LAND BASED ENVIRONMENTAL MANAGEMENT PLAN – SUB-PLAN 07

North East Business Park
Flood Mitigation Works

Lot 3 on SP266287, Lot 997 SP309372, Lot 998 SP283244
& Lot 2000 SP309388
Buckley Road, Burpengary East

A Report Prepared for
North Harbour Holdings Pty Ltd

AUGUST 2021

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Client Issue

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1 INTRODUCTION

1.1 Background

JWA Pty Ltd has been engaged by North Harbour Holdings Pty Ltd (formerly North East Business Park Pty Ltd) to complete a Land Based Environmental Management Plan (LBEMP) for the proposed excavation of an unmapped drainage corridor for flood mitigation within the North East Business Park (NEBP) development. The site is located at Nolan Drive, Morayfield and is formally described as Lot 3 SP266287, Lot 997 SP309372, Lot 998 SP283244 and Lot 2000 SP309388 (**FIGURE 1**). The site is approximately 4.87 ha. An aerial photograph of the site is shown in **FIGURE 2**.

In accordance with Condition 9 of the EPBC Approval (Ref: EPBC 2006/2912) the NEBP development is to be undertaken in accordance with the provisions of a Land Based Environmental Management Plan (LBEMP), approved by the Commonwealth Minister for the Environment, so as to ensure potential impacts to Matters of National Environmental Significance (MNES) are appropriately managed.

The following LBEMPs have previously been prepared for the NEBP and approved by the Commonwealth Minister for the Environment:

- *North East Business Park – Land Based Environmental Management Plan for Matters of National Environmental Significance (Version 2)* prepared by Cardno and dated 31 January 2014 (LBEMP for MNES v2 (Cardno, 2014)), which comprises the overarching LBEMP for the NEBP development and provides specifications for the preparation of LBEMP Sub-Plans for specific programs of approved works that are to be undertaken as part of the orderly and staged establishment of the NEBP development – approved on 17th February 2014.
- *North East Business Park – LBEMP Sub-Plan 01 (Version 2)* prepared by Cardno and dated 31 January 2014 (LBEMP Sub-Plan 01), which comprises an LBEMP Sub-Plan prepared in accordance with the specifications of the LBEMP for MNES v2 (Cardno 2014) and addressing the works program associated with preliminary works within part of the Mixed Industry and Business Area (MIBA) – approved on 17th February 2014.
- *North East Business Park – LBEMP Sub-Plan* prepared by Future-Plus Environmental and dated 22 August 2014 (LBEMP Sub-Plan 02), which comprises an LBEMP Sub-Plan prepared in accordance with the specifications of the LBEMP v2 (Cardno 2014) and addressing the works program associated with preliminary works within Phase 1 of the Residential West Area (RWA) – approved on 25th August 2014.
- *North East Business Park – LBEMP Sub-Plan* prepared by JWA Pty Ltd and dated 8 July 2015 (LBEMP Sub-Plan 03), which comprises an LBEMP Sub-Plan prepared in accordance with the specifications of the LBEMP v2 (Cardno 2014) and addressing the works program associated with preliminary works within Phase 2 of the Residential West Area (RWA) – approved on 28th July 2015.

LEGEND

- LBEMP Sub-Plan 07 Site Boundary
- NEBP Site Boundary

Scale 1:40 000 - Lengths in metres

400 0 400 800 1200 1600 2000

SOURCE: Google Maps

SCALE: 1 : 40 000 @ A3

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PROJECT
LBEMP Sub-Plan 07
North Harbour Flood Mitigation Works
Nolan Drive, Morayfield QLD
Moreton Bay Regional Council LGA

FIGURE 1

PREPARED: BW
DATE: 05 August 2021
FILE: Q15003_UnnamedCk_20210805.dwg

TITLE

LOCALITY PLAN

LEGEND

- LBEMP Sub-Plan 07 Site Boundary
- Cadastre Boundary

N

Scale 1:3000 - Lengths in metres

50 0 50 100 150 200

SOURCE: QLD Globe May 2020 Aerial Photo

SCALE: 1 : 3000 @ A3

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FIGURE 2

PREPARED: BW
DATE: 05 August 2021
FILE: Q15003_UnnamedCk_20210805.dwg

TITLE

AERIAL PHOTOGRAPH

- *North East Business Park – LBEMP Sub-Plan 04* prepared by JWA Pty Ltd and dated 13th June 2016, prepared in accordance with the specifications of the LBEMP v2 (Cardno 2014) and addressing the works program associated with works within Phases 3-7 of the RWA – approved on 17th June 2016. Sub-Plan 04 was subsequently updated to include heritage areas and an extension to the borrow pit area, with the updated plan approved in September 2017.
- *North East Business Park – LBEMP Sub-Plan 05* prepared by JWA Pty Ltd and dated 28th March 2018, prepared in accordance with the specifications of the LBEMP v2 (Cardno 2014) and addressing the works program associated with works to install the sewer line to service the NEBP development – approved on 3rd April 2018.
- *North East Business Park – LBEMP Sub-Plan 06* prepared by JWA Pty Ltd and dated 17th December 2020, prepared in accordance with the specifications of the LBEMP v2 (Cardno 2014) and addressing the works program associated with the Mixed Industry and Business Area (MIBA) and the Raff Creek Crossing bulk earthworks – approved on 4th January 2021.

FIGURE 3 shows the extent of current and previous LBEMP areas on the subject site.

1.2 Site Description

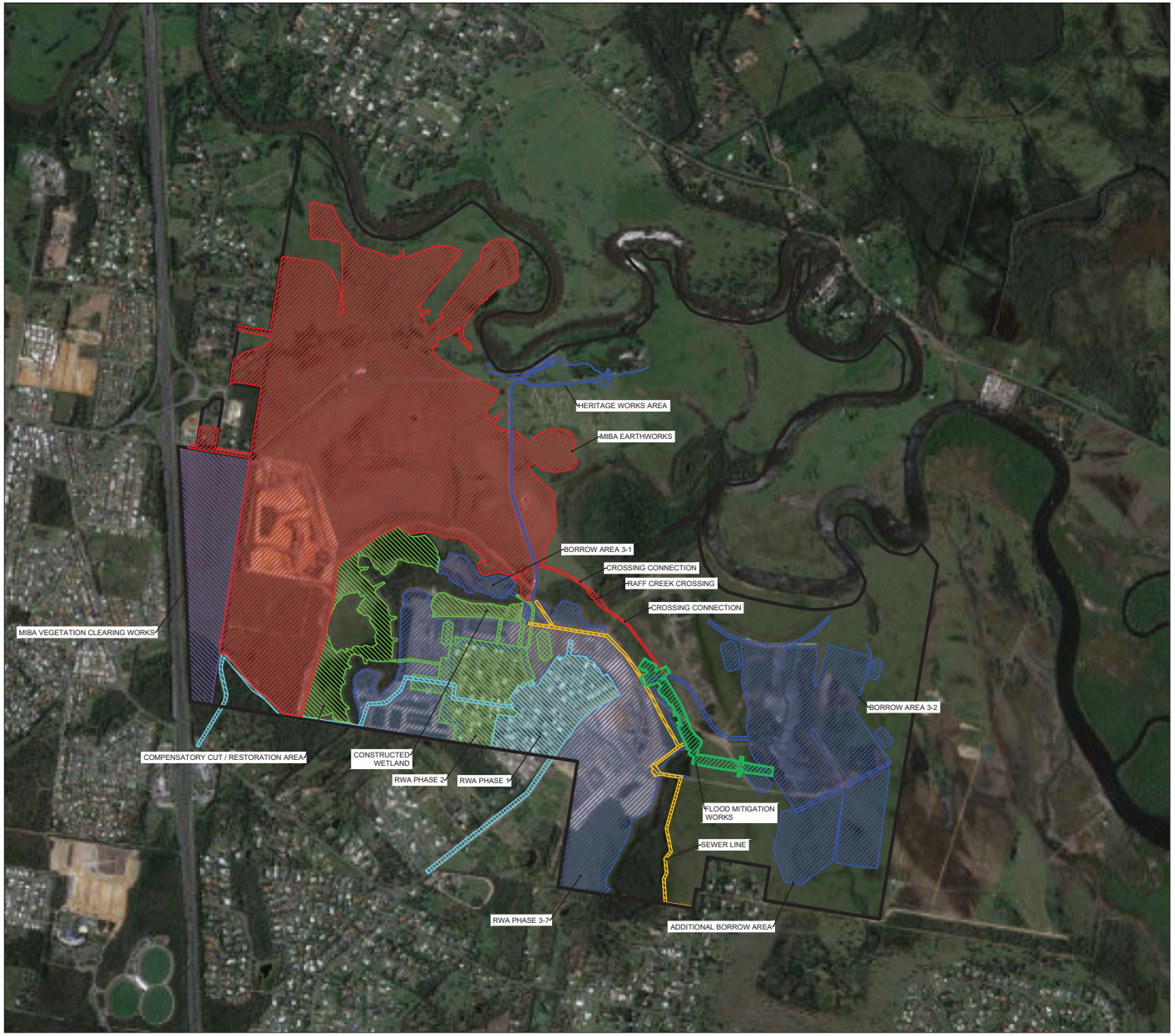
The site is undulating and partially vegetated by native open forest and disturbed grassland. A drainage line runs north-south through the area, draining into Raff Creek to the north. The Caboolture River is to the north of the subject area. To the west of the site lies residential properties, while the other boundaries are comprised of paddocks (**FIGURE 2**).

1.3 Scope and Objectives

This LBEMP provides a structured management plan with the objective of minimising the impacts of the approved works program on MNES.

Specifically, the LBEMP addresses the earthworks associated with flood mitigation works on the site, and provides:

- An overview of the location and nature of the approved program of works that is the subject of this LBEMP;
- An assessment of the likelihood of occurrence of MNES within or adjacent to the works site;
- An assessment of the risk that the works program represents to relevant MNES; and
- Environmental management specifications for those aspects of the works program that are associated with a Medium to Extreme risk of harm to one or more MNES.



N

LEGEND

- NEBP Site Boundary
- LBEMP Sub-plan 07 Extent - Flood Mitigation Works
- LBEMP Sub-plan 06 Extent
  - MIBA (remaining areas) - Bulk Earthworks
  - Raff Creek Crossing & Connection
- LBEMP Sub-plan 05 Extent - Sewer Pump Station SPS-BGY017 (PS3) Reticulation Network
- LBEMP Sub-plan 04 Extent
  - Residential West Area - Balance (Phases 3-7)
  - Borrow Areas
  - Heritage Works
- LBEMP Sub-plan 03 Extent
  - Residential West Area - Phase 2
  - Compensatory Cut / Restoration Area
  - Constructed Wetland
- LBEMP Sub-plan 02 Extent - Residential West Area Phase 1
- LBEMP Sub-plan 01 Extent - MIBA (part of) Vegetation Clearing Works

Scale 1:20 000 - Lengths in metres

200 0 200 400 600 800 1000

SOURCE: Google Earth Oct 2017 Aerial

SCALE: 1 : 20 000 @ A3

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LBEMP Sub-Plan 07
North Harbour Flood Mitigation Works
Nolan Drive, Morayfield QLD
Moreton Bay Regional Council LGA

FIGURE 3

PREPARED: BW
DATE: 05 August 2021
FILE: Q15003_UnnamedCk_20210805.dwg

TITLE
EXTENT OF CURRENT & PREVIOUS LBEMP AREAS

1.4 Roles and Responsibilities

It is the responsibility of North Harbour Holdings Pty Ltd (the Developer) to ensure that all tasks described in this LBEMP are completed within the specified timeframes.

The Developer is to ensure that all employees and contractors involved in the NEBP development works are aware of, and contractually required to comply with, the requirements of the overarching LBEMP for MNES v2 and this LBEMP Sub-Plan 07.

In the preparation of this LBEMP Sub-Plan 07, the services of an appropriately qualified and experienced ecologist have been engaged for the purposes of determining:

- The risk of negative impacts on MNES within the sewer alignment; and
- Environmental management measures required to minimise, to the greatest extent practicable, any adverse impacts on MNES.

1.5 Compliance with EPBC Act Approval Condition 9

Condition 9	Compliance
The person taking the action must prepare and submit a Land-Based Environmental Management Plan (LBEMP) for the Minister's approval. The LBEMP must include, but not be limited to, the following:	
a. Measures to minimise impacts on EPBC Act listed threatened species, including measure to care for injured fauna and a vegetation clearing strategy.	Management measures to minimise impacts on EPBC Act listed threatened species are included in **SECTION 4**. Management measures include tasks, actions and timing. This section also provides a rationale, objectives/targets and performance indicators to ensure the management measures are effective. Element 2: Fauna (**SECTION 4.2**) and Element 3: Koalas (**SECTION 4.3**) detail measures to care for injured fauna and koalas, respectively, and provides a clearing strategy that includes: - Pre-clearance surveys; - Provisions of a licenced fauna spotter/catcher; - Ensuring vegetation clearance works comply with the procedures of Policy 6: Vegetation Clearing Practices of the Nature Conservation (Koala) Conservation Plan 2006; and - Vegetation clearance is conducted in a sequential manner in order to direct Koalas and other fauna away from threatening processes or hostile environments (e.g.

Condition 9	Compliance
	roads) and towards any retained vegetation or habitat links.
b. Measures to limit the spread of pests and invasive species.	Measures to limit the spread of pests and invasive species are included in Element 5: Weeds and Pests (**SECTION 4.5**). Management measures include tasks, actions and timing. This section also provides a rationale, objectives/targets and performance indicators to ensure the management measures are effective. Management measures include: - Identify specific areas of pest infestation; - Manage pest infestations within the works site; - Minimise the introduction and dispersal of pest species; - Record keeping; and - Corrective actions.
c. Sediment and erosion controls.	Sediment and erosion control measures are included in Element 6: Soil Erosion, Sediment Loss and Water Quality (**SECTION 4.6**). Management measures include tasks, actions and timing. This section also provides a rationale, objectives/targets and performance indicators to ensure the management measures are effective.
d. Measures to implement, monitor, or improve (should deficiencies be identified) the LBEMP.	**SECTION 5** details the non-conformance and corrective action procedures should deficiencies be identified.

2 DESCRIPTION OF APPROVED WORKS PROGRAM

2.1 Description of Works Site

The works area covered by this LBEMP Sub-Plan 07 is approximately 4.87 ha in area. The works area has been included in a number of ecological assessments including:

- Terrestrial Ecology Assessment Report – Northeast Business Park (Cardno 2007);
- Ecological Assessment Report: NEBP – Residential West RoL (Cardno 2014);
- Wetland Mapping Report: North East Business Park Residential West Area (JWA 2015a);
- Ecological Assessment – North East Business Park Balance Land (JWA 2015b);
- Ecological Assessment – Flood Mitigation Works, Buckley Road, Burpengary East (JWA 2021a); and
- Vegetation and Fauna Management Plan – Flood Mitigation Works, Buckley Road, Burpengary East (JWA 2021b).

The works area is partially vegetated by native open forest with remaining areas comprised of disturbed grassland. A drainage corridor runs north-south through the site and drains into Raff Creek. The drainage corridor is a wide, highly ephemeral drainage gully with shallow, low sloping banks.

Overall, the works site has experienced substantial disturbance as a result of previous land uses, which has severely degraded the ecological values of the area. The works site was used for plantation forestry and other agricultural uses since the late 1800s. More recently, the works site has been used for cattle grazing, with vegetation dominated by a range of introduced pasture grasses and weeds.

The location of various vegetation communities and habitat types identified within the works site is shown on the Vegetation Clearance Plan shown in **FIGURE 4**.

2.2 Description of Works Program

The works program covered by this LBEMP Sub-Plan 07 are for flood mitigation and will involve reshaping the bed level of the unmapped drainage corridor, and the creation of a flood water diversion channel as shown in **APPENDIX 1**. Works will include the widening and deepening of an approximately 500 m section of an unmapped drainage corridor, excavation of an approximately 400 m flood water diversion channel to the east of the unmapped drainage corridor and construction of two (2) culverts - one (1) pipe culvert across the unmapped drainage corridor and one (1) box culvert across the flood water diversion channel (**APPENDIX 1**). These works will increase water retention and splitting of larger flood events (greater than Q20 year events) which will improve the flow of flood events through the North Harbour development.

LEGEND

- Impact Area
- LBEMP Sub-Plan 07 Site Boundary
- Cadastre Boundary

Vegetation Communities

- Community 1: Coastal and Subcoastal Floodplain Tree Swamps - Melaleuca and Eucalypt
- Community 2: Wet Terrestrial Grassland
- Community 3: Disturbed Terrestrial Grassland

N

Scale 1:3000 - Lengths in metres

50 0 50 100 150 200

SOURCE: JWA Site Investigations Feb 2021
QLD Globe May 2020 Aerial Photo

SCALE: 1 : 3000 @ A3

JWA Pty Ltd
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LBEMP Sub-Plan 07
North Harbour Flood Mitigation Works
Nolan Drive, Morayfield QLD
Moreton Bay Regional Council LGA

FIGURE 4

PREPARED: BW
DATE: 05 August 2021
FILE: Q15003_UnnamedCk_20210805.dwg

TITLE
VEGETATION CLEARING PLAN

Although the entire works site will be cleared as part of the works program, the clearance of native vegetation is limited to the removal of a combined total of approximately 1.83 ha of intact non-remnant native vegetation. A Vegetation Clearance Plan illustrating various vegetation communities/habitat types to be cleared is provided in **FIGURE 4.**

2.3 Summary of Works Program

A summary of the works site and works program covered by this LBEMP Sub-Plan 07 is provided in **TABLE 1**.

TABLE 1
DESCRIPTION OF APPROVED WORKS PROGRAM ASPECT DESCRIPTION

Aspect	Description	Figure/Plan Reference
Works Site Description	Flood Mitigation Works – Lot 3 on SP266287, Lot 997 SP309372, Lot 998 SP283244 and Lot 2000 SP309388.	Refer to **APPENDIX 1**
Works Site Area	Approximately 4.87 ha	**FIGURE 2**
Vegetation (Habitat) Types within Works Site	No mapped remnant vegetation (as mapped under the Queensland Vegetation Management Act 1999) occurs within the work areas subject to this Sub-Plan 07. Vegetation communities present include: • Coastal and Subcoastal Floodplain Tree Swamps – Melaleuca and Eucalypt: 1.83 ha; • Wet Terrestrial Grassland: 1.04 ha; and • Disturbed Terrestrial Grassland: 2.00 ha.	Refer to **FIGURE 4 – Vegetation Clearance Plan**
Nature and Extent of Vegetation Clearance Works	No mapped remnant vegetation (as mapped under the Queensland Vegetation Management Act 1999) occurs within the work areas subject to this Sub-Plan 07. The following vegetation types will be cleared as part of the works program. • Coastal and Subcoastal Floodplain Tree Swamps – Melaleuca and Eucalypt: 1.83 ha; • Wet Terrestrial Grassland: 1.04 ha; and • Disturbed Terrestrial Grassland: 2.00 ha. The clearance of non-remnant vegetation will be subject to the same controls as outlined in the EPBC approval.	Refer to **FIGURE 4 – Vegetation Clearance Plan**
Nature and Extent of Bulk Earthworks	Reshaping (widening and deepening) of the bed level of an approximately 500 m section of the	Refer to **APPENDIX 1**

Aspect	Description	Figure/Plan Reference
	unmapped drainage corridor and the excavation of an approximately 400 m long flood water diversion channel for flood mitigation works.	
Nature and Extent of Road Works	N/A	N/A
Nature and Extent of Infrastructure and Building Works	Construction of two (2) culverts - one (1) pipe culvert across the unmapped drainage corridor and one (1) box culvert across the flood water diversion channel.	Refer to **APPENDIX 1**
Nature and Extent of Landscaping Works	Turfing is to be provided to all swales and batters following completion of earthworks.	Refer to **APPENDIX 1**
Nature and Extent of Restoration Works	Turfing is to be provided to all swales and batters following completion of earthworks.	Refer to **APPENDIX 1**
Relevant State and Local Government Approvals	The Flood Mitigation Works have been approved by Moreton Bay Regional Council. As part of the approval process, the State's advice has been received and incorporated into the Council's conditions of approval.	N/A
Timing and Duration of Approved Works Program	**Commencement: Late 2021** **Complete: Mid 2022**	N/A

3 MNES RISK ASSESSMENT

3.1 Introduction

For each works program forming part of the North Harbor development, the approved overarching LBEMP for MNES v2 (Cardno 2014) requires a risk assessment of potential adverse impacts of the works program on MNES (**TABLE 2**). Table 3-2 of Section 3.3 of the LBEMP for MNES v2 (Cardno 2014) specifies the MNES that are to be considered by the LBEMP. Additional MNES have also been assessed based on the results of recent database searches completed as part of the Ecological Assessment Report – Flood Mitigation Works (JWA 2021a).

This MNES Risk Assessment for the works program the subject of this LBEMP Sub-Plan 07 has been completed based on consideration of:

- The likelihood of occurrence of specific MNES within or adjacent to the approved works site; and
- The risk assessment framework contained within Section 4 of the LBEMP for MNES v2 (Cardno 2014).

3.2 Likelihood of Occurrence Assessment

The likelihood of occurrence of MNES was based on the results of site assessments completed as part of the Ecological Assessment Report – Flood Mitigation Works (JWA 2021a).

TABLE 2
ASSESSMENT OF LIKELIHOOD OF OCCURRENCE

MNES		Habitat Requirements	Likelihood of Occurrence
Scientific Name	**Common Name**		
FLORA			
Acacia attenuata	Whipstick wattle	This species occurs on flat coastal lowland plains, at altitudes of lower than 30 m above sea level. Across this range *A. attenuata* typically occurs in seasonally waterlogged areas of wet heathland or heathland margins, open forest and woodland communities, and specifically on sandy poorly drained soils or peat swamps which are infertile. *Acacia attenuata* has been recorded growing in shrublands with *Leptospermum whitei* and *Baeckea frutescens*; in wallum with *Banksia aemula* and *Eucalyptus robusta*; in woodlands with *Corymbia trachyphloia, E. umbra* and *Banksia oblongifolia*; and in open forests of *E. umbra, E. racemosa* and *Melaleuca quinquenervia*. *Acacia attenuata* has been found in disturbed environments, such as roadsides subject to vegetation control, indicating the potential for a wide distribution within its range (DoE 2016).	**Low / Moderate**. This species was not located during recent site surveys and has not previously been recorded on the North Harbour site. *Melaleuca* tree swamps provide potentially suitable habitat.
Arthraxon hispidus	Hairy joint grass	Hairy-joint Grass is found in or on the edges of rainforest and in wet eucalypt forest, often near creeks or swamps, as well as woodland. In south-east Queensland, Hairy-joint Grass has also been recorded growing around freshwater springs on coastal foreshore dunes, in shaded small gullies, on creek banks, and on sandy alluvium in creek beds in open forests, and also with bog mosses in mound springs (DoE 2016).	**Low / Moderate**. This species was not located during recent site surveys and has not previously been recorded on the North Harbour site. *Melaleuca* tree swamps provide potentially suitable habitat.
Bosistoa transvera	Three-leaved bosistoa	Occurs in lowland subtropical rainforest up to 300m above sea level. In the Gold Coast hinterland it grows on reddish loam over basalt rock on a very steep slope in complex notophyll vine forest with emergent Brush Box (*Lophostemon confertus*). Associated canopy species include White Booyong, Soft Corkwood (*Caldcluvia paniculosa*), Rosewood (*Dysoxylum fraserianum*), Yellow Carabeen (*Sloanea woollsii*) and Giant Water Gum	**Low**. This species was not located during recent site surveys and suitable habitat for this species was not observed in the locality.

MNES		Habitat Requirements	Likelihood of Occurrence
Scientific Name	**Common Name**		
		(*Syzygium francisii*). At Buderim, Queensland, it has been found in remnant vine forest pockets within highly disturbed and weed infested habitats on a site with varying slope, from relatively flat to a steep scree slope. The species appears to occur only in areas that have experienced minimal disturbance (Dept. Environment 2012).	
Cryptocarya foetida	Stinking cryptocarya	Occurs in coastal sands, or close to the coast, occurring in littoral rainforest on old sand dunes and subtropical rainforests over slate and occasionally on basalt to an altitude of 150 m. Associated species include *Syzygium hemilamprum* (Broad-leaved Lilly Pilly), *Acronychia imperforata* (Beach Acronychia*), Cryptocarya triplinervis* (Three-veined Laurel), *Cupaniopsis anacardioides* (Tuckeroo), *Flindersia bennettiana* (Bennet's Ash*), Lophostemon confertus* (Brush Box) and *Syzygium luehmannii* (Small-leaved Lilly Pilly). Distribution, Iluka on the north coast of New South Wales, to Fraser Island in Queensland (Dept. Environment 2012).	**Low**. This species was not located during recent site surveys and suitable habitat for this species was not observed in the locality.
Cryptostylis hunteriana	Leafless tongue orchid	The Leafless Tongue-orchid has been reported to occur in a wide variety of habitats including heathlands, heathy woodlands, sedgelands, *Xanthorrheoa spp*. plains, dry sclerophyll forests (shrub/grass sub-formation and shrubby sub-formation), forested wetlands, freshwater wetlands, grasslands, grassy woodlands, rainforests and wet sclerophyll forests (grassy sub-formation). Soils are generally considered to be moist and sandy, however, this species is also known to grow in dry or peaty soils (DoE 2016).	**Low / Moderate**. This species was not located during recent site surveys and has not previously been recorded on the North Harbour site. *Melaleuca* tree swamps provide potentially suitable habitat.
Cupaniopsis shirleyana	Wedge-leaf tuckeroo	The Wedge-leaf tuckeroo occurs in various dry rainforest haitats, including riverbanks and hillside vine thickets (DoE 2020).	**Low**. This species was not located during recent site surveys and suitable habitat for this species was not observed in the locality.

MNES		Habitat Requirements	Likelihood of Occurrence
Scientific Name	**Common Name**		
Macadamia integrifolia	Macadamia nut	Occurs in remnant rainforest, including complex mixed notophyll forest, and prefers partially open areas such as rainforest edges. This species can occur in areas with slopes ranging from level to steep and in a wide range of landforms including hill crests, hill slopes, scree slopes and foot slopes, gullies, benches and terrace plains. Occurs at altitudes ranging from 5–340m above sea level (Dept. Environment 2012).	**Low**. This species was not located during recent site surveys and suitable habitat for this species was not observed in the locality.
Macadamia ternifolia	Bopple nut	Occurs in lowland warm complex notophyll vine forest and *Araucarian* notophyll vine forest on basic and intermediate volcanic soils and alluvia in higher rainfall areas of south-east Queensland. This species generally occurs in south-facing gullies with fertile, basalt-derived krasnozem soils or the interface between sandstone and basalt krasnozems. Surface soils tend to be dark, of varying textures (sandy loams to light clays), slightly acid (pH 5.5–7.0) and well drained (Dept. Environment 2012).	**Low**. This species was not located during recent site surveys and suitable habitat for this species was not observed in the locality.
Macadamia tetraphylla	Rough-shelled bush nut	Occurs in subtropical rainforest and complex notophyll vineforest, at the margins of these forests and in mixed sclerophyll forest. It occurs in restricted habitat, growing on moderate to steep hillslopes on alluvial soils at well-drained sites. This species growing at altitudes ranging from 10 to 460m ASL (Dept. Environment 2012).	**Low**. This species was not located during recent site surveys and suitable habitat for this species was not observed in the locality.
Persicaria elatior	Tall knotweed	Knotweeds grow in damp environments including coastal swamps, watercourses, lakes, damp forests and disturbed areas (NSW DECCW, 2005).	**Low.** While low lying damp areas occur on site, these are heavily disturbed by grazing and invasion of exotic grasses and other pioneering wetland species.
Phaius australis	Lesser Swamp Orchid	The Lesser Swamp-Orchid is commonly associated with coastal wet heath/sedgeland wetlands, swampy grassland or swampy forest and often where Broad-leaved paperbark or Swamp mahogany are found. Typically, the Lesser swamp-orchid is restricted to the swamp-forest margins, where it occurs in swamp sclerophyll forest (Broad-leaved paperbark/Swamp mahogany/Swamp box (*Lophostemon suaveolens*)),	**Low / Moderate**. This species was not located during recent site surveys and has not previously been recorded on the North Harbour site. *Melaleuca* tree

MNES		Habitat Requirements	Likelihood of Occurrence
Scientific Name	**Common Name**		
		swampy rainforest (often with sclerophyll emergents), or fringing open forest. It is often associated with rainforest elements such as Bangalow palm (*Archontophoenix cunninghamiana*) or Cabbage tree palm (*Livistona australis*) (DoE 2016).	swamps provide potentially suitable habitat.
Phaius bernaysii	Yellow swamp-orchid	Occurs along the margins between open forest/woodland and closed sedgeland, along the perimeter of a swamp, often in a fairly shady environment in *Melaleuca quinquenervia–Eucalyptus robusta* open forest in sandy or peaty soil. This species is currently known to occur only in one area on Stradbroke Island, near Myora in Queensland (Dept. Environment 2012).	**Low**. This species was not located during recent site surveys and suitable habitat for this species was not observed in the locality.
Rhodomyrtus psidioides	Native guava	Pioneer species found in littoral, warm temperate and subtropical rainforest and wet sclerophyll forest often near creeks and drainage lines (OEH 2021).	**Low**. This species was not located during recent site surveys and suitable habitat for this species was not observed in the locality.
Samadera bidwillii	Quassia	Occurs in lowland rainforest or on rainforest margins, but it can also be found in other forest types, such as open forest and woodland. This species is commonly found in areas adjacent to both temporary and permanent watercourses in locations up to 510m altitude. The species occurs on lithosols, skeletal soils, loam soils, sands, silts and sands with clay subsoils. Commonly associated tree species include Spotted Gum (*Corymbia citriodora*), Grey Gum (*Eucalyptus propinqua*), White Mahogany (*E. acmenoides*), Forest Red Gum (E. *tereticornis*), Pink Bloodwood (C. *intermedia*), an ironbark (*E. siderophloia*), Gum Topped Box (*E. moluccana*), Gympie Messmate (*E. cloeziana*), and Broad Leaved Ironbark (*E. fibrosa*) (Dept. Environment 2012).	**Low**. This species was not located during recent site surveys and suitable habitat for this species was not observed in the locality.
Sophora fraseri	Brush sophora	This species grows in moist habitats, often in hilly terrain at altitudes from 60–660m on shallow soils along rainforest margins in eucalypt forests or in large canopy gaps in closed forest communities (Dept.	**Low**. This species was not located during recent site surveys and suitable habitat

MNES		Habitat Requirements	Likelihood of Occurrence
Scientific Name	**Common Name**		
		Environment 2012). Occurs in wet sclerophyll forest and a range of rainforest types on shallow stony to shaly soils, of loam to clay texture derived from sandstone or basalt rocks. Associated species include: *Corymbia citriodora, Eucalyptus carnea, E. microcorys, E. acmenoides, E. propinqua* and *Lophostemon confertus*. The shrub appears to prefer growing along rainforest margins, in eucalypt forests in the vicinity of rainforests or in large canopy gaps in closed forest communities (DEHP 2013).	for this species was not observed in the locality.
Thesium australe	Austral toadflax	Austral toadflax is semi-parasitic on roots of a range of grass species, notably Kangaroo Grass (*Themeda triandra*). It occurs in shrubland, grassland or woodland, often on damp sites, in subtropical, temperate and subalpine climates over a wide range of altitudes. It occurs on soils derived from sedimentary, igneous and metamorphic geology on a range of soils including black clay loams to yellow podzolics and peaty loams. Vegetation types include open grassy heath dominated by Swamp Myrtle (*Leptospermum myrtifolium*), Small-fruit Hakea (*Hakea microcarpa*), Alpine Bottlebrush (*Callistemon sieberi*), Woolly Grevillea (*Grevillea lanigera*), Coral Heath (*Epacris microphylla*) and *Poa* spp.; Kangaroo Grass grassland surrounded by Eucalyptus woodland; and grassland dominated by Barbed-wire Grass (*Cymbopogon refractus*) (Dept. Environment 2012).	**Low**. This species was not located during recent site surveys and suitable habitat for this species was not observed in the locality.
FAUNA			
Anseranas semipalmata	Magpie Goose	The Magpie goose occurs mainly in coastal and sub-coastal areas of northern Australia. The species is now a rare vagrant in NSW. It generally inhabits open lakes, swamps and permanent wetlands which are dominated by rush and sedge vegetation, with grasslands nearby.	**Low**. Suitable habitat for this species was not observed in the locality.
Anthochaera phrygia	Regent Honey-eater	Regent Honeyeaters mostly occur in dry Box-Ironbark eucalypt woodland and dry sclerophyll forest associations in areas of low to moderate relief,	**Low**. Suitable habitat for this species was not observed in the locality.

MNES		Habitat Requirements	Likelihood of Occurrence
Scientific Name	**Common Name**		
		wherein they prefer moister, more fertile sites available, for example along creek flats, or in broad river valleys and foothills. At times of food shortage (e.g. when flowering fails in preferred habitats), Regent Honeyeaters also use other woodland types and wet lowland coastal forest dominated by Swamp Mahogany (*Eucalyptus robusta*) or Spotted Gum (*Corymbia maculata*) (DoE 2016). Regent Honeyeaters usually nest in the canopy of forests or woodlands, and in the crowns of tall trees, mostly eucalypts. Studies in the Bundarra-Barraba region indicate that birds actively select the tallest trees available to nest in. Nests in riparian sites are mostly built in rough-barked trees. Nests in woodland sites vary according to the availability of rough-barked trees: in woodlands dominated by rough-barked species (e.g. ironbarks), nests are placed in rough-barked trees; in woodlands where rough-barked trees are scarce (e.g. those dominated by White Box), nests are placed mostly in smooth-barked species (DoE 2016.)	
Apus pacificus	Fork-tailed Swift	This species occur over dry or open habitats, including riparian woodland and tea-tree swamps, low scrub, heathland or saltmarsh. They are also found at treeless grassland and sandplains covered with spinifex, open farmland and inland and coastal sand-dunes. The sometimes occur above rainforests, wet sclerophyll forest or open forest or plantations of pines (Higgins 1999). They forage aerially, up to hundreds of metres above ground, but also less then 1 m above open areas or over water. They probably roost aerially, but are occasionally observed to land. They are widespread but scattered in coastal areas from 20° S, south to Brisbane and in much of the south south-eastern region (Dept. Environment 2012).	**Moderate**. This species may forage over the site.

MNES		Habitat Requirements	Likelihood of Occurrence
Scientific Name	**Common Name**		
Ardea alba	Great egret	This species inhabits a wide range of wetland habitats including swamps and marshes; margins of rivers and lakes; damp or flooded grasslands, pastures or agricultural lands; reservoirs; sewage treatment ponds; drainage channels; salt pans and salt lakes; salt marshes; estuarine mudflats, tidal streams; mangrove swamps; coastal lagoons; and offshore reefs. This species usually frequents shallow waters (Dept. Environment 2012).	**Low / Moderate**. A small amount of foraging habitat for this species may occur within the open paddocks when wet.
Ardea ibis	Cattle egret	This species inhabits tropical and temperate grasslands, wooded lands and terrestrial wetlands. It uses predominately shallow, open and fresh wetlands including meadows and swamps with low emergent vegetation and abundant aquatic flora. This species often forages away from water on low lying grasslands, improved pastures and croplands. It is commonly found in cattle fields and other farm areas that contain livestock. This species roosts in trees, or amongst ground vegetation in or near lakes and swamps (Dept. Environment 2012).	**Low / Moderate**. A small amount of foraging habitat for this species may occur within the open paddocks when wet.
Argyreus hyberbius inconstans	Australian fritillary	The Australian fritillary butterfly is restricted to open, swampy, coastal areas (i.e. *Melaleuca* wetlands) where the larval food plant, *Viola betonicifolia,* grows as a small, insignificant ground herb in association with *Lomandra longifolia* (long leaved matrush) and grasses, especially the grass *Imperata cylindrica* (bladey grass) (DEHP 2016).	**Low.** The larval food plant has not been observed on site to date and suitable habitat was not observed in the locality.
Botaurus poiciloptilus	Australian bittern	This species occurs in terrestrial freshwater wetlands and, rarely, estuarine habitats. It favours wetlands with tall, dense vegetation, where it forages in still, shallow water up to 0.3m deep, often at the edges of pools or waterways, or from platforms or mats of vegetation over deep water. The species favours permanent and seasonal freshwater habitats, particularly those dominated by sedges, rushes and/or reeds (e.g. *Phragmites, Cyperus, Eleocharis, Juncus, Typha,*	**Low.** Potential habitat for this species may be found within vegetation associated with Raff creek, however dense aquatic vegetation (sedges, rushes) was not present in the vicinity of the work area.

MNES		Habitat Requirements	Likelihood of Occurrence
Scientific Name	**Common Name**		
		Baumea, Bolboschoenus) or cutting grass (*Gahnia*) growing over muddy or peaty substrate (Dept. Environment 2012).	
Caretta caretta	Loggerhead turtle	In Australia, Loggerhead Turtles nest on open, sandy beaches. Loggerhead Turtles choose a wide variety of tidal and sub-tidal habitat as feeding areas (DAWE 2021).	**Low**. Suitable habitat for this species was not observed in the locality.
Chalinolobus dwyeri	Large-eared pied bat	This species requires a combination of sandstone cliff/escarpment to provide roosting habitat that is adjacent to higher fertility sites, particularly box gum woodlands or river/rainforest corridors which are used for foraging. Almost all records have been found within several kilometres of cliff lines or rocky terrain. Roosting has also been observed in disused mine shafts, caves, overhangs and disused Fairy martin (*Hirundo ariel*) nests. It also possibly roosts in the hollows of trees. The structure of primary nursery roosts appears to be very specific, i.e. arch caves with dome roofs (that need to be deep enough to allow juvenile bats to learn to fly safely inside) and with indentations in the roof (presumably to allow the capture of heat). These physical characteristics are not very common in the landscape and therefore a limiting factor (Dept. Environment 2012).	**Low**. Suitable habitat for this species was not observed in the locality.
Chelonia mydas	Green turtle	Green Turtles forage in shallow benthic habitats such as tropical tidal and sub-tidal coral and rocky reef habitat or inshore seagrass beds. The shallow foraging habitat of adults contains seagrass beds or algae mats on which Green Turtles mainly feed (DAWE 2021).	**Low**. Suitable habitat for this species was not observed in the locality.
Cuculus optatus	Oriental cuckoo	This species occurs in mixed, deciduous and coniferous forests, woodlands, and open paddocks with trees (Flegg, 2002).	**Low.** No suitable foraging habitat for this species was not observed in the locality.
Cyclopsitta diophthalma coxenii	Coxen's fig-parrot	Coxen's fig-parrot occurs in rainforest habitats including subtropical rainforest, dry rainforest, littoral and developing littoral rainforest, and vine forest. Remaining populations are now concentrated into fragmented remnants of dry rainforest and cool subtropical rainforest	**Low**. Suitable habitat for this species was not observed in the locality.

MNES		Habitat Requirements	Likelihood of Occurrence
Scientific Name	**Common Name**		
		that are drier and hillier than the habitats that were occupied in the past. Within these rainforest habitats, the fig-parrot is likely to favour alluvial areas that support figs and other trees with fleshy fruits, in particular, habitats that have a high diversity of fig species, and that have a fruiting season that is staggered across moisture and altitudinal gradients (DoE 2016). Most recent records of the fig-parrot have been from small stands of remnant native vegetation, at forest edges, and in thin tracts of gallery forest (at edges of rivers or streams). Coxen's Fig-Parrot has also been recorded in other habitat types including sub-littoral mixed scrub; corridors of riparian vegetation in woodland, open woodland or other types of cleared or partially-cleared habitat; and isolated stands of fig or other trees on urban, agricultural or cleared land (DoE 2016).	
Dasyurus hallucatus	Northern quoll	This species is found within most treed habitats and is most abundant in broken, rocky country and in open eucalypt forest within 150 km of the coast. Northern quoll habitat generally encompasses some form of rocky area for denning purposes. In Queensland Northern quolls are more likely to be present in high relief areas that have shallower soils, greater cover of boulders, less fire impact and were closer to permanent water (Dept. Environment 2012).	**Low**. Suitable habitat for this species was not observed in the locality.
Dasyurus maculatus maculatus	Spotted-tailed quoll	This species occurs in coastal areas and adjacent ranges of South-east Queensland from Bundaberg to the border and inland to Monto and Stanthorpe (Dept. Environment 2012). It generally occurs in densely vegetated areas ranging from rainforest and vine-forest through to dry and wet eucalypt forest, woodland and coastal heathland (DEHP 2013). Transient males are sometimes seen in more open areas, including land cleared for pasture (DEHP 2013). The Spotted-tailed quoll is predominantly nocturnal and rests during the day in dens. Habitat	**Low**. Suitable habitat for this species was not observed in the locality.

MNES		Habitat Requirements	Likelihood of Occurrence
Scientific Name	**Common Name**		
		requirements include suitable den sites such as hollow logs, tree hollows, rock outcrops or caves (Dept. Environment 2012). Individuals also require an abundance of food, such as birds and small mammals, and large areas of relatively intact vegetation through which to forage (Dept. Environment 2012).	
Delma torquata	Collared delma	Due to specific habitat requirements, this species distribution is highly fragmented and restricted to only a few locations. The Collared delma is known from the western suburbs of Brisbane, QLD and the following sites: Bunya Mountains, Blackdown Tableland National Park (NP), Bullyard Conservation Park, D'Aguilar Range NP, Expedition NP, Naumgna and Lockyer Forest Reserves, Western Creek near Millmerran and the Toowoomba Range (Dept. Environment 2012). This species inhabits eucalypt dominated woodland and open forest where it is associated with suitable micro-habitats (exposed rocky outcrops). The ground cover is predominantly native grasses, such as Kangaroo Grass (*Themeda triandra*), Barbed-wire Grass (*Cymbopogon refractus*), Wiregrass (*Aristida* sp.) and Lomandra (*Lomandra* sp.) (Dept. Environment 2012). The presence of rocks, logs, bark and other coarse woody debris, and mats of leaf litter (typically 30–100mm thick) appears to be an essential characteristic of the collared delma microhabitat and is always present where the species occurs (Dept. Environment 2012). Whilst Collared delmas are often found associated with small rocks, the presence of small rocks is not an essential habitat characteristic (Dept. Environment 2012).	**Low**. Suitable habitat for this species was not observed in the locality.
Eretmochelys imbricata	Hawksbill turtle	Hawksbill Turtles forage in tropical tidal and sub-tidal coral and rocky reef habitat. They have also been found, though less frequently, within seagrass habitats of coastal waters, as well as the deeper habitats of trawl fisheries (DAWE 2021).	**Low**. Suitable habitat for this species was not observed in the locality.

MNES		Habitat Requirements	Likelihood of Occurrence
Scientific Name	**Common Name**		
Erythrotriorchis radiatus	Red goshawk	The Red goshawk occurs in coastal and sub-coastal areas in wooded and forested lands of tropical and warm-temperate Australia. Riverine forests are also used frequently. Such habitats typically support high bird numbers and biodiversity, especially medium to large species which the goshawk requires for prey. The Red goshawk nests in large trees, frequently the tallest and most massive in a tall stand, and nest trees are invariably within one km of permanent water (DoE 2016). The Red goshawk occurs over wooded and forested lands of tropical and warm-temperate Australia, coastal and sub-coastal. This species prefers forest and woodland with a mosaic of vegetation types, large prey populations (birds), and permanent water. The vegetation types include eucalypt woodland, open forest, tall open forest, gallery rainforest, swamp sclerophyll forest, and rainforest margins (DoE 2016).	**Moderate.** Forested areas adjoining the works site provide potential foraging habitat for this species. However, this species may also utilise scattered eucalypts within grazed areas to search for prey.
Falco hypoleucos	Grey falcon	Usually restricted to shrubland, grassland and wooded watercourses of arid and semi-arid regions, although it is occasionally found in open woodlands near the coast.	**Moderate.** Forested areas adjoining the works site provide potential foraging habitat for this species. However, this species may also utilise scattered eucalypts within grazed areas to search for prey.
Furina dunmalli	Dunmall's snake	Suitable habitat for this species includes forests and woodlands dominated by *Acacia harpophylla* on black alluvial cracking clays and Eucalypt-Bulloak associations on sandstone derived soils (Dept. Environment 2012).	**Low**. Suitable habitat for this species was not observed in the locality.
Haliaeetus leucogaster	White-bellied sea-eagle	This species has a large distribution range throughout SE QLD and is found in association with coasts, large rivers and estuaries and prefers to nest in large trees adjacent watercourses (Dept. Environment 2012).	**Low.** This species may fly over the work area, however is unlikely to nest in the immediate locality.

MNES		Habitat Requirements	Likelihood of Occurrence
Scientific Name	**Common Name**		
Hirundapus caudacutus	White-throated needletail	This species occurs flying over most types of habitat, they are probably recorded most often above wooded areas, including open forest and rainforest, and may also fly between trees or in clearings, below the canopy, but they are less commonly recorded flying above woodland. It is recorded in all coastal regions of Queensland and NSW and almost always forage aerially (Dept. Environment 2012).	**Moderate**. This species may forage over the work area.
Lathamus discolor	Swift parrot	The Swift parrot inhabits dry sclerophyll eucalypt forests and woodlands. It occasionally occurs in wet sclerophyll forests. The Swift Parrot migrates from its Tasmanian breeding grounds to overwinter in the box-ironbark forests and woodlands of Victoria, New South Wales and southern Queensland. The principal wintering grounds are the inland slopes of the Great Dividing Range and along the eastern coastal plains. In northern New South Wales and south-eastern Queensland, Narrow-leaved Red Ironbark (*E. crebra*), Forest Red Gum forests and Yellow Box forest are commonly utilised (DoE 2016).	**Moderate.** Suitable forage habitat may be provided by scattered mature trees on the site.
Lepidochelys olivacea	Pacific Ridley turtle	Olive Ridley Turtles lay clutches of eggs on sandy beaches. This species forage over shallow benthic habitats from northern Western Australia to south-east Queensland (DAWE 2021).	**Low**. Suitable habitat for this species was not observed in the locality.
Litoria olongburensis	Wallum sedge frog	The Wallum Sedge Frog is found in ephemeral, semi-permanent and permanent wetlands with emergent reeds, ferns and/or sedges, in undisturbed coastal wallum. Wallum is described as sandmass heathland and shrubland, and various forest, woodland, sedgeland and grassland communities (DoE 2016).	**Low.** Wet grassland areas within and adjoining the works site may provide potential habitat for this species, however habitat quality is low due to disturbance from cattle grazing.
Merops ornatus	Rainbow bee-eater	This species occurs in open forests and woodlands, shrublands, and in various cleared or semi-cleared habitats, including farmland and areas of human habitation. Usually occurs in open, cleared or lightly-timbered areas that are often, but not always, located in close proximity to	**Moderate.** Suitable habitat occurs on the site.

MNES		Habitat Requirements	Likelihood of Occurrence
Scientific Name	**Common Name**		
		permanent water. Also occurs in inland and coastal sand dune systems, and in mangroves (Dept. Environment 2012).	
Mixophyes fleayi	Fleay's barred frog	This species is found in wet forests, including rainforests, Antarctic beech forests, and eucalypt forests.	**Low**. Suitable habitat for this species was not observed in the locality.
Mixophyes iteratus	Giant barred frog	This species occurs along shallow rocky streams in rainforest, wet sclerophyll forest and farmland from 100 to 1000m altitude or deep, slow moving streams with steep banks in the lowlands (DEHP 2013).	**Low**. Suitable habitat for this species was not observed in the locality.
Monarcha melanopsis	Black-faced monarch	This species occurs in rainforest ecosystems, including semi-deciduous vine-thickets, complex notophyll vine-forest, tropical (mesophyll) rainforest, subtropical (notophyll) rainforest, mesophyll (broadleaf) thicket/shrubland, warm temperate rainforest, dry (monsoon) rainforest and (occasionally) cool temperate rainforest. During winter or migration, this species also occurs in marginal habitats such as 20-30 years old regrowth rainforest, nearby open eucalypt forest (mainly wet sclerophyll forests), especially in gullies with a dense, shrubby understorey as well as dry sclerophyll forests and woodlands, often with a patchy understorey. (Dept. Environment 2012).	**Low**. Suitable habitat for this species was not observed in the locality.
Monarcha trivirgatus	Spectacled monarch	This species occupies the understorey of mountain/lowland rainforests, thickly wooded gullies, and waterside vegetation; mostly well below the canopy, and occasionally mangroves (Pizzey and Knight 1997).	**Low**. Suitable habitat for this species was not observed in the locality.
Myiagra cyanoleuca	Satin flycatcher	This species occurs in heavily vegetated gullies in eucalypt-dominated forests and taller woodlands, and on migration, occurs in coastal forests, woodlands, mangroves and drier woodland and open forests (Dept. Environment 2012).	**Low**. Suitable habitat for this species was not observed in the locality.
Nannoperca oxleyana	Oxleyan pygmy perch	This species is found in slow flowing or still waters, usually those that are tannin stained and slightly acidic within lowland coastal wallum habitats (DEHP 2017).	**Low**. No suitable watercourse occurs within the vicinity of the work area.

MNES		Habitat Requirements	Likelihood of Occurrence
Scientific Name	**Common Name**		
Pandion haliaetus	Osprey	This raptor is thinly distributed in coastal Australia. It nests in singularly overtopping, generally dead trees. The Eastern osprey hunts in coastal rivers, estuaries and streams and may gather nesting material from nearby forests.	**Moderate.** This species may fly over the work area, however is unlikely to nest in the immediate locality.
Petauroides volans	Southern greater glider	This species is most abundant in tall, montane moist forests, and prefers habitat with a diversity of eucalypt species. It appears very sensitive to clearing (logging etc) and is reliant on tree hollows in old, mature trees for shelter and breeding. In southern Queensland, they have been found to require at least 2 – 4 dens trees per 2 hectares of suitable habitat (DoE, 2016).	**Low**. Suitable habitat for this species was not observed in the locality. Only scattered eucalypts are present within the MIBA area.
Phascolarctos cinereus	Koala	Koalas naturally inhabit a range of temperate, sub-tropical and tropical forest, woodland and semi-arid communities dominated by Eucalyptus species. Koala habitat can be broadly defined as any forest or woodland containing species that are known koala food trees, or shrubland with emergent food trees. The distribution of this habitat is largely influenced by land elevation, annual temperature and rainfall patterns, soil types and the resultant soil moisture availability and fertility. Preferred food and shelter trees are naturally abundant on fertile clay soils (DoE 2016).	**Moderate / High.** Evidence of koala activity has previously been recorded in the area and preferred food trees occur within the works area.
Phyllodes imperialis smithersi	Pink underwing moth	This species is found at heights below 600m in subtropical rainforest environments. It is associated with the larval food plant *Carronia multisepalea* (DoE, 2017).	**Low**. Suitable habitat for this species was not observed in the locality.
Potorous tridactylus tridactylus	Long-nosed potoroo	The long-nosed potoroo has scattered populations extending from south-eastern Queensland through to NSW. This species occurs across a range of vegetation types from subtropical and warm temperate rainforest through tall open forest with dense understory to dense coastal heaths (DEHP 2013). Its main habitat requirements are access to some form of dense vegetation for shelter and nesting materials, as well as the	**Low**. Suitable habitat for this species was not observed in the locality.

