrying out of the activity at the relevant landscape features be avoided?

The proposed works will not impact AHIMS sites. All AHIMS sites are located outside of the study area and over 400 m away of it. The banks of Ten Mile Creek where the works are proposed adjacent to the creek have been previously disturbed through landscaping, urbanisation and agriculture.

4.3.6 Step 4

Does a desktop assessment and visual inspection confirm that there are Aboriginal objects or that they are likely?

A visual inspection of the study area was conducted on the afternoon of Tuesday 11 April and the morning Wednesday 12 April 2023 by Dr Alyce Cameron (archaeologist, NSW PW).

Pedestrian inspection focused on the proposed alignment and surrounds of levee banks and the location of borrow pits. Pedestrian transects of the visual inspection are shown in Figure 4-4. For the purposes of recording, the survey was conducted using five survey units which are detailed in Table 4-3. Each of the survey units was inspected on foot by one surveyor. Details such as landform, disturbances, soil types, vegetation, ground surface visibility and ground surface exposure were recorded during the survey.

Survey Unit 1 consisted of a landscaped park north of Ten Mile Creek with short grass and scattered trees (Photo 4-1). This part of the study area has since been determined to not be required for the proposed works. Directly adjacent to the edge of the creek, a concrete and stone retaining wall is present (Photo 4-6). Along the western half of this survey unit there is also a miniature railway track. Parts of the park have buried water utilities present. The area is characterised by a gentle slope southward from Young Street towards the creek (Photo 4-7). Soils consist of a brown loam and ground surface visibility was moderate across the area.

Survey Unit 2 consists of a landscaped park between Hay Street and Ten Mile Creek (Photo 4-2), including a gazebo (Photo 4-8), picnic tables, carpark, the miniature railway track and a small station for the miniature railway (Photo 4-9). It also includes the edges of the eroding bank between Nolan Street and the Creek (Photo 4-10), as well as the northern edge of the football oval area (currently being used for pasture and grazing, Photo 4-11). Soils consist of a brown loam and ground surface visibility was moderate across the area, including adjacent to Nolan Street and the oval.

Survey Unit 3 consists of a dirt track and the edge of a garden (Photo 4-3). The dirt track is heavily eroded and there is limited topsoil remaining being mostly exposed clay.

Survey Unit 4 consists of a private property and includes farm infrastructure and outbuilding and paddocks used for cropping and grazing (Photo 4-4). The two different options for the levee bank were both surveyed. Scattered mature native trees are present in this survey area and they were checked for signs of modification or use. No culturally modified trees were recorded. The soils were consistent across this area and were a dark brown loamy clay with cracking (Photo 4-12). Ground surface visibility was variable, but overall moderate due to the amount of erosion scalding present amongst the grass.

Survey Unit 5 consists of an overgrown area between the Hume Highway, Albury Street, the Ampol Service Centre, and the Holbrook Motor Village (Photo 4-5). It has been previously cleared of vegetation and its southeast and western edges have been disturbed from the construction of the Hume Highway-Holbrook Bypass. Ground surface visibility was low overall due to overgrown grass and weeds (Photo 4-13).

No Aboriginal sites or areas of potential archaeological deposits were identified during the survey. Much of the study area is in the lower lying flood plain of Ten Mile Creek or has been developed over the past seventy years. The soils present on the surface inside the study area, in particular the southern area, indicate that the soils are related to current floodplain alluvials (see Section 3.2) as opposed to the older or younger terraces which are more likely retain Aboriginal sites.

Table 4-3: Survey units

Survey Unit	Description	Representative photograph
1	Located on the edge of the 260m contour line between Ten Mile Creek and Young Street. **Photo 4-1: View west across survey unit 1.**	
2	Located between Ten Mile Creek and the southern edges of Hay Street and Nolan Street. Includes the northern extent of the Holbrook Football Oval. **Photo 4-2: View east across survey unit 2.**	
3	Located on the eastern edge of residential houses between Macinnes Street and Bardwell Street approximately 76 m west of Ten Mile Creek. **Photo 4-3: View north across survey unit 3.**	

Survey Unit	Description	Representative photograph
4	Located in Lot 5 and Lot 6 DP1156130 and on eastern edge of Albury Street near bypass ramp. **Photo 4-4: View west across survey unit 4.**	
5	Located in the corner between Hume Highway, Albury Street and the Holbrook Motor Village. **Photo 4-5: View northwest across survey unit 5.**	

Photo 4-6: View west of concrete retaining wall and miniature railway line.

Photo 4-7: View east across survey unit 1 from Albury Street boundary.

Photo 4-8: View west across survey unit 2.

Photo 4-9: Miniature railway station.

Photo 4-10: View southeast along bank of Ten Mile Creek adjacent to Nolan Street.

Photo 4-11: View northeast along levee bank location at north of football oval.

Photo 4-12: Representative ground surface in survey unit 4.

Photo 4-13: View northwest across survey unit 5.

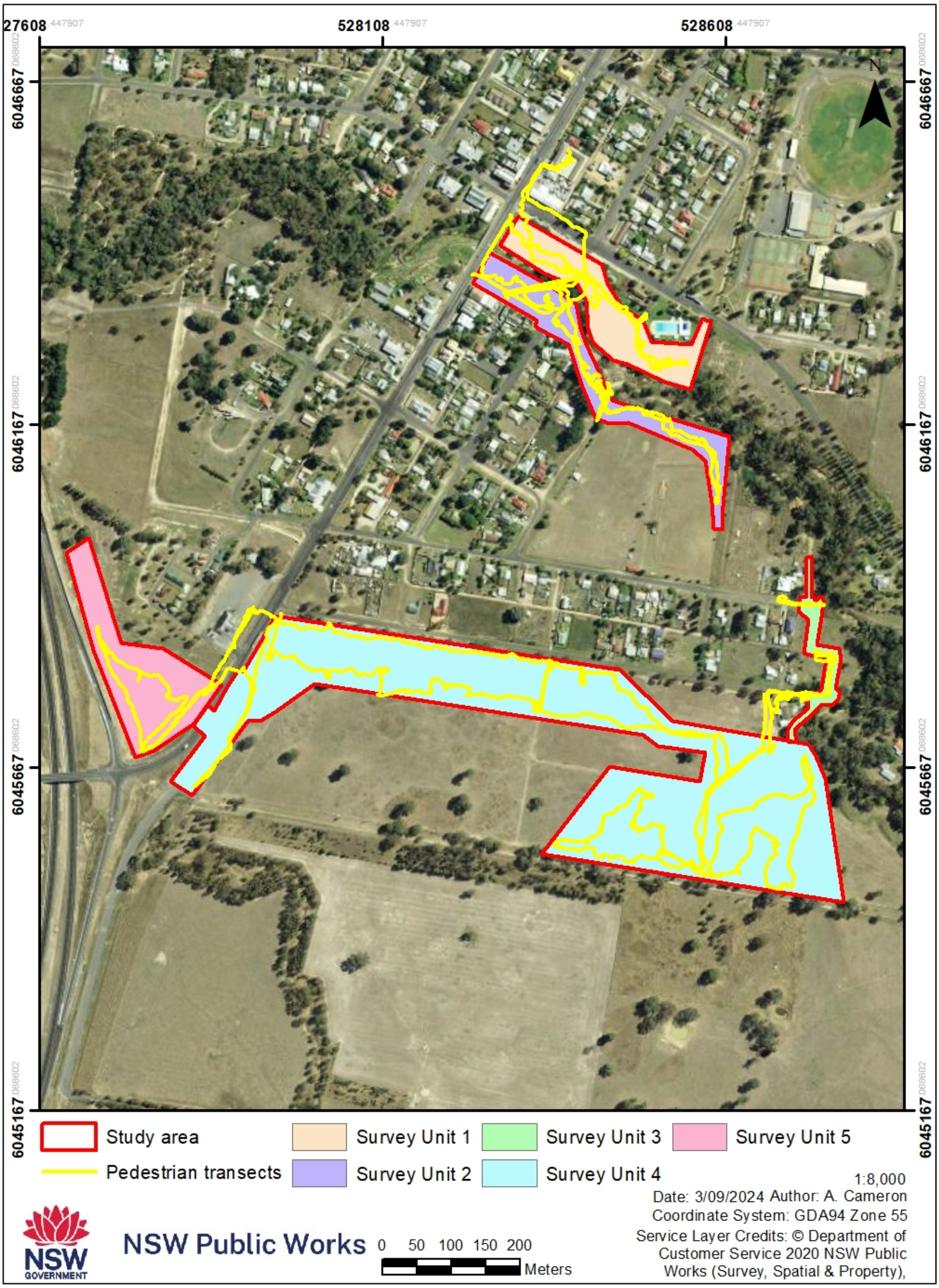

Figure 4-4: Pedestrian transects

5. Recommendations

The results of the Aboriginal due diligence assessment have determined the Proposal is unlikely to impact Aboriginal objects and will not impact on any known places or sites of cultural significance to the Aboriginal community.

No Aboriginal sites or objects have been recorded inside the study area. The study area has a low potential for archaeological deposits to be present due to prior disturbances across the area. Based on the results of this assessment, no further archaeological assessment is necessary.

The following recommendations are provided as a precautionary measure to ensure the greatest possible protection to the area's Aboriginal cultural heritage values:

1. The Proposal may proceed at the study area with no further archaeological investigation. The Proposal and all land and ground disturbance activities must be confined to inside the study area. Should the Proposal extend outside the study area then further archaeological assessment may be required.
2. All staff and contractors involved in the proposed work should be made aware of legislative protection under the NPW Act for all Aboriginal sites and objects, and the contents of the Unanticipated Finds Protocols.
3. This assessment has concluded that Aboriginal objects are unlikely to be harmed by the proposed works. However, if during works, Aboriginal objects, artefacts, or skeletal material are noted the Unanticipated Finds Protocol (Appendix C) should be followed.

6. References

Cardno. 2020. Geotechnical Investigation for Proposed Flood Mitigation Options: Culcairn, Henty, Holbrook, NSW. Report to Greater Hume Council.

Department of Environment, Climate Change & Water (DECCW). 2010. Due Diligence Code of Practice for the Protection of Aboriginal Objects in New South Wales.

Doughty D. 2003. Soil Landscapes of the Holbrook-Tallangatta 1:100,000 Sheets map and report. Department of Sustainable Natural Resources, Sydney.

Kelleher Nightingale Consulting Pty Ltd (KNC). 2009. Hume Highway Town Bypass: Holbrook Aboriginal Cultural Heritage Assessment Report. Report for Parsons Brinckerhoff on behalf of the Roads and Traffic Authority of NSW (RTA).

Kelleher Nightingale Consulting Pty Ltd (KNC). 2010. Hume Highway Town Bypass: Holbrook Aboriginal Cultural Heritage Salvage Excavation Interim Report. Report for Parsons Brinckerhoff on behalf of the Roads and Traffic Authority of NSW (RTA).

Kelleher Nightingale Consulting Pty Ltd (KNC). 2007. Hume Highway Duplication Project: Aboriginal Heritage Information for the Environmental Assessment. Report to the Roads and Traffic Authority of New South Wales (RTA).

Ryan, L. 2008. Holbrook – The Submarine Town. Greater Hume Shire Council.

WMA Water. 2017. Holbrook Floodplain Risk Management Study & Plan. Report to Greater Hume Shire Council.

Appendix A Plans for Holbrook Flood Mitigation Works

Appendix B Extensive AHIMS search & updated basic search.

Appendix C Unexpected finds protocols

If an unrecorded or unanticipated Aboriginal object, artefact, culturally modified tree or feature, are uncovered or identified while onsite, the following protocol is to be followed:

- Do not further harm the Aboriginal object/s and immediately cease all work at that location.
- Secure the area to avoid further harm to the Aboriginal object/s.
- Notify Heritage NSW as soon as practical on 131 555 providing details of the Aboriginal object/s and its location.

Do not recommence any work at the location unless authorised in writing by Heritage NSW.

If human skeletal remains are unexpectedly encountered during the works:

- All works must immediately cease.
- The area should be secured to prevent unauthorised access or further harm to the remains.
- NSW Police and Heritage NSW should be contacted.

Everybody should cooperate with the appropriate authorities and relevant Aboriginal community representatives. They should help facilitate the recording and assessment of the find/s, and the fulfilment of legal constraints, including complying with NSW Police and/or Heritage NSW directions.

Do not recommence any work at the location unless authorised in writing by Heritage NSW and NSW Police.

If find/s have been determined to be Aboriginal object/s or skeletal remains, the recommencement of work at the location/s can only occur after gaining written approval from Heritage NSW, usually in the form of an Aboriginal Heritage Impact Permit (AHIP).

Appendix F: Consultation

Rasha Haymour

From: Tony Phelps
Sent: Monday, 1 May 2023 2:29 PM
To: Rasha Haymour
Subject: FW: Consultation Letter-Holbrook Flood Mitigation Works REF
Attachments: DOC23 084907 Holbrook Flood Mitigation Works Response Letter(2).docx

Hi Rasha

Attached is Crown Land's response to the Holbrook Flood Mitigation Works proposal.
Feel free to contact me if you require

Thanks

Tony Phelps
Natural Resource Management Project Officer
Crown Lands
Department of Planning and Environment

T (02) 69372725 **E** tony.phelps@crownland.nsw.gov.au
dpie.nsw.gov.au

26-28 Johnston Street
Wagga Wagga NSW 2650

From: Rasha Haymour <rasha.haymour@pwa.nsw.gov.au>
Sent: Wednesday, 5 April 2023 4:31 PM
To: Lands-Water CL Enquiries Mailbox <cl.enquiries@crownland.nsw.gov.au>
Subject: Consultation Letter-Holbrook Flood Mitigation Works REF

Dear Sir/Madam,

NSW Public Works (NSW PW) has been engaged by the Greater Hume Council to prepare a Review of Environmental Factors (REF) for the proposed flood mitigation works at Holbrook, NSW. Further details regarding the proposal are provided in the attached letter.

The purpose of the attached letter is to invite your organisation to provide comments on the proposal. If you have any comments, it would be appreciated if you could provide a response prior to 27 April 2023.

Best Regards
Rasha

Rasha Haymour *(she/her)*
Environmental Scientist/Planner, Heritage, Environment and Planning
NSW Public Works | Department of Regional NSW

T 02 9769 9843 **M** 0419 273 938 **E** rasha.haymour@pwa.nsw.gov.au
66 Harrington Street, Sydney, NSW 2000
On **Gadigal Land**

My working days are: Mon-Thu

The Department of Regional NSW acknowledges that it stands on Country which always was and always will be Aboriginal land. We acknowledge the Traditional Custodians of the land and waters, and we show our respect for elders past, present and emerging. We are committed to providing places in which Aboriginal people are included socially, culturally and economically through thoughtful and collaborative approaches to our work

Rasha Haymour

From: Tony Phelps
Sent: Wednesday, 17 May 2023 1:13 PM
To: Rasha Haymour
Subject: RE: Consultation Letter-Holbrook Flood Mitigation Works REF

Follow Up Flag: Follow up
Flag Status: Flagged

Hi Rasha
A licence under Section 5.2.1 authorises the use or occupation of Crown Land . However, as GHS are the Crown Land Manager for the land parcels discussed they already have occupancy of the land.

When Local Government Agencies are proposing to undertake works to implement public infrastructure on Crown land, the Compulsory Acquisition process is the identified process.

As you identified acquiring Crown land may be an extensive process, but it does not necessarily mean a delay of works, See the Frequently Asked Questions web page via https://www.industry.nsw.gov.au/lands/access/compulsory-acquisition. (as provided in the Letter dated 22 April 2023).

Sorry I am not aware of any previous advice.

Regards

Tony Phelps
Natural Resource Management Project Officer
Crown Lands
Department of Planning and Environment

T (02) 69372725 **E** tony.phelps@crownland.nsw.gov.au
dpie.nsw.gov.au

26-28 Johnston Street
Wagga Wagga NSW 2650

From: Rasha Haymour <rasha.haymour@pwa.nsw.gov.au>
Sent: Tuesday, 2 May 2023 3:27 PM
To: Tony Phelps <tony.phelps@crownland.nsw.gov.au>
Subject: RE: Consultation Letter-Holbrook Flood Mitigation Works REF

Hi Tony,

You're correct. However, Section 9.2 of the CLM Act relates to the unauthorised use of Crown land, and states that it is an offence to erect a structure, clear or dig up Crown land without a lawful authority. Section 5.21 of the CLM Act allows for the granting of licences to occupy and use Crown land for a particular purpose (to obtain that lawful authority). Perhaps it is more accurate to say a license under Section 5.21 of the CLM Act.

I just note that this advice was provided by Crown land in the past.

Hope the above makes sense?

Regards
Rasha

Rasha Haymour *(she/her)*
Environmental Scientist/Planner, Heritage, Environment and Planning
NSW Public Works | Department of Regional NSW

T 02 9769 9843 **M** 0419 273 938 **E** rasha.haymour@pwa.nsw.gov.au

My working days are: Mon-Thu

From: Tony Phelps <tony.phelps@crownland.nsw.gov.au>
Sent: Tuesday, 2 May 2023 1:14 PM
To: Rasha Haymour <rasha.haymour@pwa.nsw.gov.au>
Subject: RE: Consultation Letter-Holbrook Flood Mitigation Works REF

Hi Rasha
Could you please clarify the particular permit you are discussing?
The extract below is Section 9.2 of the Crown Land Management Act 2016, which does not discuss a permit

Division 9.2 Improper use of Crown land
9.2 Unauthorised use of Crown land
(1) A person must not do any of the following—
(a) reside on Crown land,
(b) erect a structure on Crown land,
(c) graze stock on Crown land,
(d) drive stock on Crown land,
(e) clear, dig up or cultivate Crown land,
(f) interfere with any substance on, in or forming part of Crown land,
(g) deposit or leave any of the following on Crown land except in a place or receptacle provided for the purpose—
(i) any rubbish or litter, refuse, dead animal or other similar matter,
(ii) any matter of a kind prescribed by the regulations,
(h) enclose Crown land (except a road or watercourse to which section 5.36 applies).
Maximum penalty—as determined under section 11.7.
(2) A person must not cause or permit a contravention of subsection (1).
Maximum penalty—as determined under section 11.7.

Thanks

Tony Phelps
Natural Resource Management Project Officer
Crown Lands
Department of Planning and Environment

T (02) 69372725 **E** tony.phelps@crownland.nsw.gov.au
dpie.nsw.gov.au

26-28 Johnston Street
Wagga Wagga NSW 2650

From: Rasha Haymour <rasha.haymour@pwa.nsw.gov.au>
Sent: Tuesday, 2 May 2023 10:58 AM
To: Tony Phelps <tony.phelps@crownland.nsw.gov.au>
Subject: RE: Consultation Letter-Holbrook Flood Mitigation Works REF

Hi Tony,

Thank you so much for providing a response.

As acquiring Crown land is an extensive process, I think obtaining a permit under Section 9.2 of the *Crown Land Management Act* 2016 will be more practicable. This is our usual practice for projects undertaken by a public authority.
Can I ask you please to let me know if you agree that a permit under Section 9.2 will be sufficient?

Regards
Rasha

Rasha Haymour *(she/her)*
Environmental Scientist/Planner, Heritage, Environment and Planning
NSW Public Works | Department of Regional NSW

T 02 9769 9843 **M** 0419 273 938 **E** rasha.haymour@pwa.nsw.gov.au

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Sent: Monday, 1 May 2023 2:29 PM
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Subject: FW: Consultation Letter-Holbrook Flood Mitigation Works REF

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Feel free to contact me if you require

Thanks

Tony Phelps
Natural Resource Management Project Officer
Crown Lands
Department of Planning and Environment

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dpie.nsw.gov.au

26-28 Johnston Street
Wagga Wagga NSW 2650

From: Rasha Haymour <rasha.haymour@pwa.nsw.gov.au>
Sent: Wednesday, 5 April 2023 4:31 PM
To: Lands-Water CL Enquiries Mailbox <cl.enquiries@crownland.nsw.gov.au>
Subject: Consultation Letter-Holbrook Flood Mitigation Works REF

Dear Sir/Madam,

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Best Regards
Rasha

Rasha Haymour *(she/her)*
Environmental Scientist/Planner, Heritage, Environment and Planning
NSW Public Works | Department of Regional NSW

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66 Harrington Street, Sydney, NSW 2000
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My working days are: Mon-Thu

NSW Public Works
Department of Regional NSW

The Department of Regional NSW acknowledges that it stands on Country which always was and always will be Aboriginal land. We acknowledge the Traditional Custodians of the land and waters, and we show our respect for elders past, present and emerging. We are committed to providing places in which Aboriginal people are included socially, culturally and economically through thoughtful and collaborative approaches to our work

Department of Primary Industries (Fisheries)
Department of Regional NSW

FE23/339 C23/182

04 May 2023

Rasha Haymour
Environmental Scientist/Planner
Heritage, Environment and Planning
NSW Public Works
66 Harrington Street
Sydney NSW 2000
Via email: Rasha Haymour <rasha.haymour@pwa.nsw.gov.au>

Dear Rasha,

Re: Request for REF requirements – Holbrook Flood Mitigation Works – Greater Hume LGA

I refer to your letter of 5th April 2023 requesting DPI Fisheries environmental assessment requirements for the above proposal. It is understood that the proposed works involve

- the construction of two new levee banks, approximately 500m and 1,500m in length, within the southern portion of the Holbrook township, and
- the installation of six new culverts to transfer floodwaters downstream of Albury Street.

DPI Fisheries are responsible for ensuring that fish stocks are conserved and that there is "no net loss" of key fish habitats upon which they depend. To achieve this, the Department ensures that developments comply with the requirements of the *Fisheries Management Act 1994* (namely the aquatic habitat protection and threatened species conservation provisions in Parts 7 and 7A of the Act respectively) and the associated *Policy and Guidelines for Fish Habitat Conservation and Management (Update 2013).* In addition, DPI Fisheries is responsible for ensuring the sustainable management of commercial, recreational and Aboriginal cultural fishing within NSW.

The environmental assessment should specifically address impacts on the aquatic ecology of waterways or any *Key Fish Habitats* including Ten Mile Creek.

AQUATIC ECOLOGICAL ASSESSMENT

The aquatic ecological environmental assessment should be as per *Policy and Guidelines for Fish Habitat Conservation and Management (Update 2013)* and include the following information;

- Waterways that may be affected either directly or indirectly by the development or activity should be clearly identified.
- Description of aquatic and riparian vegetation should be presented and mapped.
- The extent of aquatic habitat removal or modification which may result from the proposed development,
- Details of the location of all waterway crossings, including any access tracks, timetable for construction of the proposal with details of various phases of construction
- Details of the methodology (for example directional drilling, trenching, boring) for any works within or adjacent to waterways.

- Aspects of the management of the proposal, both during construction and after completion, that relate to impact minimisation e.g. Environment Management Plans.
- A description of how the site will be rehabilitated post-construction including site stabilisation, native vegetation planting and any proposed post works habitat enhancement.

KEY ISSUES

Waterway crossings
Construction of waterway crossings should be in accordance with section 4.2 – 4.5 of the DPI Fisheries Policy & Guideline document: *Policy and Guidelines for Fish Habitat Conservation and Management (Update 2013)*.

Riparian buffer zones
The *"degradation of native riparian vegetation"* has been listed as a Key Threatening Process under the provisions of the *Fisheries Management Act* 1994. DPI Fisheries policy advocates the use of terrestrial buffer zones as per the *Policy and Guidelines for Fish Habitat Conservation and Management (Update 2013)* in order to maintain the riparian buffer zone and limit disturbance and susceptibility to bed or bank erosion.

Threatened Species, Populations and Ecological Communities– Fisheries Management Act 1994
The proposal should include a threatened aquatic species assessment (as per part 7A *Fisheries Management Act* 1994) to address whether there are likely to be any significant impacts on listed threatened species, populations or ecological communities listed under the *Fisheries Management Act 1994*. It should be noted that Ten Mile Creek is habitat for Southern Pygmy Perch, Murray Crayfish, and the Lower Murray River Aquatic Ecological Community which are listed under provisions of the *Fisheries Management Act 1994*. Further information on threatened fish species can be found here, including maps of threatened species distributions.

The matters raised by DPI Fisheries relate to the Department's responsibilities for ensuring fish stocks are conserved and that there is "no net loss" of key fish habitats upon which they depend. I can be contacted on 0484 907 343 or via email Alison.McLean@dpi.nsw.gov.au if you require any further information.

Alison McLean
Fisheries Manager, Murray Darling
Freshwater Environment Branch
NSW Department of Primary Industries

Department of Primary Industries

primefact

Southern Pygmy Perch

Nannoperca australis

November 2013 Primefact 190 Second Edition

Fisheries Ecosystems Unit, Port Stephens Fisheries Institute

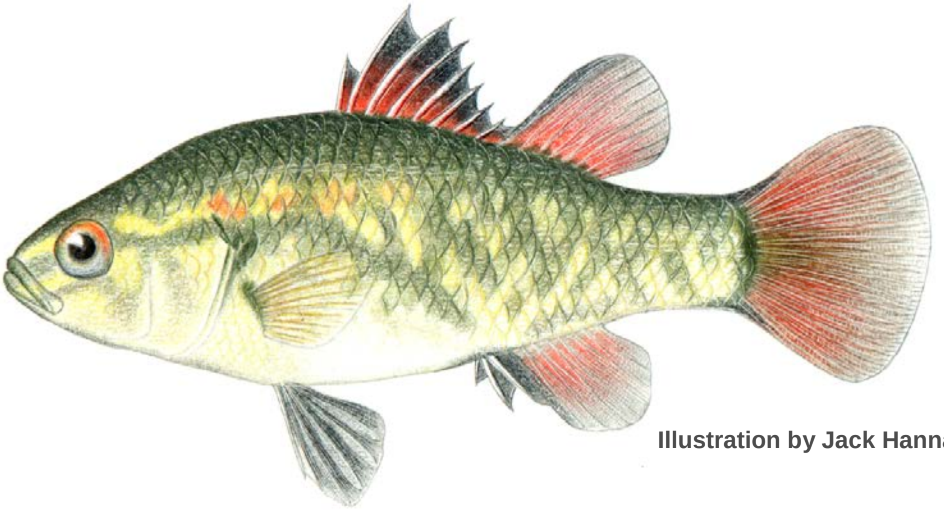


Illustration by Jack Hannan

Introduction

The Southern Pygmy Perch was once widely distributed throughout the Lachlan, Murrumbidgee and Murray River systems, as well as coastal streams in South Australia, Victoria, north-eastern Tasmania and King and Flinders Islands in Bass Strait. However, there have been large-scale reductions in its range, particularly in inland regions.

The Southern Pygmy Perch is listed as an **endangered species** in NSW. There are heavy penalties for harming, possessing, buying or selling them or for harming their habitat (see 'Legal implications').

Description

The Southern Pygmy Perch is a small fish, growing to 65 – 85 mm in length. It has a small mouth reaching to just below the eye, and a rounded tail.

Individuals vary greatly in colour depending on local habitat and other environmental conditions. Colouration has been observed to vary from pale cream to green-brown, with paler colouration on the belly. Individuals may also have irregular markings on their sides including dark spots or longitudinal bands.

Breeding males display brighter colours, with the dorsal, caudal and anal fins becoming bright red with black edges, and with the pelvic fins and region around the vent turning black.

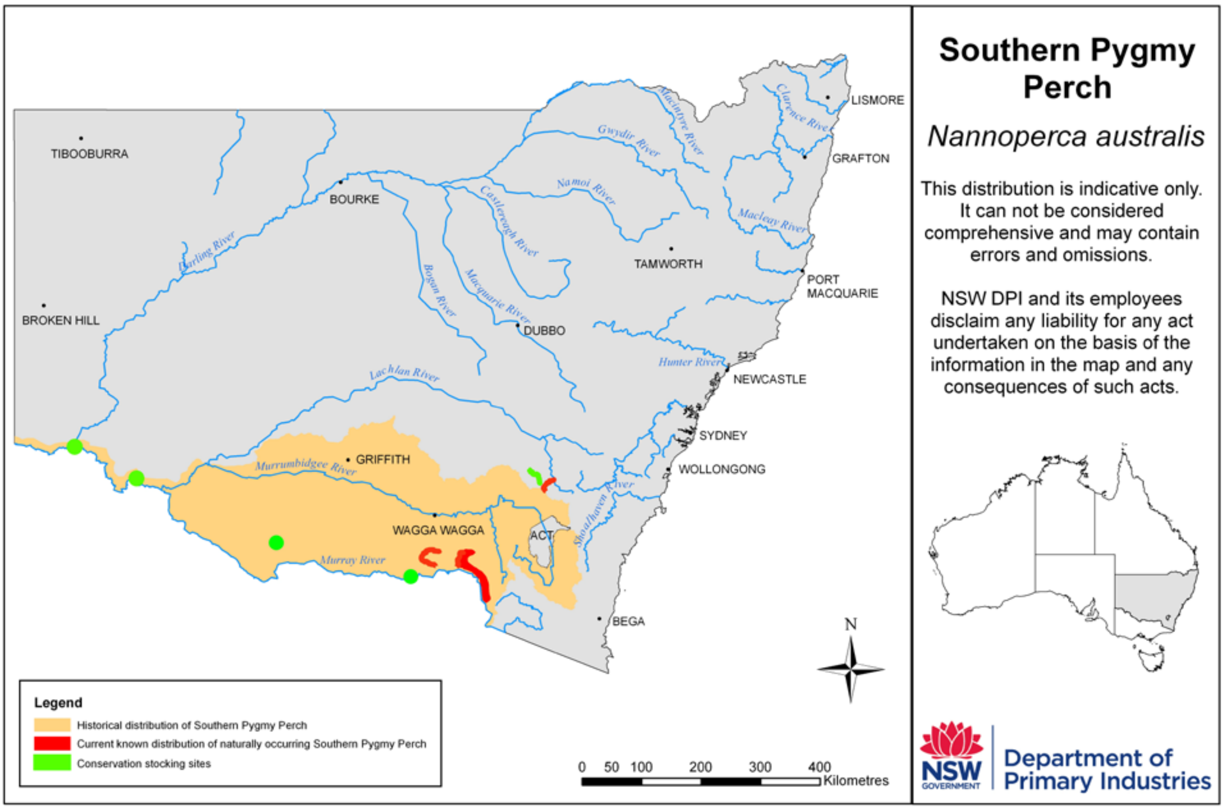


Figure 2: Historical and current known distribution of Southern Pygmy Perch in NSW.

Habitat and ecology

- The Southern Pygmy Perch is found in well-vegetated, slow-flowing or still waters including streams, lakes, billabongs and other types of wetlands.
- The species is carnivorous, feeding on a range of aquatic crustaceans and insects.
- Southern Pygmy Perch reach sexual maturity in their first year, when males are about 30 mm and females about 33 mm long.
- Breeding occurs from late winter to early spring in response to rising water temperatures.
- During the breeding season, males defend a territory in which, after a courtship display, spawning takes place.
- Each female can produce up 4000 small, transparent, non-adhesive eggs which are scattered over vegetation or rocks on the bottom.
- Newly hatched larvae are 3 - 4 mm long and emerge 2 - 4 days after fertilisation.

Why is the Southern Pygmy Perch threatened?

- Habitat degradation including loss of aquatic and riparian (riverbank) vegetation.
- Loss or modification of floodplain wetland habitats by flood mitigation works, such as levees and wetland drainage.
- Modification of natural river flows and temperatures as a result of river regulation, leading to drying and fragmentation of wetland habitats and spawning failures.
- Predation by, and competition with, introduced fish species, such as Redfin Perch (*Perca fluviatilis*) and Eastern Gambusia (*Gambusia holbrooki*).

Figure 3: Southern Pygmy Perch (Photo: Gunther Schmida)

Conservation and recovery actions

- Conserve and restore aquatic and riparian vegetation and use effective erosion and sediment control measures.
- Monitor effectiveness of conservation breeding and stocking programs for the species, and implement improvements where indicated.
- Ensure that all fish stocking activities within the natural distribution of Southern Pygmy Perch comply with appropriate environmental and genetic protocols.
- Allocate and manage environmental flows in regulated rivers, to restore natural seasonal flow patterns and reduce the impact of cold water pollution downstream of dams.
- Develop and implement control programs for introduced pest species.
- Conduct further research into the distribution, biology and ecology of the species to assist conservation planning.
- **Report any sightings of the species via the NSW DPI online form:** **http://www.dpi.nsw.gov.au/fisheries/species-protection/report-it/threatened-species-sighting-form**

Legal Implications

It is illegal to catch and keep, buy, sell, possess or harm Southern Pygmy Perch (or any other threatened species in NSW) without a specific permit, licence or other appropriate approval, and significant penalties apply. For endangered species, these penalties can include fines of up to $220,000 and up to 2 years in prison.

There can also be significant penalties for causing damage to the habitat of a threatened species without approval through actions such as dredging riverbeds.

Clearing that constitutes a routine agricultural management activity, and certain routine farming activities (other than clearing) are permitted, provided the activities are to the minimum extent reasonably necessary and all other relevant statutory approvals or authorities have been obtained.

The impact of developments or activities that require consent or approval (in accordance with the *Environmental Planning and Assessment Act 1979*) must be assessed and considered by consent or determining authorities. Where such actions are likely to result in a significant impact on a threatened species or its habitat, a detailed species impact statement must be prepared.

Strategies to be adopted for promoting the recovery of Southern Pygmy Perch must be set out in the NSW DPI Priorities Action Statement.

A recovery plan may be prepared in accordance with the provisions of the *Fisheries Management Act 1994* to promote the recovery of the species.

Figures 3 and 4: Examples of Southern Pygmy Perch habitat. Note the abundant in-stream vegetation (Photos: Luke Pearce)

Bibliography and further reading

Kuiter, R.H., Humphries, P.A. and Arthington, A.H. (1996) Family Nannopercidae – pygmy perches. pp. 168-175. In: *RM McDowall (ed), Freshwater Fishes of South-Eastern Australia* (second edition). Reed Books, Sydney.

Lintermans, M. (2007) Fishes of the Murray-Darling Basin: An introductory guide. Murray-Darling Basin Authority, Canberra.

Llewellyn, L.C. (1974) Spawning, development and distribution of the southern pygmy perch. *Nannoperca australis australis* (Günther), from inland waters in eastern Australia. *Australian Journal of Marine and Freshwater Research* 25(1): pp. 121–149.

Morris, S.A., Pollard, D.A., Gehrke, P.C. and Pogonoski, J.J. (2001) Threatened and potentially threatened freshwater fishes of coastal New South Wales and the Murray-Darling Basin. NSW Fisheries, Sydney.

For further information

See the NSW DPI website: www.dpi.nsw.gov.au

Contact the NSW DPI Threatened Species Section:

Port Stephens Fisheries Institute
Locked Bag 1
Nelson Bay NSW 2315
Fax (02) 4916 3880

Email: fisheries.threatenedspecies@dpi.nsw.gov.au

Published by the NSW Department of Primary Industries.

Check for updates of this Primefact at: www.dpi.nsw.gov.au/primefacts

PUB07/132

Figure 5: Southern Pygmy Perch (Photo: Luke Pearce)

Figure 6: Female (above) and male (below) Southern Pygmy Perch (Photo: Luke Pearce)

FISHERIES NSW REQUIREMENTS FOR THE PREPARATION OF ENVIRONMENTAL PLANNING AND ASSESSMENT DOCUMENTS

Fisheries NSW is responsible for managing aquatic species (including aquatic invertebrates), aquatic habitat and aquatic biodiversity throughout NSW. Aquatic biodiversity occurs in permanent and intermittent waterways including marine, estuarine, fresh, flowing and still waters.

Fisheries NSW requirements for the preparation of environmental planning and assessment documents are outlined in the current NSW Fisheries *Policy and Guidelines for Aquatic Habitat Management and Fish Conservation 2013* pp 26-32.

Of primary concern to Fisheries are the disturbance and/or destruction of aquatic habitats and any adverse impacts on aquatic species. Disturbance can be in the form of siltation from excessive sediment runoff, blockages to fish passage such as the construction of causeways, culverts and temporary crossings and direct impacts on aquatic habitat such as the removal of aquatic vegetation and de-snagging activities.

Fisheries has also introduced threatened aquatic species legislation, which allows for the listing of aquatic species, populations or communities as either endangered or vulnerable. This legislation is outlined in Part 7A of the *Fisheries Management Act 1994*. Aquatic threatened species are widely distributed across NSW and should be considered in any environmental assessment process. Up to date information is available on the NSW DPI Fisheries website.

Any environmental planning and assessment documents should include the following information as **an absolute minimum** to allow staff from Fisheries to make an informed decision about the potential impacts that any proposed works may have on aquatic species and their habitats.

- Location of works (including topographic map)
- Name of adjacent watercourse(s)
- Description of works to be undertaken
  - Method/s of construction
  - Timing and duration of works
- Obstructions to fish passage (temporary and permanent) identified
- Aquatic habitat conditions at the site – particularly riparian and aquatic vegetation, water depth, permanence of water flow and snags in the vicinity of the proposed works.
- Potential impacts upon aquatic and riparian habitats (both temporary and permanent)
- Proposals to mitigate impacts upon riparian and aquatic vegetation and aquatic habitats.
- Potential impacts upon water quality of the proposed works.
- Proposals to mitigate impacts upon water quality.
- An assessment of the potential impact that proposed works may have on aquatic threatened species, populations and ecological communities.

The above list outlines the minimal amount of information that is required by Fisheries to undertake an assessment of the potential impacts that a proposed activity or works may have on the local aquatic environment. Large scale works will require more detailed information to be submitted to the Department for assessment.

Rasha Haymour

From:	Alison Mclean
Sent:	Thursday, 4 May 2023 5:15 PM
To:	Rasha Haymour
Subject:	FE23/339 C23/182 DPI Fisheries REF requirements - Holbrook Flood Mitigation Works
Attachments:	Holbrook Flood Mitigation Works Greater Hume REF requirements.pdf; REF requirements.pdf; primefact-190-southern-pygmy-perch.pdf
Follow Up Flag:	Flag for follow up
Flag Status:	Flagged

Hi Rasha,

Apologies for my delayed response, I have been out of the office undertaking site inspections and attending various other things for several consecutive weeks.

Thanks for touching base in the early stages of this proposal.

Ten Mile Creek is an important site for a known population of Southern Pygmy Perch, a fish listed as endangered under provisions of the *Fisheries Management Act 1994*. I've attached some info about the species to this email and there is further info on our website. It is essential that the habitat of this species is protected, and I look forward to working further with you to ensure this as the proposal develops.

Please find my response to your REF requirements request attached. I have also provided a more general REF requirements document for your information. Of particular significance for this proposal are the issues of protecting threatened fish species and constructing fish friendly culverts/crossings to ensure fish passage is maintained.

Please don't hesitate to contact me if you require any further information. I will be back in the office next week and will be more readily available – again apologies for the delay in this response.

Kind regards,

Alison

Alison Mclean
Fisheries Manager Murray Darling
Freshwater Environment | Freshwater Environment Branch
Department of Regional NSW

M 0484 907 343 **E** alison.mclean@dpi.nsw.gov.au
PO Box 11
Jindabyne NSW 2627
regional.nsw.gov.au

Department of Regional NSW

Rasha Haymour

From: Alison Mclean
Sent: Wednesday, 12 June 2024 12:14 PM
To: Rasha Haymour
Cc: Liz Mathieson
Subject: RE: REF consultation follow- up-Holbrook Levee

Follow Up Flag: Follow up
Flag Status: Flagged

Hi Rasha,

Thanks for the update.

From the maps provided it looks as though some of the works (including the proposed culverts) are within the banks of the Creek which is considered TYPE 1 CLASS 1 Key Fish Habitat due to the presence of Southern Pygmy Perch, therefore Council will require a permit. If NSW Public works are the proponent (an Authority, not a Local Government) then a permit is not required, but consultation will be required under sec199 of the Fisheries Management Act.

Please let me know if you need anything further.

Alison

Alison Mclean
Fisheries Manager Murray Darling
Freshwater Environment | Freshwater Environment Branch
Department of Regional NSW

M 0484 907 343 **E** alison.mclean@dpi.nsw.gov.au
PO Box 11
Jindabyne NSW 2627
regional.nsw.gov.au

NSW GOVERNMENT **Department of Regional NSW**

From: Rasha Haymour <rasha.a.haymour@pwa.nsw.gov.au>
Sent: Wednesday, 12 June 2024 11:10 AM
To: Alison Mclean <alison.mclean@dpi.nsw.gov.au>
Cc: Liz Mathieson <liz.mathieson@pwa.nsw.gov.au>
Subject: REF consultation follow- up-Holbrook Levee

Hi Alison,

Hope you're keeping well.

I'm writing to you regarding the proposed Holbrook Levee project (please see attached previous correspondence FYI).

We’re currently finalizing the REF and I thought to confirm with you if a permit under Part 7 of the Fisheries Management Act will be required for the works? I’m wondering whether the project area meets the definition of a ‘Water Land’ under that Act, as it could be temporarily submerged with water (as it is a flood zone), which could trigger the need for a dredging and reclamation permit under Part 7 of the Act.

Please note that my email has changed as highlighted in yellow below.

Your quick response will be highly appreciated.

Regards
Rasha

Rasha Haymour *(she/her)*
Environmental Scientist , Heritage, Environment and Planning
NSW Public Works

T 02 9769 9906 **M** 0405999303 **E** rasha.a.haymour@pwa.nsw.gov.au
66 Harrington Street, Sydney, NSW 2000
On **Gadigal Land**

Please be advised that I have a flexible work schedule during the weekdays, so please allow some time for me to respond.

NSW GOVERNMENT

NSW Public Works

publicworks.nsw.gov.au | regional.nsw.gov.au

Contact: Department of Climate Change, Energy, the Environment and Water
Phone: 1300 081 047
Email: waterlicensing.servicedesk@dpie.nsw.gov.au

Our ref: V15/2812-8#26

7 May 2024

The General Manager
Greater Hume Shire Council
PO Box 99
HOLBROOK NSW 2644

Attention: Gayan Wickramasinghe

Emailed: GWickramasinghe@greaterhume.nsw.gov.au

Dear Sir/Madam

Re: V15/2812-8#26 - Review of Environmental Factors
Description: Holbrook Levee
Location: Various Lots, Holbrook

Thank you for your submission of the above development. The Department of Climate Change, Energy, the Environment and Water—Water (Licensing and Approvals) has reviewed the REF for the Holbrook Levee and provides the following comments:

Flood Works Approvals

Flood Work Approvals are required for works located within the vicinity of a water course or water body, which are likely to have an effect on the flow of water to or from that water course or water body, or an effect on the distribution of floodwater.

Exemptions from the requirement to hold a flood work approval are provided in Clause 47 (2) of the *Water Management Regulation (General) 2018*. Where exemptions are not applicable applications for Flood Work Approvals should be made to the department.

Should a Flood Work Approval be required, more information including how to apply can be found: https://water.dpie.nsw.gov.au/our-work/licensing-and-trade/flood-works-approvals

Works on Waterfront Land

Controlled Activity Approvals (CAA) are required for works on waterfront land unless an exemption applies.

The *Water Management Regulation (General) 2018* (clause 38) provides a CAA exemption where works are to be undertaken by a public authority, which will apply in the case as NSW Public Works will be responsible for undertaking construction works. Despite this exemption, works undertaken on waterfront land must still give consideration to the requirements outlined in the Guidelines for Controlled Activities. In this case proposed culverts and stormwater outlets must be designed and constructed in accordance with the Guidelines for Controlled Activities on Waterfront Land.

The Guideline for Controlled Activities on Waterfront Land can be found:
https://water.dpie.nsw.gov.au/our-work/licensing-and-trade/controlled-activity-approvals/guidelines

Department of Climate Change, Energy, the Environment and Water

Water take and works approvals

The draft REF notes there is the possibility of intercepting groundwater during excavation. This volume should be quantified to maximum potential take per year. A water supply work approval may be required for temporary dewatering and a water access licence may be required to account for this take unless an exemption applies.

Site water demands do not appear to be quantified or sources identified. An adequate and secure water supply should be identified for the project. Should this require new or amended water supply works approvals or additional Water Access License the department should be contacted and relevant approvals obtained prior to take or construction occurring.

More information including how to apply for water supply works approvals or Water Access Licences can be found: https://water.dpie.nsw.gov.au/our-work/licensing-and-trade/water-access-licences-and-approvals

The department recommends consultation with Crown Lands as the proposed development appears to be partially within Crown Land.

If you have any questions regarding this correspondence, please use Water Assist to obtain further information or make an enquiry: https://water.dpie.nsw.gov.au/water-assist

Yours Sincerely

K Daly

For
Sandra White
Manager
Licensing and Approvals
Department of Climate Change, Energy, the Environment and Water—Water

LOCKED BAG 5022, Parramatta, NSW 2124 | waterlicensing.servicedesk@dpie.nsw.gov.au | www.dpie.nsw.gov.au

Rasha Haymour

From: Leonie Cambage <Leonie.Cambage@transport.nsw.gov.au>
Sent: Monday, 29 May 2023 3:10 PM
To: Rasha Haymour
Cc: Government Relations oSec; Bruce Bremner; Sandra Manoharan
Subject: Holbrook Levee - NSW Public Works Consultation for REF - Transport for NSW further response
Attachments: Holbrook Levee, Consultation letter_TfNSW.pdf

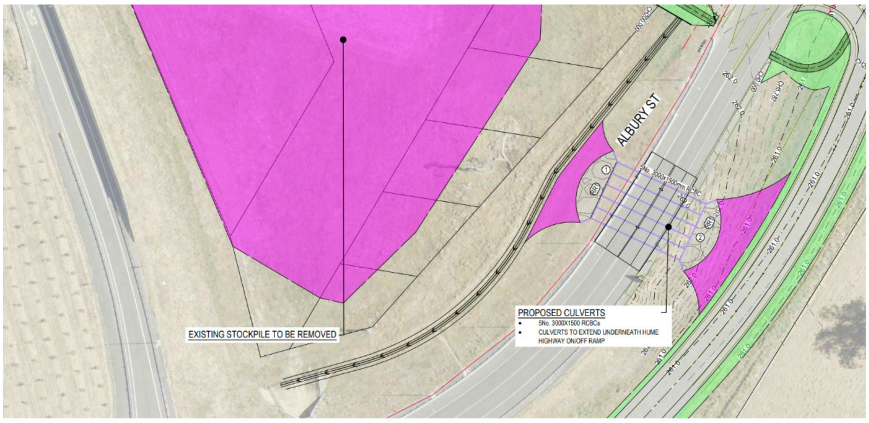
OFFICIAL: Sensitive - NSW Government

Hi Rasha

Re: the pending REF for proposed flood mitigation works at Holbrook

Further to Transport for NSW's (TfNSW) response earlier this month, below are comments about approval under the Act, and natural disasters.

Approval under the Act
TfNSW would be required to provide approval (concurrence) under s138 of *Roads Act 1993 No 33* for works that occur on classified roads. In this instance, it is proposed that five box culverts are placed on Albury Street, which is MR211, a classified regional road.



HOLBROOK 3 LAYOUT PLAN
SCALE 1:1000

Adverse impacts in the event of natural disasters
TfNSW proposes the REF should consider impacts as a result of the construction of the levees such that resident's homes, access and evacuation routes, and any other essential elements of the transport network are not adversely impacted in the event of natural disasters such as storms, heavy rainfall and flooding.

Proximity to the Hume Highway (Initial comment provided 5 May 2023)
Regarding the proximity of the levee to the Hume Highway, have flood impact assessments been conducted that confirm the installation of the levees shown on AWE200028-WE-3050 (close to the Hume Highway) does not increase the risk of water flowing over or ponding on the Highway? TfNSW would like to review these assessments.

For future correspondence:

To ensure future correspondence about the REF can be directed to the relevant area of TfNSW, could you please email it to: governmentrelations@transport.nsw.gov.au (Our ref is: ROM23_1255)

Thank you again for your patience, please don't hesitate to call or email if you need any further information.

With kind regards

Leonie Cambage
A/Senior Government Services Officer
Regional and Outer Metropolitan
Transport for NSW

T (02) 9595 5870 **E** leonie.cambage@transport.nsw.gov.au

Transport
for NSW

From: Rasha Haymour <rasha.haymour@pwa.nsw.gov.au>
Sent: Wednesday, 5 April 2023 4:39 PM
To: Information <Information@transport.nsw.gov.au>
Subject: Consultation Letter-Holbrook Flood Mitigation Works REF

Dear Sir/Madam,

NSW Public Works (NSW PW) has been engaged by the Greater Hume Council to prepare a Review of Environmental Factors (REF) for the proposed flood mitigation works at Holbrook, NSW. Further details regarding the proposal are provided in the attached letter.

The purpose of the attached letter is to invite your organisation to provide comments on the proposal. If you have any comments, it would be appreciated if you could provide a response prior to 27 April 2023.

Best Regards
Rasha

Rasha Haymour *(she/her)*
Environmental Scientist/Planner, Heritage, Environment and Planning
NSW Public Works | Department of Regional NSW

T 02 9769 9843 **M** 0419 273 938 **E** rasha.haymour@pwa.nsw.gov.au
66 Harrington Street, Sydney, NSW 2000
On **Gadigal Land**

My working days are: Mon-Thu

NSW Public Works
Department of Regional NSW

publicworks.nsw.gov.au | regional.nsw.gov.au

The Department of Regional NSW acknowledges that it stands on Country which always was and always will be Aboriginal land. We acknowledge the Traditional Custodians of the land and waters, and we show our respect for elders past, present and emerging. We are committed to providing places in which Aboriginal people are included socially, culturally and economically through thoughtful and collaborative approaches to our work

OFFICIAL: Sensitive - NSW Government

OFFICIAL: Sensitive - NSW Government

Rasha Haymour

From: Regional & Outer Metropolitan DMO <ROM_DMO@transport.nsw.gov.au>
Sent: Friday, 5 May 2023 3:57 PM
To: Rasha Haymour
Cc: Government Relations oSec
Subject: Holbrook Levee - NSW Public Works Consultation for REF - Transport for NSW response
Attachments: Holbrook Levee, Consultation letter_TfNSW.pdf

Follow Up Flag: Follow up
Flag Status: Flagged

OFFICIAL: Sensitive - NSW Government

OFFICIAL: Sensitive - NSW Government

Hi Rasha

Thank you for the opportunity for Transport for NSW (TfNSW) to provide a comment about the pending Review of Environmental Factors (REF) for proposed flood mitigation works at Holbrook.

TfNSW has reviewed the consultation letter and attachments and provides the following comment about the proximity of the levee to the Hume Highway.

'Have flood impact assessments been conducted that confirm the installation of the levees shown on AWE200028-WE-3050 (close to the Hume Highway) does not increase the risk of water flowing over or ponding on the Highway? Transport for NSW would like to review these assessments.'

To ensure future correspondence about the REF can be directed to the relevant area of TfNSW, could you please email it to: governmentrelations@transport.nsw.gov.au (Our ref is: ROM23_1255)

Please don't hesitate to call or email if you need any further information at this stage.

With kind regards

Leonie Cambage
A/Senior Government Services Officer
Regional and Outer Metropolitan
Transport for NSW

T (02) 9595 5870 **E** leonie.cambage@transport.nsw.gov.au

Transport for NSW

From: Rasha Haymour <rasha.haymour@pwa.nsw.gov.au>
Sent: Wednesday, 5 April 2023 4:39 PM

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Best Regards
Rasha

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NSW Public Works | Department of Regional NSW

T 02 9769 9843 **M** 0419 273 938 **E** rasha.haymour@pwa.nsw.gov.au
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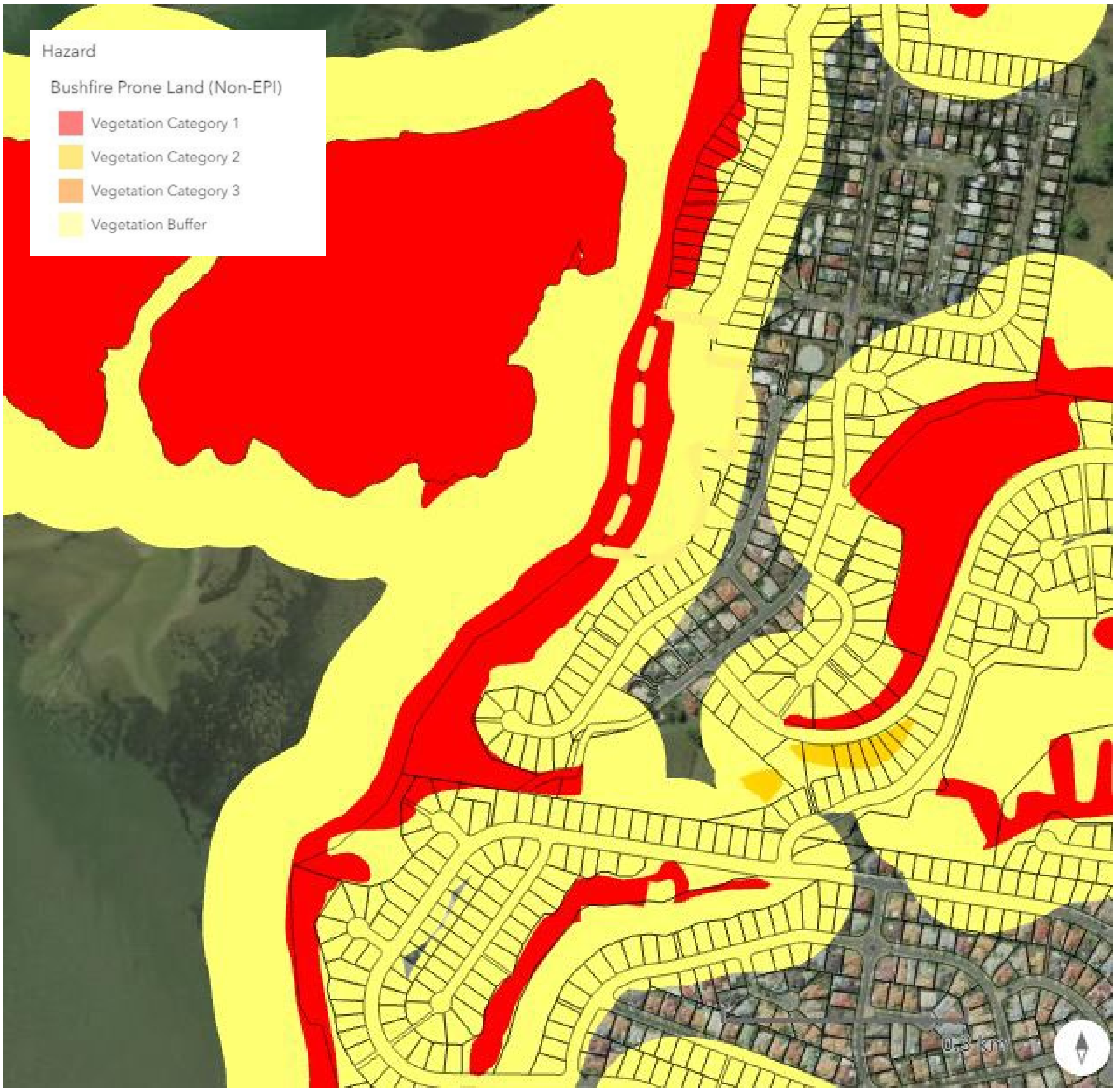
Appendix G: Bush Fire Mapping under the Rural Fires Act 1997



Source: NSW eplanning Portal (February 2023)

Appendix H: Concept Design Plan

HOLBROOK FLOOD MITIGATION DESIGN

HOLBROOK, NSW, 2644

FOR

GREATER HUME COUNCIL

LOCALITY PLAN
NTS

SCHEDULE OF DRAWINGS	
DRAWING No.	DESCRIPTION
GENERAL	
300203886-WE-3000	LOCALITY PLAN AND SCHEDULE OF DRAWINGS
300203886-WE-3001	GENERAL NOTES
300203886-WE-3050	HOLBROOK SITE PLAN
300203886-WE-3061	HOLBROOK EXISTING FEATURES AND DEMOLITION PLAN LEVEE 1 - SHEET 1
300203886-WE-3062	HOLBROOK EXISTING FEATURES AND DEMOLITION PLAN LEVEE 1 - SHEET 2
300203886-WE-3063	HOLBROOK EXISTING FEATURES AND DEMOLITION PLAN LEVEE 1 - SHEET 3
300203886-WE-3064	HOLBROOK EXISTING FEATURES AND DEMOLITION PLAN LEVEE 3
300203886-WE-3065	HOLBROOK EXISTING FEATURES AND DEMOLITION PLAN LEVEE 2 - SHEET 1
300203886-WE-3066	HOLBROOK EXISTING FEATURES AND DEMOLITION PLAN LEVEE 2 - SHEET 2
300203886-WE-3067	HOLBROOK EXISTING FEATURES AND DEMOLITION PLAN LEVEE 2 - SHEET 3
LEVEE	
300203886-WE-3101	HOLBROOK LEVEES ALIGNMENT CONTROL PLAN SHEET 1 OF 2
300203886-WE-3102	HOLBROOK LEVEES ALIGNMENT CONTROL PLAN SHEET 2 OF 2
300203886-WE-3111	HOLBROOK 1 LAYOUT PLAN SHEET 1 OF 2
300203886-WE-3112	HOLBROOK 1 LAYOUT PLAN SHEET 2 OF 2
300203886-WE-3150	HOLBROOK 2 LAYOUT PLAN SHEET 1 OF 4
300203886-WE-3151	HOLBROOK 2 LAYOUT PLAN SHEET 2 OF 4
300203886-WE-3152	HOLBROOK 2 LAYOUT PLAN SHEET 3 OF 4
300203886-WE-3153	HOLBROOK 2 LAYOUT PLAN SHEET 4 OF 4
300203886-WE-3200	HOLBROOK 3 LAYOUT PLAN
300203886-WE-3250	HAY ST LONGITUDINAL SECTIONS SHEET 1 OF 2
300203886-WE-3251	HAY ST LONGITUDINAL SECTIONS SHEET 2 OF 2
300203886-WE-3252	HOLBROOK 1 LONGITUDINAL SECTIONS SHEET 1 OF 1
300203886-WE-3253	HOLBROOK 2 LONGITUDINAL SECTIONS SHEET 1 OF 2
300203886-WE-3254	HOLBROOK 2 LONGITUDINAL SECTIONS SHEET 2 OF 2
300203886-WE-3255	HOLBROOK 3 LONGITUDINAL SECTIONS SHEET 1 OF 1
300203886-WE-3300	HOLBROOK 1 CROSS SECTIONS SHEET 1 OF 3
300203886-WE-3301	HOLBROOK 1 CROSS SECTIONS SHEET 2 OF 3
300203886-WE-3302	HOLBROOK 1 CROSS SECTIONS SHEET 3 OF 3
300203886-WE-3303	HOLBROOK 2 CROSS SECTIONS SHEET 1 OF 9
300203886-WE-3304	HOLBROOK 2 CROSS SECTIONS SHEET 2 OF 9
300203886-WE-3305	HOLBROOK 2 CROSS SECTIONS SHEET 3 OF 9
300203886-WE-3306	HOLBROOK 2 CROSS SECTIONS SHEET 4 OF 9
300203886-WE-3307	HOLBROOK 2 CROSS SECTIONS SHEET 5 OF 9
300203886-WE-3308	HOLBROOK 2 CROSS SECTIONS SHEET 6 OF 9
300203886-WE-3309	HOLBROOK 2 CROSS SECTIONS SHEET 7 OF 9
300203886-WE-3310	HOLBROOK 2 CROSS SECTIONS SHEET 8 OF 9
300203886-WE-3311	HOLBROOK 2 CROSS SECTIONS SHEET 9 OF 9
300203886-WE-3312	HOLBROOK 3 CROSS SECTIONS SHEET 1 OF 2
300203886-WE-3313	HOLBROOK 3 CROSS SECTIONS SHEET 2 OF 2
300203886-WE-3350	MAINTENANCE TRACK CROSS OVERS
DRAINAGE	
300203886-WE-3400	DRAINAGE LONGITUDINAL SECTIONS
300203886-WE-3401	DRAINAGE PIT SCHEDULE
300203886-WE-3402	DRAINAGE DETAILS
300203886-WE-3411	SWALE 1 & 2 LAYOUT PLAN SHEET 1 OF 5
300203886-WE-3412	SWALE 3 LAYOUT PLAN SHEET 2 OF 5
300203886-WE-3413	SWALE 4 & 5 LAYOUT PLAN SHEET 3 OF 5
300203886-WE-3414	SWALE 4 & 5 LAYOUT PLAN SHEET 4 OF 5
300203886-WE-3415	SWALE 6 & 7 LAYOUT PLAN SHEET 5 OF 5

SCHEDULE OF DRAWINGS	
DRAWING No.	DESCRIPTION
GEOTECHNICAL	
300203886-WE-3450	TYPICAL SECTIONS LEVEE 1
300203886-WE-3451	TYPICAL SECTIONS LEVEE 2
300203886-WE-3452	TYPICAL SECTIONS LEVEE 3
300203886-WE-3453	TYPICAL SECTIONS PAVEMENT DETAILS
300203886-WE-3454	TYPICAL SECTIONS LEVEE TRANSITION DETAILS
300203886-WE-3455	TYPICAL SECTIONS AND DETAILS GEOTECHNICAL CLAY CORE DETAILS
300203886-WE-3456	TYPICAL SECTIONS AND DETAILS SERVICE CROSSING GEOTECHNICAL DETAILS
300203886-WE-3457	TYPICAL SECTIONS AND DETAILS STORMWATER PIPE CROSSING GEOTECHNICAL DETAILS
300203886-WE-3460	TYPICAL SECTIONS AND DETAILS STORMWATER PIPE CROSSING SAND FILTER DIAPHRAGM DETAILS
ROADWORKS	
300203886-WE-3500	CULVERT & ROAD LAYOUT PLAN
300203886-WE-3501	CULVERT SECTIONS & DETAILS
300203886-WE-3502	SWALE & ROAD LONG SECTIONS
300203886-WE-3503	ROAD CROSS SECTIONS SHEET 1 OF 2
300203886-WE-3504	ROAD CROSS SECTIONS SHEET 2 OF 2
EARTHWORKS	
300203886-WE-3550	EARTHWORKS PLAN
300203886-WE-3551	EARTHWORKS TYPICAL SECTIONS
300203886-WE-3600	SET OUT TABLES SHEET 1 OF 2
300203886-WE-3601	SET OUT TABLES SHEET 2 OF 2
STRUCTURAL	
300203886-ST-3700	LEVEE RETAINING WALL STRUCTURAL NOTES
300203886-ST-3701	LEVEE RETAINING WALL INVERTED 'T' TYPE TYPICAL REINFORCEMENT DETAILS
300203886-ST-3702	LEVEE RETAINING WALL INVERTED 'T' TYPE TYPICAL SECTIONS - SHEET 1
300203886-ST-3703	LEVEE RETAINING WALL INVERTED 'T' TYPE TYPICAL SECTIONS - SHEET 2
300203886-ST-3704	LEVEE RETAINING WALL INVERTED 'T' TYPE TYPICAL SECTIONS - SHEET 3
300203886-ST-3710	LEVEE RETAINING WALL HOLBROOK LEVEES LAYOUT PLAN
300203886-ST-3711	LEVEE RETAINING WALL HOLBROOK LEVEE 1 LONGITUDINAL SECTIONS - SHEET 1
300203886-ST-3712	LEVEE RETAINING WALL HOLBROOK LEVEE 1 LONGITUDINAL SECTIONS - SHEET 2
300203886-ST-3713	LEVEE RETAINING WALL HOLBROOK LEVEE 1 LONGITUDINAL SECTIONS - SHEET 3
300203886-ST-3714	LEVEE RETAINING WALL HOLBROOK LEVEE 2 LONGITUDINAL SECTIONS - SHEET 1
300203886-ST-3715	LEVEE RETAINING WALL HOLBROOK LEVEE 2 LONGITUDINAL SECTIONS - SHEET 2
300203886-ST-3716	LEVEE RETAINING WALL HOLBROOK LEVEE 3 LONGITUDINAL SECTION
300203886-ST-3720	LEVEE RETAINING WALL HAY ST STAIRS PLAN AND SECTIONS
300203886-ST-3721	LEVEE RETAINING WALL HAY ST STAIRS STAIRS DETAILS

TELECOMMUNICATIONS SERVICE PROVIDERS

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NOTE: SERVICE LOCATIONS ARE APPROXIMATE ONLY FROM PROVIDERS PLANS. LOCATIONS ARE TO BE CONFIRMED PRIOR TO START OF CONSTRUCTION. PHONE DBYD SERVICE LOCATIONS ON **1100** FOR DETAILS.

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PLEASE CONTACT COUNCIL'S ARBORIST PRIOR TO ANY CONSTRUCTION FOR ADVICE ON TREE ROOT PROTECTION IN THE VICINITY OF THE WORKS TO BE CARRIED OUT.

SERVICE LOCATIONS

IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO CONTACT THE RELEVANT SERVICE AUTHORITIES TO ASCERTAIN THE EXACT LOCATION OF SERVICES PRIOR TO CONSTRUCTION. ALSO TO OBTAIN THE REQUIRED APPROVALS AND PERMITS.

Rev.	Date	Description	Des.	Verif.	Appd.
A	23/04/2024	TENDER ISSUE	VZ	HG	AS

NORTH

Greater Hume Council

Stantec
Stantec Australia Pty Ltd | ABN 17 007 820 322
Level 4, 501 Swanston Street
Melbourne VIC 3000
Tel: 03 8415 7777
Web: www.stantec.com/au

Drawn SB	Date 16/04/20
Checked SB	Date 16/04/20
Designed AW	Date 16/04/20
Verified	Date
Approved	Date

Client: GREATER HUME SHIRE COUNCIL

Project: HHC FLOOD LEVEE DESIGN
HOLBROOK, HENTY
& CULCAIRN

Title: LOCALITY PLAN AND SCHEDULE OF DRAWINGS

Status: FOR TENDER ONLY
NOT TO BE USED FOR CONSTRUCTION PURPOSES

VERT. DATUM	HORZ. DATUM	Scale	Size
AHD	MGA	NTS	A1

Drawing Number	Revision
300203886-WE-3000	A

DATE PLOTTED: 8 May 2024 3:06 PM BY : HAZELGROVE, ADAM

GENERAL NOTES - CIVIL SITEWORKS

1. GENERAL

ELECTRONIC PLANS — ELECTRONIC PLANS MAY BE PROVIDED TO ASSIST THE CONTRACTOR BUT DO NOT FORM PART OF THE CONTRACT. IN THE CASE OF DISCREPANCY BETWEEN THE ELECTRONIC INFORMATION AND THE HARD COPY PLANS THE HARD COPY PLANS TAKE PRECEDENT.

2. SURVEY

SURVEY DATUM — THESE PLANS ARE BASED UPON THE EXISTING CONDITIONS SURVEY PREPARED BY CARDNO PL 20045-10. LEVELS SHOWN ARE TO A.H.D. WHERE DESIGN IS OUTSIDE EX SURVEY LIDAR HAS BEEN USED HOWEVER ON SITE EX SURFACE CONDITIONS SHOULD TAKE PRECEDENCE, MATCH NEATLY.

SET OUT — THE CONTRACTOR SHALL SET OUT THE WORKS FROM THE NOMINATED DESIGN LINES, SURVEY BENCHMARKS AND CONTROL POINTS SHOWN ON THE PLANS AND TO THE SPECIFIED DETAILS. UPON REQUEST AN ELECTRONIC BASE PLAN OF THE CIVIL DRAWING CAN BE SUPPLIED.
WHERE STANTEC'S COMPUTER MODELS ARE UTILISED FOR SET OUT IT SHALL BE THE CONTRACTORS RESPONSIBILITY TO VERIFY THAT THE PROPOSED VERTICAL AND HORIZONTAL ALIGNMENT ARE CONSISTENT WITH THE INFORMATION SHOWN ON THE DRAWINGS. ANY DISCREPANCY SHALL BE REFERRED TO STANTEC PRIOR TO CONSTRUCTION.

DIMENSIONS — ALL DIMENSIONS ARE TO INVERT OF KERB OR OUTER EDGE OF LINEMARKING WHERE APPLICABLE

REFERENCES PROTECTION — THE CONTRACTOR SHALL MAINTAIN AND PROTECT THE PEGS AND SURVEY MARKS FOR THE DURATION OF THE WORKS.

AS-CONSTRUCTED SURVEY — UPON COMPLETION OF THE CIVIL WORKS THE CONTRACTOR SHALL PROVIDE CERTIFIED AS-CONSTRUCTED PLANS OF THE WORKS AND AN AS-CONSTRUCTED SURVEY OF ALL GREATER HUME SHIRE COUNCIL DRAINAGE WORKS IN D SPEC FORMAT OR EQUIVALENT TO GREATER HUME SHIRE COUNCIL REQUIREMENTS.

3. EARTHWORKS

GENERAL — EARTHWORKS SHALL BE CARRIED OUT TO THE FINISHED SURFACE LEVELS SHOWN ON THE PLANS AND CROSS SECTIONS. CUT BATTERS SHALL NOT EXCEED 1 IN 6 AND FILL BATTERS SHALL NOT EXCEED 1 IN 6 SLOPE UNLESS INDICATED OTHERWISE.

GEOTECHNICAL DATA — REFER TO THE GEOTECHNICAL REPORTS 'GEOTECHNICAL INVESTIGATION FOR PROPOSED FLOOD MITIGATION OPTIONS - AWE200028REPORT01.1' AND 'GEOTECHNICAL RECOMMENDATIONS FOR NEW PAVEMENTS AWE200028REPORT02.1' PREPARED BY CARDNO, NOW STANTEC PTY LTD FOR PAVEMENT RECOMMENDATIONS AND SOIL CONDITIONS.

SITE STRIP — THE CONTRACTOR SHALL STRIP ALL AREAS SUBJECT TO BULK EARTHWORKS , PAVEMENT CONSTRUCTION OR BUILDING WORKS OF ALL TOPSOIL AND OTHER DELETERIOUS MATERIAL. THE SITE STRIP SHALL INCLUDE REMOVAL OF ALL MATERIAL 300mm DEPTH.

SUBGRADE CONDITIONS — REFER TO THE GEOTECHNICAL REPORT FOR SUBGRADE CONDITIONS.THE SANDY/SILTY SUBGRADES IN PARTICULAR ARE SUSCEPTIBLE TO WATER PENETRATION. IT IS THE CONTRACTOR'S RESPONSIBILITY TO MAINTAIN SITE GRADING AND DRAINAGE AND TO PROTECT AND MAINTAIN SUBGRADES IN A SUITABLE CONDITION IN ORDER TO ACHIEVE THE COMPACTIONS SPECIFIED. SHOULD SUBGRADES BECOME SATURATED ANY UNSUITABLE MATERIAL IS TO BE REMOVED AND MADE GOOD WITH TYPE B GENERAL FILL AND/OR LIME/CEMENT STABILIZED AS REQUIRED IN ORDER TO MAINTAIN SUBGRADES. ALL SUBGRADES ARE TO BE PROOF ROLLED AND APPROVED PRIOR TO CONSTRUCTION OF PAVEMENTS AND/OR COMMENCEMENT OF FILLING.

COMPACTION TO AS1289 — THE CONTRACTOR SHALL OBTAIN 98% STANDARD MINIMUM DRY DENSITY COMPACTION ON ALL FINISHED SUBGRADES AND FORMATIONS. FOR LEVEE COMPACTION DETAILS REFER NOTE 15.

FILLING — PRIOR TO THE COMMENCEMENT OF FILLING THE SITE SHALL BE STRIPPED AS NOTED. FILLING IS TO BE CARRIED OUT IN STRICT ACCORDANCE WITH THE SPECIFICATIONS AND AS3798. APPROVED MATERIAL WON FROM SITE OR APPROVED IMPORTED FILL SHALL BE MOISTURE CONDITIONED IN ACCORDANCE WITH THE RECOMMENDATIONS OF THE GEOTECHNICAL REPORT PRIOR TO BEING PLACED IN UNIFORM HORIZONTAL LAYERS OF 200mm MAXIMUM DEPTH AND COMPACTED AS SPECIFIED. ALL FINISHED SURFACES SHALL ACHIEVE A MINIMUM COMPACTION OF 98% STANDARD DRY DENSITY. COMPACTION TESTING OF ALL FILL SHALL BE CARRIED OUT IN ACCORDANCE WITH THE REQUIREMENTS OF AS 3798. FOR LEVEE MATERIAL DETAILS REFER TO NOTE 15.

INSPECTION & TESTING — THE CONTRACTOR SHALL INSTRUCT A NATA REGISTERED GEOTECHNICAL ENGINEER TO CARRY OUT LEVEL 1 SUPERVISION TESTING AND REPORTING IN ACCORDANCE WITH AS3798 AND AS1289 AND TO RELEVANT COUNCIL REQUIREMENTS FOR THIS PROJECT. THIS REQUIRES THE GEOTECHNICAL CONSULTANT TO UNDERTAKE THE SAMPLING AND TESTING ON SITE AS SPECIFIED IN ADDITION THEY ARE RESPONSIBLE FOR THE SELECTION TIMING AND LOCATION OF SAMPLING ON EACH VISIT. THE GEOTECHNICAL CONSULTANT SHALL PROVIDE TEST RESULT TO THE SUPERINTENDENT AS THEY ARE TAKEN AND SUBMIT A COMPREHENSIVE FINAL REPORT TO THE SUPERINTENDENTS SATISFACTION PRIOR TO PRACTICAL COMPLETION. THE FREQUENCY OF TESTING SHALL BE IN ACCORDANCE WITH AS3798 TABLE 8.1 (ADOPTING WHICHEVER GIVES THE MOST TEST RESULTS).

REINSTATEMENT — THE CONTRACTOR SHALL REGRADE, SHAPE, TOPSOIL AND GRASS ALL ADJACENT EXISTING GRASSED AREAS THAT ARE DISTURBED OR ALTERED AS A CONSEQUENCE OF THE PROPOSED WORKS.

4. LANDSCAPING

PREPARATION — IN NEW LANDSCAPE AREAS ANY REDUNDANT PAVEMENT MATERIAL SHALL BE REMOVED & REINSTATED WITH CLEAN FILL TO 150mm BELOW FINISHED SURFACE LEVEL. UNLESS NOTED OTHERWISE ON THE LANDSCAPE PLANS, REINSTATEMENT OF A MIN 150mm OF CLEAN TOPSOIL SHALL BE PROVIDED TO ALL LANDSCAPE AREAS.

EXISTING — ALL EXISTING TREES IN THE VICINITY OF THE TRAFFICABLE AREAS THAT ARE TO BE RETAINED SHALL BE PRUNED, ROOTS CUT & SEALED WHERE THEY EXTEND BENEATH NEW WORKS, BY APPROPRIATELY QUALIFIED PERSONNEL. TREES TO BE REMOVED SHALL HAVE ALL ROOTS GRUBBED OUT AND BE MADE GOOD WITH COMPACTED FILL. NO OTHER TREES ARE TO BE DAMAGED OR REMOVED.

5. SITE CLEARANCE

DEMOLITION — ALL EXISTING REDUNDANT CONCRETE, PAVEMENT, SOIL, RUBBISH AND CONSTRUCTION DEBRIS SHALL BE TAKEN UP AND REMOVED FROM SITE.

CLEAN UP — PRIOR TO COMPLETION, THE CONTRACTOR SHALL ENSURE THE SITE OF WORKS IS TIDIED AND OBTAIN A CLEARANCE FROM THE SUPERVISING ENGINEER OR THE PROJECT MANAGER.

6. DRAINAGE

PIPES — DRAINAGE PIPES ABOVE 225Ø TO BE MINIMUM OF CLASS 2 REINFORCED CONCRETE, FRCP OR SRCP (RUBBER RING JOINTED) UNLESS OTHERWISE SPECIFIED. DRAINAGE PIPES UP TO 225Ø TO BE SEWER QUALITY UPVC (RUBBER RING JOINTED). COMPACTED CLASS 2 FCR BACKFILL SHALL BE INSTALLED TO PIPES UNDER ROAD PAVEMENTS AND BUILDING SLABS. TRENCHES IN LANDSCAPE AREAS CAN BE BACKFILLED WITH SELECTED CLAY FILL.

EXISTING PIPES — ALL EXISTING PIPES THROUGH EXISTING LANDSCAPE AREAS THAT WILL NOW BE BENEATH NEW ROAD PAVEMENT SHALL HAVE THE EXISTING BACKFILL REMOVED AND REPLACED WITH A CRUSHED ROCK BACKFILL COMPACTED TO 98% STANDARD.

PITS — DRAINAGE PITS TO BE CAST IN-SITU CONCRETE PITS AS DETAILED OR APPROVED PRECAST CONCRETE COMPLYING WITH THE RELEVANT AUSTRALIAN STANDARDS. ALL PITS DEEPER THAN 1.0M ARE TO BE PROVIDED WITH APPROVED STEP IRONS AT 300 MAX. CENTRES.

7. TRAFFIC MANAGEMENT

GENERAL — TRAFFIC MANAGEMENT SHALL BE ARRANGED BY THE CONTRACTOR FOR THE DURATION OF THE WORKS IN ACCORDANCE WITH AUSTRALIAN STANDARD AS1742.3-2002 FOR CONSTRUCTION TRAFFIC MANAGEMENT AND TO THE SATISFACTION OF ALL PARTIES, INCLUDING THE PROVISION OF ALL NECESSARY SIGNAGE, LIGHTING AND BARRICADING. TRAFFIC FLOWS IN ALL ABUTTING ROADWAYS AND ACCESS TO THE SITE SHALL REMAIN UNIMPEDED FOR THE DURATION OF THE CONTRACT. A TRAFFIC MANAGEMENT PLAN FOR ANY EXTERNAL ROADWORKS SHALL BE SUBMITTED TO GREATER HUME SHIRE COUNCIL FOR APPROVAL A MINIMUM OF TWO WEEKS PRIOR TO COMMENCEMENT OF WORKS.

8. TESTING

DATA — THE CONTRACTOR SHALL SUPPLY WRITTEN TEST RESULTS FROM A NATA REGISTERED GEOTECHNICAL ENGINEER CONFIRMING COMPLIANCE WITH THE SPECIFICATIONS FOR ALL EARTHWORKS, CONCRETE WORKS AND PAVEMENTS LAYERS.

AUDIT — TEST RESULTS WILL BE REVIEWED BY THE SUPERINTENDENT AND WHERE SO REQUIRED ADDITIONAL TESTS WILL BE PROVIDED BY THE CONTRACTOR TO THE SUPERINTENDENTS SATISFACTION.

9. SIGNAGE

GENERAL — ALL REGULATORY AND HAZARD DIRECTIONAL SIGNS TO BE INSTALLED IN CLASS 1 REFLECTIVE MATERIAL AND ALL WARNING SIGNS TO BE INSTALLED IN CLASS 2 REFLECTIVE MATERIAL TO APPROVED AUSTRALIAN STANDARDS. FOR TEMPORARY SIGNAGE DURING CONSTRUCTION WORKS, REFER TO VICROADS ROADWORKS SIGNAGE CODE.

EXISTING — WHERE NECESSARY, EXISTING TRAFFIC CONTROL SIGNS SHALL BE RELOCATED CLEAR OF PROPOSED WORKS. REDUNDANT SIGNS SHALL BE TAKEN UP AND REMOVED.

EXTENT — NEW TRAFFIC CONTROL SIGNS SHALL BE INSTALLED IN ACCORDANCE WITH THE DRAWINGS AND THE RELEVANT SPECIFICATION.

10. SERVICES

EXISTING — ALL STATUTORY AUTHORITY SERVICES MUST BE MAINTAINED AND PROTECTED BY THE CONTRACTOR AT ALL TIMES UNLESS OTHERWISE SHOWN. EXISTING SERVICE LOCATIONS SHOWN HAVE BEEN OBTAINED FROM STATUTORY AUTHORITY RECORDS AND/OR SITE PLANS WHERE AVAILABLE. NO GUARANTEE IS GIVEN THAT ALL EXISTING SERVICES ARE SHOWN AND ALL SERVICES SHOULD BE PROVEN ON SITE PRIOR TO THE COMMENCEMENT OF WORKS IN THEIR VICINITY.

ADJUSTMENTS — ALL EXISTING PITS AND SERVICE FITTINGS THAT ARE TO REMAIN WITHIN THE PAVEMENT AREAS SHALL BE REBUILT TO MATCH PROPOSED LEVELS AND WHERE APPLICABLE FITTED WITH AN APPROPRIATE HEAVY DUTY, AUTHORITY APPROVED, COVER. ELSEWHERE EXISTING SERVICES SHALL BE ADJUSTED TO SUIT NEW ADJACENT LEVELS. THE RELEVANT AUTHORITY IS TO BE NOTIFIED PRIOR TO ANY WORKS ON THEIR ASSETS AND SERVICES ARE TO BE ADJUSTED BY OR TO THE RELEVANT AUTHORITY REQUIREMENTS

11. INSPECTIONS

GENERAL — ALL WORKS SHALL BE CARRIED OUT IN ACCORDANCE WITH THE APPROVED CONSTRUCTION PROGRAMME TO THE SATISFACTION OF THE SUPERVISING ENGINEER AND SUBJECT TO PERIODICAL INSPECTION AND WRITTEN STAGED APPROVAL. ADDITIONAL INSPECTIONS CAN BE REQUESTED AT 24 HOURS NOTICE.

EXTERNAL — ALL WORKS IN ROAD RESERVATIONS SHALL REQUIRE WRITTEN APPROVAL OF THE COUNCIL'S SUPERINTENDENT AND ARE SUBJECT TO SEPARATE INSPECTIONS. SEVEN DAYS NOTICE TO BE GIVEN OF WORK COMMENCING. THE CONTRACTOR SHALL OBTAIN ALL NECESSARY ROAD OPENING PERMITS AND AUTHORITY APPROVALS PRIOR TO COMMENCING WORKS.

12. PAVEMENTS

SAWCUTTING — ALL EXISTING PAVEMENT ADJACENT TO PROPOSED KERB OR PROPOSED JOINTS SHALL BE SAWCUT IN A NEAT LINE TO THE SATISFACTION OF THE SUPERVISING ENGINEER, AND TO HAVE 300mm OVERLAP. REFER TO STANDARD DETAILS.

TRENCHING — ALL TRENCHING WORKS IN EXISTING PAVEMENTS SHALL HAVE SAWCUT EDGES AND NEW PAVEMENT REINSTATED TO NEATLY MATCH EXISTING LEVELS.

REMAINING — EXISTING PAVEMENT AREAS THAT REMAIN, WHERE CRACKING IS EVIDENT SHALL BE SEALED WITH A PROPRIETARY BITUMINOUS PRODUCT TO THE MANUFACTURERS' SPECIFICATIONS.

CONCRETE JOINTING — SAWCUT OR TOOLED CONSTRUCTION JOINTS SHALL BE PROVIDED AT MAX. 2.0m CENTRES TO ALL FOOTPATHS OR PEDESTRIAN PAVING UNLESS NOTED OTHERWISE. A 19mm EXPANSION JOINT SHALL BE PROVIDED WHENEVER RIGID PAVEMENTS ABUT FIXED STRUCTURES OR AT MAX. 15m CENTRES TO FOOTPATHS.
DOWELLED SAWCUT AND CONSTRUCTION JOINTS SHALL BE PROVIDED TO ALL VEHICULAR PAVEMENTS AS DETAILED ON THE DRAWINGS, TYPICALLY NOT GREATER THAN 6.0m CENTRES AND JOINT SPACING SHALL ENSURE SLAB LENGTH (L) =1.5 SLAB WIDTH.

PAVEMENT TESTING — EACH ROAD PAVEMENT LAYER SHALL BE TEST FOR COMPACTION BY A NATA REGISTERED GEOTECHNICAL ENGINEER IN ACCORDANCE WITH AS1289 AND SHALL MEET THE FOLLOWING STANDARDS:

ASPHALT LAYERS	UP TO 50mm THICKNESS - 94% CHARACTERISTIC VALUE OF DENSITY RATIO
	GREATER THAN 50mm THICKNESS - 96% CHARACTERISTIC VALUE OF DENSITY RATIO
BASE LAYER	98% MODIFIED DRY DENSITY
SUB BASE LAYER	98% MODIFIED DRY DENSITY
SUB GRADE	98% STANDARD DRY DENSITY

COMPACTION TEST RESULT SHALL BE FORWARDED TO THE SUPERINTENDENT AND COUNCIL'S SUPERVISING ENGINEER FOR APPROVAL PRIOR TO THE PLACEMENT OF SUBSEQUENT PAVEMENT LAYERS. TESTING RATES SHALL BE :

ARTERIAL ROADS	6 TESTS/LOT
OTHER	3 TESTS/LOT

A LOT SHALL BE THE SMALLER OF 5000m^2 OR ONE DAYS PRODUCTION.

WHERE SO REQUIRED, THE CONTRACTOR SHALL PROVIDE ADDITIONAL TEST TO THE SUPERINTENDENT'S SATISFACTION.

13. KERBS

PROPOSED — WHERE REQUIRED MATCH ALL NEW KERBS TO EXISTING LEVEL NEATLY, ENSURING MINIMUM 1 IN 250 GRADE, SAW CUTTING AND REINSTATING PAVEMENT IN FRONT OF KERB TO FALL TO NEW KERB LEVEL.

14. SPECIFICATIONS — GREATER HUME SHIRE COUNCIL SPECIFICATIONS SHALL BE USED AS THE GENERAL SPECIFICATION FOR ALL WORKS. IT IS THE CONTRACTOR'S RESPONSIBILITY TO OBTAIN A COPY OF THE CURRENT SPECIFICATIONS, ALL RELEVANT STANDARD DRAWINGS AND ALL ASSOCIATED REVISIONS AND AMENDMENTS ETC.

GEOTECHNICAL NOTES FOR LEVEES

15. CLEARING AND GRUBBING

THE SITE SHALL BE CLEARED AND GRUBBED BEFORE COMMENCEMENT OF WORKS. CLEARING IS THE REMOVAL AND DISPOSAL OF TREES AND SURFACE VEGETATION, RUBBISH, OBSTRUCTIONS, DISUSED STRUCTURES, ETC. GRUBBING IS THE REMOVAL AND DISPOSAL OF STUMPS, LARGE ROOTS AND OTHER OBSTRUCTIONS TO A DEPTH OF NOT LESS THAN 500mm.

16. STRIPPING OF TOPSOIL

TOPSOIL SHALL BE STRIPPED TO EXPOSE THE UNDERLYING NATURAL SANDS OR CLAYS. STRIPPED TOPSOIL SHALL BE STOCKPILED AND USED FOR TOPSOILING THE LEVEE WHEN THE BULK EARTHWORKS ARE COMPLETED.

17. EXCAVATION

ANY ORGANIC OR SPONGY MATERIAL REMAINING AFTER STRIPPING OF THE TOPSOIL SHALL BE REMOVED TO SPOIL. WHERE A CUT-OFF TRENCH HAS BEEN SPECIFIED TO INTERCEPT PERMEABLE LAYERS IN THE FOUNDATION, IT IS TO BE EXCAVATED TO THE LINES AND LEVELS SHOWN ON THE DRAWINGS OR AS APPROVED ON SITE BY A LEVEE/DAM/GEOTECHNICAL ENGINEER RESPONSIBLE FOR THE DESIGN OR HIS/HER AUTHORISED REPRESENTATIVE.

18. FOUNDATION TREATMENT

THE FOUNDATION MUST BE SCARIFIED AND RE-COMPACTED TO REMOVE ALL CRACKS, FISSURES AND OTHER DISCONTINUITIES IN THE UPPER FOUNDATION. THE LEVEE FOUNDATION SHALL BE PREPARED BY SCARIFYING TO A MINIMUM DEPTH OF 200mm, MOISTURE CONDITIONING TO BRING IT TO THE REQUIRED MOISTURE CONTENT AND COMPACTING TO THE SPECIFIED DENSITY FOR COMPACTED FILL.

19. MATERIALS

THE SUITABILITY OF MATERIAL TO BE USED FOR CONSTRUCTION OF THE LEVEE BANKS SHALL BE DETERMINED BY GEOTECHNICAL TESTING AND THE SUPERINTENDENT'S APPROVAL. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE PROCUREMENT OF SUFFICIENT MATERIAL TO COMPLETE THE WORK UNDER THE CONTRACT.

EARTHFILL / CLAY CORE MATERIAL TO BE USED FOR THE LEVEE SHALL CONSIST OF:

- THE MATERIAL IS FREE OF ORGANIC OR DELETERIOUS MATERIAL
- NO ROCK OR SOIL LUMPS GREATER THAN 50mm
- MORE THAN 75% PASSING THROUGH THE 4.75mm SIEVE
- MORE THAN 30% PASSING THROUGH THE 75 μm SIEVE
- A SOIL PLASTICITY INDEX OF GREATER THAN 10%
- A SOIL LIQUID LIMIT LESS THAN 50%
- A HYDRAULIC CONDUCTIVITY ON A REMOULDED SAMPLE COMPACTED TO 95% STANDARD DRY DENSITY RATIO CLOSE TO THE OPTIMUM MOISTURE CONTENT WITH A LABORATORY MEASURED COEFFICIENT OF PERMEABILITY OF LESS $1x10^{-9}$ m/s
- EMERSON NUMBER OF 4 OR GREATER
- PINHOLE EROSION OF ND2 OR LESS
- EARTHFILL MATERIAL MEETING THE REQUIREMENTS FOR THE LEVEE CORE IS EXPECTED TO HAVE A AS1726 CLASSIFICATION OF CLAY
- INITIALLY A MINIMUM OF THREE SAMPLES SHOULD BE TAKEN FROM THE BORROW SOURCE FOR THE LEVEE MATERIALS AND TESTED TO CONFIRM THAT THE SPECIFICATION HAS BEEN MET. THE SAMPLES SHOULD BE SELECTED RANDOMLY FROM THROUGHOUT THE BORROW SOURCE AREA.IF ANY OF THE TEST RESULTS FAIL THEN THE BORROW SOURCE SHOULD EITHER BE REJECTED, OR THE BORROW SOURCE SHOULD BE SEGREGATED INTO AREAS AND EACH AREA TESTED AGAIN WITH THREE TESTS TO CONFIRM COMPLIANCE. DURING THE CONSTRUCTION A SAMPLE OF THE BORROW MATERIAL SHOULD BE TAKEN ON A WEEKLY BASIS FOR CONFIRMATION TESTING TO ENSURE THAT THE SPECIFICATION IS BEING MET. IN ADDITION, IT IS RECOMMENDED THAT A DAILY VISUAL INSPECTION BE CONDUCTED BY THE GITA TO ASSESS FOR ANY VISUAL CHANGES IN THE MATERIALS. IF VISUAL CHANGES ARE IDENTIFIED THEN AN ADDITIONAL SAMPLE OF THE MATERIAL SHOULD BE TAKEN FOR COMPLIANCE TESTING AND APPROVAL BY THE GITA

20. CONSTRUCTION OF EMBANKMENTS

ONCE THE EXCAVATED BASE FOR THE EMBANKMENTS IS SUITABLY PREPARED, THE EMBANKMENT SHOULD THEN BE PLACED IN NEAR HORIZONTAL LAYERS NOT EXCEEDING 150mm (COMPACTED) IN THICKNESS. IT IS RECOMMENDED THAT THE CLAY BE OVER-PLACED ON THE SIDE SLOPES TO ENSURE COMPACTION NEAR THE EDGES OF THE EMBANKMENT AND THEN BE CUT BACK TO THE FINAL PROPOSED SIDE SLOPE SHAPE. THE LEVEE BANKS SHALL BE CONSTRUCTED TO ACHIEVE A MINIMUM DRY DENSITY RATIO OF 95% STANDARD COMPACTION AS DETERMINED BY AS 1289 - DETERMINATION OF THE DRY DENSITY/MOISTURE CONTENT RELATION OF A SOIL USING STANDARD COMPACTION EFFORT WITH THE MOISTURE CONTENT BETWEEN OMC AND +2% OF THE OMC (OPTIMUM MOISTURE CONTENT) BOTH TESTED IN ACCORDANCE WITH AUSTRALIAN STANDARD 1289 TESTING OF SOILS FOR ENGINEERING PURPOSES.

21. MOISTURE CONDITIONING OF COMPACTED CLAY

MOISTURE CONDITIONING OF THE CLAYS MAY BE REQUIRED DURING CONSTRUCTION IN ORDER TO ENSURE NEAR UNIFORM MOISTURE CONTENT FOR THE EMBANKMENTS/CLAY CORE. THE CONTRACTOR WILL NEED TO MAKE AN ON-SITE ASSESSMENT OF THE MOISTURE CONDITIONING REQUIRED DURING THE TENDER PERIOD AND THE METHODOLOGY REQUIRED TO ACHIEVE THE MOISTURE CONTENT. IF CONSIDERABLE CURING OF THE CLAY IS REQUIRED PRIOR TO COMPACTION, THIS MAY RESULT IN CONSTRUCTION DELAYS. IT IS RECOMMENDED THAT SAMPLES OF THE CLAYS BE TAKEN AND TESTED CLOSER TO CONSTRUCTION TO ALLOW THE EXTENT OF THE MOISTURE CONDITIONING TO BE DETERMINED. THE SURFACE OF THE COMPACTED LAYERS SHOULD NOT BE ALLOWED TO DRY AND CRACK BEFORE PLACEMENT OF SUBSEQUENT LAYERS. IF THIS SHOULD OCCUR, THEN ALL DRIED CLAYS SHOULD BE STRIPPED AND REPLACED, OR ALTERNATIVELY, SCARIFIED AND CONDITIONED TO THE RECOMMENDED MOISTURE TOLERANCES BEFORE PLACING THE NEXT LAYER.

22. CREST TREATMENT

THE INTEGRITY OF AN EARTHEN LEVEE IS MAINTAINED LARGELY BY ENSURING THAT THE COMPACTED BANK REMAINS AT OR NEAR ITS OPTIMUM MOISTURE CONTENT. UNDER MOST CONDITIONS, THIS REQUIRES THAT THE CREST OF THE LEVEE BE PROTECTED AGAINST DRYING OUT OR CRACKING BY THE PROVISION OF A CREST CAPPING LAYER. IN THE CASE OF UN-TRAFFICKED LEVEES, THIS COULD INVOLVE A 150 MM THICK, LOW-PLASTICITY LOCAL TOPSOIL WITH A GOOD GRASS COVER. THE GRASS VARIETIES SHOULD BE SELECTED TO SUIT LOCAL CONDITIONS, REQUIRE LOW MAINTENANCE, MINIMISE FIRE HAZARD AND PROVIDE A THICK, EROSION-RESISTANT COVER WITH A STRONG BINDING CAPACITY ROOT SYSTEM.

23. BATTER TREATMENT

BATTERS TO BE PROTECTED BY 100mm OF TOPSOIL TO BE REGRADED OVER EARTHEN LEVEE AND SEEDED

CAN BE PROTECTED BY TOPSOILING AND GRASSING AS FOR THE CREST CAPPING DESCRIBED BEFORE

24. LEVEE DESIGN - SUBSURFACE INVESTIGATION REQUIRED

THIS LEVEE DESIGN IS BASED ON A SUBSURFACE PROFILE DEVELOPED FROM A LIMITED NUMBER OF BOREHOLES. THE BOREHOLES HAVE IDENTIFIED A VARIABLE SUBSURFACE PROFILE THAT NEEDS TO BE CONFIRMED DURING CONSTRUCTION. TO ENSURE PROPER CONSTRUCTION AND STABILITY, THE ACTUAL SUBGRADE CONDITIONS MUST BE VERIFIED BY A QUALIFIED GEOTECHNICAL ENGINEER DURING THE CONSTRUCTION PROCESS.

25. CONTRACTOR ACTION REQUIRED:

THE CONTRACTOR AND THEIR APPOINTED SITE ENGINEER WILL HAVE THE RESPONSIBILITY OF CONFIRMING THE SUB SURFACE PROFILE. THEY SHOULD CONDUCT SUBSURFACE VISUAL ASSESSMENT (TEST PITS) ON A MAXIMUM OF 30-METRE INTERVALS ALONG THE LEVEE ALIGNMENT. THIS ASSESSMENT CAN BE CONDUCTED DURING LEVEE FOUNDATION HOLDPOINT AND THE THICKNESS OF THE VERY STIFF TO HARD NATURAL CLAY LAYER (VST TO HARD CLAY) SHALL BE CONFIRMED BY THE SITE ENGINEER.

NOTE: THE SPACING OF 30 METRES FOR INVESTIGATIONS IS AN UPPER LIMIT GUIDELINE. SHOULD SIGNIFICANT VARIABILITY BE IDENTIFIED THEN A CLOSER SPACING MAY BE REQUIRED AS DETERMINED BY THE SUBCONTRACTOR'S GEOTECHNICAL ENGINEER.

SPECIFICALLY, THE INVESTIGATIONS SHOULD CONFIRM THE FOLLOWING:

FOR THE BEST-CASE SUB SURFACE SCENARIO: THE THICKNESS OF THE VERY STIFF TO HARD NATURAL CLAY LAYER (VST TO HARD CLAY) MUST BE GREATER THAN 1.0 METRE. SHOULD SUCH A LAYER NOT BE IDENTIFIED (I.E. SANDS, GRAVELS, SILTS OR SOFTER CLAYS ARE ENCOUNTERED) THEN THE WORST-CASE SUB SURFACE SCENARIO SHOULD BE ADOPTED.

Rev.	Date	Description	Des.	Verif.	Appd.
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Drawn	SB	Date 16/04/20
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Designed	AW	Date 16/04/20
Verified		Date
Approved		Date

Client: GREATER HUME SHIRE COUNCIL
Project: HHC FLOOD LEVEE DESIGN
HOLBROOK, HENTY
& CULCAIRN
Title: GENERAL NOTES
Status: FOR TENDER ONLY
NOT TO BE USED FOR CONSTRUCTION PURPOSES

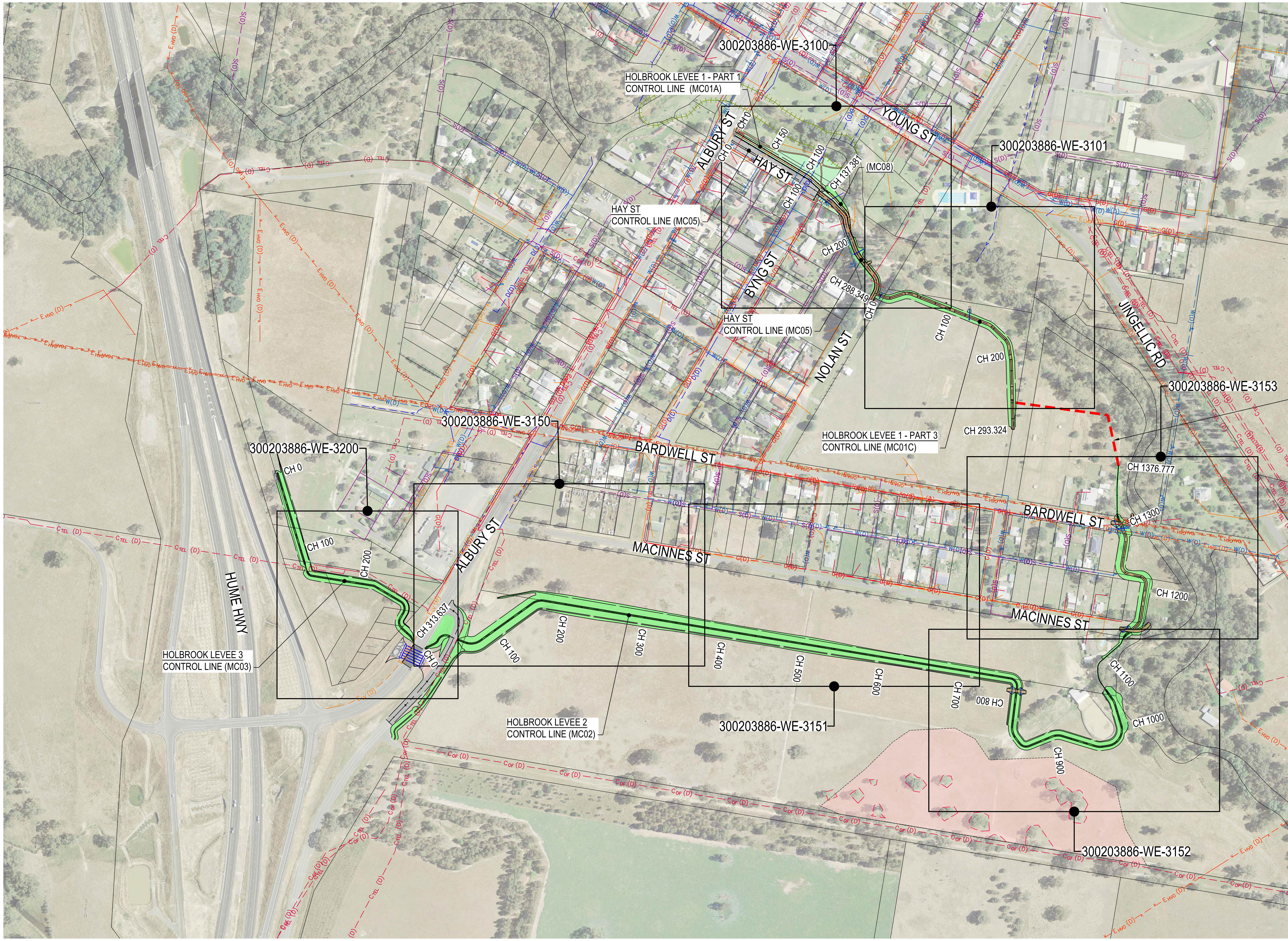
VERT. DATUM	HORZ. DATUM	Scale	Size
AHD	MGA	NTS	A1

Drawing Number: 300203886-WE-3001
Revision: A

XREF's:
CAD File: \\au2013-ppfss01\shared_projects\300203886\300 Levee Design\300203886-WE-3000.dwg

DATE PLOTTED: 8 May 2024 1:22 PM BY : HAZELGROVE, ADAM

XREFs: XR-03886-VIC-MAP; XR-AWE200028-HOLBROOK-IMAGE; XR-03886-BASE-HOL; XR_03886_SU_BYDA_STRM; XR_03886_SU_BYDA_COMM; XR_03886_SU_BYDA_ELEC; XR_03886_SU_BYDA_SERV; XR-03886-LEGEND; XR-03886-ALGN-CHNG
CAD File: \\au2013-ppfss01\shared_projects\300203886\300 Levee Design\300203886-WE-3050.dwg



THIS DESIGN INCLUDES A GAP OF APPROXIMATELY 200 METERS BETWEEN THE HOLBROOK 1 AND HOLBROOK 2 LEVEE SEGMENTS. THE COMPLETION OF THIS APPROXIMATELY 200 METER LEVEE IS CONTINGENT UPON FUTURE INVESTIGATION AND DESIGN, AIMING TO ENHANCE FLOOD PROTECTION IN THIS AREA BY PROVIDING A 600mm FREEBOARD.

LEGEND

- GRASS - TURFED
- LEVEE BENCH
- LEVEE BATTER - GRASS SEEDED
- ASPHALT PAVEMENT - P1
- ASPHALT PAVEMENT - P2
- CONCRETE PATH - C1
- GRAVEL MAINTENANCE TRACK - G1
- GRAVEL PATH - G2
- GRAVEL ROAD - G3
- ROCK BEACHING
- EARTHWORKS - CUT
- PROPERTY BOUNDARY - VICMAP
- EXISTING SURFACE DRAIN
- G(D) EXISTING GAS (BYDA)
- S(D) EXISTING SEWER (BYDA)
- W(D) EXISTING WATER RETIC. (BYDA)
- D(D) EXISTING STORMWATER PIPE (BYDA)
- E_{LV} (D) EXISTING LOW VOLTAGE - UNDERGROUND
- E_{LVO} (D) EXISTING LOW VOLTAGE - OVERHEAD
- E_{HVO} (D) EXISTING HIGH VOLTAGE - OVERHEAD
- C_{TEL} (D) EXISTING TELECOMMUNICATIONS
- SURVEY QUALITY LEVEL
- UTILITY TYPE

WARNING

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CONTRACTOR TO VERIFY EXISTING SERVICES CONNECTION LEVELS PRIOR TO CONSTRUCTION. ANY DISCREPANCIES MUST BE IMMEDIATELY IDENTIFIED AND THE SUPERINTENDENT NOTIFIED PRIOR TO CONSTRUCTION COMMENCING.

HOLBROOK SITE PLAN

SCALE 1:2500

Rev.	Date	Description	Des.	Verif.	Appd.
A	10/05/2024	TENDER ISSUE	VZ		AS

NORTH

0 50 100m
SCALE 1:2500 @A1

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Verified		Date
Approved		Date

Client: GREATER HUME SHIRE COUNCIL

Project: HHC FLOOD LEVEE DESIGN
HOLBROOK, HENTY
& CULCAIRN

Title: HOLBROOK SITE PLAN

Status: FOR TENDER ONLY
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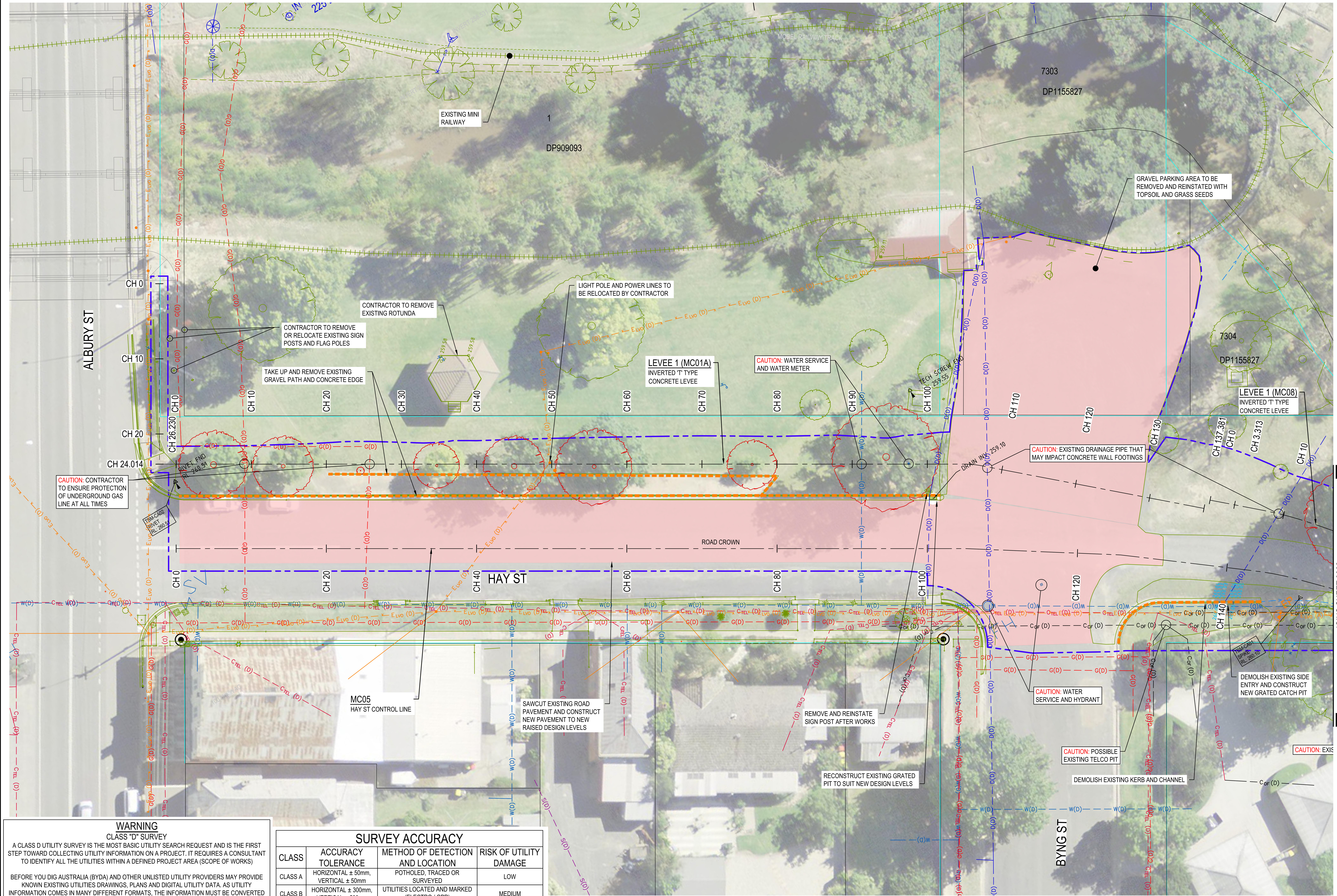
VERT. DATUM	HORZ. DATUM	Scale	Size
AHD	MGA	AS SHOWN	A1

Drawing Number: 300203886-WE-3050
Revision: A



LEGEND

260.0	EXISTING SURFACE CONTOUR - MAJOR
	EXISTING SURFACE CONTOUR - MINOR
450 450	EXISTING STORMWATER PIPE (SURVEY)
D(D)	EXISTING STORMWATER PIPE (BYDA)
>	EXISTING SURFACE DRAIN
	EXISTING DISH DRAIN
	EXISTING TOP OF BATTER
	EXISTING BOTTOM OF BATTER
	EXISTING MINI RAIL TRACK
G(D)	EXISTING GAS (BYDA)
S(D)	EXISTING SEWER (BYDA)
W(D)	EXISTING WATER RETIC. (BYDA)
C_{OF} (D)	EXISTING OPTICAL FIBRE (BYDA)
E_{HVO} (D)	EXISTING HIGH VOLTAGE - OVERHEAD
E_{LV} (A)	EXISTING LOW VOLTAGE - UNDERGROUND
E_{LVO} (A)	EXISTING LOW VOLTAGE - OVERHEAD
C_{TEL} (D)	EXISTING TELECOMMUNICATIONS
	SURVEY QUALITY LEVEL
	UTILITY TYPE
	EXISTING WIRE FENCE
	EXISTING FENCE
	EXISTING SAFETY FENCE
	EXISTING GUARDRAIL
	PROPERTY BOUNDARY - SURVEY
	PROPERTY BOUNDARY - VICMAP
	LIMIT OF WORKS
	EXISTING TREE
	EXISTING TREE TO BE REMOVED
X X X	FEATURE TO BE DEMOLISHED
	KERBS TO BE DEMOLISHED
	DRAINAGE FEATURES TO BE DEMOLISHED
	PAVEMENTS/FOOTPATHS/CROSSOVERS

WARNING

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WARNING

CLASS "D" SURVEY

A CLASS D UTILITY SURVEY IS THE MOST BASIC UTILITY SEARCH REQUEST AND IS THE FIRST STEP TOWARD COLLECTING UTILITY INFORMATION ON A PROJECT. IT REQUIRES A CONSULTANT TO IDENTIFY ALL THE UTILITIES WITHIN A DEFINED PROJECT AREA (SCOPE OF WORKS)

BEFORE YOU DIG AUSTRALIA (BYDA) AND OTHER UNLISTED UTILITY PROVIDERS MAY PROVIDE KNOWN EXISTING UTILITIES DRAWINGS, PLANS AND DIGITAL UTILITY DATA. AS UTILITY INFORMATION COMES IN MANY DIFFERENT FORMATS, THE INFORMATION MUST BE CONVERTED INTO A FORMAT THAT CAN BE UTILISED IN PLANNING AND DESIGN SOFTWARE.

IT IS IMPORTANT TO NOTE THAT THE ACCURACY OF CLASS D DATA IS UNVERIFIED, MEANING THE ACTUAL POSITION UNDERGROUND MAY DIFFER SIGNIFICANTLY FROM WHAT IS DENOTED ON A PLAN OR DIGITAL DATA PROVIDED BY THE UTILITY PROVIDER.

SURVEY ACCURACY

CLASS	ACCURACY TOLERANCE	METHOD OF DETECTION AND LOCATION	RISK OF UTILITY DAMAGE
CLASS A	HORIZONTAL ± 50mm, VERTICAL ± 50mm	POTHOLED, TRACED OR SURVEYED	LOW
CLASS B	HORIZONTAL ± 300mm, VERTICAL ± 500mm	UTILITIES LOCATED AND MARKED (ELECTRO / GPR)	MEDIUM
CLASS C	HORIZONTAL ± 500mm, VERTICAL UNKNOWN	VISUAL UTILITY IDENTIFICATION (PITS & MANHOLES SURVEYED)	HIGH
CLASS D	UNKNOWN HORIZONTAL AND VERTICAL	BYDA PLANS OR UNKNOWN SOURCE	HIGH

HOLBROOK 1 LAYOUT PLAN

SCALE 1:250

NOTE:
1. REFER TO DRAWING 300203886-WE-3001 FOR GENERAL NOTES.
2. REFER TO DRAWING 300203886-WE-3050 FOR LAYOUT KEY PLAN.

Rev.	Date	Description	Des.	Verif.	Appd.
A	10/05/2024	TENDER ISSUE	VZ		AS

NORTH

0 5 10m
SCALE 1:250 @A1

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Drawn AJH	Date 06/03/24	
Checked VZ	Date 23/04/24	
Designed AS	Date 23/04/24	
Verified	Date	
Approved	Date	

Client: GREATER HUME SHIRE COUNCIL

Project: HHC FLOOD LEVEE DESIGN
HOLBROOK, HENTY & CULCAIRN

Title: HOLBROOK EXISTING FEATURES AND DEMOLITION PLAN
LEVEE 1 - SHEET 1

Status: FOR TENDER ONLY
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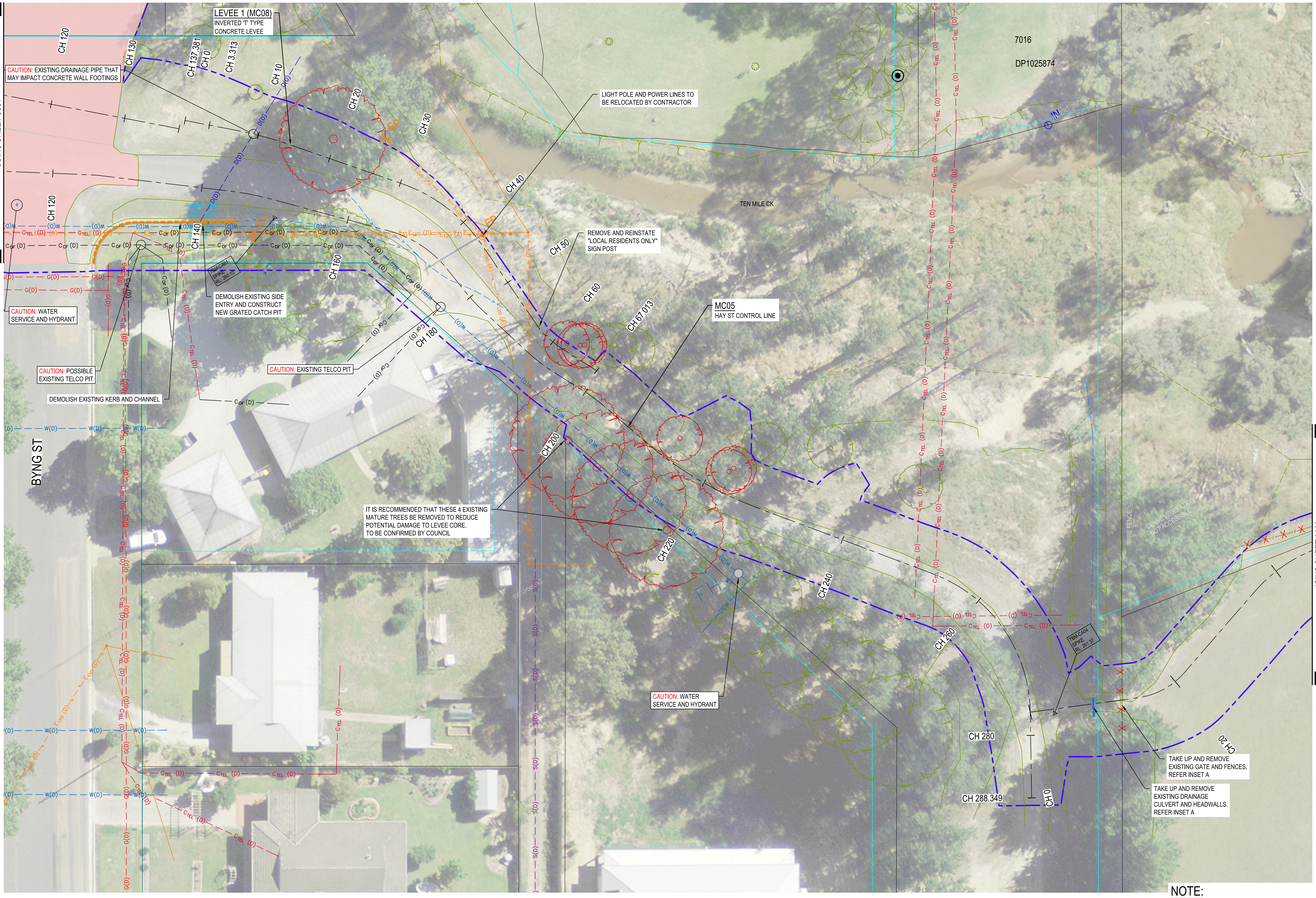
VERT. DATUM	HORZ. DATUM	Scale	Size
AHD	MGA	AS SHOWN	A1

Drawing Number: 300203886-WE-3061 | Revision: A



LEGEND

- EXISTING SURFACE CONTOUR - MAJOR
- EXISTING SURFACE CONTOUR - MINOR
- EXISTING STORMWATER PIPE (SURVEY)
- EXISTING STORMWATER PIPE (BYDA)
- EXISTING SURFACE DRAIN
- EXISTING DISH DRAIN
- EXISTING TOP OF BATTER
- EXISTING BOTTOM OF BATTER
- EXISTING MINI RAIL TRACK
- EXISTING GAS (BYDA)
- EXISTING SEWER (BYDA)
- EXISTING WATER RETIC. (BYDA)
- EXISTING OPTICAL FIBRE (BYDA)
- EXISTING HIGH VOLTAGE - OVERHEAD
- EXISTING LOW VOLTAGE - UNDERGROUND
- EXISTING LOW VOLTAGE - OVERHEAD
- EXISTING TELECOMMUNICATIONS
- SURVEY QUALITY LEVEL
- UTILITY TYPE
- EXISTING WIRE FENCE
- EXISTING FENCE
- EXISTING SAFETY FENCE
- EXISTING GUARDRAIL
- PROPERTY BOUNDARY - SURVEY
- PROPERTY BOUNDARY - VICMAP
- LIMIT OF WORKS
- EXISTING TREE
- EXISTING TREE TO BE REMOVED
- FEATURE TO BE DEMOLISHED
- KERBS TO BE DEMOLISHED
- DRAINAGE FEATURES TO BE DEMOLISHED
- PAVEMENTS/FOOTPATHS/CROSSOVERS

WARNING
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HOLBROOK 1 LAYOUT PLAN
SCALE 1:250

NOTE:
1. REFER TO DRAWING 300203886-WE-3001 FOR GENERAL NOTES.
2. REFER TO DRAWING 300203886-WE-3050 FOR LAYOUT KEY PLAN.
3. REFER TO DRAWING 300203886-WE-3061 FOR SURVEY QUALITY LEVEL NOTE.

Rev.	Date	Description	Des.	Verif.	Appd.
A	10/05/2024	TENDER ISSUE	VZ		AS

NORTH
0 5 10m
SCALE 1:250 @A1

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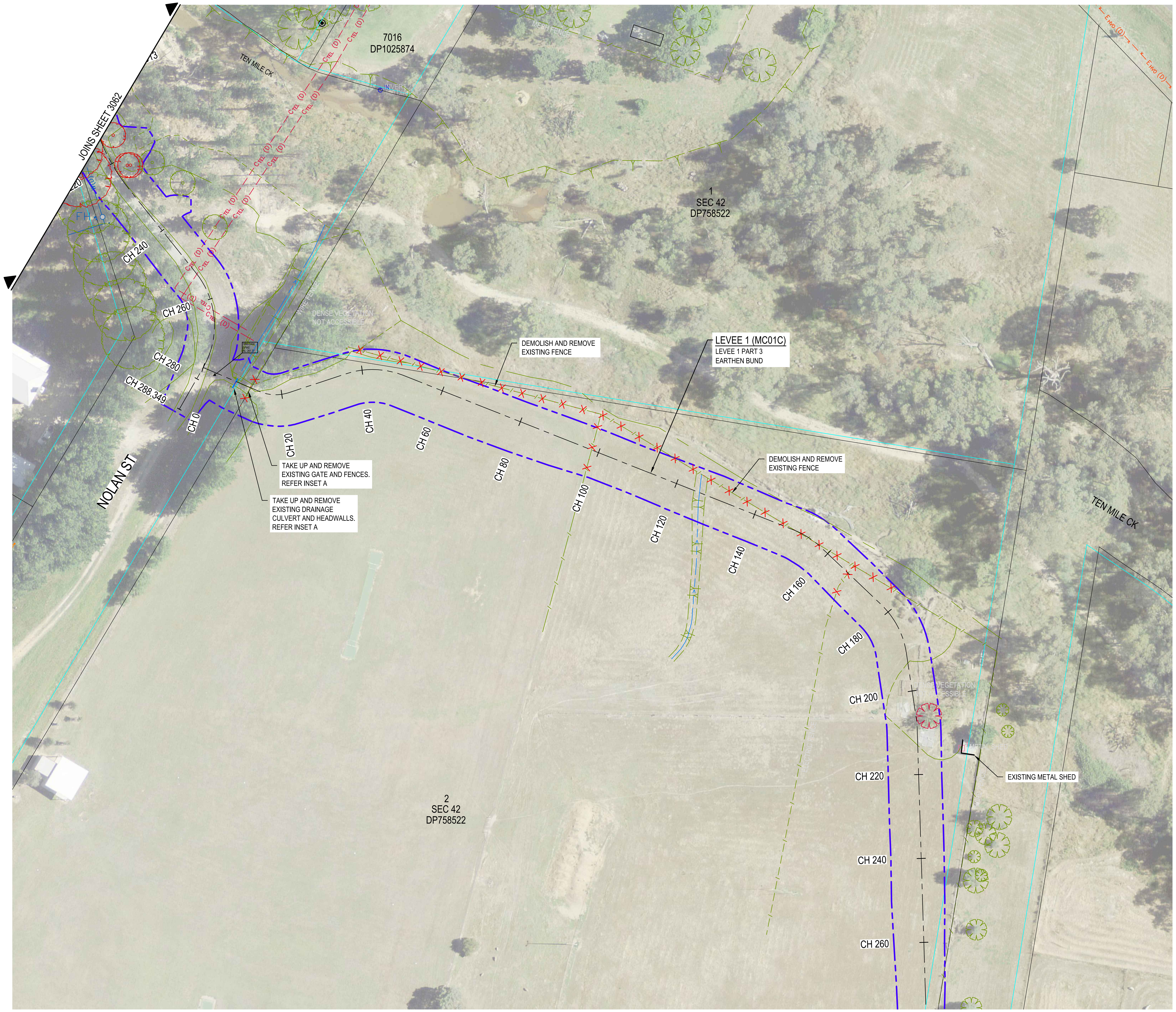
Designed AS	Date 23/04/24	
Verified	Date	
Approved	Date	

Client: GREATER HUME SHIRE COUNCIL
Project: HHC FLOOD LEVEE DESIGN HOLBROOK, HENTY & CULCAIRN
Title: HOLBROOK EXISTING FEATURES AND DEMOLITION PLAN LEVEE 1 - SHEET 2
Status: FOR TENDER ONLY — NOT TO BE USED FOR CONSTRUCTION PURPOSES
VERT. DATUM: AHD | HORZ. DATUM: MGA | Scale: AS SHOWN | Size: A1
Drawing Number: 300203886-WE-3062 | Revision: A

DATE PLOTTED: 10 May 2024 8:07 AM BY : HAZELGROVE, ADAM



HOLBROOK 1 LAYOUT PLAN

SCALE 1:500

LEGEND

260.0	EXISTING SURFACE CONTOUR - MAJOR
	EXISTING SURFACE CONTOUR - MINOR
450 450	EXISTING STORMWATER PIPE (SURVEY)
D(D)	EXISTING STORMWATER PIPE (BYDA)
>	EXISTING SURFACE DRAIN
	EXISTING DISH DRAIN
	EXISTING TOP OF BATTER
	EXISTING BOTTOM OF BATTER
	EXISTING MINI RAIL TRACK
G(D)	EXISTING GAS (BYDA)
S(D)	EXISTING SEWER (BYDA)
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C_{OF} (D)	EXISTING OPTICAL FIBRE (BYDA)
E_{HVO} (D)	EXISTING HIGH VOLTAGE - OVERHEAD
E_{LV} (A)	EXISTING LOW VOLTAGE - UNDERGROUND
E_{LVO} (A)	EXISTING LOW VOLTAGE - OVERHEAD
C_{TEL} (D)	EXISTING TELECOMMUNICATIONS
	SURVEY QUALITY LEVEL
	UTILITY TYPE
	EXISTING WIRE FENCE
	EXISTING FENCE
	EXISTING SAFETY FENCE
	EXISTING GUARDRAIL
	PROPERTY BOUNDARY - SURVEY
	PROPERTY BOUNDARY - VICMAP
	LIMIT OF WORKS
	EXISTING TREE
	EXISTING TREE TO BE REMOVED
X X X	FEATURE TO BE DEMOLISHED
	KERBS TO BE DEMOLISHED
	DRAINAGE FEATURES TO BE DEMOLISHED
	PAVEMENTS/FOOTPATHS/CROSSOVERS

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INSET A

NTS

NOTE:

1. REFER TO DRAWING 300203886-WE-3001 FOR GENERAL NOTES.
2. REFER TO DRAWING 300203886-WE-3050 FOR LAYOUT KEY PLAN.
3. REFER TO DRAWING 300203886-WE-3061 FOR SURVEY QUALITY LEVEL NOTE.

Rev.	Date	Description	Des.	Verif.	Appd.
A	10/05/2024	TENDER ISSUE	VZ		AS

NORTH

0 10 20m

SCALE 1:500 @A1

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Checked VZ	Date 23/04/24	
Designed AS	Date 23/04/24	
Verified	Date	
Approved	Date	

Client: GREATER HUME SHIRE COUNCIL

Project: HHC FLOOD LEVEE DESIGN
HOLBROOK, HENTY
& CULCAIRN

Title: HOLBROOK EXISTING FEATURES
AND DEMOLITION PLAN
LEVEE 1 - SHEET 3

Status: FOR TENDER ONLY
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AHD	MGA	AS SHOWN	A1

Drawing Number: 300203886-WE-3063 | Revision: A

DATE PLOTTED: 10 May 2024 8:07 AM BY : HAZELGROVE, ADAM

XREF's: XR-03886-VIC-MAP; XR-03886-HOLBROOK-IMAGE; XR-03886-BASE-HOL; XR-03886-LEGEND; XR-03886-SURV-HAY; XR-03886-SURV-HB1; XR_03886_SU_BYDA_COMM; XR_03886_SU_BYDA_ELEC; XR_03886_SU_BYDA_SERV; XR_03886_SU_BYDA_STRM; XR-03886-SURV-PWD; XR-03886-ALGN-CHNG; XR-03886-SURV-HB2

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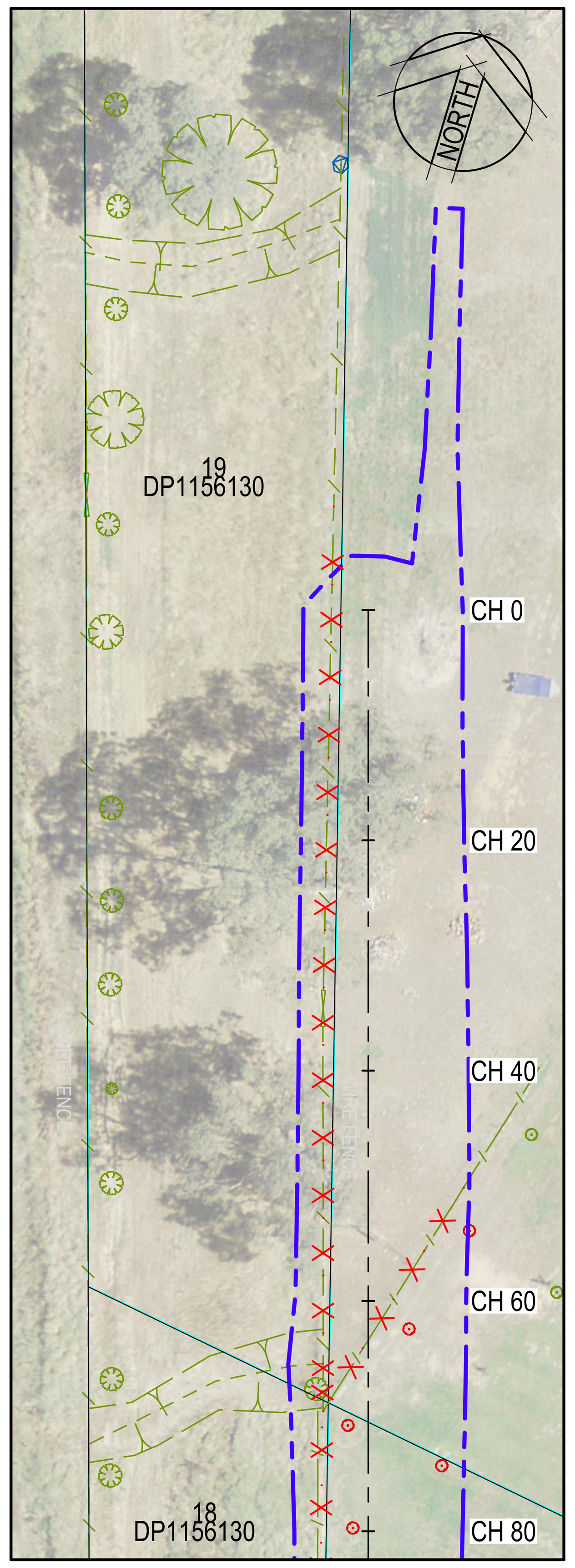
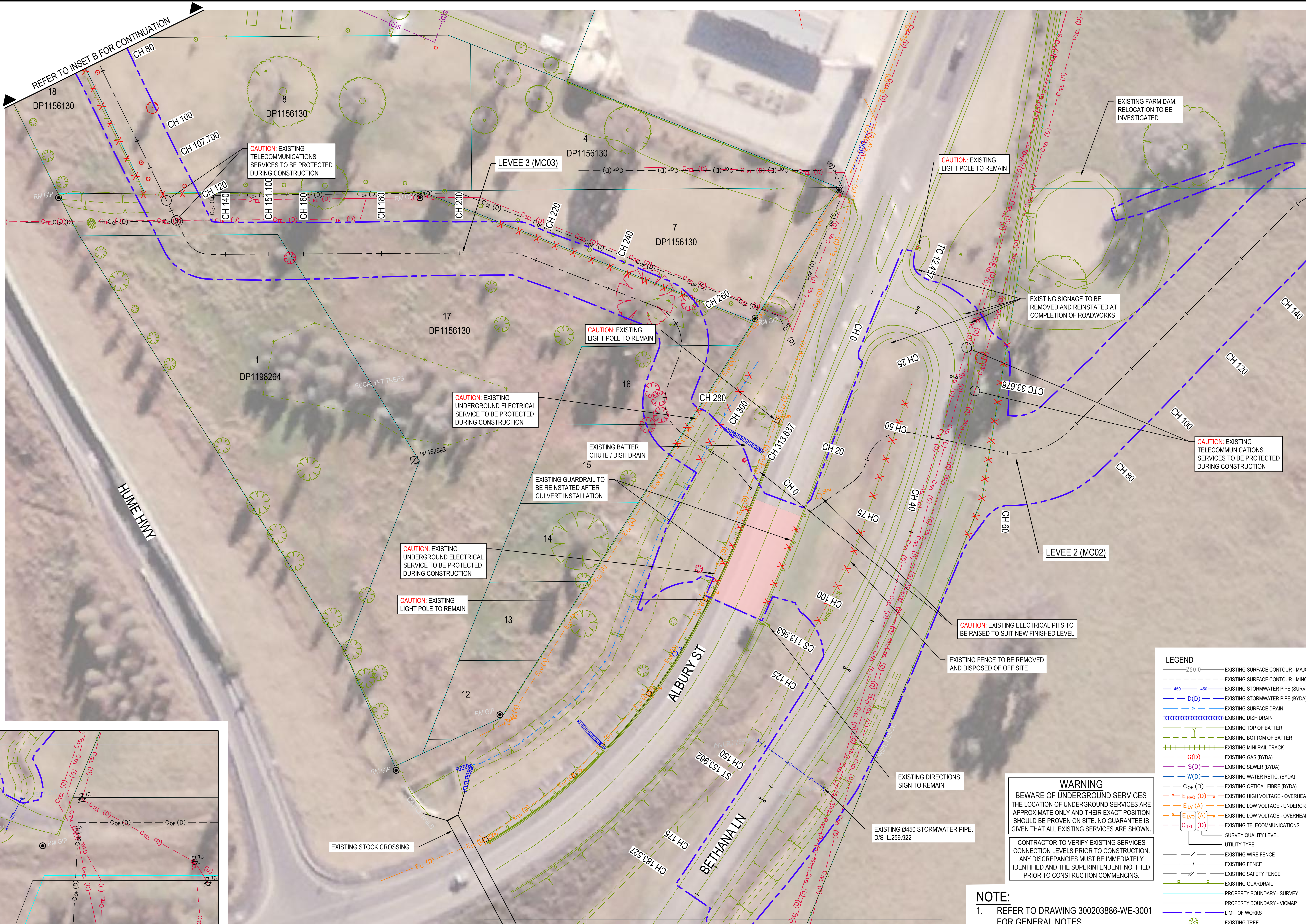
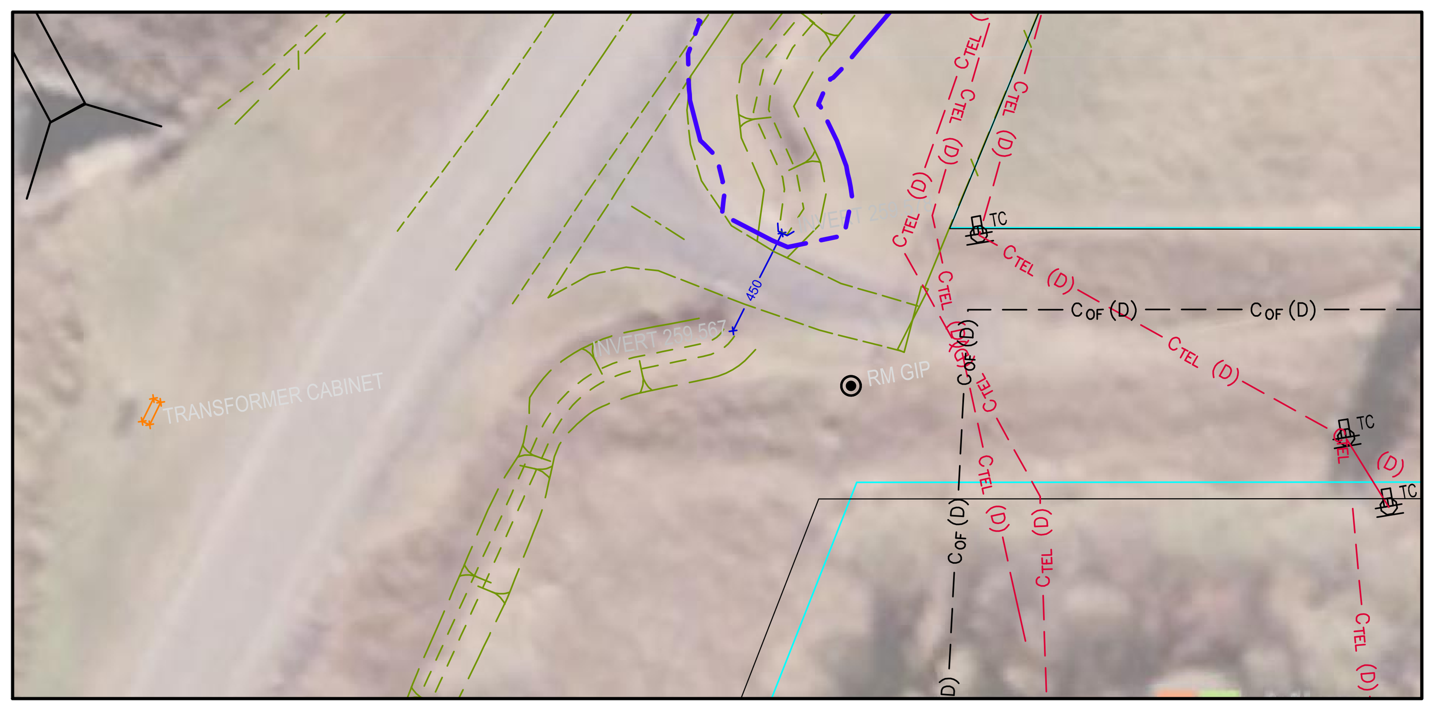


INSET B
SCALE 1:500



HOLBROOK 3 LAYOUT PLAN
SCALE 1:500



INSET C
SCALE 1:500

LEGEND

- EXISTING SURFACE CONTOUR - MAJOR
- EXISTING SURFACE CONTOUR - MINOR
- EXISTING STORMWATER PIPE (SURVEY)
- EXISTING STORMWATER PIPE (BYDA)
- EXISTING SURFACE DRAIN
- EXISTING DISH DRAIN
- EXISTING TOP OF BATTER
- EXISTING BOTTOM OF BATTER
- EXISTING MINI RAIL TRACK
- EXISTING GAS (BYDA)
- EXISTING SEWER (BYDA)
- EXISTING WATER RETIC. (BYDA)
- EXISTING OPTICAL FIBRE (BYDA)
- EXISTING HIGH VOLTAGE - OVERHEAD
- EXISTING LOW VOLTAGE - UNDERGROUND
- EXISTING LOW VOLTAGE - OVERHEAD
- EXISTING TELECOMMUNICATIONS
- SURVEY QUALITY LEVEL
- UTILITY TYPE
- EXISTING WIRE FENCE
- EXISTING FENCE
- EXISTING SAFETY FENCE
- EXISTING GUARDRAIL
- PROPERTY BOUNDARY - SURVEY
- PROPERTY BOUNDARY - VICMAP
- LIMIT OF WORKS
- EXISTING TREE
- EXISTING TREE TO BE REMOVED
- FEATURE TO BE DEMOLISHED
- KERBS TO BE DEMOLISHED
- DRAINAGE FEATURES TO BE DEMOLISHED
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NOTE:

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2. REFER TO DRAWING 300203886-WE-3050 FOR LAYOUT KEY PLAN.
3. REFER TO DRAWING 300203886-WE-3061 FOR SURVEY QUALITY LEVEL NOTE.

Rev.	Date	Description	Des.	Verif.	Appd.
A	10/05/2024	TENDER ISSUE	VZ		AS

SCALE 1:500 @A1 (0, 10, 20m)

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		Date
Drawn	AJH	06/03/24
Checked	VZ	23/04/24
Designed	AS	23/04/24
Verified		
Approved		

Client: GREATER HUME SHIRE COUNCIL
Project: HHC FLOOD LEVEE DESIGN, HOLBROOK, HENTY & CULCAIRN
Title: HOLBROOK EXISTING FEATURES AND DEMOLITION PLAN LEVEE 3

Status: FOR TENDER ONLY
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VERT. DATUM	HORZ. DATUM	Scale	Size
AHD	MGA	AS SHOWN	A1

Drawing Number: 300203886-WE-3064 | Revision: A

DATE PLOTTED: 10 May 2024 8:08 AM BY : HAZELGROVE, ADAM
XREF's: XR-03886-VIC-MAP; XR-03886-HOLBROOK-IMAGE; XR-03886-BASE-HOL; XR-03886-LEGEND; XR-03886-SURV-HAY; XR-03886-SURV-HB1; XR_03886_SU_BYDA_COMM; XR_03886_SU_BYDA_ELEC; XR_03886_SU_BYDA_SERV; XR_03886_SU_BYDA_STRM; XR-03886-SURV-PWO; XR-03886-ALGN-CHNG; XR-03886-SURV-HB2
CAD File: \\au2013-ppfss01\shared_projects\300203886\300 Levee Design\300203886-WE-3060-3067.dwg

LEGEND

- EXISTING SURFACE CONTOUR - MAJOR
- EXISTING SURFACE CONTOUR - MINOR
- EXISTING STORMWATER PIPE (SURVEY)
- EXISTING STORMWATER PIPE (BYDA)
- EXISTING SURFACE DRAIN
- EXISTING DISH DRAIN
- EXISTING TOP OF BATTER
- EXISTING BOTTOM OF BATTER
- EXISTING MINI RAIL TRACK
- EXISTING GAS (BYDA)
- EXISTING SEWER (BYDA)
- EXISTING WATER RETIC. (BYDA)
- EXISTING OPTICAL FIBRE (BYDA)
- EXISTING HIGH VOLTAGE - OVERHEAD
- EXISTING LOW VOLTAGE - UNDERGROUND
- EXISTING LOW VOLTAGE - OVERHEAD
- EXISTING TELECOMMUNICATIONS
- SURVEY QUALITY LEVEL
- UTILITY TYPE
- EXISTING WIRE FENCE
- EXISTING FENCE
- EXISTING SAFETY FENCE
- EXISTING GUARDRAIL
- PROPERTY BOUNDARY - SURVEY
- PROPERTY BOUNDARY - VICMAP
- LIMIT OF WORKS
- EXISTING TREE
- EXISTING TREE TO BE REMOVED
- FEATURE TO BE DEMOLISHED
- KERBS TO BE DEMOLISHED
- DRAINAGE FEATURES TO BE DEMOLISHED
- PAVEMENTS/FOOTPATHS/CROSSOVERS

WARNING
BEWARE OF UNDERGROUND SERVICES
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CONTRACTOR TO VERIFY EXISTING SERVICES CONNECTION LEVELS PRIOR TO CONSTRUCTION. ANY DISCREPANCIES MUST BE IMMEDIATELY IDENTIFIED AND THE SUPERINTENDENT NOTIFIED PRIOR TO CONSTRUCTION COMMENCING.

NOTE:
1. REFER TO DRAWING 300203886-WE-3001 FOR GENERAL NOTES.
2. REFER TO DRAWING 300203886-WE-3050 FOR LAYOUT KEY PLAN.
3. REFER TO DRAWING 300203886-WE-3061 FOR SURVEY QUALITY LEVEL NOTE.

HOLBROOK 2 LAYOUT PLAN
SCALE 1:500

Rev.	Date	Description	Des.	Verif.	Appd.
A	10/05/2024	TENDER ISSUE	VZ		AS

NORTH
0 10 20m
SCALE 1:500 @A1

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Drawn AJH	Date 06/03/24
Checked VZ	Date 23/04/24
Designed AS	Date 23/04/24
Verified	Date
Approved	Date

Client: GREATER HUME SHIRE COUNCIL
Project: HHC FLOOD LEVEE DESIGN HOLBROOK, HENTY & CULCAIRN
Title: HOLBROOK EXISTING FEATURES AND DEMOLITION PLAN LEVEE 2 - SHEET 1

Status: FOR TENDER ONLY
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VERT. DATUM	HORZ. DATUM	Scale	Size
AHD	MGA	AS SHOWN	A1

Drawing Number: 300203886-WE-3065
Revision: A

JOINS SHEET 3067

WARNING
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CONTRACTOR TO VERIFY EXISTING SERVICES CONNECTION LEVELS PRIOR TO CONSTRUCTION. ANY DISCREPANCIES MUST BE IMMEDIATELY IDENTIFIED AND THE SUPERINTENDENT NOTIFIED PRIOR TO CONSTRUCTION COMMENCING.

LEGEND
- 260.0 EXISTING SURFACE CONTOUR - MAJOR
- EXISTING SURFACE CONTOUR - MINOR
- 450 450 EXISTING STORMWATER PIPE (SURVEY)
- D(D) EXISTING STORMWATER PIPE (BYDA)
- > EXISTING SURFACE DRAIN
- EXISTING DISH DRAIN
- EXISTING TOP OF BATTER
- EXISTING BOTTOM OF BATTER
- EXISTING MINI RAIL TRACK
- G(D) EXISTING GAS (BYDA)
- S(D) EXISTING SEWER (BYDA)
- W(D) EXISTING WATER RETIC. (BYDA)
- C_{OF} (D) EXISTING OPTICAL FIBRE (BYDA)
- E_{HVO} (D) EXISTING HIGH VOLTAGE - OVERHEAD
- E_{LV} (A) EXISTING LOW VOLTAGE - UNDERGROUND
- E_{LVO} (A) EXISTING LOW VOLTAGE - OVERHEAD
- C_{TEL} (D) EXISTING TELECOMMUNICATIONS
- SURVEY QUALITY LEVEL
- UTILITY TYPE
- EXISTING WIRE FENCE
- EXISTING FENCE
- EXISTING SAFETY FENCE
- EXISTING GUARDRAIL
- PROPERTY BOUNDARY - SURVEY
- PROPERTY BOUNDARY - VICMAP
- LIMIT OF WORKS
- EXISTING TREE
- EXISTING TREE TO BE REMOVED
- X X X FEATURE TO BE DEMOLISHED
- KERBS TO BE DEMOLISHED
- DRAINAGE FEATURES TO BE DEMOLISHED
- PAVEMENTS/FOOTPATHS/CROSSOVERS

HOLBROOK 2 LAYOUT PLAN
SCALE 1:500

NOTE:
1. REFER TO DRAWING 300203886-WE-3001 FOR GENERAL NOTES.
2. REFER TO DRAWING 300203886-WE-3050 FOR LAYOUT KEY PLAN.
3. REFER TO DRAWING 300203886-WE-3061 FOR SURVEY QUALITY LEVEL NOTE.

Rev.	Date	Description	Des.	Verif.	Appd.
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NORTH
0 10 20m
SCALE 1:500 @A1

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Drawn AJH	Date 06/03/24
Checked VZ	Date 23/04/24
Designed AS	Date 23/04/24
Verified	Date
Approved	Date

Client: GREATER HUME SHIRE COUNCIL

Project: HHC FLOOD LEVEE DESIGN
HOLBROOK, HENTY
& CULCAIRN

Title: HOLBROOK EXISTING FEATURES
AND DEMOLITION PLAN
LEVEE 2 - SHEET 2

Status: FOR TENDER ONLY
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VERT. DATUM	HORZ. DATUM	Scale	Size
AHD	MGA	AS SHOWN	A1

Drawing Number: 300203886-WE-3066 | Revision: A

DATE PLOTTED: 10 May 2024 8:09 AM BY : HAZELGROVE, ADAM
XREFs: XR-03886-VIC-MAP; XR-03886-HOLBROOK-IMAGE; XR-03886-BASE-HOL; XR-03886-LEGEND; XR-03886-SURV-HAY; XR-03886-SURV-HB1; XR_03886_SU_BYDA_COMM; XR_03886_SU_BYDA_ELEC; XR_03886_SU_BYDA_SERV; XR_03886_SU_BYDA_STRM; XR-03886-SURV-PWO; XR-03886-ALGN-CHNG; XR-03886-SURV-HB2
CAD File: \\au2013-ppfss01\shared_projects\300203886\300 Levee Design\300203886-WE-3060-3067.dwg

WARNING

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CONTRACTOR TO VERIFY EXISTING SERVICES CONNECTION LEVELS PRIOR TO CONSTRUCTION. ANY DISCREPANCIES MUST BE IMMEDIATELY IDENTIFIED AND THE SUPERINTENDENT NOTIFIED PRIOR TO CONSTRUCTION COMMENCING.

NOTE:

1. REFER TO DRAWING 300203886-WE-3001 FOR GENERAL NOTES.
2. REFER TO DRAWING 300203886-WE-3050 FOR LAYOUT KEY PLAN.
3. REFER TO DRAWING 300203886-WE-3061 FOR SURVEY QUALITY LEVEL NOTE.

Rev.	Date	Description	Des.	Verif.	Appd.
A	10/05/2024	TENDER ISSUE	VZ		AS

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SCALE 1:500 @A1

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		Date
Drawn	AJH	06/03/24
Checked	VZ	23/04/24
Designed	AS	23/04/24
Verified		
Approved		

Client: GREATER HUME SHIRE COUNCIL

Project: HHC FLOOD LEVEE DESIGN
HOLBROOK, HENTY
& CULCAIRN

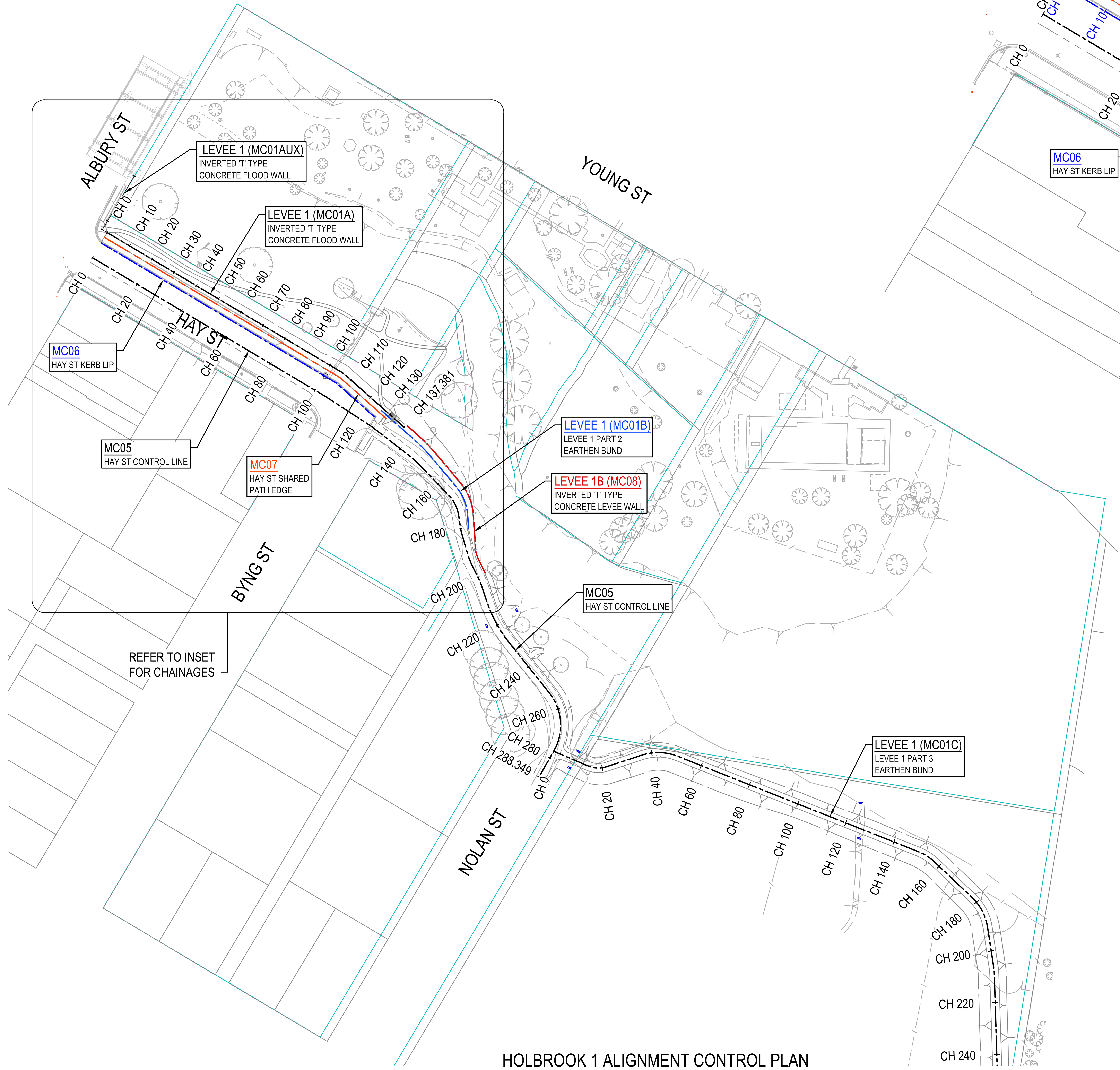
Title: HOLBROOK EXISTING FEATURES
AND DEMOLITION PLAN
LEVEE 2 - SHEET 3

Status: FOR TENDER ONLY
NOT TO BE USED FOR CONSTRUCTION PURPOSES

VERT. DATUM	HORZ. DATUM	Scale	Size
AHD	MGA	AS SHOWN	A1

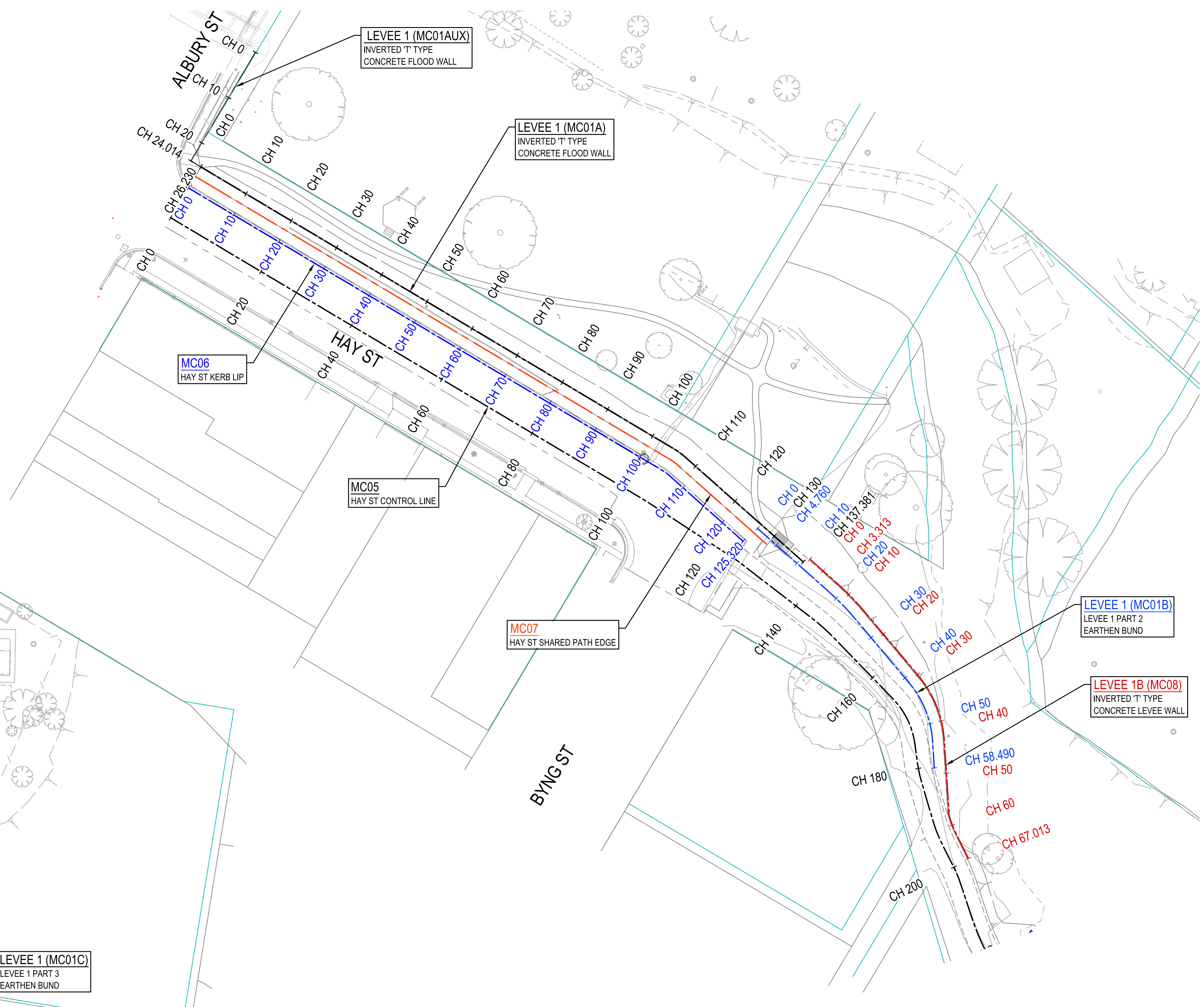
Drawing Number: 300203886-WE-3067
Revision: A

XREF's: XR-03886-VIC-MAP; XR-03886-HOLBROOK-IMAGE; XR-03886-BASE-HOL; XR-03886-LEGEND; XR-03886-SURV-HAY; XR-03886-SURV-HB1; XR_03886_SU_BYDA_COMM; XR_03886_SU_BYDA_ELEC; XR_03886_SU_BYDA_SERV; XR_03886_SU_BYDA_STRM; XR-03886-SURV-PWO; XR-03886-ALGN-CHNG; XR-03886-SURV-HB2
CAD File: \\au2013-ppfss01\shared_projects\300203886\300 Levee Design\300203886-WE-3060-3067.dwg
DATE PLOTTED: 10 May 2024 8:10 AM BY : HAZELGROVE, ADAM



HOLBROOK 1 ALIGNMENT CONTROL PLAN

SCALE 1:1000



HOLBROOK 1 INSET PLAN

SCALE 1:500

NOTE:

1. REFER TO DRAWING 300203886-WE-3001 FOR GENERAL NOTES.
2. REFER TO DRAWING 300203886-WE-3050 FOR LAYOUT KEY PLAN.
3. REFER TO DRAWINGS 300203886-WE-3250 TO 3255 FOR LONGITUDINAL SECTIONS.
4. REFER TO DRAWINGS 300203886-WE-3300 TO 3313 FOR CROSS SECTIONS.
5. REFER TO DRAWINGS 300203886-WE-3450 TO 3457 FOR TYPICAL SECTIONS AND DETAILS.

Rev.	Date	Description	Des.	Verif.	Appd.
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NORTH

0 10 20m
SCALE 1:500 @A1

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Checked	VZ	23/04/24
Designed	AS	23/04/24
Verified		
Approved		

Client: GREATER HUME SHIRE COUNCIL

Project: HHC FLOOD LEVEE DESIGN
HOLBROOK, HENTY
& CULCAIRN

Title: HOLBROOK LEVEES
ALIGNMENT CONTROL PLAN
SHEET 1 OF 2

Status: FOR TENDER ONLY
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VERT. DATUM	HORZ. DATUM	Scale	Size
AHD	MGA	AS SHOWN	A1

Drawing Number: 300203886-WE-3101 Revision: A

DATE PLOTTED: 10 May 2024 7:59 AM BY : HAZELGROVE, ADAM

CAD File: \\au2013-ppfss01\shared_projects\300203886\300 Levee Design\300203886-WE-3100-3102.dwg

NOTE:

1. REFER TO DRAWING 300203886-WE-3001 FOR GENERAL NOTES.
2. REFER TO DRAWING 300203886-WE-3050 FOR LAYOUT KEY PLAN.
3. REFER TO DRAWINGS 300203886-WE-3250 TO 3255 FOR LONGITUDINAL SECTIONS.
4. REFER TO DRAWINGS 300203886-WE-3300 TO 3313 FOR CROSS SECTIONS.
5. REFER TO DRAWINGS 300203886-WE-3450 TO 3457 FOR TYPICAL SECTIONS AND DETAILS.

HOLBROOK 2 & 3 ALIGNMENT CONTROL PLAN

SCALE 1:2000

Rev.	Date	Description	Des.	Verif.	Appd.
A	10/05/2024	TENDER ISSUE	VZ		AS

NORTH

0 50m
SCALE 1:2000 @A1

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Checked VZ	Date 23/04/24	
Designed AS	Date 23/04/24	
Verified	Date	
Approved	Date	

Client: GREATER HUME SHIRE COUNCIL

Project: HHC FLOOD LEVEE DESIGN
HOLBROOK, HENTY
& CULCAIRN

Title: HOLBROOK LEVEES
ALIGNMENT CONTROL PLAN
SHEET 2 OF 2

Status: FOR TENDER ONLY
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VERT. DATUM	HORZ. DATUM	Scale	Size
AHD	MGA	AS SHOWN	A1

Drawing Number: 300203886-WE-3102
Revision: A

DATE PLOTTED: 10 May 2024 8:00 AM BY : HAZELGROVE, ADAM

WARNING

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CONTRACTOR TO VERIFY EXISTING SERVICES CONNECTION LEVELS PRIOR TO CONSTRUCTION. ANY DISCREPANCIES MUST BE IMMEDIATELY IDENTIFIED AND THE SUPERINTENDENT NOTIFIED PRIOR TO CONSTRUCTION COMMENCING.

HOLBROOK 1 LAYOUT PLAN

SCALE 1:500

NOTES:

1. REFER TO DRAWING 300203886-WE-3000 FOR GENERAL NOTES.
2. REFER TO DRAWING 300203886-WE-3050 FOR LAYOUT KEY PLAN.
3. REFER TO DRAWINGS 300203886-WE-3250 TO 3252 FOR LONGITUDINAL SECTIONS.
4. REFER TO DRAWINGS 300203886-WE-3300 TO 3316 FOR CROSS SECTIONS.
5. REFER TO DRAWINGS 300203886-WE-3400 TO 3402 FOR DRAINAGE LONGITUDINAL SECTIONS AND DETAILS.
6. REFER TO DRAWINGS 300203886-WE-3450 TO 3457 FOR TYPICAL SECTIONS AND DETAILS.

Rev.	Date	Description	Des.	Verif.	Appd.
A	10/05/2024	TENDER ISSUE	VZ		AS

NORTH

0 10 20m

SCALE 1:500 @A1

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Drawn SB	Date 15/06/20	
Checked VZ	Date 23/04/24	
Designed AS	Date 23/04/24	
Verified	Date	
Approved	Date	

Client: GREATER HUME SHIRE COUNCIL

Project: HHC FLOOD LEVEE DESIGN
HOLBROOK, HENTY
& CULCAIRN

Title: HOLBROOK 1 LAYOUT PLAN
SHEET 1 OF 2

Status: FOR TENDER ONLY
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VERT. DATUM	HORZ. DATUM	Scale	Size
AHD	MGA	AS SHOWN	A1

Drawing Number: 300203886-WE-3111 | Revision: A

WARNING

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HOLBROOK 1 LAYOUT PLAN

SCALE 1:500

NOTES:

1. REFER TO DRAWING 300203886-WE-3000 FOR GENERAL NOTES.
2. REFER TO DRAWING 300203886-WE-3050 FOR LAYOUT KEY PLAN.
3. REFER TO DRAWINGS 300203886-WE-3250 TO 3252 FOR LONGITUDINAL SECTIONS.
4. REFER TO DRAWINGS 300203886-WE-3300 TO 3316 FOR CROSS SECTIONS.
5. REFER TO DRAWINGS 300203886-WE-3400 TO 3402 FOR DRAINAGE LONGITUDINAL SECTIONS AND DETAILS.
6. REFER TO DRAWINGS 300203886-WE-3450 TO 3457 FOR TYPICAL SECTIONS AND DETAILS.

Rev.	Date	Description	Des.	Verif.	Appd.
A	10/05/2024	TENDER ISSUE	VZ		AS

NORTH

SCALE 1:500 @A1 (0 10 20m)

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Checked	VZ	23/04/24
Designed	AS	23/04/24
Verified		
Approved		

Client: GREATER HUME SHIRE COUNCIL

Project: HHC FLOOD LEVEE DESIGN
HOLBROOK, HENTY
& CULCAIRN

Title: HOLBROOK 1 LAYOUT PLAN
SHEET 2 OF 2

Status: FOR TENDER ONLY
NOT TO BE USED FOR CONSTRUCTION PURPOSES

VERT. DATUM	HORZ. DATUM	Scale	Size
AHD	MGA	AS SHOWN	A1

Drawing Number: 300203886-WE-3112 | Revision: A

NOTES:
1. REFER TO DRAWING 300203886-WE-3001 FOR GENERAL NOTES.
2. REFER TO DRAWING 300203886-WE-3050 FOR LAYOUT KEY PLAN.
3. REFER TO DRAWINGS 300203886-WE-3250 TO 3255 FOR LONGITUDINAL SECTIONS.
4. REFER TO DRAWINGS 300203886-WE-3300 TO 3313 FOR CROSS SECTIONS.
5. REFER TO DRAWING 300203886-WE-3350 FOR MAINTENANCE CROSSOVER SECTIONS.
6. REFER TO DRAWINGS 300203886-WE-3400 TO 3402 DRAINAGE SECTIONS AND DETAILS.
7. REFER TO DRAWINGS 300203886-WE-3450 TO 3457 FOR TYPICAL SECTIONS AND DETAILS.
8. REFER TO DRAWINGS 300203886-ST-3700 TO 3721 FOR CONCRETE LEVEE WALL STRUCTURAL NOTES AND DETAILS.

WARNING
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HOLBROOK 2 LAYOUT PLAN
SCALE 1:500

Rev.	Date	Description	Des.	Verif.	Appd.
A	10/05/2024	TENDER ISSUE	VZ		AS

NORTH
0 10 20m
SCALE 1:500 @A1

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		Date
Drawn	SB	15/06/20
Checked	VZ	23/04/24
Designed	AS	23/04/24
Verified		
Approved		

Client: GREATER HUME SHIRE COUNCIL
Project: HHC FLOOD LEVEE DESIGN
HOLBROOK, HENTY
& CULCAIRN
Title: HOLBROOK 2 LAYOUT PLAN
SHEET 1 OF 4

Status: FOR TENDER ONLY
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VERT. DATUM	HORZ. DATUM	Scale	Size
AHD	MGA	AS SHOWN	A1

Drawing Number: 300203886-WE-3150
Revision: A

DATE PLOTTED: 10 May 2024 9:46 AM BY : HAZELGROVE, ADAM

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NOTES:
1. REFER TO DRAWING 300203886-WE-3001 FOR GENERAL NOTES.
2. REFER TO DRAWING 300203886-WE-3050 FOR LAYOUT KEY PLAN.
3. REFER TO DRAWINGS 300203886-WE-3250 TO 3255 FOR LONGITUDINAL SECTIONS.
4. REFER TO DRAWINGS 300203886-WE-3300 TO 3313 FOR CROSS SECTIONS.
5. REFER TO DRAWINGS 300203886-WE-3350 FOR MAINTENANCE CROSSOVER SECTIONS.
6. REFER TO DRAWINGS 300203886-WE-3400 TO 3402 DRAINAGE SECTIONS AND DETAILS.
7. REFER TO DRAWINGS 300203886-WE-3450 TO 3457 FOR TYPICAL SECTIONS AND DETAILS.
8. REFER TO DRAWINGS 300203886-ST-3700 TO 3721 FOR CONCRETE LEVEE WALL STRUCTURAL NOTES AND DETAILS.

HOLBROOK 2 LAYOUT PLAN
SCALE 1:500

Rev.	Date	Description	Des.	Verif.	Appd.
A	10/05/2024	TENDER ISSUE	VZ		AS

NORTH

0 10 20m
SCALE 1:500 @A1

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Web: www.stantec.com/au

		Date
Drawn	SB	15/06/20
Checked	VZ	23/04/24
Designed	AS	23/04/24
Verified		
Approved		

Client: GREATER HUME SHIRE COUNCIL
Project: HHC FLOOD LEVEE DESIGN
HOLBROOK, HENTY
& CULCAIRN
Title: HOLBROOK 2 LAYOUT PLAN
SHEET 2 OF 4

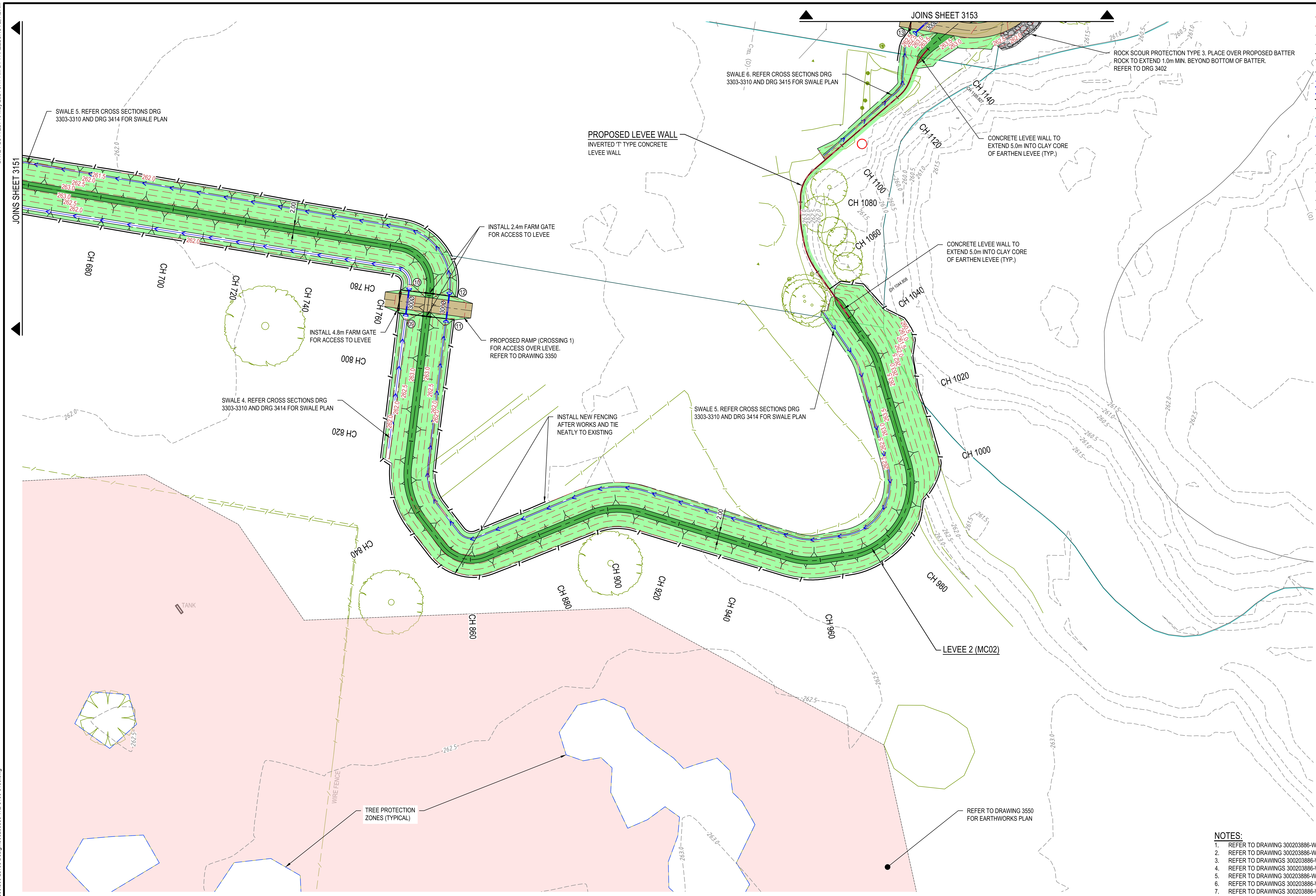
Status: FOR TENDER ONLY
NOT TO BE USED FOR CONSTRUCTION PURPOSES

VERT. DATUM	HORZ. DATUM	Scale	Size
AHD	MGA	AS SHOWN	A1

Drawing Number: 300203886-WE-3151
Revision: A

DATE PLOTTED: 10 May 2024 9:46 AM BY : HAZELGROVE, ADAM

DATE PLOTTED: 10 May 2024 9:47 AM BY : HAZELGROVE, ADAM



LEGEND

260.0	FINISHED SURFACE CONTOUR - MAJOR
	FINISHED SURFACE CONTOUR - MINOR
260.0	EXISTING SURFACE CONTOUR - MAJOR
	EXISTING SURFACE CONTOUR - MINOR
	DESIGN CENTRELINE
	PROPOSED TOP OF BATTER
	PROPOSED BOTTOM OF BATTER
	PROPOSED SWALE DRAIN
	PROPOSED DRAINAGE PIPE
	PROPOSED FENCE
	PROPOSED GUARDRAIL
	PROPERTY BOUNDARY - SURVEY
	PROPERTY BOUNDARY - VICMAP
	EXISTING SURFACE DRAIN
G(D)	EXISTING GAS (BYDA)
S(D)	EXISTING SEWER (BYDA)
W(D)	EXISTING WATER RETIC. (BYDA)
D(D)	EXISTING STORMWATER PIPE (BYDA)
E LV (D)	EXISTING LOW VOLTAGE - UNDERGROUND
E LVO (D)	EXISTING LOW VOLTAGE - OVERHEAD
E HVO (D)	EXISTING HIGH VOLTAGE - OVERHEAD
C TEL (D)	EXISTING TELECOMMUNICATIONS
	SURVEY QUALITY LEVEL
	UTILITY TYPE
	LEVEE BENCH
	LEVEE BATTER - GRASS SEEDED
	ASPHALT PAVEMENT - P1
	ASPHALT PAVEMENT - P2
	CONCRETE PATH - C1
	GRAVEL MAINTENANCE TRACK - G1
	GRAVEL PATH - G2
	GRAVEL ROAD - G3
	ROCK BEACHING
	EARTHWORKS - CUT

WARNING

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NOTES:

1. REFER TO DRAWING 300203886-WE-3001 FOR GENERAL NOTES.
2. REFER TO DRAWING 300203886-WE-3050 FOR LAYOUT KEY PLAN.
3. REFER TO DRAWINGS 300203886-WE-3250 TO 3255 FOR LONGITUDINAL SECTIONS.
4. REFER TO DRAWINGS 300203886-WE-3300 TO 3313 FOR CROSS SECTIONS.
5. REFER TO DRAWING 300203886-WE-3350 FOR MAINTENANCE CROSSOVER SECTIONS.
6. REFER TO DRAWINGS 300203886-WE-3400 TO 3402 DRAINAGE SECTIONS AND DETAILS.
7. REFER TO DRAWINGS 300203886-WE-3450 TO 3457 FOR TYPICAL SECTIONS AND DETAILS.
8. REFER TO DRAWINGS 300203886-ST-3700 TO 3721 FOR CONCRETE LEVEE WALL STRUCTURAL NOTES AND DETAILS.

HOLBROOK 2 LAYOUT PLAN

SCALE 1:500

Rev.	Date	Description	Des.	Verif.	Appd.
A	10/05/2024	TENDER ISSUE	VZ		AS

NORTH

0 10 20m
SCALE 1:500 @A1

Greater Hume Council

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Level 4, 501 Swanston Street
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Tel: 03 8415 7777
Web: www.stantec.com/au

Drawn	SB	Date 15/06/20
Checked	VZ	Date 23/04/24
Designed	AS	Date 23/04/24
Verified		Date
Approved		Date

Client: GREATER HUME SHIRE COUNCIL

Project: HHC FLOOD LEVEE DESIGN
HOLBROOK, HENTY
& CULCAIRN

Title: HOLBROOK 2 LAYOUT PLAN
SHEET 3 OF 4

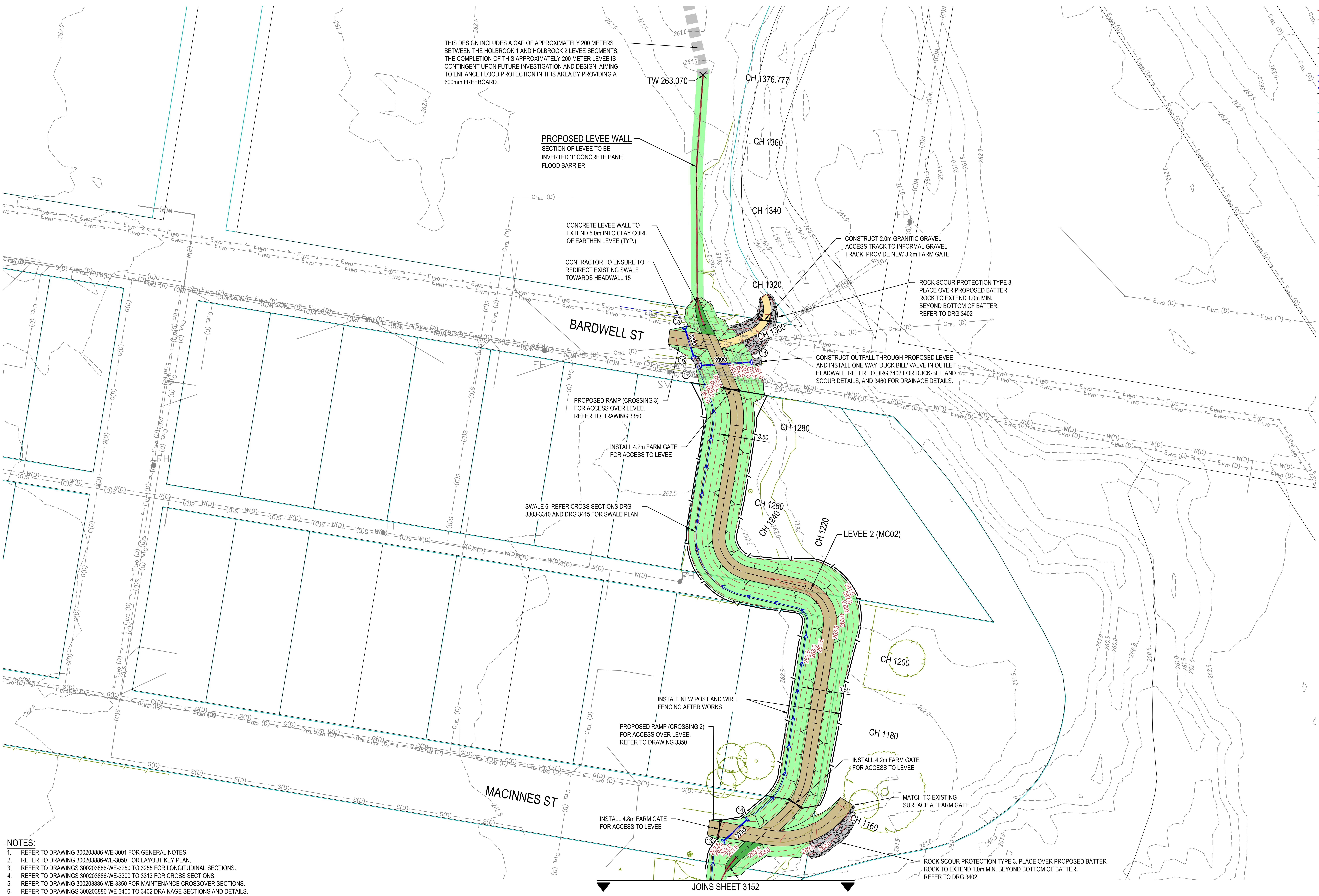
Status: FOR TENDER ONLY
NOT TO BE USED FOR CONSTRUCTION PURPOSES

VERT. DATUM	HORZ. DATUM	Scale	Size
AHD	MGA	AS SHOWN	A1

Drawing Number: 300203886-WE-3152

Revision: A

XREFs: XR-03886-VIC-MAP; XR-03886-HOLBROOK-IMAGE; XR-03886-BASE-HOL; XR-03886-CONT-E-HOL; XR-03886-SURV-HB2; XR_03886_SU_BYDA_COMM; XR_03886_SU_BYDA_ELEC; XR_03886_SU_BYDA_SERV; XR_03886_SU_BYDA_STRM; XR-03886-LEGEND; XR-03886-ALGN-CHNG; XR-03886-SURV-PWO
CAD File: \\au2013-ppfss01\shared_projects\300203886\300 Levee Design\300203886-WE-3150-3153.dwg



HOLBROOK 2 LAYOUT PLAN

SCALE 1:500

LEGEND

- FINISHED SURFACE CONTOUR - MAJOR (260.0)
- FINISHED SURFACE CONTOUR - MINOR
- EXISTING SURFACE CONTOUR - MAJOR (260.0)
- EXISTING SURFACE CONTOUR - MINOR
- DESIGN CENTRELINE
- PROPOSED TOP OF BATTER
- PROPOSED BOTTOM OF BATTER
- PROPOSED SWALE DRAIN
- PROPOSED DRAINAGE PIPE
- PROPOSED FENCE
- PROPOSED GUARDRAIL
- PROPERTY BOUNDARY - SURVEY
- PROPERTY BOUNDARY - VICMAP
- EXISTING SURFACE DRAIN
- G(D) EXISTING GAS (BYDA)
- S(D) EXISTING SEWER (BYDA)
- W(D) EXISTING WATER RETIC. (BYDA)
- D(D) EXISTING STORMWATER PIPE (BYDA)
- E_{LV} (D) EXISTING LOW VOLTAGE - UNDERGROUND
- E_{LVO} (D) EXISTING LOW VOLTAGE - OVERHEAD
- E_{HVO} (D) EXISTING HIGH VOLTAGE - OVERHEAD
- C_{TEL} (D) EXISTING TELECOMMUNICATIONS
- SURVEY QUALITY LEVEL
- UTILITY TYPE
- LEVEE BENCH
- LEVEE BATTER - GRASS SEEDED
- ASPHALT PAVEMENT - P1
- ASPHALT PAVEMENT - P2
- CONCRETE PATH - C1
- GRAVEL MAINTENANCE TRACK - G1
- GRAVEL PATH - G2
- GRAVEL ROAD - G3
- ROCK BEACHING

WARNING

BEWARE OF UNDERGROUND SERVICES

THE LOCATION OF UNDERGROUND SERVICES ARE APPROXIMATE ONLY AND THEIR EXACT POSITION SHOULD BE PROVEN ON SITE. NO GUARANTEE IS GIVEN THAT ALL EXISTING SERVICES ARE SHOWN.

CONTRACTOR TO VERIFY EXISTING SERVICES CONNECTION LEVELS PRIOR TO CONSTRUCTION. ANY DISCREPANCIES MUST BE IMMEDIATELY IDENTIFIED AND THE SUPERINTENDENT NOTIFIED PRIOR TO CONSTRUCTION COMMENCING.

NOTES:

1. REFER TO DRAWING 300203886-WE-3001 FOR GENERAL NOTES.
2. REFER TO DRAWING 300203886-WE-3050 FOR LAYOUT KEY PLAN.
3. REFER TO DRAWINGS 300203886-WE-3250 TO 3255 FOR LONGITUDINAL SECTIONS.
4. REFER TO DRAWINGS 300203886-WE-3300 TO 3313 FOR CROSS SECTIONS.
5. REFER TO DRAWING 300203886-WE-3350 FOR MAINTENANCE CROSSOVER SECTIONS.
6. REFER TO DRAWINGS 300203886-WE-3400 TO 3402 DRAINAGE SECTIONS AND DETAILS.
7. REFER TO DRAWINGS 300203886-WE-3450 TO 3457 FOR TYPICAL SECTIONS AND DETAILS.
8. REFER TO DRAWINGS 300203886-ST-3700 TO 3721 FOR CONCRETE LEVEE WALL STRUCTURAL NOTES AND DETAILS.

Rev.	Date	Description	Des.	Verif.	Appd.
A	10/05/2024	TENDER ISSUE	VZ		AS

NORTH

SCALE 1:500 (0, 10, 20m) @A1

Greater Hume Council

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Melbourne VIC 3000
Tel: 03 8415 7777
Web: www.stantec.com/au

Drawn SB	Date 15/06/20	
Checked VZ	Date 23/04/24	
Designed AS	Date 23/04/24	
Verified	Date	
Approved	Date	

Client: GREATER HUME SHIRE COUNCIL

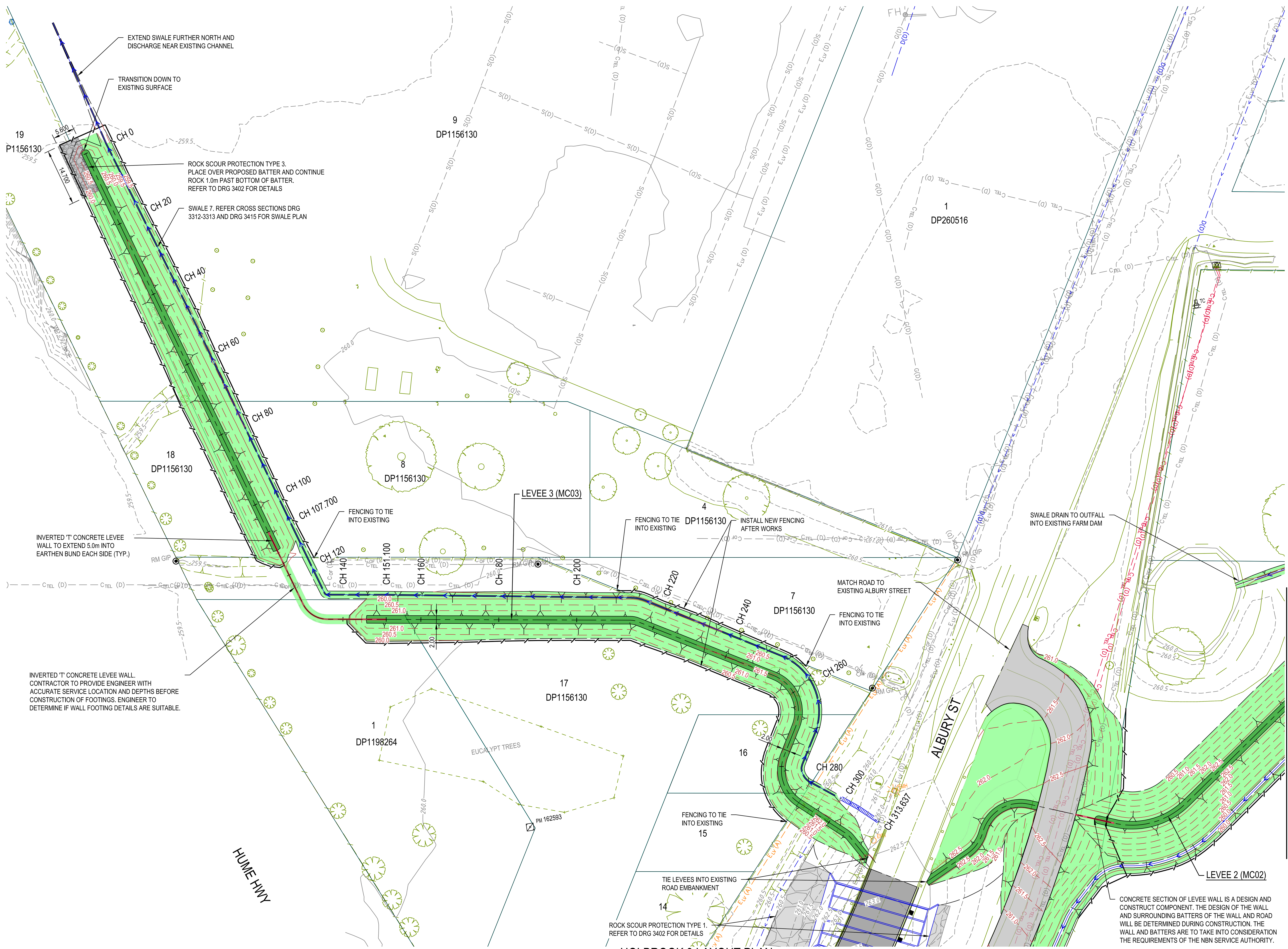
Project: HHC FLOOD LEVEE DESIGN HOLBROOK, HENTY & CULCAIRN

Title: HOLBROOK 2 LAYOUT PLAN SHEET 4 OF 4

Status: FOR TENDER ONLY — NOT TO BE USED FOR CONSTRUCTION PURPOSES

VERT. DATUM	HORZ. DATUM	Scale	Size
AHD	MGA	AS SHOWN	A1

Drawing Number: 300203886-WE-3153 — Revision: A



CONCRETE SECTION OF LEVEE WALL IS A DESIGN AND CONSTRUCT COMPONENT. THE DESIGN OF THE WALL AND SURROUNDING BATTERS OF THE WALL AND ROAD WILL BE DETERMINED DURING CONSTRUCTION. THE WALL AND BATTERS ARE TO TAKE INTO CONSIDERATION THE REQUIREMENTS OF THE NBN SERVICE AUTHORITY.

HOLBROOK 3 LAYOUT PLAN

SCALE 1:500

LEGEND

- FINISHED SURFACE CONTOUR - MAJOR (260.0)
- FINISHED SURFACE CONTOUR - MINOR
- EXISTING SURFACE CONTOUR - MAJOR (260.0)
- EXISTING SURFACE CONTOUR - MINOR
- DESIGN CENTRELINE
- PROPOSED TOP OF BATTER
- PROPOSED BOTTOM OF BATTER
- PROPOSED SWALE DRAIN
- PROPOSED DRAINAGE PIPE
- PROPOSED FENCE
- PROPOSED GUARDRAIL
- PROPERTY BOUNDARY - SURVEY
- PROPERTY BOUNDARY - VICMAP
- EXISTING SURFACE DRAIN
- G(D) EXISTING GAS (BYDA)
- S(D) EXISTING SEWER (BYDA)
- W(D) EXISTING WATER RETIC. (BYDA)
- D(D) EXISTING STORMWATER PIPE (BYDA)
- E_{LV} (D) EXISTING LOW VOLTAGE - UNDERGROUND
- E_{LVO} (D) EXISTING LOW VOLTAGE - OVERHEAD
- E_{HVO} (D) EXISTING HIGH VOLTAGE - OVERHEAD
- C_{TEL} (D) EXISTING TELECOMMUNICATIONS
- SURVEY QUALITY LEVEL
- UTILITY TYPE
- LEVEE BENCH
- LEVEE BATTER - GRASS SEEDED
- ASPHALT PAVEMENT - P1
- ASPHALT PAVEMENT - P2
- ROCK BEACHING

WARNING

BEWARE OF UNDERGROUND SERVICES

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CONTRACTOR TO VERIFY EXISTING SERVICES CONNECTION LEVELS PRIOR TO CONSTRUCTION. ANY DISCREPANCIES MUST BE IMMEDIATELY IDENTIFIED AND THE SUPERINTENDENT NOTIFIED PRIOR TO CONSTRUCTION COMMENCING.

NOTE:

1. REFER TO DRAWING 300203886-WE-3001 FOR GENERAL NOTES.
2. REFER TO DRAWING 300203886-WE-3050 FOR LAYOUT KEY PLAN.
3. REFER TO DRAWING 300203886-WE-3255 FOR LONGITUDINAL SECTION.
4. REFER TO DRAWING 300203886-WE-3312 TO 3313 FOR CROSS SECTIONS.
5. REFER TO DRAWINGS 300203886-ST-3700 TO 3721 FOR LEVEE WALL STRUCTURAL NOTES AND DETAILS.

DATE PLOTTED: 10 May 2024 9:57 AM BY : HAZELGROVE, ADAM

XREFs: XR-03886-VIC-MAP; XR-03886-HOLBROOK-IMAGE; XR-03886-BASE-HOL; XR-03886-CONT-E-HOL; XR-03886-SURV-HB2; XR_03886_SU_BYDA_COMM; XR_03886_SU_BYDA_ELEC; XR_03886_SU_BYDA_SERV; XR_03886_SU_BYDA_STRM; XR-03886-ALGN-CHNG; XR-03886-LEGEND; XR-03886-SURV-PWO

CAD File: \\au2013-ppfss01\shared_projects\300203886\300 Levee Design\300203886-WE-3200.dwg

Rev.	Date	Description	Des.	Verif.	Appd.
A	10/05/2024	TENDER ISSUE	VZ		AS

NORTH

0 10 20m

SCALE 1:500 @A1

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Web: www.stantec.com/au

Drawn SB	Date 15/06/20
Checked VZ	Date 23/04/24
Designed AS	Date 23/04/24
Verified	Date
Approved	Date

Client: GREATER HUME SHIRE COUNCIL

Project: HHC FLOOD LEVEE DESIGN HOLBROOK, HENTY & CULCAIRN

Title: HOLBROOK 3 LAYOUT PLAN

Status: FOR TENDER ONLY
NOT TO BE USED FOR CONSTRUCTION PURPOSES

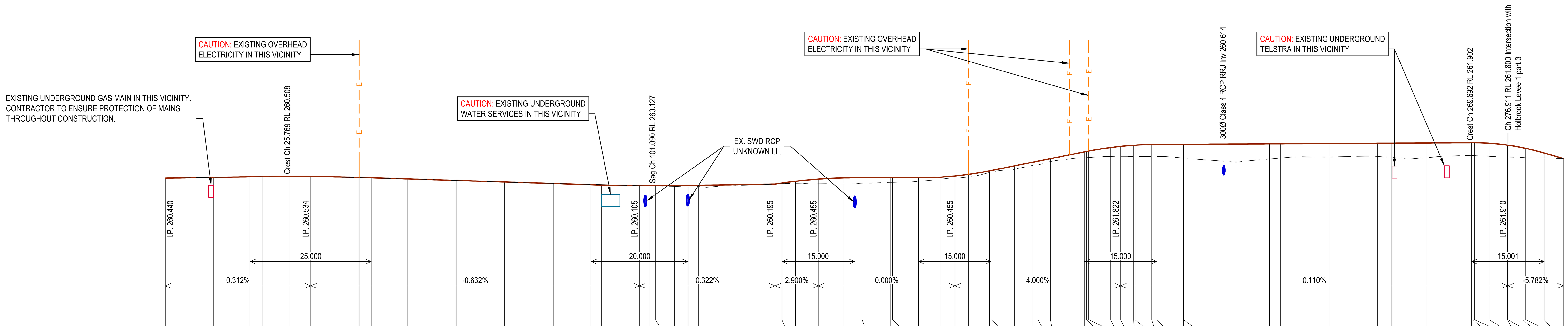
VERT. DATUM	HORZ. DATUM	Scale	Size
AHD	MGA	AS SHOWN	A1

Drawing Number: 300203886-WE-3200

Revision: A

LEGEND

———	DESIGN CENTRE LINE
— — —	EXISTING SURFACE



DESIGN SURFACE	260.440	260.471	260.495	260.501	260.508	260.504	260.469	260.455	260.407	260.344	260.281	260.218	260.168	260.156
EXISTING SURFACE	260.44	260.47	260.49	260.50	260.49	260.48	260.46	260.45	260.41	260.34	260.28	260.22	260.18	260.17
CHAINAGE	0.000	10.000	17.500	20.000	25.769	30.000	40.000	42.500	50.000	60.000	70.000	80.000	87.838	90.000

DESIGN SURFACE	260.129	260.127	260.127	260.130	260.137	260.144	260.177	260.195	260.237	260.311	260.400	260.450	260.455	260.455
EXISTING SURFACE	260.13	260.12	260.11	260.09	260.08	260.09	260.15	260.20	260.21	260.23	260.20	260.20	260.20	260.23
CHAINAGE	97.838	100.000	101.090	105.049	107.838	110.000	120.000	125.751	127.211	130.000	134.711	140.000	142.211	143.709

DESIGN SURFACE	260.455	260.455	260.455	260.483	260.530	260.596	260.740	260.755	260.948	261.091	261.140	261.241	261.522	261.540
EXISTING SURFACE	260.27	260.27	260.31	260.40	260.44	260.48	260.67	260.69	260.81	260.96	260.98	261.12	261.28	261.28
CHAINAGE	149.516	150.000	155.372	160.000	162.872	165.676	170.000	170.372	175.198	178.770	180.000	182.537	189.555	190.000

DESIGN SURFACE	261.557	261.702	261.749	261.795	261.798	261.828	261.830	261.836	261.836	261.847	261.856	261.858	261.869	261.880
EXISTING SURFACE	261.29	261.34	261.34	261.34	261.34	261.33	261.33	261.27	261.27	261.11	261.23	261.27	261.31	261.34
CHAINAGE	190.444	195.013	197.055	199.754	200.000	203.476	204.555	210.000	210.037	220.000	227.757	230.000	240.000	250.000

DESIGN SURFACE	261.884	261.891	261.902	261.902	261.902	261.880	261.802	261.800	261.693	261.668	261.476	261.249
EXISTING SURFACE	261.29	261.28	261.38	261.37	261.37	261.34	261.31	261.31	261.29	261.28	261.26	261.25
CHAINAGE	252.946	260.000	269.412	269.692	270.000	273.022	276.836	276.911	280.000	280.602	284.413	288.349

LONGITUDINAL SECTION MC05
Hay Street to Nolan St centre line Ch 0.000 to Ch 288.349
SCALES: HORIZONTAL 1:500 VERTICAL 1:100

NOTE:

1. REFER TO DRAWING 300203886-WE-3001 FOR GENERAL NOTES.
2. REFER TO DRAWING 300203886-WE-3050 FOR LAYOUT KEY PLAN.
3. REFER TO DRAWING 300203886-WE-3101 & 3102 FOR ALIGNMENT CONTROL PLANS.
4. REFER TO DRAWINGS 300203886-WE-3300 TO 3313 FOR CROSS SECTIONS.
5. REFER TO DRAWINGS 300203886-WE-3450 TO 3457 FOR TYPICAL SECTIONS AND DETAILS.
6. REFER TO DRAWINGS 300203886-ST-3700 TO 3721 FOR STRUCTURAL DETAILS.

XREF's:
CAD File: \\au2013-ppfss01\shared_projects\300203886\300 Levee Design\300203886-WE-3250-3255.dwg

Rev.	Date	Description	Des.	Verif.	Appd.
A	10/05/2024	TENDER ISSUE	VZ		AS

H: 0 10 20m
V: 0 2 4m
SCALE H:1:500 V:1:100 @A1

Greater Hume Council

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Melbourne VIC 3000
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Drawn	SB	Date 15/06/20
Checked	VZ	Date 23/04/24
Designed	AS	Date 23/04/24
Verified		Date
Approved		Date

Client: GREATER HUME SHIRE COUNCIL

Project: HHC FLOOD LEVEE DESIGN
HOLBROOK, HENTY
& CULCAIRN

Title: HAY ST LONGITUDINAL SECTIONS
SHEET 1 OF 2

Status: FOR TENDER ONLY
NOT TO BE USED FOR CONSTRUCTION PURPOSES

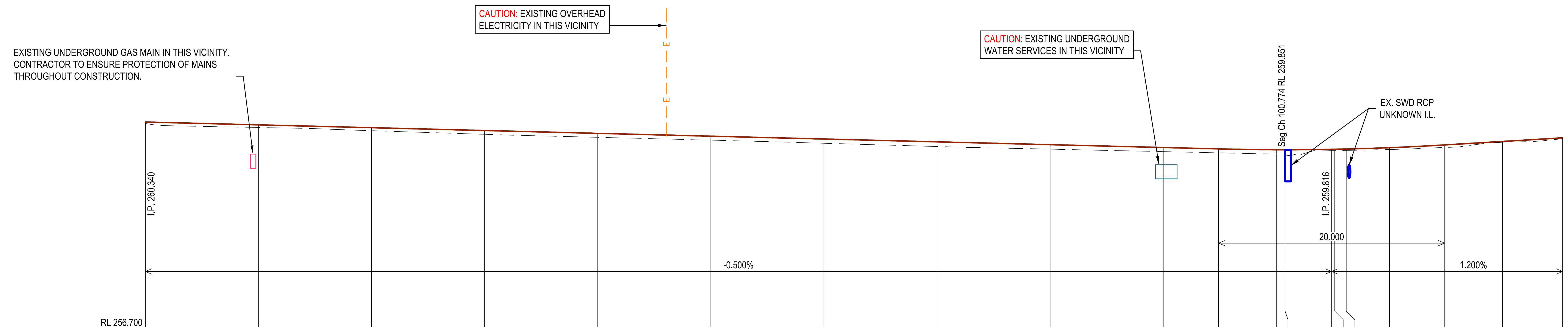
VERT. DATUM	HORZ. DATUM	Scale	Size
AHD	MGA	AS SHOWN	A1

Drawing Number: 300203886-WE-3250
Revision: A

DATE PLOTTED: 10 May 2024 9:20 AM BY : HAZELGROVE, ADAM

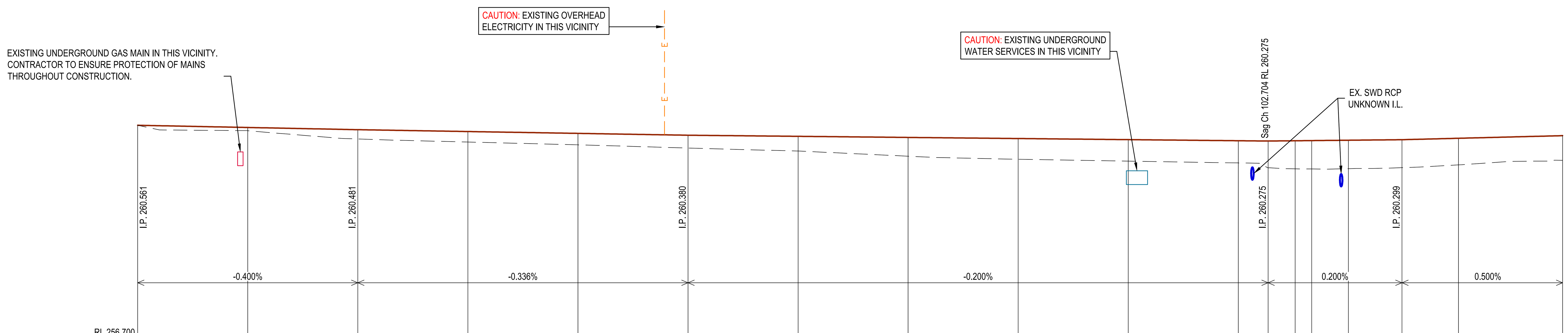
LEGEND

———	DESIGN CENTRE LINE
— — —	EXISTING SURFACE



DESIGN SURFACE	260.340	260.290	260.240	260.190	260.140	260.090	260.040	259.990	259.940	259.890	259.866	259.851	259.851	259.858	259.859	259.863	259.887	259.936	259.997	260.061
EXISTING SURFACE	260.31	260.24	260.19	260.12	260.07	260.02	259.97	259.91	259.86	259.82	259.80	259.77	259.76	259.84	259.84	259.84	259.85	259.89	259.98	260.05
CHAINAGE	0.000	10.000	20.000	30.000	40.000	50.000	60.000	70.000	80.000	90.000	94.891	100.000	100.774	104.891	105.166	106.179	110.000	114.891	120.000	125.320

LONGITUDINAL SECTION MC06
Hay Street to Nolan St lip of kerb Ch 0.000 to Ch 130.602
SCALES: HORIZONTAL 1:250 VERTICAL 1:50



DESIGN SURFACE	260.561	260.521	260.481	260.447	260.414	260.380	260.360	260.340	260.320	260.300	260.280	260.275	260.280	260.283	260.289	260.299	260.325	260.372
EXISTING SURFACE	260.56	260.46	260.31	260.26	260.20	260.15	260.09	260.00	259.94	259.91	259.88	259.79	259.77	259.77	259.77	259.79	259.84	259.93
CHAINAGE	0.000	10.000	20.000	30.000	40.000	50.000	60.000	70.000	80.000	90.000	100.000	102.704	105.166	106.660	110.000	114.866	120.000	129.465

LONGITUDINAL SECTION MC07
Hay Street to Nolan St footpath edge Ch 0.000 to Ch 131.082
SCALES: HORIZONTAL 1:250 VERTICAL 1:50

NOTE:

1. REFER TO DRAWING 300203886-WE-3001 FOR GENERAL NOTES.
2. REFER TO DRAWING 300203886-WE-3050 FOR LAYOUT KEY PLAN.
3. REFER TO DRAWING 300203886-WE-3101 & 3102 FOR ALIGNMENT CONTROL PLANS.
4. REFER TO DRAWINGS 300203886-WE-3300 TO 3313 FOR CROSS SECTIONS.
5. REFER TO DRAWINGS 300203886-WE-3450 TO 3457 FOR TYPICAL SECTIONS AND DETAILS.
6. REFER TO DRAWINGS 300203886-ST-3700 TO 3721 FOR STRUCTURAL DETAILS.

1:250 / 1:500 — 5 0 5 10 — A1 / A3 — HORIZONTAL
1:50 / 1:100 — 1 0.5 0 1 2 — A1 / A3 — VERTICAL

XREF's:
CAD File: \\au2013-ppfss01\shared_projects\300203886\300 Levee Design\300203886-WE-3250-3255.dwg

Rev.	Date	Description	Des.	Verif.	Appd.
A	10/05/2024	TENDER ISSUE	VZ		AS

Greater Hume Council

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		Date
Drawn	SB	15/06/20
Checked	VZ	23/04/24
Designed	AS	23/04/24
Verified		
Approved		

Client: GREATER HUME SHIRE COUNCIL

Project: HHC FLOOD LEVEE DESIGN
HOLBROOK, HENTY
& CULCAIRN

Title: HAY ST LONGITUDINAL SECTIONS
SHEET 2 OF 2

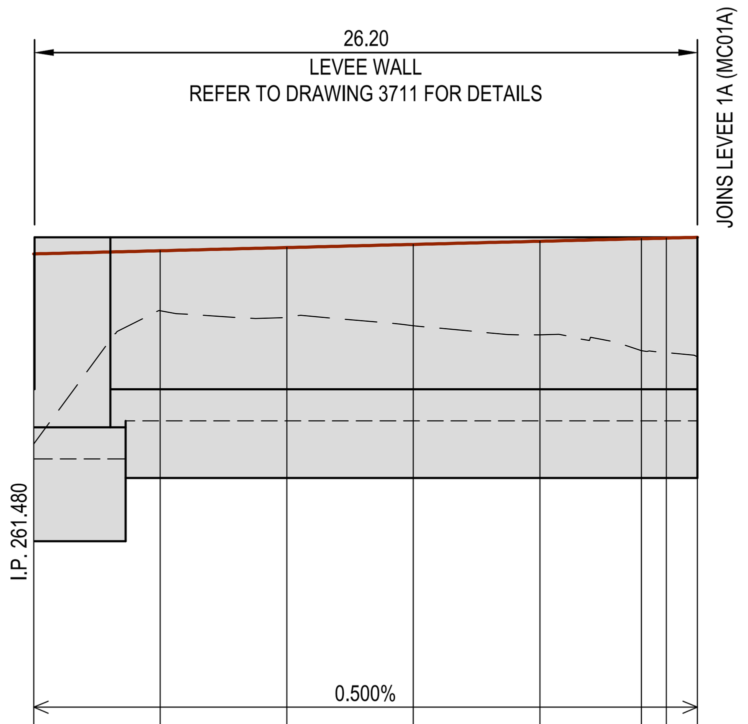
Status: FOR TENDER ONLY
NOT TO BE USED FOR CONSTRUCTION PURPOSES

VERT. DATUM	HORZ. DATUM	Scale	Size
AHD	MGA	AS SHOWN	A1

Drawing Number: 300203886-WE-3251
Revision: A

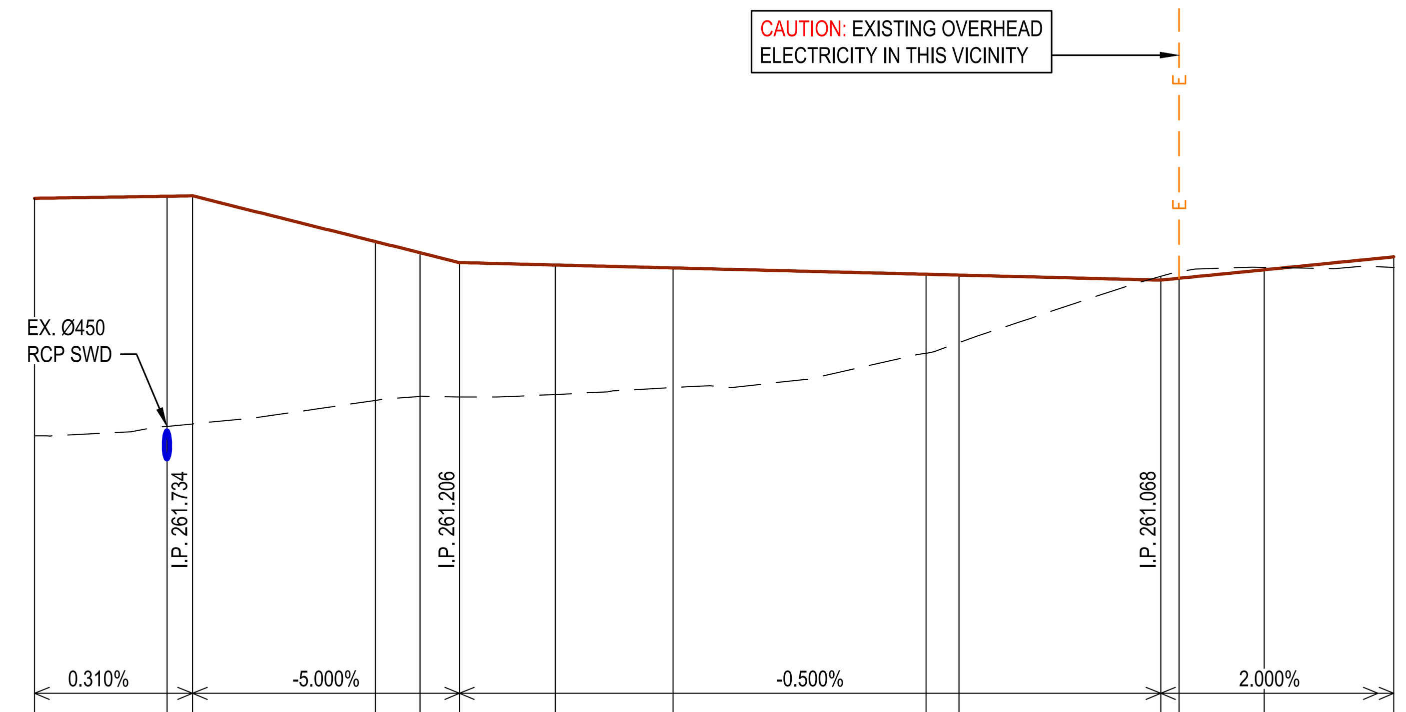
LEGEND
- DESIGN CENTRE LINE
- EXISTING SURFACE

NOTE:
LONGITUDINAL SECTIONS FOR INVERTED 'T' TYPE WALLS 'HOLBROOK LEVEE 1 PART 1 'MC01A' AND CONTROL LINE 'MC08' ARE DOCUMENTED IN STRUCTURAL DESIGN DRAWINGS.



CHAINAGE	DESIGN SURFACE	EXISTING SURFACE
0.000	261.480	259.98
5.000	261.505	261.03
10.000	261.530	260.98
15.000	261.555	260.91
20.000	261.580	260.84
24.014	261.600	260.72
25.000	261.605	260.70
26.230	261.611	260.67

LONGITUDINAL SECTION (MC01AUX)
bridge wall Ch 0.000 to Ch 26.230
SCALES: HORIZONTAL 1:250 VERTICAL 1:50



CHAINAGE	DESIGN SURFACE	EXISTING SURFACE
4.760	261.715	259.84
10.000	261.731	259.91
11.000	261.734	259.93
18.233	261.372	260.12
20.000	261.284	260.15
21.556	261.206	260.14
25.341	261.187	260.16
30.000	261.164	260.22
40.000	261.114	260.49
41.299	261.108	260.57
49.276	261.068	261.10
50.000	261.082	261.14
53.360	261.149	261.17
58.490	261.252	261.17

LONGITUDINAL SECTION MC01B
Nolan St Footpath edge Ch 0.000 to Ch 58.490
SCALES: HORIZONTAL 1:250 VERTICAL 1:50

CHAINAGE	DESIGN SURFACE	EXISTING SURFACE
0.000	261.800	261.31
2.496	261.881	261.35
2.512	261.882	261.35
4.535	261.912	261.38
5.078	261.920	261.39
10.000	261.995	261.43
14.489	262.063	261.34
20.000	262.146	261.31
21.709	262.147	261.32
30.000	262.156	261.35
36.105	262.162	261.40
40.000	262.166	261.41
50.000	262.176	261.47
50.018	262.176	261.47
60.000	262.186	261.54
70.000	262.196	261.49
80.000	262.206	261.44
90.000	262.216	261.35
100.000	262.226	261.34
110.000	262.236	261.29
120.000	262.246	261.27
130.000	262.256	261.29
140.000	262.266	261.34
146.009	262.272	261.39
150.000	262.292	261.49
150.119	262.292	261.49
157.789	262.331	261.57
160.000	262.342	261.55
170.000	262.392	261.46
177.599	262.430	261.47
180.000	262.442	261.47
190.000	262.492	261.48
190.795	262.496	261.48
194.674	262.515	261.48
200.000	262.523	261.49
206.573	262.533	261.50
208.958	262.536	261.50
210.000	262.538	261.50
220.000	262.553	261.55
230.000	262.568	261.57
240.000	262.566	261.59
250.000	262.564	261.66
257.324	262.563	261.74
260.000	262.562	261.77
270.000	262.560	261.85
280.000	262.558	262.01
289.536	262.556	262.06
290.000	262.498	262.06
293.324	262.083	262.08

LONGITUDINAL SECTION MC01C
Holbrook Levee 1 part 3 Ch 0.000 to Ch 293.324
SCALES: HORIZONTAL 1:500 VERTICAL 1:100

NOTE:
1. REFER TO DRAWING 300203886-WE-3001 FOR GENERAL NOTES.
2. REFER TO DRAWING 300203886-WE-3050 FOR LAYOUT KEY PLAN.
3. REFER TO DRAWING 300203886-WE-3101 & 3102 FOR ALIGNMENT CONTROL PLANS.
4. REFER TO DRAWINGS 300203886-WE-3300 TO 3313 FOR CROSS SECTIONS.
5. REFER TO DRAWINGS 300203886-WE-3450 TO 3457 FOR TYPICAL SECTIONS AND DETAILS.
6. REFER TO DRAWINGS 300203886-ST-3700 TO 3721 FOR STRUCTURAL DETAILS.

1:250 5 0 5 10 A1
1:500 HORIZONTAL A3
1:50 1 0.5 0 1 2 A1
1:100 VERTICAL A3

DATE PLOTTED: 10 May 2024 9:20 AM BY : HAZELGROVE, ADAM
XREF's:
CAD File: \\au2013-ppfss01\shared_projects\300203886\300 Levee Design\300203886-WE-3250-3255.dwg

Rev.	Date	Description	Des.	Verif.	Appd.
A	10/05/2024	TENDER ISSUE	VZ		AS

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		Date
Drawn	SB	15/06/20
Checked	VZ	23/04/24
Designed	AS	23/04/24
Verified		
Approved		

Client: GREATER HUME SHIRE COUNCIL
Project: HHC FLOOD LEVEE DESIGN
HOLBROOK, HENTY
& CULCAIRN
Title: HOLBROOK 1 LONGITUDINAL SECTIONS
SHEET 1 OF 1

Status: FOR TENDER ONLY
NOT TO BE USED FOR CONSTRUCTION PURPOSES

VERT. DATUM	HORZ. DATUM	Scale	Size
AHD	MGA	AS SHOWN	A1

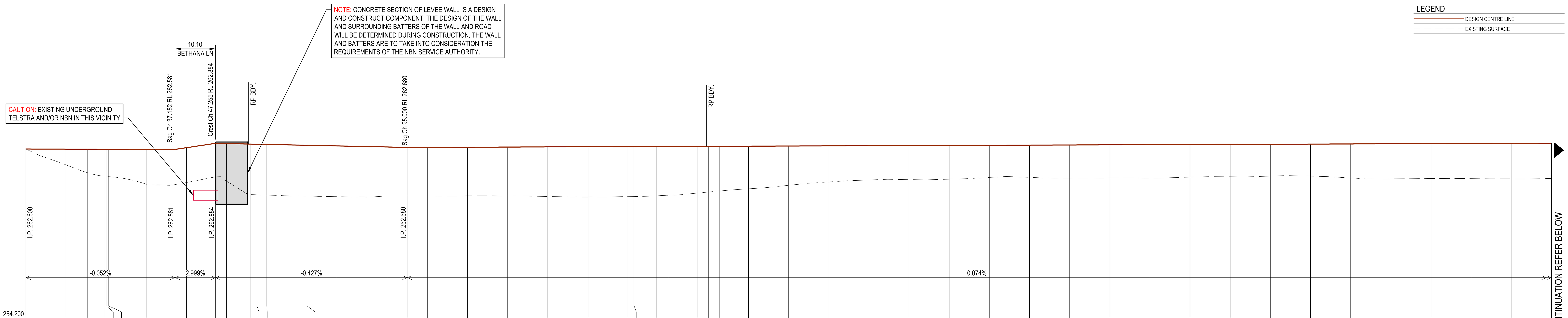
Drawing Number: 300203886-WE-3252
Revision: A

DATE PLOTTED: 10 May 2024 9:20 AM BY : HAZELGROVE, ADAM

LEGEND

DESIGN CENTRE LINE

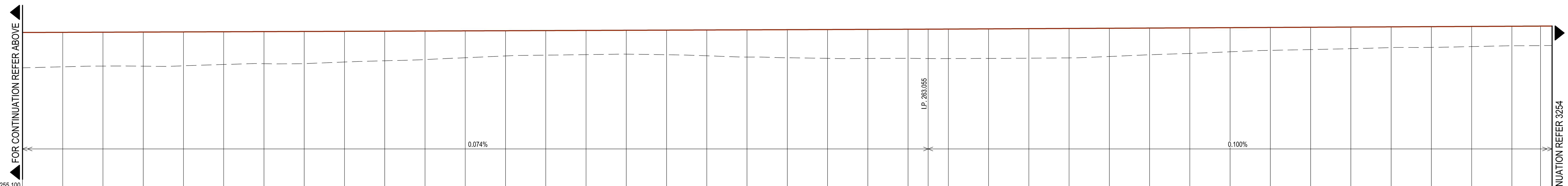
EXISTING SURFACE



RL 254.200

CHAINAGE	DESIGN SURFACE	EXISTING SURFACE
0.000	262.600	262.60
10.000	262.595	261.81
12.744	262.593	261.60
15.302	262.592	261.42
19.734	262.590	261.23
20.000	262.590	261.23
20.538	262.589	261.23
30.000	262.584	260.85
34.941	262.582	260.80
37.152	262.581	260.83
40.000		260.94
47.255		261.22
50.000	262.872	261.00
56.033	262.846	260.33
57.539	262.840	260.32
60.000	262.829	260.31
69.996	262.787	260.27
70.000	262.787	260.27
77.463	262.755	260.23
80.000	262.744	260.22
90.000	262.701	260.27
95.000	262.680	260.27
100.000	262.684	260.27
110.000	262.691	260.27
120.000	262.698	260.27
130.000	262.706	260.24
140.000	262.713	260.21
150.000	262.720	260.23
151.512	262.722	260.24
157.020	262.726	260.27
160.000	262.728	260.30
167.219	262.733	260.41
170.000	262.735	260.46
172.728	262.737	260.51
180.000	262.743	260.62
190.000	262.750	260.79
200.000	262.757	260.96
210.000	262.765	261.06
220.000	262.772	261.08
230.000	262.779	261.10
240.000	262.787	261.19
250.000	262.794	261.19
260.000	262.801	261.16
270.000	262.809	261.16
280.000	262.816	261.16
290.000	262.823	261.20
300.000	262.831	261.22
310.000	262.838	261.25
320.000	262.845	261.25
330.000	262.853	261.16
340.000	262.860	261.12
350.000	262.868	261.13
360.000	262.875	261.13
370.000	262.882	261.12
380.000	262.890	261.14

LONGITUDINAL SECTION MC02
Holbrook Levee 2 Ch 0.000 to Ch 380.000
SCALES: HORIZONTAL 1:500 VERTICAL 1:100



RL 255.100

CHAINAGE	DESIGN SURFACE	EXISTING SURFACE
380.000	262.890	261.14
390.000	262.897	261.18
400.000	262.904	261.22
410.000	262.912	261.21
420.000	262.919	261.23
430.000	262.926	261.30
440.000	262.934	261.34
450.000	262.941	261.34
460.000	262.948	261.42
470.000	262.956	261.48
480.000	262.963	261.54
490.000	262.970	261.63
500.000	262.978	261.72
510.000	262.985	261.76
520.000	262.993	261.79
530.000	263.000	261.81
540.000	263.007	261.78
550.000	263.015	261.73
560.000	263.022	261.67
570.000	263.029	261.63
580.000	263.037	261.60
590.000	263.044	261.60
600.000	263.051	261.60
605.000	263.055	261.59
610.000	263.060	261.59
620.000	263.070	261.60
630.000	263.080	261.61
640.000	263.090	261.63
650.000	263.100	261.70
660.000	263.110	261.78
670.000	263.120	261.85
680.000	263.130	261.93
690.000	263.140	262.00
700.000	263.150	262.04
710.000	263.160	262.09
720.000	263.170	262.14
730.000	263.180	262.15
740.000	263.190	262.19
750.000	263.200	262.23
757.098	263.207	262.24
760.000	263.210	262.24

LONGITUDINAL SECTION MC02
Holbrook Levee 2 Ch 380.000 to Ch 760.000
SCALES: HORIZONTAL 1:500 VERTICAL 1:100

NOTE:

1. REFER TO DRAWING 300203886-WE-3001 FOR GENERAL NOTES.
2. REFER TO DRAWING 300203886-WE-3050 FOR LAYOUT KEY PLAN.
3. REFER TO DRAWING 300203886-WE-3101 & 3102 FOR ALIGNMENT CONTROL PLANS.
4. REFER TO DRAWINGS 300203886-WE-3300 TO 3313 FOR CROSS SECTIONS.
5. REFER TO DRAWINGS 300203886-WE-3450 TO 3457 FOR TYPICAL SECTIONS AND DETAILS.
6. REFER TO DRAWINGS 300203886-ST-3700 TO 3721 FOR STRUCTURAL DETAILS.

XREF's:
CAD File: \\au2013-ppfss01\shared_projects\300203886\300 Levee Design\300203886-WE-3250-3255.dwg

Rev.	Date	Description	Des.	Verif.	Appd.
A	10/05/2024	TENDER ISSUE	VZ		AS

H: 0 10 20m
V: 0 2 4m
SCALE H:1:500 V:1:100 @A1

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		Date
Drawn	SB	15/06/20
Checked	VZ	23/04/24
Designed	AS	23/04/24
Verified		Date
Approved		Date

Client: GREATER HUME SHIRE COUNCIL

Project: HHC FLOOD LEVEE DESIGN
HOLBROOK, HENTY
& CULCAIRN

Title: HOLBROOK 2 LONGITUDINAL SECTIONS
SHEET 1 OF 2

Status: FOR TENDER ONLY
NOT TO BE USED FOR CONSTRUCTION PURPOSES

VERT. DATUM	HORZ. DATUM	Scale	Size
AHD	MGA	AS SHOWN	A1

Drawing Number: 300203886-WE-3253
Revision: A

DATE PLOTTED: 10 May 2024 9:20 AM BY : HAZELGROVE, ADAM

LEGEND

DESIGN CENTRE LINE

EXISTING SURFACE

93.50
LEVEE WALL
REFER TO DRAWING 3714 FOR DETAILS

5.00
WALL EMBEDMENT

5.00
WALL EMBEDMENT

4.00
CROSSOVER 1

RP BDY.

FOR CONTINUATION REFER 3253

FOR CONTINUATION REFER BELOW

I.P. 263.220 — I.P. 263.800 — I.P. 263.953 — I.P. 263.800

0.100% — 0.430% — 0.176% — -0.122% — -0.263%

RL 256.200

CHAINAGE	DESIGN SURFACE	EXISTING SURFACE
760.000	263.210	262.24
762.607	263.213	262.24
770.000	263.220	262.27
772.395	263.230	262.29
777.903	263.254	262.31
780.000	263.263	262.31
790.000	263.306	262.30
800.000	263.349	262.31
810.000	263.392	262.31
820.000	263.435	262.31
821.166	263.440	262.31
826.674	263.463	262.31
830.000	263.478	262.33
836.729	263.507	262.38
840.000	263.521	262.40
842.237	263.530	262.42
845.707	263.545	262.43
850.000	263.564	262.45
851.215	263.569	262.45
858.764	263.601	262.48
860.000	263.607	262.48
864.273	263.625	262.46
870.000	263.650	262.45
880.000	263.693	262.44
889.481	263.733	262.47
890.000	263.736	262.46
894.989	263.757	262.45
900.000	263.779	262.46
903.184	263.792	262.48
905.000	263.800	262.49
908.692	263.806	262.51
910.000	263.809	262.52
920.000	263.826	262.54
930.000	263.844	262.59
940.000	263.862	262.60
941.289	263.864	262.59
950.000	263.879	262.64
950.199	263.880	262.64
951.438	263.882	262.63
959.606	263.896	262.63
960.000	263.897	262.64
960.348	263.897	262.64
967.671	263.910	262.69
970.000	263.914	262.70
975.530	263.924	262.77
977.807	263.928	262.79
980.000	263.932	262.79
990.000	263.950	262.80
991.767	263.953	262.81
996.098	263.947	262.95
1000.000	263.943	263.03
1001.885	263.940	262.99
1010.000	263.930	262.94
1020.000	263.918	263.01
1020.020	263.918	263.01
1026.520	263.910	262.96
1029.471	263.907	262.97
1030.000	263.906	262.97
1035.971	263.899	262.90
1040.000	263.894	262.96
1050.000	263.882	263.23
1051.272	263.880	263.19
1059.890	263.870	262.98
1060.000	263.869	262.99
1060.723	263.869	263.03
1062.869	263.866	263.10
1066.635	263.861	263.08
1069.341	263.858	263.06
1070.000	263.857	263.03
1071.703	263.855	262.95
1072.320	263.854	262.92
1076.086	263.850	262.84
1080.000	263.845	262.88
1080.226	263.845	262.88
1081.154	263.844	262.89
1089.677	263.833	263.07
1090.000	263.833	263.03
1100.000	263.821	262.81
1110.000	263.808	262.73
1111.252	263.807	262.79
1116.385	263.801	262.82
1116.942	263.800	262.82
1117.801	263.798	262.82
1120.000	263.792	262.81
1120.703	263.790	262.80
1125.836	263.777	262.79
1127.252	263.773	262.80
1128.540	263.769	262.79
1130.000	263.766	262.76
1137.991	263.745	262.65
1140.000	263.739	262.61

LONGITUDINAL SECTION MC02
Holbrook Levee 2 Ch 760.000 to Ch 1140.000
SCALES: HORIZONTAL 1:500 VERTICAL 1:100

CAUTION: EXISTING OVERHEAD ELECTRICITY IN THIS VICINITY

6.00
CROSSOVER 2

RP BDY.

RP BDY.

3000 Class 4 RCP
RRJ Inv 261.334

69.00
LEVEE WALL
REFER TO DRAWING 3715 FOR DETAILS

5.00
CROSSOVER 3

5.00
WALL EMBEDMENT

CAUTION: EXISTING UNDERGROUND WATER SERVICES IN THIS VICINITY

FOR CONTINUATION REFER ABOVE

I.P. 263.395

-0.263% — -0.307%

RL 255.000

CHAINAGE	DESIGN SURFACE	EXISTING SURFACE
1140.000	263.739	262.61
1141.927	263.734	262.57
1150.000	263.713	262.42
1151.378	263.709	262.42
1156.403	263.696	262.34
1160.000	263.687	262.34
1165.854	263.671	262.37
1170.000	263.660	262.31
1180.000	263.634	262.22
1190.000	263.608	262.17
1196.583	263.590	262.09
1200.000	263.581	262.08
1206.034	263.566	261.85
1210.000	263.555	261.69
1211.529	263.551	261.67
1220.000	263.529	262.04
1220.980	263.526	262.09
1227.197	263.510	262.41
1230.000	263.502	262.52
1236.122	263.486	262.61
1240.000	263.476	262.54
1241.532	263.472	262.50
1250.000	263.450	262.53
1251.159	263.447	262.53
1260.000	263.424	262.46
1270.000	263.397	262.41
1270.852	263.395	262.41
1275.993	263.379	262.37
1278.991	263.370	262.37
1280.000	263.367	262.37
1285.995	263.349	262.40
1290.000	263.336	262.43
1290.399	263.335	262.40
1299.817	263.306	261.45
1300.000	263.306	261.46
1307.772	263.282	262.14
1309.536	263.276	262.03
1310.000	263.275	261.98
1317.490	263.252	262.36
1320.000	263.244	262.35
1330.000	263.214	262.30
1340.000	263.183	262.20
1340.072	263.183	262.20
1343.973	263.171	262.25
1349.790	263.153	262.22
1350.000	263.152	262.22
1353.691	263.141	262.10
1360.000	263.121	261.87
1367.059	263.100	261.38
1370.000	263.091	261.29
1376.777	263.070	261.01

LONGITUDINAL SECTION MC02
Holbrook Levee 2 Ch 1140.000 to Ch 1376.777
SCALES: HORIZONTAL 1:500 VERTICAL 1:100

NOTE:

1. REFER TO DRAWING 300203886-WE-3001 FOR GENERAL NOTES.
2. REFER TO DRAWING 300203886-WE-3050 FOR LAYOUT KEY PLAN.
3. REFER TO DRAWING 300203886-WE-3101 & 3102 FOR ALIGNMENT CONTROL PLANS.
4. REFER TO DRAWINGS 300203886-WE-3300 TO 3313 FOR CROSS SECTIONS.
5. REFER TO DRAWINGS 300203886-WE-3450 TO 3457 FOR TYPICAL SECTIONS AND DETAILS.
6. REFER TO DRAWINGS 300203886-ST-3700 TO 3721 FOR STRUCTURAL DETAILS.

XREF's:
CAD File: \\au2013-ppfss01\shared_projects\300203886\300 Levee Design\300203886-WE-3250-3255.dwg

Rev.	Date	Description	Des.	Verif.	Appd.
A	10/05/2024	TENDER ISSUE	VZ		AS

H: 0 10 20m
V: 0 2 4m
SCALE H:1:500 V:1:100 @A1

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Drawn SB Date 15/06/20
Checked VZ Date 23/04/24
Designed AS Date 23/04/24
Verified Date
Approved Date

Client GREATER HUME SHIRE COUNCIL

Project HHC FLOOD LEVEE DESIGN
HOLBROOK, HENTY
& CULCAIRN

Title HOLBROOK 2 LONGITUDINAL SECTIONS
SHEET 2 OF 2

Status FOR TENDER ONLY
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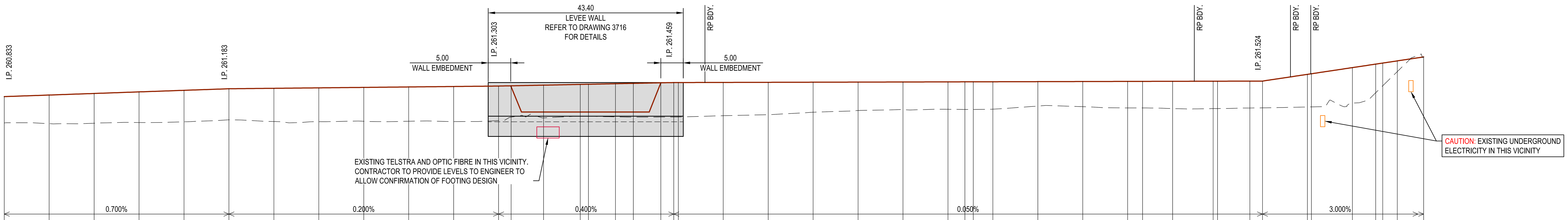
VERT. DATUM	HORZ. DATUM	Scale	Size
AHD	MGA	AS SHOWN	A1

Drawing Number 300203886-WE-3254 Revision A

LEGEND

DESIGN CENTRE LINE

EXISTING SURFACE



RL 253.600

CHAINAGE	DESIGN SURFACE	EXISTING SURFACE
0.000	260.833	259.66
10.000	260.903	259.63
20.000	260.973	259.65
30.000	261.043	259.68
40.000	261.113	259.71
50.000	261.183	259.80
60.000	261.203	259.72
70.000	261.223	259.71
80.000	261.243	259.73
90.000	261.263	259.73
100.000	261.283	259.72
110.000	261.303	259.77
112.800	261.314	259.92
120.000	261.343	259.89
128.184	261.375	259.96
130.000	261.383	259.96
136.008	261.407	259.93
140.000	261.423	259.92
146.100	261.447	259.92
148.990	261.459	259.92
150.000	261.459	259.92
160.000	261.464	259.98
170.000	261.469	260.03
180.000	261.474	260.14
190.000	261.479	260.21
200.000	261.484	260.25
210.000	261.489	260.27
213.775	261.491	260.26
215.646	261.492	260.26
220.000	261.494	260.27
230.000	261.499	260.41
240.000	261.504	260.38
250.000	261.509	260.33
253.305	261.511	260.33
260.000	261.514	260.30
269.013	261.519	260.30
270.000	261.519	260.30
277.182	261.523	260.33
280.000	261.524	260.33
290.000	261.824	260.37
290.887	261.851	260.38
300.000	262.124	260.54
305.192	262.280	261.00
306.760	262.327	261.32
310.000	262.424	261.95
315.866	262.600	262.60

LONGITUDINAL SECTION MC03
Holbrook levee 3 Ch 0.000 to Ch 315.866
SCALES: HORIZONTAL 1:500 VERTICAL 1:100

NOTE:

1. REFER TO DRAWING 300203886-WE-3001 FOR GENERAL NOTES.
2. REFER TO DRAWING 300203886-WE-3050 FOR LAYOUT KEY PLAN.
3. REFER TO DRAWING 300203886-WE-3101 & 3102 FOR ALIGNMENT CONTROL PLANS.
4. REFER TO DRAWINGS 300203886-WE-3300 TO 3313 FOR CROSS SECTIONS.
5. REFER TO DRAWINGS 300203886-WE-3450 TO 3457 FOR TYPICAL SECTIONS AND DETAILS.
6. REFER TO DRAWINGS 300203886-ST-3700 TO 3721 FOR STRUCTURAL DETAILS.

XREF's:
CAD File: \\au2013-ppfss01\shared_projects\300203886\300 Levee Design\300203886-WE-3250-3255.dwg

Rev.	Date	Description	Des.	Verif.	Appd.
A	10/05/2024	TENDER ISSUE	VZ		AS

H: 0 10 20m
V: 0 2 4m
SCALE H:1:500 V:1:100 @A1

Greater Hume Council

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		Date
Drawn	SB	15/06/20
Checked	VZ	23/04/24
Designed	AS	23/04/24
Verified		
Approved		

Client GREATER HUME SHIRE COUNCIL

Project HHC FLOOD LEVEE DESIGN
HOLBROOK, HENTY
& CULCAIRN

Title HOLBROOK 3 LONGITUDINAL SECTIONS
SHEET 1 OF 1

Status FOR TENDER ONLY
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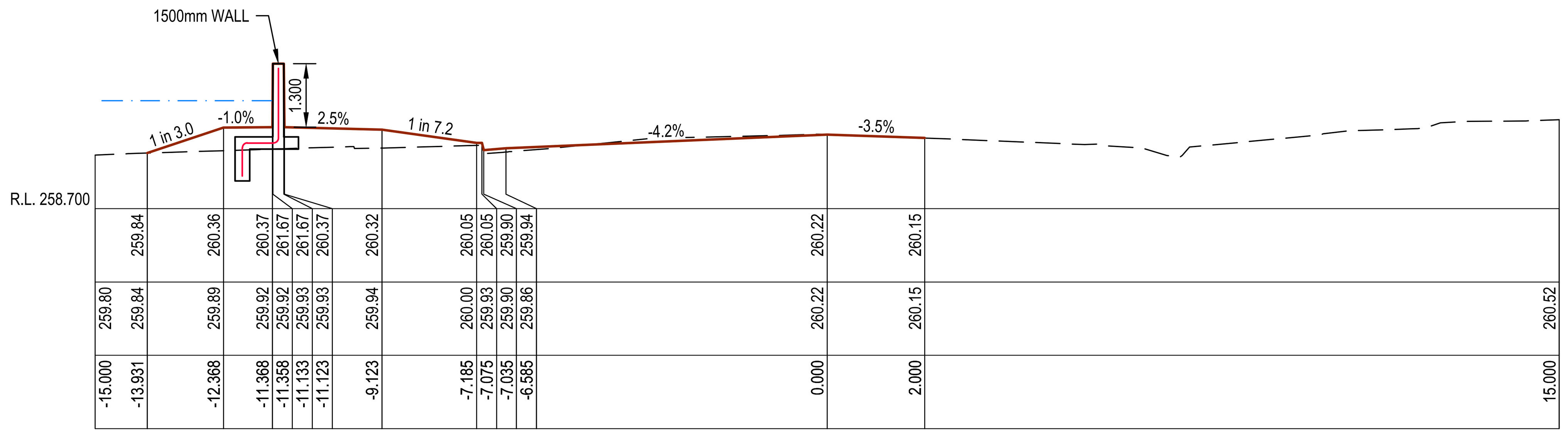
VERT. DATUM	HORZ. DATUM	Scale	Size
AHD	MGA	AS SHOWN	A1

Drawing Number 300203886-WE-3255
Revision A

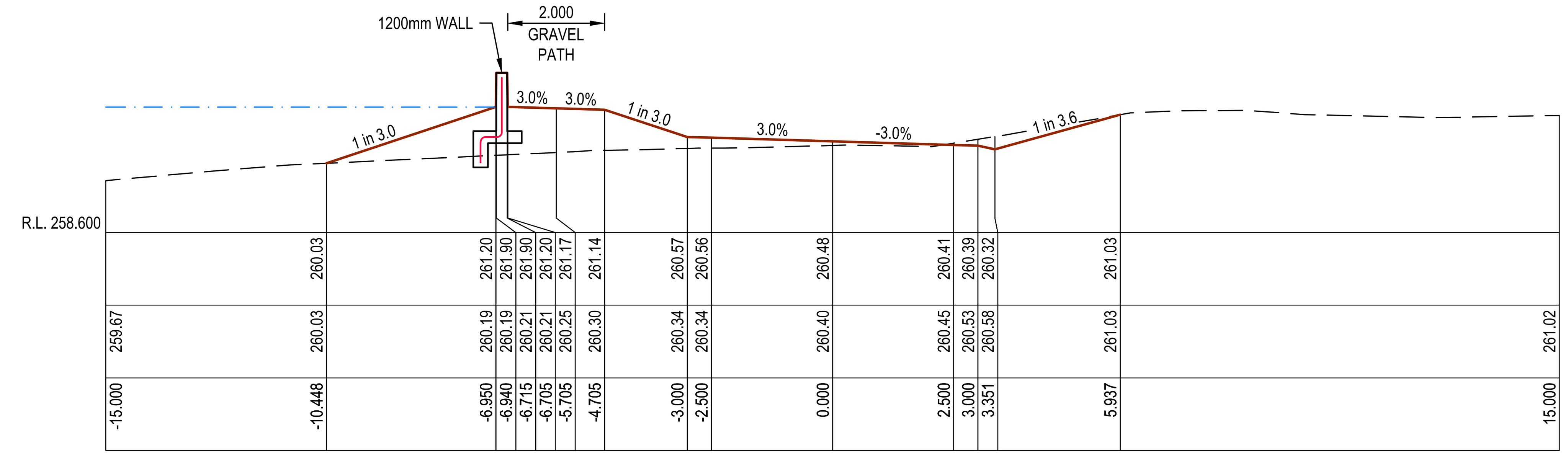
DATE PLOTTED: 10 May 2024 9:31 AM BY : HAZELGROVE, ADAM

LEGEND

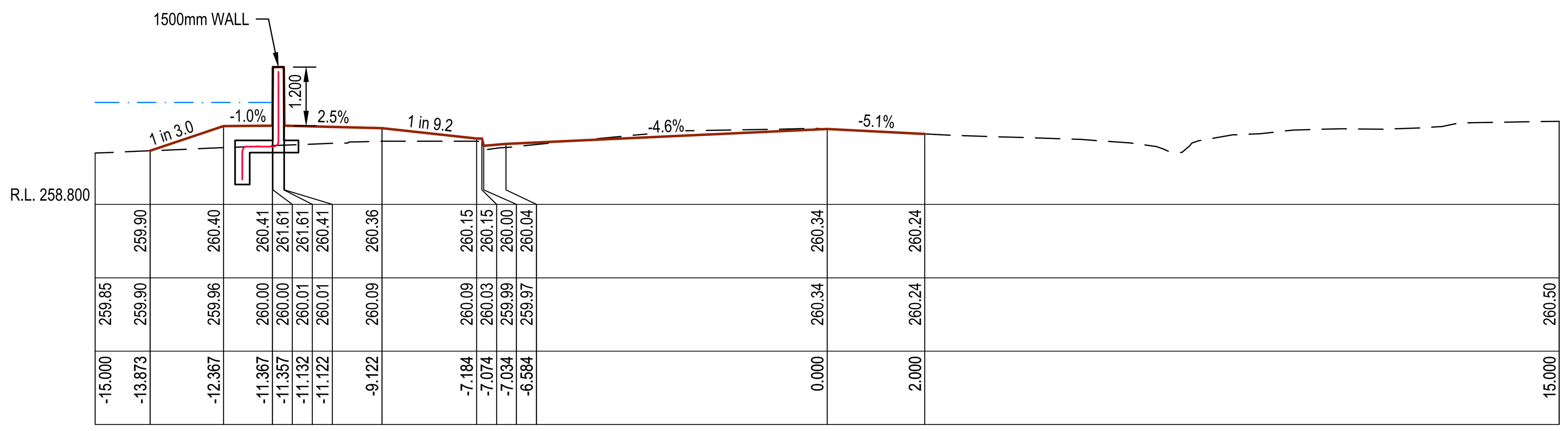
	DESIGN CENTRE LINE
	Ex 1% AEP FLOOD LEVEL
	EXISTING SURFACE
	EXISTING LIDAR SURFACE



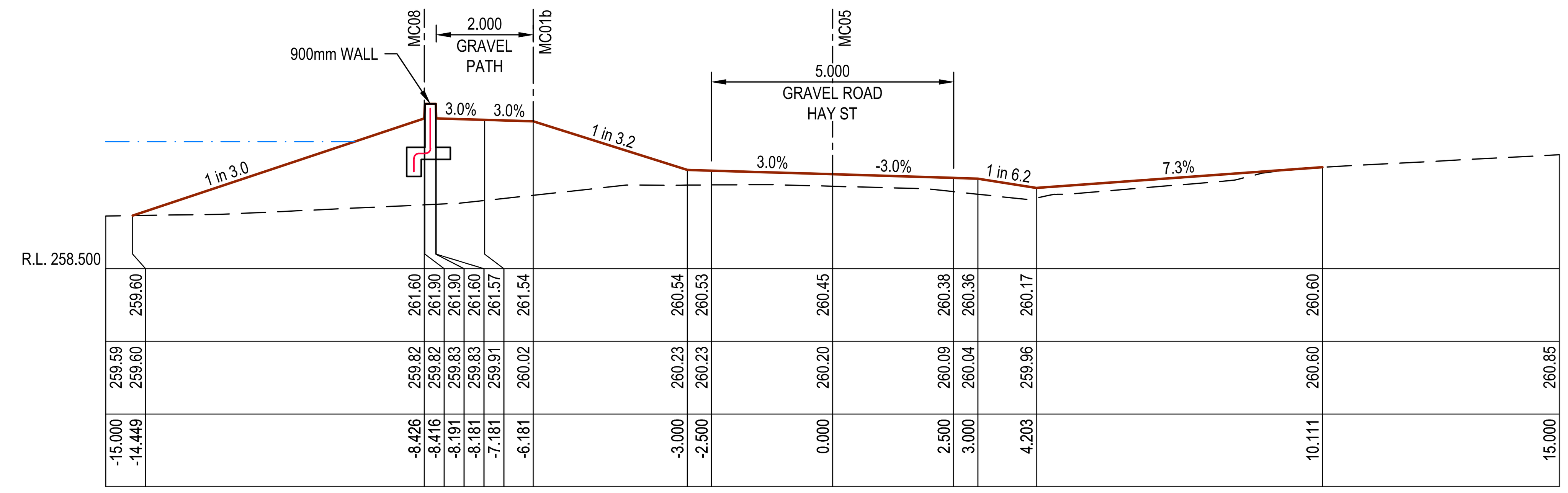
Ch 80.000
Hay Street to Nolan St centre line



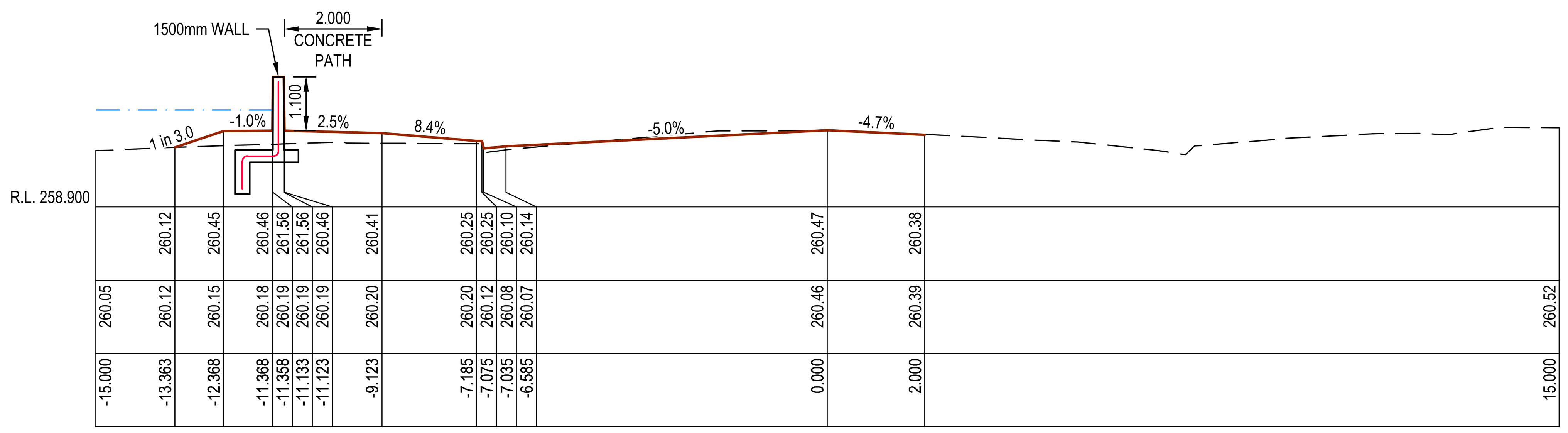
Ch 160.000
Hay Street to Nolan St centre line



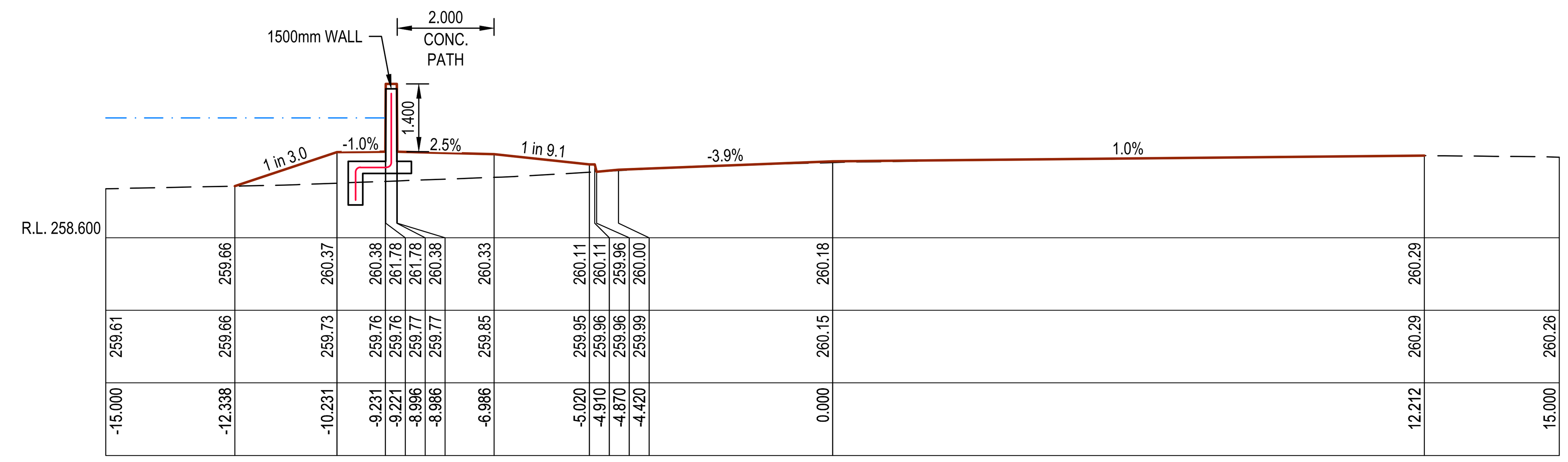
Ch 60.000
Hay Street to Nolan St centre line



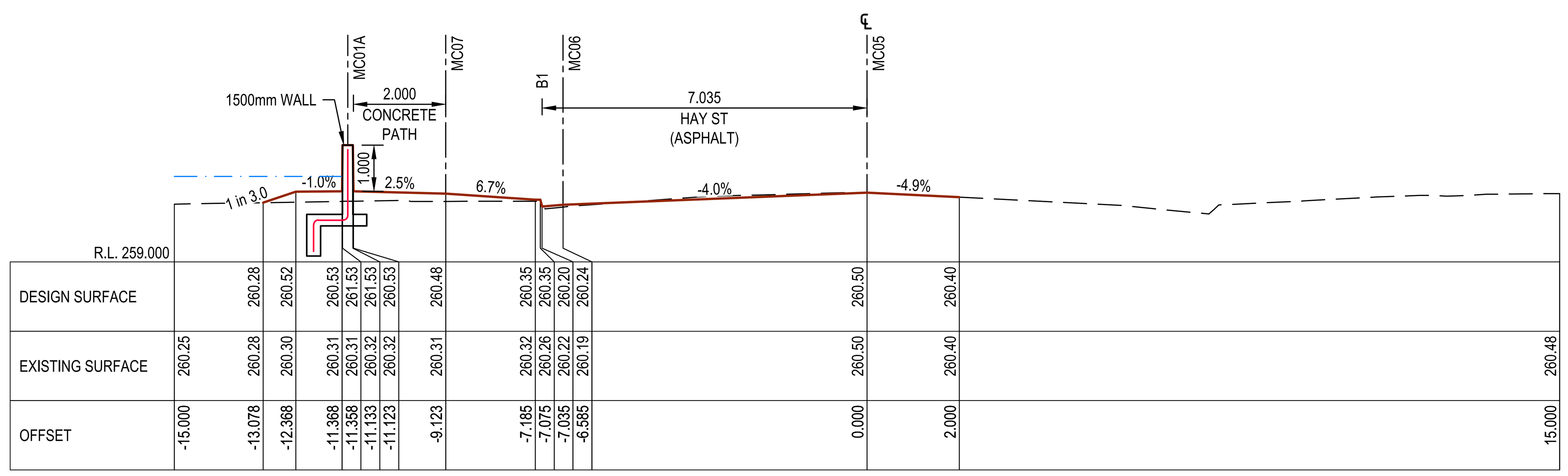
Ch 140.000
Hay Street to Nolan St centre line



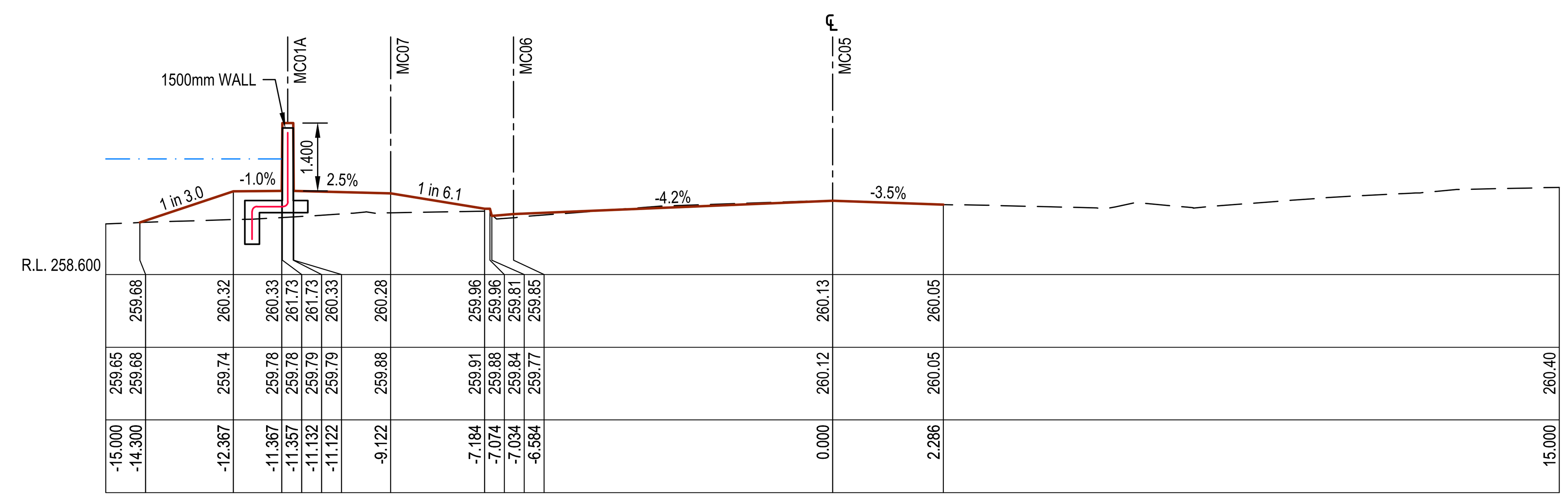
Ch 40.000
Hay Street to Nolan St centre line



Ch 120.000
Hay Street to Nolan St centre line



Ch 20.000
Hay Street to Nolan St centre line



Ch 100.000
Hay Street to Nolan St centre line

MC05 CROSS SECTIONS

SCALE 1:100

NOTE:

1. REFER TO DRAWING 300203886-WE-3001 FOR GENERAL NOTES.
2. REFER TO DRAWING 300203886-WE-3050 FOR LAYOUT KEY PLAN.
3. REFER TO DRAWINGS 300203886-WE-3250 TO 3255 FOR LONGITUDINAL SECTIONS.
4. REFER TO DRAWINGS 300203886-ST-3450 TO 3457 FOR TYPICAL SECTIONS AND GEOTECHNICAL DETAILS.
5. REFER TO DRAWINGS 300203886-ST-3700 TO 3721 FOR LEVEE WALL STRUCTURAL DETAILS.

Rev.	Date	Description	Des.	Verif.	Appd.
A	10/05/2024	TENDER ISSUE	VZ		AS

0 1 2 4m
H 1:100 @A1

Greater Hume Council

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Drawn SB	Date 15/06/20	
Checked VZ	Date 23/04/24	
Designed AS	Date 23/04/24	
Verified	Date	
Approved	Date	

Client: GREATER HUME SHIRE COUNCIL

Project: HHC FLOOD LEVEE DESIGN
HOLBROOK, HENTY
& CULCAIRN

Title: HOLBROOK 1 CROSS SECTIONS
SHEET 1 OF 3

Status: FOR TENDER ONLY
NOT TO BE USED FOR CONSTRUCTION PURPOSES

VERT. DATUM	HORZ. DATUM	Scale	Size
AHD	MGA	AS SHOWN	A1

Drawing Number: 300203886-WE-3300 Revision: A

XREF's:
CAD File: \\au2013-ppfss01\shared_projects\300203886\300 Levee Design\300203886-WE-3300-3316.dwg

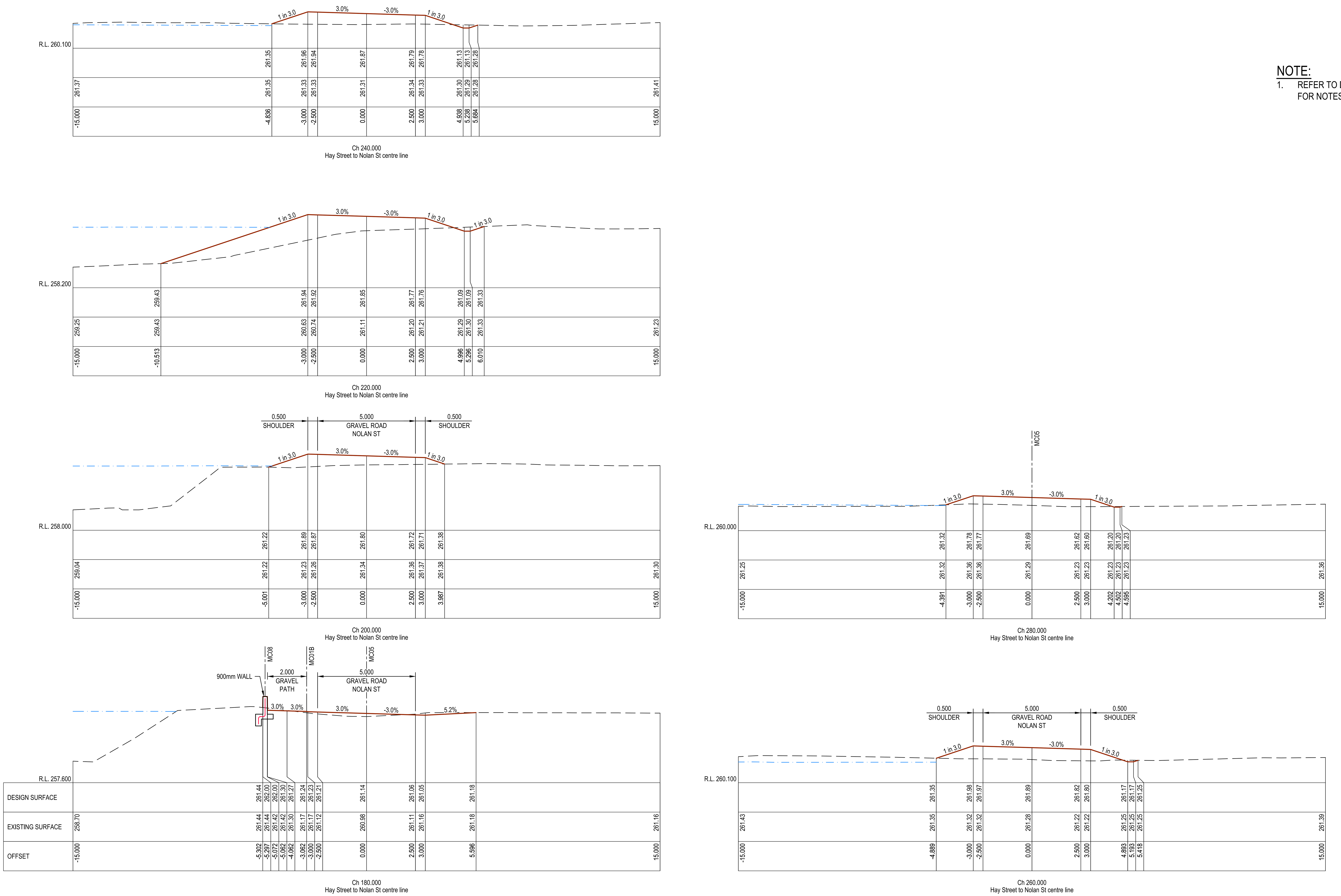
XREF's:
CAD File: \\au2013-ppfss01\shared_projects\300203886\300 Levee Design\300203886-WE-3300-3316.dwg

DATE PLOTTED: 10 May 2024 9:31 AM BY : HAZELGROVE, ADAM

LEGEND

———	DESIGN CENTRE LINE
— · —	Ex 1% AEP FLOOD LEVEL
— — —	EXISTING SURFACE
———	EXISTING LIDAR SURFACE

NOTE:
1. REFER TO DRAWING 300203886-WE-3300 FOR NOTES.



MC05 CROSS SECTIONS

SCALE 1:100

Rev.	Date	Description	Des.	Verif.	Appd.
A	10/05/2024	TENDER ISSUE	VZ		AS

0 1 2 4m
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Drawn SB	Date 15/06/20	
Checked VZ	Date 23/04/24	
Designed AS	Date 23/04/24	
Verified	Date	
Approved	Date	

Client: GREATER HUME SHIRE COUNCIL

Project: HHC FLOOD LEVEE DESIGN
HOLBROOK, HENTY
& CULCAIRN

Title: HOLBROOK 1 CROSS SECTIONS
SHEET 2 OF 3

Status: FOR TENDER ONLY
NOT TO BE USED FOR CONSTRUCTION PURPOSES

VERT. DATUM	HORZ. DATUM	Scale	Size
AHD	MGA	AS SHOWN	A1

Drawing Number	Revision
300203886-WE-3301	A

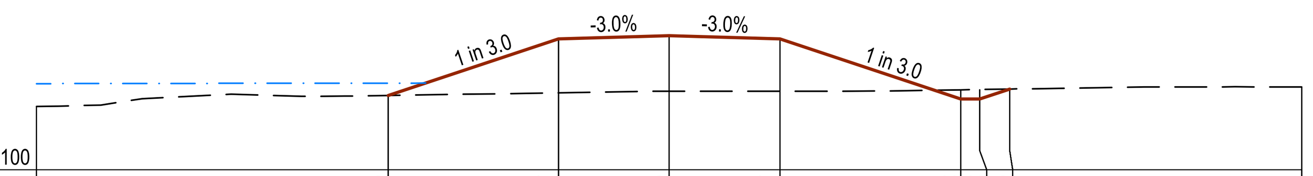
DATE PLOTTED: 10 May 2024 9:31 AM BY : HAZELGROVE, ADAM

LEGEND

- DESIGN CENTRE LINE
- Ex 1% AEP FLOOD LEVEL
- EXISTING SURFACE
- EXISTING LIDAR SURFACE

NOTE:

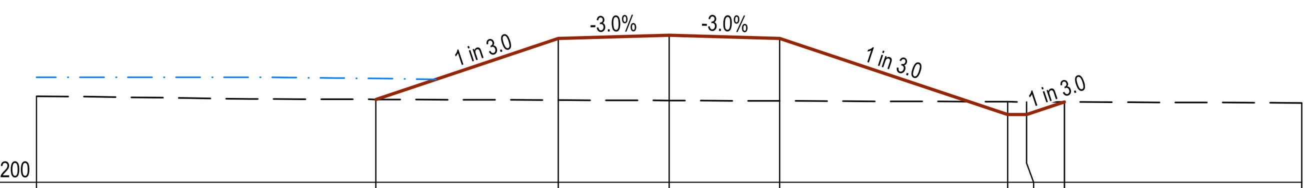
1. REFER TO DRAWING 300203886-WE-3300 FOR NOTES.



R.L. 260.100

DESIGN SURFACE		261.28	262.17	262.23	262.17	261.22	261.22	261.38	
EXISTING SURFACE	261.10	261.28	261.32	261.34	261.34	261.37	261.37	261.38	261.41
OFFSET	-10.000	-4.441	-1.750	0.000	1.750	4.610	4.910	5.382	10.000

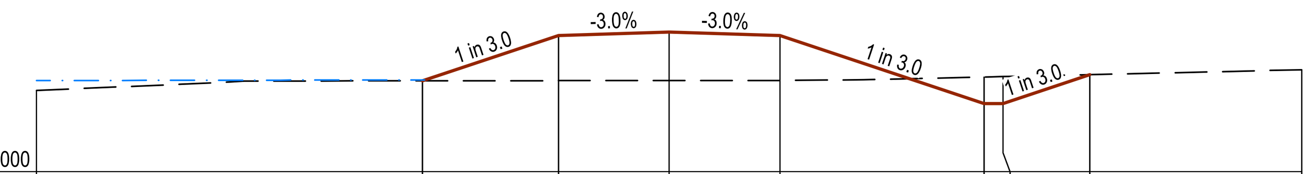
Ch 100.000
Holbrook Levee 1 part 3



R.L. 260.200

DESIGN SURFACE		261.51	262.47	262.52	262.47	261.27	261.27	261.47	
EXISTING SURFACE	261.56	261.51	261.50	261.49	261.48	261.47	261.47	261.47	261.45
OFFSET	-10.000	-4.637	-1.750	0.000	1.750	5.353	5.653	6.247	10.000

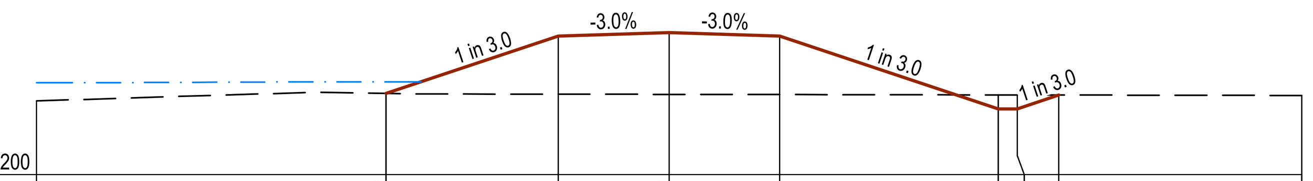
Ch 200.000
Holbrook Levee 1 part 3



R.L. 260.000

DESIGN SURFACE		261.44	262.15	262.21	262.15	261.08	261.08	261.54	
EXISTING SURFACE	261.28	261.44	261.44	261.44	261.44	261.50	261.50	261.54	261.61
OFFSET	-10.000	-3.900	-1.750	0.000	1.750	4.977	5.277	6.650	10.000

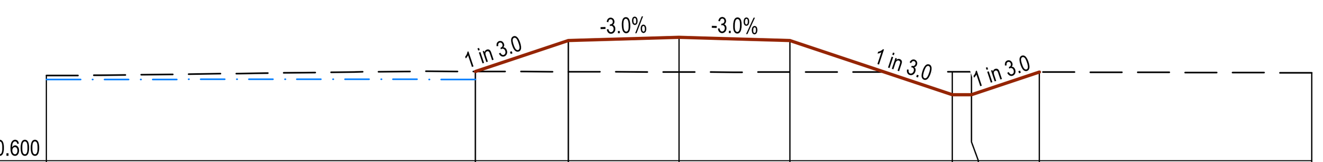
Ch 80.000
Holbrook Levee 1 part 3



R.L. 260.200

DESIGN SURFACE		261.48	262.39	262.44	262.39	261.24	261.24	261.46	
EXISTING SURFACE	261.36	261.48	261.47	261.47	261.46	261.46	261.46	261.46	261.45
OFFSET	-10.000	-4.474	-1.750	0.000	1.750	5.204	5.504	6.158	10.000

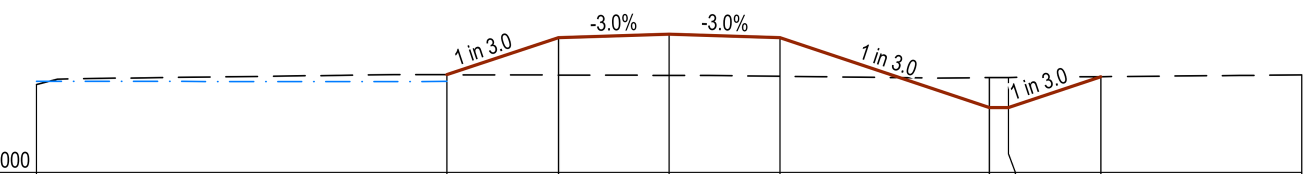
Ch 180.000
Holbrook Levee 1 part 3



R.L. 260.600

DESIGN SURFACE		262.02	262.51	262.56	262.51	261.65	261.65	262.01	
EXISTING SURFACE	261.95	262.02	262.01	262.01	262.01	262.01	262.01	262.01	262.00
OFFSET	-10.000	-3.220	-1.750	0.000	1.750	4.322	4.622	5.696	10.000

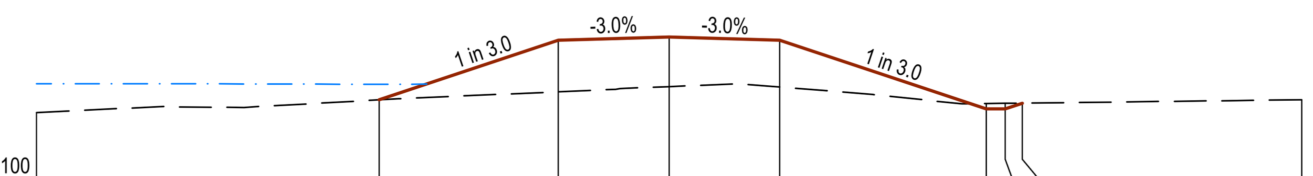
Ch 280.000
Holbrook Levee 1 part 3



R.L. 260.000

DESIGN SURFACE		261.55	262.13	262.19	262.13	261.03	261.03	261.51	
EXISTING SURFACE	261.39	261.55	261.54	261.54	261.52	261.50	261.50	261.51	261.54
OFFSET	-10.000	-3.514	-1.750	0.000	1.750	5.064	5.364	6.822	10.000

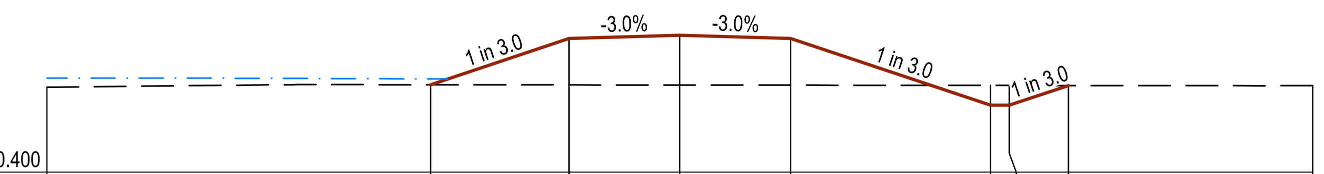
Ch 60.000
Holbrook Levee 1 part 3



R.L. 260.100

DESIGN SURFACE		261.34	262.29	262.34	262.29	261.20	261.20	261.29	
EXISTING SURFACE	261.14	261.34	261.47	261.55	261.55	261.28	261.29	261.29	261.35
OFFSET	-10.000	-4.586	-1.750	0.000	1.750	5.012	5.312	5.682	10.000

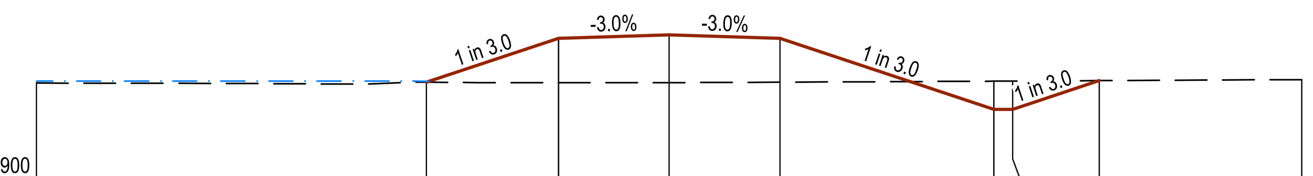
Ch 160.000
Holbrook Levee 1 part 3



R.L. 260.400

DESIGN SURFACE		261.78	262.51	262.56	262.51	261.46	261.46	261.77	
EXISTING SURFACE	261.74	261.78	261.78	261.77	261.77	261.77	261.77	261.77	261.76
OFFSET	-10.000	-3.939	-1.750	0.000	1.750	4.908	5.208	6.140	10.000

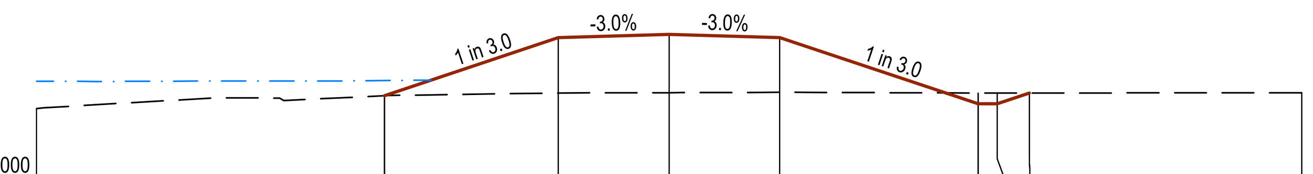
Ch 260.000
Holbrook Levee 1 part 3



R.L. 259.900

DESIGN SURFACE		261.42	262.11	262.17	262.11	260.99	260.99	261.44	
EXISTING SURFACE	261.40	261.42	261.41	261.41	261.42	261.43	261.43	261.44	261.46
OFFSET	-10.000	-3.836	-1.750	0.000	1.750	5.132	5.432	6.799	10.000

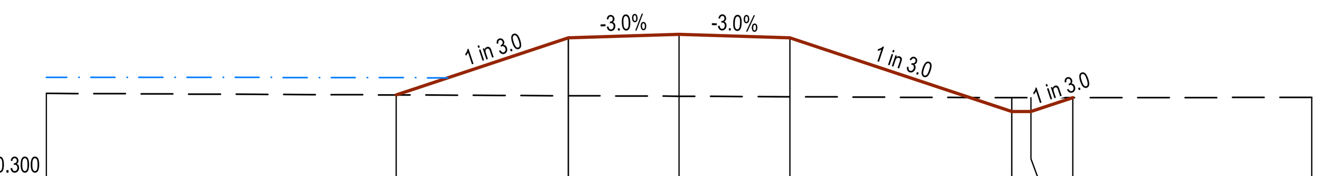
Ch 40.000
Holbrook Levee 1 part 3



R.L. 260.000

DESIGN SURFACE		261.30	262.21	262.27	262.21	261.17	261.17	261.34	
EXISTING SURFACE	261.09	261.30	261.34	261.34	261.35	261.34	261.34	261.34	261.34
OFFSET	-10.000	-4.499	-1.750	0.000	1.750	4.885	5.185	5.696	10.000

Ch 140.000
Holbrook Levee 1 part 3

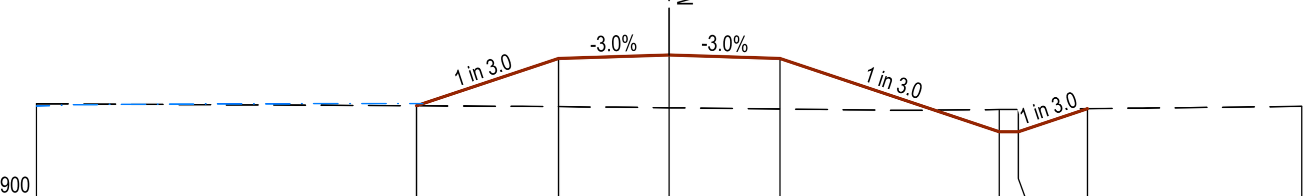


R.L. 260.300

DESIGN SURFACE		261.61	262.51	262.57	262.51	261.34	261.34	261.56	
EXISTING SURFACE	261.63	261.61	261.59	261.59	261.58	261.57	261.56	261.56	261.57
OFFSET	-10.000	-4.470	-1.750	0.000	1.750	5.263	5.563	6.225	10.000

Ch 240.000
Holbrook Levee 1 part 3

MC01C

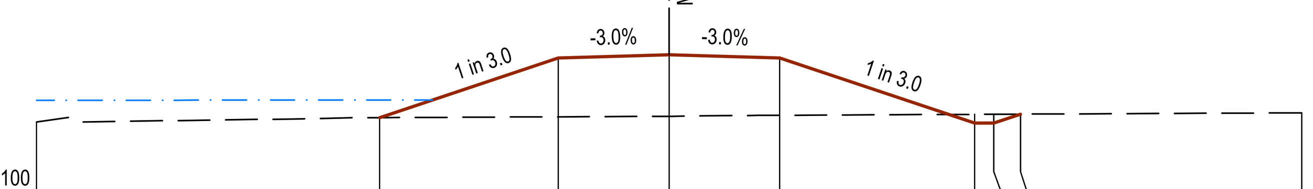


R.L. 259.900

DESIGN SURFACE		261.35	262.09	262.15	262.09	260.94	260.94	261.30	
EXISTING SURFACE	261.38	261.35	261.33	261.31	261.29	261.29	261.29	261.30	261.34
OFFSET	-10.000	-3.993	-1.750	0.000	1.750	5.219	5.519	6.609	10.000

Ch 20.000
Holbrook Levee 1 part 3

MC01C

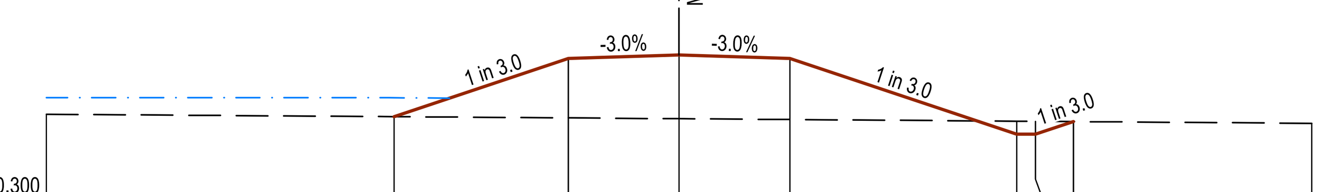


R.L. 260.100

DESIGN SURFACE		261.25	262.19	262.25	262.19	261.17	261.17	261.31	
EXISTING SURFACE	261.18	261.25	261.26	261.27	261.29	261.30	261.30	261.31	261.33
OFFSET	-10.000	-4.575	-1.750	0.000	1.750	4.832	5.132	5.554	10.000

Ch 120.000
Holbrook Levee 1 part 3

MC01C



R.L. 260.300

DESIGN SURFACE		261.58	262.50	262.55	262.50	261.31	261.31	261.50	
EXISTING SURFACE	261.62	261.58	261.56	261.55	261.54	261.51	261.51	261.50	261.48
OFFSET	-10.000	-4.505	-1.750	0.000	1.750	5.335	5.635	6.233	10.000

Ch 220.000
Holbrook Levee 1 part 3

MC001C CROSS SECTIONS

SCALE 1:100

Rev.	Date	Description	Des.	Verif.	Appd.
A	10/05/2024	TENDER ISSUE	VZ		AS

0 1 2 4m
H 1:100 @A1

Greater Hume Council

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Drawn SB Date 15/06/20
Checked VZ Date 23/04/24
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Verified Date
Approved Date

Client GREATER HUME SHIRE COUNCIL

Project HHC FLOOD LEVEE DESIGN
HOLBROOK, HENTY
& CULCAIRN

Title HOLBROOK 1 CROSS SECTIONS
SHEET 3 OF 3

Status FOR TENDER ONLY
NOT TO BE USED FOR CONSTRUCTION PURPOSES

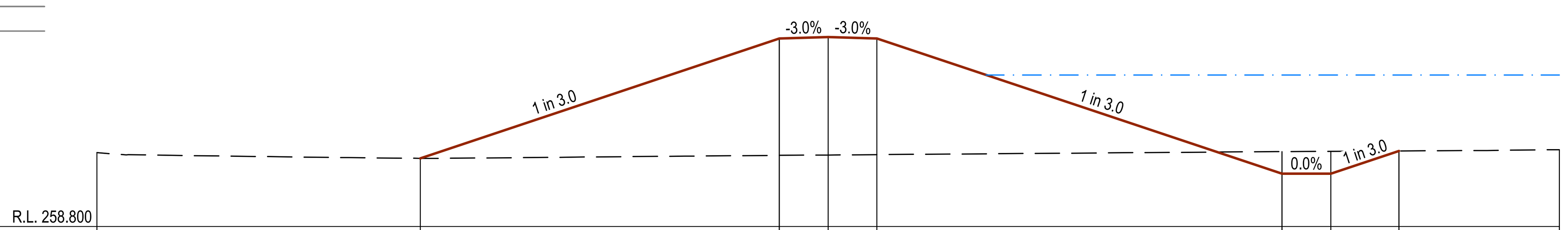
VERT. DATUM AHD | HORZ. DATUM MGA | Scale AS SHOWN | Size A1

Drawing Number 300203886-WE-3302 | Revision A

XREF's:
CAD File: \\au2013-ppfss01\shared_projects\300203886\300 Levee Design\300203886-WE-3300-3316.dwg

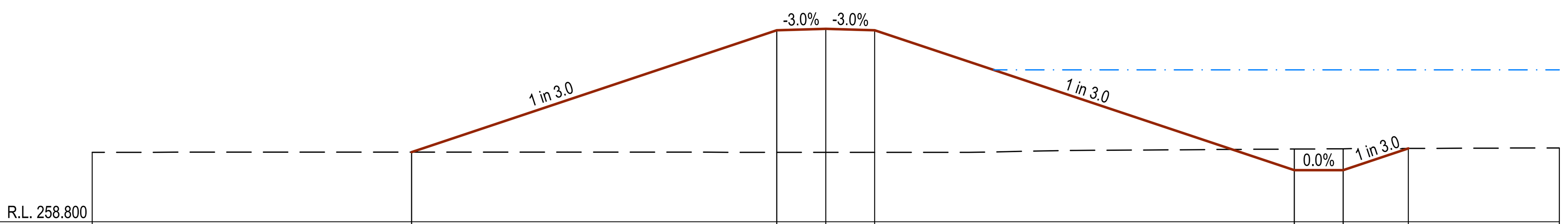
LEGEND

- DESIGN CENTRE LINE
- Ex 1% AEP FLOOD LEVEL
- EXISTING SURFACE
- EXISTING LIDAR SURFACE



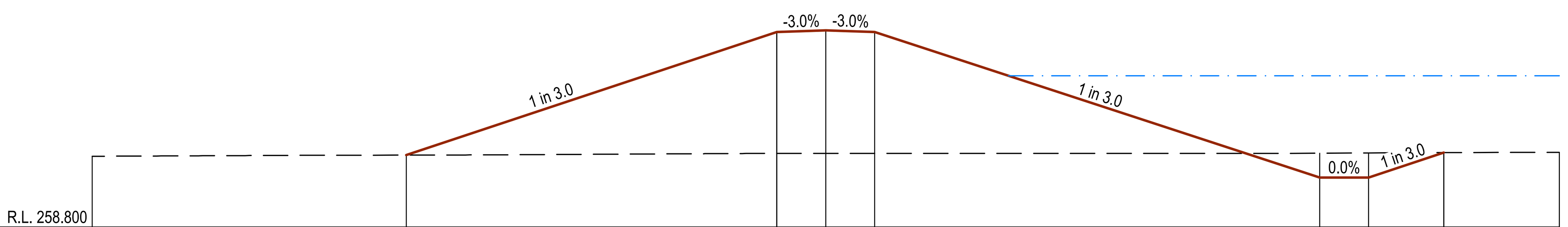
DESIGN SURFACE		260.20	262.65	262.68	262.65	259.88	259.88	260.35	
EXISTING SURFACE	260.32	260.20	260.26	260.27	260.27	260.34	260.34	260.35	260.37
OFFSET	-15.000	-8.367	-1.000	0.000	1.000	9.312	10.312	11.709	15.000

Ch 100.000
Holbrook Levee 2



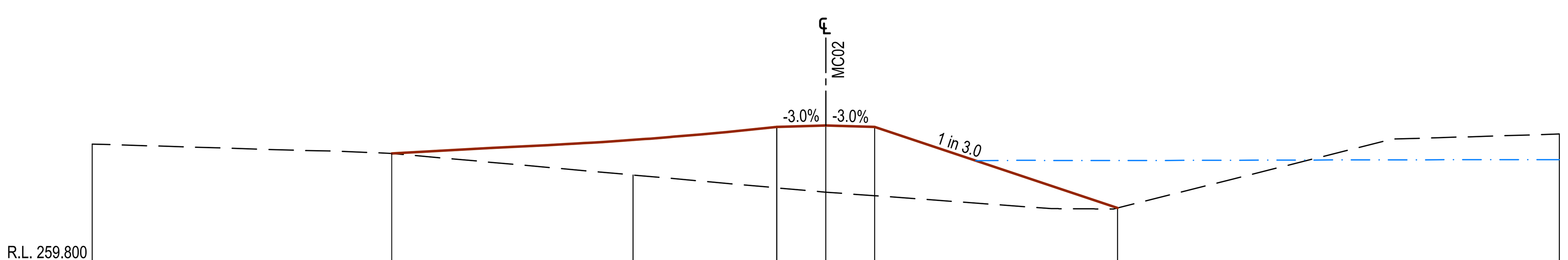
DESIGN SURFACE		260.23	262.71	262.74	262.71	259.85	259.85	260.30	
EXISTING SURFACE	260.22	260.23	260.22	260.22	260.22	260.29	260.29	260.30	260.31
OFFSET	-15.000	-8.467	-1.000	0.000	1.000	9.580	10.580	11.915	15.000

Ch 80.000
Holbrook Levee 2



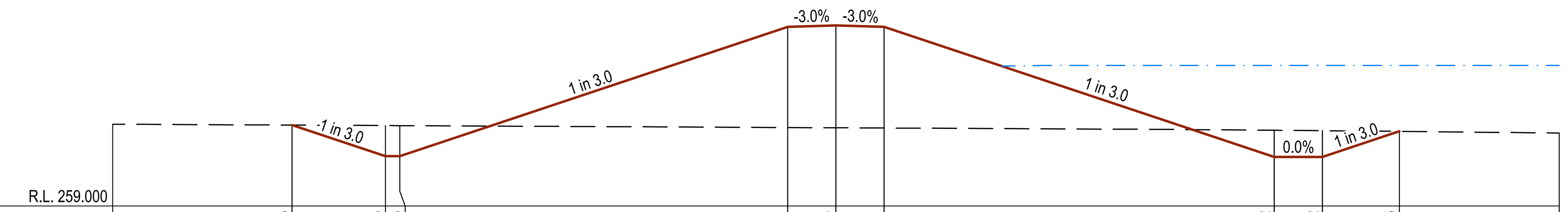
DESIGN SURFACE		260.27	262.80	262.83	262.80	259.81	259.81	260.33	
EXISTING SURFACE	260.25	260.27	260.31	260.31	260.31	260.31	260.32	260.33	260.33
OFFSET	-15.000	-8.578	-1.000	0.000	1.000	10.100	11.100	12.637	15.000

Ch 60.000
Holbrook Levee 2



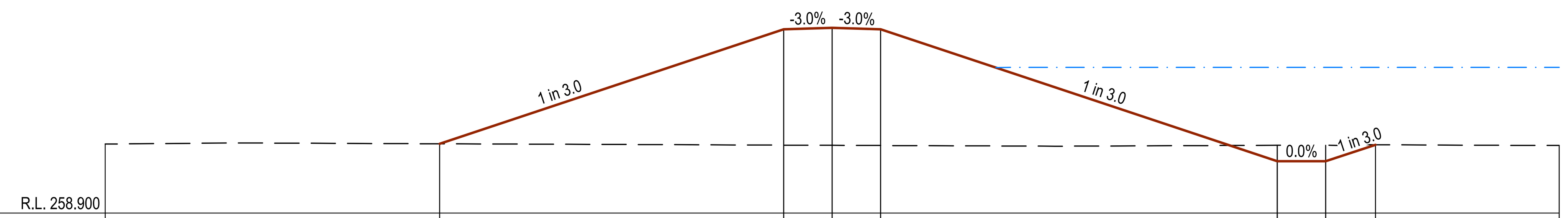
DESIGN SURFACE			261.58	262.56	262.59	262.56	260.90	
EXISTING SURFACE	262.21	262.02	261.58	261.32	261.23	261.16	260.90	262.42
OFFSET	-15.000	-8.876	-3.941	-1.000	0.000	1.000	5.965	15.000

Ch 20.000
Holbrook Levee 2



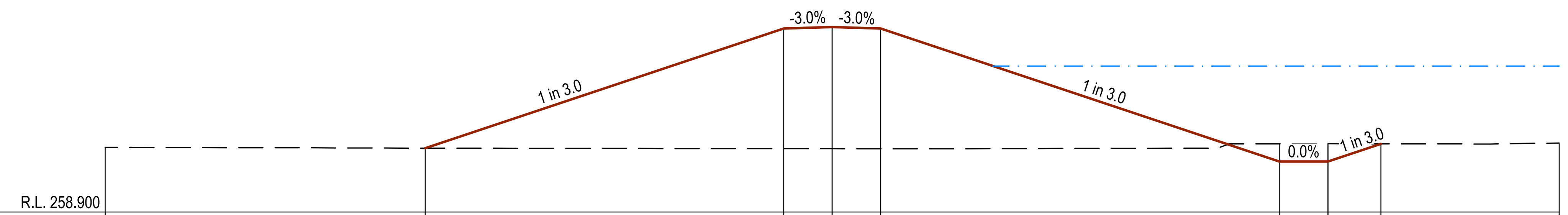
DESIGN SURFACE		260.68	260.03	260.03	262.71	262.74	262.71	260.02	260.02	260.55	
EXISTING SURFACE	260.69	260.68	260.67	260.67	260.63	260.62	260.62	260.57	260.56	260.55	260.51
OFFSET	-15.000	-11.276	-9.342	-9.042	-1.000	0.000	1.000	9.089	10.089	11.683	15.000

Ch 180.000
Holbrook Levee 2



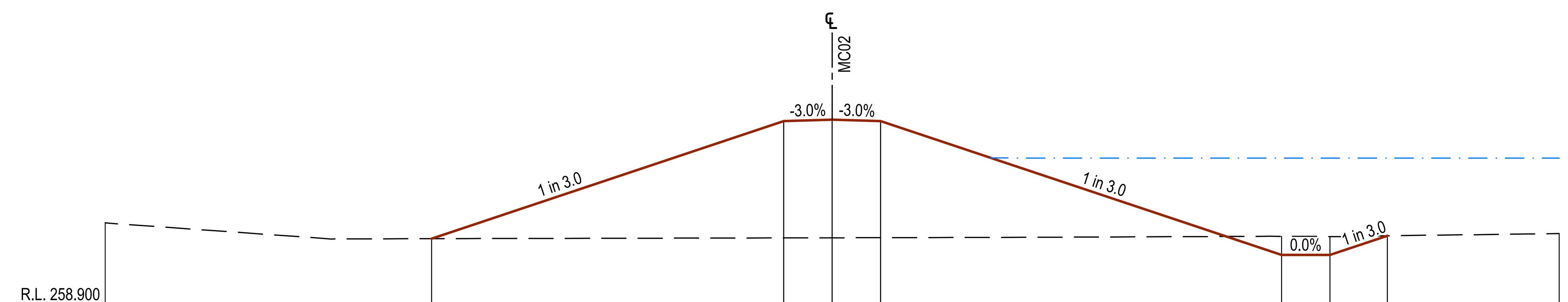
DESIGN SURFACE		260.33	262.70	262.73	262.70	259.97	259.97	260.31	
EXISTING SURFACE	260.33	260.33	260.30	260.30	260.30	260.30	260.30	260.31	260.30
OFFSET	-15.000	-8.096	-1.000	0.000	1.000	9.182	10.182	11.208	15.000

Ch 160.000
Holbrook Levee 2



DESIGN SURFACE		260.22	262.68	262.71	262.68	259.94	259.94	260.31	
EXISTING SURFACE	260.23	260.22	260.21	260.21	260.20	260.31	260.31	260.31	260.32
OFFSET	-15.000	-8.396	-1.000	0.000	1.000	9.226	10.226	11.321	15.000

Ch 140.000
Holbrook Levee 2



DESIGN SURFACE		260.25	262.67	262.70	262.67	259.91	259.91	260.31	
EXISTING SURFACE	260.57	260.25	260.26	260.27	260.27	260.30	260.29	260.31	260.35
OFFSET	-15.000	-8.264	-1.000	0.000	1.000	9.269	10.269	11.456	15.000

Ch 120.000
Holbrook Levee 2

MC02 CROSS SECTIONS
SCALE 1:100

NOTE:
1. REFER TO DRAWING 300203886-WE-3300 FOR NOTES.

Rev.	Date	Description	Des.	Verif.	Appd.
A	10/05/2024	TENDER ISSUE	VZ		AS

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H 1:100 @A1

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Drawn SB Date 15/06/20
Checked VZ Date 23/04/24
Designed AS Date 23/04/24
Verified Date
Approved Date

Client: GREATER HUME SHIRE COUNCIL
Project: HHC FLOOD LEVEE DESIGN HOLBROOK, HENTY & CULCAIRN
Title: HOLBROOK 2 CROSS SECTIONS SHEET 1 OF 9

Status: FOR TENDER ONLY
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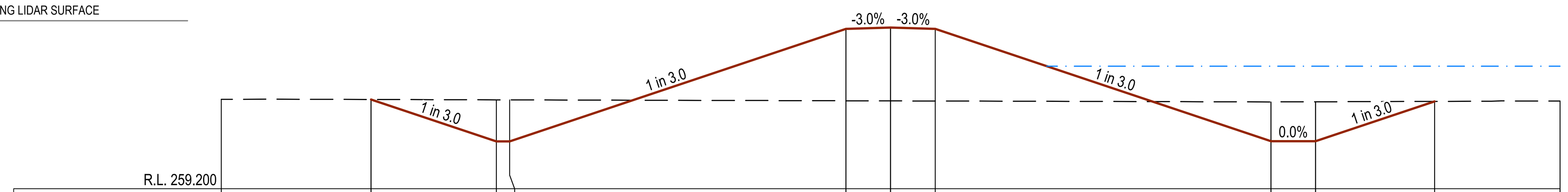
VERT. DATUM AHD | HORZ. DATUM MGA | Scale AS SHOWN | Size A1
Drawing Number 300203886-WE-3303 | Revision A

XREF's:
CAD File: \\au2013-ppfss01\shared_projects\300203886\300 Levee Design\300203886-WE-3300-3316.dwg
DATE PLOTTED: 10 May 2024 9:31 AM BY : HAZELGROVE, ADAM

DATE PLOTTED: 10 May 2024 9:31 AM BY : HAZELGROVE, ADAM

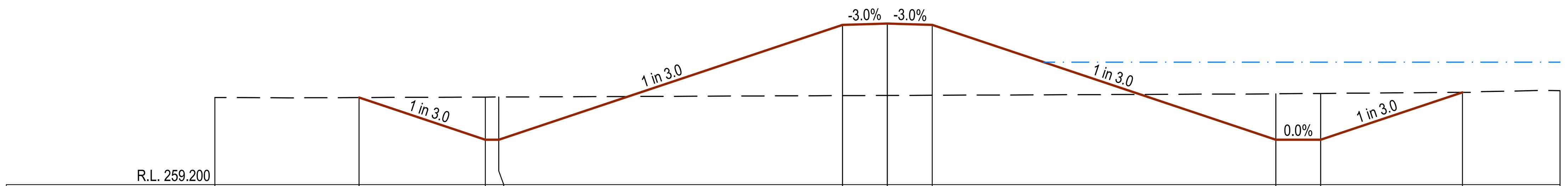
LEGEND

- DESIGN CENTRE LINE
- Ex 1% AEP FLOOD LEVEL
- EXISTING SURFACE
- EXISTING LIDAR SURFACE



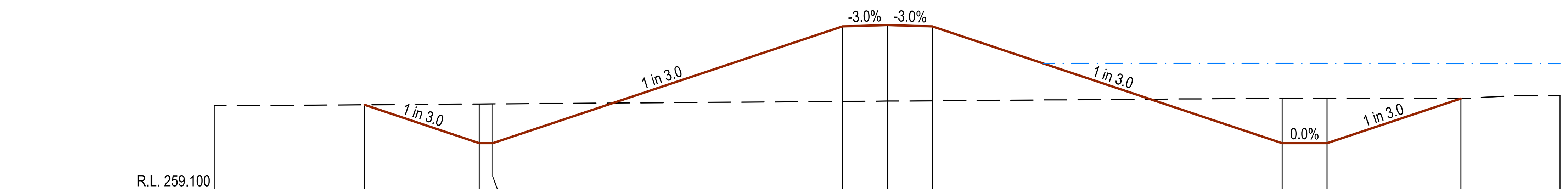
DESIGN SURFACE		261.20	260.26	260.26	262.77	262.80	262.77	260.26	260.26	261.15	
EXISTING SURFACE	261.20	261.20	261.19	261.19	261.17	261.16	261.16	261.14	261.14	261.15	261.16
OFFSET	-15.000	-11.641	-8.835	-8.535	-1.000	0.000	1.000	8.522	9.522	12.188	15.000

Ch 260.000
Holbrook Levee 2



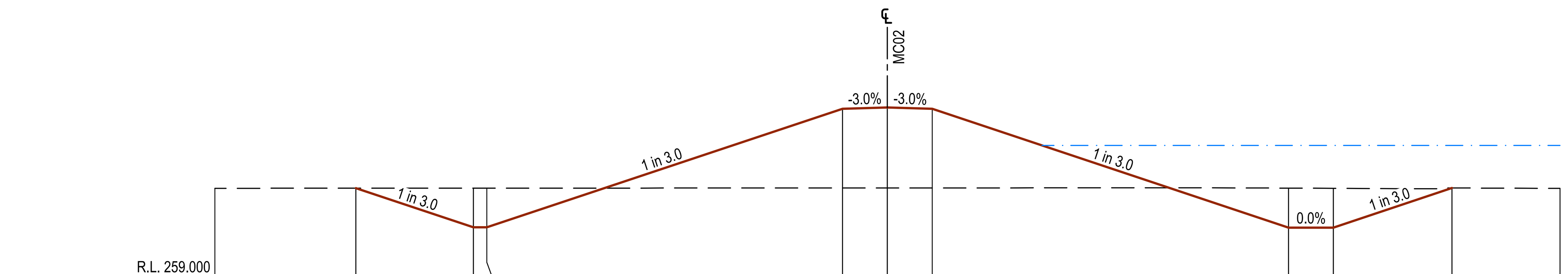
DESIGN SURFACE		261.14	260.20	260.20	262.76	262.79	262.76	260.20	260.20	261.26	
EXISTING SURFACE	261.14	261.14	261.15	261.15	261.18	261.19	261.19	261.22	261.23	261.26	261.29
OFFSET	-15.000	-11.784	-8.968	-8.668	-1.000	0.000	1.000	8.664	9.664	12.824	15.000

Ch 240.000
Holbrook Levee 2



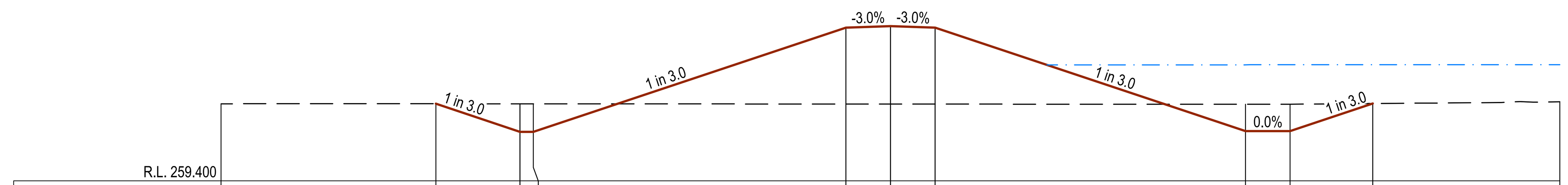
DESIGN SURFACE		261.00	260.14	260.14	262.74	262.77	262.74	260.14	260.14	261.14	
EXISTING SURFACE	260.98	261.00	261.01	261.02	261.07	261.08	261.09	261.14	261.14	261.14	261.21
OFFSET	-15.000	-11.661	-9.101	-8.801	-1.000	0.000	1.000	8.806	9.806	12.793	15.000

Ch 220.000
Holbrook Levee 2



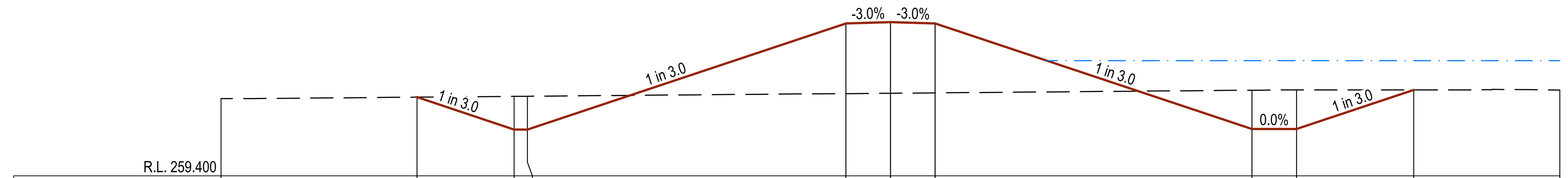
DESIGN SURFACE		260.96	260.08	260.08	262.73	262.76	262.73	260.08	260.08	260.96	
EXISTING SURFACE	260.95	260.96	260.96	260.96	260.96	260.96	260.96	260.96	260.95	260.96	260.95
OFFSET	-15.000	-11.853	-9.234	-8.934	-1.000	0.000	1.000	8.947	9.947	12.591	15.000

Ch 200.000
Holbrook Levee 2



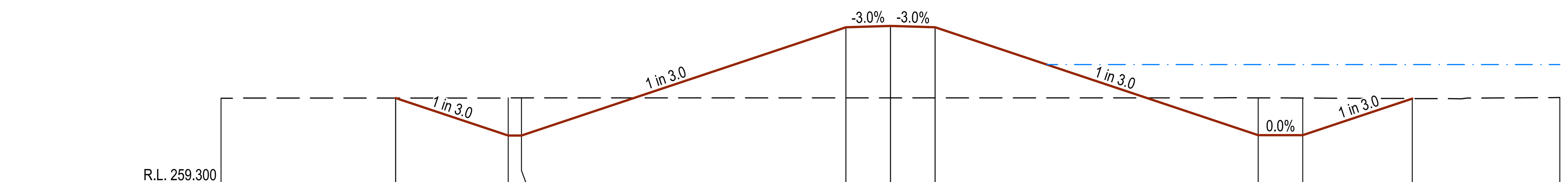
DESIGN SURFACE		261.12	260.50	260.50	262.83	262.86	262.83	260.51	260.51	261.13	
EXISTING SURFACE	261.12	261.12	261.12	261.12	261.12	261.12	261.12	261.11	261.12	261.13	261.17
OFFSET	-15.000	-10.190	-8.303	-8.003	-1.000	0.000	1.000	7.956	8.956	10.810	15.000

Ch 340.000
Holbrook Levee 2



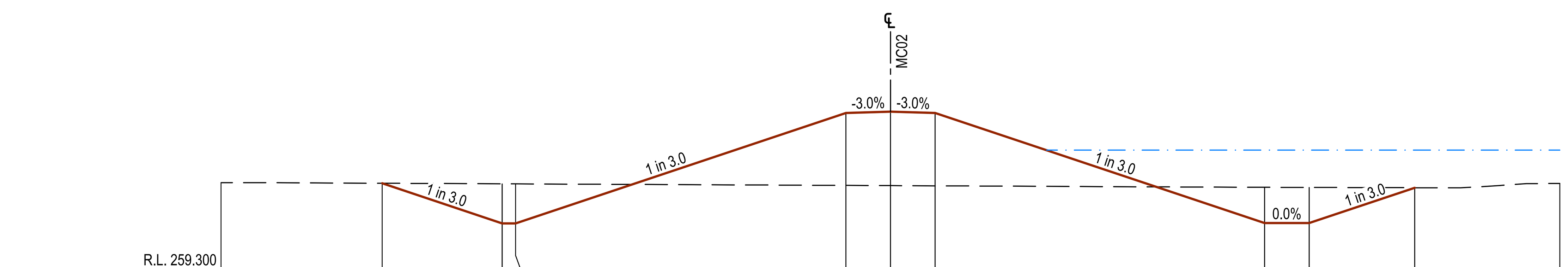
DESIGN SURFACE		261.16	260.44	260.44	262.82	262.85	262.82	260.45	260.45	261.33	
EXISTING SURFACE	261.13	261.16	261.18	261.18	261.24	261.25	261.26	261.32	261.32	261.33	261.32
OFFSET	-15.000	-10.613	-8.436	-8.136	-1.000	0.000	1.000	8.097	9.097	11.726	15.000

Ch 320.000
Holbrook Levee 2



DESIGN SURFACE		261.22	260.38	260.38	262.80	262.83	262.80	260.39	260.39	261.21	
EXISTING SURFACE	261.21	261.22	261.22	261.22	261.22	261.22	261.22	261.22	261.22	261.21	261.23
OFFSET	-15.000	-11.089	-8.569	-8.269	-1.000	0.000	1.000	8.239	9.239	11.693	15.000

Ch 300.000
Holbrook Levee 2



DESIGN SURFACE		261.21	260.32	260.32	262.79	262.82	262.79	260.33	260.33	261.11	
EXISTING SURFACE	261.23	261.21	261.20	261.20	261.17	261.16	261.16	261.12	261.12	261.11	261.21
OFFSET	-15.000	-11.390	-8.702	-8.402	-1.000	0.000	1.000	8.381	9.381	11.747	15.000

Ch 280.000
Holbrook Levee 2

MC02 CROSS SECTIONS

SCALE 1:100

NOTE:

1. REFER TO DRAWING 300203886-WE-3300 FOR NOTES.

XREF's:
CAD File: \\au2013-ppfss01\shared_projects\300203886\300 Levee Design\300203886-WE-3300-3316.dwg

Rev.	Date	Description	Des.	Verif.	Appd.
A	10/05/2024	TENDER ISSUE	VZ		AS

0 1 2 4m
H 1:100 @A1

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Level 4, 501 Swanston Street
Melbourne VIC 3000
Tel: 03 8415 7777
Web: www.stantec.com/au

Drawn	SB	Date 15/06/20
Checked	VZ	Date 23/04/24
Designed	AS	Date 23/04/24
Verified		Date
Approved		Date

Client: GREATER HUME SHIRE COUNCIL

Project: HHC FLOOD LEVEE DESIGN
HOLBROOK, HENTY
& CULCAIRN

Title: HOLBROOK 2 CROSS SECTIONS
SHEET 2 OF 9

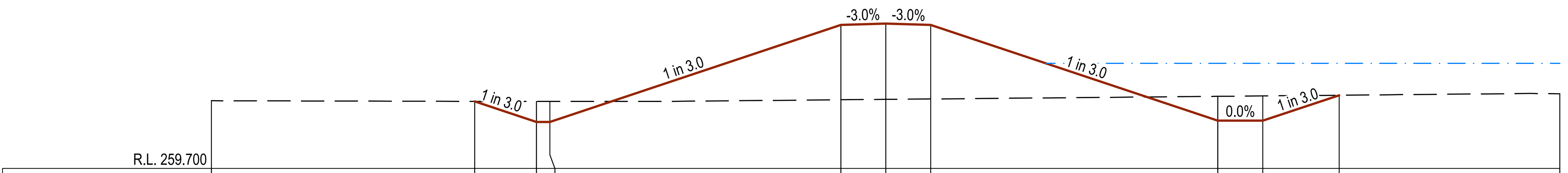
Status: FOR TENDER ONLY
NOT TO BE USED FOR CONSTRUCTION PURPOSES

VERT. DATUM	HORZ. DATUM	Scale	Size
AHD	MGA	AS SHOWN	A1

Drawing Number: 300203886-WE-3304
Revision: A

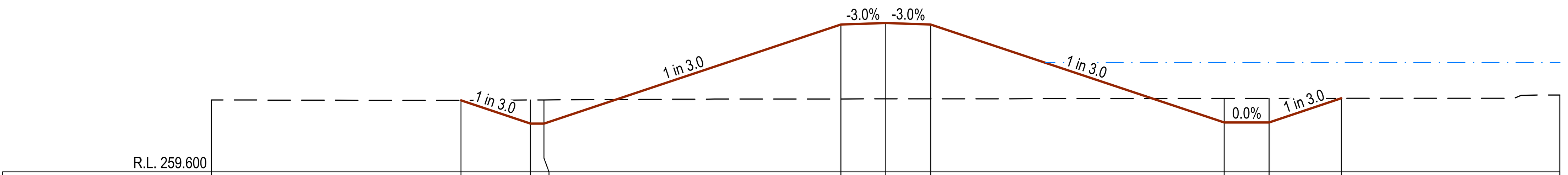
LEGEND

- DESIGN CENTRE LINE
- Ex 1% AEP FLOOD LEVEL
- EXISTING SURFACE
- EXISTING LIDAR SURFACE



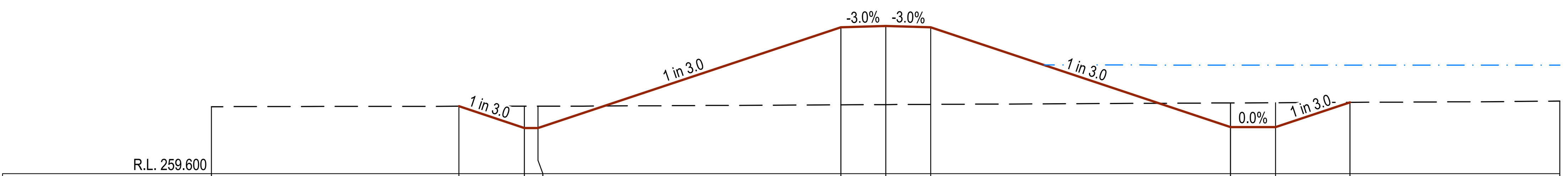
DESIGN SURFACE		261.19	260.73	260.73	262.89	262.92	262.89	260.76	260.76	261.33	
EXISTING SURFACE	261.20	261.19	261.19	261.19	261.22	261.23	261.24	261.30	261.31	261.33	261.36
OFFSET	-15.000	-9.145	-7.771	-7.471	-1.000	0.000	1.000	7.389	8.389	10.090	15.000

Ch 420.000
Holbrook Levee 2



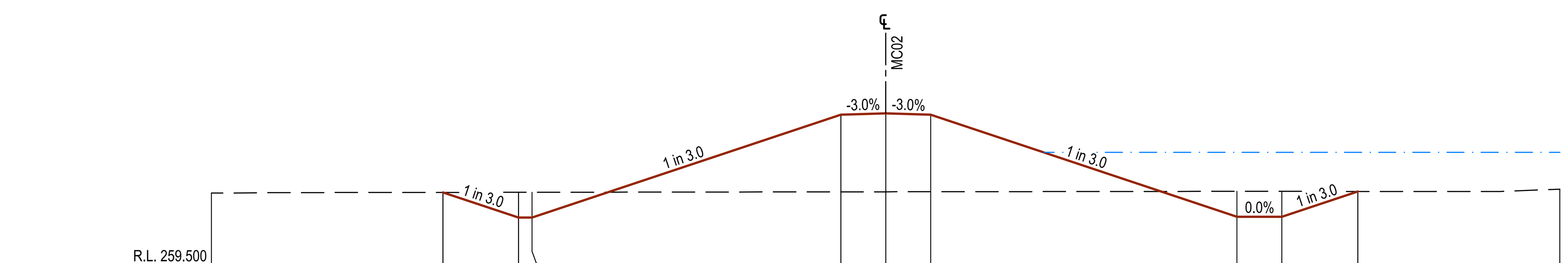
DESIGN SURFACE		261.19	260.67	260.67	262.87	262.90	262.87	260.70	260.70	261.23	
EXISTING SURFACE	261.20	261.19	261.20	261.20	261.22	261.22	261.22	261.23	261.23	261.23	261.31
OFFSET	-15.000	-9.450	-7.904	-7.604	-1.000	0.000	1.000	7.531	8.531	10.134	15.000

Ch 400.000
Holbrook Levee 2



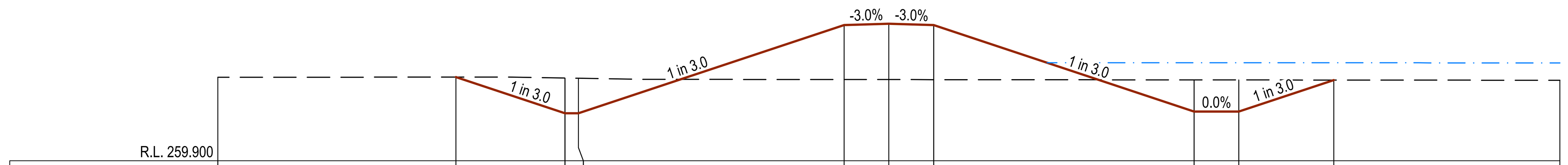
DESIGN SURFACE		261.10	260.61	260.61	262.86	262.89	262.86	260.64	260.64	261.19	
EXISTING SURFACE	261.09	261.10	261.10	261.10	261.13	261.14	261.14	261.17	261.18	261.19	261.22
OFFSET	-15.000	-9.496	-8.037	-7.737	-1.000	0.000	1.000	7.672	8.672	10.327	15.000

Ch 380.000
Holbrook Levee 2



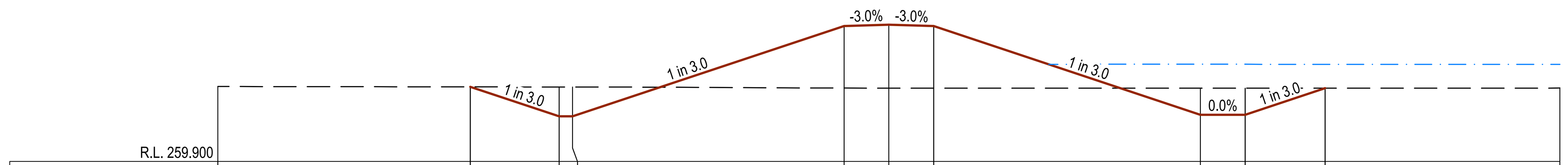
DESIGN SURFACE		261.12	260.55	260.55	262.84	262.87	262.84	260.57	260.57	261.14	
EXISTING SURFACE	261.10	261.12	261.12	261.12	261.13	261.13	261.13	261.14	261.14	261.14	261.19
OFFSET	-15.000	-9.851	-8.170	-7.870	-1.000	0.000	1.000	7.814	8.814	10.504	15.000

Ch 360.000
Holbrook Levee 2



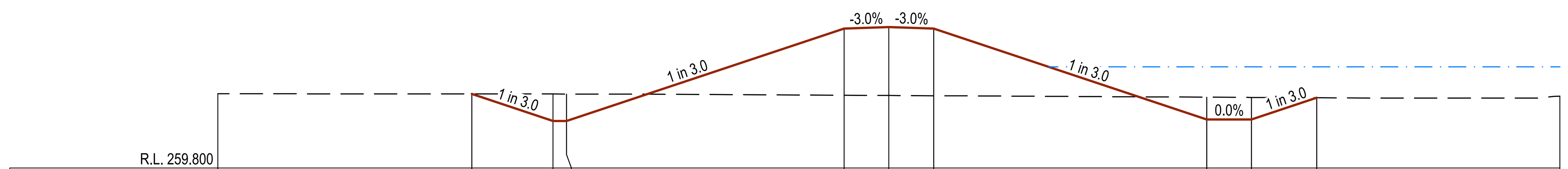
DESIGN SURFACE		261.78	260.97	260.97	262.95	262.98	262.95	261.01	261.01	261.71	
EXISTING SURFACE	261.78	261.78	261.76	261.75	261.73	261.72	261.72	261.72	261.72	261.71	261.71
OFFSET	-15.000	-9.680	-7.240	-6.940	-1.000	0.000	1.000	6.822	7.822	9.945	15.000

Ch 500.000
Holbrook Levee 2



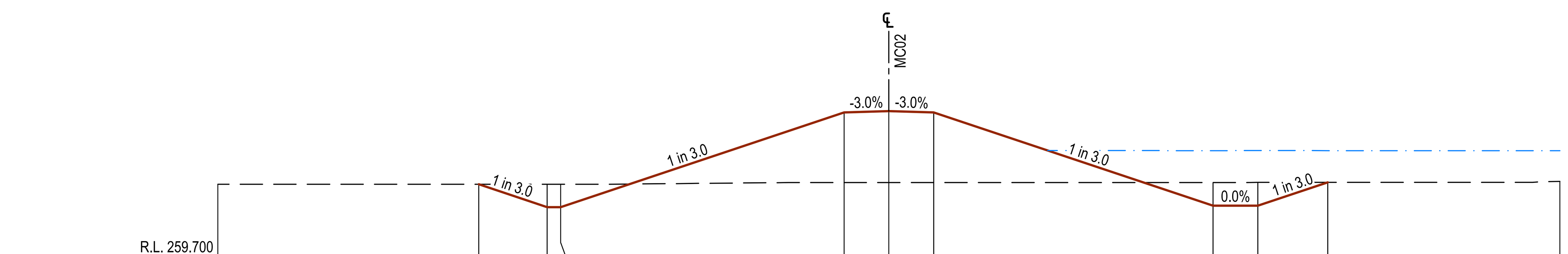
DESIGN SURFACE		261.57	260.91	260.91	262.93	262.96	262.93	260.95	260.95	261.54	
EXISTING SURFACE	261.58	261.57	261.57	261.57	261.54	261.54	261.54	261.54	261.54	261.54	261.55
OFFSET	-15.000	-9.356	-7.373	-7.073	-1.000	0.000	1.000	6.964	7.964	9.752	15.000

Ch 480.000
Holbrook Levee 2



DESIGN SURFACE		261.46	260.85	260.85	262.92	262.95	262.92	260.88	260.88	261.37	
EXISTING SURFACE	261.46	261.46	261.45	261.45	261.43	261.42	261.42	261.38	261.38	261.37	261.40
OFFSET	-15.000	-9.321	-7.505	-7.205	-1.000	0.000	1.000	7.106	8.106	9.566	15.000

Ch 460.000
Holbrook Levee 2



DESIGN SURFACE		261.30	260.79	260.79	262.90	262.93	262.90	260.82	260.82	261.34	
EXISTING SURFACE	261.30	261.30	261.30	261.30	261.34	261.34	261.34	261.34	261.34	261.34	261.36
OFFSET	-15.000	-9.167	-7.638	-7.338	-1.000	0.000	1.000	7.247	8.247	9.809	15.000

Ch 440.000
Holbrook Levee 2

MC02 CROSS SECTIONS

SCALE 1:100

NOTE:

1. REFER TO DRAWING 300203886-WE-3300 FOR NOTES.

Rev.	Date	Description	Des.	Verif.	Appd.
A	10/05/2024	TENDER ISSUE	VZ		AS

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H 1:100 @A1

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Drawn	SB	Date 15/06/20
Checked	VZ	Date 23/04/24
Designed	AS	Date 23/04/24
Verified		Date
Approved		Date

Client: GREATER HUME SHIRE COUNCIL

Project: HHC FLOOD LEVEE DESIGN
HOLBROOK, HENTY
& CULCAIRN

Title: HOLBROOK 2 CROSS SECTIONS
SHEET 3 OF 9

Status: FOR TENDER ONLY
NOT TO BE USED FOR CONSTRUCTION PURPOSES

VERT. DATUM	HORZ. DATUM	Scale	Size
AHD	MGA	AS SHOWN	A1

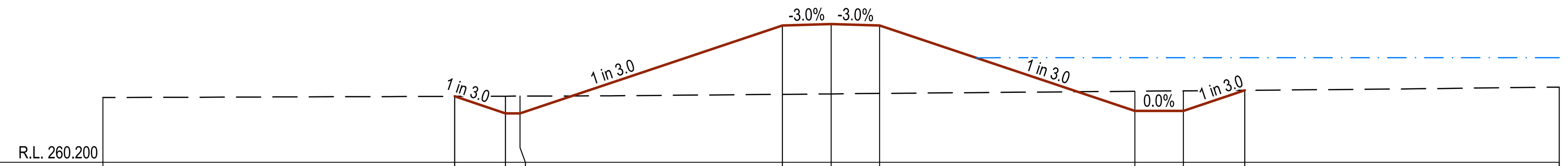
Drawing Number: 300203886-WE-3305
Revision: A

DATE PLOTTED: 10 May 2024 9:32 AM BY : HAZELGROVE, ADAM
XREF's:
CAD File: \\au2013-ppfss01\shared_projects\300203886\300 Levee Design\300203886-WE-3300-3316.dwg

LEGEND

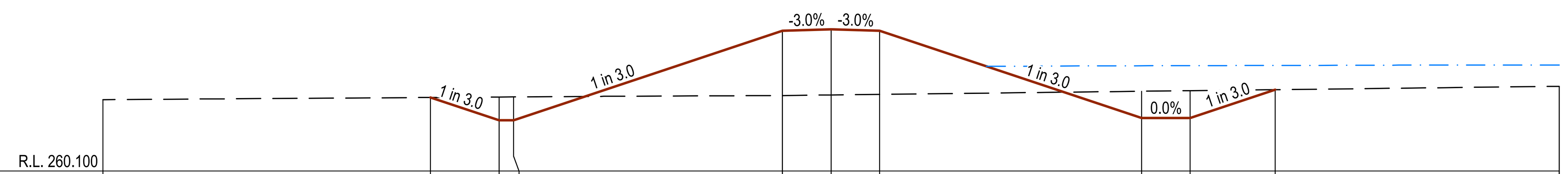
	DESIGN CENTRE LINE
	Ex 1% AEP FLOOD LEVEL
	EXISTING SURFACE
	EXISTING LIDAR SURFACE

DATE PLOTTED: 10 May 2024 9:32 AM BY : HAZELGROVE, ADAM



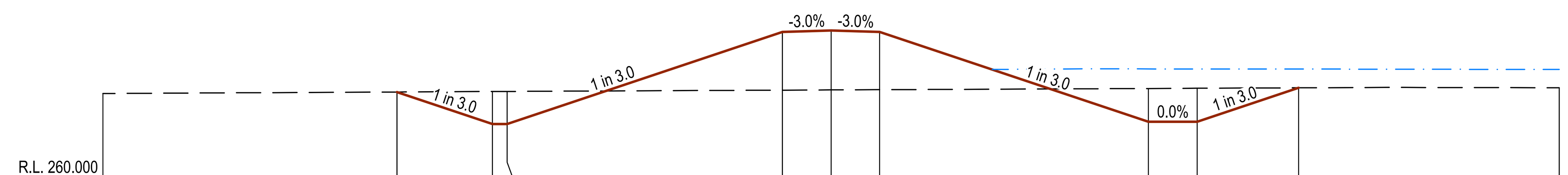
DESIGN SURFACE		261.55	261.20	261.20	263.01	263.04	263.01	261.25	261.25	261.68	
EXISTING SURFACE	261.53	261.55	261.56	261.56	261.59	261.60	261.61	261.66	261.67	261.68	261.74
OFFSET	-15.000	-7.756	-6.708	-6.408	-1.000	0.000	1.000	6.256	7.256	8.523	15.000

Ch 580.000
Holbrook Levee 2



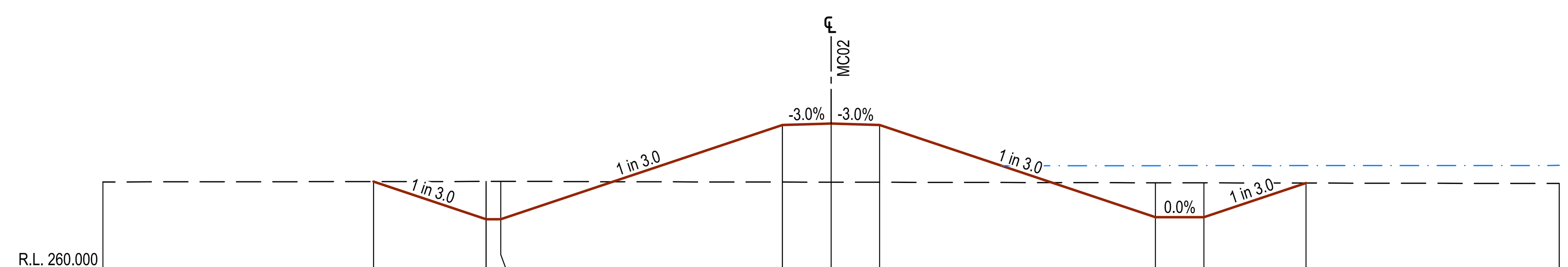
DESIGN SURFACE		261.62	261.15	261.15	262.99	263.02	262.99	261.19	261.19	261.78	
EXISTING SURFACE	261.57	261.62	261.62	261.63	261.66	261.67	261.68	261.74	261.76	261.78	261.85
OFFSET	-15.000	-8.253	-6.841	-6.541	-1.000	0.000	1.000	6.398	7.398	9.149	15.000

Ch 560.000
Holbrook Levee 2



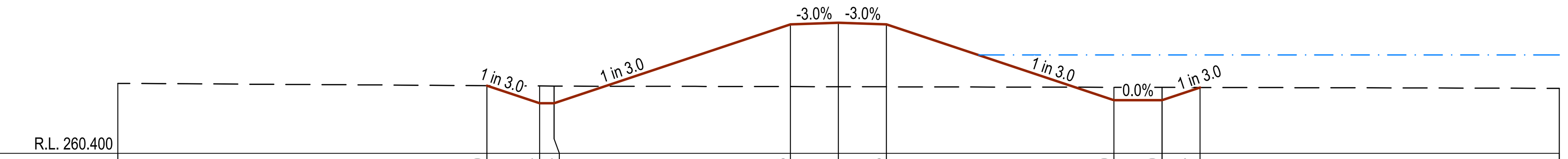
DESIGN SURFACE		261.74	261.09	261.09	262.98	263.01	262.98	261.13	261.13	261.83	
EXISTING SURFACE	261.71	261.74	261.75	261.75	261.78	261.78	261.79	261.81	261.82	261.83	261.83
OFFSET	-15.000	-8.943	-6.974	-6.674	-1.000	0.000	1.000	6.539	7.539	9.632	15.000

Ch 540.000
Holbrook Levee 2



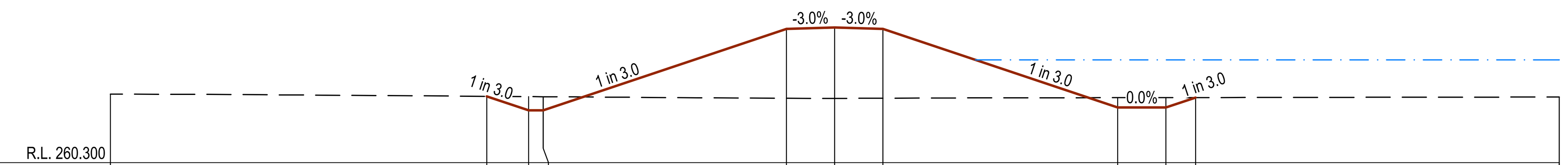
DESIGN SURFACE		261.80	261.03	261.03	262.96	262.99	262.96	261.07	261.07	261.77	
EXISTING SURFACE	261.79	261.80	261.80	261.80	261.79	261.79	261.79	261.78	261.77	261.77	261.76
OFFSET	-15.000	-9.425	-7.107	-6.807	-1.000	0.000	1.000	6.681	7.681	9.784	15.000

Ch 520.000
Holbrook Levee 2



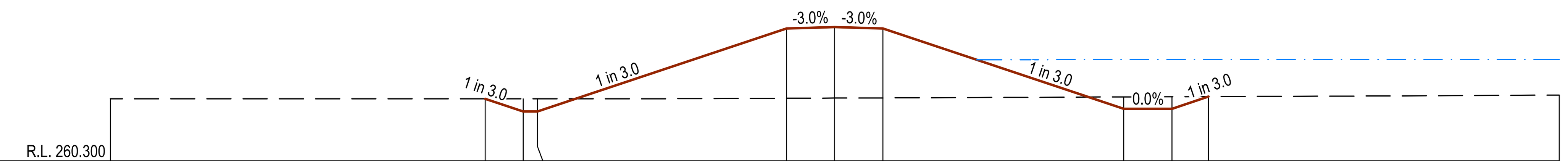
DESIGN SURFACE		261.80	261.44	261.44	263.08	263.11	263.08	261.50	261.50	261.77	
EXISTING SURFACE	261.85	261.80	261.80	261.80	261.78	261.78	261.78	261.77	261.77	261.77	261.75
OFFSET	-15.000	-7.314	-6.220	-5.920	-1.000	0.000	1.000	5.733	6.733	7.528	15.000

Ch 660.000
Holbrook Levee 2



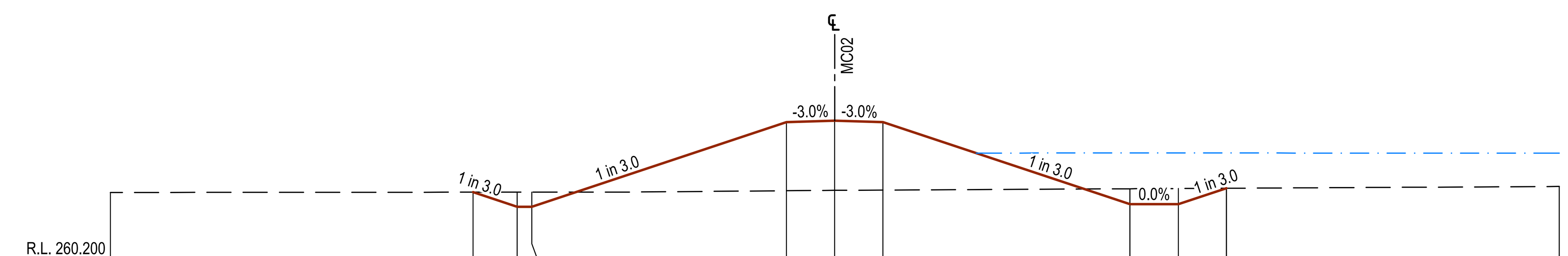
DESIGN SURFACE		261.67	261.38	261.38	263.06	263.09	263.06	261.44	261.44	261.64	
EXISTING SURFACE	261.72	261.67	261.66	261.66	261.63	261.63	261.63	261.64	261.64	261.64	261.66
OFFSET	-15.000	-7.206	-6.337	-6.037	-1.000	0.000	1.000	5.859	6.859	7.472	15.000

Ch 640.000
Holbrook Levee 2



DESIGN SURFACE		261.58	261.32	261.32	263.04	263.07	263.04	261.38	261.38	261.63	
EXISTING SURFACE	261.58	261.58	261.58	261.58	261.60	261.60	261.60	261.62	261.63	261.63	261.66
OFFSET	-15.000	-7.239	-6.454	-6.154	-1.000	0.000	1.000	5.984	6.984	7.739	15.000

Ch 620.000
Holbrook Levee 2



DESIGN SURFACE		261.57	261.26	261.26	263.02	263.05	263.02	261.32	261.32	261.65	
EXISTING SURFACE	261.56	261.57	261.57	261.57	261.60	261.60	261.61	261.64	261.64	261.65	261.69
OFFSET	-15.000	-7.487	-6.575	-6.275	-1.000	0.000	1.000	6.114	7.114	8.109	15.000

Ch 600.000
Holbrook Levee 2

MC02 CROSS SECTIONS
SCALE 1:100

NOTE:
1. REFER TO DRAWING 300203886-WE-3300 FOR NOTES.