MNES		Habitat Requirements	Likelihood of Occurrence
Scientific Name	**Common Name**		
		presence of an abundant supply of underground roots and fungi for food (DEHP 2013, Dept. Environment 2012).	
Pseudomugil mellis	Honey blue-eye	Honey blue-eye are typically found in slightly acidic and tannin-stained water in coastal heathland (wallum) swamps and streams. Wallum is a restricted region and hence any species of fauna confined to it are restricted in their distribution. However, they can also be found in clear water habitats. They inhabit freshwater dune lakes, creeks, swampy areas and wetlands.	**Low**. Suitable habitat for this species was not observed in the locality.
Pteropus poliocephalus	Grey-headed flying Fox	The Grey-headed Flying-fox requires foraging resources and roosting sites. It is a canopy-feeding frugivore and nectarivore, which utilises vegetation communities including rainforests, open forests, closed and open woodlands, Melaleuca swamps and Banksia woodlands. It also feeds on commercial fruit crops and on introduced tree species in urban areas. The primary food source is blossom from *Eucalyptus* and related genera but in some areas it also utilises a wide range of rainforest fruits. None of the vegetation communities used by the Grey-headed Flying-fox produce continuous foraging resources throughout the year. As a result, the species has adopted complex migration traits in response to ephemeral and patchy food resources (DoE 2016). The Grey-headed Flying-fox roosts in aggregations of various sizes on exposed branches. Roost sites are typically located near water, such as lakes, rivers or the coast. Roost vegetation includes rainforest patches, stands of Melaleuca, mangroves and riparian vegetation, but colonies also use highly modified vegetation in urban and suburban area (DoE 2016).	**Moderate.** This species has not previously been recorded and no roosting sites are known to occur in the vicinity of the site. However, scattered eucalypts provide potential feeding resources for this highly mobile species.
Rhipidura rufifrons	Rufous fantail	In east and south-east Australia, the Rufous fantail mainly inhabits wet sclerophyll forests, often in gullies dominated by eucalypts such as Tallow-wood (*Eucalyptus microcorys*), Mountain grey gum (*E.*	**Low**. Suitable habitat for this species was not observed in the locality.

MNES		Habitat Requirements	Likelihood of Occurrence
Scientific Name	**Common Name**		
		cypellocarpa), Narrow-leaved peppermint (*E. radiata*), Mountain ash (*E. regnans*), Alpine ash (*E. delegatensis*), Blackbutt (*E. pilularis*) or Red mahogany (*E. resinifera*); usually with a dense shrubby understorey often including ferns. They also occur in subtropical and temperate rainforests; for example near Bega in south-east NSW, where they are recorded in temperate Lilly pilly (*Acmena smithi*) rainforest, with Grey myrtle (*Backhousia myrtifolia*), Sassafras (*Doryphora sassafras*) and Sweet pittosporum (*Pittosporum undulatum*) subdominants. They occasionally occur in secondary regrowth, following logging or disturbance in forests or rainforests. When on passage, they are sometimes recorded in drier sclerophyll forests and woodlands, including Spotted gum (*Eucalyptus maculata*), Yellow box (*E. melliodora*), ironbarks or stringybarks, often with a shrubby or heath understorey. They are also recorded from parks and gardens when on passage. In north and north-east Australia, they often occur in tropical rainforest and monsoon rainforests, including semi-evergreen mesophyll vine forests, semi-deciduous vine thickets or thickets of Paperbarks (*Melaleuca* spp.) (Dept. Environment 2012).	
Rostratula australis/bhengalensis	Australian painted snipe	The Australian painted snipe generally inhabits shallow terrestrial freshwater (occasionally brackish) wetlands, including temporary and permanent lakes, swamps and claypans. They also use inundated or waterlogged grassland or saltmarsh, dams, rice crops, sewage farms and bore drains. Typical sites include those with rank emergent tussocks of grass, sedges, rushes or reeds, or samphire; often with scattered clumps of lignum *Muehlenbeckia* or canegrass or sometimes tea-tree (*Melaleuca*). The Australian painted snipe sometimes utilises areas that are lined with trees, or that have some scattered fallen or washed-up timber (DoE 2016).	**Low**. Suitable habitat for this species was not observed in the locality.

MNES		Habitat Requirements	Likelihood of Occurrence
Scientific Name	**Common Name**		
Saiphos reticulatus	Three-toed snake-tooth skink	This species inhabits rainforest and occasionally moist eucalypt forest, on loamy or sandy soils. This species feeds on earthworms and beetle grubs and is found in leaf litter, often immediately adjacent to fallen tree trunks (Dept. Environment 2012).	**Low**. Suitable habitat for this species was not observed in the locality.
Turnix melanogaster	Black-breasted button quail	This species is restricted to rainforests and forests, mostly in areas with 770-1200 mm rainfall per annum. They prefer drier low closed forests, particularly semi-evergreen vine thicket, low microphyll vine forest, araucarian microphyll vine forest and araucarian notophyll vine forest. This species may also be found in low, dense acacia thickets and, in littoral area, in vegetation behind sand dunes. An extensive dense leaf-litter layer is required for foraging and possibly also roosting. Fallen logs and a dense, heterogeneously distributed shrub layers are also considered to be important habitat characteristics for shelter and breeding (Dept. Environment 2012).	**Low**. Suitable habitat for this species was not observed in the locality.
Xeromys myoides	Water Mouse	In south-east Queensland, water mouse habitat includes mangrove communities and adjacent sedgelands, grasslands and freshwater wetlands. Mangrove communities in this region are typically comprised of A*vicenna marina var. australasica, Rhizophora stylosa,Bruguiera gymnorrhiza, Aegiceras corniculatum* and *Ceriops tagal var. australis* (DoE 2016).	**Low.** Areas of coastal and sub-coastal swamps near the site and downstream provide potential habitat for this species, although the quality of this habitat is substantially reduced by livestock disturbance. No potential habitat occurs within the work area.
Various sea birds		Sea birds are those which spend a majority of time over coastal and oceanic environments, returning to land to nest.	**Low**. Suitable habitat for these species was not observed in the vicinity of the site.
Various wading birds		Wading birds are those which spend the majority of their time foraging in shallow marine or sometimes freshwater environments, such as beaches, mudflats, estuaries, or coastal wetlands.	**Low**. Suitable habitat for these species was not observed in the vicinity of the site.

3.3 MNES Risk Assessment

To manage the risk of adverse impacts on MNES and comply with the duty of care as defined by the *Environmental Protection Act 1994*, the following is required:

- Identification of the potential environmental hazards associated with the works program;
- Assessment environmental risks; and
- Development of controls to eliminate or minimise residual environmental risk.

In accordance with AS/NZS ISO 31000:2009 Risk management – Principles and Guidelines and Section 4 of the LBEMP for MNES v2 (Cardno 2014), a project hazard identification and risk assessment has been undertaken in order to identify and evaluate the risks posed to MNES by the various construction activities associated with the works program.

This risk assessment evaluates unmitigated project specific environmental hazards, including assigning likelihood and consequence levels, to determine a risk rating for each identified risk. The criteria for determining likelihood and consequence levels, and risk ratings for each identified risk are based on AS/NZS ISO 31000:2009 and are consistent with the criteria described in Tables 4-1 to 4-3 of Section 4 of the LBEMP for MNES v2 (Cardno 2014).

Likelihood and consequence criteria and the risk rating matrix adopted in this risk assessment are provided in **TABLES 3 to 5** of this LBEMP Sub-Plan 07. The results of the risk assessment are documented in **TABLE 6** of this LBEMP Sub-Plan 07. Note that in cases where the likelihood and consequence of risks relating to a particular hazard varied across the works site, the most conservative figure was adopted.

TABLE 3
LIKELIHOOD LEVELS

Level	Descriptor	Qualitative Description
A	Almost Certain	The event is expected to occur. The event will occur on an annual (or more frequent) basis.
B	Likely	It is probable the event will occur. The event has occurred several times before at similar developments.
C	Possible	The event may or may not occur. The event may occur once during the development.
D	Unlikely	The event may occur at some time but is unlikely. The event has been known to happen from time to time at similar developments.
E	Rare	The event may occur in exceptional circumstances. The event has not been heard of occurring at similar developments.

TABLE 4
CONSEQUENCE LEVELS

Level	Descriptor	Qualitative Description
1	Insignificant	**Environment:** No damaged detected. **People:** Event does not result in injury (i.e. no medical treatment required). **Property:** No damage to property. **Amenity:** No detectable impact on amenity.
2	Minor	**Environment:** Minor impact of short duration or short term damage. **People:** Reversible injury or illness. **Property:** Minor damage to property (<$5,000 to repair). **Amenity:** Minor, localised and short term amenity impacts, no complaints.
3	Moderate	**Environment:** Short term damage, localised impact. **People:** Irreversible disability or impairment (30%) to one or more persons. **Property:** Moderate damage to property (<$50,000 to repair). **Amenity:** One (1) or two (2) complaints, impacts extending to several properties and/or lasting for several days.
4	Major	**Environment:** Significant impact locally and potential for offsite impacts. **People:** Severe injuries or impairment (60%) to one or more persons, single fatality. **Property:** Major damage to property (<$500,000 to repair). **Amenity:** Many complaints, impacts extensive and/or lasting for many days, up to five (5) properties rendered uninhabitable for more than one day.
5	Catastrophic	**Environment:** Significant impacts to regional ecosystems and threatened species, potential for widespread off site impacts. **People:** Multiple fatalities, or irreversible injuries/impairment (>60%). **Property:** Significant loss to property (>$1,000,000 to repair). **Amenity:** Multiple dwellings rendered uninhabitable for >1 day.

TABLE 5
RISK MATRIX CRITERIA

		Consequence				
		1 (Insignificant)	**2 (Minor)**	**3 (Moderate)**	**4 (Major)**	**5 (Catastrophic)**
Likelihood	**A (Almost Certain)**	Medium	High	High	Extreme	Extreme
	B (Likely)	Medium	Medium	High	High	Extreme
	C (Possible)	Low	Medium	High	High	High
	D (Unlikely)	Low	Low	Medium	Medium	High
	E (Rare)	Low	Low	Medium	Medium	High

The risk ratings presented in **TABLE 5** are to be interpreted as follows:

- **Low:** Risk can be adequately managed by routine procedures and work practices.
- **Medium:** Corrective action other than administrative controls is needed.
- **High:** Significant risk control measures need to be implemented before works commence.
- **Extreme:** Operations are not to be undertaken without extensive risk control and mitigation measures in place prior to the commencement of works.

The emphasis of this LBEMP Sub-Plan 07 is on the management of activities assessed as having a risk rating of 'Extreme', 'High' or 'Medium' for MNES that are known or considered likely to occur within (Moderate or High likelihood of occurrence) or adjacent to the works site the subject of the approved works program.

As such, for each hazard associated with the approved works program that has been assessed as having a 'Extreme', 'High' or 'Medium' level of risk to one or more MNES, applicable environmental management elements are specified in **TABLE 6** and associated detailed specifications are provided in **SECTION 4** of this LBEMP Sub-Plan 07.

TABLE 6
ENVIRONMENTAL RISK ASSESSMENT REGISTER

Hazard	Risk	MNES Potentially Impacted	Likelihood	Consequence	Risk Rating	Management Element Reference Section
Vegetation clearing and grubbing	Loss of MNES flora within areas to be cleared / grubbed.	All MNES flora.	D	3	Medium	4
	Damage to potential habitat for MNES flora and fauna intended to be retained.	All MNES flora and fauna.	D	3	Medium	2, 3, 4
	Injury, death or displacement of MNES fauna, including the Koala	All terrestrial MNES fauna.	D	3	Medium	2, 3
	Removal of topsoil resulting in loss of seed bank / tubers of MNES flora.	All MNES flora.	D	3	Medium	4
	Increased soil instability causing erosion and sedimentation of downstream waterways providing potential habitat for MNES.	All MNES flora and fauna.	C	3	High	6
Movement of construction plant and machinery, increased road traffic from construction vehicles.	Injury or death of MNES fauna, including Koalas, utilising the works site or surrounding road network.	All terrestrial MNES fauna.	D	3	Medium	2, 3
	Introduction and / or spread of weeds or pest animal / ant species causing degradation of potential habitat for MNES potential or increased competition / predation on MNES.	All MNES flora and fauna.	B	3	High	5
Construction personnel bringing dogs onto the works site.	Injury and harassment of MNES fauna, including Koalas.	All terrestrial MNES fauna.	D	2	Low	2, 3

Hazard	Risk	MNES Potentially Impacted	Likelihood	Consequence	Risk Rating	Management Element Reference Section
Bulk earthworks, including filling and excavation, generally.	Erosion and discharge of sediment-laden runoff to downstream waterways impacting on water quality and habitat for MNES, including loss or reduction of seagrass and other benthic feeding grounds within Raff Creek, Caboolture River and Moreton Bay.	All aquatic MNES flora and fauna.	C	3	High	6
Bulk earthworks, including filling and excavation, below 5m AHD.	Disturbance of potential acid sulphate soils resulting in release of acidic discharge and other contaminants to soils and downstream waterways providing potential habitat for MNES.	All aquatic MNES flora and fauna.	B	4	High	7
Construction of roads, stormwater, sewerage and water supply infrastructure, and landscaping works.	Runoff of sediment from disturbed work surfaces and stockpiles causing sedimentation of downstream waterways, impacting on water quality and habitat for MNES.	All aquatic MNES flora and fauna.	C	3	High	6
	Introduction or spread of weeds or pest animals / ants through importation of construction materials, plant and equipment.	All MNES flora and fauna.	C	3	High	5
Fire ignition caused by operation of construction plant or equipment, welding, personnel smoking or other construction activities.	Spread of uncontrolled fire resulting in loss or damage to retained vegetation providing potential habitat for MNES.	All terrestrial MNES flora and fauna.	D	2	Low	N/A

4 ENVIRONMENTAL MANAGEMENT ELEMENTS

Based on consideration of the risk assessment presented in **TABLE 6**, the following environmental management elements have been identified as applicable to the approved works program the subject of this LBEMP Sub-Plan 07:

- Element 1: LBEMP Sub-Plan Risk Assessment (refer **SECTION 3**);
- Element 2: Fauna;
- Element 3: Koalas;
- Element 4: Flora;
- Element 5: Weeds and Pests;
- Element 6: Soil Erosion, Sediment Loss and Water Quality; and
- Element 7: Acid Sulphate Soils.

Each of these environmental management elements consists of the following key components:

- **Rationale:** the reason(s) why this management element is, or is not, relevant to the specific works program the subject of this LBEMP Sub-Plan 06.
- **Objectives:** the objectives and targets to be achieved by implementing this management element.
- **Performance Indicators:** measurable indicators and standards set to assess the efficacy of management measures taken.
- **Tasks:** specific management and monitoring tasks that need to be undertaken, including:
    - Actions: details of the actions, including monitoring, to be undertaken; and
    - Timing: details concerning the timing and frequency for undertaking specific actions.

4.1 Element 1: LBEMP Sub-plan MNES Risk Assessment

SECTION 3 of this LBEMP Sub-Plan 07 details the MNES Risk Assessment undertaken for the approved works program in accordance with Element 1: LBEMP Sub-Plan MNES Risk Assessment.

4.2 Element 2: Fauna

Rationale
The works program involves the clearance of approximately 1.83 ha pf Coastal and Subcoastal Floodplain Tree Swamps (Melaleuca and Eucalypt), 1.04 ha of Wet Terrestrial Grassland and 2.00 ha of Disturbed Terrestrial Grassland. These communities provide habitat of low quality for a number of fauna species listed as MNES under the EPBC Act. The removal of vegetation has the potential to result in the direct loss of suitable habitat for terrestrial MNES fauna, particularly through the clearing of mature trees, as well as causing disturbance and possible displacement to MNES fauna utilising adjacent habitat due to construction noise. The removal of vegetation, including mature trees and disturbed grassland areas, has the potential to increase sedimentation within downstream waterways indirectly impacting suitable habitat for aquatic MNES further downstream along Raff Creek, the Caboolture River, and in Moreton Bay. Construction activities associated with the works program will involve increased movement of vehicles, plant and equipment on site, which increases the risk of causing injury or harm to fauna utilising these areas. Construction activities have the potential to introduce pest species that could degrade the quality of fauna habitat adjacent to the site. Vegetation clearance works are to be undertaken in a manner that protects habitats adjacent to the site, and encourages fauna to move out of the vegetation clearance zone and into adjacent areas of retained habitat.
Objective / Target
• Development of the works area is undertaken in a manner that minimises impacts to fauna listed as MNES. • Areas of fauna habitat that are to be retained are appropriately protected during the construction phase. • Authorised fauna habitat disturbance is carried out in accordance with best practice environmental management measures, as well as the terms and conditions of relevant permits authorising such disturbance. • Any tampering with animal breeding places or handling of native wildlife is undertaken only by persons holding the appropriate permits under the *Nature Conservation Act 1992*. • Existing infestations of pest species are controlled and no new pest species are introduced to or spread within the works site.
Performance Indicators
• Construction activities do not result in avoidable harm to any fauna listed as MNES. • Compliance with project-specific conditions of approval relating to vegetation clearing or disturbance to native fauna. • Vegetation clearing is limited to the approved clearance zones. • Vegetation adjacent to the approved clearance zones is retained and protected at all times during the construction phase.

Management Measures		
Tasks	**Actions**	**Timing**
Appropriately manage development impacts on fauna, including Koalas	A Vegetation and Fauna Management Plan (JWA 2021b) has been prepared for the site (**APPENDIX 2**).	Complete
	Implement the Vegetation and Fauna Management Plan (**APPENDIX 2**) to ensure that no environmental harm as defined under the *Environment Protection Act 1994* is caused.	Ongoing during the construction phase
Identify and protect all vegetation and fauna habitats adjacent to the approved clearance zones	Clearly define the limits of the approved clearance zones on all construction plans (refer to Vegetation Clearance Plan presented in **FIGURE 4**). The approved clearance zone is restricted to within the extent of the works site shown in **FIGURE 4**. Physically demarcate areas of vegetation and fauna habitat to be retained using high visibility temporary or permanent fencing prior to the commencement of development activities. Advise all construction personnel, including sub-contractors, of the approved clearance zones as part of the site induction. Conduct regular inspections and maintenance of fencing protecting retained vegetation and habitat to maintain effectiveness.	Prior to the commencement of any vegetation clearance
Conduct pre-clearance surveys of approved clearance zones	Survey the defined approved clearance zone for the presence, or likely presence, of fauna listed as MNES by an appropriately qualified and experienced ecologist. Mark the location of any fauna MNES that were observed during the pre-clearance surveys with GPS and flagging tape.	Prior to the commencement of any vegetation clearance
Engage an appropriately licensed Fauna Spotter / Catcher	An appropriately licenced Fauna Spotter / Catcher is to be engaged to supervise and direct vegetation clearance works. The appointed Fauna Spotter / Catcher is to inspect the approved clearance zone for fauna and is to be present on site for the duration of clearing works.	Prior to and during any vegetation clearance works

Management Measures		
Tasks	**Actions**	**Timing**
Conduct vegetation clearing in a manner that ensures any native fauna living within or adjacent to the vegetation to be removed has time to move out of the areas of disturbance without human intervention	The appointed Fauna Spotter / Catcher is to be authorised to issue relevant instructions to the vegetation clearance contractor to ensure: • Vegetation clearance works comply with the procedures of Policy 6: Vegetation Clearing Practices of the Nature Conservation (Koala) Conservation Plan 2006, including: - Limiting the extent of clearance to not more than 3 hectares of open forest in any single day; and - Ensuring that for a period of at least 12 hours, extending from 6:00pm until 6:00am on the following day, no further vegetation clearance occurs on the site; • Any vegetation occupied by native fauna is not cleared until the fauna moves out of the vegetation, or (with the exception of Koala) is relocated to a secure area of similar habitat by a licensed Fauna Spotter / Catcher; and • Vegetation clearance is conducted in a sequential manner in order to direct native fauna away from threatening processes or hostile environments (e.g. roads) and towards any retained vegetation or habitat links. Unless directed by the appointed Fauna Spotter / Catcher, vegetation clearance works are to be carried out in accordance with the specifications provided in the Vegetation Clearance Plan (**FIGURE 4**).	During all vegetation clearance works
Domestic pets are excluded from the site during vegetation clearance works	No domestic pets are to be brought into the site by contractors employed to undertake vegetation clearance works. Any contractors who ignore this management specification may, at the discretion of the	During all vegetation clearance works

Management Measures		
Tasks	**Actions**	**Timing**
	Developer or its authorised representatives, be banned from the site.	
Preparation of a post-clearance Fauna Management Report	At the completion of vegetation clearance works, a brief post-clearance Fauna Management Report is to be completed and is to contain: • Details on any incidents that occurred during the clearing; • Details of any translocated fauna, such as species, location relocated; • An evaluation of the fauna management techniques; • A description of any additional future management measures; and • The name, licence reference number and contact details of the appointed Fauna Spotter / Catcher.	Following completion of vegetation clearance works
Traffic management, and operation of construction vehicles, plant and equipment on site	Construction planning is to make appropriate provision for the safe movement of native fauna, including the MNES listed Koala, through the North Harbour site as is required by State Referral Agency Condition 7 of MCU-2004-1420. Vehicles attending and operating within the approved works site are to be operated in a manner that minimises the potential for harm to native fauna, including obeying all speed limits and utilising designated access roads as far as practicable.	Ongoing during the construction phase
Trenches and excavations	All open trenches and excavations are to be managed to minimise the potential for entrapment of native fauna by: • Minimising as far as possible the period of time when trenches/ excavations with steep sides (i.e. all slopes greater than 1V:1H) are open and accessible to native fauna; • Inspection of open trenches/ excavation each morning to identify the presence of any fauna that have become trapped;	Ongoing during the construction phase

Management Measures		
Tasks	**Actions**	**Timing**
	• Provision of assistance to entrapped native fauna, including engagement of the services of a licensed Fauna Spotter / Catcher if required; and • Establishment of exclusion fencing around any steep-sided trenches or excavations (i.e. all slopes greater than 1V:1H) that are to remain open for extended periods of time (i.e. > 48 hours).	
Care of injured fauna	Any fauna recovered during vegetation clearance works or construction works generally, will, immediately upon capture by the licensed Fauna Spotter / Catcher, be inspected for any signs of physical injury. If the fauna appears to be injured, it will be immediately transported to a suitably qualified and licensed veterinary surgeon or wildlife carer for appropriate treatment. Uninjured fauna will be relocated to suitable habitat in the surrounding area. The details for nearby, suitable wildlife care facilities are: • Royal Society for the Prevention of Cruelty to Animals (RSPCA) – Ph: 1300 264 625; • Queensland Department of Environment and Science (DES) – Ph: 1300 130 372.	Ongoing during the construction phase.
Reporting of incidents involving threatened fauna	Any incidents involving Commonwealth listed species will be reported in writing to the Department of Agriculture, Water and the Environment (Monitoring and Audit Section of the Compliance and Enforcement Branch – EPBCMonitoring@environment.gov.au) within ten (10) business days of the incident. Any incidents involving State listed species will be reported in writing to the Queensland Department of Environment and Science	Ongoing

Management Measures		
Tasks	**Actions**	**Timing**
	(DES) within ten (10) business days of the incident. The report will include the following details: • Time and date of the incident; • Details of the activity (i.e. vegetation clearance, earthworks etc.); • Details of the threatened species involved; • Impacts of the incident on the animal (i.e. deceased, injured, uninjured); • Immediate actions taken (i.e. transported for treatment, relocated etc.); • Corrective actions taken to prevent further incidents.	
Record keeping	The following records and reports are to be retained in relation to this environmental management element and shall be made available to relevant administering authorities upon request: • Photographic records of the establishment of required fencing; • The dates and locations of habitat clearance works; • The name, licence reference number and contact details of the licensed Fauna Spotter / Catcher that supervised the vegetation clearance works each day; • Details concerning any native vertebrate fauna that were injured during the approved works program and the actions taken in respect thereof; and • Post-Clearance Fauna Management Report.	Ongoing
Corrective actions	In the event of a non-compliance with the stated performance indicators, corrective action procedures should be implemented in accordance with **SECTION 5** of this LBEMP Sub-Plan 07 and the Vegetation and Fauna Management Plan (**APPENDIX X**).	Ongoing

Management Measures		
Tasks	**Actions**	**Timing**
	Appropriate corrective actions in relation to this environmental management element may include, but may not be limited to: • Cessation of vegetation clearance activities; • Restoration of fauna habitats subject to unauthorised disturbance; • Establishment of fauna exclusion fencing around the works site; • Reductions in vehicular speed limits within the works site; or • Environmental awareness training of personnel.	

4.3 Element 3: Koalas

Rationale
The works program will occur adjacent to areas of remnant eucalypt and melaleuca forest providing potential shelter habitat for Koalas. The works have the potential to cause disturbance and possible displacement of Koalas utilising adjacent habitat due to construction noise. Construction activities have the potential to introduce pest species that could pose a direct threat to Koalas or degrade the quality of Koala habitat adjacent to the site. Vegetation clearance works are to be undertaken in a manner that protects Koalas and habitats adjacent to the site.
Objective / Target
• Development is undertaken in a manner that minimises impacts to Koalas. • Areas of Koala habitat adjacent to the site are appropriately protected during the construction phase. • Authorised Koala habitat disturbance is carried out in accordance with best practice environmental management measures, as well as the terms and conditions of relevant permits authorising such disturbance. • Existing infestations of pest species are controlled and no new pest species are introduced to or spread within the works site.
Performance Indicators
• Construction activities do not result in avoidable harm to Koalas. • Compliance with project-specific conditions of approval relating to vegetation clearing or disturbance to Koalas. • Vegetation clearing is limited to the approved clearance zones. • Vegetation adjacent to the approved clearance zones is retained and protected at all times during the construction phase.

Management Measures		
Tasks	**Actions**	**Timing**
Appropriately manage development impacts on fauna, including Koalas	A Vegetation and Fauna Management Plan (JWA 2021b) has been prepared for the site (**APPENDIX 2**).	Complete
	Implement the Vegetation and Fauna Management Plan (**APPENDIX 2**) to ensure that no environmental harm as defined under the *Environment Protection Act 1994* is caused.	Ongoing during the construction phase
Identify and protect all vegetation and Koala habitat adjacent to the	Clearly define the limits of the approved clearance zones on all construction plans (refer to Vegetation Clearance Plan presented in **FIGURE 4**). The approved	Prior to the commencement of any vegetation clearance

Management Measures		
Tasks	**Actions**	**Timing**
approved clearance zones	clearance zone is restricted to within the extent of the works site shown in **FIGURE 4**. Physically demarcate areas of vegetation and fauna habitat to be retained on or adjacent to the site using high visibility temporary or permanent fencing prior to the commencement of development activities. Advise all construction personnel, including sub-contractors, of the approved clearance zones as part of the site induction. Conduct regular inspections and maintenance of fencing protecting retained vegetation and habitat to maintain effectiveness.	
Conduct pre-clearance surveys of approved clearance zones	Survey the defined approved clearance zone immediately prior to commencement of clearing for the presence of Koalas. Survey to be completed by an appropriately qualified and experienced ecologist. Mark the location of any Koalas that were observed during the pre-clearance surveys with GPS and flagging tape.	Immediately prior to the commencement of any vegetation clearance
Engage an appropriately licensed Fauna Spotter / Catcher	An appropriately licenced Fauna Spotter / Catcher is to be engaged to supervise and direct vegetation clearance works. The appointed Fauna Spotter / Catcher is to inspect the approved clearance zone for fauna and is to be present on site for the duration of clearing works.	Prior to and during any vegetation clearance works
Conduct vegetation clearing in a manner that ensures any Koala living within or adjacent to the vegetation to be removed has time to move out of the areas of disturbance without human intervention	The appointed Fauna Spotter / Catcher is to be authorised to issue relevant instructions to the vegetation clearance contractor to ensure: • Vegetation clearance works comply with the procedures of Policy 6: Vegetation Clearing Practices of the Nature Conservation (Koala) Conservation Plan 2006, including: - Limiting the extent of clearance to not more than 3	During all vegetation clearance works

Management Measures		
Tasks	**Actions**	**Timing**
	hectares of open forest in any single day; and - Ensuring that for a period of at least 12 hours, extending from 6:00pm until 6:00am on the following day, no further vegetation clearance occurs on the site; • Any tree occupied by a Koala is not cleared until the Koala moves out of the vegetation of its own accord; and • Vegetation clearance is conducted in a sequential manner in order to direct Koalas away from threatening processes or hostile environments (e.g. roads) and towards any retained vegetation or habitat links. Unless directed by the appointed Fauna Spotter / Catcher, vegetation clearance works are to be carried out in accordance with the specifications provided in the Vegetation Clearance Plan (**FIGURE 4**).	
Domestic pets are excluded from the site during vegetation clearance works	No domestic pets are to be brought into the site by contractors employed to undertake vegetation clearance works. Any contractors who ignore this management specification may, at the discretion of the Developer or its authorised representatives, be banned from the site.	During all vegetation clearance works
Preparation of a post-clearance Fauna Management Report	At the completion of vegetation clearance works, a brief post-clearance Fauna Management Report is to be completed and is to contain: • Details on any incidents that occurred during the clearing; • Details of any translocated fauna, such as species, location relocated; • An evaluation of the fauna management techniques; • A description of any additional future management measures; and	Following completion of vegetation clearance works

Management Measures		
Tasks	**Actions**	**Timing**
	• The name, licence reference number and contact details of the appointed Fauna Spotter / Catcher.	
Traffic management, and operation of construction vehicles, plant and equipment on site	Construction planning is to make appropriate provision for the safe movement of native fauna, including the MNES listed Koala, through the North Harbour site as is required by State Referral Agency Condition 7 of MCU-2004-1420. Vehicles attending and operating within the approved works site are to be operated in a manner that minimises the potential for harm to native fauna, including obeying all speed limits and utilising designated access roads as far as practicable.	Ongoing during the construction phase
Trenches and excavations	All open trenches and excavations are to be managed to minimise the potential for entrapment of Koalas by: • Minimising as far as possible the period of time when trenches/ excavations with steep sides (i.e. all slopes greater than 1V:1H) are open and accessible to native fauna; • Inspection of open trenches/ excavation each morning to identify the presence of any Koalas that have become trapped; • Provision of assistance to entrapped Koalas, including engagement of the services of a licensed Fauna Spotter/ Catcher if required; and • Establishment of exclusion fencing around any steep-sided trenches or excavations (i.e. all slopes greater than 1V:1H) that are to remain open for extended periods of time (i.e. > 48 hours).	Ongoing during the construction phase
Care of injured Koalas	Any Koalas recovered during vegetation clearance works or construction works generally, will, immediately upon capture by the licensed Fauna Spotter / Catcher, be inspected for any signs of physical injury.	Ongoing during the construction phase

Management Measures		
Tasks	**Actions**	**Timing**
	If the Koala appears to be injured, it will be immediately transported to a suitably qualified and licensed veterinary surgeon or wildlife carer for appropriate treatment. The details for nearby, suitable wildlife care facilities are: • Royal Society for the Prevention of Cruelty to Animals (RSPCA) – Ph: 1300 264 625; • Queensland Department of Environment and Science (DES) – Ph: 1300 130 372.	
Reporting of incidents involving Koalas	Any incidents involving Koalas will be reported in writing to the Department of Agriculture, Water and the Environment (Monitoring and Audit Section of the Compliance and Enforcement Branch – EPBCMonitoring@environment.gov.au) within ten (10) business days of the incident. Any incidents involving Koalas will be reported in writing to the Queensland Department of Environment and Science (DES) within ten (10) business days of the incident. The report will include the following details: • Time and date of the incident; • Details of the activity (i.e. vegetation clearance, earthworks etc.); • Impacts of the incident on the animal (i.e. deceased, injured, uninjured); • Immediate actions taken (i.e. transported for treatment, relocated etc.); • Corrective actions taken to prevent further incidents.	Ongoing
Record keeping	The following records and reports are to be retained in relation to this environmental management element and shall be made	Ongoing

Management Measures		
Tasks	**Actions**	**Timing**
	available to relevant administering authorities upon request: • Photographic records of the establishment of required fencing; • The dates and locations of habitat clearance works are to be maintained; • The name, licence reference number and contact details of the licensed Fauna Spotter / Catcher that supervised the vegetation clearance works each day; • Details concerning any Koalas present in the clearing area and the actions taken in respect thereof; and • Post-clearance Fauna Management Report.	
Corrective actions	In the event of a non-compliance with the stated performance indicators, corrective action procedures should be implemented in accordance with **SECTION 5** of this LBEMP Sub-Plan 07 and the Vegetation and Fauna Management Plan (**APPENDIX 2**). Appropriate corrective actions in relation to this environmental management element may include, but may not be limited to: • Cessation of vegetation clearance activities or activities adjacent to koala habitats; • Restoration of Koala habitats subject to unauthorised disturbance; • Establishment of fauna exclusion fencing around the works site; • Reductions in vehicular speed limits within the works site; or • Environmental awareness training of personnel.	Ongoing

4.4 Element 4: Flora

Rationale
The works program involves the clearance of approximately 1.83 ha pf Coastal and Subcoastal Floodplain Tree Swamps (Melaleuca and Eucalypt), 1.04 ha of Wet Terrestrial Grassland and 2.00 ha of Disturbed Terrestrial Grassland. These communities potentially provide habitat of low quality for a number of fauna species listed as MNES under the EPBC Act. The removal of vegetation, including mature trees and disturbed grassland areas, has the potential to increase sedimentation within downstream waterways indirectly impacting suitable habitat for MNES further downstream along Raff Creek, the Caboolture River, and in Moreton Bay. Construction activities have the potential to introduce weed species that could degrade the quality of habitat adjacent to the site. Vegetation clearance works are to be undertaken in a manner that protects habitats adjacent to the site.
Objective / Target
• Areas of native vegetation located outside of the approved clearance zone are to be retained and appropriately protected; • Authorised vegetation disturbance is carried out in accordance with best practice environmental management measures, as well as the terms and conditions of relevant permits authorising such disturbance; and • Existing weed infestations are controlled and no new weed species are introduced to, or spread within, the site.
Performance Indicators
• All necessary permits are obtained prior to commencing vegetation clearance activities, and vegetation clearance complies with all terms and conditions of applicable permits. • Native vegetation adjacent to the approved clearance zones is retained and protected at all times throughout the construction phase. • No loss or damage to native vegetation occurs outside of the approved clearance zone.

Management Measures		
Tasks	**Actions**	**Timing**
Appropriately manage development impacts on vegetation	A Vegetation and Fauna Management Plan (JWA 2021b) has been prepared for the site (**APPENDIX 2**).	Complete
	Implement the Vegetation and Fauna Management Plan (**APPENDIX 2**) to ensure that no environmental harm as defined under	Ongoing during the construction phase

Management Measures		
Tasks	**Actions**	**Timing**
	the *Environment Protection Act 1994* is caused.	
Identify and delineate areas of vegetation clearance and retention	Clearly define the limits of approved clearance zones on all construction plans (refer to Vegetation Clearance Plan presented in **FIGURE 4**). The approved clearance zone is restricted to within the extent of the works site shown in **FIGURE 4**. Physically define areas of native vegetation to be retained, within or adjacent to the approved works site, using high visibility temporary or permanent fencing prior to the commencement of development activities. Advise all construction personnel, including sub- contractors, of the approved clearance zones as part of the site induction. Conduct regular inspections and maintenance of fencing protecting retained vegetation and habitat to maintain effectiveness.	Prior to the commencement of any vegetation clearance works
Conduct pre-clearance surveys of all vegetation to be removed	A pre-clearance survey of the approved clearance zone is to be undertaken by an appropriately qualified and experienced ecologist to identify the presence of any flora listed as MNES. Clearly demarcate in the field and record the location with GPS of any flora MNES observed during the pre- clearance survey.	Prior to the commencement of any vegetation clearance works
Implement appropriate mitigation strategies for any MNES listed flora identified during the pre-clearance surveys	Determine whether it is practicable to retain and sustain the ecological functionality of the identified MNES flora in-situ, taking into account the nature of the approved development (Note: the retention of small numbers of plants in an ecologically isolated patch of land surrounded by urban/industrial development is unlikely to maintain ecological functionality). If it is possible to achieve the above, incorporate the identified MNES flora into a vegetation protection zone and manage accordingly.	Prior to commencement of vegetation clearance works in areas supporting MNES flora

Management Measures		
Tasks	**Actions**	**Timing**
	For MNES flora that are able to be successfully translocated, obtain necessary permits under the *Nature Conservation Act 1992* (NC Act) from the Queensland Department of Environment and Science (DES). MNES flora with the potential to occur in the works area and are able to be translocated include: • *Arthraxon hispidus* (Hairy Joint Grass). Undertake MNES listed flora translocation works in accordance with the terms and condition of relevant permits under the NC Act.	
Monitor the condition of retained and transplanted vegetation	Visually monitor the condition of retained/transplanted vegetation on a weekly basis for signs of stress or damage throughout the construction period. Undertake issue specific corrective actions in respect of any observed damage/stress to retained/transplanted vegetation. Monitor all MNES flora translocation works in accordance with the terms of the relevant permits issued by DES under the NC Act.	Ongoing during the construction phase and in accordance with permit conditions
Appropriate management, reuse and disposal of cleared vegetation	Locate any temporary stockpiles of cleared vegetation on-site in a manner that assists with the management of erosion and sediment loss processes (refer LBEMP Element 6). Manage cleared non-native vegetation in accordance with LBEMP Element 5. Reuse or dispose of cleared vegetation in accordance with local government requirements.	Ongoing during the construction phase

Management Measures		
Tasks	**Actions**	**Timing**
Protect MNES flora during ecological restoration works	Undertake restoration site preparation and revegetation in a manner that avoids removal or damage to MNES flora. Where ecological restoration works are to be undertaken in areas supporting MNES flora: • Mark all MNES listed flora in the restoration area with flagging tape or conspicuous marker stakes; • Carefully undertake weed management, soil preparation, and planting works so as to avoid physical or chemical disturbance to MNES flora; and • Monitor and record the responses of MNES flora to the ecological restoration works.	Ongoing during the construction phase
Reporting of incidents involving threatened flora	Any incidents involving Commonwealth listed species will be reported in writing to the Department of Agriculture, Water and the Environment (Monitoring and Audit Section of the Compliance and Enforcement Branch - EPBCMonitoring@environment.gov.au) within ten (10) business days of the incident. Any incidents involving State listed species will be reported in writing to the Queensland Department of Environment and Science (DES) within ten (10) business days of the incident. The report will include the following details: • Time and date of the incident; • Details of the activity (i.e. vegetation clearance, earthworks etc.); • Details of the threatened species involved; • Impacts of the incident on the plant; • Immediate actions taken; and • Corrective actions taken to prevent further incidents.	Ongoing
Record keeping	The following records and reports are to be retained in relation to this environmental management element and shall be made	Ongoing

Management Measures		
Tasks	**Actions**	**Timing**
	available to relevant administering authorities upon request: • Photographic records of the establishment of required temporary protection fencing and other exclusionary fencing or marking; • Records of pre-clearance survey including location of any MNES flora identified; • Records of all permits and approvals obtained for vegetation clearance works, including any translocation works; • The dates and locations of vegetation clearance works; and • Results of monitoring condition of retained and translocated vegetation, and restoration works.	
Corrective actions	In the event of a non-compliance with the stated performance indicators, corrective action procedures should be implemented in accordance with **SECTION 5** of this LBEMP Sub-Plan 07 and the Vegetation and Fauna Management Plan (**APPENDIX 2**). Appropriate corrective actions in relation to this environmental management element may include, but may not be limited to: • Cessation of vegetation clearance activities; • Maintenance or reinstatement of exclusion fencing or marking; • Restoration of vegetation subject to unauthorised clearing; or • Environmental awareness training of personnel.	Ongoing

4.5 Element 5: Weeds and Pests

Rationale

Construction activities, including vegetation clearance works, associated with the approved works program have the potential to:

- Introduce weeds or pest animal species to the works site through the importation of construction materials or the use of vehicles, plant and equipment contaminated with pest material (e.g. weed seed, eggs, pest ants);
- Further disperse invasive species within and external to the works site through the movement of construction vehicles, plant and equipment between areas infested and not currently infested with invasive species; and
- Further disperse invasive species through the reuse of cleared vegetation containing weed material across the works site.

Surveys of the NEBP site undertaken for the NEBP EIS (refer Cardno 2008) recorded the presence of a number of Class 2 and Class 3 pest plant species pursuant to the *Land Protection (Pest and Stock Route Management) Act 2002* (LP Act), as listed below:

Common Name	Scientific Name	Location on Site	LP Act Status
Groundsel Bush	*Baccharis halimifolia*	Scattered across site	Class 2
Lantana	*Lantana camara*	Scattered across site	Class 3
Broad-leaved Pepper Tree	*Schinus terebinthifolia*	Scattered across site and in disturbed riparian area	Class 3

The works site is not currently located within a National Red Imported Fire Ant Restricted Area.

Objective / Target

- Existing pest infestations are controlled prior to commencing the approved program of works.
- No new pest species are introduced to or spread within the works site as a result of the approved program of works.
- No pest species are dispersed from the works site to the surrounding environment as a result of the approved program of works.

Performance Indicators

- No invasion / dispersal of weeds or pest animal species.
- Weeds are treated in accordance with industry best practice and any relevant statutory requirements.

Management Measures		
Tasks	**Actions**	**Timing**
Appropriately manage weeds and pest species during construction	A Pest and Invasive Species Plan (JWA 2021c) has been prepared for the site (**APPENDIX 3**).	Complete
	Implement the Pest and Invasive Species Plan (**APPENDIX 3**) to ensure that no	Ongoing during the construction phase

Management Measures		
Tasks	**Actions**	**Timing**
	environmental harm as defined under the *Environment Protection Act 1994* is caused.	
Identify specific areas of pest infestation	Prior to commencing the approved program of works (i.e. vegetation clearing) conduct a survey of the works site and adjacent areas (where accessible) in accordance with the Pest and Invasive Species Plan (**APPENDIX 3**) to identify and map the presence and location of pest infestations.	Prior to commencement of the construction phase
Manage pest infestations within the works site	In areas where vegetation clearance and earthworks are to occur: • Clear and stockpile weed infested areas separately from weed free areas; and • Dispose of, rather than reuse, weed infested material in accordance with local government requirements. Following vegetation clearance works, monitor the area for new weed infestations or reinfestation in accordance with the Pest and Invasive Species Plan (**APPENDIX 3**), and treat in accordance with: • Department of Agriculture, Forestry and Fisheries (DAFF) requirements and industry best practice as detailed in http://www.daff.qld.gov.au/plants/weeds-pest-animals-ants • LBEMP Element 2 - Fauna; and • LBEMP Element 3 - Flora. Preference should be given to the use of manual control measures near waterways adjacent to works site and any herbicides used in the control of weeds on site are to be suitable for use near waterways.	Prior to and during the construction phase
Minimise the introduction and dispersal of pest species	Ensure that all vehicles, plant and equipment brought onto the works site is weed and red imported fire ant free through the use of appropriate pest hygiene declarations and / or inspections in accordance with the Pest and Invasive Species Plan (**APPENDIX 3**).	Ongoing during the construction phase

Management Measures		
Tasks	**Actions**	**Timing**
	Ensure that all equipment (e.g. machinery, vehicles and clothing) used in weed-infested areas on the works site are cleaned of weed material, including soil potentially containing weed seed, before moving into weed-free areas of the works site or off-site. (Note that the LP Act requires that written notice must be provided before supplying (including disposal to a licensed waste facility) any 'thing' (including gravel, machinery, mulch, packing material, sand, soil, vehicles etc.) that is, or could be, contaminated with certain declared Class 2 plants). Avoid any unnecessary movement of vehicles, plant and equipment, or personnel in areas of known weed infestation and in areas of retained vegetation. Ensure that all mulch and fill material imported to the site is certified as being weed and red imported fire ant free.	
Record keeping	The following records and reports are to be retained in relation to this environmental management element and shall be made available to relevant administering authorities upon request: • Copies of pest hygiene declarations or other evidence that materials and equipment used on site are pest free (e.g. inspection records); • Copies of any 'written notice' required to be provided under the LP Act; and • Records of pest monitoring and treatment conducted throughout the construction phase.	Ongoing
Corrective actions	In the event of a non-compliance with the stated performance indicators, corrective action procedures should be implemented in accordance with **SECTION 5** of this LBEMP	Ongoing

Management Measures		
Tasks	**Actions**	**Timing**
	Sub-Plan 07 and the Pest and Invasive Species Plan (**APPENDIX 3**). Appropriate corrective actions in relation to this environmental management element may include, but may not be limited to: • Treatment of any new infestations or reinfestation in accordance with the Pest and Invasive Species Plan (**APPENDIX 3**); • Review work practices to avoid unnecessary movement of people, plant or equipment into areas of known weed infestation or retained vegetation; • Consider establishing a weed washdown bay on site (refer to Pest and Invasive Species Plan – **APPENDIX 3**) to clean down equipment prior to entry / exit from the site; and • Environmental awareness training of personnel.	

4.6 Element 6: Soil Erosion, Sediment Loss and Water Quality

Rationale
The approved works program, including vegetation clearance works and bulk earthworks, has the potential to impact on water quality and potential habitat for MNES within downstream waterways and wetlands. Appropriate erosion and sedimentation controls must be implemented to minimise the release of sediment and other contaminants generated by construction activities into downstream waterways.
Objective / Target
• To minimise changes to water quality within receiving waters as a result of the approved works program. • To minimise sedimentation resulting in the loss or degradation of potential habitat for MNES within receiving waters as a result of the approved works program.
Performance Indicators
• No physical evidence of on-site erosion leading to the off-site transport and deposition of sediment. • Progressive establishment of stable soils as soon as practicable following completion of vegetation clearance and grubbing works within the works site.

Management Measures		
Tasks	**Actions**	**Timing**
Appropriately manage development activities to control soil erosion, minimise sediment loss and maintain acceptable water quality levels within receiving waterways and wetlands.	An Erosion and Sediment Control Plan has been prepared for the site (**APPENDIX 1**).	Complete
	Implement the Erosion and Sediment Control Plan (**APPENDIX 1**) to ensure that no environmental harm as defined under the *Environment Protection Act 1994* is caused.	Ongoing during the construction phase.
	Adhere to all water quality assurance measures in accordance with the Erosion and Sediment Control Plan (**APPENDIX 1**).	Ongoing during the construction phase.
Record keeping	The following records and reports are to be retained in relation to this environmental management element and shall be made available to relevant administering authorities upon request: • All records required under the approved Erosion and Sediment Control Plan.	Ongoing
Corrective actions	In the event of a non-compliance with the stated performance indicators, corrective	Ongoing

Management Measures		
Tasks	**Actions**	**Timing**
	action procedures should be implemented in accordance with **SECTION 5** of this LBEMP Sub-Plan 07 and the Erosion and Sediment Control Plan (**APPENDIX 1**).	

4.7 Element 7: Acid Sulphate Soils

Rationale
The approved works program involves filling and excavation of material below 5m AHD in areas likely to contain actual and potential acid sulphate soils (ASS). Disturbance of ASS has the potential to result in release acidic discharge and other contaminants to soil and waters impacting on potential habitat for MNES flora and fauna. Appropriate soil management practices must be employed in order to avoid detrimental impacts to land and water within and adjacent to the works site associated with disturbance to ASS. A detailed ASS management plan has been developed.
Objective / Target
• To minimise and where possible, avoid the exposure of ASS, and prevent acid leachate from leaving the site and potentially impacting on adjacent waters.
Performance Indicators
• Compliance with the requirements of relevant local and state government approvals that deal with the management of Acid Sulphate Soils.

Management Measures		
Tasks	**Actions**	**Timing**
Appropriately manage development activities involving disturbance to acid sulphate soils.	An Acid Sulphate Soils Investigation and Management Plan (Tectonic 2021) has been prepared for the site and approved by the QLD Office of the Coordinator-General (**APPENDIX 4**).	Complete
	Implement the Acid Sulphate Soils Investigation and Management Plan (**APPENDIX 4**) to ensure that no environmental harm as defined under the *Environment Protection Act 1994* is caused.	Ongoing during the construction phase.
Record keeping	The following records and reports are to be retained in relation to this environmental management element and shall be made available to relevant administering authorities upon request: • All records required under the approved Acid Sulphate Soils Management Plan.	Ongoing
Corrective actions	In the event of a non-compliance with the stated performance indicators, corrective action procedures should be implemented in accordance with **SECTION 5** of this LBEMP Sub-Plan 07.	Ongoing

5 NON-CONFORMANCE AND CORRECTIVE ACTION PROCEDURES

In the event of a non-compliance with the stated performance indicators of this LBEMP Sub-Plan 07 or any other incidents that cause actual or potential harm to any MNES, relevant investigations should be undertaken as detailed in the Implementation, Monitoring and Improvement Plan (**TABLE 7**) to identify the cause of the non-compliance; and a corrective action report (CAR) should be prepared including the following details:

- Description of the non-compliance;
- Date of non-compliance;
- Identified cause of non-compliance;
- Description of proposed corrective actions;
- Persons / entities consulted in developing corrective actions;
- Timeframe for implementation of corrective actions;
- Nominated person responsible for implementation; and
- Validation monitoring requirements.

An example CAR form is provided in **APPENDIX 5.**

Appropriate corrective actions should be determined by the Developer in consultation with relevant experts and the administering authority (where required) and shall be implemented by the Developer within the agreed timeframe noted on the CAR.

Validation monitoring should be undertaken to confirm that the nominated corrective actions have been effective.

The Developer shall maintain a register of CARs, which shall be made available to any relevant local, state or commonwealth government department, any statutory authority or any other person, consensually or as lawfully required.

The Developer shall notify the Commonwealth Department of Agriculture, Water and the Environment of any non-conformances with this LBEMP Sub-Plan 07 or any environmental incidents involving MNES as soon as practicably possible.