Rev.	Date	Description	Des.	Verif.	Appd.
A	10/05/2024	TENDER ISSUE	VZ		AS

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H 1:100 @A1

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Drawn SB Date 15/06/20
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Client GREATER HUME SHIRE COUNCIL
Project HHC FLOOD LEVEE DESIGN
HOLBROOK, HENTY
& CULCAIRN
Title HOLBROOK 2 CROSS SECTIONS
SHEET 4 OF 9

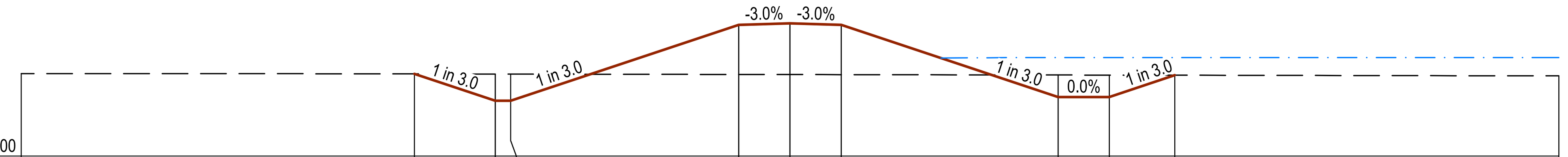
Status FOR TENDER ONLY
NOT TO BE USED FOR CONSTRUCTION PURPOSES
VERT. DATUM AHD | HORZ. DATUM MGA | Scale AS SHOWN | Size A1
Drawing Number 300203886-WE-3306 | Revision A

XREF's:
CAD File: \\au2013-ppfss01\shared_projects\300203886\300 Levee Design\300203886-WE-3300-3316.dwg

DATE PLOTTED: 10 May 2024 9:32 AM BY : HAZELGROVE, ADAM

LEGEND

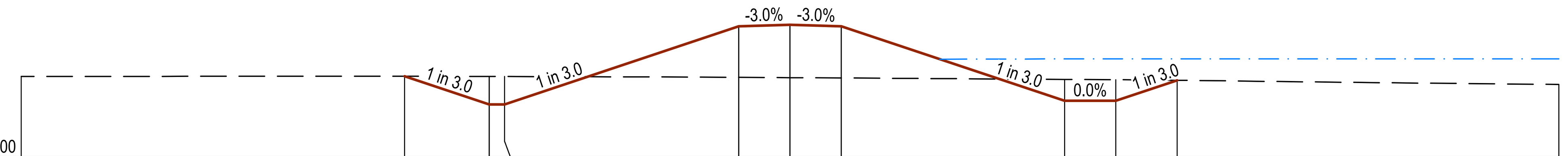
- DESIGN CENTRE LINE
- Ex 1% AEP FLOOD LEVEL
- EXISTING SURFACE
- EXISTING LIDAR SURFACE



R.L. 260.600

DESIGN SURFACE		262.20	261.68	261.68	263.16	263.19	263.16	261.75	261.75	262.18	
EXISTING SURFACE	262.21	262.20	262.20	262.20	262.19	262.19	262.19	262.18	262.18	262.18	262.16
OFFSET	-15.000	-7.327	-5.752	-5.452	-1.000	0.000	1.000	5.230	6.230	7.508	15.000

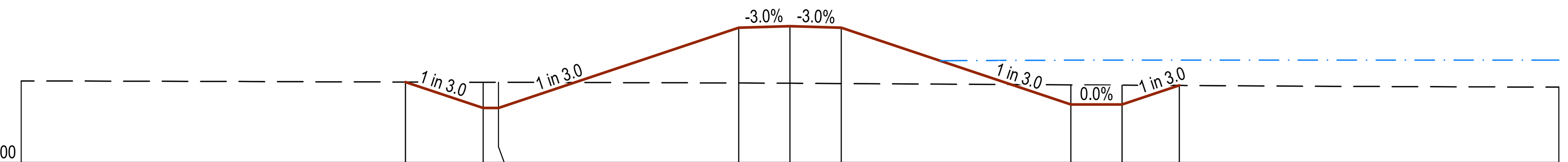
Ch 740.000
Holbrook Levee 2



R.L. 260.600

DESIGN SURFACE		262.17	261.62	261.62	263.14	263.17	263.14	261.69	261.69	262.09	
EXISTING SURFACE	262.16	262.17	262.16	262.16	262.15	262.14	262.13	262.11	262.10	262.09	262.01
OFFSET	-15.000	-7.521	-5.869	-5.569	-1.000	0.000	1.000	5.356	6.356	7.556	15.000

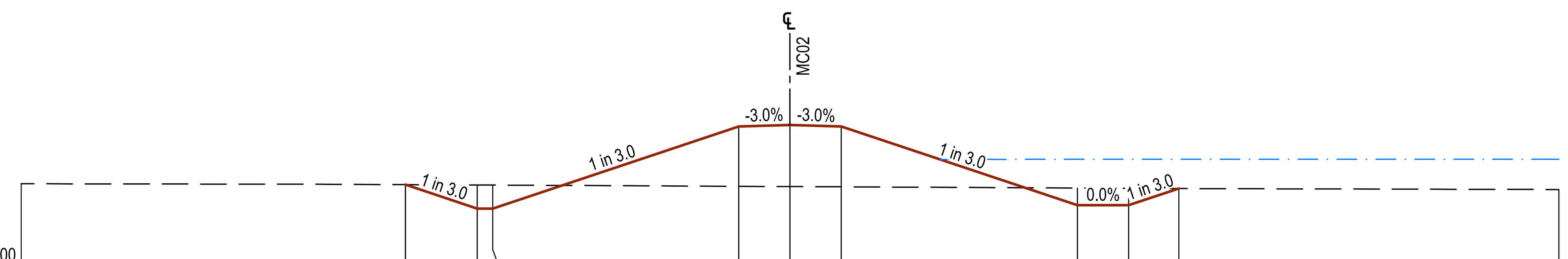
Ch 720.000
Holbrook Levee 2



R.L. 260.500

DESIGN SURFACE		262.06	261.56	261.56	263.12	263.15	263.12	261.63	261.63	262.00	
EXISTING SURFACE	262.09	262.06	262.06	262.06	262.05	262.04	262.03	262.01	262.00	262.00	261.96
OFFSET	-15.000	-7.503	-5.986	-5.686	-1.000	0.000	1.000	5.481	6.481	7.596	15.000

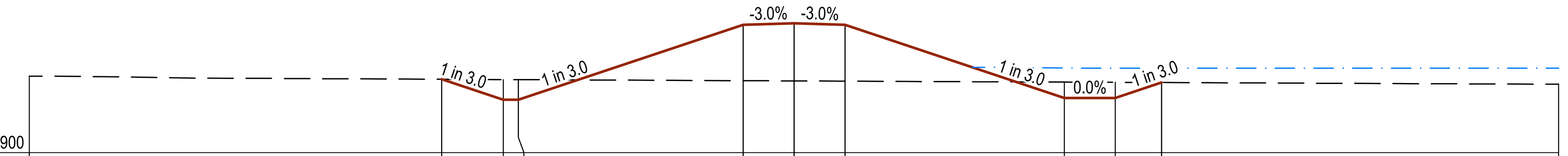
Ch 700.000
Holbrook Levee 2



R.L. 260.400

DESIGN SURFACE		261.97	261.50	261.50	263.10	263.13	263.10	261.56	261.56	261.89	
EXISTING SURFACE	261.98	261.97	261.96	261.96	261.93	261.93	261.92	261.90	261.90	261.89	261.87
OFFSET	-15.000	-7.504	-6.103	-5.803	-1.000	0.000	1.000	5.607	6.607	7.587	15.000

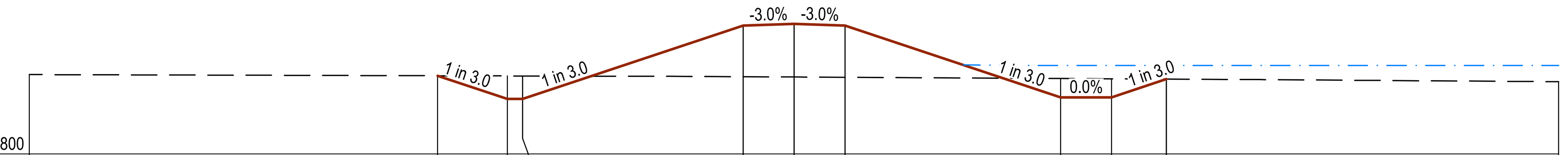
Ch 680.000
Holbrook Levee 2



R.L. 260.900

DESIGN SURFACE		262.34	261.94	261.94	263.40	263.43	263.40	261.97	261.97	262.27	
EXISTING SURFACE	262.40	262.34	262.33	262.33	262.31	262.31	262.30	262.28	262.28	262.27	262.24
OFFSET	-15.000	-6.911	-5.707	-5.407	-1.000	0.000	1.000	5.302	6.302	7.208	15.000

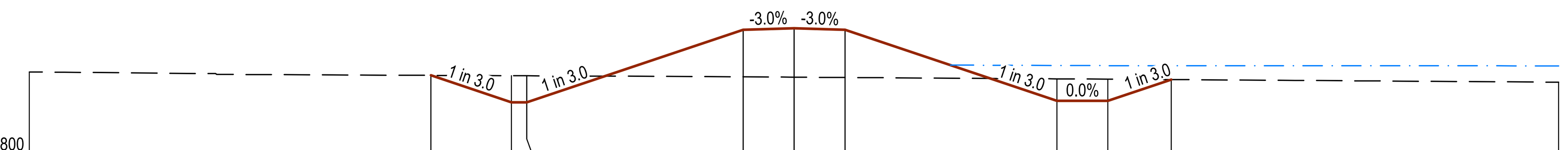
Ch 820.000
Holbrook Levee 2



R.L. 260.800

DESIGN SURFACE		262.33	261.88	261.88	263.32	263.35	263.32	261.91	261.91	262.27	
EXISTING SURFACE	262.35	262.33	262.33	262.33	262.31	262.31	262.30	262.28	262.27	262.27	262.22
OFFSET	-15.000	-6.993	-5.626	-5.326	-1.000	0.000	1.000	5.230	6.230	7.304	15.000

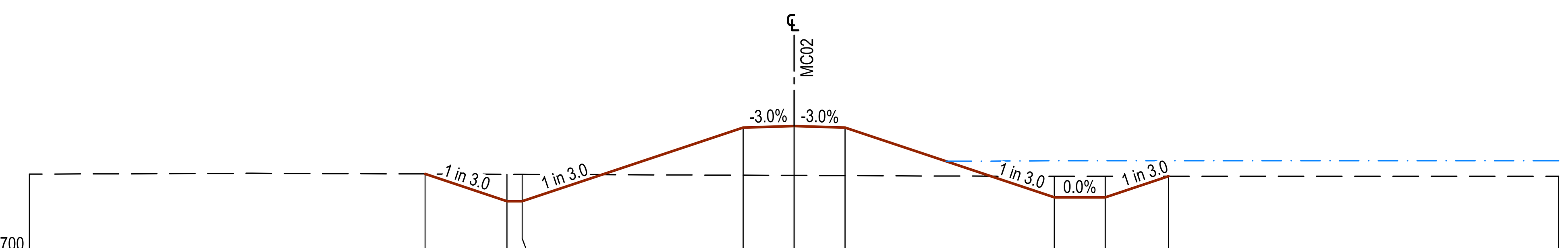
Ch 800.000
Holbrook Levee 2



R.L. 260.800

DESIGN SURFACE		262.34	261.82	261.82	263.23	263.26	263.23	261.85	261.85	262.26	
EXISTING SURFACE	262.41	262.34	262.34	262.34	262.31	262.31	262.30	262.28	262.27	262.26	262.21
OFFSET	-15.000	-7.124	-5.546	-5.246	-1.000	0.000	1.000	5.158	6.158	7.401	15.000

Ch 780.000
Holbrook Levee 2



R.L. 260.700

DESIGN SURFACE		262.27	261.74	261.74	263.18	263.21	263.18	261.81	261.81	262.23	
EXISTING SURFACE	262.27	262.27	262.26	262.26	262.24	262.24	262.24	262.23	262.23	262.23	262.23
OFFSET	-15.000	-7.237	-5.634	-5.334	-1.000	0.000	1.000	5.104	6.104	7.347	15.000

Ch 760.000
Holbrook Levee 2

MC02 CROSS SECTIONS

SCALE 1:100

NOTE:

1. REFER TO DRAWING 300203886-WE-3300 FOR NOTES.

Rev.	Date	Description	Des.	Verif.	Appd.
A	10/05/2024	TENDER ISSUE	VZ		AS

0 1 2 4m
H 1:100 @A1

Greater Hume Council

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Melbourne VIC 3000
Tel: 03 8415 7777
Web: www.stantec.com/au

Drawn SB Date 15/06/20
Checked VZ Date 23/04/24
Designed AS Date 23/04/24
Verified Date
Approved Date

Client: GREATER HUME SHIRE COUNCIL

Project: HHC FLOOD LEVEE DESIGN
HOLBROOK, HENTY
& CULCAIRN

Title: HOLBROOK 2 CROSS SECTIONS
SHEET 5 OF 9

Status: FOR TENDER ONLY
NOT TO BE USED FOR CONSTRUCTION PURPOSES

VERT. DATUM	HORZ. DATUM	Scale	Size
AHD	MGA	AS SHOWN	A1

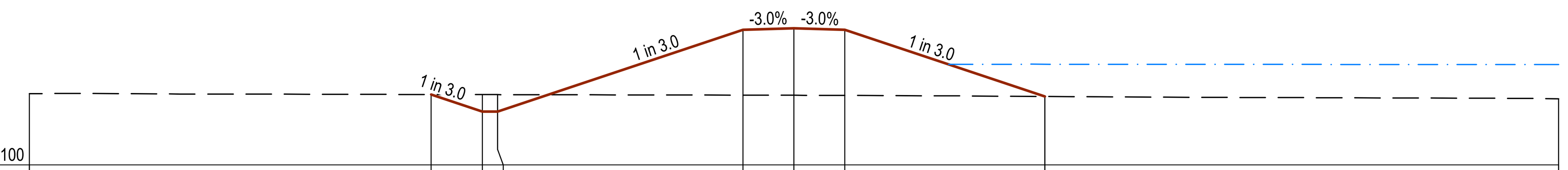
Drawing Number: 300203886-WE-3307
Revision: A

XREF's:
CAD File: \\au2013-ppfss01\shared_projects\300203886\300 Levee Design\300203886-WE-3300-3316.dwg

DATE PLOTTED: 10 May 2024 9:32 AM BY : HAZELGROVE, ADAM

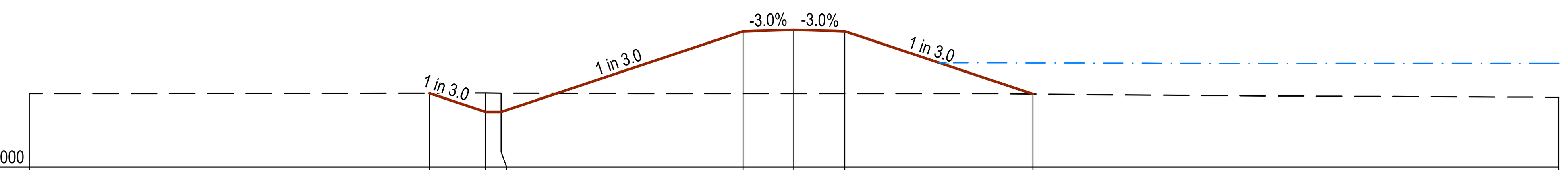
LEGEND

	DESIGN CENTRE LINE
	Ex 1% AEP FLOOD LEVEL
	EXISTING SURFACE
	EXISTING LIDAR SURFACE



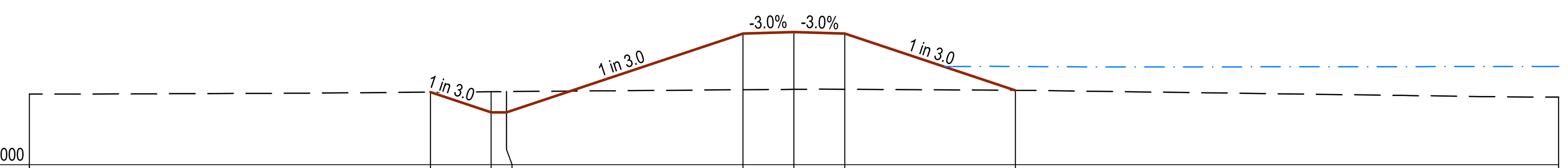
DESIGN SURFACE		262.48	262.14	262.14	263.75	263.78	263.75	262.44	
EXISTING SURFACE	262.49	262.48	262.48	262.48	262.47	262.46	262.46	262.44	262.40
OFFSET	-15.000	-7.117	-6.113	-5.813	-1.000	0.000	1.000	4.921	15.000

Ch 900.000
Holbrook Levee 2



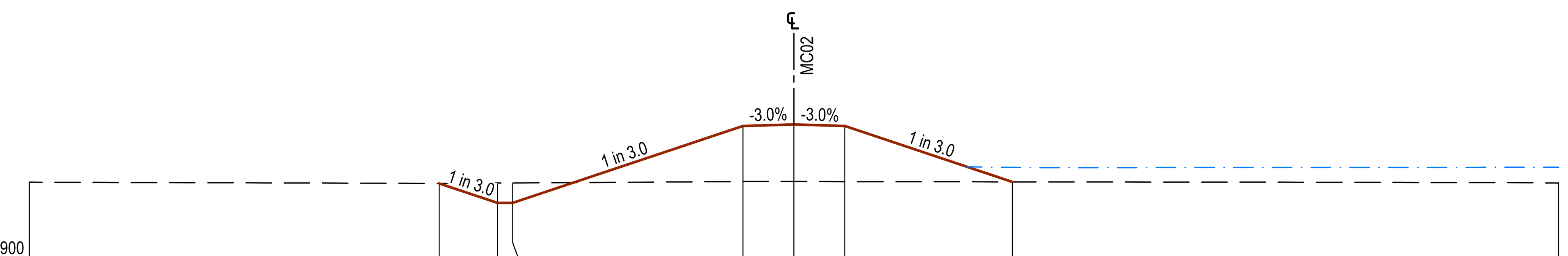
DESIGN SURFACE		262.45	262.08	262.08	263.66	263.69	263.66	262.43	
EXISTING SURFACE	262.44	262.45	262.45	262.45	262.44	262.44	262.44	262.43	262.37
OFFSET	-15.000	-7.150	-6.044	-5.744	-1.000	0.000	1.000	4.691	15.000

Ch 880.000
Holbrook Levee 2



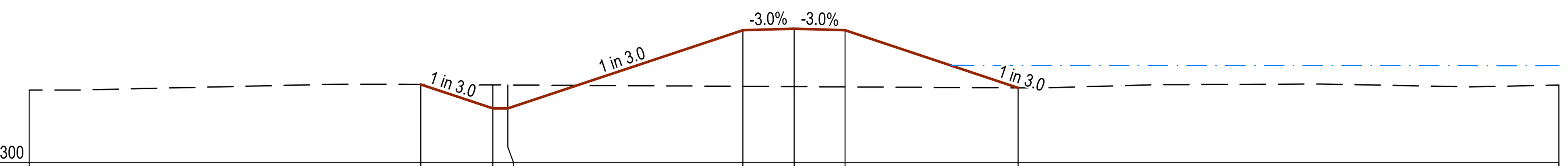
DESIGN SURFACE		262.43	262.03	262.03	263.58	263.61	263.58	262.46	
EXISTING SURFACE	262.39	262.43	262.43	262.44	262.47	262.48	262.48	262.46	262.33
OFFSET	-15.000	-7.127	-5.938	-5.638	-1.000	0.000	1.000	4.344	15.000

Ch 860.000
Holbrook Levee 2



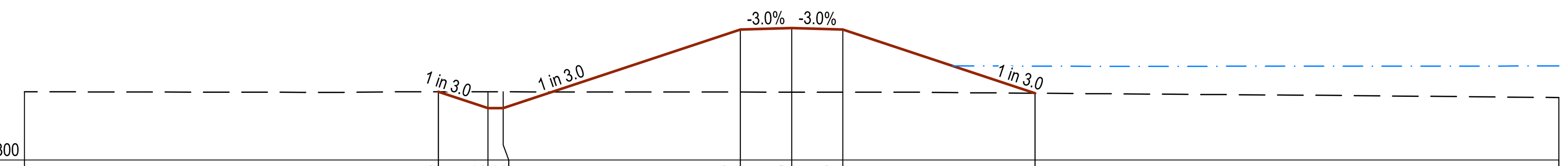
DESIGN SURFACE		262.37	261.98	261.98	263.49	263.52	263.49	262.40	
EXISTING SURFACE	262.39	262.37	262.37	262.37	262.40	262.40	262.40	262.40	262.37
OFFSET	-15.000	-6.961	-5.818	-5.518	-1.000	0.000	1.000	4.282	15.000

Ch 840.000
Holbrook Levee 2



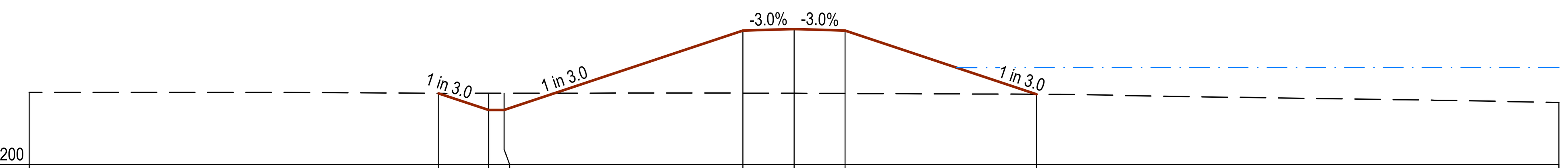
DESIGN SURFACE		262.84	262.37	262.37	263.90	263.93	263.90	262.77	
EXISTING SURFACE	262.73	262.84	262.83	262.83	262.80	262.79	262.79	262.77	262.83
OFFSET	-15.000	-7.322	-5.909	-5.609	-1.000	0.000	1.000	4.397	15.000

Ch 980.000
Holbrook Levee 2



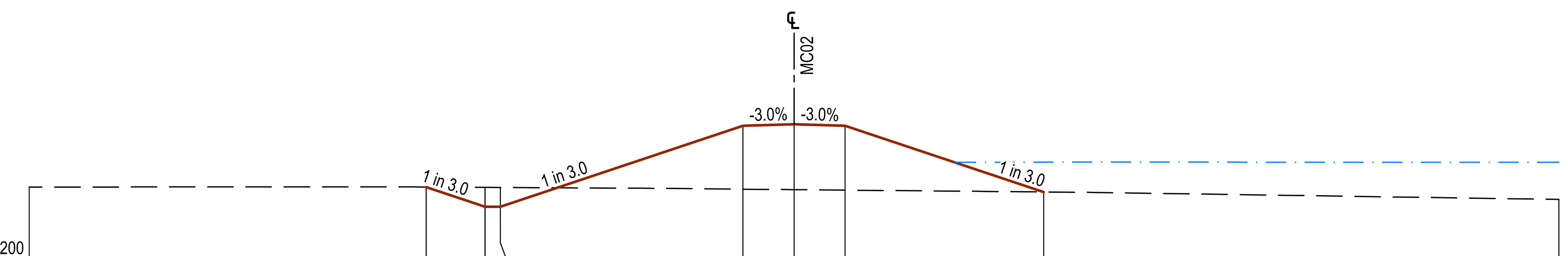
DESIGN SURFACE		262.64	262.32	262.32	263.87	263.90	263.87	262.61	
EXISTING SURFACE	262.64	262.64	262.64	262.64	262.64	262.64	262.63	262.61	262.53
OFFSET	-15.000	-6.905	-5.939	-5.639	-1.000	0.000	1.000	4.759	15.000

Ch 960.000
Holbrook Levee 2



DESIGN SURFACE		262.60	262.27	262.27	263.83	263.86	263.83	262.58	
EXISTING SURFACE	262.62	262.60	262.60	262.60	262.60	262.60	262.59	262.58	262.42
OFFSET	-15.000	-6.969	-5.986	-5.686	-1.000	0.000	1.000	4.756	15.000

Ch 940.000
Holbrook Levee 2



DESIGN SURFACE		262.60	262.21	262.21	263.80	263.83	263.80	262.50	
EXISTING SURFACE	262.59	262.60	262.59	262.59	262.55	262.54	262.53	262.50	262.35
OFFSET	-15.000	-7.214	-6.058	-5.758	-1.000	0.000	1.000	4.894	15.000

Ch 920.000
Holbrook Levee 2

MC02 CROSS SECTIONS

SCALE 1:100

NOTE:

1. REFER TO DRAWING 300203886-WE-3300 FOR NOTES.

XREF's:
CAD File: \\au2013-ppfss01\shared_projects\300203886\300 Levee Design\300203886-WE-3300-3316.dwg

Rev.	Date	Description	Des.	Verif.	Appd.
A	10/05/2024	TENDER ISSUE	VZ		AS

0 1 2 4m
H 1:100 @A1

Greater Hume Council

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Tel: 03 8415 7777
Web: www.stantec.com/au

Drawn SB	Date 15/06/20	
Checked VZ	Date 23/04/24	
Designed AS	Date 23/04/24	
Verified	Date	
Approved	Date	

Client: GREATER HUME SHIRE COUNCIL

Project: HHC FLOOD LEVEE DESIGN
HOLBROOK, HENTY
& CULCAIRN

Title: HOLBROOK 2 CROSS SECTIONS
SHEET 6 OF 9

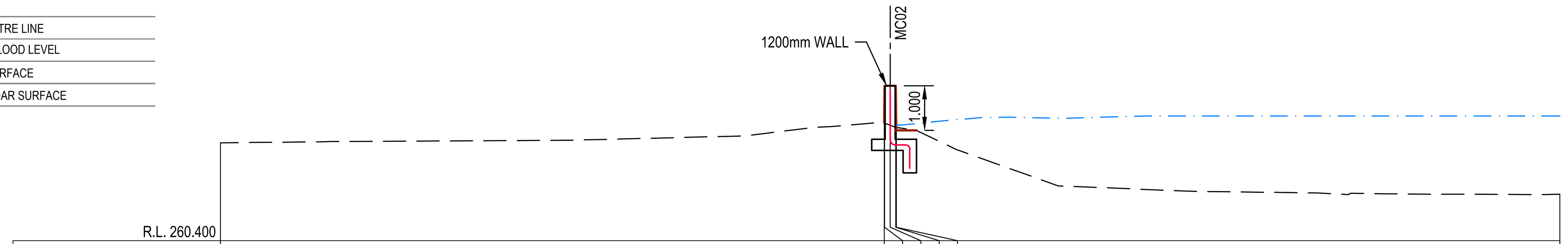
Status: FOR TENDER ONLY
NOT TO BE USED FOR CONSTRUCTION PURPOSES

VERT. DATUM	HORZ. DATUM	Scale	Size
AHD	MGA	AS SHOWN	A1

Drawing Number: 300203886-WE-3308
Revision: A

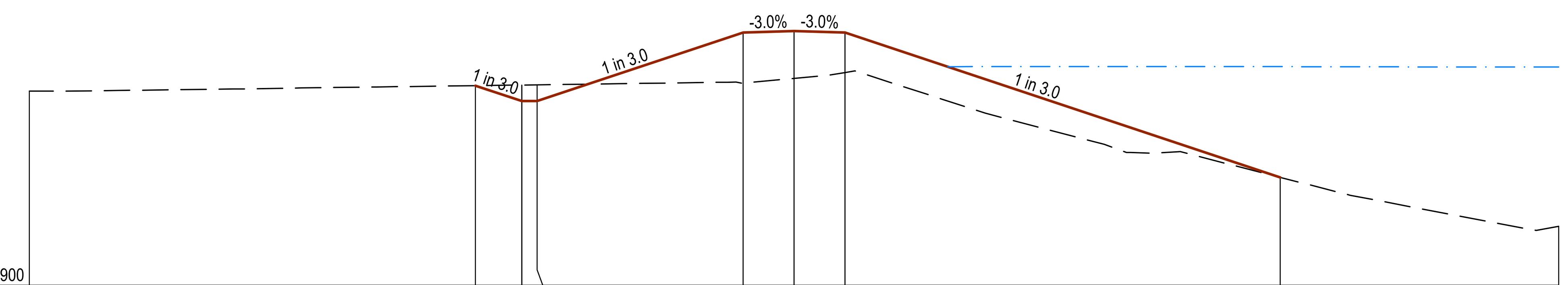
LEGEND

- DESIGN CENTRE LINE
- Ex 1% AEP FLOOD LEVEL
- EXISTING SURFACE
- EXISTING LIDAR SURFACE



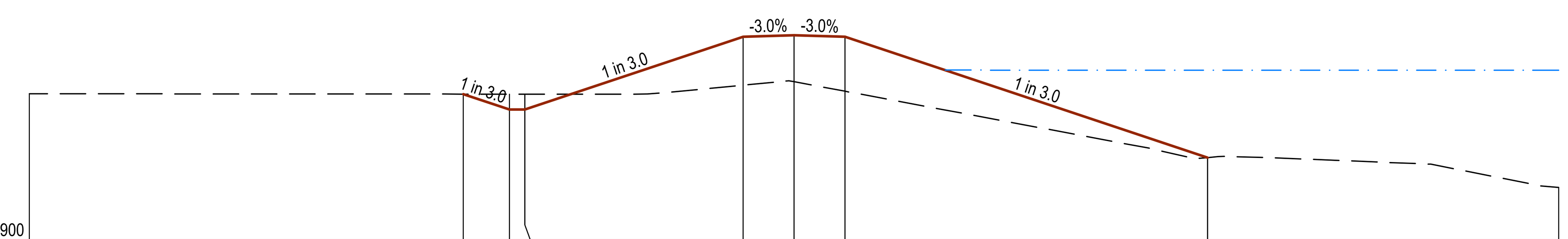
DESIGN SURFACE		263.03	263.87	263.87	263.87	262.94	
EXISTING SURFACE	262.59	263.03	263.03	262.99	262.94	262.94	261.44
OFFSET	-15.000	-0.133	-0.125	0.000	0.125	0.134	15.000

Ch 1060.000
Holbrook Levee 2



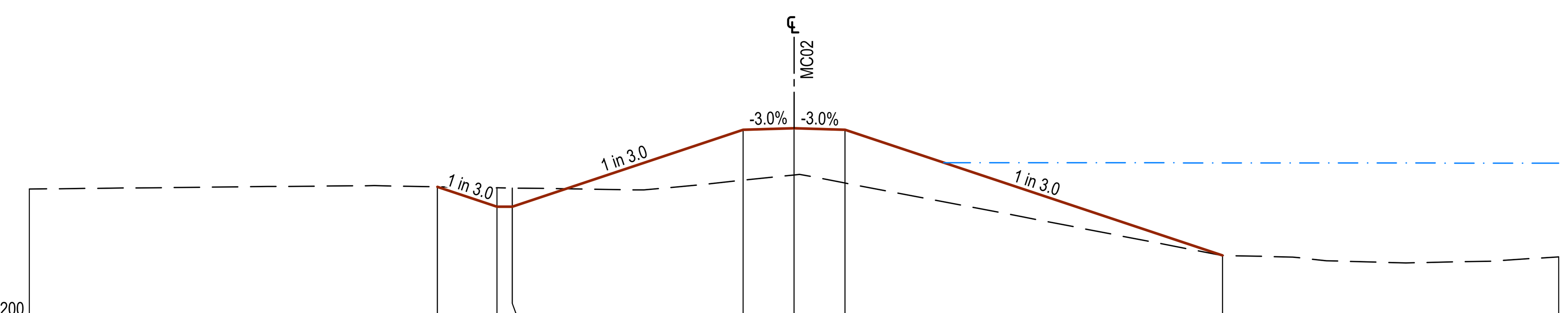
DESIGN SURFACE		262.82	262.52	262.52	263.86	263.89	263.86	261.02	
EXISTING SURFACE	262.71	262.82	262.83	262.84	262.87	262.96	263.08	261.02	260.05
OFFSET	-15.000	-6.252	-5.340	-5.040	-1.000	0.000	1.000	9.537	15.000

Ch 1040.000
Holbrook Levee 2



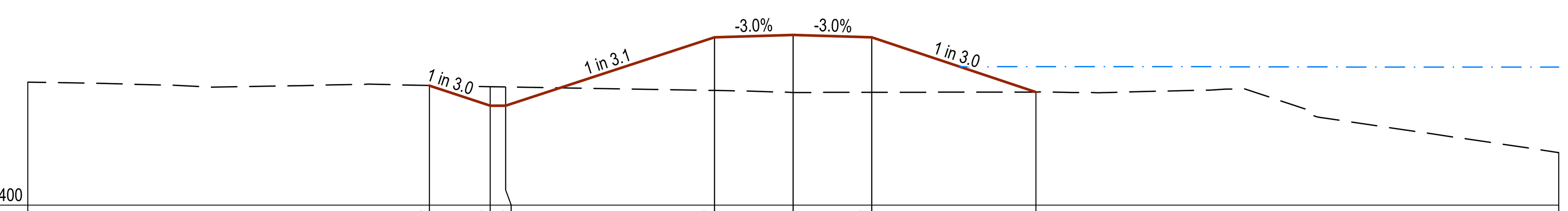
DESIGN SURFACE		262.76	262.46	262.46	263.89	263.92	263.89	261.52	
EXISTING SURFACE	262.77	262.76	262.76	262.76	262.94	263.01	262.82	261.52	260.93
OFFSET	-15.000	-6.490	-5.582	-5.282	-1.000	0.000	1.000	8.110	15.000

Ch 1020.000
Holbrook Levee 2



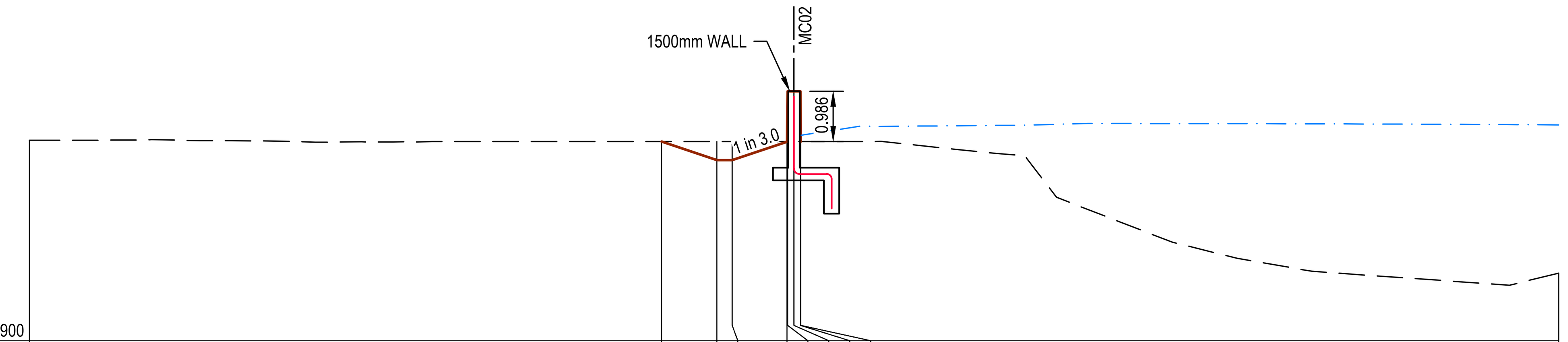
DESIGN SURFACE		262.79	262.40	262.40	263.91	263.94	263.91	261.44	
EXISTING SURFACE	262.75	262.79	262.77	262.77	262.92	263.03	262.87	261.44	261.42
OFFSET	-15.000	-6.997	-5.828	-5.528	-1.000	0.000	1.000	8.404	15.000

Ch 1000.000
Holbrook Levee 2



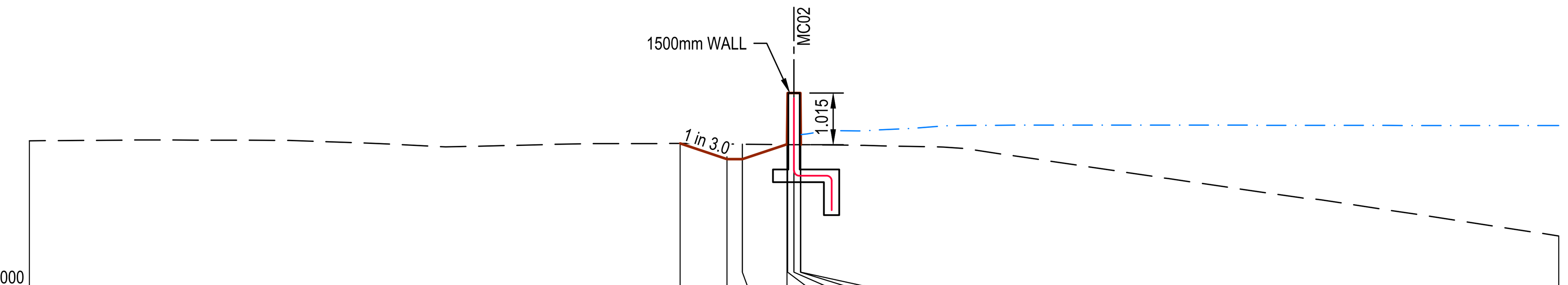
DESIGN SURFACE		262.75	262.35	262.35	263.69	263.74	263.69	262.62	
EXISTING SURFACE	262.82	262.75	262.73	262.72	262.65	262.61	262.61	262.62	261.43
OFFSET	-15.000	-7.129	-5.937	-5.637	-1.540	0.000	1.540	4.756	15.000

Ch 1140.000
Holbrook Levee 2



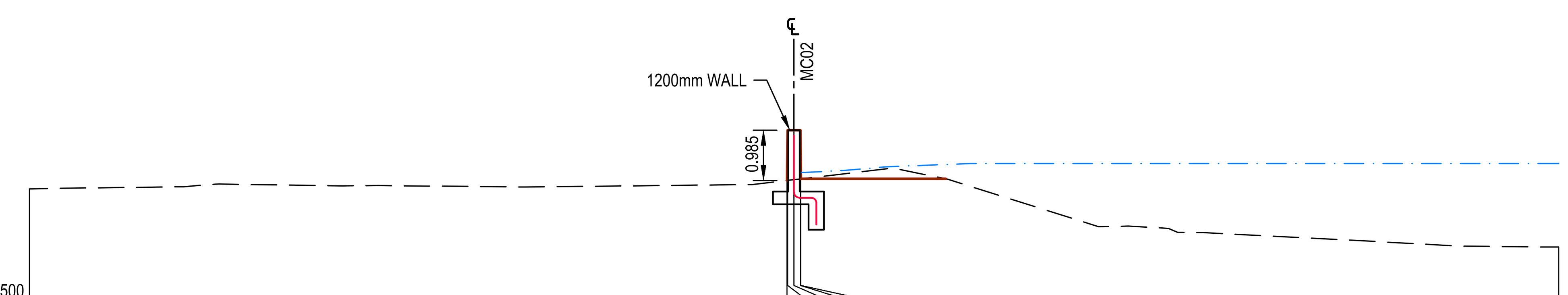
DESIGN SURFACE		262.80	262.44	262.44	262.80	263.79	263.79	263.79	262.81	
EXISTING SURFACE	262.83	262.80	262.81	262.81	262.81	262.81	262.81	262.81	262.81	260.22
OFFSET	-15.000	-2.595	-1.512	-1.212	-0.135	-0.125	0.000	0.125	0.135	15.000

Ch 1120.000
Holbrook Levee 2



DESIGN SURFACE		262.83	262.52	262.52	262.81	263.82	263.82	263.82	262.81	
EXISTING SURFACE	262.88	262.83	262.82	262.82	262.81	262.81	262.81	262.81	262.81	261.01
OFFSET	-15.000	-2.231	-1.313	-1.013	-0.135	-0.125	0.000	0.125	0.135	15.000

Ch 1100.000
Holbrook Levee 2



DESIGN SURFACE		262.86	263.85	263.85	263.85	262.89	
EXISTING SURFACE	262.70	262.86	262.86	262.88	262.89	262.89	261.55
OFFSET	-15.000	-0.135	-0.125	0.000	0.125	0.135	15.000

Ch 1080.000
Holbrook Levee 2

MC02 CROSS SECTIONS

SCALE 1:100

NOTE:

1. REFER TO DRAWING 300203886-WE-3300 FOR NOTES.

Rev.	Date	Description	Des.	Verif.	Appd.
A	10/05/2024	TENDER ISSUE	VZ		AS

0 1 2 4m
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Greater Hume Council

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Stantec Australia Pty Ltd | ABN 17 007 820 322
Level 4, 501 Swanston Street
Melbourne VIC 3000
Tel: 03 8415 7777
Web: www.stantec.com/au

Drawn SB Date 15/06/20
Checked VZ Date 23/04/24
Designed AS Date 23/04/24
Verified Date
Approved Date

Client: GREATER HUME SHIRE COUNCIL

Project: HHC FLOOD LEVEE DESIGN HOLBROOK, HENTY & CULCAIRN

Title: HOLBROOK 2 CROSS SECTIONS SHEET 7 OF 9

Status: FOR TENDER ONLY
NOT TO BE USED FOR CONSTRUCTION PURPOSES

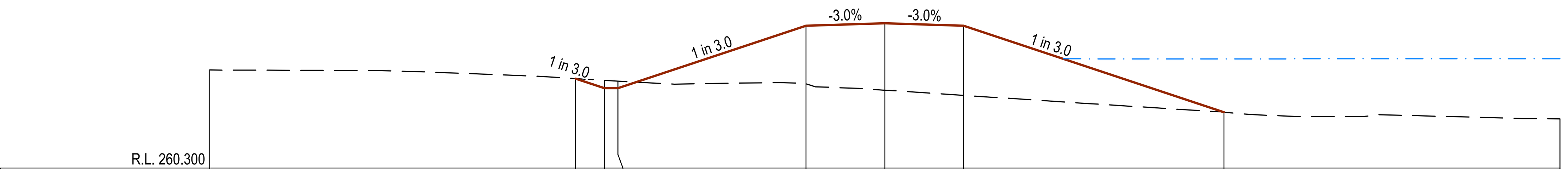
VERT. DATUM AHD | HORZ. DATUM MGA | Scale AS SHOWN | Size A1

Drawing Number 300203886-WE-3309 | Revision A

DATE PLOTTED: 10 May 2024 9:32 AM BY : HAZELGROVE, ADAM
XREF's:
CAD File: \\au2013-ppfss01\shared_projects\300203886\300 Levee Design\300203886-WE-3300-3316.dwg

LEGEND

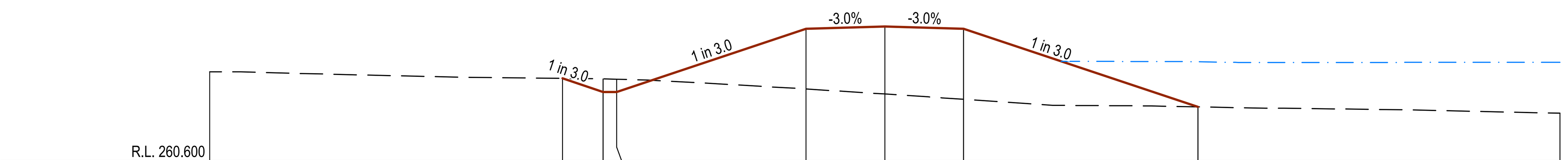
	DESIGN CENTRE LINE
	Ex 1% AEP FLOOD LEVEL
	EXISTING SURFACE
	EXISTING LIDAR SURFACE



R.L. 260.300

DESIGN SURFACE		262.30	262.08	262.08	263.48	263.53	263.48	261.55	
EXISTING SURFACE	262.49	262.30	262.26	262.24	262.18	262.04	261.92	261.55	261.40
OFFSET	-15.000	-6.872	-6.231	-5.931	-1.750	0.000	1.750	7.537	15.000

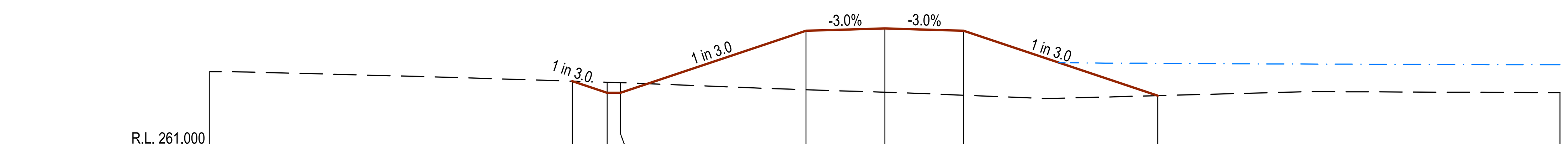
Ch 1220.000
Holbrook Levee 2



R.L. 260.600

DESIGN SURFACE		262.43	262.13	262.13	263.53	263.58	263.53	261.79	
EXISTING SURFACE	262.57	262.43	262.42	262.41	262.19	262.08	261.96	261.79	261.65
OFFSET	-15.000	-7.164	-6.259	-5.959	-1.750	0.000	1.750	6.954	15.000

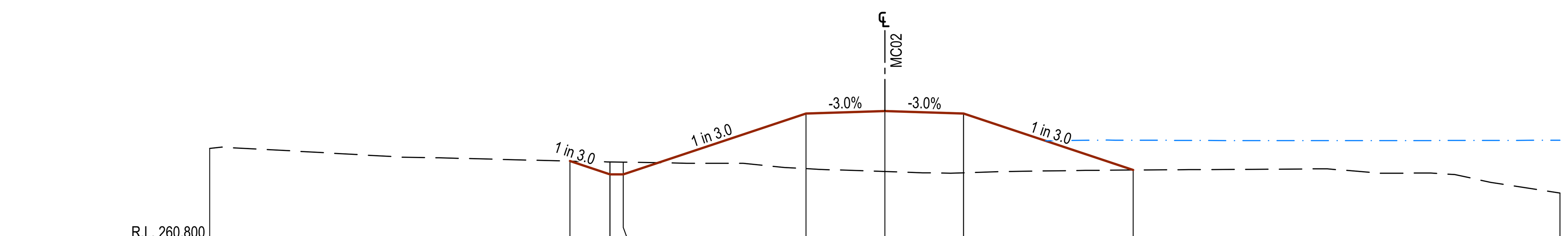
Ch 1200.000
Holbrook Levee 2



R.L. 261.000

DESIGN SURFACE		262.46	262.21	262.21	263.58	263.63	263.58	262.14	
EXISTING SURFACE	262.67	262.46	262.44	262.43	262.27	262.22	262.15	262.14	262.21
OFFSET	-15.000	-6.946	-6.173	-5.873	-1.750	0.000	1.750	6.063	15.000

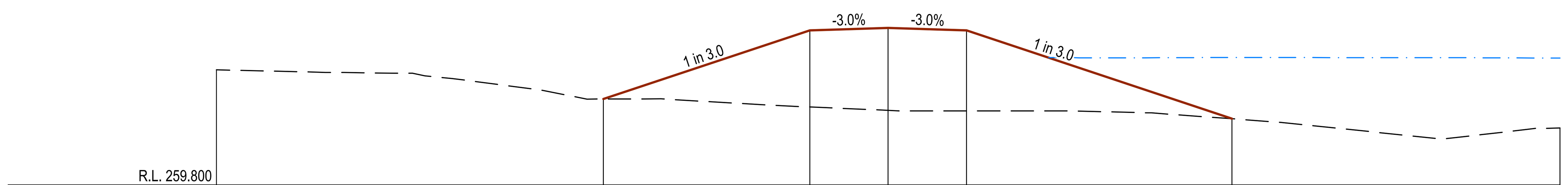
Ch 1180.000
Holbrook Levee 2



R.L. 260.800

DESIGN SURFACE		262.58	262.28	262.28	263.63	263.69	263.63	262.38	
EXISTING SURFACE	262.86	262.58	262.56	262.55	262.41	262.34	262.32	262.38	261.87
OFFSET	-15.000	-6.998	-6.110	-5.810	-1.750	0.000	1.750	5.516	15.000

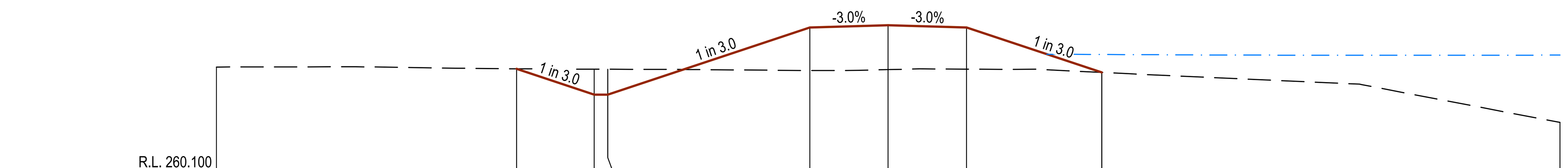
Ch 1160.000
Holbrook Levee 2



R.L. 259.800

DESIGN SURFACE		261.72	263.25	263.31	263.25	261.28	
EXISTING SURFACE	262.37	261.72	261.54	261.46	261.45	261.28	261.07
OFFSET	-15.000	-6.357	-1.750	0.000	1.750	7.679	15.000

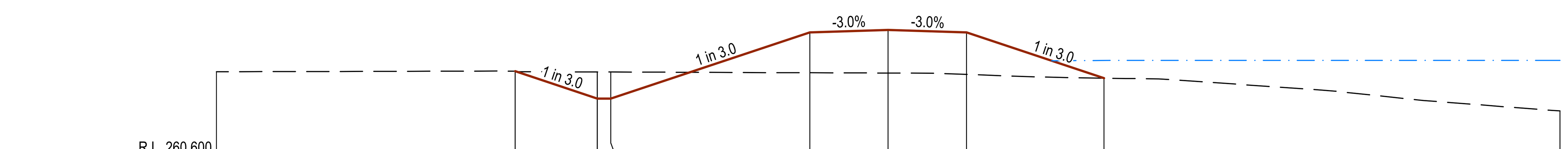
Ch 1300.000
Holbrook Levee 2



R.L. 260.100

DESIGN SURFACE		262.39	261.81	261.81	263.31	263.37	263.31	262.31	
EXISTING SURFACE	262.43	262.39	262.38	262.38	262.35	262.37	262.38	262.31	261.19
OFFSET	-15.000	-8.300	-6.561	-6.261	-1.750	0.000	1.750	4.769	15.000

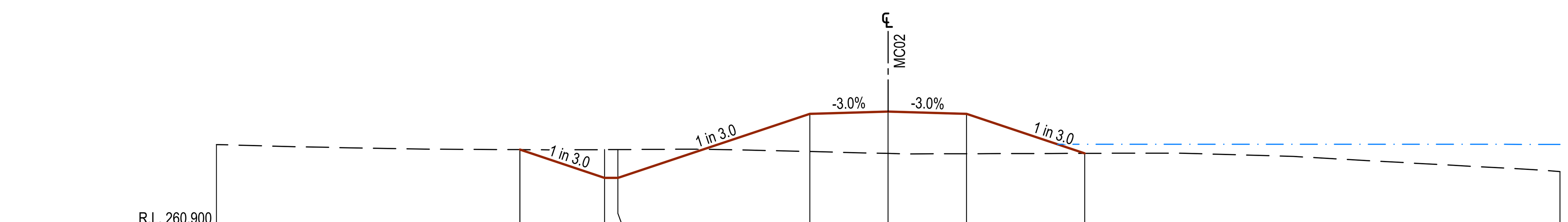
Ch 1280.000
Holbrook Levee 2



R.L. 260.600

DESIGN SURFACE		262.50	261.89	261.89	263.37	263.42	263.37	262.35	
EXISTING SURFACE	262.49	262.50	262.49	262.48	262.47	262.46	262.43	262.35	261.61
OFFSET	-15.000	-8.330	-6.494	-6.194	-1.750	0.000	1.750	4.822	15.000

Ch 1260.000
Holbrook Levee 2



R.L. 260.900

DESIGN SURFACE		262.63	262.00	262.00	263.42	263.48	263.42	262.54	
EXISTING SURFACE	262.74	262.63	262.63	262.63	262.58	262.54	262.54	262.54	262.14
OFFSET	-15.000	-8.222	-6.332	-6.032	-1.750	0.000	1.750	4.388	15.000

Ch 1240.000
Holbrook Levee 2

MC02 CROSS SECTIONS

SCALE 1:100

NOTE:

1. REFER TO DRAWING 300203886-WE-3300 FOR NOTES.

DATE PLOTTED: 10 May 2024 9:32 AM BY : HAZELGROVE, ADAM

Rev.	Date	Description	Des.	Verif.	Appd.
A	10/05/2024	TENDER ISSUE	VZ		AS

0 1 2 4m
H 1:100 @A1

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Drawn SB Date 15/06/20
Checked VZ Date 23/04/24
Designed AS Date 23/04/24
Verified Date
Approved Date

Client: GREATER HUME SHIRE COUNCIL

Project: HHC FLOOD LEVEE DESIGN HOLBROOK, HENTY & CULCAIRN

Title: HOLBROOK 2 CROSS SECTIONS SHEET 8 OF 9

Status: FOR TENDER ONLY
NOT TO BE USED FOR CONSTRUCTION PURPOSES

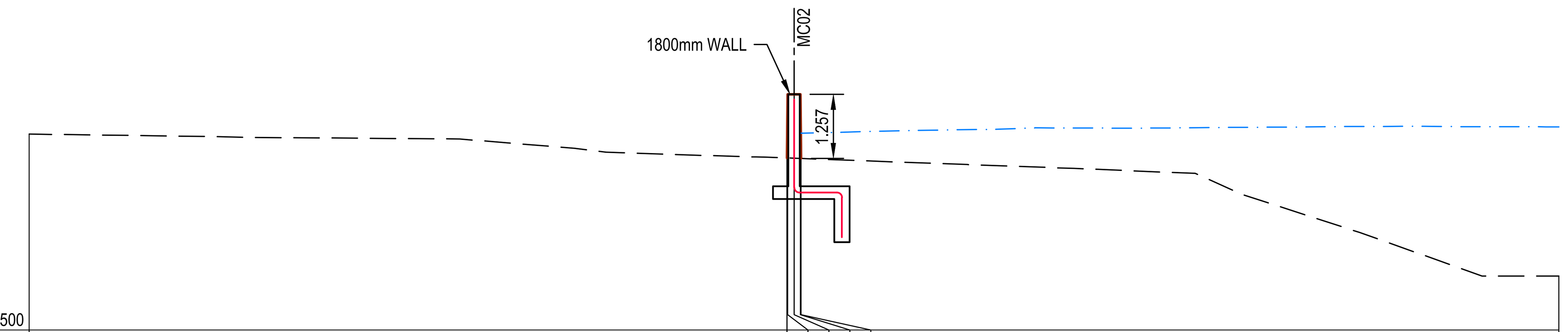
VERT. DATUM	HORZ. DATUM	Scale	Size
AHD	MGA	AS SHOWN	A1

Drawing Number: 300203886-WE-3310 Revision: A

XREF's:
CAD File: \\au2013-ppfss01\shared_projects\300203886\300 Levee Design\300203886-WE-3300-3316.dwg

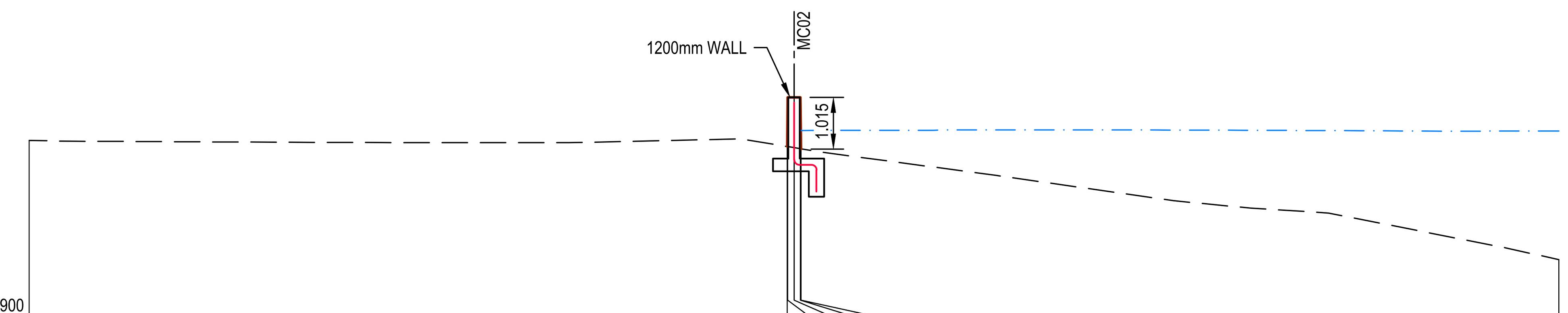
LEGEND

	DESIGN CENTRE LINE
	Ex 1% AEP FLOOD LEVEL
	EXISTING SURFACE
	EXISTING LIDAR SURFACE



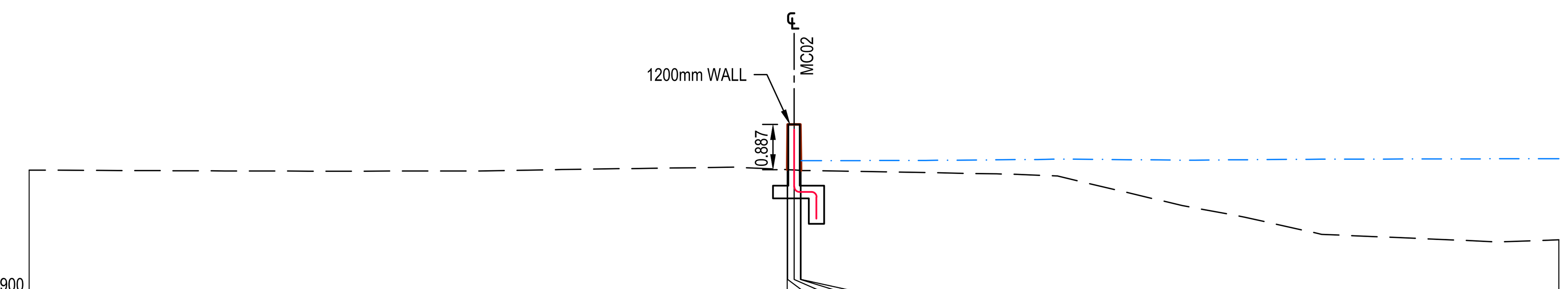
DESIGN SURFACE		261.87	263.12	263.12	263.12	261.86	
EXISTING SURFACE	262.34	261.87	261.87	261.87	261.87	261.86	259.56
OFFSET	-15.000	-0.137	-0.125	0.000	0.125	0.138	15.000

Ch 1360.000
Holbrook Levee 2



DESIGN SURFACE		262.22	263.18	263.18	263.18	262.17	
EXISTING SURFACE	262.34	262.22	262.22	262.20	262.18	262.17	260.00
OFFSET	-15.000	-0.135	-0.125	0.000	0.125	0.135	15.000

Ch 1340.000
Holbrook Levee 2



DESIGN SURFACE		262.36	263.24	263.24	263.24	262.34	
EXISTING SURFACE	262.35	262.36	262.36	262.35	262.34	262.34	260.98
OFFSET	-15.000	-0.134	-0.125	0.000	0.125	0.134	15.000

Ch 1320.000
Holbrook Levee 2

MC02 CROSS SECTIONS

SCALE 1:100

NOTE:

1. REFER TO DRAWING 300203886-WE-3300 FOR NOTES.

Rev.	Date	Description	Des.	Verif.	Appd.
A	10/05/2024	TENDER ISSUE	VZ		AS

0 1 2 4m
H 1:100 @A1

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Drawn	SB	Date 15/06/20
Checked	VZ	Date 23/04/24
Designed	AS	Date 23/04/24
Verified		Date
Approved		Date

Client: GREATER HUME SHIRE COUNCIL

Project: HHC FLOOD LEVEE DESIGN
HOLBROOK, HENTY
& CULCAIRN

Title: HOLBROOK 2 CROSS SECTIONS
SHEET 9 OF 9

Status: FOR TENDER ONLY
NOT TO BE USED FOR CONSTRUCTION PURPOSES

VERT. DATUM	HORZ. DATUM	Scale	Size
AHD	MGA	AS SHOWN	A1

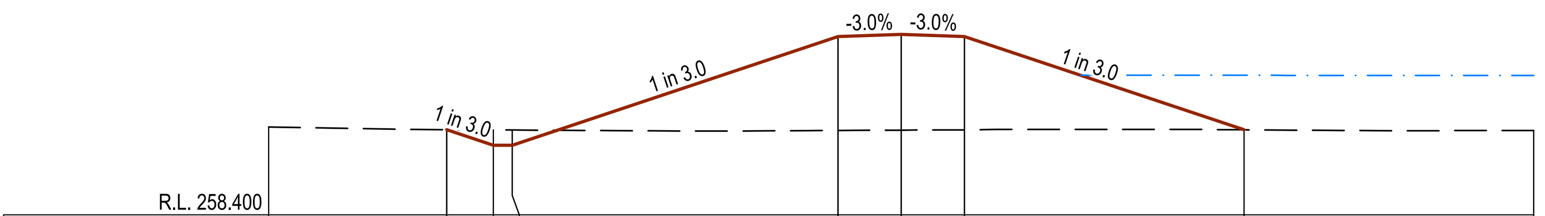
Drawing Number	Revision
300203886-WE-3311	A

DATE PLOTTED: 10 May 2024 9:32 AM BY : HAZELGROVE, ADAM

XREF's:
CAD File: \\au2013-ppfss01\shared_projects\300203886\300 Levee Design\300203886-WE-3300-3316.dwg

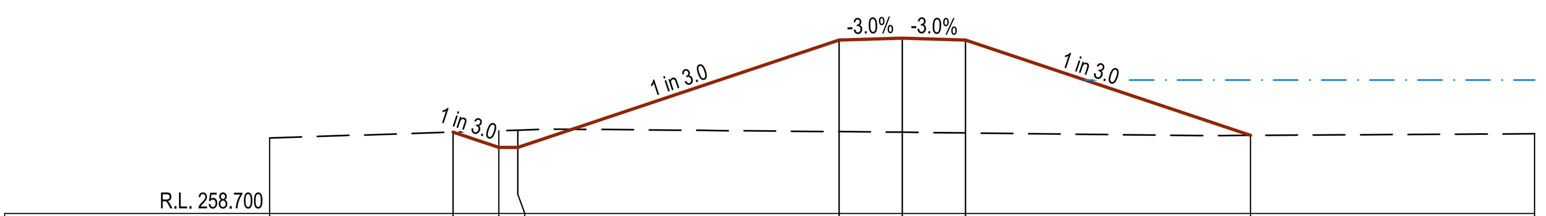
LEGEND

	DESIGN CENTRE LINE
	Ex 1% AEP FLOOD LEVEL
	EXISTING SURFACE
	EXISTING LIDAR SURFACE



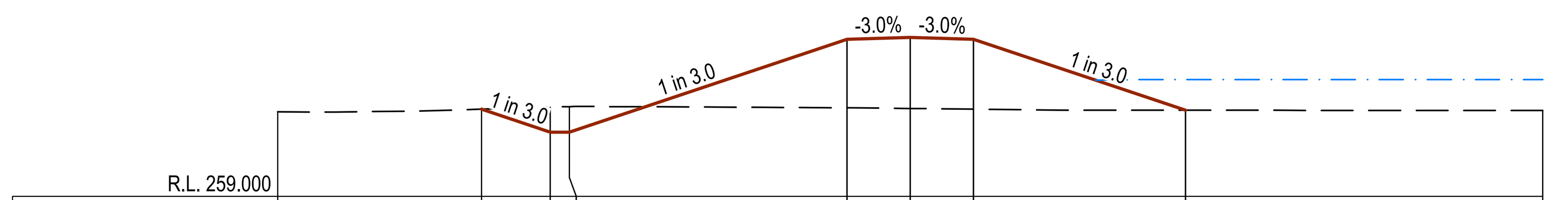
DESIGN SURFACE		259.74	259.50	259.50	261.21	261.24	261.21	259.74	
EXISTING SURFACE	259.78	259.74	259.74	259.74	259.73	259.73	259.74	259.74	259.73
OFFSET	-10.000	-7.185	-6.447	-6.147	-1.000	0.000	1.000	5.418	10.000

Ch 80.000
Holbrook levee 3



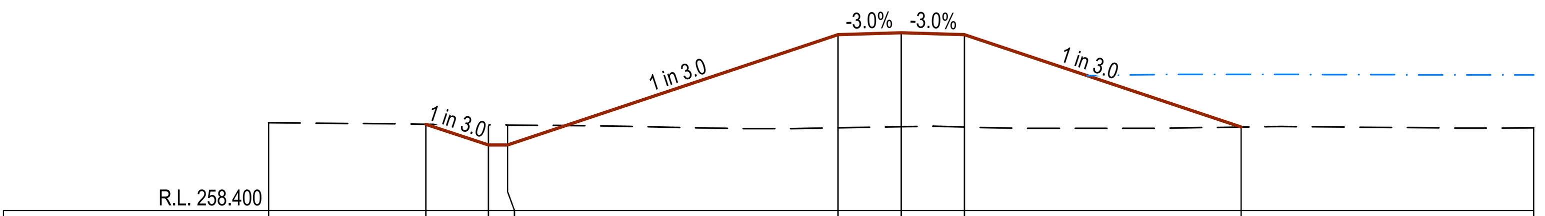
DESIGN SURFACE		259.98	259.74	259.74	261.43	261.46	261.43	259.93	
EXISTING SURFACE	259.89	259.98	260.01	260.01	259.99	259.98	259.97	259.93	259.96
OFFSET	-10.000	-7.101	-6.377	-6.077	-1.000	0.000	1.000	5.508	10.000

Ch 160.000
Holbrook levee 3



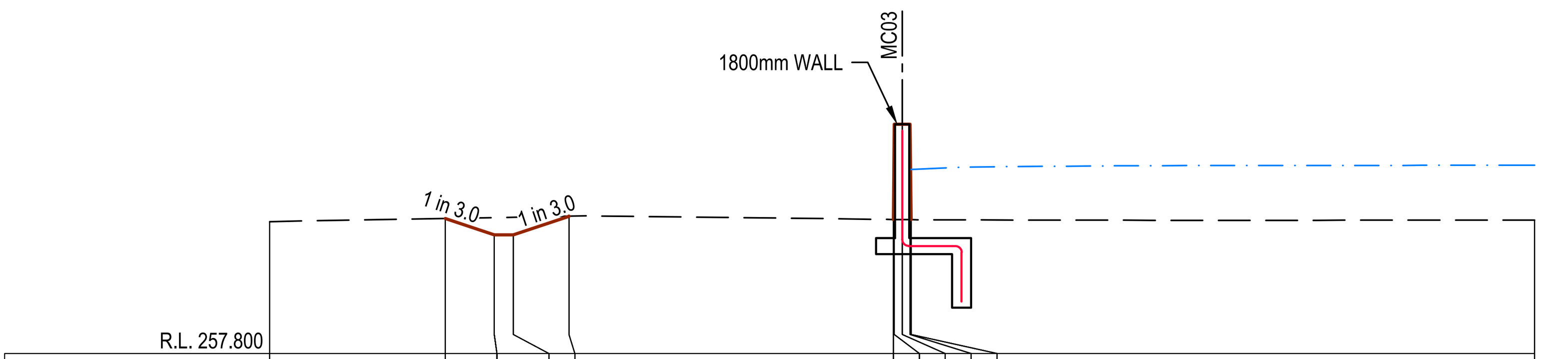
DESIGN SURFACE		260.37	260.01	260.01	261.47	261.50	261.47	260.36	
EXISTING SURFACE	260.33	260.37	260.41	260.42	260.40	260.38	260.37	260.36	260.35
OFFSET	-10.000	-6.776	-5.689	-5.389	-1.000	0.000	1.000	4.350	10.000

Ch 240.000
Holbrook levee 3



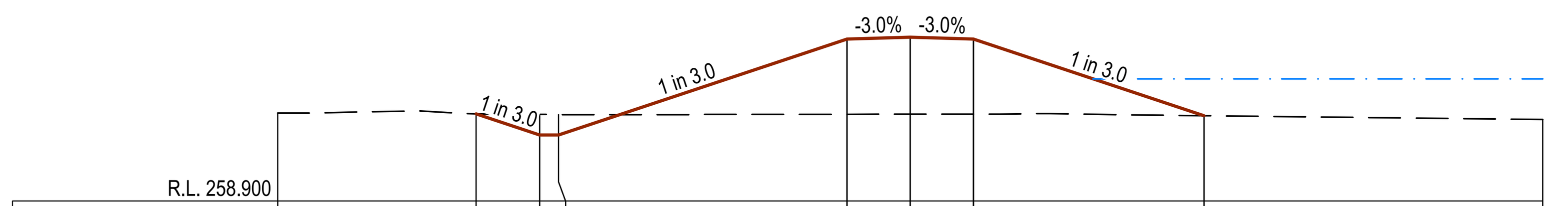
DESIGN SURFACE		259.76	259.43	259.43	261.17	261.20	261.17	259.72	
EXISTING SURFACE	259.78	259.76	259.75	259.75	259.70	259.72	259.72	259.72	259.70
OFFSET	-10.000	-7.513	-6.524	-6.224	-1.000	0.000	1.000	5.372	10.000

Ch 60.000
Holbrook levee 3



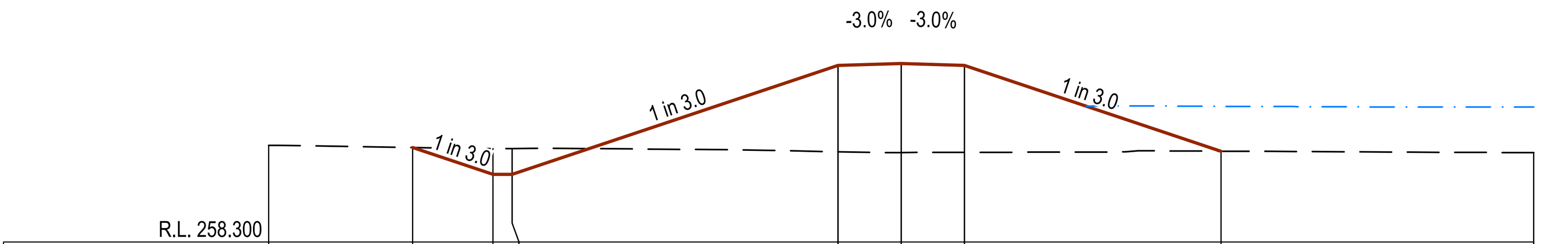
DESIGN SURFACE		259.93	259.68	259.68	259.97	259.92	261.42	261.42	261.42	259.92	
EXISTING SURFACE	259.88	259.93			259.97	259.92	259.92	259.92	259.92	259.92	259.91
OFFSET	-10.000	-7.227	-6.450	-6.150	-5.270	-0.140	-0.125	0.000	0.125	0.140	10.000

Ch 140.000
Holbrook levee 3



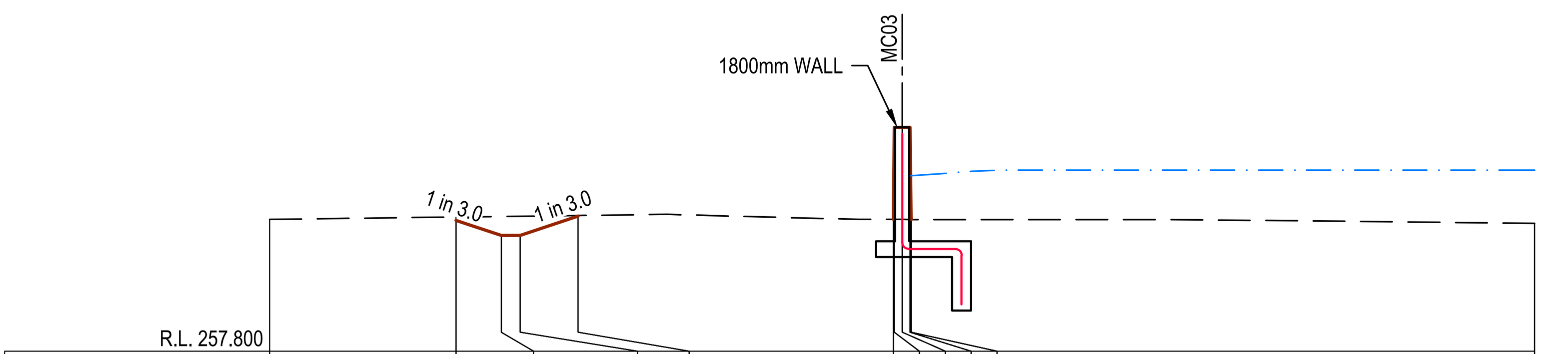
DESIGN SURFACE		260.28	259.95	259.95	261.46	261.49	261.46	260.25	
EXISTING SURFACE	260.29	260.28	260.27	260.27	260.27	260.27	260.28	260.25	260.19
OFFSET	-10.000	-6.863	-5.857	-5.557	-1.000	0.000	1.000	4.642	10.000

Ch 220.000
Holbrook levee 3



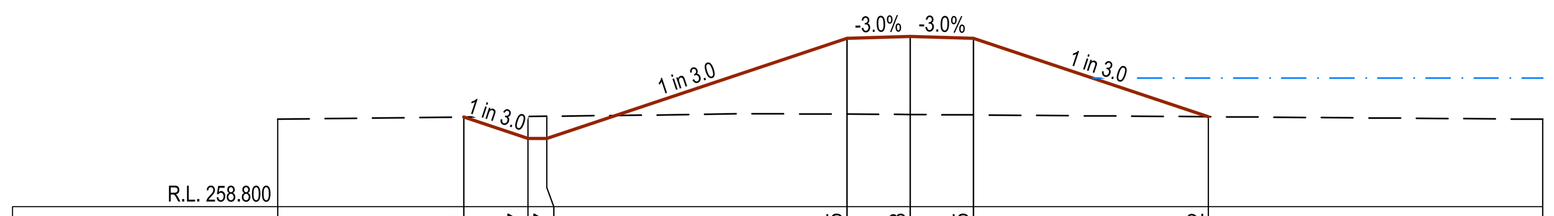
DESIGN SURFACE		259.79	259.37	259.37	261.08	261.11	261.08	259.73	
EXISTING SURFACE	259.82	259.79	259.77	259.77	259.72	259.71	259.71	259.73	259.71
OFFSET	-10.000	-7.721	-6.452	-6.152	-1.000	0.000	1.000	5.055	10.000

Ch 40.000
Holbrook levee 3



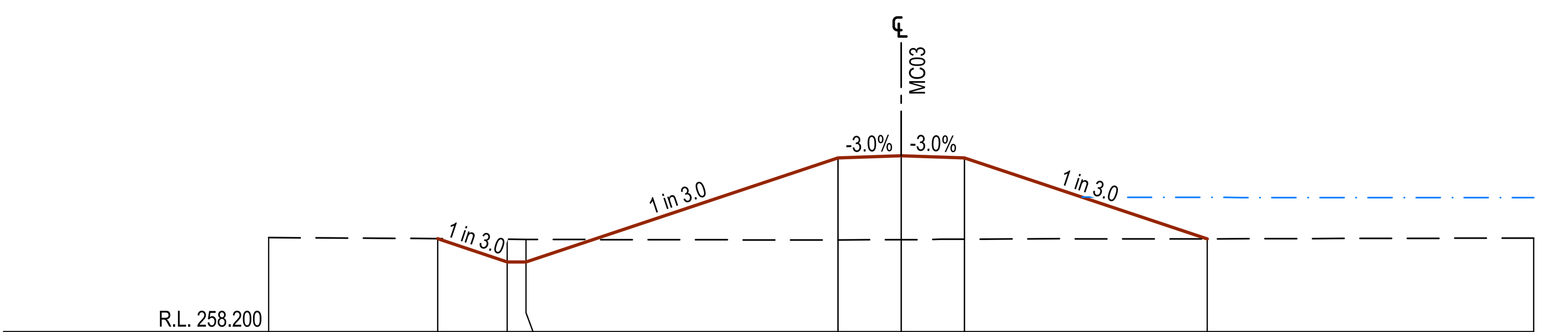
DESIGN SURFACE		259.87	259.63	259.63	259.94	259.89	261.34	261.34	261.34	259.89	
EXISTING SURFACE	259.89	259.87			259.94	259.89	259.89	259.89	259.89	259.89	259.82
OFFSET	-10.000	-7.057	-6.341	-6.041	-5.127	-0.140	-0.125	0.000	0.125	0.140	10.000

Ch 120.000
Holbrook levee 3



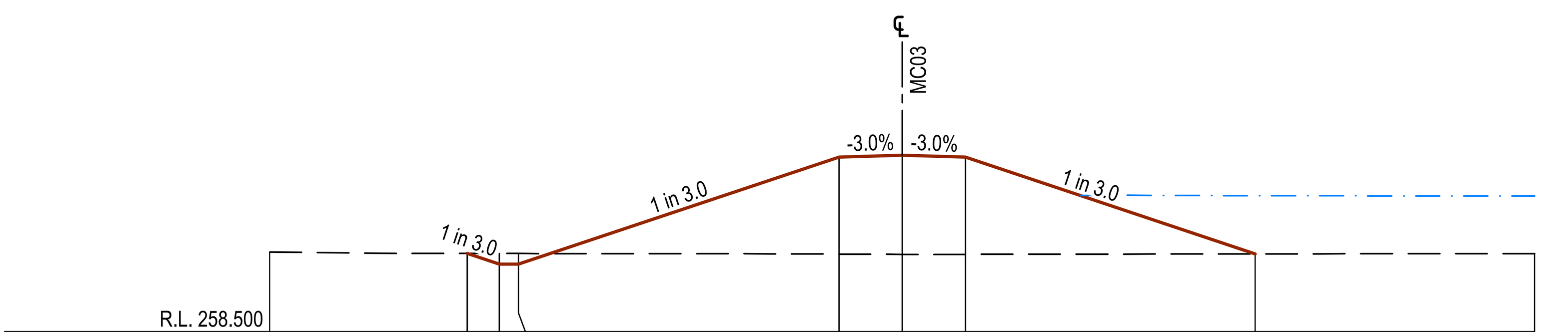
DESIGN SURFACE		260.21	259.87	259.87	261.45	261.48	261.45	260.22	
EXISTING SURFACE	260.18	260.21	260.22	260.23	260.26	260.25	260.24	260.22	260.18
OFFSET	-10.000	-7.055	-6.042	-5.742	-1.000	0.000	1.000	4.711	10.000

Ch 200.000
Holbrook levee 3



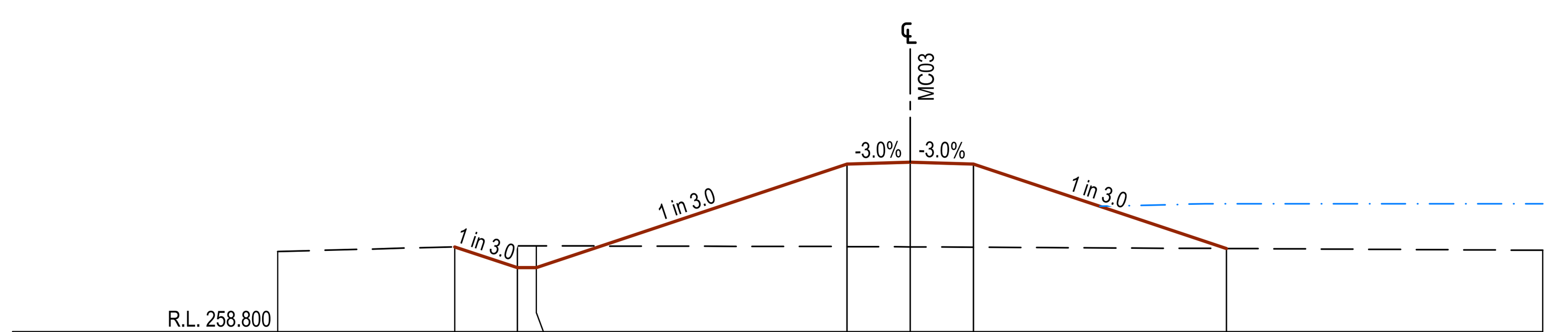
DESIGN SURFACE		259.67	259.30	259.30	260.94	260.97	260.94	259.66	
EXISTING SURFACE	259.68	259.67	259.66	259.66	259.65	259.65	259.66	259.66	259.68
OFFSET	-10.000	-7.328	-6.229	-5.929	-1.000	0.000	1.000	4.837	10.000

Ch 20.000
Holbrook levee 3



DESIGN SURFACE		259.73	259.56	259.56	261.25	261.28	261.25	259.73	
EXISTING SURFACE	259.76	259.73	259.73	259.73	259.72	259.72	259.72	259.73	259.73
OFFSET	-10.000	-6.877	-6.369	-6.069	-1.000	0.000	1.000	5.580	10.000

Ch 100.000
Holbrook levee 3



DESIGN SURFACE		260.14	259.81	259.81	261.44	261.47	261.44	260.11	
EXISTING SURFACE	260.06	260.14	260.15	260.15	260.14	260.14	260.13	260.11	260.08
OFFSET	-10.000	-7.199	-6.210	-5.910	-1.000	0.000	1.000	5.000	10.000

Ch 180.000
Holbrook levee 3

MC03 CROSS SECTIONS
SCALE 1:100

NOTE:
1. REFER TO DRAWING 300203886-WE-3300 FOR NOTES.

DATE PLOTTED: 10 May 2024 9:32 AM BY : HAZELGROVE, ADAM

XREF's:
CAD File: \\au2013-ppfss01\shared_projects\300203886\300 Levee Design\300203886-WE-3300-3316.dwg

Rev.	Date	Description	Des.	Verif.	Appd.
A	10/05/2024	TENDER ISSUE	VZ		AS

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Drawn SB	Date 15/06/20	
Checked VZ	Date 23/04/24	
Designed AS	Date 23/04/24	
Verified	Date	
Approved	Date	

Client: GREATER HUME SHIRE COUNCIL

Project: HHC FLOOD LEVEE DESIGN
HOLBROOK, HENTY
& CULCAIRN

Title: HOLBROOK 3 CROSS SECTIONS
SHEET 1 OF 2

Status: FOR TENDER ONLY
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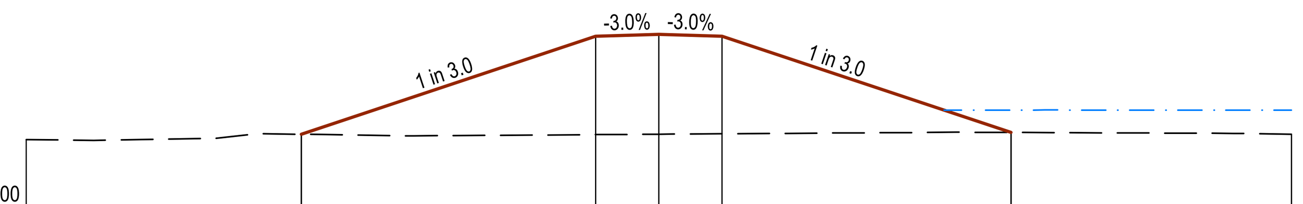
VERT. DATUM	HORZ. DATUM	Scale	Size
AHD	MGA	AS SHOWN	A1

Drawing Number: 300203886-WE-3312
Revision: A

LEGEND

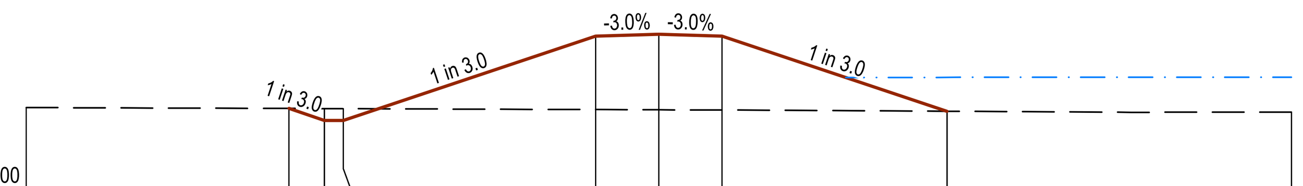
	DESIGN CENTRE LINE
	Ex 1% AEP FLOOD LEVEL
	EXISTING SURFACE
	EXISTING LIDAR SURFACE



R.L. 259.400

DESIGN SURFACE		260.54	262.09	262.12	262.09	260.57	
EXISTING SURFACE	260.46	260.54	260.54	260.54	260.55	260.57	260.55
OFFSET	-10.000	-5.652	-1.000	0.000	1.000	5.568	10.000

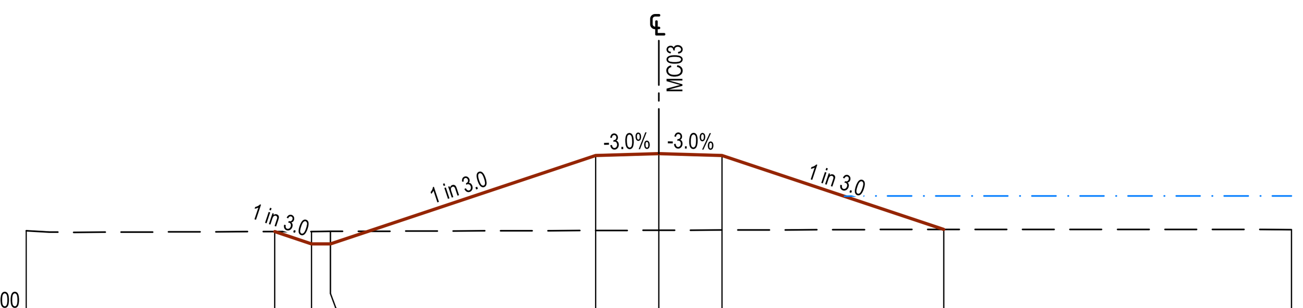
Ch 300.000
Holbrook levee 3



R.L. 259.100

DESIGN SURFACE		260.35	260.17	260.17	261.49	261.52	261.49	260.31	
EXISTING SURFACE	260.37	260.35	260.35	260.35	260.34	260.33	260.33	260.31	260.30
OFFSET	-10.000	-5.846	-5.285	-4.985	-1.000	0.000	1.000	4.556	10.000

Ch 280.000
Holbrook levee 3



R.L. 259.000

DESIGN SURFACE		260.28	260.09	260.09	261.48	261.51	261.48	260.32	
EXISTING SURFACE	260.29	260.28	260.28	260.28	260.30	260.30	260.30	260.32	260.31
OFFSET	-10.000	-6.068	-5.490	-5.190	-1.000	0.000	1.000	4.505	10.000

Ch 260.000
Holbrook levee 3

MC03 CROSS SECTIONS

SCALE 1:100

NOTE:

1. REFER TO DRAWING 300203886-WE-3300 FOR NOTES.

Rev.	Date	Description	Des.	Verif.	Appd.
A	10/05/2024	TENDER ISSUE	VZ		AS

0 1 2 4m
H 1:100 @A1

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Drawn SB	Date 15/06/20
Checked VZ	Date 23/04/24
Designed AS	Date 23/04/24
Verified	Date
Approved	Date

Client: GREATER HUME SHIRE COUNCIL

Project: HHC FLOOD LEVEE DESIGN
HOLBROOK, HENTY
& CULCAIRN

Title: HOLBROOK 3 CROSS SECTIONS
SHEET 2 OF 2

Status: FOR TENDER ONLY
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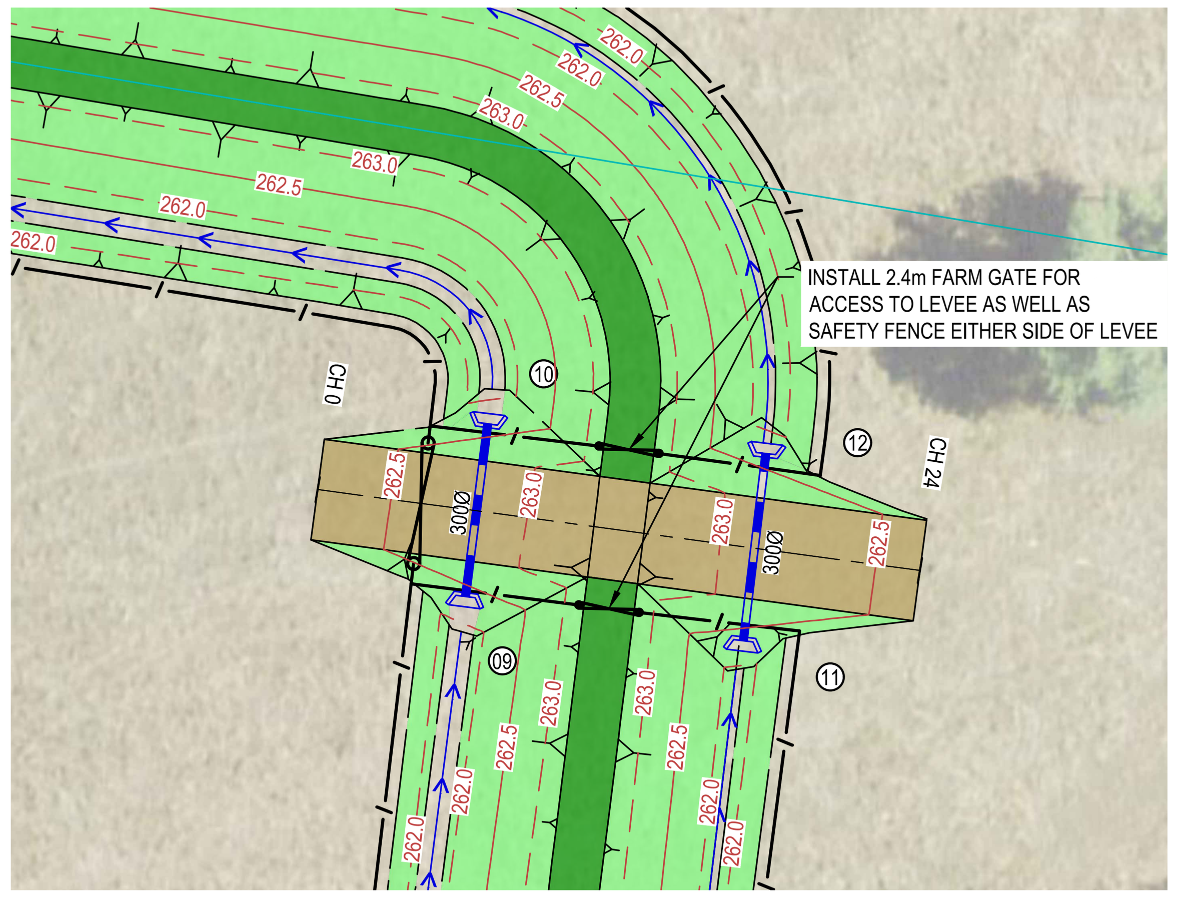
VERT. DATUM	HORZ. DATUM	Scale	Size
AHD	MGA	AS SHOWN	A1

Drawing Number: 300203886-WE-3313
Revision: A

DATE PLOTTED: 10 May 2024 9:32 AM BY : HAZELGROVE, ADAM

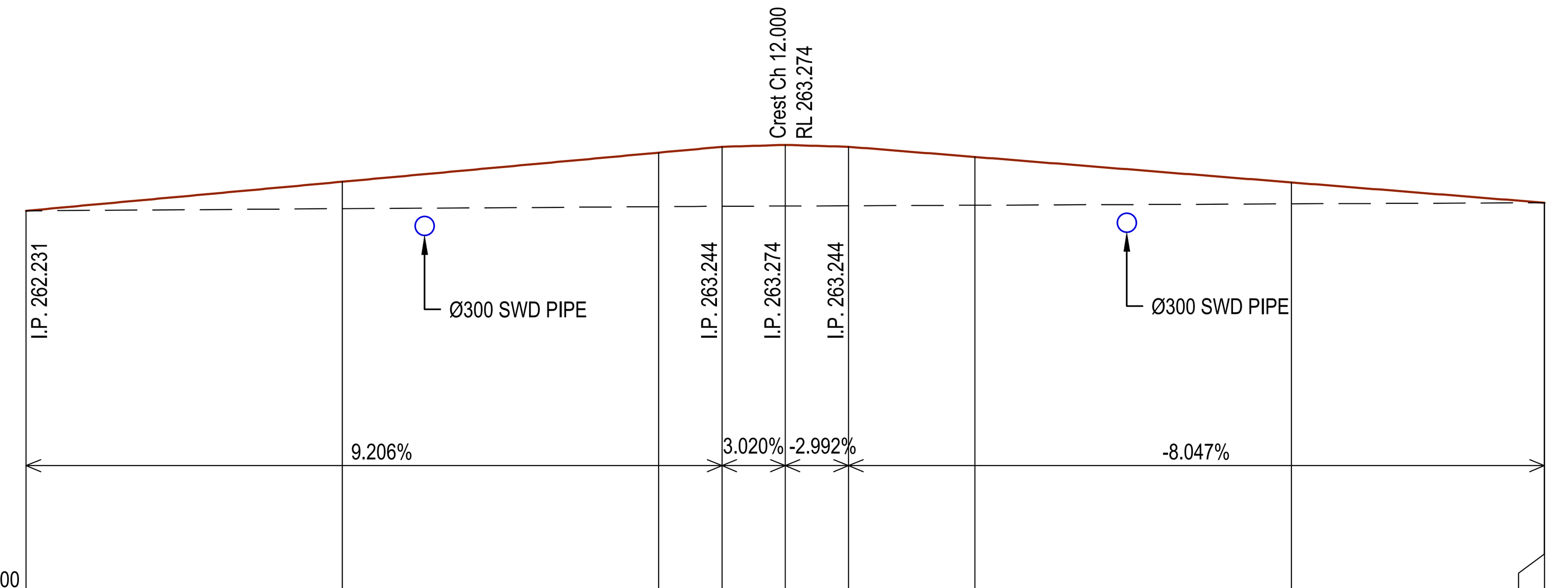
XREF's:
CAD File: \\au2013-ppfss01\shared_projects\300203886\300 Levee Design\300203886-WE-3300-3316.dwg

NORTH



CROSSOVER 1

1:250



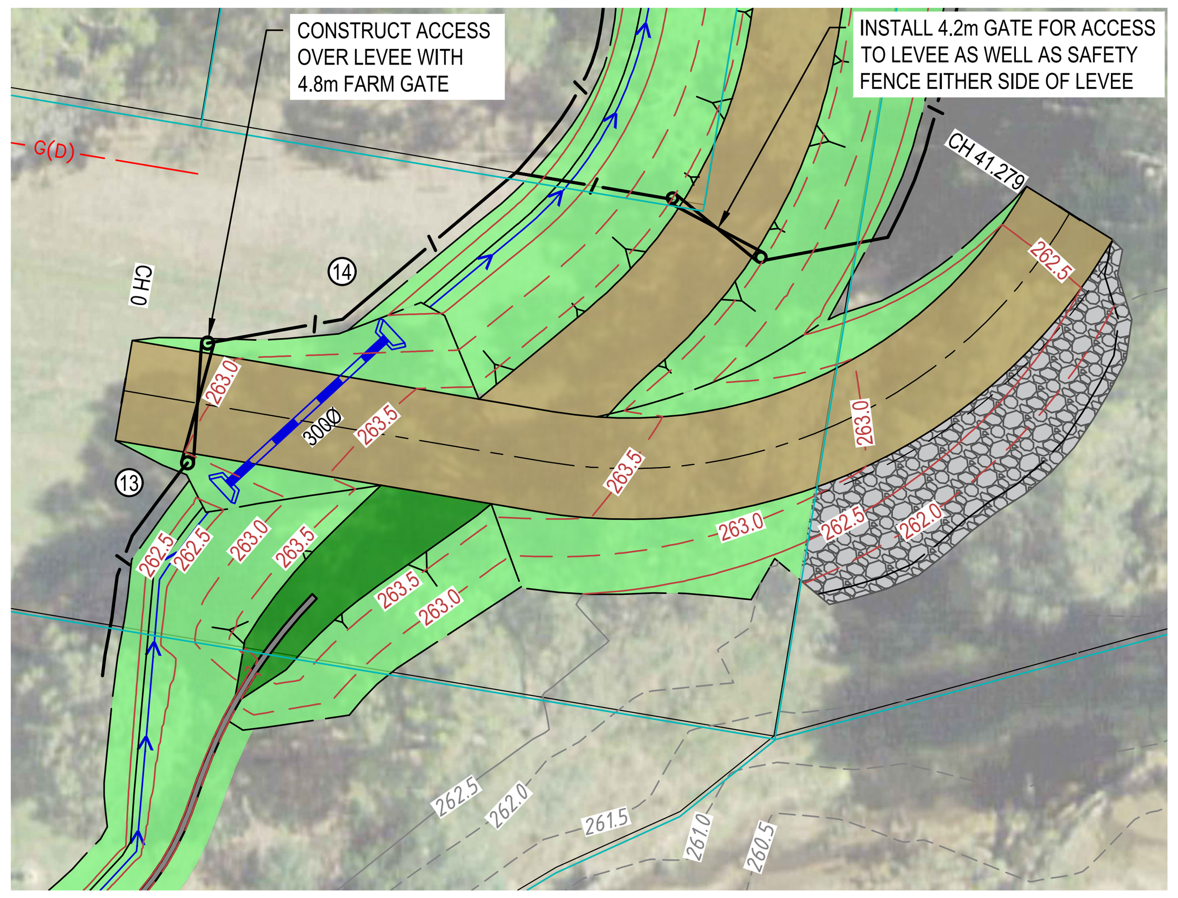
RL 256.200

DESIGN SURFACE	262.231	262.692	263.152	263.244	263.274	263.244	263.083	262.681	262.359	262.359
EXISTING SURFACE	262.23	262.27	262.30	262.30	262.31	262.31	262.32	262.34	262.36	262.36
CHAINAGE	0.000	5.000	10.000	11.000	12.000	13.000	15.000	20.000	24.000	24.001

LONGITUDINAL SECTION
CROSSOVER 1 Ch 0.000 to Ch 24.001
SCALES: HORIZONTAL 1:100 VERTICAL 1:100

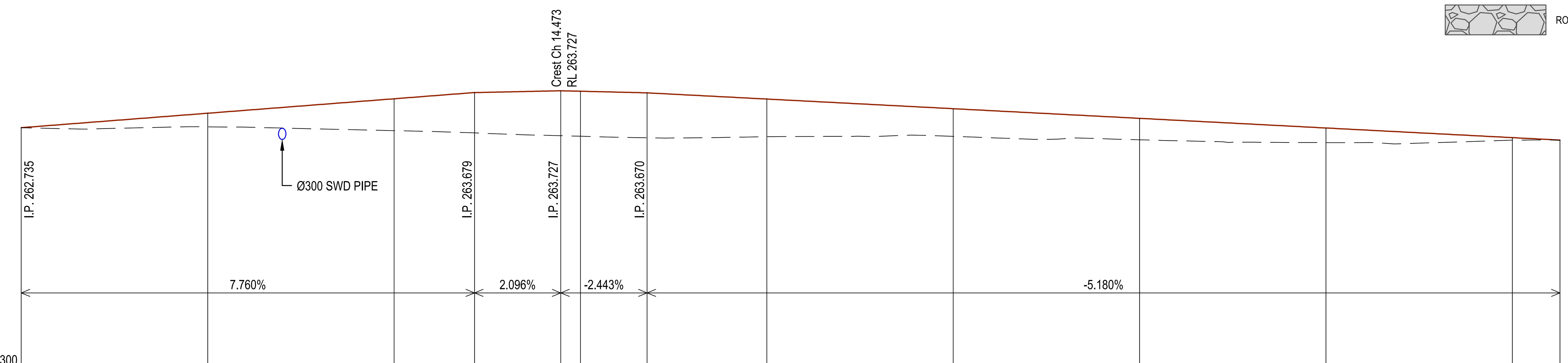
LEGEND

- DESIGN CENTRE LINE
- EXISTING SURFACE
- 260.0 FINISHED SURFACE CONTOUR - MAJOR
- FINISHED SURFACE CONTOUR - MINOR
- 260.0 EXISTING SURFACE CONTOUR - MAJOR
- EXISTING SURFACE CONTOUR - MINOR
- DESIGN CENTRELINE
- PROPOSED TOP OF BATTER
- PROPOSED BOTTOM OF BATTER
- PROPOSED SWALE DRAIN
- PROPOSED DRAINAGE PIPE
- PROPOSED FENCE
- PROPERTY BOUNDARY - SURVEY
- PROPERTY BOUNDARY - VICMAP
- EXISTING SURFACE DRAIN
- G(D) EXISTING GAS (BYDA)
- S(D) EXISTING SEWER (BYDA)
- W(D) EXISTING WATER RETIC. (BYDA)
- D(D) EXISTING STORMWATER PIPE (BYDA)
- E_{LV} (D) EXISTING LOW VOLTAGE - UNDERGROUND
- E_{LVO} (D) EXISTING LOW VOLTAGE - OVERHEAD
- E_{HVO} (D) EXISTING HIGH VOLTAGE - OVERHEAD
- C_{TEL} (D) EXISTING TELECOMMUNICATIONS
- SURVEY QUALITY LEVEL
- UTILITY TYPE
- LEVEE BENCH
- LEVEE BATTER - GRASS SEEDED
- GRAVEL MAINTENANCE TRACK - G1
- GRAVEL PATH - G2
- GRAVEL ROAD - G3
- ROCK BEACHING



CROSSOVER 2

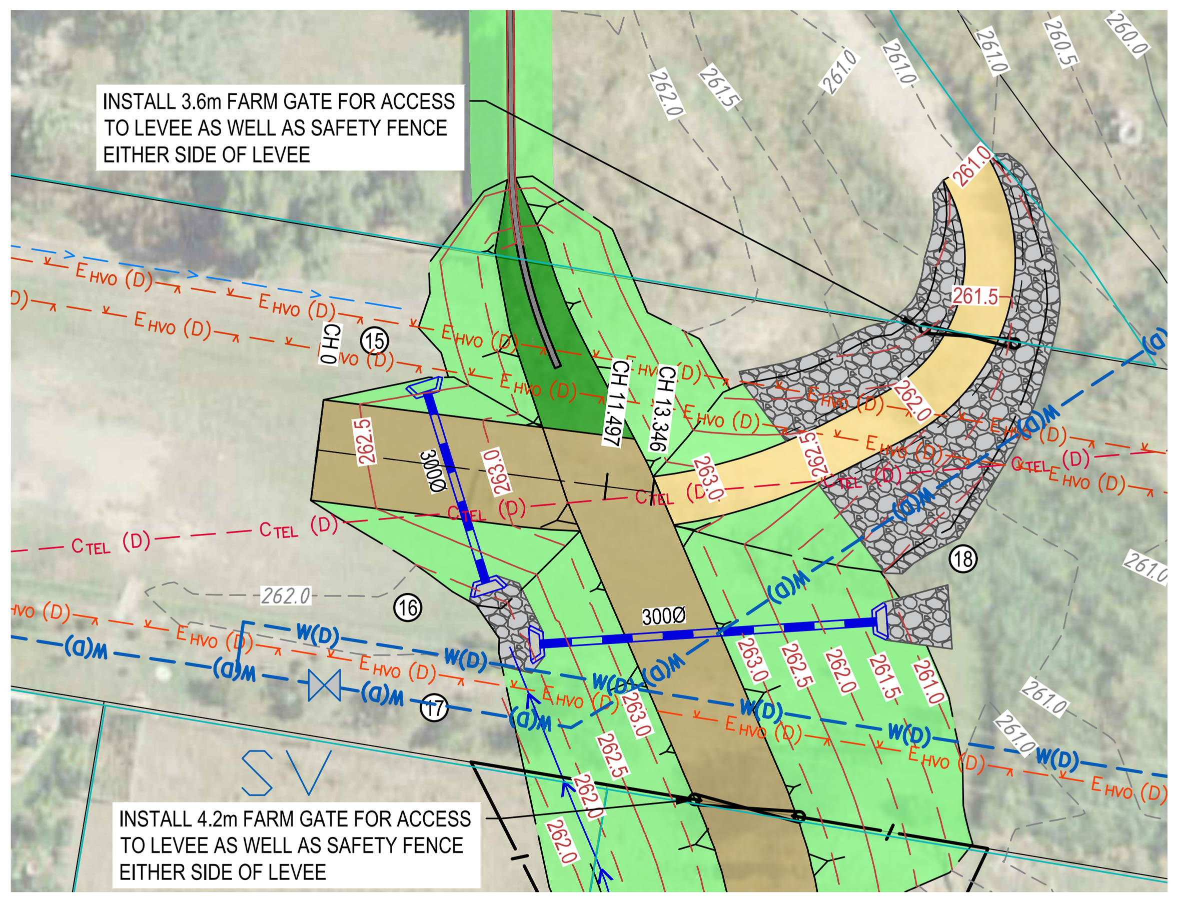
1:250



RL 256.300

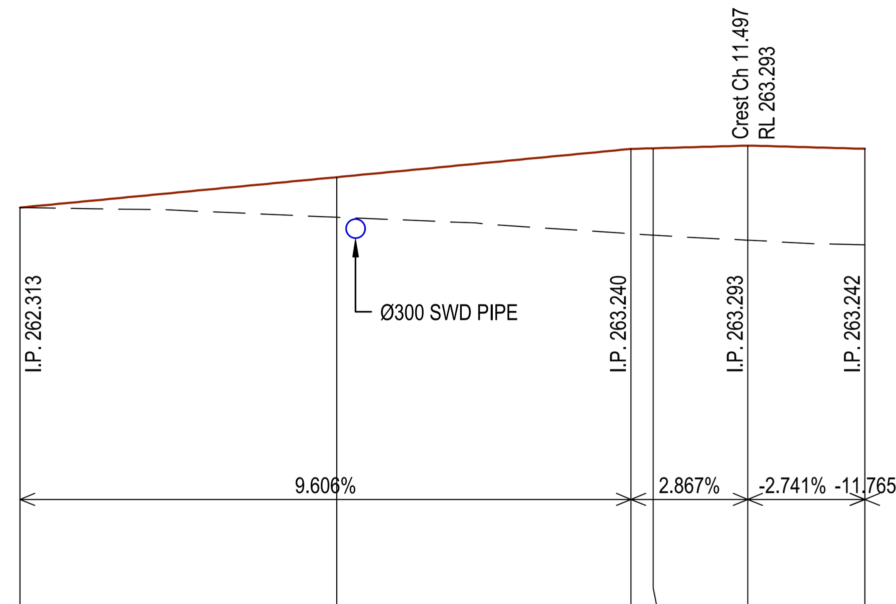
DESIGN SURFACE	262.735	263.123	263.511	263.679	263.727	263.714	263.670	263.504	263.245	262.986	262.727	262.468	262.402
EXISTING SURFACE	262.73	262.76	262.66	262.59	262.52	262.50	262.47	262.49	262.50	262.41	262.33	262.40	262.40
CHAINAGE	0.000	5.000	10.000	12.159	14.473	15.000	16.788	20.000	25.000	30.000	35.000	40.000	41.279

LONGITUDINAL SECTION
CROSSOVER 2 Ch 0.000 to Ch 41.279
SCALES: HORIZONTAL 1:100 VERTICAL 1:100



CROSSOVER 3

1:250



RL 255.700

DESIGN SURFACE	262.313	262.793	263.240	263.250	263.293	263.242
EXISTING SURFACE	262.31	262.16	261.90	261.88	261.80	261.72
CHAINAGE	0.000	5.000	9.651	10.000	11.497	13.346

LONGITUDINAL SECTION
CROSSOVER 3 Ch 0.000 to Ch 13.346
SCALES: HORIZONTAL 1:100 VERTICAL 1:100

WARNING

BEWARE OF UNDERGROUND SERVICES
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CONTRACTOR TO VERIFY EXISTING SERVICES CONNECTION LEVELS PRIOR TO CONSTRUCTION. ANY DISCREPANCIES MUST BE IMMEDIATELY IDENTIFIED AND THE SUPERINTENDENT NOTIFIED PRIOR TO CONSTRUCTION COMMENCING.

NOTE:

1. REFER TO DRAWING 300203886-WE-3001 FOR GENERAL NOTES.
2. REFER TO DRAWING 300203886-WE-3050 FOR LAYOUT KEY PLAN.
3. REFER TO DRAWINGS 300203886-WE-3152 TO 3153 FOR MAINTENANCE CROSSOVER LOCATIONS.
4. REFER TO DRAWINGS 300203886-WE-3400 TO 3402 DRAINAGE LONG SECTIONS AND DETAILS.
5. REFER TO DRAWINGS 300203886-WE-3450 TO 3457 FOR TYPICAL SECTIONS AND DETAILS.

Rev.	Date	Description	Des.	Verif.	Appd.
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SCALE 1:100 0 1 2 4m @A1
SCALE 1:250 0 5 10m @A1

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Checked	VZ	23/04/24
Designed	AS	23/04/24
Verified		
Approved		

Client: GREATER HUME SHIRE COUNCIL
Project: HHC FLOOD LEVEE DESIGN
HOLBROOK, HENTY
& CULCAIRN
Title: MAINTENANCE TRACK CROSS OVERS

Status: FOR TENDER ONLY
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VERT. DATUM	HORZ. DATUM	Scale	Size
AHD	MGA	AS SHOWN	A1

Drawing Number: 300203886-WE-3350
Revision: A

DATE PLOTTED: 10 May 2024 10:01 AM BY : HAZELGROVE, ADAM

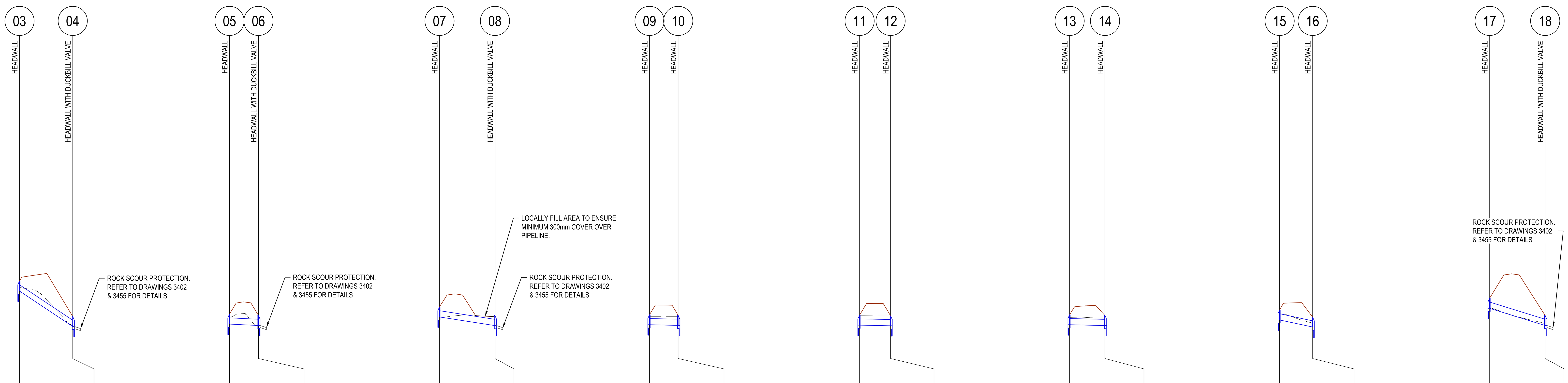
XREFs: XR-03886-VIC-MAP; XR-03886-HOLBROOK-IMAGE; XR-03886-BASE-HOL; XR-03886-SURV-HAY; XR-03886-SURV-HB1; XR_03886_SU_BYDA_STRM; XR_03886_SU_BYDA_COMM; XR_03886_SU_BYDA_ELEC; XR_03886_SU_BYDA_SERV; XR-03886-LEGEND; XR-03886-ALGN-CHNG; XR-03886-SURV-PWD
CAD File: \\au2013-ppfss01\shared_projects\300203886\300 Levee Design\300203886-WE-3350.dwg

DATE PLOTTED: 8 May 2024 1:57 PM BY : HAZELGROVE, ADAM

LEGEND

- EXISTING SURFACE
- DESIGN SURFACE
- PROPOSED DRAINAGE
- (2) PIT NUMBER

NOTE:
CONTRACTOR TO VERIFY EXISTING SERVICES CONNECTION LEVELS PRIOR TO CONSTRUCTION. ANY DISCREPANCIES MUST BE IMMEDIATELY IDENTIFIED AND THE SUPERINTENDENT NOTIFIED PRIOR TO CONSTRUCTION COMMENCING.



PIPE DETAILS SLOPE/GRADE DATUM RL 254.4	300Ø Class 4 RCP RRJ 1:7.5	
DEPTH TO INVERT	0.482	0.483
INVERT LEVEL	261.088	259.387
FINISHED SURFACE	261.570	259.870
EXISTING SURFACE	261.262	259.432
CHAINAGE	0.000	12.754
	12.754	

PIPE DETAILS SLOPE/GRADE DATUM RL 255.8	300Ø Class 4 RCP RRJ 1:106.8	
DEPTH TO INVERT	0.480	0.485
INVERT LEVEL	260.900	260.835
FINISHED SURFACE	261.380	261.320
EXISTING SURFACE	261.247	260.829
CHAINAGE	0.000	6.944
	6.944	

PIPE DETAILS SLOPE/GRADE DATUM RL 255.7	300Ø Class 4 RCP RRJ 1:31.9	
DEPTH TO INVERT	0.485	0.481
INVERT LEVEL	261.145	260.729
FINISHED SURFACE	261.630	261.210
EXISTING SURFACE	261.137	261.210
CHAINAGE	0.000	13.284
	13.284	

PIPE DETAILS SLOPE/GRADE DATUM RL 256.8	300Ø Class 4 RCP RRJ 1:229.2	
DEPTH TO INVERT	0.480	0.480
INVERT LEVEL	261.870	261.840
FINISHED SURFACE	262.350	262.320
EXISTING SURFACE	262.275	262.272
CHAINAGE	0.000	6.876
	6.876	

PIPE DETAILS SLOPE/GRADE DATUM RL 256.8	300Ø Class 4 RCP RRJ 1:248.2	
DEPTH TO INVERT	0.480	0.480
INVERT LEVEL	261.850	261.820
FINISHED SURFACE	262.330	262.300
EXISTING SURFACE	262.325	262.339
CHAINAGE	0.000	7.445
	7.445	

PIPE DETAILS SLOPE/GRADE DATUM RL 257.3	300Ø Class 4 RCP RRJ 1:212.3	
DEPTH TO INVERT	0.480	0.480
INVERT LEVEL	262.370	262.330
FINISHED SURFACE	262.850	262.810
EXISTING SURFACE	262.724	262.685
CHAINAGE	0.000	8.491
	8.491	

PIPE DETAILS SLOPE/GRADE DATUM RL 256.7	300Ø Class 4 RCP RRJ 1:23.3	
DEPTH TO INVERT	0.480	0.480
INVERT LEVEL	262.000	261.660
FINISHED SURFACE	262.480	262.140
EXISTING SURFACE	262.294	261.850
CHAINAGE	0.000	7.919
	7.919	

PIPE DETAILS SLOPE/GRADE DATUM RL 255.8	300Ø Class 4 RCP RRJ 1:16.2	
DEPTH TO INVERT	0.480	0.481
INVERT LEVEL	261.660	260.835
FINISHED SURFACE	262.140	261.316
EXISTING SURFACE	261.670	260.923
CHAINAGE	0.000	13.327
	13.327	

DRAINAGE LONGITUNDINAL SECTIONS

SCALES: HORIZONTAL 1:500 VERTICAL 1:100

CAD File: \\au2013-ppfss01\shared_projects\300203886\300 Levee Design\300203886-WE-3400-3402.dwg

XREF's:

Rev.	Date	Description	Des.	Verif.	Appd.
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H: 0 10 20m
V: 0 2 4m
SCALE H:1:500 V:1:100 @A1

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Checked VZ	Date 23/04/24
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Verified	Date
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Client: GREATER HUME SHIRE COUNCIL

Project: HHC FLOOD LEVEE DESIGN
HOLBROOK, HENTY
& CULCAIRN

Title: DRAINAGE LONGITUDINAL SECTIONS

Status: FOR TENDER ONLY
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VERT. DATUM	HORZ. DATUM	Scale	Size
AHD	MGA	AS SHOWN	A1

Drawing Number: 300203886-WE-3400
Revision: A

PIT SCHEDULE

Pit No.	Pit Type	Pit Width	Pit Length	Outlet Diameter	Outlet Invert RL	Inlet Diameter	Inlet Invert RL	Pit Depth	Pit Lid Level	Easting	Northing	Comment
		(mm)	(mm)	(mm)	(m)	(mm)	(m)	(m)	(m)	(m)	(m)	
01	GULLY PIT TYPE SA	850	850	TBC	259.10	AS EXISTING		0.750	259.85	528337.91	6046332.960	CONSTRUCT GULLY PIT TYPE SA AS PER RMS STANDARD R0220-01. NOTE: FUTURE SUBMERSIBLE PUMP PIT MAY BE REQUIRED TO INSTALL NEXT TO THE GRATE SIDE ENTRY PIT FOR FLOOD PROTECTION DURING MAJOR FLOOD EVENT.
02	GRATED GULLY PIT	700	825	AS EXISTING		-	-	TBC	260.165	528364.66	6046301.484	REMOVE EX. SIDE ENTRY PIT AND REPLACE WITH GRATED GULLY PIT AS PER RMS STANDARD R0220-14
03	HEADWALL	REFER STANDARD		300	261.088	-	-	0.482	261.570	528400.37	6046236.712	CONSTRUCT SINGLE CELL HEADWALL FOR Ø300 PIPELINE AS PER RMS STANDARD R0210-15
04	HEADWALL	REFER STANDARD		-	-	300	259.387	0.483	259.870	528411.64	6046242.679	CONSTRUCT SINGLE CELL HEADWALL FOR Ø300 PIPELINE AS PER RMS STANDARD R0210-15 WITH DUCKBILL VALVE
05	HEADWALL	REFER STANDARD		300	260.900	-	-	0.480	261.380	528432.14	6046182.092	CONSTRUCT SINGLE CELL HEADWALL FOR Ø300 PIPELINE AS PER RMS STANDARD R0210-15
06	HEADWALL	REFER STANDARD		-	-	300	260.835	0.485	261.320	528435.51	6046188.166	CONSTRUCT SINGLE CELL HEADWALL FOR Ø300 PIPELINE AS PER RMS STANDARD R0210-15 WITH DUCKBILL VALVE
07	HEADWALL	REFER STANDARD		300	261.145	-	-	0.485	261.630	528543.97	6046154.910	CONSTRUCT SINGLE CELL HEADWALL FOR Ø300 PIPELINE AS PER RMS STANDARD R0210-15
08	HEADWALL	REFER STANDARD		-	-	300	260.729	0.481	261.210	528544.54	6046168.182	CONSTRUCT SINGLE CELL HEADWALL FOR Ø300 PIPELINE AS PER RMS STANDARD R0210-15 WITH DUCKBILL VALVE
09	HEADWALL	REFER STANDARD		300	261.870	-	-	0.480	262.350	528596.89	6045688.915	CONSTRUCT SINGLE CELL HEADWALL FOR Ø300 PIPELINE AS PER RMS STANDARD R0210-15
10	HEADWALL	REFER STANDARD		-	-	300	261.840	0.480	262.320	528597.76	6045695.735	CONSTRUCT SINGLE CELL HEADWALL FOR Ø300 PIPELINE AS PER RMS STANDARD R0210-15
11	HEADWALL	REFER STANDARD		300	261.850	-	-	0.480	262.330	528607.85	6045687.169	CONSTRUCT SINGLE CELL HEADWALL FOR Ø300 PIPELINE AS PER RMS STANDARD R0210-15
12	HEADWALL	REFER STANDARD		-	-	300	261.820	0.480	262.300	528608.74	6045694.561	CONSTRUCT SINGLE CELL HEADWALL FOR Ø300 PIPELINE AS PER RMS STANDARD R0210-15
13	HEADWALL	REFER STANDARD		300	262.370	-	-	0.480	262.850	528735.82	6045765.748	CONSTRUCT SINGLE CELL HEADWALL FOR Ø300 PIPELINE AS PER RMS STANDARD R0210-15
14	HEADWALL	REFER STANDARD		-	-	300	262.330	0.480	262.810	528742.07	6045771.494	CONSTRUCT SINGLE CELL HEADWALL FOR Ø300 PIPELINE AS PER RMS STANDARD R0210-15
15	HEADWALL	REFER STANDARD		300	262.000	-	-	0.480	262.480	528725.35	6045904.172	CONSTRUCT SINGLE CELL HEADWALL FOR Ø300 PIPELINE AS PER RMS STANDARD R0210-15
16	HEADWALL	REFER STANDARD		-	-	300	261.660	0.480	262.140	528727.69	6045896.607	CONSTRUCT SINGLE CELL HEADWALL FOR Ø300 PIPELINE AS PER RMS STANDARD R0210-15
17	HEADWALL	REFER STANDARD		300	261.660	-	-	0.480	262.140	528729.82	6045894.183	CONSTRUCT SINGLE CELL HEADWALL FOR Ø300 PIPELINE AS PER RMS STANDARD R0210-15
18	HEADWALL	REFER STANDARD		-	-	300	260.835	0.481	261.316	528743.12	6045895.067	CONSTRUCT SINGLE CELL HEADWALL FOR Ø300 PIPELINE AS PER RMS STANDARD R0210-15 WITH DUCKBILL VALVE

NOTES:

1. ALL PITS ARE TO BE FOLLOWED RMS STANDARDS UNLESS NOTED OTHERWISE.
2. PITS DEEPER THAN 1.00m SHALL BE FITTED WITH STEPIRONS, FIRST STEPIRON TO BE 300mm FROM THE BOTTOM OF THE PIT.
3. COVER LEVELS TO BE SET TO MATCH THE FINISHED SURFACE PROFILES AND ADJACENT CONSTRUCTION.
4. ALL GRATED PITS TO HAVE BICYCLE SAFE LOCKDOWN GRATES.
5. ALL PITS IN ROAD RESERVE TO BE FITTED WITH CLASS D COVERS OR GRATES.
6. LEVELS OF ALL EXISTING PIPE INVERTS TO BE CONNECTED TO TO BE CONFIRMED PRIOR TO CONSTRUCTION.

DATE PLOTTED: 8 May 2024 1:57 PM BY : HAZELGROVE, ADAM

XREF's:
CAD File: \\au2013-ppfss01\shared_projects\300203886\300 Levee Design\300203886-WE-3400-3402.dwg

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A	10/05/2024	TENDER ISSUE	VZ		AS

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Drawn SB Date 15/06/20
Checked VZ Date 23/04/24
Designed AS Date 23/04/24
Verified Date
Approved Date

Client: GREATER HUME SHIRE COUNCIL
Project: HHC FLOOD LEVEE DESIGN HOLBROOK, HENTY & CULCAIRN
Title: DRAINAGE PIT SCHEDULE
Status: FOR TENDER ONLY
NOT TO BE USED FOR CONSTRUCTION PURPOSES
VERT. DATUM: AHD | HORZ. DATUM: MGA | Scale: AS SHOWN | Size: A1
Drawing Number: 300203886-WE-3401 | Revision: A

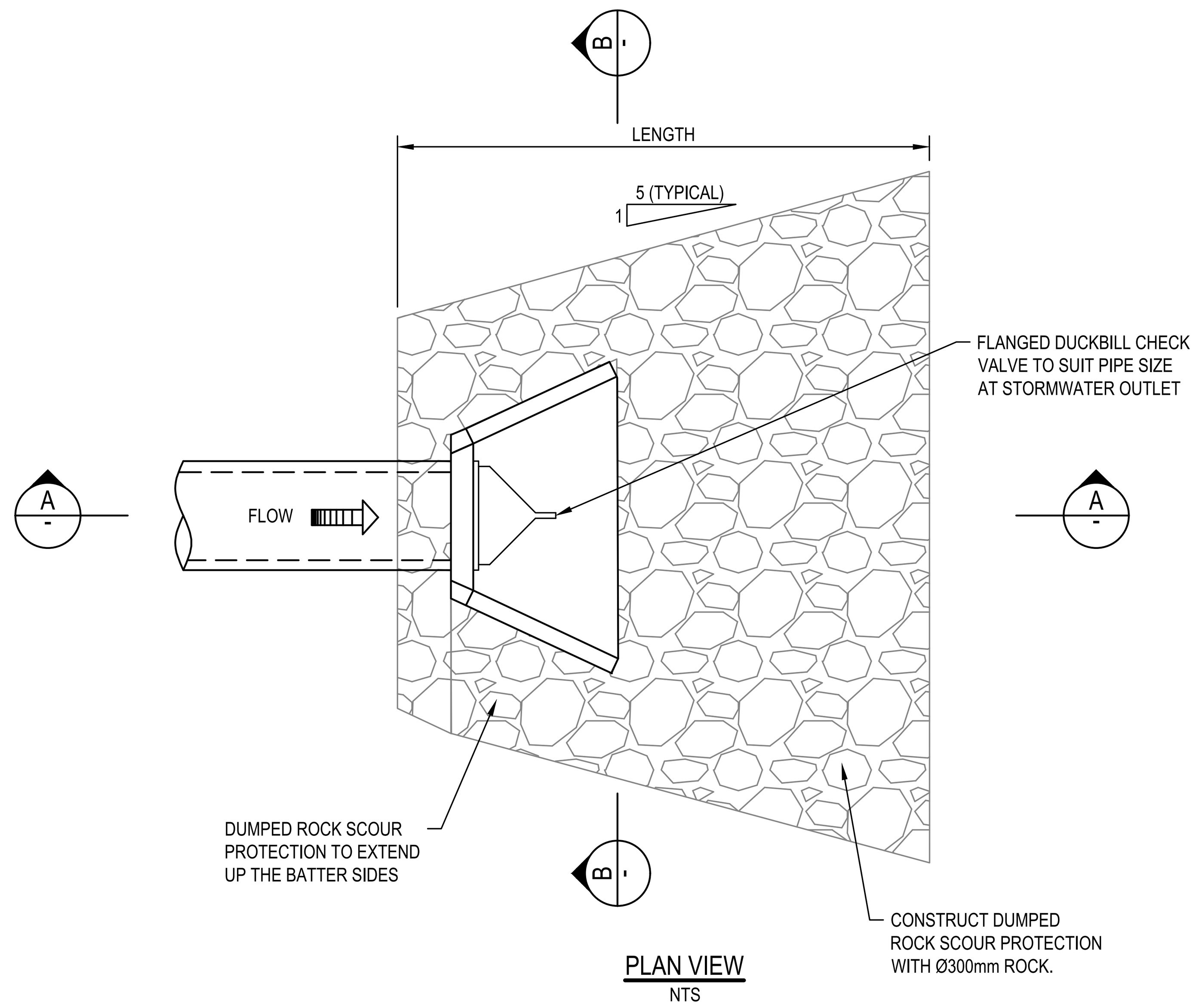
DATE PLOTTED: 10 May 2024 10:11 AM BY : HAZELGROVE, ADAM

RIP RAP ROCK BEACHING & SCOUR PROTECTION NOTES

1. ROCK USED SHALL COMPLY WITH THESE NOTES AND THE DRAWINGS. THE REQUIREMENT APPLIES TO BOTH IMPORTED ROCK AND IN-SITU ROCK WHICH IS RE-USED.
2. INDIVIDUAL ROCKS SHALL BE FREE FROM CRACKS, CLEAVAGE PLANES, SEAMS AND DEFECTS WHICH WOULD RESULT IN THE BREAKDOWN OF THE ROCK IN A WATER ENVIRONMENT.
3. ROCK RIPRAP SHALL CONFORM TO THE FOLLOWING CRITERIA;
4. ROCKS SHALL BE ROUGH AND ANGULAR
5. ROCKS SHALL BE WEDGED AND LOCKED TOGETHER SUCH THAT THEY ARE NOT FREE TO MOVE.
6. RIP RAP SHALL NOT BE ROLLED OR DROPPED INTO POSITION, IT SHALL BE PLACED. THE METHOD OF ROCK PLACEMENT SHALL BE SUCH AS TO; MINIMISE ITS BREAKDOWN ON HANDLING AND PRODUCTION OF FINES, MINIMISE THE SEGREGATION OF VARIOUS GRADES OF ROCK AND RESTRICT WATER CONTAMINATION.
7. ROCKS TO BE HARD SOUND ROCK WITH SHARP EDGES. ROUNDED OR SUBSTANTIALLY WEATHERED ROCK IS NOT ACCEPTABLE.
8. ROCK SIZES ARE BASED ON ROCK HAVING DENSITY OF 2.6 OR GREATER (2600KG/m3)
9. THICKNESS OF ROCK ARMOUR BLANKET TO BE ON AVERAGE 2 x d50 WITH A MINIMUM THICKNESS OF 1.5 x d50
10. MINIMUM WET STRENGTH OF ROCK = 15Mpa
11. MINIMUM DRY STRENGTH OF ROCK = 25Mpa
12. NO ROCK SHOULD HAVE A LENGTH EXCEEDING 2.5 TIMES ITS BREADTH OR THICKNESS
13. ROCK SHOULD NOT BE SINGLE SIZED, BUT INSTEAD, SHOULD BE A WELL-GRADED MIXTURE DESIGNED TO ENSURE THAT ALL INTERSTICES BETWEEN LARGE ROCKS ARE FILLED WITH ROCKS OF PROGRESSIVELY SMALLER SIZE.

GEOTEXTILE NOTES

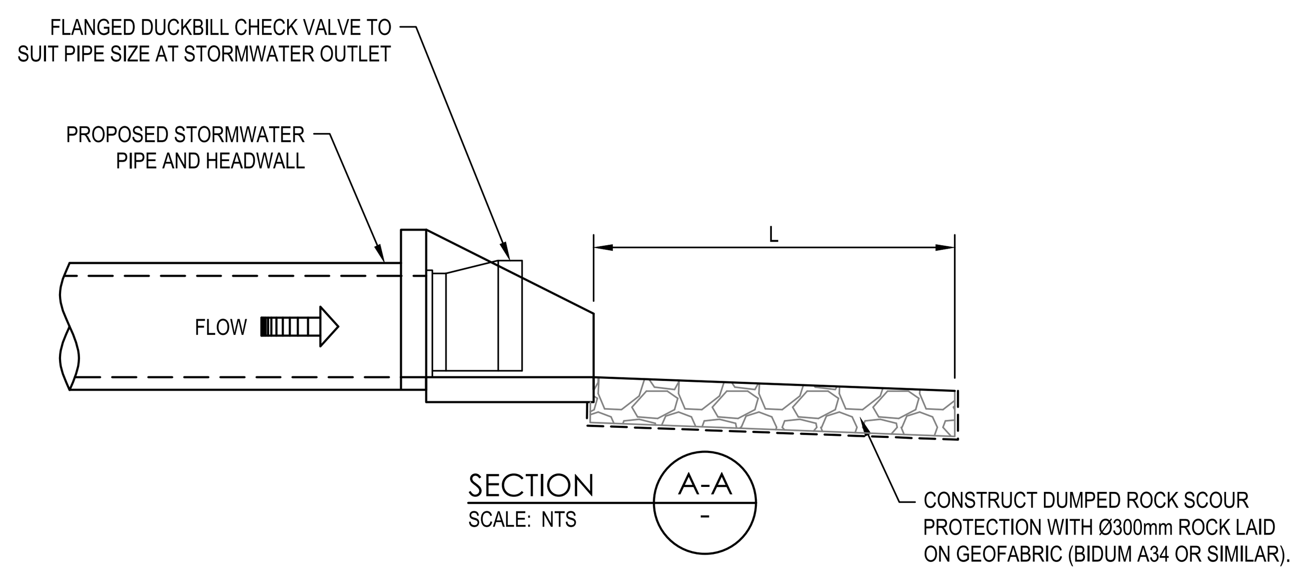
14. SELECTION AND INSTALLATION OF GEOTEXTILE SHALL BE BIDIM A34 OR APPROVED EQUIVALENT.
15. GEOTEXTILE TO BE LAID ON A CONTINUOUS BED FREE OF VOIDS AND FREE OF SHARP OBJECTS TO PREVENT TEARING.
16. GEOTEXTILE SHALL NOT BE PLACED IN STANDING WATER. DEWATERING SHALL BE CARRIED OUT PRIOR TO PLACEMENT OF ANY GEOTEXTILE.



PLAN VIEW
NTS

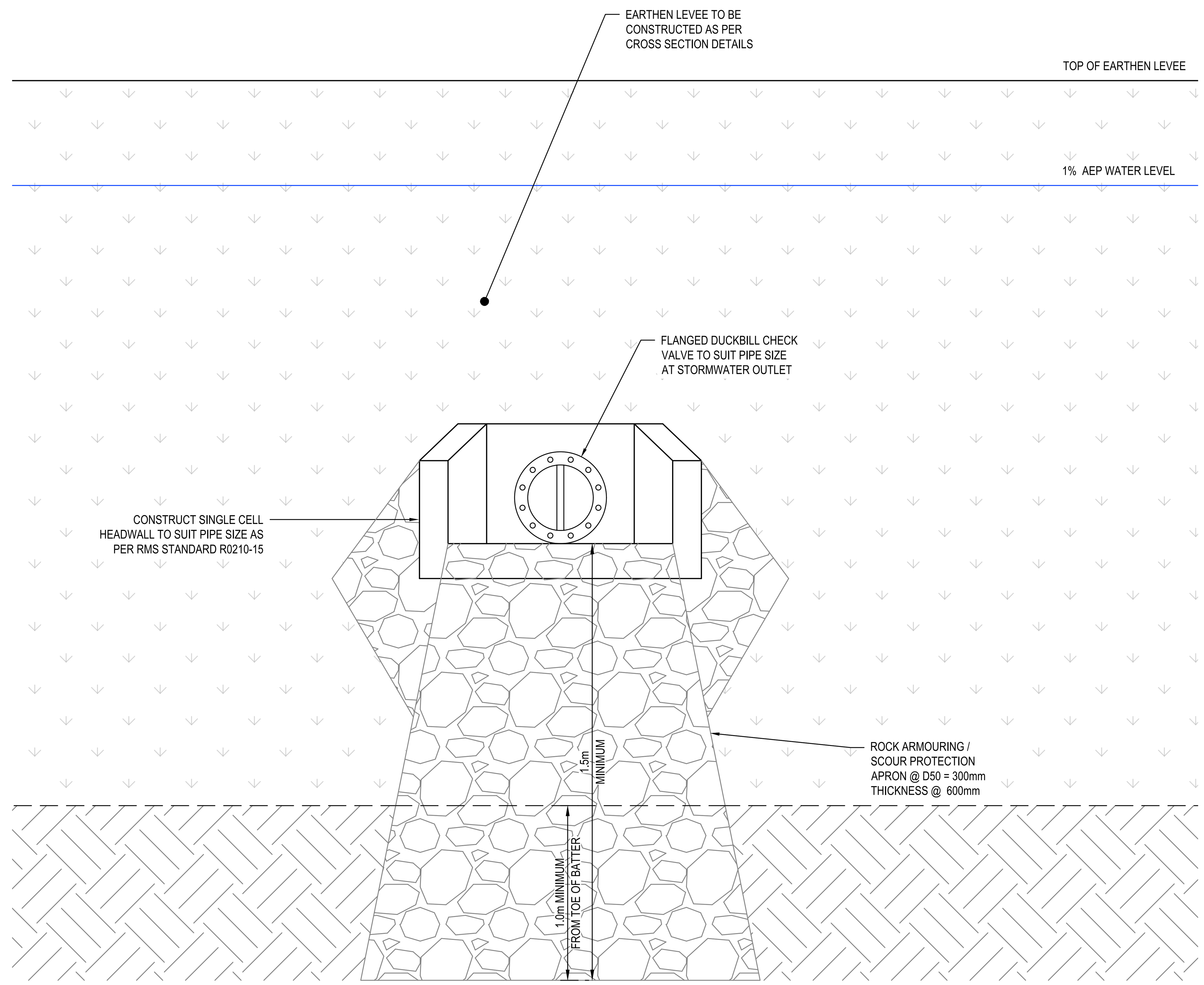
HEADWALL DETAIL WITH ROCK SCOUR PROTECTION

N.T.S

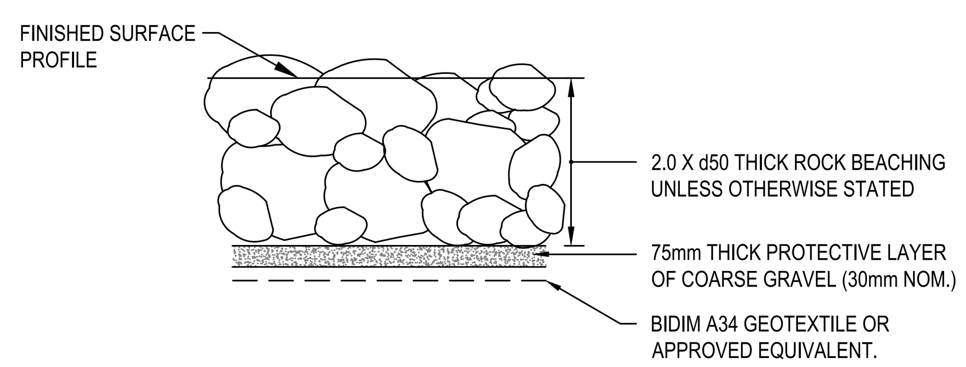


SECTION A-A
SCALE: NTS

ROCK OUTLET SCOUR PROTECTION				
TYPE	LOCATION	d50 ROCK	MIN. LENGTH (m)	THICKNESS
TYPE 1	CULVERT INLET	300mm	3.00	800mm
	CULVERT OUTLET	300mm	4.70	800mm
TYPE 2	Ø300 HEADWALL	300mm	2.00	600mm
TYPE 3	ROCK ARMOURING OVER LEVEE BATTERS	150mm	1.00	300mm



SECTION B-B
SCALE: NTS



ROCK SCOUR PROTECTION / BEACHING TYPICAL DETAIL
NOT TO SCALE

XREF's:
CAD File: \\au2013-ppfss01\shared_projects\300203886\300 Levee Design\300203886-WE-3400-3402.dwg

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Checked VZ	Date 23/04/24
Designed AS	Date 23/04/24
Verified	Date
Approved	Date

Client GREATER HUME SHIRE COUNCIL
Project HHC FLOOD LEVEE DESIGN HOLBROOK, HENTY & CULCAIRN
Title DRAINAGE DETAILS

Status FOR TENDER ONLY
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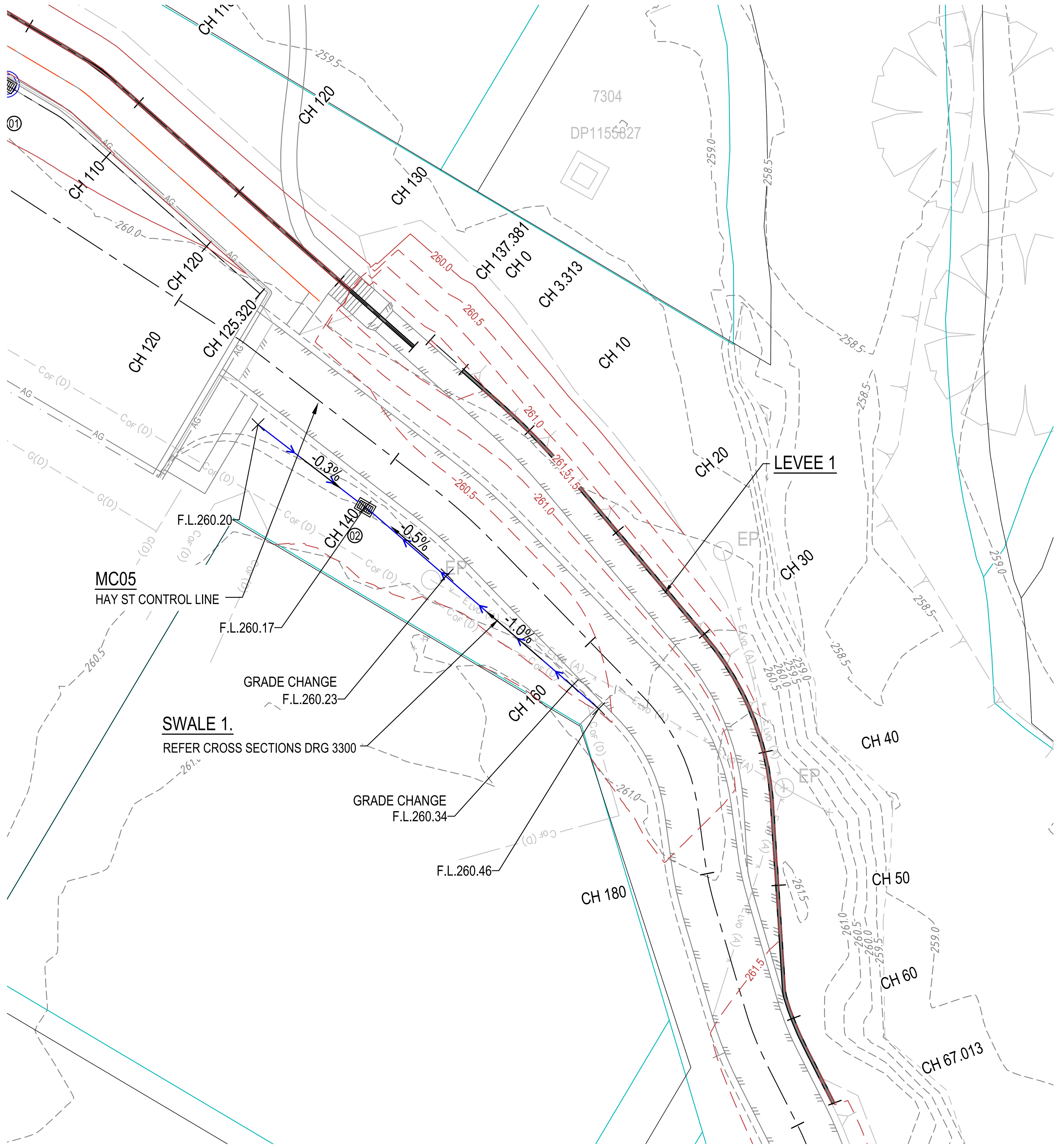
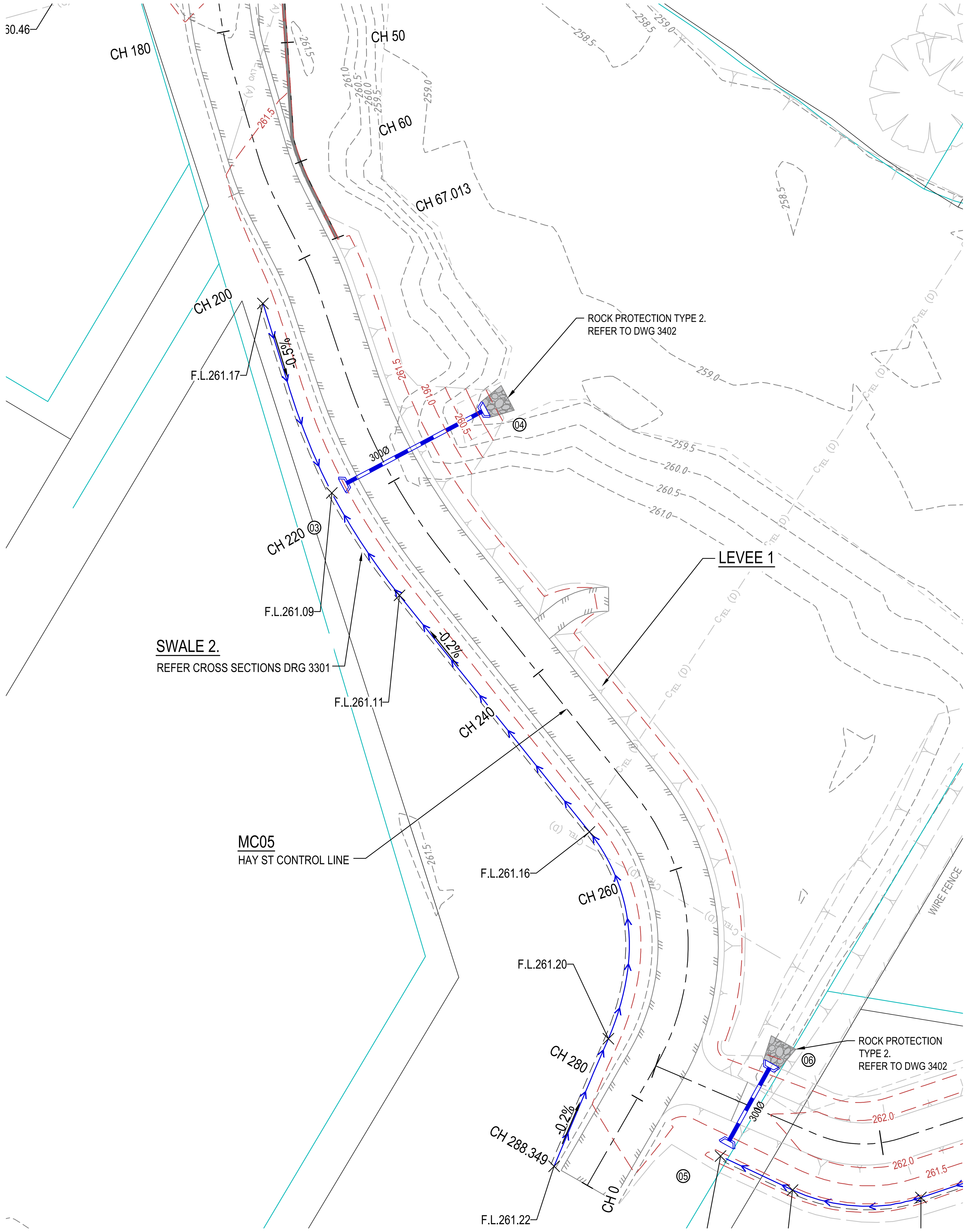
VERT. DATUM	HORZ. DATUM	Scale	Size
AHD	MGA	AS SHOWN	A1

Drawing Number 300203886-WE-3402 Revision A

LEGEND
- 260.0 FINISHED SURFACE CONTOUR - MAJOR
- FINISHED SURFACE CONTOUR - MINOR
- 260.0 EXISTING SURFACE CONTOUR - MAJOR
- EXISTING SURFACE CONTOUR - MINOR
- PROPOSED TOP OF BATTER
- PROPOSED BOTTOM OF BATTER
- PROPOSED SWALE DRAIN
- PROPOSED DRAINAGE PIPE
- PROPERTY BOUNDARY - SURVEY
- PROPERTY BOUNDARY - VICMAP
- F.L.261.0 FINISHED SPOT LEVEL OF SWALE



SWALE 1 LAYOUT PLAN
SCALE 1:250



SWALE 2 LAYOUT PLAN
SCALE 1:250

0 5 10 15 20 25m
SCALE 1:250 @A1

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NOTE:
1. REFER TO DRAWING 300203886-WE-3001 FOR GENERAL NOTES.
2. REFER TO DRAWING 300203886-WE-3050 FOR LAYOUT KEY PLAN.
3. REFER TO DRAWINGS 300203886-WE-3101 & 3102 FOR ALIGNMENT LAYOUT PLANS.
4. REFER TO DRAWINGS 300203886-WE-3312 TO 3313 FOR CROSS SECTIONS.
5. REFER TO DRAWING 300203886-WE-3402 FOR ROCK SCOUR PROTECTION NOTES AND DETAILS.

Rev.	Date	Description	Des.	Verif.	Appd.
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Designed AS	Date 23/04/24	
Verified	Date	
Approved	Date	

Client: GREATER HUME SHIRE COUNCIL

Project: HHC FLOOD LEVEE DESIGN HOLBROOK, HENTY & CULCAIRN

Title: SWALE 1 & 2 LAYOUT PLAN SHEET 1 OF 5

Status: FOR TENDER ONLY
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VERT. DATUM	HORZ. DATUM	Scale	Size
AHD	MGA	AS SHOWN	A1

Drawing Number: 300203886-WE-3411 Revision: A

DATE PLOTTED: 10 May 2024 10:18 AM BY : HAZELGROVE, ADAM
XREFs: XR-03886-ALGN-CHNG; XR-03886-BASE-HOL; XR-03886-SURV-PWD; XR-03886-VIC-MAP; XR-03886-LEGEND
CAD File: \\au2013-ppfss01\shared_projects\300203886\300 Levee Design\300203886-WE-3411-3415.dwg

SWALE 3 LAYOUT PLAN
SCALE 1:250

SWALE 3 LAYOUT PLAN
SCALE 1:250

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LEGEND
- 260.0 — FINISHED SURFACE CONTOUR - MAJOR
- FINISHED SURFACE CONTOUR - MINOR
- 260.0 — EXISTING SURFACE CONTOUR - MAJOR
- EXISTING SURFACE CONTOUR - MINOR
- PROPOSED TOP OF BATTER
- PROPOSED BOTTOM OF BATTER
- PROPOSED SWALE DRAIN
- PROPOSED DRAINAGE PIPE
- PROPERTY BOUNDARY - SURVEY
- PROPERTY BOUNDARY - VICMAP
- F.L.261.0 — FINISHED SPOT LEVEL OF SWALE

0 5 10 15 20 25m
SCALE 1:250 @A1

Rev.	Date	Description	Des.	Verif.	Appd.
A	10/05/2024	TENDER ISSUE	VZ		AS

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Drawn	AC	09/04/2024
Checked	VZ	23/04/24
Designed	AS	23/04/24
Verified		
Approved		

Client: GREATER HUME SHIRE COUNCIL
Project: HHC FLOOD LEVEE DESIGN, HOLBROOK, HENTY & CULCAIRN
Title: SWALE 3 LAYOUT PLAN SHEET 2 OF 5

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VERT. DATUM	HORZ. DATUM	Scale	Size
AHD	MGA	AS SHOWN	A1

Drawing Number: 300203886-WE-3412
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DATE PLOTTED: 10 May 2024 10:19 AM BY : HAZELGROVE, ADAM
XREFs: XR-03886-ALGN-CHNG; XR-03886-BASE-HOL; XR-03886-SURV-PWD; XR-03886-VIC-MAP; XR-03886-LEGEND
CAD File: \\au2013-ppfss01\shared_projects\300203886\300 Levee Design\300203886-WE-3411-3415.dwg

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BEWARE OF UNDERGROUND SERVICES
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CONTRACTOR TO VERIFY EXISTING SERVICES CONNECTION LEVELS PRIOR TO CONSTRUCTION. ANY DISCREPANCIES MUST BE IMMEDIATELY IDENTIFIED AND THE SUPERINTENDENT NOTIFIED PRIOR TO CONSTRUCTION COMMENCING.