TABLE 7
IMPLEMENTATION, MONITORING AND IMPROVEMENT PLAN

Element	Monitoring Activity			Incident Response	Corrective Action
	What	When	Who		
Fauna (**SECTION 4.2**)	Fauna fencing	Pre, during and post construction	Principal Contractor	Contractor/Fauna Spotter/Ecologist to investigate circumstances and cause of incident	Fencing to be reviewed, adjusted, and replaced as deemed necessary following an incident assessment. Adjustments to the maintenance schedule may be required and plans modified accordingly.
	Health of retained habitat	Pre, during and post construction	Principal Contractor/Ecologist	Contractor/Ecologist to investigate removal or poor health of vegetation earmarked for retention	Fencing/barriers demarcating/protecting retained vegetation to be reviewed, adjusted, and replaced as deemed necessary following an incident assessment. Similarly, sediment and water flow regimes should be reviewed. Amendments to clearing operating procedures should be considered where applicable. Adjustments to the fencing/barrier maintenance schedule may be required and plans modified accordingly. Rehabilitation works will be necessary where significant degradation or loss of vegetation has occurred.
	Fauna safety	Pre and during construction	Principal Contractor/Fauna Spotter	Contractor/Fauna Spotter to investigate circumstances and cause of incident	The following aspects of fauna safety are to be reviewed and adjusted as appropriate: • Pre-clearing fauna surveys and relocations; • Tree-hollow inspections; • Vehicle speed limits; • Employee fauna awareness training; and/or

Element	Monitoring Activity			Incident Response	Corrective Action
	What	When	Who		
					• Clearing procedure. The Vegetation and Fauna Management Plan (**APPENDIX 2**) will be reviewed and adapted to reflect any changes deemed necessary.
Koalas (**SECTION 4.3**)	Koala safety	Pre and during construction	Principal Contractor/Fauna Spotter/MBRC/DES	Contractor/Fauna Spotter to investigate circumstances and cause of incident	The following aspects of Koala safety are to be reviewed and adjusted as appropriate: • Pre-clearing koala surveys and relocations; • Vehicle speed limits; • Compliance with no dog policies; • Employee fauna awareness training; • Fencing; and/or • Clearing procedure. The Vegetation and Fauna Management Plan (**APPENDIX 2**) will be reviewed and adapted to reflect any changes deemed necessary.
Flora (**SECTION 4.4**)	Health of retained vegetation	Pre, during and post construction	Principal Contractor/Ecologist	Contractor/Ecologist	Fencing/barriers demarcating/protecting retained vegetation to be reviewed, adjusted, and replaced as deemed necessary following and incident assessment. Similarly, sediment and water flow regimes should be reviewed. Amendments to clearing operating procedures may be considered where appropriate. Adjustments to fencing/barrier maintenance schedule may be required and plans modified accordingly.

Element	Monitoring Activity			Incident Response	Corrective Action
	What	When	Who		
					Rehabilitation works will be necessary where significant vegetation degradation or loss has occurred. The Vegetation and Fauna Management Plan (**APPENDIX 2**) will be reviewed and adapted to reflect any changes deemed necessary.
	Protection of threatened plants	Pre, during and post construction	Principal Contractor/Ecologist	Contractor/Ecologist	No threatened plants are currently known from the site. If threatened plants are identified on or adjacent to the clearing area, the management strategy for such plants must be reviewed and adapted to the species and location. Clearing, maintenance, and rehabilitation procedures must be adapted to ensure an appropriate ecological outcome. The Vegetation and Fauna Management Plan (**APPENDIX 2**) will be reviewed and adapted to reflect any changes deemed necessary.
Weeds and Pests (**SECTION 4.5**)	Minimisation of weed introduction and spread	Pre, during and post construction	Principal Contractor/Landscaper/ Bush rehabilitator	Contractor/Ecologist/ Landscaper/Bush Rehabilitator	Weed infestations are to be prevented and managed as outlined in the Pest and Invasive Species Plan (**APPENDIX 3**). If infestations occur, measures contained in the Plan should be reviewed and adapted based on the weed species and extent of infestation.
	Control of pest animals	During and post construction	Principal Contractor/Ecologist	Contractor/Ecologist	Pest populations are to be managed as outlined in the Pest and Invasive Species Plan (**APPENDIX 3**). If pests are recorded, measures contained in the Plan should be reviewed and adapted based on the pest species and extent of presence.

Element	Monitoring Activity			Incident Response	Corrective Action
	What	When	Who		
Soil Erosion, Sediment Loss and Water Quality (**SECTION 4.6**)	Control of erosion and sedimentation	Pre, during and post construction	Principal Contractor/Engineer	Contractor/Engineer	Erosion and sedimentation control devices are to be maintained as per the Erosion and Sediment Control Strategy (**APPENDIX 1**). If the measures contained within this plan do not result in acceptable outcomes, the plan should be reviewed and modified accordingly. Ongoing monitoring must be implemented to ensure that revised management measures are successful.
	Maintenance of appropriate water quality and surface flow regimes	Pre, during and post construction	Principal Contractor/Engineer	Contractor/Engineer	Water quality and flow regimes are to be maintained as per the Erosion and Sediment Control Strategy (**APPENDIX 1**). If the measures contained within this plan do not result in acceptable outcomes, the plan should be reviewed and modified. Ongoing monitoring must be implemented to ensure that revised management measures are successful.
Acid Sulphate Soils (**SECTION 4.7**)	Acid sulphate soils are appropriately managed	Pre, during and post construction	Principal Contractor/Engineer	Contractor/Engineer	Acid sulphate soils are to be maintained as per the Acid Sulphate Soils Investigation and Management Plan (**APPENDIX 4**). If the measures contained within this plan do not result in acceptable outcomes, the plan should be reviewed and modified. Ongoing monitoring must be implemented to ensure that revised management measures are successful.

6 RECORD KEEPING

The Developer is to maintain appropriate records concerning all tasks and actions undertaken in accordance with this LBEMP Sub-Plan 07 including:

- Copies of all relevant permits or approvals relevant to the works the subject of this LBEMP Sub-Plan 07;
- The name, qualifications and contact details of the suitably qualified ecologist engaged to the assist in the preparation of this LBEMP Sub-Plan 07;
- The dates and findings of the pre-clearance flora and fauna surveys and the name, qualifications and contact details of the suitably qualified ecologist who completed the surveys;
- The name, qualifications and contact details of the licensed Fauna Spotter / Catcher engaged to supervise vegetation clearance works;
- The dates and locations of all vegetation clearance works;
- The post-clearance Fauna Management Report as required by **SECTIONS 4.2 and 4.3** of this LBEMP Sub-Plan 07;
- Any records required to be kept in for specific environmental management elements as identified in **SECTION 4** of this LBEMP Sub-Plan 07; and
- All incident reports and corrective action requests generated during the works program.

All records shall be kept for a minimum of five (5) years following completion of the works program and shall be made available to any relevant local, state or commonwealth government department, statutory authority or any other person, consensually or as lawfully required.

REFERENCES

Cardno (2007). *Terrestrial Ecology Assessment Report – Northeast Business Park.* Report prepared for North East Business Park.

Cardno (2014). *Ecological Assessment Report: NEBP – Residential West RoL*. Report prepared for North East Business Park.

Cardno (2014) *North East Business Park – Land Based Environmental Management Plan for Matters of National Environmental Significance (Version 2).* Report prepared for North East Business Park.

JWA (2015a) *Wetland Mapping Report: North East Business Park Residential West Area*. Report prepared for North East Business Park Pty Ltd.

JWA (2015b) *Ecological Assessment – North East Business Park Balance Land, Farry Road, Burpengary East.* Report prepared for North East Business Park Pty Ltd.

JWA (2021a) *Ecological Assessment – Flood Mitigation Works, Buckley Road, Burpengary East.* Report prepared for North Harbour Holdings Pty Ltd.

JWA (2021b) *Vegetation and Fauna Management Plan – Flood Mitigation Works, Buckley Road, Burpengary East*. Report prepared for North Harbour Holdings Pty Ltd.

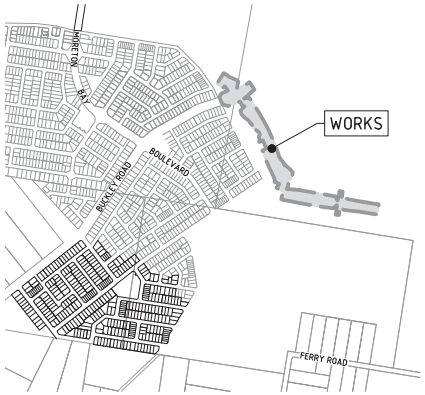
JWA (2021c) *Pest and Invasive Species Plan – Flood Mitigation Works, Buckley Road, Burpengary East*. Report prepared for North Harbour Holdings Pty Ltd.

Queensland Herbarium (2019) Regional Ecosystems Description Database (REDD).

Tectonic Geotechnical Pty Ltd (2021) *Acid Sulfate Soil Investigation and Management Plan – Proposed Compensatory Cut, Unnamed Drainage Corridor North Harbour.* Report Prepared for North Harbour Holdings Pty Ltd.

APPENDIX 1 – Erosion & Sediment Control Plan (KN GROUP 2021)

BULK EARTHWORKS AND CULVERTS



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DRAWING INDEX

DRAWING NO.	DRAWING TITLE
20-185-01	LOCALITY PLAN, DRAWING INDEX
20-185-02	EARTHWORKS CONTOUR PLAN
20-185-03	CULVERT DETAILS SHEET 1
20-185-04	CULVERT DETAILS SHEET 2
20-185-05	SEDIMENT AND EROSION CONTROL PLAN
20-185-06	SEDIMENT AND EROSION CONTROL NOTES
20-185-07	SEDIMENT AND EROSION CONTROL DETAILS
20-185-08	SEDIMENT AND EROSION BASIN NOTES
20-185-09	SAFETY IN DESIGN

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REVISIONS

No	Description	Date	By
A	FOR APPROVAL	02.02.2021	RW

NORTH

Client

BULK EARTHWORKS

Approved Director - RPEQ 17544

Drawing Title
LOCALITY PLAN,
DRAWING INDEX

Drawn	Designed	Checked	Date
RW	JB	MAS	FEB 21

Scale	Sheet
AS SHOWN	01 of 09

	Drawing No	Revision
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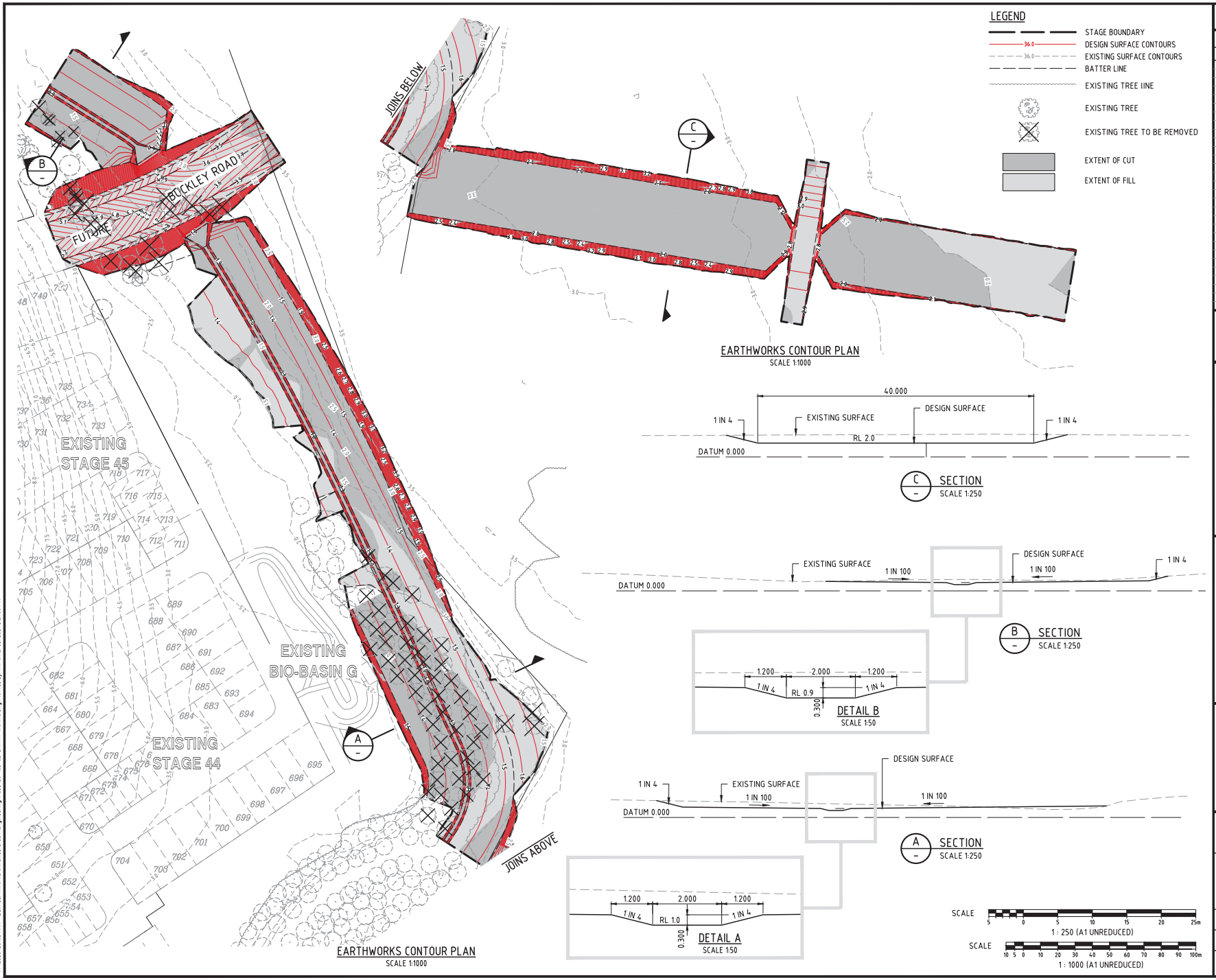

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EARTHWORKS
CONTOUR PLAN

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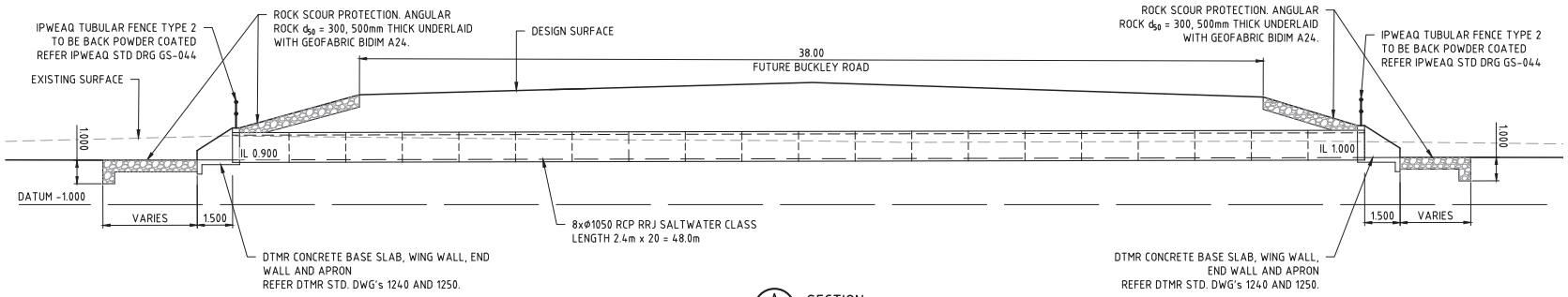

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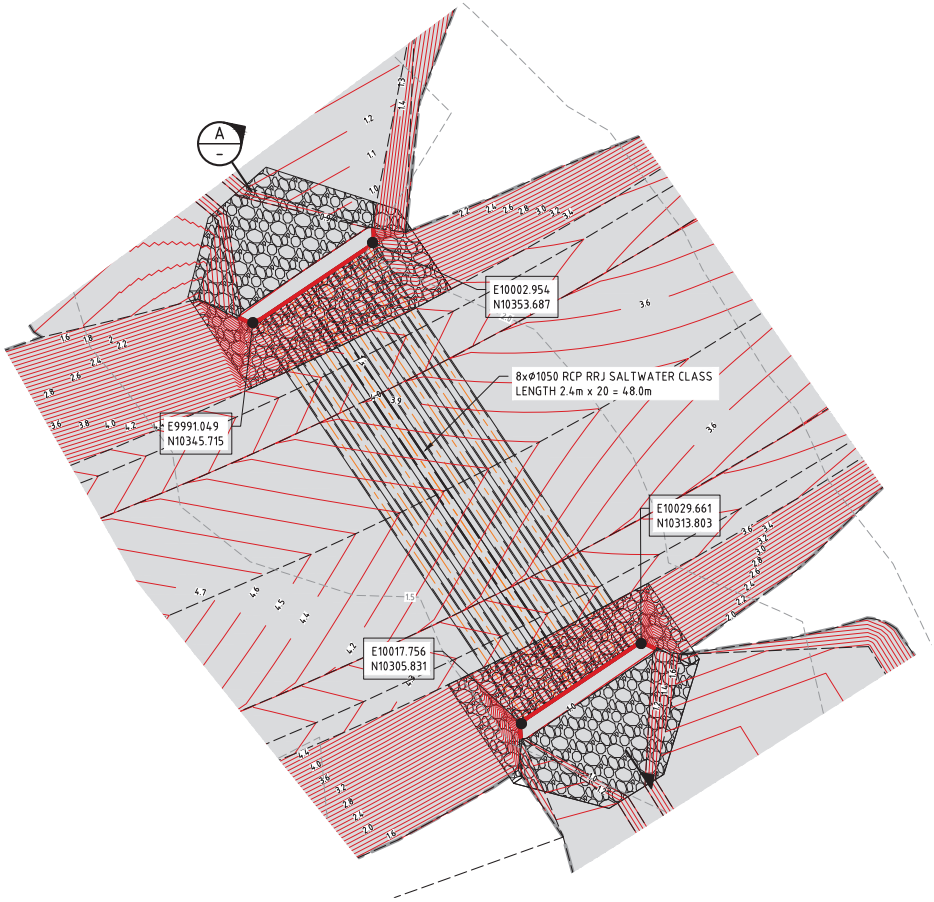

CULVERT DETAILS
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NOTE:
1. ALL CONCRETE IN HEADWALLS TO BE 40MPa AND 55mm MIN COVER
2. ALL REINFORCED CONCRTE PIPES TO BE RUBBER RING JOINT AND SALT WATER CLASS.

LEGEND
- STAGE BOUNDARY
- 36.0 DESIGN SURFACE CONTOURS
- 36.0 EXISTING SURFACE CONTOURS
- BATTER LINE

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Drawing Title
CULVERT DETAILS
SHEET 1

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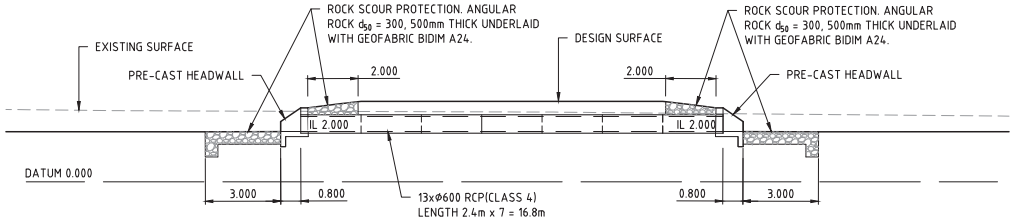

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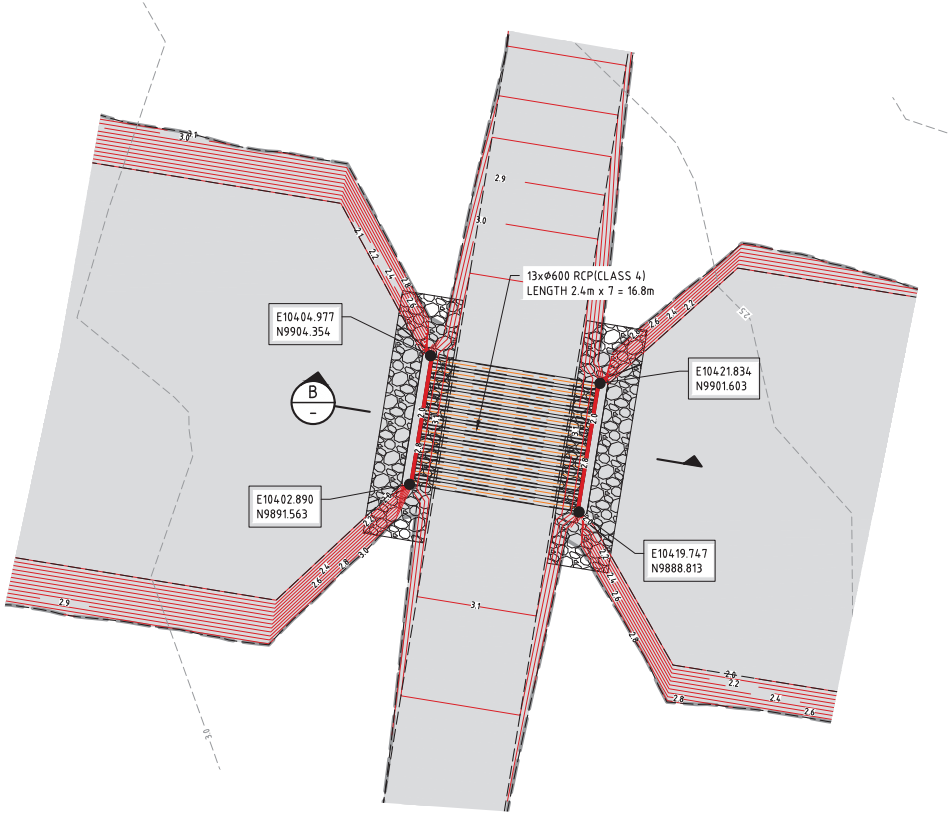

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LEGEND

- STAGE BOUNDARY
- 36.0 DESIGN SURFACE CONTOURS
- 36.0 EXISTING SURFACE CONTOURS
- BATTER LINE

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Drawing Title
CULVERT DETAILS
SHEET 2

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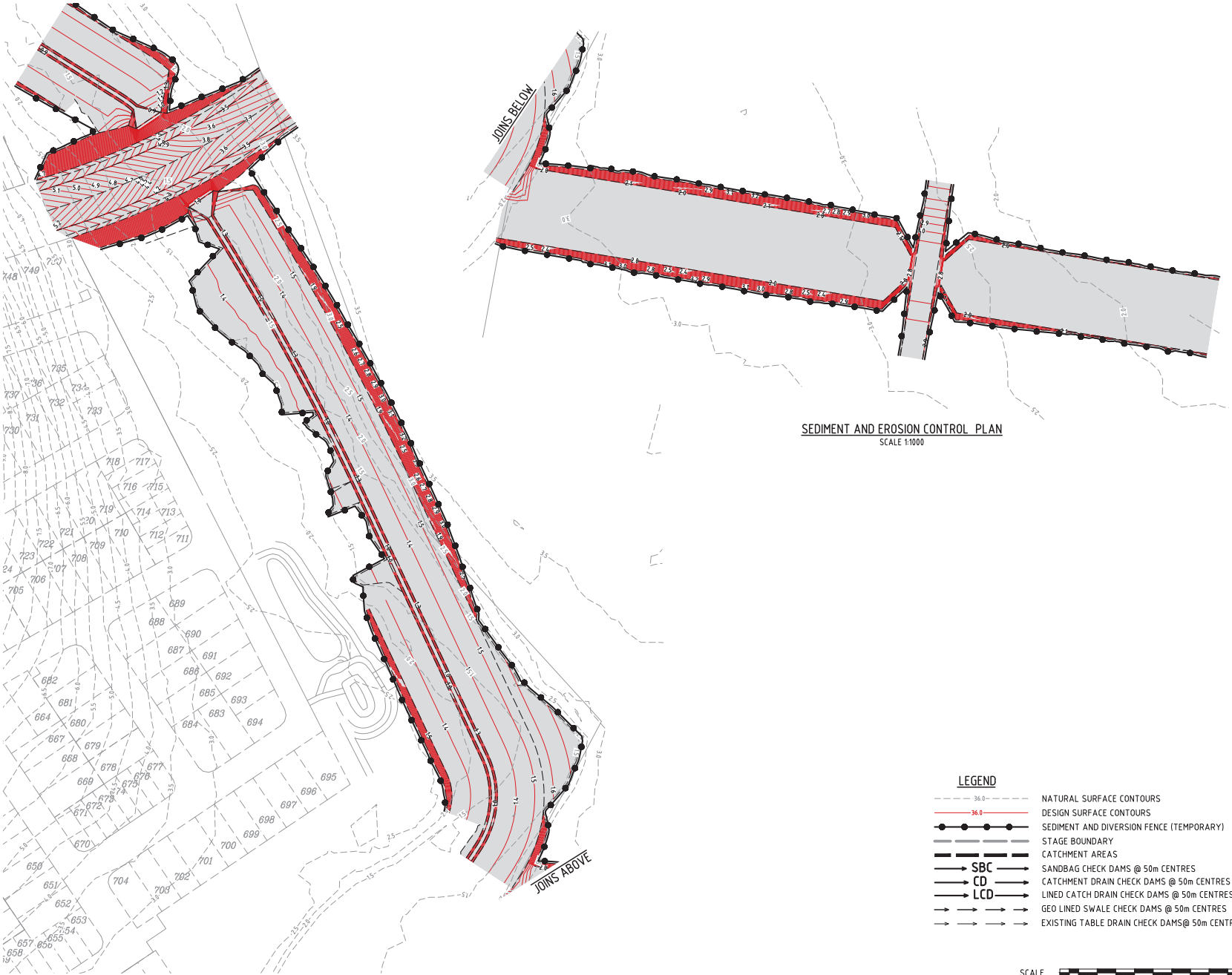

SEDIMENT AND EROSION CONTROL PLAN
SCALE 1:1000

SEDIMENT AND EROSION CONTROL PLAN
SCALE 1:1000

LEGEND

- NATURAL SURFACE CONTOURS
- DESIGN SURFACE CONTOURS
- SEDIMENT AND DIVERSION FENCE (TEMPORARY)
- STAGE BOUNDARY
- CATCHMENT AREAS
- SBC — SANDBAG CHECK DAMS @ 50m CENTRES
- CD — CATCHMENT DRAIN CHECK DAMS @ 50m CENTRES
- LCD — LINED CATCH DRAIN CHECK DAMS @ 50m CENTRES
- GEO LINED SWALE CHECK DAMS @ 50m CENTRES
- EXISTING TABLE DRAIN CHECK DAMS@ 50m CENTRES

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REVISIONS

No	Description	Date	By
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Drawing Title

SEDIMENT AND EROSION CONTROL PLAN

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EROSION AND SEDIMENT CONTROL PROGRAM

1. THIS PROGRAM AND ASSOCIATED PLANS SHOULD BE READ IN CONJUNCTION WITH THE SITE MANAGEMENT SPECIFICATION INCORPORATED IN THE CONTRACT DOCUMENTS. THE PROVISIONS OF THE SPECIFICATION ARE TO BE STRICTLY ADHERED TO.
2. THE BASIC OBJECTIVES OF THE EROSION AND SEDIMENT CONTROL ARE:
   I. IDENTIFY CRITICAL AREAS AND PROVIDE APPROPRIATE ATTENTION TO THOSE AREAS.
   II. PLAN SITE LAYOUTS SO THAT ACCESS TO ALL REQUIRED DRAINAGE EROSION AND SEDIMENT CONTROL MEASURE IS MAINTAINED.
   III. LIMIT EXPOSURE TIME BY PROGRAMMING TO MINIMISE THE AREA OF LAND EXPOSED TO POTENTIALLY ADVERSE WEATHER CONDITIONS AT ANY ONE TIME. I.E. PROGRESSIVELY CLEAR AND REVEGETATE.
   IV. PROVIDE CONTROL MEASURES INCLUDING TEMPORARY AND PERMANENT DRAINAGE, EROSION AND SEDIMENT CONTROLS.
3. THE EROSION AND SEDIMENT CONTROL SHALL COMPLY WITH BEST PRACTICE FOR EROSION AND SEDIMENT CONTROL, THE POLLUTION CONTROL MANUAL FOR URBAN STORMWATER MANAGEMENT, THE QUEENSLAND URBAN DRAINAGE MANUAL, THE SOIL EROSION AND SEDIMENT CONTROL – ENGINEERING GUIDELINES FOR QUEENSLAND (CURRENT EDITIONS) AND INTERNATIONAL EROSION CONTROL ASSOCIATION (ICEA).
4. CONSTRUCTION SEQUENCE THE CONSTRUCTION SEQUENCE WILL GENERALLY BE:
   I. OBTAIN ALL NECESSARY PERMITS AND APPROVALS BEFORE SITE ESTABLISHMENTS.
   II. HOLD A PRE-CONSTRUCTION CONFERENCE.
   III. STABILISE ALL CONSTRUCTION ACCESS ROUTES AND ENTRY/EXIT POINTS.
   IV. ESTABLISH SEDIMENT CONTROL STRUCTURES AND TEMPORARY DRAINAGE CONTROL MEASURES AS NECESSARY.
   V. CARRY OUT BULK EARTHWORKS.
   VI. MAINTAIN AND REPAIR DRAINAGE, EROSION AND SEDIMENT CONTROL MEASURES.
   VII. REMOVE SEDIMENT CONTROL MEASURES WHEN THE SITE IS STABILISED. I.E. >70% GROUND COVER
   VIII. THE CONTRACTOR SHALL PREPARE A SUPPLEMENTARY EROSION AND SEDIMENT CONTROL PLAN TO SUIT HIS/HER CONSTRUCTION METHODOLOGY, AND SUBMIT THIS PLAN FOR APPROVAL TO THE SUPERINTENDENT. IT SHOULD BE NOTED THAT ANY SIGNIFICANT VARIATION TO THIS PLAN MAY REQUIRE RESUBMISSION TO COUNCIL FOR APPROVAL. THE CLIENT SHALL NOT BE RESPONSIBLE FOR ANY SUCH ASSOCIATED DELAY.
5. ALL ESC DEVICES ARE TO BE INSPECTED WEEKLY, PRIOR TO EXPECTED AND AFTER RAINFALL ANY DAMAGE IS TO BE REPAIRED AS REQUIRED TO MAINTAIN THEIR EFFICACY.
6. ALL TEMPORARY EROSION AND SEDIMENT CONTROL (ESC) MEASURE TO BE MAINTAINED AND FULLY OPERATIONAL DURING THE MAINTENANCE PERIOD AND ARE TO BE REMOVED AFTER THE SATISFACTORY COMPLETION OF AN OFF-MAINTENANCE INSPECTION BY COUNCIL AND PRIOR TO FORMAL ACCEPTANCE "OFF MAINTENANCE8 BY COUNCIL.
7. PRIOR TO THE COMMENCEMENT OF CONSTRUCTION, THE CONTRACTOR IS TO PROVIDE A DETAILED PROGRAM TO THE SUPERINTENDENT SHOWING THE TIMING FOR ALL WORKS ASSOCIATED WITH THE PROJECT, NOMINATING, IN PARTICULAR, THE PROGRAM FOR INSTALLATION OF SOIL AND EROSION CONTROL SYSTEMS.
8. EARTHWORKS SHALL BE CARRIED OUT IN SUCH A MANNER THAT THE SITE IS MAINTAINED IN A WELL DRAINED CONDITION, AREAS OF LOOSE SOIL ARE MINIMISED AND CONCENTRATIONS OF STORMWATER ARE MINIMISED. BULK EARTHWORKS WILL BE CARRIED OUT OVER THE ENTIRE SITE IN ONE STAGE.
9. CONSTRUCTION AREAS SHALL BE AT ONE NOMINATED POINT ON SOUTH DEEBING CREEK ROAD. A SHAKE DOWN AS DETAILED ON THE PLAN COMPRISING FREE DRAINAGE GRAVEL SHALL BE LOCATED ADJACENT TO THE POINT OF ACCESS WHERE VEHICLES CAN BE WASHED DOWN PRIOR TO EXIT TO THE STREET SYSTEM IF REQUIRED. THE WASH DOWN AREA SHALL BE KEPT FREE OF MUD.
10. FOR DETAILS OF ENTRY/EXIT SEDIMENT PAD REFER TO BEST PRACTICE EROSION & SEDIMENT CONTROL BOOK 1, PAGE 2.48, FIGURE 2.6.
11. SUPPLEMENTARY EROSION AND SEDIMENT CONTROL DEVICES MAY BE REQUIRED AT THE DISCRETION OF THE SUPERINTENDENT.
12. SEDIMENTATION FENCES TO BE PLACED AS SHOWN. FOR DETAILS OF SEDIMENT FENCE REFER BEST PRACTICE EROSION & SEDIMENT CONTROL BOOK 1, PAGE 2.50, FIGURE 2.8.
13. WHERE SEDIMENT FENCES ARE SHOWN TO BE CONSTRUCTED IN AREAS OF SIGNIFICANT EARTHWORKS, ERECTION OF THE FENCE MAY BE DEFERRED UNTIL COMPLETION OF THE BULK EARTHWORKS, SUBJECT TO ABSENCE OF RAIN.

TREES

1. ENSURE COMPLIANCE WITH THE REQUIREMENTS OF AS4970 – TREES ON CONSTRUCTION SITES. THIS MAY REQUIRE CONSULTATION AND GUIDANCE FROM A CLASS V CERTIFIED ARBORIST AS TREES OUTSIDE THE IMMEDIATE WORK AREA MAY BE AFFECTED.

EROSION AND SEDIMENTATION CONTROL NOTES:

TOPSOIL

1. STRIP AND STOCKPILE AVAILABLE TOPSOIL (ASSUMED AVERAGE DEPTH 150MM) FROM ALL DISTURBED AREAS PRIOR TO BULK EARTHWORKS. GRADE EVENLY BETWEEN ALLOTMENT FINISHED SURFACE LEVELS AND ENSURE LOTS ARE FREE DRAINING.
2. MINIMUM SLOPE ACROSS ALLOTMENTS TO BE 1%.
3. ALL FOOTPATHS, BATTERS, AND EARTHWORKS AFFECTED ALLOTMENTS ARE TO BE TOPSOILED TO A MINIMUM DEPTH OF 150MM (LIGHTLY COMPACTED) AND TURFED WHERE SPECIFIED.
4. SEDIMENT FENCES TO BE PLACED AS SHOWN. FOR DETAILS OF SEDIMENT FENCE REFER BEST PRACTICE EROSION & SEDIMENT CONTROL BOOK 1, PAGE 2.50, FIGURE 2.7. SEDIMENT FENCED TO BE REPAIRED AND EXCESSIVE SEDIMENT DEPOSITS SHALL BE REMOVED ONCE CAPACITY FALLS BELOW 75%

SEDIMENT FENCES

1. FOR DETAILS OF SEDIMENT FENCE REFER BEST PRACTICE EROSION & SEDIMENT CONTROL BOOK 1, PAGE 2.50, FIGURE 2.8.
2. SEDIMENT FENCES TO BE REPAIRED AS REQUIRED AND EXCESSIVE SEDIMENT DEPOSITS SHOULD BE REMOVED.
3. INSTALL KERB INLETS WITH GRAVEL RANGING FROM 50MM TO 75MM IN SIZE SHALL BE INSTALLED AT ALL COMPLETED INLETS. REFER IPWEAQ STANDARD DRAWING D-0041. THESE SHALL BE MAINTAINED IN A CLEAN CONDITION. IN THE EVENT OF HEAVY RAIN THEY SHALL BE REMOVED TO MINIMISE THE POTENTIAL FOR FLOODING.
4. CHECKS OF SILT CONTROL DEVICES ARE TO BE MADE WEEKLY, OR AFTER ANY SIGNIFICANT STORM EVENT TO ENSURE INTEGRITY AND PERFORMANCE.

TURFING

1. PROVIDE TURFING TO ENTIRE WIDTH OF ALL SWALES, FOOTPATHS, AND 1 IN 4 CUT AND FILL BATTERS.
2. FOOTPATH BATTERS ARE TO BE STABILISED WITH TOPSOIL (AND TURFED) AS SOON AS PRACTICAL AFTER THE BATTERS HAVE BEEN COMPLETED.

DURING CONSTRUCTION SEQUENCE:

1. TOPSOIL STOCKPILES SHALL BE LESS THAN 1M DEEP AND UNCOMPACTED. A SEDIMENTATION FENCE SHALL BE CONSTRUCTED ON THE D/S SIDE, OR THE STOCKPILE STABILISED WITH VEGETATION, MULCH, OR A SOIL STABILISER.
2. SEDIMENTATION FENCES TO BE PLACED AS SHOWN.
3. REGULARLY INSPECT BANKS AND REPAIR ANY SLUMPS, WHEEL TRACK DAMAGE OR LOSS OF FREEBOARD.
4. REMOVE SEDIMENT TO AVOID PONDING FROM CATCH DRAINS.
5. REMOVE EXCESSIVE SEDIMENT FROM UPSTREAM OF CHECK DAM.
6. ROAD RESERVE TO BE USED AS HAUL ROAD.
7. A CATCH DRAINOR DIVERSION BANK IS TO BE PROVIDED ON THE TOP SIDE OF ALL CUTS, WITH DISCHARGE EITHER TO UNDISTURBED GRASS LANDS OR TO THE CROSS ROAD DRAINAGE.
8. SUPPLEMENTARY EROSION AND SEDIMENT CONTROL DEVISED MAY BE REQUIRED AT THE DISCRETION OF THE ENGINEER.
9. WATER QUALITY SAMPLES MUST BE TAKEN AND ANALYSED PRIOR TO THE RELEASE OF ANY WATER FROM THE SEDIMENT POND. WATER QUALITY MUST SATISFY THE FOLLOWING CRITERIA: TSS<50MG/L PH BETWEEN 6.5 AND 8.5.
10. ALL WATER QUALITY DATA INCLUDING DATES OF RAINFALL, TESTING AND WATER RELEASE MUST BE MAINTAINED IN AN ON-SITE REGISTER. THIS REGISTER IS TO BE MAINTAINED FOR THE DURATION OF THE APPROVED WORKS AND BE AVAILABLE ON SITE FOR INSPECTION BY COUNCIL OFFICERS ON REQUEST.
11. EXPOSED AREAS ON LOTS ARE TO BE SEEDED AND MULCHED (E.G. HYDROMULCHED). MULCH SHALL BE APPLIED AT A MINIMUM RATE OF 2.5T/HA. ALTERNATIVELY THEY SHALL BE DRILL-SEEDED AND IRRIGATED SO AS TO ENSURE >70% GROUND COVER WITHIN 14 DAYS FROM NOVEMBER TO APRIL, OR 30 DAYS FROM MAY TO OCTOBER.

FOLLOWING CONSTRUCTION:

1. SEDIMENTATION FENCES TO BE MAINTAINED UNTIL TURFING IS COMPLETED.
2. SEDIMENT BASINS TO BE CHECKED AFTER EVERY SIGNIFICANT STORM AND DESILTED ONCE THE SETTLEMENT LIMIT HAS BEEN REACHED.

DO NOT SCALE THIS DRAWING
IF IN DOUBT - ASK!

REVISIONS

No	Description	Date	By
A	FOR APPROVAL	02.02.2021	RW

NORTH

Client

North Harbour

BULK EARTHWORKS

kn group

Approved Director - RPEQ 17544

Drawing Title

SEDIMENT AND EROSION CONTROL NOTES

Drawn	Designed	Checked	Date
RW	JB	MAS	FEB 21

Scale	Sheet
AS SHOWN	06 of 09

	Drawing No	Revision
A1	20-185- 06	A

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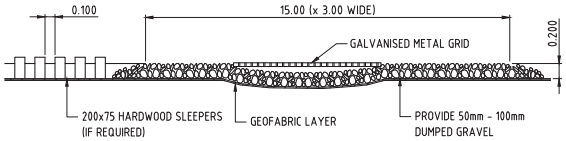
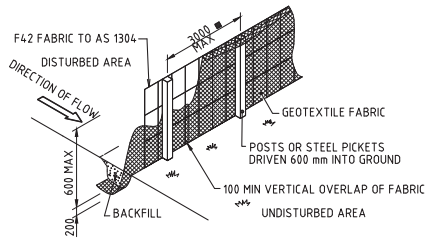


SITE ACCESS POINT SHAKEDOWN FACILITY
N.T.S.



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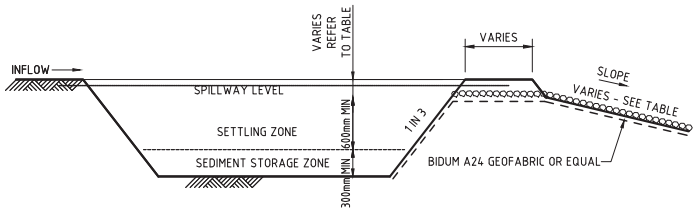

TYPE C BASIN DETAIL
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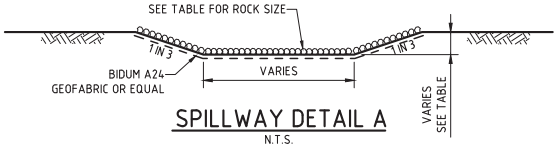

SPILLWAY DETAIL A
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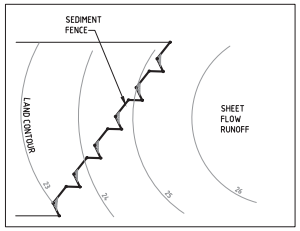
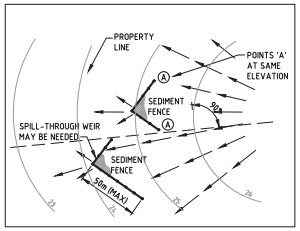
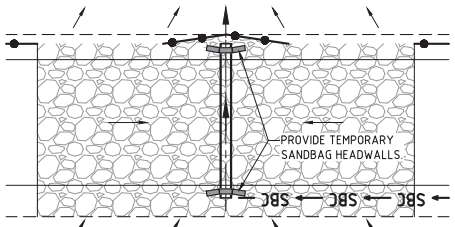
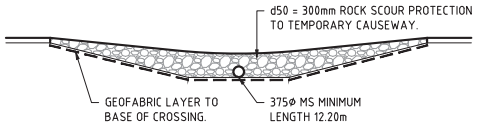




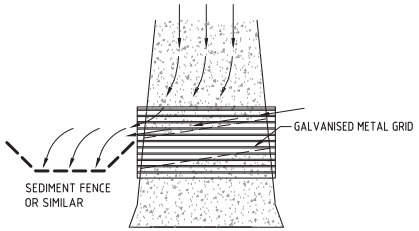
SILT FENCE DETAILS



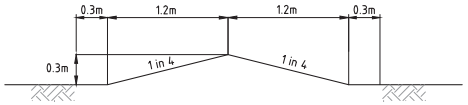
DETAIL 'A' TEMPORARY CROSSING PLAN
SCALE 1:100



DETAIL 'A' TEMPORARY CROSSING SECTION
SCALE 1:100



SITE ACCESS POINT ENTRY/EXIT PAD
N.T.S.



BUND SECTION
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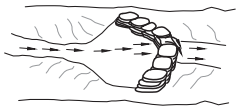
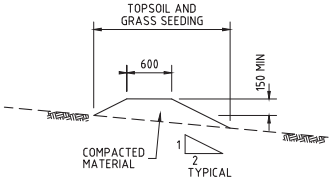
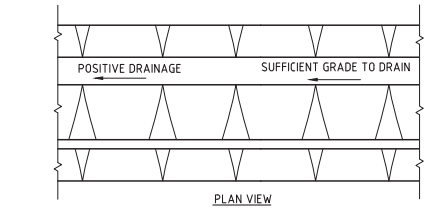


SANDBAG CHECK DAM
N.T.S.



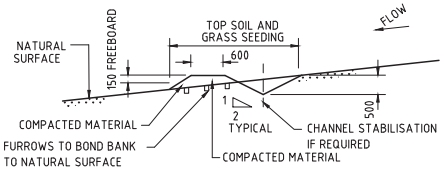
DIVERSION DRAINAGE BANK
N.T.S.



TYPICAL LINED CATCH DRAIN
SCALE 1 : 40

LCD NO.	WIDTH	DEPTH
1	1.500	0.450
2	1.500	0.450
3	1.500	0.300
4	1.500	0.250
5	1.500	0.300
6	1.500	0.300
7	1.500	0.250
8	1.500	0.200
9	1.500	0.350
10	1.500	0.300

PLAN VIEW



PLACE FILTER FABRIC ACROSS DRAIN AT 30m MAXIMUM INTERVALS AND AT OUTLET OF DRAIN, OR AS REQUIRED TO CONTROL SEDIMENT MOVEMENT ALONG DRAIN.

CROSS SECTION

CATCHMENT DRAIN
N.T.S.

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REVISIONS

No	Description	Date	By
A	FOR APPROVAL	02.02.2021	RW

NORTH

Client

North Harbour
local right at home

BULK EARTHWORKS

kn group

Approved Director - RPEQ 17544

Drawing Title

SEDIMENT AND EROSION CONTROL DETAILS

Drawn	Designed	Checked	Date
RW	JB	MAS	FEB 21

Scale	Sheet
AS SHOWN	07 of 09

	Drawing No	Revision
A1	20-185- 07	A

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BASIN NOTES

1. ALL BASINS SHALL BE CONSTRUCTED PRIOR TO THE COMMENCMENT OF MAJOR EARTHWORKS IN THE RELEVANT CATCHMENT.
2. AN APPROPRIATELY MARKED (E.G. PAINTED) DE-SILTING MARKER POST MUST BE INSTALLED IN THE BASIN TO INDICATE THE TOP OF THE SEDIMENT STORAGE ZONE. THE BASIN MUST BE DE-SILTED. IF THE SEDIMENT IS ALREADY ABOVE THIS MARKER POINT, OR IF THE NEXT STORM IS LIKELY TO CAUSE SEDIMENT TO SETTLE ABOVE THIS MARKER POINT.
3. PRIOR TO DISCHARGE OF WATER FROM A SEDIMENT BASIN, IT IS ESSENTIAL FOR THE WATER QUALITY TO COMPLY WITH ALL SPECIFIED WATER QUALITY OBJECTIVES (WQOS) (E.G. WATER PH IN THE RANGE OF 6.5 – 8.5).
4. THE RECOMMENDED WATER QUALITY STANDARD FOR SEDIMENT BASINS IS PRESENTED IN TABLE B18.

TABLE B18 – RECOMMENDED DISCHARGE STANDARD FOR DE-WATERING OPERATIONS

SITE CONDITIONS	DISCHARGE WATER QUALITY STANDARD
POST-STORM DE-WATERING OF SEDIMENT BASINS (E.G. TYPE F AND D BASINS, AND TYPE C BASINS OPERATING AS WET-BASINS).	90 PERCENTILE TOTAL SUSPENDED SOLIDS (TSS) CONCENTRATION NOT EXCEEDING 50MG/L.

TECHNICAL NOTES B5 – BASIN FLOCCULATION

THE CONTRACTOR SHALL, IN CONJUNCTION WITH THE SITE EROSION AND SEDIMENT CONTROL SPECIALIST, DETERMINE THE MOST APPROPRIATE FLOCCULANT FOR THE SITE. A PROCEDURE FOR THE MANUAL DOSING OF GYPSUM OR SIMILAR (DEVELOPED FROM LANDCOM, 2004) IS AS FOLLOWS:

1. PLACE REQUIRED GYPSUM QUANTITY (SAY 32KG/100M3 OF WATER) IN APPROXIMATELY 50L DRUM PERFORATED WITH 25MM HOLES AT 150MM SPACING.
2. SUSPEND THE SCREENED, RECIRCULATING PUMP INTAKE INTO THE DRUM.
3. LIFT THE DRUM INTO THE BASIN SUCH THAT BASIN WATER CAN ENTER AND CIRCULATED THROUGH THE DRUM.
4. USING THE PUMP, SPRAY THE GYPSUM-RICH SOLUTION EVENLY OVER THE SURFACE OF THE BASIN UNTIL THE GYPSUM IS FULLY REMOVED FROM THE DRUM. THE PUMP OUTLET MUST SPRAY THE MIXTURE OVER A WIDE AREA RATHER THAN JUST DISCHARGING AS A CONFINED "JETö.
5. ALTERNATIVELY, IF TWO PUMPS ARE AVAILABLE, USE THE TWO PUMPS TO CIRCULATE BASIN WATER FIRST TO THE ON-SHORE TANK, AND THEN FROM THE TANK OVER THE SURFACE OF THE BASIN. A LARGE MIXING TANK WILL USUALLY BE REQUIRED.
6. ALTERNATIVE PRODUCTS INCLUDE POLYALUMINIUM CHLORIDE (PAC), POLYACRYLAMIDE (PAC).

B3 BASIN CONSTRUCTION AND MAINTENANCE MATERIALS

- EARTH FILL: CLEAN SOIL WITH EMERSON CLASS 2(1), 3, 4, OR 5, AND FREE OF ROOTS, WOODY VEGETATION, ROCKS AND OTHER UNSUITABLE MATERIAL. SOIL WITH EMERSON CLASS 4 AND 5 MAY NOT BE SUITABLE DEPENDING ON PARTICLE SIZE AND DISTRIBUTION AND DEGREE OF DISPERSION. CLASS 2(1) SHOULD ONLY BE USED UPON RECOMMENDATION FROM GEOTECHNICAL SPECIALIST. [ALTERNATIVELY, SET A STANDARD BASED ON EXCHANGEABLE SODIUM PERCENTAGE – SEEK EXPERT ADVICE.]
- RISER PIPE: MINIMUM 250MM DIAMETER.
- SPILLWAY ROCK: HARD, ANGULAR, DURABLE, WEATHER RESISTANT AND EVENLY GRADED ROCK WITH 50% BY WEIGHT LARGER THAN THE SPECIFIED NOMINAL (D50) ROCK SIZE. LARGER ROCK SHOULD DOMINATE, WITH SUFFICIENT SMALL ROCK TO FILL THE VOIDS BETWEEN THE LARGER ROCK. THE DIAMETER OF THE LARGEST ROCK SIZE SHOULD BE NO LARGER THAN 1.5 TIMES THE NOMINAL ROCK SIZE. THE SPECIFIC GRAVITY SHOULD BE AT LEAST 2.5.
- GEOTEXTILE FABRIC: HEAVY-DUTY, NEEDLE-PUNCHED, NON-WOVEN FILTER CLOTH, MINIMUM BIDIM A24 OR EQUIVALENT.

CONSTRUCTION

1. NOTWITHSTANDING ANY DESCRIPTION CONTAINED WITHIN THE APPROVED PLANS OR SPECIFICATIONS, THE CONTRACTOR SHALL BE RESPONSIBLE FOR SATISFYING THEMSELVES AS TO THE NATURE AND EXTENT OF THE SPECIFIED WORKS AND THE PHYSICAL AND LEGAL CONDITIONS UNDER WHICH THE WORKS WILL BE CARRIED OUT. THIS SHALL INCLUDE MEANS OF ACCESS, EXTENT OF CLEARING, NATURE OF MATERIAL TO BE EXCAVATED, TYPE AND SIZE OF MECHANICAL PLAN REQUIRED, LOCATION AND SUITABILITY OF WATER SUPPLY FOR CONSTRUCTION AND TESTING PURPOSES, AND ANY OTHER LIKE MATTERS AFFECTING THE CONSTRUCTION OF THE WORKS.
2. REFER TO APPROVED PLANS FOR LOCATION, DIMENSIONS, AND CONSTRUCTION DETAILS. IF THERE ARE QUESTIONS OR PROBLEMS WITH THE LOCATION, DIMENSIONS, OR METHOD OF INSTALLATION, CONTACT THE ENGINEER OR RESPONSIBLE ON-SITE OFFICER FOR ASSISTANCE.
3. BEFORE STARTING ANY CLEARING OR CONSTRUCTION, ENSURE ALL THE NECESSARY MATERIALS AND COMPONENTS ARE ON THE SITE TO AVOID DELAYS IN COMPLETING THE POND ONCE WORKS BEGIN.
4. INSTALL REQUIRED SHORT-TERM SEDIMENT CONTROL MEASURES DOWNSTREAM OF THE PROPOSED EARTHWORKS TO CONTROL SEDIMENT RUNOFF DURING CONSTRUCTION OF THE BASIN.
5. THE AREA TO BE COVERED BY THE EMBANKMENT, BORROW PITS AND INCIDENTAL WORKS, TOGETHER WITH AN AREA EXTENDING BEYOND THE LIMITS OF EACH FOR A DISTANCE NOT EXCEEDING FIVE (5) METRES ALL AROUND MUST BE CLEARED OF ALL TREES, SCRUB, STUMPS, ROOTS, DEAD TIMBER AND RUBBISH AND DISPOSED OF IN A SUITABLE MANNER. DELAY CLEARING THE MAIN POND AREA UNTIL THE EMBANKMENT IS COMPLETE. [MODIFY AS NECESSARY TO LIMIT TOTAL AREA OF DISTURBANCE AND ANY DAMAGE TO PROTECTED VEGETATION].
6. ENSURE ALL HOLES MADE BY GRUBBING WITHIN THE EMBANKMENT FOOTPRINT ARE FILLED WITH SOUND MATERIAL, ADEQUATELY COMPACTED, AND FINISHED FLUSH WITH THE NATURAL SURFACE.
7. IS SUITABLE AND IT IS PLACED IN THE CORRECT ZONE ACCORDING TO ITS CLASSIFICATION.

CUT-OFF TRENCH:

1. BEFORE CONSTRUCTION OF THE CUT-OFF TRENCH OR ANY ANCILLARY WORKS WITHIN THE EMBANKMENT FOOTPRINT, ALL GRASS GROWTH AND TOPSOIL MUST BE REMOVED FROM THE AREA TO BE OCCUPIED BY THE EMBANKMENT AND MUST BE DEPOSITED CLEAR OF THIS AREA AND RESERVED FOR TOPDRESSING THE COMPLETING EMBANKMENT.
2. EXCAVATE A CUT-OFF TRENCH ALONG THE CENTRE LINE OF THE EARTH FILL EMBANKMENT. CUT THE TRENCH TO STABLE SOIL MATERIAL, BUT IN NO CASE MAKE IT LESS THAN 600MM DEEP. THE CUT-OFF TRENCH MUST EXTEND INTO BOTH ABUTMENTS TO AT LEAST THE ELEVATION OF THE RISER PIPE CREST. MAKE THE MINIMUM BOTTOM WIDTH WIDE ENOUGH TO PERMIT OPERATION OF EXCAVATION AND COMPACTION EQUIPMENT, BUT IN NO CASE LESS THAN 600MM. MAKE THE SIDE SLOPES OF THE TRENCH NO STEEPER THAN 1:1 (H:V).
3. ENSURE ALL WATER, LOOSE SOIL, AND ROCK ARE REMOVED FROM THE TRENCH BEFORE BACKFILLING COMMENCES. THE CUT-OFF TRENCH MUST BE BACKFILLED WITH SELECTED EARTH-FILL OF THE TYPE SPECIFIED FOR THE EMBANKMENT, AND THIS SOIL MUST HAVE A MOISTURE CONTENT AND DEGREE OF COMPACTION THE SAME AS THAT SPECIFIED FOR THE SELECTED CORE ZONE.
4. MATERIAL EXCAVATED FROM THE CUT-OFF TRENCH MAY BE USED IN CONSTRUCTION OF THE EMBANKMENT PROVIDED IT IS SUITABLE AND IT IS PLACED IN THE CORRECT ZONE ACCORDING TO ITS CLASSIFICATION.

EMBANKMENT:

1. SCARIFY AREAS ON WHICH FILL IS TO BE PLACED BEFORE PLACING THE FILL.
2. ENSURE ALL FILL MATERIAL USED TO FORM THE EMBANKMENT MEETS THE SPECIFICATIONS CERTIFIED BY A GEOTECHNICAL SPECIALIST.
3. THE FILL MATERIAL MUST CONTAIN SUFFICIENT MOISTURE SO IT CAN BE FORMED BY HAND INTO A BALL WITHOUT CRUMBLING. IF WATER CAN BE SQUEEZED OUT OF THE BALL, IT IS TOO WET FOR PROPER COMPACTION. PLACE FILL MATERIAL IN 150 TO 250MM CONTINUOUS LAYERS OVER THE ENTIRE LENGTH OF THE FILL AREA THEN COMPACT BEFORE PLACEMENT OF FURTHER FILL.
4. PLACE RISER PIPE OUTLET SYSTEM, IF SPECIFIED, IN APPROPRIATE SEQUENCE WITH THE EMBANKMENT FILLING. REFER TO SPECIFICATIONS SUPPLIED BELOW.
5. UNLESS OTHERWISE SPECIFIED ON THE APPROVED PLANS, COMPACT THE SOIL AT ABOUT 1% TO 2% WET OF OPTIMUM AND TO 95% MODIFIED OR 100% STANDARD COMPACTION.
6. WHERE BOTH DISPERSIVE AND NON-DISPERSIVE CLASSIFIED EARTH-FILL MATERIALS ARE AVAILABLE, NON-DISPERSIVE EARTH-FILL MUST BE USED IN THE CORE ZONE. THE REMAINING CLASSIFIED EARTH-FILL MATERIALS MUST ONLY BE USED AS DIRECTED BY [INSERT TITLE].
7. WHERE SPECIFIED, CONSTRUCT THE EMBANKMENT TO AN ELEVATION 10% HIGHER THAN THE DESIGN HEIGHT TO ALLOW FOR SETTLING; OTHERWISE FINISHED DIMENSIONS OF THE EMBANKMENT AFTER SPREADING OF TOPSOIL MUST CONFORM TO THE DRAWING WITH A TOLERANCE OF 75MM FORM THE SPECIFIED DIMENSIONS.
8. ENSURE DEBRIS AND OTHER UNSUITABLE BUILDING WASTE IN NOT PLACED WITHIN THE EARTH EMBANKMENT.
9. AFTER COMPLETION OF THE EMBANKMENT ALL LOOSE UNCOMPACTED EARTH-FILL MATERIAL OF THE UPSTREAM AND DOWNSTREAM BATTER MUST BE REMOVED PRIOR TO SPREADING OF TOPSOIL.
10. TOPSOIL AND REVEGETATE/STABILISED ALL EXPOSED EARTH AS DIRECTED WITHIN THE APPROVED PLANS.
11. WHERE THE SITE IS TO BE REVEGETATED, THE TOPSOIL AND UPPER 500MM OF THE SUBSOIL SHALL MEET THE SPECIFICATIONS SET BY A SOIL SCIENTIST.

ESTABLISHMENT OF SETTLING POND:

1. THE AREA TO BE COVERED BY THE STORED WATER OUTSIDE THE LIMITS OF THE BORROW PITS MUST BE CLEARED OF ALL SCRUB AND RUBBISH. TREES MUST BE CUT DOWN STUMP HIGH AND REMOVED FROM THE IMMEDIATE VICINITY OF THE WORK.
2. ESTABLISH ALL REQUIRED INFLOW CHUTES AND INLET BAFFLES, IF SPECIFIED, TO ENABLE WATER TO DISCHARGE INTO THE BASIN IN A MANNER THAT WILL NOT CAUSE SOIL EROSION NOR THE RE-SUSPENSION OF SETTLED SEDIMENT.
3. INSTALL A SEDIMENT STORAGE LEVEL MARKER POST WITH A CROSS MEMBER SET JUST BELOW THE TOP OF THE SEDIMENT STORAGE ZONE (AS SPECIFIED ON THE APPROVED PLANS). USE AT LEAST A 75MM WIDE POST FIRMLY SET INTO THE BASIN FLOOR.
4. IF SPECIFIED, INSTALL INTERNAL SETTLING POND BAFFLES. ENSURE THE CREST OF THESE BAFFLES IS SET LEVEL WITH OR JUST BELOW, THE ELEVATION OF THE EMERGENCY SPILLWAY CREST.
5. INSTALL ALL APPROPRIATE MEASURE TO MINIMISE SAFETY RISK TO ON-SITE PERSONNEL AND THE PUBLIC CAUSED BY THE PRESENCE OF THE SETTLING POND. AVOID STEEP, SMOOTH INTERNAL SLOPES. APPROPRIATELY FENCE THE SETTLING POND AND POST WARNING SIGNS IF UNSUPERVISED ACCESS IS LIKELY OR THERE IS CONSIDERED TO BE AN UNACCEPTABLE RISK TO THE PUBLIC.

SPILLWAY CONSTRUCTION:

1. THE SPILLWAY MUST BE EXCAVATED AS SHOWN ON THE PLANS, AND THE EXCAVATED MATERIAL IF CLASSIFIED AS SUITABLE, MUST BE USED IN THE EMBANKMENT, AND IF NOT SUITABLE IT MUST BE DISPOSED OF INTO SPOIL HEAPS.
2. ENSURE EXCAVATED DIMENSIONS ALLOW ADEQUATE BOXING-OUT SUCH THAT THE SPECIFIED ELEVATIONS, GRADES, CHUTE WIDTH, AND ENTRANCE AND EXIT SLOPES FOR THE EMERGENCY SPILLWAY WILL BE ACHIEVED AFTER PLACEMENT OF THE ROCK OR OTHER SCOUR PROTECTION MEASURES AS SPECIFIED IN THE PLANS.
3. PLACE SPECIFIED SCOUR PROTECTION MEASURES ON THE EMERGENCY SPILLWAY. ENSURE THE FINISHED GRADE BLENDS WITH THE SURROUNDING AREA TO ALLOW A SMOOTH FLOW TRANSITION FROM SPILLWAY TO DOWNSTREAM CHANNEL.
4. IF A SYNTHETIC FILTER FABRIC UNDERLAY IS SPECIFIED, PLACE THE FILTER FABRIC DIRECTLY ON THE PREPARED FOUNDATION. IF MORE THAN 1 SHEET OF FILTER FABRIC IS REQUIRED, OVERLAP THE EDGES BY AT LEAST 300MM AND PLACE ANCHOR PINS AT MINIMUM 1M SPACING ALONG THE OVERLAP. BURY THE UPSTREAM END OF THE FABRIC A MINIMUM 300MM BELOW GROUND AND WHERE NECESSARY, BURY THE LOWER END OF THE FABRIC OR OVERLAP A MINIMUM 300MM OVER THE NEXT DOWNSTREAM SECTION AS REQUIRED. ENSURE THE FILTER FABRIC EXTENDS AT LEAST 1000MM UPSTREAM OF THE SPILLWAY CREST.
5. TAKE CARE NOT TO DAMAGE THE FABRIC DURING OR AFTER PLACEMENT. IF DAMAGE OCCURS, REMOVE THE ROCK AND REPAIR THE SHEET BY ADDING ANOTHER LAYER OF FABRIC WITH A MINIMUM OVERLAP OF 300MM AROUND THE DAMAGED AREA. IF EXTENSIVE DAMAGE IS SUSPECTED, REMOVE AND REPLACE THE ENTIRE SHEET.
6. WHERE LARGE ROCK IS USED, OR MACHINE PLACEMENT IS DIFFICULT, A MINIMUM 100MM LAYER OF FINE GRAVEL, AGGREGATE, OR SAND MAY BE NEEDED TO PROTECT THE FABRIC.
7. PLACEMENT OF ROCK SHOULD FOLLOW IMMEDIATELY AFTER PLACEMENT OF THE FILTER FABRIC. PLACE ROCK SO THAT IF FORMS A DENSE, WELL-GRADED MASS OF ROCK WITH A MINIMUM OF VOIDS. THE DESIRED DISTRIBUTION OF ROCK THROUGHOUT THE MASS MAY BE OBTAINED BY SELECTIVE LOADING AT THE QUARRY AND CONTROLLED DUMPING DURING FINAL PLACEMENT.
8. THE FINISHED SLOPE SHOULD BE FREE OF POCKETS OF SMALL ROCK OR CLUSTERS OF LARGE ROCKS. HAND PLACING MAY BE NECESSARY TO ACHIEVE THE PROPER DISTRIBUTION OF ROCK SIZES TO PRODUCE A RELATIVELY SMOOTH, UNIFORM SURFACE. THE FINISHED GRADE OF THE ROCK SHOULD BLEND WITH THE SURROUNDING AREA. NO OVERFALL OR PROTRUSION OF ROCK SHOULD BE APPARENT.
9. ENSURE THAT THE FINAL ARRANGEMENT OF THE SPILLWAY CREST WILL NOT PROMOTE EXCESSIVE FLOW THROUGH THE ROCK SUCH THAT THE WATER CAN BE RETAINED WITHIN THE SETTLING BASIN AN ELEVATION NO LESS THAN 50MM ABOVE OR BELOW THE NOMINATED SPILLWAY CREST ELEVATION.

MAINTENANCE OF SEDIMENT BASIN

1. INSPECT THE SEDIMENT BASIN DURING THE FOLLOWING PERIODS:
   (i) DURING CONSTRUCTION TO DETERMINE WHETHER MACHINERY, FALLING TREES, OR CONSTRUCTION ACTIVITY HAS DAMAGED ANY COMPONENTS OF THE SEDIMENT BASIN. IF DAMAGE HAS OCCURRED, REPAIR IT.
   (ii) AFTER EACH RUNOFF EVENT. INSPECT THE EROSION DAMAGE AT FLOW ENTRY AND EXIT POINTS. IF DAMAGE HAS OCCURRED, MAKE THE NECESSARY REPAIRS.
   (iii) AT LEAST WEEKLY DURING THE NOMINATED WET SEASON (IF ANY) OTHERWISE AT LEAST FORTNIGHTLY.
   (i) PRIOR TO, AND IMMEDIATELY AFTER, PERIOD OF "STOP WORKö OR SITE "SHUTDOWNö.
2. CLEAN OUT ACCUMULATED SEDIMENT WHEN IT REACHES THE MARKER BOARD/POST, AND RESTORE THE ORIGINAL STORAGE VOLUME. PLACE SEDIMENT IN A DISPOSABLE AREA OR, IF APPROPRIATE, MIX WITH DRY SOIL ON THE SITE.
3. DO NOT DISPOSE OF SEDIMENT IN A MANNER THAT WILL CREATE AN EROSION OR POLLUTION HAZARD.
4. CHECK ALL VISIBLE PIPE CONNECTIONS FOR LEAKS, AND REPAIR AS NECESSARY.
5. CHECK FILL MATERIAL IN THE DAM FOR EXCESSIVE SETTLEMENT, SLUMPING OF THE SLOPES OR PIPING BETWEEN THE CONDUIT AND THE EMBANKMENT; MAKE ALL NECESSARY REPAIRS.
6. REMOVE ALL TRASH AND OTHER DEBRIS FROM THE BASIN AND RISER.
7. SUBMERGED INFLOW PIPES MUST BE INSPECTED AND DE-SILTED (AS REQUIRED) AFTER EACH INFLOW EVENT.

REMOVAL OF SEDIMENT BASIN

1. WHEN GRADING AND CONSTRUCTION IN THE DRAINAGE AREA ABOVE A TEMPORARY SEDIMENT BASIN IS COMPLETED AND THE DISTURBED AREAS ARE ADEQUATELY STABILISED (>70% GROUND COVER) WITH HYDROMULCH OR MULCHIN 6 AS APPROVED BY MBRC, THE BASIN MUST BE REMOVED OR OTHERWISE INCORPORATED INTO THE PERMANENT STORMWATER DRAINAGE SYSTEM. IN EITHER CASE, SEDIMENT SHOULD BE CLEARED AND PROPERLY DISPOSED OF AND THE BASIN AREA STABILISED.
2. BEFORE STARTING ANY MAINTENANCE WORK ON THE BASIN OR SPILLWAY, INSTALL ALL NECESSARY SHORT-TERM SEDIMENT CONTROL MEASURES DOWNSTREAM OF THE SEDIMENT BASIN.
3. ALL WATER AND SEDIMENT MUST BE REMOVED FROM THE BASIN PRIOR TO THE DAM'S REMOVAL. DISPOSE OF SEDIMENT AND WATER IN A MANNER THAT WILL NOT CREATE AN EROSION OR POLLUTION HAZARD.
4. BRING THE DISTURBED AREA TO A PROPER GRADE, THEN SMOOTH, COMPACT, AND STABILISE AND/OR REVEGETATE AS REQUIRED TO ESTABLISH A STABLE LAND SURFACE.

DO NOT SCALE THIS DRAWING
IF IN DOUBT - ASK!

REVISIONS

No	Description	Date	By
A	FOR APPROVAL	02.02.2021	RW

NORTH

Client

North Harbour
find right at home

BULK EARTHWORKS

kn group

Approved Director - RPEQ 17544

Drawing Title

SEDIMENT AND EROSION BASIN NOTES

Drawn	Designed	Checked	Date
RW	JB	MAS	FEB 21

Scale	Sheet
AS SHOWN	08 of 09

A1	Drawing No	Revision
	20-185- 08	A

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Client: NORTH EAST BUSINESS PARK

Project: NORTH HARBOUR RESIDENTIAL WEST
BULK EARTHWORKS

Prepared By: Mark Shaw — Date: 2nd February 2021
Reviewed By: Robert Mander — Date: 2nd February 2021

Safety in Design Analysis

- Complete Safety in Design Analysis by populating the table where applicable with all of the relevant safety issues for the project. For example:

☐ Positioning of new services adjacent to existing live services	☒ Slope Stability
☐ Construction adjacent to existing road carriageways	☒ Dust Control
☐ Pedestrians	☒ Erosion and Sediment Control/Management
☒ Civil Construction Workers	☒ Sediment Basin Construction
☒ Maintenance Workers	☒ Wetland Construction
☒ Work Place Health and Safety Constraints	☒ Working under traffic
☐ Unusual material handling	
☐ Falls from heights	Project Specific Design Elements:
☐ Underground Services (existing)	
☐ Electrical Service Installation	
☐ Gas Service Installation	
☐ Communication Installation	
☐ Traffic Signal Installation	
☒ Landscape Workers	
☐ Line marking Workers	
☒ Excavation – open cut trenching - Trench excavation depths	
☐ Tunnel Boring	
☒ Confined Spaces	
☒ Lifting of loads	
☒ Unloading of materials and storage	
☐ Storage of hazardous materials	
☒ Geotechnical investigation – works	
☒ Bulk Earthworks	
☐ List all relevant safety studies	

The following table summarises the safety in design issues considered.

Section of Works	Identify any Potential Incident or Hazard	Consequence	Likelihood	Risk Rating	Risk Control Measures	Consequence	Likelihood	Residual Risk Rating (after design applied)	Risk Manager
Earthworks Material Investigation	Geotechnical Investigation	C	3	S	SWMS required by Contractor	D	3	M	Contractor
Road Works	Pedestrians Injury	B	3	M	TMP to be provided by Contractor to exclude pedestrians from work site	E	3	L	Contractor
	Civil Construction Workers – Injury	A	4	H	TMP and SWMS required for all activities	C	3	S	Contractor
	Maintenance Workers	A	4	H	TMP and SWMS required for all activities	C	3	S	Contractor
	Underground Services (Existing)	A	3	H	DBYD information to be sort prior to design. Existing to be located by survey if applicable to design. All existing services to be located and depths confirmed prior to commencement. SWMS to be provided by Contractor.	C	3	S	Designer/ Contractor
Working adjacent to existing infrastructure	Conflict between construction equipment / personnel and live infrastructure in particular Power lines	B	4	S	All existing services highlighted in the documentation. Contractor to complete DBYD search before commencing works. SWMS to be provided by Contractor	C	4	M	Designer/ Contractor
Service trench/ pipe installation	Location of all trenches to provide clearance to all other services and all structures or batters/embankments	A	3	H	Mains located with safe working clearance to existing pressure mains, structures and batters/embankments	C	3	M	Designer
	Trench depth	A	4	M	Depth of trenches minimised for both safety and cost efficiency	C	4	M	Designer
Works within Confined Spaces	Construction of manholes structures	A	4	M	Contractor to ensure work undertaken in a manner complying with safe work method statements	D	5	L	Contractor
Silt and Erosion Control	Public access to water retaining temporary sediment basins	A	5	S	Protection measures – that is fencing off all water retaining structures with side slopes greater than 1 in 5 as described in International Erosion Control Association (Australasia) Table [illegible]	D	4	M	Designer/ Contractor

RISK ASSESSMENT AND CONTROL

Risk Assessment			
Select **one** category from each of the columns below that best represents the likely outcome if the potential hazard actually did occur. For each consequence consider the **most likely outcome** and **not** the "absolute worst" case.			
Consequence		**Likelihood**	
A	Death – major environmental damage	1	Certain
B	Permanent Disability – severe environmental damage	2	Probable
C	Lost Time Injury – moderate environmental damage	3	Possible
D	Medical Treatment Injury – minor environmental damage	4	Unlikely
E	First Aid Treatment	5	Very Unlikely

H: High Risk **S: Significant Risk**

M: Moderate Risk **L: Low Risk**

Read the Risk Rating from the matrix below:

Risk Assessment Matrix	A	B	C	D	E
1	H	H	H	S	S
2	H	H	S	S	M
3	H	H	S	M	L
4	H	S	M	L	L
5	S	S	M	L	L

RISK RATING

Certain - means an event or situation that is happening more or less all the time, including continuous situations.
Permanent Disability – means a disability, such as loss of a limb or eyesight, loss of hearing, chronic skin disorder, chronic back disorder, emphysema, and the like

Probable – means an event or situation that occurs or is likely to occur about ten times or more per year
Possible – means an event or situation that occurs or is likely to occur about once per year
Unlikely – means an event or situation that occurs or is likely to occur less frequently than once every ten years

Issued 2nd February 2021 Rev - A

DO NOT SCALE THIS DRAWING
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REVISIONS

No	Description	Date	By
A	FOR APPROVAL	02.02.2021	RW

Client

BULK EARTHWORKS

Approved Director - RPEQ 17544

Drawing Title
SAFETY IN DESIGN

Drawn	Designed	Checked	Date
RW	JB	MAS	FEB 21

Scale	Sheet
AS SHOWN	09 of 09

	Drawing No	Revision
A1	20-185- 09	A

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APPENDIX 2 – VEGETATION AND FAUNA MANAGEMENT PLAN (JWA 2021B)

VEGETATION AND FAUNA MANAGEMENT PLAN

Flood Mitigation Works
Lot 3 on SP266287, Lot 997 SP309372, Lot 998 SP283244
& Lot 2000 SP309388
Buckley Road, Burpengary East

A Report Prepared for
North Harbour Holdings Pty Ltd

MAY 2021

JWA Pty Ltd
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DOCUMENT CONTROL

Document

Title	Vegetation and Fauna Management Plan
Job Number	Q15029
File Reference	\\SERVER\data\2015 CLIENTS\Q15003_Northeast Business Park, Morayfield\Reports\VFMP Unnamed Creek 2021
Version and Date	RW2 07/05/21
Client	North Harbour Holdings Pty Ltd

Revision History (office use only)

Issue	Version	Draft/ Final	Date	Distributed To	No. Copies	Media	Delivery Method
1	RW1	DRAFT	29/04/21	JWA	1	word	Email
2	RW2	FINAL	07/05/21	Client	1	.pdf	Email

Client Issue

Version	Date Sent	Author		Approved by	
		Name	Initials	Name	Initials
RW1	29/04/21	Nicole Davies	ND	Adam McArthur	AM
RW2	07/05/21	Nicole Davies	ND	Adam McArthur	AM

TABLE OF CONTENTS

1 Introduction

1.1 Background

JWA Pty Ltd has been engaged by North Harbour Holdings Pty Ltd to complete a Vegetation and Fauna Management Plan (VFMP) for the proposed excavation of an unmapped drainage corridor for flood mitigation at North Harbour, Morayfield. This VFMP provides specific measures for mitigating and/or minimising the potential impacts on vegetation and fauna because of development activities on the subject site. The VFMP also aims to ensure the long-term health and safety of trees to be retained on site.

1.2 The Subject Site

The site is located at North Harbour, Morayfield (**FIGURE 1**). The land forms part of:

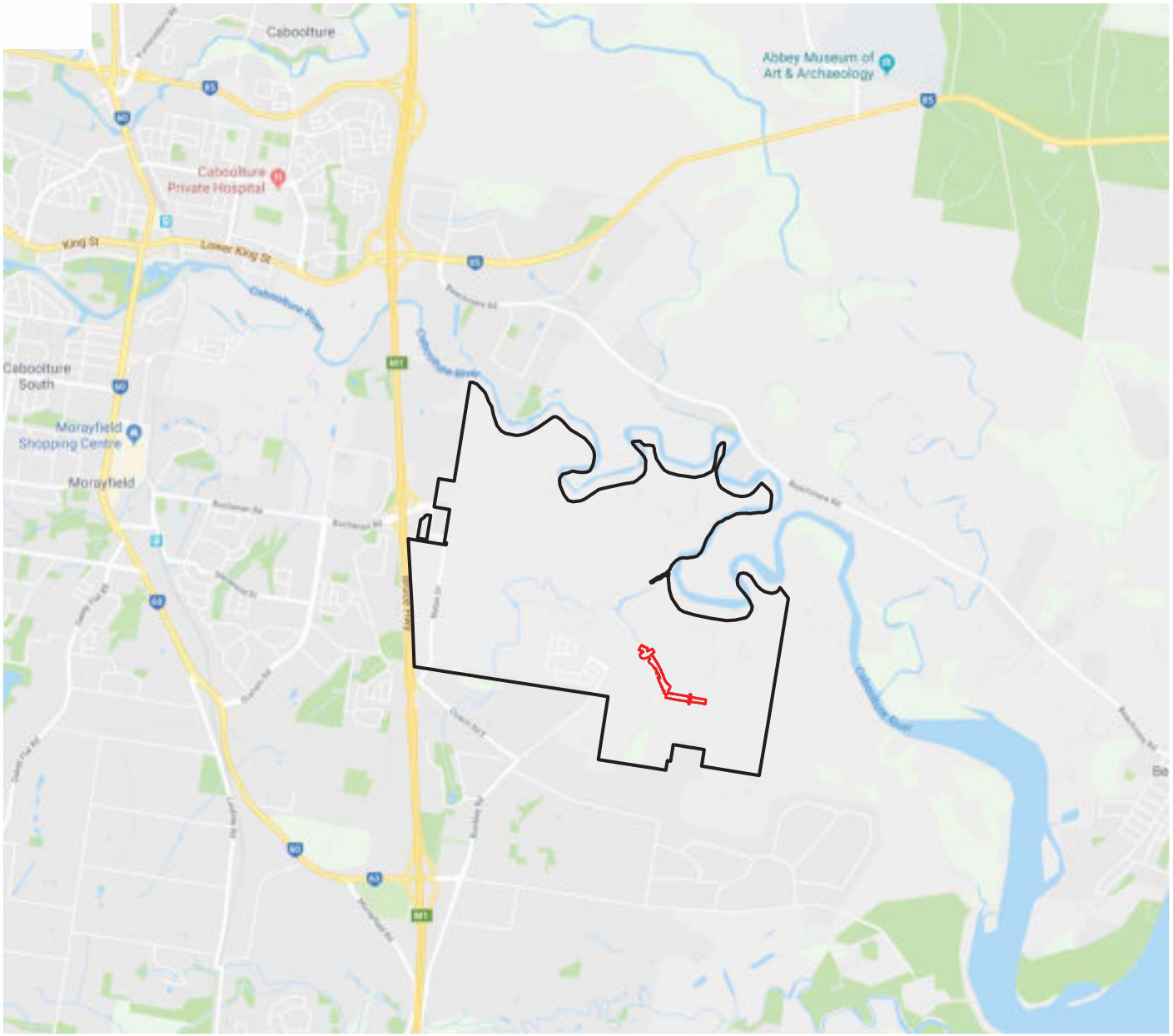
- Lot 3 SP266287;
- Lot 997 SP309372;
- Lot 998 SP283244; and
- Lot 2000 SP309388.

An aerial photograph of the site is shown in **FIGURE 2**.

The survey area is partially vegetated by native open forest and disturbed grassland. The site is undulating, with a drainage line running through the area. To the west lies residential properties, while the other boundaries are comprised of paddocks. Caboolture River runs is to the north of the subject area.

1.3 The Proposed Development

The proposed works are for flood mitigation and will encompass reshaping the bed level of the unmapped drainage corridor, and the creation of a flood water diversion channel as shown in the attached engineering drawings (see design drawings in **APPENDIX 1**). Works will include the widening and deepening of a ~500 m section of an unmapped drainage corridor, excavation of a ~400 m flood water diversion channel to the east of the unmapped drainage corridor and construction of two (2) culverts; one (1) pipe culvert across the unmapped drainage corridor and one (1) box culvert across the flood water diversion channel (**APPENDIX 1**). This increase in water retention and splitting of larger flood events (greater than Q20 year events) will improve the flow of flood events through the North Harbour development. The drainage corridor is currently not mapped according to the Queensland Waterway Barrier Works mapping; however, Raff Creek is identified as a tidal waterway at the confluence with the unmapped drainage corridor, and a moderate waterway approximately 350 m upstream of the confluence.



LEGEND

- Extent of Works
- NEBP Site Boundary

N

Scale 1:40 000 - Lengths in metres

400 0 400 800 1200 1600 2000

SOURCE: Google Maps SCALE: 1 : 40 000 @ A3 *JWA Pty Ltd* *Ecological Consultants*	CLIENT North Harbour Holdings Pty Ltd PROJECT Vegetation & Fauna Management Plan NEBP Flood Mitigation Works Nolan Drive, Morayfield QLD Moreton Bay Regional Council LGA	FIGURE 1 PREPARED: BW DATE: 13 April 2021 FILE: Q15003_UnnamedCk_20210413.dwg	TITLE LOCALITY PLAN

LEGEND

- Extent of Works
- Cadastre Boundary

N

Scale 1:3000 - Lengths in metres

50 0 50 100 150 200

SOURCE: QLD Globe May 2020 Aerial Photo

SCALE: 1 : 3000 @ A3

JWA Pty Ltd
Ecological Consultants

CLIENT
North Harbour Holdings Pty Ltd

PROJECT
Vegetation & Fauna Management Plan
NEBP Flood Mitigation Works
Nolan Drive, Morayfield QLD
Moreton Bay Regional Council LGA

FIGURE 2

PREPARED: BW
DATE: 13 April 2021
FILE: Q15003_UnnamedCk_20210413.dwg

TITLE

AERIAL PHOTOGRAPH

2 Existing Ecological Values

2.1 Background

An Ecological Assessment of the subject site has previously been completed (JWA 2021). This assessment included identification of vegetation communities and threatened flora on site, along with a brief fauna survey. No Commonwealth or State listed threatened flora or fauna species were recorded on the subject site. However, several threatened fauna species were considered possible occurrences.

2.2 Vegetation Communities

2.2.1 Introduction

Three (3) broad vegetation communities were identified on the subject site. This section provides a description of each of the vegetation communities and a discussion of the condition and conservation status of each. The conservation status of vegetation communities is discussed with reference to the Regional Ecosystem Description Database (Queensland Herbarium 2014) and the Queensland *Vegetation Management (VM) Act 1999* where appropriate.

2.2.2 Community 1: Coastal and Subcoastal Floodplain Tree Swamps – Melaleuca and Eucalypt

Location and Area
This wetland community is located along the unmapped drainage corridor, beyond the tidal influence (**FIGURE 3**).

Description
The unmapped drainage corridor is a wide, highly ephemeral drainage gully with shallow, low sloping banks.

Canopy species include Broad-leaved paperbark (*Melaleuca quinquenervia*), Queensland blue gum (*Eucalyptus tereticornis*), Grey ironbark (*Eucalyptus siderophloia*), Pink bloodwood (*Corymbia intermedia*) and Swamp sheoak (*Casuarina glauca*). Sometimes the Eucalypts are emergent.

The understorey is dominated by a combination of native species and introduced plants. Native species Narrow-leaved paperbark (*Melaleuca linariifolia*), Umbrella cheese tree (Gloc*hidion sumatranum*), Red ash (*Alphitonia excelsa*) and Acacia spp. Introduced species include Slash pine (*Pinus elliotti**), Broadleaved pepper tree (*Schinus terebinthifolia**), Groundsel bush (*Baccharis halimifolia**), Lantana (*Lantana camara**), Devils fig (*Solanum torvum**) and Wild tobacco (*Solanum mauritianum**).

The groundcover includes some native species but was mostly exotic species. Native species include Saw sedge (*Gahnia sieberiana*), Phragmites (*Phragmites australis* - can have a weedy habit), Jointed rush (*Juncus kraussii*), Snake vine (*Stephania japonica*). Phragmites and Ghania were locally dominant in some areas of the community when associated with the drainage line. Introduced species include Fleabane (*Conyza sp.**), Blue billygoat weed

LEGEND

- Extent of Works
- Cadastre Boundary

Vegetation Communities

- Community 1: Coastal and Subcoastal Floodplain Tree Swamps - Melaleuca and Eucalypt
- Community 2: Wet Terrestrial Grassland
- Community 3: Disturbed Terrestrial Grassland

N

Scale 1:3000 - Lengths in metres

50 0 50 100 150 200

SOURCE: JWA Site Investigations Feb 2021
QLD Globe May 2020 Aerial Photo

SCALE: 1 : 3000 @ A3

JWA Pty Ltd
Ecological Consultants

CLIENT
North Harbour Holdings Pty Ltd

PROJECT
Vegetation & Fauna Management Plan
NEBP Flood Mitigation Works
Nolan Drive, Morayfield QLD
Moreton Bay Regional Council LGA

FIGURE 3

PREPARED: BW
DATE: 13 April 2021
FILE: Q15003_UnnamedCk_20210413.dwg

TITLE

VEGETATION COMMUNITIES

(*Agerarum houstonianum**), Annual ragweed (*Ambrosia artemisiifolia**), Cobbler's pegs (*Bidens Pilosa**), Bindweed (*Convolvulus sp.**), Common couch (*Elymus repens**), Siratro (*Macroptilium atropurpurem**), Red natal grass (*Melinis repens**), Bitter melon (*Momordica charantia**), and Brazilian vervain (*Verbena brasiliensis**).

Condition
Most of this community is in moderate condition.

Conservation Status
This area is not mapped as remnant vegetation and therefore has no conservation status under the *VM Act 1999*.

2.2.3 Community 2: Wet Terrestrial Grassland

Location and Area
This community is located within the drainage line beyond the tidal influence (**FIGURE 3**).

Description
Groundcovers include both exotic pasture herbs and grasses and native species. Native species include *Cyperus sp.*, *Persicaria* sp., *Tricoryne sp., B*lady grass (*Imperata cylindrica*) and *Paspalum* sp. pasture grasses. Introduced species include rat's tail grass (*Sporobolus* sp.*), *Cynodon dactylon**, *Lepidium* sp.*, and *Conyza* sp.*.

Condition
This vegetation community it is in poor condition given the lack of a shrub or tree layer. Grazing impacts are evident.

Conservation Status
This area is not mapped as remnant vegetation and has no conservation status under the *VM Act 1999.*

2.2.4 Community 3: Disturbed Terrestrial Grassland

Location and Area
This community is located over a large portion of the site (**FIGURE 3**).

Description
This community is comprised of open pasture with the occasional regrowth Acacia spp., Paperbark or clump of Lantana. There is also the occasional melon hole populated with sedges such as *Cyperus polystachyos*, *Fimbristylis spp*., *Juncus spp*., and Frogsmouth (Ph*ilydrum lanuginosum*). Pasture grasses include *Paspalum sp*.* and *Cynodon dactylon**. Introduced species include rat's tail grass (*Sporobolus sp*.*), *Convolvulus sp*.*, *Lepidium sp*.*, *Conyza sp*.*, and *Passiflora subpeltata*.

Condition
As grazing pasture this community is in good condition with only light grazing impacts. As a vegetation community it is in poor condition given the lack of a shrub or tree layer.

Conservation Status
This area is not mapped as remnant vegetation and has no conservation status under the *VM Act 1999*.

2.3 Significant Flora and Fauna Species

No flora or fauna species listed as threatened under either the Commonwealth *Environment Protection Biodiversity and Conservation (EPBC) Act* (*1999*) or Queensland *Nature Conservation (NC) Act (1992)* have been recorded on the subject site (JWA 2021).

2.4 Fauna Habitat

Habitat suitability assessments of the threatened and migratory fauna species that are known to occur or are considered possible occurrences in the locality determined that seven (7) threatened species had reasonable potential to be present within the subject site. These species are listed below:

- Grey-headed flying fox (*Pteropus poliocephalus*).
- Koala (*Phascolarctos cinereus*);
- Osprey (*Pandion haliaetus*);
- Rainbow bee-eater (*Merops ornatus*);
- Swift parrot (*Lathamus discolor*);
- Wallum froglet (*Crinia tinnula*); and
- White-throated needletail (*Hirundapus caudacutus*).

3 Management of Vegetation

3.1 Introduction

This section identifies vegetation to be retained and removed and contains specific management strategies for mitigating and/or minimising the potential impacts on vegetation to be retained on the subject site.

3.2 Vegetation Management Objectives

1. Tree clearing shall commence as soon as possible after Operational Works approval for the subject site has been granted by Council, and the site has been properly prepared for clearing operations.
2. Tree clearing shall be carried out in accordance with approved documents and Council conditions.
3. Implementation of vegetation clearance, stockpiling, recycling, or disposal practices that maximise the re-use of native vegetation and minimises the potential for spreading weed species.
4. If individual trees or other specific vegetation that require protection are identified in land adjacent to a clearance zone, such protection shall be provided.
5. The mulching of weed species will not occur on site. Weed species shall be removed for disposal off-site to minimise the risk of propagation.
6. Prior to the mulching of cleared vegetation stockpiled on site, the stockpile shall be checked for weed species and Myrtle Rust and, where fertile weed material or Myrtle Rust exists, the material shall be removed for disposal off-site to minimise the risk of spread or propagation.
7. Tree clearing operations shall be completed in a manner that provides maximum protection of the health and livelihood of native fauna. Appropriate fauna management strategies to be employed during clearing operations are addressed in **SECTION 4.**
8. Disposal of cleared vegetation will be managed in an environmentally responsible manner.
9. Trees planted as part of the developments landscaping will include the same species as the trees that have been removed.

3.3 Identification of Retained/Removed Vegetation

All trees over 10 cm diameter at breast height (DBH) within and directly adjacent to the works area have been located using handheld GPS and identified to species level by two (2) JWA ecologists on the 8th April 2021. **APPENDIX 2** contains details of all surveyed trees and provides the species name, diameter at breast height (dbh), canopy spread, height and habitat values of each tree.

A Tree Retention Plan (TRP) has been prepared for the subject site. All trees within the extent of works are to be removed (**FIGURE 4**). For trees adjacent to the works area, Tree Protection Zones (TPZ) have been calculated in accordance with Australian Standard AS 4970-2009 (Protection of Trees on Development Sites) and are shown on **FIGURE 4**. If proposed works will result in greater than 10% encroachment on the TPZ of a tree, the tree has been designated for removal. All trees to be retained and those to be removed are listed in **APPENDIX 2** and are shown on **FIGURE 4**.

Of the two-hundred and four (204) trees surveyed within and adjacent to the proposed works area, eighteen (18) trees will be retained and one hundred and eighty-six (186) will be removed.

3.4 Vegetation Protection Guidelines

All retained vegetation likely to be impacted by construction works will be managed in accordance with the following tree protection guidelines. These procedures will ensure that retained trees adjacent to development areas will survive construction works and will remain in a healthy condition. The procedures will also ensure that any activity taking place within the drip line of any retained tree will not significantly impact on the survival of the tree.

In order to protect retained vegetation, the following procedures are to be followed:

1. *Identifying a Tree Protection Zone*: All retained vegetation and individual trees likely to be impacted upon by development works will be marked prior to construction works. The size and shape of a particular protection zone will vary according to individual tree species. The zone will be determined prior to commencing the project and will remain in place until project completion.
2. *Pruning*: Prior to establishing a tree protection zone, trees to be protected will be pruned focusing on removal of dead or broken branches. The purpose of this activity is primarily safety, but it serves as a monitor for any damage that may occur during construction. Any pruning works are to be carried out by a qualified arboriculturist (minimum AQF Level 5 Diploma in Arboriculture). All works will adhere to the Australian Standards AS 4373 – 1996 (Pruning of Amenity Trees).
3. *Establishing the Tree Protection Zone*: The following measures will be taken to protect the tree in the long term:
    - Exclusion Fencing – Temporary fencing consisting of high visibility webbing and star pickets will be installed at the edge of works line prior to construction works (**FIGURE 4**). Temporary fencing will remain in place until all tree clearing and earthworks within or immediately adjacent to the retained vegetation have been completed.
    - *Tree Protection Fences:* Tree protection fences shall be installed in the locations shown in **FIGURE 4** in accordance with the Australian Standard AS 4970-2009 (Protection of Trees on Development Sites) (**FIGURE 5**). Tree protection fences should be installed under the supervision of a qualified ecologist or arborist, prior to the tree clearing phase.

LEGEND

- Extent of Works
- Cadastre Boundary

Tree Retention Plan

- Surveyed Tree to be Retained
- Surveyed Tree to be Removed
- Tree Protection Zone
- Tree Protection Fencing

N

Scale 1:3000 - Lengths in metres

50 0 50 100 150 200

SOURCE: QLD Globe May 2020 Aerial Photo

SCALE: 1 : 3000 @ A3

JWA Pty Ltd
Ecological Consultants

CLIENT
North Harbour Holdings Pty Ltd

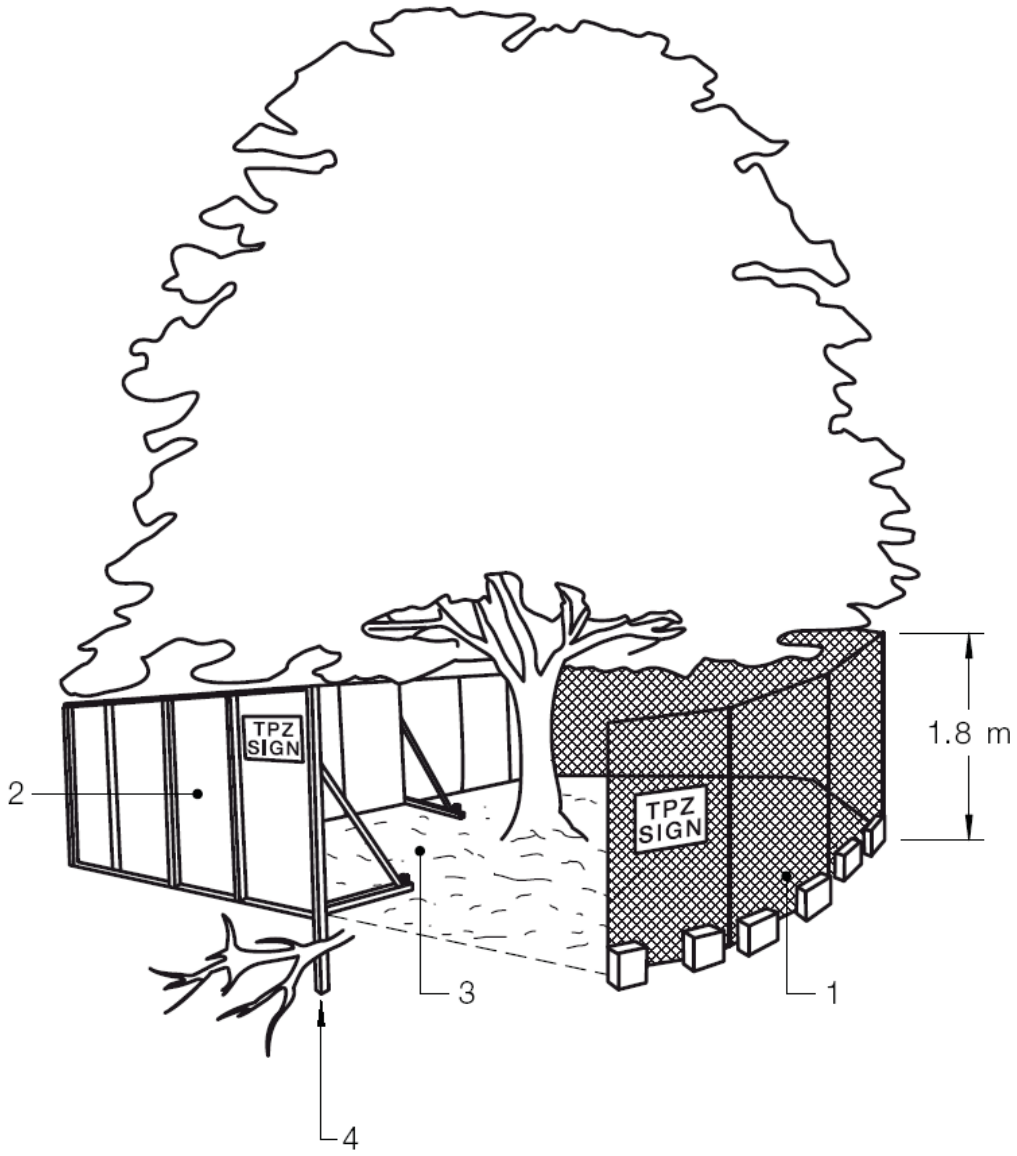
PROJECT
Vegetation & Fauna Management Plan
NEBP Flood Mitigation Works
Nolan Drive, Morayfield QLD
Moreton Bay Regional Council LGA

FIGURE 4

PREPARED: BW
DATE: 13 April 2021
FILE: Q15003_UnnamedCk_20210413.dwg

TITLE

TREE RETENTION PLAN



LEGEND:

1. Chain wire mesh panels with shade cloth (if required) attached, held in place with concrete feet.
2. Alternative plywood or wooded paling fence panels. This fencing material also prevents building materials or soil entering the TPZ.
3. Mulch installation across surface or TPZ (at the discretion of the project aborist). No excavation, construction activity, grade changes, surface treatment or storage of materials of any kind is permitted within the TPZ.
4. Bracing is permissible within the TPZ. Installation of supports should avoid damaging roots.

SOURCE: AS 4970-2009 Protection of Trees on Development Sites SCALE: Not to Scale JWA PTY LTD Ecological Consultants	CLIENT North East Business Park Pty Ltd PROJECT Vegetation & Fauna Management Plan NEBP Flood Mitigation Works Nolan Drive, Morayfield QLD Moreton Bay Regional Council LGA	**FIGURE 5** PREPARED: BW DATE: 13 April 2021 FILE: Q15003_Tree Protection.cdr	TITLE **TREE PROTECTION**

- Trunk protection – 1.8m high palings strapped to the trunk.
- Mulching – 100 mm of composted mulch cover over the ground within the tree protection zone in order to retain soil moisture and encourage microbial activity.
- Irrigation – natural moisture levels should be maintained.
- Drainage – the natural drainage patterns around the root zone should not be altered.
- Signage – as follows:
    - Tree Protection zone
    - No vehicle movement
    - No storage of building materials
    - No washing of equipment
    - Contact name and number for enquires.

4. *Pre-start meeting:* Prior to commencement of clearing works, the applicant will arrange a pre-start meeting with Gold Coast Development Assessment Officers. Prior to the pre-start meeting, the applicant (or appointed contractor) should ensure that the relevant fencing along the boundary of the retained vegetation is installed.

5. *Activities within the Tree Protection Zone:* No activities will be undertaken with the tree protection zones (TPZs) without the supervision of a suitably qualified arborist. Council is to be notified if any activity is likely to adversely impact on the health of retained trees. Within the retained vegetation the following activities shall not be permitted:
    - storage and mixing of materials;
    - vehicle parking;
    - liquid disposal;
    - machinery repairs and/or refuelling;
    - construction site office or shed;
    - combustion of any material;
    - stockpiling of soil, rubble or debris;
    - any filling or excavation including trench line, topsoil skimming and/or surface excavation, unless otherwise approved by a suitably qualified Arborist; and
    - unauthorised pesticide, herbicide or chemical applications.

6. *Trenching and Excavation*: When trenching or excavation is to be undertaken within the root zone of any tree, roots will be severed cleanly rather than torn with a backhoe or other excavation equipment. All roots are to be exposed first and then cut cleanly with a sharp saw or loppers. Exposed roots are to be kept moist and covered with hessian for the duration of the exposure. Where roots

with a diameter larger than 50mm are encountered excavation should be undertaken by hand or small implements.

7. *Activities Adjacent to Retained Trees*: All activities in an area adjacent to any retained tree or area are to be carried out in such a manner as to minimise any damage to trees. Trees to be removed will be felled in a direction away from trees to be retained. Where an individual tree to be retained may be impacted by the removal of another tree located at close proximity, the roots of the tree to be disturbed (and the tree to be retained, where required) are to be severed cleanly by a qualified Arborist. All roots are to be exposed first and then cut cleanly with a sharp saw or loppers.

8. *Clearing Works*: Site works shall occur in the following sequence; cutting, shearing of felled vegetation and tub grinding. Where vegetation is cleared or removed, vegetation waste shall be mulched and retained on site for re-use in landscape works. Each area is to be mulched immediately upon completion of clearing and grubbing works. Any vegetation not suitable for mulching (i.e. fertile material from weed species) will not be mulch and will be transported to an appropriate facility.

   Hollow logs shall not be mulched. If any hollow logs are located on site they will be relocated to areas proposed for landscaping.

9. *Disposal of Debris*: Clearing and disposal of vegetation to be in accordance with Council requirements and conditions. Prior to the commencement of operational works all rubbish and foreign matter from the area is to be removed and appropriately disposed of off-site. Pit burning of cleared vegetation is strictly prohibited as is the burning of other refuse/waste on site.

10. *Prevention of Erosion*: Erosion and sediment control works shall be undertaken in general accordance with Soil Erosion and Sediment Control Engineering Guidelines for Queensland Institution of Engineers Australia (Qld) and any Sediment Control Management Plan prepared for the subject site.

    As construction activities may cause potential sedimentation impacts on retained vegetation, temporary erosion and sedimentation control fencing is to be provided on site. The sediment fencing will be placed in such a way to prevent sediment entering the waterway on the subject site. All sediment fencing is in place before site preparation and other earthworks commence. Prior to any site preparation operations the Project Manager (or other suitably qualified personnel) shall undertake an inspection of all sediment fencing. Erosion and sediment control measures will require inspection and maintenance throughout the course of construction works, during the maintenance period and following each rainfall event.

    The erosion and sediment control measures are not to be dismantled until the works on site have been completed and all areas where soil has been disturbed have been revegetated or covered by mulch layer. Mulching should be to a minimum thickness of 10 cm to help stop overland water flows and encourage soil infiltration.

Where sediment deposition has occurred as a consequence of construction activities, work will be undertaken to relocate the sediment to a stabilised area. Such restoration will be completed in a reasonable timeframe.

11. *Monitoring and Reporting:* Monthly site inspections will be completed to ensure that protection measures are being implemented. Inspections are to be coordinated with the construction supervisor to ensure that where practical supervision for works within TPZ's is combined with the general assessment of protection measures. Inspections will be undertaken and documented by the Project Arborist. Records of all inspections are to be provided to the applicant.

3.5 Stockpile Locations

Cleared vegetation and site mulch will be stockpiled/stored on site within the development area. Storage or stockpiling will not occur within tree protection zones, park or environmental covenant areas.