LEGEND

- 260.0 FINISHED SURFACE CONTOUR - MAJOR
- FINISHED SURFACE CONTOUR - MINOR
- 260.0 EXISTING SURFACE CONTOUR - MAJOR
- EXISTING SURFACE CONTOUR - MINOR
- PROPOSED TOP OF BATTER
- PROPOSED BOTTOM OF BATTER
- PROPOSED SWALE DRAIN
- PROPOSED DRAINAGE PIPE
- PROPERTY BOUNDARY - SURVEY
- PROPERTY BOUNDARY - VICMAP
- F.L.261.0 FINISHED SPOT LEVEL OF SWALE

Rev.	Date	Description	Des.	Verif.	Appd.
A	10/05/2024	TENDER ISSUE	VZ		AS

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Drawn	AC	09/04/2024
Checked	VZ	23/04/24
Designed	AS	23/04/24
Verified		
Approved		

Client: GREATER HUME SHIRE COUNCIL

Project: HHC FLOOD LEVEE DESIGN
HOLBROOK, HENTY
& CULCAIRN

Title: SWALE 4 & 5 LAYOUT PLAN
SHEET 3 OF 5

Status: FOR TENDER ONLY
NOT TO BE USED FOR CONSTRUCTION PURPOSES

VERT. DATUM	HORZ. DATUM	Scale	Size
AHD	MGA	AS SHOWN	A1

Drawing Number: 300203886-WE-3413 Revision: A

DATE PLOTTED: 10 May 2024 10:19 AM BY : HAZELGROVE, ADAM

DATE PLOTTED: 10 May 2024 10:19 AM BY : HAZELGROVE, ADAM

XREFs: XR-03886-ALGN-CHNG; XR-03886-BASE-HOL; XR-03886-SURV-PWD; XR-03886-VIC-MAP; XR-03886-LEGEND
CAD File: \\au2013-ppfss01\shared_projects\300203886\300 Levee Design\300203886-WE-3411-3415.dwg

Rev.	Date	Description	Des.	Verif.	Appd.
A	10/05/2024	TENDER ISSUE	VZ		AS

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		Date
Drawn	AC	09/04/2024
Checked	VZ	23/04/24
Designed	AS	23/04/24
Verified		
Approved		

Client: GREATER HUME SHIRE COUNCIL

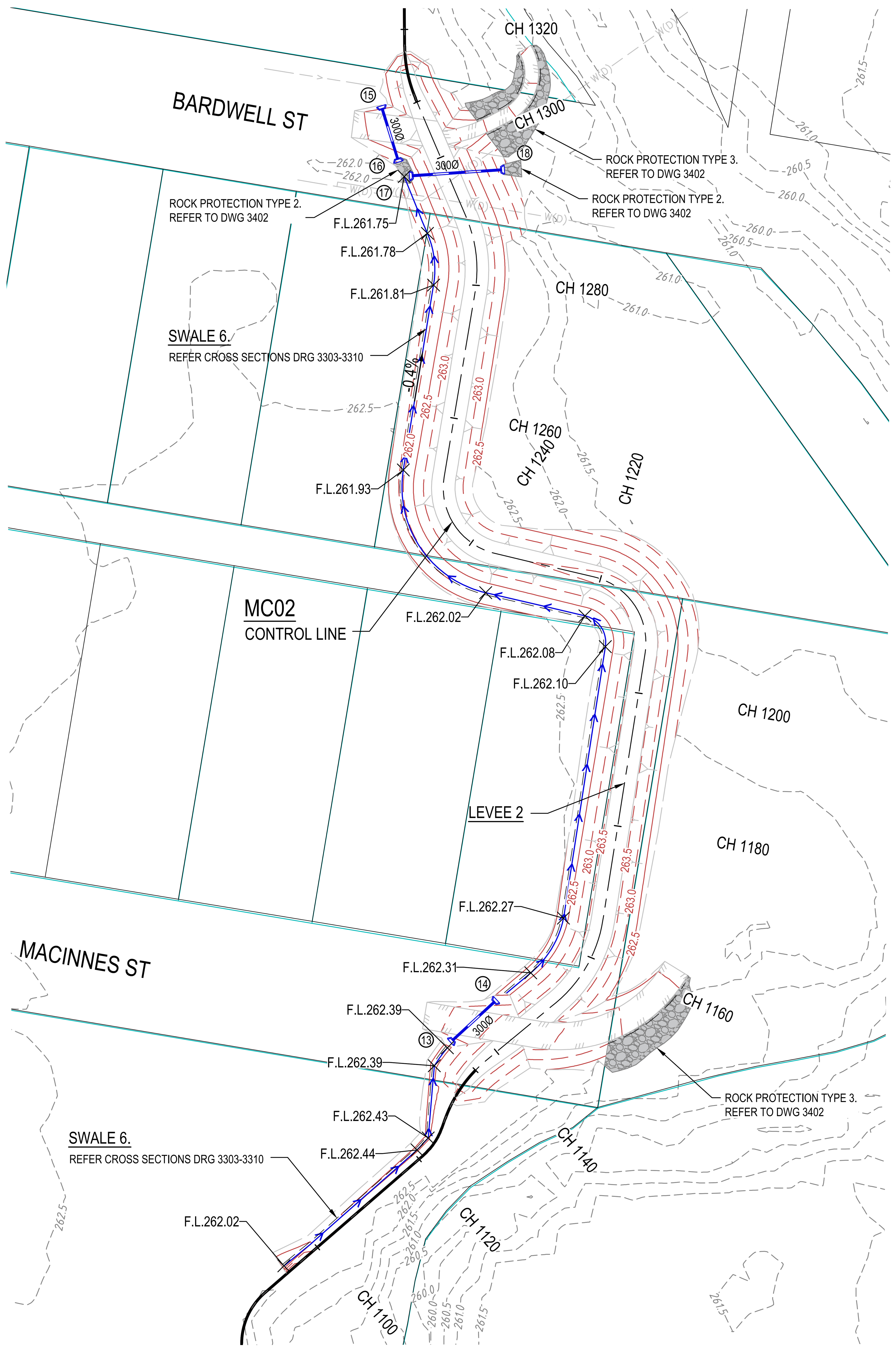
Project: HHC FLOOD LEVEE DESIGN
HOLBROOK, HENTY
& CULCAIRN

Title: SWALE 4 & 5 LAYOUT PLAN
SHEET 4 OF 5

Status: FOR TENDER ONLY
NOT TO BE USED FOR CONSTRUCTION PURPOSES

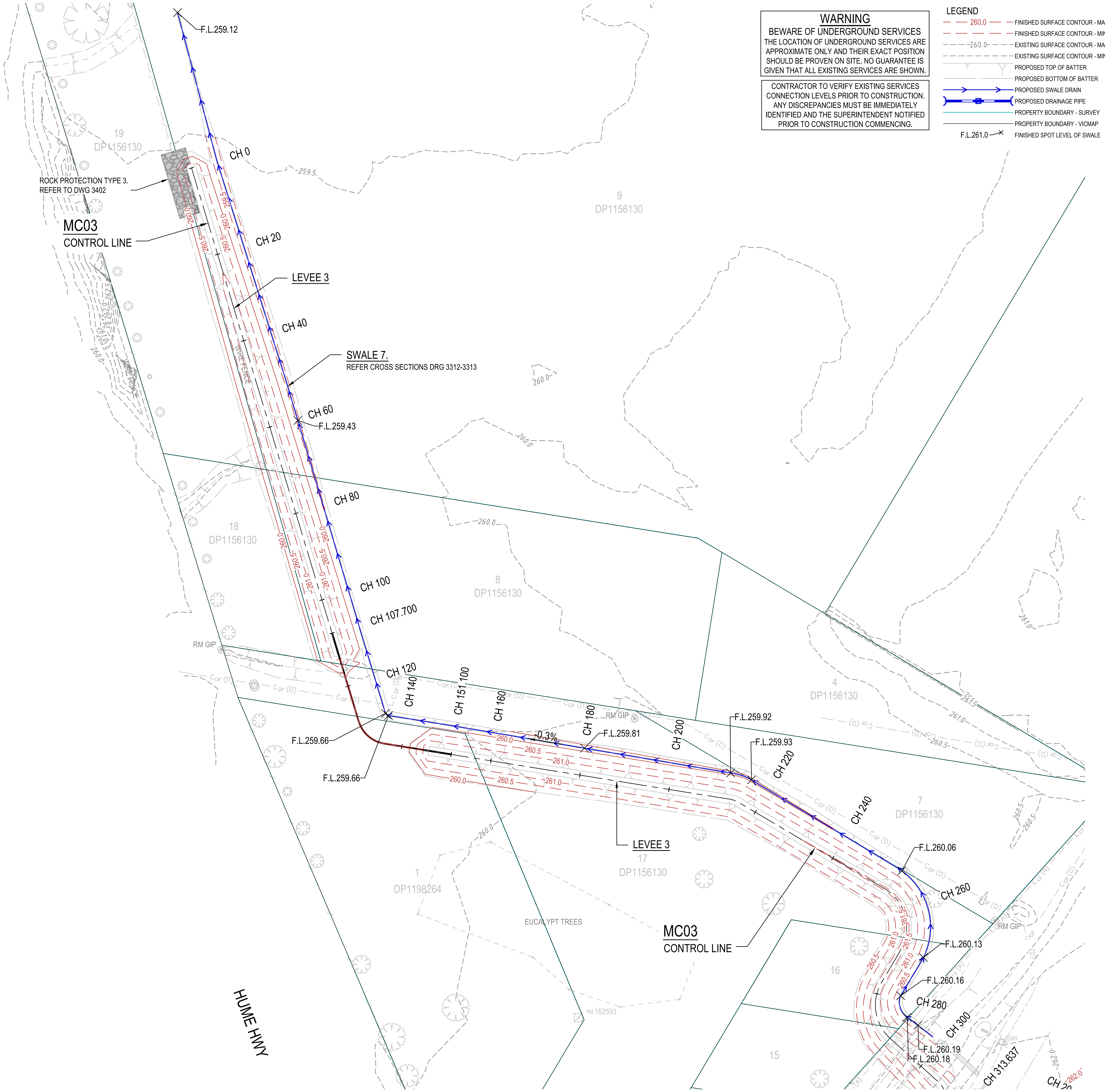
VERT. DATUM	HORZ. DATUM	Scale	Size
AHD	MGA	AS SHOWN	A1

Drawing Number	Revision
300203886-WE-3414	A



SWALE 6 LAYOUT PLAN

SCALE 1:500



SWALE 7 LAYOUT PLAN

SCALE 1:500

0 10 20 30 40 50m

SCALE 1:500 @A1

WARNING

BEWARE OF UNDERGROUND SERVICES

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CONTRACTOR TO VERIFY EXISTING SERVICES CONNECTION LEVELS PRIOR TO CONSTRUCTION. ANY DISCREPANCIES MUST BE IMMEDIATELY IDENTIFIED AND THE SUPERINTENDENT NOTIFIED PRIOR TO CONSTRUCTION COMMENCING.

LEGEND

- 260.0 — FINISHED SURFACE CONTOUR - MAJOR
- FINISHED SURFACE CONTOUR - MINOR
- 260.0 — EXISTING SURFACE CONTOUR - MAJOR
- EXISTING SURFACE CONTOUR - MINOR
- PROPOSED TOP OF BATTER
- PROPOSED BOTTOM OF BATTER
- PROPOSED SWALE DRAIN
- PROPOSED DRAINAGE PIPE
- PROPERTY BOUNDARY - SURVEY
- PROPERTY BOUNDARY - VICMAP
- F.L.261.0 — FINISHED SPOT LEVEL OF SWALE

DATE PLOTTED: 10 May 2024 10:20 AM BY : HAZELGROVE, ADAM

XREF's: XR-03886-ALGN-CHNG; XR-03886-BASE-HOL; XR-03886-SURV-PWD; XR-03886-VIC-MAP; XR-03886-LEGEND

CAD File: \\au2013-ppfss01\shared_projects\300203886\300 Levee Design\300203886-WE-3411-3415.dwg

Rev.	Date	Description	Des.	Verif.	Appd.
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		Date
Drawn	AC	09/04/2024
Checked	VZ	23/04/24
Designed	AS	23/04/24
Verified		
Approved		

Client: GREATER HUME SHIRE COUNCIL

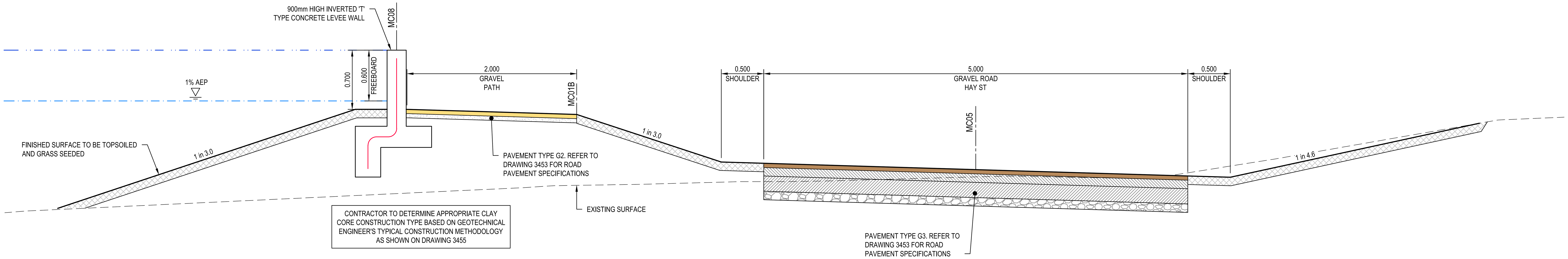
Project: HHC FLOOD LEVEE DESIGN HOLBROOK, HENTY & CULCAIRN

Title: SWALE 6 & 7 LAYOUT PLAN SHEET 5 OF 5

Status: FOR TENDER ONLY — NOT TO BE USED FOR CONSTRUCTION PURPOSES

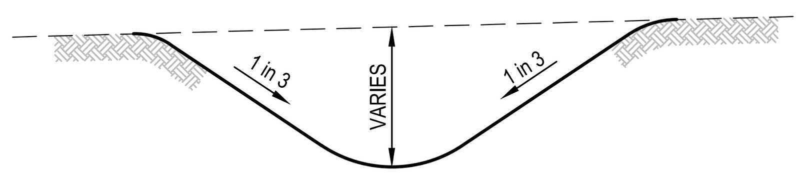
VERT. DATUM	HORZ. DATUM	Scale	Size
AHD	MGA	AS SHOWN	A1

Drawing Number: 300203886-WE-3415 — Revision: A



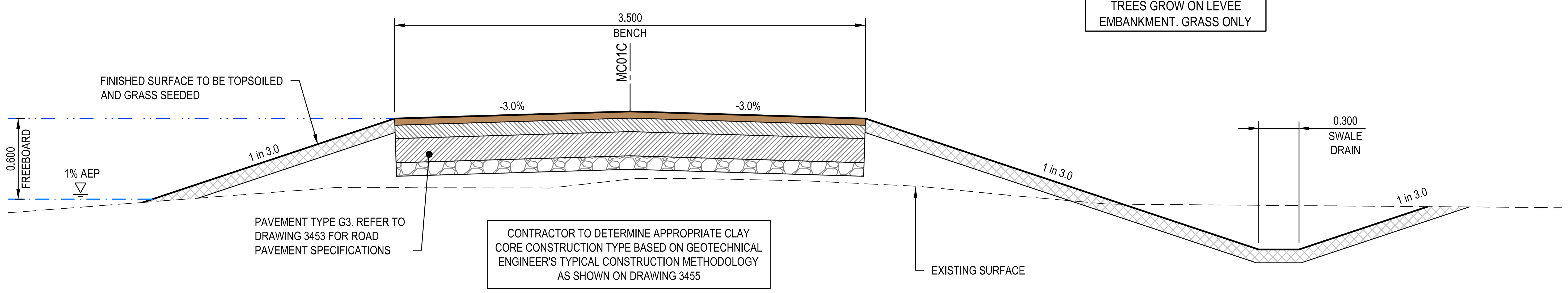
HOLBROOK 1 (MC05) TYPICAL RETAINING WALL DETAIL
SCALE 1:25
Hay Street to Nolan St centre line
(Based on Ch 160.000)

NOTE:
MAINTENANCE TO ENSURE NO TREES GROW ON LEVEE EMBANKMENT. GRASS ONLY

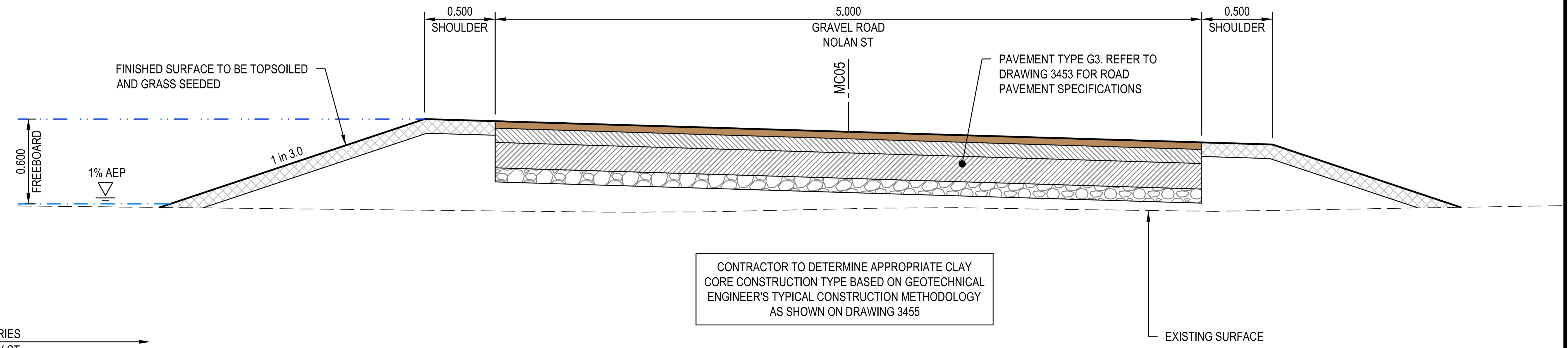


NOTES:
1. SWALE TO BE GRADED TO NOMINATED OUTLETS. FINISH WITH 100mm TOPSOIL.

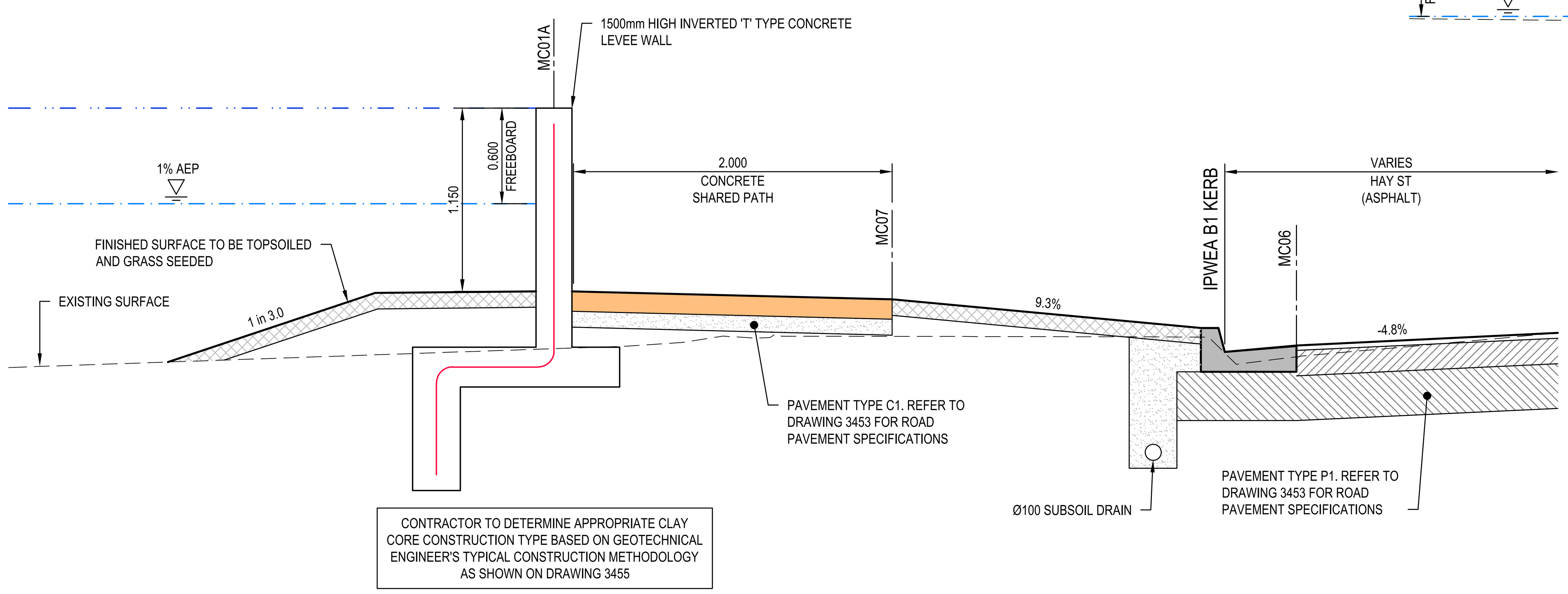
SWALE/CATCH DRAIN DETAIL
NOT TO SCALE



HOLBROOK 1 (MC01C) TYPICAL LEVEE DETAIL
SCALE 1:20
Holbrook Levee 1 part 3
(Based on Ch 10.000)



HOLBROOK 1 (MC05) TYPICAL LEVEE DETAIL
SCALE 1:20
Hay Street to Nolan St centre line
(Based on Ch 250.000)



HOLBROOK 1 (MC01A) TYPICAL RETAINING WALL DETAIL
SCALE 1:20
Hay Street to Nolan St centre line
(Based on Ch 50.000)

NOTE:
1. REFER TO DRAWING 300203886-WE-3001 FOR GENERAL NOTES.
2. REFER TO DRAWING 300203886-WE-3050 FOR LAYOUT KEY PLAN.
3. REFER TO DRAWINGS 300203886-WE-3101 & 3102 FOR ALIGNMENT LAYOUT PLANS.
4. REFER TO DRAWING 300203886-WE-3255 FOR LONGITUDINAL SECTION.
5. REFER TO DRAWINGS 300203886-WE-3312 TO 3313 FOR CROSS SECTIONS.
6. REFER TO DRAWING 300203886-WE-3454 FOR GEOTECHNICAL NOTES AND DETAILS.
7. REFER TO DRAWINGS 300203886-WE-3700 TO 3721 FOR STRUCTURAL NOTES AND DETAILS.

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A	10/05/2024	TENDER ISSUE	VZ		AS

SCALE 1:25 @A1 (0 0.5 1m)

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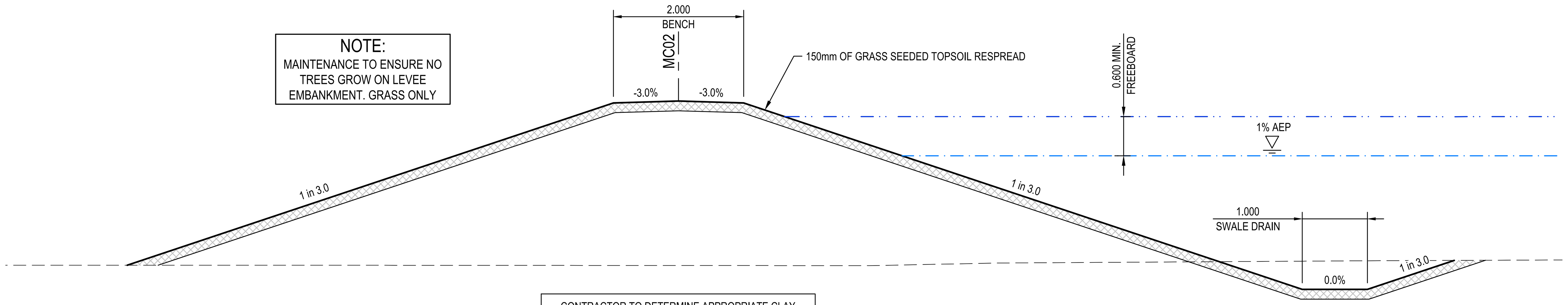
Drawn AJH	Date 25/03/2024	
Checked VZ	Date 23/04/24	
Designed AS	Date 23/04/24	
Verified	Date	
Approved	Date	

Client: GREATER HUME SHIRE COUNCIL
Project: HHC FLOOD LEVEE DESIGN
HOLBROOK, HENTY
& CULCAIRN
Title: TYPICAL SECTIONS
LEVEE 1
Status: FOR TENDER ONLY
NOT TO BE USED FOR CONSTRUCTION PURPOSES
VERT. DATUM: AHD | HORZ. DATUM: MGA | Scale: AS SHOWN | Size: A1
Drawing Number: 300203886-WE-3450 | Revision: A

DATE PLOTTED: 10 May 2024 2:27 PM BY : HAZELGROVE, ADAM
XREF's:
CAD File: \\au2013-ppfss01\shared_projects\300203886\300 Levee Design\300203886-WE-3450-3457.dwg

NOTE:
MAINTENANCE TO ENSURE NO TREES GROW ON LEVEE EMBANKMENT. GRASS ONLY

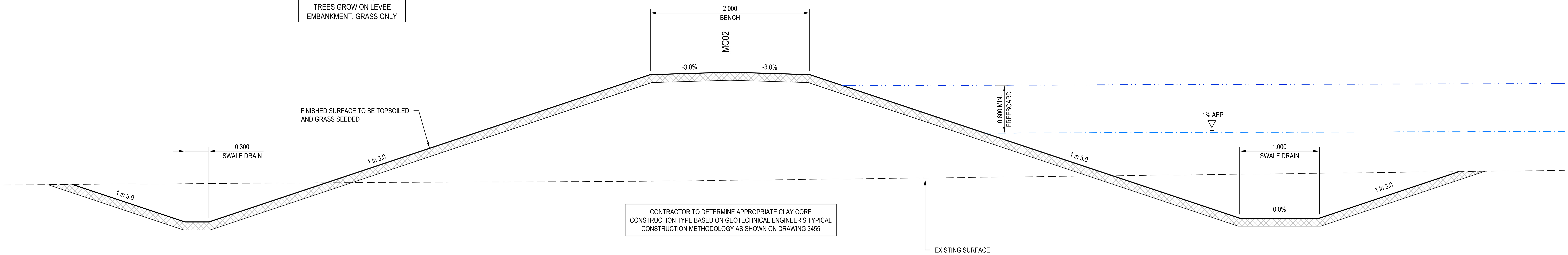


CONTRACTOR TO DETERMINE APPROPRIATE CLAY CORE CONSTRUCTION TYPE BASED ON GEOTECHNICAL ENGINEER'S TYPICAL CONSTRUCTION METHODOLOGY AS SHOWN ON DRAWING 3455

HOLBROOK 2 (MC02) TYPICAL DETAIL

SCALE 1:50
HOLBROOK LEVEE 2 WITH SWALE ON DRY SIDE ONLY
Ch 80.000

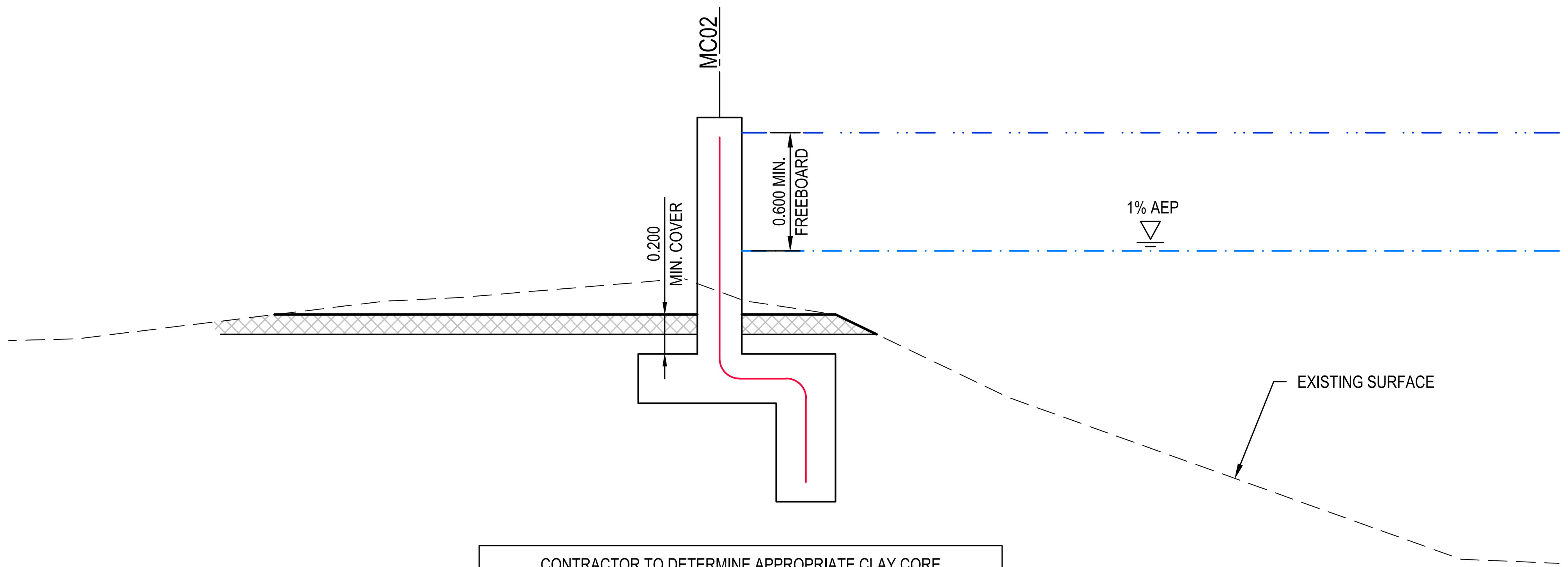
NOTE:
MAINTENANCE TO ENSURE NO TREES GROW ON LEVEE EMBANKMENT. GRASS ONLY



CONTRACTOR TO DETERMINE APPROPRIATE CLAY CORE CONSTRUCTION TYPE BASED ON GEOTECHNICAL ENGINEER'S TYPICAL CONSTRUCTION METHODOLOGY AS SHOWN ON DRAWING 3455

HOLBROOK 2 (MC02) TYPICAL LEVEE DETAIL

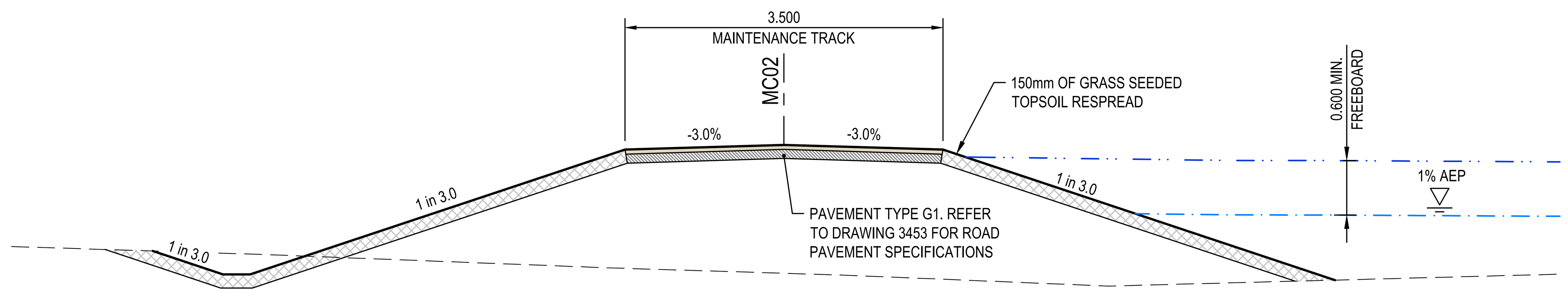
SCALE 1:25
HOLBROOK LEVEE 2 WITH SWALE ON BOTH SIDES
Ch 560.000



CONTRACTOR TO DETERMINE APPROPRIATE CLAY CORE CONSTRUCTION TYPE BASED ON GEOTECHNICAL ENGINEER'S TYPICAL CONSTRUCTION METHODOLOGY AS SHOWN ON DRAWING 3455

HOLBROOK 2 (MC02) TYPICAL WALL DETAIL

SCALE 1:25
HOLBROOK LEVEE 2 WITH WALL
Ch 1060.000



CONTRACTOR TO DETERMINE APPROPRIATE CLAY CORE CONSTRUCTION TYPE BASED ON GEOTECHNICAL ENGINEER'S TYPICAL CONSTRUCTION METHODOLOGY AS SHOWN ON DRAWING 3455

HOLBROOK 2 (MC02) TYPICAL DETAIL

SCALE 1:50
HOLBROOK LEVEE 2 WITH ACCESS TRACK
Ch 1180.000

NOTE:
1. REFER TO DRAWING 300203886-WE-3001 FOR GENERAL NOTES.
2. REFER TO DRAWING 300203886-WE-3050 FOR LAYOUT KEY PLAN.
3. REFER TO DRAWINGS 300203886-WE-3101 & 3102 FOR ALIGNMENT LAYOUT PLANS.
4. REFER TO DRAWING 300203886-WE-3255 FOR LONGITUDINAL SECTION.
5. REFER TO DRAWINGS 300203886-WE-3312 TO 3313 FOR CROSS SECTIONS.
6. REFER TO DRAWING 300203886-WE-3454 FOR GEOTECHNICAL NOTES AND DETAILS.
7. REFER TO DRAWINGS 300203886-WE-3700 TO 3721 FOR STRUCTURAL NOTES AND DETAILS.

Rev.	Date	Description	Des.	Verif.	Appd.
A	10/05/2024	TENDER ISSUE	VZ		AS

SCALE 1:25 @A1 (0, 0.5, 1m)
SCALE 1:50 @A1 (0, 1, 2m)

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Drawn	AJH	25/03/2024
Checked	VZ	23/04/24
Designed	AS	23/04/24
Verified		
Approved		

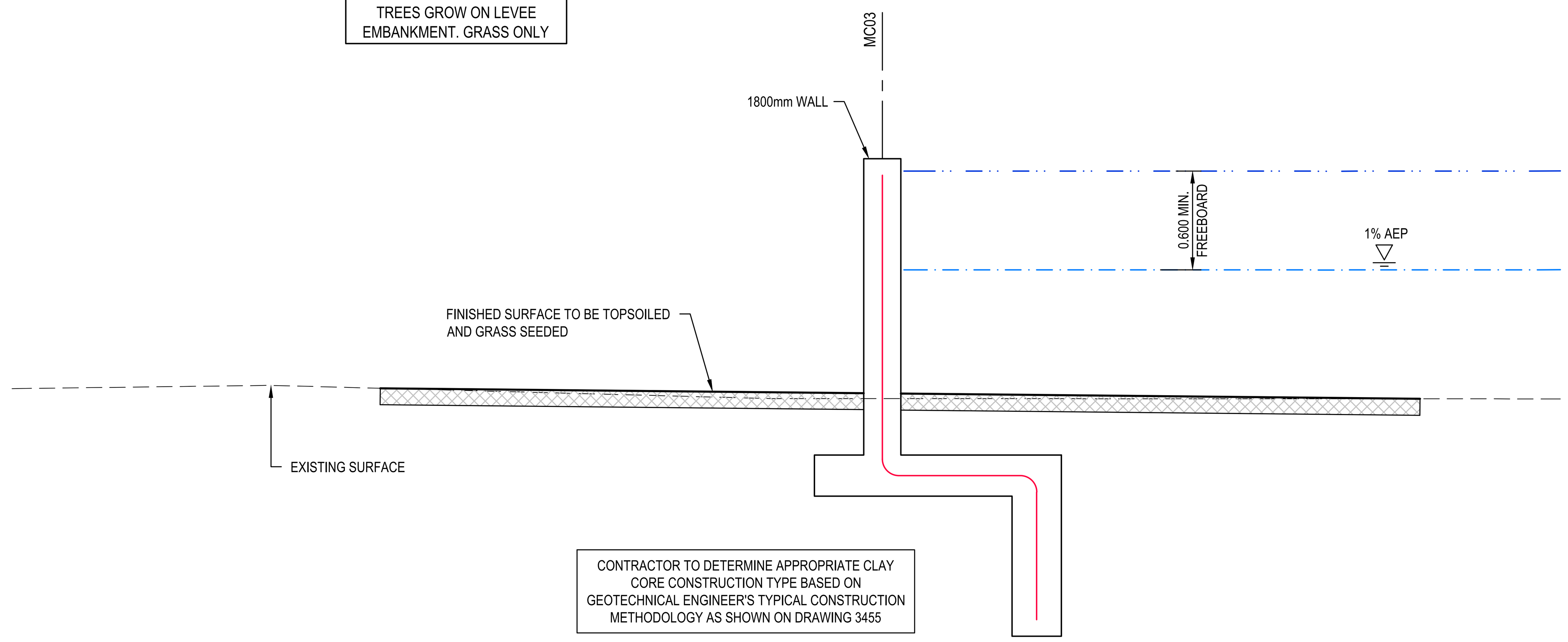
Client: GREATER HUME SHIRE COUNCIL
Project: HHC FLOOD LEVEE DESIGN HOLBROOK, HENTY & CULCAIRN
Title: TYPICAL SECTIONS LEVEE 2
Status: FOR TENDER ONLY
NOT TO BE USED FOR CONSTRUCTION PURPOSES

VERT. DATUM	HORZ. DATUM	Scale	Size
AHD	MGA	AS SHOWN	A1

Drawing Number: 300203886-WE-3451
Revision: A

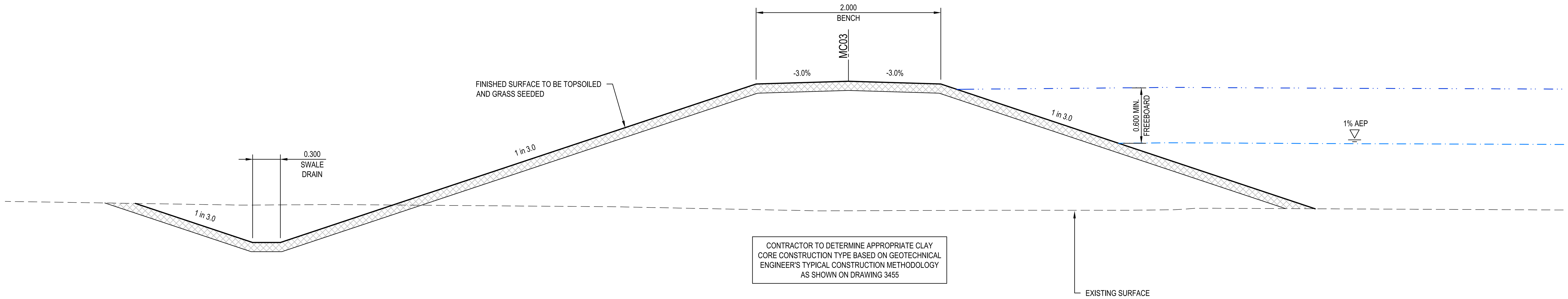
DATE PLOTTED: 10 May 2024 2:27 PM BY : HAZELGROVE, ADAM
XREF's:
CAD File: \\au2013-ppfss01\shared_projects\300203886\300 Levee Design\300203886-WE-3450-3457.dwg

NOTE:
MAINTENANCE TO ENSURE NO TREES GROW ON LEVEE EMBANKMENT. GRASS ONLY



HOLBROOK 3 (MC03) TYPICAL WALL DETAIL
SCALE 1:25

Holbrook levee 3
Ch 122.000



HOLBROOK 3 (MC03) TYPICAL LEVEE DETAIL
SCALE 1:25

Holbrook levee 3
Ch 40.000

NOTE:
1. REFER TO DRAWING 300203886-WE-3001 FOR GENERAL NOTES.
2. REFER TO DRAWING 300203886-WE-3050 FOR LAYOUT KEY PLAN.
3. REFER TO DRAWINGS 300203886-WE-3101 & 3102 FOR ALIGNMENT LAYOUT PLANS.
4. REFER TO DRAWING 300203886-WE-3255 FOR LONGITUDINAL SECTION.
5. REFER TO DRAWINGS 300203886-WE-3312 TO 3313 FOR CROSS SECTIONS.
6. REFER TO DRAWING 300203886-WE-3454 FOR GEOTECHNICAL NOTES AND DETAILS.
7. REFER TO DRAWINGS 300203886-WE-3700 TO 3721 FOR STRUCTURAL NOTES AND DETAILS.

LEVEE 3 TYPICAL SECTIONS
SCALE 1:25

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0 0.5 1m
SCALE 1:25 @A1

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Drawn	AJH	25/03/2024
Checked	VZ	23/04/24
Designed	AS	23/04/24
Verified		
Approved		

Client: GREATER HUME SHIRE COUNCIL

Project: HHC FLOOD LEVEE DESIGN
HOLBROOK, HENTY
& CULCAIRN

Title: TYPICAL SECTIONS
LEVEE 3

Status: FOR TENDER ONLY
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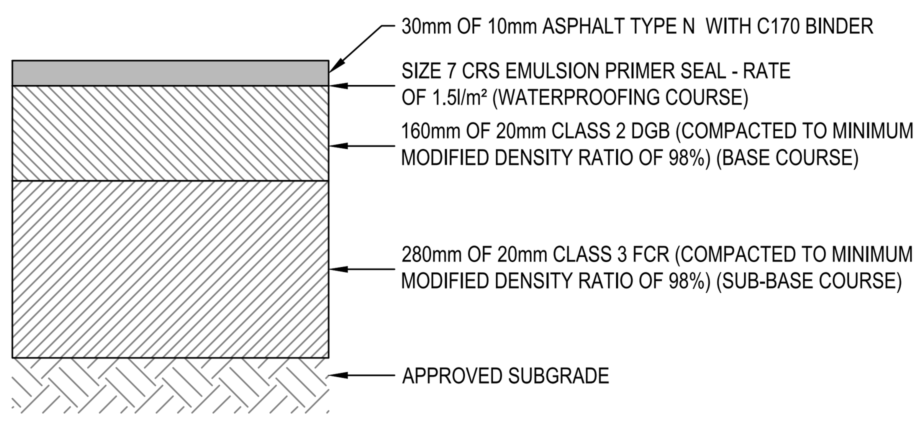
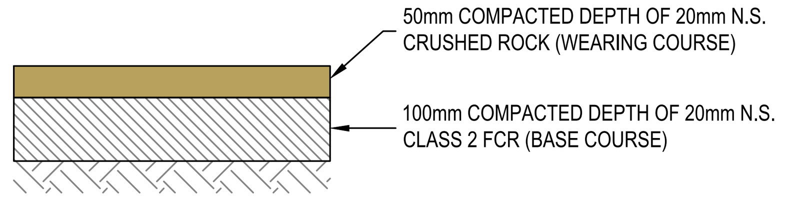
VERT. DATUM	HORZ. DATUM	Scale	Size
AHD	MGA	AS SHOWN	A1

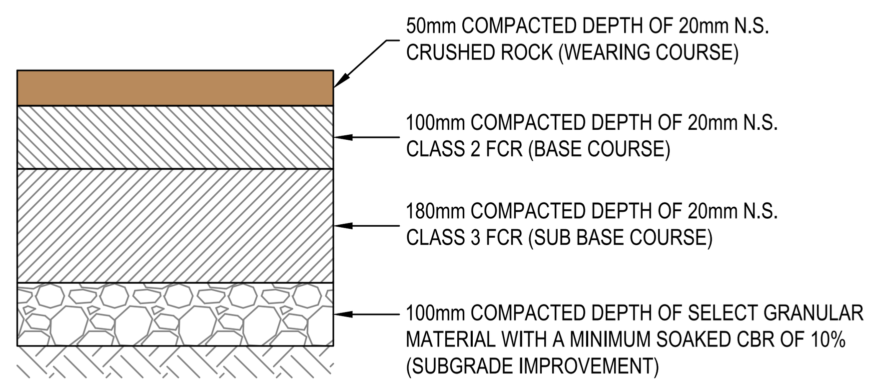
Drawing Number: 300203886-WE-3452
Revision: A



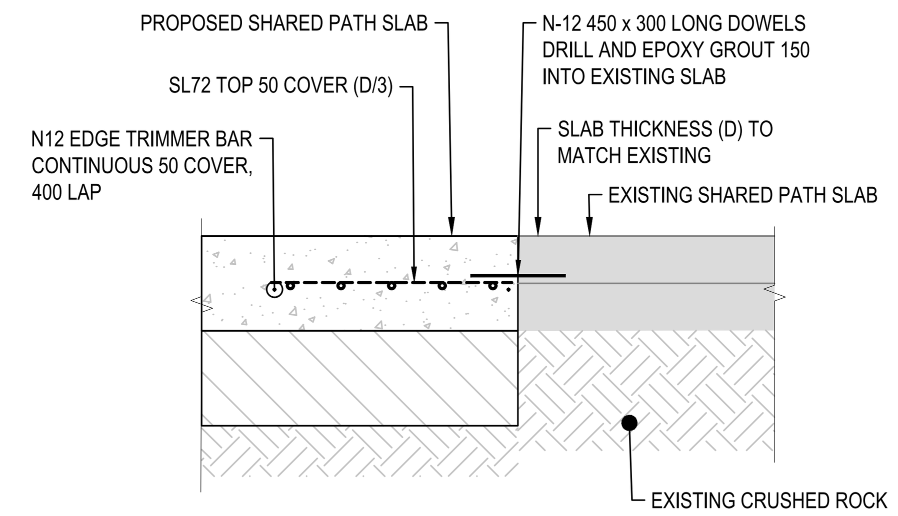
HAY ST & BETHANA LN ASPHALT ROADWAY
PAVEMENT TYPE P1
NOT TO SCALE



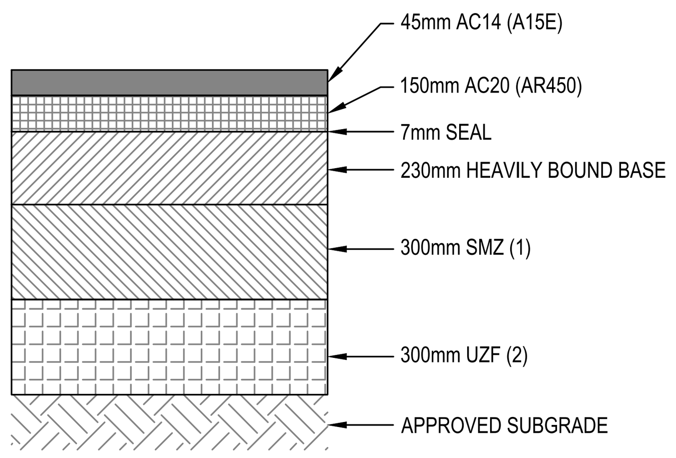
MAINTENANCE TRACK
PAVEMENT TYPE G1
NOT TO SCALE



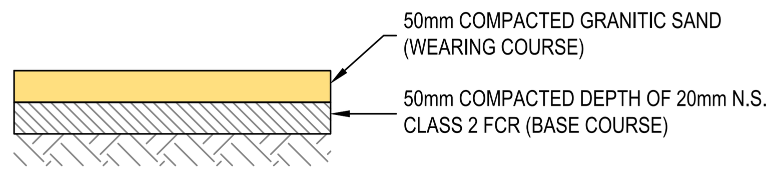
GRAVEL ROADWAY (HAY ST & NOLAN ST)
PAVEMENT TYPE G3
NOT TO SCALE



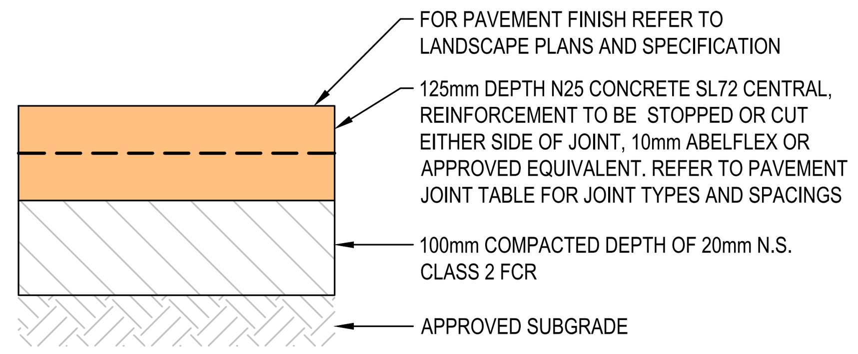
CONNECTION OF EXISTING &
PROPOSED SHARED PATH SLABS
NOT TO SCALE



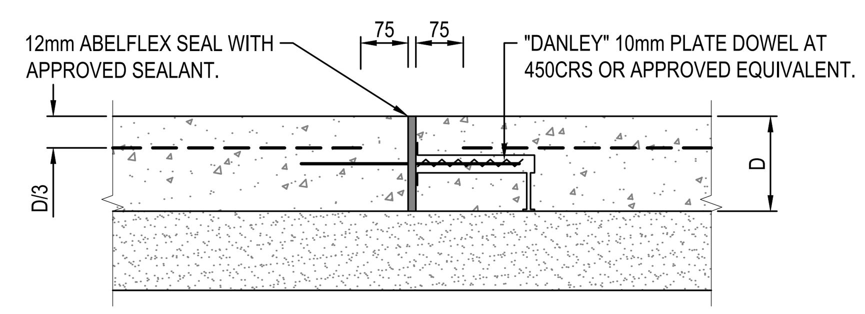
ALBURY STREET ASPHALT ROADWAY
PAVEMENT TYPE P2
NOT TO SCALE



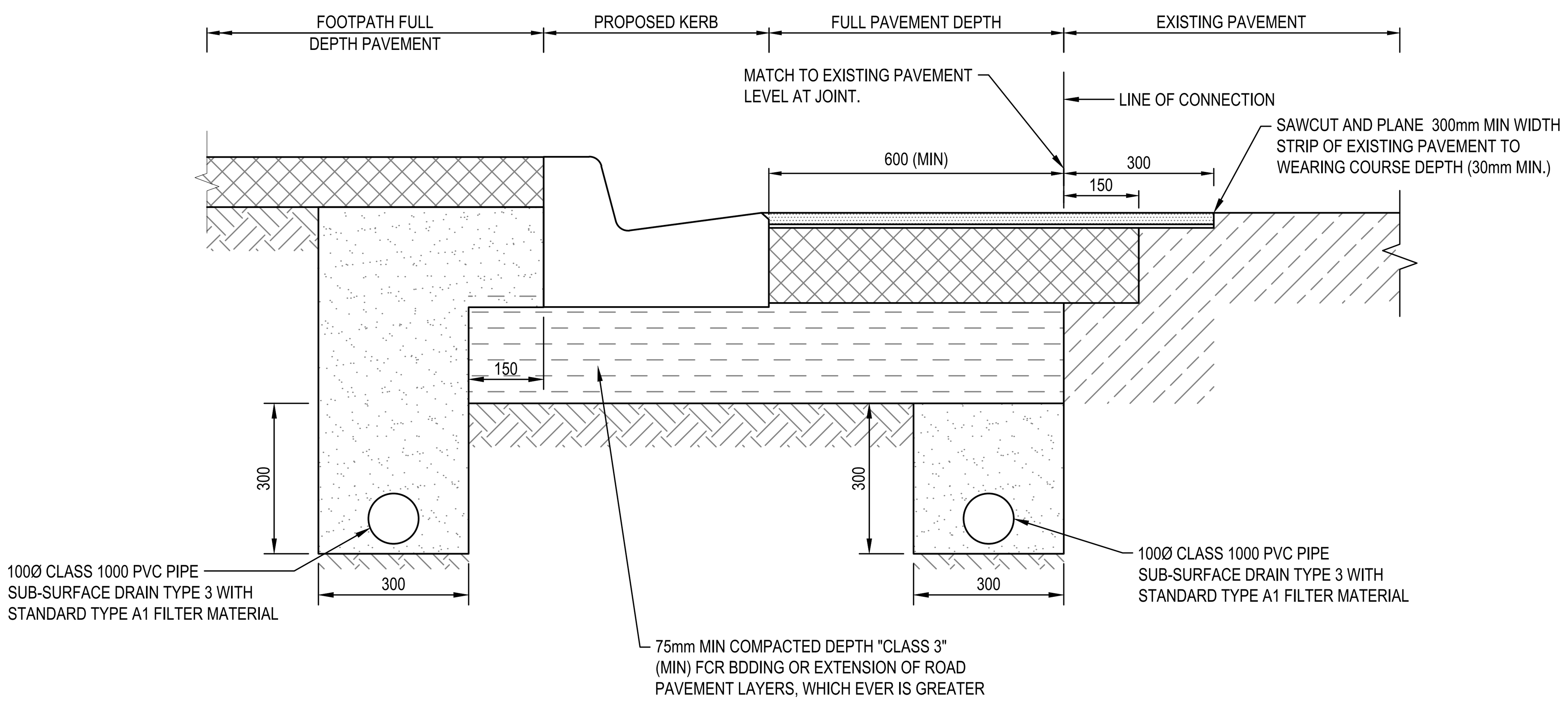
GRANITIC SAND PARK PATH
PAVEMENT TYPE G2
NOT TO SCALE



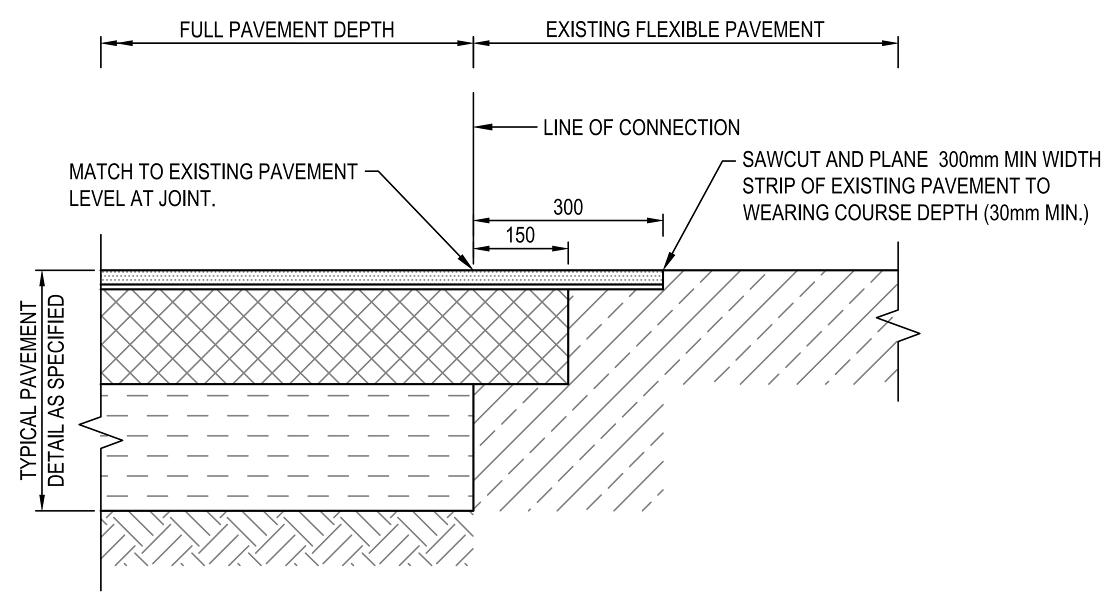
LIGHT DUTY CONCRETE FOOTPATH
PAVEMENT TYPE C1
NOT TO SCALE



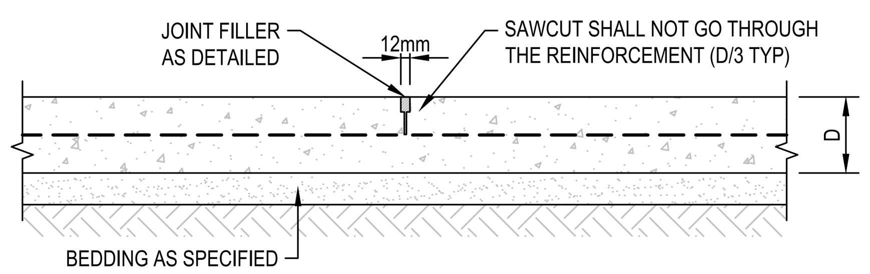
DOWELED EXPANSION JOINT
NOT TO SCALE



MATCHING EXISTING AND PROPOSED PAVEMENTS WITH KERB
NOT TO SCALE

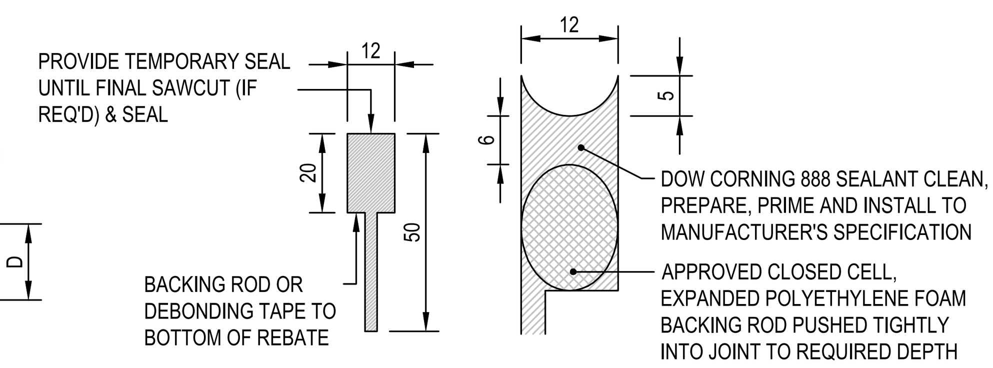


MATCHING EXISTING AND
PROPOSED PAVEMENTS
NOT TO SCALE



LIGHT DUTY SAWCUT JOINT DETAIL
LIGHT DUTY PAVEMENT ONLY

NOTES
1. SAWCUT WITHIN 24 HOUR PERIOD AFTER CONCRETE IS POURED UNLESS AGREED OTHERWISE BY THE ENGINEER.
2. REFER ALSO STANDARD NOTES.
3. FOR USE WITH LIGHT DUTY PAVEMENTS ONLY.



JOINT FILLER DETAIL

PAVEMENT JOINT SPACINGS

PAVEMENT WIDTH (m)	JOINT TYPE & SPACINGS
2.5 (LIGHT DUTY)	SC - 2.5m : EJ 12m

* EJ - EXPANSION JOINT, SC - SAWCUT

CONCRETE JOINT DETAILS
NOT TO SCALE

Rev.	Date	Description	Des.	Verif.	Appd.
A	10/05/2024	TENDER ISSUE	VZ		AS

H: 0 20 40m
V: 0 2 4m
SCALE H:1:1000 V:1:100 @A1

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Drawn AJH Date 25/03/2024
Checked VZ Date 23/04/24
Designed AS Date 23/04/24
Verified Date
Approved Date

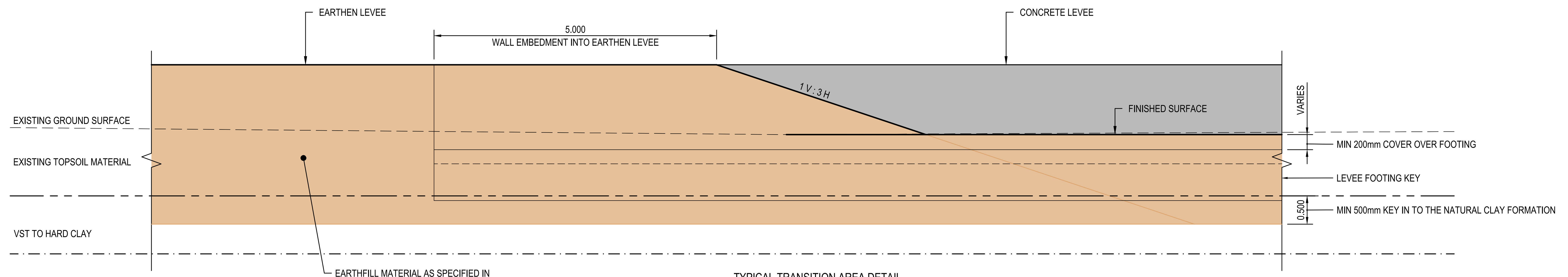
Client GREATER HUME SHIRE COUNCIL
Project HHC FLOOD LEVEE DESIGN HOLBROOK, HENTY & CULCAIRN
Title TYPICAL SECTIONS PAVEMENT DETAILS

Status FOR TENDER ONLY
NOT TO BE USED FOR CONSTRUCTION PURPOSES

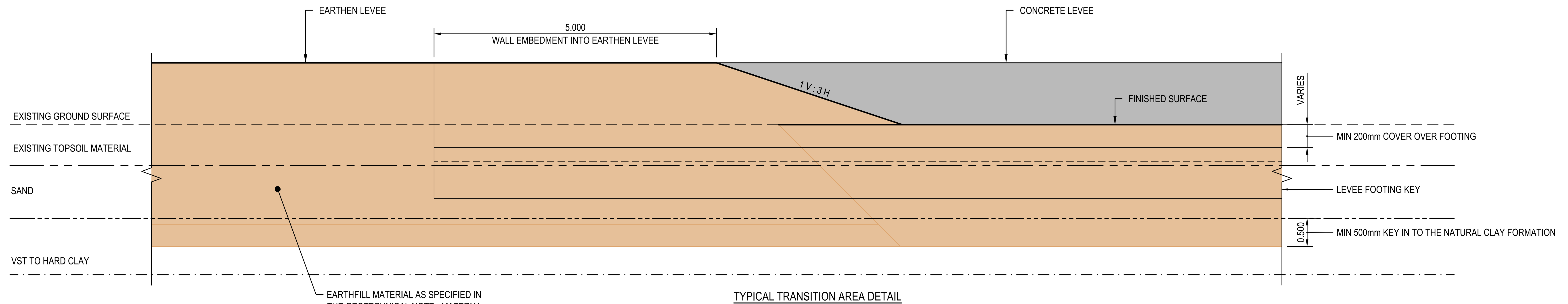
VERT. DATUM	HORZ. DATUM	Scale	Size
AHD	MGA	AS SHOWN	A1

Drawing Number 300203886-WE-3453 Revision A

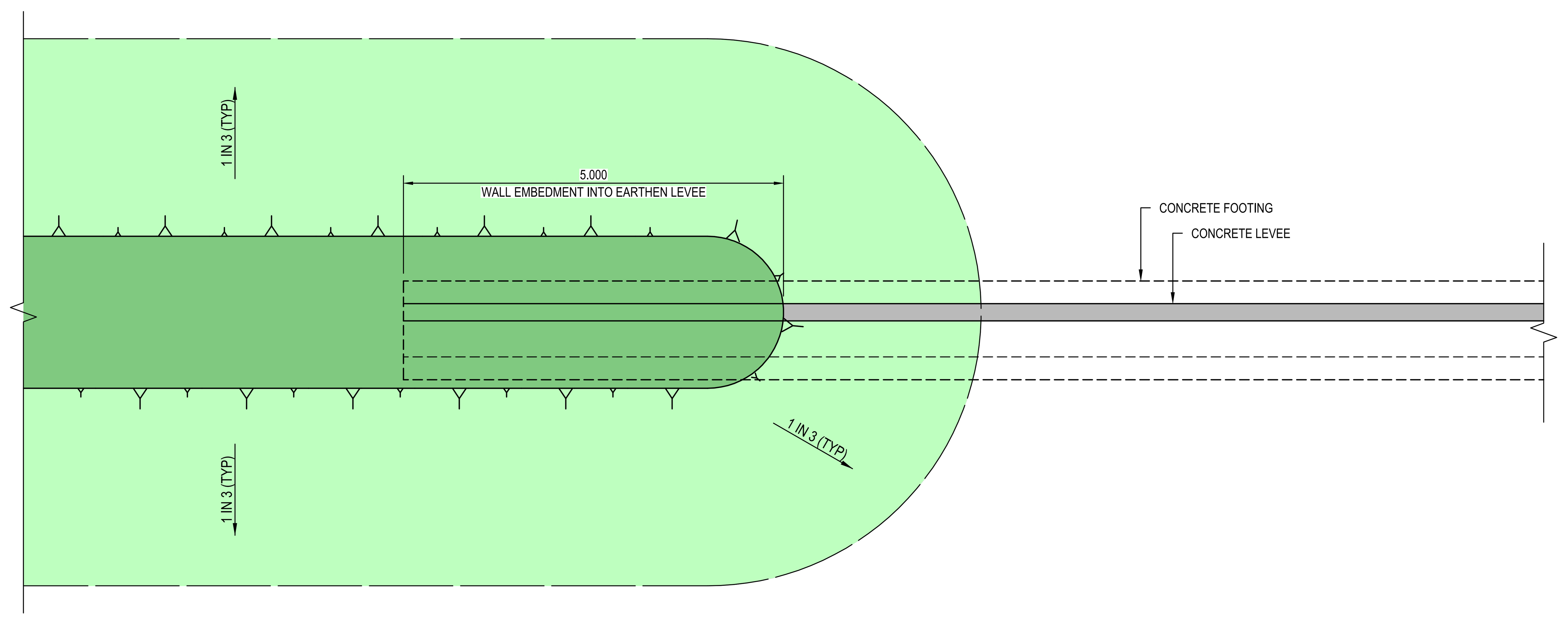
DATE PLOTTED: 10 May 2024 2:27 PM BY : HAZELGROVE, ADAM
XREF's:
CAD File: \\au2013-ppfss01\shared_projects\300203886\300 Levee Design\300203886-WE-3450-3457.dwg



TYPICAL TRANSITION AREA DETAIL
TYPE 01:
GENERAL SUB SURFACE PROFILE



TYPICAL TRANSITION AREA DETAIL
TYPE 02:
WORST CASE SUB SURFACE PROFILE



TYPICAL TRANSITION AREA DETAIL
PLAN VIEW
SCALE 1:50

NOTE:
1. REFER TO DRAWING 300203886-WE-3001 FOR GENERAL NOTES.
2. REFER TO DRAWING 300203886-WE-3050 FOR LAYOUT KEY PLAN.
3. REFER TO DRAWINGS 300203886-WE-3101 & 3102 FOR ALIGNMENT LAYOUT PLANS.
4. REFER TO DRAWING 300203886-WE-3255 FOR LONGITUDINAL SECTION.
5. REFER TO DRAWINGS 300203886-WE-3312 TO 3313 FOR CROSS SECTIONS.
6. REFER TO DRAWING 300203886-WE-3454 FOR GEOTECHNICAL NOTES AND DETAILS.
7. REFER TO DRAWINGS 300203886-WE-3700 TO 3721 FOR STRUCTURAL NOTES AND DETAILS.

Rev.	Date	Description	Des.	Verif.	Appd.
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SCALE 1:50 @A1 (0 1 2m)

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Drawn AJH Date 25/03/2024
Checked RS Date 23/04/24
Designed AS Date 23/04/24
Verified Date
Approved Date

Client: GREATER HUME SHIRE COUNCIL
Project: HHC FLOOD LEVEE DESIGN HOLBROOK, HENTY & CULCAIRN
Title: TYPICAL SECTIONS LEVEE TRANSITION DETAILS

Status: FOR TENDER ONLY
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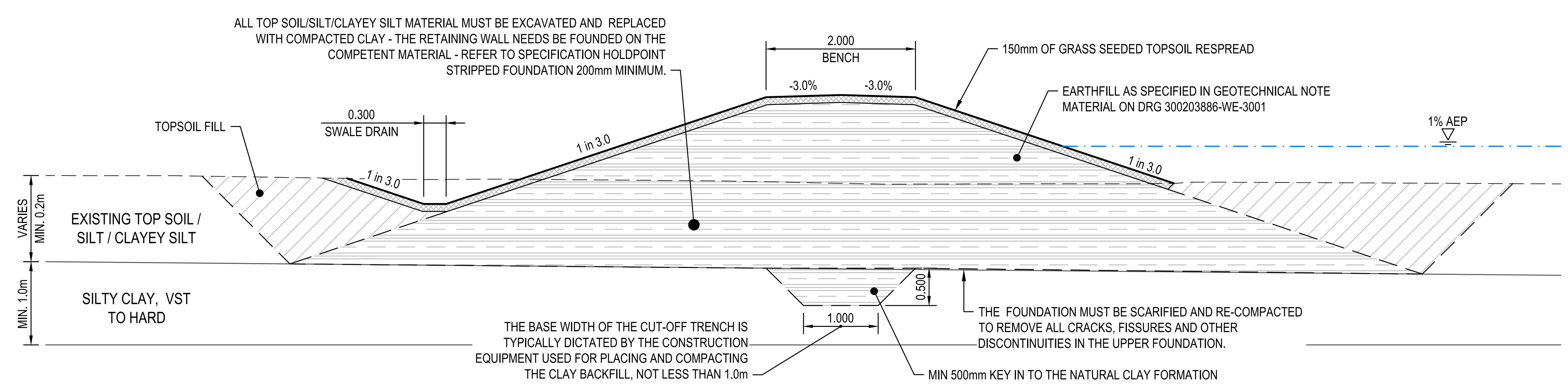
VERT. DATUM	HORZ. DATUM	Scale	Size
AHD	MGA	AS SHOWN	A1

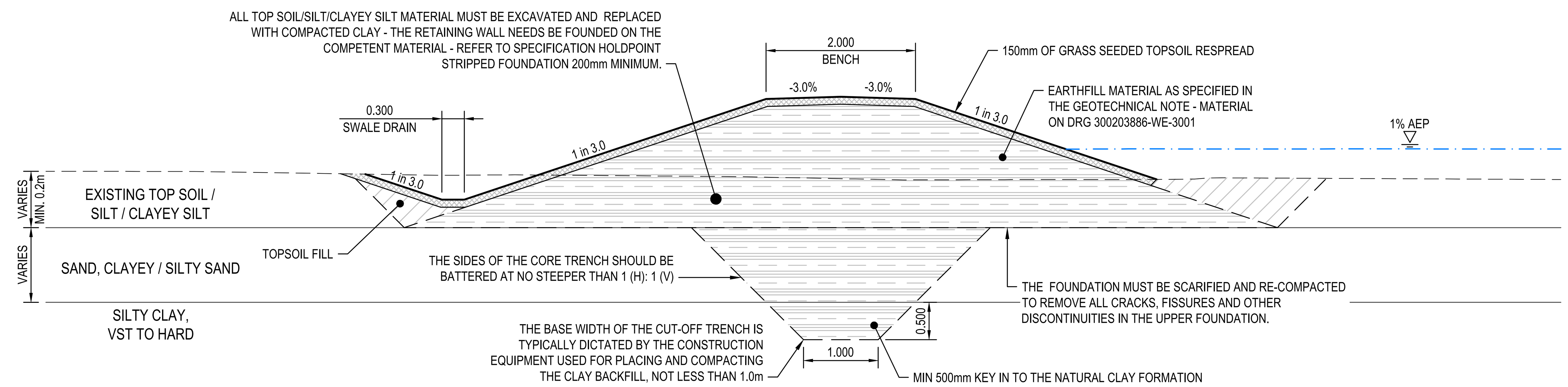
Drawing Number: 300203886-WE-3454 Revision: A

DATE PLOTTED: 10 May 2024 2:28 PM BY : HAZELGROVE, ADAM
XREF's:
CAD File: \\au2013-ppfss01\shared_projects\300203886\300 Levee Design\300203886-WE-3450-3457.dwg

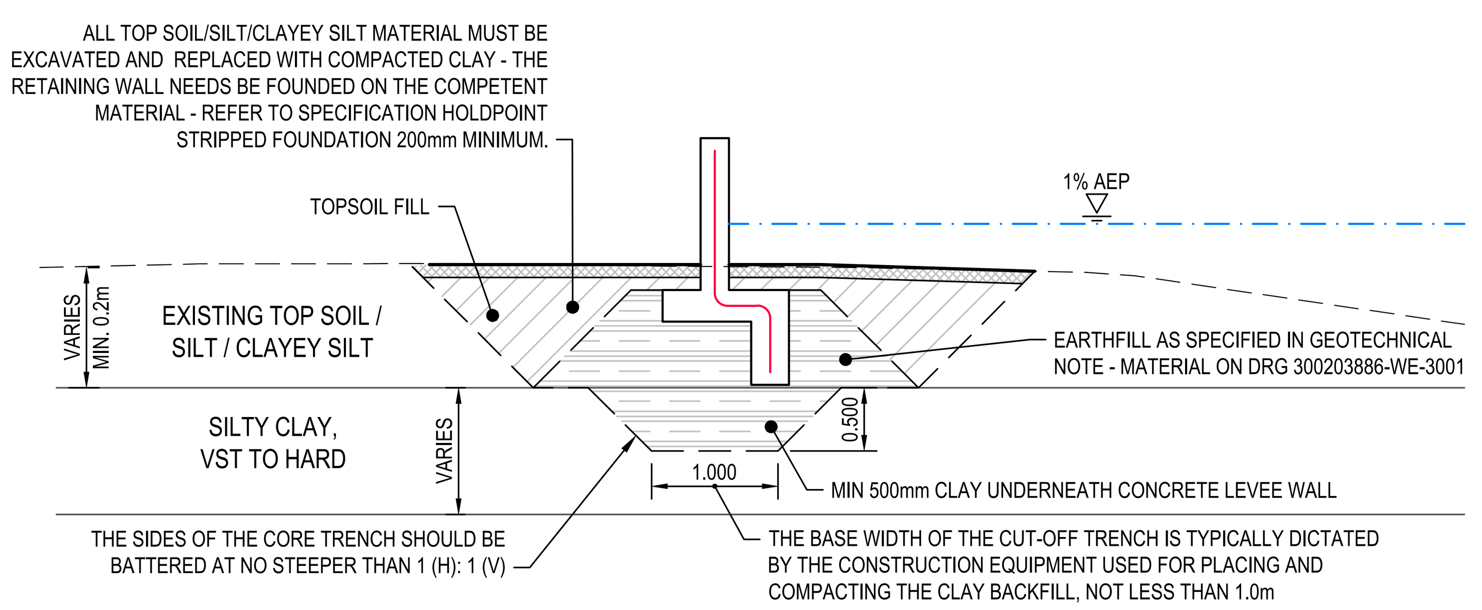
NOTE:
1. REFER TO DRAWING 300203886-WE-3001 FOR GENERAL NOTES.
2. REFER TO DRAWING 300203886-WE-3050 FOR LAYOUT KEY PLAN.
3. REFER TO DRAWINGS 300203886-WE-3101 & 3102 FOR ALIGNMENT LAYOUT PLANS.
4. REFER TO DRAWING 300203886-WE-3255 FOR LONGITUDINAL SECTION.
5. REFER TO DRAWINGS 300203886-WE-3312 TO 3313 FOR CROSS SECTIONS.
6. REFER TO DRAWING 300203886-WE-3454 FOR GEOTECHNICAL NOTES AND DETAILS.
7. REFER TO DRAWINGS 300203886-WE-3700 TO 3721 FOR STRUCTURAL NOTES AND DETAILS.



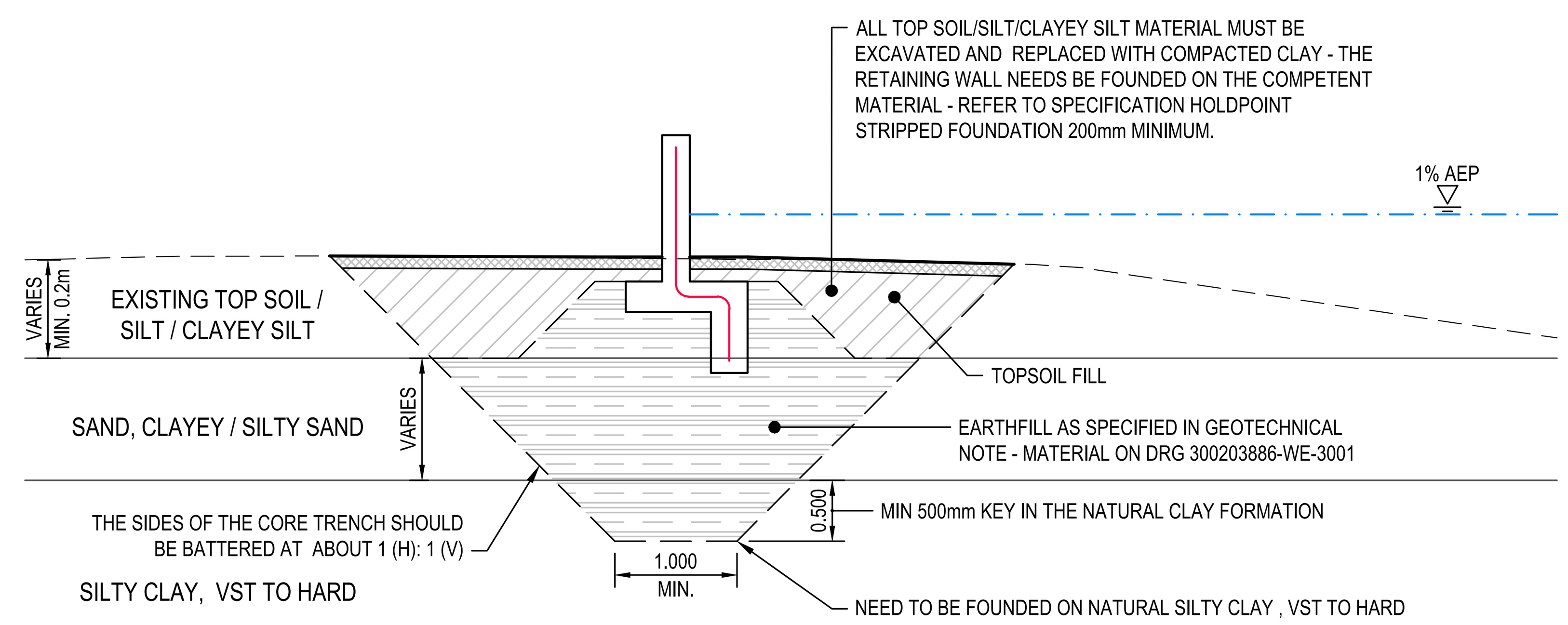
TYPE 01: EARTHEN LEVEE BUND
GENERAL CLAY SUB SURFACE PROFILE



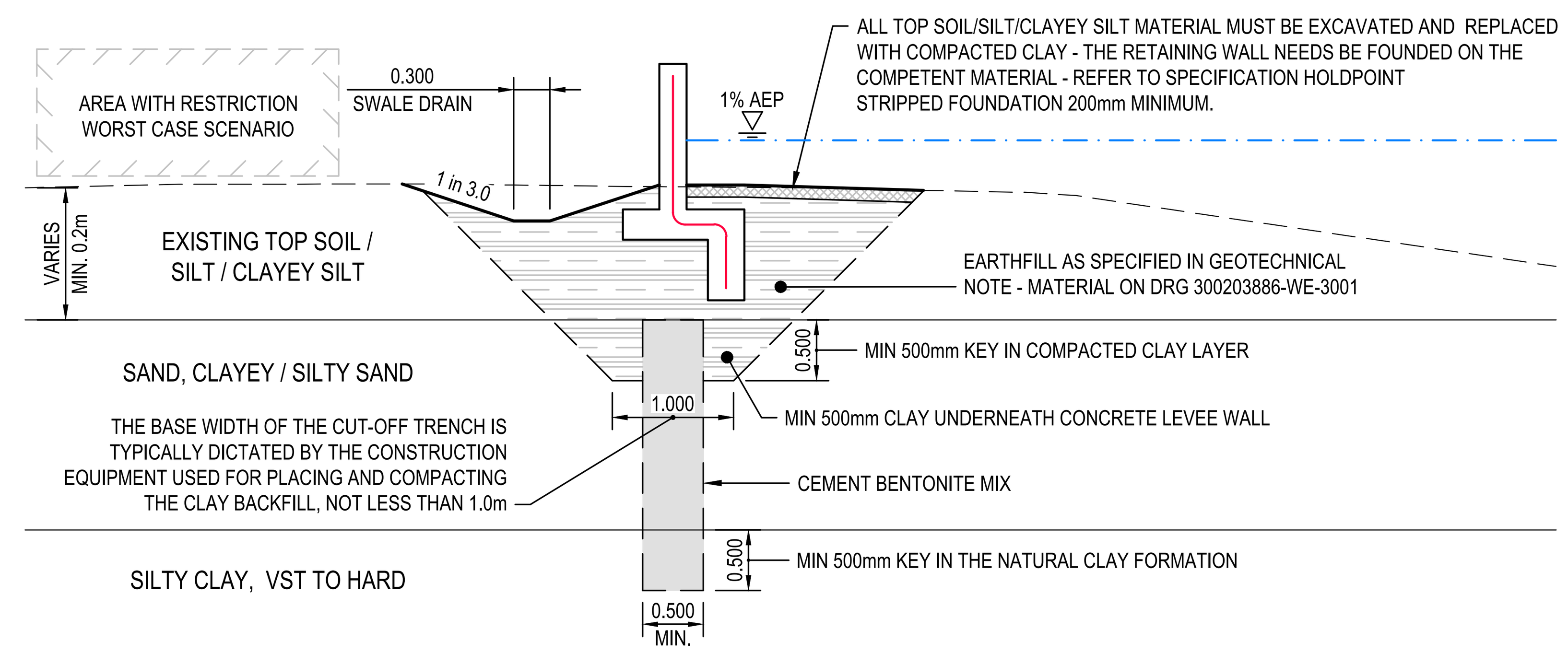
TYPE 02: EARTHEN LEVEE BUND
WORST CASE SUB SURFACE PROFILE



TYPE 03: CONCRETE LEVEE WALL
GENERAL CLAY SUB SURFACE PROFILE
FOUNDING MATERIAL NATURAL VST TO HARD CLAY WITH MIN. THICKNESS 1.0m



TYPE 04: CONCRETE LEVEE WALL
WORST CASE SUB SURFACE PROFILE
NO RESTRICTION



TYPE 05: CONCRETE LEVEE WALL
WORST CASE SUB SURFACE PROFILE
AREA WITH RESTRICTION

TYPICAL LEVEE CONSTRUCTION TYPES
SCALE 1:50

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SCALE 1:50 @A1

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Drawn AJH Date 25/03/2024
Checked RS Date 23/04/24
Designed AS Date 23/04/24
Verified Date
Approved Date

Client: GREATER HUME SHIRE COUNCIL
Project: HHC FLOOD LEVEE DESIGN HOLBROOK, HENTY & CULCAIRN
Title: TYPICAL SECTIONS AND DETAILS GEOTECHNICAL CLAY CORE DETAILS

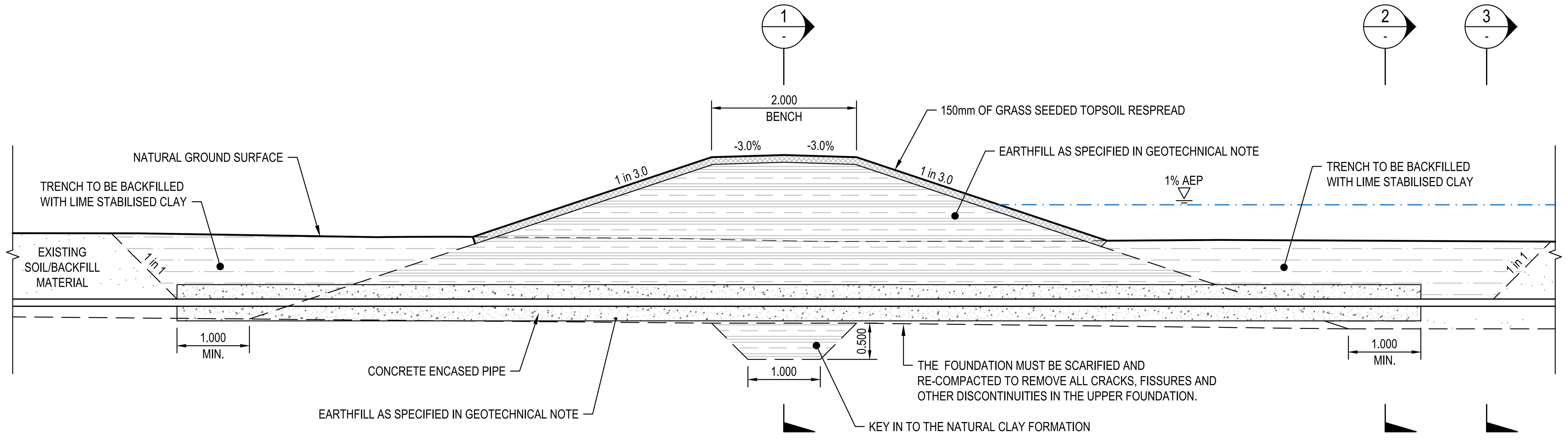
Status: FOR TENDER ONLY
NOT TO BE USED FOR CONSTRUCTION PURPOSES

VERT. DATUM	HORZ. DATUM	Scale	Size
AHD	MGA	AS SHOWN	A1

Drawing Number: 300203886-WE-3455 Revision: A

DATE PLOTTED: 10 May 2024 2:28 PM BY : HAZELGROVE, ADAM
CAD File: \\au2013-ppfss01\shared_projects\300203886\300 Levee Design\300203886-WE-3450-3457.dwg
XREF's:

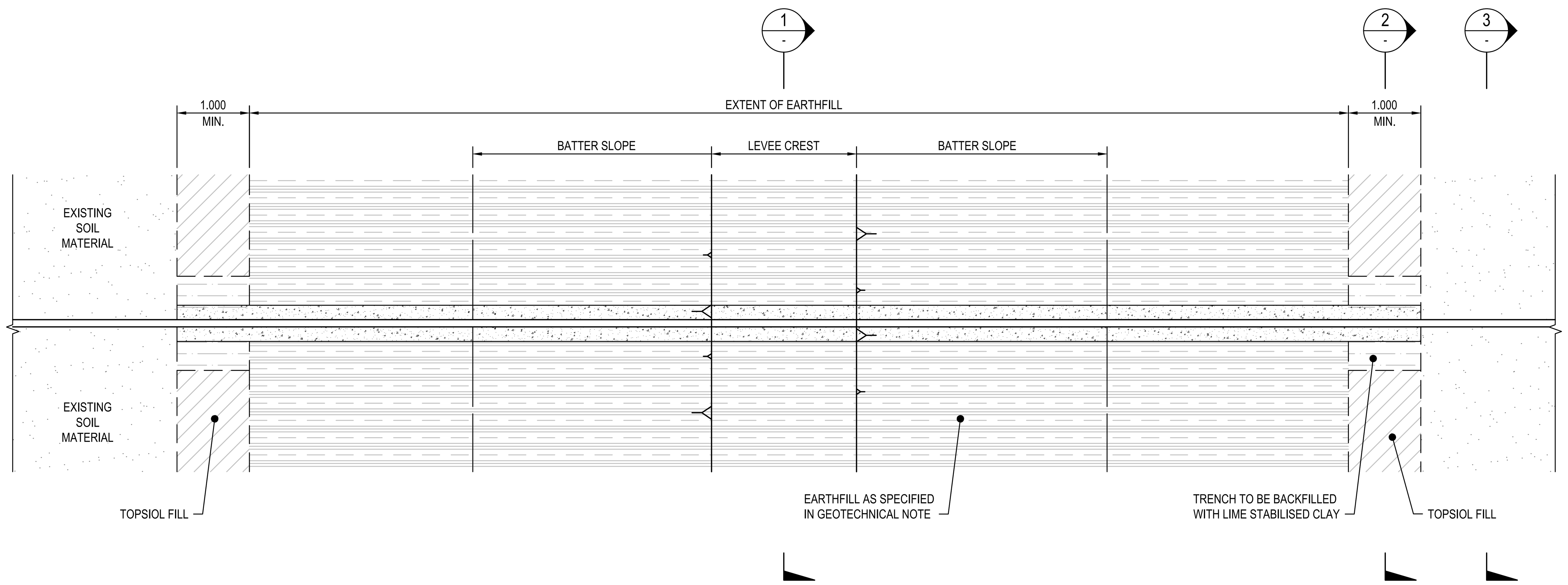
DATE PLOTTED: 10 May 2024 2:28 PM BY : HAZELGROVE, ADAM



EXISTING SERVICE THROUGH LEVEE

LONGITUDINAL SECTIONS

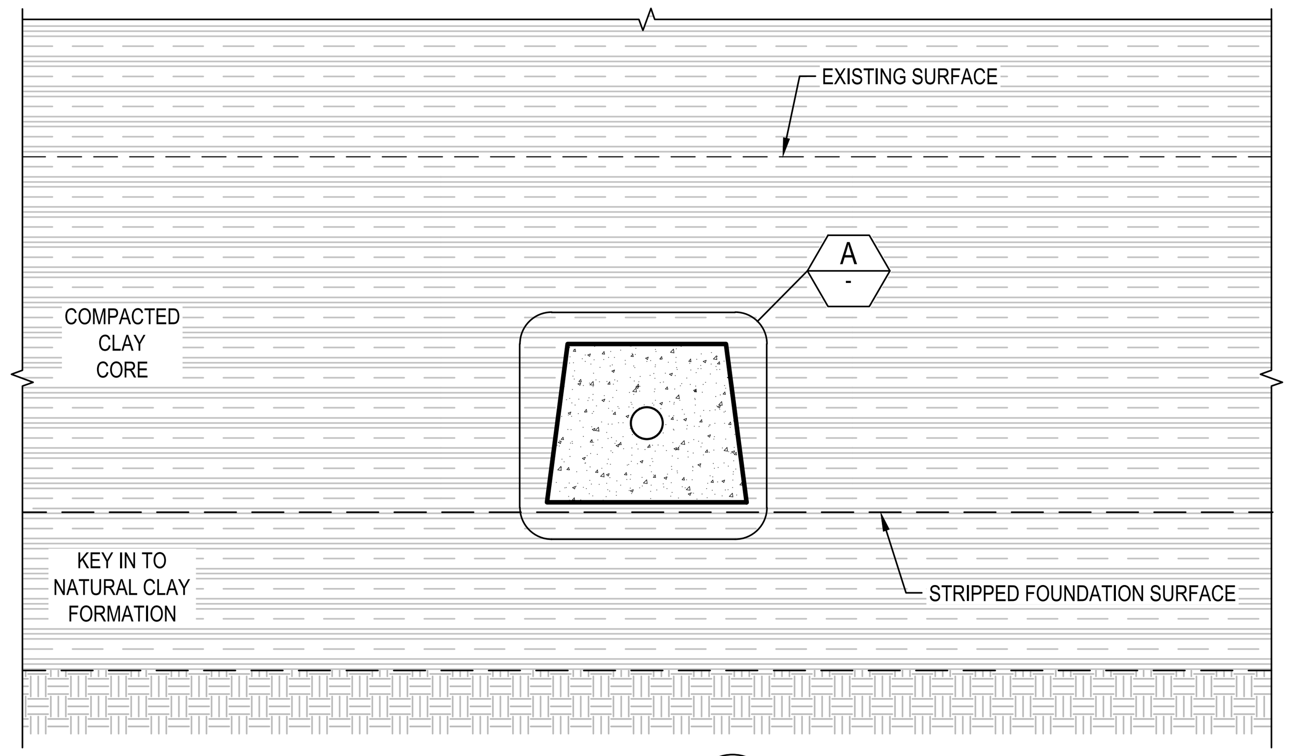
SCALE A1 - 1 : 50
A3 - 1 : 100



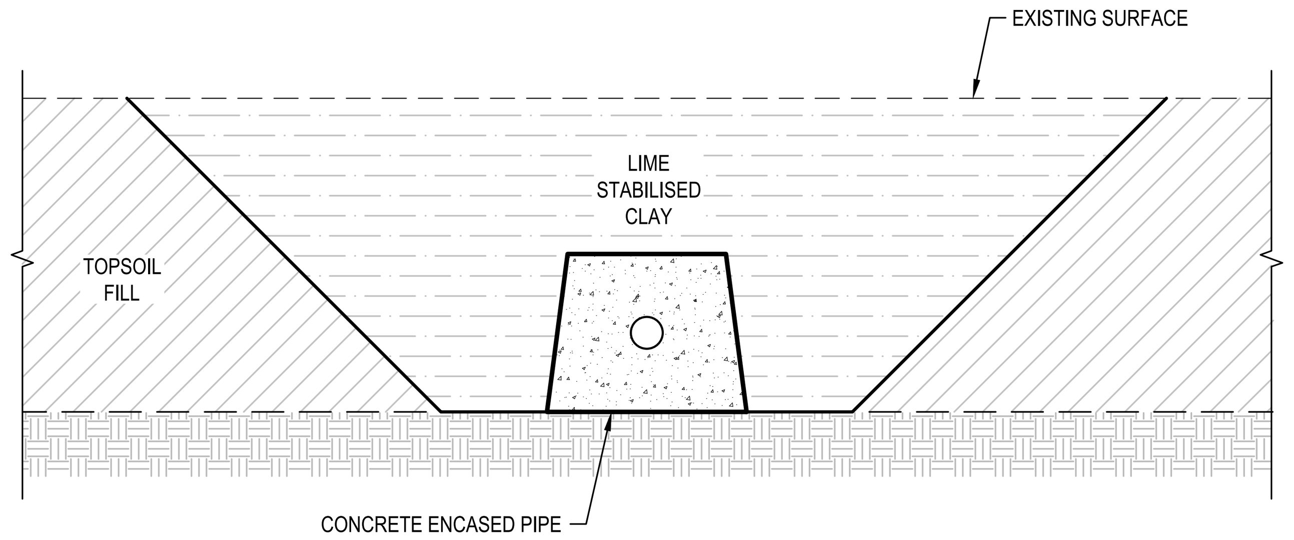
EXISTING SERVICE THROUGH LEVEE

PLAN

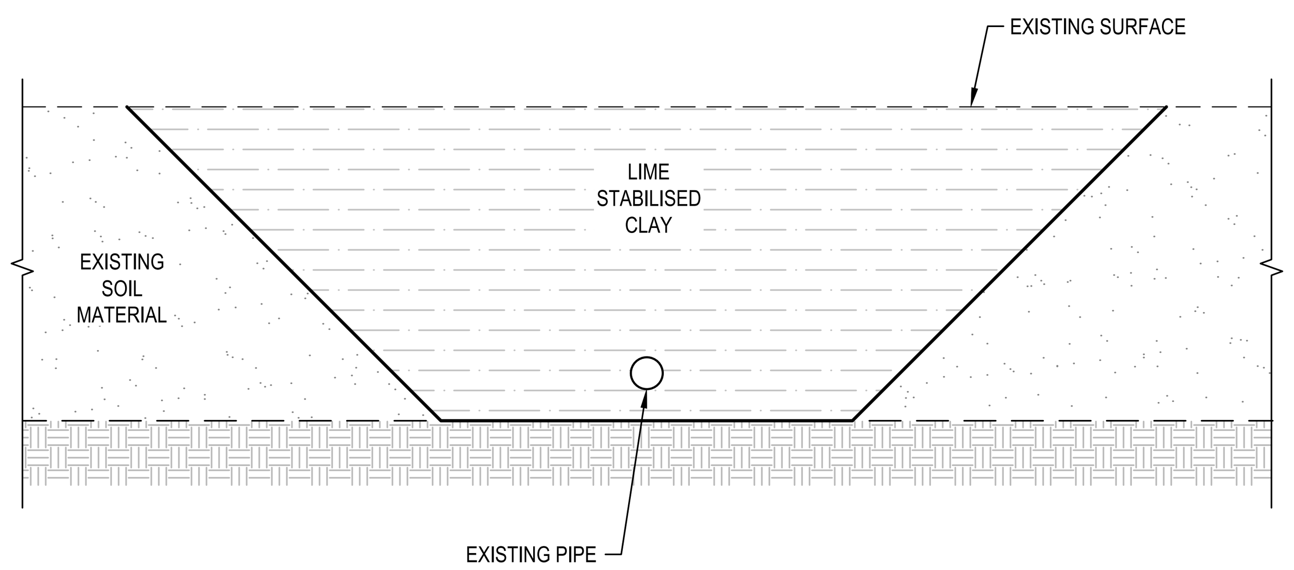
SCALE A1 - 1 : 50
A3 - 1 : 100



SECTION 1
SCALE 1:20



SECTION 2
SCALE 1:20



SECTION 3
SCALE 1:20

EXISTING SERVICE THROUGH LEVEE

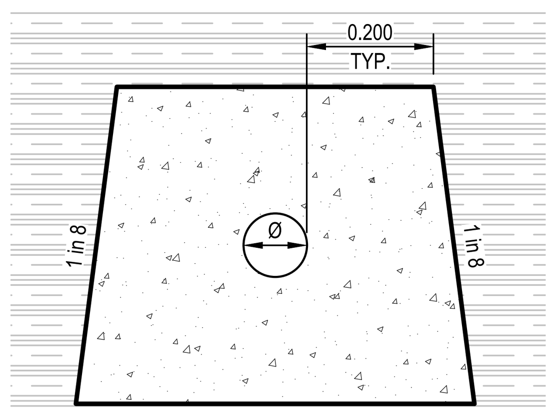
TYPICAL CROSS SECTIONS

SCALE A1 - 1 : 20
A3 - 1 : 40

INLET AND OUTLET PIPES DETAILS:

CARE NEEDS TO BE TAKEN IN THE CONSTRUCTION OF ANY PIPES THROUGH THE EMBANKMENTS OR CUT SIDE SLOPES. THESE SHOULD BE AVOIDED, WHERE POSSIBLE, AND PARTICULAR CARE NEEDS TO BE TAKEN IN THE CONSTRUCTION OF THESE PIPES AND TRENCHES AS UNCONTROLLED WATER FLOW THROUGH THESE ZONES CAN RESULT IN PIPING FAILURES. ALL PIPES THAT RUN UNDERNEATH OR THROUGH EMBANKMENTS SHOULD BE LAID INTO A BED OF CONCRETE FOR THE FULL LENGTH OF THE PIPE. THE PIPE SHOULD BE FULLY ENCASED FOR THE FULL WIDTH OF THE EMBANKMENT EXTENDING AT LEAST 1.0m EITHER SIDE INTO THE NATURAL CLAYS.

- THE TRENCH, EXCAVATED FOR THE PIPELINE, SHOULD BE BATTERED BACK AT A 1:1 SLOPE OR FLATTER AND FULLY COMPACTED WHEN BACKFILLED.
- STEEL AND PLASTIC PIPES SHOULD HAVE WELDED OR FLANGED JOINTS. CONCRETE PIPES SHOULD HAVE RUBBER RING JOINTS.
- THE PIPES SHOULD HAVE SUITABLE LONG-TERM CORROSION PROTECTION.
- THE WIDTH OF THE TRENCH SHOULD PROVIDE A MINIMUM SPACE OF 600 MM AT THE BASE OF THE CONCRETE CRADLE/ ENCASEMENT TO FACILITATE GOOD COMPACTION. THE SIDES OF THE TRENCH SHOULD BE BATTERED TO FLATTER THAN 1(H): 1(V).
- WHERE INLET PIPES ENTER THE LEVEE FROM AN AREA OF CUT THEN THE TRENCH AROUND THE PIPE SHOULD BE BACKFILLED WITH LIME STABILISED CLAY MATERIAL TO MINIMISE THE POTENTIAL FOR EROSION AROUND THE PIPE.
- IN AREAS WHERE INLET OR OUTLET WATER PIPES EXIT THE EMBANKMENTS OR CUT SIDE SLOPES, IT IS IMPORTANT THAT THE COMPLETE BACKFILLING AND COMPACTION AROUND THE UPSTREAM SECTION OF THE PIPES IS ACHIEVED AS IT IS PARTICULARLY SUSCEPTIBLE TO PIPING FAILURE IF POORLY COMPACTED.
- EXCAVATIONS FOR PIPE INSTALLATIONS SHOULD NOT BE LEFT OPEN FOR LONG PERIODS ALLOWING THE EXPOSED CLAYS TO DRY AND DEVELOP SHRINKAGE CRACKS.



DETAIL A
SCALE 1:10

NOTE:

1. REFER TO DRAWING 300203886-WE-3001 FOR GENERAL NOTES.
2. REFER TO DRAWING 300203886-WE-3050 FOR LAYOUT KEY PLAN.
3. REFER TO DRAWINGS 300203886-WE-3101 & 3102 FOR ALIGNMENT LAYOUT PLANS.
4. REFER TO DRAWING 300203886-WE-3255 FOR LONGITUDINAL SECTION.
5. REFER TO DRAWINGS 300203886-WE-3312 TO 3313 FOR CROSS SECTIONS.
6. REFER TO DRAWING 300203886-WE-3454 FOR GEOTECHNICAL NOTES AND DETAILS.
7. REFER TO DRAWINGS 300203886-WE-3700 TO 3721 FOR STRUCTURAL NOTES AND DETAILS.

Rev.	Date	Description	Des.	Verif.	Appd.
A	10/05/2024	TENDER ISSUE	VZ		AS

SCALE 1:10 (0, 0.2, 0.4m) @A1
SCALE 1:20 (0, 0.5, 0.8m) @A1
SCALE 1:50 (0, 1, 2m) @A1

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Drawn AJH	Date 25/03/2024	
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Designed AS	Date 23/04/24	
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Approved	Date	

Client: GREATER HUME SHIRE COUNCIL

Project: HHC FLOOD LEVEE DESIGN
HOLBROOK, HENTY
& CULCAIRN

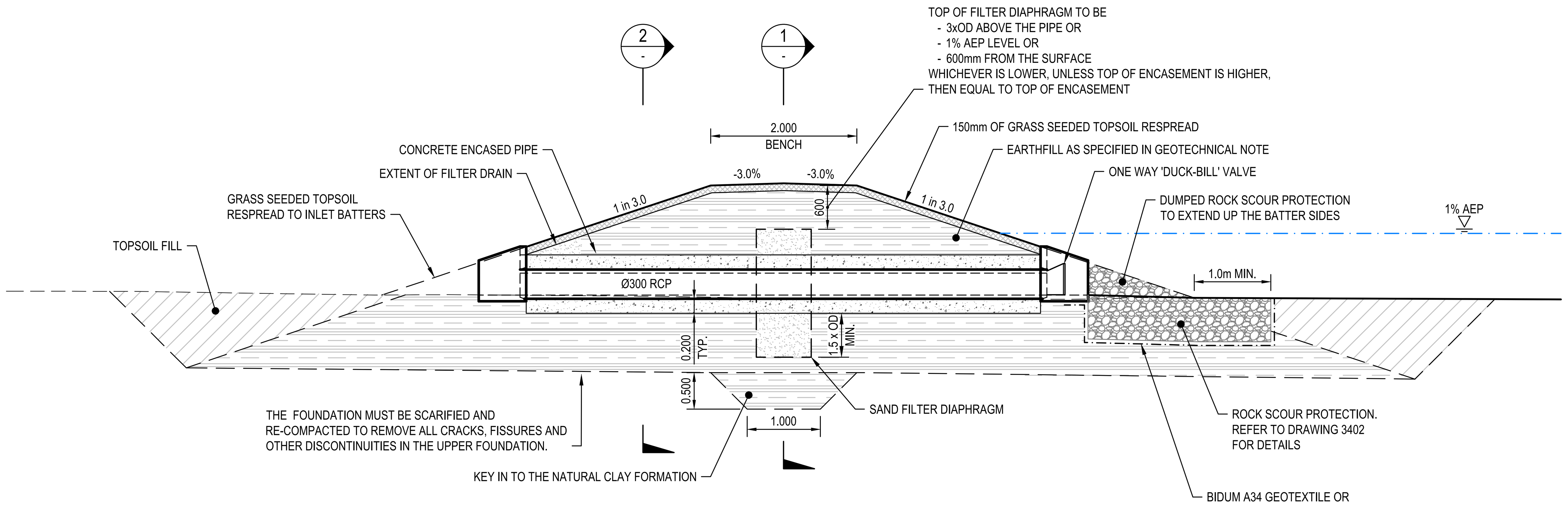
Title: TYPICAL SECTIONS AND DETAILS
SERVICE CROSSING
GEOTECHNICAL DETAILS

Status: FOR TENDER ONLY
NOT TO BE USED FOR CONSTRUCTION PURPOSES

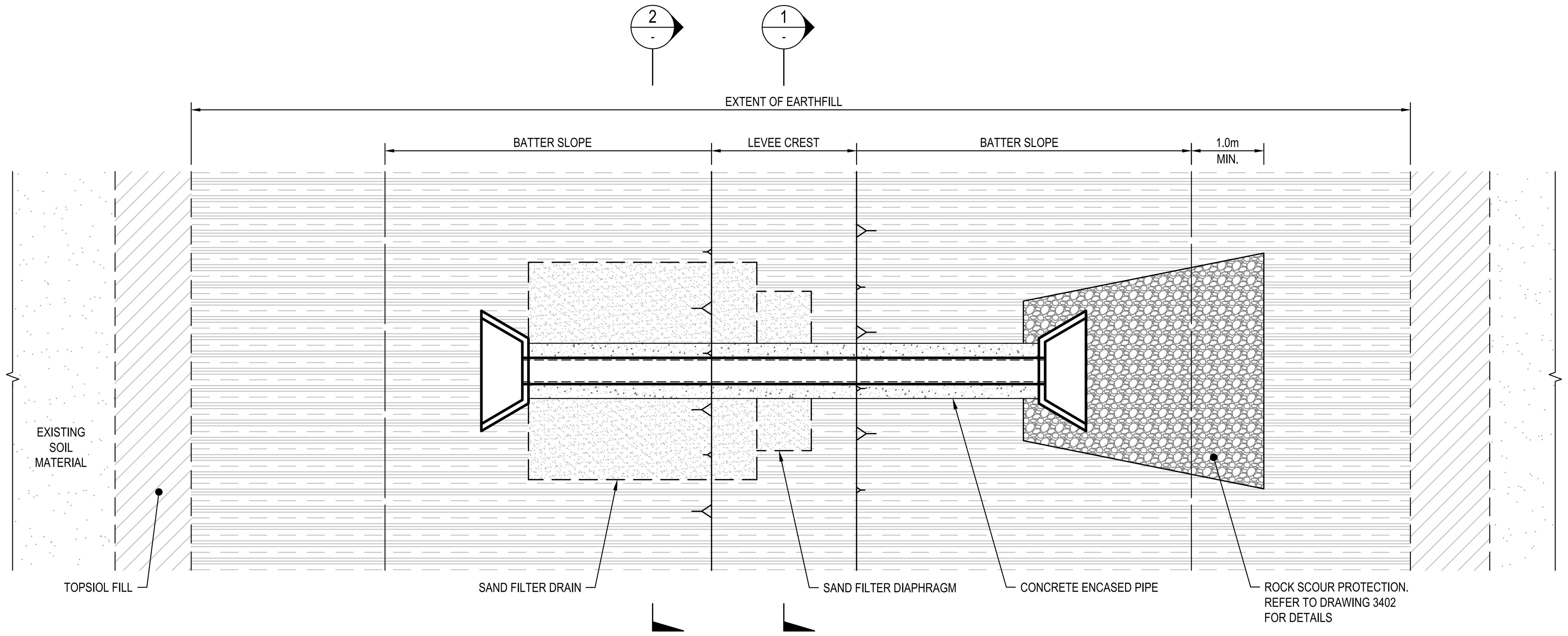
VERT. DATUM	HORZ. DATUM	Scale	Size
AHD	MGA	AS SHOWN	A1

Drawing Number: 300203886-WE-3456
Revision: A

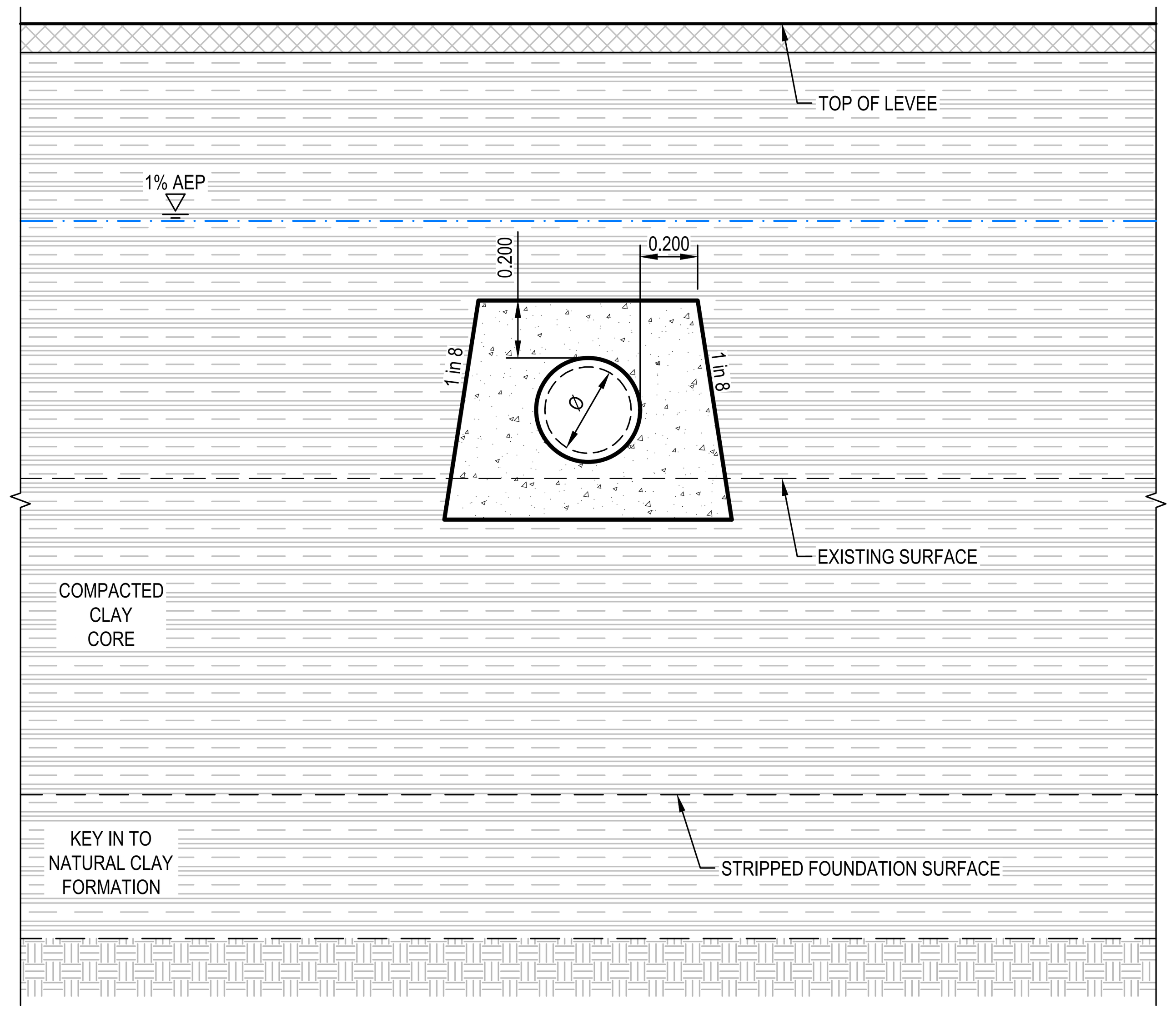
XREF's:
CAD File: \\au2013-ppfss01\shared_projects\300203886\300 Levee Design\300203886-WE-3450-3457.dwg



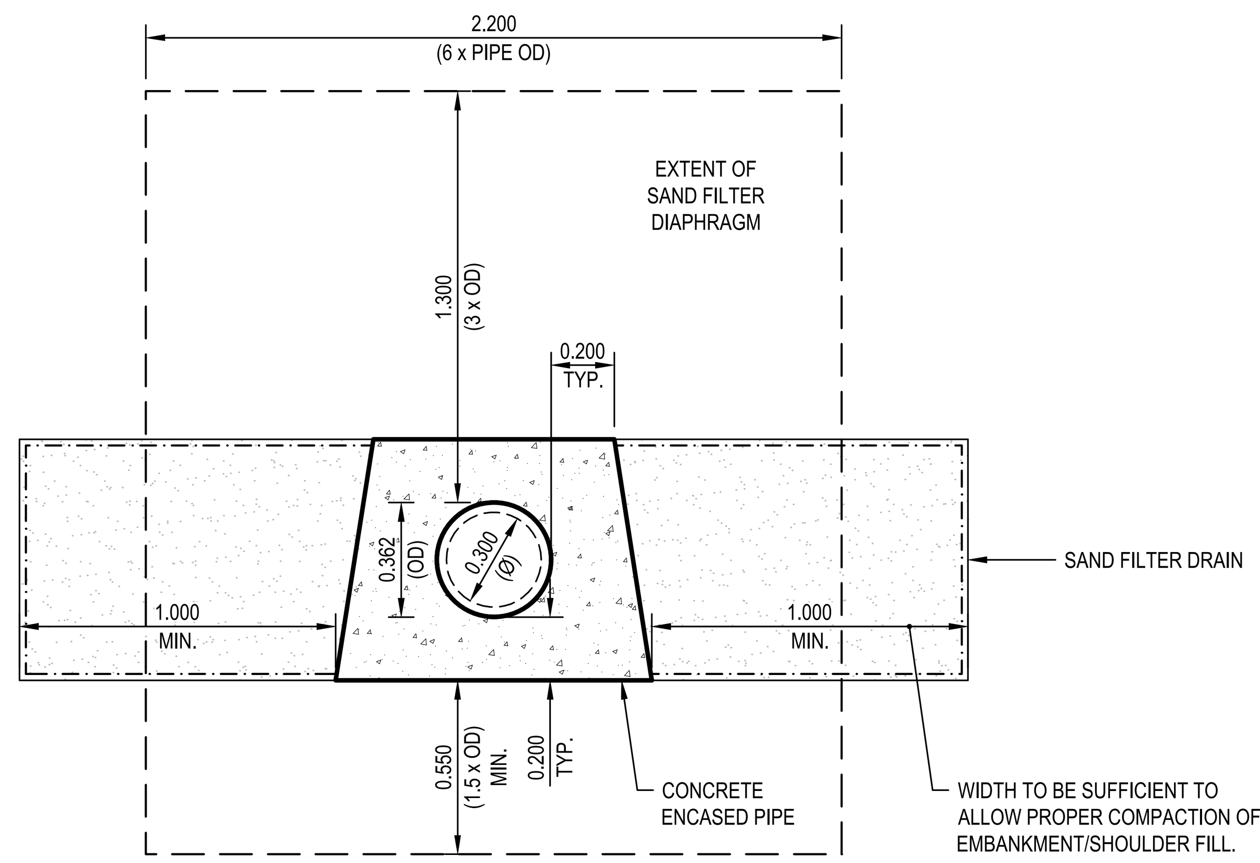
STORMWATER PIPE THROUGH LEVEE
LONGITUDINAL SECTIONS
SCALE A1 - 1 : 50
A3 - 1 : 100



STORMWATER PIPE THROUGH LEVEE
PLAN
SCALE A1 - 1 : 50
A3 - 1 : 100



SECTION 1
SCALE 1:20



SECTION 2
SCALE 1:20

STORMWATER PIPE THROUGH LEVEE
TYPICAL CROSS SECTIONS
SCALE A1 - 1 : 20
A3 - 1 : 40

INLET AND OUTLET PIPES DETAILS:

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- THE PIPES SHOULD HAVE SUITABLE LONG-TERM CORROSION PROTECTION.
- THE WIDTH OF THE TRENCH SHOULD PROVIDE A MINIMUM SPACE OF 600 MM AT THE BASE OF THE CONCRETE CRADLE/ ENCASEMENT TO FACILITATE GOOD COMPACTION. THE SIDES OF THE TRENCH SHOULD BE BATTERED TO FLATTER THAN 1(H): 1(V).
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- EXCAVATIONS FOR PIPE INSTALLATIONS SHOULD NOT BE LEFT OPEN FOR LONG PERIODS ALLOWING THE EXPOSED CLAYS TO DRY AND DEVELOP SHRINKAGE CRACKS.

NOTE:

1. REFER TO DRAWING 300203886-WE-3001 FOR GENERAL NOTES.
2. REFER TO DRAWING 300203886-WE-3050 FOR LAYOUT KEY PLAN.
3. REFER TO DRAWINGS 300203886-WE-3101 & 3102 FOR ALIGNMENT LAYOUT PLANS.
4. REFER TO DRAWING 300203886-WE-3255 FOR LONGITUDINAL SECTION.
5. REFER TO DRAWINGS 300203886-WE-3312 TO 3313 FOR CROSS SECTIONS.
6. REFER TO DRAWING 300203886-WE-3454 FOR GEOTECHNICAL NOTES AND DETAILS.
7. REFER TO DRAWINGS 300203886-WE-3700 TO 3721 FOR STRUCTURAL NOTES AND DETAILS.

Rev.	Date	Description	Des.	Verif.	Appd.
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SCALE 1:20 @A1 (0, 0.5, 0.8m)
SCALE 1:50 @A1 (0, 1, 2m)

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Drawn	AJH	25/03/2024
Checked	RS	23/04/24
Designed	AS	23/04/24
Verified		
Approved		

Client: GREATER HUME SHIRE COUNCIL
Project: HHC FLOOD LEVEE DESIGN HOLBROOK, HENTY & CULCAIRN
Title: TYPICAL SECTIONS AND DETAILS STORMWATER PIPE CROSSING GEOTECHNICAL DETAILS

Status: FOR TENDER ONLY
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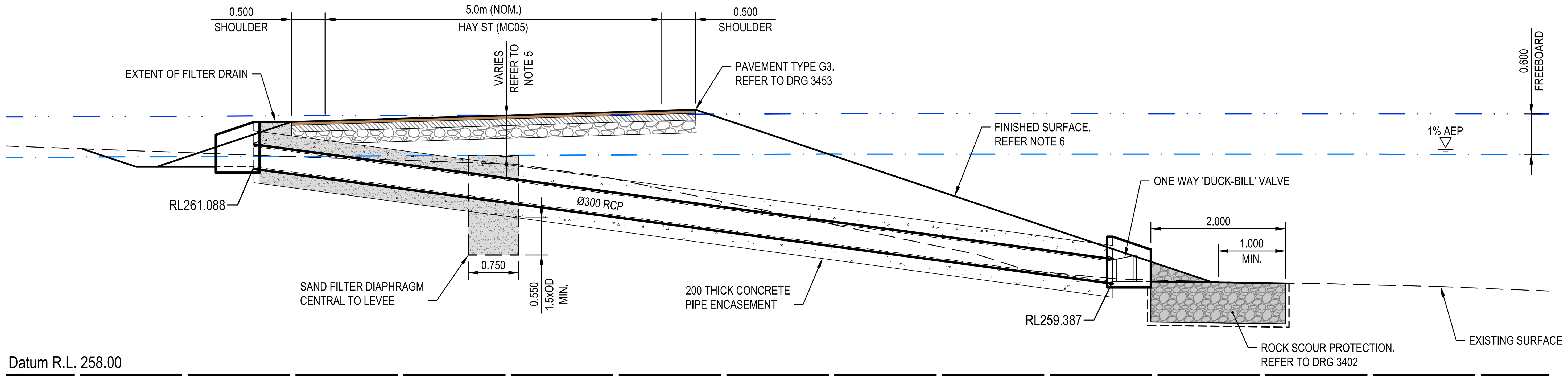
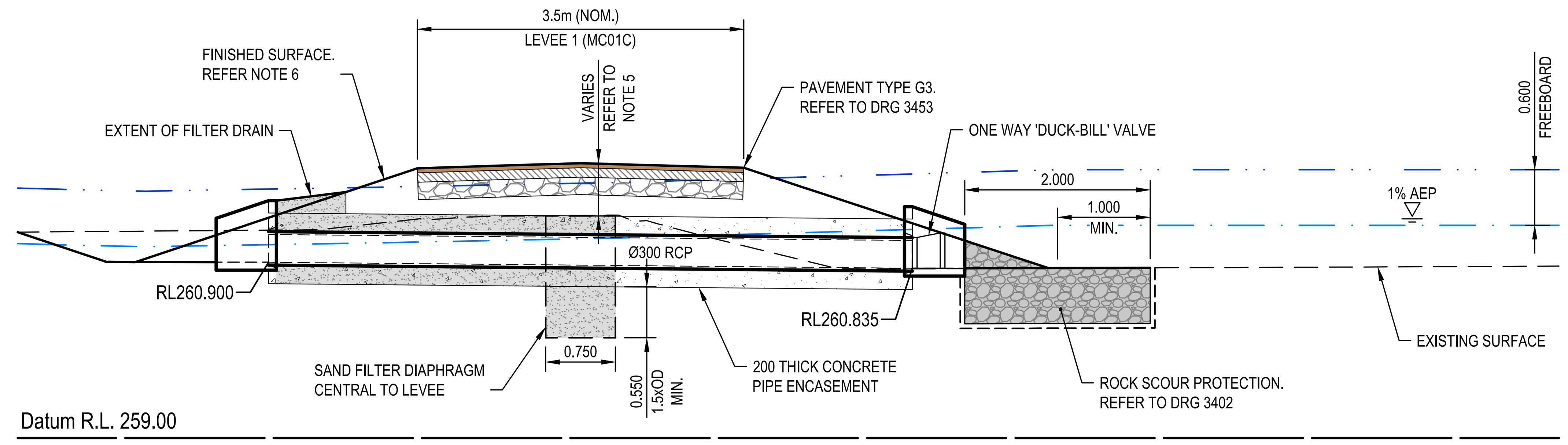
VERT. DATUM	HORZ. DATUM	Scale	Size
AHD	MGA	AS SHOWN	A1

Drawing Number: 300203886-WE-3457
Revision: A



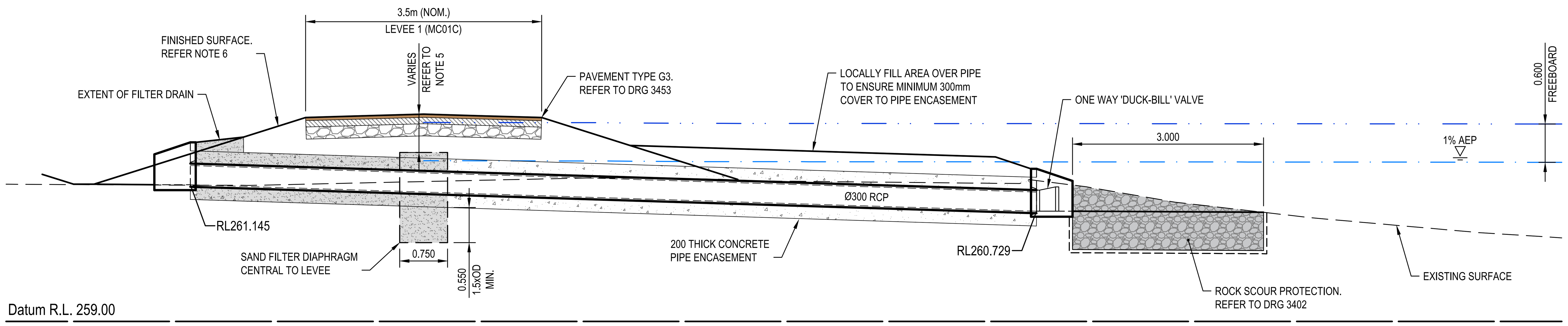
PIPE 03 TO 04

SCALE 1:50



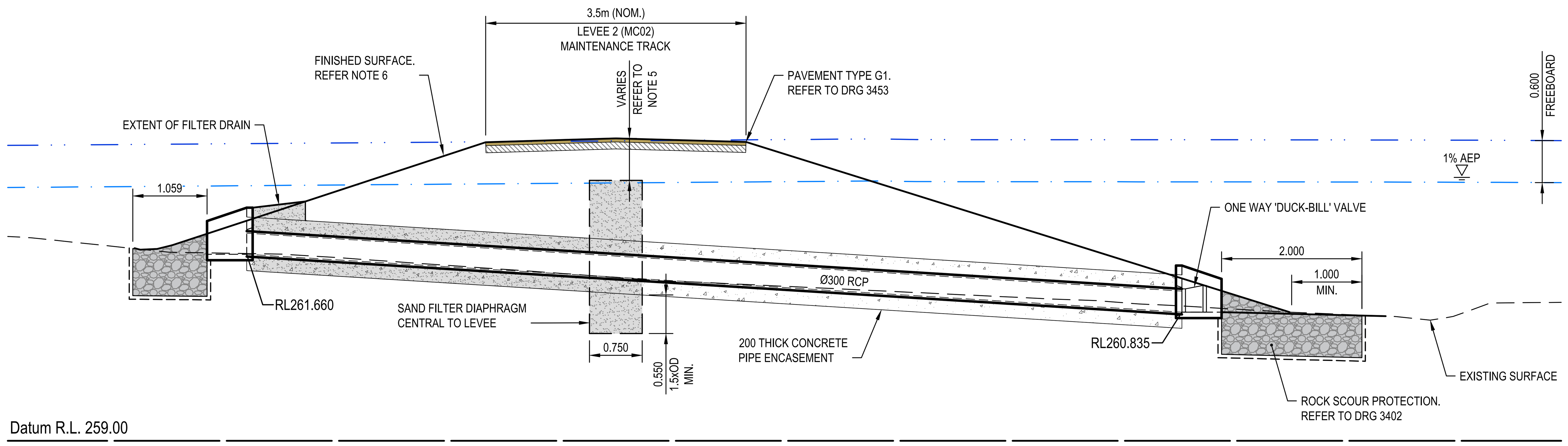
PIPE 05 TO 06

SCALE 1:50



PIPE 07 TO 08

SCALE 1:50



PIPE 17 TO 18

SCALE 1:50

NOTES:

1. REFER TO DRAWING 300203886-WE-3001 FOR GENERAL NOTES.
2. REFER TO DRAWINGS 300203886-WE-3111 TO 3153 FOR LEVEE LAYOUT PLANS.
3. REFER TO DRAWINGS 300203886-WE-3400 TO 3402 FOR DRAINAGE LONGITUDINAL SECTIONS AND DETAILS.
4. REFER TO DRAWINGS 300203886-WE-3450 TO 3457 FOR TYPICAL SECTIONS AND DETAILS.
5. TOP OF FILTER DIAPHRAGM TO BE
   - 3xOD ABOVE THE PIPE, OR
   - 1% AEP LEVEL, OR
   - 600mm FROM THE SURFACE

   WHICHEVER IS LOWER, UNLESS TOP OF ENCASEMENT IS HIGHER, THEN EQUAL TO TOP OF ENCASEMENT.
6. CONTRACTOR TO DETERMINE APPROPRIATE CLAY CORE CONSTRUCTION TYPE BASED ON GEOTECHNICAL ENGINEER'S TYPICAL CONSTRUCTION METHODOLOGY AS SHOWN ON DRAWINGS 3455 TO 3457

DATE PLOTTED: 10 May 2024 10:43 AM BY : HAZELGROVE, ADAM

XREFs: XR-03886-ALGN-CHNG; XR-03886-BASE-HOL; XR-03886-SURV-PWD; XR-03886-VIC-MAP; XR-03886-LEGEND; XR_03886_SU_BYDA_ELEC; XR_03886_SU_BYDA_SERV; XR_03886_SU_BYDA_COMM; XR_03886_SU_BYDA_STRM
CAD File: \\au2013-ppfss01\shared_projects\300203886\300 Levee Design\300203886-WE-3460.dwg

Rev.	Date	Description	Des.	Verif.	Appd.
A	10/05/2024	TENDER ISSUE	VZ		AS

0 1 2m
SCALE 1:50 @A1

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Drawn	AJH	25/03/2024
Checked	RS	23/04/24
Designed	AS	23/04/24
Verified		Date
Approved		Date

Client: GREATER HUME SHIRE COUNCIL

Project: HHC FLOOD LEVEE DESIGN
HOLBROOK, HENTY
& CULCAIRN

Title: TYPICAL SECTIONS AND DETAILS
STORMWATER PIPE CROSSING
SAND FILTER DIAPHRAGM DETAILS

Status: FOR TENDER ONLY
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VERT. DATUM	HORZ. DATUM	Scale	Size
AHD	MGA	AS SHOWN	A1

Drawing Number: 300203886-WE-3460 | Revision: A

DESIGN AND CONSTRUCT NOTE:

DRAINAGE CULVERTS

SUPPLY, DESIGN, INSTALLATION AND CERTIFICATION OF CULVERTS, HEADWALLS AND BASE SLAB BY SPECIALIST CONTRACTOR / CONSULTING ENGINEER.

CONCRETE LEVEE WALL

SUPPLY, DESIGN, INSTALLATION AND CERTIFICATION OF CONCRETE LEVEE WALL AND FOOTINGS BY CONTRACTOR

PAVEMENT MARKING TYPES

ID.	TYPE	EXAMPLE	WIDTH	DESCRIPTION
DBL	Barrier Line (Both Directions)		80mm Lines 80mm Gap	Double Line, Continuous
BLL	Lane Line (Broken)		100mm	3.0 Metre Line, 9.0 Metre Gap
EL	Edge Line		150mm	Continuous
TL	Turn Lines		100mm	0.6 Metre Line, 0.6 Metre Gap
GWL	Give Way Line		300mm	0.6 Metre Line, 0.6 Metre Gap

LEGEND

- FINISHED SURFACE CONTOUR - MAJOR
- FINISHED SURFACE CONTOUR - MINOR
- EXISTING SURFACE CONTOUR - MAJOR
- EXISTING SURFACE CONTOUR - MINOR
- DESIGN CENTRELINE
- PROPOSED TOP OF BATTER
- PROPOSED BOTTOM OF BATTER
- PROPOSED SWALE DRAIN
- PROPOSED DRAINAGE PIPE
- PROPOSED FENCE
- PROPOSED GUARDRAIL
- SIGN POST / GUIDE POST
- PROPERTY BOUNDARY - SURVEY
- PROPERTY BOUNDARY - VICMAP
- EXISTING TREE
- EXISTING SWALE DRAIN
- EXISTING GAS (BYDA)
- EXISTING SEWER (BYDA)
- EXISTING WATER RETICULATION (BYDA)
- EXISTING STORMWATER PIPE (BYDA)
- EXISTING LOW VOLTAGE - UNDERGROUND
- EXISTING LOW VOLTAGE - OVERHEAD
- EXISTING HIGH VOLTAGE - OVERHEAD
- EXISTING TELECOMMUNICATIONS
- SURVEY QUALITY LEVEL
- UTILITY TYPE
- GRASS - TURFED
- LEVEE BENCH
- LEVEE BATTER - GRASS SEEDED
- ASPHALT PAVEMENT - P1
- ASPHALT PAVEMENT - P2
- ROCK BEACHING

WARNING

BEWARE OF UNDERGROUND SERVICES
THE LOCATION OF UNDERGROUND SERVICES HAVE BEEN INTERPOLATED FROM GIS DATA OR KNOWN POSITIONS OF VALVES, MANHOLES ETC. OR INFORMATION SUPPLIED BY SERVICE AUTHORITIES. NO RESPONSIBILITY IS TAKEN FOR THE ACCURACY OF THE INTERPOLATED INFORMATION SUPPLIED. ENSURE ALL SERVICES ARE ACCURATELY LOCATED PRIOR TO COMMENCEMENT OF WORK

CULVERT & ROAD LAYOUT PLAN

SCALE 1:250

Rev.	Date	Description	Des.	Verif.	Appd.
A	10/05/2024	TENDER ISSUE	VZ		AS

NORTH

0 5 10m
SCALE 1:250 @A1

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Drawn	AJH	25/03/2024
Checked	VZ	23/04/24
Designed	SP	23/04/24
Verified		
Approved		

Client: GREATER HUME SHIRE COUNCIL

Project: HHC FLOOD LEVEE DESIGN
HOLBROOK, HENTY
& CULCAIRN

Title: CULVERT & ROAD LAYOUT PLAN

Status: FOR TENDER ONLY
NOT TO BE USED FOR CONSTRUCTION PURPOSES

VERT. DATUM	HORZ. DATUM	Scale	Size
AHD	MGA	AS SHOWN	A1

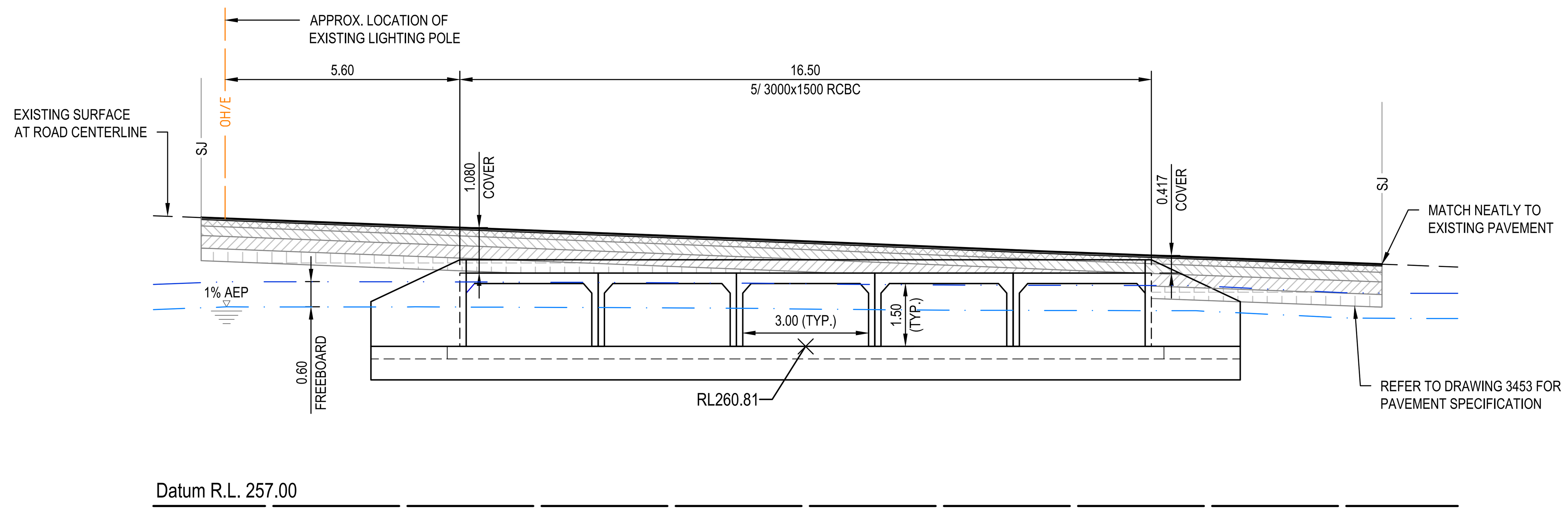
Drawing Number: 300203886-WE-3500
Revision: A

DATE PLOTTED: 10 May 2024 10:51 AM BY : HAZELGROVE, ADAM

CAD File: \\au2013-ppfss01\shared_projects\300203886\300 Levee Design\300203886-WE-3500-3506.dwg

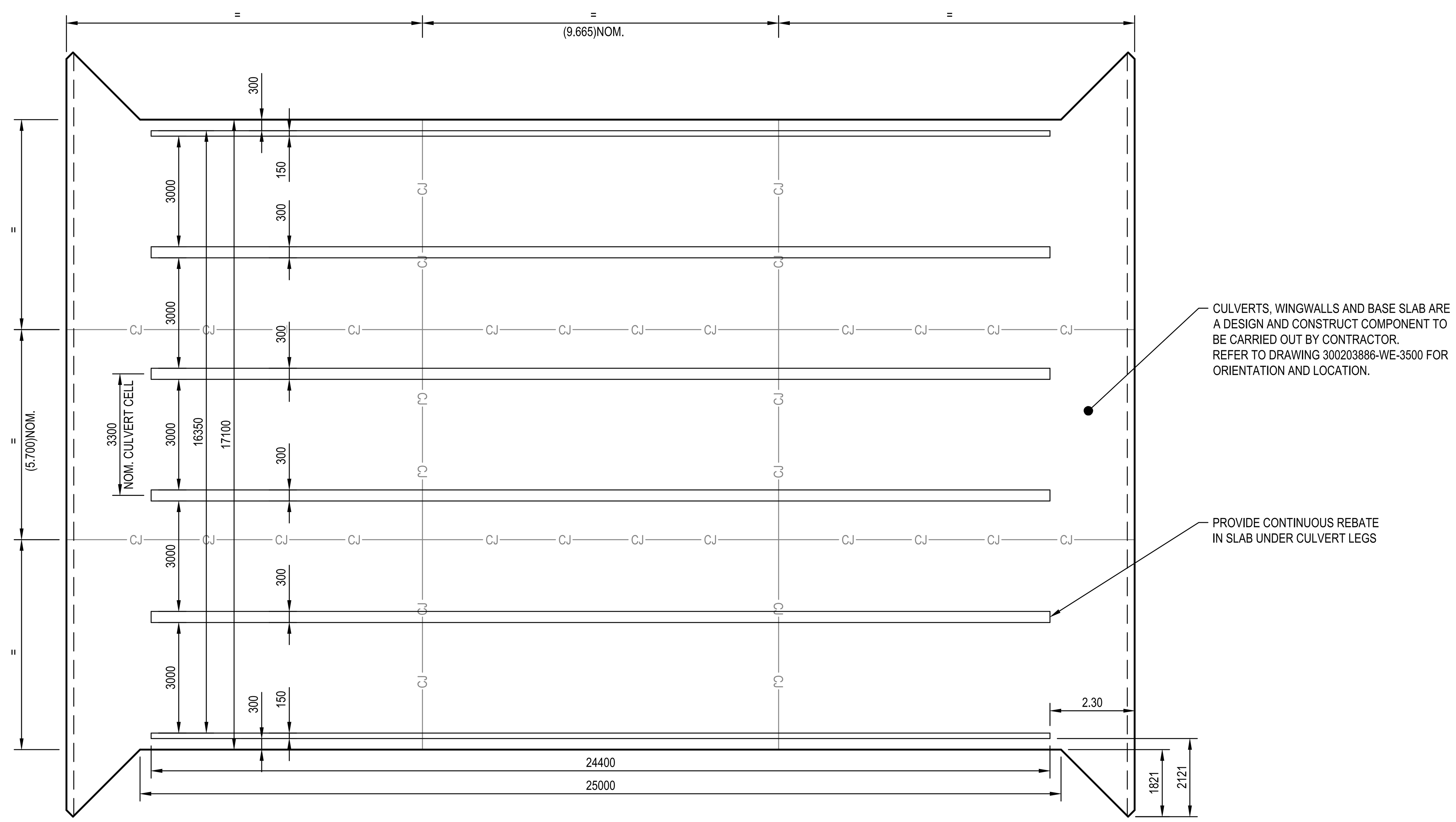
DATE PLOTTED: 10 May 2024 2:43 PM BY : HAZELGROVE, ADAM

SECTION 1 / 3500
SCALE 1:100



SECTION 2
SCALE 1:100

NOTE: REFER TO DRAWING 3453 FOR PAVEMENT SPECIFICATIONS AND MATCHING TO EXISTING PAVEMENT DETAILS



CONCRETE BASE SLAB
SCALE 1:100

NOTE:
PRECAST CONCRETE CULVERTS & LINK SLAB AS PER MANUFACTURER'S SPECIFICATION. TO BE SOURCED BY CONTRACTOR.
CULVERTS AND LINK SLABS TO BE DESIGNED IN ACCORDANCE WITH AS5100 AND AS1597.2. WHERE DISCREPANCIES EXIST BETWEEN THESE TWO STANDARDS, AS5100 IS TO TAKE PRECEDENCE.
SUPPLIER TO PROVIDE CERTIFICATION TO THE BUILDING SURVEYOR AND RELEVANT AUTHORITIES SATISFACTION THAT THEIR CULVERTS COMPLY WITH ALL RELEVANT AUSTRALIAN STANDARDS.
AS A MINIMUM , THE CULVERTS/LINK SLAB ARE TO BE DESIGNED FOR THE FOLLOWING:
- WEIGHT OF SOIL ABOVE THE CULVERT/LINK SLAB UNITS
- LOADS IMPOSED DURING CONSTRUCTION (COMPACTION LOADS ETC.)
- LIVE LOADS DUE TO TRAFFIC LOADING 15kPa (VERTICAL)
- LATERAL LOADS ON SIDES OF END CULVERTS DUE TO LATERAL EARTH PRESSURES IMPOSED FROM THE FILL MATERIAL TO THE SIDE OF AND ABOVE THE CULVERT.

DESIGN AND CONSTRUCT NOTE:
SUPPLY, DESIGN, INSTALLATION AND CERTIFICATION OF CULVERTS, HEADWALLS AND BASE SLAB BY SPECIALIST CONTRACTOR / CONSULTING ENGINEER

XREFs: XR-03886-VIC-MAP; XR-03886-HOLBROOK-IMAGE; XR-03886-CONT-E-HOL; XR-03886-SURV-HB2; XR_03886_SU_BYDA_STRM; XR_03886_SU_BYDA_COMM; XR_03886_SU_BYDA_ELEC; XR_03886_SU_BYDA_SERV; XR-03886-SURV-PWD; XR-03886-ALGN-CHNG; XR-03886-LEGEND; XR-03886-BASE-HOL
CAD File: \\au2013-ppfss01\shared_projects\300203886\300 Levee Design\300203886-WE-3500-3506.dwg

Rev.	Date	Description	Des.	Verif.	Appd.
A	10/05/2024	TENDER ISSUE	VZ		AS

SCALE 1:10 @A1 (0, 0.2, 0.4m)
SCALE 1:20 @A1 (0, 0.5, 0.8m)
SCALE 1:100 @A1 (0, 1, 2, 4m)

Greater Hume Council

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Stantec Australia Pty Ltd | ABN 17 007 820 322
Level 4, 501 Swanston Street
Melbourne VIC 3000
Tel: 03 8415 7777
Web: www.stantec.com/au

Drawn AJH	Date 25/03/2024	
Checked VZ	Date 23/04/24	
Designed SP	Date 23/04/24	
Verified	Date	
Approved	Date	

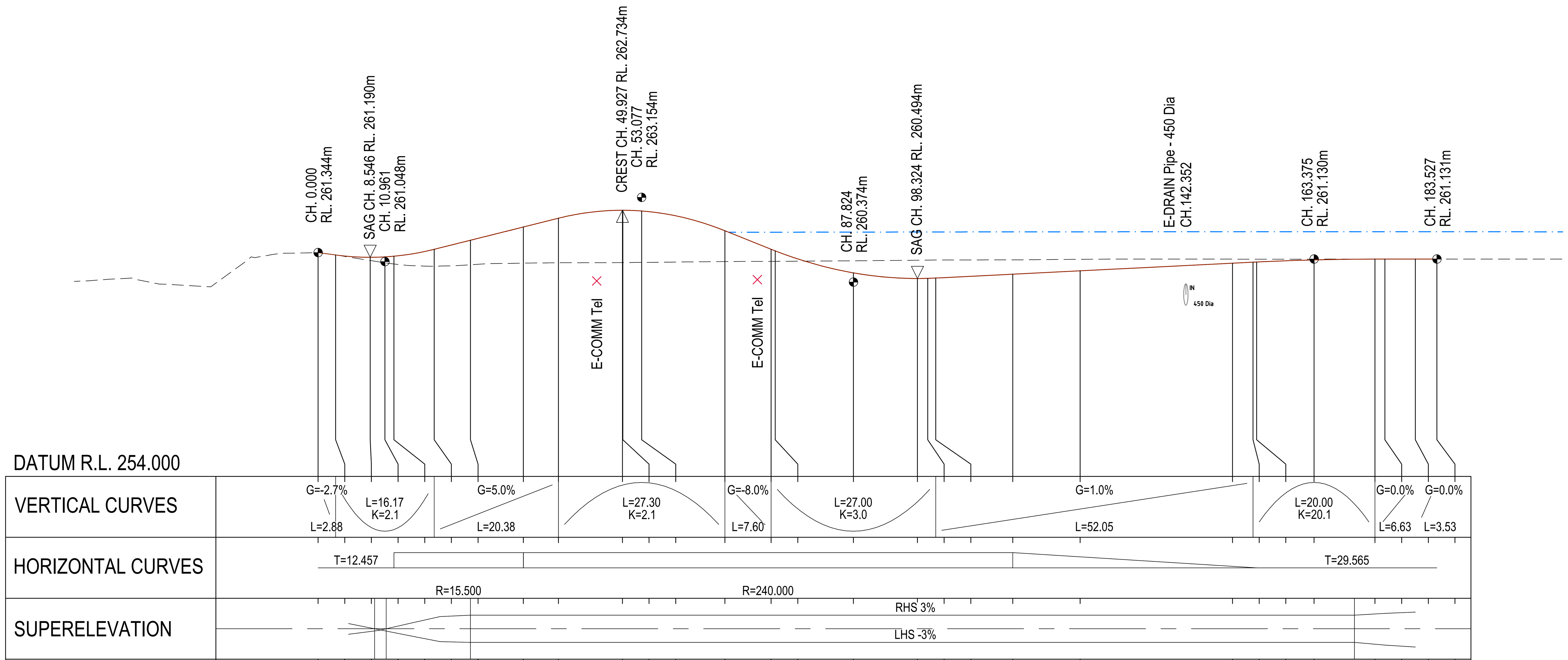
Client: GREATER HUME SHIRE COUNCIL
Project: HHC FLOOD LEVEE DESIGN HOLBROOK, HENTY & CULCAIRN
Title: CULVERT SECTIONS & DETAILS
Status: FOR TENDER ONLY — NOT TO BE USED FOR CONSTRUCTION PURPOSES

VERT. DATUM	HORZ. DATUM	Scale	Size
AHD	MGA	AS SHOWN	A1

Drawing Number: 300203886-WE-3501 — Revision: A

ROAD - MC10 HORIZONTAL POINTS

PT	CHAINAGE	EASTING	NORTHING	HEIGHT	BEARING	RAD/SPIRAL	A.LENGTH	DEFL.ANGLE	L.TANGENT	S.TANGENT	L.TANGENT 2	S.TANGENT 2
IP 1	0.000	527889.578	6045797.906	261.344	121°35'00.80"							
TC	12.457	527900.190	6045791.382	261.226	121°35'00.80"							
IP 2	23.067	527910.966	6045784.757	261.653		R = 15.500	21.219	78°26'10.34"				
CC	33.676	527906.636	6045772.871	262.184	200°01'11.15"							
IP 3	84.474	527888.981	6045724.418	260.814		R = 240.000	80.286	23°56'29.56"				
CS	113.963	527867.160	6045703.390	260.635	219°11'12.09"	L = 40.000			70.255	50.886	26.676	13.342
ST	153.962	527840.212	6045673.847	261.035	223°57'40.71"							
IP 4	183.527	527819.689	6045652.566	261.131	223°57'40.71"							



DESIGN LEVELS	EXISTING LEVELS	CHAINAGE
261.344	261.344	0.000
261.266	261.268	2.876
261.190	261.084	8.546
261.204	261.008	10.961
261.226	260.969	12.457
261.452	260.897	19.046
261.750	260.946	25.000
262.184	260.999	33.676
262.471	261.011	39.427
262.734	261.018	49.927
262.734	261.018	50.000
262.710	261.023	53.077
262.062	261.051	66.727
261.454	261.059	74.324
261.401	261.060	75.000
260.678	261.074	87.824
260.494	261.096	98.324
260.499	261.099	100.000
260.509	261.102	101.324
260.635	261.107	113.963
260.746	261.125	125.000
260.996	261.129	150.000
261.030	261.128	153.375
261.035	261.128	153.962
261.105	261.129	163.375
261.130	261.130	173.375
261.130	261.130	175.000
261.131	261.131	180.000
261.131	261.131	183.527

BETHANA LN
LONGITUDINAL SECTION - MC10

WARNING
BEWARE OF UNDERGROUND SERVICES
THE LOCATION OF UNDERGROUND SERVICES ARE APPROXIMATE ONLY AND THEIR EXACT POSITION SHOULD BE PROVEN ON SITE. NO GUARANTEE IS GIVEN THAT ALL EXISTING SERVICES ARE SHOWN.

CONTRACTOR TO VERIFY EXISTING SERVICES CONNECTION LEVELS PRIOR TO CONSTRUCTION. ANY DISCREPANCIES MUST BE IMMEDIATELY IDENTIFIED AND THE SUPERINTENDENT NOTIFIED PRIOR TO CONSTRUCTION COMMENCING.

DATE PLOTTED: 10 May 2024 10:51 AM BY : HAZELGROVE, ADAM

XREFs: XR-03886-VIC-MAP; XR-03886-HOLBROOK-IMAGE; XR-03886-CONT-E-HOL; XR-03886-SURV-HB2; XR_03886_SU_BYDA_STRM; XR_03886_SU_BYDA_COMM; XR_03886_SU_BYDA_ELEC; XR_03886_SU_BYDA_SERV; XR-03886-SURV-PWD; XR-03886-ALGN-CHNG; XR-03886-LEGEND; XR-03886-BASE-HOL
CAD File: \\au2013-ppfss01\shared_projects\300203886\300 Levee Design\300203886-WE-3500-3506.dwg

Rev.	Date	Description	Des.	Verif.	Appd.
A	10/05/2024	TENDER ISSUE	VZ		AS

H: 0 10 20m
V: 0 2 4m
SCALE H:1:500 V:1:100 @A1

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Level 4, 501 Swanston Street
Melbourne VIC 3000
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Drawn AJH	Date 25/03/2024	
Checked VZ	Date 23/04/24	
Designed SP	Date 23/04/24	
Verified	Date	
Approved	Date	

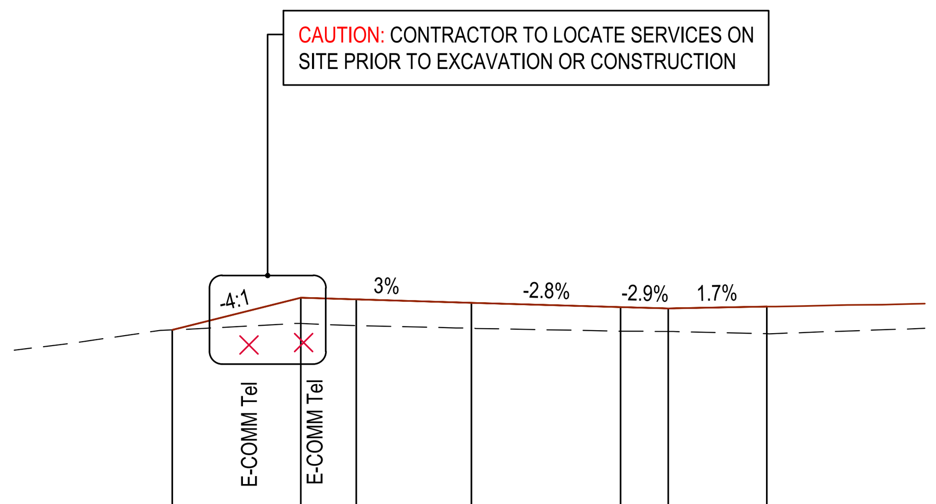
Client: GREATER HUME SHIRE COUNCIL
Project: HHC FLOOD LEVEE DESIGN
HOLBROOK, HENTY
& CULCAIRN
Title: SWALE & ROAD
LONG SECTIONS

Status: FOR TENDER ONLY
NOT TO BE USED FOR CONSTRUCTION PURPOSES

VERT. DATUM	HORZ. DATUM	Scale	Size
AHD	MGA	AS SHOWN	A1

Drawing Number: 300203886-WE-3502
Revision: A

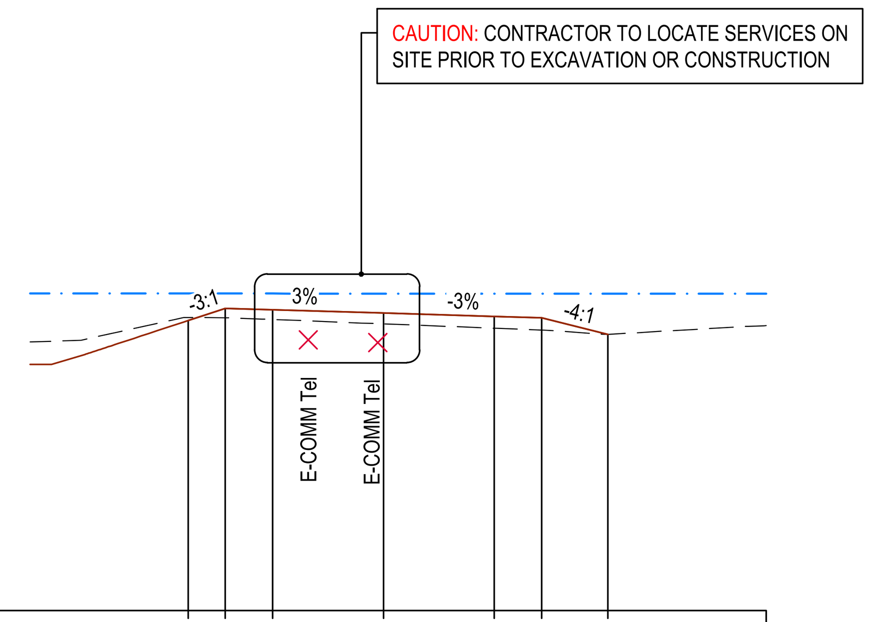
LEGEND
DESIGN CENTRE LINE
Ex 1% AEP FLOOD LEVEL
EXISTING SURFACE



DATUM 253.0

STRING LABELS	IA10	ES10	LE10		LE11	ES11	IA11
DESIGN LEVELS	260.896	261.911	261.859	261.750	261.619	261.575	261.630
EXISTING LEVELS	260.896	261.098	261.032	260.946	260.857	260.844	260.774
OFFSET	-9.457	-5.398	-3.647	0.000	4.712	6.223	9.330

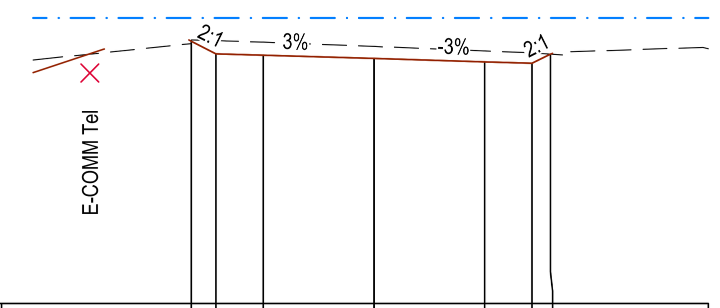
CHAINAGE 25



DATUM 252.0

STRING LABELS	IA10	ES10	LE10		LE11	ES11	IA11
DESIGN LEVELS	261.167	261.551	261.506	261.401	261.296	261.251	260.729
EXISTING LEVELS	261.259	261.255	261.199	261.06	260.924	260.865	260.729
OFFSET	-6.167	-5.000	-3.500	0.000	3.500	5.000	7.089

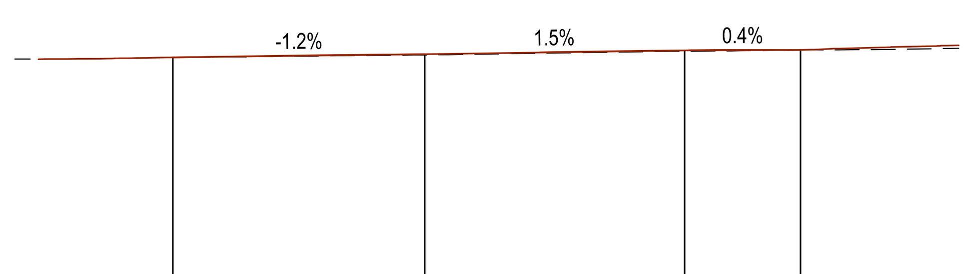
CHAINAGE 75



DATUM 253.0

STRING LABELS	IA10	ES10	LE10		LE11	ES11	IA11
DESIGN LEVELS	261.286	260.896	260.851	260.746	260.641	260.596	260.685
EXISTING LEVELS	261.214	261.314	261.263	261.125	260.987	260.925	260.885
OFFSET	-5.780	-5.000	-3.500	0.000	3.500	5.000	5.579

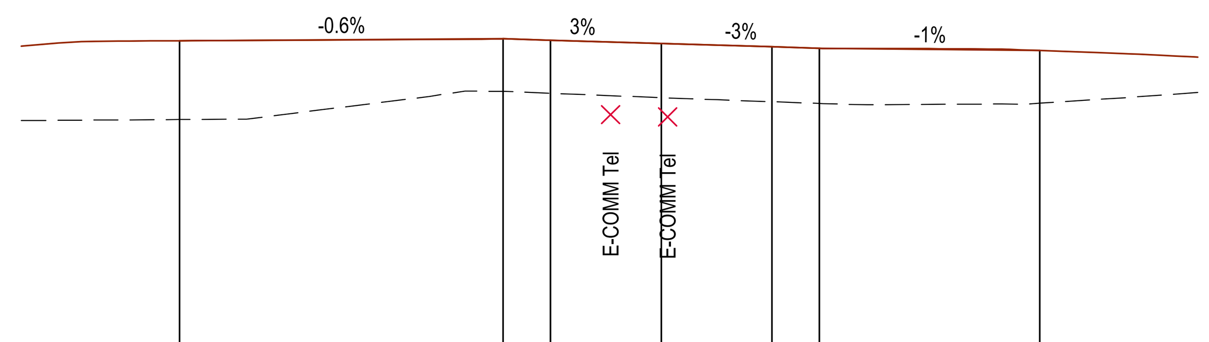
CHAINAGE 125



DATUM 254.0

STRING LABELS	LE10		LE11	ES11 IA11
DESIGN LEVELS	261.121	261.220	261.341	261.357
EXISTING LEVELS	261.123	261.195	261.313	261.357
OFFSET	-7.969	0.000	8.214	11.886

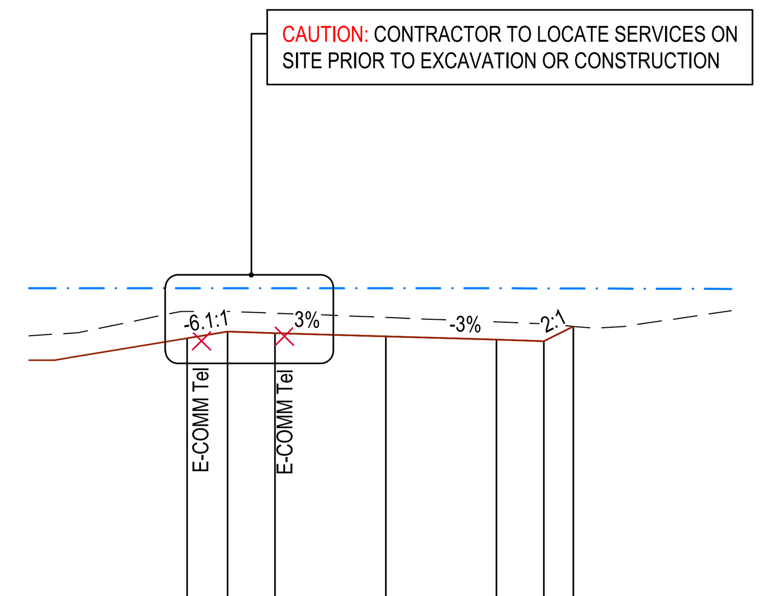
CHAINAGE 5



DATUM 253.0

STRING LABELS	IA10	ES10	LE10		LE11	ES11	IA11
DESIGN LEVELS	262.821	262.884	262.839	262.734	262.629	262.584	262.514
EXISTING LEVELS	260.326	261.217	261.16	261.018	260.892	260.834	260.844
OFFSET	-15.230	-5.000	-3.500	0.000	3.500	5.000	11.961

CHAINAGE 50



DATUM 252.0

STRING LABELS	IA10	ES10	LE10		LE11	ES11	IA11
DESIGN LEVELS	260.438	260.649	260.604	260.499	260.394	260.349	260.812
EXISTING LEVELS	261.288	261.288	261.233	261.099	260.957	260.896	260.812
OFFSET	-6.278	-5.000	-3.500	0.000	3.500	5.000	5.926

CHAINAGE 100

BETHANA LN (MC10)

WARNING
BEWARE OF UNDERGROUND SERVICES
THE LOCATION OF UNDERGROUND SERVICES ARE APPROXIMATE ONLY AND THEIR EXACT POSITION SHOULD BE PROVEN ON SITE. NO GUARANTEE IS GIVEN THAT ALL EXISTING SERVICES ARE SHOWN.

CONTRACTOR TO VERIFY EXISTING SERVICES CONNECTION LEVELS PRIOR TO CONSTRUCTION. ANY DISCREPANCIES MUST BE IMMEDIATELY IDENTIFIED AND THE SUPERINTENDENT NOTIFIED PRIOR TO CONSTRUCTION COMMENCING.

Rev.	Date	Description	Des.	Verif.	Appd.
A	10/05/2024	TENDER ISSUE	VZ		AS

0 5 8m
H 1:200 @A1

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		Date
Drawn	AJH	25/03/2024
Checked	VZ	23/04/24
Designed	SP	23/04/24
Verified		
Approved		

Client: GREATER HUME SHIRE COUNCIL
Project: HHC FLOOD LEVEE DESIGN
HOLBROOK, HENTY
& CULCAIRN
Title: ROAD CROSS SECTIONS
SHEET 1 OF 2

Status: FOR TENDER ONLY
NOT TO BE USED FOR CONSTRUCTION PURPOSES

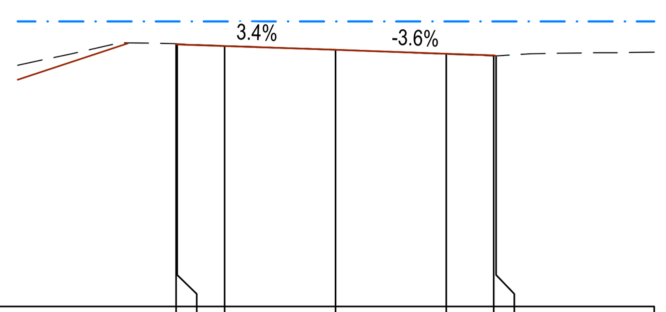
VERT. DATUM	HORZ. DATUM	Scale	Size
AHD	MGA	AS SHOWN	A1

Drawing Number: 300203886-WE-3503
Revision: A

DATE PLOTTED: 10 May 2024 10:51 AM BY : HAZELGROVE, ADAM
XREFs: XR-03886-VIC-MAP; XR-03886-HOLBROOK-IMAGE; XR-03886-CONT-E-HOL; XR-03886-SURV-HB2; XR_03886_SU_BYDA_STRM; XR_03886_SU_BYDA_COMM; XR_03886_SU_BYDA_ELEC; XR_03886_SU_BYDA_SERV; XR-03886-SURV-PWD; XR-03886-ALGN-CHNG; XR-03886-LEGEND; XR-03886-BASE-HOL
CAD File: \\au2013-ppfss01\shared_projects\300203886\300 Levee Design\300203886-WE-3500-3506.dwg

LEGEND

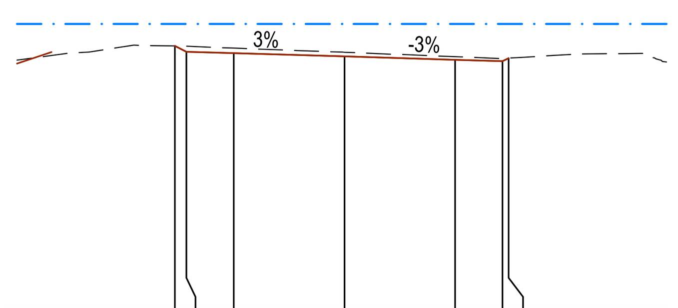
——	DESIGN CENTRE LINE
— · —	Ex 1% AEP FLOOD LEVEL
– – –	EXISTING SURFACE



DATUM 253.0

STRING LABELS	IA10	ES10	LE10		LE11	ES11	IA11
DESIGN LEVELS	261.317	261.300	261.249	261.130	261.004	260.950	260.933
EXISTING LEVELS	261.317	261.316	261.26	261.13	260.99	260.93	260.933
OFFSET	-5.033	-5.000	-3.500	0.000	3.500	5.000	5.071

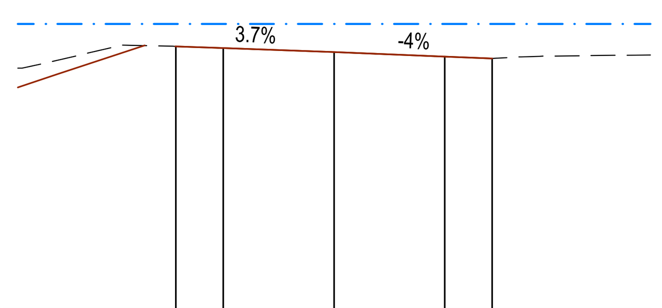
CHAINAGE 175



DATUM 253.0

STRING LABELS	IA10	ES10	LE10		LE11	ES11	IA11
DESIGN LEVELS	261.326	261.146	261.101	260.996	260.891	260.846	260.942
EXISTING LEVELS	261.326	261.317	261.26	261.129	260.989	260.93	260.942
OFFSET	-5.361	-5.000	-3.500	0.000	3.500	5.000	5.191

CHAINAGE 150



DATUM 253.0

STRING LABELS	ES10 IA10	LE10		LE11	ES11 IA11
DESIGN LEVELS	261.315	261.260	261.131	260.989	260.930
EXISTING LEVELS	261.315	261.26	261.131	260.989	260.93
OFFSET	-5.000	-3.500	0.000	3.500	5.000

CHAINAGE 180

BETHANA LN (MC10)

WARNING

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CONTRACTOR TO VERIFY EXISTING SERVICES CONNECTION LEVELS PRIOR TO CONSTRUCTION. ANY DISCREPANCIES MUST BE IMMEDIATELY IDENTIFIED AND THE SUPERINTENDENT NOTIFIED PRIOR TO CONSTRUCTION COMMENCING.