3.6 Weed Management Protocols

The following weed species management protocols are to be followed:

1. Soil disturbance within retained vegetation and any areas to be landscaped shall be kept to a minimum to avoid weed recruitment.
1. Clearing operations are to ensure that propagative material from cleared weeds does not spread across the site. The earthworks machinery must not introduce weed material to the site or spread such material throughout the site.
2. All mulch produced on site (by mulching cleared vegetation and trees) shall specifically exclude fertile material from weed species (where a risk of proposition exists) and be stored outside of the retained vegetation. Vegetation mulching will be suitably controlled to avoid contamination. Any fertile weed material will be transported from the site to an approved disposal facility.
3. All nursery stock for landscaping purposes shall be weed, pest and disease free and certified as such by the supplier where feasible. The certificates are to be obtained prior to the commencement of any regeneration/revegetation works on site.
4. Weed or potential weed species shall not be planted during landscaping operations.

4 Management of Fauna

4.1 Introduction

This section outlines the recommended management strategies for mitigating and/or minimising the potential impacts on fauna during clearing operations on the subject site.

4.2 Provision of Spotter Catcher

A suitably qualified and licenced fauna spotter catcher will be appointed to conduct a pre-clearing site inspection and is to be present during clearing. The spotter catcher is also to direct the civil works contractor in relation to any fauna issues. The contractor will provide access to equipment that may be required by the spotter-catcher (e.g. cherry picker, chainsaw) as well as qualified operators.

4.3 Management of Fauna During Construction

In order to ensure the most suitable ecological outcome and to ensure that possible impacts on significant species are minimised, the commencement of site work shall take place in accordance with the following:

1. All contractors and their employees are to be aware of their obligations under this Vegetation and Fauna Management Plan. An appropriately qualified and licenced fauna spotter catcher shall be present at the pre-start meeting or safety induction to outline the requirements during construction.
2. The clearing of vegetation and other works will be completed in a manner and direction that ensures maximum fauna movement away from operational works towards areas of retained vegetation to the west of the proposed works areas. This disturbance stimuli will provide fauna with time to leave the site, thus maximising the chances of fauna survival while reducing the need for human intervention for translocation or rescue purposes. The use of temporary fauna proof barrier fencing may be necessary to direct fauna to the fauna relocation area and away from works areas. Electric and barbed fencing is not to be utilised within or adjacent to the construction area.
3. Immediately prior to any clearing operations and during the felling of any identified habitat trees, the fauna spotter catcher shall be present to inspect the trees and relocate remaining fauna.
4. Immediately prior to tree removal, the fauna spotter/catcher shall attempt to "flush out" any denning or nesting animals not observed during the initial tree inspection. This may involve hitting target trees with a sledgehammer or other heavy implement. Trees with hollows should be laid on the ground carefully.
5. If any denning or nesting animals are observed within hollow limbs, but cannot be readily removed by the fauna spotter catcher using the methodology above, a site specific methodology must be identified. It is recommended that in these instances, hollow branches should be removed and placed in a secure location. The ends of hollows should be plugged prior to removal of the branch. Hollow branches should be transported to the fauna relocation area and unplugged.

6. No tree is to be cleared if wildlife is present, or if the crown of the tree overlaps one in which fauna is present.

7. Following felling, a second inspection of the relevant trees shall be carried out to relocate fauna disturbed by the clearing process or remaining within the felled timber to a suitable location within retained habitat. The relocation area selected should be well vegetated and provide appropriate habitat for the species being released. Nocturnal animals (i.e. bats, gliders, etc.) should be released at dusk. The second inspection will also allow the fauna spotter catcher to accurately document the number of hollows removed (and requiring replacement with nest boxes).

8. Any injured animals requiring treatment or euthanasia shall be immediately removed and taken to an appropriately qualified veterinary surgeon. Contact details for the nearest veterinary clinics are provided below.

   Burpengary Veterinary Hospital
   51 Progress Road
   Burpengary QLD 4505
   (07) 3888 2292

   Morayfield Vet Clinic
   285 Morayfield Road
   Morayfield QLD 4506
   (07) 5498 6555

   Australia Zoo Wildlife Hospital
   1638 Steve Irwin Way
   Beerwah QLD 4519
   (07) 5436 2097

   Any animals requiring support or rehabilitation other than vet assistance will be taken to a qualified wildlife carer or centre.

9. Following the completion of each clearing stage, capture and release records will be supplied to QPWS in accordance with their licensing conditions. A copy of these records, if requested, shall be supplied to Council.

10. A report from the fauna spotter catcher shall be provided to the clearing contractor and Council Ecologist within two (2) weeks of completion of clearing activities.

4.4 General Management Protocols for Fauna Groups

4.4.1 Introduction

A summary addressing the removal and relocation methods for each broad faunal group is provided in the sections below. Each summary has considered that species observed on site and those species likely to occur in the area to be disturbed.

4.4.2 Amphibians

The site contains a range of suitable habitat for frogs, including a wetland community located along the unmapped drainage corridor, beyond the tidal influence, sedges and flood prone pasture with melon holes. Most suitable frog habitats on site have been degraded due to damage by cattle and feral pigs, invasive weeds, and the known presence of introduced fauna species including Cane toads (*Rhinella marinus*).

Potential habitat areas due to be disturbed will be inspected for the presence of amphibians. If an amphibian is identified in an area of disturbance, the animal will be captured and relocated. To reduce the risk of disease, hygiene protocols will follow the Hygiene Protocol for the Control of Disease in Frogs (DECC 2018). Amphibians will be handled with unused, non-powdered and talc-free gloves. To minimize stress and the risk of death during translocation, translocation will comply with standard operating procedures. Amphibians will be transported in single-use light weight plastic bags and released as soon as possible to reduce stress.

4.4.3 Reptiles

The absence of rocky habitats on-site diminishes the number of reptile species likely to occur on-site, however potential habitat areas due to be disturbed will be inspected for the presence of reptiles. In the event that a reptile is identified the works area, the animal will be captured and relocated.

4.4.4 Birds

The subject site provides some suitable forage and nesting habitat for a range of common and disturbance adapted native forest and woodland bird species.

Birds will be "flushed" from areas of disturbance using appropriate techniques. Many birds previously recorded from the site generally occur in the canopy. These birds shall be "flushed" by gently nudging the tree with machinery prior to felling.

If bird eggs are found within a tree to be felled and are not readily identifiable as belonging to a threatened bird species, the eggs will be removed and taken to a wildlife rehabilitation centre or carer for incubation.

4.4.5 Mammals

As previously discussed, all trees to be removed are to be inspected by a suitably qualified ecologist for denning or nesting animals. All mammals occurring within a tree will be flushed out using the earthworks machinery to nudge the tree. If the animal cannot be "flushed" from the tree the animal will be removed. The animal is to be removed by placing a pillow slip over the hollow end of the branch and removing the limb by chain sawing the other end. Koalas shall not be handled or interfered with in any way, but rather allowed to move on overnight. Refer to **SECTION 4.5.3** for management actions specific to Koalas.

4.4.6 Issues Relating to All Fauna

No dogs are to be permitted on site during clearing works.

4.5 Threatened Species Management Protocols

4.5.1 Introduction

If any Commonwealth or State listed significant fauna species occur on the subject site during clearing operations, the following fauna management actions shall be implemented.

4.5.2 Acid Frogs

In the event that any acid frogs (i.e. Wallum froglets) are identified within disturbance areas, whether habitat or otherwise, the acid frogs will be captured and relocated to adjacent habitat. See **Section 4.4.2** for minimising disease risk during translocation.

4.5.3 Koalas

All koala habitat trees with a diameter of 10 cm at 1.3 m above ground height must only be cleared in the presence of a fauna spotter catcher with appropriate koala experience. If a koala is identified in any tree marked for removal, whether habitat or otherwise, that tree is not to be removed until the koala has dispersed from the tree and a 10m buffer is to be established within which there is to be no works occurring until the koala has moved on of its own accord. The nudging of trees with koalas is not permitted. The tree can only to be removed following inspection by the fauna spotter/catcher to ensure that the koala has dispersed, and that the removal of the tree poses no direct threat to the health or survival of the koala. Koalas are not to be handled.

The Nature Conservation (Koala) Conservation Plan 2017 states that for a clearing site of greater than 6 ha, no more than 3 ha or 3% of the site's areas (whichever is the greater) may be cleared in any one stage. Between each stage, a minimum of one period of twelve (12) hours starting at 6pm and finishing at 6 am must occur in which no trees are cleared on the site.

4.5.4 Grey-headed Flying Fox

In the event that a Grey-headed flying fox roost tree is identified, that tree is not to be removed or modified.

4.5.5 Osprey, White-bellied Sea Eagle, and Other Threatened Arboreal Bird species

If these birds are identified in any tree marked for removal, whether habitat or otherwise, that tree must not be removed until the bird(s) has dispersed from the tree. If required, the tree shall be left overnight to enable the bird(s) to move away. The tree shall only to be removed following its inspection by an appropriately qualified ecologist to ensure that the bird(s) have dispersed, and that the removal of the tree poses no direct threat to the health or survival of the bird. If eggs are found on site, the tree will be left until juvenile birds have fledged.

4.5.6 Wading and Wetland Bird Species

It is not anticipated that clearing works will directly impact wading and wetland birds, as most of this habitat will be retained. However, if these birds are identified in any vegetation marked for removal, that vegetation must not be removed until the bird(s) has dispersed. The vegetation shall only to be removed following inspection by an appropriately qualified ecologist to ensure that the bird(s) have dispersed, and that the removal of the vegetation poses no direct threat to the health or survival of the bird. If eggs are found on site, the vegetation will be left until juvenile birds have fledged.

4.5.7 Microbats

If a microbat roost is identified in a tree to be removed, the hollow is to be secured using a piece of towel or rag firmly placed in the entrance of the hollow to prevent escape. Once the hollow entrance is secured the project arborist or fauna spotter/catcher will then cut the entire hollow limb off below the cavity where the branch remains solid. Where required, a small window may be carefully cut into the hollow, allowing the spotter/catcher to plug the hollow above and below the window. The limb can then be lowered to the ground. The limb will then be held in a cool, quiet location until translocation to a suitable relocation site the same day of capture, when at dusk the hollow entrance is re-opened to allow the fauna to emerge of its own accord. A suitably sized replacement bat box will be installed at the release site prior to the release of the microbats.

5 Summary

JWA Pty Ltd has been engaged by North Harbour Holdings Pty Ltd to complete a VFMP for the proposed excavation of an unmapped drainage corridor for flood mitigation at North Harbour, Morayfield.

This VFMP provides specific measures for mitigating and/or minimising the potential impacts on vegetation and fauna because of development activities on the subject site. The VFMP also aims to ensure the long-term health and safety of trees to be retained on site.

Specific actions include:

- Identification and demarcation of retained and removed vegetation;
- The use of fencing to protect retained vegetation;
- The management of weeds on the site; and
- The use of a suitably qualified fauna spotter catcher;
- General Fauna Management Protocols for:
    - Amphibians;
    - Reptiles;
    - Birds; and
    - Mammals.
- Specific Threatened Species Management Protocols for:
    - Acid frogs;
    - Koala;
    - Grey-headed flying fox;
    - Osprey, White-bellied sea eagle and other threatened arboreal bird species;
    - Wading and wetland bird species; and
    - Microbats.

The implementation of this VFMP will result in the minimisation of impacts on retained vegetation due to development activities on the subject site and will result in all native fauna being safely relocated to neighbouring vegetation and that fauna injury or death of fauna during clearing operations is avoided.

References

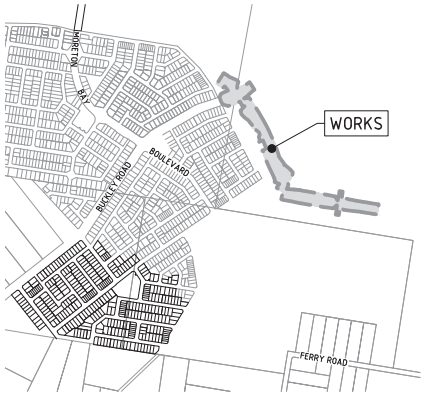
Department of Environment, Climate Change and Water (DECC) (2008) Threatened Species Management Information Circular No.6 – Hygiene protocol for the control of disease in frogs. NSW DECC, Sydney.

JWA (2021) Ecological Assessment - Flood Mitigation Works. Lot 3 on SP266287, Lot 997 SP309372, Lot 998 SP283244 and Lot 2000 SP309388, Buckley Road, Burpengary East. A Report prepared for North Harbour Holdings Pty Ltd

Queensland Herbarium (2019) Regional Ecosystems Description Database (REDD).

Appendix 1 – Engineering Drawings (KN Group 2021)

BULK EARTHWORKS AND CULVERTS



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DRAWING INDEX

DRAWING NO.	DRAWING TITLE
20-185-01	LOCALITY PLAN, DRAWING INDEX
20-185-02	EARTHWORKS CONTOUR PLAN
20-185-03	CULVERT DETAILS SHEET 1
20-185-04	CULVERT DETAILS SHEET 2
20-185-05	SEDIMENT AND EROSION CONTROL PLAN
20-185-06	SEDIMENT AND EROSION CONTROL NOTES
20-185-07	SEDIMENT AND EROSION CONTROL DETAILS
20-185-08	SEDIMENT AND EROSION BASIN NOTES
20-185-09	SAFETY IN DESIGN

DO NOT SCALE THIS DRAWING
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REVISIONS

No	Description	Date	By
A	FOR APPROVAL	02.02.2021	RW

NORTH

Client

BULK EARTHWORKS

Approved Director - RPEQ 17544

Drawing Title
LOCALITY PLAN,
DRAWING INDEX

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RW	JB	MAS	FEB 21

Scale	Sheet
AS SHOWN	01 of 09

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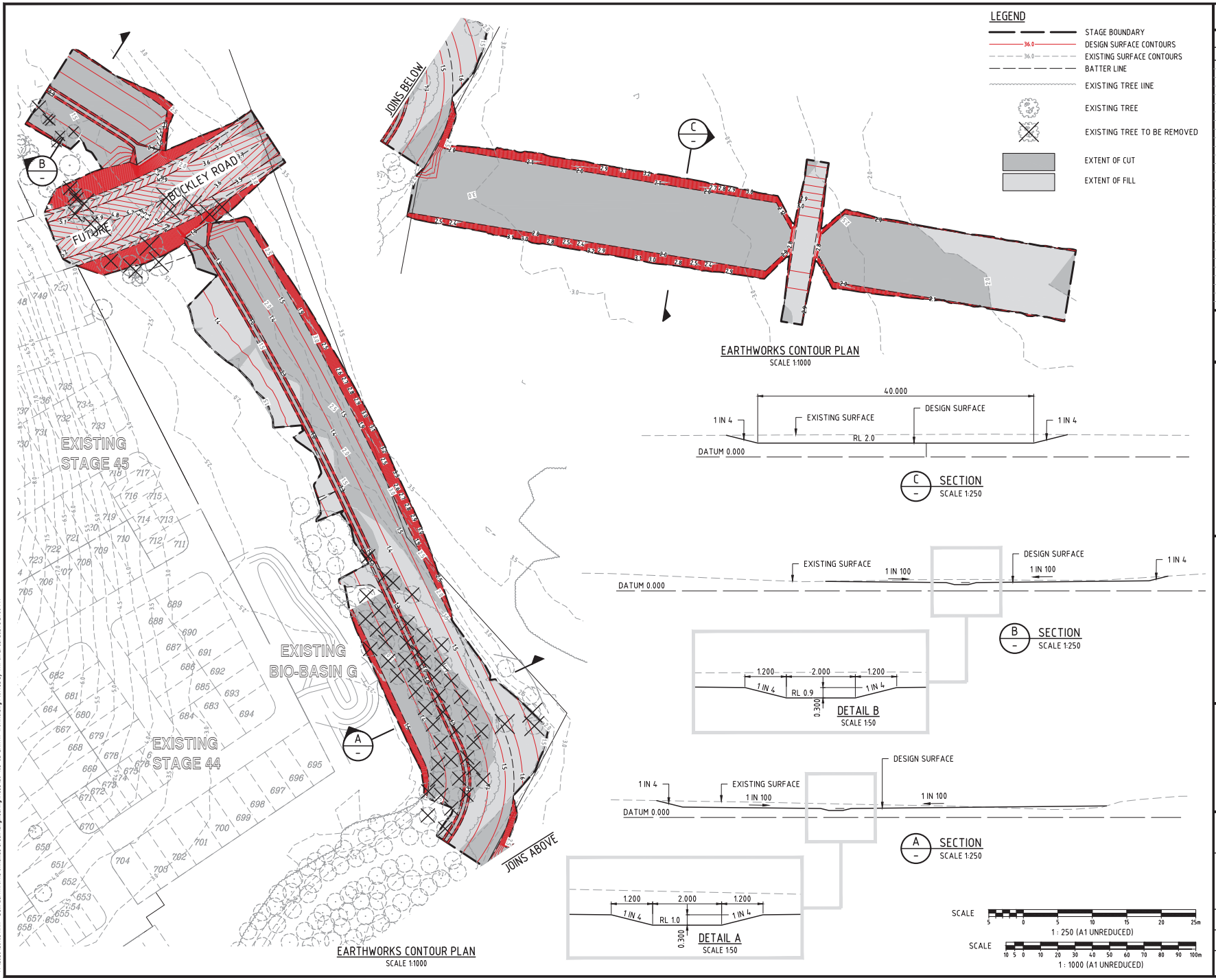

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No	Description	Date	By
A	FOR APPROVAL	02.02.2021	RW

NORTH

Client

North Harbour
feel right at home

BULK EARTHWORKS

kn group

Approved Director - RPEQ 17544

Drawing Title

EARTHWORKS
CONTOUR PLAN

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RW	JB	MAS	FEB 21

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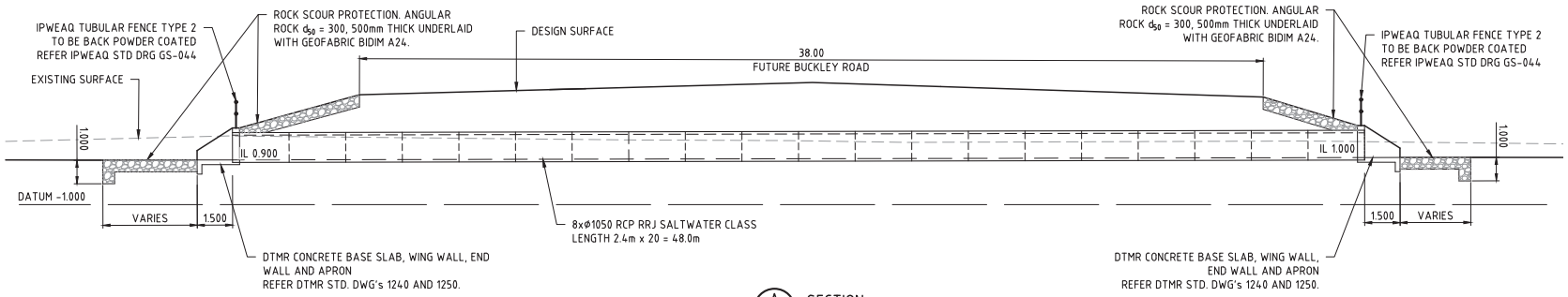

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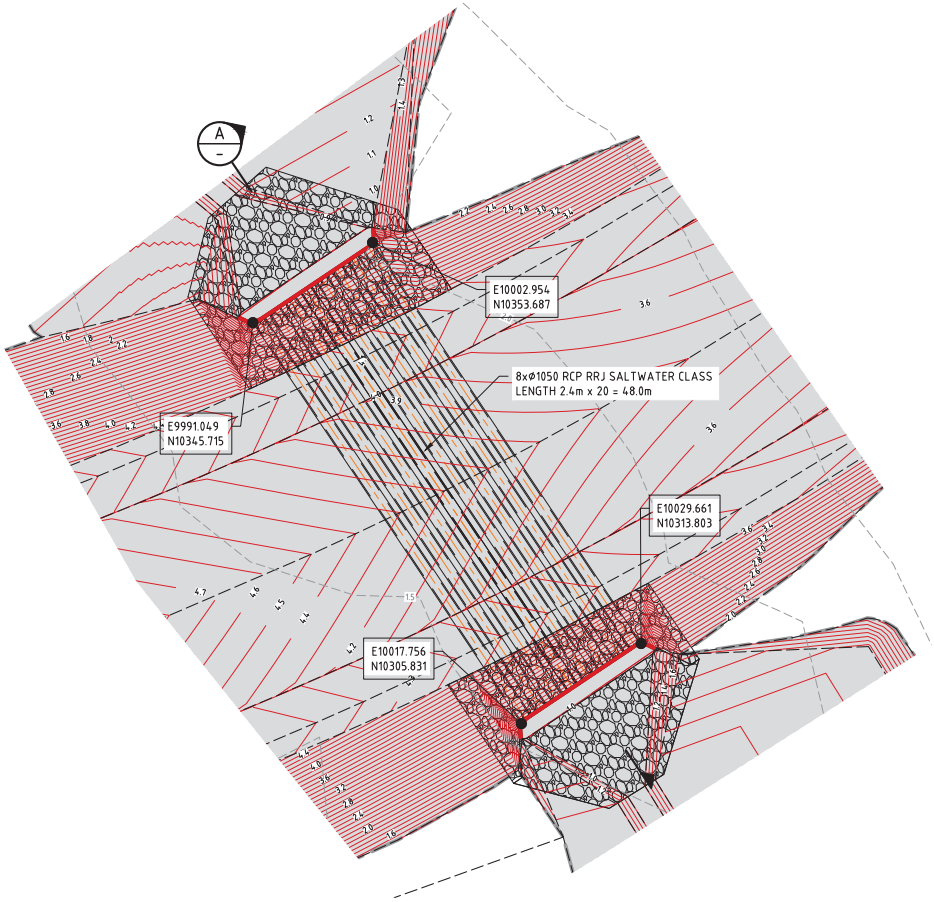

CULVERT DETAILS
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NOTE:
1. ALL CONCRETE IN HEADWALLS TO BE 40MPa AND 55mm MIN COVER
2. ALL REINFORCED CONCRTE PIPES TO BE RUBBER RING JOINT AND SALT WATER CLASS.

LEGEND
- STAGE BOUNDARY
- 36.0 DESIGN SURFACE CONTOURS
- 36.0 EXISTING SURFACE CONTOURS
- BATTER LINE

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REVISIONS

No	Description	Date	By
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NORTH

Client: North Harbour

BULK EARTHWORKS

kn group

Approved Director - RPEQ 17544

Drawing Title
CULVERT DETAILS
SHEET 1

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	Drawing No	Revision
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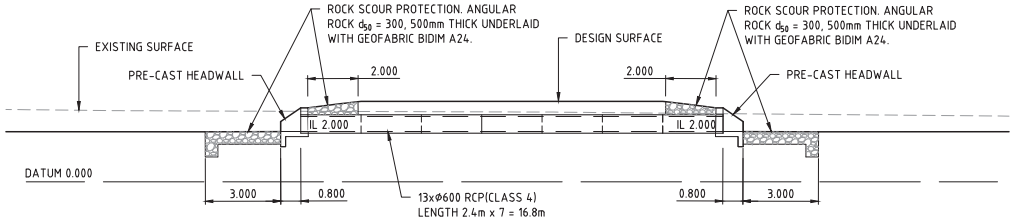

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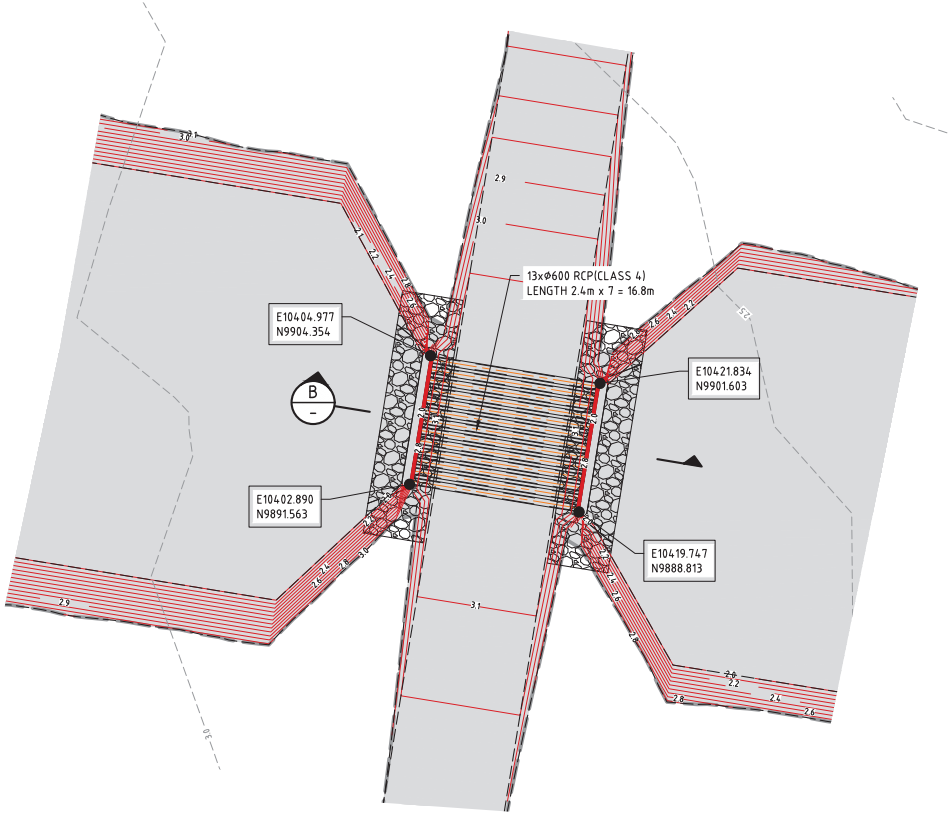

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LEGEND

- STAGE BOUNDARY
- 36.0 DESIGN SURFACE CONTOURS
- 36.0 EXISTING SURFACE CONTOURS
- BATTER LINE

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SCALE 5 0 5 10 15 20 25m
1 : 250 (A1 UNREDUCED)

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BULK EARTHWORKS

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Drawing Title
CULVERT DETAILS
SHEET 2

Drawn	Designed	Checked	Date
RW	JB	MAS	FEB 21

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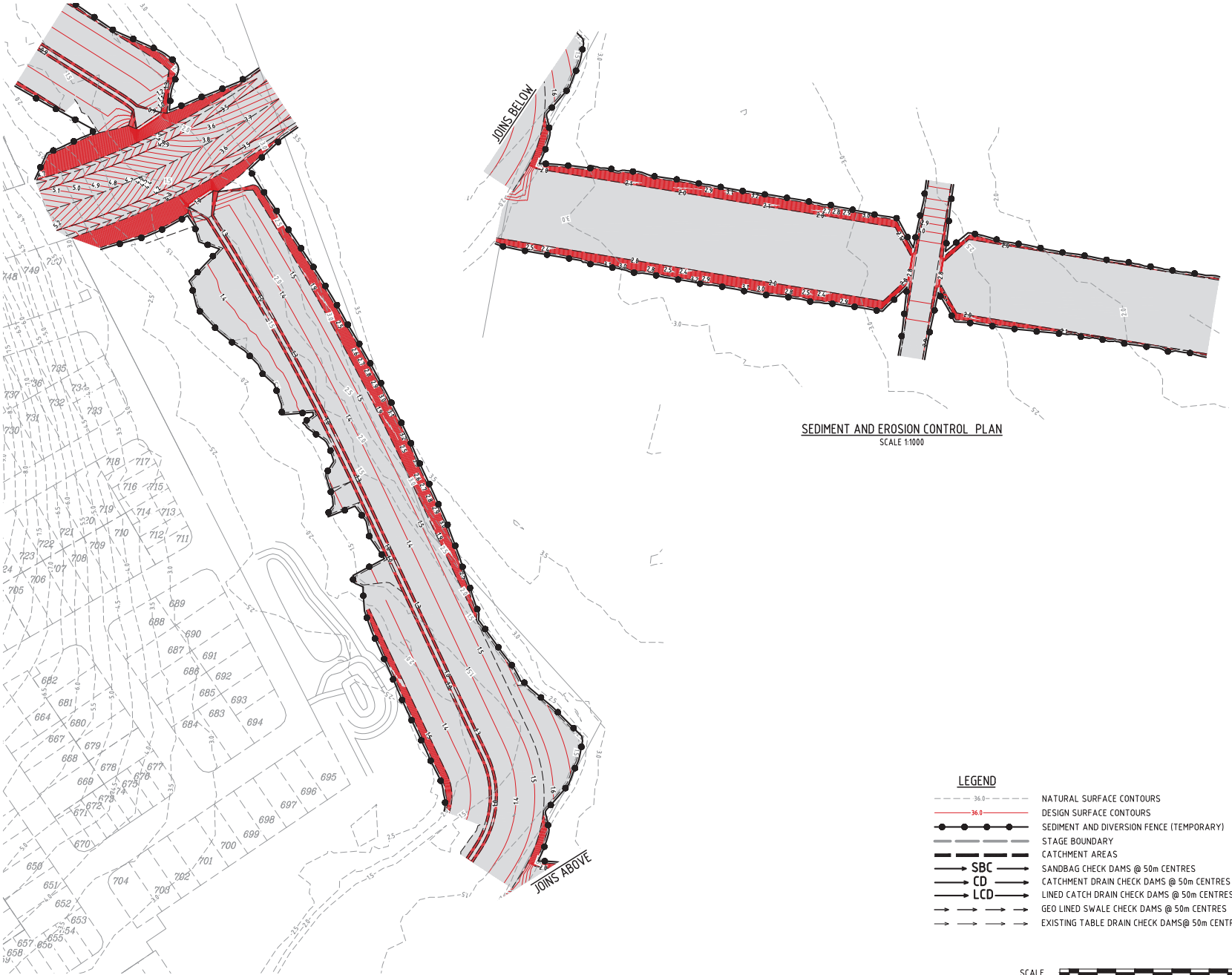

SEDIMENT AND EROSION CONTROL PLAN
SCALE 1:1000

SEDIMENT AND EROSION CONTROL PLAN
SCALE 1:1000

LEGEND

- NATURAL SURFACE CONTOURS
- DESIGN SURFACE CONTOURS
- SEDIMENT AND DIVERSION FENCE (TEMPORARY)
- STAGE BOUNDARY
- CATCHMENT AREAS
- SBC — SANDBAG CHECK DAMS @ 50m CENTRES
- CD — CATCHMENT DRAIN CHECK DAMS @ 50m CENTRES
- LCD — LINED CATCH DRAIN CHECK DAMS @ 50m CENTRES
- GEO LINED SWALE CHECK DAMS @ 50m CENTRES
- EXISTING TABLE DRAIN CHECK DAMS@ 50m CENTRES

SCALE 20 10 0 20 40 60 80 100 120 140 160 180 200m
1 : 2000 (A1 UNREDUCED)

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REVISIONS

No	Description	Date	By
A	FOR APPROVAL	02.02.2021	RW

NORTH

Client

North Harbour

BULK EARTHWORKS

kn group

Approved Director - RPEQ 17544

Drawing Title

SEDIMENT AND EROSION CONTROL PLAN

Drawn	Designed	Checked	Date
RW	JB	MAS	FEB 21

Scale	Sheet
AS SHOWN	05 of 09

	Drawing No	Revision
A1	20-185- 05	A

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EROSION AND SEDIMENT CONTROL PROGRAM

1. THIS PROGRAM AND ASSOCIATED PLANS SHOULD BE READ IN CONJUNCTION WITH THE SITE MANAGEMENT SPECIFICATION INCORPORATED IN THE CONTRACT DOCUMENTS. THE PROVISIONS OF THE SPECIFICATION ARE TO BE STRICTLY ADHERED TO.
2. THE BASIC OBJECTIVES OF THE EROSION AND SEDIMENT CONTROL ARE:
   I. IDENTIFY CRITICAL AREAS AND PROVIDE APPROPRIATE ATTENTION TO THOSE AREAS.
   II. PLAN SITE LAYOUTS SO THAT ACCESS TO ALL REQUIRED DRAINAGE EROSION AND SEDIMENT CONTROL MEASURE IS MAINTAINED.
   III. LIMIT EXPOSURE TIME BY PROGRAMMING TO MINIMISE THE AREA OF LAND EXPOSED TO POTENTIALLY ADVERSE WEATHER CONDITIONS AT ANY ONE TIME. I.E. PROGRESSIVELY CLEAR AND REVEGETATE.
   IV. PROVIDE CONTROL MEASURES INCLUDING TEMPORARY AND PERMANENT DRAINAGE, EROSION AND SEDIMENT CONTROLS.
3. THE EROSION AND SEDIMENT CONTROL SHALL COMPLY WITH BEST PRACTICE FOR EROSION AND SEDIMENT CONTROL, THE POLLUTION CONTROL MANUAL FOR URBAN STORMWATER MANAGEMENT, THE QUEENSLAND URBAN DRAINAGE MANUAL, THE SOIL EROSION AND SEDIMENT CONTROL – ENGINEERING GUIDELINES FOR QUEENSLAND (CURRENT EDITIONS) AND INTERNATIONAL EROSION CONTROL ASSOCIATION (ICEA).
4. CONSTRUCTION SEQUENCE THE CONSTRUCTION SEQUENCE WILL GENERALLY BE:
   I. OBTAIN ALL NECESSARY PERMITS AND APPROVALS BEFORE SITE ESTABLISHMENTS.
   II. HOLD A PRE-CONSTRUCTION CONFERENCE.
   III. STABILISE ALL CONSTRUCTION ACCESS ROUTES AND ENTRY/EXIT POINTS.
   IV. ESTABLISH SEDIMENT CONTROL STRUCTURES AND TEMPORARY DRAINAGE CONTROL MEASURES AS NECESSARY.
   V. CARRY OUT BULK EARTHWORKS.
   VI. MAINTAIN AND REPAIR DRAINAGE, EROSION AND SEDIMENT CONTROL MEASURES.
   VII. REMOVE SEDIMENT CONTROL MEASURES WHEN THE SITE IS STABILISED. I.E. >70% GROUND COVER
   VIII. THE CONTRACTOR SHALL PREPARE A SUPPLEMENTARY EROSION AND SEDIMENT CONTROL PLAN TO SUIT HIS/HER CONSTRUCTION METHODOLOGY, AND SUBMIT THIS PLAN FOR APPROVAL TO THE SUPERINTENDENT. IT SHOULD BE NOTED THAT ANY SIGNIFICANT VARIATION TO THIS PLAN MAY REQUIRE RESUBMISSION TO COUNCIL FOR APPROVAL. THE CLIENT SHALL NOT BE RESPONSIBLE FOR ANY SUCH ASSOCIATED DELAY.
5. ALL ESC DEVICES ARE TO BE INSPECTED WEEKLY, PRIOR TO EXPECTED AND AFTER RAINFALL ANY DAMAGE IS TO BE REPAIRED AS REQUIRED TO MAINTAIN THEIR EFFICACY.
6. ALL TEMPORARY EROSION AND SEDIMENT CONTROL (ESC) MEASURE TO BE MAINTAINED AND FULLY OPERATIONAL DURING THE MAINTENANCE PERIOD AND ARE TO BE REMOVED AFTER THE SATISFACTORY COMPLETION OF AN OFF-MAINTENANCE INSPECTION BY COUNCIL AND PRIOR TO FORMAL ACCEPTANCE "OFF MAINTENANCE8 BY COUNCIL.
7. PRIOR TO THE COMMENCEMENT OF CONSTRUCTION, THE CONTRACTOR IS TO PROVIDE A DETAILED PROGRAM TO THE SUPERINTENDENT SHOWING THE TIMING FOR ALL WORKS ASSOCIATED WITH THE PROJECT, NOMINATING, IN PARTICULAR, THE PROGRAM FOR INSTALLATION OF SOIL AND EROSION CONTROL SYSTEMS.
8. EARTHWORKS SHALL BE CARRIED OUT IN SUCH A MANNER THAT THE SITE IS MAINTAINED IN A WELL DRAINED CONDITION, AREAS OF LOOSE SOIL ARE MINIMISED AND CONCENTRATIONS OF STORMWATER ARE MINIMISED. BULK EARTHWORKS WILL BE CARRIED OUT OVER THE ENTIRE SITE IN ONE STAGE.
9. CONSTRUCTION AREAS SHALL BE AT ONE NOMINATED POINT ON SOUTH DEEBING CREEK ROAD. A SHAKE DOWN AS DETAILED ON THE PLAN COMPRISING FREE DRAINAGE GRAVEL SHALL BE LOCATED ADJACENT TO THE POINT OF ACCESS WHERE VEHICLES CAN BE WASHED DOWN PRIOR TO EXIT TO THE STREET SYSTEM IF REQUIRED. THE WASH DOWN AREA SHALL BE KEPT FREE OF MUD.
10. FOR DETAILS OF ENTRY/EXIT SEDIMENT PAD REFER TO BEST PRACTICE EROSION & SEDIMENT CONTROL BOOK 1, PAGE 2.48, FIGURE 2.6.
11. SUPPLEMENTARY EROSION AND SEDIMENT CONTROL DEVICES MAY BE REQUIRED AT THE DISCRETION OF THE SUPERINTENDENT.
12. SEDIMENTATION FENCES TO BE PLACED AS SHOWN. FOR DETAILS OF SEDIMENT FENCE REFER BEST PRACTICE EROSION & SEDIMENT CONTROL BOOK 1, PAGE 2.50, FIGURE 2.8.
13. WHERE SEDIMENT FENCES ARE SHOWN TO BE CONSTRUCTED IN AREAS OF SIGNIFICANT EARTHWORKS, ERECTION OF THE FENCE MAY BE DEFERRED UNTIL COMPLETION OF THE BULK EARTHWORKS, SUBJECT TO ABSENCE OF RAIN.

TREES

1. ENSURE COMPLIANCE WITH THE REQUIREMENTS OF AS4970 – TREES ON CONSTRUCTION SITES. THIS MAY REQUIRE CONSULTATION AND GUIDANCE FROM A CLASS V CERTIFIED ARBORIST AS TREES OUTSIDE THE IMMEDIATE WORK AREA MAY BE AFFECTED.

EROSION AND SEDIMENTATION CONTROL NOTES:

TOPSOIL

1. STRIP AND STOCKPILE AVAILABLE TOPSOIL (ASSUMED AVERAGE DEPTH 150MM) FROM ALL DISTURBED AREAS PRIOR TO BULK EARTHWORKS. GRADE EVENLY BETWEEN ALLOTMENT FINISHED SURFACE LEVELS AND ENSURE LOTS ARE FREE DRAINING.
2. MINIMUM SLOPE ACROSS ALLOTMENTS TO BE 1%.
3. ALL FOOTPATHS, BATTERS, AND EARTHWORKS AFFECTED ALLOTMENTS ARE TO BE TOPSOILED TO A MINIMUM DEPTH OF 150MM (LIGHTLY COMPACTED) AND TURFED WHERE SPECIFIED.
4. SEDIMENT FENCES TO BE PLACED AS SHOWN. FOR DETAILS OF SEDIMENT FENCE REFER BEST PRACTICE EROSION & SEDIMENT CONTROL BOOK 1, PAGE 2.50, FIGURE 2.7. SEDIMENT FENCED TO BE REPAIRED AND EXCESSIVE SEDIMENT DEPOSITS SHALL BE REMOVED ONCE CAPACITY FALLS BELOW 75%

SEDIMENT FENCES

1. FOR DETAILS OF SEDIMENT FENCE REFER BEST PRACTICE EROSION & SEDIMENT CONTROL BOOK 1, PAGE 2.50, FIGURE 2.8.
2. SEDIMENT FENCES TO BE REPAIRED AS REQUIRED AND EXCESSIVE SEDIMENT DEPOSITS SHOULD BE REMOVED.
3. INSTALL KERB INLETS WITH GRAVEL RANGING FROM 50MM TO 75MM IN SIZE SHALL BE INSTALLED AT ALL COMPLETED INLETS. REFER IPWEAQ STANDARD DRAWING D-0041. THESE SHALL BE MAINTAINED IN A CLEAN CONDITION. IN THE EVENT OF HEAVY RAIN THEY SHALL BE REMOVED TO MINIMISE THE POTENTIAL FOR FLOODING.
4. CHECKS OF SILT CONTROL DEVICES ARE TO BE MADE WEEKLY, OR AFTER ANY SIGNIFICANT STORM EVENT TO ENSURE INTEGRITY AND PERFORMANCE.

TURFING

1. PROVIDE TURFING TO ENTIRE WIDTH OF ALL SWALES, FOOTPATHS, AND 1 IN 4 CUT AND FILL BATTERS.
2. FOOTPATH BATTERS ARE TO BE STABILISED WITH TOPSOIL (AND TURFED) AS SOON AS PRACTICAL AFTER THE BATTERS HAVE BEEN COMPLETED.

DURING CONSTRUCTION SEQUENCE:

1. TOPSOIL STOCKPILES SHALL BE LESS THAN 1M DEEP AND UNCOMPACTED. A SEDIMENTATION FENCE SHALL BE CONSTRUCTED ON THE D/S SIDE, OR THE STOCKPILE STABILISED WITH VEGETATION, MULCH, OR A SOIL STABILISER.
2. SEDIMENTATION FENCES TO BE PLACED AS SHOWN.
3. REGULARLY INSPECT BANKS AND REPAIR ANY SLUMPS, WHEEL TRACK DAMAGE OR LOSS OF FREEBOARD.
4. REMOVE SEDIMENT TO AVOID PONDING FROM CATCH DRAINS.
5. REMOVE EXCESSIVE SEDIMENT FROM UPSTREAM OF CHECK DAM.
6. ROAD RESERVE TO BE USED AS HAUL ROAD.
7. A CATCH DRAINOR DIVERSION BANK IS TO BE PROVIDED ON THE TOP SIDE OF ALL CUTS, WITH DISCHARGE EITHER TO UNDISTURBED GRASS LANDS OR TO THE CROSS ROAD DRAINAGE.
8. SUPPLEMENTARY EROSION AND SEDIMENT CONTROL DEVISED MAY BE REQUIRED AT THE DISCRETION OF THE ENGINEER.
9. WATER QUALITY SAMPLES MUST BE TAKEN AND ANALYSED PRIOR TO THE RELEASE OF ANY WATER FROM THE SEDIMENT POND. WATER QUALITY MUST SATISFY THE FOLLOWING CRITERIA: TSS<50MG/L PH BETWEEN 6.5 AND 8.5.
10. ALL WATER QUALITY DATA INCLUDING DATES OF RAINFALL, TESTING AND WATER RELEASE MUST BE MAINTAINED IN AN ON-SITE REGISTER. THIS REGISTER IS TO BE MAINTAINED FOR THE DURATION OF THE APPROVED WORKS AND BE AVAILABLE ON SITE FOR INSPECTION BY COUNCIL OFFICERS ON REQUEST.
11. EXPOSED AREAS ON LOTS ARE TO BE SEEDED AND MULCHED (E.G. HYDROMULCHED). MULCH SHALL BE APPLIED AT A MINIMUM RATE OF 2.5T/HA. ALTERNATIVELY THEY SHALL BE DRILL-SEEDED AND IRRIGATED SO AS TO ENSURE >70% GROUND COVER WITHIN 14 DAYS FROM NOVEMBER TO APRIL, OR 30 DAYS FROM MAY TO OCTOBER.

FOLLOWING CONSTRUCTION:

1. SEDIMENTATION FENCES TO BE MAINTAINED UNTIL TURFING IS COMPLETED.
2. SEDIMENT BASINS TO BE CHECKED AFTER EVERY SIGNIFICANT STORM AND DESILTED ONCE THE SETTLEMENT LIMIT HAS BEEN REACHED.

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REVISIONS

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A	FOR APPROVAL	02.02.2021	RW

NORTH

Client

North Harbour

BULK EARTHWORKS

kn group

Approved Director - RPEQ 17544

Drawing Title

SEDIMENT AND EROSION CONTROL NOTES

Drawn	Designed	Checked	Date
RW	JB	MAS	FEB 21

Scale	Sheet
AS SHOWN	06 of 09

	Drawing No	Revision
A1	20-185- 06	A

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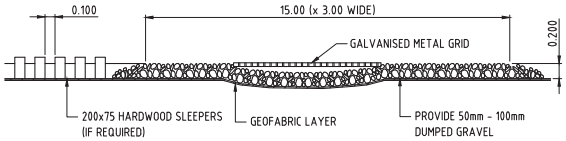

SITE ACCESS POINT SHAKEDOWN FACILITY
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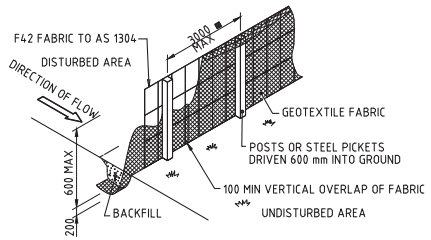

SEDIMENT FENCE
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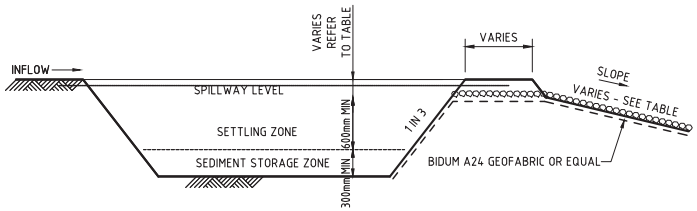

TYPE C BASIN DETAIL
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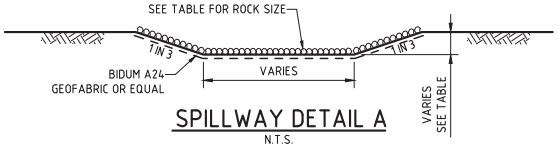

SPILLWAY DETAIL A
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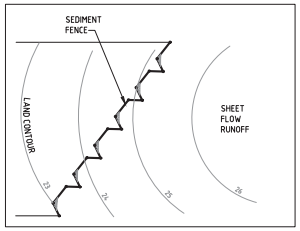
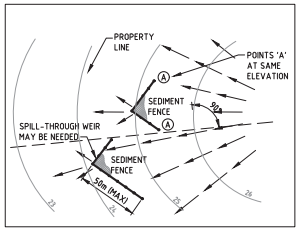
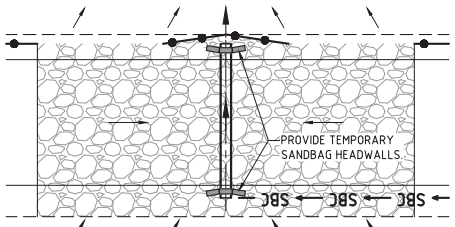




SILT FENCE DETAILS



DETAIL 'A' TEMPORARY CROSSING PLAN
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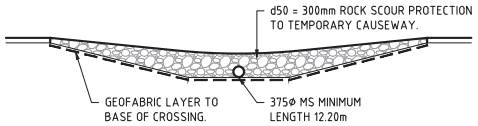

DETAIL 'A' TEMPORARY CROSSING SECTION
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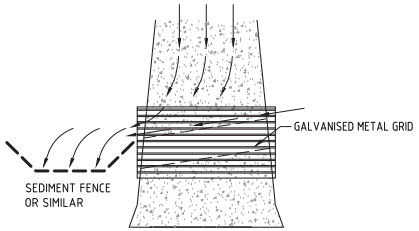
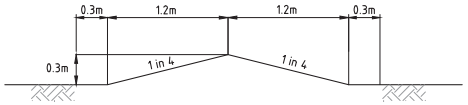


SITE ACCESS POINT ENTRY/EXIT PAD
N.T.S.



BUND SECTION
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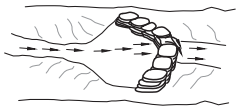
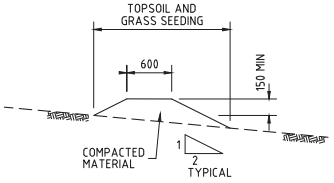
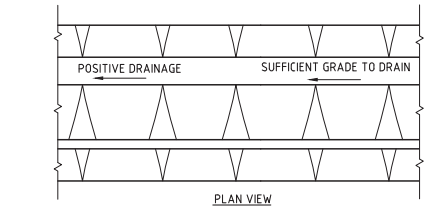


SANDBAG CHECK DAM
N.T.S.



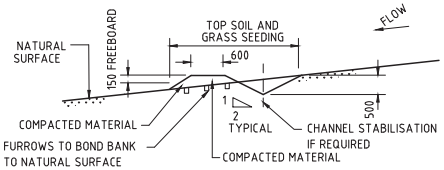
DIVERSION DRAINAGE BANK
N.T.S.



TYPICAL LINED CATCH DRAIN
SCALE 1 : 40

LCD NO.	WIDTH	DEPTH
1	1.500	0.450
2	1.500	0.450
3	1.500	0.300
4	1.500	0.250
5	1.500	0.300
6	1.500	0.300
7	1.500	0.250
8	1.500	0.200
9	1.500	0.350
10	1.500	0.300

PLAN VIEW



PLACE FILTER FABRIC ACROSS DRAIN AT 30m MAXIMUM INTERVALS AND AT OUTLET OF DRAIN, OR AS REQUIRED TO CONTROL SEDIMENT MOVEMENT ALONG DRAIN.

CROSS SECTION

CATCHMENT DRAIN
N.T.S.

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REVISIONS

No	Description	Date	By
A	FOR APPROVAL	02.02.2021	RW

NORTH

Client

North Harbour
local right at home

BULK EARTHWORKS

kn group

Approved Director - RPEQ 17544

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SEDIMENT AND EROSION CONTROL DETAILS

Drawn	Designed	Checked	Date
RW	JB	MAS	FEB 21

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A1	20-185- 07	A

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BASIN NOTES

1. ALL BASINS SHALL BE CONSTRUCTED PRIOR TO THE COMMENCMENT OF MAJOR EARTHWORKS IN THE RELEVANT CATCHMENT.
2. AN APPROPRIATELY MARKED (E.G. PAINTED) DE-SILTING MARKER POST MUST BE INSTALLED IN THE BASIN TO INDICATE THE TOP OF THE SEDIMENT STORAGE ZONE. THE BASIN MUST BE DE-SILTED. IF THE SEDIMENT IS ALREADY ABOVE THIS MARKER POINT, OR IF THE NEXT STORM IS LIKELY TO CAUSE SEDIMENT TO SETTLE ABOVE THIS MARKER POINT.
3. PRIOR TO DISCHARGE OF WATER FROM A SEDIMENT BASIN, IT IS ESSENTIAL FOR THE WATER QUALITY TO COMPLY WITH ALL SPECIFIED WATER QUALITY OBJECTIVES (WQOS) (E.G. WATER PH IN THE RANGE OF 6.5 – 8.5).
4. THE RECOMMENDED WATER QUALITY STANDARD FOR SEDIMENT BASINS IS PRESENTED IN TABLE B18.

TABLE B18 – RECOMMENDED DISCHARGE STANDARD FOR DE-WATERING OPERATIONS

SITE CONDITIONS	DISCHARGE WATER QUALITY STANDARD
POST-STORM DE-WATERING OF SEDIMENT BASINS (E.G. TYPE F AND D BASINS, AND TYPE C BASINS OPERATING AS WET-BASINS).	90 PERCENTILE TOTAL SUSPENDED SOLIDS (TSS) CONCENTRATION NOT EXCEEDING 50MG/L.