Rev.	Date	Description	Des.	Verif.	Appd.
A	10/05/2024	TENDER ISSUE	VZ		AS

0 5 8m
H 1:200 @A1

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Level 4, 501 Swanston Street
Melbourne VIC 3000
Tel: 03 8415 7777
Web: www.stantec.com/au

Drawn	AJH	Date 25/03/2024
Checked	VZ	Date 23/04/24
Designed	SP	Date 23/04/24
Verified		Date
Approved		Date

Client: GREATER HUME SHIRE COUNCIL

Project: HHC FLOOD LEVEE DESIGN
HOLBROOK, HENTY
& CULCAIRN

Title: ROAD CROSS SECTIONS
SHEET 2 OF 2

Status: FOR TENDER ONLY
NOT TO BE USED FOR CONSTRUCTION PURPOSES

VERT. DATUM	HORZ. DATUM	Scale	Size
AHD	MGA	AS SHOWN	A1

Drawing Number	Revision
300203886-WE-3504	A

DATE PLOTTED: 10 May 2024 10:51 AM BY : HAZELGROVE, ADAM

XREFs: XR-03886-VIC-MAP; XR-03886-HOLBROOK-IMAGE; XR-03886-CONT-E-HOL; XR-03886-SURV-HB2; XR_03886_SU_BYDA_STRM; XR_03886_SU_BYDA_COMM; XR_03886_SU_BYDA_ELEC; XR_03886_SU_BYDA_SERV; XR-03886-SURV-PWD; XR-03886-ALGN-CHNG; XR-03886-LEGEND; XR-03886-BASE-HOL
CAD File: \\au2013-ppfss01\shared_projects\300203886\300 Levee Design\300203886-WE-3500-3506.dwg

EXISTING STOCKPILE

SCALE 1:750

EARTHWORKS VOLUMES

DATE: 05/04/2024

Volumes from tin "Surface Existing" to tin "Surface Stockpile" - (with no plan polygon)

CUT VOLUMES ARE NEGATIVE
FILL VOLUMES ARE POSITIVE

TOTAL CUT	-6,030.539 m³
TOTAL FILL	228.193 m³
TOTAL BALANCE	5,802.346 m³
IE EXCESS OF CUT OVER FILL	5,802.346 m³

NOTE:
1. INDICATED EARTHWORKS VOLUMES ARE NETT AND EXCLUDE BULKING / COMPACTION FACTORS;
2. NO ALLOWANCE HAS BEEN MADE FOR SPOIL GENERATED FROM SERVICE TRENCHING
3. NO ALLOWANCE HAS BEEN MADE FOR THE STRIPPING OF TOPSOIL
4. NO ALLOWANCE HAS BEEN MADE FOR FOOTING FOUNDATIONS

Surface Analysis: Elevation Ranges

Number	Color	Minimum Elevation (m)	Maximum Elevation (m)
1		-0.600	-0.500
2		-0.500	-0.400
3		-0.400	-0.300
4		-0.300	-0.200
5		-0.200	-0.100
6		-0.100	0.000
7		0.000	0.100
8		0.100	0.200

LEGEND

260.0	FINISHED SURFACE CONTOUR - MAJOR
	FINISHED SURFACE CONTOUR - MINOR
260.0	EXISTING SURFACE CONTOUR - MAJOR
	EXISTING SURFACE CONTOUR - MINOR
	PROPOSED TOP OF BATTER
	PROPOSED BOTTOM OF BATTER
	PROPOSED SWALE DRAIN
	PROPOSED DRAINAGE PIPE
	PROPERTY BOUNDARY - SURVEY
	PROPERTY BOUNDARY - VICMAP
	TREE PROTECTION ZONE
	EXISTING POST AND WIRE FENCE
	EXISTING TREE
W(D)	EXISTING WATER RETICULATION (BYDA)
D(D)	EXISTING STORMWATER PIPE (BYDA)
G(D)	EXISTING GAS (BYDA)
C_{OF} (D)	EXISTING OPTICAL FIBRE (BYDA)
E_{HVO} (D)	EXISTING HIGH VOLTAGE - OVERHEAD
C_{TEL} (D)	EXISTING TELECOMMUNICATIONS
	SURVEY QUALITY LEVEL
	UTILITY TYPE

WARNING
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CONTRACTOR TO VERIFY EXISTING SERVICES CONNECTION LEVELS PRIOR TO CONSTRUCTION. ANY DISCREPANCIES MUST BE IMMEDIATELY IDENTIFIED AND THE SUPERINTENDENT NOTIFIED PRIOR TO CONSTRUCTION COMMENCING.

NOTE:
SPOIL TO BE REMOVED FROM PROJECT AREA AND CARTED TO STP BORROW AREA SITE AND SPREAD OUT THERE.

0 15 30 45 60 75m
SCALE 1:750 @A1

Rev.	Date	Description	Des.	Verif.	Appd.
A	10/05/2024	TENDER ISSUE	VZ		AS

Greater Hume Council

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Drawn AJH	Date 25/03/2024
Checked VZ	Date 23/04/24
Designed AS	Date 23/04/24
Verified	Date
Approved	Date

Client: GREATER HUME SHIRE COUNCIL

Project: HHC FLOOD LEVEE DESIGN
HOLBROOK, HENTY
& CULCAIRN

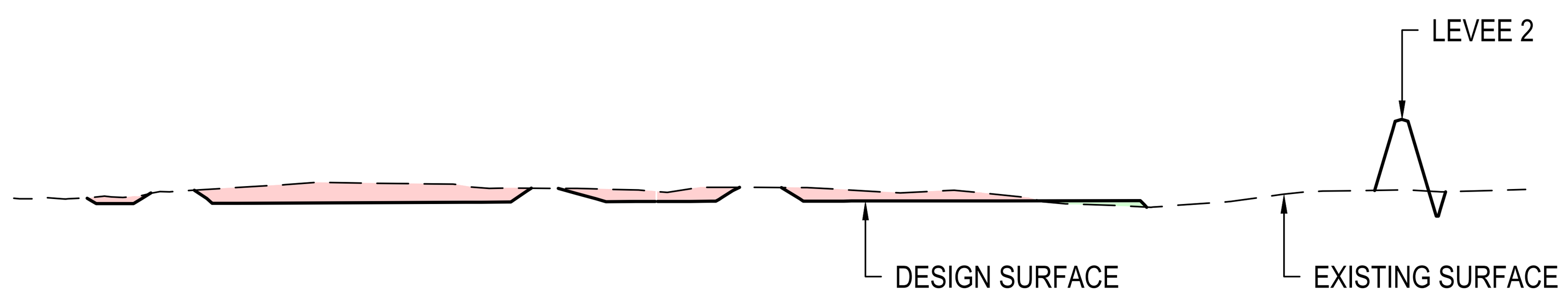
Title: EARTHWORKS PLAN

Status: FOR TENDER ONLY
NOT TO BE USED FOR CONSTRUCTION PURPOSES

VERT. DATUM	HORZ. DATUM	Scale	Size
AHD	MGA	AS SHOWN	A1

Drawing Number: 300203886-WE-3550
Revision: A

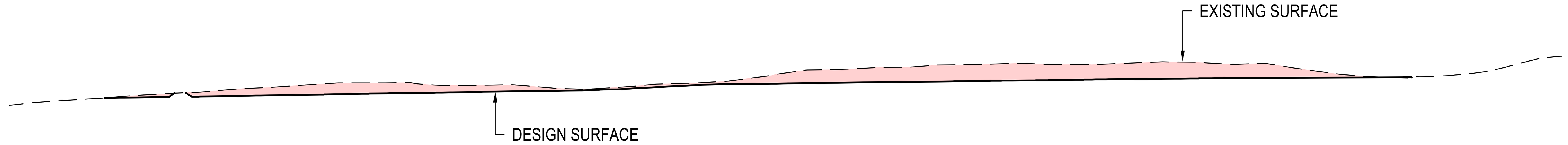
DATE PLOTTED: 7 May 2024 5:23 PM BY : HAZELGROVE, ADAM
XREFs: XR-03886-ALGN-CHNG; XR-03886-BASE-HOL; XR-03886-SURV-PWD; XR-03886-VIC-MAP; XR-03886-LEGEND; XR_03886_SU_BYDA_ELEC; XR_03886_SU_BYDA_SERV; XR_03886_SU_BYDA_COMM
CAD File: \\au2013-ppfss01\shared_projects\300203886\300 Levee Design\300203886-WE-3550-3551.dwg



Datum R.L.260.0

CUT/FILL DEPTHS		0.057	0.274	0.305	0.146	0.176		0.132	0.061				
DESIGN LEVELS		262.241	262.186	262.195	262.278	262.211		262.220	262.222				
EXISTING LEVELS	262.264	262.297	262.460	262.500	262.424	262.387	262.435	262.351	262.283	262.124	262.305	262.393	262.403
CHAINAGE	00	20	40	60	80	100	120	140	160	180	200	220	240

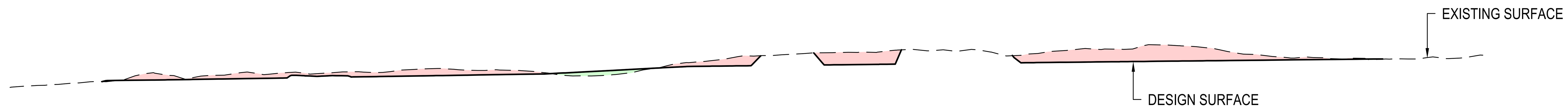
SECTION 3 / 3550
SCALE H 1:1000
V 1:100



Datum R.L.260.0

CUT/FILL DEPTHS			0.077	0.166	0.258	0.305	0.209	0.188	0.037	0.079	0.077	0.320	0.401	0.459	0.479	0.426	0.464	0.408	0.290	0.042			
DESIGN LEVELS			262.081	262.111	262.146	262.180	262.212	262.243	262.271	262.354	262.444	262.471	262.497	262.522	262.547	262.573	262.597	262.620	262.629	262.636			
EXISTING LEVELS	261.853	262.018	262.157	262.278	262.404	262.485	262.421	262.432	262.309	262.433	262.521	262.791	262.897	262.981	263.026	262.999	263.061	263.028	262.919	262.679	262.669	262.916	263.234
CHAINAGE	00	20	40	60	80	100	120	140	160	180	200	220	240	260	280	300	320	340	360	380	400	420	436.161

SECTION 2 / 3550
SCALE H 1:1000
V 1:100



Datum R.L.260.0

CUT/FILL DEPTHS			0.139	0.080	0.145	0.090	0.133	0.214	0.137	-0.104	-0.097	0.136	0.098	0.236	0.407			0.388	0.405	0.463	0.183	0.063	-0.009		
DESIGN LEVELS			262.095	262.123	262.155	262.227	262.217	262.249	262.280	262.341	262.447	262.543	262.782	262.742	262.608			262.674	262.696	262.718	262.739	262.761	262.780		
EXISTING LEVELS	261.865	262.003	262.234	262.203	262.300	262.317	262.350	262.463	262.417	262.237	262.350	262.679	262.880	262.978	263.016	263.070	262.875	263.062	263.101	263.181	262.922	262.824	262.771	262.806	262.901
CHAINAGE	00	20	40	60	80	100	120	140	160	180	200	220	240	260	280	300	320	340	360	380	400	420	440	460	472.781

SECTION 1 / 3550
SCALE H 1:1000
V 1:100

EARTHWORKS - CUT
EARTHWORKS - FILL

H: 0 20 40 60 80 100m
V: 0 2 4 6 8 10m
SCALE: H:1:1000 V:1:100 @A1

Rev.	Date	Description	Des.	Verif.	Appd.
A	10/05/2024	TENDER ISSUE	VZ		AS

Greater Hume Council

Stantec
Stantec Australia Pty Ltd | ABN 17 007 820 322
Level 4, 501 Swanston Street
Melbourne VIC 3000
Tel: 03 8415 7777
Web: www.stantec.com/au

Drawn AJH Date 25/03/2024
Checked VZ Date 23/04/24
Designed AS Date 23/04/24
Verified Date
Approved Date

Client: GREATER HUME SHIRE COUNCIL
Project: HHC FLOOD LEVEE DESIGN
HOLBROOK, HENTY
& CULCAIRN
Title: EARTHWORKS TYPICAL SECTIONS

Status: FOR TENDER ONLY
NOT TO BE USED FOR CONSTRUCTION PURPOSES

VERT. DATUM	HORZ. DATUM	Scale	Size
AHD	MGA	AS SHOWN	A1

Drawing Number: 300203886-WE-3551
Revision: A

DATE PLOTTED: 7 May 2024 5:23 PM BY : HAZELGROVE, ADAM
XREFs: XR-03886-ALGN-CHNG; XR-03886-BASE-HOL; XR-03886-SURV-PWD; XR-03886-VIC-MAP; XR-03886-LEGEND; XR_03886_SU_BYDA_ELEC; XR_03886_SU_BYDA_SERV; XR_03886_SU_BYDA_COMM
CAD File: \\au2013-ppfss01\shared_projects\300203886\300 Levee Design\300203886-WE-3550-3551.dwg

Holbrook Levee 1 Hay St Centre Line Set-Out Table (MC05)

CHAINAGE	EASTING	NORTHING	LEVEL	COMMENTS
0.000	528247.982	6046378.855	260.440	START OF SETOUT LINE
10.000	528256.574	6046373.738	260.471	INTERMEDIATE SETOUT POINT
20.000	528265.165	6046368.621	260.501	INTERMEDIATE SETOUT POINT
30.000	528273.757	6046363.504	260.504	INTERMEDIATE SETOUT POINT
40.000	528282.348	6046358.386	260.469	INTERMEDIATE SETOUT POINT
50.000	528290.940	6046353.269	260.407	INTERMEDIATE SETOUT POINT
60.000	528299.531	6046348.152	260.344	INTERMEDIATE SETOUT POINT
70.000	528308.123	6046343.035	260.281	INTERMEDIATE SETOUT POINT
80.000	528316.715	6046337.917	260.218	INTERMEDIATE SETOUT POINT
90.000	528325.306	6046332.800	260.156	INTERMEDIATE SETOUT POINT
100.000	528333.898	6046327.683	260.127	INTERMEDIATE SETOUT POINT
105.049	528338.235	6046325.099	260.130	BENDING POINT
110.000	528342.382	6046322.395	260.144	INTERMEDIATE SETOUT POINT
120.000	528350.758	6046316.932	260.177	INTERMEDIATE SETOUT POINT
125.751	528355.576	6046313.790	260.195	START OF GRAVEL ROAD/BENDING POINT
130.000	528358.942	6046311.198	260.311	INTERMEDIATE SETOUT POINT
140.000	528366.867	6046305.099	260.450	INTERMEDIATE SETOUT POINT
143.709	528369.806	6046302.836	260.455	START OF ARC (R40)
149.516	528374.135	6046298.973	260.455	END OF ARC (R40)
150.000	528374.471	6046298.626	260.455	INTERMEDIATE SETOUT POINT
160.000	528381.430	6046291.444	260.483	INTERMEDIATE SETOUT POINT
165.676	528385.380	6046287.367	260.596	START OF ARC (R15)
170.000	528387.902	6046283.874	260.740	INTERMEDIATE SETOUT POINT
175.198	528389.471	6046278.946	260.948	END OF ARC (R15)
178.770	528389.951	6046275.406	261.091	START OF ARC (R25)
180.000	528390.146	6046274.192	261.140	INTERMEDIATE SETOUT POINT
182.537	528390.736	6046271.726	261.241	END OF ARC (R25)
190.000	528392.838	6046264.564	261.540	INTERMEDIATE SETOUT POINT
190.444	528392.963	6046264.138	261.557	START OF ARC (R25)
195.013	528394.642	6046259.896	261.702	END OF ARC (R25)
199.754	528396.782	6046255.665	261.795	START OF ARC (R25)
200.000	528396.892	6046255.445	261.798	INTERMEDIATE SETOUT POINT
203.476	528398.209	6046252.231	261.828	END OF ARC (R25)
210.000	528400.257	6046246.037	261.836	INTERMEDIATE SETOUT POINT
210.037	528400.269	6046246.003	261.836	START OF ARC (R50)
220.000	528404.316	6046236.916	261.847	INTERMEDIATE SETOUT POINT
227.757	528408.667	6046230.504	261.856	END OF ARC (R50)
230.000	528410.067	6046228.751	261.858	INTERMEDIATE SETOUT POINT
240.000	528416.306	6046220.937	261.869	INTERMEDIATE SETOUT POINT
250.000	528422.546	6046213.122	261.880	INTERMEDIATE SETOUT POINT
252.946	528424.384	6046210.820	261.884	START OF ARC (R20)
260.000	528427.733	6046204.653	261.891	INTERMEDIATE SETOUT POINT
270.000	528428.436	6046194.782	261.902	INTERMEDIATE SETOUT POINT
276.836	528426.104	6046188.391	261.802	END OF ARC (R20)
276.911	528426.067	6046188.326	261.800	INTERSECTION WITH LEVEE 1 PART 2
280.000	528424.530	6046185.646	261.693	INTERMEDIATE SETOUT POINT
288.349	528420.377	6046178.404	261.249	END OF SETOUT LINE

Holbrook Levee 1 Part 3 Centre Line Set-Out Table (MC01C)

CHAINAGE	EASTING	NORTHING	LEVEL	COMMENTS
0.000	528426.067	6046188.326	261.800	INTERSECTION WITH LEVEE 1 PART 1
10.000	528435.263	6046184.399	261.995	INTERMEDIATE SETOUT POINT
14.489	528439.391	6046182.636	262.063	START OF ARC (R10)
20.000	528444.789	6046181.942	262.146	INTERMEDIATE SETOUT POINT
21.709	528446.450	6046182.336	262.147	END OF ARC (R10)
30.000	528454.323	6046184.932	262.156	INTERMEDIATE SETOUT POINT
36.105	528460.121	6046186.844	262.162	START OF ARC (R20)
40.000	528463.916	6046187.697	262.166	INTERMEDIATE SETOUT POINT
50.000	528473.733	6046186.452	262.176	INTERMEDIATE SETOUT POINT
50.018	528473.750	6046186.445	262.176	END OF ARC (R20)
60.000	528483.030	6046182.769	262.186	INTERMEDIATE SETOUT POINT
70.000	528492.328	6046179.087	262.196	INTERMEDIATE SETOUT POINT
80.000	528501.625	6046175.404	262.206	INTERMEDIATE SETOUT POINT
90.000	528510.922	6046171.722	262.216	INTERMEDIATE SETOUT POINT
100.000	528520.219	6046168.039	262.226	INTERMEDIATE SETOUT POINT
110.000	528529.517	6046164.357	262.236	INTERMEDIATE SETOUT POINT
120.000	528538.814	6046160.674	262.246	INTERMEDIATE SETOUT POINT
130.000	528548.111	6046156.992	262.256	INTERMEDIATE SETOUT POINT
140.000	528557.409	6046153.310	262.266	INTERMEDIATE SETOUT POINT
150.000	528566.706	6046149.627	262.292	INTERMEDIATE SETOUT POINT
150.119	528566.817	6046149.583	262.292	START OF ARC (R20)
157.789	528573.239	6046145.477	262.331	END OF ARC (R20)
160.000	528574.841	6046143.953	262.342	INTERMEDIATE SETOUT POINT
170.000	528582.085	6046137.059	262.392	INTERMEDIATE SETOUT POINT
177.599	528587.590	6046131.821	262.430	START OF ARC (R20)
180.000	528589.226	6046130.065	262.442	INTERMEDIATE SETOUT POINT
190.000	528593.442	6046121.112	262.492	INTERMEDIATE SETOUT POINT
190.795	528593.577	6046120.329	262.496	END OF ARC (R20)
200.000	528594.956	6046111.228	262.523	INTERMEDIATE SETOUT POINT
206.573	528595.940	6046104.729	262.533	START OF ARC (R20)
208.958	528596.156	6046102.355	262.536	END OF ARC (R20)
210.000	528596.189	6046101.313	262.538	INTERMEDIATE SETOUT POINT
220.000	528596.499	6046091.318	262.553	INTERMEDIATE SETOUT POINT
230.000	528596.810	6046081.323	262.568	INTERMEDIATE SETOUT POINT
240.000	528597.121	6046071.328	262.566	INTERMEDIATE SETOUT POINT
250.000	528597.432	6046061.333	262.564	INTERMEDIATE SETOUT POINT
260.000	528597.743	6046051.338	262.562	INTERMEDIATE SETOUT POINT
270.000	528598.054	6046041.342	262.560	INTERMEDIATE SETOUT POINT
280.000	528598.364	6046031.347	262.558	INTERMEDIATE SETOUT POINT
290.000	528598.675	6046021.352	262.498	INTERMEDIATE SETOUT POINT
293.324	528598.779	6046018.030	262.083	END OF SETOUT LINE

Hay Street Lip of Kerb (MC06)

CHAINAGE	EASTING	NORTHING	LEVEL	COMMENTS
0.000	528251.352	6046384.512	260.340	START OF SETOUT LINE
10.000	528259.943	6046379.395	260.290	INTERMEDIATE SETOUT POINT
20.000	528268.535	6046374.278	260.240	INTERMEDIATE SETOUT POINT
30.000	528277.126	6046369.161	260.190	INTERMEDIATE SETOUT POINT
40.000	528285.718	6046364.043	260.140	INTERMEDIATE SETOUT POINT
50.000	528294.309	6046358.926	260.090	INTERMEDIATE SETOUT POINT
60.000	528302.901	6046353.809	260.040	INTERMEDIATE SETOUT POINT
70.000	528311.492	6046348.692	259.990	INTERMEDIATE SETOUT POINT
80.000	528320.084	6046343.574	259.940	INTERMEDIATE SETOUT POINT
90.000	528328.675	6046338.457	259.890	INTERMEDIATE SETOUT POINT
100.000	528337.267	6046333.340	259.851	INTERMEDIATE SETOUT POINT
105.166	528341.706	6046330.696	259.859	START OF ARC (R5)
106.179	528342.522	6046330.099	259.863	END OF ARC (R5)
110.000	528345.378	6046327.561	259.887	INTERMEDIATE SETOUT POINT
120.000	528352.853	6046320.918	259.997	INTERMEDIATE SETOUT POINT
125.320	528356.829	6046317.384	260.061	END OF SETOUT LINE

Hay Street Edge of Footpath (MC07)

CHAINAGE	EASTING	NORTHING	LEVEL	COMMENTS
0.000	528252.651	6046386.693	260.561	START OF SETOUT LINE
10.000	528261.242	6046381.576	260.521	INTERMEDIATE SETOUT POINT
20.000	528269.834	6046376.458	260.481	INTERMEDIATE SETOUT POINT
30.000	528278.425	6046371.341	260.447	INTERMEDIATE SETOUT POINT
40.000	528287.017	6046366.224	260.414	INTERMEDIATE SETOUT POINT
50.000	528295.608	6046361.107	260.380	INTERMEDIATE SETOUT POINT
60.000	528304.200	6046355.989	260.360	INTERMEDIATE SETOUT POINT
70.000	528312.791	6046350.872	260.340	INTERMEDIATE SETOUT POINT
80.000	528321.383	6046345.755	260.320	INTERMEDIATE SETOUT POINT
90.000	528329.974	6046340.638	260.300	INTERMEDIATE SETOUT POINT
100.000	528338.566	6046335.521	260.280	INTERMEDIATE SETOUT POINT
105.166	528343.004	6046332.877	260.280	START OF ARC (R8)
106.660	528344.208	6046331.996	260.283	END OF ARC (R8)
110.000	528346.704	6046329.777	260.289	INTERMEDIATE SETOUT POINT
120.000	528354.179	6046323.134	260.325	INTERMEDIATE SETOUT POINT
129.465	528361.254	6046316.847	260.372	END OF SETOUT LINE

Nolan Street Edge of Footpath (MC01B)

CHAINAGE	EASTING	NORTHING	LEVEL	COMMENTS
4.760	528363.143	6046316.657	261.715	START OF SETOUT LINE
10.000	528367.060	6046313.176	261.731	INTERMEDIATE SETOUT POINT
18.233	528373.214	6046307.707	261.372	START OF ARC (R49)
20.000	528374.514	6046306.509	261.284	INTERMEDIATE SETOUT POINT
25.341	528378.167	6046302.617	261.187	END OF ARC (R49)
30.000	528381.165	6046299.051	261.164	INTERMEDIATE SETOUT POINT
40.000	528387.602	6046291.398	261.114	INTERMEDIATE SETOUT POINT
41.299	528388.438	6046290.404	261.108	START OF ARC (R19)
50.000	528392.346	6046282.714	261.082	INTERMEDIATE SETOUT POINT
53.360	528392.856	6046279.398	261.149	END OF ARC (R19)
58.490	528393.187	6046274.278	261.252	END OF SETOUT LINE

COORDINATE DATUM NOTE

- Levels shown are to Australian Height Datum vide GNSS using SMARTNET AUS RTK CORRECTIONS adjusted to PM 109259 with a stated value of RL 266.116
- Coordinates are to MGA Zone 55 vide GNSS using PM 4410 and PM 162592

Rev.	Date	Description	Des.	Verif.	Appd.
A	10/05/2024	TENDER ISSUE	VZ	HG	AS

Greater Hume Council

Stantec

Stantec Australia Pty Ltd | ABN 17 007 820 322
Level 4, 501 Swanston Street
Melbourne VIC 3000
Tel: 03 8415 7777
Web: www.stantec.com/au

Drawn AJH Date 25/03/2024
Checked VZ Date 23/04/24
Designed AS Date 23/04/24
Verified Date
Approved Date

Client GREATER HUME SHIRE COUNCIL

Project HHC FLOOD LEVEE DESIGN
HOLBROOK, HENTY
& CULCAIRN

Title SET OUT TABLES
SHEET 1 OF 2

Status FOR TENDER ONLY
NOT TO BE USED FOR CONSTRUCTION PURPOSES

VERT. DATUM	HORZ. DATUM	Scale	Size
AHD	MGA	AS SHOWN	A1

Drawing Number 300203886-WE-3600 Revision A

DATE PLOTTED: 8 May 2024 3:52 PM BY : HAZELGROVE, ADAM

XREF's:
CAD File: \\au2013-ppfss01\shared_projects\300203886\300 Levee Design\300203886-WE-3600-3601.dwg

Holbrook Levee 2 Centre Line Set-Out Table (MC02)

CHAINAGE	EASTING	NORTHING	LEVEL	COMMENTS
0.000	527864.666	6045744.867	262.600	MATCH INTO ALBURY ST
10.000	527873.688	6045749.180	262.595	INTERMEDIATE SETOUT POINT
12.744	527876.164	6045750.363	262.593	START OF ARC (R10)
19.734	527880.958	6045755.255	262.590	END OF ARC (R10)/START OF ARC (R10)
20.000	527881.071	6045755.495	262.590	INTERMEDIATE SETOUT POINT
30.000	527888.884	6045761.054	262.584	INTERMEDIATE SETOUT POINT
34.941	527893.734	6045760.426	262.582	END OF ARC (R10)
37.152	527895.791	6045759.615	262.581	MATCH INTO BETHANA LANE
47.255	527905.189	6045755.908	262.884	MATCH INTO BETHANA LANE
50.000	527907.742	6045754.900	262.872	INTERMEDIATE SETOUT POINT
57.539	527914.756	6045752.133	262.840	START OF ARC (R20)
60.000	527917.094	6045751.373	262.829	INTERMEDIATE SETOUT POINT
70.000	527926.990	6045751.346	262.787	INTERMEDIATE SETOUT POINT
77.463	527933.723	6045754.465	262.755	END OF ARC (R20)
80.000	527935.787	6045755.940	262.744	INTERMEDIATE SETOUT POINT
90.000	527943.923	6045761.754	262.701	INTERMEDIATE SETOUT POINT
100.000	527952.060	6045767.568	262.684	INTERMEDIATE SETOUT POINT
110.000	527960.196	6045773.382	262.691	INTERMEDIATE SETOUT POINT
120.000	527968.332	6045779.196	262.698	INTERMEDIATE SETOUT POINT
130.000	527976.468	6045785.010	262.706	INTERMEDIATE SETOUT POINT
140.000	527984.605	6045790.823	262.713	INTERMEDIATE SETOUT POINT
150.000	527992.741	6045796.637	262.720	INTERMEDIATE SETOUT POINT
157.020	527998.452	6045800.718	262.726	START OF ARC (R20)
160.000	528000.997	6045802.264	262.728	INTERMEDIATE SETOUT POINT
170.000	528010.652	6045804.438	262.735	INTERMEDIATE SETOUT POINT
172.728	528013.364	6045804.174	262.737	END OF ARC (R20)
180.000	528020.538	6045802.980	262.743	INTERMEDIATE SETOUT POINT
190.000	528030.402	6045801.338	262.750	INTERMEDIATE SETOUT POINT
200.000	528040.267	6045799.696	262.757	INTERMEDIATE SETOUT POINT
210.000	528050.131	6045798.054	262.765	INTERMEDIATE SETOUT POINT
220.000	528059.995	6045796.411	262.772	INTERMEDIATE SETOUT POINT
230.000	528069.859	6045794.769	262.779	INTERMEDIATE SETOUT POINT
240.000	528079.724	6045793.127	262.787	INTERMEDIATE SETOUT POINT
250.000	528089.588	6045791.485	262.794	INTERMEDIATE SETOUT POINT
260.000	528099.452	6045789.843	262.801	INTERMEDIATE SETOUT POINT
270.000	528109.316	6045788.200	262.809	INTERMEDIATE SETOUT POINT
280.000	528119.180	6045786.558	262.816	INTERMEDIATE SETOUT POINT
290.000	528129.045	6045784.916	262.823	INTERMEDIATE SETOUT POINT
300.000	528138.909	6045783.274	262.831	INTERMEDIATE SETOUT POINT
310.000	528148.773	6045781.632	262.838	INTERMEDIATE SETOUT POINT
320.000	528158.637	6045779.989	262.845	INTERMEDIATE SETOUT POINT
330.000	528168.502	6045778.347	262.853	INTERMEDIATE SETOUT POINT
340.000	528178.366	6045776.705	262.860	INTERMEDIATE SETOUT POINT
350.000	528188.230	6045775.063	262.868	INTERMEDIATE SETOUT POINT
360.000	528198.094	6045773.421	262.875	INTERMEDIATE SETOUT POINT
370.000	528207.959	6045771.779	262.882	INTERMEDIATE SETOUT POINT
380.000	528217.823	6045770.136	262.890	INTERMEDIATE SETOUT POINT
390.000	528227.687	6045768.494	262.897	INTERMEDIATE SETOUT POINT
400.000	528237.551	6045766.852	262.904	INTERMEDIATE SETOUT POINT
410.000	528247.416	6045765.210	262.912	INTERMEDIATE SETOUT POINT
420.000	528257.280	6045763.568	262.919	INTERMEDIATE SETOUT POINT
430.000	528267.144	6045761.925	262.926	INTERMEDIATE SETOUT POINT
440.000	528277.008	6045760.283	262.934	INTERMEDIATE SETOUT POINT
450.000	528286.873	6045758.641	262.941	INTERMEDIATE SETOUT POINT
460.000	528296.737	6045756.999	262.948	INTERMEDIATE SETOUT POINT
470.000	528306.601	6045755.357	262.956	INTERMEDIATE SETOUT POINT
480.000	528316.465	6045753.715	262.963	INTERMEDIATE SETOUT POINT
490.000	528326.330	6045752.072	262.970	INTERMEDIATE SETOUT POINT
500.000	528336.194	6045750.430	262.978	INTERMEDIATE SETOUT POINT
510.000	528346.058	6045748.788	262.985	INTERMEDIATE SETOUT POINT
520.000	528355.922	6045747.146	262.993	INTERMEDIATE SETOUT POINT
530.000	528365.786	6045745.504	263.000	INTERMEDIATE SETOUT POINT
540.000	528375.651	6045743.861	263.007	INTERMEDIATE SETOUT POINT
550.000	528385.515	6045742.219	263.015	INTERMEDIATE SETOUT POINT

Holbrook Levee 2 Centre Line Set-Out Table (MC02)

CHAINAGE	EASTING	NORTHING	LEVEL	COMMENTS
560.000	528395.379	6045740.577	263.022	INTERMEDIATE SETOUT POINT
570.000	528405.243	6045738.935	263.029	INTERMEDIATE SETOUT POINT
580.000	528415.108	6045737.293	263.037	INTERMEDIATE SETOUT POINT
590.000	528424.972	6045735.650	263.044	INTERMEDIATE SETOUT POINT
600.000	528434.836	6045734.008	263.051	INTERMEDIATE SETOUT POINT
610.000	528444.700	6045732.366	263.060	INTERMEDIATE SETOUT POINT
620.000	528454.565	6045730.724	263.070	INTERMEDIATE SETOUT POINT
630.000	528464.429	6045729.082	263.080	INTERMEDIATE SETOUT POINT
640.000	528474.293	6045727.440	263.090	INTERMEDIATE SETOUT POINT
650.000	528484.157	6045725.797	263.100	INTERMEDIATE SETOUT POINT
660.000	528494.022	6045724.155	263.110	INTERMEDIATE SETOUT POINT
670.000	528503.886	6045722.513	263.120	INTERMEDIATE SETOUT POINT
680.000	528513.750	6045720.871	263.130	INTERMEDIATE SETOUT POINT
690.000	528523.614	6045719.229	263.140	INTERMEDIATE SETOUT POINT
700.000	528533.479	6045717.586	263.150	INTERMEDIATE SETOUT POINT
710.000	528543.343	6045715.944	263.160	INTERMEDIATE SETOUT POINT
720.000	528553.207	6045714.302	263.170	INTERMEDIATE SETOUT POINT
730.000	528563.071	6045712.660	263.180	INTERMEDIATE SETOUT POINT
740.000	528572.936	6045711.018	263.190	INTERMEDIATE SETOUT POINT
750.000	528582.800	6045709.376	263.200	INTERMEDIATE SETOUT POINT
760.000	528592.664	6045707.733	263.210	INTERMEDIATE SETOUT POINT
762.607	528595.235	6045707.305	263.213	START OF ARC (R10)
770.000	528601.453	6045703.623	263.220	INTERMEDIATE SETOUT POINT
777.903	528603.516	6045696.206	263.254	END OF ARC (R10)
780.000	528603.257	6045694.125	263.263	INTERMEDIATE SETOUT POINT
790.000	528602.023	6045684.202	263.306	INTERMEDIATE SETOUT POINT
800.000	528600.788	6045674.278	263.349	INTERMEDIATE SETOUT POINT
810.000	528599.553	6045664.355	263.392	INTERMEDIATE SETOUT POINT
820.000	528598.318	6045654.431	263.435	INTERMEDIATE SETOUT POINT
826.674	528597.494	6045647.808	263.463	START OF ARC (R20)
830.000	528597.359	6045644.489	263.478	INTERMEDIATE SETOUT POINT
840.000	528600.213	6045635.013	263.521	INTERMEDIATE SETOUT POINT
842.237	528601.472	6045633.166	263.530	END OF ARC (R20)
850.000	528606.197	6045627.006	263.564	INTERMEDIATE SETOUT POINT
851.215	528606.937	6045626.042	263.569	START OF ARC (R10)
860.000	528614.492	6045622.136	263.607	INTERMEDIATE SETOUT POINT
864.273	528618.667	6045622.877	263.625	END OF ARC (R10)
870.000	528623.966	6045625.051	263.650	INTERMEDIATE SETOUT POINT
880.000	528633.217	6045628.847	263.693	INTERMEDIATE SETOUT POINT
890.000	528642.469	6045632.642	263.736	INTERMEDIATE SETOUT POINT
894.989	528647.085	6045634.536	263.757	START OF ARC (R20)
900.000	528651.909	6045635.840	263.779	INTERMEDIATE SETOUT POINT
908.692	528660.506	6045635.164	263.806	END OF ARC (R20)
910.000	528661.758	6045634.783	263.809	INTERMEDIATE SETOUT POINT
920.000	528671.323	6045631.868	263.826	INTERMEDIATE SETOUT POINT
930.000	528680.889	6045628.953	263.844	INTERMEDIATE SETOUT POINT
940.000	528690.455	6045626.037	263.862	INTERMEDIATE SETOUT POINT
950.000	528700.021	6045623.122	263.879	INTERMEDIATE SETOUT POINT
951.438	528701.396	6045622.703	263.882	START OF ARC (R20)
960.000	528709.864	6045622.009	263.897	INTERMEDIATE SETOUT POINT
960.348	528710.209	6045622.058	263.897	END OF ARC (R20)
967.671	528717.450	6045623.150	263.910	START OF ARC (R20)
970.000	528719.728	6045623.631	263.914	INTERMEDIATE SETOUT POINT
980.000	528728.335	6045628.515	263.932	INTERMEDIATE SETOUT POINT
990.000	528733.546	6045636.928	263.950	INTERMEDIATE SETOUT POINT
1000.000	528734.087	6045646.809	263.943	INTERMEDIATE SETOUT POINT
1001.885	528733.635	6045648.638	263.940	END OF ARC (R20)
1010.000	528731.317	6045656.415	263.930	INTERMEDIATE SETOUT POINT
1020.000	528728.461	6045665.999	263.918	INTERMEDIATE SETOUT POINT
1029.471	528725.757	6045675.075	263.907	START OF ARC (R20)
1030.000	528725.599	6045675.580	263.906	INTERMEDIATE SETOUT POINT
1035.971	528722.930	6045680.897	263.899	END OF ARC (R20)
1040.000	528720.606	6045684.188	263.894	INTERMEDIATE SETOUT POINT
1049.808	528714.951	6045692.201	263.882	END OF EARTHEN LEVEE

Holbrook Levee 2 Centre Line Set-Out Table (MC02)

CHAINAGE	EASTING	NORTHING	LEVEL	COMMENTS
1050.000	528714.840	6045692.358	263.882	INTERMEDIATE SETOUT POINT
1060.000	528709.073	6045700.528	263.869	INTERMEDIATE SETOUT POINT
1060.723	528708.656	6045701.118	263.869	START OF ARC (R20)
1069.341	528705.333	6045708.998	263.858	END OF ARC (R20)
1070.000	528705.212	6045709.646	263.857	INTERMEDIATE SETOUT POINT
1072.320	528704.789	6045711.927	263.854	START OF ARC (R20)
1076.086	528704.452	6045715.672	263.850	END OF ARC (R20)
1080.000	528704.470	6045719.586	263.845	INTERMEDIATE SETOUT POINT
1081.154	528704.476	6045720.740	263.844	START OF ARC (R10)
1089.677	528707.927	6045728.252	263.833	END OF ARC (R10)
1090.000	528708.172	6045728.464	263.833	INTERMEDIATE SETOUT POINT
1100.000	528715.730	6045735.012	263.821	INTERMEDIATE SETOUT POINT
1110.000	528723.288	6045741.560	263.808	INTERMEDIATE SETOUT POINT
1120.000	528730.845	6045748.108	263.792	INTERMEDIATE SETOUT POINT
1120.703	528731.377	6045748.569	263.790	START OF ARC (R10)
1125.836	528734.244	6045752.758	263.777	END OF ARC (R10)
1127.252	528734.721	6045754.091	263.773	START OF ARC (R20)
1130.000	528735.821	6045756.607	263.766	INTERMEDIATE SETOUT POINT
1132.798	528737.285	6045758.989	263.758	START OF EARTHEN LEVEE
1137.991	528740.817	6045762.776	263.745	END OF ARC (R20)
1140.000	528742.366	6045764.055	263.739	INTERMEDIATE SETOUT POINT
1142.798	528744.524	6045765.837	263.732	CHANGE OF LEVEE WIDTH
1150.000	528750.077	6045770.423	263.713	INTERMEDIATE SETOUT POINT
1151.378	528751.140	6045771.300	263.709	START OF ARC (R20)
1160.000	528756.418	6045778.033	263.687	INTERMEDIATE SETOUT POINT
1165.854	528758.159	6045783.600	263.671	END OF ARC (R20)
1170.000	528758.806	6045787.695	263.660	INTERMEDIATE SETOUT POINT
1180.000	528760.367	6045797.573	263.634	INTERMEDIATE SETOUT POINT
1190.000	528761.928	6045807.450	263.608	INTERMEDIATE SETOUT POINT
1200.000	528763.489	6045817.327	263.581	INTERMEDIATE SETOUT POINT
1206.034	528764.431	6045823.288	263.566	START OF ARC (R10)
1210.000	528764.267	6045827.224	263.555	INTERMEDIATE SETOUT POINT
1220.000	528757.803	6045834.306	263.529	INTERMEDIATE SETOUT POINT
1220.980	528756.862	6045834.578	263.526	END OF ARC (R10)
1230.000	528748.085	6045836.661	263.502	INTERMEDIATE SETOUT POINT
1236.122	528742.129	6045838.074	263.486	START OF ARC (R10)
1240.000	528738.621	6045839.669	263.476	INTERMEDIATE SETOUT POINT
1250.000	528734.450	6045848.303	263.450	INTERMEDIATE SETOUT POINT
1251.159	528734.574	6045849.455	263.447	END OF ARC (R10)
1260.000	528736.034	6045858.174	263.424	INTERMEDIATE SETOUT POINT
1270.000	528737.685	6045868.037	263.397	INTERMEDIATE SETOUT POINT
1278.991	528739.170	6045876.905	263.370	START OF ARC (R20)
1280.000	528739.311	6045877.903	263.367	INTERMEDIATE SETOUT POINT
1290.000	528737.984	6045887.710	263.336	INTERMEDIATE SETOUT POINT
1290.399	528737.830	6045888.079	263.335	END OF ARC (R20)
1300.000	528734.052	6045896.905	263.306	INTERMEDIATE SETOUT POINT
1303.956	528732.495	6045900.541	263.293	CHANGE OF LEVEE WIDTH
1309.536	528730.299	6045905.671	263.276	START OF ARC (R20)
1310.000	528730.121	6045906.100	263.275	INTERMEDIATE SETOUT POINT
1313.955	528729.021	6045909.892	263.263	END OF EARTHEN LEVEE
1317.490	528728.685	6045913.407	263.252	END OF ARC (R20)
1320.000	528728.668	6045915.916	263.244	INTERMEDIATE SETOUT POINT
1330.000	528728.601	6045925.916	263.214	INTERMEDIATE SETOUT POINT
1340.000	528728.533	6045935.916	263.183	INTERMEDIATE SETOUT POINT
1349.790	528728.467	6045945.706	263.153	START OF ARC (R50)
1350.000	528728.466	6045945.916	263.152	INTERMEDIATE SETOUT POINT
1353.691	528728.593	6045949.604	263.141	END OF ARC (R50)
1360.000	528729.042	6045955.897	263.121	INTERMEDIATE SETOUT POINT
1370.000	528729.754	6045965.871	263.091	INTERMEDIATE SETOUT POINT
1376.777	528730.237	6045972.631	263.070	END OF SETOUT LINE

Holbrook Levee 3 Centre Line Set-Out Table (MC03)

CHAINAGE	EASTING	NORTHING	LEVEL	COMMENTS
0.000	527680.613	6045962.941	260.833	START OF SETOUT LINE
10.000	527683.505	6045953.368	260.903	INTERMEDIATE SETOUT POINT
20.000	527686.397	6045943.796	260.973	INTERMEDIATE SETOUT POINT
30.000	527689.290	6045934.223	261.043	INTERMEDIATE SETOUT POINT
40.000	527692.182	6045924.650	261.113	INTERMEDIATE SETOUT POINT
50.000	527695.074	6045915.078	261.183	INTERMEDIATE SETOUT POINT
60.000	527697.966	6045905.505	261.203	INTERMEDIATE SETOUT POINT
70.000	527700.858	6045895.933	261.223	INTERMEDIATE SETOUT POINT
80.000	527703.750	6045886.360	261.243	INTERMEDIATE SETOUT POINT
90.000	527706.643	6045876.787	261.263	INTERMEDIATE SETOUT POINT
100.000	527709.535	6045867.215	261.283	INTERMEDIATE SETOUT POINT
110.000	527712.427	6045857.642	261.303	INTERMEDIATE SETOUT POINT
112.800	527713.237	6045854.962	261.314	END OF EARTHEN LEVEE
120.000	527715.319	6045848.069	261.343	INTERMEDIATE SETOUT POINT
128.184	527717.686	6045840.235	261.375	START OF ARC (R7)
130.000	527718.430	6045838.584	261.383	INTERMEDIATE SETOUT POINT
136.008	527723.274	6045835.349	261.407	END OF ARC (R7)
140.000	527727.215	6045834.714	261.423	INTERMEDIATE SETOUT POINT
146.100	527733.237	6045833.744	261.447	START OF EARTHEN LEVEE
150.000	527737.088	6045833.124	261.459	INTERMEDIATE SETOUT POINT
160.000	527746.961	6045831.534	261.464	INTERMEDIATE SETOUT POINT
170.000	527756.833	6045829.944	261.469	INTERMEDIATE SETOUT POINT
180.000	527766.706	6045828.353	261.474	INTERMEDIATE SETOUT POINT
190.000	527776.579	6045826.763	261.479	INTERMEDIATE SETOUT POINT
200.000	527786.452	6045825.173	261.484	INTERMEDIATE SETOUT POINT
210.000	527796.324	6045823.583	261.489	INTERMEDIATE SETOUT POINT
213.775	527800.052	6045822.983	261.491	START OF ARC (R5)
215.646	527801.800	6045822.351	261.492	END OF ARC (R5)
220.000	527805.549	6045820.136	261.494	INTERMEDIATE SETOUT POINT
230.000	527814.159	6045815.049	261.499	INTERMEDIATE SETOUT POINT
240.000	527822.768	6045809.961	261.504	INTERMEDIATE SETOUT POINT
250.000	527831.377	6045804.874	261.509	INTERMEDIATE SETOUT POINT
253.305	527834.223	6045803.193	261.511	START OF ARC (R10)
260.000	527838.467	6045798.177	261.514	INTERMEDIATE SETOUT POINT
269.013	527837.745	6045789.496	261.519	END OF ARC (R10)
270.000	527837.243	6045788.647	261.519	INTERMEDIATE SETOUT POINT
277.182	527833.589	6045782.463	261.523	START OF ARC (R10)
280.000	527832.514	6045779.869	261.524	INTERMEDIATE SETOUT POINT
290.000	527834.869	6045770.574	261.824	INTERMEDIATE SETOUT POINT
290.887	527835.500	6045769.951	261.851	END OF ARC (R10)
300.000	527842.267	6045763.847	262.124	INTERMEDIATE SETOUT POINT
305.192	527846.122	6045760.370	262.280	START OF ARC (R5)
306.760	527847.104	6045759.155	262.327	END OF ARC (R5)
310.000	527848.723	6045756.348	262.424	INTERMEDIATE SETOUT POINT
315.866	527851.653	6045751.267	262.600	MATCH INTO ALBURY ST

Rev.	Date	Description	Des.	Verif.	Appd.
A	10/05/2024	TENDER ISSUE	VZ	HG	AS

Greater Hume Council

Stantec
Stantec Australia Pty Ltd | ABN 17 007 820 322
Level 4, 501 Swanston Street
Melbourne VIC 3000
Tel: 03 8415 7777
Web: www.stantec.com/au

Drawn AJH Date 25/03/2024
Checked VZ Date 23/04/24
Designed AS Date 23/04/24
Verified Date
Approved Date

Client GREATER HUME SHIRE COUNCIL
Project HHC FLOOD LEVEE DESIGN
HOLBROOK, HENTY
& CULCAIRN
Title SET OUT TABLES
SHEET 2 OF 2

Status FOR TENDER ONLY
NOT TO BE USED FOR CONSTRUCTION PURPOSES

VERT. DATUM	HORZ. DATUM	Scale	Size
AHD	MGA	AS SHOWN	A1

Drawing Number 300203886-WE-3601
Revision A

DATE PLOTTED: 8 May 2024 3:52 PM BY : HAZELGROVE, ADAM
XREF's:
CAD File: \\au2013-ppfss01\shared_projects\300203886\300 Levee Design\300203886-WE-3600-3601.dwg

GENERAL:

1. ALL THE DISCREPANCY SHALL BE REFERRED TO THE STANTEC ENGINEER FOR RESOLUTION PRIOR TO PROCEEDING WITH WORKS.
2. CONTRACTOR TO LOCATE ALL SERVICES ON THE SITE PRIOR TO COMMENCING WORK.
3. CONTRACTOR TO PROTECT ALL EXISTING SERVICES ON SITE.
4. ALL DRAWINGS SHALL BE REFERRED TO FOR SET OUT AND DETAILS.
5. THE CONTRACTOR IS RESPONSIBLE FOR SETTING OUT AND ALIGNMENTS.
6. THE CONTRACTOR IS RESPONSIBLE FOR THE DESIGN, INSTALLATION AND MAINTENANCE OF ANY NECESSARY TEMPORARY WORKS.
7. IF GROUND WATER IS ENCOUNTERED DURING THE CONSTRUCTION, CONTRACTOR SHOULD PROVIDE APPROPRIATE MEANS OF CONTROLLING GROUND WATER TO PREVENT SEEPAGE INTO CONSTRUCTION AREA.
8. THE EXTENT OF EXCAVATION REQUIRED SHALL BE MARKED OUT ON THE GROUND HAVING REGARD TO THE POSITIONS OF WORKING SPACE FOR CONSTRUCTION, BACKFILL REQUIRED AND DRAINAGE PROVISIONS.
9. SHOULD SIGN OF DISTRESS OR UNDUE SETTLEMENT OR ANY SIGN OF INSTABILITY BE DETECTED DURING THE COURSE OF CONSTRUCTION, ALL WORKS MUST CEASE AND THE ENGINEER BE INFORMED IMMEDIATELY.
10. AS PART OF THE CONTRACTOR ASSESSMENT OF GEOTECHNICAL INFORMATION, THE CONTRACTOR SHALL REFER TO THE GEOTECHNICAL REPORTS 'GEOTECHNICAL INVESTIGATION FOR PROPOSED FLOOD MITIGATION OPTIONS - AWE200028REPORT01.1' AND 'GEOTECHNICAL RECOMMENDATIONS FOR NEW PAVEMENTS AWE200028REPORT02.1' PREPARED BY CARDNO, NOW STANTEC PTY LTD PRIOR TO TENDER SUBMISSION, CONTRACTOR SHALL VISIT THE SITE AND SATISFY HIMSELF TO THE ACCESS REQUIREMENTS AND TEMPORARY WORK REQUIRED TO SATISFY THEIR CONSTRUCTION METHODS.
11. GROUND CONDITION MAY VARY. DUE ALLOWANCE SHALL BE MADE BY THE CONTRACTOR FOR CHANGES IN GROUND CONDITIONS.

LEVEE WALLS:

1. THE DESIGN HAS BEEN CARRIED OUT IN ACCORDANCE WITH;
   - AS4678 - EARTH RETAINING STRUCTURES
   - AS3600 - CONCRETE STRUCTURES
   - AS1170 - STRUCTURAL DESIGN ACTIONS
2. DESIGN EXPOSURE CLASSIFICATION

WIND LOADS:

REGION		= A
REGION WIND SPEEDS	V 1000(u)	= 46.0m/s
	V 20(s)	= 37.0m/s
CLIMATE CHANGE MULTIPLIER	Mc	= 1.00
DIRECTION MULTIPLIER	Md	= 1.00
TERRAIN/HEIGHT MULTIPLIER	Mz,cat	= 0.90
SHIELDING MULTIPLIER	Ms	= 1.00
TOPOGRAPHIC MULTIPLIER	Mt	= 1.00
INTERNAL PRESSURE COEFF.	Cpt	= +1.2
LIMIT STATE WIND SPEED	V DES	= 41.9m/s
WIND CLASSIFICATION		= N3 (W41N)

REINFORCEMENT

1. REINFORCING BARS AND MESH SHALL COMPLY WITH AS4671.
2. REINFORCEMENT SYMBOLS
   N - HOT ROLLED GRADE 500N DEFORMED BAR
   R - STRUCTURAL GRADE ROUND BAR
   RL, SL, L, - WELDED WIRE MESH
   W - STEEL WIRE
3. BARS SHALL BE BENT IN ACCORDANCE WITH AS3600.
4. REINFORCEMENT IS SHOWN DIAGRAMMATICALLY AND IS NOT NECESSARILY SHOWN IN TRUE PROJECTION.
5. SPLICES IN REINFORCEMENT ARE TO BE MADE ONLY IN THE POSITIONS SHOWN ON THE DRAWINGS OR AS OTHERWISE APPROVED BY THE PRINCIPAL'S AUTHORISED PERSON.
6. WELDING OF REINFORCEMENT IS NOT PERMITTED WITHOUT THE APPROVAL OF THE PRINCIPAL'S AUTHORISED PERSON.
7. REINFORCEMENT IS TO BE SUPPORTED IN ITS CORRECT POSITION WITHIN THE TOLERANCES OF AS3600 BY APPROVED BAR CHAIRS, SPACES OR SUPPORT BARS.
8. MINIMUM LAP LENGTHS FOR GRADE 500N BARS UNLESS SHOWN OTHERWISE SHALL BE
   N12 - 400 N16 - 500 N20 - 650 N24 - 800 N28 - 1000 N32 - 1200 N36 - 1500
   TOP BARS IN SLABS AND BEAMS GREATER THAN 300 THICK TO HAVE LAPS INCREASED BY 25%.
9. PROVIDE 500 x 500 'L' BARS TO ALL CORNERS. (2-N12 TOP & BOTTOM TO FOOTINGS UNO.)

FOUNDATIONS

1. THE FOUNDATIONS HAVE BEEN DESIGNED FOR THE FOLLOWING MAXIMUM ALLOWABLE BEARING CAPACITIES.

ELEMENT	PRESSURE (kPa)
FOOTINGS	100

2. FOUNDATIONS SHALL BE INSPECTED BY THE PRINCIPAL'S AUTHORISED PERSON BEFORE PLACING FOOTINGS. FOOTINGS SHALL BE POURED AS SOON AS POSSIBLE AFTER APPROVAL OF THE FOUNDATION AND SHALL BE MAINTAINED FREE FROM WATER AND LOOSE MATERIAL. FOUNDATIONS WHICH ARE ALLOWED TO SOFTEN OR ARE EXPOSED TO EXCESSIVE WATER SHALL BE OVER EXCAVATED AND BACKFILLED WITH BLINDING CONCRETE TO THE DESIGN FOUNDING LEVEL.
3. THE SITE SHALL BE STRIPPED OF ALL TOPSOIL AND ORGANIC MATERIAL.
4. CLAY CORE TO BE COMPACTED AND INSPECTED BY GEOTECHNICAL ENGINEER PRIOR TO PLACEMENT OF REINFORCEMENT.

CONCRETE

1. CONCRETE SHALL COMPLY WITH THE REQUIREMENTS OF AS3600. CONCRETE GRADE REFERS TO THE MINIMUM 28 DAY COMPRESSIVE STRENGTH F'C IN MPa AND THE PREFIX N OR S REFERS TO NORMAL CLASS OR SPECIAL CLASS CONCRETE AS SPECIFIED.

ELEMENT	GRADE(MPa)	MIN. COVER (mm)	MAX. AGGREGATE SIZE (mm)
WALLS	N40	50	20
STAIRS	N32	40	20

2. CONCRETE SIZES DO NOT INCLUDE APPLIED FINISHES.
3. NO CONSTRUCTION JOINTS, OTHER THAN THESE SHOWN ON THE DRAWINGS, SHALL BE USED WITHOUT THE APPROVAL OF THE PRINCIPAL'S AUTHORISED PERSON.
4. THE FOLLOWING FINISHES SHALL BE PROVIDED TO CONCRETE SURFACES.

ELEMENT	FINISH
WALLS	CLASS 2
STAIRS	CLASS 2

WHERE NOT SPECIFIED, FORMED FINISHES SHALL BE CLASS 3 TO AS3610 AND UNFORMED SURFACES SHALL BE A STEEL TROWEL FINISH.

5. EXPOSED EDGES SHALL BE CHAMFERED 20mm.
6. CONCRETE SHALL NOT BE PLACED UNTIL REINFORCEMENT, FORMWORK ETC. ARE INSPECTED AND APPROVED BY THE PRINCIPAL'S AUTHORISED PERSON.
7. CONCRETE SHALL BE MECHANICALLY VIBRATED TO GIVE MAXIMUM COMPACTION WITHOUT SEGREGATION.
8. CONCRETE ELEMENTS SHALL BE CURED BY METHODS APPROPRIATE TO THEIR FINAL APPLICATION.

Rev.	Date	Description	Des.	Verif.	Appd.
A	10/05/2024	TENDER ISSUE	AR	HG	AR

Greater Hume Council

Stantec
Stantec Australia Pty Ltd | ABN 17 007 820 322
Level 4, 501 Swanston Street
Melbourne VIC 3000
Tel: 03 8415 7777
Web: www.stantec.com/au

Drawn	AJH	Date 25/03/2024
Checked	AS	Date 25/03/2024
Designed	AR	Date 25/03/2024
Verified		Date
Approved		Date

Client: GREATER HUME SHIRE COUNCIL

Project: HHC FLOOD LEVEE DESIGN HOLBROOK, HENTY & CULCAIRN

Title: LEVEE RETAINING WALL STRUCTURAL NOTES

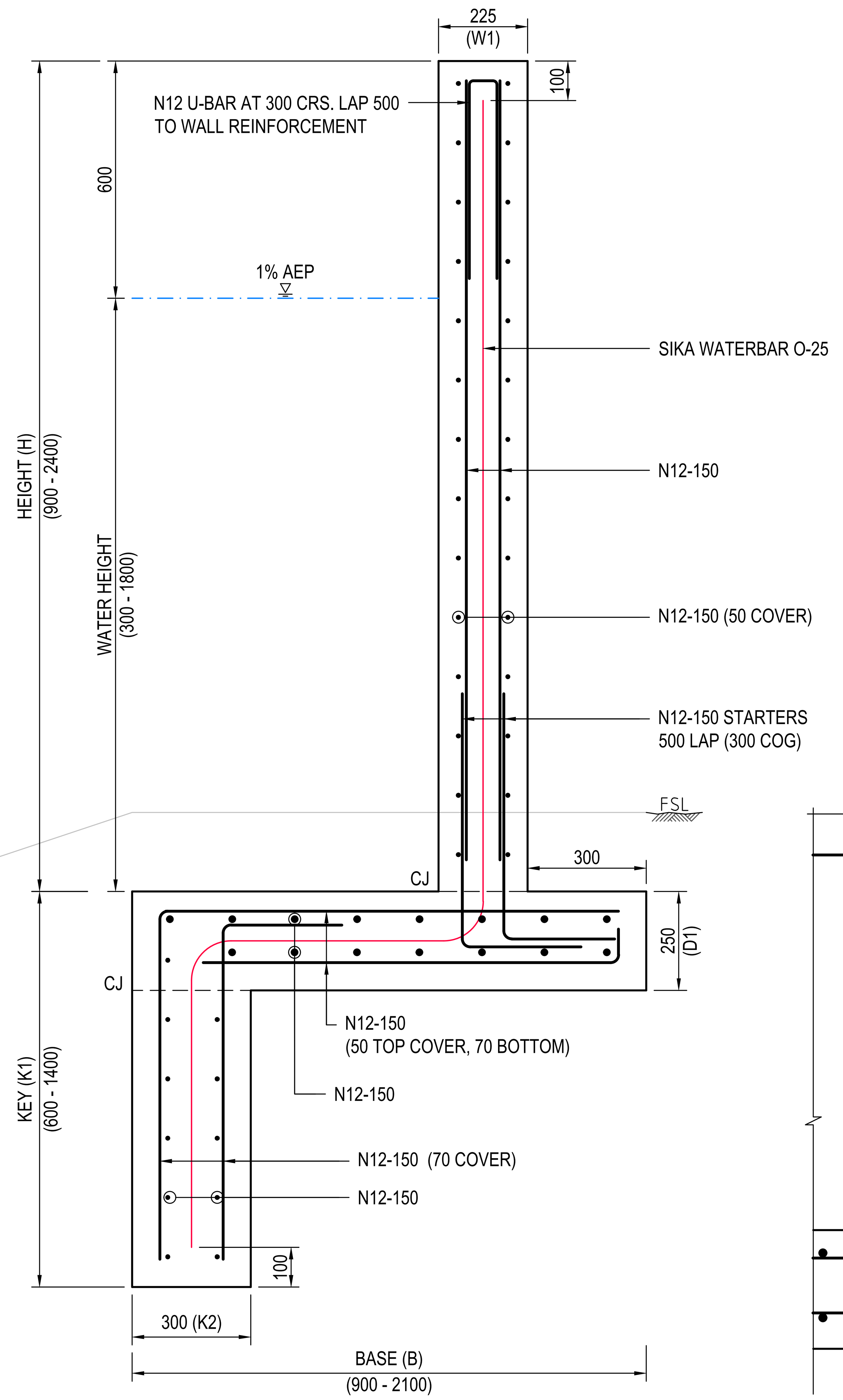
Status: FOR TENDER ONLY
NOT TO BE USED FOR CONSTRUCTION PURPOSES

VERT. DATUM	HORZ. DATUM	Scale	Size
AHD	MGA	AS SHOWN	A1

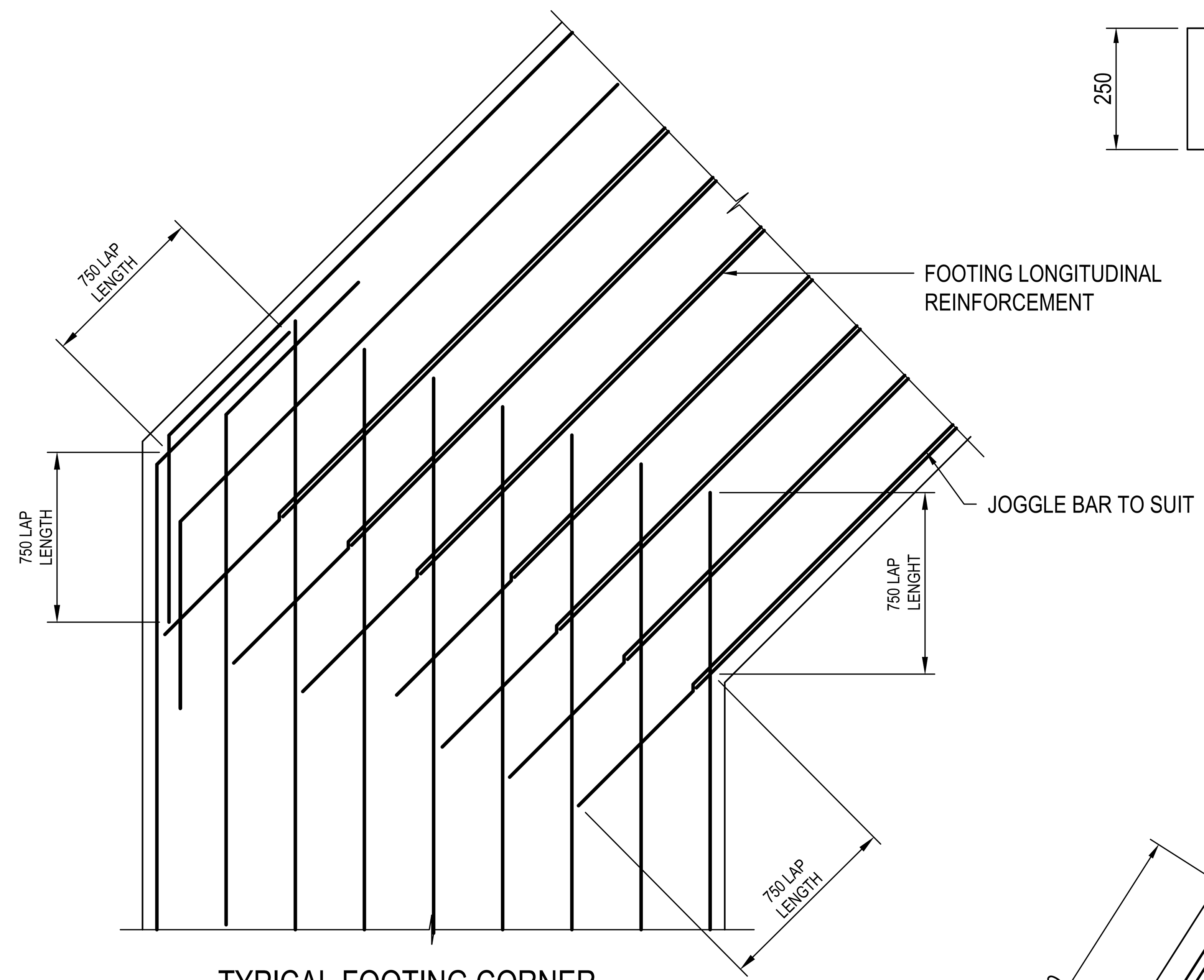
Drawing Number: 300203886-ST-3700 Revision: A

INVERTED 'T' FLOOD BARRIER - LEVEE WALL

WALL HEIGHT [H] (m)	WATER HEIGHT	WALL THICKNESS [W1] (m)	BASE [B] (m)	FOOTING DEPTH [D1] (m)	KEY DEPTH [K1] (m)	KEY WIDTH [K2] (m)
0.900	0.300	0.225	0.900	0.250	0.600	0.300
1.200	0.600	0.225	1.100	0.250	0.700	0.300
1.500	0.900	0.225	1.300	0.250	0.900	0.300
1.800	1.200	0.225	1.500	0.250	1.100	0.300
2.100	1.500	0.225	1.800	0.250	1.200	0.300
2.400	1.800	0.225	2.100	0.250	1.400	0.300

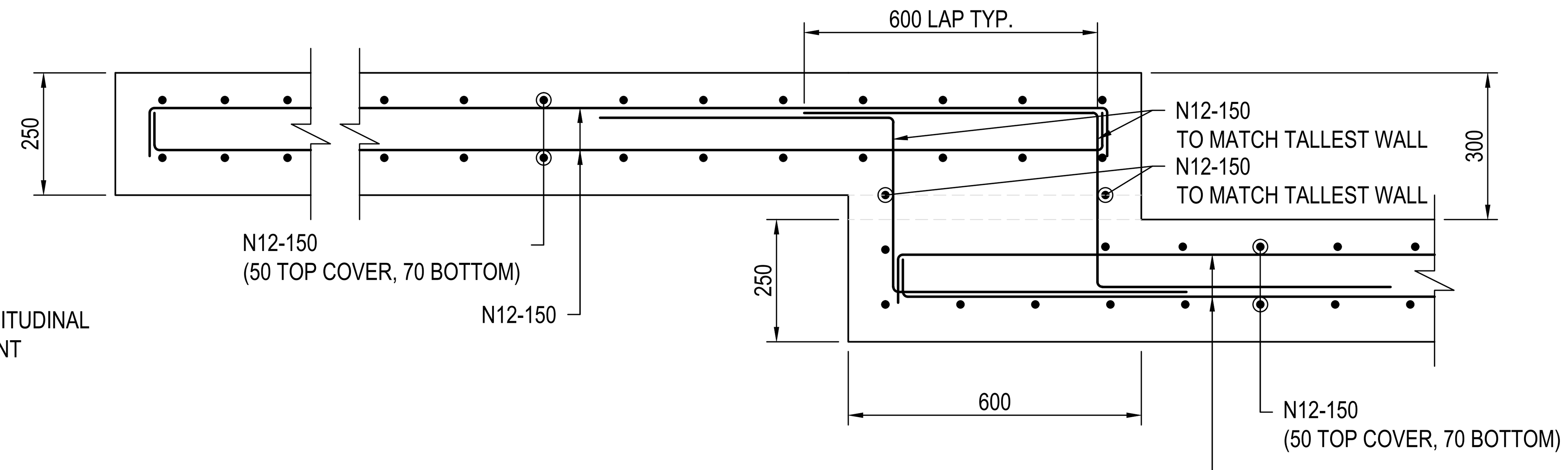


900 TO 2400 HEIGHT
LEVEE WALL
SCALE A1 - 1 : 10
A3 - 1 : 20

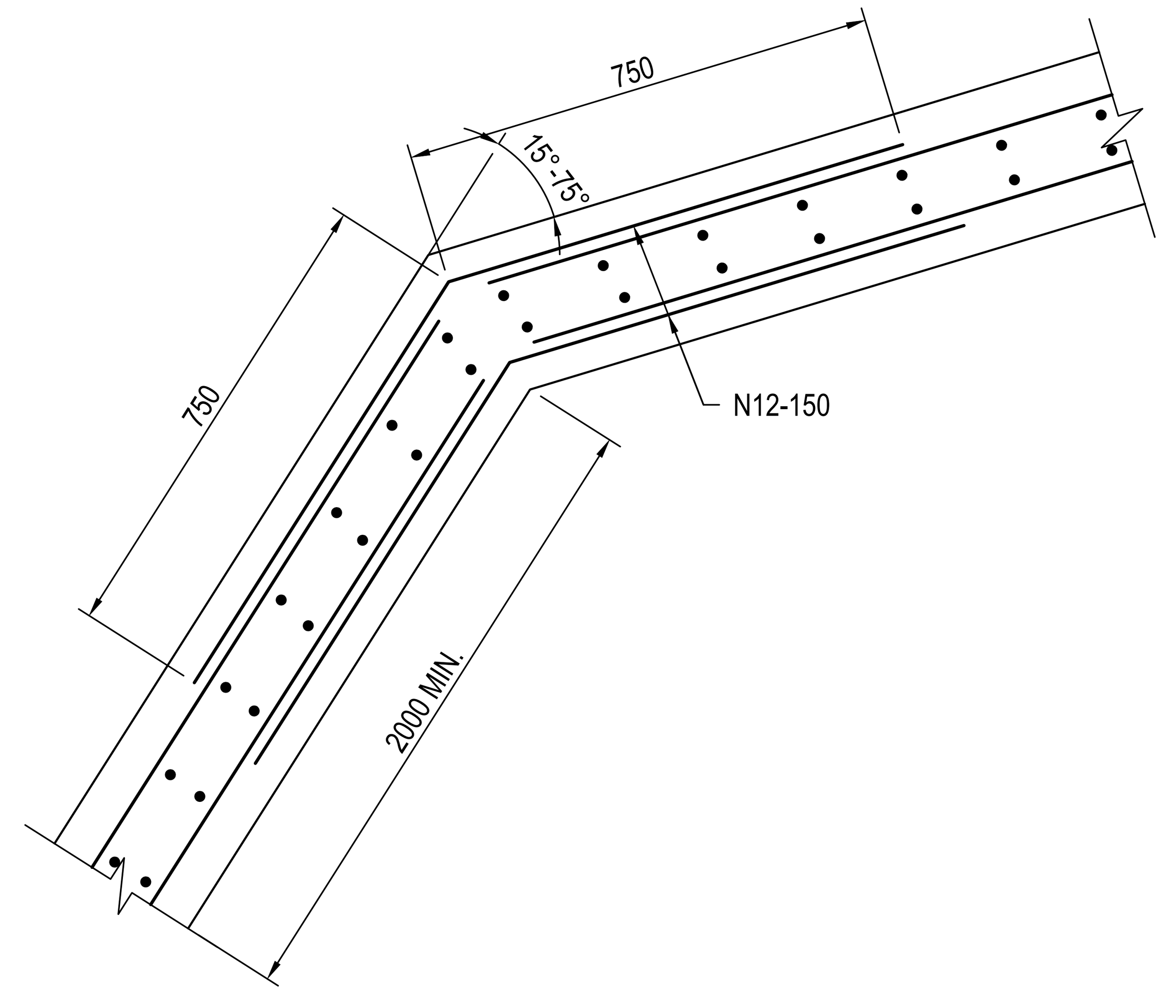


TYPICAL FOOTING CORNER
SCALE 1:20

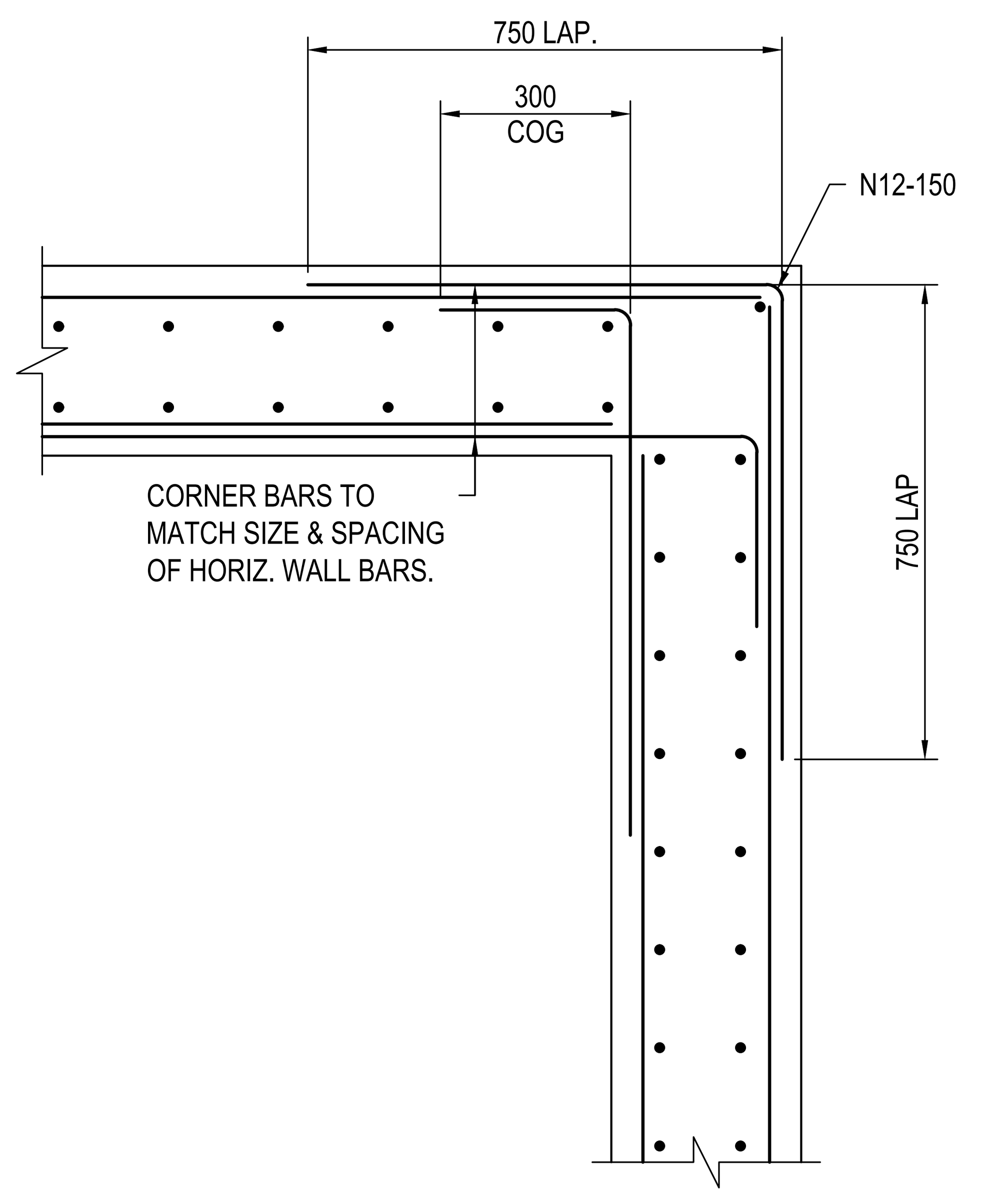
TRANSVERSE FOOTING REINFORCEMENT OMITTED FOR CLARITY



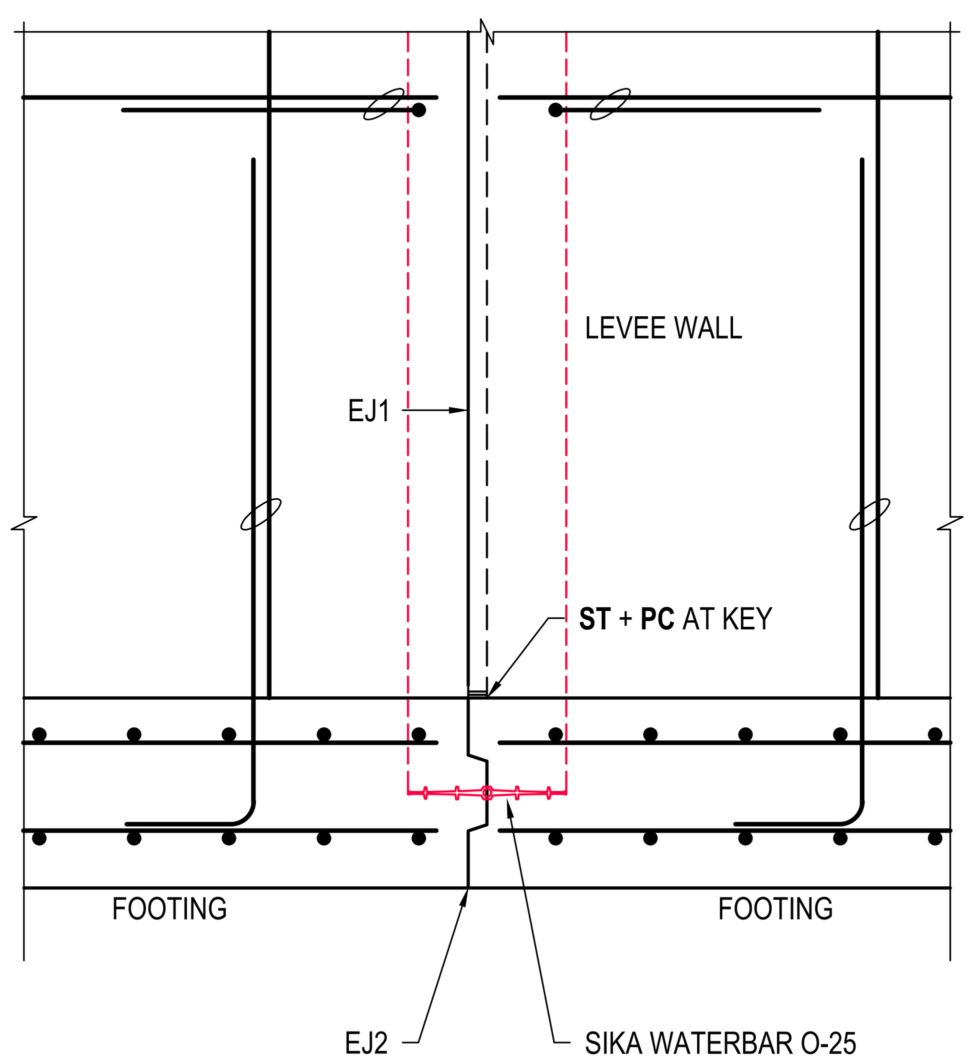
TYPICAL FOOTING STEP DETAIL
SCALE 1:10



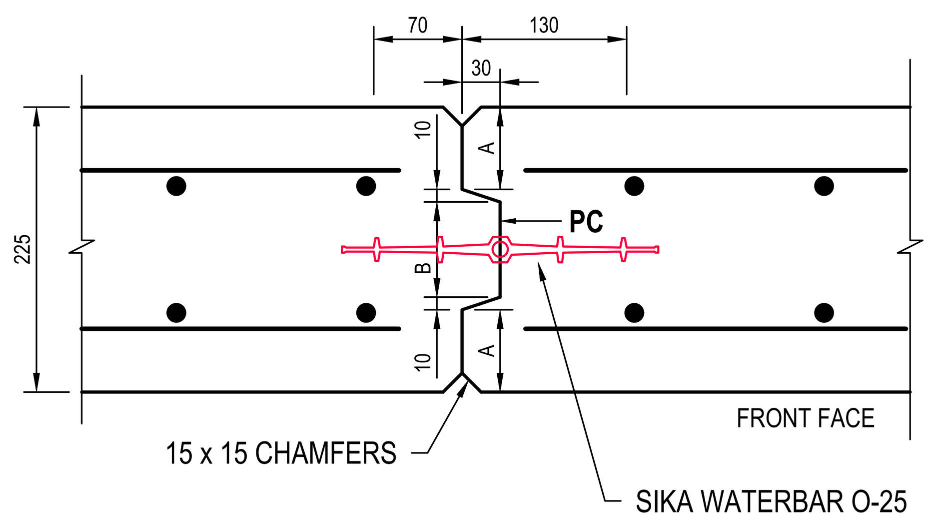
TYPICAL WALL CORNER DETAIL TYPE 2
SCALE 1:10



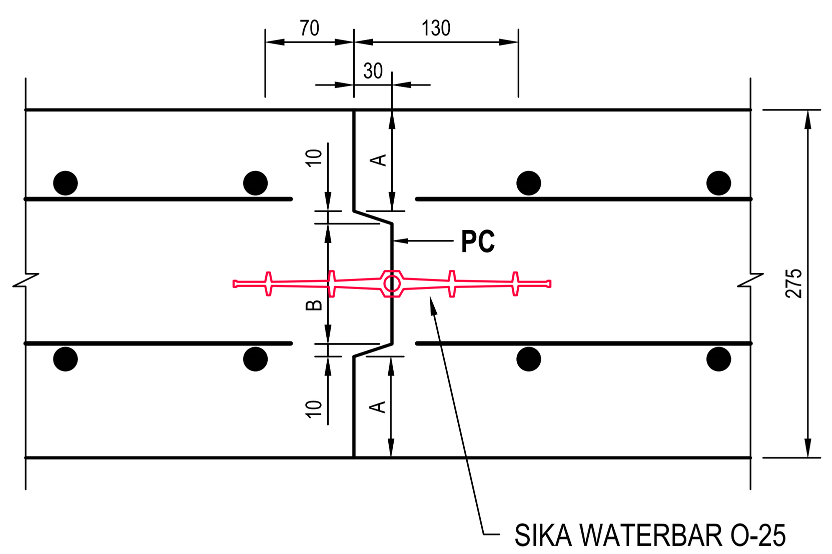
TYPICAL WALL CORNER DETAIL TYPE 1
SCALE 1:10



TYPICAL EXPANSION JOINT ELEVATION
SCALE 1:10



EXPANSION JOINT - EJ1 (WALLS ONLY)



EXPANSION JOINT - EJ2 (FOOTINGS ONLY)
KEY SIMILAR

EXPANSION JOINTS
SCALE 1:5

EJ1/EJ2 AT 8.0m MAX CRS. AND 2.0m CLEAR OF ANY CHANGE IN DIRECTION OF WALL

NOTE:
EXPANSION JOINT EJ1 TO ALIGN WITH EXPANSION JOINT EJ2.

EXPANSION JOINT KEY SIZE

W1 / D1 (mm)	DIM 'A' (mm)	DIM 'B' (mm)
225	65	75
250	75	80
300	90	100

LEGEND:

ST	STEEL TROWEL FINISH TO SURFACE
PC	2 COATS WATER BASE PAINT BEFORE POURING SECOND CONCRETE
CJ	CONSTRUCTION JOINT (OPTIONAL)

0 100 200 300 400 500mm
SCALE 1:5 @A1
0 200 400 600 800 1000mm
SCALE 1:10 @A1
0 500 1000 1500 2000mm
SCALE 1:20 @A1

DATE PLOTTED: 9 May 2024 3:50 PM BY : HAZELGROVE, ADAM

XREF's:
CAD File: \\au2013-ppfss01\shared_projects\300203886\300 Levee Design\300203886-ST-3701-3704.dwg

Rev.	Date	Description	Des.	Verif.	Appd.
A	10/05/2024	TENDER ISSUE	AR		AR

Greater Hume Council

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Drawn	AJH	Date 25/03/2024
Checked	AS	Date 25/03/2024
Designed	AR	Date 25/03/2024
Verified		Date
Approved		Date

Client: GREATER HUME SHIRE COUNCIL

Project: HHC FLOOD LEVEE DESIGN
HOLBROOK, HENTY
& CULCAIRN

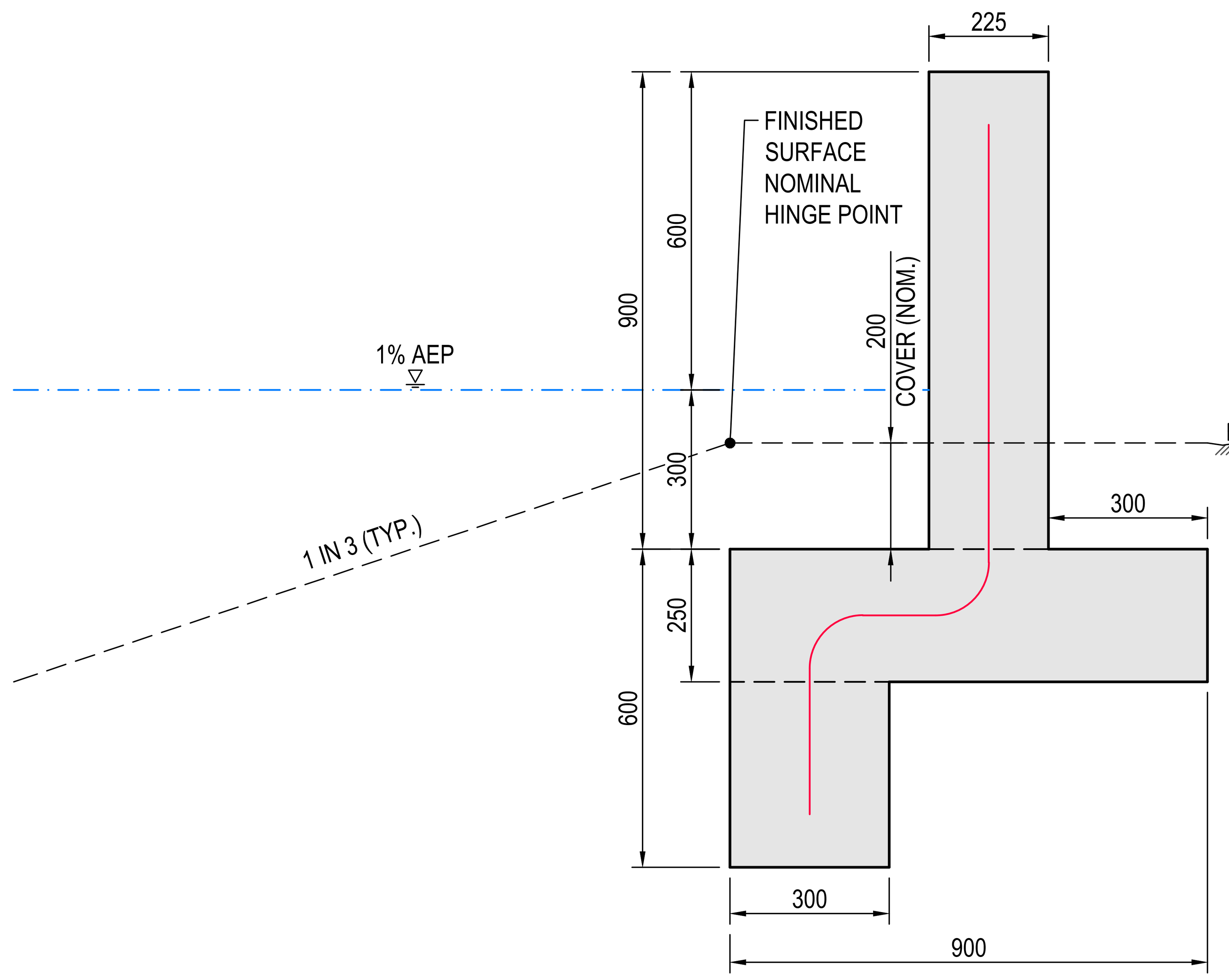
Title: LEVEE RETAINING WALL
INVERTED 'T' TYPE
TYPICAL REINFORCEMENT DETAILS

Status: FOR TENDER ONLY
NOT TO BE USED FOR CONSTRUCTION PURPOSES

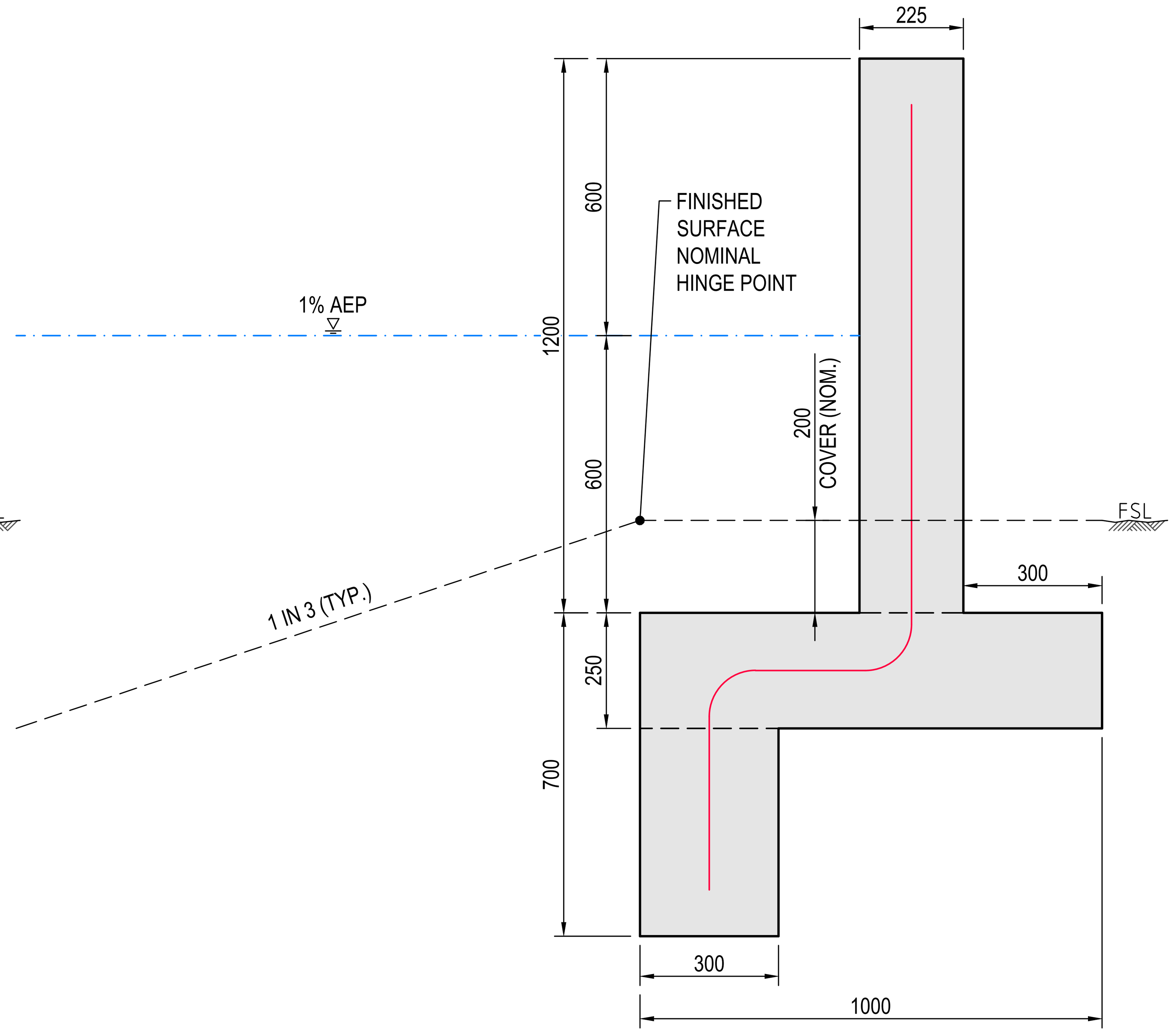
VERT. DATUM	HORZ. DATUM	Scale	Size
AHD	MGA	AS SHOWN	A1

Drawing Number	Revision
300203886-ST-3701	A

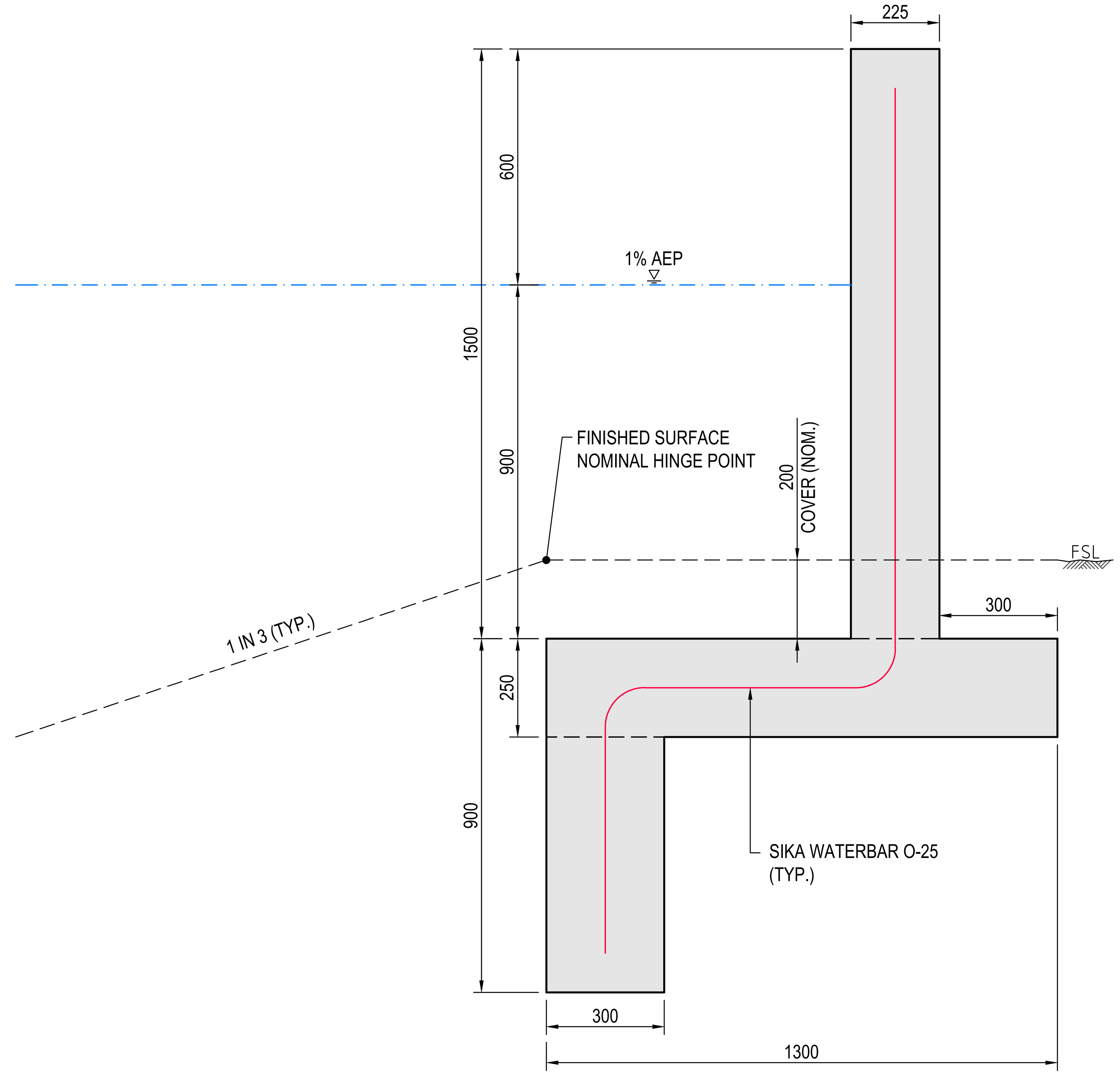
DATE PLOTTED: 9 May 2024 3:50 PM BY : HAZELGROVE, ADAM



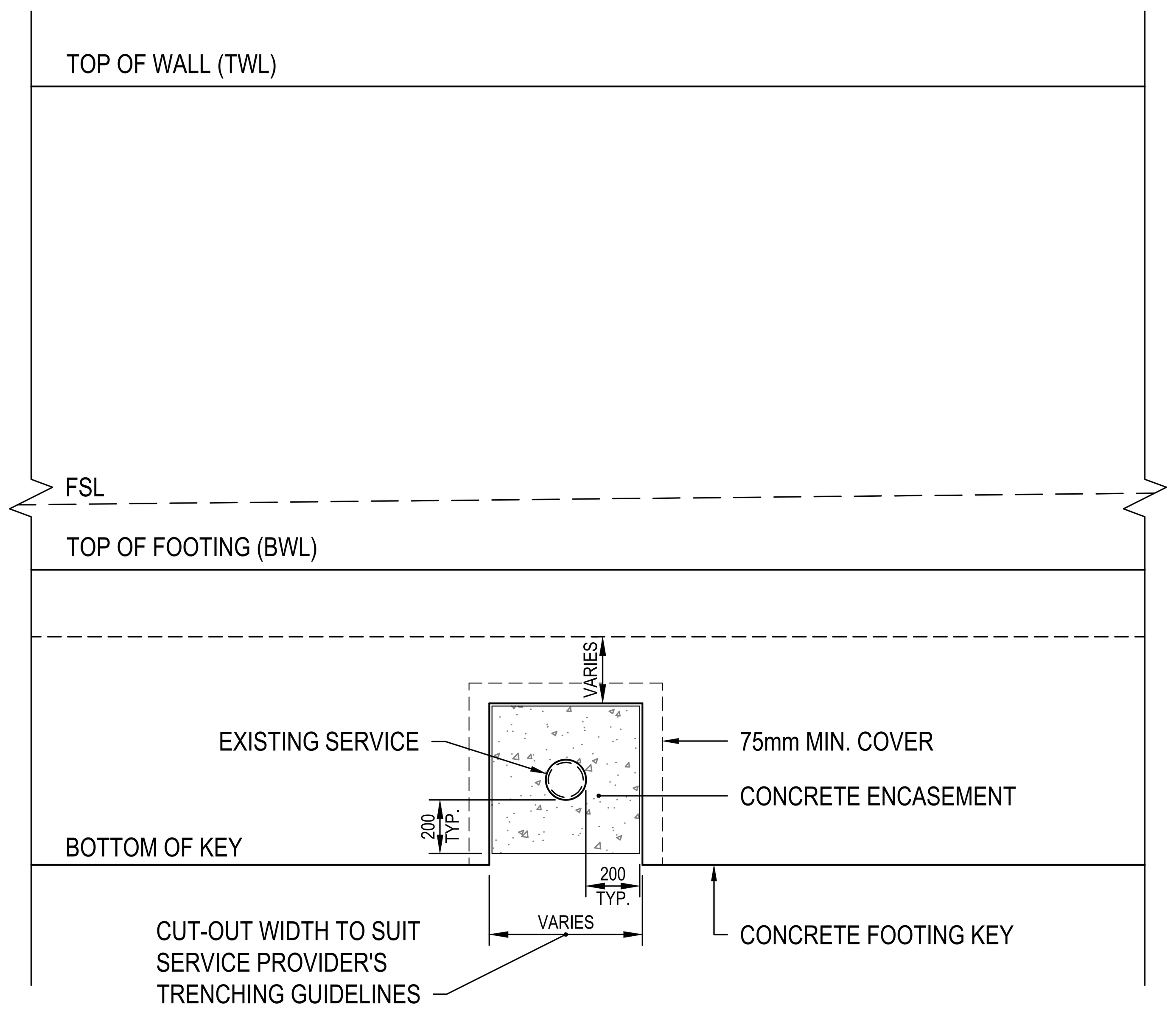
LEVEE WALL - 900 HIGH
SCALE 1:10



LEVEE WALL - 1200 HIGH
SCALE 1:10



LEVEE WALL - 1500 HIGH
SCALE 1:10



FOOTING KEY CUT-OUT DETAIL
LEVEE WALL
SCALE A1 - 1 : 20
A3 - 1 : 40

0 200 400 600 800 1000mm
SCALE 1:10 @A1

XREF's:
CAD File: \\au2013-ppfss01\shared_projects\300203886\300 Levee Design\300203886-ST-3701-3704.dwg

Rev.	Date	Description	Des.	Verif.	Appd.
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Checked	AS	Date 25/03/2024
Designed	AR	Date 25/03/2024
Verified		Date
Approved		Date

Client: GREATER HUME SHIRE COUNCIL

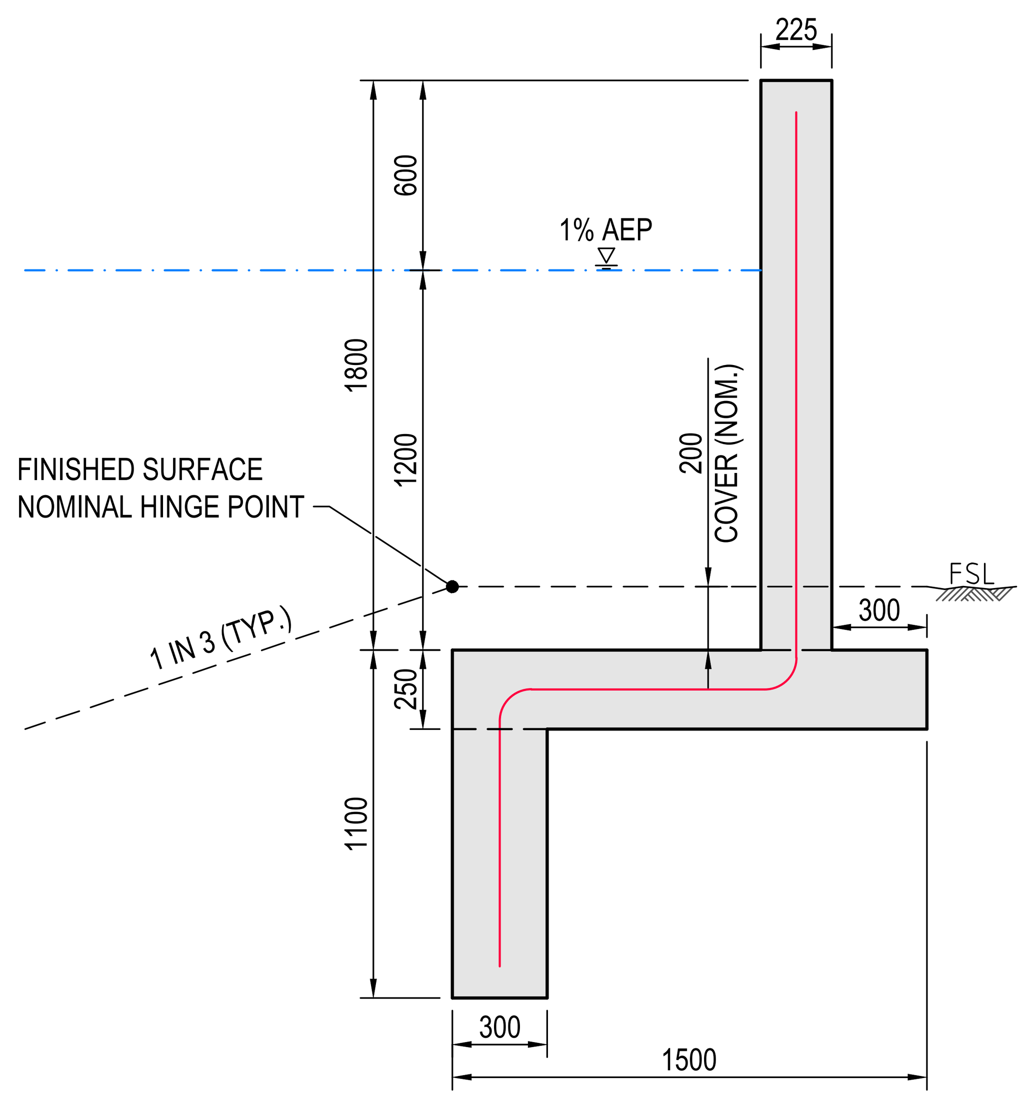
Project: HHC FLOOD LEVEE DESIGN
HOLBROOK, HENTY
& CULCAIRN

Title: LEVEE RETAINING WALL
INVERTED 'T' TYPE
TYPICAL SECTIONS - SHEET 1

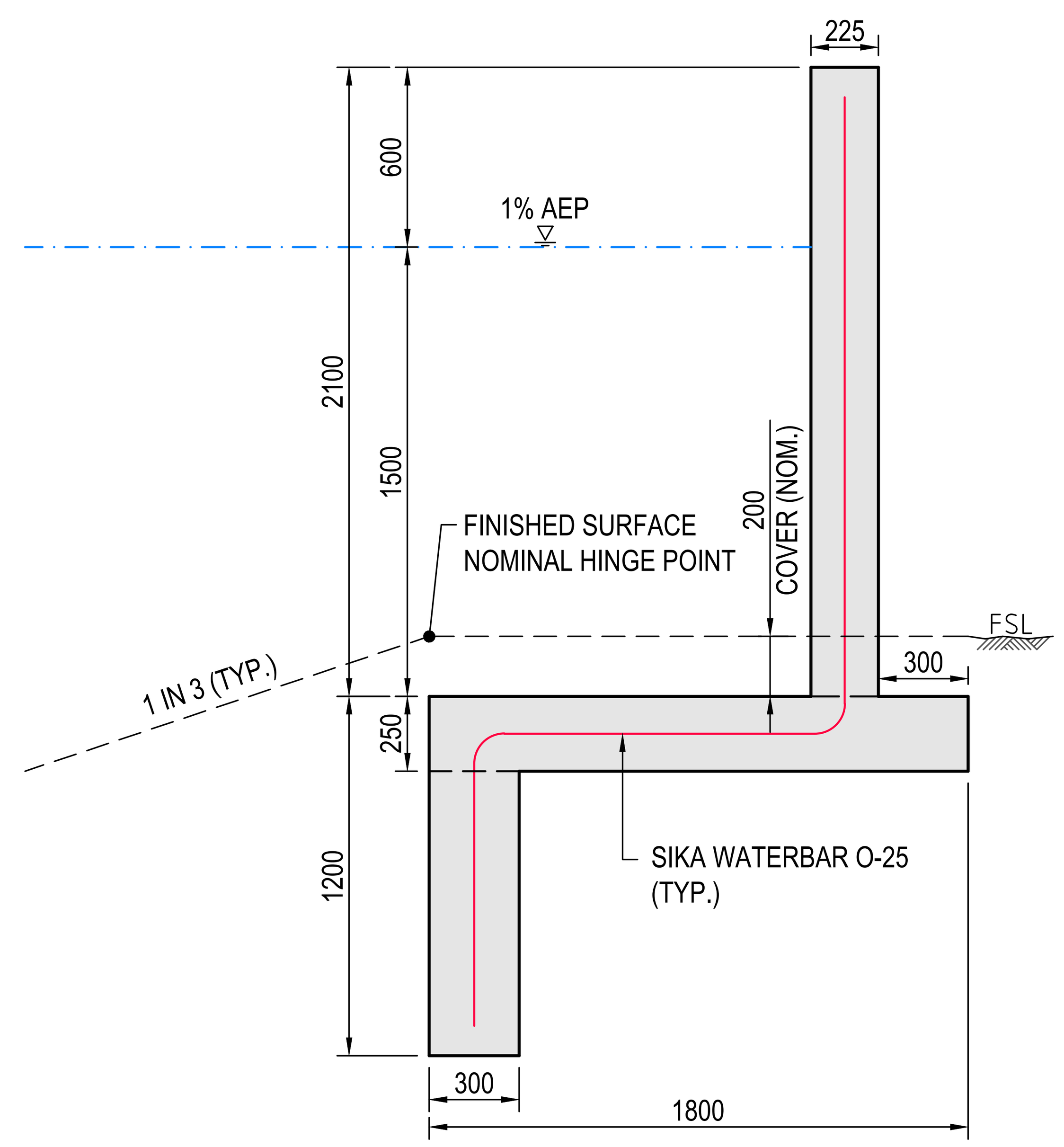
Status: FOR TENDER ONLY
NOT TO BE USED FOR CONSTRUCTION PURPOSES

VERT. DATUM	HORZ. DATUM	Scale	Size
AHD	MGA	AS SHOWN	A1

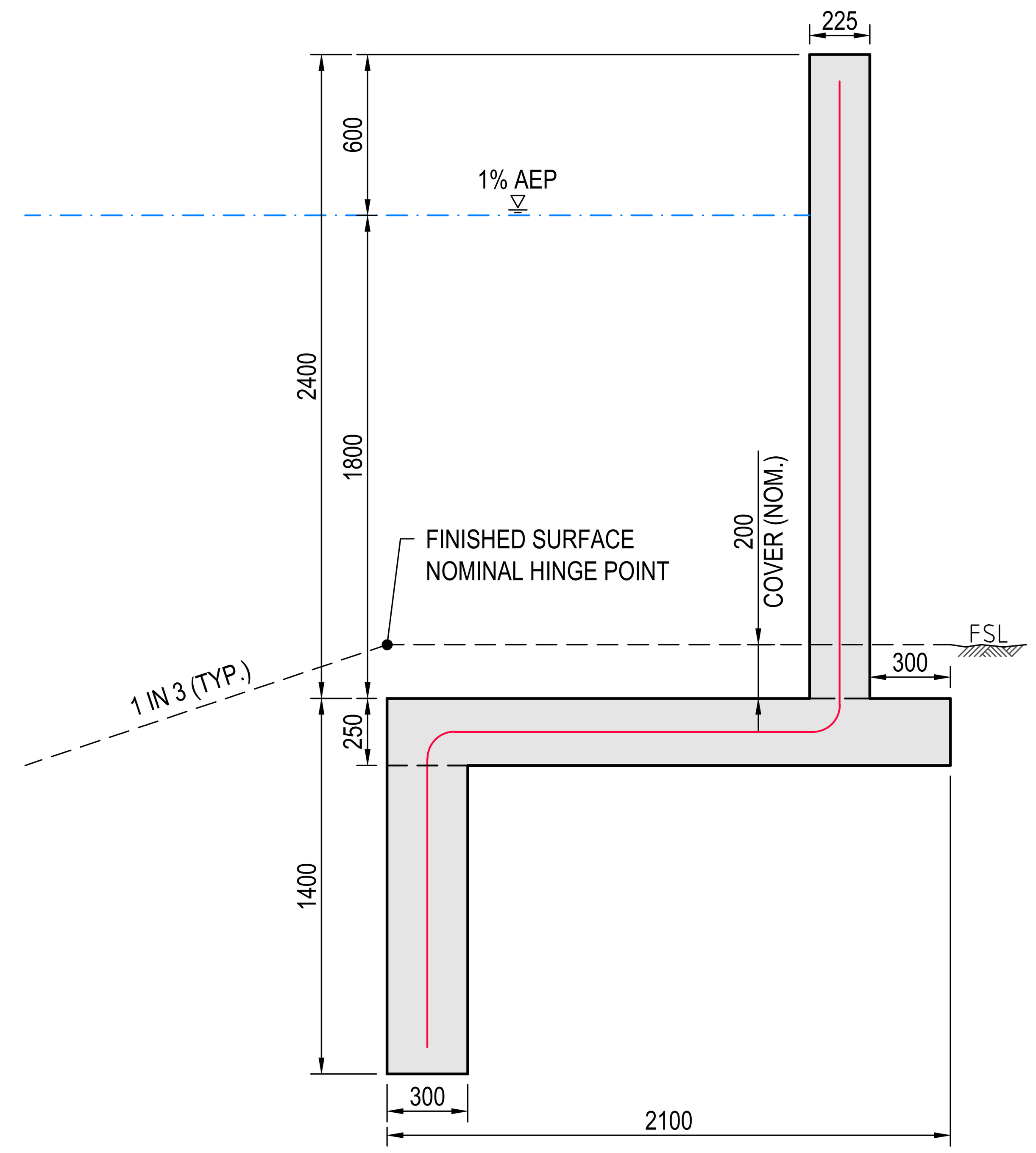
Drawing Number: 300203886-ST-3702
Revision: A



LEVEE WALL - 1800 HIGH
SCALE 1:20



LEVEE WALL - 2100 HIGH
SCALE 1:20



LEVEE WALL - 2400 HIGH
SCALE 1:20

0 500 1000 1500 2000mm
SCALE 1:20 @A1

DATE PLOTTED: 9 May 2024 3:50 PM BY : HAZELGROVE, ADAM

XREF's:
CAD File: \\au2013-ppfss01\shared_projects\300203886\300 Levee Design\300203886-ST-3701-3704.dwg

Rev.	Date	Description	Des.	Verif.	Appd.
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Checked	AS	Date 25/03/2024
Designed	AR	Date 25/03/2024
Verified		Date
Approved		Date

Client: GREATER HUME SHIRE COUNCIL

Project: HHC FLOOD LEVEE DESIGN
HOLBROOK, HENTY
& CULCAIRN

Title: LEVEE RETAINING WALL
INVERTED 'T' TYPE
TYPICAL SECTIONS - SHEET 2

Status: FOR TENDER ONLY
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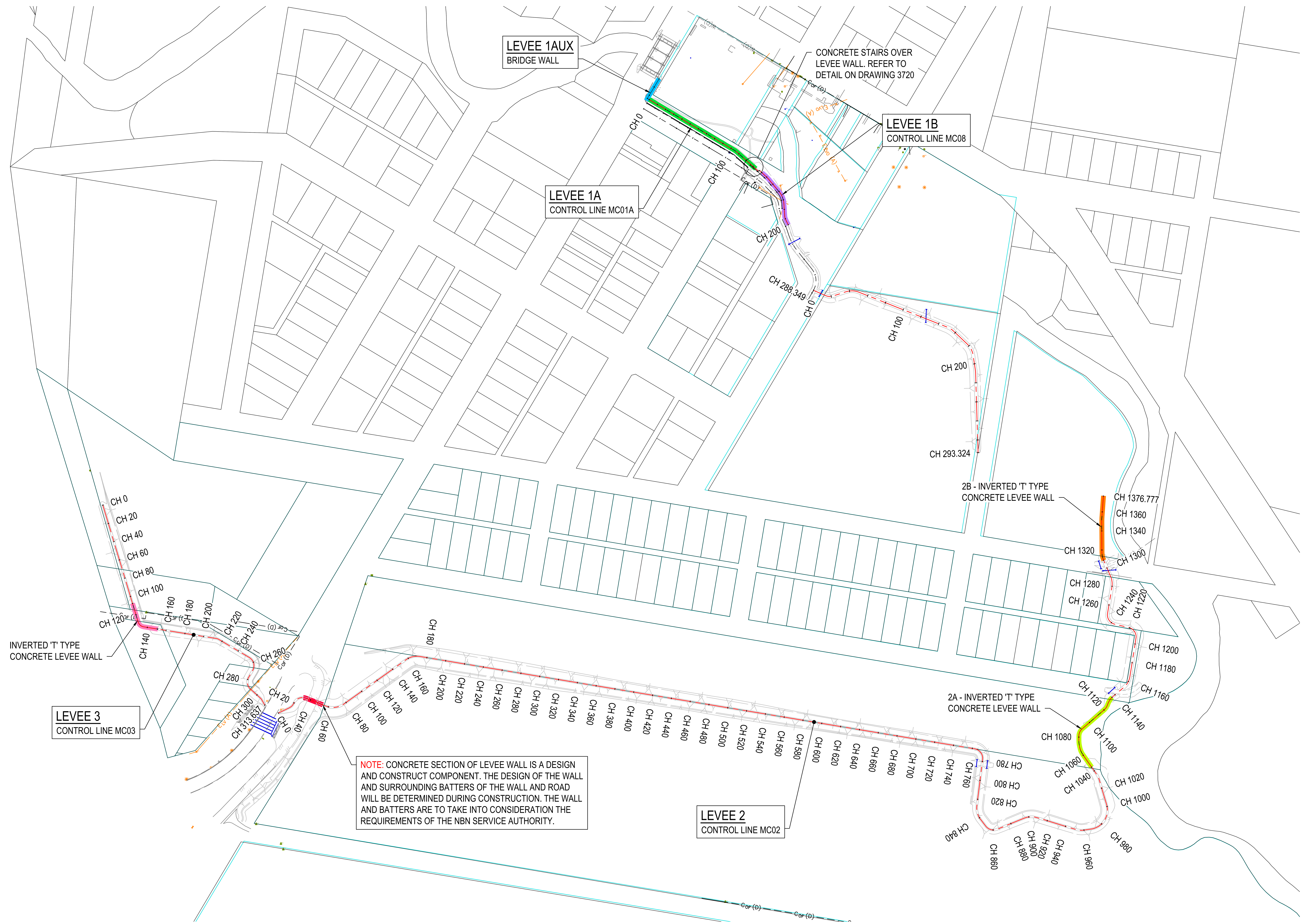
VERT. DATUM	HORZ. DATUM	Scale	Size
AHD	MGA	AS SHOWN	A1

Drawing Number	Revision
300203886-ST-3703	A



LEGEND

- LEVEE WALL 1 AUX
- LEVEE WALL 1A
- LEVEE WALL 1B
- LEVEE WALL 2A
- LEVEE WALL 2B
- LEVEE WALL 3

CONCRETE LEVEE WALL LAYOUT PLAN

SCALE 1:2000

Rev.	Date	Description	Des.	Verif.	Appd.
A	10/05/2024	TENDER ISSUE	AJH	HG	AR

NORTH

0 50 80m
SCALE 1:2000 @A1

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		Date
Drawn	AJH	25/03/2024
Checked	AS	25/03/2024
Designed	AR	25/03/2024
Verified		
Approved		

Client: GREATER HUME SHIRE COUNCIL

Project: HHC FLOOD LEVEE DESIGN
HOLBROOK, HENTY
& CULCAIRN

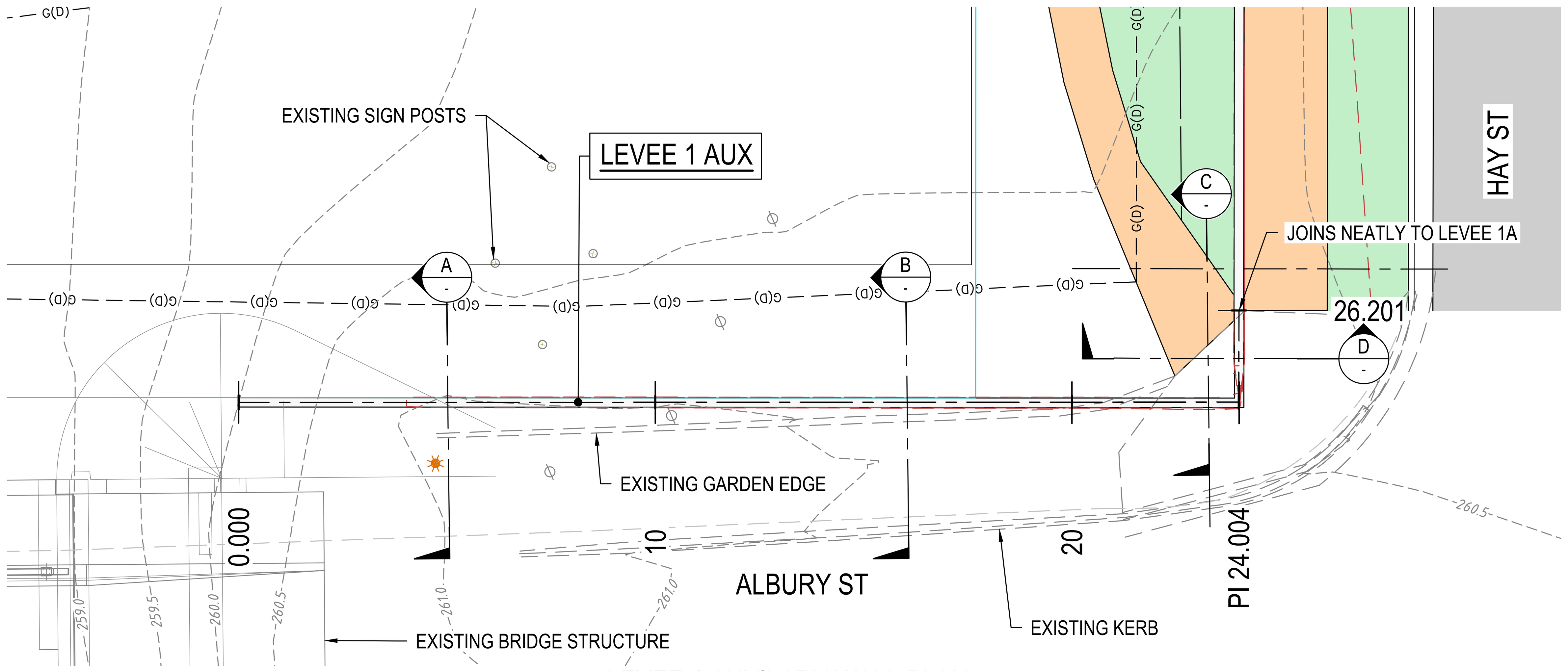
Title: LEVEE RETAINING WALL
HOLBROOK LEVEES
LAYOUT PLAN

Status: FOR TENDER ONLY
NOT TO BE USED FOR CONSTRUCTION PURPOSES

VERT. DATUM	HORZ. DATUM	Scale	Size
AHD	MGA	AS SHOWN	A1

Drawing Number: 300203886-ST-3710
Revision: A

DATE PLOTTED: 9 May 2024 3:56 PM BY : HAZELGROVE, ADAM

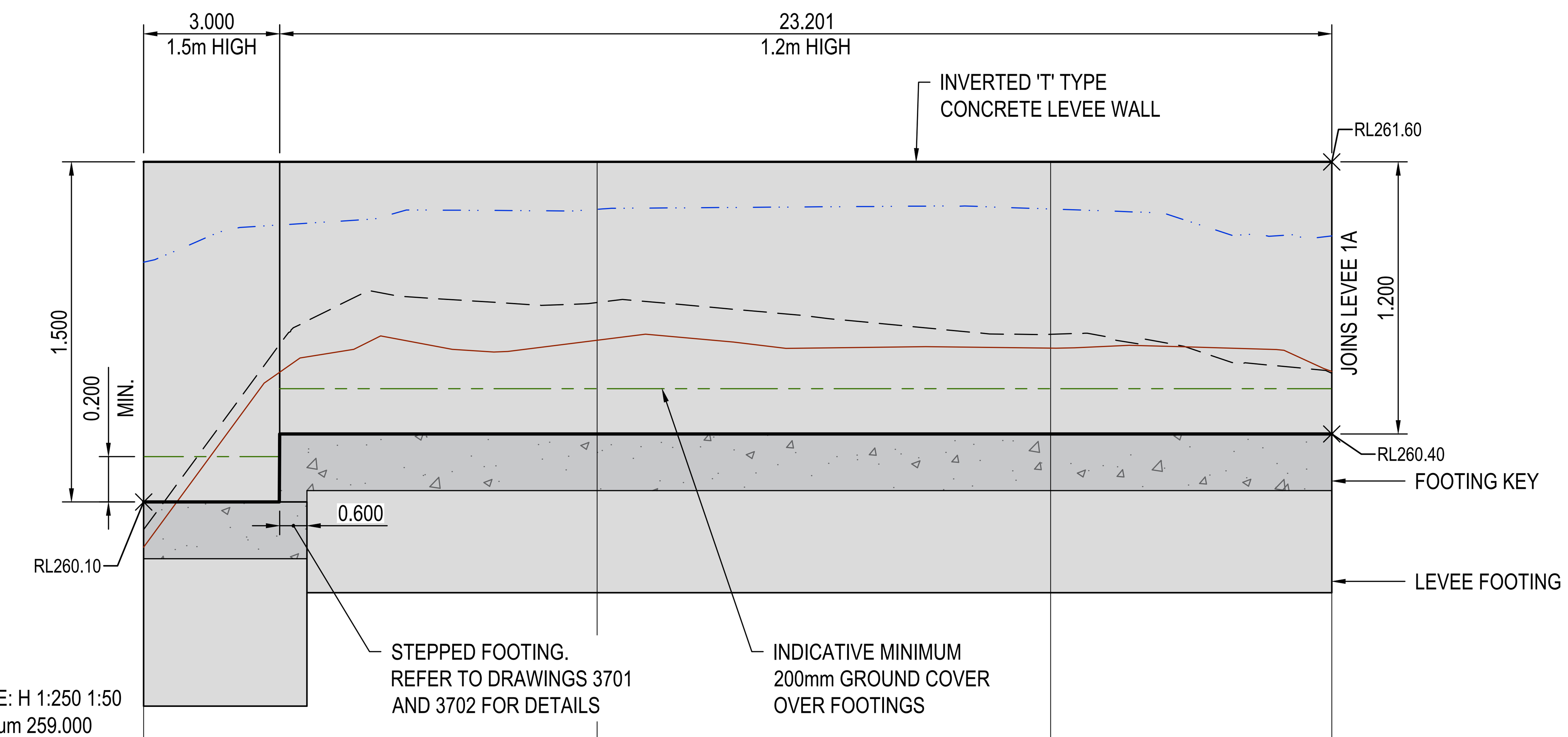


LEVEE 1 AUXILARY WALL PLAN

SCALE 1:100

LEGEND

- GRASS - TURFED
- LEVEE BENCH
- LEVEE BATTER - GRASS SEEDED
- ASPHALT PAVEMENT - P1
- ASPHALT PAVEMENT - P2
- CONCRETE PATH - C1
- GRAVEL MAINTENANCE TRACK - G1
- GRAVEL PATH - G2
- GRAVEL ROAD - G3
- 260.0 DESIGN CONTOURS
- 260.0 EXISTING CONTOURS
- LEVEE CONTROL LINE
- LEVEE TOP OF WALL (TWL)
- LEVEE BOTTOM OF WALL (BWL)
- FINISHED SURFACE LEVEL
- EXISTING SURFACE LEVEL
- 1% AEP FLOOD LEVEL + 600mm FREEBOARD
- INDICATIVE 200mm MIN. FOOTING COVER



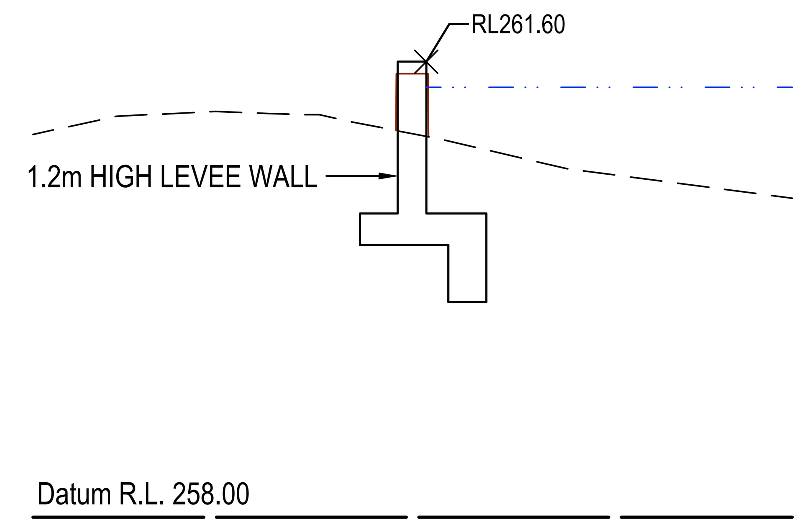
SCALE: H 1:250 1:50
Datum 259.000

WALL HEIGHT	1.500			1.200	1.200	1.200	1.200		1.200	1.200
DESIGN TWL	261.600			261.600	261.600	261.600	261.600		261.600	261.600
DESIGN BWL	260.100	260.100	260.400	260.400	260.400	260.400	260.400	260.400	260.400	260.400
1% AEP + 600mm				261.347	261.391	261.402	261.392		261.274	
EXISTING LEVELS				261.031	260.980	260.911	260.840		260.700	
CHAINAGE	0.000	2.990	3.000	5.000	10.000	15.000	20.000	24.004	25.000	26.201

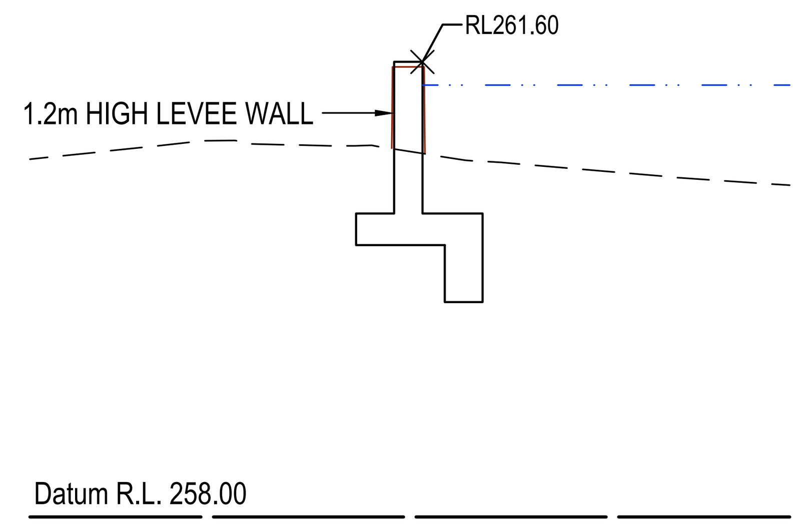
HOL LEVEE 1 AUX LONG SECTION

LEVEE 1 AUXILARY WALL LONGITUDINAL SECTION

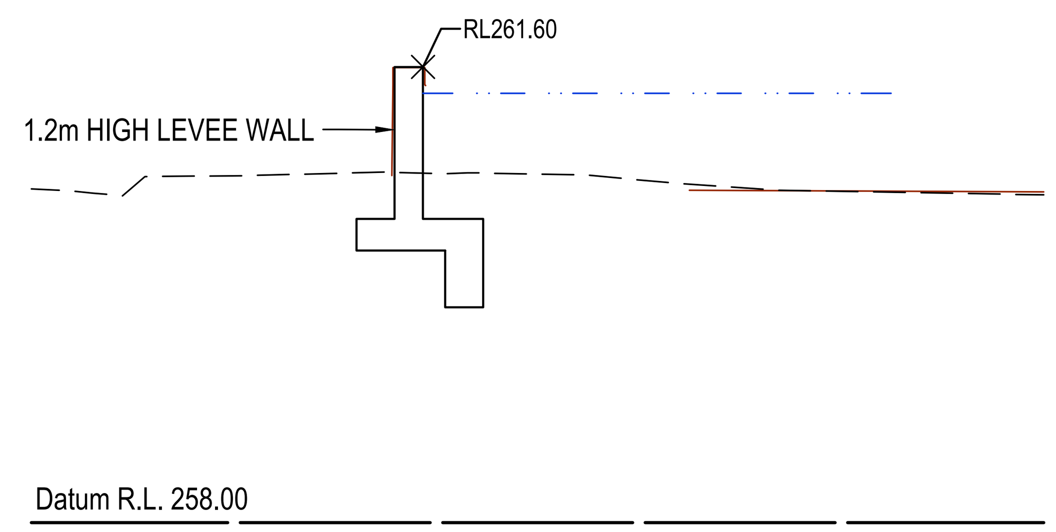
SCALE H 1:100 V 1:20



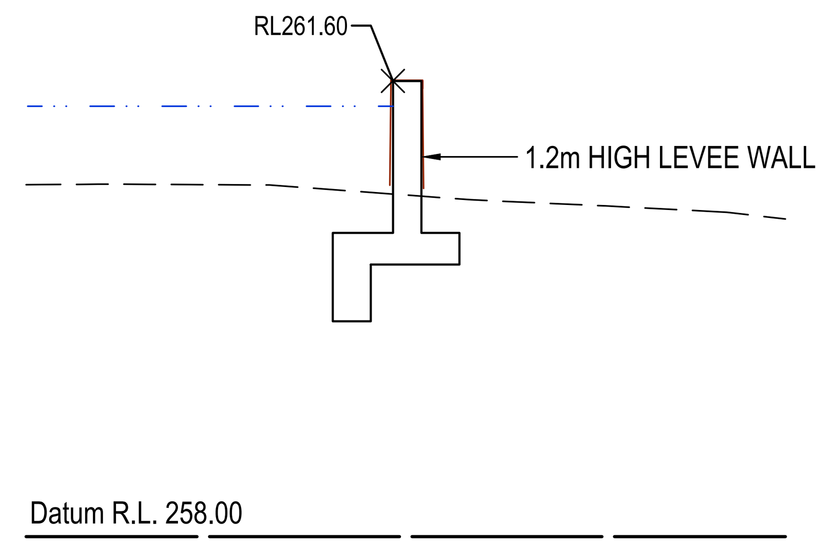
SECTION A
SCALE 1:50



SECTION B
SCALE 1:50



SECTION C
SCALE 1:50



SECTION D
SCALE 1:50

Rev.	Date	Description	Des.	Verif.	Appd.
A	10/05/2024	TENDER ISSUE	AJH	HG	AR

SCALE 1:20 @A1
SCALE 1:50 @A1
SCALE 1:100 @A1

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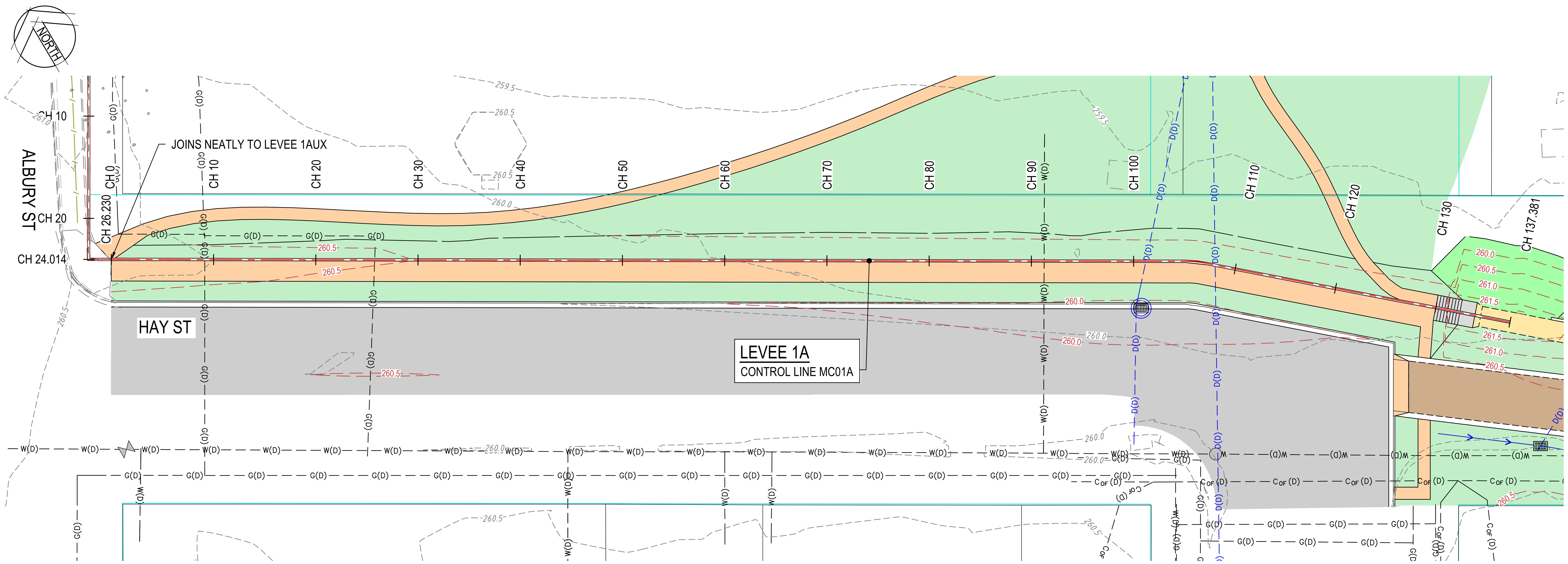
Drawn AJH Date 25/03/2024
Checked AS Date 25/03/2024
Designed AR Date 25/03/2024
Verified Date
Approved Date

Client: GREATER HUME SHIRE COUNCIL
Project: HHC FLOOD LEVEE DESIGN HOLBROOK, HENTY & CULCAIRN
Title: LEVEE RETAINING WALL HOLBROOK LEVEE 1 LONGITUDINAL SECTIONS - SHEET 1

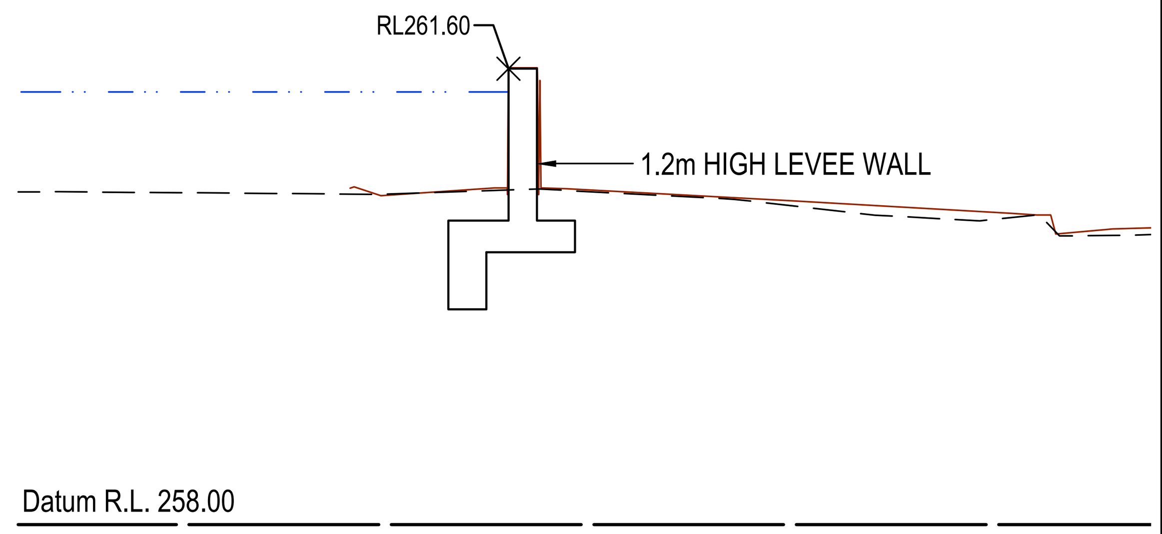
Status: FOR TENDER ONLY
NOT TO BE USED FOR CONSTRUCTION PURPOSES
VERT. DATUM: AHD | HORZ. DATUM: MGA | Scale: AS SHOWN | Size: A1
Drawing Number: 300203886-ST-3711 | Revision: A

DATE PLOTTED: 9 May 2024 2:41 PM BY : HAZELGROVE, ADAM
XREFs: XR-03886-VIC-MAP; XR-03886-BASE-HOL; XR-03886-ALGN-CHNG; XR-03886-SURV-PWD; XR_03886_SU_BYDA_STRM; XR_03886_SU_BYDA_SERV; XR-03886-LEGEND
CAD File: \\au2013-ppfss01\shared_projects\300203886\300 Levee Design\300203886-ST-3710-3716.dwg



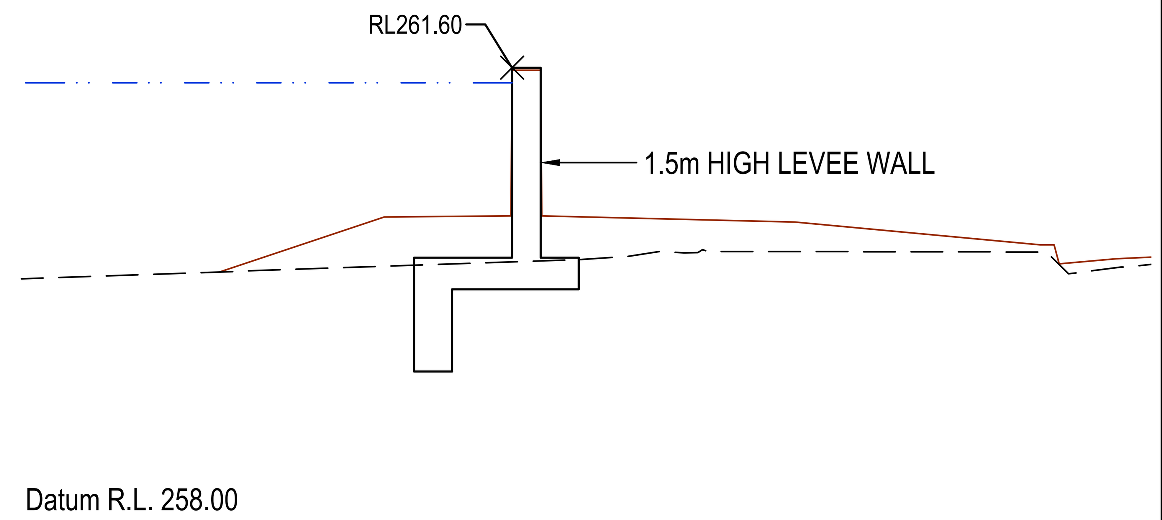
LEVEE 1A PLAN

SCALE 1:250



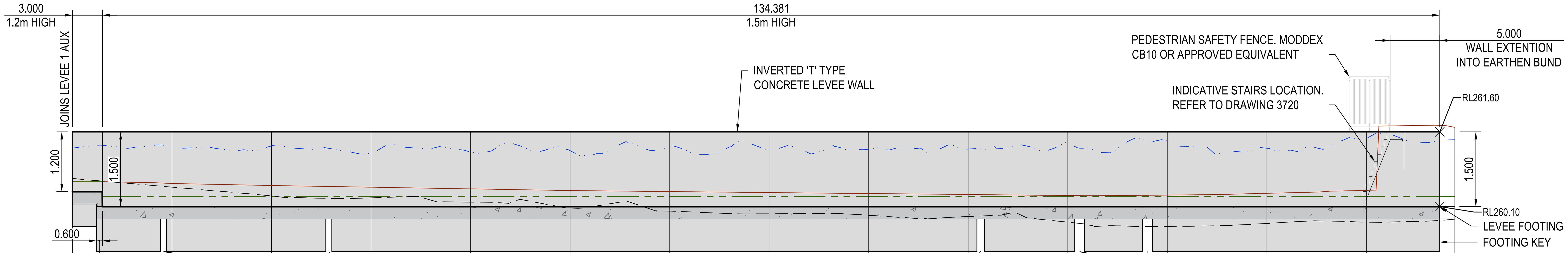
LEVEE 1A CH.1.00

SCALE 1:50



LEVEE 1A CH.50

SCALE 1:50



SCALE: H 1:250 1:50
Datum 258.000

STEPPED FOOTING. REFER TO DRAWINGS 3701 AND 3702 FOR DETAILS

CAUTION: APPROXIMATE LOCATION OF GAS MAIN. REFER TO NOTES

CAUTION: APPROXIMATE LOCATION OF WATER MAIN. REFER TO NOTES

CAUTION: APPROXIMATE LOCATION OF DRAINAGE PIPES. REFER TO NOTES

WALL HEIGHT	1.200			1.500	1.500	1.500	1.500	1.500	1.500	1.500	1.500	1.500	1.500	1.500	1.500	1.500	1.500	
DESIGN TWL	261.600			261.600	261.600	261.600	261.600	261.600	261.600	261.600	261.600	261.600	261.600	261.600	261.600	261.600	261.600	
DESIGN BWL	260.400	260.400	260.100	260.100	260.100	260.100	260.100	260.100	260.100	260.100	260.100	260.100	260.100	260.100	260.100	260.100	260.100	
1% AEP + 600mm				261.299	261.318	261.180	261.197	261.221	261.305	261.242	261.238	261.254	261.374	261.414	261.270	261.467		261.442
EXISTING LEVELS				260.490	260.314	260.275	260.189	260.071	260.008	259.954	259.925	259.900	259.786	259.702	259.760	259.788		259.848
CHAINAGE	0.000	3.000	3.010	10.000	20.000	30.000	40.000	50.000	60.000	70.000	80.000	90.000	100.000	110.000	120.000	130.000	137.381	138.881

HOL LEVEE 1A LONG SECTION

LEVEE 1A WALL LONGITUDINAL SECTION

SCALE H 1:250 V 1:50

NOTES:
1. REFER TO DRAWINGS 300203886-ST-3700 TO 3707 FOR STRUCTURAL NOTES AND DETAILS.
2. REFER TO DRAWINGS 300203886-WE-3400 TO 3456 FOR GEOTECHNICAL NOTES AND DETAILS.
3. SERVICES LOCATIONS SHOWN ARE APPROXIMATE. CONTRACTOR TO VERIFY EXISTING SERVICES LEVELS PRIOR TO CONSTRUCTION. ANY DISCREPANCIES MUST BE IMMEDIATELY IDENTIFIED AND THE SUPERINTENDENT NOTIFIED PRIOR TO CONSTRUCTION COMMENCING.
4. IF EXISTING SERVICES ARE FOUND TO BE AT A LEVEL THAT CONFLICTS WITH FOOTING KEY A 'CUT-OUT' MAY BE PROVIDED TO ALLOW SERVICES TO PASS THROUGH.

LEGEND
- GRASS - TURFED
- LEVEE BENCH
- LEVEE BATTER - GRASS SEEDED
- ASPHALT PAVEMENT - P1
- ASPHALT PAVEMENT - P2
- CONCRETE PATH - C1
- GRAVEL MAINTENANCE TRACK - G1
- GRAVEL PATH - G2
- GRAVEL ROAD - G3
- 260.0 DESIGN CONTOURS
- 260.0 EXISTING CONTOURS
- LEVEE CONTROL LINE
- LEVEE TOP OF WALL (TWL)
- LEVEE BOTTOM OF WALL (BWL)
- FINISHED SURFACE LEVEL
- EXISTING SURFACE LEVEL
- 1% AEP FLOOD LEVEL + 600mm FREEBOARD
- INDICATIVE 200mm MIN. FOOTING COVER

DATE PLOTTED: 16 May 2024 10:40 AM BY : HAZELGROVE, ADAM
XREFs: XR-03886-VIC-MAP; XR-03886-BASE-HOL; XR-03886-ALGN-CHNG; XR-03886-SURV-PWO; XR_03886_SU_BYDA_STRM; XR_03886_SU_BYDA_SERV; XR-03886-LEGEND
CAD File: \\au2013-ppfss01\shared_projects\300203886\300 Levee Design\300203886-ST-3710-3716.dwg

Rev.	Date	Description	Des.	Verif.	Appd.
A	10/05/2024	TENDER ISSUE	AJH	HG	AR

SCALE 1:50 @A1 — 0 1 2m
SCALE 1:250 @A1 — 0 5 10m

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Drawn	AJH	Date 25/03/2024
Checked	AS	Date 25/03/2024
Designed	AR	Date 25/03/2024
Verified		Date
Approved		Date

Client: GREATER HUME SHIRE COUNCIL

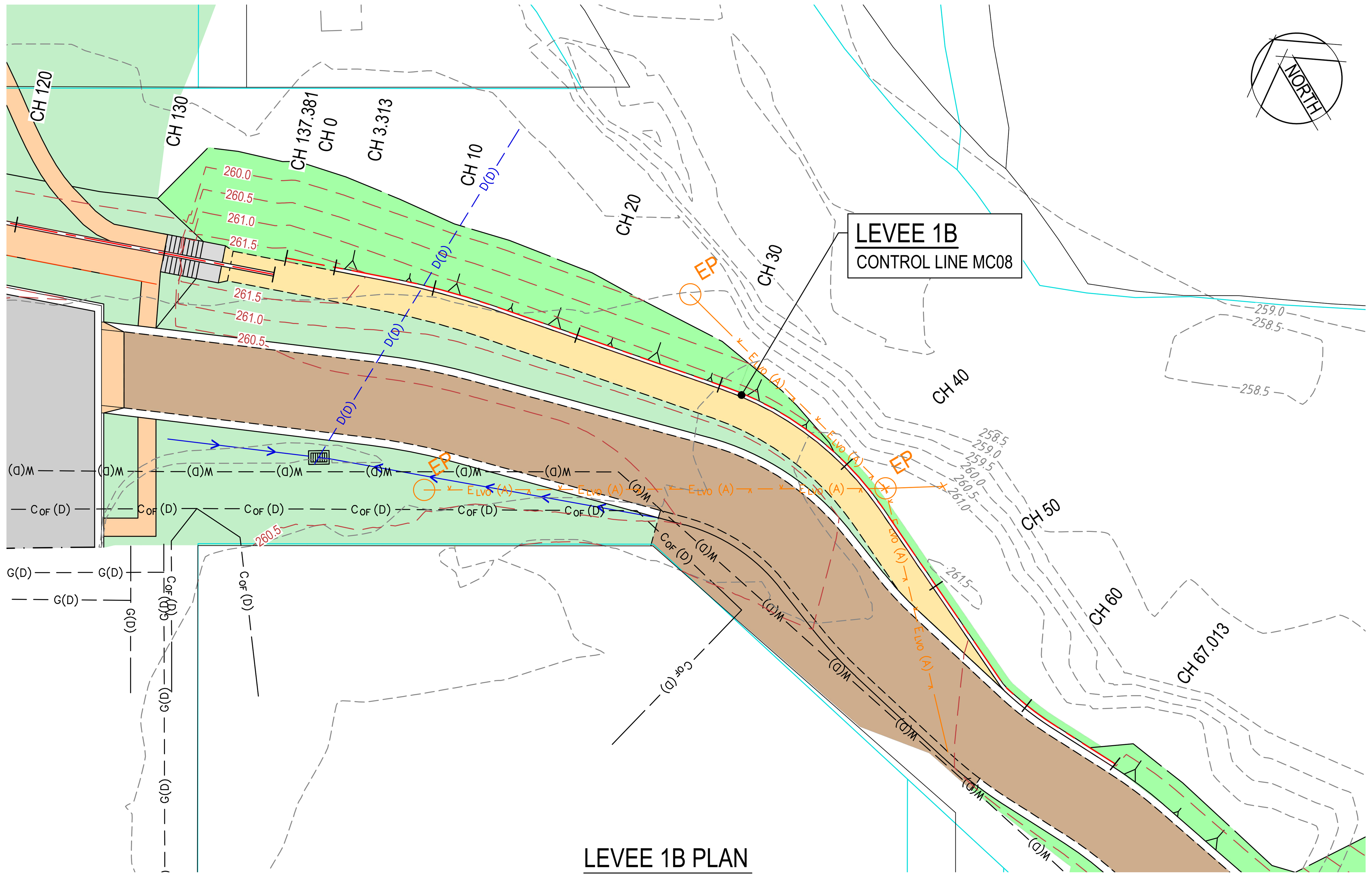
Project: HHC FLOOD LEVEE DESIGN
HOLBROOK, HENTY
& CULCAIRN

Title: LEVEE RETAINING WALL
HOLBROOK LEVEE 1
LONGITUDINAL SECTIONS - SHEET 2

Status: FOR TENDER ONLY
NOT TO BE USED FOR CONSTRUCTION PURPOSES

VERT. DATUM	HORZ. DATUM	Scale	Size
AHD	MGA	AS SHOWN	A1

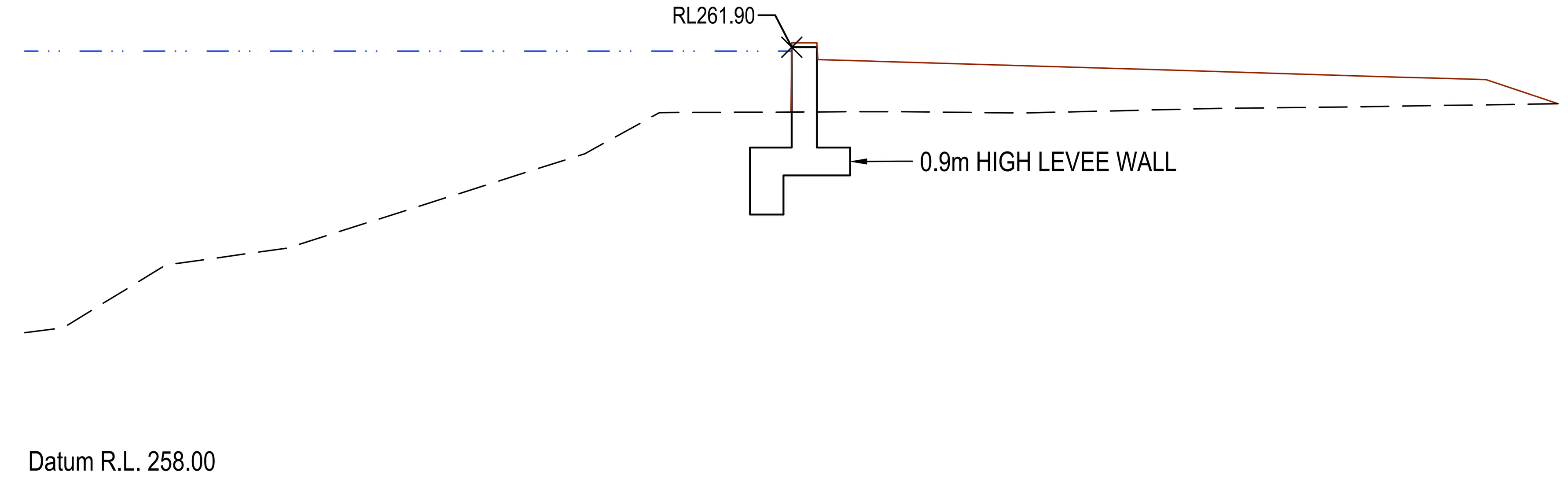
Drawing Number: 300203886-ST-3712
Revision: A



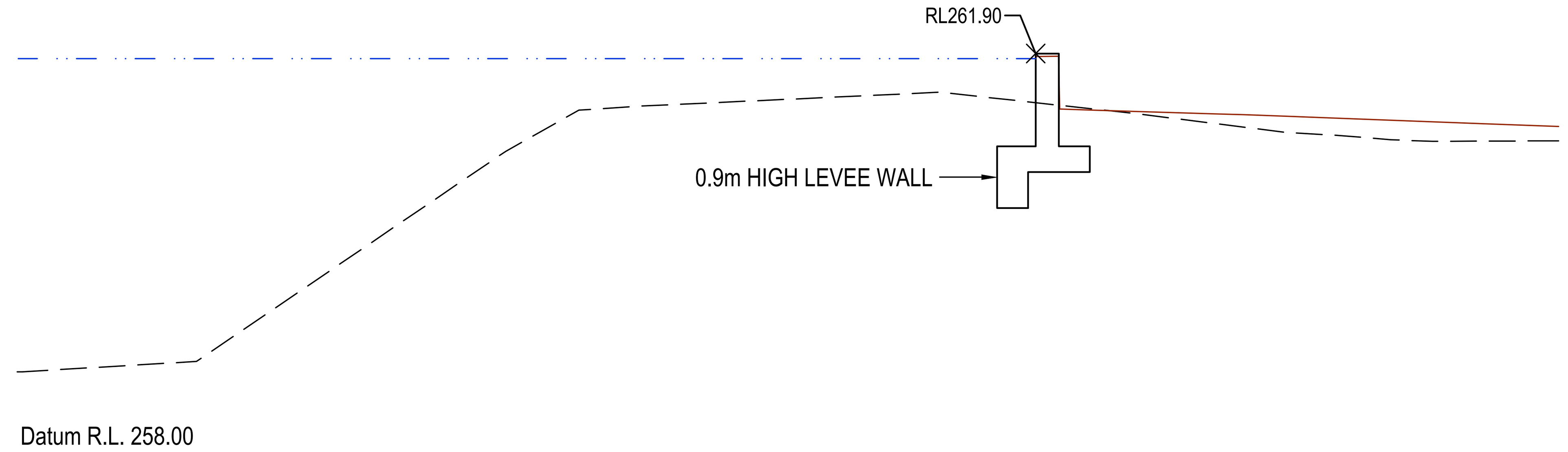
LEVEE 1B PLAN
SCALE 1:250

NOTES:
1. REFER TO DRAWINGS 300203886-ST-3700 TO 3707 FOR STRUCTURAL NOTES AND DETAILS.
2. REFER TO DRAWINGS 300203886-WE-3400 TO 3456 FOR GEOTECHNICAL NOTES AND DETAILS.
3. SERVICES LOCATIONS SHOWN ARE APPROXIMATE. CONTRACTOR TO VERIFY EXISTING SERVICES LEVELS PRIOR TO CONSTRUCTION. ANY DISCREPANCIES MUST BE IMMEDIATELY IDENTIFIED AND THE SUPERINTENDENT NOTIFIED PRIOR TO CONSTRUCTION COMMENCING.
4. IF EXISTING SERVICES ARE FOUND TO BE AT A LEVEL THAT CONFLICTS WITH FOOTING KEY A 'CUT-OUT' MAY BE PROVIDED TO ALLOW SERVICES TO PASS THROUGH.

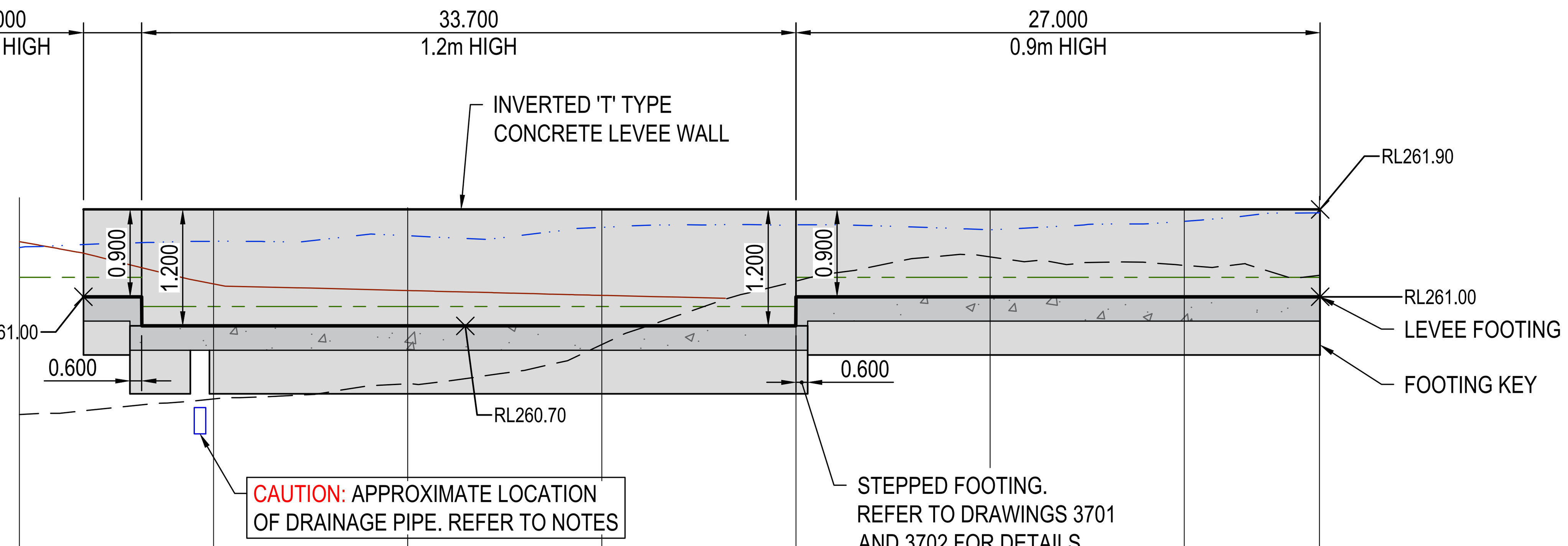
LEGEND
- GRASS - TURFED
- LEVEE BENCH
- LEVEE BATTER - GRASS SEEDED
- ASPHALT PAVEMENT - P1
- ASPHALT PAVEMENT - P2
- CONCRETE PATH - C1
- GRAVEL MAINTENANCE TRACK - G1
- GRAVEL PATH - G2
- GRAVEL ROAD - G3
- 260.0 DESIGN CONTOURS
- 260.0 EXISTING CONTOURS
- LEVEE CONTROL LINE
- LEVEE TOP OF WALL (TWL)
- LEVEE BOTTOM OF WALL (BWL)
- FINISHED SURFACE LEVEL
- EXISTING SURFACE LEVEL
- 1% AEP FLOOD LEVEL + 600mm FREEBOARD
- INDICATIVE 200mm MIN. FOOTING COVER



LEVEE 1B CH.62
SCALE 1:50



LEVEE 1B CH.50
SCALE 1:50

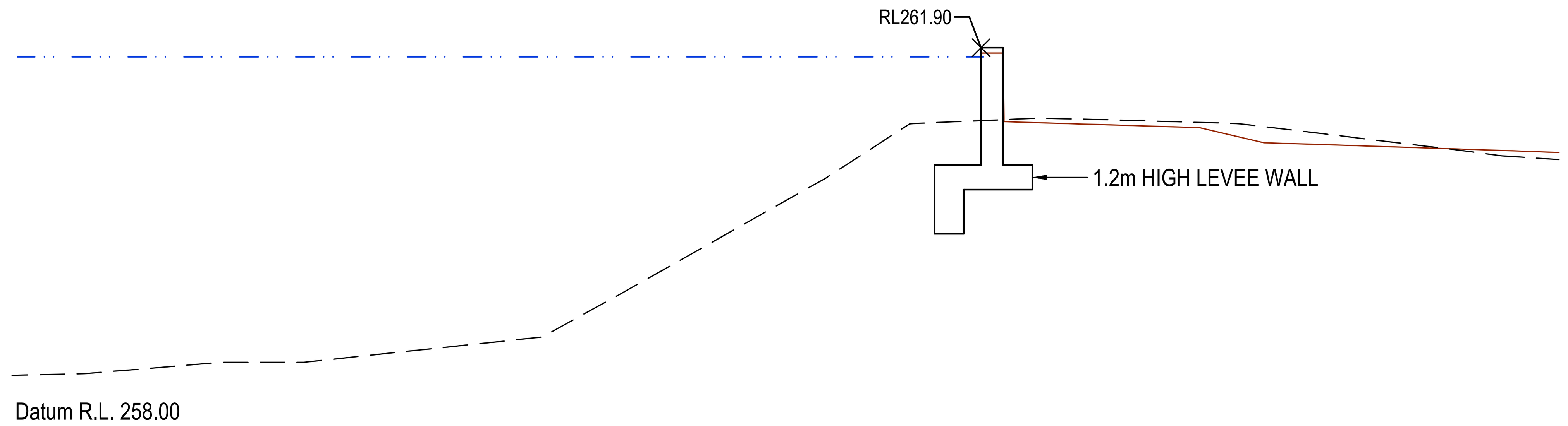


SCALE: H 1:250 1:50
Datum 258.000

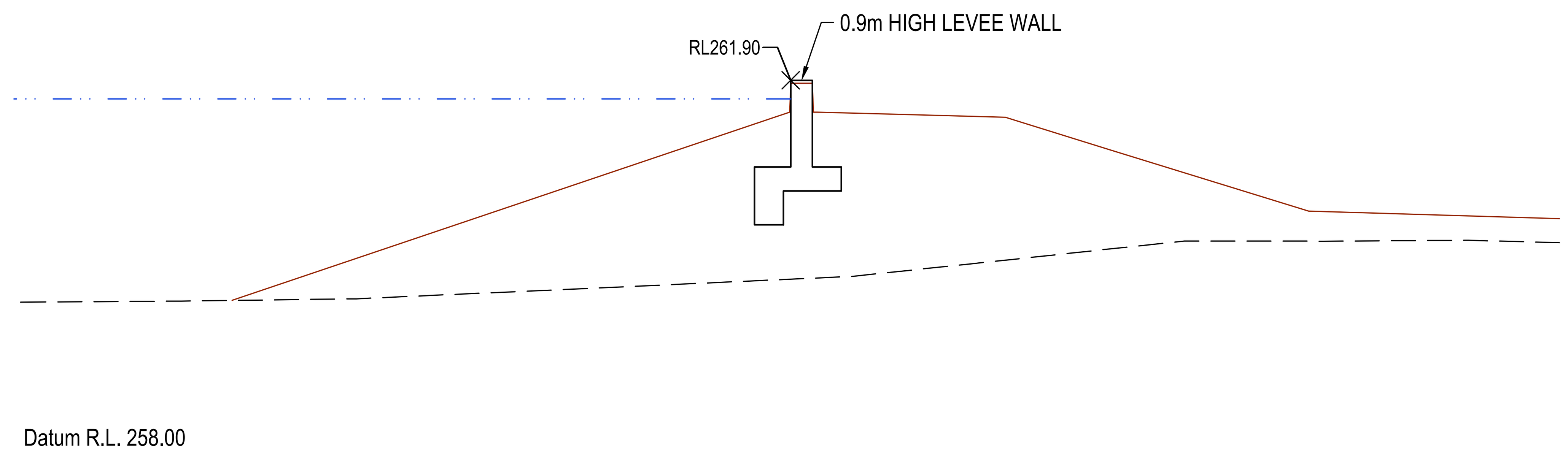
WALL HEIGHT		0.900			1.200	1.200	1.200	0.900		0.900	0.900	0.900
DESIGN TWL		261.900			261.900	261.900	261.900	261.900		261.900	261.900	261.900
DESIGN BWL		261.000	261.000	260.700	260.700	260.700	260.700	260.700	261.000	261.000	261.000	261.000
1% AEP + 600mm					261.572	261.629	261.716	261.741		261.692	261.777	
EXISTING LEVELS					259.947	260.104	260.507	261.160		261.411	261.324	
CHAINAGE	0.000	3.300	6.300	6.310	10.000	20.000	30.000	39.990	40.000	50.000	60.000	66.468

HOL LEVEE 1B WALL LONG SECTION

LEVEE 1B WALL LONGITUDINAL SECTION
SCALE H 1:250 V 1:50



LEVEE 1B CH.40
SCALE 1:50



LEVEE 1B CH.4.0
SCALE 1:50

Rev.	Date	Description	Des.	Verif.	Appd.
A	10/05/2024	TENDER ISSUE	AJH	HG	AR

SCALE 1:50 @A1
SCALE 1:250 @A1

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		Date
Drawn	AJH	25/03/2024
Checked	AS	25/03/2024
Designed	AR	25/03/2024
Verified		Date
Approved		Date

Client: GREATER HUME SHIRE COUNCIL

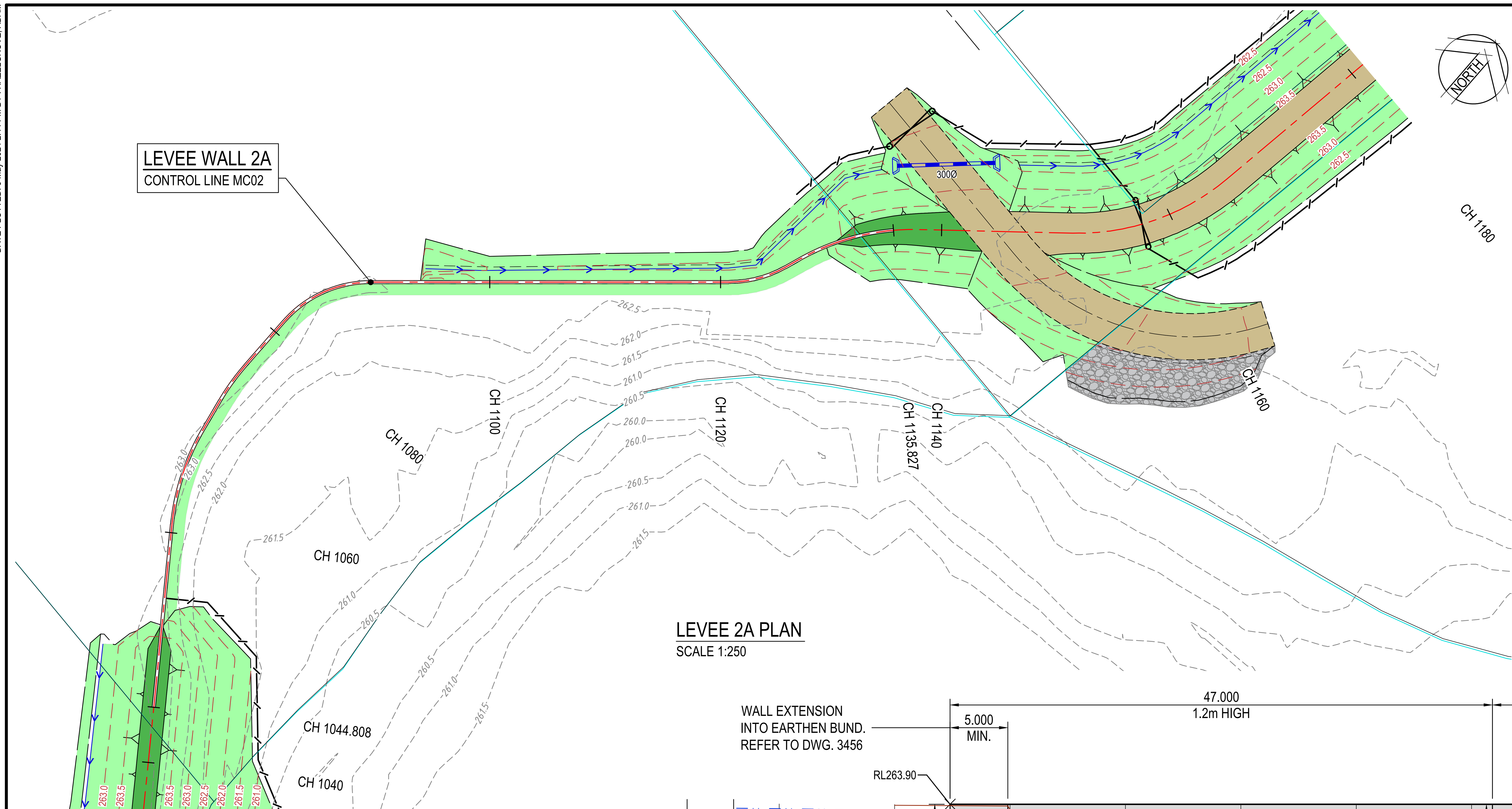
Project: HHC FLOOD LEVEE DESIGN
HOLBROOK, HENTY
& CULCAIRN

Title: LEVEE RETAINING WALL
HOLBROOK LEVEE 1
LONGITUDINAL SECTIONS - SHEET 3

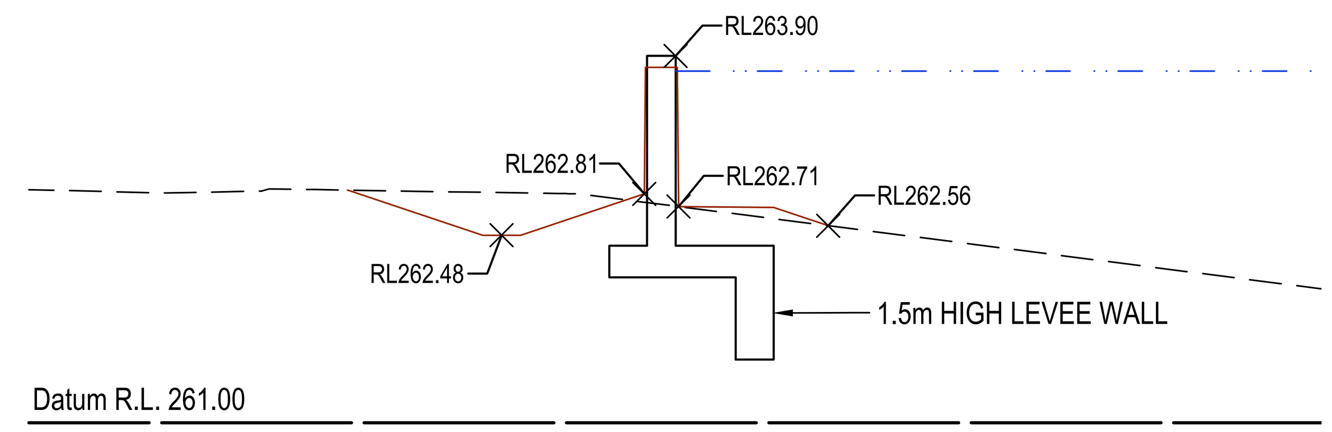
Status: FOR TENDER ONLY
NOT TO BE USED FOR CONSTRUCTION PURPOSES

VERT. DATUM	HORZ. DATUM	Scale	Size
AHD	MGA	AS SHOWN	A1

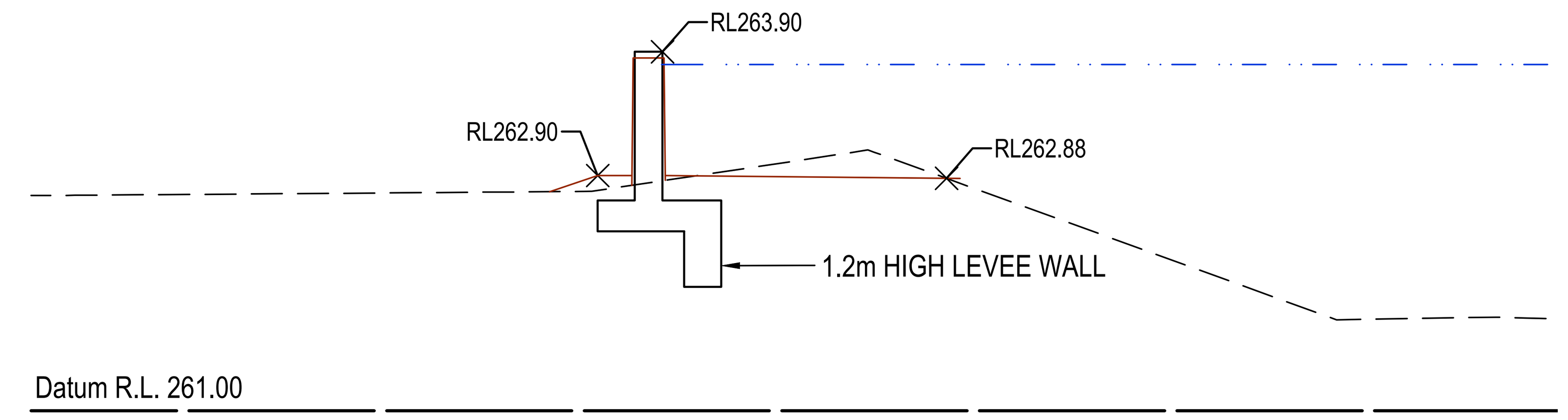
Drawing Number: 300203886-ST-3713
Revision: A



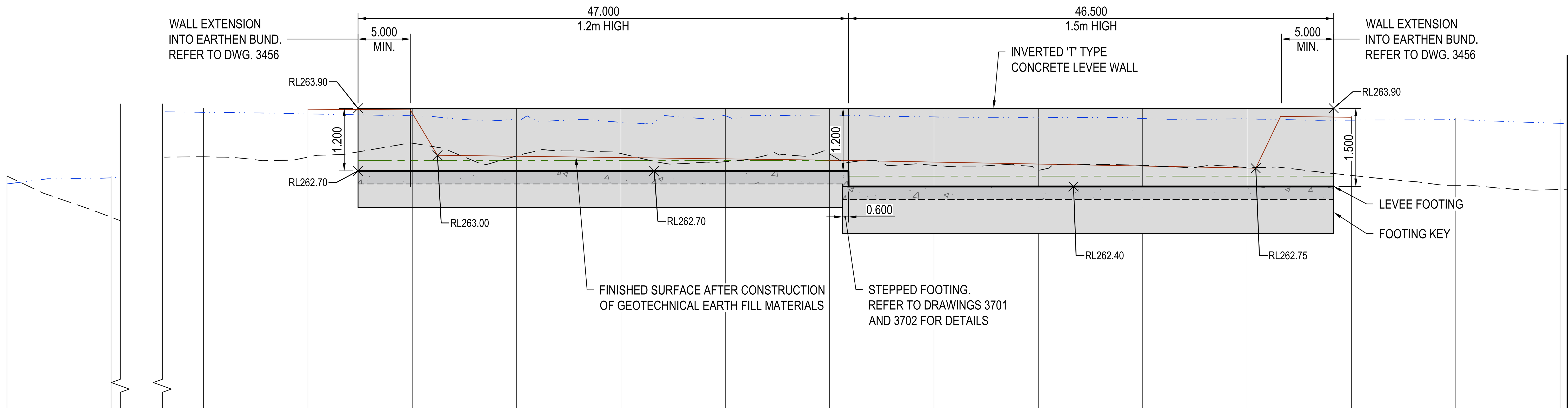
LEVEE 2A PLAN
SCALE 1:250



LEVEE 2A CH.1100
SCALE 1:50



LEVEE 2A CH.1076
SCALE 1:50



SCALE: H 1:250 1:50
Datum 258.000

WALL HEIGHT					1.200	1.200	1.200	1.200	1.200	1.200			1.500	1.500	1.500	1.500	1.500			
DESIGN TWL					263.900	263.900	263.900	263.900	263.900	263.900			263.900	263.900	263.900	263.900	263.900			
DESIGN BWL					262.700	262.700	262.700	262.700	262.700	262.700			262.400	262.400	262.400	262.400	262.400			
1% AEP + 600mm		262.566	263.823	263.793		263.755	263.687	263.629	263.761	263.769			263.734	263.725	263.702	263.695		263.673	263.681	263.610
EXISTING LEVELS		261.810	262.970	262.963		263.232	262.986	263.033	262.876	263.026			262.807	262.726	262.806	262.761		262.613	262.424	262.345
CHAINAGE	0.000	10.000	1030.000	1040.000	1044.808	1050.000	1060.000	1070.000	1080.000	1090.000	1091.808	1091.818	1100.000	1110.000	1120.000	1130.000	1138.308	1140.000	1150.000	1160.000

HOL LEVEE 2 LONG SECTION

LEVEE 2A WALL LONGITUDINAL SECTION
SCALE H 1:250 V 1:50

NOTES:
1. REFER TO DRAWINGS 300203886-ST-3700 TO 3707 FOR STRUCTURAL NOTES AND DETAILS.
2. REFER TO DRAWINGS 300203886-WE-3400 TO 3456 FOR GEOTECHNICAL NOTES AND DETAILS.
3. SERVICES LOCATIONS SHOWN ARE APPROXIMATE. CONTRACTOR TO VERIFY EXISTING SERVICES LEVELS PRIOR TO CONSTRUCTION. ANY DISCREPANCIES MUST BE IMMEDIATELY IDENTIFIED AND THE SUPERINTENDENT NOTIFIED PRIOR TO CONSTRUCTION COMMENCING.
4. IF EXISTING SERVICES ARE FOUND TO BE AT A LEVEL THAT CONFLICTS WITH FOOTING KEY A 'CUT-OUT' MAY BE PROVIDED TO ALLOW SERVICES TO PASS THROUGH.

LEGEND
- GRASS - TURFED
- LEVEE BENCH
- LEVEE BATTER - GRASS SEEDED
- GRAVEL MAINTENANCE TRACK - G1
- GRAVEL PATH - G2
- GRAVEL ROAD - G3
- ROCK BEACHING
- 260.0 DESIGN CONTOURS
- 260.0 EXISTING CONTOURS
- LEVEE CONTROL LINE
- LEVEE TOP OF WALL (TWL)
- LEVEE BOTTOM OF WALL (BWL)
- FINISHED SURFACE LEVEL
- EXISTING SURFACE LEVEL
- 1% AEP FLOOD LEVEL + 600mm FREEBOARD
- INDICATIVE 200mm MIN. FOOTING COVER

DATE PLOTTED: 9 May 2024 2:44 PM BY : HAZELGROVE, ADAM

XREFs: XR-03886-VIC-MAP; XR-03886-BASE-HOL; XR-03886-ALGN-CHNG; XR-03886-SURV-PWD; XR_03886_SU_BYDA_STRM; XR_03886_SU_BYDA_SERV; XR-03886-LEGEND
CAD File: \\au2013-ppfss01\shared_projects\300203886\300 Levee Design\300203886-ST-3710-3716.dwg

Rev.	Date	Description	Des.	Verif.	Appd.
A	10/05/2024	TENDER ISSUE	AJH	HG	AR

SCALE 1:50 @A1 (0, 1, 2m)
SCALE 1:250 @A1 (0, 5, 10m)

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Web: www.stantec.com/au

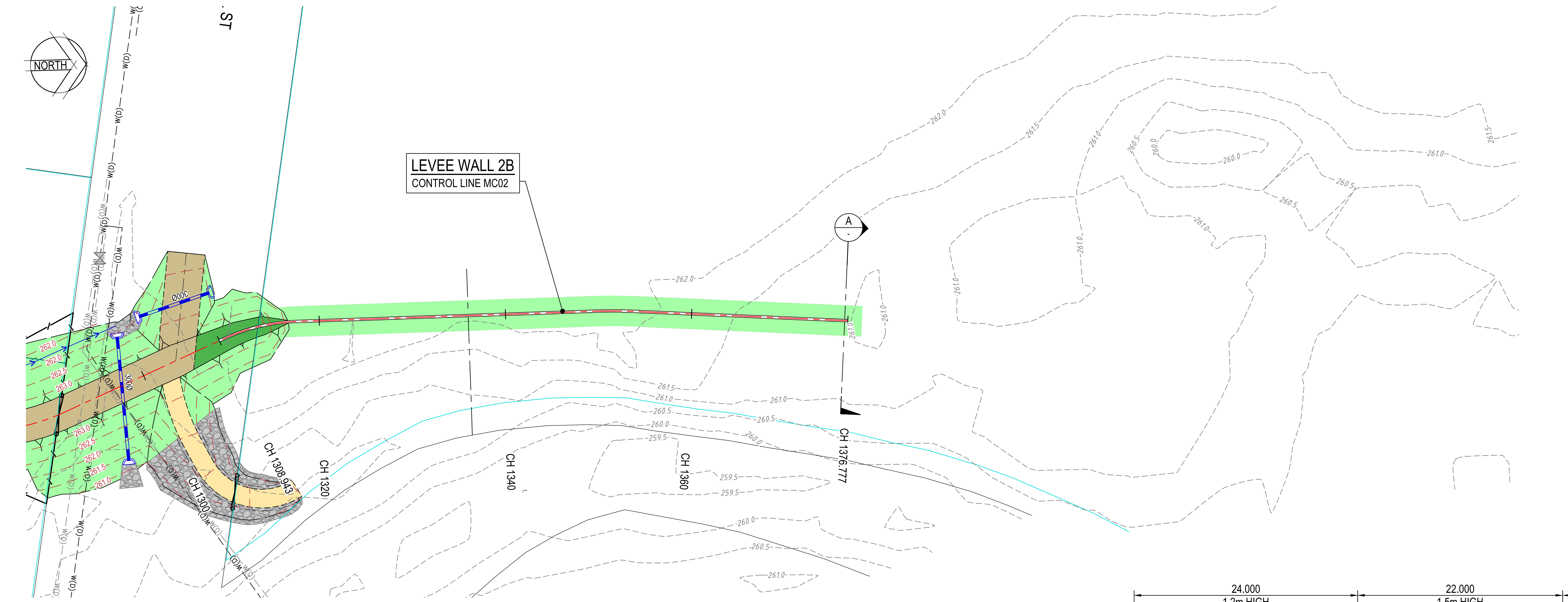
Drawn AJH Date 25/03/2024
Checked AS Date 25/03/2024
Designed AR Date 25/03/2024
Verified Date
Approved Date

Client: GREATER HUME SHIRE COUNCIL
Project: HHC FLOOD LEVEE DESIGN HOLBROOK, HENTY & CULCAIRN
Title: LEVEE RETAINING WALL HOLBROOK LEVEE 2 LONGITUDINAL SECTIONS - SHEET 1

Status: FOR TENDER ONLY
NOT TO BE USED FOR CONSTRUCTION PURPOSES

VERT. DATUM	HORZ. DATUM	Scale	Size
AHD	MGA	AS SHOWN	A1

Drawing Number: 300203886-ST-3714
Revision: A

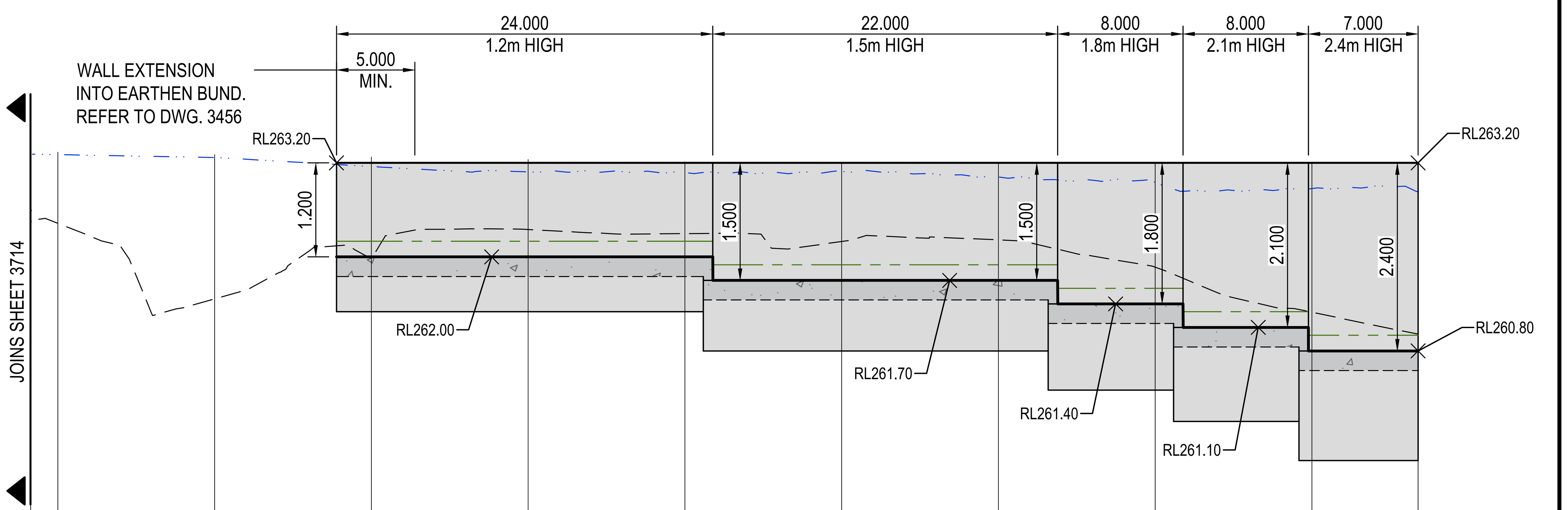


LEGEND

- GRASS - TURFED
- LEVEE BENCH
- LEVEE BATTER - GRASS SEEDED
- GRAVEL MAINTENANCE TRACK - G1
- GRAVEL PATH - G2
- GRAVEL ROAD - G3
- ROCK BEACHING
- DESIGN CONTOURS
- EXISTING CONTOURS
- LEVEE CONTROL LINE
- LEVEE TOP OF WALL (TWL)
- LEVEE BOTTOM OF WALL (BWL)
- FINISHED SURFACE LEVEL
- EXISTING SURFACE LEVEL
- 1% AEP FLOOD LEVEL + 600mm FREEBOARD
- INDICATIVE 200mm MIN. FOOTING COVER

NOTES:
1. REFER TO DRAWINGS 300203886-ST-3700 TO 3707 FOR STRUCTURAL NOTES AND DETAILS.
2. REFER TO DRAWINGS 300203886-WE-3400 TO 3456 FOR GEOTECHNICAL NOTES AND DETAILS.
3. SERVICES LOCATIONS SHOWN ARE APPROXIMATE. CONTRACTOR TO VERIFY EXISTING SERVICES LEVELS PRIOR TO CONSTRUCTION. ANY DISCREPANCIES MUST BE IMMEDIATELY IDENTIFIED AND THE SUPERINTENDENT NOTIFIED PRIOR TO CONSTRUCTION COMMENCING.
4. IF EXISTING SERVICES ARE FOUND TO BE AT A LEVEL THAT CONFLICTS WITH FOOTING KEY A 'CUT-OUT' MAY BE PROVIDED TO ALLOW SERVICES TO PASS THROUGH.

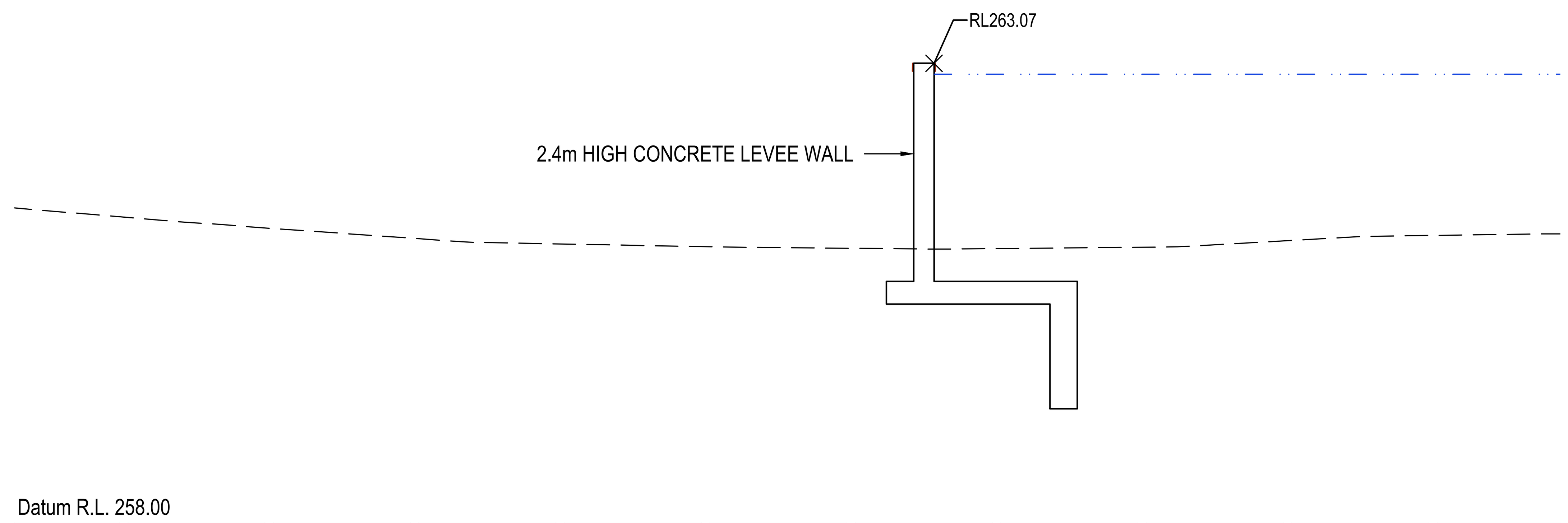
LEVEE 2B PLAN
SCALE 1:250



SCALE: H 1:250 1:50
Datum 258.000

CHAINAGE	WALL HEIGHT	DESIGN TWL	DESIGN BWL	1% AEP + 600mm	EXISTING LEVELS
0.000					
1290.000				263.305	262.428
1300.000				263.269	261.464
1307.777	1.200	263.200	262.000		
1310.000	1.200	263.200	262.000	263.154	261.980
1320.000	1.200	263.200	262.000	263.085	262.350
1330.000	1.200	263.200	262.000	263.079	262.297
1331.777					
1331.787					
1340.000	1.500	263.200	261.700	263.090	262.197
1350.000	1.500	263.200	261.700	263.020	262.218
1353.777					
1353.787					
1360.000	1.800	263.200	261.400	262.952	261.870
1361.777					
1361.787					
1369.777	2.400	263.200	260.800	262.872	261.294
1369.787					
1370.000					
1376.777	2.400	263.200	260.800	262.833	261.015

LEVEE 2B WALL LONGITUDINAL SECTION
SCALE H 1:250 V 1:50



LEVEE 2B CH.1376
SCALE 1:50

Rev.	Date	Description	Des.	Verif.	Appd.
A	10/05/2024	TENDER ISSUE	AJH	HG	AR

SCALE 1:50 @A1
SCALE 1:250 @A1

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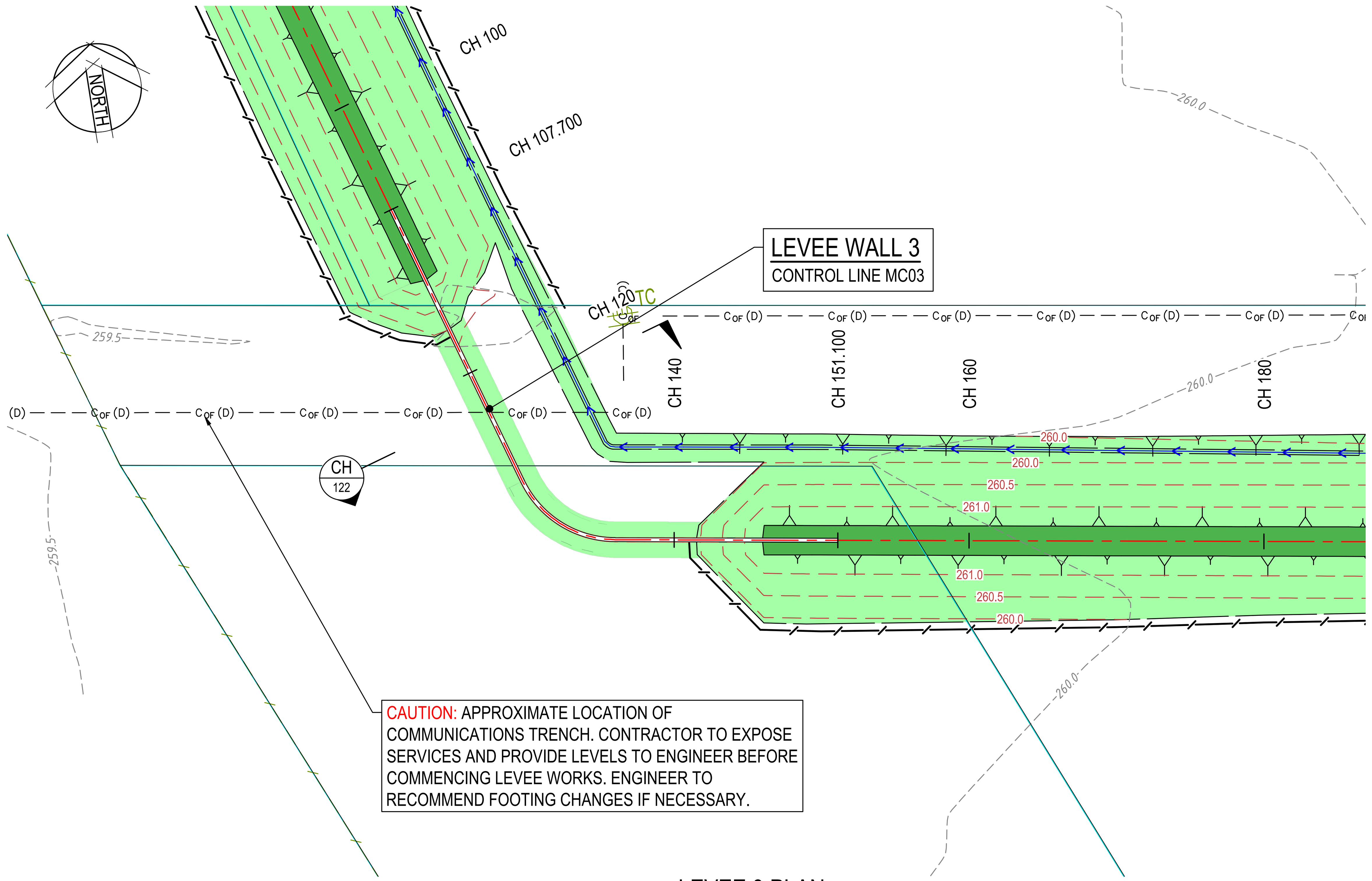
Drawn AJH Date 25/03/2024
Checked AS Date 25/03/2024
Designed AR Date 25/03/2024
Verified Date
Approved Date

Client: GREATER HUME SHIRE COUNCIL
Project: HHC FLOOD LEVEE DESIGN HOLBROOK, HENTY & CULCAIRN
Title: LEVEE RETAINING WALL HOLBROOK LEVEE 2 LONGITUDINAL SECTIONS - SHEET 2

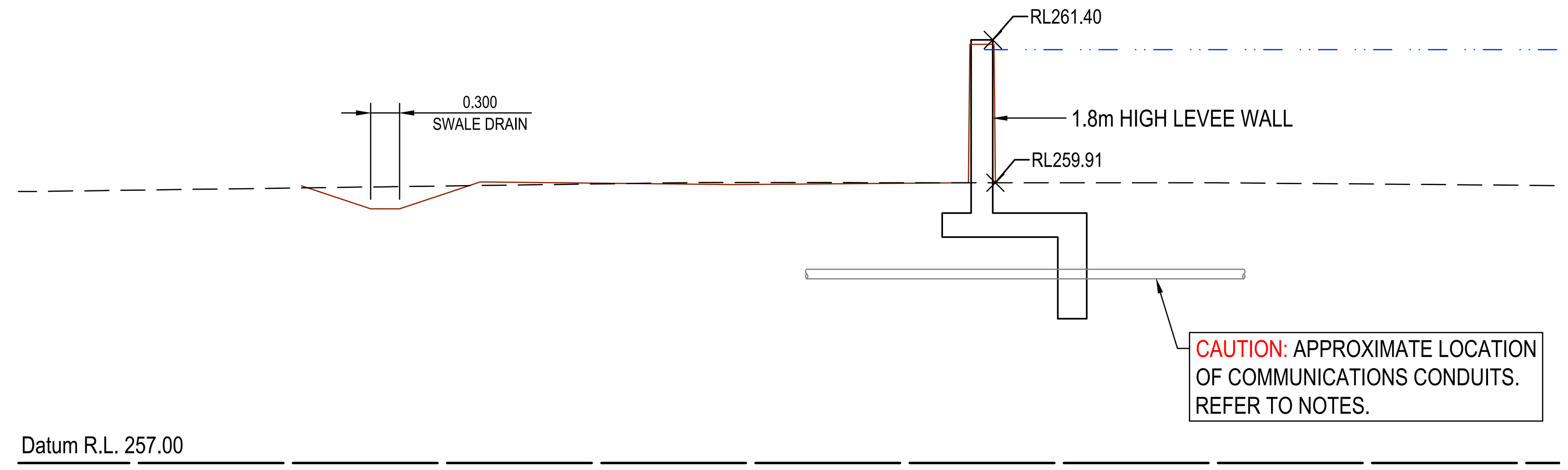
Status: FOR TENDER ONLY
NOT TO BE USED FOR CONSTRUCTION PURPOSES

VERT. DATUM AHD | HORZ. DATUM MGA | Scale AS SHOWN | Size A1
Drawing Number 300203886-ST-3715 | Revision A

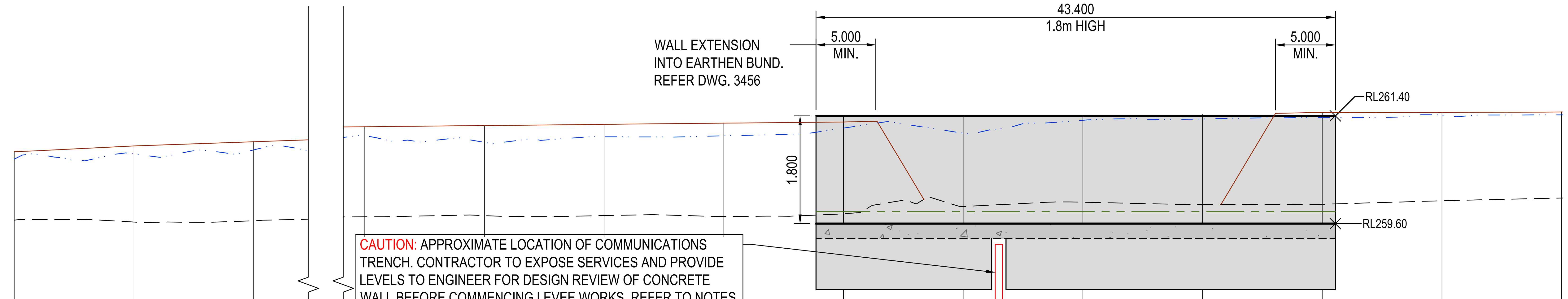
XREFs: XR-03886-VIC-MAP; XR-03886-BASE-HOL; XR-03886-ALGN-CHNG; XR-03886-SURV-PWO; XR_03886_SU_BYDA_STRM; XR_03886_SU_BYDA_SERV; XR-03886-LEGEND
CAD File: \\au2013-ppfss01\shared_projects\300203886\300_Levee Design\300203886-ST-3710-3716.dwg



LEVEE 3 PLAN
SCALE 1:250



LEVEE 3 CH.122.881
SCALE 1:50



SCALE: H 1:250 1:50
Datum 258.000

CHAINAGE	WALL HEIGHT	DESIGN TWL	DESIGN BWL	1% AEP + 600mm	EXISTING LEVELS
0.000					
10.000				260.764	259.627
20.000				260.831	259.648
70.000				261.072	259.714
80.000				260.958	259.734
90.000				261.050	259.735
100.000				261.066	259.718
107.700	1.800	261.400	259.600		
110.000	1.800	261.400	259.600	261.196	259.766
120.000	1.800	261.400	259.600	261.111	259.886
130.000	1.800	261.400	259.600	261.326	259.958
140.000	1.800	261.400	259.600	261.347	259.917
150.000	1.800	261.400	259.600	261.371	259.924
151.100	1.800	261.400	259.600		
160.000				261.410	259.982
170.000				261.416	260.028

HOL LEVEE 3 LONG SECTION

LEVEE 3 WALL LONGITUDINAL SECTION
SCALE H 1:250 V 1:50

NOTES:
1. REFER TO DRAWINGS 300203886-ST-3700 TO 3707 FOR STRUCTURAL NOTES AND DETAILS.
2. REFER TO DRAWINGS 300203886-WE-3400 TO 3456 FOR GEOTECHNICAL NOTES AND DETAILS.
3. SERVICES LOCATIONS SHOWN ARE APPROXIMATE. CONTRACTOR TO VERIFY EXISTING SERVICES LEVELS PRIOR TO CONSTRUCTION. ANY DISCREPANCIES MUST BE IMMEDIATELY IDENTIFIED AND THE SUPERINTENDENT NOTIFIED PRIOR TO CONSTRUCTION COMMENCING.
4. IF EXISTING SERVICES ARE FOUND TO BE AT A LEVEL THAT CONFLICTS WITH FOOTING KEY A 'CUT-OUT' MAY BE PROVIDED TO ALLOW SERVICES TO PASS THROUGH.

LEGEND
- GRASS - TURFED
- LEVEE BENCH
- LEVEE BATTER - GRASS SEEDED
- 260.0 DESIGN CONTOURS
- 260.0 EXISTING CONTOURS
- LEVEE CONTROL LINE
- LEVEE TOP OF WALL (TWL)
- LEVEE BOTTOM OF WALL (BWL)
- FINISHED SURFACE LEVEL
- EXISTING SURFACE LEVEL
- 1% AEP FLOOD LEVEL + 600mm FREEBOARD
- INDICATIVE 200mm MIN. FOOTING COVER

Rev.	Date	Description	Des.	Verif.	Appd.
A	10/05/2024	TENDER ISSUE	AR	HG	AR

SCALE 1:50 @A1 (0, 1, 2m)
SCALE 1:250 @A1 (0, 5, 10m)

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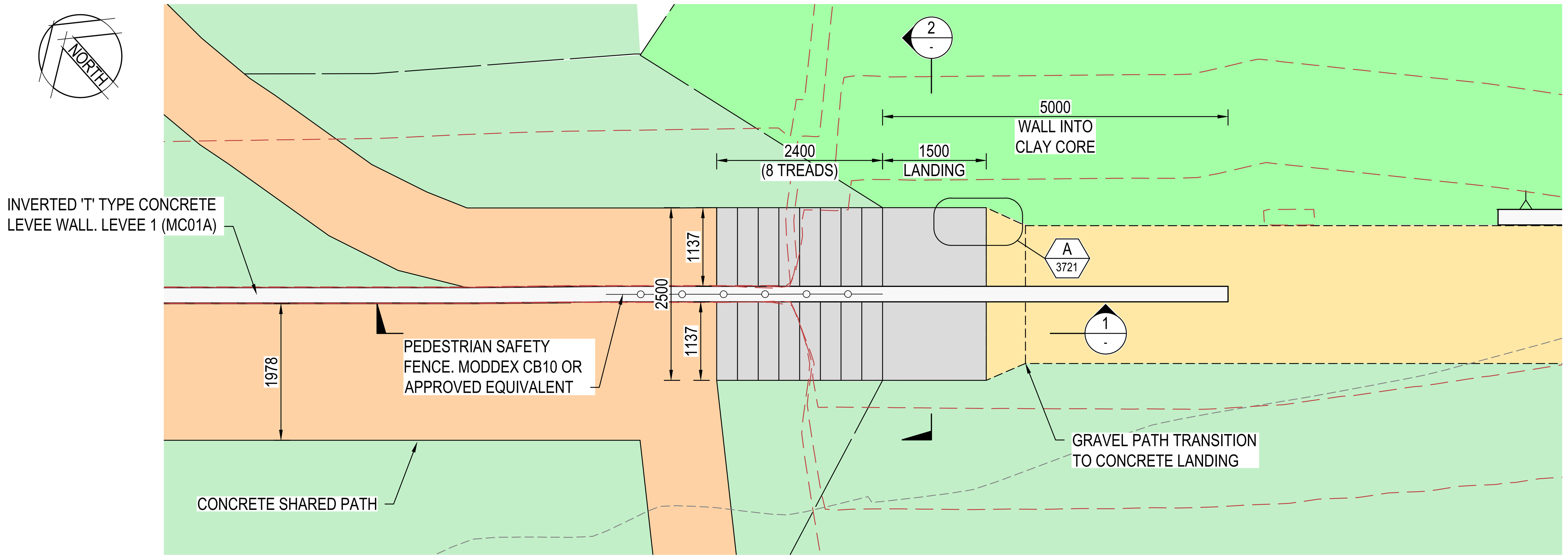
Drawn	AJH	Date 25/03/2024
Checked	AS	Date 25/03/2024
Designed	AR	Date 25/03/2024
Verified		Date
Approved		Date

Client: GREATER HUME SHIRE COUNCIL
Project: HHC FLOOD LEVEE DESIGN HOLBROOK, HENTY & CULCAIRN
Title: LEVEE RETAINING WALL HOLBROOK LEVEE 3 LONGITUDINAL SECTION
Status: FOR TENDER ONLY
NOT TO BE USED FOR CONSTRUCTION PURPOSES

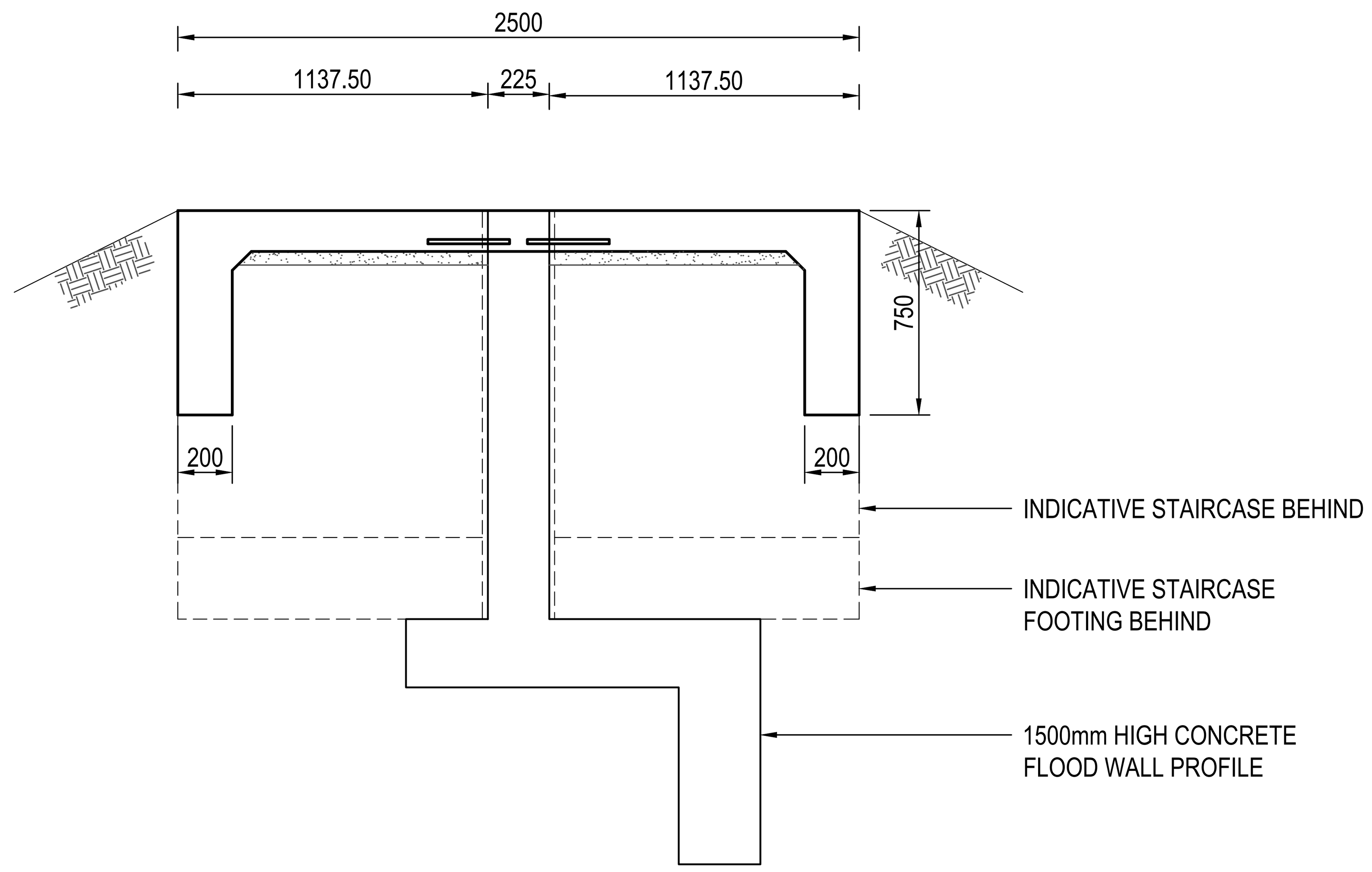
VERT. DATUM	HORZ. DATUM	Scale	Size
AHD	MGA	AS SHOWN	A1

Drawing Number: 300203886-ST-3716
Revision: A

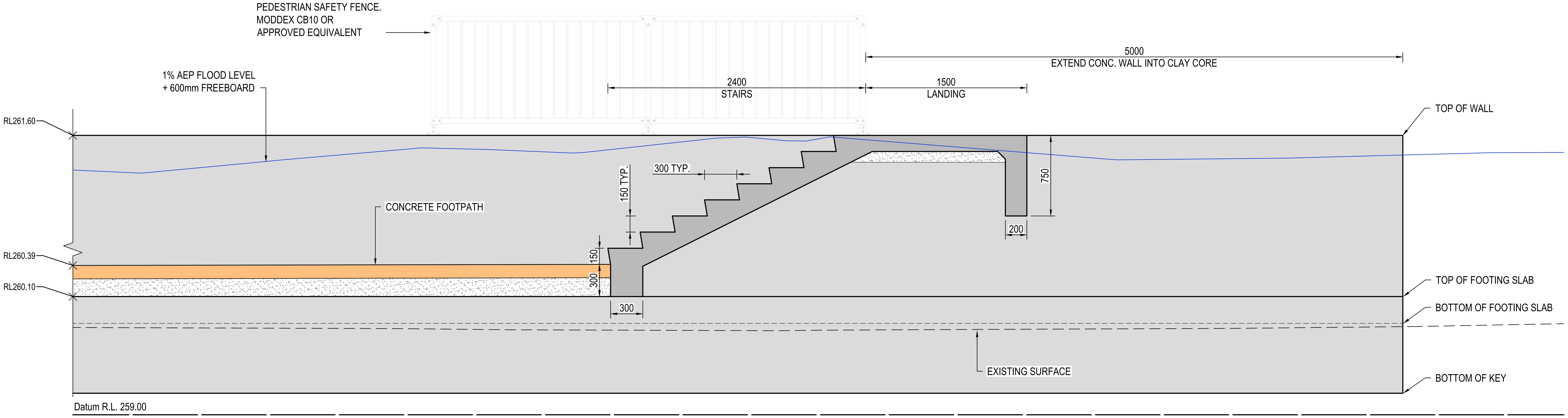
DATE PLOTTED: 16 May 2024 9:38 AM BY : HAZELGROVE, ADAM
XREFs: XR-03886-VIC-MAP; XR-03886-BASE-HOL; XR-03886-ALGN-CHNG; XR-03886-SURV-PWO; XR_03886_SU_BYDA_STRM; XR_03886_SU_BYDA_SERV; XR-03886-LEGEND
CAD File: \\au2013-ppfss01\shared_projects\300203886\300 Levee Design\300203886-ST-3710-3716.dwg



LEVEE 1 STAIRS - HAY ST
PLAN
SCALE A1 - 1 : 50
A3 - 1 : 100



HAY ST STAIRS
SECTION 2 -
SCALE A1 - 1 : 20
A3 - 1 : 40



HAY ST STAIRS
SECTION 1 -
SCALE A1 - 1 : 20
A3 - 1 : 40

Rev.	Date	Description	Des.	Verif.	Appd.
A	10/05/2024	TENDER ISSUE	AR		AR

SCALE 1:20 @A1 (0, 0.5, 0.8m)
SCALE 1:50 @A1 (0, 1, 2m)

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Web: www.stantec.com/au

Drawn AJH	Date 25/03/2024	
Checked AS	Date 25/03/2024	
Designed AR	Date 25/03/2024	
Verified	Date	
Approved	Date	

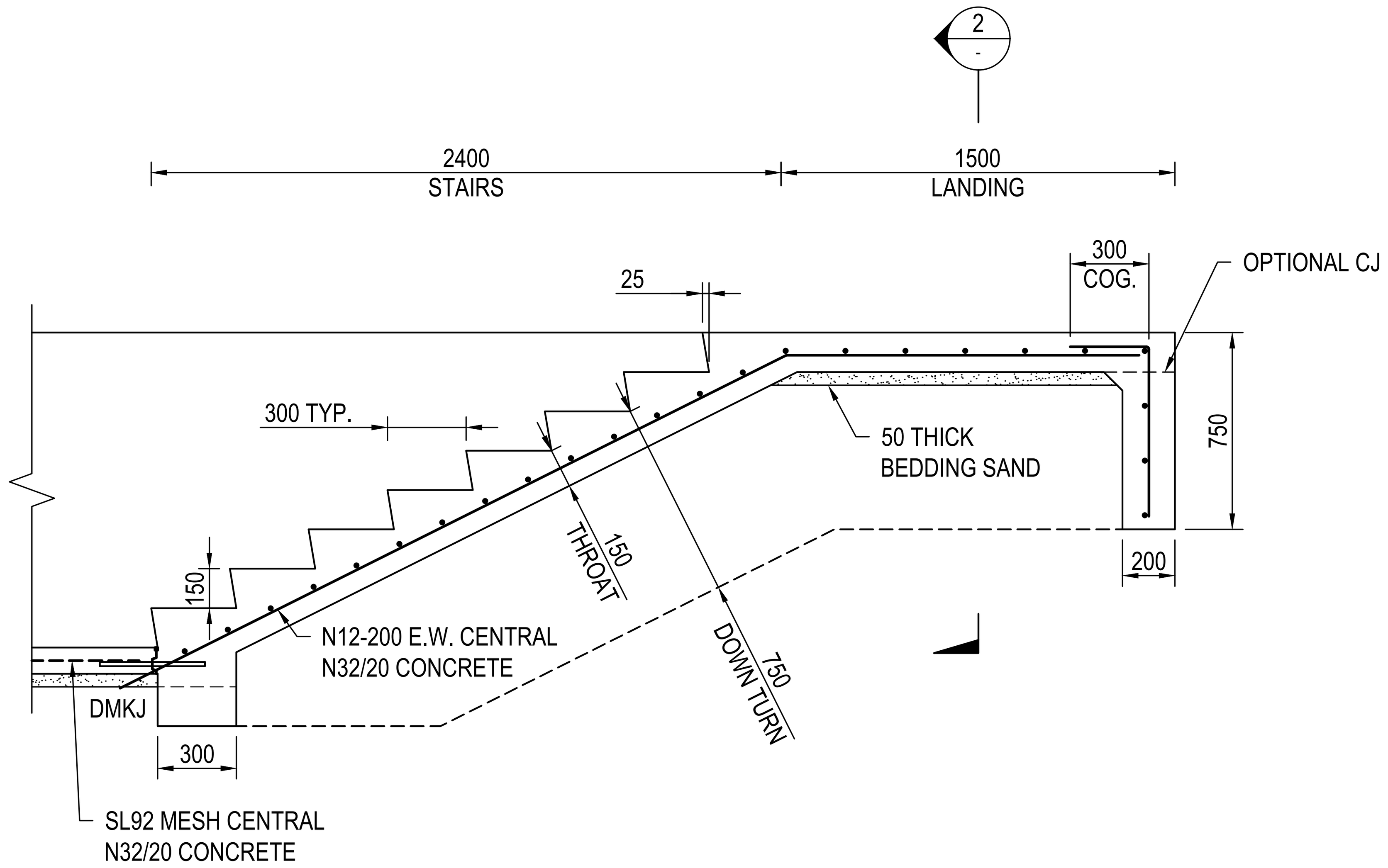
Client: GREATER HUME SHIRE COUNCIL
Project: HHC FLOOD LEVEE DESIGN
HOLBROOK, HENTY
& CULCAIRN
Title: LEVEE RETAINING WALL
HAY ST STAIRS
PLAN AND SECTIONS

Status: FOR TENDER ONLY
NOT TO BE USED FOR CONSTRUCTION PURPOSES

VERT. DATUM	HORZ. DATUM	Scale	Size
AHD	MGA	AS SHOWN	A1

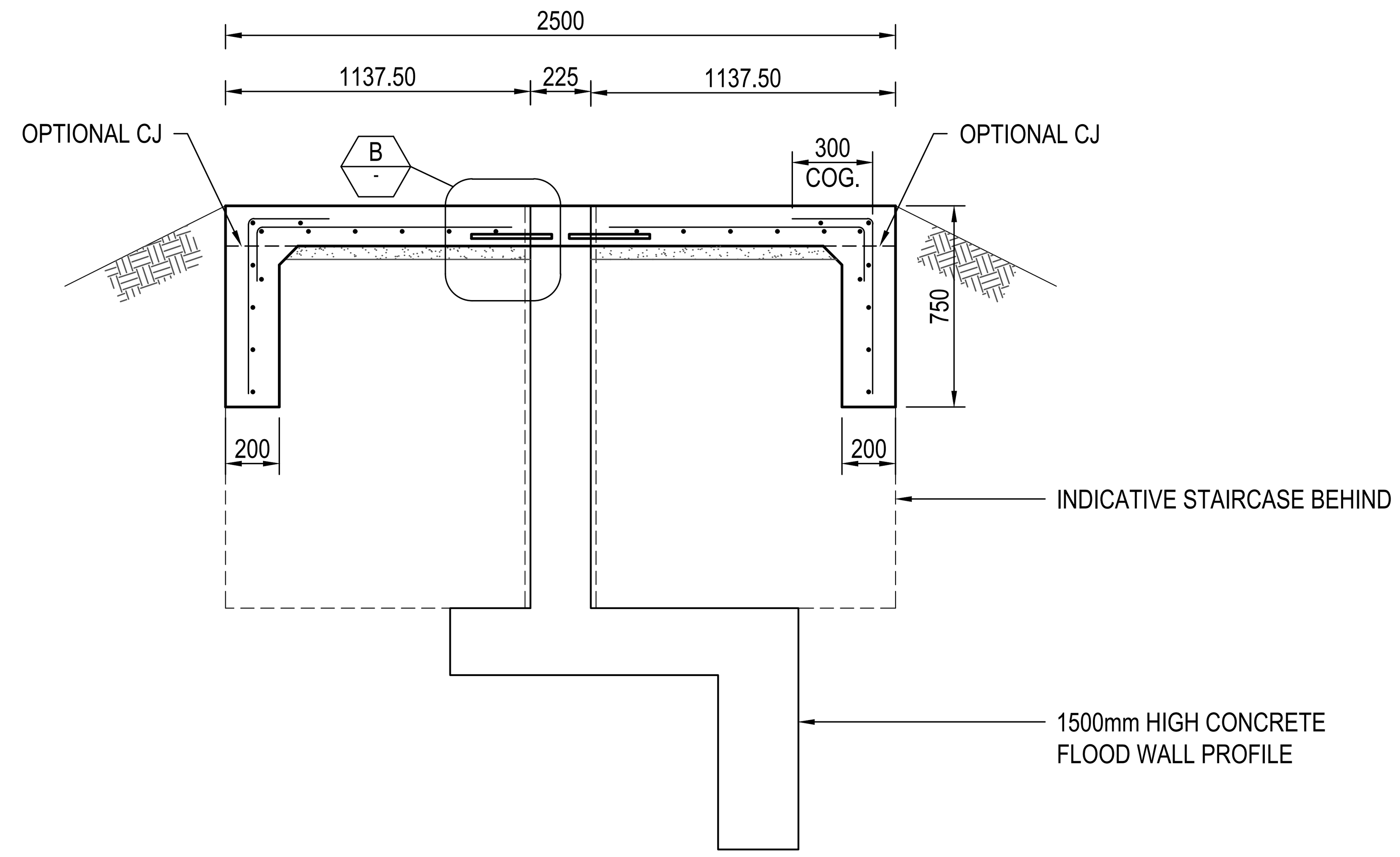
Drawing Number: 300203886-ST-3720
Revision: A

DATE PLOTTED: 8 May 2024 5:30 PM BY : HAZELGROVE, ADAM



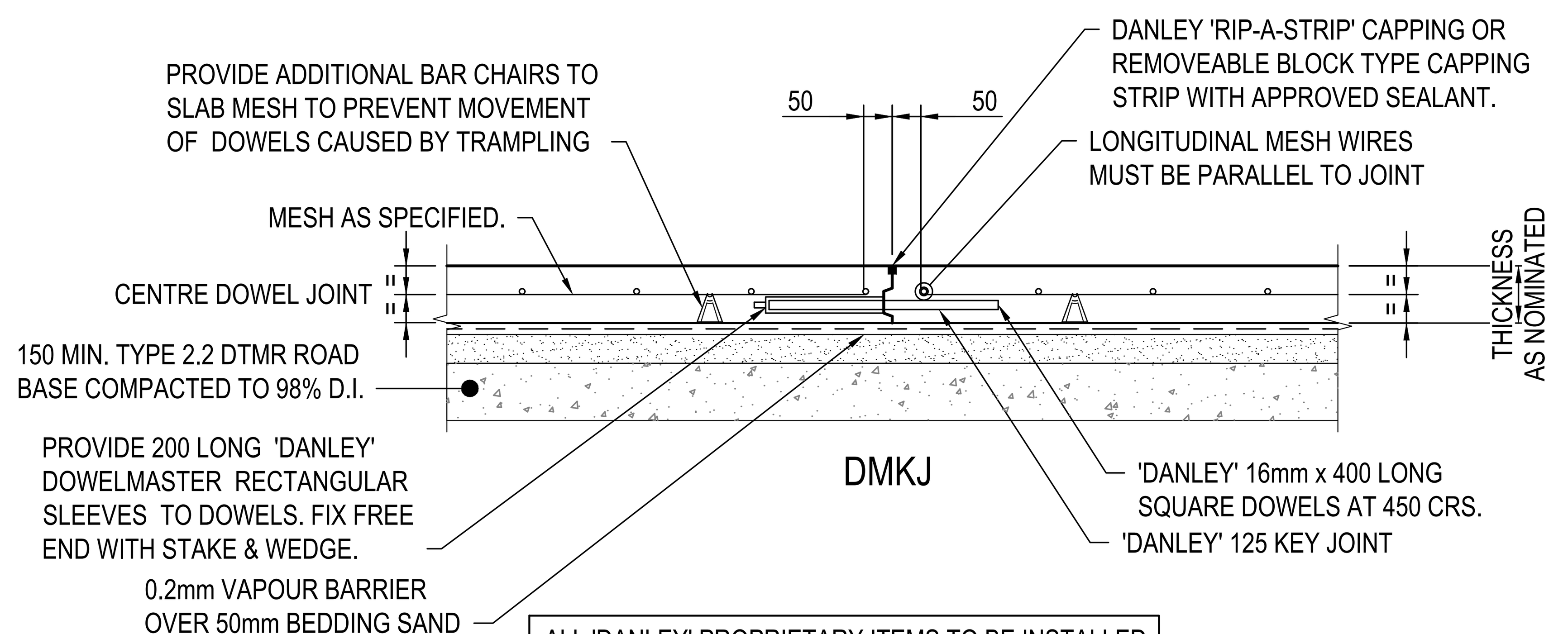
TYPICAL STAIR REINFORCEMENT DETAIL

SCALE A1 - 1 : 20
A3 - 1 : 40



HAY ST STAIRS SECTION 2

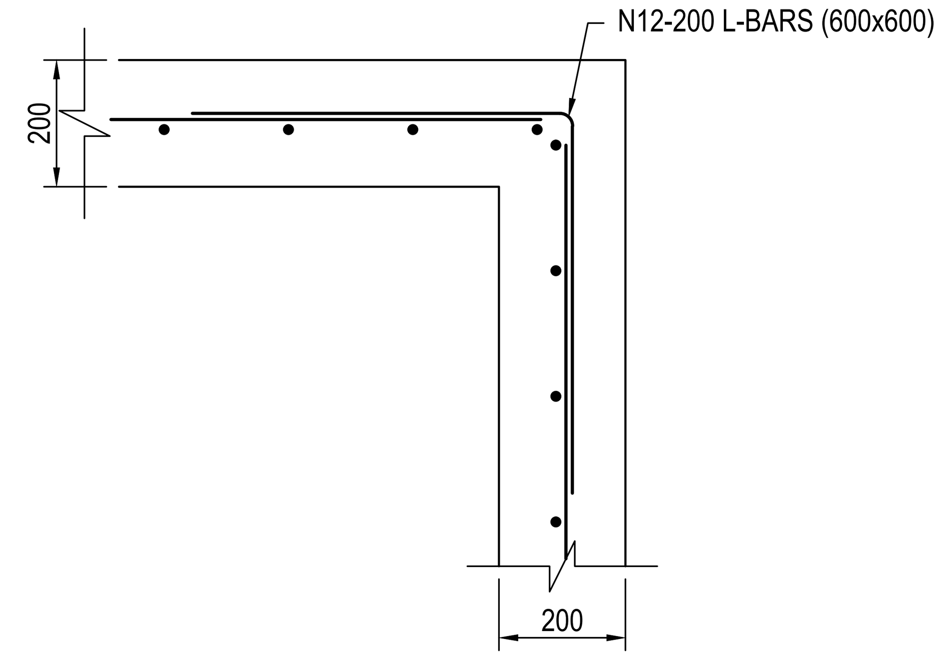
SCALE A1 - 1 : 20
A3 - 1 : 40



ALL 'DANLEY' PROPRIETARY ITEMS TO BE INSTALLED
IN STRICT ACCORDANCE WITH MANUFACTURERS
SPECIFICATIONS.
DANLEY CODE: *KJ100x3M4STK*

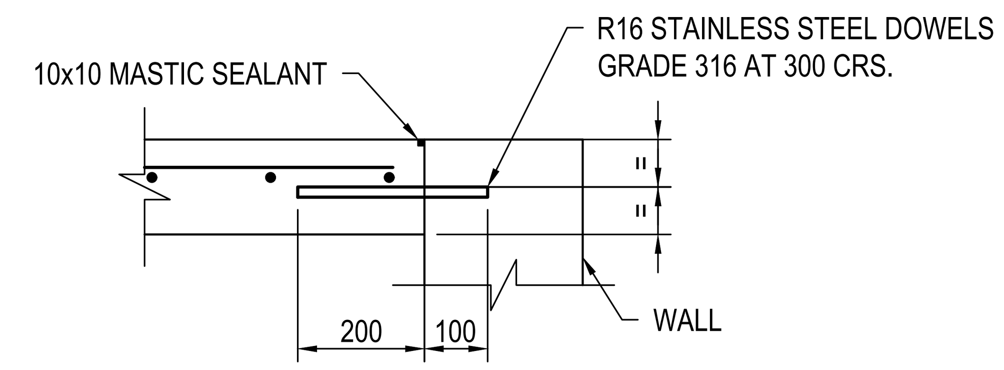
TYPICAL DANLEY 'DOWELMASTER' & KEY JOINT DETAIL (DMKJ)

SCALE A1 - 1 : 10
A3 - 1 : 20



DETAIL A

3720
SCALE 1:10



DETAIL B

SCALE 1:10

Rev.	Date	Description	Des.	Verif.	Appd.
A	10/05/2024	TENDER ISSUE	AR		AR

0 0.2 0.4m
SCALE 1:10 @A1

Greater Hume Council

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Level 4, 501 Swanston Street
Melbourne VIC 3000
Tel: 03 8415 7777
Web: www.stantec.com/au

Drawn RL Date 25/03/2024
Checked AS Date 25/03/2024
Designed AR Date 25/03/2024
Verified Date
Approved Date

Client: GREATER HUME SHIRE COUNCIL
Project: HHC FLOOD LEVEE DESIGN
HOLBROOK, HENTY
& CULCAIRN
Title: LEVEE RETAINING WALL
HAY ST STAIRS
STAIRS DETAILS

Status: FOR TENDER ONLY
NOT TO BE USED FOR CONSTRUCTION PURPOSES

VERT. DATUM	HORZ. DATUM	Scale	Size
AHD	MGA	AS SHOWN	A1

Drawing Number: 300203886-ST-3721
Revision: A

XREFs: XR-03886-VIC-MAP; XR-03886-BASE-HOL
CAD File: \\au2013-ppfss01\shared_projects\300203886\300 Levee Design\300203886-ST-3720.dwg

Appendix I: Geotechnical Investigation

Geotechnical Investigation for Proposed Flood Mitigation Options

Culcairn, Henty, Holbrook, NSW

AWE200028Report01.1

Prepared for

Greater Hume Council

23 April 2020

Contact Information

Cardno Victoria Pty Ltd
ABN 47 106 610 913

Level 4
501 Swanston Street
Melbourne VIC 3000
Australia

www.cardno.com
Phone +61 3 8415 7777
Fax +61 3 8415 7788

Document Information

Prepared for	Greater Hume Council
Project Name	Culcairn, Henty, Holbrook, NSW
File Reference	AWE200028Report01.1
Job Reference	AWE200028Report01.1
Date	23 April 2020
Version Number	01.1

Author(s):

Jack Barclay B.Env(Civil), MEng(Hons)
Experienced Geotechnical Engineer

Effective Date 23/04/2020

Approved By:

Davin Slade BE(Civil), MPavTech, MIEAust, CPEng, NER
Principal Geotechnical Engineer

Date Approved 23/04/2020

Document History

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1 Introduction

Cardno Victoria Pty Ltd (Cardno) has been engaged by the Greater Hume Council (Council) to provide flood mitigation consultancy services for the townships of Culcairn, Henty and Holbrook in New South Wales. Several flood mitigation options have been proposed for the townships, these include:

> Option A3 – Lowering of the stock route near Balfour Street Intersection (Culcairn Floodplain Risk Management Study and Plan, WMA Water, 2017);

> Option S2 – Anabranch levees located within Culcairn;

> Option L1, L3 and L5 – Combined Levee System (Henty Floodplain Risk Management Study and Plan, WMA Water, 2017); and

> Option CL/ BL – Ten Mile Creek Southern Floodplain Levee System (Holbrook Floodplain Risk Management Study and Plan, WMA Water, 2017).

Cardno has completed a geotechnical investigation to assess the geotechnical viability of the proposed flood mitigation options and provide recommendations for their design and construction. The geotechnical investigation was carried out in general accordance with Cardno's Tender Submission (Ref: 489599190010226) dated 24 April 2019.

The scope of the geotechnical investigation for the proposed flood levee covered in this report includes the following:

1. Sub-surface ground profile and geological setting;
2. The depth to the groundwater (if encountered);
3. The suitability of the site for the proposed levee works and the geotechnical issues that may impact on their construction;
4. Recommendations for side slopes and crest width of the levee;
5. Recommendations for slope stabilisation and protection that may be required;
6. The allowable bearing pressures of the soil with respect to supporting the levee and discussion of potential long-term serviceability issues such as differential settlement;
7. A discussion of construction or modification options for the levee that may be required;
8. Pavement design recommendations, where required
9. A discussion of potential construction constraints;
10. The excavatability of the soils;
11. The suitability of the on-site soils for use in the construction of the levee;
12. Recommendations for moisture conditioning, placement and compaction of the soils to construct the levee, and;
13. Recommendations for appropriate construction equipment and methodologies.

2 Limitations of the Report

The report is limited to the investigation of the proposed flood levee and specifically covers the issues discussed in the project scope identified in above. No earthworks balance, contamination or environmental conclusions or recommendations are made in this report.

The levee recommendations in this report are based on a 1% Annual Exceedance Probability (1%AEP) flood event. It is assumed that sufficient time will pass for the elevated groundwater levels to equilibrate prior to a similar flood event occurring again.

The limitations of geotechnical reports are appended in Appendix D.

3 Site Locations

The townships of Culcairn, Henty and Holbrook are located within the south east Riverina region of New South Wales, between the regional centres of Albury and Wagga Wagga. The town centres typically consist of a central high street surrounded by residential properties and associated civic amenities; with the surrounding areas mostly comprising cleared agricultural land.

Billabong Creek, Buckargingah Creek and Ten Mile Creek pass through Culcairn, Henty and Holbrook, respectively. The local topography and geomorphology of these towns is largely dominated by fluvial processes associated with these creek and tributary systems.

3.1 Culcairn

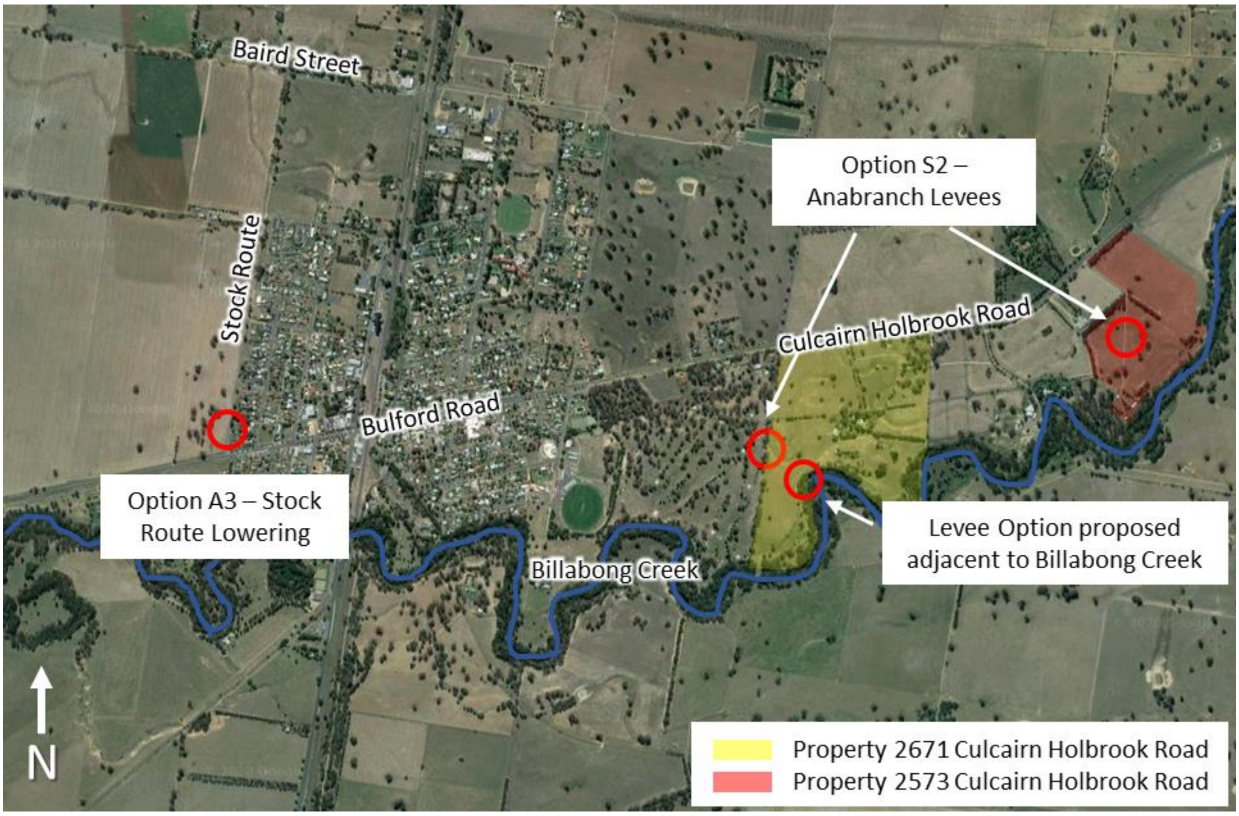

Figure 3-1 Proposed flood mitigation options located within Culcairn (Nearmap – 1 Jan 2015)

3.1.2 Stock Route near the intersection of Balfour Street (Option A3)

An existing Stock Route is located to the west of the Culcairn town centre between Balfour Street and Baird Street. The Stock Route comprises a 1.5 km single lane unsealed gravel road. It is understood that lowering of the Stock Route is proposed immediately to the north of the Balfour intersection extending approximately 45m to the north, this area is highlighted in Figure 3-1. This portion of the road is currently elevated slightly relatively to the adjacent roadsides.

The roadsides surrounding the proposed road lowering have a ground cover of grasses and small shrubs. A cluster of trees is located to the east of the road. A fixed park bench and bike rack are also located on the eastern side of the road. The Stock Route has a gentle fall to the north with minor undulation across its length.

Figure 3-2 Looking north along the Stock Route from the intersection of Balfour Street

3.1.3 Billabong Creek and Billabong Creek Anabranch System (Option S2)

A Billabong Creek Anabranch system passes through the Culcairn town centre, originating from the east of the town at the property 2573 Culcairn-Holbrook Road. It is understood that two anabranch levees are proposed at the areas highlighted in Figure 3-1. The eastern anabranch levee is located on the gravel driveway entrance to 2573 Culcairn Holbrook Road property and the western anabranch levee is located on the boundary between the Culcairn Golf Club and 2671 Culcairn-Holbrook Road property.

These portions of the anabranch system comprised a shallow, rounded, meandering, dry channel approximately 20 m – 30 m wide. The areas adjacent to the proposed levees generally comprise open paddocks used for animal grazing with sporadic clusters of trees.

Figure 3-3 Anabranch investigation along the boundary of 2671 Culcairn-Holbrook Road and the Culcairn Golf Course

An investigation was conducted adjacent to Billabong Creek within 2671 Culcairn-Holbrook Road property, in the area indicated in Figure 3-1. The northern banks of the creek showed evidence of recent erosion and slope failure, indicated by fallen trees and the development of a head scarp at the top of the bank, as shown in Figure 3-4.

Figure 3-4 Erosion along the northern banks of Billabong Creek

The riparian zone of the creek is densely vegetated with shrubs and young to established trees. The northern bank of the creek is steeply inclined.

3.2 Henty

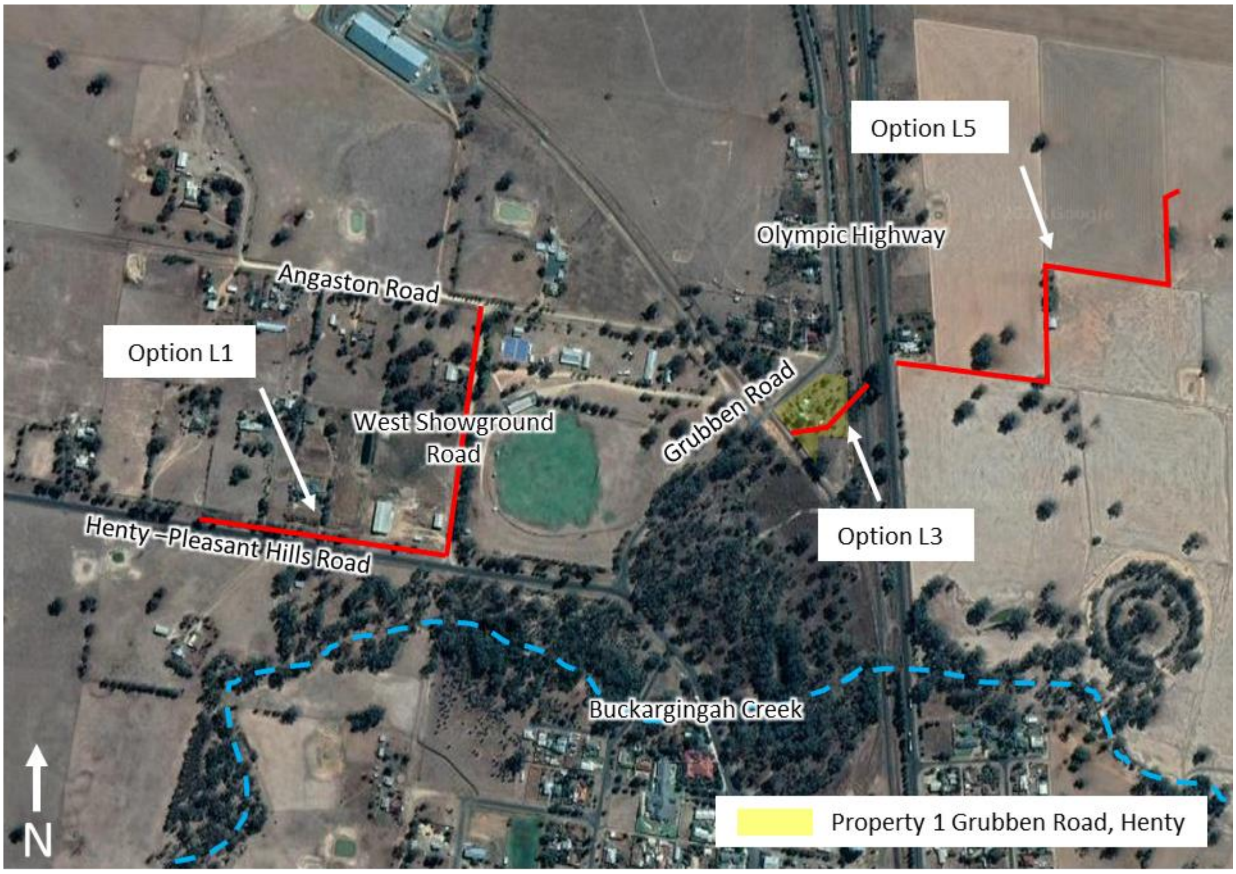

Figure 3-5 Proposed levee alignments within the Henty and the approximate location of Buckargingah Creek.

The proposed levee options L1, L3 and L5 are located approximately 1 km to the north west of the Henty town centre.

The levee option L1 extends south along West Showground Road from the intersection of Angaston Road and West Showground Road for approximately 360m to the intersection of Henty-Pleasant Hills Road and West Showground Road and then west along Henty-Pleasant Hills Road for approximately 360m.

The proposed alignment is occupied by an unsealed gravel roadway along West Showgrounds Road and an asphalt sealed roadway along Henty-Pleasant Hills Road. The roadsides are mostly vegetated with the exception of gravel driveway cross overs. A row of trees is located along the eastern boundary of West Showgrounds Road, within the adjacent sports reserve. Sporadic clusters of trees otherwise bound the roads along the proposed alignment. The alignment has an overall gentle fall to the south east.

Figure 3-6 Henty-Pleasant Road looking east towards the intersection of Henty-Pleasant Road and West Showground Road.

The levee option L3 is located at the rear of the residential property at 1 Grubben Road and extends approximately 130 m between the Henty-Rand Railway Line and the Olympic Highway. The proposed alignment has a ground cover comprising grasses and small shrubs, with a sparse covering of young and established trees. The alignment has a gentle fall to the north east.

The levee option L5 is located within agricultural land on the eastern side of the Olympic Highway. No geotechnical investigation was not conducted within this area.

3.3 Holbrook

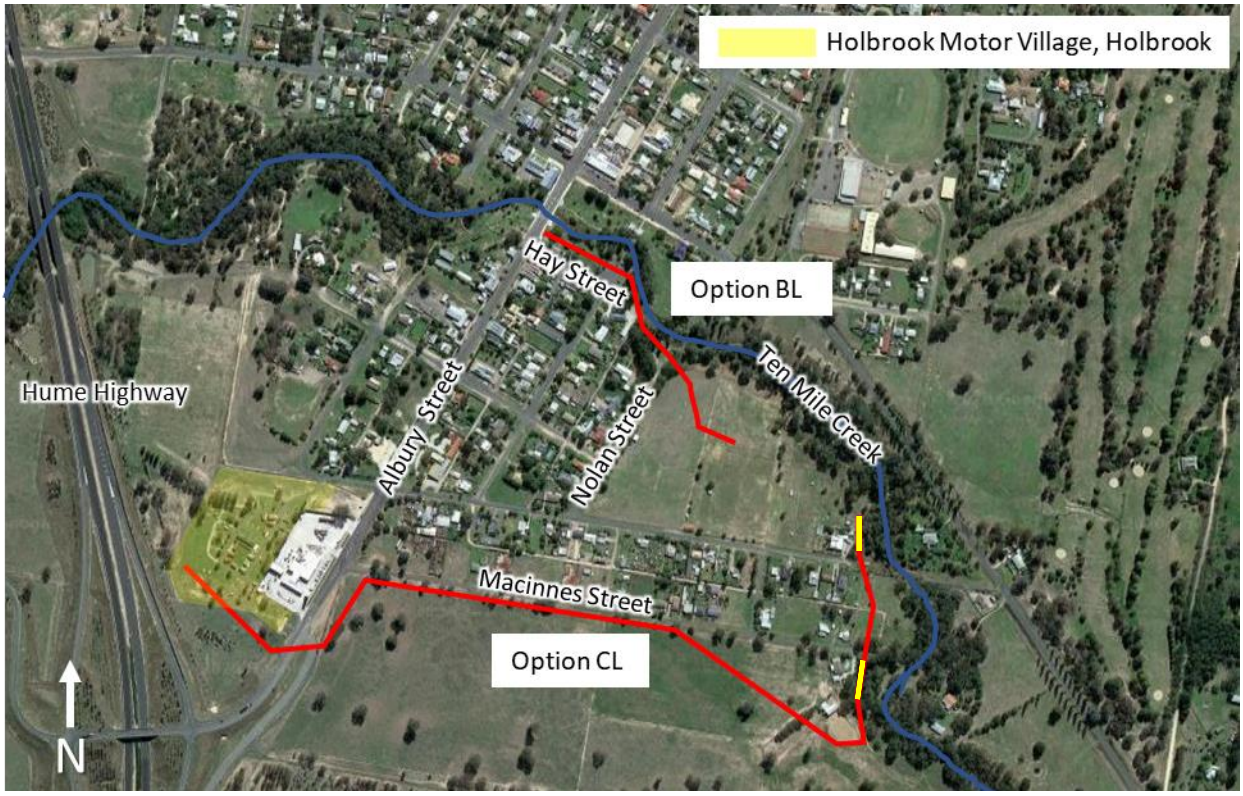

Figure 3-7 Proposed levee options within Holbrook

3.3.2 Hay Street to Nolan Street (Option BL)

The proposed levee Option BL begins at the intersection of Hay Street and Albury Street, and extends south east along Hay Street and Nolan Street (parallel to Ten Mile Creek) and into a sports field at its eastern extent. The Hay Street and Nolan Street portions of the alignment are within approximately 30 m of Ten Mile Creek; as the alignment enters the field the creek diverges to the east.

The conditions along the alignment range from open grassed areas with little tree cover, such as within the sports field at its eastern extent and along Hay Street; to dense tree cover along Nolan Street.

The topography across the alignment similarly varies from a relatively low-lying portion along Hay Street that raises gradually on to a raised terrace along Nolan Street. However, the site generally has a slight fall to the north (towards the creek)

3.3.3 Macinnes Street to Hume Highway (Option CL)

The proposed levee Option CL extends from the Holbrook Motor Village in the west, across the Albury Street-Hume Highway on-off ramp embankment, along Macinnes Street for approximately 500m where it turns south east towards Ten Mile Creek; as it approaches Ten Mile Creek it turns north, roughly following the creek for 350m.

The southern and western portions of the alignment typically comprised grassed areas with sporadic tree cover. The eastern portion that runs north-south along Ten Mile Creek enters the riparian zone of the creek in parts which is relatively heavily vegetated, as shown in Figure 3-8. It is understood that portions of the CL alignment highlighted in yellow are to comprise levee walls instead of earthen embankments. The alignment is generally flat with local undulation and steepened areas near the creek.

Figure 3-8 Option CL alignment looking north along the Ten Mile Creek

4 Site Geology

The geological map of the area (Wagga Wagga, 1:250,000), indicates that all three sites are predominantly underlain by Quaternary aged Alluvium consisting of gravels, sand, silt and clay. Ordovician and Silurian aged igneous intrusive and metamorphic rock are indicated to be present in the vicinity of the sites.

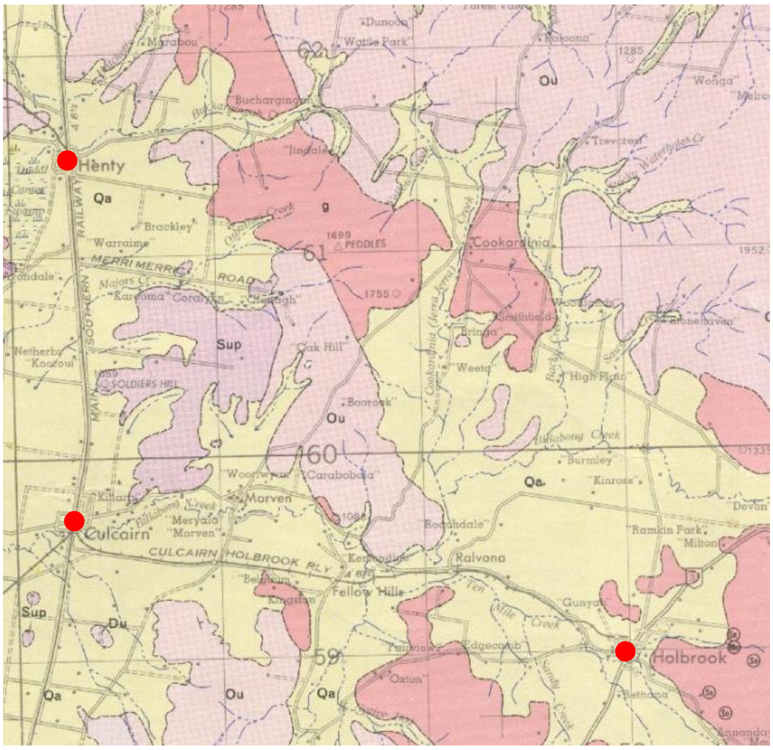

Figure 4-1 Extract of local geology map (Wagga Wagga 1:250,000) with the Culcairn, Henty and Holbrook town centres highlighted (red dots)

The fieldwork observations were consistent with the published geological indications with clays, silts, sands and gravel encountered in the boreholes.

5 Fieldwork

The fieldwork was carried out between 11 and 14 November 2019 by an experienced geotechnical engineer and a geotechnician who set out the boreholes, conducted the drilling, logged the ground encountered, and conducted and recorded the sampling and in-situ testing. Pocket Penetrometer (PP) testing and Dynamic Cone Penetration (DCP) testing was carried out to estimate the in-situ strength parameters subgrade. Disturbed bulk and un-disturbed tube samples of the soils were taken from each test location for reference and further geotechnical testing.

5.1 Safe Work Procedures

Prior to mobilisation and commencement of the fieldwork, a *Dial Before You Dig* (DBYD) underground service request was completed to identify utility assets near the proposed borehole locations. A *Safe Work Method Statement* (SWMS) was prepared to help identify and mitigate potential hazards. The work was conducted in accordance with the documented *Safe Work Procedures* as set out in Cardno's company *Safety Management Plan*.

Prior to commencement of the fieldwork it was deemed necessary to clear all of the borehole locations of underground and overhead services. Cardno engaged a licensed service locator who cleared these boreholes using electromagnetic and ground penetrating radar clearance methods.

5.2 Geotechnical Site Investigation

Twenty (20 No.) boreholes identified as BH01 to BH20 were drilled using a 6WD mounted drilling rig. The number of boreholes drilled at each town is listed in Table 5-1 below. The boreholes were drilled to depths of between 2.7 m and 6.0 m below ground level. Borehole locations are shown on the site plans in Appendix A.

The primary purpose of the boreholes was to identify the levee construction material and the ground stratigraphy, including any fill, potential erodible layers or sand/gravel lenses. The records of the boreholes accompanied by a Unified Soil Classification System (USCS) are presented in Appendix B.

Table 5-1 Number of Boreholes in each town

Town Centre	No. of boreholes	Borehole ID
Culcairn	5	BH01, BH02, BH03, BH04, BH05
Henty	5	BH16, BH17, BH18, BH19, BH20
Holbrook	10	BH06, BH07, BH08, BH09, BH10, BH11, BH12, BH13, BH14, BH15

Disturbed and undisturbed samples of the soils were taken from each test location for reference and further geotechnical testing. Pocket Penetrometer (PP) and Dynamic Cone Penetration (DCP) tests were carried out to determine the in-situ shear strength of the cohesive soils and density of the non-cohesive soils, respectively.

The fieldwork was carried out by an experienced geotechnical engineer and a geotechnician who set out the boreholes, conducted the drilling, logged the ground encountered, and conducted and recorded the sampling and in-situ testing.

6 Laboratory Testing

The geotechnical laboratory testing was undertaken in Cardno's NATA accredited soils laboratory and consisted of:

> Moisture Content Determinations

> Atterberg Limit Tests

> Particle Size Distributions

> Emerson Class Tests

> Standard Compaction Tests

> Shrink Swell Index Testing

The test records are presented in Appendix C.

7 Results of the Investigation

7.1 Subsurface Profile

The generalised subsurface profile encountered in the boreholes along each levee alignment and at the Culcairn Stock Route is shown below. For further details, the reader is referred to the appended borehole records.

Table 7-1 Generalised Subsurface Profile – BH01 – Option A3 - Stock Route Lowering

FILL, Sandy SILT (ML) trace gravel, low plasticity, orange, friable, dry, moist, dry of plastic limit, fine sand encountered to a depth of 0.3m,
Overlying;
Silty CLAY (CL) with sand**,** low plasticity, hard, brown orange to pale orange, moist, dry of plastic limit to moist, encountered to a maximum borehole termination depth of 2.7 m

Table 7-2 Generalised Subsurface Profile – BH02 & BH05 – Option S2 – Anabranch Levees

TOPSOIL/GRASSMATTER encountered to a depth of 0.1 m,
Overlying;
Sandy SILT/ Sandy Clayey SILT/ SILT (ML) low plasticity, friable, dark brown to brown, grey, moist, dry of plastic limit, fine sand, encountered to depths of between 2.1 m to 4.2m,
Overlying;
Silty Sandy CLAY (CL) low plasticity, stiff to firm, dark brown mottled grey, moist near plastic limit, encountered to a maximum borehole termination depth of 2.7 m in BH05 only.

Table 7-3 Generalised Subsurface Profile – BH03 & BH04 – Levee Options Proposed Adjacent to Billabong Creek

TOPSOIL/GRASSMATTER encountered to a depth of 0.2 m,
Overlying;
Silty CLAY (CL) low plasticity, hard, orange and orange mottled brown, moist, dry of plastic limit, minor interbedded sand zones intersected below 1.7 m, encountered to a maximum borehole depth of 4.2m

Table 7-4 Generalised Subsurface Profile – BH06 to BH09 – Option BL Levee, Holbrook

TOPSOIL/GRASSMATTER encountered to depths of 0.1 m to 0.2 m,
Or;
FILL, Sandy Silty CLAY (CI)/ Silty SAND (SM), moderate plasticity, fine to medium grained, brown, grey, orange, medium dense and very stiff, moist, near plastic limit, encountered to a depth of 1.5 m, only encountered in BH06,
Overlying;
Clayey SILT/ Sandy SILT with clay/ SILT (ML) with sand, low plasticity, soft to friable, brown, orange, grey, moist, dry of plastic limit to wet, wet of liquid limit, fine grained sand, encountered to depths of between 0.5 m to 2.5 m,
Overlying;
Silty CLAY (CL - CI) with or trace sand, low to moderate plasticity, stiff to hard, brown, orange, grey, moist, dry of plastic limit to near plastic limit, fine to medium sand, encountered to depths of 1.2 m to 2.7 m, not encountered in BH06;
Overlying;
Silty Clayey SAND/ Clayey SAND (SM - SC), fine to medium grained, poorly graded, grey, brown, loose to very dense, moist, wet, encountered to depths of 2.7 m to 5.5 m, not encountered in BH09,
Overlying;
Sandy CLAY (CH), high plasticity, orange, grey, firm, moist, wet of plastic limit encountered to a maximum borehole depth of 5.7 m, encountered in BH06 only.

Table 7-5 Generalised Subsurface Profile – BH10 to BH15 – Option CL Levee, Holbrook

TOPSOIL/GRASSMATTER encountered to depths of between 0.20 m to 0.2 m,

Or;

FILL, Silty SAND (SM) with gravel, fine grained, brown, loose, subrounded, dry, encountered to a depth of 0.3m, only encountered in BH14,

Overlying;

Sandy Clayey SILT/ Sandy SILT (ML) low plasticity, friable, brown, orange, white, moist, dry of plastic limit, fine grained sand, encountered to depths of between 0.4 m to 0.9 m and not encountered in BH14,

Overlying;

Silty CLAY/Silty Sandy CLAY (CL - CH) with sand**,** low to high plasticity, stiff to hard, red, brown, grey, moist, dry of plastic limit, moist, near plastic limit, fine sand, encountered to depths of 1.3 m to 3.2 m,

Overlying;

Silty Clayey SAND/ Silty SAND (SM – SC), fine to coarse grained, poorly graded, subrounded, brown, medium dense to very dense, moist and wet, encountered to depths of 2.3 m to 4.2 m in BH10, BH11, BH12, BH13,

Overlying;

Silty CLAY/ Silty Sandy CLAY (CL - CH), low to high plasticity, brown, grey, stiff to hard, moist near plastic limit and moist, dry of plastic limit, fine sand, encountered to a maximum borehole depth of 2.7 m in BH10, BH11, BH14 and BH15.

Table 7-6 Generalised Subsurface Profile – BH16 to BH20 – Option L1 and L3 Levees, Henty

TOPSOIL/GRASSMATTER encountered to depths of between 0.1 m to 0.2 m,

Overlying;

Clayey SILT/ Sandy SILT/ SILT (ML) low plasticity, friable, brown, white, orange, grey, moist, dry of plastic limit, fine grained sand, encountered to depths of between 0.3 m to 0.6 m, not encountered in BH20

Overlying;

Silty CLAY (CL - CI) trace sand, low to moderate plasticity, very stiff to hard, brown, orange, grey, moist, dry of plastic limit, fine to medium sand, encountered to a maximum borehole depth of 2.7 m

7.2 Groundwater

Appreciable groundwater ingress was encountered in the boreholes conducted within the Billabong Anabranch system in Culcairn and within some of the boreholes conducted along Ten Mile Creek, Holbrook. However, as the boreholes were not left open for a significant amount of time presence of absence of groundwater cannot be precluded in other locations. It is common for a perched water table to develop in the upper fill, sand and silt layers overlying the clays after sustained rainfall or during the wetter months.

7.2.1 Culcairn

Groundwater was encountered in BH02, which was conducted at the base of the Billabong Creek Anabranch in Culcairn. The groundwater was encountered during drilling at an approximate depth of 2.9 m below ground level. The borehole were not left open for sufficient time to allow the groundwater table to equalise and therefore accurate groundwater depths were not recorded. Further field investigation and monitoring is required to accurately assess the depth to the groundwater table.

7.2.2 Holbrook

Groundwater was encountered in BH06 and BH12. The groundwater was encountered during drilling at approximate depths of 1.5 m, and 3.2 m below ground level, respectively. Rapid groundwater ingress was encountered in BH06 and BH12 and appeared to coincide with the intersection of sand and gravel zones. The boreholes were not left open for sufficient time to allow the groundwater table to equalise and therefore accurate groundwater depths were not recorded. Further field investigation and monitoring is required to accurately assess the depth to the groundwater table.

7.2.3 Henty

No appreciable groundwater ingress or saturated soils was encountered within the boreholes conducted along the L1 and L3 levee alignments in Henty.

7.3 Laboratory Testing

7.3.1 Culcairn

The results of the laboratory and field tests are summarised in Table 7-7. The results confirm the presence of variable materials across the site including silts, sands and clays across the proposed levees.

The clay material tested were found to be dry (-4.5% to -3.6%) of the Optimum Moisture Content (OMC). The clays and silts were low plasticity with liquid limits in the range of 15% - 35% and plasticity indices in the range of 1% to 24%.

The Emerson Class tests were conducted using distilled water and indicated the on-site clays are dispersive with Emerson Class Numbers between 1 and 3.

7.3.2 Holbrook

The results of the laboratory and field tests are summarised in Table 7-8. The results confirm the presence of variable materials across the site including silts, sands and clays and gravels.

The clay material tested were found to be dry to slightly dry (-4.7% to -1.7%) of the Optimum Moisture Content (OMC). The clays and silts were between low and high plasticity with liquid limits in the range of 21% - 70% and plasticity indices in the range of 8% to 53%.

The Emerson Class tests were conducted using distilled water and indicated the on-site clays are dispersive to non-dispersive with Emerson Class Numbers between 1 and 7. The majority of samples returned an Emerson Class number of 1 – 3 indicating the clays are highly dispersive to moderately dispersive.

The clays were found to have shrink swell index values of between 0.8 and 4.8 indicating low to high potential reactivity.

Noting, the successfully recovered shrink swell samples were collected from the Holbrook Levee sites. Attempts were made to collect samples from the other site but due to the hard condition of the clay soils sufficient material could not be recovered. In any case the clays soils across the townships and the climate conditions are commensurate and equivalent results are anticipated.

7.3.3 Henty

The results of the laboratory and field tests are summarised in Table 7-9. The results confirm the presence of variable materials across the site including silts, sands and clays and gravels.

The clay material tested were found to be very dry to dry (-5.5% to -4.0%) of the Optimum Moisture Content (OMC). The clays and silts were between low and intermediate plasticity with liquid limits in the range of 17% - 41% and plasticity indices in the range of 3% to 36%.

The Emerson Class tests were conducted using distilled water and indicated the on-site clays are dispersive to non-dispersive with Emerson Class Numbers between 1 and 3.

Table 7-7 Summary of Culcairn Laboratory Results

Borehole No.	Depth (m)	Soil Description	Field Moisture Content (%)	Optimum Moisture Content (%)	Percent Passing 425µm (%)	Percent Passing 75µm (%)	Particle Size 2µm (%)	Liquid Limit (%)	Plasticity Index (%)	Emerson Class	Shrink Swell Index (Iss)
BH01	0.5	Silty CLAY (CL) with Sand, brown orange to pale brown			100	79	20[1]	27	13		
BH02	0.2 – 0.4	Sandy Clayey SILT (ML) dark brown to brown			98	49	18				
BH02	2.0	Sandy SILT (ML) brown to grey			88	41	5	15	1		
BH03	0.2-0.5	Silty CLAY (CL) orange mottled brown			100	91	6	22	8		
BH03	1.1 – 1.3	Silty CLAY (CL) orange mottled brown			100	96	17[1]	34	22	2	
BH03	1.2 – 2.0	Silty CLAY (CL) orange mottled brown	9.5	14.0							
BH04	0.2 – 0.4	Silty CLAY (CL) orange			100	93	14[1]	23	11		
BH04	1.7 – 1.9	Silty CLAY (CL) pale brown and orange			100	94	35	35	24	1	
BH04	1.7-2.7	Silty CLAY (CL) pale brown and orange	11.9	15.5							
BH05	1.4 – 1.6	SILT (ML) with Sand, pale brown mottled grey			99	78	4				
BH05	2.1 – 2.4	Silty Sandy CLAY (CL) dark brown mottled grey			90	69	18	27	14	3	

Table 7-8 Summary of Holbrook Laboratory Results for

Borehole No.	Depth (m)	Soil Description	Field Moisture Content (%)	Optimum Moisture Content (%)	Percent Passing 425µm (%)	Percent Passing 75µm (%)	Particle Size 2µm (%)	Liquid Limit (%)	Plasticity Index (%)	Emerson Class	Shrink Swell Index (Iss)
BH06	2.1 – 2.3	Sandy SILT (ML) with Clay, grey mottled brown			97	64	6				
BH06	3.5 – 3.6	Silty Sandy CLAY (CL) dark grey						31	19		
BH06	5.7	Silty CLAY (CH) orange grey						55	42		
BH07	0.2 – 0.5	SILT (ML) with Sand, pale brown			94	78	4				
BH07	0.7 – 1.0	Silty CLAY (CL) with Sand, pale brown			96	77	23	31	18	2	
BH08	0.5-1.0	Silty CLAY (CI) with Sand, dark red	9.3	14							
BH08	0.6 -0.8	Silty CLAY (CI) with Sand, dark red									0.8
BH08	0.9-1.0	Silty CLAY (CI) with Sand, dark red			95	79		41	29	3	
BH09	0.6-1.0	Silty CLAY (CI) trace Sand, brown orange and grey									1.1
BH09	0.8	Silty CLAY (CI) trace Sand, brown orange and grey			97	86	32	44	33	7	
BH09	0.5-1.5	Silty CLAY (CI) trace Sand, brown orange and grey	14.7	16.5							
BH10	0.2 – 0.4	Sandy SILT (ML), pale brown			94	59	0				
BH10	0.6 - 0.7	Sandy Silty CLAY (CI) red mottled brown grey			94	69	28	43	31	1	

Borehole No.	Depth (m)	Soil Description	Field Moisture Content (%)	Optimum Moisture Content (%)	Percent Passing 425µm (%)	Percent Passing 75µm (%)	Particle Size 2µm (%)	Liquid Limit (%)	Plasticity Index (%)	Emerson Class	Shrink Swell Index (Iss)
BH10	0.7-1.1	Sandy Silty CLAY (CI) red mottled brown grey									1.1
BH10	0.5-1.2	Sandy Silty CLAY (CI) red mottled brown grey	14.8	16.5							
BH10	2.5	Silty CLAY (CH) brown and grey						70	53		
BH11	0.9 – 1.0	Silty CLAY (CI) with Sand, brown and dark grey			93	72	23	37	26	3	
BH11	2.7	Silty sandy CLAY (CL) brown and grey						30	15		
BH12	0.6 – 0.7	Silty Sandy CLAY (CL) brown and grey						35	21	1	
BH12	1.5	Silty Sandy CLAY (CL) brown and grey			93	60	15[1]				
BH12	3.2	Silty SAND (SM) dark brown to brown			39	19	3				
BH13	0.6	Silty CLAY (CI) with Sand, brown and grey			96	72	21[1]	42	30	3	
BH13	0.75-1.2	Silty CLAY (CI) with Sand, brown and grey									1.4
BH13	0.5-1.9	Silty CLAY (CI) with Sand, brown and grey	13.6	15.5							
BH14	0.4	Silty CLAY (CL) pale brown and grey			81	69	10[1]	21	8		
BH14	0.6	Silty CLAY (CH) dark brown orange mottled brown			96	91	52	68	50	3	
BH14	1.2-2.7	Silty CLAY (CH) dark brown orange mottled brown	19.9	23							

Borehole No.	Depth (m)	Soil Description	Field Moisture Content (%)	Optimum Moisture Content (%)	Percent Passing 425µm (%)	Percent Passing 75µm (%)	Particle Size 2µm (%)	Liquid Limit (%)	Plasticity Index (%)	Emerson Class	Shrink Swell Index (Iss)
BH15	0.4	Silty CLAY (CL) brown grey			93	88	24	29	17	1	
BH15	0.5-0.7	Silty CLAY (CL) brown grey									4.8

Table 7-9 Summary of Henty Laboratory Results for Culcairn

Borehole No.	Depth (m)	Soil Description	Field Moisture Content (%)	Optimum Moisture Content (%)	Percent Passing 425µm (%)	Percent Passing 75µm (%)	Particle Size 2µm (%)	Liquid Limit (%)	Plasticity Index (%)	Emerson Class	Shrink Swell Index (Iss)
BH16	0.3	Sandy SILT (ML) pale brown						18	3		
BH16	0.6	Silty CLAY (CL) with Sand, orange brown mottled grey			81	75	27	29	18	1	
BH16	0.5-2.3	Silty CLAY (CL) with Sand, orange brown mottled grey	14.0	19.5							
BH17	0.5	Silty CLAY (CI) trace Sand, dark brown orange mottled grey			99	95	33	49	36	1	
BH18	0.3	Clay SILT (ML) pale brown to white			98	94	4	17	2		
BH18	1.5	Silty CLAY (CL) trace Sand, brown mottled grey						34	21	1	
BH18	0.6-2.5	Silty CLAY (CL) trace Sand, brown mottled grey	11.0	15							
BH19	0.3	Silty CLAY (CI) brown mottled grey			99	98	34	41	29	2	
BH20	0.2	Silty CLAY (CL) pale brown						25	12		
BH20	0.3	Silty CLAY (CL) brown mottled grey			99	95	23[1]	35	25	3	
BH20	0.8-2.0	Silty CLAY (CL) brown mottled grey	11.2	16							

[1] Percentage passing 2µm was interpolated from particle size distribution plot

8 Analysis

8.1 Seepage Analysis

A seepage analysis was carried out where:

> The proposed levee alignment is underlain by more than 1.0m of silty material that is prone to piping, or;

> The proposed levee alignment is underlain by more than 1.0m of fill (coarse permeable materials).

Piping failure of the underlying subgrade material is the process by which seepage results in removal of fines along a path between the upstream and downstream toes of a levee. For piping failure to occur seepage must exit through the downstream toe of the levee. The presence of the above founding materials presents a risk of piping failure in the following levee areas:

> Culcairn, Option S2 Billabong Creek Anabranch levees at BH02 and BH05

> Holbrook, Levee Option BL, within the Hay Street park area, adjacent to Ten Mile Creek at BH06.

A seepage analysis was conducted for these locations to assess if seepage would reach the downstream toe during a (1%AEP) flood event. The analysis was conducted using Rocscience Inc Slide 2018 Software. The modelled scenario assumes that sufficient time will pass for the elevated groundwater levels to equilibrate prior to a similar flood event occurring again.

Hydraulic and geometric specifications related to the two-dimensional (2D) seepage assessment for those areas are provided in Table 8-1. The following assumptions are adopted for the assessment:

> The Billabong Creek Anabranch levee embankment fill is assumed to sit directly above the foundation materials described in the table.

> The Hay Street Levee was modelled assuming the stripping and placement of a 0.5 m thick bed of engineered fill;

> The geometric dimension of the levees is based on the preliminary drawings AWE200028-WE-0210 Rev 1, AWE200028-WE-0220 Rev 1 and AWE200028-WE-0310 Rev 1.

> Based on the geotechnical investigation the foundation materials are either sandy clayey SILT (ML), SILT (ML) or Fill comprising of Silty SAND (SM);

> Hydraulic gradient is assumed to be the ratio of the water height to the levee base width.

Table 8-1: Section Geometry for Seepage Assessment

Levee	Location	Nearby Boreholes	Foundation Material	Levee Height (m)	Water Level Height (m)	Levee Width (m)	Key Depth (m)	Hydraulic Gradient
Option S2-Anabranch Levee, Culcairn	East	BH02	Sandy Clayey SILT (ML)	2.7	2.5	21	1.0	0.12
	West	BH05	SILT (ML)	1.8	1.6	12.8	1.0	0.13
Option BL Holbrook Levee,	Hay Street	BH06	Fill, silty SAND (SM)	1.9	1.4	14	1.0	0.10

8.1.1 Billabong Creek Anabranch Levee (Option S2)

Based on Table 8-1, the western anabranch levee is approximately half the width of the other levee section in consideration. Therefore, it is the shortest distance for the water to reach the downstream toe of the levee during a flood event and is identified to be the worst cross section. As a result, only this section has been analysed in this seepage assessment.

A transient seepage analysis was carried out for Billabong Creek Anabranch Levee (Option S2) using Slide 2018 software. The initial groundwater depth was modelled at surface level to generate the transient analysis, this was to account for local saturation prior to a flood event. The transient analysis modelled the whole event for a 1% AEP flood starting from raising up to maximum water level and dropping down within 2 days (flood is expected rise within 0.5 days, 1 day at the maximum water level, and 0.5 days to drop down) to estimate the maximum discharge velocity throughout the event.

Permeability values of 5x10^{-6} m/s for the foundation material, 5x10^{-9} m/s for the proposed levee fill material and 1x10^{-9} m/s for the proposed clay core were adopted for the analysis. The results of the discharge velocity are presented in Figure 8-1. The discharge velocity varies across the base of the levee with an estimated maximum discharge rate of 0.24 m/d. During a flood event, the seepage will require significantly longer than the expected flood duration of 2 days to reach the levee embankment downstream toe.

Based on this assessment, the proposed levee dimensions in the areas of concern are expected to be sufficiently wide to minimise the risk of seepage under the levee and piping failure of the levee. Therefore, the deep silt profile in these areas do not need to be excavated and replaced but rather can be constructed on subject to the subgrade preparation requirements in Section 9.5.1.3.

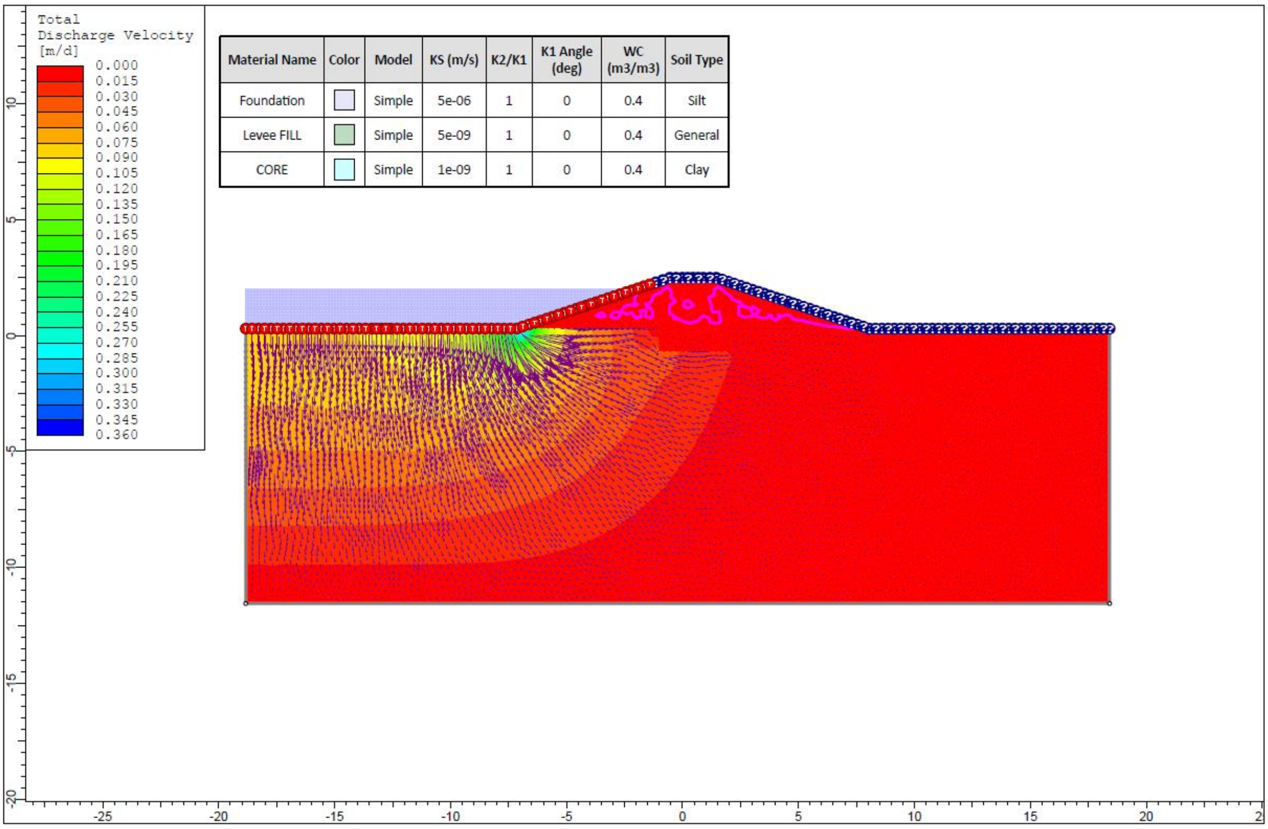

Figure 8-1 Seepage analysis of the Billabong Creek Anabranch Levee

8.1.2 Hay Street Park, Holbrook (Option BL)

The transient analysis modelled the whole event for a 1% AEP flood starting from raising up to maximum water level and dropping down within a 16-hour period (flood is expected rise within 4 hours, 8 hours at the maximum water level, and 4 hours to drop down) to estimate the maximum discharge velocity throughout the event.

Permeability values of 1x10^{-4} m/s for the foundation material (Fill, Silty Sand), 1x10^{-6} for the underlying natural Silt, 5x10^{-9} m/s for the proposed levee fill material and 1x10^{-9} m/s for the prosed clay core were adopted for the analysis. The groundwater table was modelled at a depth of 1.5 m below ground level.

The results of the discharge velocity is presented in Figure 8-2. The discharge velocity beneath the proposed levee embankment is assessed to be on average 1m/day, however, higher discharge velocities are estimated in isolated areas (at the upstream toe and around the levee key). During a flood event, the seepage will require more than 14 days to reach the downstream levee embankment toe which is longer than the expected flood duration of 16 hours.

Based on this assessment, the proposed levee widths in the areas of concern are expected to be sufficiently wide to minimise the risk of seepage under the levee and piping failure of the levee. Therefore, the existing fill material in these areas do not need to be excavated and replaced but rather can be constructed on subject to the subgrade preparation requirements in Section 9.5.1.2.

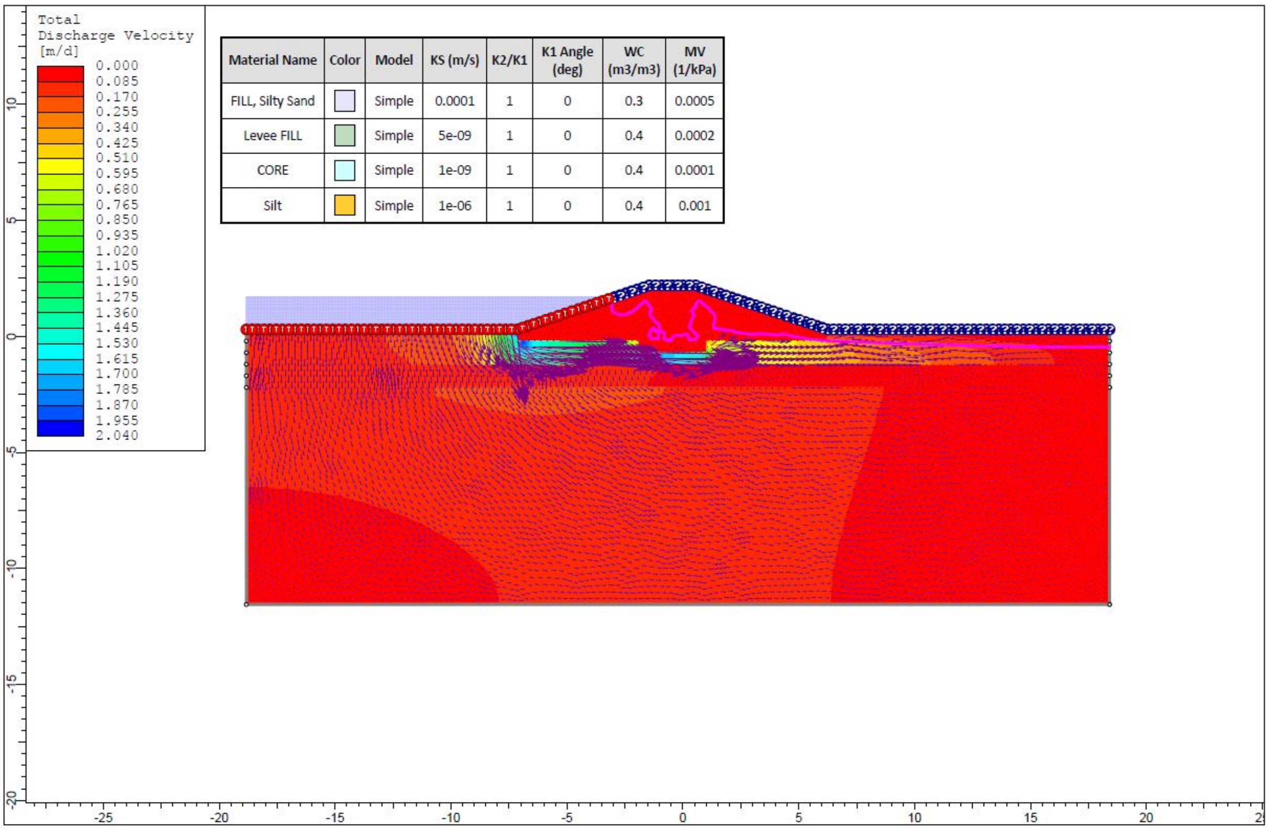

Figure 8-2 Seepage analysis of the Hay Street Levee

8.2 Pavement Analysis

It is understood that a section of the Culcairn stock route, which extends 45 m north of the intersection between Balfour Street is to be lowered by approximately 200 mm.

8.2.1 Subgrade Design California Bearing Ratio (CBR)

Borehole BH06 was drilled within the Culcairn Stock Route roadside and intersected fill to a depth of 0.20 m underlain by natural silty clay. A design CBR of 3% has been adopted for the natural silty clay subgrade. Subgrade preparation must be undertaken as per the recommendations in Section 9.8.5.

8.2.2 Design Traffic

Design traffic of 1×10^4 Equivalent Standard Axles (ESAs) representing occasional municipal trucks and agricultural freight was adopted for the stock route as it is typically used for local traffic only.

8.2.3 Design of Unsealed Granular Pavement Profiles

An unsealed granular pavement profile is proposed for the stock route lowering. The unsealed granular pavements have been designed using Figure 4.3 of Austroads AGPT06-09.

9 Conclusions and Recommendations

The sites located within Culcairn, Henty and Holbrook are generally suitable for the proposed flood mitigation options. Nonetheless, there are a number of issues and geotechnical conditions that may influence the design and construction of the levees that need to be carefully considered by the designer.

The boreholes drilled across the sites generally intersected an upper profile of variable depth of silty and sandy soils overlying intermixed layers of cohesive clays and non-cohesive sands and gravels of varying composition, thickness and strength.

The design of the levees will need to consider several aspects including:

> soil strata

> allowable bearing pressures

> type and quantity of locally available materials to construct the levee

> available footprint for the levee

> appropriate batter angles to prevent stability issues

> erosion protection of levee batters.

The following sections discuss the recommendations for the design of the levee.

The designer and contractor need to be made aware of the intermixed cohesive and non-cohesive soils and the potential for both construction and in-service issues such as poor foundation conditions, erosion and piping and flow of flood water under the levee structure.

9.1 Subsurface Conditions

9.1.1 Groundwater

Groundwater was observed at depths of 1.5 m and 3.2 m below ground level (approximate creek level) in BH06 and BH12 conducted along Ten Mile Creek, Holbrook, and in BH02 at a depth of 2.9 m below the base of the Billabong Creek Anabranch, Culcairn.

Groundwater is expected to impact the construction of the Option BL levee, Holbrook between approximate chainage Ch0.0 and Ch150.0 (within the Hay Street Park area). The contractor should make provision for dewatering should the excavations encounter groundwater ingress. The proposed construction of a deep foundation system for a portion of the Option CL Levee, Holbrook may encounter groundwater ingress and the contractor will need to make allowances for dewatering of the excavation should it be encountered during construction.

The presence of perched water in the soils overlying the clays in the wetter months cannot be precluded.

9.1.2 Site classification

Although AS2870-2011 Residential Slabs and Footings is not directly applicable for the purpose of this development, it can still be used as a guide for the design of the levee and levee wall foundations. It is recommended that the sites be classified as 'P' (P Site) in accordance with AS2870-2011 Residential Slabs and Footings due to the presence of localised uncontrolled fill up to 1.5m, the proximity of significant trees and the potential for abnormal moisture conditions associated with flooding.

9.1.2.1 Holbrook – Characteristic Surface Movement (y_S)

An estimation of the characteristic surface movement (y_s) was computed using the method outlined in AS2870 – 2011 and the laboratory Shrink Swell Index results conducted in Holbrook. Characteristic surface movements of between 14 mm and 89 mm were calculated suggesting the reactivity along the Option CL and BL levee alignments ranges from slightly reactive to extremely reactive.

The calculations did not consider any further abnormal moisture conditions as defined in AS2870-2011 Clause 1.3.3. Abnormal moisture conditions may increase the differential movement across a foundation as they wet or dry the soil in isolated locations. This causes localised surface movement in excess of the characteristic surface movement. This results in increased stresses on the structure and a decreased probability of serviceability and safety of the building during its design life, as described in Clause 1.3.1 AS2870-2011.Any levee walls that incorporate shallow foundations must considered the reactivity induced movement in their design.

Although laboratory testing could not be conducted for samples collected at the levee alignments in Culcairn and Henty, it is anticipated that similar characteristic surface movements would be calculated for these sites, as the climate zone and soil types are equivalent.

9.2 Proposed Levees Sites

9.2.1 Option S2 Billabong Creek Anabranch Levees and the Northern Banks of Billabong Creek, Culcairn

A significant profile of silt was encountered within the boreholes (BH02 and BH05) conducted at the base of the Billabong Creek Anabranches. A seepage analysis presented in Section 8.1 was conducted to assess the suitability of the proposed site for the S2 levees. The analysis indicates that seepage below the levee will not reach the downstream toe in a 1%AEP flood event. Therefore, the potential of piping failure of these levees is considered to be low. The silt material, in the context of the geometry of the proposed levee is deemed suitable as a founding stratum in this localised area. However, the designer needs to ensure a suitable clay key is incorporated into the design and subgrade preparation practices presented in Section 9.5.1 are strictly prescribed.

The proposed levees located adjacent to the banks of Billabong Creek must consider the current conditions of the creek banks and where required adopt the recommendations outlined in Section 9.4.4.

9.2.2 Option L1 and L3 Levees, Henty

The surface conditions at Option L1 and L3 are generally suitable for the proposed levees, however, deepened areas of silt were encountered and care should be taken to ensure all deleterious material is stripped prior to construction of the levee as per the recommendations of presented in Section 9.5.1.

9.2.3 Option BL - Holbrook

Mixed fill material to a depth of 1.5m overlying saturated alluvium was encountered along the banks of Ten Mile Creek within the Hay Street reserve area (encountered in BH06 only). A seepage analysis presented in Section 8.1 was conducted to assess the suitability of the existing fill as the levee foundation material. The analysis indicates that seepage below the levee will not reach the downstream toe in a 1%AEP flood event. Therefore, the potential of piping failure of these levees is considered to be minimal. The analysis is described in detail in Section 8.1. The fill material, in the context of the geometry of the proposed levee is deemed suitable as a founding stratum in this localised area. However, the designer needs to ensure a suitable clay key is incorporated into the design and subgrade preparation practices presented in Section 9.5.1 are strictly prescribed.

9.2.4 Option CL – Holbrook

This alignment is generally suitable for the proposed levee. It is understood that the section of the Option CL levee between Ten Mile Creek and the adjacent residential properties will comprise Levee walls. An assessment of the existing banks of Ten Mile Creek should be conducted to determine the viability of earthen levees and any required bank improvement works.

9.3 Suitability of On-site Material for Levee Construction

The investigation identified a subsurface profile predominately comprising intermixed in-situ layers of gravel, sand, silt and clay ranging between dispersive and non-dispersive materials. Isolated areas of fill material and organic rich topsoils were also encountered along the alignments.

Construction of the levee using site won soils should generally be limited to the clays, silty clay and sandy clay soils. Noting, low plasticity clays (plasticity index <10%) and highly erodible clays (Emerson Class >4) were encountered within the boreholes, these clays are not suitable for use in construction of the clay core or key.

The silty soils are unsuitable for use as engineered fill due to their propensity to soften with a change in moisture content. The silt soils can be stockpiled and reused for landscaping purposes where appropriate.

The gravelly and sandy soils are typically low in clay content and are unlikely to be suitable for use in the levee construction as these soils will not be sufficiently impervious and excessive seepage of floodwater through the levee can occur. In addition, these soils are readily erodible and could cause levee failure during a flood event.

9.4 Levee Embankment Design

9.4.1 Geometry

The earthen levees would ideally be entirely constructed using suitable compacted clay soil. However, this is unlikely to be economical as all the material will need to be imported. For this reason, it is recommended to consider a clay core and key with engineered fill supporting each side. A design incorporating a clay core has the benefit of providing a low permeability barrier reducing the seepage through the levee and also reducing the volume of imported low hydraulic conductivity clay.

The levees should be founded on a suitable stratum which will require excavation of any unsuitable fill and silty soils (with the exception of some isolated areas), any organic matter or any other deleterious material. The design must incorporation a clay key to reduce flow under the levee, the depth of which will be dependent on the subgrade conditions.

The levees should be constructed using suitable materials and placed and compacted as engineered fill. The levee should be designed incorporating a minimum 2 m wide crest with batters either side. The permanent levee batters should not exceed 1V:3H without additional engineering measures.

Where the batters are required to exceed 1V:3H it is recommended that a permanent slope and veneer stabilisation measure is incorporated in the design, such as a geocell system or appropriately designed and constructed rock revetment. This system should be designed to provide sufficient stability of the batters and consider potential hydraulic forces from flood events. Further design requirements are discussed in later sections.

9.4.2 Clay Core and Clay Key

The clay core should be a minimum of 2 m in horizontal thickness. The clay key should also be a minimum of 2 m in horizontal thickness where an earth embankment levee is proposed and a minimum of 0.5 m horizontal thickness where a structural levee wall is to be used.

Where clays are encountered at the foundation level, a 0.5 m deep key should be excavated into the clay before constructing the levee embankment. Where sands and gravels are encountered, a 1.0 m deep key should be excavated into the material.

Where silts or fill soils are encountered at the foundation level a seepage analysis is required to assess a suitable key depth. This was conducted for the Billabong Creek Anabranch Levees (Option S2) in Culcairn and within the Hay Street Park portion of the Option BL Levee, Holbrook. The analysis showed a minimum 1.0 m deep key will be necessary to reduce the potential for piping failure to occur at these locations. Therefore a 1.0 m deep key should be excavated into this material at the assessed locations, noting care the subgrade preparation recommendations outlined in Section 9.5.1 must be strictly adhered to. Where fill is encountered elsewhere across the alignment a seepage analysis will be required to determine a suitable key depth.

The purpose of the key is to reduce and slow near-surface infiltration under the levee and reduce the potential for a piping failure under the levee. However, the key will not prevent infiltration and some flow of water under the levee can be expected, especially where sands or gravels are present.

The clay used in the construction of the clay core and key should be selected such that:

- The material is free of organic or deleterious material
- No rock or soil lumps greater than 50 mm
- More than 70% passing through the 19 mm sieve
- More than 30% passing through the 75 µm sieve
- More than 15% passing through the 2 µm sieve
- A soil plasticity index of greater than 10%
- A hydraulic conductivity on a remoulded sample compacted to 95% Standard Dry Density Ratio close to the Optimum Moisture Content with a laboratory measured coefficient of permeability of less $1x10^{-9}$ m/s
- Emerson Number of 4 or greater

> Pinhole Erosion of ND2 or less.

9.4.3 Levee Batters

The levee batters either side of the clay core should be constructed with clay rich engineered fill concurrently with the clay core. The engineered fill should consist of either silty or sandy clay selected such that:

> The material is free of organic or deleterious material

> No rock greater than 50 mm

> Emerson Number of 4 or greater

> An angle of internal friction exceeding the proposed batter angle.

9.4.4 Existing River Bank – Ten Mile Creek, Holbrook and Billabong Creek, Culcairn

As discussed earlier in this report the existing creek banks along Ten Mile Creek, Holbrook and Billabong Creek, Culcairn are variable in geometry and conditions. It is recommended that the design of the levee consider the condition and proximity of the proposed levee to the existing river bank. Where required, the existing river bank should be repaired and maintained to prevent damage or loss of support to the levee.

Particular attention will need to be paid to the creek banks along Billabong Creek, Culcairn between BH03 and BH04. The banks in this area show signs of significant erosion and instability.

Where possible, the existing river and levee banks should be re-profiled to a maximum slope batter of 1V:3H. Where batter slopes steeper than this are required, is recommended that a permanent slope support measure such as a rock revetment is incorporated into the design. This system should be designed to provide sufficient stability of the batters and consider potential hydraulic forces from regular flow and flood events. However, where these measures cannot be practically implemented it is recommended that the offset of the proposed levee from the creek be reviewed.

A thorough inspection of all creek banks located within close proximity to the proposed levees must be conducted and inspection reports and photographic records of the river banks should be included in the site management plan. On-going monitoring of the creek banks should be conducted and periodic repair should be anticipated.

9.4.5 Erosion Protection

The crest and batters should be protected from erosion and desiccation with a suitable depth of topsoil and vegetation or permanent erosion control mats. An agronomist familiar with local conditions should be consulted during vegetation selection, and the vegetation should be limited to appropriately selected local grasses that maintain good root growth year-round. Trees and large rooted vegetation should be avoided.

9.4.6 Levee Penetrations

Any penetrations through the levee such as pipes or conduits are particularly susceptible to piping failure, if poorly compacted. Filter zones along the pipes need to be incorporated to prevent the development of piping. Care must be taken to ensure that the pipe trenches are only backfilled with properly compacted clay and that no sand or gravel is used. This normally involves the use of hand-held compaction equipment. As an alternative, concrete cut-offs could be considered.

9.5 Levee Embankment - Construction

9.5.1 Levee Subgrade Preparation

Preparation of the levee subgrade at Hay Street Park, Holbrook and the Billabong Creek Anabranch levees, Culcairn should be conducted in accordance with the recommendations in Sections 0 and 9.5.1.3. All other levee locations may be prepared in accordance with the general subgrade recommendations below.

9.5.1.1 General Subgrade Preparation

Before constructing the levee, all upper silts, fill and organic material should be stripped to expose the underlying clays, sands, gravels or suitable silts or fill.

Once the foundation level has been achieved, it is recommended the exposed surface should be scarified to a depth of approximately 200 mm, moisture conditioned and then compacted in accordance with the recommendations provided in Section 9.5.2, in preparation for the clay core and levee embankment construction. Any localised soft spots or areas containing deleterious material should be excavated and replaced with clay rich engineered fill in layers.

9.5.1.2 Subgrade Preparation at Hay Street Park, Holbrook (Option BL)

In areas where a seepage analysis has been conducted and the underlying fill has been identified as a founding material with a low risk of piping failure the following subgrade preparation steps should be undertaken:

> The subgrade should be inspected by a geotechnical engineer to confirm whether the subgrade is formed by fill. If the subgrade comprises fill, it should be assessed for re-use as a suitable subgrade for levee construction (i.e. comprise of clay, sand or gravel). If no deleterious material is identified the exposed surface should be should be scarified to a depth of approximately 200 mm, moisture conditioned and then compacted.

> If the subgrade fill comprises a significant portion of deleterious material or foreign (anthropogenic) material it should be stripped to a minimum depth of 500mm below the subgrade level; and

> Any excavation below subgrade level shall be brought back to subgrade level with engineered fill in lifts not exceeding 250mm compacted thickness with each lift compacted to achieve a minimum of 95% Standard Dry Density Ratio within +/-3% of the Optimum Moisture Content.

9.5.1.3 Subgrade Preparation at Billabong Creek Anabranch Levees (Option S2)

In areas where a seepage analysis has been conducted and the underlying silt has been identified as a founding material with a low risk of piping failure the following subgrade preparation steps should be undertaken:

> The subgrade should be inspected a geotechnical engineer to confirm whether the subgrade is formed by silt. If the subgrade comprises silt, and no soft spots are identified the exposed surface should be should be scarified to a depth of approximately 200 mm, moisture conditioned and then compacted; and

> Any soft spots identified should be excavated out and replaced with engineered fill compacted in lifts not exceeding 250mm compacted thickness with each lift compacted to achieve a minimum of 95% Standard Dry Density Ratio within +/-3% of the Optimum Moisture Content.

> However, it is noted that silt has the propensity to soften when exposed to moisture making construction of the clay core and key as well as the levee embankments problematic. As a prudent measure the following should be adhered to for ease of construction: Strip the underlying silt to a minimum depth of 500mm below the subgrade level; and

> Any excavation below subgrade level shall be brought back to subgrade level with engineered fill in lifts not exceeding 250mm compacted thickness with each lift compacted to achieve a minimum of 95% Standard Dry Density Ratio within +/-3% of the Optimum Moisture Content.

9.5.2 Construction of Clay Core and Clay Key

The clay core and key should be placed in layers of no greater than 250 mm loose or 200 mm compacted. The clay for the core and key should be moisture conditioned to be between 0% and +3% of the OMC (Optimum Moisture Content) and preferably between +1% and +3%, and compacted to at least 95% Standard Dry Density Ratio in accordance with Australian Standard 1289 *Testing of Soils for Engineering Purposes*.

Moisture conditioning of the clays will likely be required during construction, and the contractor needs to make an assessment as to the moisture conditioning required and methodology to achieve the required moisture content and compaction.

It is recommended that the clay core and key be compacted using a vibrating sheep foot, pad foot or tamping roller. Rubber tyred, or steel drum rollers are not recommended, as these tend to create horizontal laminations between layers. Compacted surfaces should not be allowed to dry and crack before placing subsequent lifts. If this should occur, then all dried clay should be stripped and replaced or alternatively, scarified and conditioned to the recommended moisture tolerances before placing the next layer. To prevent laminations occurring between compacted layers, subsequent layers should be compacted and kneaded into the underlying layer. Quality assurance and quality control recommendations during construction are discussed in later sections.

9.5.3 Construction of Clay Rich Engineered Fill

This material should be placed in near horizontal layers not exceeding 250 mm loose or 200 mm compacted thickness and be compacted to at least 95% Standard Dry Density Ratio in accordance with Australian Standard 1289 *Testing of Soils for Engineering Purposes*. Quality assurance and quality control recommendations are discussed in later sections.

It is recommended that the clay rich engineered fill be over-placed on the batters to ensure compaction near the edges is achieved and then be cut back to the final proposed batter.

9.5.4 Stabilisation of Earthen Batters

Due to the dispersive and erodible nature of in-situ material the earthen batter slopes constructed using these materials must be stabilised using in-situ lime stabilisation. Should this method be adopted, levee embankments should be stabilised upon completion of the placement and compaction process to a minimum depth of 200 mm.

No laboratory testing has been undertaken to determine the type or amount of additive, lime or cement, to sufficiently increase the erosion resistance of the material. Previous experience with lime stabilisation of similar type soils indicates that the amount of lime and/or cement is dependent on the actual lime and cement to be used and their interaction with the material. If in-situ stabilisation is considered to be an option then it is recommended that an appropriate mix design be determined for the stabilisation by a NATA accredited soils laboratory.

9.5.5 Difficulty in Excavation

The excavation of the in-situ soils at the proposed levee sites and road lowering should be readily handled with hydraulic excavators. It is not expected that rock will be encountered in the excavation depths for the proposed works.

9.5.6 Quality Assurance and Control during Construction

The integrity and long-term performance of the earthen levees will largely depend on the quality of construction of the embankments and clay core.

The layer thicknesses, material compatibility and compaction techniques used in the construction of the compacted clay core and levee embankments should be carefully controlled to ensure the required density and hydraulic conductivity are achieved. The quality of construction, adequacy of the supervision, including the number of layers and bonding between layers, is most important.

Supervision during construction is an important component to ensure that the clay core and levee embankments are properly constructed. It is recommended that the consulting design engineer attend the site at regular intervals, to ensure the conformance with the specification.

It is recommended that a geotechnical engineer be engaged to provide on-site advice at critical times such as when the bulk excavation is completed, commencement of the embankment and liner construction, and periodically during the placement of the clay.

The geotechnical investigation has highlighted the expected ground conditions across the site, including clays, silts, sands and gravels which may be encountered during construction. The contract documents and supervision must reflect this. It is recommended that an experienced engineer be appointed as the Clerk of Works, who has a clear understanding of the requirements of the levees and has the ability and authority to direct the contractor to reject any unsuitable materials. A compacted clay core requires high quality of construction to ensure that the core will perform as expected.

9.5.7 Compaction Testing

It is important to ensure that the moisture content of the clay fill being placed is within the specified tolerances and the clay layer placement thicknesses adhere to those recommended.

The Standard Dry Density ratio of the clay needs to be determined by an experienced geotechnical inspection and testing authority (GITA) who are NATA registered for the particular tests carried out. The in-situ density testing and compaction testing should be carried out in accordance with AS 1289 *Methods of Testing Soils for Engineering Purposes.* One Hilf compaction or Standard compaction test is required per density test. One-point density tests or nuclear moisture contents values are not acceptable.

While not directly applicable to clay cores or levee embankments, it is recommended that the principles in AS 3798-2007 *Guidelines to Earthworks for Commercial and Residential Developments* are adopted. It is recommended that any fill used for the clay core and levee embankment, should be inspected and tested in accordance with Level 1, as described in Section 8 of AS 3798, with testing conducting in accordance with the following schedule:

> 1 test per layer per 2,500m^2 placed; or
> 1 test per 500m^3 placed distributed evenly throughout the depth and area; or
> 3 tests per day of work, whichever requires the most tests.

As per Section 8.2 of AS 3798, the GITA needs to have competent personnel on site at all times while earthwork operations are undertaken. Such operations include:

> Completion of removal of topsoil;
> Placing of imported or cut material;
> Compaction and adding/removal of moisture;
> Trenching or backfilling, where required;
> Test rolling;
> Testing.

At the completion of the earthworks program the GITA should provide a report setting out the inspections, sampling and testing it has carried out and the locations and results of such tests. The report should also provide an option as to whether the earthworks comply with the specification and drawings.

9.6 Levee Wall – Option CL, Holbrook

It is understood that a levee wall system is proposed along portions of the Option CL alignment that run parallel to Ten Mile Creek.

The wall should be designed to resist the hydraulic forces during the design flood event and include a suitable freeboard to prevent overtopping.

The designer also needs to consider the long-term founding conditions, including any loss of support as a result of erosion of any adjacent riverbank.

The levee wall should be designed to prevent excessive flow under the wall by using a clay cut-off or similar as discussed in Section 9.4.2, particularly where non-cohesive sands and gravels are encountered at shallow depth.

9.6.1 Deep Foundation System

Where the wall system requires a deep foundation system such as soldier piles with infill panels the spacing of the piles has a significant effect on the appropriate methodology for designing the piles. It is assumed that all levee walls adopting a deep foundation system are primarily supporting the levee wall facing units and floodwater only and no soil above the ground surface is required to be retained or vertical loading applied. Where this system is used, a minimum 2.0 m wide clay key should be installed along the full length of the wall and infill panels socketed into this key to a minimum of 0.5 m depth.

9.6.2 Spacing of the Piles

It is understood that the levee walls and pile foundations are to be designed to resist hydrostatic forces only, and not to be designed for soil retention. However, a soil retention condition can develop where soil erosion occurs adjacent to the toe of the wall. In this situation the lateral loads imparted on the individual piles will be dependent on the spacing of the piles. When the piles are closely spaced, generally considered to be less than 2.5 – 3.0 m centre to centre spacing, the soils will arch between the piles and the piles will be required to resist the lateral loads across the full width between the piles. If the piles are more widely spaced, the soils will tend to flow between the piles and the load imparted will be due to the movement of soil between the piles.

For the lateral resistance, the spacing determines whether the piles will act independently or as a continuous retaining wall. If the piles are spaced at less than 3 – 4 pile diameters centre to centre, the piles will tend to act as a single ‘retaining wall’ while if the piles are more widely spaced they will act independently. While the decision as to the pile spacing is up to the structural engineer, the preferred approach is for the piles to act as a retaining wall (i.e. spaced less than 3 – 4 pile diameters) to avoid possible distress to the structures above.

The following sections provide recommendations for the pressure distributions for the applied loads and resistances for the piles. The parameters provided are ultimate design parameters. Loading factors and/or strength reduction factors in accordance with the AS 4678 – 2002 *Earth Retaining Structures* need to be applied.

9.6.3 Minimum Pile Founding Depth

The piles will need to be founded deep enough so the required lateral passive resistance can be achieved. As the wall will not be vertically loaded the lateral passive resistance will govern the pile founding depth.

The depth where passive resistance of the piles can be adopted needs to consider the steeply sloping creek bank. Passive resistance can be adopted provided the following are achieved:

> Minimum 1 m embedment below the ground surface

> Minimum 4D horizontal setback distance from the creek bank, where D is the pile diameter, assuming no further creek bank erosion occurs.

Where the above two conditions cannot be met, it will be necessary to deepen the piles to a depth at such that a minimum 1 m embedment is provided below the depth the slope face is beyond 4D from the outside edge of the pile as shown in Figure 9-1. This area should also be protected from erosion and subsequent loss of support or lateral resistance.

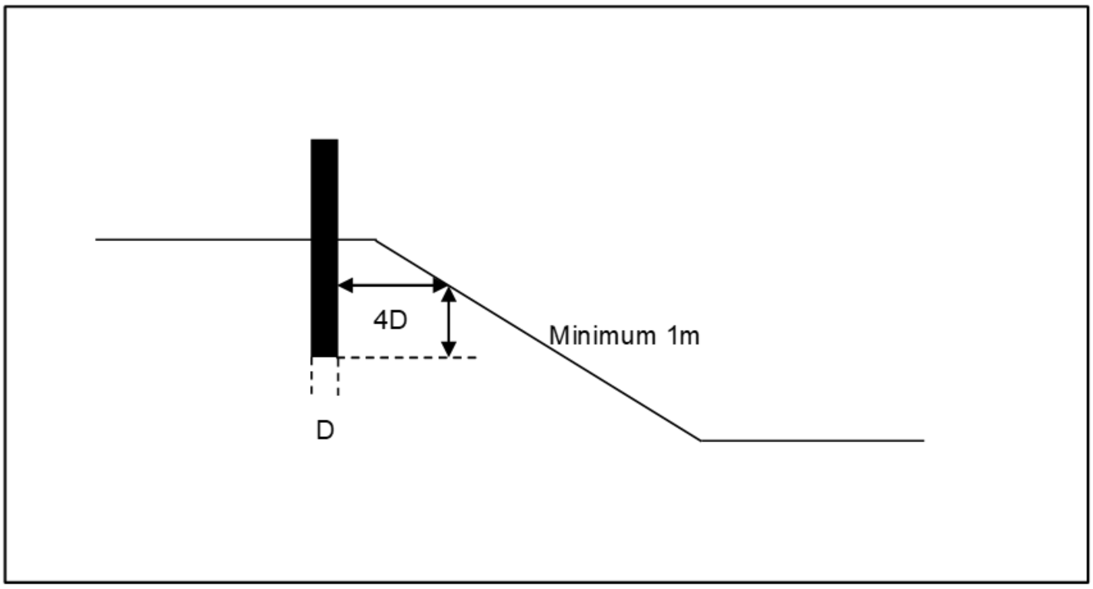

Figure 9-1 Levee Wall Minimum Embedment

Where this is the case, soldier piles must be checked to confirm their retention capacity of the soil above this depth.

9.6.4 Ultimate Bearing Pressures

The ultimate pile end bearing pressure resistance should be not greater than 200 kPa when founded within the clay, gravel or sand soils. A geotechnical reduction factor, ϕ_g of 0.42 has been evaluated based on the requirements of Section 4.3 of AS2159 *Piling – Design & Installation* and needs to be applied to the above pile design parameters.

9.6.5 Lateral Pile Pressure

The levee pile wall should be designed to ensure sufficient embedment depth to resist horizontal hydraulic loads acting on the river side of the wall during the design flood events by assuming a lateral triangular hydraulic pressure (Ph) acting on the above ground section of the wall as follow:

$$P_h = 10.Z_h \text{ (kPa)}$$

where:

> Z_h is the depth of water acting on the above ground face of the wall

In addition to the hydraulic loading from the river side, a soil surcharge and live loading surcharge should be considered assuming loss of support due to erosion of the soils on the river side of the wall.

Where the piles are to be placed closer than 4D to the crest of slope as shown in Figure 9-1, the pile design must be checked against the soil surcharge and live loading condition acting towards the river.

Provided that the top of the wall is free to move outwards by at least 0.5% of its height and the wall is not supported with ground anchors or struts and is designed as a fully cantilevered wall the following active pressure distribution (P_a) applies which increases with depth

$$P_a = K_a.\gamma_b.z + 5z + K_a.S \text{ (kPa)}$$

where:

> K_a is the active pressure coefficient, 0.35

> γ_b is the buoyant density of the soils in kN/m^3, typically 8kN/m^3

> S is the ground surcharge in kPa behind the wall

> z is the embedment depth in metres

The pressure distribution should be multiplied by the pile spacing to calculate the load on each individual pile.

The above values assume that the pile levee wall will predominantly be required to retain the hydraulic forces acting on it with some load from the existing soils, and the slope behind the levee wall is near horizontal.

The design parameters provided above are ultimate design parameters. An appropriate loading factor needs to be applied to these parameters in accordance with AS4678-2002.

9.6.6 Lateral Pile Resistance

Provided that the piles are spaced at least 4 pile diameters apart the piles will act independently and the ultimate lateral resistance may be calculated by adopting the ultimate lateral resistance outlined below in Table 9-1. These lateral resistances are based on the estimated soil parameters outlined in Figure 9-1.

Table 9-1 Estimated soil parameters for lateral pile resistance

Geological Unit	Undrained Cohesion (Cu) kPa	Drained friction angle	Unit Weight	Buoyant unit weight
	Cu	Ø' (°)	γ (kN/m^3)	γ' (kN/m^3)
Silty SAND/ clayey SAND (medium dense or better)	-	34	18	8
Silty CLAY (very stiff or better)	100	-	18	8

Table 9-1 Ultimate Lateral Pile Resistance

Geolgoical Unit	Ultimate Lateral Resistance (kPa)
Silty SAND/ Clayey SAND (medium dense or better)	$3.\gamma'.Z^2 + 3.\gamma'.D.Z$
Silty CLAY (very stiff or better)	9.Cu = 900

Using methods of Broms (1964), where Cu is the undrained shear strength of the soil
Where Z is the embedment depth of the pile below the unplanned excavation
Where D is the diameter of the pile
Where γ' is the effective unit weight of the soil

No pile resistance should be adopted below the depth at which the pile is a minimum 4D from the slope face as shown in Figure 9-1.

An appropriate factor of safety or strength reduction factor needs to be applied in accordance with AS4678-2002 – *Earth Retaining Structures*.

9.7 Post Flood Monitoring

The levees should be inspected periodically to monitor the condition of the erosion control measures. The erosion control measures should be maintained, as any deterioration could have a detrimental effect on the long-term performance of the levee. The site management plan should include regular inspections, particularly after flood events or after extended dry periods followed by heavy rainfall events, or where burrowing animals are identified.

The site management plan should incorporate a photographic record and any damage or change in profile should be monitored and repaired as required.

9.8 Pavement Design (Lowering of Stock Route, Culcairn)

Unsealed granular pavements are considered appropriate for the proposed lowering of the Stock Route in Culcairn. Provided that the pavements are constructed as recommended in the report and are subjected to the maximum DESA the pavement profiles can be expected to achieve their design lives.

Table 9-2 provides a summary of the designs for the unsealed gravel pavement profile.

Table 9-2: Unsealed Granular Pavement – Stock Route Lowering

Layer	Thickness (mm)	Component
Wearing Course	50	20mm nominal size Crushed Rock, compacted to at least 98% Modified Dry Density Ratio with a mean value of at least 100% Modified Dry Density Ratio and within 1% of the Modified Optimum Moisture Content selected in accordance with Section 9.8.1.
Base Course	100	20mm nominal size Class 2 Densely Graded Base (DGB), compacted to at least 98% Modified Dry Density Ratio with a mean value of at least 100% Modified Dry Density Ratio and within 1% of the Modified Optimum Moisture Content
Select Sub-Base Course	190	Select granular material with a minimum soaked CBR of 10% compacted to at least 98% Standard Dry Density Ratio with a mean value of at least 100% Standard Dry Density Ratio and within 1% of the Standard Optimum Moisture Content and a percentage swell of less than 1.5%
Total Pavement Depth	340	
Natural Subgrade		Silty CLAY tested to confirm an in-situ CBR of at least 3.0% OR approved FILL compacted to at least 100% Standard Dry Density ratio (soaked CBR≥3%) within 2% of the Standard Optimum Moisture Content.
DESA		1.0×10^4 ESAs

9.8.1 Specification for Granular Pavement Wearing Course

The wearing course material needs to provide good wearing resistance and is considered to be a sacrificial layer of the unsealed granular pavement. The material must have:

> A soaked CBR of more than 40%;

> A Plasticity Index (PI) of less than 12%;

> PI x % passing 0.425mm of less than 250.

> A hydraulic conductivity of less than 1 x 10^{-4} m/s when compacted to at least 100% Standard Dry Density ratio. The layer thickness should be a minimum of at least 2.5 times the maximum particle size in the layer.

The wearing course will require maintenance over the life of the pavement. This will include patrol grading and replenishment of the wearing course material after some years as the thickness is reduced and/or when a large amount of the fine material has been lost as dust.

9.8.2 Alternative to Class 2 DGB Crushed Rock

Class 2 DGB is the preferred material for the construction of the base course. However, due to the rural nature of the site use of alternate materials may be considered subject to appropriate review by an experienced pavement engineer. As a minimum laboratory testing should be conducted on samples of the proposed material to assess its suitability in accordance with Section 3.2.2 of Austroads AGPT-6-09. Conducting such an analysis is beyond the scope of this report.

9.8.3 Finishing Requirements for Crushed Rock Layers

Care is required to ensure that the crushed rock, or other pavement layers, do not become wet or saturated prior to the placement of subsequent layers. Significant wetting of these layers after completion of the compaction works but prior to sealing can result in significant issues such as the development of excess pore water pressures and also pumping of fines in the crushed rock after sealing of the pavement. This can then result in distress to the newly constructed pavement even though compaction had been achieved. If inundation of the crushed rock layers occurs before the pavement can be sealed due to issues such as heavy rains or flooding it is recommended that the crushed rock be ripped, reworked and dried back and then re-compacted as required prior to placement of subsequent layers or seals. Compaction testing or proof rolling alone as a replacement for ripping and reworking is not recommended as this will not necessarily identify localised zones of saturation within the pavement that are not visible from the surface or do not respond to a single proof roll.

9.8.4 Specification for Selected Sub-Base

Earthworks material to be used as selected granular sub-base shall have a minimum soaked CBR of 10% and be a DGS20 material as per RMS Specification D&C 3051.

Where council's or road authorities refer to a 'Capping Layer' for pavement designs that layer shall be considered to be a 'Selected Sub-base' for this report.

This layer should be a minimum of 150 mm thick or at least 2.5 times the maximum particle size in the layer. The layer should extend to a distance of at least 1.0 m behind the kerb and channel or the edge of the road pavement.

9.8.5 General Subgrade Preparation Requirements

An informal proof roll should be conducted on the subgrade with a single pass of a heavy, smooth wheeled roller to locate any soft spots or softened areas. If the informal proof roll identifies that there are localised soft spots or softened areas, it is recommended that Dynamic Cone Penetrometer testing be conducted on the exposed subgrade to assess the in-situ CBR. Failure of the informal proof roll should not be considered a failure of the subgrade achieving the design requirements, but a pass of the proof roll is considered a confirmation of the design requirements. An experienced geotechnical engineer should conduct the DCP testing in accordance with AS1289 6.3.2 *Testing of Soils for Engineering Purposes* with the CBR determined using the correlation provided in Figure 5.3 of Austroads AGPT02-2017 *Guide to Pavement Technology Part 2: Pavement Structural Design*. Testing is recommended at 10m intervals on alternating sides of the road in the areas identified with soft spots. The DCP testing should be conducted to a depth of at least 1.0m below the pavement subgrade level. Multiple proof rolls or excessive trafficking with construction equipment is not recommended due to the potential for pumping of the subgrade to result in further softening of the subgrade.

If the DCP testing identifies the in-situ subgrade CBR is less than the design CBR of the pavement, and these areas should be removed and replaced with either clayey sand or clayey gravel. This material should be placed in near horizontal layers not exceeding 200 mm in thickness and be compacted to at least 98% Standard dry density ratio. The upper 200 mm should be compacted to at least 100% Standard dry density ratio. Particular care needs to be taken in the areas where underground services are below the pavement, to ensure that the backfill over the services is adequately compacted. Alternatively, a pavement profile design with a lower design CBR reflecting the poor ground conditions may be adopted.

The performance of the pavement is dependent on the control of the moisture within the subgrade. If the pavement is constructed on a wet subgrade, the drying out of the subgrade may cause shrinkage of the subgrade and cracking of the pavement. Conversely, if the subgrade is very dry at the time of construction, the subgrade may heave over time and result in distortion of the pavement.

The subgrade moisture content must be maintained near the equilibrium moisture content during the life of the pavement. This may involve the use of below-ground drainage systems that cut off the lateral water flows and prevent the subgrade from becoming saturated at any time during the life of the pavement. Surface drainage would be required to prevent the ponding of surface water on the pavement surface.

9.8.6 Drainage

To ensure that the pavement will perform adequately, an adjacent roadside swale or table drain is required. The invert of the drain should be excavated to a depth of about 300 mm below the level of the bottom of subbase. Where the pavement design not include a subbase layer, and the base layer lies directly on the select sub base then the drain invert should extend to a depth of about 300mm below the bottom of the

In order to minimise infiltration from the drains into the subgrade, it is recommended that the drains be surrounded with at least 150mm thickness of non-expansive select sub-base. This can be achieved by deepening of the select sub-base in the vicinity of the drain to 150mm below the level of the drain.

No pooling of surface water, particularly during construction, should be permitted.

References

AS 1726 - 2017 Geotechnical Site Investigations

AS2870 – 2011 Residential Slabs and Footings

AS 1289 - Methods of Testing Soils for Engineering Purposes

AS3798 - 2007 Guidelines to Earthworks for Commercial and Residential Developments

Broms, B.B. (1964) Lateral Resistance of Piles in Cohesive Soils, Journal of the Soil Mechanics and Foundation Division, Proc., ASCE, 90 (SM2), 27-63

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Cardno (2019) Tender Submission – Culcairn, Henty and Holbrook Flood Mitigation Works, 489599190010226, 24 April 2019.

Road and Maritime Services (RMS) QA Specification 3051 – Granular Pavement Base and Subbase Materials

Australia 1:250,000 Geological Series, Wagga Wagga Sheets S1 55-15, 1960.