TECHNICAL NOTES B5 – BASIN FLOCCULATION

THE CONTRACTOR SHALL, IN CONJUNCTION WITH THE SITE EROSION AND SEDIMENT CONTROL SPECIALIST, DETERMINE THE MOST APPROPRIATE FLOCCULANT FOR THE SITE. A PROCEDURE FOR THE MANUAL DOSING OF GYPSUM OR SIMILAR (DEVELOPED FROM LANDCOM, 2004) IS AS FOLLOWS:

1. PLACE REQUIRED GYPSUM QUANTITY (SAY 32KG/100M3 OF WATER) IN APPROXIMATELY 50L DRUM PERFORATED WITH 25MM HOLES AT 150MM SPACING.
2. SUSPEND THE SCREENED, RECIRCULATING PUMP INTAKE INTO THE DRUM.
3. LIFT THE DRUM INTO THE BASIN SUCH THAT BASIN WATER CAN ENTER AND CIRCULATED THROUGH THE DRUM.
4. USING THE PUMP, SPRAY THE GYPSUM-RICH SOLUTION EVENLY OVER THE SURFACE OF THE BASIN UNTIL THE GYPSUM IS FULLY REMOVED FROM THE DRUM. THE PUMP OUTLET MUST SPRAY THE MIXTURE OVER A WIDE AREA RATHER THAN JUST DISCHARGING AS A CONFINED "JETö.
5. ALTERNATIVELY, IF TWO PUMPS ARE AVAILABLE, USE THE TWO PUMPS TO CIRCULATE BASIN WATER FIRST TO THE ON-SHORE TANK, AND THEN FROM THE TANK OVER THE SURFACE OF THE BASIN. A LARGE MIXING TANK WILL USUALLY BE REQUIRED.
6. ALTERNATIVE PRODUCTS INCLUDE POLYALUMINIUM CHLORIDE (PAC), POLYACRYLAMIDE (PAC).

B3 BASIN CONSTRUCTION AND MAINTENANCE MATERIALS

- EARTH FILL: CLEAN SOIL WITH EMERSON CLASS 2(1), 3, 4, OR 5, AND FREE OF ROOTS, WOODY VEGETATION, ROCKS AND OTHER UNSUITABLE MATERIAL. SOIL WITH EMERSON CLASS 4 AND 5 MAY NOT BE SUITABLE DEPENDING ON PARTICLE SIZE AND DISTRIBUTION AND DEGREE OF DISPERSION. CLASS 2(1) SHOULD ONLY BE USED UPON RECOMMENDATION FROM GEOTECHNICAL SPECIALIST. [ALTERNATIVELY, SET A STANDARD BASED ON EXCHANGEABLE SODIUM PERCENTAGE – SEEK EXPERT ADVICE.]
- RISER PIPE: MINIMUM 250MM DIAMETER.
- SPILLWAY ROCK: HARD, ANGULAR, DURABLE, WEATHER RESISTANT AND EVENLY GRADED ROCK WITH 50% BY WEIGHT LARGER THAN THE SPECIFIED NOMINAL (D50) ROCK SIZE. LARGER ROCK SHOULD DOMINATE, WITH SUFFICIENT SMALL ROCK TO FILL THE VOIDS BETWEEN THE LARGER ROCK. THE DIAMETER OF THE LARGEST ROCK SIZE SHOULD BE NO LARGER THAN 1.5 TIMES THE NOMINAL ROCK SIZE. THE SPECIFIC GRAVITY SHOULD BE AT LEAST 2.5.
- GEOTEXTILE FABRIC: HEAVY-DUTY, NEEDLE-PUNCHED, NON-WOVEN FILTER CLOTH, MINIMUM BIDIM A24 OR EQUIVALENT.

CONSTRUCTION

1. NOTWITHSTANDING ANY DESCRIPTION CONTAINED WITHIN THE APPROVED PLANS OR SPECIFICATIONS, THE CONTRACTOR SHALL BE RESPONSIBLE FOR SATISFYING THEMSELVES AS TO THE NATURE AND EXTENT OF THE SPECIFIED WORKS AND THE PHYSICAL AND LEGAL CONDITIONS UNDER WHICH THE WORKS WILL BE CARRIED OUT. THIS SHALL INCLUDE MEANS OF ACCESS, EXTENT OF CLEARING, NATURE OF MATERIAL TO BE EXCAVATED, TYPE AND SIZE OF MECHANICAL PLAN REQUIRED, LOCATION AND SUITABILITY OF WATER SUPPLY FOR CONSTRUCTION AND TESTING PURPOSES, AND ANY OTHER LIKE MATTERS AFFECTING THE CONSTRUCTION OF THE WORKS.
2. REFER TO APPROVED PLANS FOR LOCATION, DIMENSIONS, AND CONSTRUCTION DETAILS. IF THERE ARE QUESTIONS OR PROBLEMS WITH THE LOCATION, DIMENSIONS, OR METHOD OF INSTALLATION, CONTACT THE ENGINEER OR RESPONSIBLE ON-SITE OFFICER FOR ASSISTANCE.
3. BEFORE STARTING ANY CLEARING OR CONSTRUCTION, ENSURE ALL THE NECESSARY MATERIALS AND COMPONENTS ARE ON THE SITE TO AVOID DELAYS IN COMPLETING THE POND ONCE WORKS BEGIN.
4. INSTALL REQUIRED SHORT-TERM SEDIMENT CONTROL MEASURES DOWNSTREAM OF THE PROPOSED EARTHWORKS TO CONTROL SEDIMENT RUNOFF DURING CONSTRUCTION OF THE BASIN.
5. THE AREA TO BE COVERED BY THE EMBANKMENT, BORROW PITS AND INCIDENTAL WORKS, TOGETHER WITH AN AREA EXTENDING BEYOND THE LIMITS OF EACH FOR A DISTANCE NOT EXCEEDING FIVE (5) METRES ALL AROUND MUST BE CLEARED OF ALL TREES, SCRUB, STUMPS, ROOTS, DEAD TIMBER AND RUBBISH AND DISPOSED OF IN A SUITABLE MANNER. DELAY CLEARING THE MAIN POND AREA UNTIL THE EMBANKMENT IS COMPLETE. [MODIFY AS NECESSARY TO LIMIT TOTAL AREA OF DISTURBANCE AND ANY DAMAGE TO PROTECTED VEGETATION].
6. ENSURE ALL HOLES MADE BY GRUBBING WITHIN THE EMBANKMENT FOOTPRINT ARE FILLED WITH SOUND MATERIAL, ADEQUATELY COMPACTED, AND FINISHED FLUSH WITH THE NATURAL SURFACE.
7. IS SUITABLE AND IT IS PLACED IN THE CORRECT ZONE ACCORDING TO ITS CLASSIFICATION.

CUT-OFF TRENCH:

1. BEFORE CONSTRUCTION OF THE CUT-OFF TRENCH OR ANY ANCILLARY WORKS WITHIN THE EMBANKMENT FOOTPRINT, ALL GRASS GROWTH AND TOPSOIL MUST BE REMOVED FROM THE AREA TO BE OCCUPIED BY THE EMBANKMENT AND MUST BE DEPOSITED CLEAR OF THIS AREA AND RESERVED FOR TOPDRESSING THE COMPLETING EMBANKMENT.
2. EXCAVATE A CUT-OFF TRENCH ALONG THE CENTRE LINE OF THE EARTH FILL EMBANKMENT. CUT THE TRENCH TO STABLE SOIL MATERIAL, BUT IN NO CASE MAKE IT LESS THAN 600MM DEEP. THE CUT-OFF TRENCH MUST EXTEND INTO BOTH ABUTMENTS TO AT LEAST THE ELEVATION OF THE RISER PIPE CREST. MAKE THE MINIMUM BOTTOM WIDTH WIDE ENOUGH TO PERMIT OPERATION OF EXCAVATION AND COMPACTION EQUIPMENT, BUT IN NO CASE LESS THAN 600MM. MAKE THE SIDE SLOPES OF THE TRENCH NO STEEPER THAN 1:1 (H:V).
3. ENSURE ALL WATER, LOOSE SOIL, AND ROCK ARE REMOVED FROM THE TRENCH BEFORE BACKFILLING COMMENCES. THE CUT-OFF TRENCH MUST BE BACKFILLED WITH SELECTED EARTH-FILL OF THE TYPE SPECIFIED FOR THE EMBANKMENT, AND THIS SOIL MUST HAVE A MOISTURE CONTENT AND DEGREE OF COMPACTION THE SAME AS THAT SPECIFIED FOR THE SELECTED CORE ZONE.
4. MATERIAL EXCAVATED FROM THE CUT-OFF TRENCH MAY BE USED IN CONSTRUCTION OF THE EMBANKMENT PROVIDED IT IS SUITABLE AND IT IS PLACED IN THE CORRECT ZONE ACCORDING TO ITS CLASSIFICATION.

EMBANKMENT:

1. SCARIFY AREAS ON WHICH FILL IS TO BE PLACED BEFORE PLACING THE FILL.
2. ENSURE ALL FILL MATERIAL USED TO FORM THE EMBANKMENT MEETS THE SPECIFICATIONS CERTIFIED BY A GEOTECHNICAL SPECIALIST.
3. THE FILL MATERIAL MUST CONTAIN SUFFICIENT MOISTURE SO IT CAN BE FORMED BY HAND INTO A BALL WITHOUT CRUMBLING. IF WATER CAN BE SQUEEZED OUT OF THE BALL, IT IS TOO WET FOR PROPER COMPACTION. PLACE FILL MATERIAL IN 150 TO 250MM CONTINUOUS LAYERS OVER THE ENTIRE LENGTH OF THE FILL AREA THEN COMPACT BEFORE PLACEMENT OF FURTHER FILL.
4. PLACE RISER PIPE OUTLET SYSTEM, IF SPECIFIED, IN APPROPRIATE SEQUENCE WITH THE EMBANKMENT FILLING. REFER TO SPECIFICATIONS SUPPLIED BELOW.
5. UNLESS OTHERWISE SPECIFIED ON THE APPROVED PLANS, COMPACT THE SOIL AT ABOUT 1% TO 2% WET OF OPTIMUM AND TO 95% MODIFIED OR 100% STANDARD COMPACTION.
6. WHERE BOTH DISPERSIVE AND NON-DISPERSIVE CLASSIFIED EARTH-FILL MATERIALS ARE AVAILABLE, NON-DISPERSIVE EARTH-FILL MUST BE USED IN THE CORE ZONE. THE REMAINING CLASSIFIED EARTH-FILL MATERIALS MUST ONLY BE USED AS DIRECTED BY [INSERT TITLE].
7. WHERE SPECIFIED, CONSTRUCT THE EMBANKMENT TO AN ELEVATION 10% HIGHER THAN THE DESIGN HEIGHT TO ALLOW FOR SETTLING; OTHERWISE FINISHED DIMENSIONS OF THE EMBANKMENT AFTER SPREADING OF TOPSOIL MUST CONFORM TO THE DRAWING WITH A TOLERANCE OF 75MM FORM THE SPECIFIED DIMENSIONS.
8. ENSURE DEBRIS AND OTHER UNSUITABLE BUILDING WASTE IN NOT PLACED WITHIN THE EARTH EMBANKMENT.
9. AFTER COMPLETION OF THE EMBANKMENT ALL LOOSE UNCOMPACTED EARTH-FILL MATERIAL OF THE UPSTREAM AND DOWNSTREAM BATTER MUST BE REMOVED PRIOR TO SPREADING OF TOPSOIL.
10. TOPSOIL AND REVEGETATE/STABILISED ALL EXPOSED EARTH AS DIRECTED WITHIN THE APPROVED PLANS.
11. WHERE THE SITE IS TO BE REVEGETATED, THE TOPSOIL AND UPPER 500MM OF THE SUBSOIL SHALL MEET THE SPECIFICATIONS SET BY A SOIL SCIENTIST.

ESTABLISHMENT OF SETTLING POND:

1. THE AREA TO BE COVERED BY THE STORED WATER OUTSIDE THE LIMITS OF THE BORROW PITS MUST BE CLEARED OF ALL SCRUB AND RUBBISH. TREES MUST BE CUT DOWN STUMP HIGH AND REMOVED FROM THE IMMEDIATE VICINITY OF THE WORK.
2. ESTABLISH ALL REQUIRED INFLOW CHUTES AND INLET BAFFLES, IF SPECIFIED, TO ENABLE WATER TO DISCHARGE INTO THE BASIN IN A MANNER THAT WILL NOT CAUSE SOIL EROSION NOR THE RE-SUSPENSION OF SETTLED SEDIMENT.
3. INSTALL A SEDIMENT STORAGE LEVEL MARKER POST WITH A CROSS MEMBER SET JUST BELOW THE TOP OF THE SEDIMENT STORAGE ZONE (AS SPECIFIED ON THE APPROVED PLANS). USE AT LEAST A 75MM WIDE POST FIRMLY SET INTO THE BASIN FLOOR.
4. IF SPECIFIED, INSTALL INTERNAL SETTLING POND BAFFLES. ENSURE THE CREST OF THESE BAFFLES IS SET LEVEL WITH OR JUST BELOW, THE ELEVATION OF THE EMERGENCY SPILLWAY CREST.
5. INSTALL ALL APPROPRIATE MEASURE TO MINIMISE SAFETY RISK TO ON-SITE PERSONNEL AND THE PUBLIC CAUSED BY THE PRESENCE OF THE SETTLING POND. AVOID STEEP, SMOOTH INTERNAL SLOPES. APPROPRIATELY FENCE THE SETTLING POND AND POST WARNING SIGNS IF UNSUPERVISED ACCESS IS LIKELY OR THERE IS CONSIDERED TO BE AN UNACCEPTABLE RISK TO THE PUBLIC.

SPILLWAY CONSTRUCTION:

1. THE SPILLWAY MUST BE EXCAVATED AS SHOWN ON THE PLANS, AND THE EXCAVATED MATERIAL IF CLASSIFIED AS SUITABLE, MUST BE USED IN THE EMBANKMENT, AND IF NOT SUITABLE IT MUST BE DISPOSED OF INTO SPOIL HEAPS.
2. ENSURE EXCAVATED DIMENSIONS ALLOW ADEQUATE BOXING-OUT SUCH THAT THE SPECIFIED ELEVATIONS, GRADES, CHUTE WIDTH, AND ENTRANCE AND EXIT SLOPES FOR THE EMERGENCY SPILLWAY WILL BE ACHIEVED AFTER PLACEMENT OF THE ROCK OR OTHER SCOUR PROTECTION MEASURES AS SPECIFIED IN THE PLANS.
3. PLACE SPECIFIED SCOUR PROTECTION MEASURES ON THE EMERGENCY SPILLWAY. ENSURE THE FINISHED GRADE BLENDS WITH THE SURROUNDING AREA TO ALLOW A SMOOTH FLOW TRANSITION FROM SPILLWAY TO DOWNSTREAM CHANNEL.
4. IF A SYNTHETIC FILTER FABRIC UNDERLAY IS SPECIFIED, PLACE THE FILTER FABRIC DIRECTLY ON THE PREPARED FOUNDATION. IF MORE THAN 1 SHEET OF FILTER FABRIC IS REQUIRED, OVERLAP THE EDGES BY AT LEAST 300MM AND PLACE ANCHOR PINS AT MINIMUM 1M SPACING ALONG THE OVERLAP. BURY THE UPSTREAM END OF THE FABRIC A MINIMUM 300MM BELOW GROUND AND WHERE NECESSARY, BURY THE LOWER END OF THE FABRIC OR OVERLAP A MINIMUM 300MM OVER THE NEXT DOWNSTREAM SECTION AS REQUIRED. ENSURE THE FILTER FABRIC EXTENDS AT LEAST 1000MM UPSTREAM OF THE SPILLWAY CREST.
5. TAKE CARE NOT TO DAMAGE THE FABRIC DURING OR AFTER PLACEMENT. IF DAMAGE OCCURS, REMOVE THE ROCK AND REPAIR THE SHEET BY ADDING ANOTHER LAYER OF FABRIC WITH A MINIMUM OVERLAP OF 300MM AROUND THE DAMAGED AREA. IF EXTENSIVE DAMAGE IS SUSPECTED, REMOVE AND REPLACE THE ENTIRE SHEET.
6. WHERE LARGE ROCK IS USED, OR MACHINE PLACEMENT IS DIFFICULT, A MINIMUM 100MM LAYER OF FINE GRAVEL, AGGREGATE, OR SAND MAY BE NEEDED TO PROTECT THE FABRIC.
7. PLACEMENT OF ROCK SHOULD FOLLOW IMMEDIATELY AFTER PLACEMENT OF THE FILTER FABRIC. PLACE ROCK SO THAT IF FORMS A DENSE, WELL-GRADED MASS OF ROCK WITH A MINIMUM OF VOIDS. THE DESIRED DISTRIBUTION OF ROCK THROUGHOUT THE MASS MAY BE OBTAINED BY SELECTIVE LOADING AT THE QUARRY AND CONTROLLED DUMPING DURING FINAL PLACEMENT.
8. THE FINISHED SLOPE SHOULD BE FREE OF POCKETS OF SMALL ROCK OR CLUSTERS OF LARGE ROCKS. HAND PLACING MAY BE NECESSARY TO ACHIEVE THE PROPER DISTRIBUTION OF ROCK SIZES TO PRODUCE A RELATIVELY SMOOTH, UNIFORM SURFACE. THE FINISHED GRADE OF THE ROCK SHOULD BLEND WITH THE SURROUNDING AREA. NO OVERFALL OR PROTRUSION OF ROCK SHOULD BE APPARENT.
9. ENSURE THAT THE FINAL ARRANGEMENT OF THE SPILLWAY CREST WILL NOT PROMOTE EXCESSIVE FLOW THROUGH THE ROCK SUCH THAT THE WATER CAN BE RETAINED WITHIN THE SETTLING BASIN AN ELEVATION NO LESS THAN 50MM ABOVE OR BELOW THE NOMINATED SPILLWAY CREST ELEVATION.

MAINTENANCE OF SEDIMENT BASIN

1. INSPECT THE SEDIMENT BASIN DURING THE FOLLOWING PERIODS:
   (i) DURING CONSTRUCTION TO DETERMINE WHETHER MACHINERY, FALLING TREES, OR CONSTRUCTION ACTIVITY HAS DAMAGED ANY COMPONENTS OF THE SEDIMENT BASIN. IF DAMAGE HAS OCCURRED, REPAIR IT.
   (ii) AFTER EACH RUNOFF EVENT. INSPECT THE EROSION DAMAGE AT FLOW ENTRY AND EXIT POINTS. IF DAMAGE HAS OCCURRED, MAKE THE NECESSARY REPAIRS.
   (iii) AT LEAST WEEKLY DURING THE NOMINATED WET SEASON (IF ANY) OTHERWISE AT LEAST FORTNIGHTLY.
   (i) PRIOR TO, AND IMMEDIATELY AFTER, PERIOD OF "STOP WORKö OR SITE "SHUTDOWNö.
2. CLEAN OUT ACCUMULATED SEDIMENT WHEN IT REACHES THE MARKER BOARD/POST, AND RESTORE THE ORIGINAL STORAGE VOLUME. PLACE SEDIMENT IN A DISPOSABLE AREA OR, IF APPROPRIATE, MIX WITH DRY SOIL ON THE SITE.
3. DO NOT DISPOSE OF SEDIMENT IN A MANNER THAT WILL CREATE AN EROSION OR POLLUTION HAZARD.
4. CHECK ALL VISIBLE PIPE CONNECTIONS FOR LEAKS, AND REPAIR AS NECESSARY.
5. CHECK FILL MATERIAL IN THE DAM FOR EXCESSIVE SETTLEMENT, SLUMPING OF THE SLOPES OR PIPING BETWEEN THE CONDUIT AND THE EMBANKMENT; MAKE ALL NECESSARY REPAIRS.
6. REMOVE ALL TRASH AND OTHER DEBRIS FROM THE BASIN AND RISER.
7. SUBMERGED INFLOW PIPES MUST BE INSPECTED AND DE-SILTED (AS REQUIRED) AFTER EACH INFLOW EVENT.

REMOVAL OF SEDIMENT BASIN

1. WHEN GRADING AND CONSTRUCTION IN THE DRAINAGE AREA ABOVE A TEMPORARY SEDIMENT BASIN IS COMPLETED AND THE DISTURBED AREAS ARE ADEQUATELY STABILISED (>70% GROUND COVER) WITH HYDROMULCH OR MULCHIN 6 AS APPROVED BY MBRC, THE BASIN MUST BE REMOVED OR OTHERWISE INCORPORATED INTO THE PERMANENT STORMWATER DRAINAGE SYSTEM. IN EITHER CASE, SEDIMENT SHOULD BE CLEARED AND PROPERLY DISPOSED OF AND THE BASIN AREA STABILISED.
2. BEFORE STARTING ANY MAINTENANCE WORK ON THE BASIN OR SPILLWAY, INSTALL ALL NECESSARY SHORT-TERM SEDIMENT CONTROL MEASURES DOWNSTREAM OF THE SEDIMENT BASIN.
3. ALL WATER AND SEDIMENT MUST BE REMOVED FROM THE BASIN PRIOR TO THE DAM'S REMOVAL. DISPOSE OF SEDIMENT AND WATER IN A MANNER THAT WILL NOT CREATE AN EROSION OR POLLUTION HAZARD.
4. BRING THE DISTURBED AREA TO A PROPER GRADE, THEN SMOOTH, COMPACT, AND STABILISE AND/OR REVEGETATE AS REQUIRED TO ESTABLISH A STABLE LAND SURFACE.

DO NOT SCALE THIS DRAWING
IF IN DOUBT - ASK!

REVISIONS

No	Description	Date	By
A	FOR APPROVAL	02.02.2021	RW

NORTH

Client

North Harbour
find right at home

BULK EARTHWORKS

kn group

Approved Director - RPEQ 17544

Drawing Title

SEDIMENT AND EROSION BASIN NOTES

Drawn	Designed	Checked	Date
RW	JB	MAS	FEB 21

Scale	Sheet
AS SHOWN	08 of 09

A1	Drawing No	Revision
	20-185- 08	A

M:\2020\20185 NHH - Bulk Earthworks Unnamed Creek\Engineering\Acad\20-185-05-08-SED-CONTR.dwg Plotted by RW on 2/03/2021 3:21:34 PM

Client: NORTH EAST BUSINESS PARK

Project: NORTH HARBOUR RESIDENTIAL WEST
BULK EARTHWORKS

Prepared By: Mark Shaw — Date: 2nd February 2021
Reviewed By: Robert Mander — Date: 2nd February 2021

Safety in Design Analysis

- Complete Safety in Design Analysis by populating the table where applicable with all of the relevant safety issues for the project. For example:

☐ Positioning of new services adjacent to existing live services	☒ Slope Stability
☐ Construction adjacent to existing road carriageways	☒ Dust Control
☐ Pedestrians	☒ Erosion and Sediment Control/Management
☒ Civil Construction Workers	☒ Sediment Basin Construction
☒ Maintenance Workers	☒ Wetland Construction
☒ Work Place Health and Safety Constraints	☒ Working under traffic
☐ Unusual material handling	Project Specific Design Elements:
☐ Falls from heights	
☐ Underground Services (existing)	
☐ Electrical Service Installation	
☐ Gas Service Installation	
☐ Communication Installation	
☐ Traffic Signal Installation	
☒ Landscape Workers	
☐ Line marking Workers	
☒ Excavation – open cut trenching - Trench excavation depths	
☐ Tunnel Boring	
☒ Confined Spaces	
☒ Lifting of loads	
☒ Unloading of materials and storage	
☐ Storage of hazardous materials	
☒ Geotechnical investigation – works	
☒ Bulk Earthworks	
☐ List all relevant safety studies	

The following table summarises the safety in design issues considered.

Section of Works	Identify any Potential Incident or Hazard	Consequence	Likelihood	Risk Rating	Risk Control Measures	Consequence	Likelihood	Residual Risk Rating (after design applied)	Risk Manager
Earthworks Material Investigation	Geotechnical Investigation	C	3	S	SWMS required by Contractor	D	3	M	Contractor
Road Works	Pedestrians Injury	B	3	M	TMP to be provided by Contractor to exclude pedestrians from work site	E	3	L	Contractor
	Civil Construction Workers – Injury	A	4	H	TMP and SWMS required for all activities	C	3	S	Contractor
	Maintenance Workers	A	4	H	TMP and SWMS required for all activities	C	3	S	Contractor
	Underground Services (Existing)	A	3	H	DBYD information to be sort prior to design. Existing to be located by survey if applicable to design. All existing services to be located and depths confirmed prior to commencement. SWMS to be provided by Contractor	D	3	S	Designer/ Contractor
Working adjacent to existing infrastructure	Conflict between construction equipment / personnel and live infrastructure in particular Power lines	B	3	S	All existing services highlighted in the documentation. Contractor to complete DBYD search before commencing works. SWMS to be provided by Contractor	C	4	M	Designer/ Contractor
Service trench/ pipe installation	Location of all trenches to provide clearance to all other services and all structures or batters/embankments	A	3	H	Mains located with safe working clearance to existing pressure mains, structures and batters/embankments	C	4	M	Designer
	Trench depth	A	4	M	Depth of trenches minimised for both safety and cost efficiency	D	4	M	Designer
Works within Confined Spaces	Construction of manholes structures	A	4	M	Contractor to ensure works undertaken in a manner complying with safe work method statements	D	5	L	Contractor
Silt and Erosion Control	Public access to water retaining temporary sediment basins	A	5	S	Protection measures – that is fencing off all water retaining structures with side slopes greater than 1 in 3 as described in International Erosion Control Association (Australasia) Table [illegible]	D	4	M	Designer/ Contractor

RISK ASSESSMENT AND CONTROL

Risk Assessment			
Select **one** category from each of the columns below that best represents the likely outcome if the potential hazard actually did occur. For each consequence consider the **most likely outcome** and **not** the "absolute worst" case.			
Consequence		**Likelihood**	
A	Death – major environmental damage	1	Certain
B	Permanent Disability – severe environmental damage	2	Probable
C	Lost Time Injury – moderate environmental damage	3	Possible
D	Medical Treatment Injury – minor environmental damage	4	Unlikely
E	First Aid Treatment	5	Very Unlikely

H: High Risk — **S: Significant Risk**

M: Moderate Risk — **L: Low Risk**

Read the Risk Rating from the matrix below:

Risk Assessment Matrix	A	B	C	D	E
1	H	H	H	S	S
2	H	H	S	S	M
3	H	H	S	M	L
4	H	S	M	L	L
5	S	S	M	L	L

RISK RATING

Certain - means an event or situation that is happening more or less all the time, including continuous situations
Permanent Disability – means a disability, such as loss of a limb or eyesight, loss of hearing, chronic skin disorder, chronic back disorder, emphysema, and the like
Probable – means an event or situation that occurs or is likely to occur about ten times or more per year
Possible – means an event or situation that occurs or is likely to occur about once per year
Unlikely – means an event or situation that occurs or is likely to occur less frequently than once every ten years

Issued 2nd February 2021 Rev - A

DO NOT SCALE THIS DRAWING
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REVISIONS

No	Description	Date	By
A	FOR APPROVAL	02.02.2021	RW

Client

North Harbour

BULK EARTHWORKS

Approved Director - RPEQ 17544

Drawing Title
SAFETY IN DESIGN

Drawn	Designed	Checked	Date
RW	JB	MAS	FEB 21

Scale	Sheet
AS SHOWN	09 of 09

	Drawing No	Revision
A1	20-185- 09	A

Appendix 2 – Tree Details

Tree ID	Common Name	Tree Species	DBH (cm)	Height (m)	Canopy Spread (m)	Habitat Tree	Habitat Features	Notes	Remove/Retain
1	QLD blue gum	*Eucalyptus tereticornis*	32	20	9				Retain
2	QLD blue gum	*Eucalyptus tereticornis*	25	19	4				Retain
3	QLD blue gum	*Eucalyptus tereticornis*	20	17	3				Retain
4	QLD blue gum	*Eucalyptus tereticornis*	19	18	3				Retain
5-16	Broad-leaved paperbark	*Melaleuca quinquenervia*	21, 30, 35, 22, 20, 28, 32, 38 (2 stems), 19, 16, 12, 23	6-10	3-6				Remove
17-23	Swamp oak	*Casuarina glauca*	28, 26, 24 (2 stems), 20, 19, 16, 16	6-8	2-4				Remove
24	Broad-leaved paperbark	*Melaleuca quinquenervia*	32	8	4				Remove
25	Snow-in-summer	*Melaleuca linariifolia*	32	5	5				Remove
26	Snow-in-summer	*Melaleuca linariifolia*	30	5	5				Remove
27	Broad-leaved paperbark	*Melaleuca quinquenervia*	19 + 24 + 12	7	4				Remove
28	Broad-leaved paperbark	*Melaleuca quinquenervia*	29	7	3				Remove
29	QLD blue gum	*Eucalyptus tereticornis*	50	20	12				Retain
30	Stag		40	19		Yes	Hollows		Remove
31	Broad-leaved paperbark	*Melaleuca quinquenervia*	29	7	4				Remove
32	Broad-leaved paperbark	*Melaleuca quinquenervia*	16	4	2				Remove
33	QLD blue gum	*Eucalyptus tereticornis*	31	15	6				Remove
34	QLD blue gum	*Eucalyptus tereticornis*	20	6	3				Remove
35	QLD blue gum	*Eucalyptus tereticornis*	62	25	15				Remove
36	Grey ironbark	*Eucalyptus siderophloia*	48	25	12				Remove
37	QLD blue gum	*Eucalyptus tereticornis*	65	28	15				Remove
38	QLD blue gum	*Eucalyptus tereticornis*	15	8	3				Remove
39	QLD blue gum	*Eucalyptus tereticornis*	25	20	6				Remove
40	Broad-leaved paperbark	*Melaleuca quinquenervia*	22	6	4				Remove
41	Cheese tree	*Glochidion ferdinandi*	20	5	5				Remove
42	Pink bloodwood	*Corymbia intermedia*	25	10	9				Remove
43	Snow-in-summer	*Melaleuca linariifolia*	26 + 29	6	4				Remove
44	Snow-in-summer	*Melaleuca linariifolia*	41 + 36 + 35	8	8				Remove
45	Broad-leaved paperbark	*Melaleuca quinquenervia*	29	8	3				Remove
46	Broad-leaved paperbark	*Melaleuca quinquenervia*	54 + 43	10	8				Remove
47	Grey ironbark	*Eucalyptus siderophloia*	32 + 50	20	8			Dead	Remove
48	Broad-leaved paperbark	*Melaleuca quinquenervia*	55	19	8				Remove
49	Broad-leaved paperbark	*Melaleuca quinquenervia*	30	8	4				Remove
50	Broad-leaved paperbark	*Melaleuca quinquenervia*	35	7	3				Remove
51	Snow-in-summer	*Melaleuca linariifolia*	34	6	6				Remove
52	Broad-leaved paperbark	*Melaleuca quinquenervia*	30	8	3				Remove
53	Broad-leaved paperbark	*Melaleuca quinquenervia*	35	8	5				Remove
54	Broad-leaved paperbark	*Melaleuca quinquenervia*	37	8	6				Remove
55	Broad-leaved paperbark	*Melaleuca quinquenervia*	20 + 19 + 12 + 10	7	4				Remove

Tree ID	Common Name	Tree Species	DBH (cm)	Height (m)	Canopy Spread (m)	Habitat Tree	Habitat Features	Notes	Remove/Retain
56	Broad-leaved paperbark	*Melaleuca quinquenervia*	31	7	4				Remove
57-63	Broad-leaved paperbark	*Melaleuca quinquenervia*	45, 27, 28, 38, 30, 44, 42	7-8	4-8				Retain
64-67	Swamp oak	*Casuarina glauca*	14, 15, 29, 27	7-8	2-4				Retain
68	Broad-leaved paperbark	*Melaleuca quinquenervia*	33	8	4				Remove
69	Broad-leaved paperbark	*Melaleuca quinquenervia*	32	8	4				Remove
70	Broad-leaved paperbark	*Melaleuca quinquenervia*	36	8	5				Remove
71	Pink bloodwood	*Corymbia intermedia*	27	18	5				Remove
72	QLD blue gum	*Eucalyptus tereticornis*	61	29	15				Remove
73	Broad-leaved paperbark	*Melaleuca quinquenervia*	36	10	4				Remove
74-79	Swamp oak	*Casuarina glauca*	19, 20, 22, 21, 26, 14	6-8	3-4				Remove
80	Red ash	*Alphitonia excelsa*	24	11	2				Remove
81	QLD blue gum	*Eucalyptus tereticornis*	25	16	3				Remove
82	Broad-leaved paperbark	*Melaleuca quinquenervia*	33	8	6				Remove
83	Broad-leaved paperbark	*Melaleuca quinquenervia*	56 + 62	12	10				Remove
84	Broad-leaved paperbark	*Melaleuca quinquenervia*	34	7	3				Remove
85-91	Broad-leaved paperbark	*Melaleuca quinquenervia*	42, 37, 33, 36, 30, 69 (2 stem), 32	8-10	4-6				Remove
92	QLD blue gum	*Eucalyptus tereticornis*	75	25	12				Remove
93	Broad-leaved paperbark	*Melaleuca quinquenervia*	60	20	12				Remove
94	Broad-leaved paperbark	*Melaleuca quinquenervia*	28	20	8				Remove
95-103	Broad-leaved paperbark	*Melaleuca quinquenervia*	27, 30, 34, 31, 49, 30, 31, 32, 70 (3 stem)	8-10	4-6				Remove
104	Foambark	*Jagera pseudorhus*	24	8	4				Remove
105	QLD blue gum	*Eucalyptus tereticornis*	24	20	3				Remove
106	Broad-leaved paperbark	*Melaleuca quinquenervia*	12	7	2				Remove
107	Broad-leaved paperbark	*Melaleuca quinquenervia*	18	7	2				Remove
108	Broad-leaved paperbark	*Melaleuca quinquenervia*	12	5	1				Remove
109	QLD blue gum	*Eucalyptus tereticornis*	15+17	15	2				Remove
110	QLD blue gum	*Eucalyptus tereticornis*	14	9	2				Remove
111	QLD blue gum	*Eucalyptus tereticornis*	30	20	5				Remove
112	QLD blue gum	*Eucalyptus tereticornis*	10	9	2				Remove
113	QLD blue gum	*Eucalyptus tereticornis*	72	29	12				Remove
114-137	Broad-leaved paperbark	*Melaleuca quinquenervia*	26, 13, 34, 42, 39, 30, 49, 30, 36, 28, 32, 27, 41, 42, 32, 22, 19, 33, 33, 35, 21, 26, 14, 22	7-12	2-8				Remove
138	Broad-leaved paperbark	*Melaleuca quinquenervia*	35	15	5				Remove
139	QLD blue gum	*Eucalyptus tereticornis*	47	27	10				Remove
140	QLD blue gum	*Eucalyptus tereticornis*	28	25	7				Remove
141	Broad-leaved paperbark	*Melaleuca quinquenervia*	36	12	6				Remove
142	Red ash	*Alphitonia excelsa*	15	5	2				Remove
143	Swamp box	*Lophostemon suaveolens*	31 + 37	15	8				Remove

Tree ID	Common Name	Tree Species	DBH (cm)	Height (m)	Canopy Spread (m)	Habitat Tree	Habitat Features	Notes	Remove/Retain
144-177	Broad-leaved paperbark	*Melaleuca quinquenervia*	30, 56 (2 stems), 48, 28, 21, 64 (2 stems), 35, 44, 53, 39, 50, 19, 22, 39, 65, 80 (2 stems), 36, 33, 37, 30, 30, 36, 31, 42, 38, 51, 46, 17, 38, 44, 21, 26, 51, 32	8-15	6-12				Remove
178	Red ash	*Alphitonia excelsa*	23	6	4				Remove
179	QLD blue gum	*Eucalyptus tereticornis*	10	6	2				Remove
180	QLD blue gum	*Eucalyptus tereticornis*	33	20	5				Remove
181	QLD blue gum	*Eucalyptus tereticornis*	11	10	2				Remove
182	QLD blue gum	*Eucalyptus tereticornis*	18	1	3				Remove
183	Narrow-leaved paperbark	*Melaleuca linariifolia*	38	8	6				Remove
184	QLD blue gum	*Eucalyptus tereticornis*	75	29	15				Remove
185	Broad-leaved paperbark	*Melaleuca quinquenervia*	45	15	7				Remove
186	Broad-leaved paperbark	*Melaleuca quinquenervia*	40	16	6				Remove
187	QLD blue gum	*Eucalyptus tereticornis*	80	25	12				Remove
188-193	Broad-leaved paperbark	*Melaleuca quinquenervia*	26, 30, 32, 32, 20, 26	6-8	4-6				Remove
194	QLD blue gum	*Eucalyptus tereticornis*	46	22	8				Remove
195	Narrow-leaved paperbark	*Melaleuca linariifolia*	35	8	6				Remove
196	QLD blue gum	*Eucalyptus tereticornis*	35	20	6				Remove
197	QLD blue gum	*Eucalyptus tereticornis*	40	20	8				Remove
198	QLD blue gum	*Eucalyptus tereticornis*	40	20	6				Remove
MIBA 104	QLD blue gum	*Eucalyptus tereticornis*	40	23	10				Retain
MIBA 105	QLD blue gum	*Eucalyptus tereticornis*	70	26	9				Retain
MIBA 106	QLD blue gum	*Eucalyptus tereticornis*	95	25	10				Remove
MIBA 107	QLD blue gum	*Eucalyptus tereticornis*	70	26	10				Remove

APPENDIX 3 – PEST AND INVASIVE SPECIES PLAN (JWA 2021C)

PEST AND INVASIVE SPECIES PLAN

North Harbour
Flood Mitigation Works

A Report Prepared for
North Harbour Holdings Pty Ltd

AUGUST 2021

JWA PTY LTD
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DOCUMENT CONTROL

Document

Title	Pest and Invasive Species Plan, North East Business Park – Flood Mitigation Works
Job Number	Q15003
File Reference	\\SERVER\data\QLD CLIENT FILES\15003_North East Business Park, Morayfield\Reports\Land Based Env Mgt Plan
Version and Date	RW3 11/08/21
Client	North Harbour Holdings Pty Ltd

Revision History **(office use only)**

Issue	Version	Draft/Final	Date Sent	Distributed to	No. Copies	Media	Delivery Method
1	RW1	DRAFT	05/08/21	JWA	1	Word	Email
2	RW2	DRAFT	09/08/21	Client	1	.pdf	Email
3	RW3	FINAL	11/08/21	Client	1	.pdf	Email

Client Issue

Version	Date	Author		Approved by	
		Name	Initials	Name	Initials
RW2	09/08/21	Belinda Whyburn / Adam McArthur	BW / AM	Adam McArthur	AM
RW3	11/08/21	Belinda Whyburn / Adam McArthur	BW / AM	Adam McArthur	AM

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1 INTRODUCTION

1.1 Background

JWA Pty Ltd has been engaged by North Harbour Holdings Pty Ltd (formerly North East Business Park Pty Ltd) to prepare a Pest and Invasive Species Plan (PISP). The PISP forms part of the Land-based Environmental Management Plan (LBEMP) sub-plan 07 developed for the proposed excavation of an unmapped drainage corridor for flood mitigation within the North East Business Park (NEBP) development.

This PISP provides details regarding the processes involved with works and management of pests and invasive species during the bulk earthworks phase. It should be noted that management of weeds and pests following this stage will be covered by other management plans e.g. Site Rehabilitation Plan, Biting Insect Management Plan.

1.2 The Subject Site

The site is located at Nolan Drive, Morayfield and is formally described as Lot 3 SP266287, Lot 997 SP309372, Lot 998 SP283244 and Lot 2000 SP309388 (**FIGURE 1**). The site is approximately 4.87 ha. An aerial photograph of the site is shown in **FIGURE 2**.

The site is undulating and partially vegetated by native open forest and disturbed grassland. A drainage line runs north-south through the area, draining into Raff Creek to the north. The Caboolture River is to the north of the subject area. To the west of the site lies residential properties, while the other boundaries are comprised of paddocks.

1.3 The Proposed Works

The works program covered by the LBEMP Sub-Plan 07 are for flood mitigation and will involve reshaping the bed level of the unmapped drainage corridor, and the creation of a flood water diversion channel as shown in **ATTACHMENT 1**. Works will include the widening and deepening of an approximately 500 m section of an unmapped drainage corridor, excavation of an approximately 400 m flood water diversion channel to the east of the unmapped drainage corridor and construction of two (2) culverts - one (1) pipe culvert across the unmapped drainage corridor and one (1) box culvert across the flood water diversion channel (**ATTACHMENT 1**). These works will increase water retention and splitting of larger flood events (greater than Q20 year events) which will improve the flow of flood events through the North Harbour development.

1.4 Objectives

The PISP is intended to assist North Harbour Holdings Pty Ltd in managing the impacts of pest and invasive species (flora and fauna) before, during, and after construction.

LEGEND

- Extent of Works
- NEBP Site Boundary

Scale 1:40 000 - Lengths in metres

400 0 400 800 1200 1600 2000

SOURCE: Google Maps SCALE: 1 : 40 000 @ A3 *JWA Pty Ltd* *Ecological Consultants*	CLIENT North Harbour Holdings Pty Ltd PROJECT Pest and Invasive Species Plan North Harbour Flood Mitigation Works Nolan Drive, Morayfield QLD Moreton Bay Regional Council LGA	FIGURE 1 PREPARED: BW DATE: 05 August 2021 FILE: Q15003_UnnamedCk_20210805.dwg	TITLE LOCALITY PLAN

LEGEND

- Extent of Works
- Cadastre Boundary

N

Scale 1:3000 - Lengths in metres

50 0 50 100 150 200

SOURCE: QLD Globe May 2020 Aerial Photo

SCALE: 1 : 3000 @ A3

JWA Pty Ltd
Ecological Consultants

CLIENT
North Harbour Holdings Pty Ltd

PROJECT
Pest and Invasive Species Plan
North Harbour Flood Mitigation Works
Nolan Drive, Morayfield QLD
Moreton Bay Regional Council LGA

FIGURE 2

PREPARED: BW
DATE: 05 August 2021
FILE: Q15003_UnnamedCk_20210805.dwg

TITLE

AERIAL PHOTOGRAPH

The aim of the PISP is to develop a comprehensive and integrated approach to guide the short- and long-term management of pests and invasive species within open space areas of the MIBA site.

Specific objectives of the PISP are to:

- Identify pests and invasive species (flora and fauna) that have been, or are likely to be, recorded on the subject site;
- Prioritise management based on species;
- Develop methods to examine, control, and/or eradication 'high priority' weeds and invasive species; and
- Recommend long-term control methods, including monitoring and reporting.

1.5 Format of the PISP

The PISP is structured as follows:

1. Introduction;
2. Existing Ecological Values;
3. Weed Management;
4. Pest Control; and
5. Monitoring and Reporting.

2 EXISTING ECOLOGICAL VALUES

2.1 Background

An Ecological Assessment of the subject site has previously been completed (JWA 2021). This assessment included identification of vegetation communities and threatened flora on site, along with a brief fauna survey. No Commonwealth or State listed threatened flora or fauna species were recorded on the subject site. However, several threatened fauna species were considered possible occurrences.

2.2 Vegetation Communities

2.2.1 Introduction

Three (3) broad vegetation communities were identified on the subject site. This section provides a description of each of the vegetation communities and a discussion of the condition and conservation status of each. The conservation status of vegetation communities is discussed with reference to the Regional Ecosystem Description Database (Queensland Herbarium 2019) and the Queensland *Vegetation Management (VM) Act 1999* where appropriate.

2.2.2 Community 1: Coastal and Subcoastal Floodplain Tree Swamps – Melaleuca and Eucalypt

Location and Area
This wetland community is located along the unmapped drainage corridor, beyond the tidal influence (**FIGURE 3**).

Description
The unmapped drainage corridor is a wide, highly ephemeral drainage gully with shallow, low sloping banks.

Canopy species include Broad-leaved paperbark (*Melaleuca quinquenervia*), Queensland blue gum (*Eucalyptus tereticornis*), Grey ironbark (*Eucalyptus siderophloia*), Pink bloodwood (*Corymbia intermedia*) and Swamp sheoak (*Casuarina glauca*). Sometimes the Eucalypts are emergent.

The understorey is dominated by a combination of native species and introduced plants. Native species Narrow-leaved paperbark (*Melaleuca linariifolia*), Umbrella cheese tree (Gloc*hidion sumatranum*), Red ash (*Alphitonia excelsa*) and Acacia spp. Introduced species include Slash pine (*Pinus elliotti**), Broadleaved pepper tree (*Schinus terebinthifolia**), Groundsel bush (*Baccharis halimifolia**), Lantana (*Lantana camara**), Devils fig (*Solanum torvum**) and Wild tobacco (*Solanum mauritianum**).

The groundcover includes some native species but was mostly exotic species. Native species include Saw sedge (*Gahnia sieberiana*), Phragmites (*Phragmites australis* - can have a weedy habit), Jointed rush (*Juncus kraussii*), Snake vine (*Stephania japonica*). Phragmites and Ghania were locally dominant in some areas of the community when associated with

LEGEND

- Extent of Works
- Cadastre Boundary
- Indicative Weed Monitoring Location

Vegetation Communities

- Community 1: Coastal and Subcoastal Floodplain Tree Swamps - Melaleuca and Eucalypt
- Community 2: Wet Terrestrial Grassland
- Community 3: Disturbed Terrestrial Grassland

N

Scale 1:3000 - Lengths in metres

50 0 50 100 150 200

SOURCE: JWA Site Investigations Feb 2021
QLD Globe May 2020 Aerial Photo

SCALE: 1 : 3000 @ A3

JWA Pty Ltd
Ecological Consultants

CLIENT
North Harbour Holdings Pty Ltd

PROJECT
Pest and Invasive Species Plan
North Harbour Flood Mitigation Works
Nolan Drive, Morayfield QLD
Moreton Bay Regional Council LGA

FIGURE 3

PREPARED: BW
DATE: 05 August 2021
FILE: Q15003_UnnamedCk_20210805.dwg

TITLE VEGETATION COMMUNITIES & INDICATIVE MONITORING LOCATION

the drainage line. Introduced species include Fleabane (*Conyza sp.**), Blue billygoat weed (*Agerarum houstonianum**), Annual ragweed (*Ambrosia artemisiifolia**), Cobbler's pegs (*Bidens Pilosa**), Bindweed (*Convolvulus sp.**), Common couch (*Elymus repens**), Siratro (*Macroptilium atropurpurem**), Red natal grass (*Melinis repens**), Bitter melon (*Momordica charantia**), and Brazilian vervain (*Verbena brasiliensis**).

Condition
Most of this community is in moderate condition.

Conservation Status
This area is not mapped as remnant vegetation and therefore has no conservation status under the *VM Act 1999*.

2.2.3 Community 2: Wet Terrestrial Grassland

Location and Area
This community is located within the drainage line beyond the tidal influence (**FIGURE 3**).

Description
Groundcovers include both exotic pasture herbs and grasses and native species. Native species include *Cyperus sp.*, *Persicaria* sp., *Tricoryne sp., B*lady grass (*Imperata cylindrica*) and *Paspalum* sp. pasture grasses. Introduced species include rat's tail grass (*Sporobolus* sp.*), *Cynodon dactylon**, *Lepidium* sp.*, and *Conyza* sp.*.

Condition
This vegetation community it is in poor condition given the lack of a shrub or tree layer. Grazing impacts are evident.

Conservation Status
This area is not mapped as remnant vegetation and has no conservation status under the *VM Act 1999.*

2.2.4 Community 3: Disturbed Terrestrial Grassland

Location and Area
This community is located over a large portion of the site (**FIGURE 3**).

Description
This community is comprised of open pasture with the occasional regrowth Acacia spp., Paperbark or clump of Lantana. There is also the occasional melon hole populated with sedges such as *Cyperus polystachyos*, *Fimbristylis spp.*, *Juncus spp.*, and Frogsmouth (Ph*ilydrum lanuginosum*). Pasture grasses include *Paspalum sp.** and *Cynodon dactylon**. Introduced species include rat's tail grass (*Sporobolus sp.**), *Convolvulus sp.**, *Lepidium sp.**, *Conyza sp.**, and *Passiflora subpeltata*.

Condition

As grazing pasture this community is in good condition with only light grazing impacts. As a vegetation community it is in poor condition given the lack of a shrub or tree layer.

Conservation Status
This area is not mapped as remnant vegetation and has no conservation status under the *VM Act 1999*.

2.3 Significant Flora and Fauna Species

No flora or fauna species listed as threatened under either the Commonwealth *Environment Protection Biodiversity and Conservation (EPBC) Act* (*1999*) or Queensland *Nature Conservation (NC) Act (1992)* have been recorded on the subject site (JWA 2021).

2.4 Fauna Habitat

Habitat suitability assessments of the threatened and migratory fauna species that are known to occur or are considered possible occurrences in the locality determined that seven (7) threatened species had reasonable potential to be present within the subject site. These species are listed below:

- Grey-headed flying fox (*Pteropus poliocephalus*).
- Koala (*Phascolarctos cinereus*);
- Osprey (*Pandion haliaetus*);
- Rainbow bee-eater (*Merops ornatus*);
- Swift parrot (*Lathamus discolor*);
- Wallum froglet (*Crinia tinnula*); and
- White-throated needletail (*Hirundapus caudacutus*).

3 WEED MANAGEMENT

3.1 Introduction

The focus for weed management is the removal of existing weeds and prevention of further infestations. Weed control will also occur as part of landscaping and rehabilitation works associated with the development and will be described in a separate management plan.

3.2 Weeds on Site

Several weeds have been recorded on the subject site. The following are some of the major weed species identified:

- Lantana* (*Lantana camara*) - Weed of National Significance (WoNS), Class 3 declared weed;
- Annual ragweed* (*Ambrosia artemisiifolia*)- Class 3 declared weed;
- Broadleaved pepper tree* (*Schinus terebinthifolia*)- Class 3 declared weed;
- Groundsel bush* (*Baccharis halimifolia*)- Class 3 declared weed; and
- Rat's tail grass* (Sporobolus sp.) - Class 3 declared weed.

3.3 Weed Species Management Protocols

The weed species management protocols are as follows:

1. No soil disturbance is to occur within areas of retained vegetation. Soil disturbance within retained vegetation and any areas to be landscaped shall be kept to a minimum to avoid weed recruitment.
2. All nursery stock for landscaping purposes shall be weed, pest and disease free and certified as such by the supplier where feasible. The certificates are to be obtained prior to the commencement of any regeneration/revegetation works on site.
3. All mulch produced on site (by mulching cleared vegetation and trees) shall specifically exclude fertile material from weed species (where a risk of proposition exists) and be stored outside of the retained vegetation. Vegetation mulching will be suitably controlled to avoid contamination. Any fertile weed material will be transported from the site to an approved disposal facility.
4. Weed or potential weed species shall not be planted during landscaping operations.
5. Weeds on the subject site will be managed using suitable control measures (i.e. chemical and/or physical control) as outlined in **ATTACHMENT 2**.
6. Clearing operations are to ensure that propagative material from cleared weeds does not spread across the site. Vehicles, earthworks machinery, clothing and other equipment must not introduce weed material to the site or spread such material throughout the site. Vehicles and machinery are to be cleaned in accordance with

the Vehicle and Machinery Cleandown Procedures (QLD Department of Agriculture and Fisheries 2019).

7. Weed monitoring will occur monthly as per **SECTION 5.2.**

Specific weed control methodology is contained within **ATTACHMENT 2**.

4 PEST CONTROL

4.1 Introduction

The focus for pest management is the prevention of further pest infestations through implementation of precautions during construction and through development/landscaping design. The following sections provides guidance on the specific measures to be implemented for pests and invasive species likely to occur.

4.2 General

A general induction of all construction personnel will aim to ensure awareness of pest animal, and the related issues, responsibilities and mitigation procedures. An induction should cover include the following (as a minimum):

- Pest species covered by the PISP and relevant / helpful key identification tools;
- Biosecurity procedures to ensure high risk species such as fire ants/yellow crazy ants are not brought onto the site via construction equipment etc.
- Strict adherence to a no domestic dogs policy on the subject site during construction; and
- Requirement to report any direct or indirect evidence of pest animals (sightings, footprints, scats, dead or injured native fauna).

4.3 Dog (*Canus familiaris*) Management

On the subject site, any risks to native fauna mortality or injury are most likely to result from domestic dogs that are introduced by construction personnel, or that may roam from nearby properties. Domestic dogs are particularly of concern for their potential to cause injury or death to koalas in the area. The following measures are recommended:

- Construction personnel are prohibited from bringing dogs onto the site.
- Any sightings of dogs during bulk earthworks are to be immediately reported to the site foreman.
- Moreton Bay Regional Council (MBRC) will be contacted to assist with the containment and/or removal of feral dogs or roaming domestic dogs.

4.4 Cane Toad (*Bufo marina*) Management

Cane toads occur across most of QLD and almost all of Southeast Queensland (SEQ) (Kearney et al. 2008). It is important to maintain or lower cane toad abundance in order to minimise impacts as prey (i.e. due to their high level of toxicity) and as predators / competitors on small native animals such as frogs. The following measures are expected to ensure cane toad numbers on subject site are reduced and/or remain low:

- Construction materials to be brought on site, including soils and landscaping materials, must be inspected for cane toads.
- Development activities must not create areas where water may pool and stagnate, thereby creating habitat for cane toads.
- Any construction or reprofiling of drainage lines should encourage flow and regular flushing, and incorporate dense fringing vegetation to discourage cane toads
- Dense plantings should be incorporated into landscaping around newly created waterways and wetlands (e.g. stormwater detention basins, lakes etc.) to discourage access by cane toads.

4.5 Fire Ants (*Solenopsis invicta*) and Yellow Crazy Ant (*Anoplolepis gracilipes*) Management

Fire ants are considered to be a super pest because of their aggressive and highly adaptive nature (DAF 2019). Nests can also be found next to or under objects on the ground, such as timber, logs, rocks, pavers or bricks, and disturbed ground around pots and buildings (Business Queensland 2019). Fire ant species can cause immense damage to the environment and industries that rely on it. They can also be dangerous to human health due to painful stings and possible allergic reactions.

Yellow crazy ants have been detected in residential, industrial, commercial, agricultural and forest environments in coastal areas of QLD and in some suburbs in SEQ. The species will typically nest in areas with access to water or some moisture e.g. along creek banks, in utility service pits or piles of timber, under logs, debris or leaf litter, and around perimeters of buildings and within retaining walls where moisture is retained (DAF 2020).

The following measures are recommended to minimise the risk of introduction, and to manage any unavoidable infestation:

- Personnel are to receive training prior to commencement of works in general fire/yellow crazy ant identification and biosecurity requirements.
- All materials imported to the site that may contain fire ants, including soil, turf, mulch etc, must be obtained in compliance with the fire ant biosecurity measures contained within the Biosecurity Regulation 2016.
- Development activity should avoid (where practical) the build-up of construction / landscaping materials (e.g. timber, logs, stones) to minimise opportunities for nesting.
- Development activities must not create areas where water may pool and stagnate, thereby increasing the suitability of nesting habitat for yellow crazy ants.
- Biosecurity QLD should be notified within 24 hours of any potential fire ant or yellow crazy ant presence.

4.6 Mosquitofish Management

Mosquitofish occupy shallow, slow moving waterbodies and are predators and/or competitors of small native fish and tadpoles. The following measures are recommended to discourage their presence on the subject site.

- Development activities must not create areas where water may pool and stagnate, thereby creating habitat for mosquito fish.
- Any construction or reprofiling of drainage lines should encourage flow and regular flushing and incorporate dense fringing vegetation to discourage mosquitofish.

4.7 Mosquito and Biting Midge Management

The North Habour and broader locality support habitat resources for a mosquito and biting midge species that have the potential to impact on existing and future residents and users of the locality. The freshwater and saline wetlands and waterbodies within the locality presently provide a range of different habitat types for mosquito species known to be pests and vectors of communicable human viruses within the Moreton Bay Region. These habitats include the following:

- Slightly brackish and freshwater pools in Paperbark wetlands and mangroves provide habitat for *Verrallina funerea* and *Ochlerotatus vigilax*, which are known vectors of Ross River Virus and Barmah Forest fever. Both species are most frequently experienced at pest levels in areas situated within 5 km of breeding grounds.
- Freshwater pools provide habitat for *Culex annulirostris, Oclherotatus notoscriptus, Coquillettidia linealis* and *Culex quinquefasciatus*, which are known vectors of viruses such as Ross River Virus, Barmah Forest Virus, Australian Encephalitis, Japanese Encephalitis, Murray Valley Encephalitis and Kunjin.
- Intertidal and brackish pools provide habitat for *Culex sitiens* and *Aedes alterans*, both known to be vectors of Ross River Virus.

Biting midges breed in environments, ranging from rainforests to coastal foreshores and estuarine systems. Biting midges are not known to transmit disease amongst humans and as such do not possess the same public health management risk as mosquitoes. Nevertheless, biting midge may during periods of high abundance cause discomfort to people in close proximity to midge breeding/larval habitats. It is likely that the NEBP site provides habitat for the several pestiferous species of biting midges, namely *Culicoides subimmaculatus, C. molestus* and *C. longior*. In addition to these species, *C. ornatus*, which appears to be undergoing a range expansion south of the Hervey Bay region, is also likely to be encountered. The main areas of potential breeding habitat for these species are the tidally influenced flats and banks of the Caboolture River and Raff Creek.

Control methods for mosquitos/midges during the earthworks phase includes the following:

- Pools of standing water, which may provide breeding habitat for some species of biting insect, will not be allowed to form.

- In the event that an increase in biting insects is noted through complaints from adjacent properties, the contractor and proponent will work with relevant MBRC officers to determine the source of the problem and undertake rectification as per current MBRC procedures.

5 MONITORING AND REPORTING

5.1 Introduction

To achieve the objectives of the PISP it will be necessary to monitor populations of weeds and pest species. This section outlines monitoring requirements during construction.

5.2 Weed Monitoring

5.2.1 Introduction

Monitoring is crucial in ensuring the continuing success of the weed control methods. Monitoring of the following areas for appearance of new weeds will be undertaken during earthworks:

- Vehicle washdown areas and adjacent overflows;
- Active construction areas;
- Stockpile/laydown areas;
- Areas of retained vegetation; and
- Other vulnerable areas as identified by the Environmental Manager or ecologist.

5.2.2 Active Construction Zones

The Contractor, specifically their appointed Environmental Manager, is responsible for undertaking monthly inspections of vehicle washdown areas and overflows, stockpile/laydown areas, and the general active construction zone to ensure appropriate weed hygiene measures as outlined in this plan are properly implemented. Spot checks of vehicles, machinery, equipment and materials are also to be undertaken.

5.2.3 Retained Vegetation

5.2.3.1 Introduction

Areas of retained vegetation immediately adjacent to the construction area must be regularly monitored for weeds by the ecologist, to ensure the efficacy of the control methods in this PISP and to detect and manage infestations in a timely manner.

5.2.3.2 Baseline Monitoring

Baseline data will be gathered by the ecologist prior to commencement of works to assist in documenting any changes in weed diversity and numbers due to earthworks activities.

Monitoring locations will be selected based on potential for disturbance and to cover a variety of habitat types. Plot-based surveys (20m x 20m) will be undertaken at each monitoring location and will include an estimate of the percentage (%) cover in the plot of individual weed species and a count of the number of each species. A baseline monitoring proforma is contained in **ATTACHMENT 3**. Indicative monitoring locations are shown in

FIGURE 3. Visual inspection of all other retained vegetation areas will also be completed whilst moving between monitoring sites, and any weed infestations noted for control.

5.2.3.3 Monitoring During Construction

Monitoring will continue as described for the baseline monitoring. Monitoring will be completed six (6) monthly during bulk earthworks, and will continue for a period of six (6) months following completion of bulk earthworks. Depending on the findings during the baseline monitoring (**SECTION 5.2.3.2)** the frequency monitoring during construction may be increased.

5.3 Pest Monitoring

Management of pests on the site will focus on prevention of infestations. Monitoring will therefore focus on ensuring that protocols are adhered to and implemented effectively. The Environmental Manager is responsible for weekly monitoring of the following:

- All soils, mulches, turf, plants and other materials brought on to the site are in compliance with the necessary measures under the Biosecurity Regulation 2016 in terms of Fire ant and Yellow crazy ant control;
- No pools of standing water are allowed to form on the site, that may provide breeding opportunities for Cane toads or biting insects.

Compliance with 'No Dog' policies is to be monitored during bulk earthworks.

5.4 Reporting

The Environmental Manager is to prepare a report on a monthly basis outlining the following, as they pertain to their monitoring duties as per **SECTIONS 5.2.2** and **5.3**:

- Monitoring actions undertaken;
- Problems identified; and
- Actions taken to address identified problems.

Additionally, the ecologist will provide a monthly report outlining the results of weed monitoring in retained vegetation, any identified problems and recommended actions as per **SECTION 5.2.3**.

Reports are to be provided to MBRC, Queensland State Government Departments or the Commonwealth Department of Agriculture, Water and the Environment on request.

REFERENCES

Business Queensland (2019) Identifying fire ants. Business Queensland, Queensland Government. Available at: https://www.business.qld.gov.au/industries/farms-fishing-forestry/agriculture/land-management/health-pests-weeds-diseases/pests/fire-ants/fire-ants-qld/identifying.

DAF (2019) Fire ants. Department of Agriculture and Fisheries (DAF), Queensland Government. Available at: https://www.daf.qld.gov.au/business-priorities/biosecurity/invasive-plants-animals/ants/fire-ants.

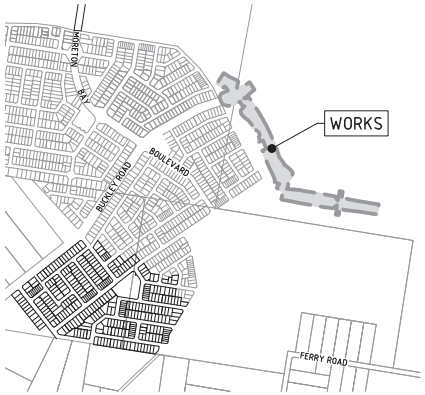
DAF (2019) Vehicle and machinery cleandown procedures. Department of Agriculture and Fisheries (DAF), Queensland Government. Available at: https://www.daf.qld.gov.au/__data/assets/pdf_file/0011/58178/cleandown-procedures.pdf

DAF (2020) Yellow crazy ants *Anoplolepis gracilipes*. Department of Agriculture and Fisheries (DAF), Queensland Government. Available at: https://www.daf.qld.gov.au/__data/assets/pdf_file/0011/76637/yellow-crazy-ant.pdf.

Kearney, M, Phillips, BL, Tracy, CR, Christian, KA, Betts, G & Porter, WP (2008) 'Modelling species distributions without using species distributions: the cane toad in Australia under current and future climates.' Ecography, vol. 31, pp. 423–434.

ATTACHMENT 1 – ENGINEERING DRAWINGS (KN GROUP 2021)

BULK EARTHWORKS AND CULVERTS



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DRAWING INDEX

DRAWING NO.	DRAWING TITLE
20-185-01	LOCALITY PLAN, DRAWING INDEX
20-185-02	EARTHWORKS CONTOUR PLAN
20-185-03	CULVERT DETAILS SHEET 1
20-185-04	CULVERT DETAILS SHEET 2
20-185-05	SEDIMENT AND EROSION CONTROL PLAN
20-185-06	SEDIMENT AND EROSION CONTROL NOTES
20-185-07	SEDIMENT AND EROSION CONTROL DETAILS
20-185-08	SEDIMENT AND EROSION BASIN NOTES
20-185-09	SAFETY IN DESIGN

DO NOT SCALE THIS DRAWING
IF IN DOUBT - ASK!

REVISIONS

No	Description	Date	By
A	FOR APPROVAL	02.02.2021	RW

NORTH

Client

BULK EARTHWORKS

Approved Director - RPEQ 17544

Drawing Title
LOCALITY PLAN,
DRAWING INDEX

Drawn	Designed	Checked	Date
RW	JB	MAS	FEB 21

Scale	Sheet
AS SHOWN	01 of 09

	Drawing No	Revision
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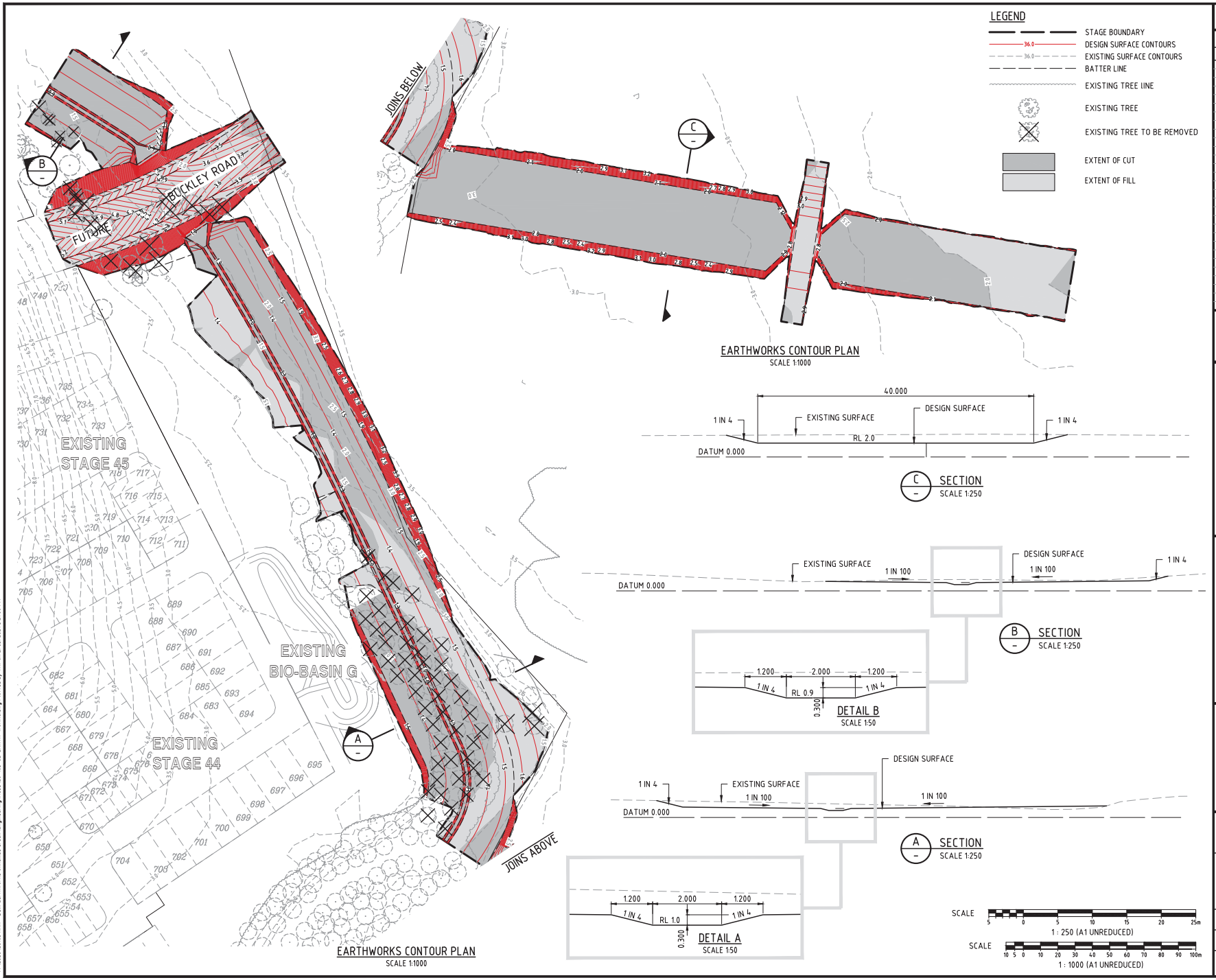

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REVISIONS

No	Description	Date	By
A	FOR APPROVAL	02.02.2021	RW

NORTH

Client

North Harbour
feel right at home

BULK EARTHWORKS

kn group

Approved Director - RPEQ 17544

Drawing Title

EARTHWORKS
CONTOUR PLAN

Drawn	Designed	Checked	Date
RW	JB	MAS	FEB 21

Scale	Sheet
AS SHOWN	02 of 09

Drawing No	Revision
20-185- 02	A

A1

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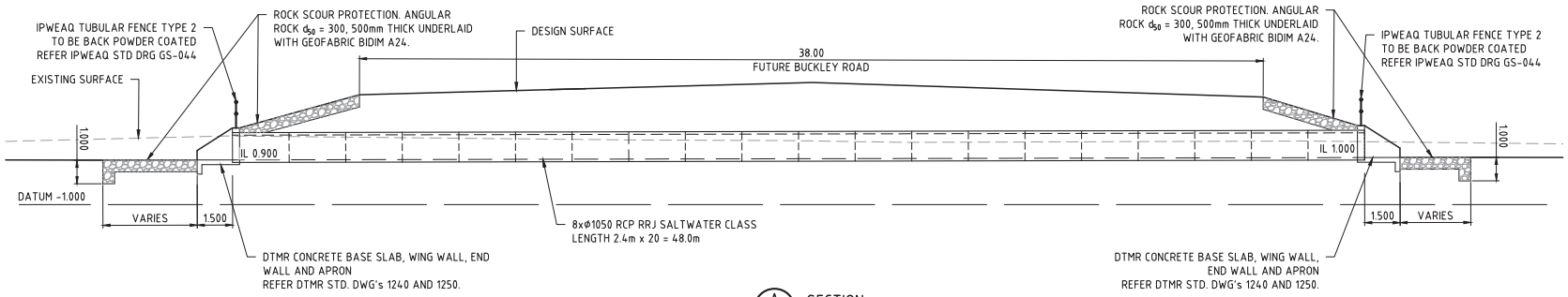

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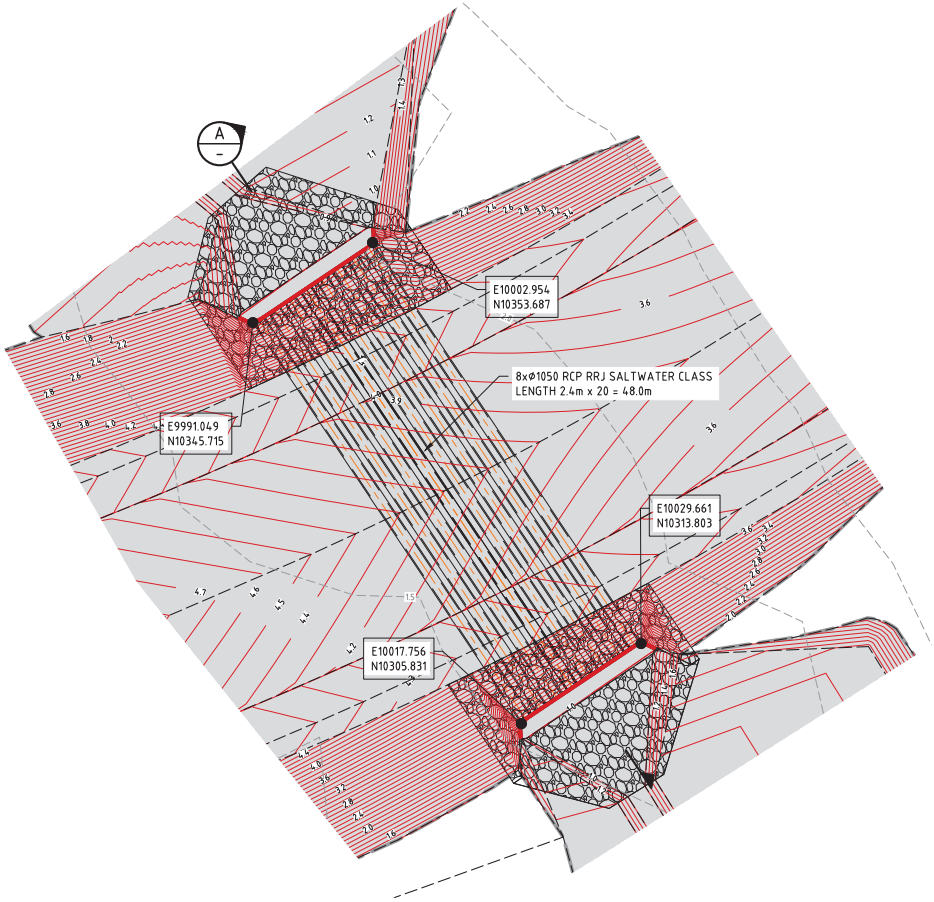

CULVERT DETAILS
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NOTE:
1. ALL CONCRETE IN HEADWALLS TO BE 40MPa AND 55mm MIN COVER
2. ALL REINFORCED CONCRTE PIPES TO BE RUBBER RING JOINT AND SALT WATER CLASS.

LEGEND
- STAGE BOUNDARY
- 36.0 DESIGN SURFACE CONTOURS
- 36.0 EXISTING SURFACE CONTOURS
- BATTER LINE

SCALE 1 0.5 0 1 2 3 4 5 6 7 8 9 10m
1 : 100 (A1 UNREDUCED)

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DO NOT SCALE THIS DRAWING
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REVISIONS

No	Description	Date	By
A	FOR APPROVAL	02.02.2021	RW

NORTH

Client: North Harbour

BULK EARTHWORKS

kn group

Approved Director - RPEQ 17544

Drawing Title
CULVERT DETAILS
SHEET 1

Drawn	Designed	Checked	Date
RW	JB	MAS	FEB 21

Scale	Sheet
AS SHOWN	03 of 09

	Drawing No	Revision
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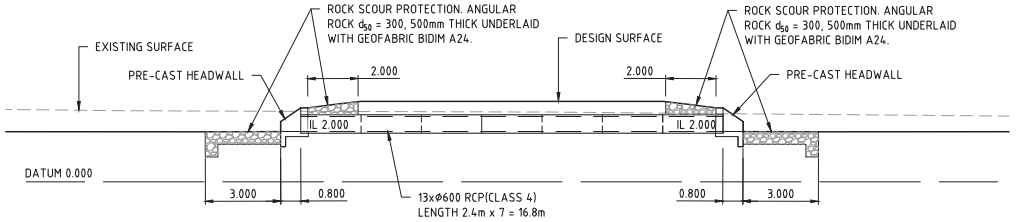

B – SECTION
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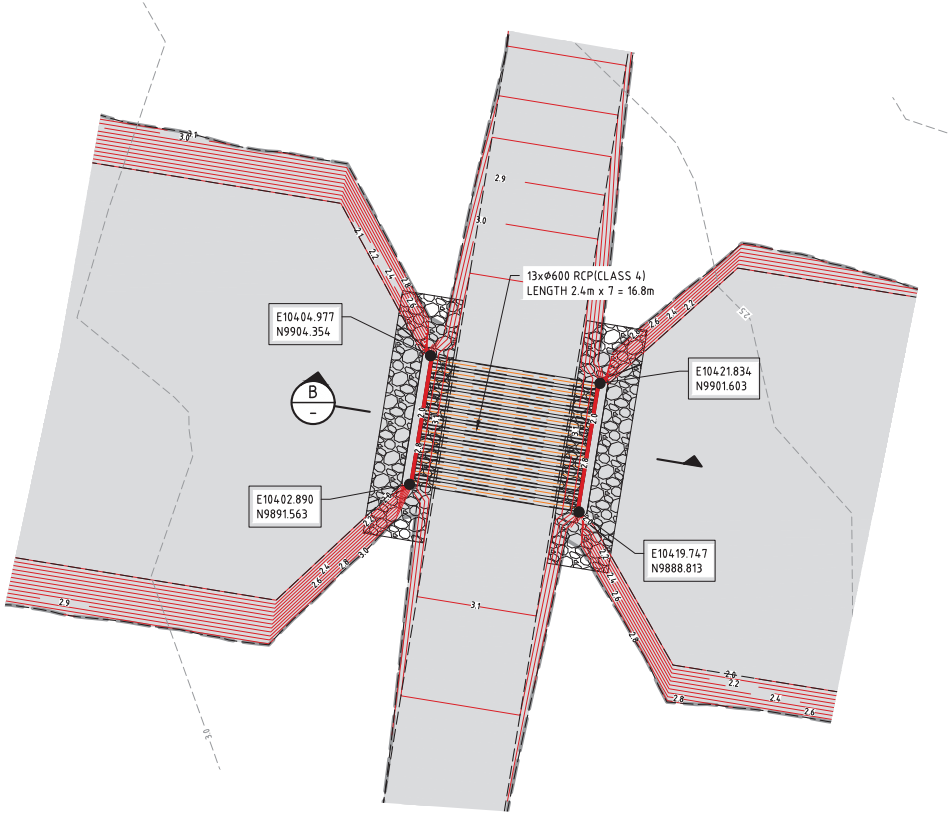

CULVERT DETAILS
SCALE 1:250

LEGEND

- STAGE BOUNDARY
- 36.0 DESIGN SURFACE CONTOURS
- 36.0 EXISTING SURFACE CONTOURS
- BATTER LINE

SCALE 1 0.5 0 1 2 3 4 5 6 7 8 9 10m
1 : 100 (A1 UNREDUCED)

SCALE 5 0 5 10 15 20 25m
1 : 250 (A1 UNREDUCED)

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REVISIONS

No	Description	Date	By
A	FOR APPROVAL	02.02.2021	RW

NORTH

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Drawing Title
CULVERT DETAILS
SHEET 2

Drawn	Designed	Checked	Date
RW	JB	MAS	FEB 21

Scale	Sheet
AS SHOWN	04 of 09

	Drawing No	Revision
A1	20-185- 04	A

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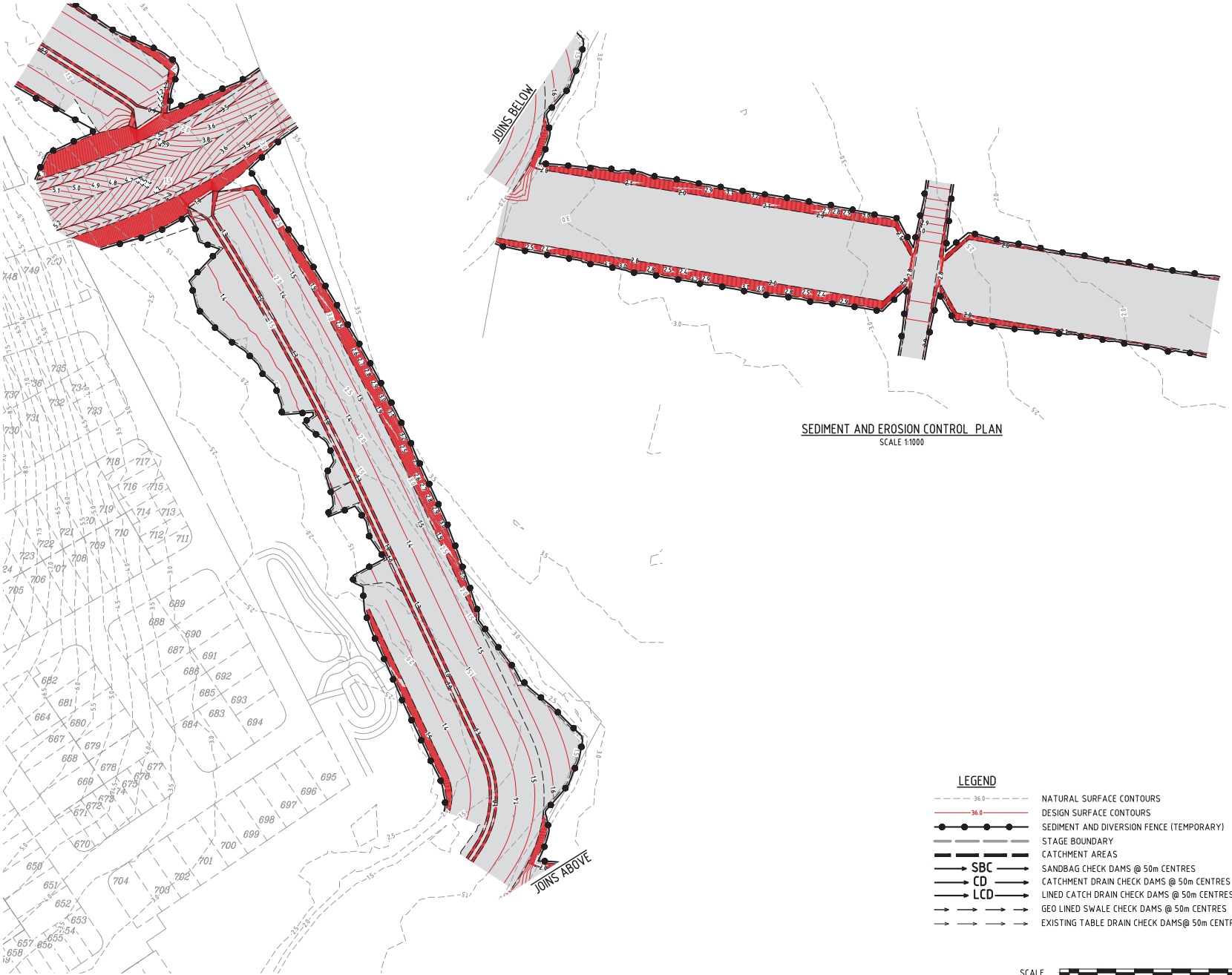

SEDIMENT AND EROSION CONTROL PLAN
SCALE 1:1000

SEDIMENT AND EROSION CONTROL PLAN
SCALE 1:1000

LEGEND

- NATURAL SURFACE CONTOURS
- DESIGN SURFACE CONTOURS
- SEDIMENT AND DIVERSION FENCE (TEMPORARY)
- STAGE BOUNDARY
- CATCHMENT AREAS
- SBC — SANDBAG CHECK DAMS @ 50m CENTRES
- CD — CATCHMENT DRAIN CHECK DAMS @ 50m CENTRES
- LCD — LINED CATCH DRAIN CHECK DAMS @ 50m CENTRES
- GEO LINED SWALE CHECK DAMS @ 50m CENTRES
- EXISTING TABLE DRAIN CHECK DAMS@ 50m CENTRES

SCALE 20 10 0 20 40 60 80 100 120 140 160 180 200m
1 : 2000 (A1 UNREDUCED)

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No	Description	Date	By
A	FOR APPROVAL	02.02.2021	RW

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Drawing Title

SEDIMENT AND EROSION CONTROL PLAN

Drawn	Designed	Checked	Date
RW	JB	MAS	FEB 21

Scale	Sheet
AS SHOWN	05 of 09

	Drawing No	Revision
A1	20-185- 05	A

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EROSION AND SEDIMENT CONTROL PROGRAM

1. THIS PROGRAM AND ASSOCIATED PLANS SHOULD BE READ IN CONJUNCTION WITH THE SITE MANAGEMENT SPECIFICATION INCORPORATED IN THE CONTRACT DOCUMENTS. THE PROVISIONS OF THE SPECIFICATION ARE TO BE STRICTLY ADHERED TO.
2. THE BASIC OBJECTIVES OF THE EROSION AND SEDIMENT CONTROL ARE:
   I. IDENTIFY CRITICAL AREAS AND PROVIDE APPROPRIATE ATTENTION TO THOSE AREAS.
   II. PLAN SITE LAYOUTS SO THAT ACCESS TO ALL REQUIRED DRAINAGE EROSION AND SEDIMENT CONTROL MEASURE IS MAINTAINED.
   III. LIMIT EXPOSURE TIME BY PROGRAMMING TO MINIMISE THE AREA OF LAND EXPOSED TO POTENTIALLY ADVERSE WEATHER CONDITIONS AT ANY ONE TIME. I.E. PROGRESSIVELY CLEAR AND REVEGETATE.
   IV. PROVIDE CONTROL MEASURES INCLUDING TEMPORARY AND PERMANENT DRAINAGE, EROSION AND SEDIMENT CONTROLS.
3. THE EROSION AND SEDIMENT CONTROL SHALL COMPLY WITH BEST PRACTICE FOR EROSION AND SEDIMENT CONTROL, THE POLLUTION CONTROL MANUAL FOR URBAN STORMWATER MANAGEMENT, THE QUEENSLAND URBAN DRAINAGE MANUAL, THE SOIL EROSION AND SEDIMENT CONTROL – ENGINEERING GUIDELINES FOR QUEENSLAND (CURRENT EDITIONS) AND INTERNATIONAL EROSION CONTROL ASSOCIATION (ICEA).
4. CONSTRUCTION SEQUENCE THE CONSTRUCTION SEQUENCE WILL GENERALLY BE:
   I. OBTAIN ALL NECESSARY PERMITS AND APPROVALS BEFORE SITE ESTABLISHMENTS.
   II. HOLD A PRE-CONSTRUCTION CONFERENCE.
   III. STABILISE ALL CONSTRUCTION ACCESS ROUTES AND ENTRY/EXIT POINTS.
   IV. ESTABLISH SEDIMENT CONTROL STRUCTURES AND TEMPORARY DRAINAGE CONTROL MEASURES AS NECESSARY.
   V. CARRY OUT BULK EARTHWORKS.
   VI. MAINTAIN AND REPAIR DRAINAGE, EROSION AND SEDIMENT CONTROL MEASURES.
   VII. REMOVE SEDIMENT CONTROL MEASURES WHEN THE SITE IS STABILISED. I.E. >70% GROUND COVER
   VIII. THE CONTRACTOR SHALL PREPARE A SUPPLEMENTARY EROSION AND SEDIMENT CONTROL PLAN TO SUIT HIS/HER CONSTRUCTION METHODOLOGY, AND SUBMIT THIS PLAN FOR APPROVAL TO THE SUPERINTENDENT. IT SHOULD BE NOTED THAT ANY SIGNIFICANT VARIATION TO THIS PLAN MAY REQUIRE RESUBMISSION TO COUNCIL FOR APPROVAL. THE CLIENT SHALL NOT BE RESPONSIBLE FOR ANY SUCH ASSOCIATED DELAY.
5. ALL ESC DEVICES ARE TO BE INSPECTED WEEKLY, PRIOR TO EXPECTED AND AFTER RAINFALL ANY DAMAGE IS TO BE REPAIRED AS REQUIRED TO MAINTAIN THEIR EFFICACY.
6. ALL TEMPORARY EROSION AND SEDIMENT CONTROL (ESC) MEASURE TO BE MAINTAINED AND FULLY OPERATIONAL DURING THE MAINTENANCE PERIOD AND ARE TO BE REMOVED AFTER THE SATISFACTORY COMPLETION OF AN OFF-MAINTENANCE INSPECTION BY COUNCIL AND PRIOR TO FORMAL ACCEPTANCE "OFF MAINTENANCE8 BY COUNCIL.
7. PRIOR TO THE COMMENCEMENT OF CONSTRUCTION, THE CONTRACTOR IS TO PROVIDE A DETAILED PROGRAM TO THE SUPERINTENDENT SHOWING THE TIMING FOR ALL WORKS ASSOCIATED WITH THE PROJECT, NOMINATING, IN PARTICULAR, THE PROGRAM FOR INSTALLATION OF SOIL AND EROSION CONTROL SYSTEMS.
8. EARTHWORKS SHALL BE CARRIED OUT IN SUCH A MANNER THAT THE SITE IS MAINTAINED IN A WELL DRAINED CONDITION, AREAS OF LOOSE SOIL ARE MINIMISED AND CONCENTRATIONS OF STORMWATER ARE MINIMISED. BULK EARTHWORKS WILL BE CARRIED OUT OVER THE ENTIRE SITE IN ONE STAGE.
9. CONSTRUCTION AREAS SHALL BE AT ONE NOMINATED POINT ON SOUTH DEEBING CREEK ROAD. A SHAKE DOWN AS DETAILED ON THE PLAN COMPRISING FREE DRAINAGE GRAVEL SHALL BE LOCATED ADJACENT TO THE POINT OF ACCESS WHERE VEHICLES CAN BE WASHED DOWN PRIOR TO EXIT TO THE STREET SYSTEM IF REQUIRED. THE WASH DOWN AREA SHALL BE KEPT FREE OF MUD.
10. FOR DETAILS OF ENTRY/EXIT SEDIMENT PAD REFER TO BEST PRACTICE EROSION & SEDIMENT CONTROL BOOK 1, PAGE 2.48, FIGURE 2.6.
11. SUPPLEMENTARY EROSION AND SEDIMENT CONTROL DEVICES MAY BE REQUIRED AT THE DISCRETION OF THE SUPERINTENDENT.
12. SEDIMENTATION FENCES TO BE PLACED AS SHOWN. FOR DETAILS OF SEDIMENT FENCE REFER BEST PRACTICE EROSION & SEDIMENT CONTROL BOOK 1, PAGE 2.50, FIGURE 2.8.
13. WHERE SEDIMENT FENCES ARE SHOWN TO BE CONSTRUCTED IN AREAS OF SIGNIFICANT EARTHWORKS, ERECTION OF THE FENCE MAY BE DEFERRED UNTIL COMPLETION OF THE BULK EARTHWORKS, SUBJECT TO ABSENCE OF RAIN.

TREES

1. ENSURE COMPLIANCE WITH THE REQUIREMENTS OF AS4970 – TREES ON CONSTRUCTION SITES. THIS MAY REQUIRE CONSULTATION AND GUIDANCE FROM A CLASS V CERTIFIED ARBORIST AS TREES OUTSIDE THE IMMEDIATE WORK AREA MAY BE AFFECTED.

EROSION AND SEDIMENTATION CONTROL NOTES:

TOPSOIL

1. STRIP AND STOCKPILE AVAILABLE TOPSOIL (ASSUMED AVERAGE DEPTH 150MM) FROM ALL DISTURBED AREAS PRIOR TO BULK EARTHWORKS. GRADE EVENLY BETWEEN ALLOTMENT FINISHED SURFACE LEVELS AND ENSURE LOTS ARE FREE DRAINING.
2. MINIMUM SLOPE ACROSS ALLOTMENTS TO BE 1%.
3. ALL FOOTPATHS, BATTERS, AND EARTHWORKS AFFECTED ALLOTMENTS ARE TO BE TOPSOILED TO A MINIMUM DEPTH OF 150MM (LIGHTLY COMPACTED) AND TURFED WHERE SPECIFIED.
4. SEDIMENT FENCES TO BE PLACED AS SHOWN. FOR DETAILS OF SEDIMENT FENCE REFER BEST PRACTICE EROSION & SEDIMENT CONTROL BOOK 1, PAGE 2.50, FIGURE 2.7. SEDIMENT FENCED TO BE REPAIRED AND EXCESSIVE SEDIMENT DEPOSITS SHALL BE REMOVED ONCE CAPACITY FALLS BELOW 75%

SEDIMENT FENCES

1. FOR DETAILS OF SEDIMENT FENCE REFER BEST PRACTICE EROSION & SEDIMENT CONTROL BOOK 1, PAGE 2.50, FIGURE 2.8.
2. SEDIMENT FENCES TO BE REPAIRED AS REQUIRED AND EXCESSIVE SEDIMENT DEPOSITS SHOULD BE REMOVED.
3. INSTALL KERB INLETS WITH GRAVEL RANGING FROM 50MM TO 75MM IN SIZE SHALL BE INSTALLED AT ALL COMPLETED INLETS. REFER IPWEAQ STANDARD DRAWING D-0041. THESE SHALL BE MAINTAINED IN A CLEAN CONDITION. IN THE EVENT OF HEAVY RAIN THEY SHALL BE REMOVED TO MINIMISE THE POTENTIAL FOR FLOODING.
4. CHECKS OF SILT CONTROL DEVICES ARE TO BE MADE WEEKLY, OR AFTER ANY SIGNIFICANT STORM EVENT TO ENSURE INTEGRITY AND PERFORMANCE.

TURFING

1. PROVIDE TURFING TO ENTIRE WIDTH OF ALL SWALES, FOOTPATHS, AND 1 IN 4 CUT AND FILL BATTERS.
2. FOOTPATH BATTERS ARE TO BE STABILISED WITH TOPSOIL (AND TURFED) AS SOON AS PRACTICAL AFTER THE BATTERS HAVE BEEN COMPLETED.

DURING CONSTRUCTION SEQUENCE:

1. TOPSOIL STOCKPILES SHALL BE LESS THAN 1M DEEP AND UNCOMPACTED. A SEDIMENTATION FENCE SHALL BE CONSTRUCTED ON THE D/S SIDE, OR THE STOCKPILE STABILISED WITH VEGETATION, MULCH, OR A SOIL STABILISER.
2. SEDIMENTATION FENCES TO BE PLACED AS SHOWN.
3. REGULARLY INSPECT BANKS AND REPAIR ANY SLUMPS, WHEEL TRACK DAMAGE OR LOSS OF FREEBOARD.
4. REMOVE SEDIMENT TO AVOID PONDING FROM CATCH DRAINS.
5. REMOVE EXCESSIVE SEDIMENT FROM UPSTREAM OF CHECK DAM.
6. ROAD RESERVE TO BE USED AS HAUL ROAD.
7. A CATCH DRAINOR DIVERSION BANK IS TO BE PROVIDED ON THE TOP SIDE OF ALL CUTS, WITH DISCHARGE EITHER TO UNDISTURBED GRASS LANDS OR TO THE CROSS ROAD DRAINAGE.
8. SUPPLEMENTARY EROSION AND SEDIMENT CONTROL DEVISED MAY BE REQUIRED AT THE DISCRETION OF THE ENGINEER.
9. WATER QUALITY SAMPLES MUST BE TAKEN AND ANALYSED PRIOR TO THE RELEASE OF ANY WATER FROM THE SEDIMENT POND. WATER QUALITY MUST SATISFY THE FOLLOWING CRITERIA: TSS<50MG/L PH BETWEEN 6.5 AND 8.5.
10. ALL WATER QUALITY DATA INCLUDING DATES OF RAINFALL, TESTING AND WATER RELEASE MUST BE MAINTAINED IN AN ON-SITE REGISTER. THIS REGISTER IS TO BE MAINTAINED FOR THE DURATION OF THE APPROVED WORKS AND BE AVAILABLE ON SITE FOR INSPECTION BY COUNCIL OFFICERS ON REQUEST.
11. EXPOSED AREAS ON LOTS ARE TO BE SEEDED AND MULCHED (E.G. HYDROMULCHED). MULCH SHALL BE APPLIED AT A MINIMUM RATE OF 2.5T/HA. ALTERNATIVELY THEY SHALL BE DRILL-SEEDED AND IRRIGATED SO AS TO ENSURE >70% GROUND COVER WITHIN 14 DAYS FROM NOVEMBER TO APRIL, OR 30 DAYS FROM MAY TO OCTOBER.

FOLLOWING CONSTRUCTION:

1. SEDIMENTATION FENCES TO BE MAINTAINED UNTIL TURFING IS COMPLETED.
2. SEDIMENT BASINS TO BE CHECKED AFTER EVERY SIGNIFICANT STORM AND DESILTED ONCE THE SETTLEMENT LIMIT HAS BEEN REACHED.

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REVISIONS

No	Description	Date	By
A	FOR APPROVAL	02.02.2021	RW

NORTH

Client

North Harbour

BULK EARTHWORKS

kn group

Approved Director - RPEQ 17544

Drawing Title

SEDIMENT AND EROSION CONTROL NOTES

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RW	JB	MAS	FEB 21

Scale	Sheet
AS SHOWN	06 of 09

	Drawing No	Revision
A1	20-185- 06	A

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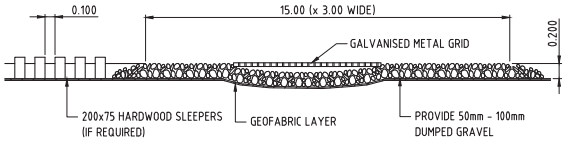

SITE ACCESS POINT SHAKEDOWN FACILITY
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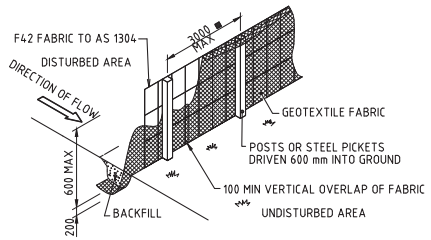

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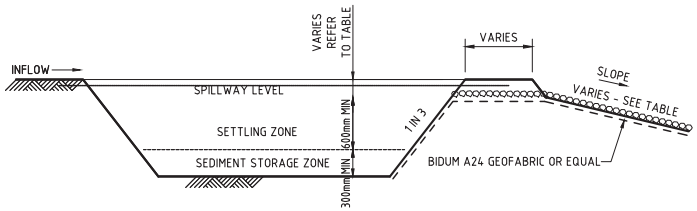

TYPE C BASIN DETAIL
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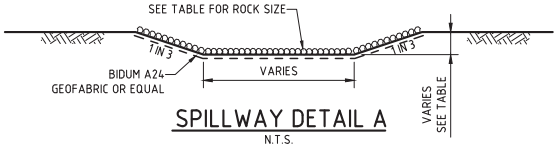

SPILLWAY DETAIL A
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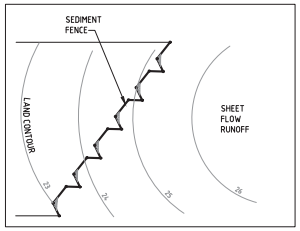
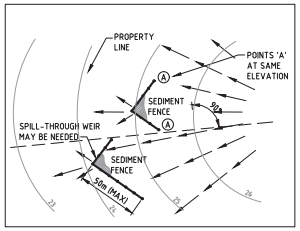
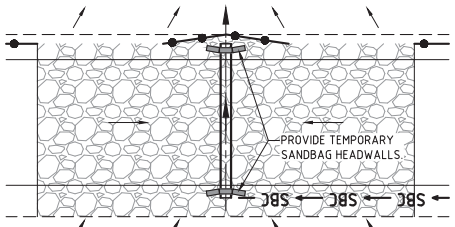




SILT FENCE DETAILS



DETAIL 'A' TEMPORARY CROSSING PLAN
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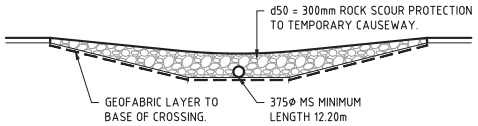

DETAIL 'A' TEMPORARY CROSSING SECTION
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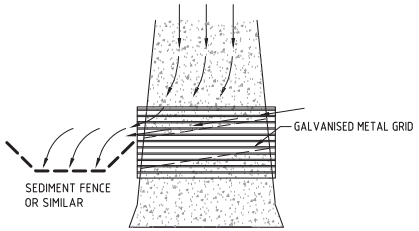

SITE ACCESS POINT ENTRY/EXIT PAD
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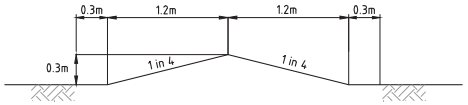

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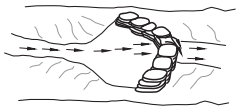

SANDBAG CHECK DAM
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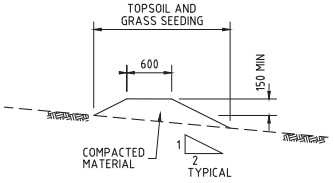

DIVERSION DRAINAGE BANK
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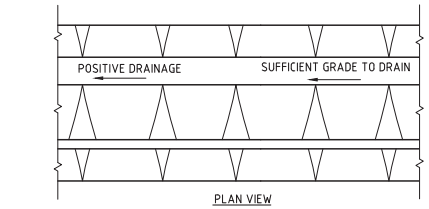

TYPICAL LINED CATCH DRAIN
SCALE 1 : 40

LCD NO.	WIDTH	DEPTH
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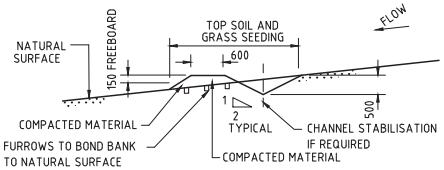
2	1.500	0.450
3	1.500	0.300
4	1.500	0.250
5	1.500	0.300
6	1.500	0.300
7	1.500	0.250
8	1.500	0.200
9	1.500	0.350
10	1.500	0.300

PLAN VIEW



PLACE FILTER FABRIC ACROSS DRAIN AT 30m MAXIMUM INTERVALS AND AT OUTLET OF DRAIN, OR AS REQUIRED TO CONTROL SEDIMENT MOVEMENT ALONG DRAIN.

CROSS SECTION

CATCHMENT DRAIN
N.T.S.

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REVISIONS

No	Description	Date	By
A	FOR APPROVAL	02.02.2021	RW

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Approved Director - RPEQ 17544

Drawing Title

SEDIMENT AND EROSION CONTROL DETAILS

Drawn	Designed	Checked	Date
RW	JB	MAS	FEB 21

Scale	Sheet
AS SHOWN	07 of 09

	Drawing No	Revision
A1	20-185- 07	A

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BASIN NOTES

1. ALL BASINS SHALL BE CONSTRUCTED PRIOR TO THE COMMENCMENT OF MAJOR EARTHWORKS IN THE RELEVANT CATCHMENT.
2. AN APPROPRIATELY MARKED (E.G. PAINTED) DE-SILTING MARKER POST MUST BE INSTALLED IN THE BASIN TO INDICATE THE TOP OF THE SEDIMENT STORAGE ZONE. THE BASIN MUST BE DE-SILTED. IF THE SEDIMENT IS ALREADY ABOVE THIS MARKER POINT, OR IF THE NEXT STORM IS LIKELY TO CAUSE SEDIMENT TO SETTLE ABOVE THIS MARKER POINT.
3. PRIOR TO DISCHARGE OF WATER FROM A SEDIMENT BASIN, IT IS ESSENTIAL FOR THE WATER QUALITY TO COMPLY WITH ALL SPECIFIED WATER QUALITY OBJECTIVES (WQOS) (E.G. WATER PH IN THE RANGE OF 6.5 – 8.5).
4. THE RECOMMENDED WATER QUALITY STANDARD FOR SEDIMENT BASINS IS PRESENTED IN TABLE B18.

TABLE B18 – RECOMMENDED DISCHARGE STANDARD FOR DE-WATERING OPERATIONS

SITE CONDITIONS	DISCHARGE WATER QUALITY STANDARD
POST-STORM DE-WATERING OF SEDIMENT BASINS (E.G. TYPE F AND D BASINS, AND TYPE C BASINS OPERATING AS WET-BASINS).	90 PERCENTILE TOTAL SUSPENDED SOLIDS (TSS) CONCENTRATION NOT EXCEEDING 50MG/L.