Austroads, Guide to Pavement Technology Part 6: Unsealed Pavements, AGPT06-09, 2009

APPENDIX

A

SITE PLANS

DATE PLOTTED: 6 April 2020 5:06 AM BY : JACK BARCLAY

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Cardno Victoria Pty Ltd | ABN 47 106 610 913
Level 4, 501 Swanston Street
Melbourne VIC 3000
Tel: 03 8415 7777 Fax: 03 8415 7788
Web: www.cardno.com.au

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Datum	Date	Scale	Size
	25/02/2020	Not Avaliable	A3

Drawing Number	Revision
Figure 01 - BH01	01

XREF's:
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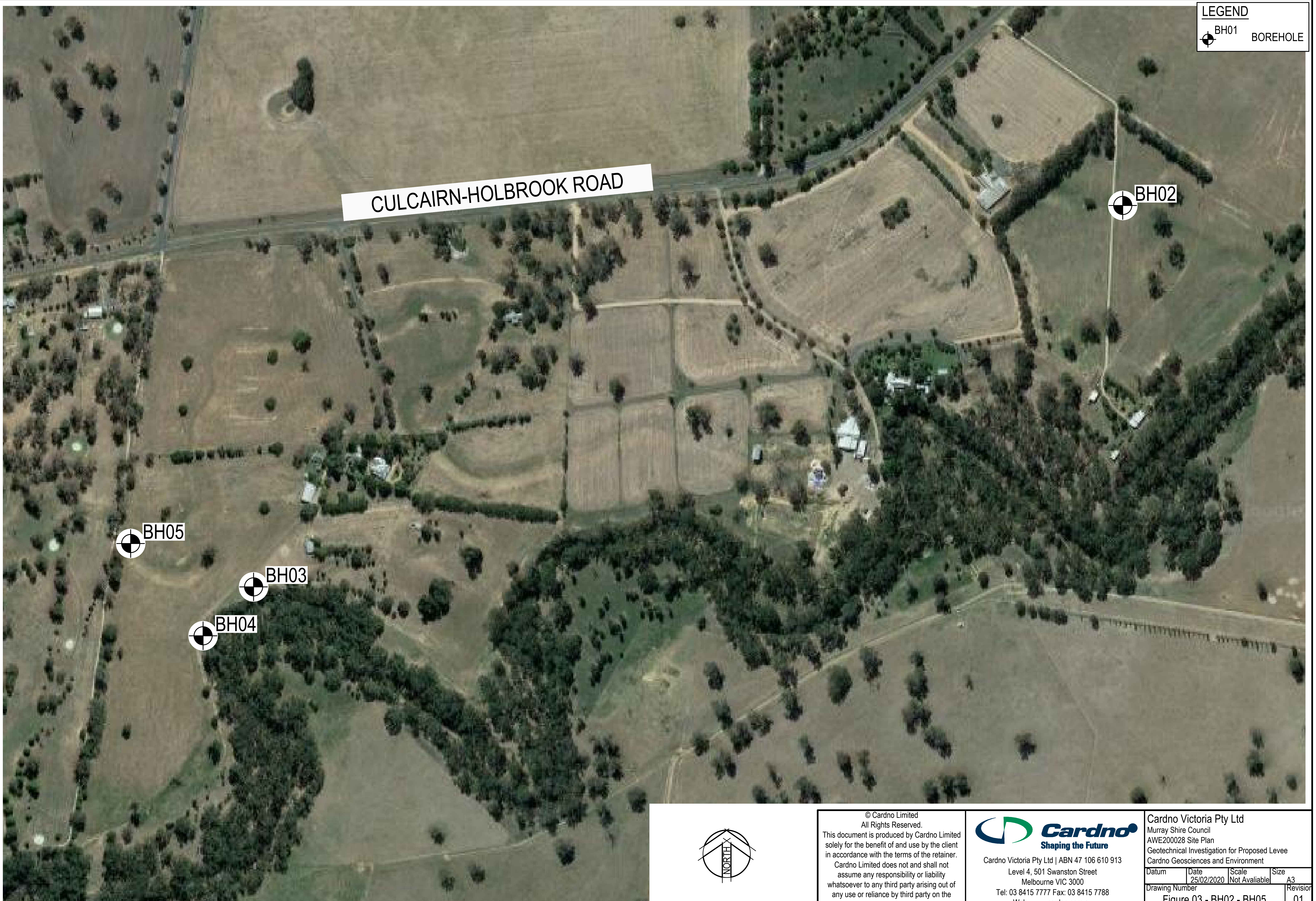

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Datum	Date	Scale	Size
	25/02/2020	Not Avaliable	A3

Drawing Number	Revision
Figure 03 - BH02 - BH05	01

DATE PLOTTED: 21 April 2020 2:22 PM BY : JACK BARCLAY
XREF's:
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Level 4, 501 Swanston Street
Melbourne VIC 3000
Tel: 03 8415 7777 Fax: 03 8415 7788
Web: www.cardno.com.au

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Datum	Date	Scale	Size
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Drawing Number	Revision
Figure 04 - BH06 - BH15	01

XREF's:
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Level 4, 501 Swanston Street
Melbourne VIC 3000
Tel: 03 8415 7777 Fax: 03 8415 7788
Web: www.cardno.com.au

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Datum	Date	Scale	Size
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Drawing Number	Revision
Figure 07 - BH16 - BH20	01

XREF's:
CAD File: C:\Users\john.barclay\Desktop\Working Drawings\BH16 - BH20.dwg

APPENDIX

B

BOREHOLE RECORDS

Borehole Record: BH01

Cardno
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Project: Henty, Holbrook, Culcairn Levee Alignments	**Position:** E: 502891 N: 6052842	**Date St.:** 13/11/2019 **Date Comp.:** 13/11/2019
Location: Henty, Holbrook, Culcairn, NSW	**Surface Level:** Ground Surface	**Drill Rig:** Landcrusier Mounted ATS drill rig
	Stickup: N/A	**Drilling Method:** 100mm Dia. Solid Auger
Job No.: AWE200028	**Inclination:**	**Logged/Checked:** JB / KV

Depth (m)	Description of Strata	Graphic Log	Depth (m)	Sample	In Situ Testing	Remarks
0.0	FILL, Sandy SILT (ML) trace gravel, low plasticity, orange, moist, dry of plastic limit, fine sand, and fine gravel, friable		0.0			
0.3	Silty CLAY (CL) with sand, low plasticity, brown orange to pale brown, hard, moist, dry of plastic limit, fine to medium sand, recovered as powder, high silt fraction			0.30/D		
0.5			0.5	0.50/D		
1.0			1.0	1.00/D		
1.5			1.5			
2.0			2.0	2.00/D		
				2.40/D		
2.5			2.5			
	End of hole at target depth					

Key:
For explanation of abbreviations and symbols, refer to Cardno UCS or Rock Notes

Notes:

Groundwater Observations:
No groundwater encountered

Borehole Record: BH02

Cardno Shaping the Future

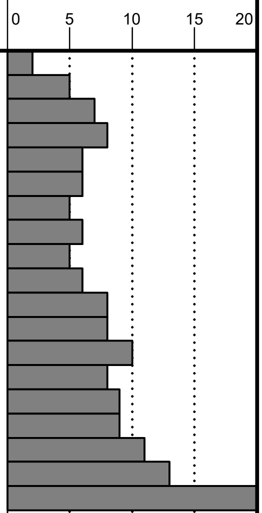
Project: Henty, Holbrook, Culcairn Levee Alignments
Location: Henty, Holbrook, Culcairn, NSW
Job No.: AWE200028

Position: E: 506275 N: 6053284
Surface Level: Ground Surface
Stickup: N/A
Inclination:

Date St.: 13/11/2019 **Date Comp.:** 13/11/2019
Drill Rig: Landcrusier Mounted ATS drill rig
Drilling Method: 100mm Dia. Solid Auger
Logged/Checked: JB / KV

Depth (m)	Description of Strata	Graphic Log	Depth (m)	Sample	In Situ Testing
0.0	TOPSOIL/GRASSMATTER		0.0		
	Sandy Clayey SILT (ML) dark brown to brown, moist, dry of plastic limit, fine sand, friable			0.20-0.4/D 0.20-2.0/BS	
0.5	Pale brown below 0.5 m		0.5		
1.0			1.0	1.00/D	
	Pale grey to white below 1.2 m				
1.5			1.5	1.50/D	
2.0	Sandy SILT (ML) brown to grey, moist, dry of plastic limit, fine sand, friable		2.0	2.00/D	
2.5			2.5		
3.0	Wet, wet of liquid limit below 2.9 m		3.0	3.00/D	
3.5			3.5		
4.0			4.0	4.00/D	
	End of hole at target depth				

Dynamic Cone Penetrometer blows/100mm



Key:
For explanation of abbreviations and symbols, refer to Cardno UCS or Rock Notes

Notes:
DCP testing conducted in accordance with AS1289.6.3.2

Groundwater Observations:
Groundwater encountered below approximately 2.9 m

Borehole Record: BH03

Project: Henty, Holbrook, Culcairn Levee Alignments	**Position:** E: 505095 N: 6052768	**Date St.:** 11/11/2019 **Date Comp.:** 11/11/2019
Location: Henty, Holbrook, Culcairn, NSW	**Surface Level:** Ground Surface	**Drill Rig:** Landcrusier Mounted ATS drill rig
	Stickup: N/A	**Drilling Method:** 100mm Dia. Solid Auger
Job No.: AWE200028	**Inclination:**	**Logged/Checked:** JB / KV

Depth (m)	Description of Strata	Graphic Log	Depth (m)	Sample	In Situ Testing	Remarks
0.0	TOPSOIL/GRASSMATTER		0.0			
	Silty CLAY (CL) low plasticity, orange mottled brown, hard, moist, dry of plastic limit, hard-friable between 0.20 m to 1.1 m, large silt fraction			0.20-0.5/D		
0.5			0.5			
1.0			1.0	1.10-1.3/D 1.20-2.0/B		
1.5			1.5		PP=400	
	Minor (50mm to 150mm) interbedded fine grained sand zones below 1.7 m			1.80-2.0/D	PP=220	
2.0			2.0			
2.5			2.5	2.50-2.7/D	PP=400	
	End of hole at target depth					

Key:
For explanation of abbreviations and symbols, refer to Cardno UCS or Rock Notes

Notes:

Groundwater Observations:
No groundwater encountered

Borehole Record: BH04

Project: Henty, Holbrook, Culcairn Levee Alignments	**Position:** E: 505025 N: 6052691
Location: Henty, Holbrook, Culcairn, NSW	**Surface Level:** Ground Surface
	Stickup: N/A
Job No.: AWE200028	**Inclination:**
Date St.: 11/11/2019 **Date Comp.:** 11/11/2019	**Drill Rig:** Landcrusier Mounted ATS drill rig
Drilling Method: 100mm Dia. Solid Auger	**Logged/Checked:** JB / KV

Depth (m)	Description of Strata	Graphic Log	Depth (m)	Sample	In Situ Testing	Remarks
0.0	TOPSOIL/GRASSMATTER		0.0			
	Silty CLAY (CL) low plasticity, orange, hard, moist, dry of plastic limit, large silt fraction, recovered as powder			0.20-0.4/D		
0.5			0.5			
1.0	Pale orange to pale brown below 0.9 m		1.0	1.00-1.5/D		
1.5			1.5			
	Silt fraction decreasing below 1.7 m			1.70-1.9/D 1.70-2.7/BS		
2.0			2.0			
2.5	Minor (<100mm) interbedded fine grained sand zones below 2.5 m		2.5	2.50-2.7/D		
3.0			3.0			
3.5			3.5			
4.0			4.0	4.00-4.2/D		
	End of hole at target depth					

Key:
For explanation of abbreviations and symbols, refer to Cardno UCS or Rock Notes

Notes:

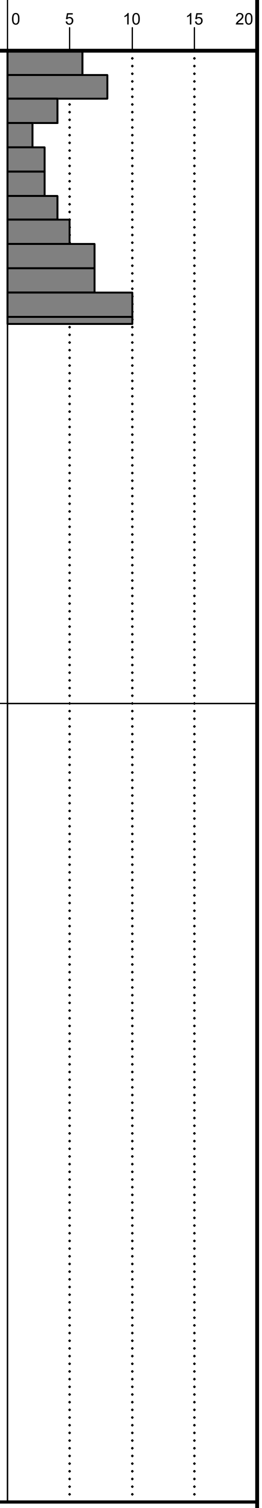
Groundwater Observations:
No groundwater encountered

Borehole Record: BH05

Project: Henty, Holbrook, Culcairn Levee Alignments	**Position:** E: 504942 N: 6052831	**Date St.:** 11/11/2019 **Date Comp.:** 11/11/2019
Location: Henty, Holbrook, Culcairn, NSW	**Surface Level:** Ground Surface	**Drill Rig:** Landcrusier Mounted ATS drill rig
	Stickup: N/A	**Drilling Method:** 100mm Dia. Solid Auger
Job No.: AWE200028	**Inclination:**	**Logged/Checked:** JB / KV

Depth (m)	Description of Strata	Sample	In Situ Testing
0.0	TOPSOIL/GRASSMATTER		
	SILT (ML) with sand, low plasticity, pale brown mottled grey, moist, dry of plastic limit, fine sand, friable	0.30-0.5/D 0.80-1.0/D 1.40-1.6/D 1.90-2.1/D	
2.0	Silty Sandy CLAY (CL) low plasticity, dark brown mottled grey, stiff to firm, moist, near plastic limit, fine to medium sand	2.10-2.4/D 2.10-2.7/BS	PP=150
2.5	End of hole at target depth		

Dynamic Cone Penetrometer blows/100mm



Key:
For explanation of abbreviations and symbols, refer to Cardno UCS or Rock Notes

Notes:
DCP testing conducted in accordance with AS1289.6.3.2

Groundwater Observations:
No groundwater encountered

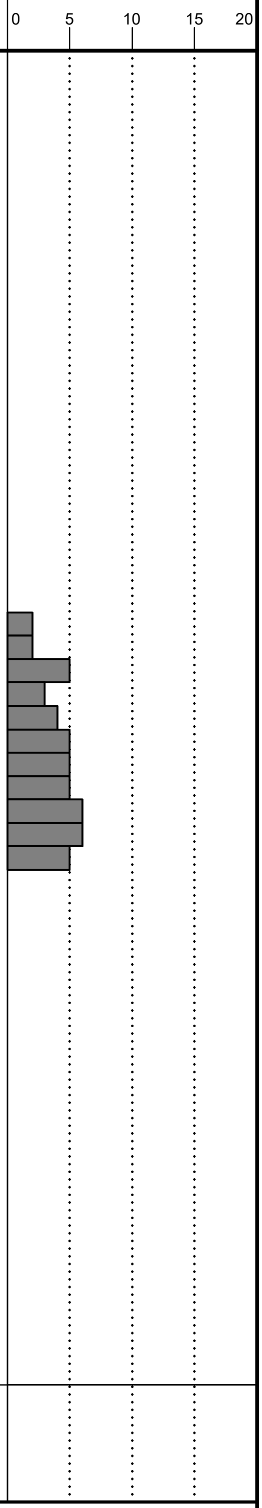
Cardno Shaping the Future

Borehole Record: BH06

Project: Henty, Holbrook, Culcairn Levee Alignments	**Position:** E: 528331 N: 6046356	**Date St.:** 12/11/2019	**Date Comp.:** 12/11/2019
Location: Henty, Holbrook, Culcairn, NSW	**Surface Level:** Ground Surface	**Drill Rig:** Landcrusier Mounted ATS drill rig	
	Stickup: N/A	**Drilling Method:** 100mm Dia. Solid Auger	
Job No.: AWE200028	**Inclination:**	**Logged/Checked:** JB / KV	

Depth (m)	Description of Strata	Sample	In Situ Testing
0.0	FILL, Sandy Silty CLAY (CI) moderate plasticity, grey mottled brown, very stiff, moist, near plastic limit, Coarse sand inclusions		PP=300
0.5	FILL, Silty SAND (SM) fine to medium grained, poorly graded, subrounded, grey mottled brown orange, loose, moist Trace brick rubble enountered at 0.8m Sandy gravel zone (100mm) encountered at 1.4 m		
1.5	Sandy SILT (ML) with clay, fine grained, poorly graded, low plasticity, grey mottled brown, soft, wet, wet of liquid limit	1.50-1.7/D 1.50-2.7/BS	
2.0	Becoming grey	2.10-2.3/D	
2.5	Silty Clayey SAND (SC-SM) fine grained, poorly graded, dark grey, loose, wet, trace organic matter		
3.5	Low plasticity Silty Sandy CLAY (CL) zone between 3.5 m - 3.6 m	3.50-3.6/D	
4.0	Brown mottled green grey below 4.0 m	4.00-4.2/D	
4.5	Medium to coarse grained below 4.5 m		
5.0		5.00/D	
5.4	Minor (100 mm) fine grained gravel zone at 5.4 m, rapid groundwater ingress		
5.5	Sandy CLAY (CH) high plasticity, orange grey, firm, moist, wet of plastic limit	5.70/D	PP=100
5.7	End of hole at target depth		

Dynamic Cone Penetrometer blows/100mm



Key: For explanation of abbreviations and symbols, refer to Cardno UCS or Rock Notes

Notes: DCP testing conducted in accordence with AS1289.6.3.2

Groundwater Observations: Groundwater encountered below approximately 1.5 m

Borehole Record: BH07

Cardno
Shaping the Future

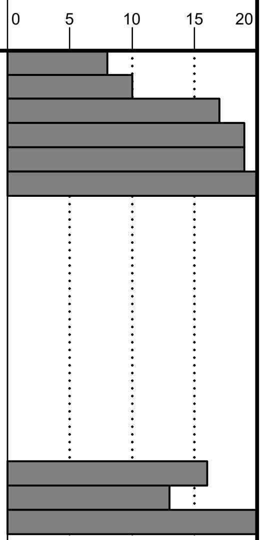
Project: Henty, Holbrook, Culcairn Levee Alignments
Location: Henty, Holbrook, Culcairn, NSW
Job No.: AWE200028

Position: E: 528402
N: 6046257
Surface Level: Ground Surface
Stickup: N/A
Inclination:

Date St.: 12/11/2019 **Date Comp.:** 12/11/2019
Drill Rig: Landcrusier Mounted ATS drill rig
Drilling Method: 100mm Dia. Solid Auger
Logged/Checked: JB / KV

Depth (m)	Description of Strata	Sample	In Situ Testing
0.0	TOPSOIL/GRASSMATTER		
	SILT (ML) with sand, low plasticity, pale brown, moist, dry of plastic limit, fine sand, friable	0.20-0.5/D	
0.5	Silty CLAY (CL) with sand, low plasticity, pale brown, very stiff to hard, moist, dry of plastic limit, fine sand	0.60-2.7/BS 0.70-1.0/D	PP=250
1.0			
1.5		1.50-1.6/D	PP=700
	Silty Clayey SAND (SC-SM) fine to medium grained, poorly graded, pale brown, dense to very dense, moist		
2.0		2.00/D	
2.5			
	End of hole at target depth	2.70/D	

Dynamic Cone Penetrometer blows/100mm



Key:
For explanation of abbreviations and symbols, refer to Cardno UCS or Rock Notes

Notes:
DCP testing conducted in accordance with AS1289.6.3.2

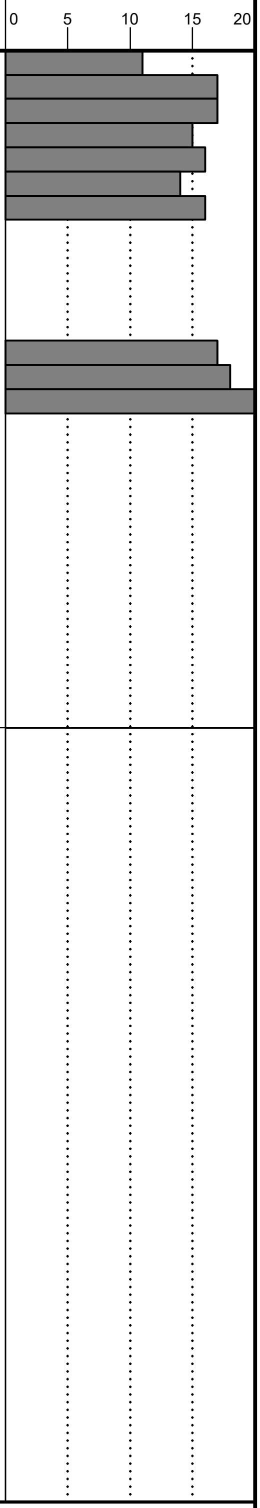
Groundwater Observations:
No groundwater encountered

Cardno Shaping the Future	Borehole Record: BH08	PAGE 1 OF 1

Project: Henty, Holbrook, Culcairn Levee Alignments	**Position:** E: 528419 N: 6046227	**Date St.:** 12/11/2019 **Date Comp.:** 12/11/2019
Location: Henty, Holbrook, Culcairn, NSW	**Surface Level:** Ground Surface	**Drill Rig:** Landcrusier Mounted ATS drill rig
	Stickup: N/A	**Drilling Method:** 100mm Dia. Solid Auger
Job No.: AWE200028	**Inclination:**	**Logged/Checked:** JB / KV

Depth (m)	Description of Strata	Graphic Log	Depth (m)	Sample	In Situ Testing
0.0	TOPSOIL/GRASSMATTER		0.0		
	SILT (ML) with sand, poorly graded, low plasticity, pale brown to brown, moist, dry of plastic limit, fine sand, friable			0.20-0.4/D	
0.5	Silty CLAY (CI) with sand, medium plasticity, dark red, hard, moist, dry of plastic limit, fine sand		0.5	0.50/D 0.50-1.0/BS 0.60-0.8/U50	PP=800
				0.90-1.0/D	PP=800
1.0			1.0		
	Clayey SAND (SC-SM) fine to medium grained, poorly graded, pale brown, dense, moist, minor interbedded clay zones				
1.5			1.5	1.50/D	
2.0			2.0		
2.5			2.5		
	End of hole at target depth			2.80/D	

Dynamic Cone Penetrometer blows/100mm



Key:	**Notes:**	**Groundwater Observations:**
For explanation of abbreviations and symbols, refer to Cardno UCS or Rock Notes	DCP testing conducted in accordence with AS1289.6.3.2	No groundwater encountered

Borehole Record: BH09

Cardno Shaping the Future

Project: Henty, Holbrook, Culcairn Levee Alignments	**Position:** E: 528474 N: 6046177	**Date St.:** 12/11/2019 **Date Comp.:** 12/11/2019
Location: Henty, Holbrook, Culcairn, NSW	**Surface Level:** Ground Surface	**Drill Rig:** Landcrusier Mounted ATS drill rig
	Stickup: N/A	**Drilling Method:** 100mm Dia. Solid Auger
Job No.: AWE200028	**Inclination:**	**Logged/Checked:** JB / KV

Depth (m)	Description of Strata	Graphic Log	Depth (m)	Sample	In Situ Testing	Remarks
0.0	TOPSOIL/GRASSMATTER		0.0			
	Sandy SILT (ML) low plasticity, brown, moist, dry of plastic limit, fine sand, friable			0.20-0.4/D		
0.5	Silty CLAY (CI) trace sand, moderate plasticity, brown orange and grey, stiff to very stiff, moist, near plastic limit, fine to medium sand		0.5	0.50-1.5/BS 0.60-1.0/U50	PP=300	
				0.80/D	PP=200	
1.0			1.0			
1.5			1.5	1.50/D	PP=400	
2.0	Grey below 2.0 m		2.0			
2.5	Minor (50mm) sand zone (possible calcareous) at 2.5 m		2.5	2.50-2.7/D	PP=200	
	End of hole at target depth					

Key:
For explanation of abbreviations and symbols, refer to Cardno UCS or Rock Notes

Notes:

Groundwater Observations:
No groundwater encountered

Borehole Record: BH10

Project: Henty, Holbrook, Culcairn Levee Alignments	**Position:** E: 528723 N: 6045627	**Date St.:** 12/11/2019	**Date Comp.:** 12/11/2019
Location: Henty, Holbrook, Culcairn, NSW	**Surface Level:** Ground Surface	**Drill Rig:** Landcrusier Mounted ATS drill rig	
	Stickup: N/A	**Drilling Method:** 100mm Dia. Solid Auger	
Job No.: AWE200028	**Inclination:**	**Logged/Checked:** JB / KV	

Depth (m)	Description of Strata	Graphic Log	Depth (m)	Sample	In Situ Testing	Dynamic Cone Penetrometer blows/100mm
0.0	TOPSOIL/GRASSMATTER		0.0			
	Sandy SILT (ML) low plasticity, pale brown, moist, dry of plastic limit, fine sand, friable			0.20-0.4/D		
0.5	Silty Sandy CLAY (CI) moderate plasticity, red mottled brown grey, hard, moist, dry of plastic limit, fine to medium sand		0.5	0.50-1.2/BS 0.60-0.7/D 0.70-1.1/U50	PP=600 PP=800	
1.0			1.0			
1.5	Very stiff below 1.4 m		1.5	1.40-1.5/D	PP=250	
	Silty Clayey SAND (SC-SM) medium grained, poorly graded, subrounded, brown, dense, moist					
2.0			2.0	2.00/D		
2.5	Silty CLAY (CH) high plasticity, brown and grey, hard, moist, dry of plastic limit		2.5	2.50/D	PP=600	
	End of hole at target depth					

Key:
For explanation of abbreviations and symbols, refer to Cardno UCS or Rock Notes

Notes:
DCP testing conducted in accordence with AS1289.6.3.2

Groundwater Observations:
No groundwater encountered

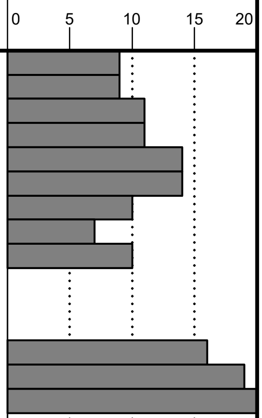
Borehole Record: BH11

Cardno
Shaping the Future

Project:	Henty, Holbrook, Culcairn Levee Alignments
Location:	Henty, Holbrook, Culcairn, NSW
Job No.:	AWE200028
Position:	E: 528749 N: 6045761
Surface Level:	Ground Surface
Stickup:	N/A
Inclination:	
Date St.:	12/11/2019
Date Comp.:	12/11/2019
Drill Rig:	Landcrusier Mounted ATS drill rig
Drilling Method:	100mm Dia. Solid Auger
Logged/Checked:	JB / KV

Depth (m)	Description of Strata	Sample	In Situ Testing
0.0	TOPSOIL/GRASSMATTER		
	Sandy SILT (ML) low plasticity, brown, moist, dry of plastic limit, fine sand, Friable	0.20-0.4/D	
		0.80-1.3/U50	PP=600
		0.90-1.0/D	PP=500
1.0	Silty CLAY (CI) with sand, moderate plasticity, brown and dark grey, hard, moist, dry of plastic limit, fine sand	1.00/BS	
	Silty Clayey SAND (SC-SM) fine to medium grained, poorly graded, subrounded, brown, dense to very dense, moist		
2.0	Silty SAND (SM) fine to medium grained, poorly graded, subrounded, brown, dense to very dense, moist	2.00/D	
2.5	Silty Sandy CLAY (CL) low plasticity, brown and grey, stiff, moist, near plastic limit, fine sand	2.70/D	PP=150
	End of hole at target depth		

Dynamic Cone Penetrometer blows/100mm



Key:
For explanation of abbreviations and symbols, refer to Cardno UCS or Rock Notes

Notes:
DCP testing conducted in accordence with AS1289.6.3.2

Groundwater Observations:
No groundwater encountered

Borehole Record: BH12

Cardno — Shaping the Future

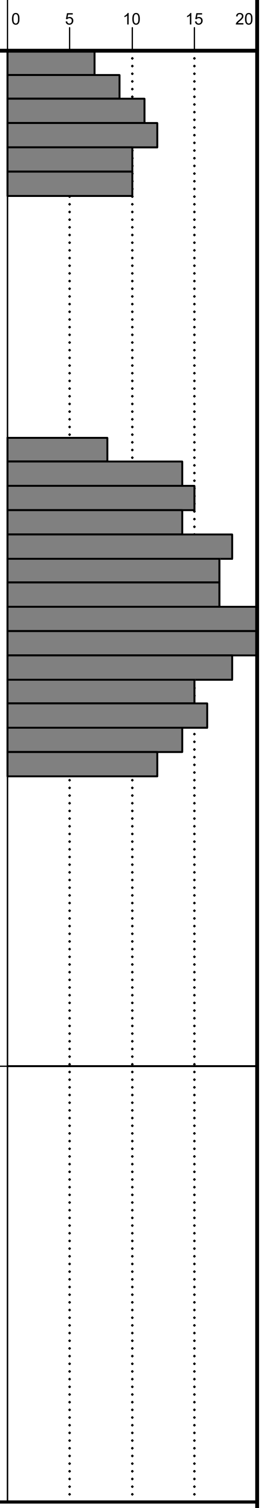
Project: Henty, Holbrook, Culcairn Levee Alignments
Location: Henty, Holbrook, Culcairn, NSW
Job No.: AWE200028

Position: E: 528729 N: 6045933
Surface Level: Ground Surface
Stickup: N/A
Inclination:

Date St.: 12/11/2019 **Date Comp.:** 12/11/2019
Drill Rig: Landcrusier Mounted ATS drill rig
Drilling Method: 100mm Dia. Solid Auger
Logged/Checked: JB / KV

Depth (m)	Description of Strata	Depth (m)	Sample	In Situ Testing
0.0	TOPSOIL/GRASSMATTER	0.0		
	Sandy SILT (ML) pale brown, moist, dry of plastic limit, fine sand, friable		0.20-0.4/D	
0.5	Sandy Silty CLAY (CL) low plasticity, brown and grey, hard, moist, dry of plastic limit, fine sand, sand fraction increasing with depth	0.5	0.60-1.5/BS 0.60-0.7/D 0.61-1.1/U50	PP=600 PP=600
1.0		1.0		
1.5		1.5	1.50/D	PP=400
2.0		2.0	2.00/D	PP=400
2.5		2.5	2.50/D	
3.0		3.0		
	Silty SAND (SM) medium to coarse grained, poorly graded, subrounded, dark brown to brown, medium dense, wet		3.20/D	
3.5		3.5		
4.0		4.0	4.00/D	
	End of hole at target depth			

Dynamic Cone Penetrometer blows/100mm



Key:
For explanation of abbreviations and symbols, refer to Cardno UCS or Rock Notes

Notes:
DCP testing conducted in accordence with AS1289.6.3.2

Groundwater Observations:
Groundwater encountered below approximately 3.2 m

Borehole Record: BH13

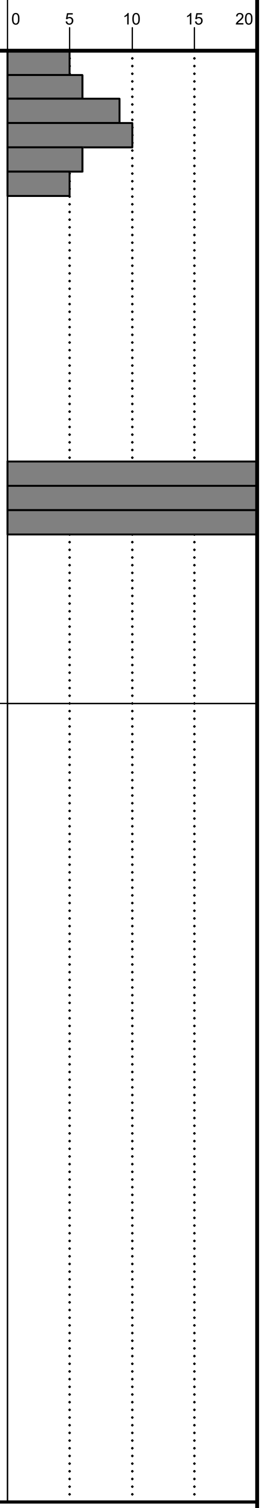
Project: Henty, Holbrook, Culcairn Levee Alignments
Location: Henty, Holbrook, Culcairn, NSW
Job No.: AWE200028

Position: E: 528342
N: 6045828
Surface Level: Ground Surface
Stickup: N/A
Inclination:

Date St.: 13/11/2019 **Date Comp.:** 13/11/2019
Drill Rig: Landcrusier Mounted ATS drill rig
Drilling Method: 100mm Dia. Solid Auger
Logged/Checked: JB / KV

Depth (m)	Description of Strata	Sample	In Situ Testing
0.0	TOPSOIL/GRASSMATTER		
	Sandy Clayey SILT (ML) low plasticity, pale brown, moist, dry of plastic limit, fine sand, friable, clay fractional increasing, gradational contact to clay	0.30/D	
0.5	Silty CLAY (CI) with sand, moderate plasticity, brown and grey, very stiff, moist, near plastic limit, fine sand, sand fraction increasing with depth	0.60/D	PP=200
		0.75-1.2/U50	PP=400
1.0		1.00/D	PP=250
1.5		1.50/D	PP=250
1.9	Silty SAND (SM) fine to medium grained, poorly graded, subrounded, pale brown, dense to very dense, moist Minor (100mm) interbedded clay zones below 2.0 m		
2.5			
	End of hole at target depth		

Dynamic Cone Penetrometer blows/100mm



Key:
For explanation of abbreviations and symbols, refer to Cardno UCS or Rock Notes

Notes:
DCP testing conducted in accordance with AS1289.6.3.2

Groundwater Observations:
No groundwater encountered

Borehole Record: BH14

Cardno
Shaping the Future

Project: Henty, Holbrook, Culcairn Levee Alignments	**Position:** E: 527841 N: 6045829	**Date St.:** 14/11/2019	**Date Comp.:** 14/11/2019
Location: Henty, Holbrook, Culcairn, NSW	**Surface Level:** Ground Surface	**Drill Rig:** Landcrusier Mounted ATS drill rig	
	Stickup: N/A	**Drilling Method:** 100mm Dia. Solid Auger	
Job No.: AWE200028	**Inclination:**	**Logged/Checked:** JB / KV	

Depth (m)	Description of Strata	Graphic Log	Depth (m)	Sample	In Situ Testing	Remarks
0.0	FILL, Silty SAND (SM) with gravel, fine grained, subrounded, brown, loose, dry, intermixed/ disturbed material		0.0			
	Sandy Silty CLAY (CL) low plasticity, pale brown and grey, hard, moist, dry of plastic limit, fine sand			0.40/D		
0.5	Silty CLAY (CH) trace sand, high plasticity, dark brown orange mottled brown, hard, moist, dry of plastic limit, fine sand, sand fraction increasing with depth		0.5	0.60/D 0.70-1.2/U50	PP=600 PP=600	
1.0			1.0			
1.5			1.5	1.50/D	PP=800	
2.0			2.0			
2.5			2.5			
	End of hole at target depth					

Key: For explanation of abbreviations and symbols, refer to Cardno UCS or Rock Notes	**Notes:**	**Groundwater Observations:** No groundwater encountered

Borehole Record: BH15

Cardno
Shaping the Future

Project: Henty, Holbrook, Culcairn Levee Alignments	**Position:** E: 527889 N: 6045766	**Date St.:** 14/11/2019 **Date Comp.:** 14/11/2019
Location: Henty, Holbrook, Culcairn, NSW	**Surface Level:** Ground Surface	**Drill Rig:** Landcrusier Mounted ATS drill rig
	Stickup: N/A	**Drilling Method:** 100mm Dia. Solid Auger
Job No.: AWE200028	**Inclination:**	**Logged/Checked:** JB / KV

Depth (m)	Description of Strata	Graphic Log	Depth (m)	Sample	In Situ Testing	Remarks
0.0	TOPSOIL/GRASSMATTER		0.0			
	Clayey SILT (ML) low plasticity, dark grey mottled brown, firm, moist, wet of plastic limit			0.20/D		
				0.40/D	PP=50	
0.5	Silty CLAY (CL) low plasticity, brown grey, firm to stiff, moist, wet of plastic limit		0.5	0.50-2.7/BS 0.50-0.7/U50	PP=100	
1.0			1.0	1.20/D	PP=100	
1.5	Clayey silt zone (150mm) at 1.7 m		1.5			
2.0	Grey, stiff below 2.0 m		2.0	2.00/D	PP=200	
2.5			2.5	2.50/D	PP=200	
	End of hole at target depth					

Key:
For explanation of abbreviations and symbols, refer to Cardno UCS or Rock Notes

Notes:

Groundwater Observations:
No groundwater encountered

Borehole Record: BH16

Project: Henty, Holbrook, Culcairn Levee Alignments	**Position:** E: 503084 N: 6070303	**Date St.:** 13/11/2019 **Date Comp.:** 13/11/2019
Location: Henty, Holbrook, Culcairn, NSW	**Surface Level:** Ground Surface	**Drill Rig:** Landcrusier Mounted ATS drill rig
	Stickup: N/A	**Drilling Method:** 100mm Dia. Solid Auger
Job No.: AWE200028	**Inclination:**	**Logged/Checked:** JB / KV

Depth (m)	Description of Strata	Graphic Log	Depth (m)	Sample	In Situ Testing	Remarks
0.0	TOPSOIL/GRASSMATTER		0.0			
	Sandy SILT (ML) low plasticity, pale brown, moist, dry of plastic limit, fine sand, friable			0.30/D		
0.5	Silty CLAY (CL) with sand, low plasticity, orange brown mottled grey, hard, moist, dry of plastic limit, fine to medium sand, sand fraction decreasing with depth		0.5	0.50-2.3/BS 0.60/D 0.60-1.0/U50	PP=600 PP=600	
1.0	Friable between 1.1m to 1.9m		1.0	1.00/D	PP=600	
1.5			1.5			
2.0	Dark orange below 1.9 m		2.0	2.00/D	PP=600	
2.5			2.5			
	End of hole at target depth					

Key:
For explanation of abbreviations and symbols, refer to Cardno UCS or Rock Notes

Notes:

Groundwater Observations:
No groundwater encountered

Borehole Record: BH17

Cardno
Shaping the Future

Project: Henty, Holbrook, Culcairn Levee Alignments
Location: Henty, Holbrook, Culcairn, NSW
Job No.: AWE200028

Position: E: 502574 N: 6070271
Surface Level: Ground Surface
Stickup: N/A
Inclination:

Date St.: 13/11/2019 **Date Comp.:** 13/11/2019
Drill Rig: Landcrusier Mounted ATS drill rig
Drilling Method: 100mm Dia. Solid Auger
Logged/Checked: JB / KV

Depth (m)	Description of Strata	Graphic Log	Depth (m)	Sample	In Situ Testing	Remarks
0.0	TOPSOIL/GRASSMATTER		0.0			
	Clayey SILT (ML) low plasticity, pale brown to white, moist, dry of plastic limit, friable			0.30/D		
0.5	Silty CLAY (CI) trace sand, moderate plasticity, dark brown orange mottled grey, very stiff to hard, moist, dry of plastic limit, fine sand, sand fraction increasing with depth		0.5	0.50/D 0.50-2.5/BS 0.65-1.0/U50	PP=600	
1.0			1.0			
1.5			1.5	1.50/D	PP=400	
2.0			2.0			
2.5			2.5	2.50/D	PP=600	
	End of hole at target depth					

Key:
For explanation of abbreviations and symbols, refer to Cardno UCS or Rock Notes

Notes:

Groundwater Observations:
No groundwater encountered

Borehole Record: BH18

Project: Henty, Holbrook, Culcairn Levee Alignments	**Position:** E: 502560 N: 6070189
Location: Henty, Holbrook, Culcairn, NSW	**Surface Level:** Ground Surface
	Stickup: N/A
Job No.: AWE200028	**Inclination:**
Date St.: 13/11/2019 **Date Comp.:** 13/11/2019	
Drill Rig: Landcrusier Mounted ATS drill rig	
Drilling Method: 100mm Dia. Solid Auger	
Logged/Checked: JB / KV	

Depth (m)	Description of Strata	Graphic Log	Depth (m)	Sample	In Situ Testing	Remarks
0.0	TOPSOIL/GRASSMATTER		0.0			
	SILT (ML) low plasticity, pale brown to white, moist, dry of plastic limit, friable			0.30/D		
0.5	Silty CLAY (CL) trace sand, low plasticity, brown mottled grey, hard, moist, dry of plastic limit, fine to medium sand, Sand fraction increasing with depth		0.5	0.60-1.0/U50		
1.0			1.0			
1.5			1.5	1.50/D		
2.0			2.0			
2.5			2.5	2.50/D		
	End of hole at target depth					

Key:
For explanation of abbreviations and symbols, refer to Cardno UCS or Rock Notes

Notes:

Groundwater Observations:
No groundwater encountered

Cardno Shaping the Future

Borehole Record: BH19

Project: Henty, Holbrook, Culcairn Levee Alignments
Location: Henty, Holbrook, Culcairn, NSW
Job No.: AWE200028

Position: E: 502480 N: 6070134
Surface Level: Ground Surface
Stickup: N/A
Inclination:

Date St.: 13/11/2019 **Date Comp.:** 13/11/2019
Drill Rig: Landcrusier Mounted ATS drill rig
Drilling Method: 100mm Dia. Solid Auger
Logged/Checked: JB / KV

Depth (m)	Description of Strata	Graphic Log	Depth (m)	Sample	In Situ Testing	Remarks
0.0	TOPSOIL/GRASSMATTER		0.0			
	Clayey SILT (ML) low plasticity, pale brown, moist, dry of plastic limit, friable, gradational contact to clay			0.20/D 0.30/D 0.40-0.9/U50	PP=600	
0.5	Silty CLAY (CI) moderate plasticity, brown mottled grey, very stiff to hard, moist, dry of plastic limit		0.5			
1.0	Trace sand, fine to medium grained below 1.0m		1.0			
1.5			1.5	1.50/D	PP=400	
2.0			2.0			
2.5	Stiff below 2.5 m		2.5	2.50/D	PP=300	
	End of hole at target depth					

Key:
For explanation of abbreviations and symbols, refer to Cardno UCS or Rock Notes

Notes:

Groundwater Observations:
No groundwater encountered

Borehole Record: BH20

Cardno
Shaping the Future

Project: Henty, Holbrook, Culcairn Levee Alignments	**Position:** E: 502364 N: 6070152	**Date St.:** 13/11/2019 **Date Comp.:** 13/11/2019
Location: Henty, Holbrook, Culcairn, NSW	**Surface Level:** Ground Surface	**Drill Rig:** Landcrusier Mounted ATS drill rig
	Stickup: N/A	**Drilling Method:** 100mm Dia. Solid Auger
Job No.: AWE200028	**Inclination:**	**Logged/Checked:** JB / KV

Depth (m)	Description of Strata	Graphic Log	Depth (m)	Sample	In Situ Testing	Remarks
0.0	TOPSOIL/GRASSMATTER		0.0			
	Silty CLAY (CL) low plasticity, pale brown mottled grey, hard, moist, dry of plastic limit, high silt fraction decreasing below 0.3 m			0.20/D 0.30/D 0.35-0.8/U50	PP=600	
0.5			0.5			
1.0			1.0			
1.5	Minor (100mm) interbedded clayey sand zones below 1.5m		1.5	1.50/D	PP=600	
2.0			2.0			
2.5	Very stiff below 2.5 m		2.5	2.50/D	PP=300	
	End of hole at target depth					

Key:
For explanation of abbreviations and symbols, refer to Cardno UCS or Rock Notes

Notes:

Groundwater Observations:
No groundwater encountered

Unified Classification System (Geotechnology)

(in accordance with AS1726)

PARTICLE SIZES

TERM	SIZE (mm)
BOULDER	>200
COBBLE	60 to 200
GRAVEL	
Coarse	20 to 60
Medium	6 to 20
Fine	2 to 6
SAND	
Coarse	0.6 to 2
Medium	0.2 to 0.6
Fine	0.06 to 0.2
SILT	0.002 to 0.06
CLAY	< 0.002

COHESIVE SOILS

TERM	UNDRAINED SHEAR STRENGTH (kPa)
Very Soft	0 to 12.5
Soft	12.5 to 25
Firm	25 to 50
Stiff	50 to 100
Very Stiff	100 to 200
Hard	≥ 200

COHESIONLESS SOILS

TERM	'N' (SPT) VALUE (blows / 300mm)	RELATIVE DENSITY (%)	ANGLE SHEAR RESISTANCE (degrees)
Very Loose	0 to 4	< 15	25 to 30
Loose	4 to 10	15 to 35	27 to 32
Medium Dense	10 to 30	35 to 65	30 to 35
Dense	30 to 50	65 to 85	35 to 40
Very Dense	> 50	≥ 85	38 to 43

STRUCTURE

TERM	SIZE OF BLOCKS (mm)
Blocky	> 60
Cloddy	20 to 60
Nutty	6 to 20
Granular	0.6 to 6
Prismatic	Stated
Shattered	< 10

SAMPLES

BS = Bulk sample
D = Disturbed sample
U(n) = Undisturbed tube sample ('n' denotes internal dia in mm)
■ = Undisturbed tube recovery
▨ = Undisturbed tube non-recovery
⊠ = SPT Disturbed sample

GROUNDWATER

GW = Groundwater depth (m) or level (RL)
bgl = Below ground level
swl = Standing water level

FIELD TESTS

W = Field permeability test
P = Pressuremeter test
ID = Insitu density test
SPT(9) = Standard Penetrometer Test (*blows per 300 mm*) (63.5 kg hammer dropped 760mm)
PP = Pocket Penetrometer (kPa)
DCP = Dynamic Cone Penetrometer Test

IDENTIFICATION OF SOILS

FILL

COARSE GRAINED SOILS

Coarse-grained soils (<35% fines)

Gravels 50% >2.36mm	GW	Well graded gravels and gravel-sand mixtures, little or no fines
	GP	Poorly graded gravels and gravel-sand mixtures, little or no fines
	GM	Silty gravels and gravel- sand-clay mixtures
	GC	Clayey gravels, gravel-sand-clay mixture
Sands 50% <2.36m	SW	Well graded sands and gravelly sands, little or no fines
	SP	Poorly graded sands and gravelly sands, little or no fines
	SM	Silty sand, sandy silt mixture
	SC	Clayey sands, sandy clay mixtures

FINE GRAINED SOILS

Fine-grained soils (>35% fines)

Silts & Clays LL< 50	ML	Inorganic silts, very fine sands, rock flour, silty or clayey fine sands of low plasticity
	CL CI	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays
	OL	Organic silts and organic silty clays of low plasticity
Silts & Clays LL> 50	MH	Inorganic silts, micaceous or diatomaceous fine sands or silts, elastic silts of high plasticity
	CH	Inorganic clays of high plasticity, gravelly clays, sandy clays, silty clays
	OH	Organic clays and silts of medium to high plasticity
Highly Organic Soils	Pt	Peat and other highly organic soils

MINOR COMPONENTS

Coarse Grained Soils:
Trace: <5% fines
With: >5% and <12% fines
Prefix 'Silty/Clayey': >12% fines
% accessory coarse faction
Trace: <15% sand/gravel
With: >15% and <30% sand/gravel
Prefix 'Sandy/Gravelly': >30% sand/gravel

Fine Grained Soils:
Trace: <15% sand/gravel
With: >15% and <30% sand/gravel
Prefix 'Sandy/Gravelly': >30% sand/gravel

APPENDIX

C

LABORATORY TEST RESULTS

Cardno
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Cardno Geosciences and Environment
ABN: 47 106 610 913

Address:
501 Swanston Street,
Melbourne VIC 3000

Laboratory: Geosciences and Environment
Phone: 03 8415 7777
Fax: 03 8415 7788
Email: Darryl.pather@cardno.com.au

MOISTURE CONTENT REPORT

Client:	Cardno Victoria	Report Number:	3145/R/2058-1
Client Address:	501 Swanston Street, Melbourne	Project Number:	3145/P/490
Project:	Henty, Holbrook, Culcairn Levee investigation	Lot Number:	
Location:	Level 4, 501 Swanston Street, Melbourne	Internal Test Request:	3145/T/655
Supplied To:	n/a	Client Reference/s:	AWE200028
Area Description:		Report Date / Page:	21/04/2020 Page 1 of 2

Test Procedures:	AS1289.2.1.1

Sample Number	3145/S/13053	3145/S/13056	3145/S/13065	3145/S/13069
ID / Client ID	-	-	-	-
Lot Number	-	-	-	-
Date / Time Sampled	11/11/2019	11/11/2019	12/11/2019	12/11/2019
Sampling Method	AS1289.1.2.1 Cl 6.5.3	AS1289.1.2.1 Cl 6.5.3	AS1289.1.2.1 Cl 6.5.3	AS1289.1.2.1 Cl 6.5.3
Date Tested	16/12/2019	16/12/2019	10/02/2020	12/02/2020
Material Source	Bulk Sample	Bulk Sample	Bulk Sample	Bulk Sample
Material Type	Insitu	Insitu	Insitu	Insitu
Location on Site	BH03 1.2-2.0m	BH04 1.7-2.7m	BH08 0.5-1.0m	BH09 0.5-1.5m
Moisture Content (%)	**9.5**	**11.9**	**9.3**	**14.7**
Sample Description	**Silty CLAY orange mottled brown**	**Silty CLAY pale brown and orange**	**Silty CLAY with sand dark red**	**Silty CLAY trace sand brown orange & grey**

Sample Number	3145/S/13072	3145/S/13082	3145/S/13088	3145/S/13094
ID / Client ID	-	-	-	-
Lot Number	-	-	-	-
Date / Time Sampled	12/11/2019	13/11/2019	14/11/2019	13/11/2019
Sampling Method	AS1289.1.2.1 Cl 6.5.3	AS1289.1.2.1 Cl 6.5.3	AS1289.1.2.1 Cl 6.5.3	AS1289.1.2.1 Cl 6.5.3
Date Tested	12/02/2020	12/02/2020	12/02/2020	12/02/2020
Material Source	Bulk Sample	Bulk Sample	Bulk Sample	Bulk Sample
Material Type	Insitu	Insitu	Insitu	Insitu
Location on Site	BH10 0.5-1.2m	BH13 0.5-1.9m	BH14 1.2-2.7m	BH16 0.5-2.3m
Moisture Content (%)	**14.8**	**13.6**	**19.9**	**14.0**
Sample Description	**Sandy silty CLAY red mottled brown grey**	**Silty CLAY with sand brown & grey**	**Silty CLAY dark brown orange mottled brown**	**Silty CLAY with sand orange brown mottled grey**

Remarks

NATA

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Accreditation Number: 3145

Approved Signatory: Darryl Pather
Form ID: W95Rep Rev 1

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ABN: 47 106 610 913

Address:
501 Swanston Street,
Melbourne VIC 3000

Laboratory: Geosciences and Environment
Phone: 03 8415 7777
Fax: 03 8415 7788
Email: Darryl.pather@cardno.com.au

MOISTURE CONTENT REPORT

Client:	Cardno Victoria	Report Number:	3145/R/2058-1
Client Address:	501 Swanston Street, Melbourne	Project Number:	3145/P/490
Project:	Henty, Holbrook, Culcairn Levee investigation	Lot Number:	
Location:	Level 4, 501 Swanston Street, Melbourne	Internal Test Request:	3145/T/655
Supplied To:	n/a	Client Reference/s:	AWE200028
Area Description:		Report Date / Page:	21/04/2020 Page 2 of 2

Test Procedures:	AS1289.2.1.1

Sample Number	3145/S/13099	3145/S/13105		
ID / Client ID	-	-		
Lot Number	-	-		
Date / Time Sampled	13/11/2019	13/11/2019		
Sampling Method	AS1289.1.2.1 Cl 6.5.3	AS1289.1.2.1 Cl 6.5.3		
Date Tested	12/02/2020	12/02/2020		
Material Source	Bulk Sample	Bulk Sample		
Material Type	Insitu	Insitu		
Location on Site	BH18 0.6-2.5m	BH20 0.8-2.0m		
Moisture Content (%)	**11.0**	**11.2**		
Sample Description	**Silty CLAY trace sand brown mottled grey**	**Silty CLAY brown mottled grey**		

Sample Number				
ID / Client ID				
Lot Number				
Date / Time Sampled				
Sampling Method				
Date Tested				
Material Source				
Material Type				
Location on Site				
Moisture Content (%)				
Sample Description				

Remarks

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Email: Darryl.pather@cardno.com.au

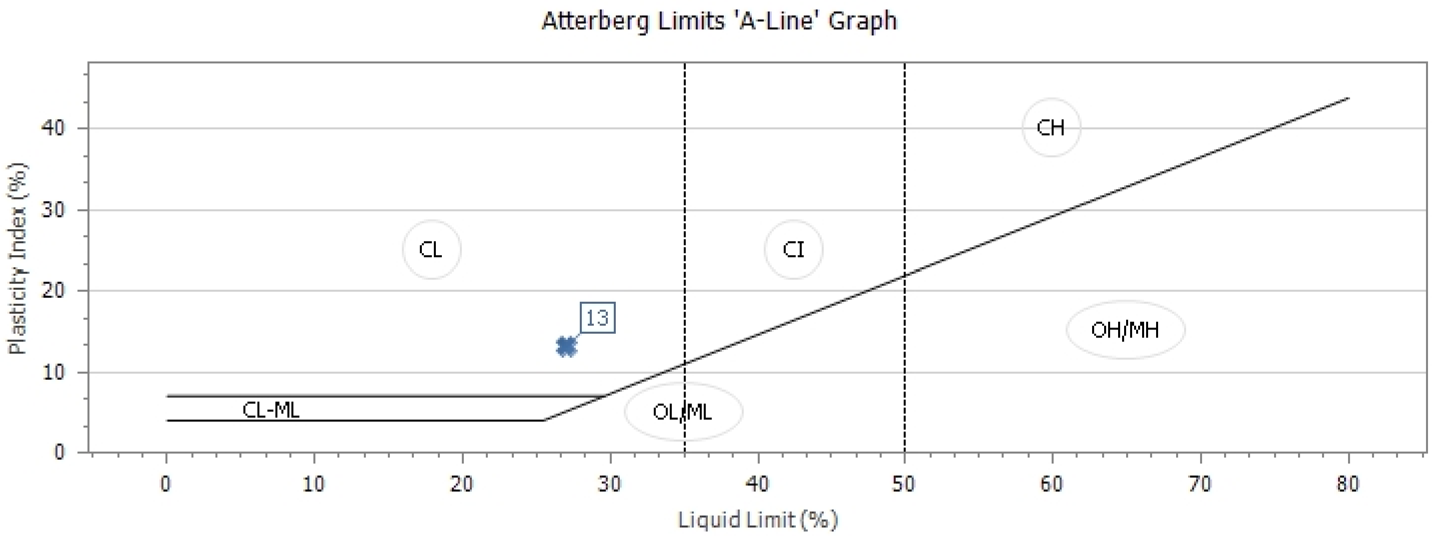
ATTERBERG LIMITS REPORT

Client:	Cardno Victoria	Report Number:	3145/R/2060-1
Client Address:	501 Swanston Street, Melbourne	Project Number:	3145/P/490
Project:	Henty, Holbrook, Culcairn Levee investigation	Lot Number:	
Location:	Level 4, 501 Swanston Street, Melbourne	Internal Test Request:	3145/T/655
Supplied To:	n/a	Client Reference/s:	AWE200028
Area Description:		Report Date / Page:	21/04/2020 Page 1 of 29

Test Procedures:	AS1289.3.1.2, AS 1289.3.3.1, AS1289.3.2.1, AS1289.2.1.1		
Sample Number	3145/S/13048	Sample Location	
Sampling Method	AS1289.1.2.1 Cl 6.5.3	Location on Site	BH01
Date Sampled	13/11/2019		0.5m
Sampled By	Thilina Wanasingha		
Date Tested	19/12/2019		
Att. Drying Method	Air Dried	Material Source	Disturbed
Atterberg Preparation	Dry Sieved	Material Type	Insitu
Material Description	Silty CLAY with sand brown orange to pale brown		

Atterberg Limits Results

Atterberg Limit	Specification Minimum	Test Result	Specification Maximum
Liquid Limit (%)		**27**	
Plastic Limit (%)		**14**	
Plasticity Index (%)		**13**	
Linear Shrinkage (%)			
Linear Shrinkage Defects:			



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Fax: 03 8415 7788
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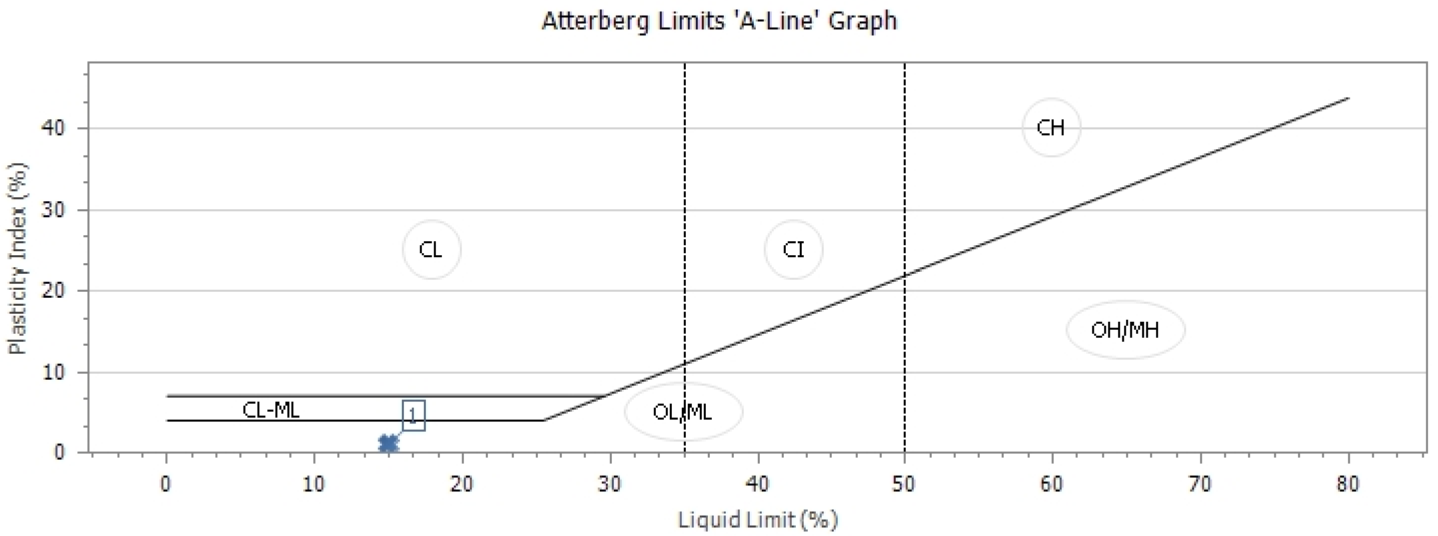
Client:	Cardno Victoria	Report Number:	3145/R/2060-1
Client Address:	501 Swanston Street, Melbourne	Project Number:	3145/P/490
Project:	Henty, Holbrook, Culcairn Levee investigation	Lot Number:	
Location:	Level 4, 501 Swanston Street, Melbourne	Internal Test Request:	3145/T/655
Supplied To:	n/a	Client Reference/s:	AWE200028
Area Description:		Report Date / Page:	21/04/2020 Page 2 of 29

Test Procedures:	AS1289.3.1.2, AS 1289.3.3.1, AS1289.3.2.1, AS1289.2.1.1		
Sample Number	3145/S/13050	Sample Location	
Sampling Method	AS1289.1.2.1 Cl 6.5.3	Location on Site	BH02
Date Sampled	13/11/2019		2..0m
Sampled By	Thilina Wanasingha		
Date Tested	19/12/2019		
Att. Drying Method	Air Dried	Material Source	Disturbed
Atterberg Preparation	Dry Sieved	Material Type	Insitu
Material Description	Sandy SILT brown to grey		

Atterberg Limits Results

Atterberg Limit	Specification Minimum	Test Result	Specification Maximum
Liquid Limit (%)		**15**	
Plastic Limit (%)		**14**	
Plasticity Index (%)		**1**	
Linear Shrinkage (%)			
Linear Shrinkage Defects:			



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Melbourne VIC 3000

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Fax: 03 8415 7788
Email: Darryl.pather@cardno.com.au

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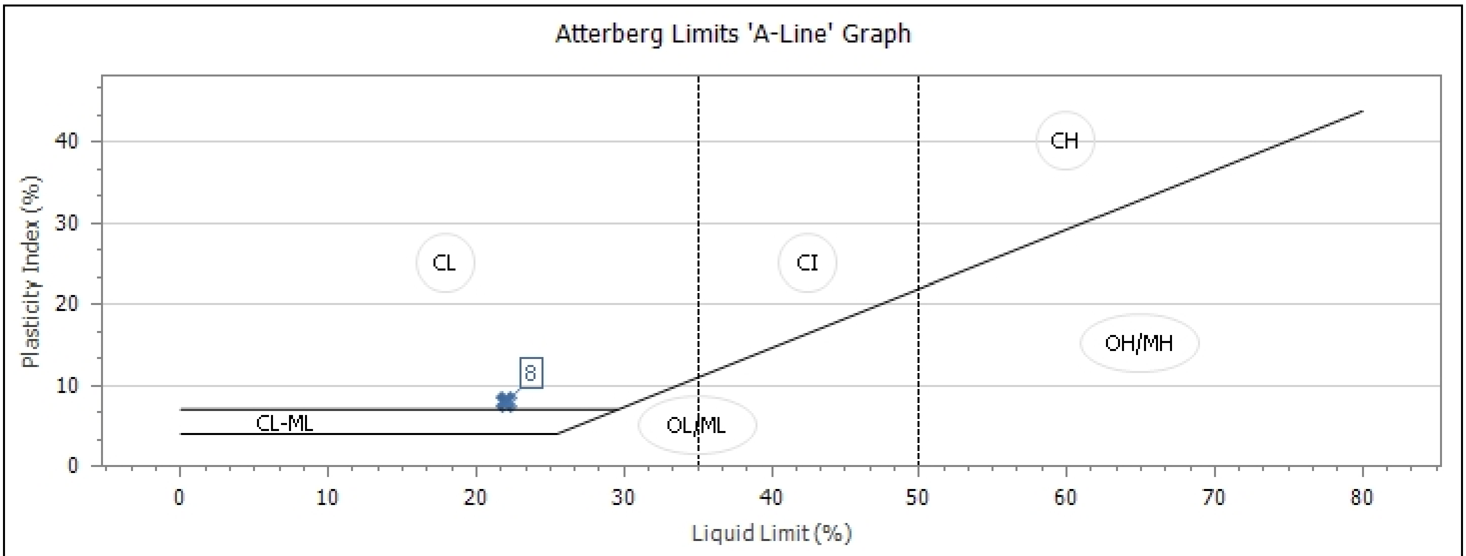
Client:	Cardno Victoria	Report Number:	3145/R/2060-1
Client Address:	501 Swanston Street, Melbourne	Project Number:	3145/P/490
Project:	Henty, Holbrook, Culcairn Levee investigation	Lot Number:	
Location:	Level 4, 501 Swanston Street, Melbourne	Internal Test Request:	3145/T/655
Supplied To:	n/a	Client Reference/s:	AWE200028
Area Description:		Report Date / Page:	21/04/2020 Page 3 of 29

Test Procedures:	AS1289.3.1.2, AS 1289.3.3.1, AS1289.3.2.1, AS1289.2.1.1		
Sample Number	3145/S/13051	Sample Location	
Sampling Method	AS1289.1.2.1 Cl 6.5.3	Location on Site	BH03
Date Sampled	11/11/2019		0.2-0.5m
Sampled By	Thilina Wanasingha		
Date Tested	16/01/2020		
Att. Drying Method	Air Dried	Material Source	Disturbed
Atterberg Preparation	Dry Sieved	Material Type	Insitu
Material Description	Silty CLAY orange mottled brown		

Atterberg Limits Results

Atterberg Limit	Specification Minimum	Test Result	Specification Maximum
Liquid Limit (%)		**22**	
Plastic Limit (%)		**14**	
Plasticity Index (%)		**8**	
Linear Shrinkage (%)			
Linear Shrinkage Defects:			



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Melbourne VIC 3000

Laboratory: Geosciences and Environment
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Fax: 03 8415 7788
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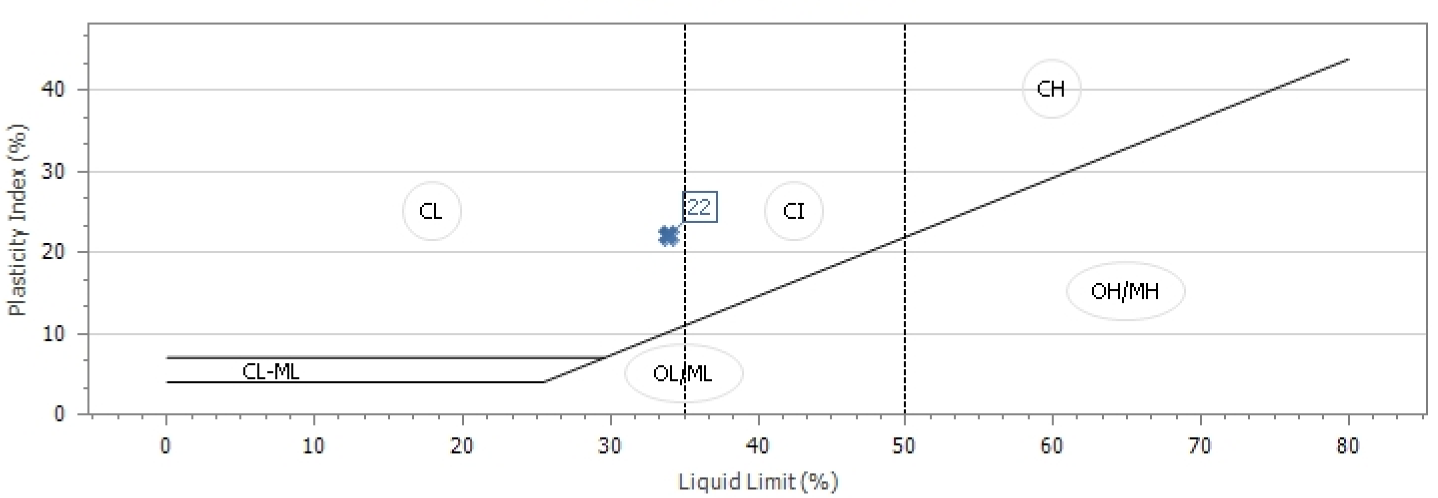
ATTERBERG LIMITS REPORT

Client:	Cardno Victoria	Report Number:	3145/R/2060-1
Client Address:	501 Swanston Street, Melbourne	Project Number:	3145/P/490
Project:	Henty, Holbrook, Culcairn Levee investigation	Lot Number:	
Location:	Level 4, 501 Swanston Street, Melbourne	Internal Test Request:	3145/T/655
Supplied To:	n/a	Client Reference/s:	AWE200028
Area Description:		Report Date / Page:	21/04/2020 Page 4 of 29

Test Procedures:	AS1289.3.1.2, AS 1289.3.3.1, AS1289.3.2.1, AS1289.2.1.1		
Sample Number	3145/S/13052	Sample Location	
Sampling Method	AS1289.1.2.1 Cl 6.5.3	Location on Site	BH03
Date Sampled	11/11/2019		1.1-1.3m
Sampled By	Thilina Wanasingha		
Date Tested	15/01/2020		
Att. Drying Method	Air Dried	Material Source	Disturbed
Atterberg Preparation	Dry Sieved	Material Type	Insitu
Material Description	Silty CLAY orange mottled brown		

Atterberg Limits Results

Atterberg Limit	Specification Minimum	Test Result	Specification Maximum
Liquid Limit (%)		**34**	
Plastic Limit (%)		**12**	
Plasticity Index (%)		**22**	
Linear Shrinkage (%)			
Linear Shrinkage Defects:			



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ABN: 47 106 610 913

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Melbourne VIC 3000

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Phone: 03 8415 7777
Fax: 03 8415 7788
Email: Darryl.pather@cardno.com.au

ATTERBERG LIMITS REPORT

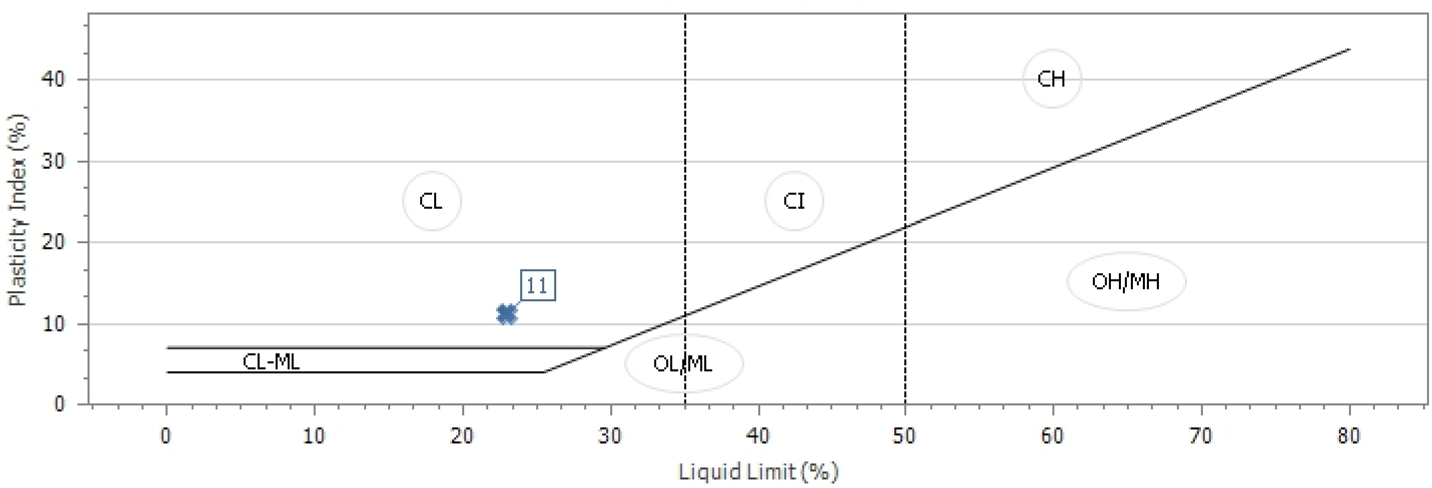
Client:	Cardno Victoria	Report Number:	3145/R/2060-1
Client Address:	501 Swanston Street, Melbourne	Project Number:	3145/P/490
Project:	Henty, Holbrook, Culcairn Levee investigation	Lot Number:	
Location:	Level 4, 501 Swanston Street, Melbourne	Internal Test Request:	3145/T/655
Supplied To:	n/a	Client Reference/s:	AWE200028
Area Description:		Report Date / Page:	21/04/2020 Page 5 of 29

Test Procedures:	AS1289.3.1.2, AS 1289.3.3.1, AS1289.3.2.1, AS1289.2.1.1		
Sample Number	3145/S/13054	Sample Location	
Sampling Method	AS1289.1.2.1 Cl 6.5.3	Location on Site	BH04
Date Sampled	11/11/2019		0.2-.04m
Sampled By	Thilina Wanasingha		
Date Tested	19/12/2019		
Att. Drying Method	Air Dried	Material Source	Disturbed
Atterberg Preparation	Dry Sieved	Material Type	Insitu
Material Description	Silty CLAY orange		

Atterberg Limits Results

Atterberg Limit	Specification Minimum	Test Result	Specification Maximum
Liquid Limit (%)		**23**	
Plastic Limit (%)		**12**	
Plasticity Index (%)		**11**	
Linear Shrinkage (%)			
Linear Shrinkage Defects:			

Atterberg Limits 'A-Line' Graph



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Address:
501 Swanston Street,
Melbourne VIC 3000

Laboratory: Geosciences and Environment
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Fax: 03 8415 7788
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ATTERBERG LIMITS REPORT

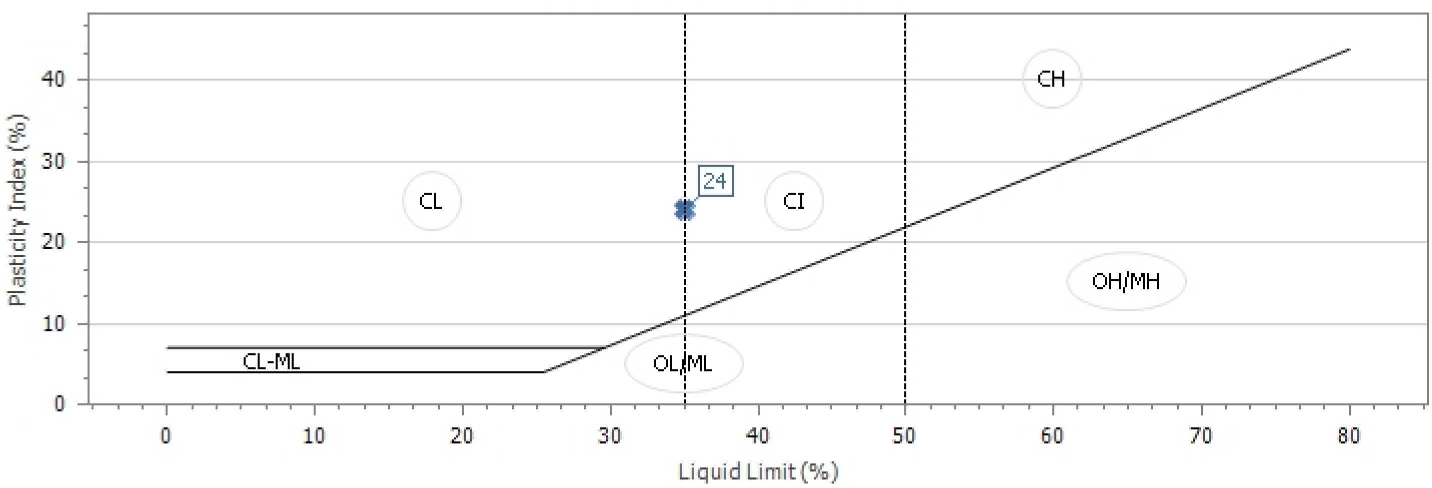
Client:	Cardno Victoria	Report Number:	3145/R/2060-1
Client Address:	501 Swanston Street, Melbourne	Project Number:	3145/P/490
Project:	Henty, Holbrook, Culcairn Levee investigation	Lot Number:	
Location:	Level 4, 501 Swanston Street, Melbourne	Internal Test Request:	3145/T/655
Supplied To:	n/a	Client Reference/s:	AWE200028
Area Description:		Report Date / Page:	21/04/2020 Page 6 of 29

Test Procedures:	AS1289.3.1.2, AS 1289.3.3.1, AS1289.3.2.1, AS1289.2.1.1		
Sample Number	3145/S/13055	Sample Location	
Sampling Method	AS1289.1.2.1 Cl 6.5.3	Location on Site	BH04
Date Sampled	11/11/2019		1.7-1.9m
Sampled By	Thilina Wanasingha		
Date Tested	13/01/2020		
Att. Drying Method	Air Dried	Material Source	Disturbed
Atterberg Preparation	Dry Sieved	Material Type	Insitu
Material Description	Silty CLAY pale brown and orange		

Atterberg Limits Results

Atterberg Limit	Specification Minimum	Test Result	Specification Maximum
Liquid Limit (%)		**35**	
Plastic Limit (%)		**11**	
Plasticity Index (%)		**24**	
Linear Shrinkage (%)			
Linear Shrinkage Defects:			

Atterberg Limits 'A-Line' Graph



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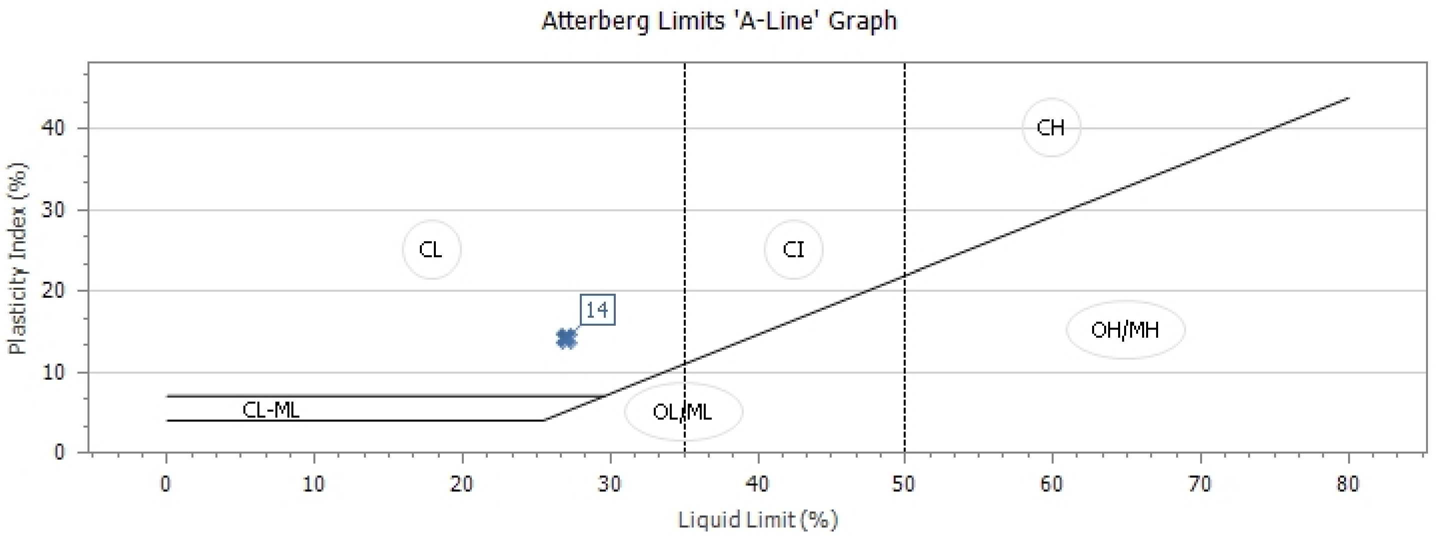
ATTERBERG LIMITS REPORT

Client:	Cardno Victoria	Report Number:	3145/R/2060-1
Client Address:	501 Swanston Street, Melbourne	Project Number:	3145/P/490
Project:	Henty, Holbrook, Culcairn Levee investigation	Lot Number:	
Location:	Level 4, 501 Swanston Street, Melbourne	Internal Test Request:	3145/T/655
Supplied To:	n/a	Client Reference/s:	AWE200028
Area Description:		Report Date / Page:	21/04/2020 Page 7 of 29

Test Procedures:	AS1289.3.1.2, AS 1289.3.3.1, AS1289.3.2.1, AS1289.2.1.1		
Sample Number	3145/S/13058	Sample Location	
Sampling Method	AS1289.1.2.1 Cl 6.5.3	Location on Site	BH05
Date Sampled	11/11/2019		2.1-2.4m
Sampled By	Thilina Wanasingha		
Date Tested	15/01/2020		
Att. Drying Method	Air Dried	Material Source	Disturbed
Atterberg Preparation	Dry Sieved	Material Type	Insitu
Material Description	Silty sandy CLAY dark brown mottled grey		

Atterberg Limits Results

Atterberg Limit	Specification Minimum	Test Result	Specification Maximum
Liquid Limit (%)		**27**	
Plastic Limit (%)		**13**	
Plasticity Index (%)		**14**	
Linear Shrinkage (%)			
Linear Shrinkage Defects:			



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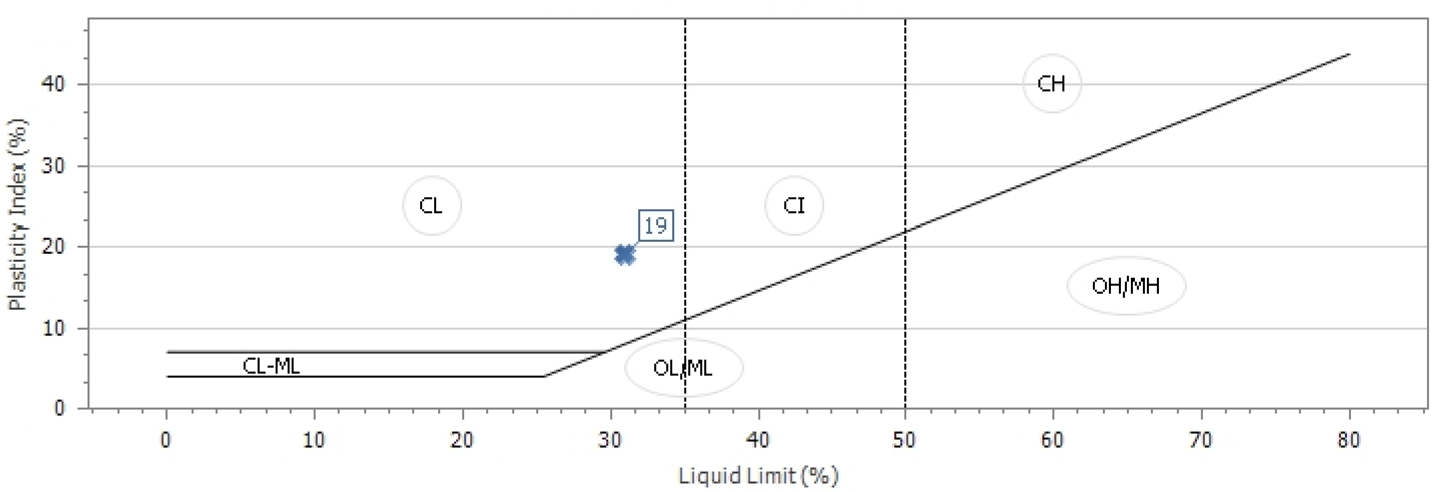
Project:	Henty, Holbrook, Culcairn Levee investigation	Lot Number:	
Location:	Level 4, 501 Swanston Street, Melbourne	Internal Test Request:	3145/T/655
Supplied To:	n/a	Client Reference/s:	AWE200028
Area Description:		Report Date / Page:	21/04/2020 Page 8 of 29

Test Procedures:	AS1289.3.1.2, AS 1289.3.3.1, AS1289.3.2.1, AS1289.2.1.1		
Sample Number	3145/S/13061	Sample Location	
Sampling Method	AS1289.1.2.1 Cl 6.5.3	Location on Site	BH06
Date Sampled	12/11/2019		3.5-3.6m
Sampled By	Thilina Wanasingha		
Date Tested	4/02/2020		
Att. Drying Method	Air Dried	Material Source	Disturbed
Atterberg Preparation	Dry Sieved	Material Type	Insitu
Material Description	Silty sandy CLAY dark grey		

Atterberg Limits Results

Atterberg Limit	Specification Minimum	Test Result	Specification Maximum
Liquid Limit (%)		**31**	
Plastic Limit (%)		**12**	
Plasticity Index (%)		**19**	
Linear Shrinkage (%)			
Linear Shrinkage Defects:			

Atterberg Limits 'A-Line' Graph



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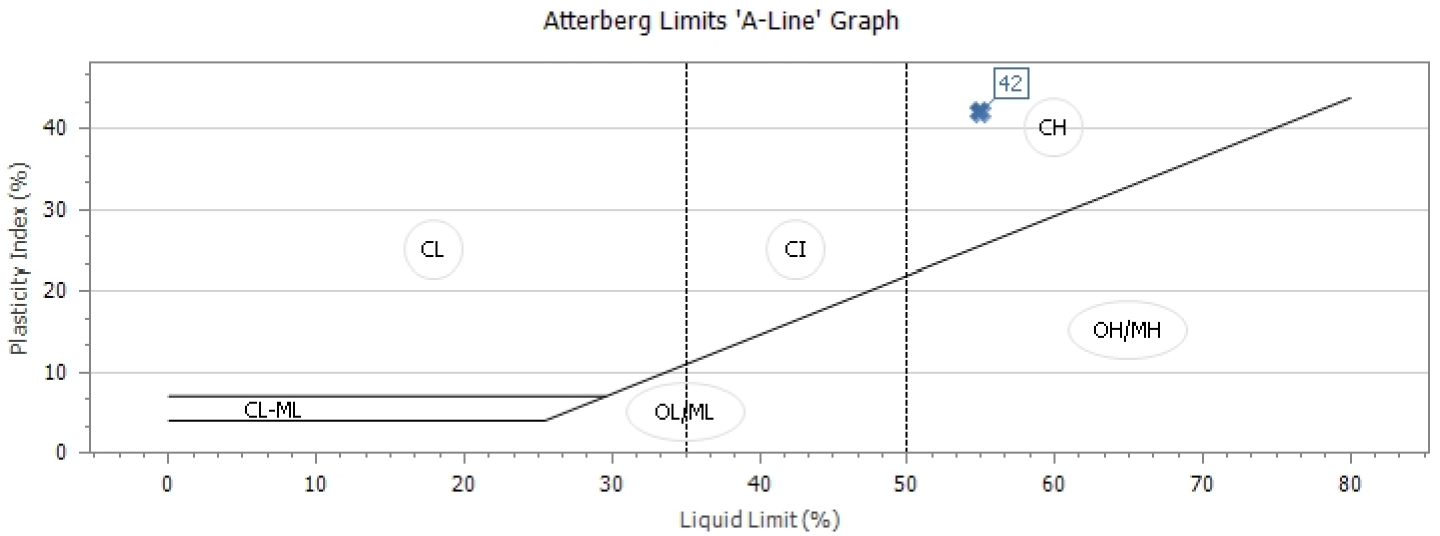
Client Address:	501 Swanston Street, Melbourne	Project Number:	3145/P/490
Project:	Henty, Holbrook, Culcairn Levee investigation	Lot Number:	
Location:	Level 4, 501 Swanston Street, Melbourne	Internal Test Request:	3145/T/655
Supplied To:	n/a	Client Reference/s:	AWE200028
Area Description:		Report Date / Page:	21/04/2020 Page 9 of 29

Test Procedures:	AS1289.3.1.2, AS 1289.3.3.1, AS1289.3.2.1, AS1289.2.1.1		
Sample Number	3145/S/13062	Sample Location	
Sampling Method	AS1289.1.2.1 Cl 6.5.3	Location on Site	BH06
Date Sampled	12/11/2019		5.7m
Sampled By	Thilina Wanasingha		
Date Tested	31/01/2020		
Att. Drying Method	Air Dried	Material Source	Disturbed
Atterberg Preparation	Dry Sieved	Material Type	Insitu
Material Description	Silty CLAY orange grey		

Atterberg Limits Results

Atterberg Limit	Specification Minimum	Test Result	Specification Maximum
Liquid Limit (%)		**55**	
Plastic Limit (%)		**13**	
Plasticity Index (%)		**42**	
Linear Shrinkage (%)			
Linear Shrinkage Defects:			



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Remarks

NATA

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Accreditation Number: 3145

Approved Signatory: Darryl Pather
Form ID: W11Rep Rev 1

Cardno Shaping the Future

Cardno Geosciences and Environment
ABN: 47 106 610 913

Address:
501 Swanston Street,
Melbourne VIC 3000

Laboratory: Geosciences and Environment
Phone: 03 8415 7777
Fax: 03 8415 7788
Email: Darryl.pather@cardno.com.au

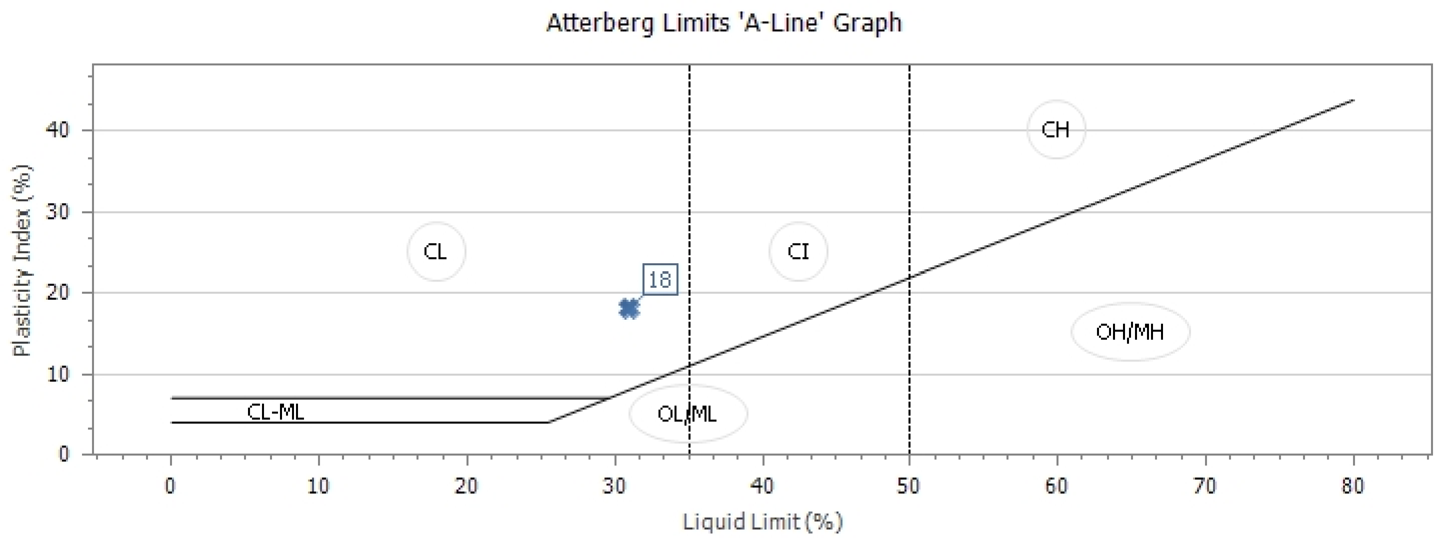
ATTERBERG LIMITS REPORT

Client:	Cardno Victoria	Report Number:	3145/R/2060-1
Client Address:	501 Swanston Street, Melbourne	Project Number:	3145/P/490
Project:	Henty, Holbrook, Culcairn Levee investigation	Lot Number:	
Location:	Level 4, 501 Swanston Street, Melbourne	Internal Test Request:	3145/T/655
Supplied To:	n/a	Client Reference/s:	AWE200028
Area Description:		Report Date / Page:	21/04/2020 Page 10 of 29

Test Procedures:	AS1289.3.1.2, AS 1289.3.3.1, AS1289.3.2.1, AS1289.2.1.1			
Sample Number	3145/S/13064	Sample Location		
Sampling Method	AS1289.1.2.1 Cl 6.5.3	Location on Site		BH07
Date Sampled	12/11/2019			0.7-1.0m
Sampled By	Thilina Wanasingha			
Date Tested	22/01/2020			
Att. Drying Method	Air Dried	Material Source	Disturbed	
Atterberg Preparation	Dry Sieved	Material Type	Insitu	
Material Description	Silty CLAY with sand pale brown			

Atterberg Limits Results

Atterberg Limit	Specification Minimum	Test Result	Specification Maximum
Liquid Limit (%)		**31**	
Plastic Limit (%)		**13**	
Plasticity Index (%)		**18**	
Linear Shrinkage (%)			
Linear Shrinkage Defects:			



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Phone: 03 8415 7777
Fax: 03 8415 7788
Email: Darryl.pather@cardno.com.au

ATTERBERG LIMITS REPORT

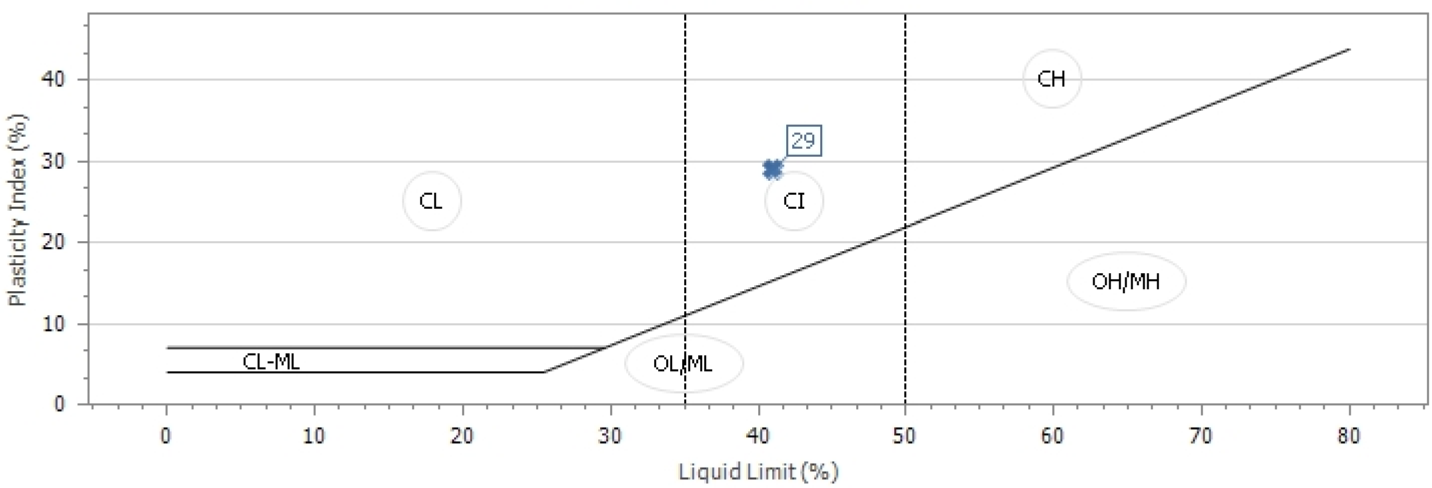
Client:	Cardno Victoria	Report Number:	3145/R/2060-1
Client Address:	501 Swanston Street, Melbourne	Project Number:	3145/P/490
Project:	Henty, Holbrook, Culcairn Levee investigation	Lot Number:	
Location:	Level 4, 501 Swanston Street, Melbourne	Internal Test Request:	3145/T/655
Supplied To:	n/a	Client Reference/s:	AWE200028
Area Description:		Report Date / Page:	21/04/2020 Page 11 of 29

Test Procedures:	AS1289.3.1.2, AS 1289.3.3.1, AS1289.3.2.1, AS1289.2.1.1		
Sample Number	3145/S/13067	Sample Location	
Sampling Method	AS1289.1.2.1 Cl 6.5.3	Location on Site	BH08
Date Sampled	12/11/2019		0.9-1.0m
Sampled By	Thilina Wanasingha		
Date Tested	5/02/2020		
Att. Drying Method	Air Dried	Material Source	Disturbed
Atterberg Preparation	Dry Sieved	Material Type	Insitu
Material Description	Silty CLAY with sand dark red		

Atterberg Limits Results

Atterberg Limit	Specification Minimum	Test Result	Specification Maximum
Liquid Limit (%)		**41**	
Plastic Limit (%)		**12**	
Plasticity Index (%)		**29**	
Linear Shrinkage (%)			
Linear Shrinkage Defects:			

Atterberg Limits 'A-Line' Graph



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Fax: 03 8415 7788
Email: Darryl.pather@cardno.com.au

ATTERBERG LIMITS REPORT

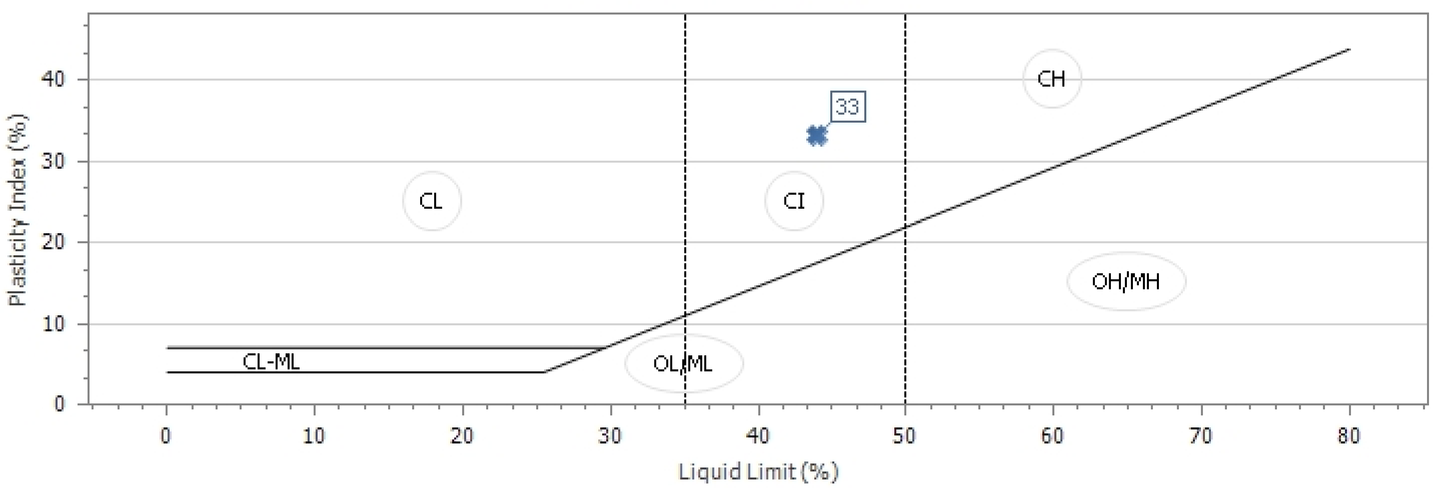
Client:	Cardno Victoria	Report Number:	3145/R/2060-1
Client Address:	501 Swanston Street, Melbourne	Project Number:	3145/P/490
Project:	Henty, Holbrook, Culcairn Levee investigation	Lot Number:	
Location:	Level 4, 501 Swanston Street, Melbourne	Internal Test Request:	3145/T/655
Supplied To:	n/a	Client Reference/s:	AWE200028
Area Description:		Report Date / Page:	21/04/2020 Page 12 of 29

Test Procedures:	AS1289.3.1.2, AS 1289.3.3.1, AS1289.3.2.1, AS1289.2.1.1		
Sample Number	3145/S/13071	Sample Location	
Sampling Method	AS1289.1.2.1 Cl 6.5.3	Location on Site	BH09
Date Sampled	12/11/2019		0.8m
Sampled By	Thilina Wanasingha		
Date Tested	6/02/2020		
Att. Drying Method	Air Dried	Material Source	Disturbed
Atterberg Preparation	Dry Sieved	Material Type	Insitu
Material Description	Silty CLAY trace sand brown orange & grey		

Atterberg Limits Results

Atterberg Limit	Specification Minimum	Test Result	Specification Maximum
Liquid Limit (%)		**44**	
Plastic Limit (%)		**11**	
Plasticity Index (%)		**33**	
Linear Shrinkage (%)			
Linear Shrinkage Defects:			

Atterberg Limits 'A-Line' Graph



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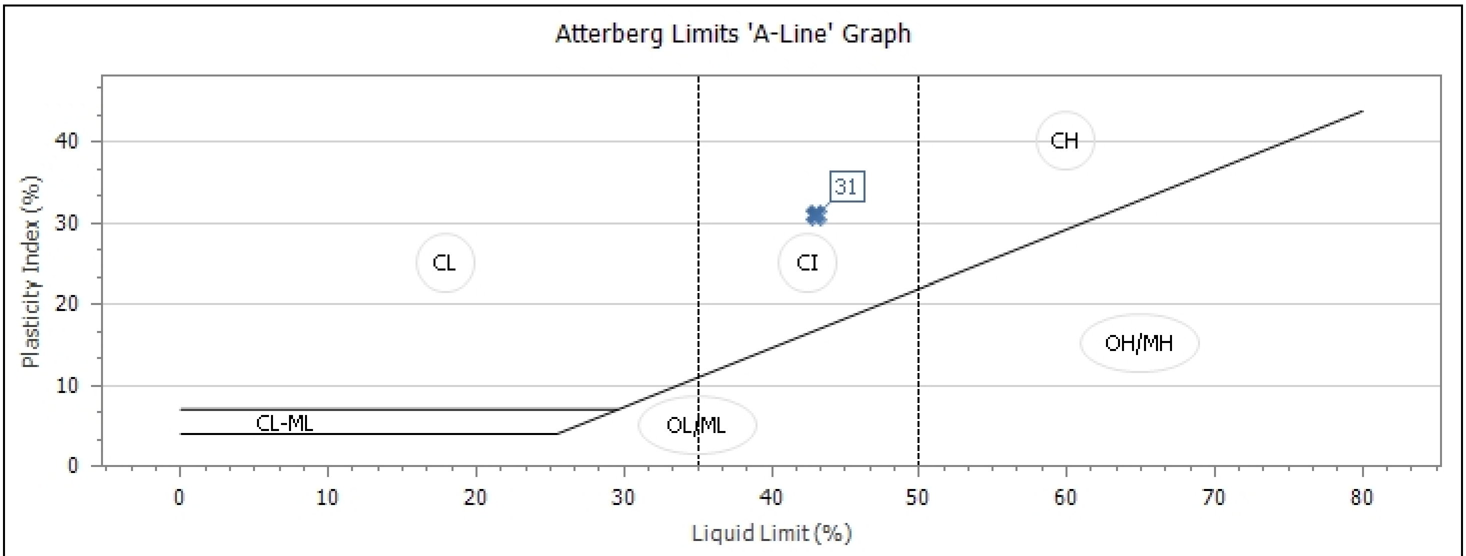
ATTERBERG LIMITS REPORT

Client:	Cardno Victoria	Report Number:	3145/R/2060-1
Client Address:	501 Swanston Street, Melbourne	Project Number:	3145/P/490
Project:	Henty, Holbrook, Culcairn Levee investigation	Lot Number:	
Location:	Level 4, 501 Swanston Street, Melbourne	Internal Test Request:	3145/T/655
Supplied To:	n/a	Client Reference/s:	AWE200028
Area Description:		Report Date / Page:	21/04/2020 Page 13 of 29

Test Procedures:	AS1289.3.1.2, AS 1289.3.3.1, AS1289.3.2.1, AS1289.2.1.1		
Sample Number	3145/S/13074	Sample Location	
Sampling Method	AS1289.1.2.1 Cl 6.5.3	Location on Site	BH10
Date Sampled	12/11/2019		0.6-0.7m
Sampled By	Thilina Wanasingha		
Date Tested	31/01/2020		
Att. Drying Method	Air Dried	Material Source	Disturbed
Atterberg Preparation	Dry Sieved	Material Type	Insitu
Material Description	Sandy silty CLAY red mottled brown grey		

Atterberg Limits Results

Atterberg Limit	Specification Minimum	Test Result	Specification Maximum
Liquid Limit (%)		**43**	
Plastic Limit (%)		**12**	
Plasticity Index (%)		**31**	
Linear Shrinkage (%)			
Linear Shrinkage Defects:			



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Laboratory: Geosciences and Environment
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Fax: 03 8415 7788
Email: Darryl.pather@cardno.com.au

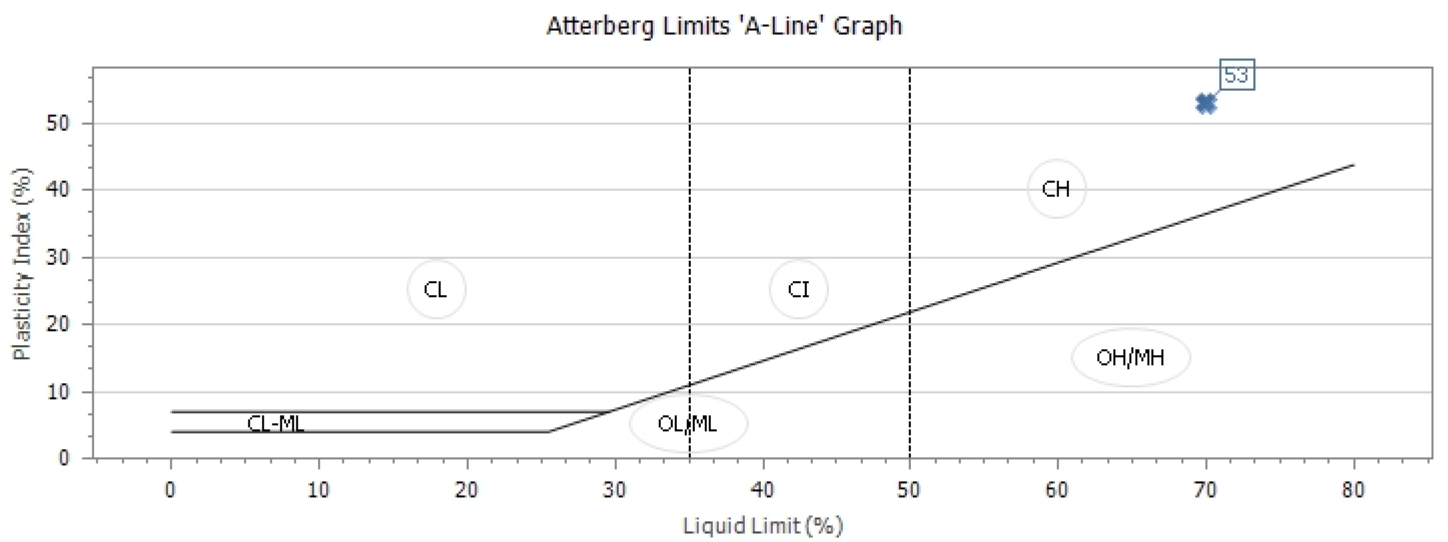
ATTERBERG LIMITS REPORT

Client:	Cardno Victoria	Report Number:	3145/R/2060-1
Client Address:	501 Swanston Street, Melbourne	Project Number:	3145/P/490
Project:	Henty, Holbrook, Culcairn Levee investigation	Lot Number:	
Location:	Level 4, 501 Swanston Street, Melbourne	Internal Test Request:	3145/T/655
Supplied To:	n/a	Client Reference/s:	AWE200028
Area Description:		Report Date / Page:	21/04/2020 Page 21 of 29

Test Procedures:	AS1289.3.1.2, AS 1289.3.3.1, AS1289.3.2.1, AS1289.2.1.1		
Sample Number	3145/S/13091	Sample Location	
Sampling Method	AS1289.1.2.1 Cl 6.5.3	Location on Site	BH10
Date Sampled	12/11/2019		2.5m
Sampled By	Thilina Wanasingha		
Date Tested	29/01/2020		
Att. Drying Method	Air Dried	Material Source	Disturbed
Atterberg Preparation	Dry Sieved	Material Type	Insitu
Material Description	Silty CLAY brown & grey		

Atterberg Limits Results

Atterberg Limit	Specification Minimum	Test Result	Specification Maximum
Liquid Limit (%)		**70**	
Plastic Limit (%)		**17**	
Plasticity Index (%)		**53**	
Linear Shrinkage (%)			
Linear Shrinkage Defects:			



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Melbourne VIC 3000

Laboratory: Geosciences and Environment
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Fax: 03 8415 7788
Email: Darryl.pather@cardno.com.au

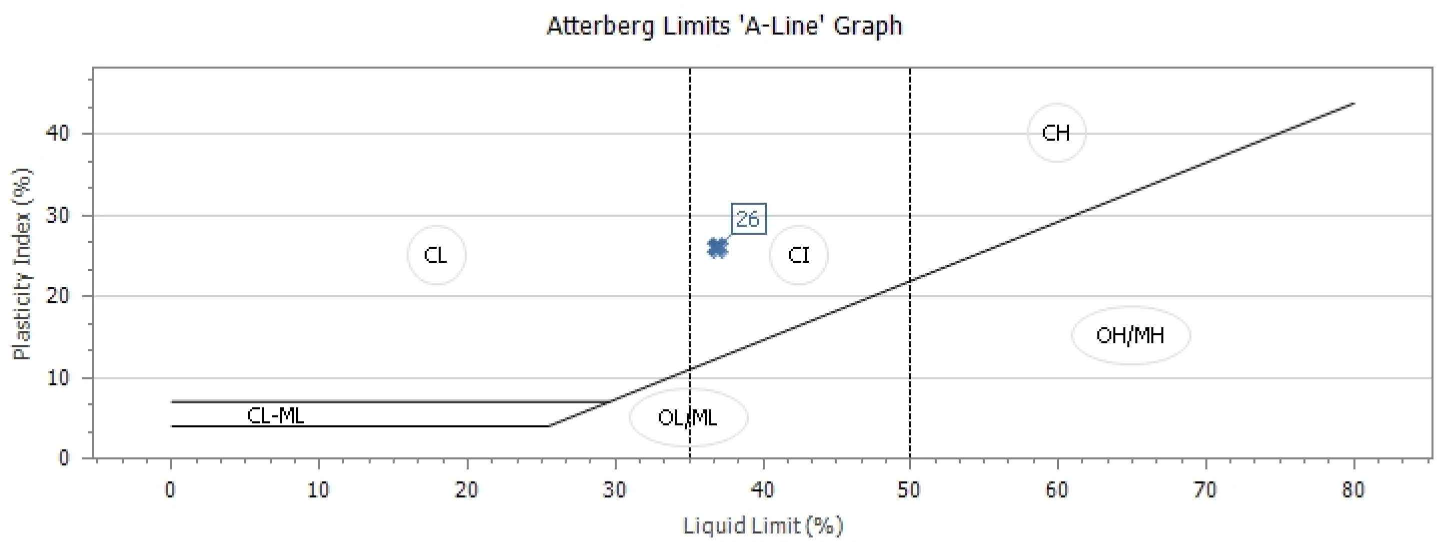
ATTERBERG LIMITS REPORT

Client:	Cardno Victoria	Report Number:	3145/R/2060-1
Client Address:	501 Swanston Street, Melbourne	Project Number:	3145/P/490
Project:	Henty, Holbrook, Culcairn Levee investigation	Lot Number:	
Location:	Level 4, 501 Swanston Street, Melbourne	Internal Test Request:	3145/T/655
Supplied To:	n/a	Client Reference/s:	AWE200028
Area Description:		Report Date / Page:	21/04/2020 Page 14 of 29

Test Procedures:	AS1289.3.1.2, AS 1289.3.3.1, AS1289.3.2.1, AS1289.2.1.1		
Sample Number	3145/S/13076	Sample Location	
Sampling Method	AS1289.1.2.1 Cl 6.5.3	Location on Site	BH11
Date Sampled	12/11/2019		0.9-1.0m
Sampled By	Thilina Wanasingha		
Date Tested	21/01/2020		
Att. Drying Method	Air Dried	Material Source	Disturbed
Atterberg Preparation	Dry Sieved	Material Type	Insitu
Material Description	Silty CLAY with sand brown & dark grey		

Atterberg Limits Results

Atterberg Limit	Specification Minimum	Test Result	Specification Maximum
Liquid Limit (%)		**37**	
Plastic Limit (%)		**11**	
Plasticity Index (%)		**26**	
Linear Shrinkage (%)			
Linear Shrinkage Defects:			



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ABN: 47 106 610 913
Address:
501 Swanston Street,
Melbourne VIC 3000

Laboratory: Geosciences and Environment
Phone: 03 8415 7777
Fax: 03 8415 7788
Email: Darryl.pather@cardno.com.au

ATTERBERG LIMITS REPORT

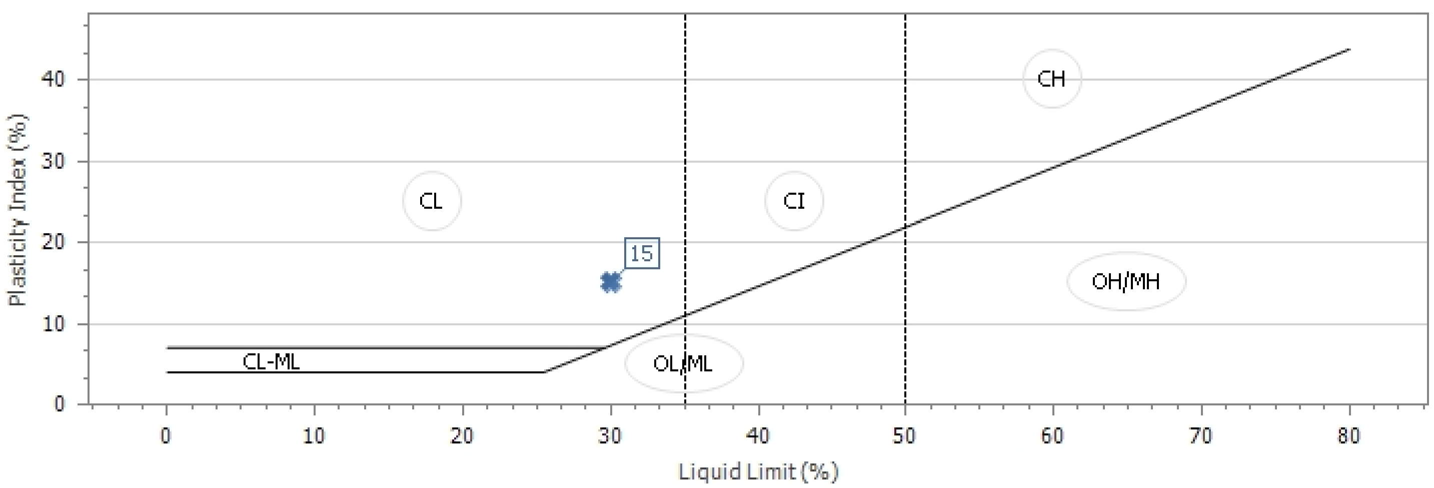
Client:	Cardno Victoria	Report Number:	3145/R/2060-1
Client Address:	501 Swanston Street, Melbourne	Project Number:	3145/P/490
Project:	Henty, Holbrook, Culcairn Levee investigation	Lot Number:	
Location:	Level 4, 501 Swanston Street, Melbourne	Internal Test Request:	3145/T/655
Supplied To:	n/a	Client Reference/s:	AWE200028
Area Description:		Report Date / Page:	21/04/2020 Page 15 of 29

Test Procedures:	AS1289.3.1.2, AS 1289.3.3.1, AS1289.3.2.1, AS1289.2.1.1		
Sample Number	3145/S/13078	Sample Location	
Sampling Method	AS1289.1.2.1 Cl 6.5.3	Location on Site	BH11
Date Sampled	12/11/2019		2.7m
Sampled By	Thilina Wanasingha		
Date Tested	24/01/2020		
Att. Drying Method	Air Dried	Material Source	Disturbed
Atterberg Preparation	Dry Sieved	Material Type	Insitu
Material Description	Silty sandy CLAY brown & grey		

Atterberg Limits Results

Atterberg Limit	Specification Minimum	Test Result	Specification Maximum
Liquid Limit (%)		**30**	
Plastic Limit (%)		**15**	
Plasticity Index (%)		**15**	
Linear Shrinkage (%)			
Linear Shrinkage Defects:			

Atterberg Limits 'A-Line' Graph



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ATTERBERG LIMITS REPORT

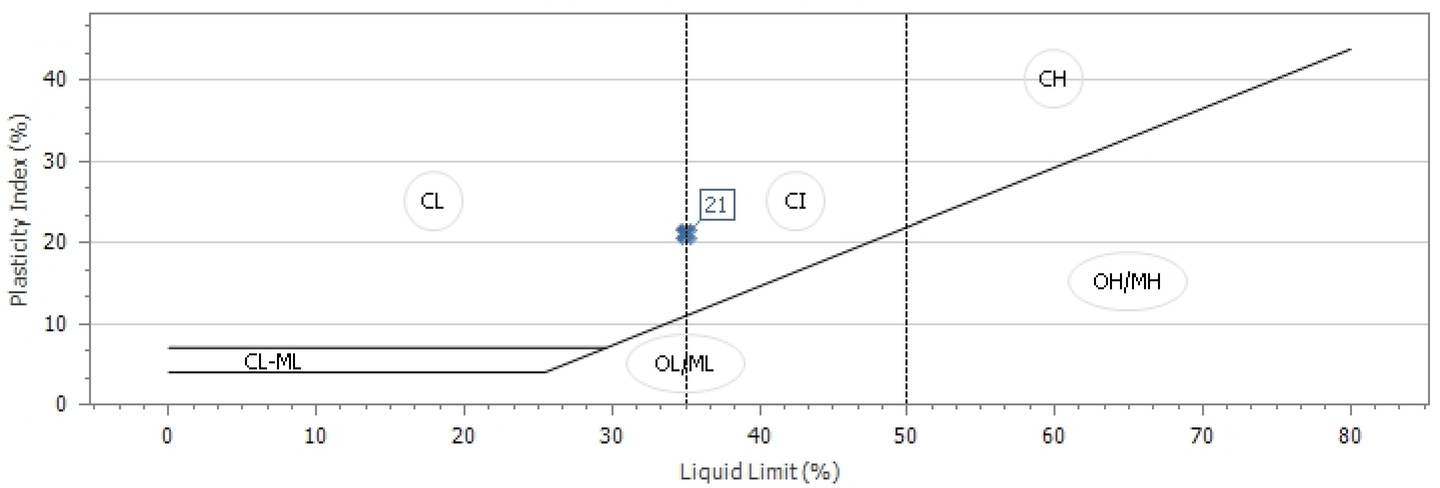
Client:	Cardno Victoria	Report Number:	3145/R/2060-1
Client Address:	501 Swanston Street, Melbourne	Project Number:	3145/P/490
Project:	Henty, Holbrook, Culcairn Levee investigation	Lot Number:	
Location:	Level 4, 501 Swanston Street, Melbourne	Internal Test Request:	3145/T/655
Supplied To:	n/a	Client Reference/s:	AWE200028
Area Description:		Report Date / Page:	21/04/2020 Page 16 of 29

Test Procedures:	AS1289.3.1.2, AS 1289.3.3.1, AS1289.3.2.1, AS1289.2.1.1		
Sample Number	3145/S/13079	Sample Location	
Sampling Method	AS1289.1.2.1 Cl 6.5.3	Location on Site	BH12
Date Sampled	12/11/2019		0.6-0.7m
Sampled By	Thilina Wanasingha		
Date Tested	29/01/2020		
Att. Drying Method	Air Dried	Material Source	Disturbed
Atterberg Preparation	Dry Sieved	Material Type	Insitu
Material Description	Silty sandy CLAY brown & grey		

Atterberg Limits Results

Atterberg Limit	Specification Minimum	Test Result	Specification Maximum
Liquid Limit (%)		**35**	
Plastic Limit (%)		**14**	
Plasticity Index (%)		**21**	
Linear Shrinkage (%)			
Linear Shrinkage Defects:			

Atterberg Limits 'A-Line' Graph



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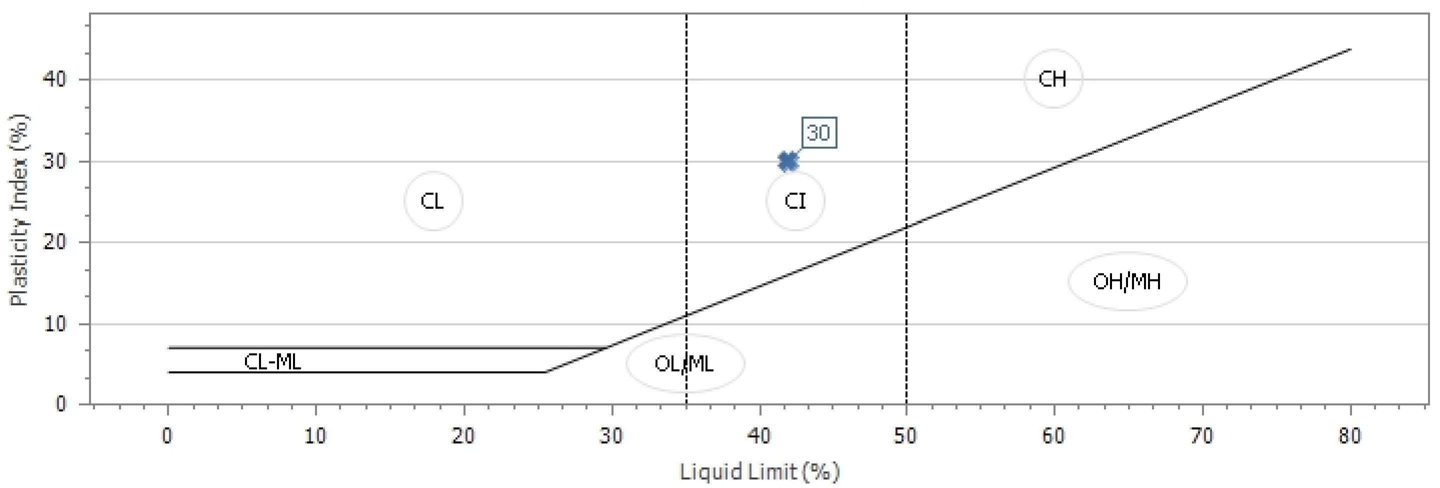
Client Address:	501 Swanston Street, Melbourne	Project Number:	3145/P/490
Project:	Henty, Holbrook, Culcairn Levee investigation	Lot Number:	
Location:	Level 4, 501 Swanston Street, Melbourne	Internal Test Request:	3145/T/655
Supplied To:	n/a	Client Reference/s:	AWE200028
Area Description:		Report Date / Page:	21/04/2020 Page 17 of 29

Test Procedures:	AS1289.3.1.2, AS 1289.3.3.1, AS1289.3.2.1, AS1289.2.1.1		
Sample Number	3145/S/13084	Sample Location	
Sampling Method	AS1289.1.2.1 Cl 6.5.3	Location on Site	BH13
Date Sampled	13/11/2019		0.6m
Sampled By	Thilina Wanasingha		
Date Tested	4/02/2020		
Att. Drying Method	Air Dried	Material Source	Disturbed
Atterberg Preparation	Dry Sieved	Material Type	Insitu
Material Description	Silty CLAY with sand brown & grey		

Atterberg Limits Results

Atterberg Limit	Specification Minimum	Test Result	Specification Maximum
Liquid Limit (%)		**42**	
Plastic Limit (%)		**12**	
Plasticity Index (%)		**30**	
Linear Shrinkage (%)			
Linear Shrinkage Defects:			

Atterberg Limits 'A-Line' Graph



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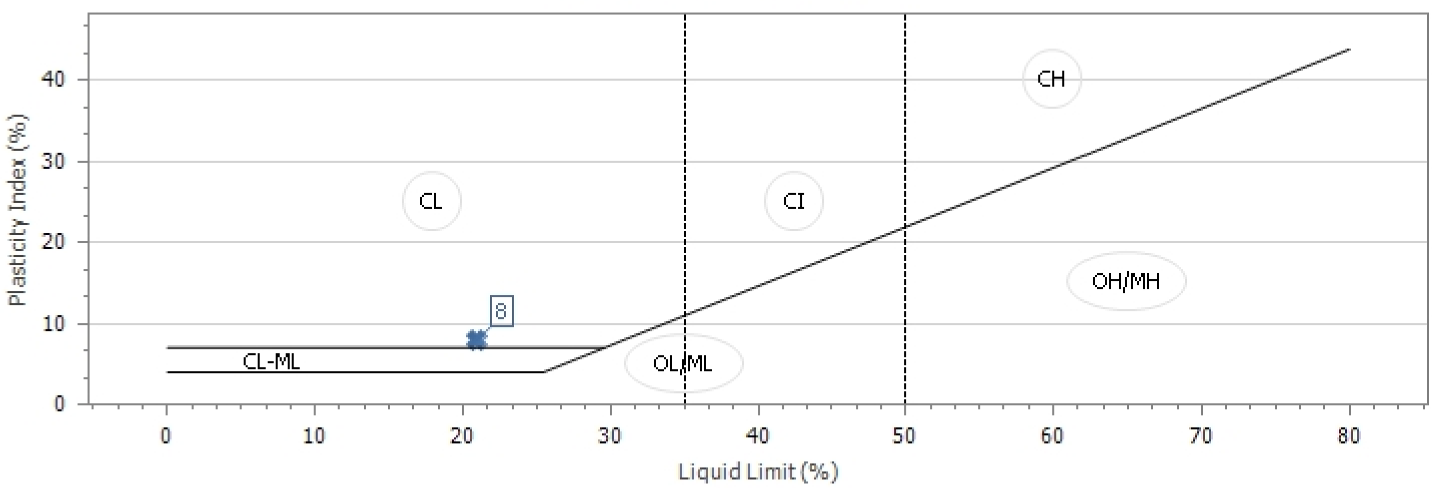
Client Address:	501 Swanston Street, Melbourne	Project Number:	3145/P/490
Project:	Henty, Holbrook, Culcairn Levee investigation	Lot Number:	
Location:	Level 4, 501 Swanston Street, Melbourne	Internal Test Request:	3145/T/655
Supplied To:	n/a	Client Reference/s:	AWE200028
Area Description:		Report Date / Page:	21/04/2020 Page 18 of 29

Test Procedures:	AS1289.3.1.2, AS 1289.3.3.1, AS1289.3.2.1, AS1289.2.1.1		
Sample Number	3145/S/13085	Sample Location	
Sampling Method	AS1289.1.2.1 Cl 6.5.3	Location on Site	BH14
Date Sampled	14/11/2019		0.4m
Sampled By	Thilina Wanasingha		
Date Tested	21/01/2020		
Att. Drying Method	Air Dried	Material Source	Disturbed
Atterberg Preparation	Dry Sieved	Material Type	Insitu
Material Description	Silty CLAY pale brown & grey		

Atterberg Limits Results

Atterberg Limit	Specification Minimum	Test Result	Specification Maximum
Liquid Limit (%)		**21**	
Plastic Limit (%)		**13**	
Plasticity Index (%)		**8**	
Linear Shrinkage (%)			
Linear Shrinkage Defects:			

Atterberg Limits 'A-Line' Graph



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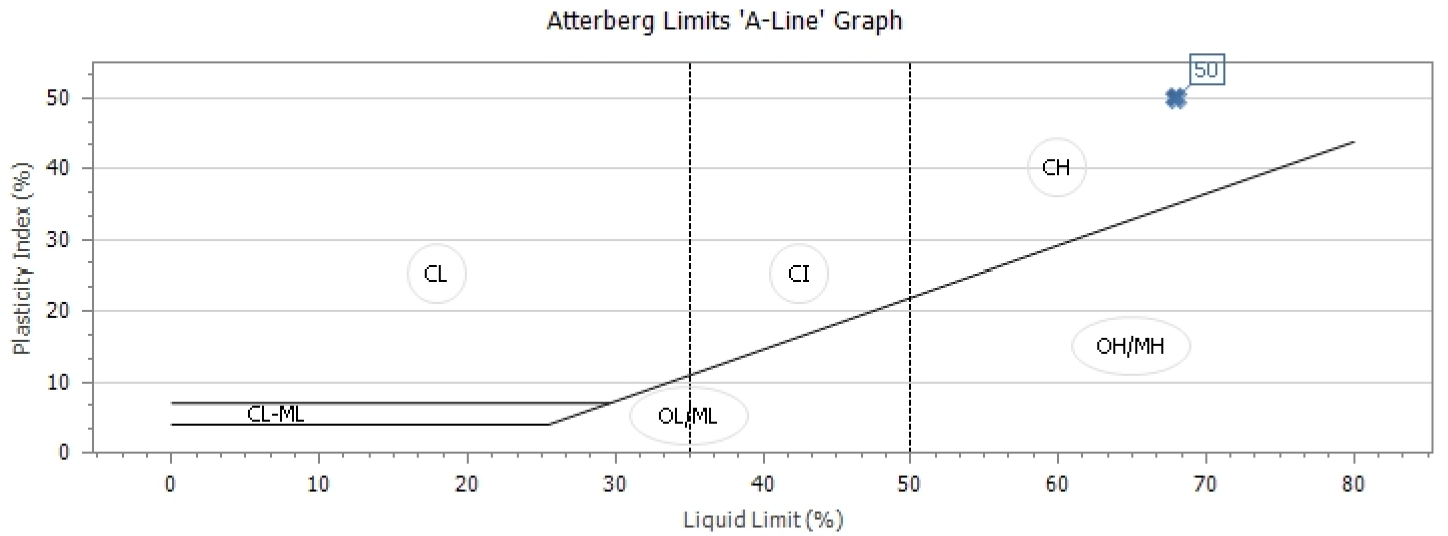
Project:	Henty, Holbrook, Culcairn Levee investigation	Lot Number:	
Location:	Level 4, 501 Swanston Street, Melbourne	Internal Test Request:	3145/T/655
Supplied To:	n/a	Client Reference/s:	AWE200028
Area Description:		Report Date / Page:	21/04/2020 Page 19 of 29

Test Procedures:	AS1289.3.1.2, AS 1289.3.3.1, AS1289.3.2.1, AS1289.2.1.1		
Sample Number	3145/S/13086	Sample Location	
Sampling Method	AS1289.1.2.1 Cl 6.5.3	Location on Site	BH14
Date Sampled	14/11/2019		0.6m
Sampled By	Thilina Wanasingha		
Date Tested	4/02/2020		
Att. Drying Method	Air Dried	Material Source	Disturbed
Atterberg Preparation	Dry Sieved	Material Type	Insitu
Material Description	Silty CLAY dark brown orange mottled brown		

Atterberg Limits Results

Atterberg Limit	Specification Minimum	Test Result	Specification Maximum
Liquid Limit (%)		**68**	
Plastic Limit (%)		**18**	
Plasticity Index (%)		**50**	
Linear Shrinkage (%)			
Linear Shrinkage Defects:			



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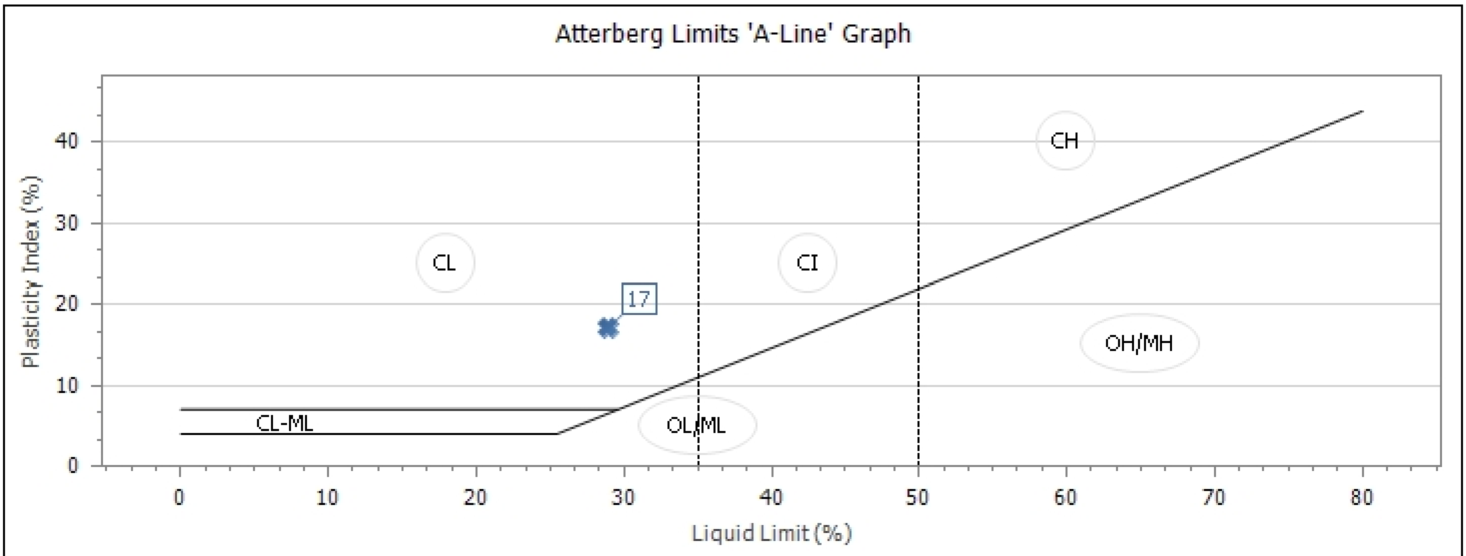
ATTERBERG LIMITS REPORT

Client:	Cardno Victoria	Report Number:	3145/R/2060-1
Client Address:	501 Swanston Street, Melbourne	Project Number:	3145/P/490
Project:	Henty, Holbrook, Culcairn Levee investigation	Lot Number:	
Location:	Level 4, 501 Swanston Street, Melbourne	Internal Test Request:	3145/T/655
Supplied To:	n/a	Client Reference/s:	AWE200028
Area Description:		Report Date / Page:	21/04/2020 Page 20 of 29

Test Procedures:	AS1289.3.1.2, AS 1289.3.3.1, AS1289.3.2.1, AS1289.2.1.1		
Sample Number	3145/S/13089	Sample Location	
Sampling Method	AS1289.1.2.1 Cl 6.5.3	Location on Site	BH15
Date Sampled	14/11/2019		0.4m
Sampled By	Thilina Wanasingha		
Date Tested	31/01/2020		
Att. Drying Method	Air Dried	Material Source	Disturbed
Atterberg Preparation	Dry Sieved	Material Type	Insitu
Material Description	Silty CLAY brown grey		

Atterberg Limits Results

Atterberg Limit	Specification Minimum	Test Result	Specification Maximum
Liquid Limit (%)		**29**	
Plastic Limit (%)		**12**	
Plasticity Index (%)		**17**	
Linear Shrinkage (%)			
Linear Shrinkage Defects:			



(AS1726 'A-Line' Graph Not Covered By NATA Endorsement)

Remarks

Approved Signatory: Darryl Pather
Form ID: W11Rep Rev 1

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Cardno Geosciences and Environment
ABN: 47 106 610 913

Address:
501 Swanston Street,
Melbourne VIC 3000

Laboratory: Geosciences and Environment
Phone: 03 8415 7777
Fax: 03 8415 7788
Email: Darryl.pather@cardno.com.au

ATTERBERG LIMITS REPORT

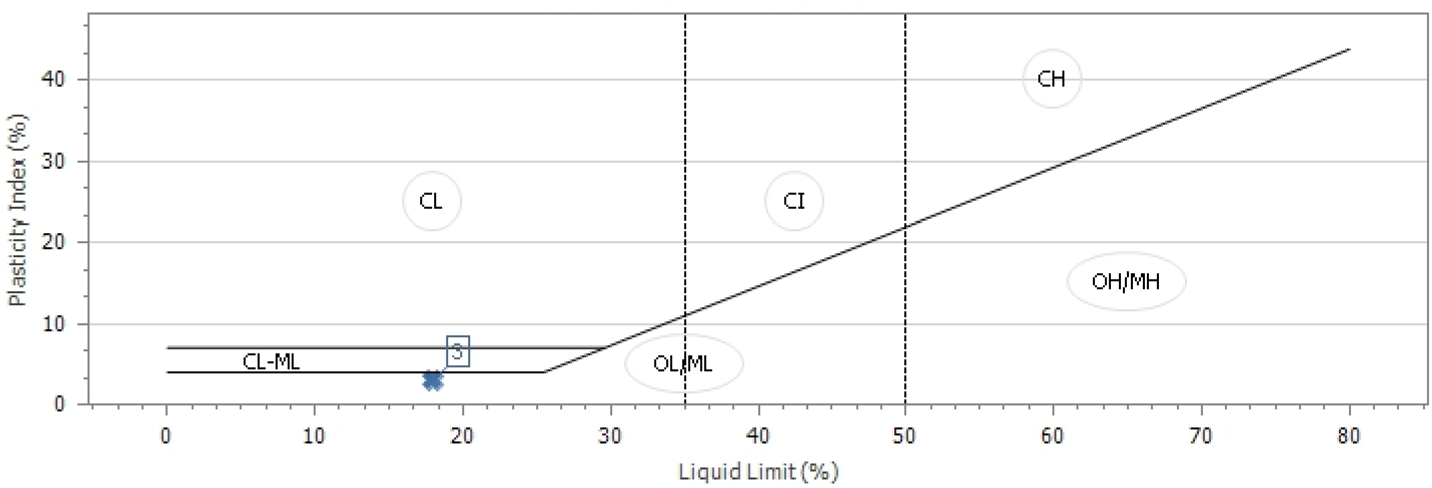
Client:	Cardno Victoria	Report Number:	3145/R/2060-1
Client Address:	501 Swanston Street, Melbourne	Project Number:	3145/P/490
Project:	Henty, Holbrook, Culcairn Levee investigation	Lot Number:	
Location:	Level 4, 501 Swanston Street, Melbourne	Internal Test Request:	3145/T/655
Supplied To:	n/a	Client Reference/s:	AWE200028
Area Description:		Report Date / Page:	21/04/2020 Page 22 of 29

Test Procedures:	AS1289.3.1.2, AS 1289.3.3.1, AS1289.3.2.1, AS1289.2.1.1		
Sample Number	3145/S/13092	Sample Location	
Sampling Method	AS1289.1.2.1 Cl 6.5.3	Location on Site	BH16
Date Sampled	13/11/2019		0.3m
Sampled By	Thilina Wanasingha		
Date Tested	24/01/2020		
Att. Drying Method	Air Dried	Material Source	Disturbed
Atterberg Preparation	Dry Sieved	Material Type	Insitu
Material Description	Sandy SILT pale brown		

Atterberg Limits Results

Atterberg Limit	Specification Minimum	Test Result	Specification Maximum
Liquid Limit (%)		**18**	
Plastic Limit (%)		**15**	
Plasticity Index (%)		**3**	
Linear Shrinkage (%)			
Linear Shrinkage Defects:			

Atterberg Limits 'A-Line' Graph



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Remarks

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Accreditation Number: 3145

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Cardno Geosciences and Environment
ABN: 47 106 610 913

Address:
501 Swanston Street,
Melbourne VIC 3000

Laboratory: Geosciences and Environment
Phone: 03 8415 7777
Fax: 03 8415 7788
Email: Darryl.pather@cardno.com.au

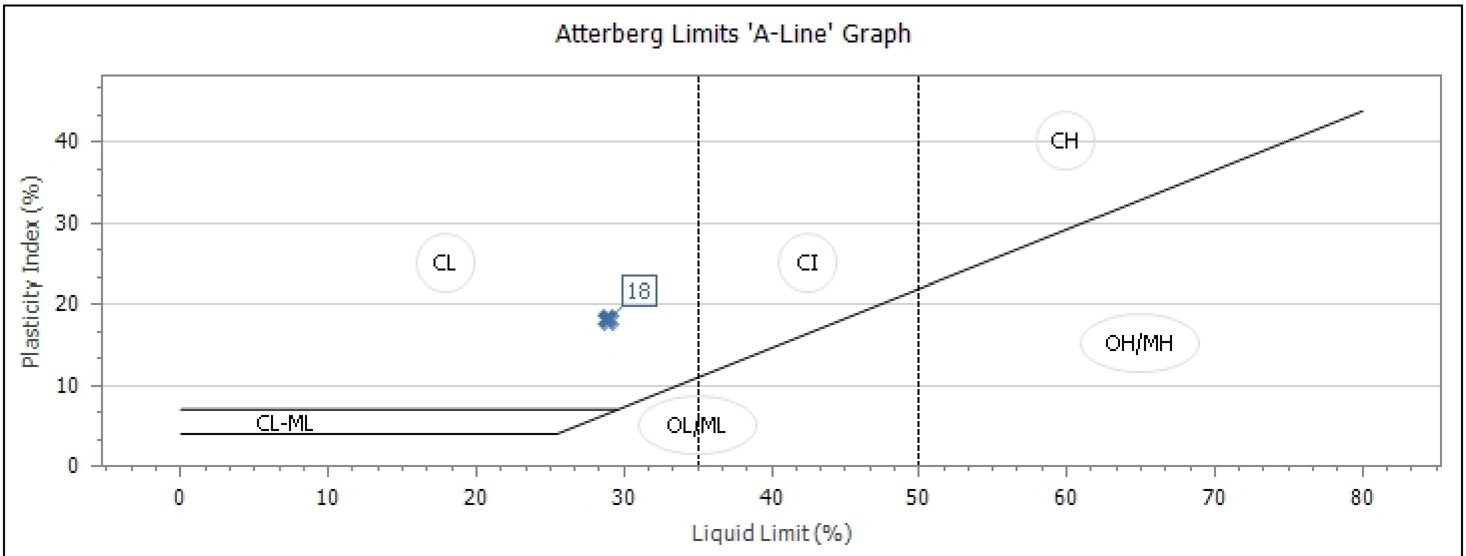
ATTERBERG LIMITS REPORT

Client:	Cardno Victoria	Report Number:	3145/R/2060-1
Client Address:	501 Swanston Street, Melbourne	Project Number:	3145/P/490
Project:	Henty, Holbrook, Culcairn Levee investigation	Lot Number:	
Location:	Level 4, 501 Swanston Street, Melbourne	Internal Test Request:	3145/T/655
Supplied To:	n/a	Client Reference/s:	AWE200028
Area Description:		Report Date / Page:	21/04/2020 Page 23 of 29

Test Procedures:	AS1289.3.1.2, AS 1289.3.3.1, AS1289.3.2.1, AS1289.2.1.1		
Sample Number	3145/S/13093	Sample Location	
Sampling Method	AS1289.1.2.1 Cl 6.5.3	Location on Site	BH16
Date Sampled	13/11/2019		0.6m
Sampled By	Thilina Wanasingha		
Date Tested	22/01/2020		
Att. Drying Method	Air Dried	Material Source	Disturbed
Atterberg Preparation	Dry Sieved	Material Type	Insitu
Material Description	Silty CLAY with sand orange brown mottled grey		

Atterberg Limits Results

Atterberg Limit	Specification Minimum	Test Result	Specification Maximum
Liquid Limit (%)		**29**	
Plastic Limit (%)		**11**	
Plasticity Index (%)		**18**	
Linear Shrinkage (%)			
Linear Shrinkage Defects:			



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Cardno Geosciences and Environment
ABN: 47 106 610 913

Address:
501 Swanston Street,
Melbourne VIC 3000

Laboratory: Geosciences and Environment
Phone: 03 8415 7777
Fax: 03 8415 7788
Email: Darryl.pather@cardno.com.au

ATTERBERG LIMITS REPORT

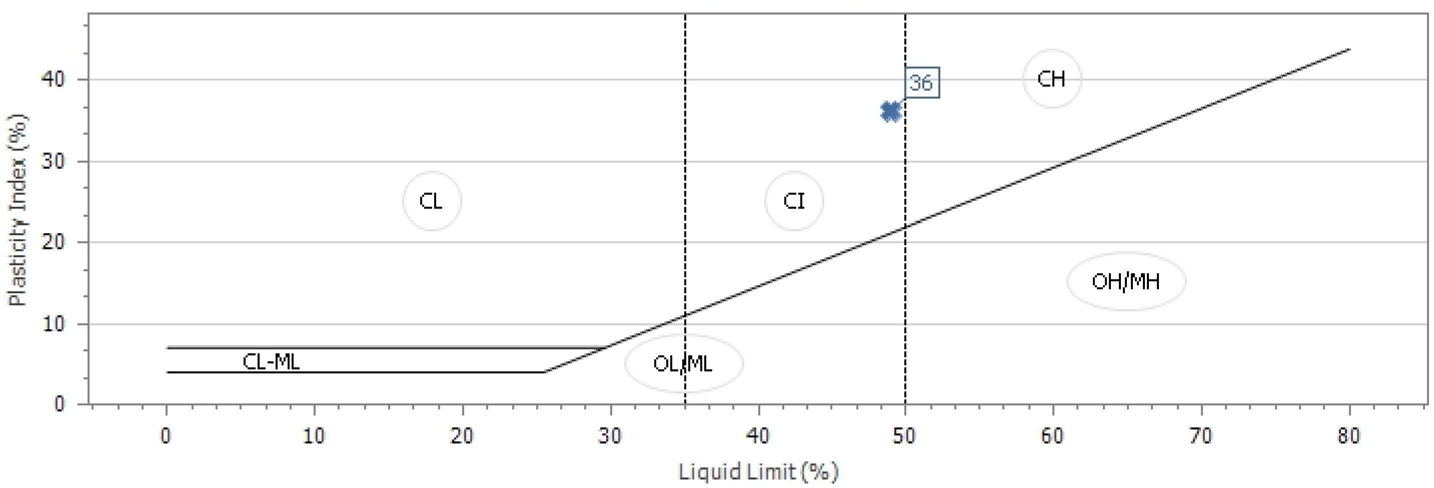
Client:	Cardno Victoria	Report Number:	3145/R/2060-1
Client Address:	501 Swanston Street, Melbourne	Project Number:	3145/P/490
Project:	Henty, Holbrook, Culcairn Levee investigation	Lot Number:	
Location:	Level 4, 501 Swanston Street, Melbourne	Internal Test Request:	3145/T/655
Supplied To:	n/a	Client Reference/s:	AWE200028
Area Description:		Report Date / Page:	21/04/2020 Page 24 of 29

Test Procedures:	AS1289.3.1.2, AS 1289.3.3.1, AS1289.3.2.1, AS1289.2.1.1		
Sample Number	3145/S/13096	Sample Location	
Sampling Method	AS1289.1.2.1 Cl 6.5.3	Location on Site	BH17
Date Sampled	13/11/2019		0.5m
Sampled By	Thilina Wanasingha		
Date Tested	29/01/2020		
Att. Drying Method	Air Dried	Material Source	Disturbed
Atterberg Preparation	Dry Sieved	Material Type	Insitu
Material Description	Silty CLAY trace sand dark brown orange mottled grey		

Atterberg Limits Results

Atterberg Limit	Specification Minimum	Test Result	Specification Maximum
Liquid Limit (%)		**49**	
Plastic Limit (%)		**13**	
Plasticity Index (%)		**36**	
Linear Shrinkage (%)			
Linear Shrinkage Defects:			

Atterberg Limits 'A-Line' Graph



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Remarks

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Cardno Geosciences and Environment
ABN: 47 106 610 913
Address:
501 Swanston Street,
Melbourne VIC 3000

Laboratory: Geosciences and Environment
Phone: 03 8415 7777
Fax: 03 8415 7788
Email: Darryl.pather@cardno.com.au

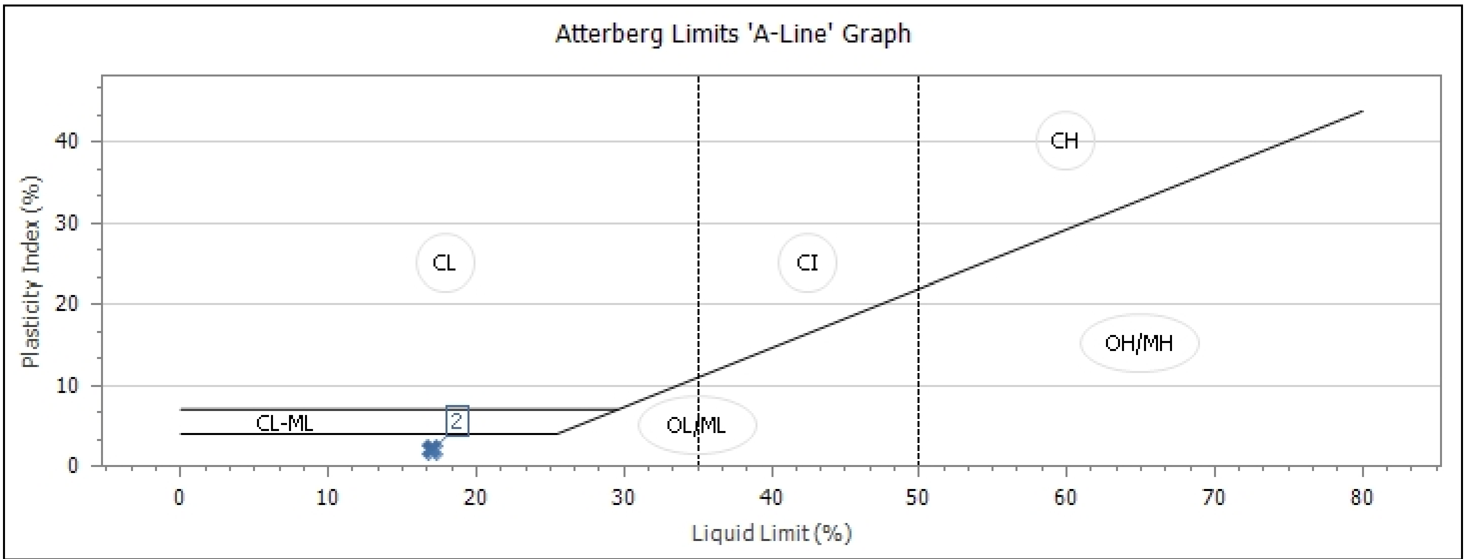
ATTERBERG LIMITS REPORT

Client:	Cardno Victoria	Report Number:	3145/R/2060-1
Client Address:	501 Swanston Street, Melbourne	Project Number:	3145/P/490
Project:	Henty, Holbrook, Culcairn Levee investigation	Lot Number:	
Location:	Level 4, 501 Swanston Street, Melbourne	Internal Test Request:	3145/T/655
Supplied To:	n/a	Client Reference/s:	AWE200028
Area Description:		Report Date / Page:	21/04/2020 Page 25 of 29

Test Procedures:	AS1289.3.1.2, AS 1289.3.3.1, AS1289.3.2.1, AS1289.2.1.1		
Sample Number	3145/S/13098	Sample Location	
Sampling Method	AS1289.1.2.1 Cl 6.5.3	Location on Site	BH18
Date Sampled	13/11/2019		0.3m
Sampled By	Thilina Wanasingha		
Date Tested	24/01/2020		
Att. Drying Method	Air Dried	Material Source	Disturbed
Atterberg Preparation	Dry Sieved	Material Type	Insitu
Material Description	Clay SILT pale brown to white		

Atterberg Limits Results

Atterberg Limit	Specification Minimum	Test Result	Specification Maximum
Liquid Limit (%)		**17**	
Plastic Limit (%)		**15**	
Plasticity Index (%)		**2**	
Linear Shrinkage (%)			
Linear Shrinkage Defects:			



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Remarks

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Accreditation Number: 3145

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Form ID: W11Rep Rev 1

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ABN: 47 106 610 913

Address:
501 Swanston Street,
Melbourne VIC 3000

Laboratory: Geosciences and Environment
Phone: 03 8415 7777
Fax: 03 8415 7788
Email: Darryl.pather@cardno.com.au

ATTERBERG LIMITS REPORT

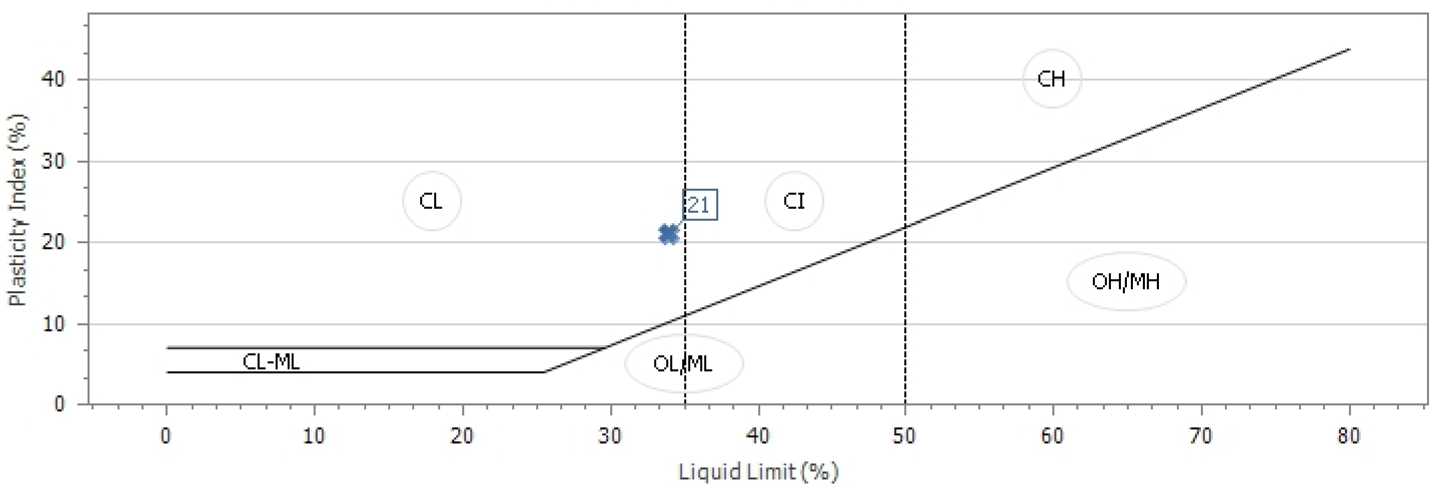
Client:	Cardno Victoria	Report Number:	3145/R/2060-1
Client Address:	501 Swanston Street, Melbourne	Project Number:	3145/P/490
Project:	Henty, Holbrook, Culcairn Levee investigation	Lot Number:	
Location:	Level 4, 501 Swanston Street, Melbourne	Internal Test Request:	3145/T/655
Supplied To:	n/a	Client Reference/s:	AWE200028
Area Description:		Report Date / Page:	21/04/2020 Page 26 of 29

Test Procedures:	AS1289.3.1.2, AS 1289.3.3.1, AS1289.3.2.1, AS1289.2.1.1		
Sample Number	3145/S/13100	Sample Location	
Sampling Method	AS1289.1.2.1 Cl 6.5.3	Location on Site	BH18
Date Sampled	13/11/2019		1.5m
Sampled By	Thilina Wanasingha		
Date Tested	21/01/2020		
Att. Drying Method	Air Dried	Material Source	Disturbed
Atterberg Preparation	Dry Sieved	Material Type	Insitu
Material Description	Silty CLAY trace sand brown mottled grey		

Atterberg Limits Results

Atterberg Limit	Specification Minimum	Test Result	Specification Maximum
Liquid Limit (%)		**34**	
Plastic Limit (%)		**13**	
Plasticity Index (%)		**21**	
Linear Shrinkage (%)			
Linear Shrinkage Defects:			

Atterberg Limits 'A-Line' Graph



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ABN: 47 106 610 913

Address:
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Melbourne VIC 3000

Laboratory: Geosciences and Environment
Phone: 03 8415 7777
Fax: 03 8415 7788
Email: Darryl.pather@cardno.com.au

ATTERBERG LIMITS REPORT

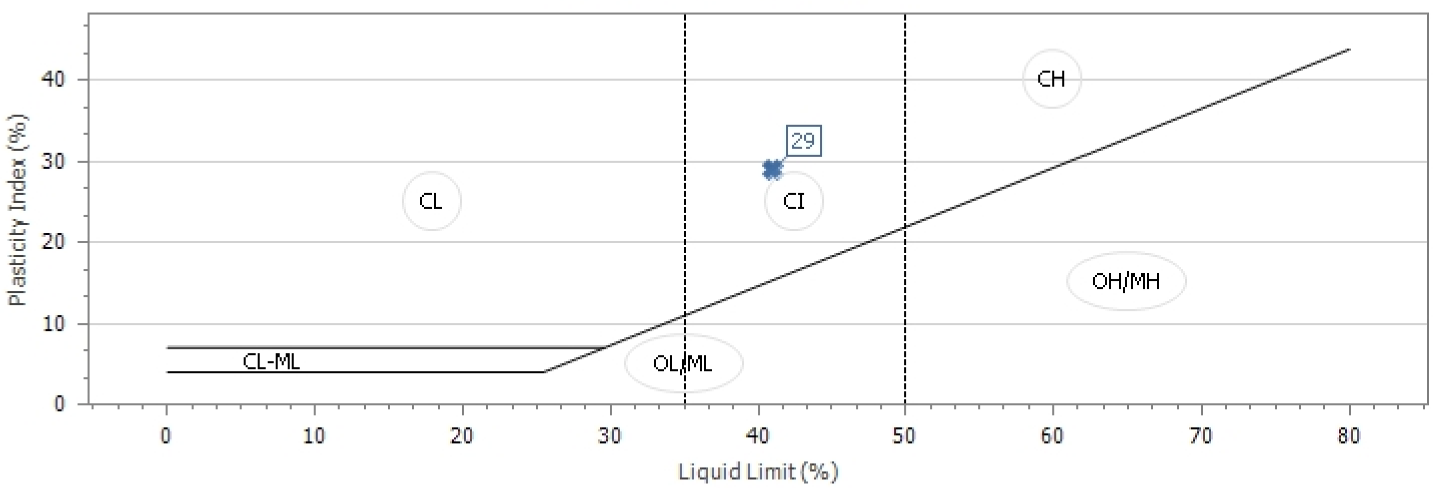
Client:	Cardno Victoria	Report Number:	3145/R/2060-1
Client Address:	501 Swanston Street, Melbourne	Project Number:	3145/P/490
Project:	Henty, Holbrook, Culcairn Levee investigation	Lot Number:	
Location:	Level 4, 501 Swanston Street, Melbourne	Internal Test Request:	3145/T/655
Supplied To:	n/a	Client Reference/s:	AWE200028
Area Description:		Report Date / Page:	21/04/2020 Page 27 of 29

Test Procedures:	AS1289.3.1.2, AS 1289.3.3.1, AS1289.3.2.1, AS1289.2.1.1		
Sample Number	3145/S/13101	Sample Location	
Sampling Method	AS1289.1.2.1 Cl 6.5.3	Location on Site	BH19
Date Sampled	13/11/2019		0.3m
Sampled By	Thilina Wanasingha		
Date Tested	7/02/2020		
Att. Drying Method	Air Dried	Material Source	Disturbed
Atterberg Preparation	Dry Sieved	Material Type	Insitu
Material Description	Silty CLAY brown mottled grey		

Atterberg Limits Results

Atterberg Limit	Specification Minimum	Test Result	Specification Maximum
Liquid Limit (%)		**41**	
Plastic Limit (%)		**12**	
Plasticity Index (%)		**29**	
Linear Shrinkage (%)			
Linear Shrinkage Defects:			

Atterberg Limits 'A-Line' Graph



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Address:
501 Swanston Street,
Melbourne VIC 3000

Laboratory: Geosciences and Environment
Phone: 03 8415 7777
Fax: 03 8415 7788
Email: Darryl.pather@cardno.com.au

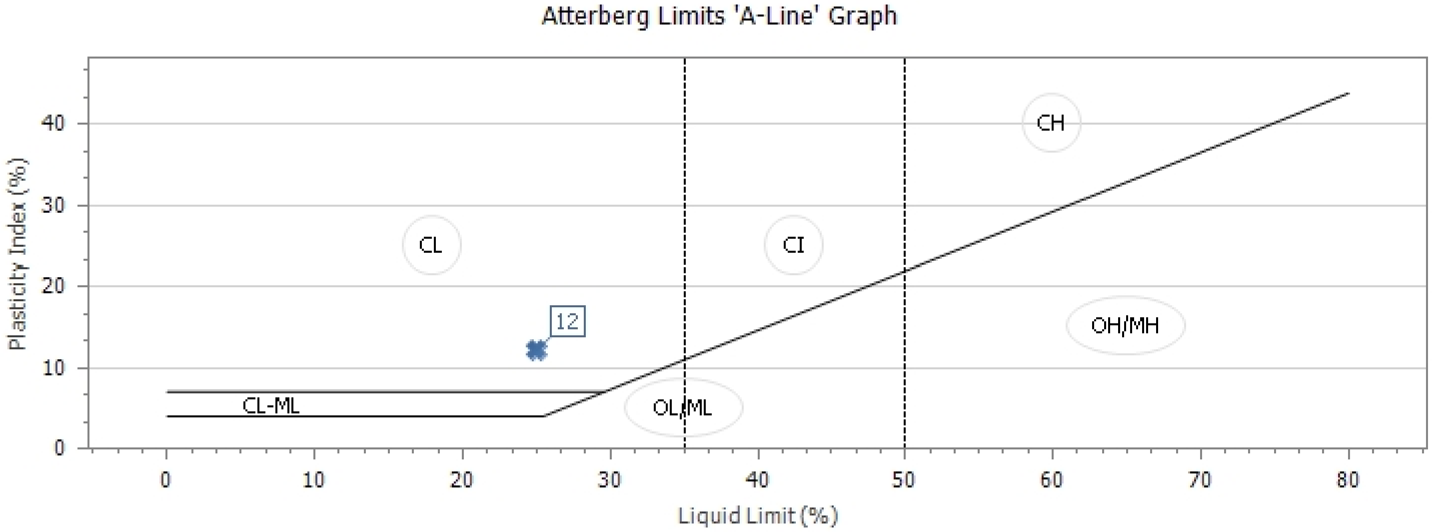
ATTERBERG LIMITS REPORT

Client:	Cardno Victoria	Report Number:	3145/R/2060-1
Client Address:	501 Swanston Street, Melbourne	Project Number:	3145/P/490
Project:	Henty, Holbrook, Culcairn Levee investigation	Lot Number:	
Location:	Level 4, 501 Swanston Street, Melbourne	Internal Test Request:	3145/T/655
Supplied To:	n/a	Client Reference/s:	AWE200028
Area Description:		Report Date / Page:	21/04/2020 Page 28 of 29

Test Procedures:	AS1289.3.1.2, AS 1289.3.3.1, AS1289.3.2.1, AS1289.2.1.1		
Sample Number	3145/S/13103	Sample Location	
Sampling Method	AS1289.1.2.1 Cl 6.5.3	Location on Site	BH20
Date Sampled	13/11/2019		0.2m
Sampled By	Thilina Wanasingha		
Date Tested	31/01/2020		
Att. Drying Method	Air Dried	Material Source	Disturbed
Atterberg Preparation	Dry Sieved	Material Type	Insitu
Material Description	Silty CLAY pale brown		

Atterberg Limits Results

Atterberg Limit	Specification Minimum	Test Result	Specification Maximum
Liquid Limit (%)		**25**	
Plastic Limit (%)		**13**	
Plasticity Index (%)		**12**	
Linear Shrinkage (%)			
Linear Shrinkage Defects:			



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ABN: 47 106 610 913

Address:
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Melbourne VIC 3000

Laboratory: Geosciences and Environment
Phone: 03 8415 7777
Fax: 03 8415 7788
Email: Darryl.pather@cardno.com.au

ATTERBERG LIMITS REPORT

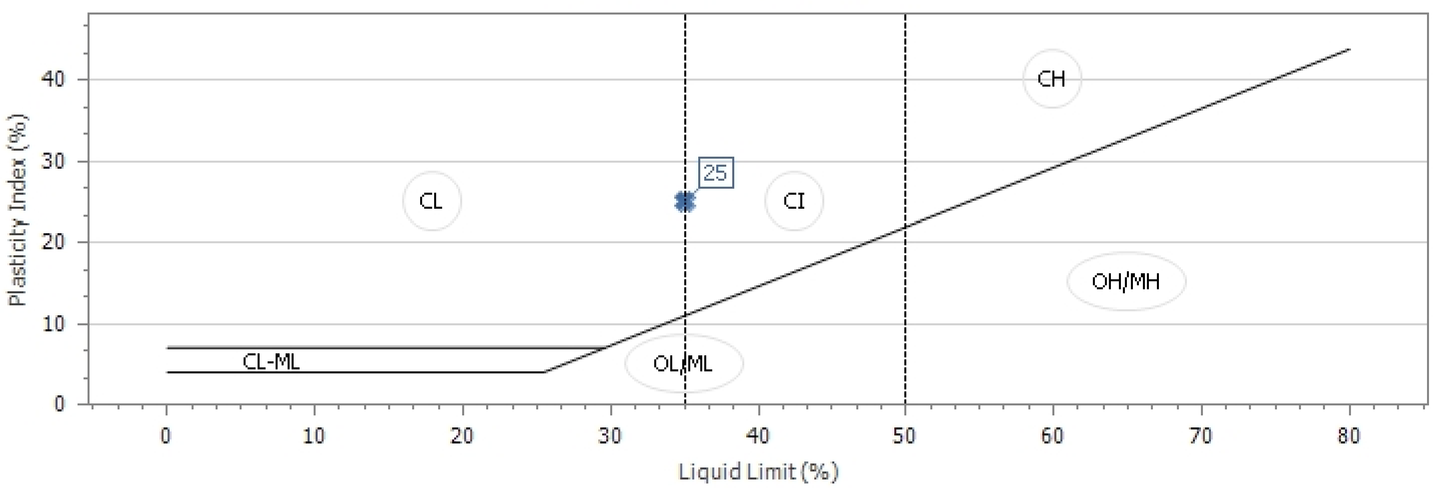
Client:	Cardno Victoria	Report Number:	3145/R/2060-1
Client Address:	501 Swanston Street, Melbourne	Project Number:	3145/P/490
Project:	Henty, Holbrook, Culcairn Levee investigation	Lot Number:	
Location:	Level 4, 501 Swanston Street, Melbourne	Internal Test Request:	3145/T/655
Supplied To:	n/a	Client Reference/s:	AWE200028
Area Description:		Report Date / Page:	21/04/2020 Page 29 of 29

Test Procedures:	AS1289.3.1.2, AS 1289.3.3.1, AS1289.3.2.1, AS1289.2.1.1		
Sample Number	3145/S/13104	Sample Location	
Sampling Method	AS1289.1.2.1 Cl 6.5.3	Location on Site	BH20
Date Sampled	13/11/2019		0.3m
Sampled By	Thilina Wanasingha		
Date Tested	4/02/2020		
Att. Drying Method	Air Dried	Material Source	Disturbed
Atterberg Preparation	Dry Sieved	Material Type	Insitu
Material Description	Silty CLAY brown mottled grey		

Atterberg Limits Results

Atterberg Limit	Specification Minimum	Test Result	Specification Maximum
Liquid Limit (%)		**35**	
Plastic Limit (%)		**10**	
Plasticity Index (%)		**25**	
Linear Shrinkage (%)			
Linear Shrinkage Defects:			

Atterberg Limits 'A-Line' Graph



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Cardno Geosciences and Environment
ABN: 47 106 610 913

Address:
501 Swanston Street,
Melbourne VIC 3000

Laboratory: Geosciences and Environment
Phone: 03 8415 7777
Fax: 03 8415 7788
Email: Darryl.pather@cardno.com.au

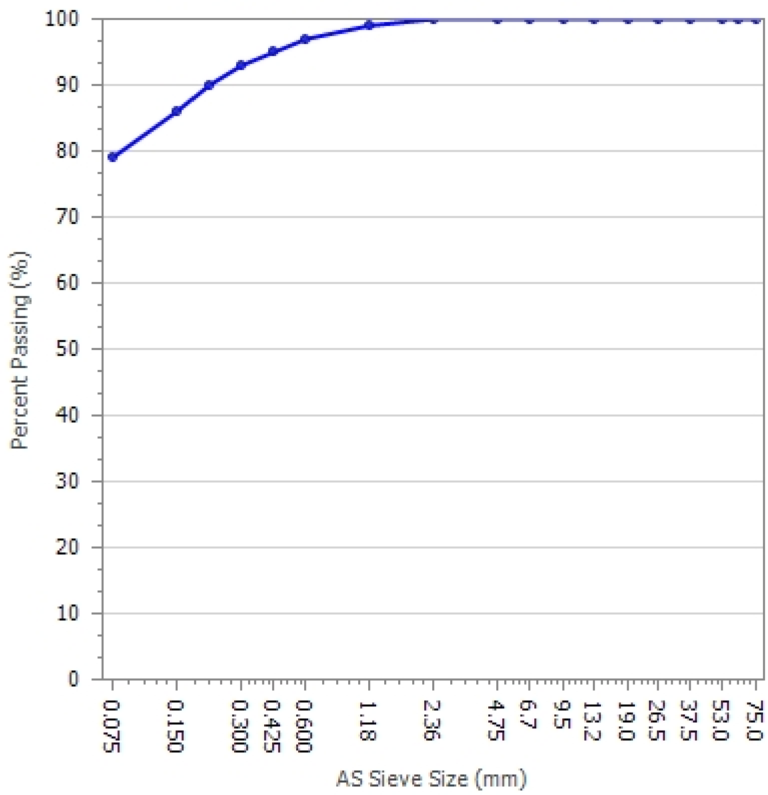
PARTICLE SIZE DISTRIBUTION REPORT

Client:	Cardno Victoria	Report Number:	3145/R/2059-1
Client Address:	501 Swanston Street, Melbourne	Project Number:	3145/P/490
Project:	Henty, Holbrook, Culcairn Levee investigation	Lot Number:	
Location:	Level 4, 501 Swanston Street, Melbourne	Internal Test Request:	3145/T/655
Supplied To:	n/a	Client Reference/s:	AWE200028
Area Description:		Report Date / Page:	17/02/2020 Page 1 of 1

Test Procedures:	AS1289.3.6.1		
Sample Number	3145/S/13067	Sample Location	
Sampling Method	AS1289.1.2.1 Cl 6.5.3	Location on Site	BH08
Date Sampled	12/11/2019		0.9-1.0m
Sampled By	Thilina Wanasingha		
Date Tested	5/02/2020		
Material Source	Disturbed	Material Type	Insitu

AS Sieve (mm)	Specification Minimum	**Percent Passing (%)**	Specification Maximum
75.0		**100**	
63.0		**100**	
53.0		**100**	
37.5		**100**	
26.5		**100**	
19.0		**100**	
13.2		**100**	
9.5		**100**	
6.7		**100**	
4.75		**100**	
2.36		**100**	
1.18		**99**	
0.600		**97**	
0.425		**95**	
0.300		**93**	
0.212		**90**	
0.150		**86**	
0.075		**79**	

PARTICLE SIZE DISTRIBUTION GRAPH



Remarks

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Accreditation Number: 3145

Approved Signatory: Darryl Pather
Form ID: W9Rep Rev 2

Cardno
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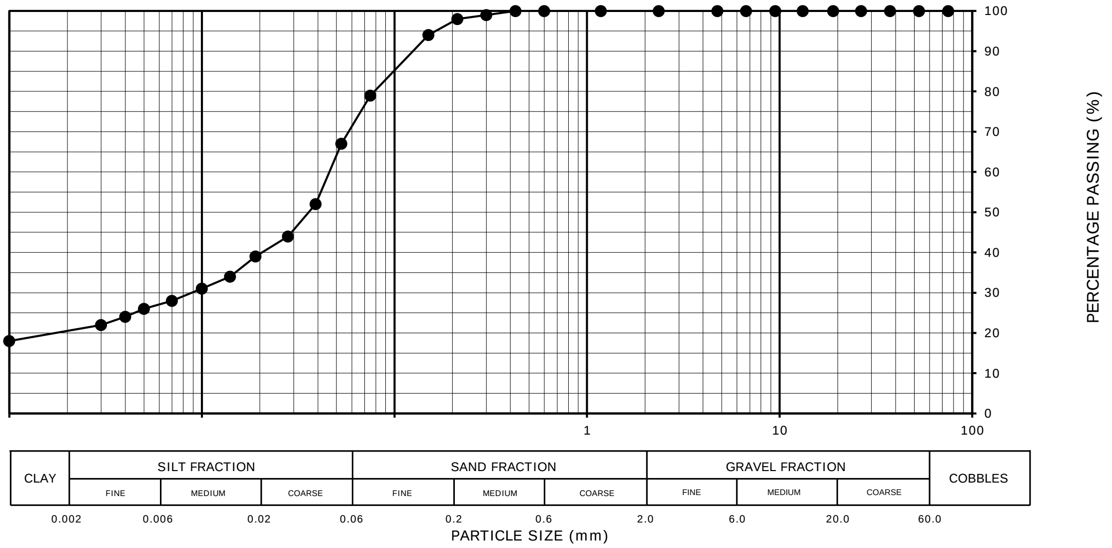
Level 4, 501 Swanston Street,
Melbourne, VIC 3000
Australia

Determination of Particle Size Distribution of a Soil
Standard Method of Analysis by Sieving and Hydrometer

Client :	**Cardno Victoria**	Report Number:	**AWE200028-1**
Client Address :	**501 Swanston Street, Melbourne VIC 3000, Australia**	Page Number :	**1 of 1**
		Report Date:	**10/02/2020**
Job Number :	**AWE200028**	Test Method :	**AS1289.3.6.1 AS1289.3.6.3**
Project :	**Henty, Holbrook, Culcairn Levee investigation**		
Location :	**Henty, Holbrook, Culcairn, NSW**		

Lab No:	**3145/S/13048**	Date Sampled:	**13/11/2019**
ID No :		Sample Method:	**AS1289.1.2.1.6.5.3**
Lot No :		BH / TP. No. :	**BH01**
Date Tested:	**18/12/2019**	Depth (m) :	**0.5**
Sample Total Dry Mass :	**75.3g**	Pretreatment Loss (%) :	**0**
Hydrometer Type :	**B5916**	Dispersion Methods :	**Sodium Hexametaphosphate**
Soil Description :	**Silty CLAY with Sand brown orange to pale brown**		
Remarks:			

Sieve Aperture (mm)	Percentage Passing of Total	Particle Diameter (µm)	Percentage Passing of Total
75	100	53	67
53	100	39	52
37.5	100	28	44
26.5	100	19	39
19	100	14	34
13.2	100	10	31
9.5	100	7	28
6.7	100	5	26
4.75	100	4	24
2.36	100	3	22
1.18	100	1	18
0.6	100		
0.425	100		
0.3	99		
0.212	98		
0.15	94		
0.075	79		



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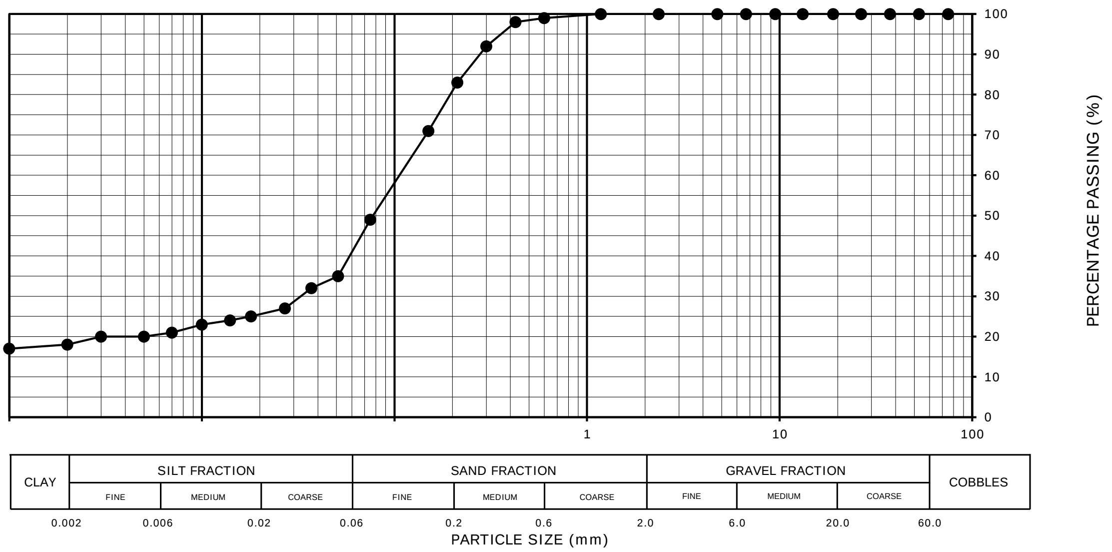
Level 4, 501 Swanston Street,
Melbourne, VIC 3000
Australia

Determination of Particle Size Distribution of a Soil
Standard Method of Analysis by Sieving and Hydrometer

Client :	**Cardno Victoria**	Report Number:	**AWE200028-2**
Client Address :	**501 Swanston Street, Melbourne VIC 3000, Australia**	Page Number :	**1 of 1**
		Report Date:	**11/02/2020**
Job Number :	**AWE200028**	Test Method :	**AS1289.3.6.1 AS1289.3.6.3**
Project :	**Henty, Holbrook, Culcairn Levee investigation**		
Location :	**Henty, Holbrook, Culcairn, NSW**		

Lab No:	**3145/S/13049**	Date Sampled:	**13/11/2019**
ID No :		Sample Method:	**AS1289.1.2.1.6.5.3**
Lot No :		BH / TP. No. :	**BH02**
Date Tested:	**18/12/2019**	Depth (m) :	**0.2-0.4**
Sample Total Dry Mass :	**127.5g**	Pretreatment Loss (%) :	**0**
Hydrometer Type :	**B5916**	Dispersion Methods :	**Sodium Hexametaphosphate**
Soil Description :	**Sandy Clayey SILT dark brown to brown**		
Remarks:			

Sieve Aperture (mm)	Percentage Passing of Total	Particle Diameter (µm)	Percentage Passing of Total
75	100	51	35
53	100	37	32
37.5	100	27	27
26.5	100	18	25
19	100	14	24
13.2	100	10	23
9.5	100	7	21
6.7	100	5	20
4.75	100	3	20
2.36	100	2	18
1.18	100	1	17
0.6	99		
0.425	98		
0.3	92		
0.212	83		
0.15	71		
0.075	49		



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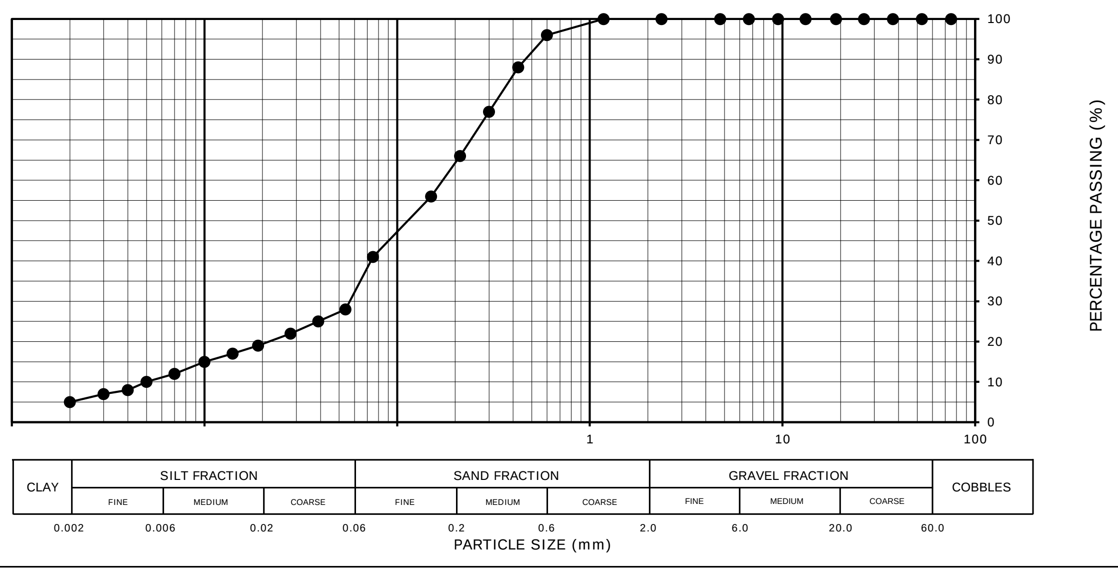
Determination of Particle Size Distribution of a Soil
Standard Method of Analysis by Sieving and Hydrometer

Client :	**Cardno Victoria**	Report Number:	**AWE200028-3**
Client Address :	**501 Swanston Street, Melbourne VIC 3000, Australia**	Page Number :	**1 of 1**
		Report Date:	**11/02/2020**
Job Number :	**AWE200028**	Test Method :	**AS1289.3.6.1** **AS1289.3.6.3**
Project :	**Henty, Holbrook, Culcairn Levee investigation**		
Location :	**Henty, Holbrook, Culcairn, NSW**		

Lab No:	**3145/S/13050**	Date Sampled:	**13/11/2019**
ID No :		Sample Method:	**AS1289.1.2.1.6.5.3**
Lot No :		BH / TP. No. :	**BH02**
Date Tested:	**18/12/2019**	Depth (m) :	**2.0**
Sample Total Dry Mass :	**117.4g**	Pretreatment Loss (%) :	**0**
Hydrometer Type :	**B5916**	Dispersion Methods :	**Sodium Hexametaphosphate**
Soil Description :	**Sandy SILT brown to grey**		
Remarks:			

Sieve Aperture (mm)	Percentage Passing of Total	Particle Diameter (µm)	Percentage Passing of Total
75	100	54	28
53	100	39	25
37.5	100	28	22
26.5	100	19	19
19	100	14	17
13.2	100	10	15
9.5	100	7	12
6.7	100	5	10
4.75	100	4	8
2.36	100	3	7
1.18	100	2	5
0.6	96		
0.425	88		
0.3	77		
0.212	66		
0.15	56		
0.075	41		



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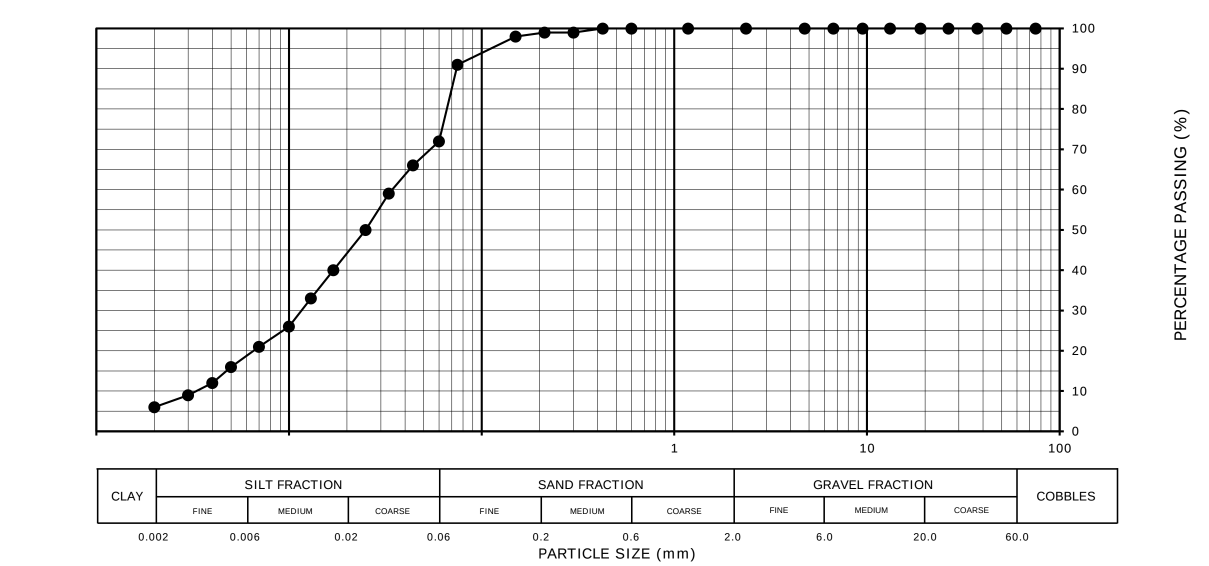
Determination of Particle Size Distribution of a Soil
Standard Method of Analysis by Sieving and Hydrometer

Client :	Cardno Victoria	Report Number:	AWE200028-4
Client Address :	501 Swanston Street, Melbourne VIC 3000, Australia	Page Number :	1 of 1
		Report Date:	12/02/2020
Job Number :	AWE200028	Test Method :	AS1289.3.6.1 AS1289.3.6.3
Project :	Henty, Holbrook, Culcairn Levee investigation		
Location :	Henty, Holbrook, Culcairn, NSW		

Lab No:	3145/S/13051	Date Sampled:	11/11/2019
ID No :		Sample Method:	AS1289.1.2.1.6.5.3
Lot No :		BH / TP. No. :	BH03
Date Tested:	19/12/2019	Depth (m) :	0.2-0.5
Sample Total Dry Mass :	105.7g	Pretreatment Loss (%) :	0
Hydrometer Type :	B5916	Dispersion Methods :	Sodium Hexametaphosphate
Soil Description :	Silty CLAY orange mottled brown		
Remarks:			

Sieve Aperture (mm)	Percentage Passing of Total	Particle Diameter (µm)	Percentage Passing of Total
75	100	60	72
53	100	44	66
37.5	100	33	59
26.5	100	25	50
19	100	17	40
13.2	100	13	33
9.5	100	10	26
6.7	100	7	21
4.75	100	5	16
2.36	100	4	12
1.18	100	3	9
0.6	100	2	6
0.425	100		
0.3	99		
0.212	99		
0.15	98		
0.075	91		



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NATA Accred No:3145	FORM NUMBER : 3145

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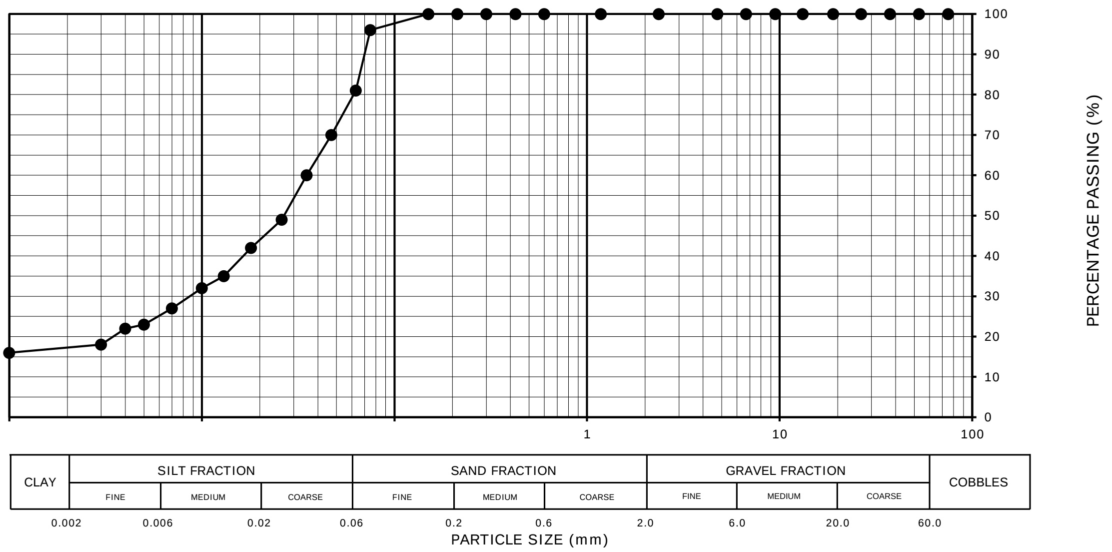
Determination of Particle Size Distribution of a Soil
Standard Method of Analysis by Sieving and Hydrometer

Client :	Cardno Victoria	Report Number:	AWE200028-5
Client Address :	501 Swanston Street, Melbourne VIC 3000, Australia	Page Number :	1 of 1
		Report Date:	12/02/2020
Job Number :	AWE200028	Test Method :	AS1289.3.6.1 AS1289.3.6.3
Project :	Henty, Holbrook, Culcairn Levee investigation		
Location :	Henty, Holbrook, Culcairn, NSW		

Lab No:	3145/S/13052	Date Sampled:	11/11/2019
ID No :		Sample Method:	AS1289.1.2.1.6.5.3
Lot No :		BH / TP. No. :	BH03
Date Tested:	19/12/2019	Depth (m) :	1.1-1.3
Sample Total Dry Mass :	100.4g	Pretreatment Loss (%) :	0
Hydrometer Type :	B5916	Dispersion Methods :	Sodium Hexametaphosphate
Soil Description :	Silty CLAY orange mottled brown		
Remarks:			

Sieve Aperture (mm)	Percentage Passing of Total	Particle Diameter (µm)	Percentage Passing of Total
75	100	63	81
53	100	47	70
37.5	100	35	60
26.5	100	26	49
19	100	18	42
13.2	100	13	35
9.5	100	10	32
6.7	100	7	27
4.75	100	5	23
2.36	100	4	22
1.18	100	3	18
0.6	100	1	16
0.425	100		
0.3	100		
0.212	100		
0.15	100		
0.075	96		



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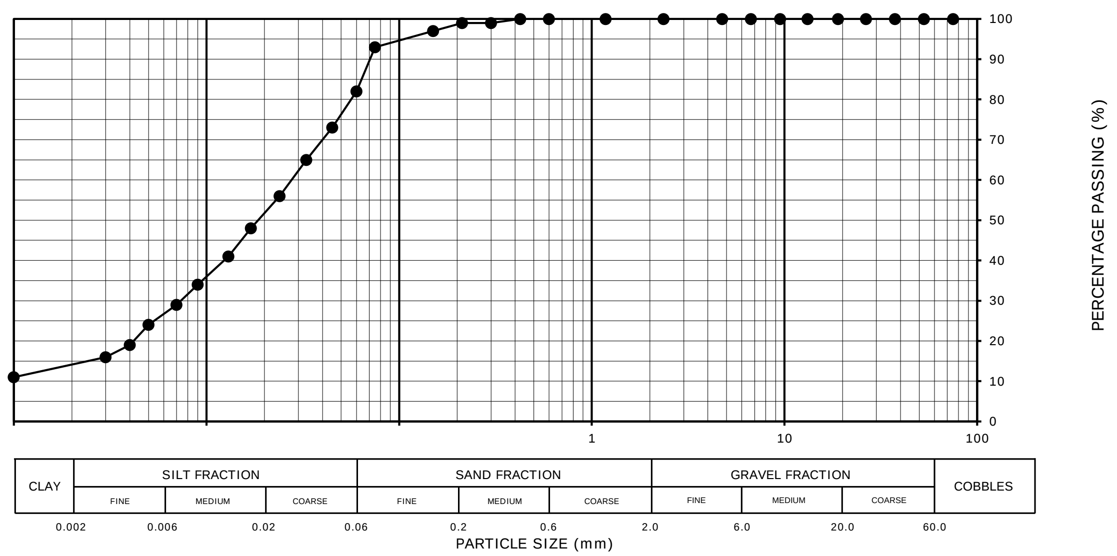
Determination of Particle Size Distribution of a Soil
Standard Method of Analysis by Sieving and Hydrometer

Client :	**Cardno Victoria**	Report Number:	**AWE200028-6**
Client Address :	**501 Swanston Street, Melbourne VIC 3000, Australia**	Page Number :	**1 of 1**
		Report Date:	**12/02/2020**
Job Number :	**AWE200028**	Test Method :	**AS1289.3.6.1 AS1289.3.6.3**
Project :	**Henty, Holbrook, Culcairn Levee investigation**		
Location :	**Henty, Holbrook, Culcairn, NSW**		

Lab No:	**3145/S/13054**	Date Sampled:	**11/11/2019**
ID No :		Sample Method:	**AS1289.1.2.1.6.5.3**
Lot No :		BH / TP. No. :	**BH04**
Date Tested:	**19/12/2019**	Depth (m) :	**0.2-0.4**
Sample Total Dry Mass :	**111.6g**	Pretreatment Loss (%) :	**0**
Hydrometer Type :	**B5916**	Dispersion Methods :	**Sodium Hexametaphosphate**
Soil Description :	**Silty CLAY orange**		
Remarks:			

Sieve Aperture (mm)	Percentage Passing of Total	Particle Diameter (µm)	Percentage Passing of Total
75	100	60	82
53	100	45	73
37.5	100	33	65
26.5	100	24	56
19	100	17	48
13.2	100	13	41
9.5	100	9	34
6.7	100	7	29
4.75	100	5	24
2.36	100	4	19
1.18	100	3	16
0.6	100	1	11
0.425	100		
0.3	99		
0.212	99		
0.15	97		
0.075	93		



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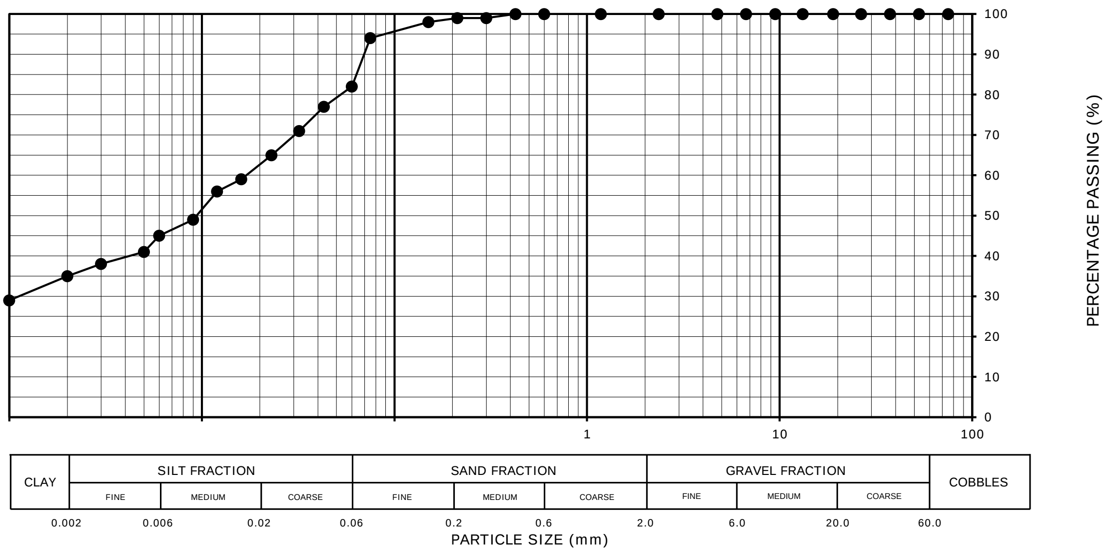
Determination of Particle Size Distribution of a Soil
Standard Method of Analysis by Sieving and Hydrometer

Client :	**Cardno Victoria**	Report Number:	**AWE200028-7**
Client Address :	**501 Swanston Street, Melbourne VIC 3000, Australia**	Page Number :	**1 of 1**
		Report Date:	**12/02/2020**
Job Number :	**AWE200028**	Test Method :	**AS1289.3.6.1 AS1289.3.6.3**
Project :	**Henty, Holbrook, Culcairn Levee investigation**		
Location :	**Henty, Holbrook, Culcairn, NSW**		

Lab No:	**3145/S/13055**	Date Sampled:	**11/11/2019**
ID No :		Sample Method:	**AS1289.1.2.1.6.5.3**
Lot No :		BH / TP. No. :	**BH04**
Date Tested:	**20/01/2020**	Depth (m) :	**1.7-1.9**
Sample Total Dry Mass :	**116.5g**	Pretreatment Loss (%) :	**0**
Hydrometer Type :	**B5916**	Dispersion Methods :	**Sodium Hexametaphosphate**
Soil Description :	**Silty CLAY pale brown & orange**		
Remarks:			

Sieve Aperture (mm)	Percentage Passing of Total	Particle Diameter (µm)	Percentage Passing of Total
75	100	60	82
53	100	43	77
37.5	100	32	71
26.5	100	23	65
19	100	16	59
13.2	100	12	56
9.5	100	9	49
6.7	100	6	45
4.75	100	5	41
2.36	100	3	38
1.18	100	2	35
0.6	100	1	29
0.425	100		
0.3	99		
0.212	99		
0.15	98		
0.075	94		



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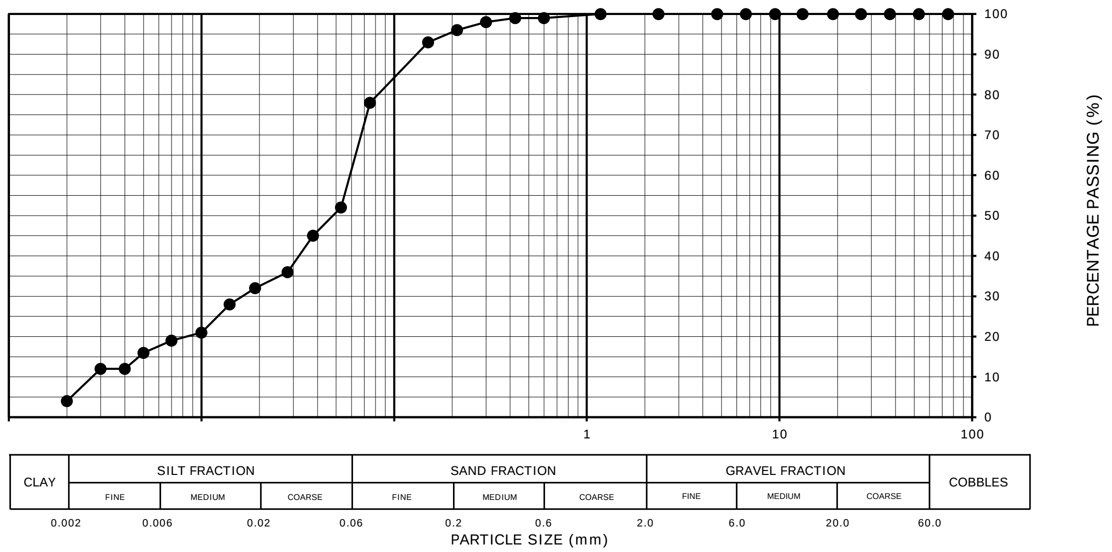
Determination of Particle Size Distribution of a Soil
Standard Method of Analysis by Sieving and Hydrometer

Client :	**Cardno Victoria**	Report Number:	**AWE200028-8**
Client Address :	**501 Swanston Street, Melbourne VIC 3000, Australia**	Page Number :	**1 of 1**
		Report Date:	**12/02/2020**
Job Number :	**AWE200028**	Test Method :	**AS1289.3.6.1 AS1289.3.6.3**
Project :	**Henty, Holbrook, Culcairn Levee investigation**		
Location :	**Henty, Holbrook, Culcairn, NSW**		

Lab No:	**3145/S/13057**	Date Sampled:	**11/11/2019**
ID No :		Sample Method:	**AS1289.1.2.1.6.5.3**
Lot No :		BH / TP. No. :	**BH05**
Date Tested:	**15/01/2020**	Depth (m) :	**1.4-1.6**
Sample Total Dry Mass :	**156.3g**	Pretreatment Loss (%) :	**0**
Hydrometer Type :	**B5916**	Dispersion Methods :	**Sodium Hexametaphosphate**
Soil Description :	**SILT with Sand pale brown mottled grey**		
Remarks:			

Sieve Aperture (mm)	Percentage Passing of Total	Particle Diameter (µm)	Percentage Passing of Total
75	100	53	52
53	100	38	45
37.5	100	28	36
26.5	100	19	32
19	100	14	28
13.2	100	10	21
9.5	100	7	19
6.7	100	5	16
4.75	100	4	12
2.36	100	3	12
1.18	100	2	4
0.6	99		
0.425	99		
0.3	98		
0.212	96		
0.15	93		
0.075	78		



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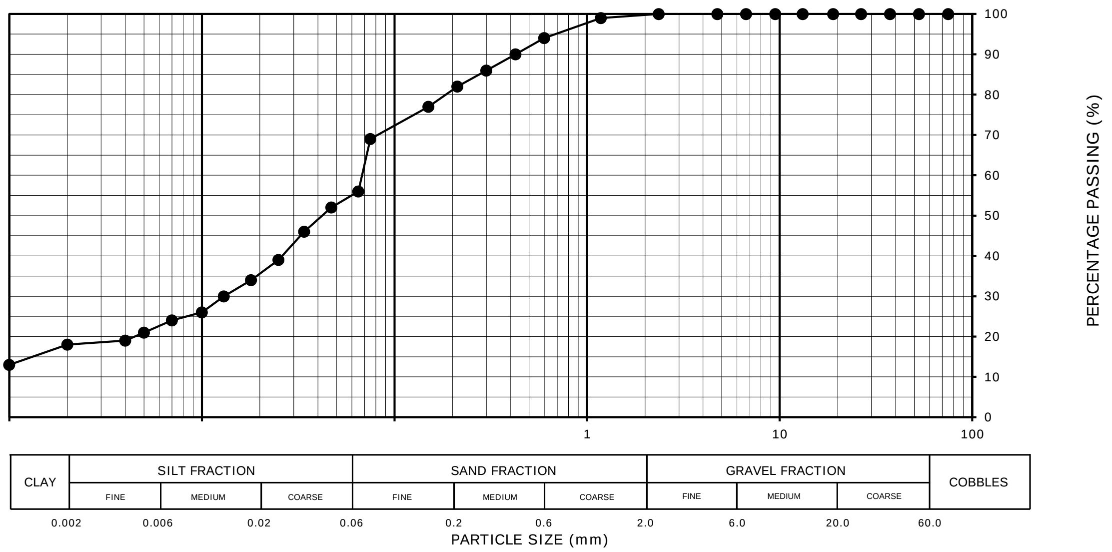
Determination of Particle Size Distribution of a Soil
Standard Method of Analysis by Sieving and Hydrometer

Client :	**Cardno Victoria**	Report Number:	**AWE200028-9**
Client Address :	**501 Swanston Street, Melbourne VIC 3000, Australia**	Page Number :	**1 of 1**
		Report Date:	**12/02/2020**
Job Number :	**AWE200028**	Test Method :	**AS1289.3.6.1** **AS1289.3.6.3**
Project :	**Henty, Holbrook, Culcairn Levee investigation**		
Location :	**Henty, Holbrook, Culcairn, NSW**		

Lab No:	**3145/S/13058**	Date Sampled:	**11/11/2019**
ID No :		Sample Method:	**AS1289.1.2.1.6.5.3**
Lot No :		BH / TP. No. :	**BH05**
Date Tested:	**15/01/2020**	Depth (m) :	**2.1-2.4**
Sample Total Dry Mass :	**120.9g**	Pretreatment Loss (%) :	**0**
Hydrometer Type :	**B5916**	Dispersion Methods :	**Sodium Hexametaphosphate**
Soil Description :	**Silty Sandy CLAY dark brown mottled grey**		
Remarks:			

Sieve Aperture (mm)	Percentage Passing of Total	Particle Diameter (µm)	Percentage Passing of Total
75	100	65	56
53	100	47	52
37.5	100	34	46
26.5	100	25	39
19	100	18	34
13.2	100	13	30
9.5	100	10	26
6.7	100	7	24
4.75	100	5	21
2.36	100	4	19
1.18	99	2	18
0.6	94	1	13
0.425	90		
0.3	86		
0.212	82		
0.15	77		
0.075	69		



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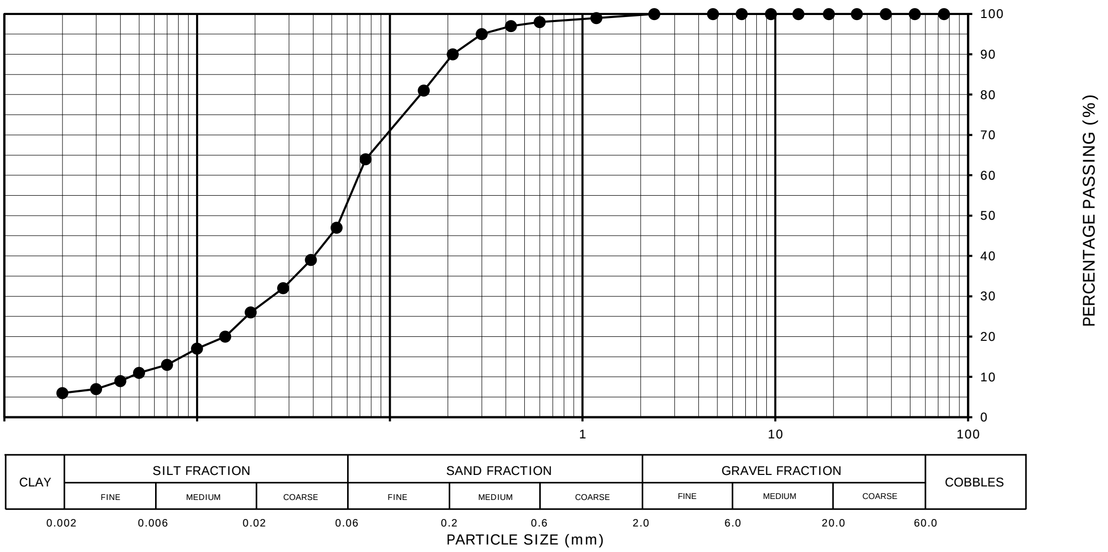
Determination of Particle Size Distribution of a Soil
Standard Method of Analysis by Sieving and Hydrometer

Client :	Cardno Victoria	Report Number:	AWE200028-10
Client Address :	501 Swanston Street, Melbourne VIC 3000, Australia	Page Number :	1 of 1
		Report Date:	12/02/2020
Job Number :	AWE200028	Test Method :	AS1289.3.6.1 AS1289.3.6.3
Project :	Henty, Holbrook, Culcairn Levee investigation		
Location :	Henty, Holbrook, Culcairn, NSW		

Lab No:	3145/S/13059	Date Sampled:	12/11/2019
ID No :		Sample Method:	AS1289.1.2.1.6.5.3
Lot No :		BH / TP. No. :	BH06
Date Tested:	10/02/2020	Depth (m) :	2.1-2.3
Sample Total Dry Mass :	222g	Pretreatment Loss (%) :	0
Hydrometer Type :	B5916	Dispersion Methods :	Sodium Hexametaphosphate
Soil Description :	Sandy SILT with Clay grey mottled brown		
Remarks:			

Sieve Aperture (mm)	Percentage Passing of Total	Particle Diameter (µm)	Percentage Passing of Total
75	100	53	47
53	100	39	39
37.5	100	28	32
26.5	100	19	26
19	100	14	20
13.2	100	10	17
9.5	100	7	13
6.7	100	5	11
4.75	100	4	9
2.36	100	3	7
1.18	99	2	6
0.6	98		
0.425	97		
0.3	95		
0.212	90		
0.15	81		
0.075	64		



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Determination of Particle Size Distribution of a Soil
Standard Method of Analysis by Sieving and Hydrometer

Client :	Cardno Victoria	Report Number:	AWE200028-11
Client Address :	501 Swanston Street, Melbourne VIC 3000, Australia	Page Number :	1 of 1
		Report Date:	13/02/2020
Job Number :	AWE200028	Test Method :	AS1289.3.6.1 AS1289.3.6.3
Project :	Henty, Holbrook, Culcairn Levee investigation		
Location :	Henty, Holbrook, Culcairn, NSW		

Lab No:	3145/S/13063	Date Sampled:	12/11/2019
ID No :		Sample Method:	AS1289.1.2.1.6.5.3
Lot No :		BH / TP. No. :	BH07
Date Tested:	4/02/2020	Depth (m) :	0.2-0.5
Sample Total Dry Mass :	213.2g	Pretreatment Loss (%) :	0
Hydrometer Type :	B5916	Dispersion Methods :	Sodium Hexametaphosphate
Soil Description :	SILT with Sand pale brown		
Remarks:			

Sieve Aperture (mm)	Percentage Passing of Total	Particle Diameter (µm)	Percentage Passing of Total
75	100	66	66
53	100	49	58
37.5	100	36	49
26.5	100	27	38
19	100	19	30
13.2	100	14	24
9.5	99	10	19
6.7	99	7	14
4.75	99	5	11
2.36	98	4	8
1.18	98	3	8
0.6	96	2	4
0.425	94		
0.3	92		
0.212	89		
0.15	86		
0.075	78		

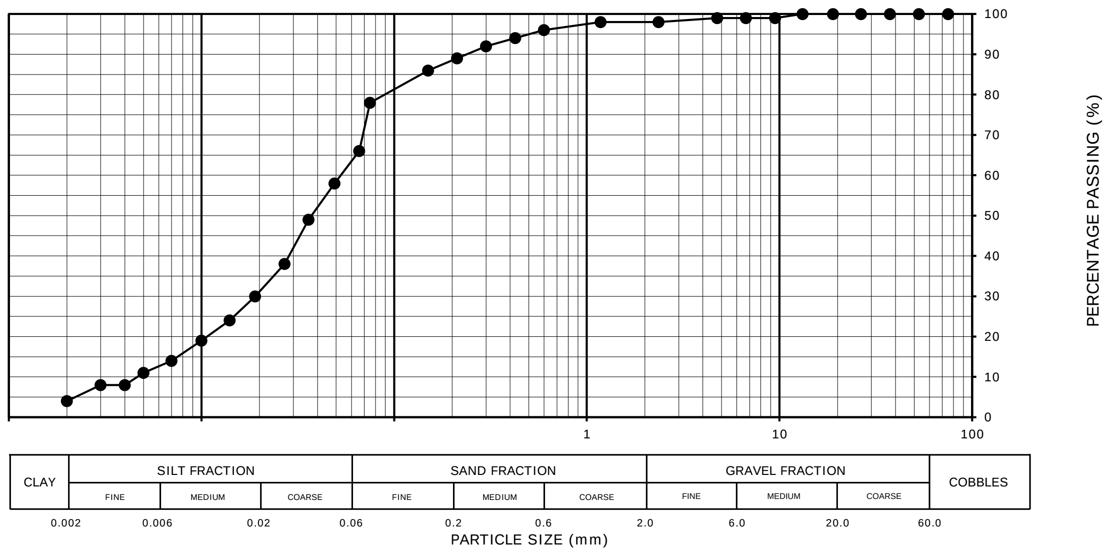

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FIGURE NUMBER

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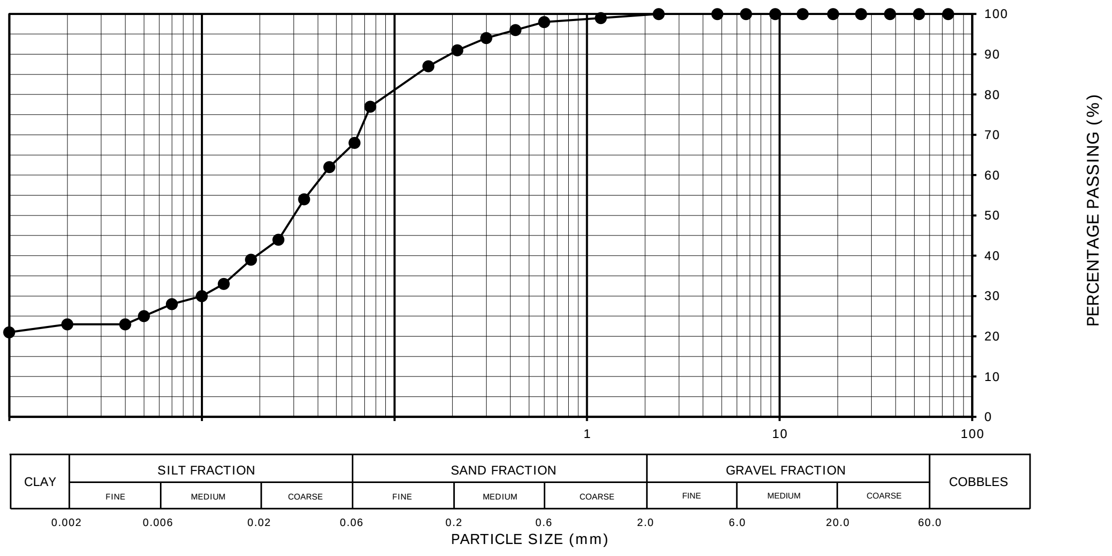
Determination of Particle Size Distribution of a Soil
Standard Method of Analysis by Sieving and Hydrometer

Client :	**Cardno Victoria**	Report Number:	**AWE200028-12**
Client Address :	**501 Swanston Street, Melbourne VIC 3000, Australia**	Page Number :	**1 of 1**
		Report Date:	**13/02/2020**
Job Number :	**AWE200028**	Test Method :	**AS1289.3.6.1 AS1289.3.6.3**
Project :	**Henty, Holbrook, Culcairn Levee investigation**		
Location :	**Henty, Holbrook, Culcairn, NSW**		

Lab No:	**3145/S/13064**	Date Sampled:	**12/11/2019**
ID No :		Sample Method:	**AS1289.1.2.1.6.5.3**
Lot No :		BH / TP. No. :	**BH07**
Date Tested:	**3/02/2020**	Depth (m) :	**0.7-1.0**
Sample Total Dry Mass :	**208.9g**	Pretreatment Loss (%) :	**0**
Hydrometer Type :	**B5916**	Dispersion Methods :	**Sodium Hexametaphosphate**
Soil Description :	**Silty CLAY with Sand pale brown**		
Remarks:			

Sieve Aperture (mm)	Percentage Passing of Total	Particle Diameter (µm)	Percentage Passing of Total
75	100	62	68
53	100	46	62
37.5	100	34	54
26.5	100	25	44
19	100	18	39
13.2	100	13	33
9.5	100	10	30
6.7	100	7	28
4.75	100	5	25
2.36	100	4	23
1.18	99	2	23
0.6	98	1	21
0.425	96		
0.3	94		
0.212	91		
0.15	87		
0.075	77		



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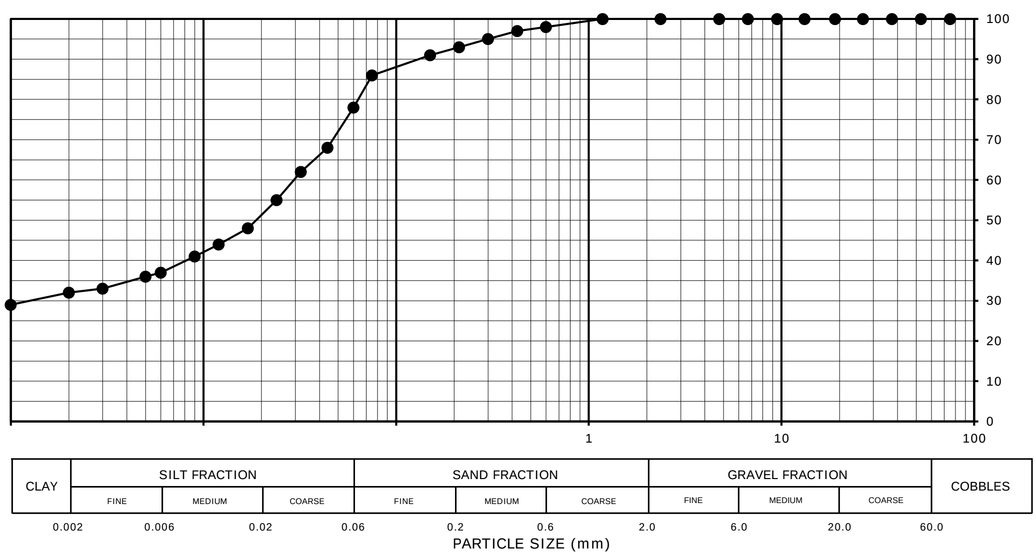
Determination of Particle Size Distribution of a Soil
Standard Method of Analysis by Sieving and Hydrometer

Client :	**Cardno Victoria**	Report Number:	**AWE200028-13**
Client Address :	**501 Swanston Street, Melbourne VIC 3000, Australia**	Page Number :	**1 of 1**
		Report Date:	**13/02/2020**
Job Number :	**AWE200028**	Test Method :	**AS1289.3.6.1 AS1289.3.6.3**
Project :	**Henty, Holbrook, Culcairn Levee investigation**		
Location :	**Henty, Holbrook, Culcairn, NSW**		

Lab No:	**3145/S/13071**	Date Sampled:	**12/11/2019**
ID No :		Sample Method:	**AS1289.1.2.1.6.5.3**
Lot No :		BH / TP. No. :	**BH09**
Date Tested:	**11/02/2020**	Depth (m) :	**0.8**
Sample Total Dry Mass :	**156.3g**	Pretreatment Loss (%) :	**0**
Hydrometer Type :	**B5916**	Dispersion Methods :	**Sodium Hexametaphosphate**
Soil Description :	**Silty CLAY trace Sand brown orange & grey**		
Remarks:			

Sieve Aperture (mm)	Percentage Passing of Total	Particle Diameter (µm)	Percentage Passing of Total
75	100	60	78
53	100	44	68
37.5	100	32	62
26.5	100	24	55
19	100	17	48
13.2	100	12	44
9.5	100	9	41
6.7	100	6	37
4.75	100	5	36
2.36	100	3	33
1.18	100	2	32
0.6	98	1	29
0.425	97		
0.3	95		
0.212	93		
0.15	91		
0.075	86		



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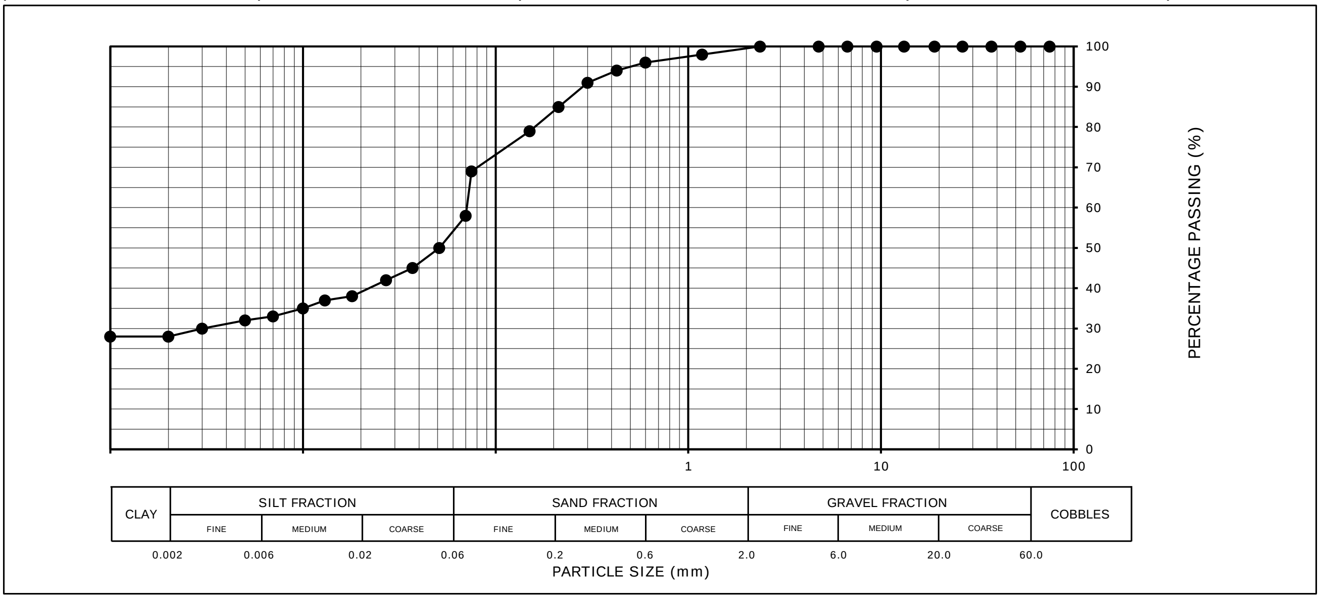
Determination of Particle Size Distribution of a Soil
Standard Method of Analysis by Sieving and Hydrometer

Client :	**Cardno Victoria**	Report Number:	**AWE200028-14**
Client Address :	**501 Swanston Street, Melbourne VIC 3000, Australia**	Page Number :	**1 of 1**
		Report Date:	**13/02/2020**
Job Number :	**AWE200028**	Test Method :	**AS1289.3.6.1** **AS1289.3.6.3**
Project :	**Henty, Holbrook, Culcairn Levee investigation**		
Location :	**Henty, Holbrook, Culcairn, NSW**		

Lab No:	**3145/S/13074**	Date Sampled:	**12/11/2019**
ID No :		Sample Method:	**AS1289.1.2.1.6.5.3**
Lot No :		BH / TP. No. :	**BH10**
Date Tested:	**3/02/2020**	Depth (m) :	**0.6-0.7**
Sample Total Dry Mass :	**130.1g**	Pretreatment Loss (%) :	**0**
Hydrometer Type :	**B5916**	Dispersion Methods :	**Sodium Hexametaphosphate**
Soil Description :	**Sandy Silty CLAY red mottled brown grey**		
Remarks:			

Sieve Aperture (mm)	Percentage Passing of Total	Particle Diameter (µm)	Percentage Passing of Total
75	100	70	58
53	100	51	50
37.5	100	37	45
26.5	100	27	42
19	100	18	38
13.2	100	13	37
9.5	100	10	35
6.7	100	7	33
4.75	100	5	32
2.36	100	3	30
1.18	98	2	28
0.6	96	1	28
0.425	94		
0.3	91		
0.212	85		
0.15	79		
0.075	69		



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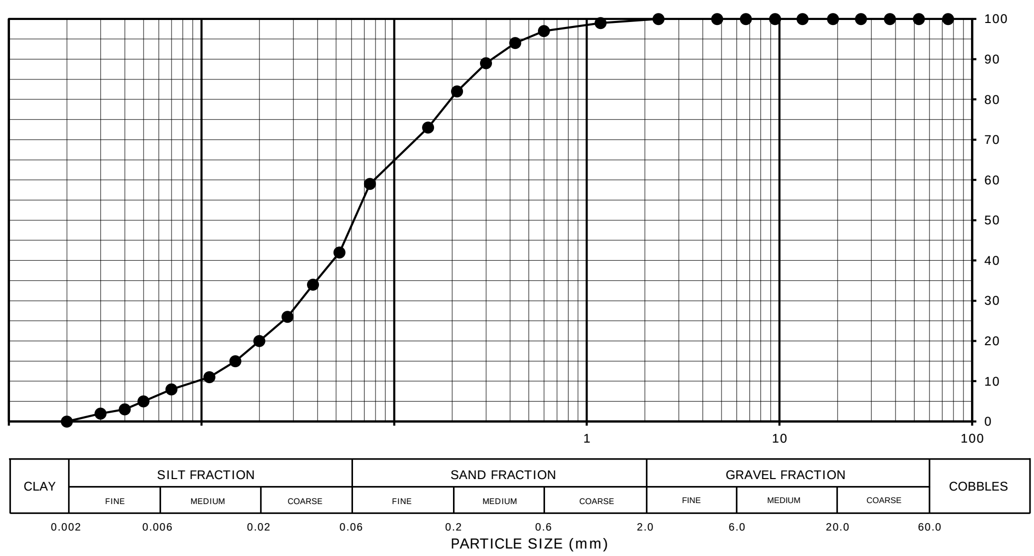
Determination of Particle Size Distribution of a Soil
Standard Method of Analysis by Sieving and Hydrometer

Client :	**Cardno Victoria**	Report Number:	**AWE200028-15**
Client Address :	**501 Swanston Street, Melbourne VIC 3000, Australia**	Page Number :	**1 of 1**
		Report Date:	**13/02/2020**
Job Number :	**AWE200028**	Test Method :	**AS1289.3.6.1 AS1289.3.6.3**
Project :	**Henty, Holbrook, Culcairn Levee investigation**		
Location :	**Henty, Holbrook, Culcairn, NSW**		

Lab No:	**3145/S/13075**	Date Sampled:	**12/11/2019**
ID No :		Sample Method:	**AS1289.1.2.1.6.5.3**
Lot No :		BH / TP. No. :	**BH10**
Date Tested:	**21/01/2020**	Depth (m) :	**0.2-0.4**
Sample Total Dry Mass :	**135g**	Pretreatment Loss (%) :	**0**
Hydrometer Type :	**B5916**	Dispersion Methods :	**Sodium Hexametaphosphate**
Soil Description :	**Sandy SILT pale brown**		
Remarks:			

Sieve Aperture (mm)	Percentage Passing of Total	Particle Diameter (µm)	Percentage Passing of Total
75	100	52	42
53	100	38	34
37.5	100	28	26
26.5	100	20	20
19	100	15	15
13.2	100	11	11
9.5	100	7	8
6.7	100	5	5
4.75	100	4	3
2.36	100	3	2
1.18	99	2	0
0.6	97		
0.425	94		
0.3	89		
0.212	82		
0.15	73		
0.075	59		



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	NATA Accred No:3145	FORM NUMBER : 3145

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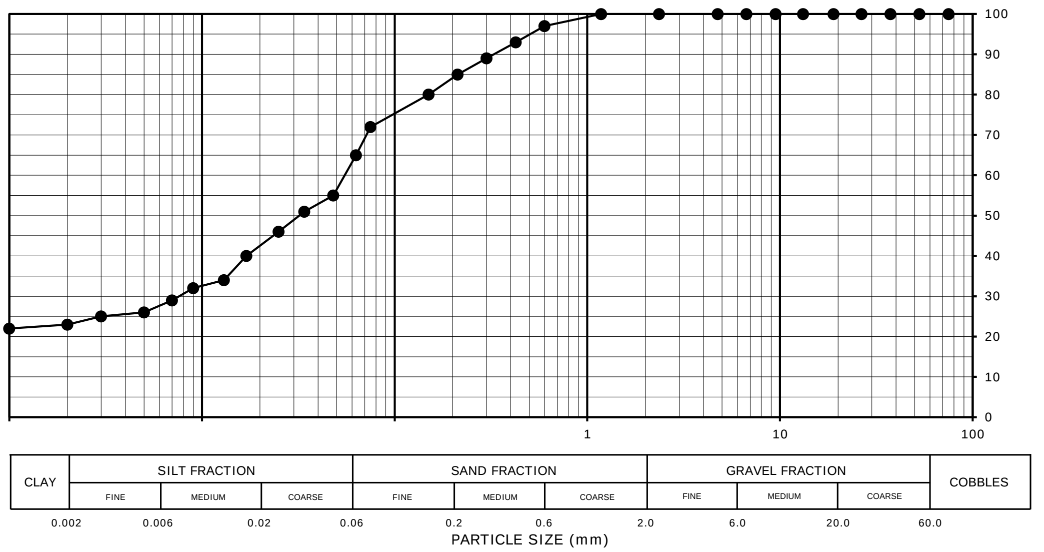
Determination of Particle Size Distribution of a Soil
Standard Method of Analysis by Sieving and Hydrometer

Client :	**Cardno Victoria**	Report Number:	**AWE200028-16**
Client Address :	**501 Swanston Street, Melbourne VIC 3000, Australia**	Page Number :	**1 of 1**
		Report Date:	**13/02/2020**
Job Number :	**AWE200028**	Test Method :	**AS1289.3.6.1 AS1289.3.6.3**
Project :	**Henty, Holbrook, Culcairn Levee investigation**		
Location :	**Henty, Holbrook, Culcairn, NSW**		

Lab No:	**3145/S/13076**	Date Sampled:	**12/11/2019**
ID No :		Sample Method:	**AS1289.1.2.1.6.5.3**
Lot No :		BH / TP. No. :	**BH11**
Date Tested:	**21/01/2020**	Depth (m) :	**0.9-1**
Sample Total Dry Mass :	**123g**	Pretreatment Loss (%) :	**0**
Hydrometer Type :	**B5916**	Dispersion Methods :	**Sodium Hexametaphosphate**
Soil Description :	**Silty CLAY with Sand brown & dark grey**		
Remarks:			

Sieve Aperture (mm)	Percentage Passing of Total	Particle Diameter (µm)	Percentage Passing of Total
75	100	63	65
53	100	48	55
37.5	100	34	51
26.5	100	25	46
19	100	17	40
13.2	100	13	34
9.5	100	9	32
6.7	100	7	29
4.75	100	5	26
2.36	100	3	25
1.18	100	2	23
0.6	97	1	22
0.425	93		
0.3	89		
0.212	85		
0.15	80		
0.075	72		



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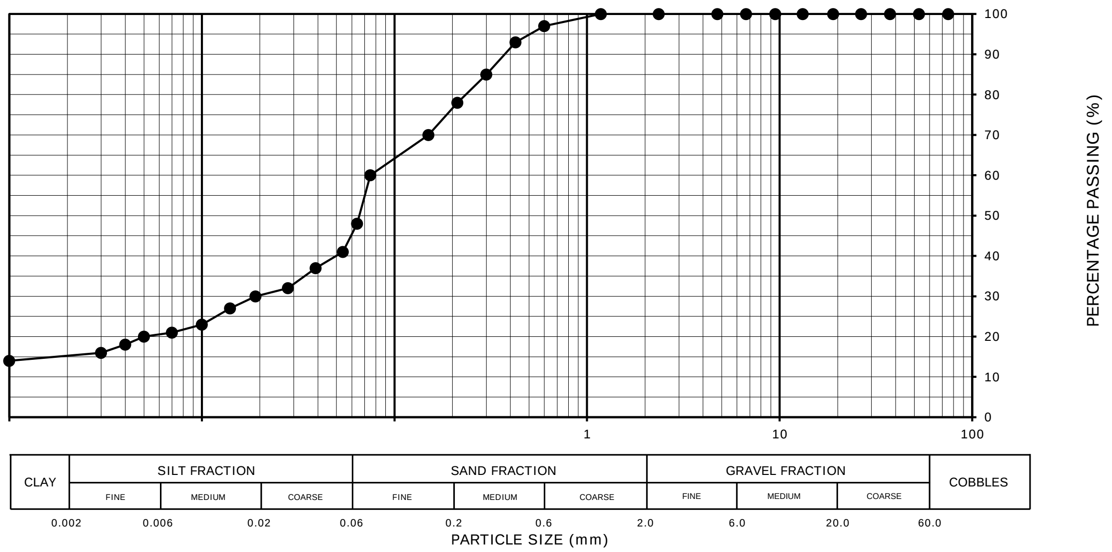
Determination of Particle Size Distribution of a Soil
Standard Method of Analysis by Sieving and Hydrometer

Client :	**Cardno Victoria**	Report Number:	**AWE200028-17**
Client Address :	**501 Swanston Street, Melbourne VIC 3000, Australia**	Page Number :	**1 of 1**
		Report Date:	**13/02/2020**
Job Number :	**AWE200028**	Test Method :	**AS1289.3.6.1 AS1289.3.6.3**
Project :	**Henty, Holbrook, Culcairn Levee investigation**		
Location :	**Henty, Holbrook, Culcairn, NSW**		

Lab No:	**3145/S/13080**	Date Sampled:	**12/11/2019**
ID No :		Sample Method:	**AS1289.1.2.1.6.5.3**
Lot No :		BH / TP. No. :	**BH12**
Date Tested:	**10/02/2020**	Depth (m) :	**1.5**
Sample Total Dry Mass :	**184.6g**	Pretreatment Loss (%) :	**0**
Hydrometer Type :	**B5916**	Dispersion Methods :	**Sodium Hexametaphosphate**
Soil Description :	**Silty Sandy CLAY brown & grey**		
Remarks:			

Sieve Aperture (mm)	Percentage Passing of Total	Particle Diameter (µm)	Percentage Passing of Total
75	100	64	48
53	100	54	41
37.5	100	39	37
26.5	100	28	32
19	100	19	30
13.2	100	14	27
9.5	100	10	23
6.7	100	7	21
4.75	100	5	20
2.36	100	4	18
1.18	100	3	16
0.6	97	1	14
0.425	93		
0.3	85		
0.212	78		
0.15	70		
0.075	60		



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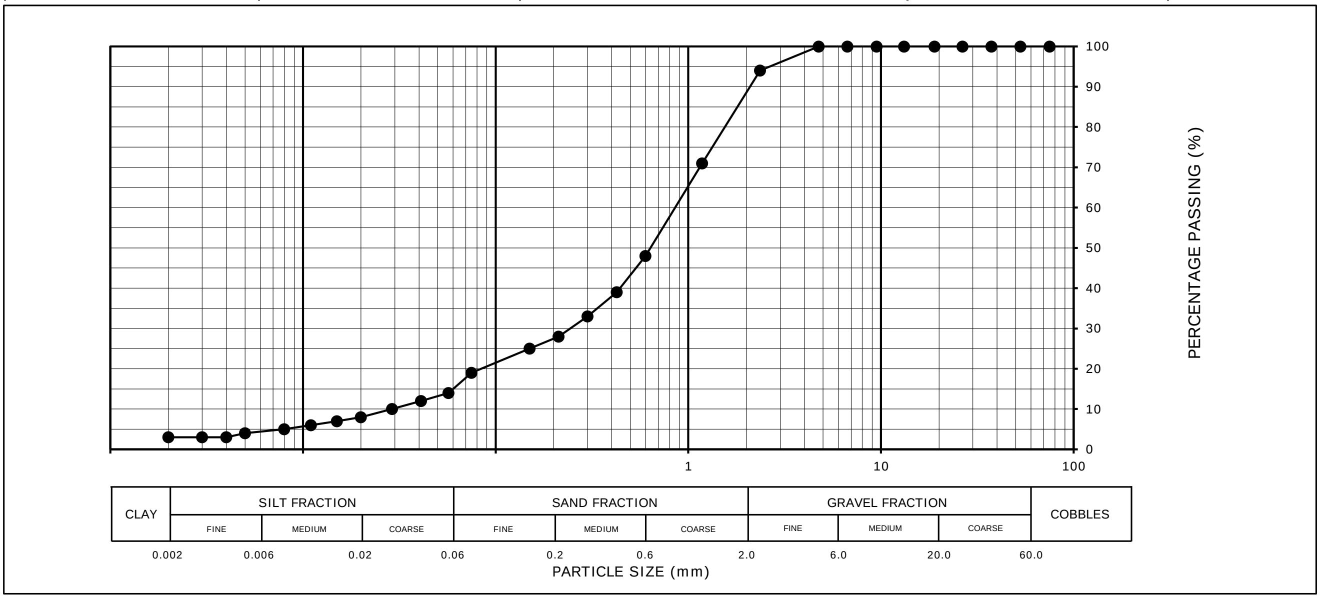
Determination of Particle Size Distribution of a Soil
Standard Method of Analysis by Sieving and Hydrometer

Client :	**Cardno Victoria**	Report Number:	**AWE200028-18**
Client Address :	**501 Swanston Street, Melbourne VIC 3000, Australia**	Page Number :	**1 of 1**
		Report Date:	**13/02/2020**
Job Number :	**AWE200028**	Test Method :	**AS1289.3.6.1 AS1289.3.6.3**
Project :	**Henty, Holbrook, Culcairn Levee investigation**		
Location :	**Henty, Holbrook, Culcairn, NSW**		

Lab No:	**3145/S/13081**	Date Sampled:	**12/11/2019**
ID No :		Sample Method:	**AS1289.1.2.1.6.5.3**
Lot No :		BH / TP. No. :	**BH12**
Date Tested:	**6/02/2020**	Depth (m) :	**3.2**
Sample Total Dry Mass :	**181.8g**	Pretreatment Loss (%) :	**0**
Hydrometer Type :	**B5916**	Dispersion Methods :	**Sodium Hexametaphosphate**
Soil Description :	**Silty SAND dark brown to brown**		
Remarks:			

Sieve Aperture (mm)	Percentage Passing of Total	Particle Diameter (µm)	Percentage Passing of Total
75	100	57	14
53	100	41	12
37.5	100	29	10
26.5	100	20	8
19	100	15	7
13.2	100	11	6
9.5	100	8	5
6.7	100	5	4
4.75	100	4	3
2.36	94	3	3
1.18	71	2	3
0.6	48		
0.425	39		
0.3	33		
0.212	28		
0.15	25		
0.075	19		



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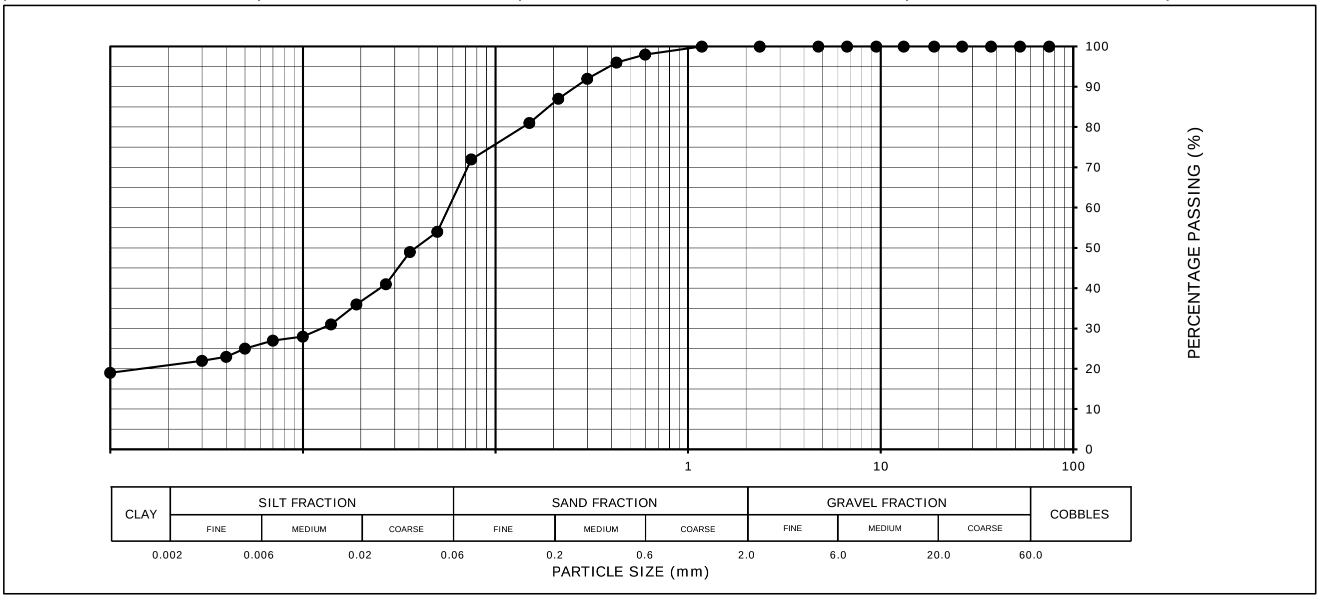
Determination of Particle Size Distribution of a Soil
Standard Method of Analysis by Sieving and Hydrometer

Client :	Cardno Victoria	Report Number:	AWE200028-19
Client Address :	501 Swanston Street, Melbourne VIC 3000, Australia	Page Number :	1 of 1
		Report Date:	13/02/2020
Job Number :	AWE200028	Test Method :	AS1289.3.6.1 AS1289.3.6.3
Project :	Henty, Holbrook, Culcairn Levee investigation		
Location :	Henty, Holbrook, Culcairn, NSW		

Lab No:	3145/S/13084	Date Sampled:	13/11/2019
ID No :		Sample Method:	AS1289.1.2.1.6.5.3
Lot No :		BH / TP. No. :	BH13
Date Tested:	6/02/2020	Depth (m) :	0.6
Sample Total Dry Mass :	191.9g	Pretreatment Loss (%) :	0
Hydrometer Type :	B5916	Dispersion Methods :	Sodium Hexametaphosphate
Soil Description :	Silty CLAY with Sand brown & grey		
Remarks:			

Sieve Aperture (mm)	Percentage Passing of Total	Particle Diameter (µm)	Percentage Passing of Total
75	100	50	54
53	100	36	49
37.5	100	27	41
26.5	100	19	36
19	100	14	31
13.2	100	10	28
9.5	100	7	27
6.7	100	5	25
4.75	100	4	23
2.36	100	3	22
1.18	100	1	19
0.6	98		
0.425	96		
0.3	92		
0.212	87		
0.15	81		
0.075	72		



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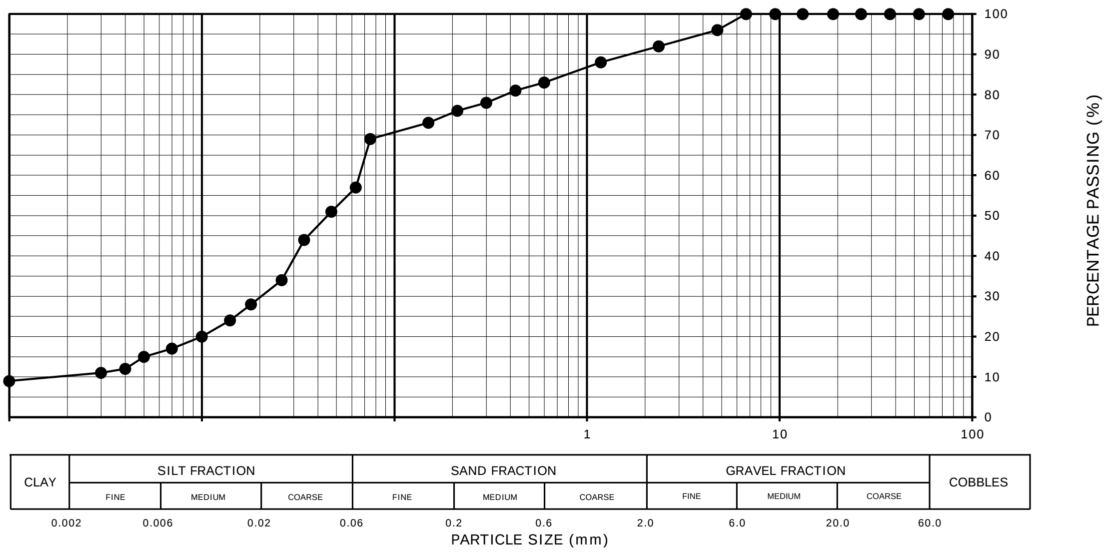
Determination of Particle Size Distribution of a Soil
Standard Method of Analysis by Sieving and Hydrometer

Client :	**Cardno Victoria**	Report Number:	**AWE200028-20**
Client Address :	**501 Swanston Street, Melbourne VIC 3000, Australia**	Page Number :	**1 of 1**
		Report Date:	**13/02/2020**
Job Number :	**AWE200028**	Test Method :	**AS1289.3.6.1** **AS1289.3.6.3**
Project :	**Henty, Holbrook, Culcairn Levee investigation**		
Location :	**Henty, Holbrook, Culcairn, NSW**		

Lab No:	**3145/S/13085**	Date Sampled:	**14/11/2019**
ID No :		Sample Method:	**AS1289.1.2.1.6.5.3**
Lot No :		BH / TP. No. :	**BH14**
Date Tested:	**21/01/2020**	Depth (m) :	**0.4**
Sample Total Dry Mass :	**88.1g**	Pretreatment Loss (%) :	**0**
Hydrometer Type :	**B5916**	Dispersion Methods :	**Sodium Hexametaphosphate**
Soil Description :	**Silty CLAY pale brown & grey**		
Remarks:			

Sieve Aperture (mm)	Percentage Passing of Total	Particle Diameter (µm)	Percentage Passing of Total
75	100	63	57
53	100	47	51
37.5	100	34	44
26.5	100	26	34
19	100	18	28
13.2	100	14	24
9.5	100	10	20
6.7	100	7	17
4.75	96	5	15
2.36	92	4	12
1.18	88	3	11
0.6	83	1	9
0.425	81		
0.3	78		
0.212	76		
0.15	73		
0.075	69		



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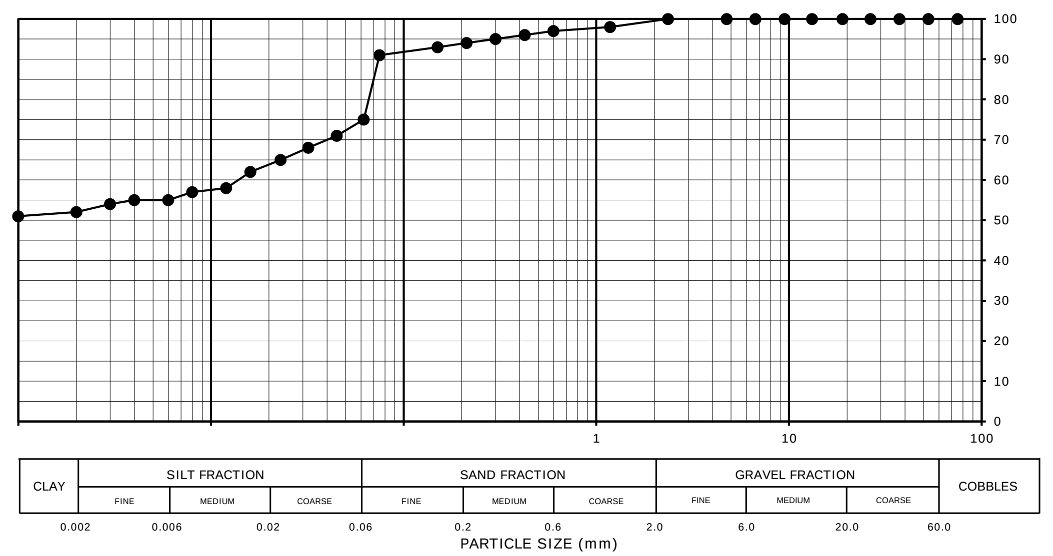
Determination of Particle Size Distribution of a Soil
Standard Method of Analysis by Sieving and Hydrometer

Client :	**Cardno Victoria**	Report Number:	**AWE200028-21**
Client Address :	**501 Swanston Street, Melbourne VIC 3000, Australia**	Page Number :	**1 of 1**
		Report Date:	**13/02/2020**
Job Number :	**AWE200028**	Test Method :	**AS1289.3.6.1** **AS1289.3.6.3**
Project :	**Henty, Holbrook, Culcairn Levee investigation**		
Location :	**Henty, Holbrook, Culcairn, NSW**		

Lab No:	**3145/S/13086**	Date Sampled:	**14/11/2019**
ID No :		Sample Method:	**AS1289.1.2.1.6.5.3**
Lot No :		BH / TP. No. :	**BH14**
Date Tested:	**11/02/2020**	Depth (m) :	**0.6**
Sample Total Dry Mass :	**116.1g**	Pretreatment Loss (%) :	**0**
Hydrometer Type :	**B5916**	Dispersion Methods :	**Sodium Hexametaphosphate**
Soil Description :	**Silty CLAY dark brown orange mottled brown**		
Remarks:			

Sieve Aperture (mm)	Percentage Passing of Total	Particle Diameter (µm)	Percentage Passing of Total
75	100	62	75
53	100	45	71
37.5	100	32	68
26.5	100	23	65
19	100	16	62
13.2	100	12	58
9.5	100	8	57
6.7	100	6	55
4.75	100	4	55
2.36	100	3	54
1.18	98	2	52
0.6	97	1	51
0.425	96		
0.3	95		
0.212	94		
0.15	93		
0.075	91		



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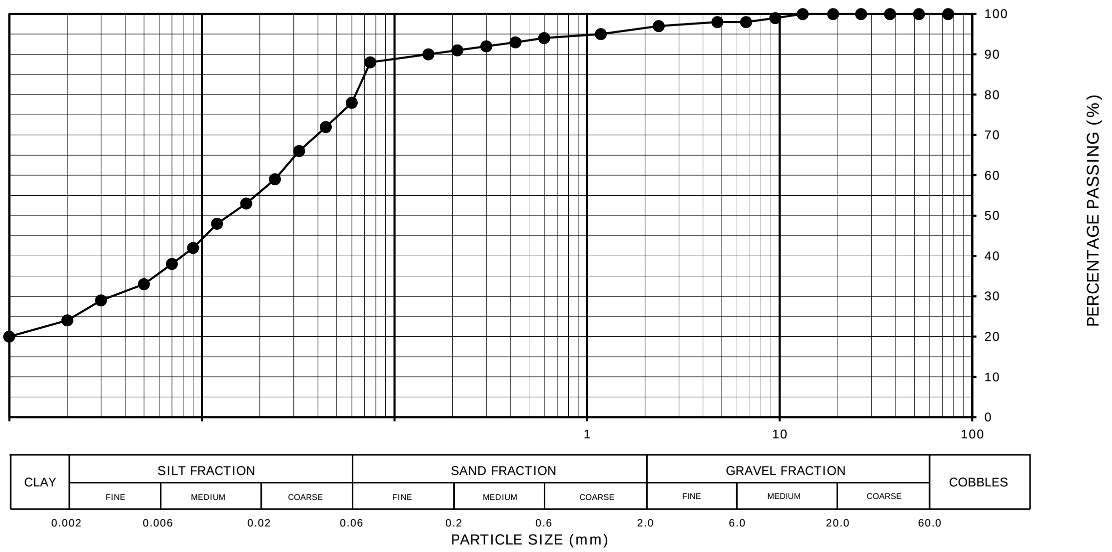
Determination of Particle Size Distribution of a Soil
Standard Method of Analysis by Sieving and Hydrometer

Client :	**Cardno Victoria**	Report Number:	**AWE200028-22**
Client Address :	**501 Swanston Street, Melbourne VIC 3000, Australia**	Page Number :	**1 of 1**
		Report Date:	**13/02/2020**
Job Number :	**AWE200028**	Test Method :	**AS1289.3.6.1 AS1289.3.6.3**
Project :	**Henty, Holbrook, Culcairn Levee investigation**		
Location :	**Henty, Holbrook, Culcairn, NSW**		

Lab No:	**3145/S/13089**	Date Sampled:	**14/11/2019**
ID No :		Sample Method:	**AS1289.1.2.1.6.5.3**
Lot No :		BH / TP. No. :	**BH15**
Date Tested:	**6/02/2020**	Depth (m) :	**0.4**
Sample Total Dry Mass :	**246.5g**	Pretreatment Loss (%) :	**0**
Hydrometer Type :	**B5916**	Dispersion Methods :	**Sodium Hexametaphosphate**
Soil Description :	**Silty CLAY brown grey**		
Remarks:			

Sieve Aperture (mm)	Percentage Passing of Total	Particle Diameter (µm)	Percentage Passing of Total
75	100	60	78
53	100	44	72
37.5	100	32	66
26.5	100	24	59
19	100	17	53
13.2	100	12	48
9.5	99	9	42
6.7	98	7	38
4.75	98	5	33
2.36	97	3	29
1.18	95	2	24
0.6	94	1	20
0.425	93		
0.3	92		
0.212	91		
0.15	90		
0.075	88		



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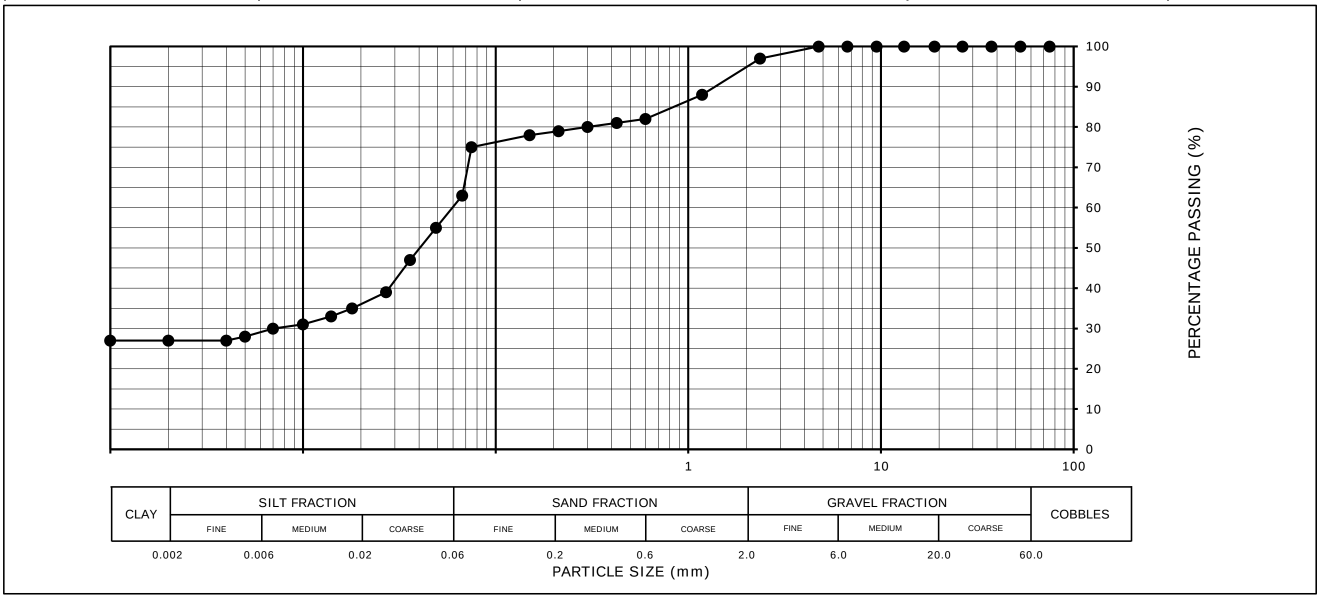
Determination of Particle Size Distribution of a Soil
Standard Method of Analysis by Sieving and Hydrometer

Client :	**Cardno Victoria**	Report Number:	**AWE200028-23**
Client Address :	**501 Swanston Street, Melbourne VIC 3000, Australia**	Page Number :	**1 of 1**
		Report Date:	**13/02/2020**
Job Number :	**AWE200028**	Test Method :	**AS1289.3.6.1 AS1289.3.6.3**
Project :	**Henty, Holbrook, Culcairn Levee investigation**		
Location :	**Henty, Holbrook, Culcairn, NSW**		

Lab No:	**3145/S/13093**	Date Sampled:	**13/11/2019**
ID No :		Sample Method:	**AS1289.1.2.1.6.5.3**
Lot No :		BH / TP. No. :	**BH16**
Date Tested:	**3/02/2020**	Depth (m) :	**0.6**
Sample Total Dry Mass :	**199.3g**	Pretreatment Loss (%) :	**0**
Hydrometer Type :	**B5916**	Dispersion Methods :	**Sodium Hexametaphosphate**
Soil Description :	**Silty CLAY with Sand orange brown mottled grey**		
Remarks:			

Sieve Aperture (mm)	Percentage Passing of Total	Particle Diameter (µm)	Percentage Passing of Total
75	100	67	63
53	100	49	55
37.5	100	36	47
26.5	100	27	39
19	100	18	35
13.2	100	14	33
9.5	100	10	31
6.7	100	7	30
4.75	100	5	28
2.36	97	4	27
1.18	88	2	27
0.6	82	1	27
0.425	81		
0.3	80		
0.212	79		
0.15	78		
0.075	75		



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FORM NUMBER : 3145

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Shaping the Future

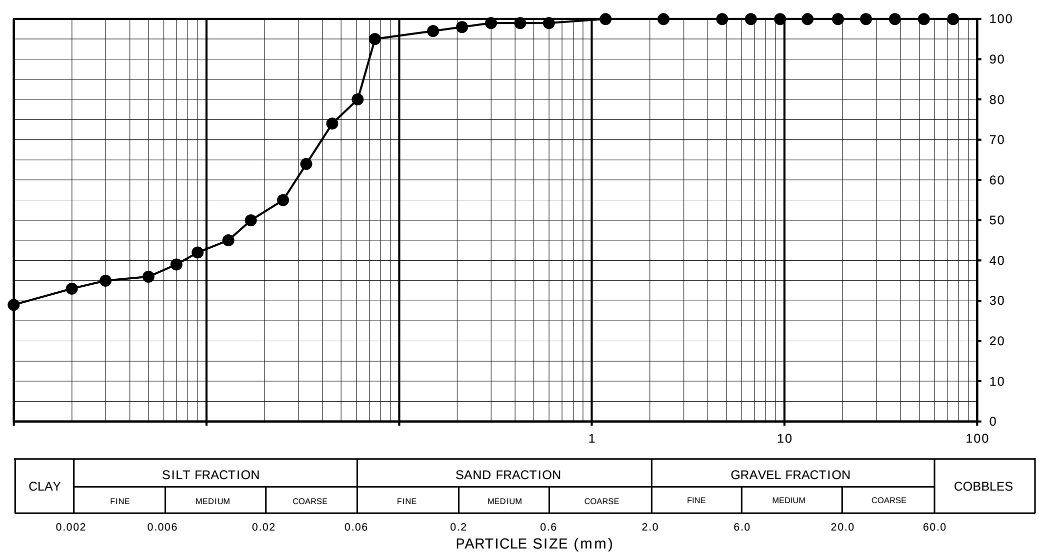
Level 4, 501 Swanston Street,
Melbourne, VIC 3000
Australia

Determination of Particle Size Distribution of a Soil
Standard Method of Analysis by Sieving and Hydrometer

Client :	**Cardno Victoria**	Report Number:	**AWE200028-24**
Client Address :	**501 Swanston Street, Melbourne VIC 3000, Australia**	Page Number :	**1 of 1**
		Report Date:	**13/02/2020**
Job Number :	**AWE200028**	Test Method :	**AS1289.3.6.1** **AS1289.3.6.3**
Project :	**Henty, Holbrook, Culcairn Levee investigation**		
Location :	**Henty, Holbrook, Culcairn, NSW**		

Lab No:	**3145/S/13096**	Date Sampled:	**13/11/2019**
ID No :		Sample Method:	**AS1289.1.2.1.6.5.3**
Lot No :		BH / TP. No. :	**BH17**
Date Tested:	**4/02/2020**	Depth (m) :	**0.5**
Sample Total Dry Mass :	**241.4g**	Pretreatment Loss (%) :	**0**
Hydrometer Type :	**B5916**	Dispersion Methods :	**Sodium Hexametaphosphate**
Soil Description :	**Silty CLAY trace Sand dark brown orange mottled grey**		
Remarks:			

Sieve Aperture (mm)	Percentage Passing of Total	Particle Diameter (µm)	Percentage Passing of Total
75	100	61	80
53	100	45	74
37.5	100	33	64
26.5	100	25	55
19	100	17	50
13.2	100	13	45
9.5	100	9	42
6.7	100	7	39
4.75	100	5	36
2.36	100	3	35
1.18	100	2	33
0.6	99	1	29
0.425	99		
0.3	99		
0.212	98		
0.15	97		
0.075	95		



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REV: 08/15

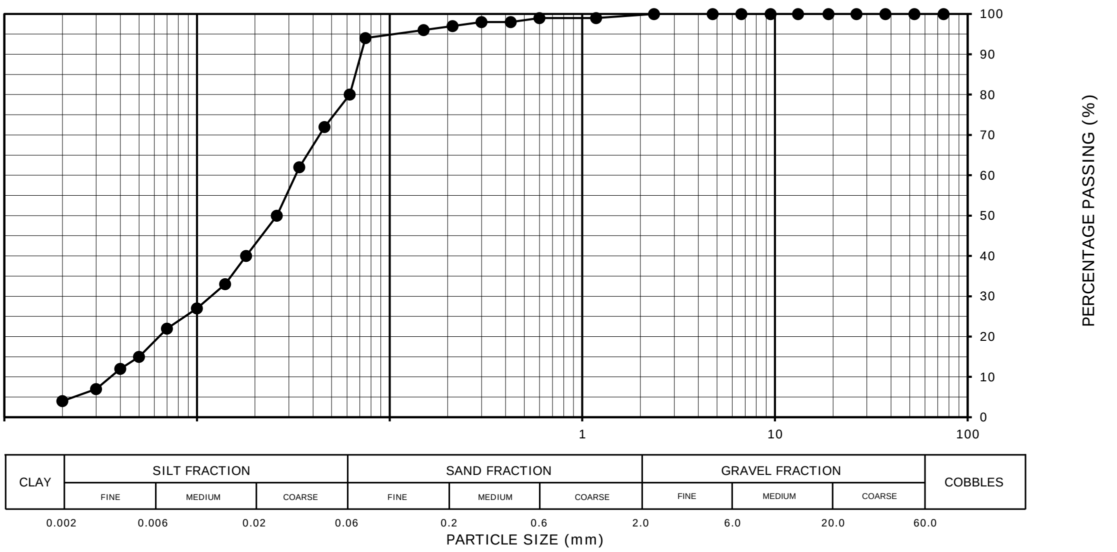
Level 4, 501 Swanston Street,
Melbourne, VIC 3000
Australia

Determination of Particle Size Distribution of a Soil
Standard Method of Analysis by Sieving and Hydrometer

Client :	Cardno Victoria	Report Number:	AWE200028-25
Client Address :	501 Swanston Street, Melbourne VIC 3000, Australia	Page Number :	1 of 1
		Report Date:	13/02/2020
Job Number :	AWE200028	Test Method :	AS1289.3.6.1 AS1289.3.6.3
Project :	Henty, Holbrook, Culcairn Levee investigation		
Location :	Henty, Holbrook, Culcairn, NSW		

Lab No:	3145/S/13098	Date Sampled:	13/11/2019
ID No :		Sample Method:	AS1289.1.2.1.6.5.3
Lot No :		BH / TP. No. :	BH18
Date Tested:	4/02/2020	Depth (m) :	0.3
Sample Total Dry Mass :	201.8g	Pretreatment Loss (%) :	0
Hydrometer Type :	B5916	Dispersion Methods :	Sodium Hexametaphosphate
Soil Description :	Clay SILT pale brown to white		
Remarks:			

Sieve Aperture (mm)	Percentage Passing of Total	Particle Diameter (µm)	Percentage Passing of Total
75	100	62	80
53	100	46	72
37.5	100	34	62
26.5	100	26	50
19	100	18	40
13.2	100	14	33
9.5	100	10	27
6.7	100	7	22
4.75	100	5	15
2.36	100	4	12
1.18	99	3	7
0.6	99	2	4
0.425	98		
0.3	98		
0.212	97		
0.15	96		
0.075	94		



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Level 4, 501 Swanston Street,
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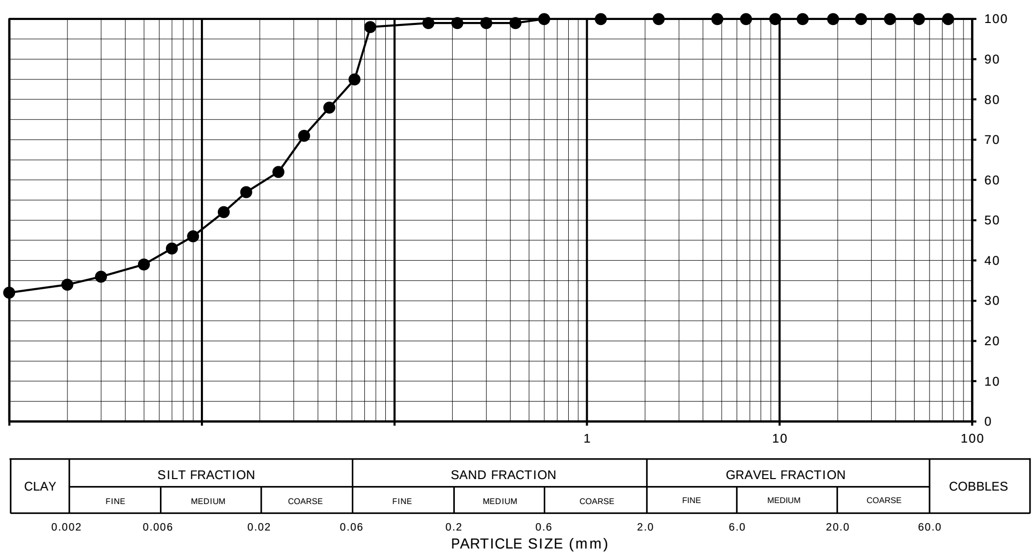
Determination of Particle Size Distribution of a Soil
Standard Method of Analysis by Sieving and Hydrometer

Client :	**Cardno Victoria**	Report Number:	**AWE200028-26**
Client Address :	**501 Swanston Street, Melbourne VIC 3000, Australia**	Page Number :	**1 of 1**
		Report Date:	**13/02/2020**
Job Number :	**AWE200028**	Test Method :	**AS1289.3.6.1 AS1289.3.6.3**
Project :	**Henty, Holbrook, Culcairn Levee investigation**		
Location :	**Henty, Holbrook, Culcairn, NSW**		

Lab No:	**3145/S/13101**	Date Sampled:	**13/11/2019**
ID No :		Sample Method:	**AS1289.1.2.1.6.5.3**
Lot No :		BH / TP. No. :	**BH19**
Date Tested:	**10/02/2020**	Depth (m) :	**0.3**
Sample Total Dry Mass :	**130.2g**	Pretreatment Loss (%) :	**0**
Hydrometer Type :	**B5916**	Dispersion Methods :	**Sodium Hexametaphosphate**
Soil Description :	**Silty CLAY brown mottled grey**		
Remarks:			

Sieve Aperture (mm)	Percentage Passing of Total	Particle Diameter (µm)	Percentage Passing of Total
75	100	62	85
53	100	46	78
37.5	100	34	71
26.5	100	25	62
19	100	17	57
13.2	100	13	52
9.5	100	9	46
6.7	100	7	43
4.75	100	5	39
2.36	100	3	36
1.18	100	2	34
0.6	100	1	32
0.425	99		
0.3	99		
0.212	99		
0.15	99		
0.075	98		



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NATA Accred No:3145

FIGURE NUMBER

FORM NUMBER : 3145

REV: 08/15

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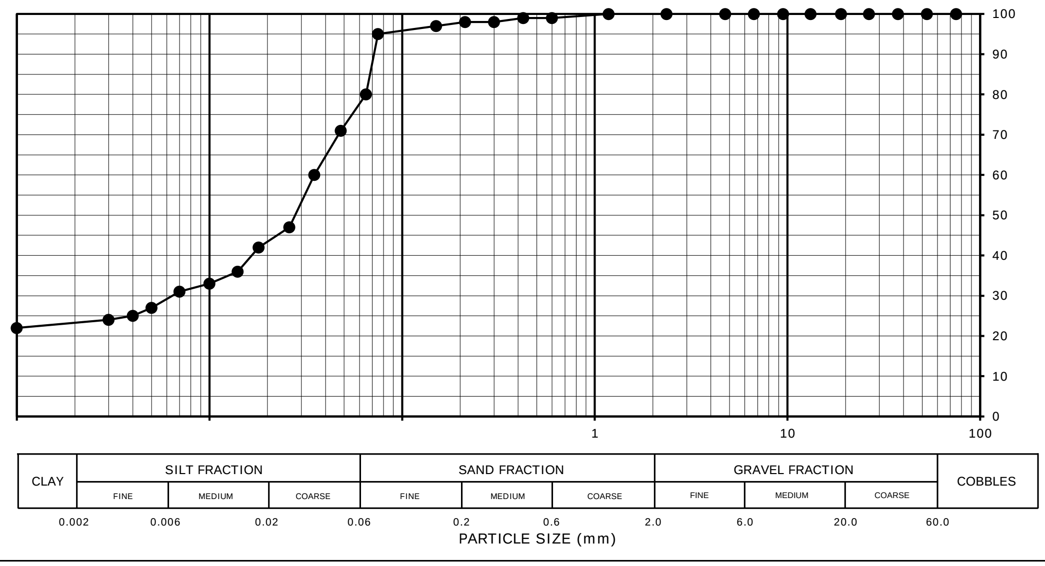
Determination of Particle Size Distribution of a Soil
Standard Method of Analysis by Sieving and Hydrometer

Client :	Cardno Victoria	Report Number:	AWE200028-27
Client Address :	501 Swanston Street, Melbourne VIC 3000, Australia	Page Number :	1 of 1
		Report Date:	13/02/2020
Job Number :	AWE200028	Test Method :	AS1289.3.6.1 AS1289.3.6.3
Project :	Henty, Holbrook, Culcairn Levee investigation		
Location :	Henty, Holbrook, Culcairn, NSW		

Lab No:	3145/S/13104	Date Sampled:	13/11/2019
ID No :		Sample Method:	AS1289.1.2.1.6.5.3
Lot No :		BH / TP. No. :	BH20
Date Tested:	11/02/2020	Depth (m) :	0.3
Sample Total Dry Mass :	80.1g	Pretreatment Loss (%) :	0
Hydrometer Type :	B5916	Dispersion Methods :	Sodium Hexametaphosphate
Soil Description :	Silty CLAY brown mottled grey		
Remarks:			

Sieve Aperture (mm)	Percentage Passing of Total	Particle Diameter (µm)	Percentage Passing of Total
75	100	65	80
53	100	48	71
37.5	100	35	60
26.5	100	26	47
19	100	18	42
13.2	100	14	36
9.5	100	10	33
6.7	100	7	31
4.75	100	5	27
2.36	100	4	25
1.18	100	3	24
0.6	99	1	22
0.425	99		
0.3	98		
0.212	98		
0.15	97		
0.075	95		



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Cardno Geosciences and Environment
ABN: 47 106 610 913

Address:
501 Swanston Street,
Melbourne VIC 3000

Laboratory: Geosciences and Environment
Phone: 03 8415 7777
Fax: 03 8415 7788
Email: Darryl.pather@cardno.com.au

EMERSON CLASS NUMBER REPORT

Client:	Cardno Victoria	Report Number:	3145/R/2061-1
Client Address:	501 Swanston Street, Melbourne	Project Number:	3145/P/490
Project:	Henty, Holbrook, Culcairn Levee investigation	Lot Number:	
Location:	Level 4, 501 Swanston Street, Melbourne	Internal Test Request:	3145/T/655
Supplied To:	n/a	Client Reference/s:	AWE200028
Area Description:		Report Date / Page:	21/04/2020 Page 1 of 5

Test Procedures:	AS1289.3.8.1

Sample Number	3145/S/13052	3145/S/13055	3145/S/13058	3145/S/13064
ID / Client ID	-	-	-	-
Lot Number	-	-	-	-
Date / Time Sampled	11/11/2019	11/11/2019	11/11/2019	12/11/2019
Material Source	Disturbed	Disturbed	Disturbed	Disturbed
Material Type	Insitu	Insitu	Insitu	Insitu
Sampling Method	AS1289.1.2.1 Cl 6.5.3	AS1289.1.2.1 Cl 6.5.3	AS1289.1.2.1 Cl 6.5.3	AS1289.1.2.1 Cl 6.5.3
Water Type	Distilled	Distilled	Distilled	Distilled
Water Temperature (C°)	20	21	20	20
Location on Site	BH03 1.1-1.3m	BH04 1.7-1.9m	BH05 2.1-2.4m	BH07 0.7-1.0m
Soil Description	Silty CLAY orange mottled brown	Silty CLAY pale brown and orange	Silty sandy CLAY dark brown mottl	Silty CLAY with sand pale brown
Emerson Class Number	**2**	**1**	**3**	**2**

Remarks

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Accreditation Number: 3145

Approved Signatory: Darryl Pather
Form ID: W34Rep Rev 2

Cardno Geosciences and Environment
ABN: 47 106 610 913

Address:
501 Swanston Street,
Melbourne VIC 3000

Laboratory: Geosciences and Environment
Phone: 03 8415 7777
Fax: 03 8415 7788
Email: Darryl.pather@cardno.com.au

EMERSON CLASS NUMBER REPORT

Client:	Cardno Victoria	Report Number:	3145/R/2061-1
Client Address:	501 Swanston Street, Melbourne	Project Number:	3145/P/490
Project:	Henty, Holbrook, Culcairn Levee investigation	Lot Number:	
Location:	Level 4, 501 Swanston Street, Melbourne	Internal Test Request:	3145/T/655
Supplied To:	n/a	Client Reference/s:	AWE200028
Area Description:		Report Date / Page:	21/04/2020 Page 2 of 5

Test Procedures:	AS1289.3.8.1

Sample Number	3145/S/13067	3145/S/13071	3145/S/13074	3145/S/13076
ID / Client ID	-	-	-	-
Lot Number	-	-	-	-
Date / Time Sampled	12/11/2019	12/11/2019	12/11/2019	12/11/2019
Material Source	Disturbed	Disturbed	Disturbed	Disturbed
Material Type	Insitu	Insitu	Insitu	Insitu
Sampling Method	AS1289.1.2.1 Cl 6.5.3	AS1289.1.2.1 Cl 6.5.3	AS1289.1.2.1 Cl 6.5.3	AS1289.1.2.1 Cl 6.5.3
Water Type	Distilled	Distilled	Distilled	Distilled
Water Temperature (C°)	20	19	21	20
Location on Site	BH08 0.9-1.0m	BH09 0.8m	BH10 0.6-0.7m	BH11 0.9-1.0m
Soil Description	Silty CLAY with sand dark red	Silty CLAY trace sand brown oran	Sandy silty CLAY red mottled bro	Silty CLAY with sand brown & dar
Emerson Class Number	**3**	**7**	**1**	**3**

Remarks

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EMERSON CLASS NUMBER REPORT

Client:	Cardno Victoria	Report Number:	3145/R/2061-1
Client Address:	501 Swanston Street, Melbourne	Project Number:	3145/P/490
Project:	Henty, Holbrook, Culcairn Levee investigation	Lot Number:	
Location:	Level 4, 501 Swanston Street, Melbourne	Internal Test Request:	3145/T/655
Supplied To:	n/a	Client Reference/s:	AWE200028
Area Description:		Report Date / Page:	21/04/2020 Page 3 of 5

Test Procedures:	AS1289.3.8.1

Sample Number	3145/S/13079	3145/S/13084	3145/S/13086	3145/S/13089
ID / Client ID	-	-	-	-
Lot Number	-	-	-	-
Date / Time Sampled	12/11/2019	13/11/2019	14/11/2019	14/11/2019
Material Source	Disturbed	Disturbed	Disturbed	Disturbed
Material Type	Insitu	Insitu	Insitu	Insitu
Sampling Method	AS1289.1.2.1 Cl 6.5.3	AS1289.1.2.1 Cl 6.5.3	AS1289.1.2.1 Cl 6.5.3	AS1289.1.2.1 Cl 6.5.3
Water Type	Distilled	Distilled	Distilled	Distilled
Water Temperature (C°)	21	20	20	21
Location on Site	BH12	BH13	BH14	BH15
	0.6-0.7m	0.6m	0.6m	0.4m
Soil Description	Silty sandy CLAY brown & grey	Silty CLAY with sand brown & gre	Silty CLAY dark brown orange mot	Silty CLAY brown grey
Emerson Class Number	**1**	**3**	**3**	**1**

Remarks

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Melbourne VIC 3000

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Fax: 03 8415 7788
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EMERSON CLASS NUMBER REPORT

Client:	Cardno Victoria	Report Number:	3145/R/2061-1
Client Address:	501 Swanston Street, Melbourne	Project Number:	3145/P/490
Project:	Henty, Holbrook, Culcairn Levee investigation	Lot Number:	
Location:	Level 4, 501 Swanston Street, Melbourne	Internal Test Request:	3145/T/655
Supplied To:	n/a	Client Reference/s:	AWE200028
Area Description:		Report Date / Page:	21/04/2020 Page 4 of 5

Test Procedures:	AS1289.3.8.1

Sample Number	3145/S/13093	3145/S/13096	3145/S/13100	3145/S/13101
ID / Client ID	-	-	-	-
Lot Number	-	-	-	-
Date / Time Sampled	13/11/2019	13/11/2019	13/11/2019	13/11/2019
Material Source	Disturbed	Disturbed	Disturbed	Disturbed
Material Type	Insitu	Insitu	Insitu	Insitu
Sampling Method	AS1289.1.2.1 Cl 6.5.3	AS1289.1.2.1 Cl 6.5.3	AS1289.1.2.1 Cl 6.5.3	AS1289.1.2.1 Cl 6.5.3
Water Type	Distilled	Distilled	Distilled	Distilled
Water Temperature (C°)	19	21	21	19
Location on Site	BH16	BH17	BH18	BH19
	0.6m	0.5m	1.5m	0.3m
Soil Description	Silty CLAY with sand orange brow	Silty CLAY trace sand dark brown	Silty CLAY trace sand brown mottl	Silty CLAY brown mottled grey
Emerson Class Number	**1**	**1**	**1**	**2**

Remarks

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Melbourne VIC 3000

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Fax: 03 8415 7788
Email: Darryl.pather@cardno.com.au

EMERSON CLASS NUMBER REPORT

Client:	Cardno Victoria	Report Number:	3145/R/2061-1
Client Address:	501 Swanston Street, Melbourne	Project Number:	3145/P/490
Project:	Henty, Holbrook, Culcairn Levee investigation	Lot Number:	
Location:	Level 4, 501 Swanston Street, Melbourne	Internal Test Request:	3145/T/655
Supplied To:	n/a	Client Reference/s:	AWE200028
Area Description:		Report Date / Page:	21/04/2020 Page 5 of 5

Test Procedures:	AS1289.3.8.1

Sample Number	3145/S/13104			
ID / Client ID	-			
Lot Number	-			
Date / Time Sampled	13/11/2019			
Material Source	Disturbed			
Material Type	Insitu			
Sampling Method	AS1289.1.2.1 Cl 6.5.3			
Water Type	Distilled			
Water Temperature (C°)	21			
Location on Site	BH20 0.3m			
Soil Description	Silty CLAY brown mottled grey			
Emerson Class Number	**3**			

Remarks

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Fax: 03 8415 7788
Email: Darryl.pather@cardno.com.au

MOISTURE DENSITY RELATIONSHIP REPORT

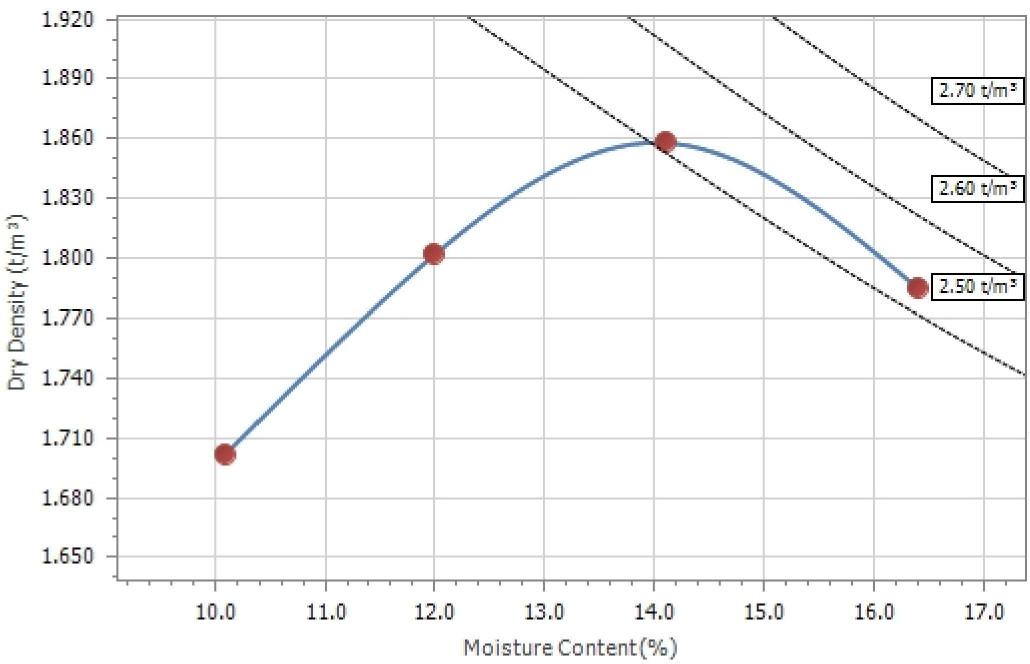
Client:	Cardno Victoria	Report Number:	3145/R/2062-1
Client Address:	501 Swanston Street, Melbourne	Project Number:	3145/P/490
Project:	Henty, Holbrook, Culcairn Levee investigation	Lot Number:	
Location:	Level 4, 501 Swanston Street, Melbourne	Internal Test Request:	3145/T/655
Supplied To:	n/a	Client Reference/s:	AWE200028
Area Description:		Report Date / Page:	21/04/2020 Page 1 of 10

Test Procedures	AS1289.5.1.1, AS1289.2.1.1	Sample Location	
Sample Number	3145/S/13053	Location on Site	BH03
Sampling Method	AS1289.1.2.1 Cl 6.5.3		1.2-2.0m
Date Sampled	11/11/2019		
Sampled By	Thilina Wanasingha		
Date Tested	10/02/2020	Compactive Effort	Standard
Material Source	Bulk Sample	Fraction Tested (mm)	< 19.0mm
Material Type	Insitu	Percent Oversize (%)	0.0
Liquid Limit Method	n/a	Total Curing Time (hrs)	n/a
Material Description	Silty CLAY orange mottled brown		

Moisture / Density Relationship Data

Moisture Content (%)	Dry Density (t/m³)
10.1	1.702
12.0	1.802
14.1	1.858
16.4	1.785

MOISTURE DENSITY RELATIONSHIP PLOT



Maximum Dry Density (t/m³):	**1.86**	**Optimum Moisture Content (%):**	**14.0**

Remarks

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NATA

Accreditation Number: 3145

Approved Signatory: Darryl Pather
Form ID: W4Rep Rev2

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ABN: 47 106 610 913

Address:
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Melbourne VIC 3000

Laboratory: Geosciences and Environment
Phone: 03 8415 7777
Fax: 03 8415 7788
Email: Darryl.pather@cardno.com.au

MOISTURE DENSITY RELATIONSHIP REPORT

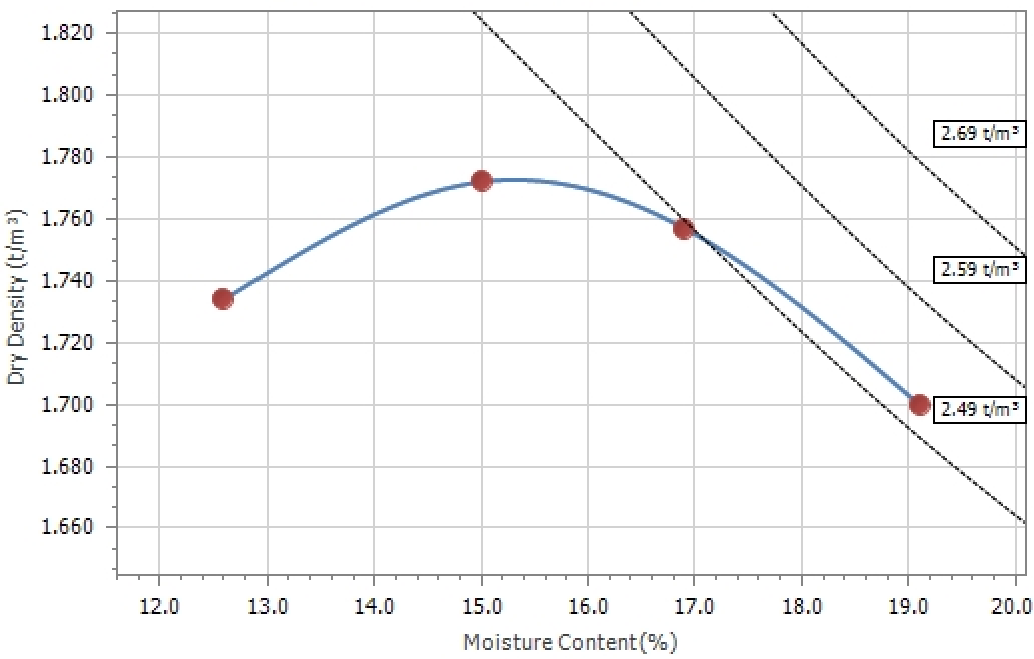
Client:	Cardno Victoria	Report Number:	3145/R/2062-1
Client Address:	501 Swanston Street, Melbourne	Project Number:	3145/P/490
Project:	Henty, Holbrook, Culcairn Levee investigation	Lot Number:	
Location:	Level 4, 501 Swanston Street, Melbourne	Internal Test Request:	3145/T/655
Supplied To:	n/a	Client Reference/s:	AWE200028
Area Description:		Report Date / Page:	21/04/2020 Page 2 of 10

Test Procedures	AS1289.5.1.1, AS1289.2.1.1	Sample Location	
Sample Number	3145/S/13056	Location on Site	BH04
Sampling Method	AS1289.1.2.1 Cl 6.5.3		1.7-2.7m
Date Sampled	11/11/2019		
Sampled By	Thilina Wanasingha		
Date Tested	10/02/2020	Compactive Effort	Standard
Material Source	Bulk Sample	Fraction Tested (mm)	< 19.0mm
Material Type	Insitu	Percent Oversize (%)	0.0
Liquid Limit Method	n/a	Total Curing Time (hrs)	n/a
Material Description	Silty CLAY pale brown and orange		

Moisture / Density Relationship Data

Moisture Content (%)	Dry Density (t/m^3)
12.6	1.734
15.0	1.772
16.9	1.757
19.1	1.700

MOISTURE DENSITY RELATIONSHIP PLOT



Maximum Dry Density (t/m^3):	**1.77**	**Optimum Moisture Content (%):**	**15.5**

Remarks

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Accreditation Number: 3145

Approved Signatory: Darryl Pather
Form ID: W4Rep Rev2

Cardno Geosciences and Environment
ABN: 47 106 610 913

Address:
501 Swanston Street,
Melbourne VIC 3000

Laboratory: Geosciences and Environment
Phone: 03 8415 7777
Fax: 03 8415 7788
Email: Darryl.pather@cardno.com.au

MOISTURE DENSITY RELATIONSHIP REPORT

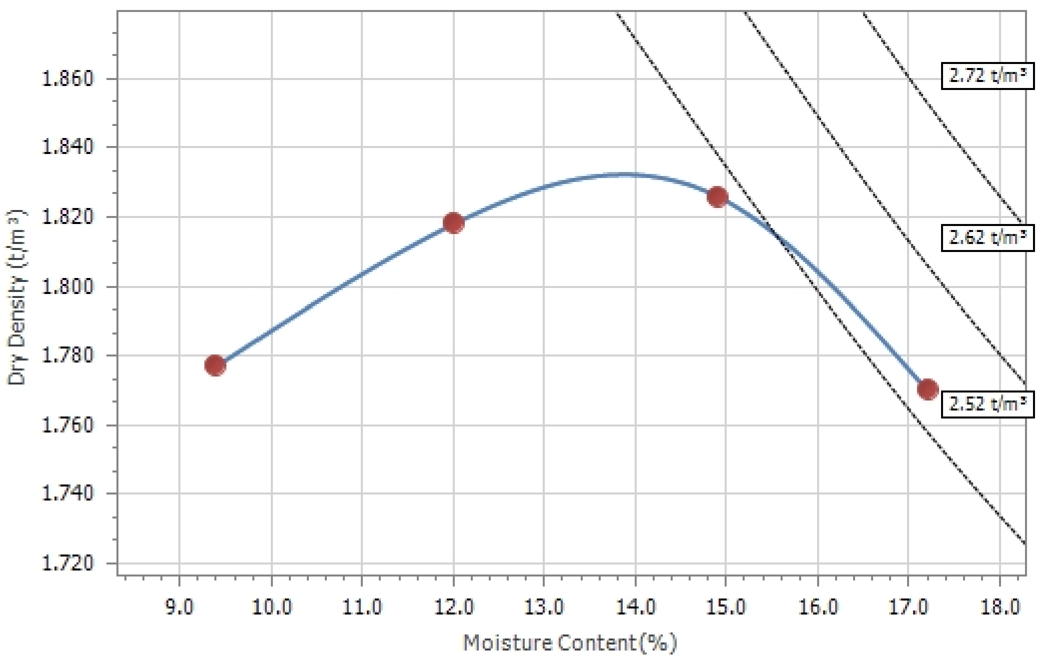
Client:	Cardno Victoria	Report Number:	3145/R/2062-1
Client Address:	501 Swanston Street, Melbourne	Project Number:	3145/P/490
Project:	Henty, Holbrook, Culcairn Levee investigation	Lot Number:	
Location:	Level 4, 501 Swanston Street, Melbourne	Internal Test Request:	3145/T/655
Supplied To:	n/a	Client Reference/s:	AWE200028
Area Description:		Report Date / Page:	21/04/2020 Page 3 of 10

Test Procedures	AS1289.5.1.1, AS1289.2.1.1	Sample Location	
Sample Number	3145/S/13065	Location on Site	BH08
Sampling Method	AS1289.1.2.1 Cl 6.5.3		0.5-1.0m
Date Sampled	12/11/2019		
Sampled By	Thilina Wanasingha		
Date Tested	10/02/2020	Compactive Effort	Standard
Material Source	Bulk Sample	Fraction Tested (mm)	< 19.0mm
Material Type	Insitu	Percent Oversize (%)	0.0
Liquid Limit Method	n/a	Total Curing Time (hrs)	n/a
Material Description	Silty CLAY with sand dark red		

Moisture / Density Relationship Data

Moisture Content (%)	Dry Density (t/m³)
9.4	1.777
12.0	1.818
14.9	1.826
17.2	1.770

MOISTURE DENSITY RELATIONSHIP PLOT



Maximum Dry Density (t/m³):	**1.83**	**Optimum Moisture Content (%):**	**14.0**

Remarks

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Accreditation Number: 3145

Approved Signatory: Darryl Pather
Form ID: W4Rep Rev2

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Cardno Geosciences and Environment
ABN: 47 106 610 913

Address:
501 Swanston Street,
Melbourne VIC 3000

Laboratory: Geosciences and Environment
Phone: 03 8415 7777
Fax: 03 8415 7788
Email: Darryl.pather@cardno.com.au

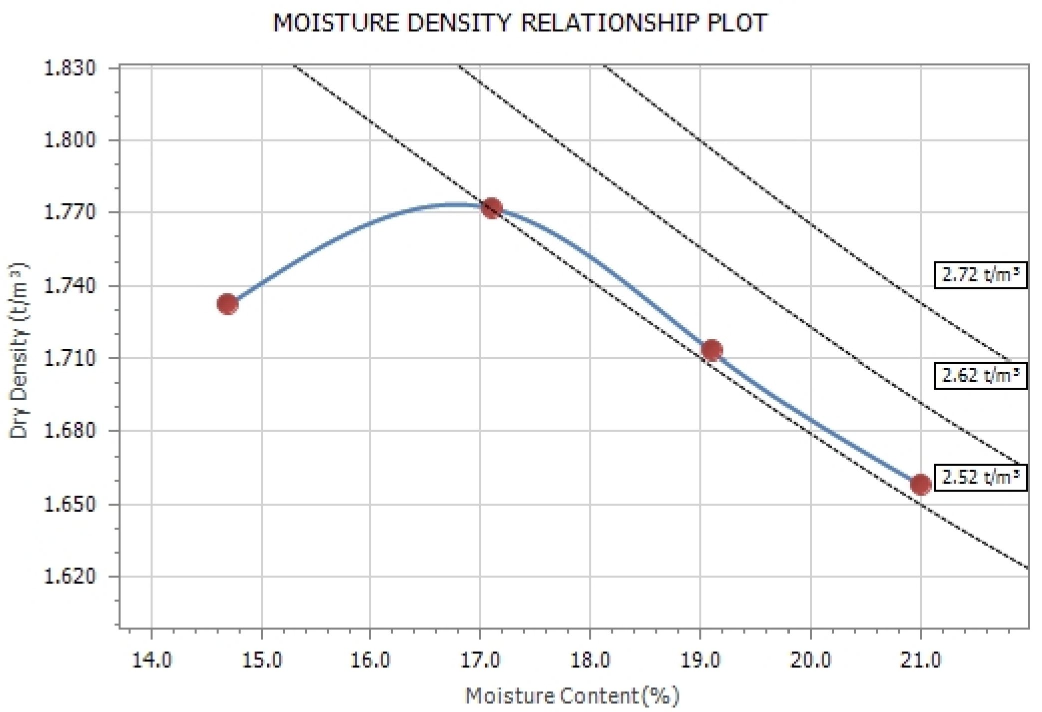
MOISTURE DENSITY RELATIONSHIP REPORT

Client:	Cardno Victoria	Report Number:	3145/R/2062-1
Client Address:	501 Swanston Street, Melbourne	Project Number:	3145/P/490
Project:	Henty, Holbrook, Culcairn Levee investigation	Lot Number:	
Location:	Level 4, 501 Swanston Street, Melbourne	Internal Test Request:	3145/T/655
Supplied To:	n/a	Client Reference/s:	AWE200028
Area Description:		Report Date / Page:	21/04/2020 Page 4 of 10

Test Procedures	AS1289.5.1.1, AS1289.2.1.1	Sample Location	
Sample Number	3145/S/13069	Location on Site	BH09
Sampling Method	AS1289.1.2.1 Cl 6.5.3		0.5-1.5m
Date Sampled	12/11/2019		
Sampled By	Thilina Wanasingha		
Date Tested	11/02/2020	Compactive Effort	Standard
Material Source	Bulk Sample	Fraction Tested (mm)	< 19.0mm
Material Type	Insitu	Percent Oversize (%)	0.0
Liquid Limit Method	n/a	Total Curing Time (hrs)	n/a
Material Description	Silty CLAY trace sand brown orange & grey		

Moisture / Density Relationship Data

Moisture Content (%)	Dry Density (t/m³)
14.7	1.732
17.1	1.772
19.1	1.713
21.0	1.658



Maximum Dry Density (t/m³):	**1.77**	**Optimum Moisture Content (%):**	**16.5**

Remarks

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Email: Darryl.pather@cardno.com.au

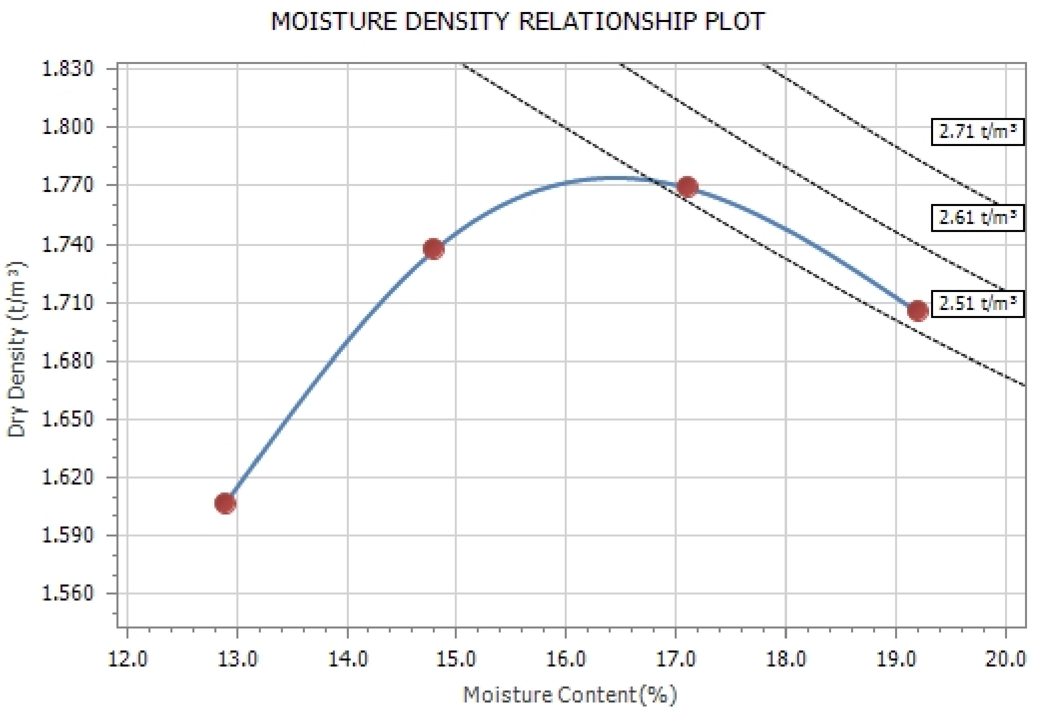
MOISTURE DENSITY RELATIONSHIP REPORT

Client:	Cardno Victoria	Report Number:	3145/R/2062-1
Client Address:	501 Swanston Street, Melbourne	Project Number:	3145/P/490
Project:	Henty, Holbrook, Culcairn Levee investigation	Lot Number:	
Location:	Level 4, 501 Swanston Street, Melbourne	Internal Test Request:	3145/T/655
Supplied To:	n/a	Client Reference/s:	AWE200028
Area Description:		Report Date / Page:	21/04/2020

Test Procedures	AS1289.5.1.1, AS1289.2.1.1	Sample Location	
Sample Number	3145/S/13072	Location on Site	BH10
Sampling Method	AS1289.1.2.1 Cl 6.5.3		0.5-1.2m
Date Sampled	12/11/2019		
Sampled By	Thilina Wanasingha		
Date Tested	11/02/2020	Compactive Effort	Standard
Material Source	Bulk Sample	Fraction Tested (mm)	< 19.0mm
Material Type	Insitu	Percent Oversize (%)	0.0
Liquid Limit Method	n/a	Total Curing Time (hrs)	n/a
Material Description	Sandy silty CLAY red mottled brown grey		

Moisture / Density Relationship Data

Moisture Content (%)	Dry Density (t/m^3)
12.9	1.607
14.8	1.737
17.1	1.769
19.2	1.705



Maximum Dry Density (t/m^3):	**1.77**	**Optimum Moisture Content (%):**	**16.5**

Remarks

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MOISTURE DENSITY RELATIONSHIP REPORT

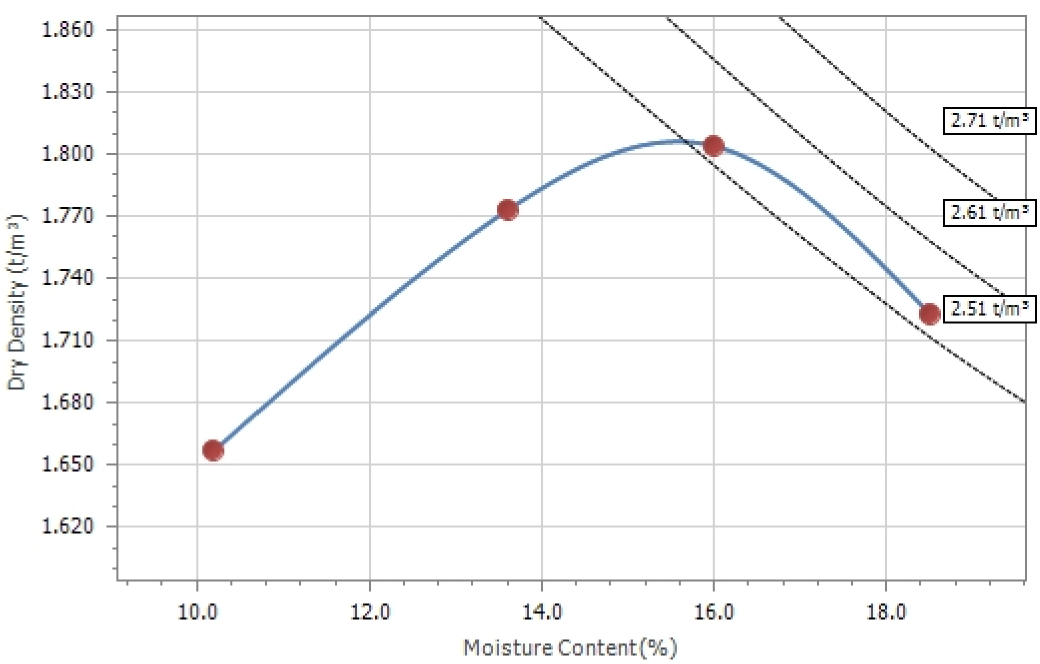
Client:	Cardno Victoria	Report Number:	3145/R/2062-1
Client Address:	501 Swanston Street, Melbourne	Project Number:	3145/P/490
Project:	Henty, Holbrook, Culcairn Levee investigation	Lot Number:	
Location:	Level 4, 501 Swanston Street, Melbourne	Internal Test Request:	3145/T/655
Supplied To:	n/a	Client Reference/s:	AWE200028
Area Description:		Report Date / Page:	21/04/2020

Test Procedures	AS1289.5.1.1, AS1289.2.1.1	Sample Location	
Sample Number	3145/S/13082	Location on Site	BH13
Sampling Method	AS1289.1.2.1 Cl 6.5.3		0.5-1.9m
Date Sampled	13/11/2019		
Sampled By	Thilina Wanasingha		
Date Tested	11/02/2020	Compactive Effort	Standard
Material Source	Bulk Sample	Fraction Tested (mm)	< 19.0mm
Material Type	Insitu	Percent Oversize (%)	0.0
Liquid Limit Method	n/a	Total Curing Time (hrs)	n/a
Material Description	Silty CLAY with sand brown & grey		

Moisture / Density Relationship Data

Moisture Content (%)	Dry Density (t/m³)
10.2	1.657
13.6	1.773
16.0	1.804
18.5	1.723

MOISTURE DENSITY RELATIONSHIP PLOT



Maximum Dry Density (t/m³):	**1.81**	**Optimum Moisture Content (%):**	**15.5**

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MOISTURE DENSITY RELATIONSHIP REPORT

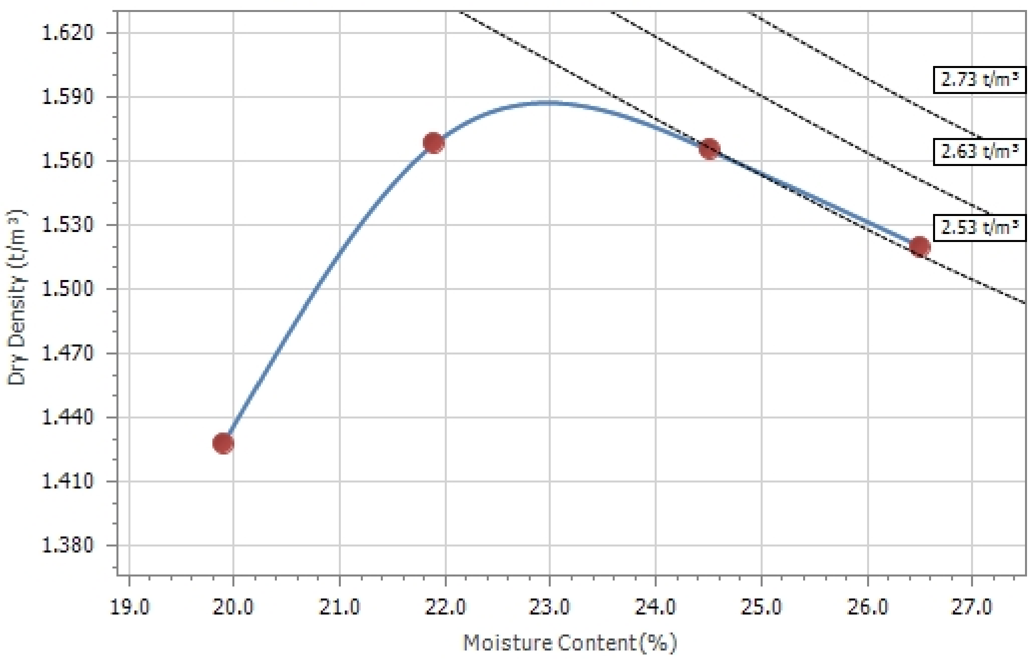
Client:	Cardno Victoria	Report Number:	3145/R/2062-1
Client Address:	501 Swanston Street, Melbourne	Project Number:	3145/P/490
Project:	Henty, Holbrook, Culcairn Levee investigation	Lot Number:	
Location:	Level 4, 501 Swanston Street, Melbourne	Internal Test Request:	3145/T/655
Supplied To:	n/a	Client Reference/s:	AWE200028
Area Description:		Report Date / Page:	21/04/2020 Page 7 of 10

Test Procedures	AS1289.5.1.1, AS1289.2.1.1	Sample Location	
Sample Number	3145/S/13088	Location on Site	BH14
Sampling Method	AS1289.1.2.1 Cl 6.5.3		1.2-2.7m
Date Sampled	14/11/2019		
Sampled By	Thilina Wanasingha		
Date Tested	11/02/2020	Compactive Effort	Standard
Material Source	Bulk Sample	Fraction Tested (mm)	< 19.0mm
Material Type	Insitu	Percent Oversize (%)	0.0
Liquid Limit Method	n/a	Total Curing Time (hrs)	n/a
Material Description	Silty CLAY dark brown orange mottled brown		

Moisture / Density Relationship Data

Moisture Content (%)	Dry Density (t/m³)
19.9	1.428
21.9	1.568
24.5	1.565
26.5	1.520

MOISTURE DENSITY RELATIONSHIP PLOT



Maximum Dry Density (t/m³):	**1.59**	**Optimum Moisture Content (%):**	**23.0**

Remarks

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MOISTURE DENSITY RELATIONSHIP REPORT

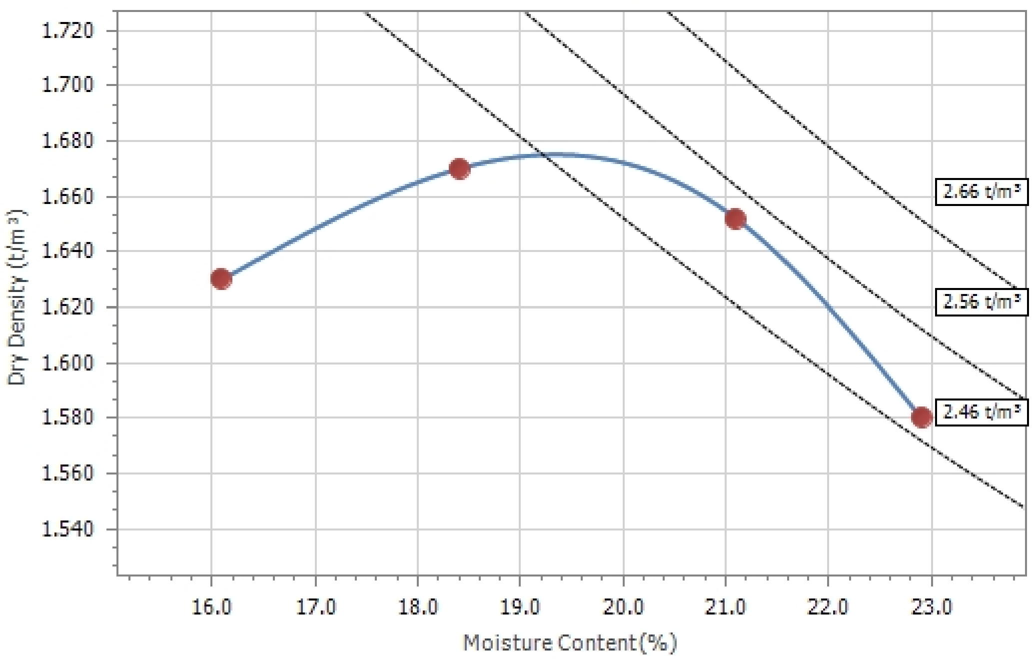
Client:	Cardno Victoria	Report Number:	3145/R/2062-1
Client Address:	501 Swanston Street, Melbourne	Project Number:	3145/P/490
Project:	Henty, Holbrook, Culcairn Levee investigation	Lot Number:	
Location:	Level 4, 501 Swanston Street, Melbourne	Internal Test Request:	3145/T/655
Supplied To:	n/a	Client Reference/s:	AWE200028
Area Description:		Report Date / Page:	21/04/2020 Page 8 of 10

Test Procedures	AS1289.5.1.1, AS1289.2.1.1	Sample Location	
Sample Number	3145/S/13094	Location on Site	BH16
Sampling Method	AS1289.1.2.1 Cl 6.5.3		0.5-2.3m
Date Sampled	13/11/2019		
Sampled By	Thilina Wanasingha		
Date Tested	11/02/2020	Compactive Effort	Standard
Material Source	Bulk Sample	Fraction Tested (mm)	< 19.0mm
Material Type	Insitu	Percent Oversize (%)	0.0
Liquid Limit Method	n/a	Total Curing Time (hrs)	n/a
Material Description	Silty CLAY with sand orange brown mottled grey		

Moisture / Density Relationship Data

Moisture Content (%)	Dry Density (t/m³)
16.1	1.630
18.4	1.670
21.1	1.652
22.9	1.580

MOISTURE DENSITY RELATIONSHIP PLOT



Maximum Dry Density (t/m³):	**1.68**	**Optimum Moisture Content (%):**	**19.5**

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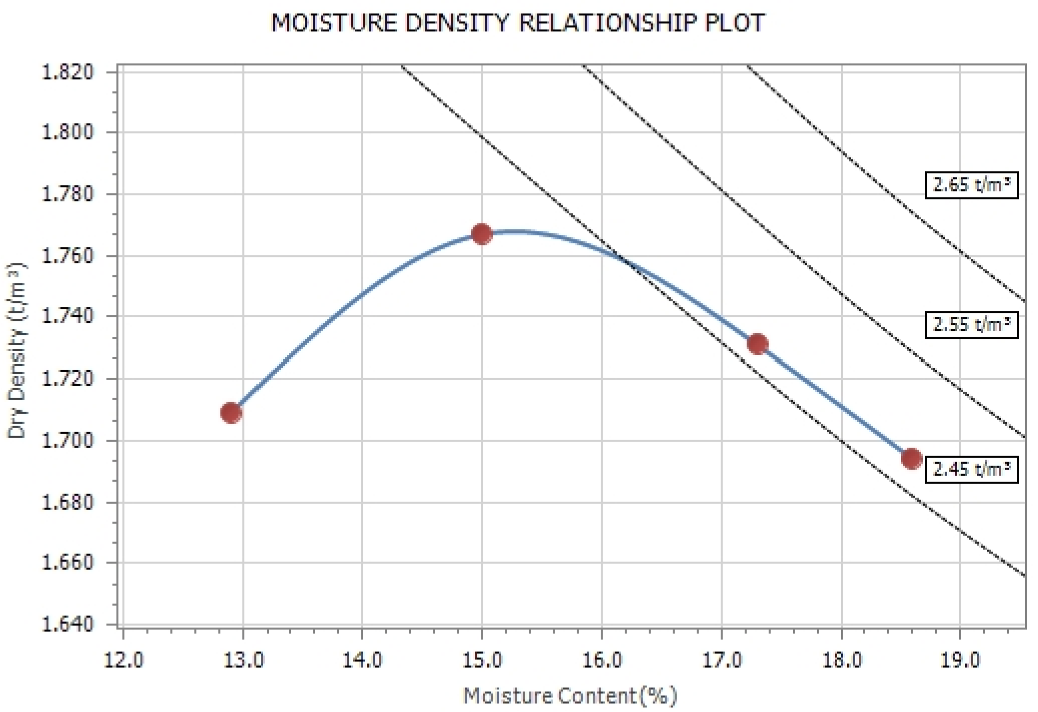
MOISTURE DENSITY RELATIONSHIP REPORT

Client:	Cardno Victoria	Report Number:	3145/R/2062-1
Client Address:	501 Swanston Street, Melbourne	Project Number:	3145/P/490
Project:	Henty, Holbrook, Culcairn Levee investigation	Lot Number:	
Location:	Level 4, 501 Swanston Street, Melbourne	Internal Test Request:	3145/T/655
Supplied To:	n/a	Client Reference/s:	AWE200028
Area Description:		Report Date / Page:	21/04/2020 Page 9 of 10

Test Procedures	AS1289.5.1.1, AS1289.2.1.1	Sample Location	
Sample Number	3145/S/13099	Location on Site	BH18
Sampling Method	AS1289.1.2.1 Cl 6.5.3		0.6-2.5m
Date Sampled	13/11/2019		
Sampled By	Thilina Wanasingha		
Date Tested	11/02/2020	Compactive Effort	Standard
Material Source	Bulk Sample	Fraction Tested (mm)	< 19.0mm
Material Type	Insitu	Percent Oversize (%)	0.0
Liquid Limit Method	n/a	Total Curing Time (hrs)	n/a
Material Description	Silty CLAY trace sand brown mottled grey		

Moisture / Density Relationship Data

Moisture Content (%)	Dry Density (t/m^3)
12.9	1.709
15.0	1.767
17.3	1.731
18.6	1.694



Maximum Dry Density (t/m^3):	**1.77**	**Optimum Moisture Content (%):**	**15.0**

Remarks

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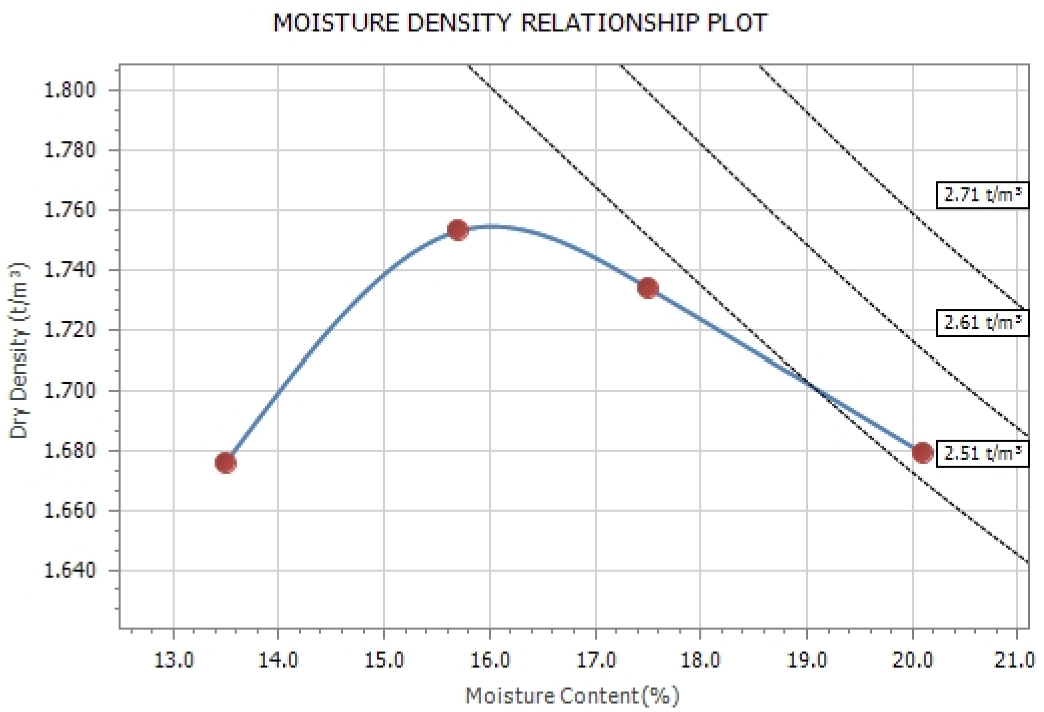
MOISTURE DENSITY RELATIONSHIP REPORT

Client:	Cardno Victoria	Report Number:	3145/R/2062-1
Client Address:	501 Swanston Street, Melbourne	Project Number:	3145/P/490
Project:	Henty, Holbrook, Culcairn Levee investigation	Lot Number:	
Location:	Level 4, 501 Swanston Street, Melbourne	Internal Test Request:	3145/T/655
Supplied To:	n/a	Client Reference/s:	AWE200028
Area Description:		Report Date / Page:	21/04/2020 Page 10 of 10

Test Procedures	AS1289.5.1.1, AS1289.2.1.1	Sample Location	
Sample Number	3145/S/13105	Location on Site	BH20
Sampling Method	AS1289.1.2.1 Cl 6.5.3		0.8-2.0m
Date Sampled	13/11/2019		
Sampled By	Thilina Wanasingha		
Date Tested	12/02/2020	Compactive Effort	Standard
Material Source	Bulk Sample	Fraction Tested (mm)	< 19.0mm
Material Type	Insitu	Percent Oversize (%)	0.0
Liquid Limit Method	n/a	Total Curing Time (hrs)	n/a
Material Description	Silty CLAY brown mottled grey		

Moisture / Density Relationship Data

Moisture Content (%)	Dry Density (t/m³)
13.5	1.676
15.7	1.753
17.5	1.734
20.1	1.679



Maximum Dry Density (t/m³):	**1.76**	**Optimum Moisture Content (%):**	**16.0**

Remarks

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Email: Darryl.pather@cardno.com.au

SHRINK SWELL INDEX

Client:	Cardno Victoria	Report Number:	3145/R/2069-1
Client Address:	501 Swanston Street, Melbourne	Project Number:	3145/P/490
Project:	Henty, Holbrook, Culcairn Levee investigation	Lot Number:	
Location:	Level 4, 501 Swanston Street, Melbourne	Internal Test Request:	3145/T/655
Supplied To:	n/a	Client Reference/s:	AWE200028
Area Description:		Report Date / Page:	21/04/2020 Page 1 of 5

Test Procedures:	AS1289.7.1.1, AS1289.2.1.1	Location on Site	BH08 0.6-.08m
Sample Number	3145/S/13066		
Sampling Method	AS1289.1.2.1 Cl 6.5.3		
Date Sampled	12/11/2019		
Sampled By	Thilina Wanasingha	Material Source	Undisturbed U50
Date Tested	16/01/2020	Material Type	Insitu

Soil Description:	Silty CLAY with sand dark red		
Cracking / Crumbling:	No cracking, no crumbling.		
Estimated Inert Inclusions (%):	8.00	Swell Pre-Soak Moisture Content (%)	8.9
Shrinkage Moisture Content (%):	8.6	Swell Post-Soak Moisture Content (%)	17.1

Shrinkage Strain (%)	0.7	Shrink / Swell Index	0.8
Swell Strain (%)	1.4		

Remarks

NATA

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Phone: 03 8415 7777
Fax: 03 8415 7788
Email: Darryl.pather@cardno.com.au

SHRINK SWELL INDEX

Client:	Cardno Victoria	Report Number:	3145/R/2069-1
Client Address:	501 Swanston Street, Melbourne	Project Number:	3145/P/490
Project:	Henty, Holbrook, Culcairn Levee investigation	Lot Number:	
Location:	Level 4, 501 Swanston Street, Melbourne	Internal Test Request:	3145/T/655
Supplied To:	n/a	Client Reference/s:	AWE200028
Area Description:		Report Date / Page:	21/04/2020 Page 2 of 5

Test Procedures:	AS1289.7.1.1, AS1289.2.1.1	Location on Site	BH09
Sample Number	3145/S/13070		0.6-1.0m
Sampling Method	AS1289.1.2.1 Cl 6.5.3		
Date Sampled	12/11/2019		
Sampled By	Thilina Wanasingha	Material Source	Undisturbed U50
Date Tested	16/01/2020	Material Type	Insitu

Soil Description:	Silty CLAY trace sand brown orange & grey		
Cracking / Crumbling:	Slight cracking, no crumbling.		
Estimated Inert Inclusions (%):	6.00	Swell Pre-Soak Moisture Content (%)	16.1
Shrinkage Moisture Content (%):	15.9	Swell Post-Soak Moisture Content (%)	17.7

Shrinkage Strain (%)	1.6	Shrink / Swell Index	1.1
Swell Strain (%)	0.6		

Remarks

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SHRINK SWELL INDEX

Client:	Cardno Victoria	Report Number:	3145/R/2069-1
Client Address:	501 Swanston Street, Melbourne	Project Number:	3145/P/490
Project:	Henty, Holbrook, Culcairn Levee investigation	Lot Number:	
Location:	Level 4, 501 Swanston Street, Melbourne	Internal Test Request:	3145/T/655
Supplied To:	n/a	Client Reference/s:	AWE200028
Area Description:		Report Date / Page:	21/04/2020 Page 3 of 5

Test Procedures:	AS1289.7.1.1, AS1289.2.1.1	Location on Site	BH10
Sample Number	3145/S/13073		0.7-1.1m
Sampling Method	AS1289.1.2.1 Cl 6.5.3		
Date Sampled	12/11/2019		
Sampled By	Thilina Wanasingha	Material Source	Undisturbed U50
Date Tested	16/01/2020	Material Type	Insitu

Soil Description:	Sandy silty CLAY red mottled brown grey		
Cracking / Crumbling:	No cracking, no crumbling.		
Estimated Inert Inclusions (%):	6.00	Swell Pre-Soak Moisture Content (%)	10.4
Shrinkage Moisture Content (%):	10.6	Swell Post-Soak Moisture Content (%)	16.9

Shrinkage Strain (%)	1.0	Shrink / Swell Index	1.1
Swell Strain (%)	1.9		

Remarks

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Melbourne VIC 3000

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SHRINK SWELL INDEX

Client:	Cardno Victoria	Report Number:	3145/R/2069-1
Client Address:	501 Swanston Street, Melbourne	Project Number:	3145/P/490
Project:	Henty, Holbrook, Culcairn Levee investigation	Lot Number:	
Location:	Level 4, 501 Swanston Street, Melbourne	Internal Test Request:	3145/T/655
Supplied To:	n/a	Client Reference/s:	AWE200028
Area Description:		Report Date / Page:	21/04/2020 Page 4 of 5

Test Procedures:	AS1289.7.1.1, AS1289.2.1.1	Location on Site	BH13 0.75-1.2m
Sample Number	3145/S/13083		
Sampling Method	AS1289.1.2.1 Cl 6.5.3		
Date Sampled	13/11/2019		
Sampled By	Thilina Wanasingha	Material Source	Undisturbed U50
Date Tested	21/01/2020	Material Type	Insitu

Soil Description:	Silty CLAY with sand brown & grey		
Cracking / Crumbling:	No cracking, no crumbling.		
Estimated Inert Inclusions (%):	6.00	Swell Pre-Soak Moisture Content (%)	16.4
Shrinkage Moisture Content (%):	16.5	Swell Post-Soak Moisture Content (%)	17.6

Shrinkage Strain (%)	2.4	Shrink / Swell Index	1.4
Swell Strain (%)	0.1		

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SHRINK SWELL INDEX

Client:	Cardno Victoria	Report Number:	3145/R/2069-1
Client Address:	501 Swanston Street, Melbourne	Project Number:	3145/P/490
Project:	Henty, Holbrook, Culcairn Levee investigation	Lot Number:	
Location:	Level 4, 501 Swanston Street, Melbourne	Internal Test Request:	3145/T/655
Supplied To:	n/a	Client Reference/s:	AWE200028
Area Description:		Report Date / Page:	21/04/2020 Page 5 of 5

Test Procedures:	AS1289.7.1.1, AS1289.2.1.1	Location on Site	BH15
Sample Number	3145/S/13090		0.5-0.7m
Sampling Method	AS1289.1.2.1 Cl 6.5.3		
Date Sampled	14/11/2019		
Sampled By	Thilina Wanasingha	Material Source	Undisturbed U50
Date Tested	23/01/2020	Material Type	Insitu

Soil Description:	Silty CLAY brown grey		
Cracking / Crumbling:	No cracking, no crumbling.		
Estimated Inert Inclusions (%):	2.00	Swell Pre-Soak Moisture Content (%)	28.5
Shrinkage Moisture Content (%):	29.4	Swell Post-Soak Moisture Content (%)	30.2

Shrinkage Strain (%)	8.1	Shrink / Swell Index	4.8
Swell Strain (%)	1.1		

Remarks

NATA

The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.
Accredited for compliance with ISO/IEC 17025 - Testing

Accreditation Number: 3145

Approved Signatory: Darryl Pather
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APPENDIX

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LIMITATIONS OF REPORT

LIMITATIONS OF GEOTECHNICAL REPORTS

The purpose of this report is to provide a geotechnical assessment of the sites examined. The information provided herein will reduce the exposure to risks, but no geotechnical assessment can eliminate them. Nonetheless, even a rigorous assessment may fail to detect all of the geotechnical conditions on a site. Site variations may have occurred in areas not investigated or sampled.

This geotechnical report should not be used when the nature of the proposed site usage changes, when the size, layout, or location of the development is modified, when the site ownership changes nor should it be applied to a nearby area. No environmental assessment has been undertaken nor is implied.

This site geotechnical assessment identifies actual subsurface conditions where the samples were taken and at the time they were taken. Any soil tests completed, were carried out in Cardno's NATA accredited soil laboratory. Geotechnical engineers then interpreted the laboratory results and field data and rendered an opinion about the overall subsurface conditions, including the soil type, extent of the soil layers, and their likely impact on the proposed development, with a discussion of the implications considered likely. The actual conditions may differ from the inferred conditions, as no person (no matter how qualified) or even the most detailed subsurface investigation can predict with confidence what may be hidden by soil or water or may have altered with time. Often the interface between different geotechnical areas may be more abrupt or gradual than anticipated. The actual conditions in an area may differ from those predicted.

Site assessments are limited by time, and natural processes such as erosion, or mankind altering the ground conditions, including the site levels or filled areas, may affect a site assessment. This geotechnical assessment is prepared in response to a client's specific requirements. No person other than the client should apply the report without first conferring with Cardno.

Costly problems can occur if the report is misinterpreted. To avoid these problems, Cardno should be retained to work with the appropriate design professionals and to review the adequacy of their plans and specifications relative to the geotechnical matters.

This report should only be reproduced in its entirety. Reproduction of borehole or testpit logs alone without the entire report should not be permitted. Redrafting of the borehole or testpit logs for inclusion in drawings or other reports should not be allowed as errors in the drafting can occur. It is recommended that the report be made available in entirety to persons and organisations involved in the project such as contractors. Simply disclaiming responsibility for the accuracy of the subsurface or geotechnical information does not insulate the organisation from liability. The more information a contractor has available to him, the better able he is to avoid costly construction problems and costly adversarial situations.

Finally, geotechnical reports are based extensively on opinion and judgment and are less exact than other sciences. The report may contain a number of explanatory clauses or limitations on the results to inform the client about the restrictions of the report. These clauses are not meant to be exculpatory clauses to foist liability onto another person, but to identify where Cardno's and the client's responsibilities start and finish. Their use is to clarify where individual responsibilities lie and to allow the individual to take appropriate actions.