TECHNICAL NOTES B5 – BASIN FLOCCULATION

THE CONTRACTOR SHALL, IN CONJUNCTION WITH THE SITE EROSION AND SEDIMENT CONTROL SPECIALIST, DETERMINE THE MOST APPROPRIATE FLOCCULANT FOR THE SITE. A PROCEDURE FOR THE MANUAL DOSING OF GYPSUM OR SIMILAR (DEVELOPED FROM LANDCOM, 2004) IS AS FOLLOWS:

1. PLACE REQUIRED GYPSUM QUANTITY (SAY 32KG/100M3 OF WATER) IN APPROXIMATELY 50L DRUM PERFORATED WITH 25MM HOLES AT 150MM SPACING.
2. SUSPEND THE SCREENED, RECIRCULATING PUMP INTAKE INTO THE DRUM.
3. LIFT THE DRUM INTO THE BASIN SUCH THAT BASIN WATER CAN ENTER AND CIRCULATED THROUGH THE DRUM.
4. USING THE PUMP, SPRAY THE GYPSUM-RICH SOLUTION EVENLY OVER THE SURFACE OF THE BASIN UNTIL THE GYPSUM IS FULLY REMOVED FROM THE DRUM. THE PUMP OUTLET MUST SPRAY THE MIXTURE OVER A WIDE AREA RATHER THAN JUST DISCHARGING AS A CONFINED "JETö.
5. ALTERNATIVELY, IF TWO PUMPS ARE AVAILABLE, USE THE TWO PUMPS TO CIRCULATE BASIN WATER FIRST TO THE ON-SHORE TANK, AND THEN FROM THE TANK OVER THE SURFACE OF THE BASIN. A LARGE MIXING TANK WILL USUALLY BE REQUIRED.
6. ALTERNATIVE PRODUCTS INCLUDE POLYALUMINIUM CHLORIDE (PAC), POLYACRYLAMIDE (PAC).

B3 BASIN CONSTRUCTION AND MAINTENANCE MATERIALS

- EARTH FILL: CLEAN SOIL WITH EMERSON CLASS 2(1), 3, 4, OR 5, AND FREE OF ROOTS, WOODY VEGETATION, ROCKS AND OTHER UNSUITABLE MATERIAL. SOIL WITH EMERSON CLASS 4 AND 5 MAY NOT BE SUITABLE DEPENDING ON PARTICLE SIZE AND DISTRIBUTION AND DEGREE OF DISPERSION. CLASS 2(1) SHOULD ONLY BE USED UPON RECOMMENDATION FROM GEOTECHNICAL SPECIALIST. [ALTERNATIVELY, SET A STANDARD BASED ON EXCHANGEABLE SODIUM PERCENTAGE – SEEK EXPERT ADVICE.]
- RISER PIPE: MINIMUM 250MM DIAMETER.
- SPILLWAY ROCK: HARD, ANGULAR, DURABLE, WEATHER RESISTANT AND EVENLY GRADED ROCK WITH 50% BY WEIGHT LARGER THAN THE SPECIFIED NOMINAL (D50) ROCK SIZE. LARGER ROCK SHOULD DOMINATE, WITH SUFFICIENT SMALL ROCK TO FILL THE VOIDS BETWEEN THE LARGER ROCK. THE DIAMETER OF THE LARGEST ROCK SIZE SHOULD BE NO LARGER THAN 1.5 TIMES THE NOMINAL ROCK SIZE. THE SPECIFIC GRAVITY SHOULD BE AT LEAST 2.5.
- GEOTEXTILE FABRIC: HEAVY-DUTY, NEEDLE-PUNCHED, NON-WOVEN FILTER CLOTH, MINIMUM BIDIM A24 OR EQUIVALENT.

CONSTRUCTION

1. NOTWITHSTANDING ANY DESCRIPTION CONTAINED WITHIN THE APPROVED PLANS OR SPECIFICATIONS, THE CONTRACTOR SHALL BE RESPONSIBLE FOR SATISFYING THEMSELVES AS TO THE NATURE AND EXTENT OF THE SPECIFIED WORKS AND THE PHYSICAL AND LEGAL CONDITIONS UNDER WHICH THE WORKS WILL BE CARRIED OUT. THIS SHALL INCLUDE MEANS OF ACCESS, EXTENT OF CLEARING, NATURE OF MATERIAL TO BE EXCAVATED, TYPE AND SIZE OF MECHANICAL PLAN REQUIRED, LOCATION AND SUITABILITY OF WATER SUPPLY FOR CONSTRUCTION AND TESTING PURPOSES, AND ANY OTHER LIKE MATTERS AFFECTING THE CONSTRUCTION OF THE WORKS.
2. REFER TO APPROVED PLANS FOR LOCATION, DIMENSIONS, AND CONSTRUCTION DETAILS. IF THERE ARE QUESTIONS OR PROBLEMS WITH THE LOCATION, DIMENSIONS, OR METHOD OF INSTALLATION, CONTACT THE ENGINEER OR RESPONSIBLE ON-SITE OFFICER FOR ASSISTANCE.
3. BEFORE STARTING ANY CLEARING OR CONSTRUCTION, ENSURE ALL THE NECESSARY MATERIALS AND COMPONENTS ARE ON THE SITE TO AVOID DELAYS IN COMPLETING THE POND ONCE WORKS BEGIN.
4. INSTALL REQUIRED SHORT-TERM SEDIMENT CONTROL MEASURES DOWNSTREAM OF THE PROPOSED EARTHWORKS TO CONTROL SEDIMENT RUNOFF DURING CONSTRUCTION OF THE BASIN.
5. THE AREA TO BE COVERED BY THE EMBANKMENT, BORROW PITS AND INCIDENTAL WORKS, TOGETHER WITH AN AREA EXTENDING BEYOND THE LIMITS OF EACH FOR A DISTANCE NOT EXCEEDING FIVE (5) METRES ALL AROUND MUST BE CLEARED OF ALL TREES, SCRUB, STUMPS, ROOTS, DEAD TIMBER AND RUBBISH AND DISPOSED OF IN A SUITABLE MANNER. DELAY CLEARING THE MAIN POND AREA UNTIL THE EMBANKMENT IS COMPLETE. [MODIFY AS NECESSARY TO LIMIT TOTAL AREA OF DISTURBANCE AND ANY DAMAGE TO PROTECTED VEGETATION].
6. ENSURE ALL HOLES MADE BY GRUBBING WITHIN THE EMBANKMENT FOOTPRINT ARE FILLED WITH SOUND MATERIAL, ADEQUATELY COMPACTED, AND FINISHED FLUSH WITH THE NATURAL SURFACE.
7. IS SUITABLE AND IT IS PLACED IN THE CORRECT ZONE ACCORDING TO ITS CLASSIFICATION.

CUT-OFF TRENCH:

1. BEFORE CONSTRUCTION OF THE CUT-OFF TRENCH OR ANY ANCILLARY WORKS WITHIN THE EMBANKMENT FOOTPRINT, ALL GRASS GROWTH AND TOPSOIL MUST BE REMOVED FROM THE AREA TO BE OCCUPIED BY THE EMBANKMENT AND MUST BE DEPOSITED CLEAR OF THIS AREA AND RESERVED FOR TOPDRESSING THE COMPLETING EMBANKMENT.
2. EXCAVATE A CUT-OFF TRENCH ALONG THE CENTRE LINE OF THE EARTH FILL EMBANKMENT. CUT THE TRENCH TO STABLE SOIL MATERIAL, BUT IN NO CASE MAKE IT LESS THAN 600MM DEEP. THE CUT-OFF TRENCH MUST EXTEND INTO BOTH ABUTMENTS TO AT LEAST THE ELEVATION OF THE RISER PIPE CREST. MAKE THE MINIMUM BOTTOM WIDTH WIDE ENOUGH TO PERMIT OPERATION OF EXCAVATION AND COMPACTION EQUIPMENT, BUT IN NO CASE LESS THAN 600MM. MAKE THE SIDE SLOPES OF THE TRENCH NO STEEPER THAN 1:1 (H:V).
3. ENSURE ALL WATER, LOOSE SOIL, AND ROCK ARE REMOVED FROM THE TRENCH BEFORE BACKFILLING COMMENCES. THE CUT-OFF TRENCH MUST BE BACKFILLED WITH SELECTED EARTH-FILL OF THE TYPE SPECIFIED FOR THE EMBANKMENT, AND THIS SOIL MUST HAVE A MOISTURE CONTENT AND DEGREE OF COMPACTION THE SAME AS THAT SPECIFIED FOR THE SELECTED CORE ZONE.
4. MATERIAL EXCAVATED FROM THE CUT-OFF TRENCH MAY BE USED IN CONSTRUCTION OF THE EMBANKMENT PROVIDED IT IS SUITABLE AND IT IS PLACED IN THE CORRECT ZONE ACCORDING TO ITS CLASSIFICATION.

EMBANKMENT:

1. SCARIFY AREAS ON WHICH FILL IS TO BE PLACED BEFORE PLACING THE FILL.
2. ENSURE ALL FILL MATERIAL USED TO FORM THE EMBANKMENT MEETS THE SPECIFICATIONS CERTIFIED BY A GEOTECHNICAL SPECIALIST.
3. THE FILL MATERIAL MUST CONTAIN SUFFICIENT MOISTURE SO IT CAN BE FORMED BY HAND INTO A BALL WITHOUT CRUMBLING. IF WATER CAN BE SQUEEZED OUT OF THE BALL, IT IS TOO WET FOR PROPER COMPACTION. PLACE FILL MATERIAL IN 150 TO 250MM CONTINUOUS LAYERS OVER THE ENTIRE LENGTH OF THE FILL AREA THEN COMPACT BEFORE PLACEMENT OF FURTHER FILL.
4. PLACE RISER PIPE OUTLET SYSTEM, IF SPECIFIED, IN APPROPRIATE SEQUENCE WITH THE EMBANKMENT FILLING. REFER TO SPECIFICATIONS SUPPLIED BELOW.
5. UNLESS OTHERWISE SPECIFIED ON THE APPROVED PLANS, COMPACT THE SOIL AT ABOUT 1% TO 2% WET OF OPTIMUM AND TO 95% MODIFIED OR 100% STANDARD COMPACTION.
6. WHERE BOTH DISPERSIVE AND NON-DISPERSIVE CLASSIFIED EARTH-FILL MATERIALS ARE AVAILABLE, NON-DISPERSIVE EARTH-FILL MUST BE USED IN THE CORE ZONE. THE REMAINING CLASSIFIED EARTH-FILL MATERIALS MUST ONLY BE USED AS DIRECTED BY [INSERT TITLE].
7. WHERE SPECIFIED, CONSTRUCT THE EMBANKMENT TO AN ELEVATION 10% HIGHER THAN THE DESIGN HEIGHT TO ALLOW FOR SETTLING; OTHERWISE FINISHED DIMENSIONS OF THE EMBANKMENT AFTER SPREADING OF TOPSOIL MUST CONFORM TO THE DRAWING WITH A TOLERANCE OF 75MM FORM THE SPECIFIED DIMENSIONS.
8. ENSURE DEBRIS AND OTHER UNSUITABLE BUILDING WASTE IN NOT PLACED WITHIN THE EARTH EMBANKMENT.
9. AFTER COMPLETION OF THE EMBANKMENT ALL LOOSE UNCOMPACTED EARTH-FILL MATERIAL OF THE UPSTREAM AND DOWNSTREAM BATTER MUST BE REMOVED PRIOR TO SPREADING OF TOPSOIL.
10. TOPSOIL AND REVEGETATE/STABILISED ALL EXPOSED EARTH AS DIRECTED WITHIN THE APPROVED PLANS.
11. WHERE THE SITE IS TO BE REVEGETATED, THE TOPSOIL AND UPPER 500MM OF THE SUBSOIL SHALL MEET THE SPECIFICATIONS SET BY A SOIL SCIENTIST.

ESTABLISHMENT OF SETTLING POND:

1. THE AREA TO BE COVERED BY THE STORED WATER OUTSIDE THE LIMITS OF THE BORROW PITS MUST BE CLEARED OF ALL SCRUB AND RUBBISH. TREES MUST BE CUT DOWN STUMP HIGH AND REMOVED FROM THE IMMEDIATE VICINITY OF THE WORK.
2. ESTABLISH ALL REQUIRED INFLOW CHUTES AND INLET BAFFLES, IF SPECIFIED, TO ENABLE WATER TO DISCHARGE INTO THE BASIN IN A MANNER THAT WILL NOT CAUSE SOIL EROSION NOR THE RE-SUSPENSION OF SETTLED SEDIMENT.
3. INSTALL A SEDIMENT STORAGE LEVEL MARKER POST WITH A CROSS MEMBER SET JUST BELOW THE TOP OF THE SEDIMENT STORAGE ZONE (AS SPECIFIED ON THE APPROVED PLANS). USE AT LEAST A 75MM WIDE POST FIRMLY SET INTO THE BASIN FLOOR.
4. IF SPECIFIED, INSTALL INTERNAL SETTLING POND BAFFLES. ENSURE THE CREST OF THESE BAFFLES IS SET LEVEL WITH OR JUST BELOW, THE ELEVATION OF THE EMERGENCY SPILLWAY CREST.
5. INSTALL ALL APPROPRIATE MEASURE TO MINIMISE SAFETY RISK TO ON-SITE PERSONNEL AND THE PUBLIC CAUSED BY THE PRESENCE OF THE SETTLING POND. AVOID STEEP, SMOOTH INTERNAL SLOPES. APPROPRIATELY FENCE THE SETTLING POND AND POST WARNING SIGNS IF UNSUPERVISED ACCESS IS LIKELY OR THERE IS CONSIDERED TO BE AN UNACCEPTABLE RISK TO THE PUBLIC.

SPILLWAY CONSTRUCTION:

1. THE SPILLWAY MUST BE EXCAVATED AS SHOWN ON THE PLANS, AND THE EXCAVATED MATERIAL IF CLASSIFIED AS SUITABLE, MUST BE USED IN THE EMBANKMENT, AND IF NOT SUITABLE IT MUST BE DISPOSED OF INTO SPOIL HEAPS.
2. ENSURE EXCAVATED DIMENSIONS ALLOW ADEQUATE BOXING-OUT SUCH THAT THE SPECIFIED ELEVATIONS, GRADES, CHUTE WIDTH, AND ENTRANCE AND EXIT SLOPES FOR THE EMERGENCY SPILLWAY WILL BE ACHIEVED AFTER PLACEMENT OF THE ROCK OR OTHER SCOUR PROTECTION MEASURES AS SPECIFIED IN THE PLANS.
3. PLACE SPECIFIED SCOUR PROTECTION MEASURES ON THE EMERGENCY SPILLWAY. ENSURE THE FINISHED GRADE BLENDS WITH THE SURROUNDING AREA TO ALLOW A SMOOTH FLOW TRANSITION FROM SPILLWAY TO DOWNSTREAM CHANNEL.
4. IF A SYNTHETIC FILTER FABRIC UNDERLAY IS SPECIFIED, PLACE THE FILTER FABRIC DIRECTLY ON THE PREPARED FOUNDATION. IF MORE THAN 1 SHEET OF FILTER FABRIC IS REQUIRED, OVERLAP THE EDGES BY AT LEAST 300MM AND PLACE ANCHOR PINS AT MINIMUM 1M SPACING ALONG THE OVERLAP. BURY THE UPSTREAM END OF THE FABRIC A MINIMUM 300MM BELOW GROUND AND WHERE NECESSARY, BURY THE LOWER END OF THE FABRIC OR OVERLAP A MINIMUM 300MM OVER THE NEXT DOWNSTREAM SECTION AS REQUIRED. ENSURE THE FILTER FABRIC EXTENDS AT LEAST 1000MM UPSTREAM OF THE SPILLWAY CREST.
5. TAKE CARE NOT TO DAMAGE THE FABRIC DURING OR AFTER PLACEMENT. IF DAMAGE OCCURS, REMOVE THE ROCK AND REPAIR THE SHEET BY ADDING ANOTHER LAYER OF FABRIC WITH A MINIMUM OVERLAP OF 300MM AROUND THE DAMAGED AREA. IF EXTENSIVE DAMAGE IS SUSPECTED, REMOVE AND REPLACE THE ENTIRE SHEET.
6. WHERE LARGE ROCK IS USED, OR MACHINE PLACEMENT IS DIFFICULT, A MINIMUM 100MM LAYER OF FINE GRAVEL, AGGREGATE, OR SAND MAY BE NEEDED TO PROTECT THE FABRIC.
7. PLACEMENT OF ROCK SHOULD FOLLOW IMMEDIATELY AFTER PLACEMENT OF THE FILTER FABRIC. PLACE ROCK SO THAT IF FORMS A DENSE, WELL-GRADED MASS OF ROCK WITH A MINIMUM OF VOIDS. THE DESIRED DISTRIBUTION OF ROCK THROUGHOUT THE MASS MAY BE OBTAINED BY SELECTIVE LOADING AT THE QUARRY AND CONTROLLED DUMPING DURING FINAL PLACEMENT.
8. THE FINISHED SLOPE SHOULD BE FREE OF POCKETS OF SMALL ROCK OR CLUSTERS OF LARGE ROCKS. HAND PLACING MAY BE NECESSARY TO ACHIEVE THE PROPER DISTRIBUTION OF ROCK SIZES TO PRODUCE A RELATIVELY SMOOTH, UNIFORM SURFACE. THE FINISHED GRADE OF THE ROCK SHOULD BLEND WITH THE SURROUNDING AREA. NO OVERFALL OR PROTRUSION OF ROCK SHOULD BE APPARENT.
9. ENSURE THAT THE FINAL ARRANGEMENT OF THE SPILLWAY CREST WILL NOT PROMOTE EXCESSIVE FLOW THROUGH THE ROCK SUCH THAT THE WATER CAN BE RETAINED WITHIN THE SETTLING BASIN AN ELEVATION NO LESS THAN 50MM ABOVE OR BELOW THE NOMINATED SPILLWAY CREST ELEVATION.

MAINTENANCE OF SEDIMENT BASIN

1. INSPECT THE SEDIMENT BASIN DURING THE FOLLOWING PERIODS:
   (i) DURING CONSTRUCTION TO DETERMINE WHETHER MACHINERY, FALLING TREES, OR CONSTRUCTION ACTIVITY HAS DAMAGED ANY COMPONENTS OF THE SEDIMENT BASIN. IF DAMAGE HAS OCCURRED, REPAIR IT.
   (ii) AFTER EACH RUNOFF EVENT. INSPECT THE EROSION DAMAGE AT FLOW ENTRY AND EXIT POINTS. IF DAMAGE HAS OCCURRED, MAKE THE NECESSARY REPAIRS.
   (iii) AT LEAST WEEKLY DURING THE NOMINATED WET SEASON (IF ANY) OTHERWISE AT LEAST FORTNIGHTLY.
   (i) PRIOR TO, AND IMMEDIATELY AFTER, PERIOD OF "STOP WORKö OR SITE "SHUTDOWNö.
2. CLEAN OUT ACCUMULATED SEDIMENT WHEN IT REACHES THE MARKER BOARD/POST, AND RESTORE THE ORIGINAL STORAGE VOLUME. PLACE SEDIMENT IN A DISPOSABLE AREA OR, IF APPROPRIATE, MIX WITH DRY SOIL ON THE SITE.
3. DO NOT DISPOSE OF SEDIMENT IN A MANNER THAT WILL CREATE AN EROSION OR POLLUTION HAZARD.
4. CHECK ALL VISIBLE PIPE CONNECTIONS FOR LEAKS, AND REPAIR AS NECESSARY.
5. CHECK FILL MATERIAL IN THE DAM FOR EXCESSIVE SETTLEMENT, SLUMPING OF THE SLOPES OR PIPING BETWEEN THE CONDUIT AND THE EMBANKMENT; MAKE ALL NECESSARY REPAIRS.
6. REMOVE ALL TRASH AND OTHER DEBRIS FROM THE BASIN AND RISER.
7. SUBMERGED INFLOW PIPES MUST BE INSPECTED AND DE-SILTED (AS REQUIRED) AFTER EACH INFLOW EVENT.

REMOVAL OF SEDIMENT BASIN

1. WHEN GRADING AND CONSTRUCTION IN THE DRAINAGE AREA ABOVE A TEMPORARY SEDIMENT BASIN IS COMPLETED AND THE DISTURBED AREAS ARE ADEQUATELY STABILISED (>70% GROUND COVER) WITH HYDROMULCH OR MULCHIN 6 AS APPROVED BY MBRC, THE BASIN MUST BE REMOVED OR OTHERWISE INCORPORATED INTO THE PERMANENT STORMWATER DRAINAGE SYSTEM. IN EITHER CASE, SEDIMENT SHOULD BE CLEARED AND PROPERLY DISPOSED OF AND THE BASIN AREA STABILISED.
2. BEFORE STARTING ANY MAINTENANCE WORK ON THE BASIN OR SPILLWAY, INSTALL ALL NECESSARY SHORT-TERM SEDIMENT CONTROL MEASURES DOWNSTREAM OF THE SEDIMENT BASIN.
3. ALL WATER AND SEDIMENT MUST BE REMOVED FROM THE BASIN PRIOR TO THE DAM'S REMOVAL. DISPOSE OF SEDIMENT AND WATER IN A MANNER THAT WILL NOT CREATE AN EROSION OR POLLUTION HAZARD.
4. BRING THE DISTURBED AREA TO A PROPER GRADE, THEN SMOOTH, COMPACT, AND STABILISE AND/OR REVEGETATE AS REQUIRED TO ESTABLISH A STABLE LAND SURFACE.

DO NOT SCALE THIS DRAWING
IF IN DOUBT - ASK!

REVISIONS

No	Description	Date	By
A	FOR APPROVAL	02.02.2021	RW

NORTH

Client

North Harbour
find right at home

BULK EARTHWORKS

kn group

Approved Director - RPEQ 17544

Drawing Title

SEDIMENT AND EROSION BASIN NOTES

Drawn	Designed	Checked	Date
RW	JB	MAS	FEB 21

Scale	Sheet
AS SHOWN	08 of 09

A1	Drawing No	Revision
	20-185- 08	A

M:\2020\20185 NHH - Bulk Earthworks Unnamed Creek\Engineering\Acad\20-185-05-08-SED-CONTR.dwg Plotted by RW on 2/03/2021 3:21:34 PM

Client: NORTH EAST BUSINESS PARK

Project: NORTH HARBOUR RESIDENTIAL WEST
BULK EARTHWORKS

Prepared By: Mark Shaw — Date: 2nd February 2021
Reviewed By: Robert Mander — Date: 2nd February 2021

Safety in Design Analysis

- Complete Safety in Design Analysis by populating the table where applicable with all of the relevant safety issues for the project. For example:

☐ Positioning of new services adjacent to existing live services	☒ Slope Stability
☐ Construction adjacent to existing road carriageways	☒ Dust Control
☐ Pedestrians	☒ Erosion and Sediment Control/Management
☒ Civil Construction Workers	☒ Sediment Basin Construction
☒ Maintenance Workers	☒ Wetland Construction
☒ Work Place Health and Safety Constraints	☒ Working under traffic
☐ Unusual material handling	
☐ Falls from heights	Project Specific Design Elements:
☐ Underground Services (existing)	
☐ Electrical Service Installation	
☐ Gas Service Installation	
☐ Communication Installation	
☐ Traffic Signal Installation	
☒ Landscape Workers	
☐ Line marking Workers	
☒ Excavation – open cut trenching – Trench excavation depths	
☐ Tunnel Boring	
☒ Confined Spaces	
☒ Lifting of loads	
☒ Unloading of materials and storage	
☐ Storage of hazardous materials	
☒ Geotechnical investigation – works	
☒ Bulk Earthworks	
☐ List all relevant safety studies	

The following table summarises the safety in design issues considered.

Section of Works	Identify any Potential Incident or Hazard	Consequence	Likelihood	Risk Rating	Risk Control Measures	Consequence	Likelihood	Residual Risk Rating (after design applied)	Risk Manager
Earthworks Material Investigation	Geotechnical investigation	C	3	S	SWMS required by Contractor	D	3	M	Contractor
Road Works	Pedestrians Injury	B	3	M	TMP to be provided by Contractor to exclude pedestrians from work site	E	3	L	Contractor
	Civil Construction Workers – Injury	A	4	H	TMP and SWMS required for all activities	C	3	S	Contractor
	Maintenance Workers	A	4	H	TMP and SWMS required for all activities	C	3	S	Contractor
	Underground Services (Existing)	A	3	H	DBYD information to be sort prior to design. Existing to be located by survey if applicable to design. All existing services to be located and depths confirmed prior to commencement. SWMS to be provided by Contractor.	D	3	S	Designer/ Contractor
Working adjacent to existing infrastructure	Conflict between construction equipment / personnel and live infrastructure in particular Power lines	B	4	S	All existing services highlighted in the documentation. Contractor to complete DBYD search before commencing works. SWMS to be provided by Contractor	C	4	M	Designer/ Contractor
Service trench/ pipe installation	Location of all trenches to provide clearance to all other services and all structures or batters/embankments	A	4	H	Mains located with safe working clearance to existing pressure mains, structures and batters/embankments	C	4	M	Designer
	Trench depth	A	4	M	Depth of trenches minimised for both safety and cost efficiency	D	4	M	Designer
Works within Confined Spaces	Construction of manholes structures	A	4	M	Contractor to ensure work undertaken in a manner complying with safe work method statements	D	5	L	Contractor
Silt and Erosion Control	Public access to water retaining temporary sediment basins	A	5	S	Protection measures – that is fencing off all water retaining structures with side slopes greater than 1 in 3 as described in International Erosion Control Association (Australasia) Table B5	D	4	M	Designer/ Contractor

RISK ASSESSMENT AND CONTROL

Risk Assessment			
Select **one** category from each of the columns below that best represents the likely outcome if the potential hazard actually did occur. For each consequence consider the **most likely outcome** and **not** the "absolute worst" case.			
Consequence		**Likelihood**	
A	Death – major environmental damage	1	Certain
B	Permanent Disability – severe environmental damage	2	Probable
C	Lost Time Injury – moderate environmental damage	3	Possible
D	Medical Treatment Injury – minor environmental damage	4	Unlikely
E	First Aid Treatment	5	Very Unlikely

H: High Risk — **S: Significant Risk**

M: Moderate Risk — **L: Low Risk**

Read the Risk Rating from the matrix below:

Risk Assessment Matrix	A	B	C	D	E
1	H	H	H	S	S
2	H	H	S	S	M
3	H	H	S	M	L
4	H	S	M	L	L
5	S	S	M	L	L

RISK RATING

Certain - means an event or situation that is happening more or less all the time, including continuous situations.
Permanent Disability – means a disability, such as loss of a limb or eyesight, loss of hearing, chronic skin disorder, chronic back disorder, emphysema, and the like

Probable – means an event or situation that occurs or is likely to occur about ten times or more per year
Possible – means an event or situation that occurs or is likely to occur about once per year
Unlikely – means an event or situation that occurs or is likely to occur less frequently than once every ten years

Issued 2nd February 2021 Rev - A

DO NOT SCALE THIS DRAWING
IF IN DOUBT - ASK!

REVISIONS

No	Description	Date	By
A	FOR APPROVAL	02.02.2021	RW

Client

North Harbour

BULK EARTHWORKS

kn group

Approved Director - RPEQ 17544

Drawing Title
SAFETY IN DESIGN

Drawn	Designed	Checked	Date
RW	JB	MAS	FEB 21

Scale	Sheet
AS SHOWN	09 of 09

Size	Drawing No	Revision
A1	20-185- 09	A

ATTACHMENT 2 – WEED CONTROL METHODOLOGY

Primary Weeding

Weed eradication will be undertaken on a progressive basis through localised treatment of grass species via mechanical removal (hoe/rake, hand pulling and/or slashing) or with Roundup Biactive©. Woody weed species will be hand pulled or controlled using weed control techniques listed below**.** Weed removal techniques have been provided for all weed species observed on the subject site as well as noxious and environmental weeds that may occur on the subject site over time.

All chemical users will follow directions as per chemical material data sheets for use and installation. Utmost care must be taken when utilizing chemicals to ensure that no drift occurs outside of the treatment area. Spraying should not occur on windy days or within 24 hours of predicted rainfall.

Primary weeding should commence at the start of the active growing period (approximately November), or on an as needed basis.

Preparation before spraying, in the form of manual clearing of weeds from around native plants, must be carried out. Small native plants less than 20 cm in height are to be marked with a stake to indicate retention.

Weed material that does not contain any fertile parts will be mulched and spread on the ground and any weeds that may have fertile parts present will be disposed of at an approved waste disposal facility such as Council landfills or transfer stations.

Secondary Weeding

Secondary weeding involves the eradication of weeds that have been overlooked or re-shoot after primary treatment. Secondary weeding will occur three (3) to four (4) months after primary weeding and no later than six (6) months.

Weed Species and Treatment Methods

Common Name	Scientific Name	Control Method
Balloon cotton bush	*Gomphocarpus physocarpus*	**Hand Weeding** for all specimens under 10 cm. **Blanket and Spot** spraying with 1 part Roundup Biactive: 100 parts water for larger specimens or areas
Crofton weed	*Ageratina adenophora*	
Blue billygoat weed	*Ageratum houstonianum*	
Annual ragweed	*Ambrosia artemisiifolia*	
Paspalum	*Paspalum* spp.	
Kikuyu	*Pennisetum clandestinum*	
Paramatta grass	*Sporobolus africanus*	
Whiskey grass	*Androgogon virginicus*	

Common Name	Scientific Name	Control Method
Groundsel bush Bitou bush	*Baccharis halimifolia* *Chrysanthemoides monilifera*	**Hand Weeding** for all specimens where the soil is moist. Dispose of removed plants. **Cut stump** and apply with 1 part Roundup Biactive: 100 parts water
Singapore daisy Coastal morning glory	*Wedelia trilobata* *Ipomoea cairica*	**Hand Weeding** for all specimens using a knife to loosen soil and leather gloves making sure all plant parts and rhizomes are removed. Dispose of removed plants. **Blanket and Spot** spraying with 1 part Roundup Biactive: 100 parts water
Winter senna	*Senna pendula*	**Hand Weeding** for small specimens, using a knife to loosen soil and leather gloves making sure all plant parts are removed. Larger specimens may need to be removed with a mattock. Dispose of removed plants. **Cut Stump** for large specimens using 1 part Roundup Biactive: 1.5 parts water.
Slash pine Camphor laurel Lantana Wild tobacco Cadaghi Umbrella tree Castor oil plant Broad-leaved pepper tree	*Pinus elliottii* *Cinnamomum camphora* *Lantana camara* *Solanum mauritianum* *Corymbia torreliana* *Schefflera actinophylla* *Ricinus communis* *Schinus terebinthefolius*	**Hand Weeding** for all small specimens under 20 cm. **Cut Stump** for all specimens over 20 cm tall using 1 part Roundup Biactive ©: 1.5 parts water. **Stem injection** for up to 60cm diameter using 2ml Roundup Biactive undiluted
Example of Registered Glyphosate Herbicides: ▪ *Defender Home and Garden ™* ▪ *Roundup Biactive ™ / Roundup ™* ▪ *Zero ™* *Example of Registered Metasulfuron Herbicide:* ▪ *Brush - Off™*		

The following are control techniques that are to be utilised on site:

- **Cut Stump Method** - This method involves cutting plant stems as close to ground level as possible and immediately painting the cut stump with herbicide. This treatment can also be applied as a basal bark application to the first 15-20 cm (entire circumference) of an uncut stem if the adult bark has not yet developed. Chemical use with this application is dependent on the proximity of the weed to naturally ponding water or waterways and whether the chemical is registered for aquatic use.

- **Basal Bark Method** - This method involves applying a herbicide to the lower 35-45 cm bark around the entire stem using a hand-pump backpack sprayer fitted with a shut-off at the wand tip and an adjustable cone nozzle or a small, ATV (All Terrain Vehicle)-mounted sprayer with a shut-off at the wand tip and an adjustable cone nozzle.

- **Ring Barking -** This method involves removing the lower bark from the stem using a sharp implement to expose the phloem and xylem tissue to the outer environment thereby destroying it.

- **Spray Method** - There are two (2) types of spraying methods that will be employed where appropriate:
    - Selective blanket spraying: The area must initially be checked for the presence of any native species. Any weeds within 2 m of the drip zone of existing native species will be removed by hand. Alternatively, native species will be covered with impermeable material (e.g. a tarpaulin) for protection during spraying;
    - Spot spraying: The spray nozzle will be kept close to ground to avoid any overspray. Individual weeds will be spot-sprayed at the site. This method of spraying will be employed as native species are interspersed throughout the exotic grasses; and
    - Herbicides specific to each target species, where appropriate, will be identified prior to the implementation of any works. Herbicides will be applied in accordance with the manufacturer's specifications and when environmental conditions are most preferred (e.g. wind and rainfall).

- **Stem Injection** - Herbicides may be applied directly to the plant via stem injection. This involves applying a herbicide to the plant directly through drilling a hole into the stem and inserting the chemical. Axe cuts for stem injection can also be used. Cuts can be made at regular intervals around the stem and should leave a "pocket" into which the chemical must be immediately injected. Axe cuts should penetrate the cambium layer, but not the hardwood.

- **Wick Wiping** - This method employs vehicle-mounted (broad acre application) or hand-held equipment (small area/single plant application) to wipe or brush concentrated herbicide onto weeds. The herbicide is applied from permeable rope that is permanently connected to a reservoir containing Glyphosate. For purposes of weed control where accessibility to the infestation is low, a handheld 'wick wipe' will be used. This will also be incorporated for the control of emergent species. This method is particularly safe to use in areas where weed species are interspersed with native plants as there is no spray drift of herbicide.

- **Cutting and Chipping** - Manual weeding may involve cutting and chipping, pulling, digging or slashing and is preferred, depending on the growth stage and situation as detailed:

    - Where native plants are growing within a weed infestation and the use of selective herbicide is not possible;
    - Where inadequate foliage is present to allow for successful uptake of herbicide e.g. Mile-a-minute runners typically exhibit this trait; and
    - When hand weeding, the stem must be grasped firmly at the base of the plant and pulled. A trowel, mattock or sharp knife may be needed to loosen the soil. Care must be taken not to leave behind stems or other plant pieces that may re-shoot. Hand weeding should also be undertaken at times when weeds are not seeding to reduce dispersal and spread. Hand pulling is not recommended for some weed species as they readily sucker if their roots are disturbed e.g. *Lantana camara*. This method will be employed when removing exotic grass species within retained vegetation.

ATTACHMENT 3 - BASELINE DATA PROFORMA

Work Area Number:	**Date:**
Climatic Condition:	
Vegetation type:	
☐ Rainforest ☐ Sclerophyll Forest ☐ Wetland	
☐ Woodland ☐ Heath ☐ Riparian Veg	
Native Regeneration Scoring at Time of Assessment:	
☐ Negligible ☐ Poor ☐ Moderate ☐ Good ☐ Exceptional	

NATIVE PLANT SPECIES LIST *Details of native plant species present and their abundance within the work area*			
Stratum	**Native Plants**		**Abundance**
	Common Name	**Scientific Name**	
Lower			

Mid			
Upper			

THREATENED PLANT SPECIES/ENDANGERED ECOLOGICAL COMMUNITIES LIST *List of threatened plant species/Endangered Ecological Communities found at the work area*		
Species and Conservation Status	**Number of Plants**	**Management Implications**

Endangered Ecological Community	**Management Implications**

HABITAT FEATURES	
Fauna observed: *e.g. Turkey mound present on site.*	
Fauna habitat features present on site:	
☐ Hollows in trees	☐ Wet or damp areas (including soaks / springs)
☐ Mature or over-mature trees	☐ Leaf litter
☐ Dead standing trees	☐ Native grasses, rushes and sedges
☐ Rocks and boulders	☐ Fleshy fruited trees and shrubs
☐ Fallen logs	☐ Nectar bearing trees and shrubs
☐ Caves, mineshafts or overhangs	☐ Dense understorey shrubs
☐ Springs	☐ Prickly understorey shrubs
☐ Lagoons	☐ Seasonal cracks in the soil
☐ Pools	☐ Other (please specify):
☐ Watercourses / gullies	
☐ Riparian areas	
Comments:	

ENVIRONMENTAL WEED SPECIES LIST

Details of weed species present and their abundance within the work area

Stratum	Major Environmental Weeds		Percentage Cover %
	Common Name	Scientific Name	
Lower			

Mid			
Upper			

OTHER THREATS OR IMPACTS			
Feral Animal Presence:	**Area of Most Disturbance**	**Impact**	**Management Implications**
EXAMPLE: Cane Toad	*Open disturbed area*	*On native fauna*	*Monitor presence*
Possible Negative Impacts	**Impact**	**Management Implications**	
EXAMPLE: Stock intrusion	*On regenerating native plants*	*Stock intrusion is unlikely, however if evidence of significant negative impact of regenerating native vegetation is detected, then fencing of stock may be required.*	
EXAMPLE: Herbicide drift	*On threatened XXXX plant and on native plants*	*Use of herbicides to control weeds around the threatened plants will have to be done with utmost care and only by experienced bush regenerators. In any case weed control using herbicides must comply with current Best Management Practice*	
ENVIRONMENTAL RESTORATION ISSUES			
Weaknesses			
EXAMPLES: Exposed, no canopy, high light. Copious weed regeneration following disturbance. Sloping site difficult to work in. XXX threatened species present in abundance.			

Strengths	
EXAMPLES: Good seed source for native recruitment. Some native regeneration occurring.	
Restoration Objectives for Work Area	
EXAMPLE: To undertake all enhancement plantings and the first stage weed control program by the release of the subdivision certificate, and to achieve an 80% native species canopy cover in all areas by November 2009.	

APPENDIX 4 – ACID SULPHATE SOIL INVESTIGATION AND MANAGEMENT PLAN (TECTONIC 2021)

ACID SULFATE SOIL INVESTIGATION & MANAGEMENT PLAN

Proposed Compensatory Cut
Unnamed Drainage Corridor, North Harbour

Report for: North Harbour Holdings Pty Ltd
21030-001-Rev0
10 March 2021

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Document Review

Document No.	Revision	Prepared By	Reviewed By	Date Issued
001	0	Mark Thomson	Ashley Davey	10 March 2021

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Executive Summary

This report has been prepared to identify the risks associated with possible disturbance of acid sulfate soil (ASS) and provide a series of management strategies for excavation of material for proposed compensatory cut earthworks, as part of ongoing development of North Harbour Residential West.

Completion of the compensatory cut is proposed to improve local drainage, provide compensatory flood offset and win material as part of development of North Harbour Residential West.

The depth and nature of excavation will be generally consistent with the grade and profile of the existing drainage corridor, with proposed excavation being typically less than 0.5 m below existing ground levels (BGL) across most of the site, but up to a maximum 1.5 m BGL in parts. Excavated material will be re-used as controlled fill within the North Harbour residential development area.

An ASS management plan for works associated with the North Harbour development has been previously completed and approved by the office of the Queensland Coordinator General *(Acid Sulfate Soil Investigation Report and Management Plan (Revision 8)*, prepared by Coffey Geotechnics Pty Ltd, Report No. GEOTKPAR01976AC-D (Rev8)).

Site investigation involving quantitative laboratory analysis confirms that the materials which will be disturbed by proposed compensatory cut do not contain any significant levels of potential of actual ASS (i.e. the site soils are non-ASS and Non-PASS). The overall risk associated with potential for oxidation of these soils is negligible.

Existing acidity, comprising predominantly of non-sulfuric based acidity, is present within the soils at strengths measured up to 210 mol H+ per tonne (averaging 46 mol H+ per tonne). While significant actual acidity has been found to be present within the assessed soil profile, the nature of the acidity is deemed to be non-sulfuric. These soils are therefore classified as acidic, non-sulfuric (ANS) soil.

Based on an excavation volume of approximately 15,000 m³, with an average net acidity of 46 mol H+ per tonne, these works are categorised as requiring an "extra high level" of treatment, per the categorisation guide set out in the Queensland Acid Sulfate Soil Technical Manual. This categorisation rating is principally due to the large volume of material to be disturbed, as opposed to strength and nature of acidity present and assumes the acidity to be associated with ASS. Whilst it is noted that the project would fall within the extra high treatment category, it is expected that due to the lack of identified ASS hazard, these works can be appropriately managed through application of environmental management strategies for ANS soil, as already detailed in the approved ASSMP.

The following management recommendations align with the strategies detailed within the approved ASSMP and will be followed during works mitigate risk of adverse environmental impacts related to the disturbance of acidic soil.

Site management will include the following key features:

- Avoidance of any disturbance of soil or water outside the immediate proposed works area.
- Treatment of disturbed soils to neutralise the risk posed by existing non-sulfuric acidity.
- Undertake active management of surface and groundwater conditions to minimise construction disturbances.
- Manage construction water quality to prevent uncontrolled release or impact to downstream water quality conditions.

To monitor works associated with the proposed compensatory cut, two surface water monitoring locations will be established upstream and downstream of proposed works, to monitor potential impacts to surface water quality within the drainage corridor as a result of construction.

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1.0 INTRODUCTION

This report has been prepared to identify the risks associated with possible disturbance of acid sulfate soil (ASS) and provide a series of management strategies for excavation of material for proposed compensatory cut earthworks, as part of ongoing development of North Harbour Residential West. The investigation was performed by Tectonic for North Harbour Holdings (NHH), in accordance with Proposal P21002-Rev0, dated 12 January 2021.

An existing ASS management plan for works associated with ongoing North Harbour Residential West development has been approved by the office of the Queensland Coordinator General (Acid Sulfate Soil Investigation Report and Management Plan (Revision 8), prepared by Coffey Geotechnics Pty Ltd, Report No. GEOTKPAR01976AC-D (Rev8)).

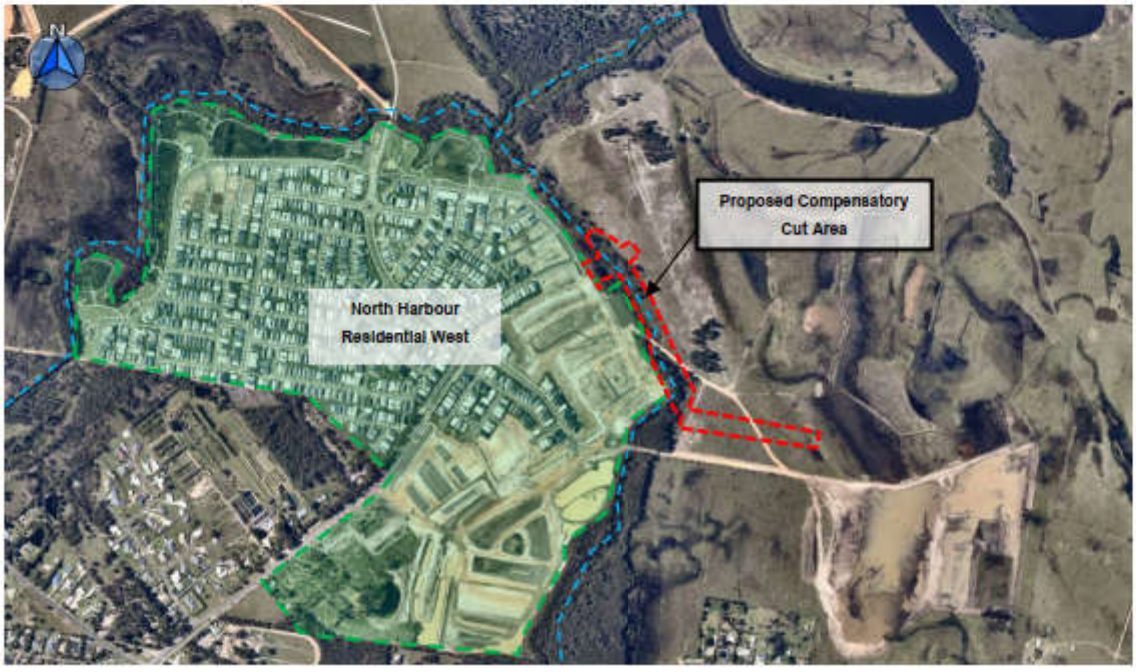
This report investigates the risk of ASS being disturbed as a result of proposed compensatory cut works, and provides recommended acidic soil management strategies, intended to align with the strategies detailed within the approved ASSMP for the wider site. This is approach is intended to ensure that potential environmental hazards associated with excavation of material from the proposed compensatory cut and placement within North Harbour Residential West will be effectively managed and mitigated.

2.0 SITE DESCRIPTION

The subject site comprises an approximate 5 ha area within the North Harbour development precinct, situated to the east of North Harbour Residential West. The subject area comprises mostly pastural land, partially adjacent and within an unnamed drainage corridor near the eastern perimeter of the current North Harbour Residential West development.

Existing ground cover comprises thick grasses and patches of well-established shrubs and native trees, particularly within lower sections of the drainage corridor. Existing ground surfaces within the subject site typically grade toward the drainage alignment with existing ground surface elevations ranging between RL 1 m and RL 3.5 m AHD.

Text Figure 1 below illustrates the site location and surrounds. Text Figure 2 over page shows the site condition at the time of investigation.



Text Figure 1: Current Development Area & Proposed Compensatory Cut

Text Figure 2: Typical site condition at the time of investigation

3.0 PROPOSED DEVELOPMENT

Bulk earthworks plans prepared by KN Group (DWG No. 20-185 01-09, Feb 2021) indicate an approximate 5 ha compensatory cut, occurring adjacent and within an unnamed drainage corridor. The proposed works will include re-profiling of the existing ground surface level within the proposed compensatory cut area to remove high sections of ground, creating a consistent ground surface level, providing both compensatory flood mitigation storage and a formalised drainage pathway.

A copy of the bulk earthworks design plans is provided in Appendix A, which includes conceptual erosion and sediment control strategies for the proposed borrow area.

The proposed depth of excavation will vary across the cut area but will be mostly limited to stripping of high vegetation and organic topsoil up to 0.5 m below existing ground surface, with some minor excavation of higher ground expected to extend no greater than 1.5 m below the existing ground surface level. It is estimated that approximately 15,000 m^3 will be disturbed during excavation. Excavated material, where suitable, will be re-used as bulk fill within residential stages of North Harbour Residential West. Following the completion of earthworks typical ground elevation across the drainage corridor will range from RL 1.0 m AHD (at the base of the central drainage pathway) to RL 3.5 m AHD at works edges, tying in with the surrounding ground surface levels.

All excavation and placement of material during the proposed works will be managed in accordance with the existing approved ASSMP and as detailed herein.

4.0 INFORMATION ON ACID SULFATE SOIL

There are two principal forms of acidic soil associated with the North Harbour development precinct. The first type is ASS which can be damaging to the environment and built structures. Development involving ASS must comply with the requirements of state and local regulations pertaining to ASS. This includes the State Planning Policy, the Morton Bay Regional Council's Planning Policy and their attendant guidelines.

The second type of acidity present in soil is non-sulfuric acidity, termed Acidic, Non-Sulfuric acidity (ANS). Soils with non-sulfuric acidity are very common in leached landscapes throughout coastal Queensland. These types of soil are mentioned in the Queensland Acid Sulfate Soil Technical Manual, which states that it is unnecessary to regulate these acidic soils as ASS due to their inherent low risk. However, to operate within the requirements of Queensland environmental law, it is prudent to manage the acidity in line with best practice management criteria, if large volumes of ANS soils are going to be disturbed.

It is noted that large volumes of ANS soils have been disturbed without management strategies over many years without any reported environmental impact. This type of acidity thus presents significantly less environmental hazard than disturbance of ASS.

4.1 Acid Sulfate Soil

ASS is common in low-lying coastal areas of Queensland, typically in Holocene to Pleistocene (Quaternary) age alluvial sediments, which typically exist below an elevation of RL 5.0 m AHD. Such areas are often characterised by the presence of estuaries, swamps, floodplains, salt marshes and mangroves. The affected soils contain iron sulfides, most frequently pyrite, which, when exposed to air, can oxidise to form sulfuric acid.

Soils containing iron sulphides are commonly termed *potential ASS (PASS)*. Existing acidity attributed to the past oxidation of ASS may also be present as a result of the previous exposure of PASS material to aerobic conditions. This is commonly termed *actual ASS (AASS)*. Also included in the definition of AASS are soils that contain sparingly soluble salts such as jarosite, that can form during the oxidation of sulfides and are capable of generating further acidity as they later dissolve or hydrolyse under acidic conditions. Potential acidity bound up in these salts is referred to as *'retained acidity'*.

Sulfuric acidity created by disturbance of ASS presents an environmental risk due to its potential to rapidly alter the pH of soil and water within an environment and increase the mobility of metals which may be naturally present in the soil (i.e. iron and aluminium), thereby producing a leachate contaminated by both high levels of acidity and metals. Associated chemical reactions in highly affected waters can also strip the leachate and the receiving environment of dissolved oxygen. Such leachate, if released into sensitive environments, can have significant adverse effects including degradation of the water quality in receiving areas, fish disease/kills, reduced crop productivity, corrosion of built structures and health related issues. In view of these potential effects, it is critical that any development that occurs within an area likely to contain ASS is planned, managed and monitored appropriately so as to minimise or remove the risk of adverse environmental outcomes.

4.2 Non-sulfuric Acidity (ANS Soil)

ANS is common in residual and leached landscapes, and generally occurs as a result of hydrolysis reactions associated with leaching of the soils or the breakdown of organics. These forms of acidity are not related to ASS and are not considered as potentially harmful as ASS due to their generally weak nature and low mobility. Where significant volumes of soils with non-sulfuric acidity are expected to be disturbed by the proposed development, appropriate risk assessment and, if necessary, management controls may be undertaken to ensure potential environmental hazards are appropriately mitigated.

ANS can be identified during an acid based account, through measurement of soluble sulfur (S_{KCl}) following TAA analysis. ANS soils are identified by the following criteria:

- TAA exceeding 18 mol H+/tonne.
- low soluble sulfur (e.g. S_{KCl} < 0.03%)
- no reportable oxidisable sulfur (using S_{CR} or S_{POS} test methods)
- no visual or reportable jarosite, or similar acid-producing iron or aluminium hydroxy-sulfate minerals (using S_{RAS} or S_{NAS} test methods).

Risk assessment for ANS is prudent for soil that exceed the ASS action criteria for management (i.e. existing acidity above 18 mol H+/tonne), however as ANS soils are generally formed as a result of a slow soil weathering process, the acidity is typically well bound to the soil and is not readily mobile, therefore the potential for existing acidity to leach and create environmental issues is relatively low where levels of acidity are generally less than 50 mol H+/tonne.

When large volumes of ANS soils are excavated and placed in locations where they may be subject to readily leached, acidity and metals may be transported out of the soil. For this reason, a series of management strategies have been defined to manage the risk associated with ANS soils. ANS management generally involves neutralisation with agricultural lime, using liming rates guided by quantitative test results.

As the degree of risk posed by ANS is not as potentially hazardous as ASS, neutralisation may typically be undertaken through placement of guard layers, without need for inclusion of safety factors, to intercept and neutralise any leachate. Thorough mixing of treated soil, a fully contained treatment pad or intensive verification testing are not required. The lime guard layers are considered adequate to intercept any potential acidic leachate which may be caused by ANS.

5.0 ASS INVESTIGATION & ASSESSMENT

A site investigation has been undertaken incorporating a review of published geological and ASS risk mapping information and site sampling and analysis, to identify and characterise the presence or absence of ASS across the site, and to quantify potential risks based on the disturbances proposed.

Site investigation has been carried out in general accordance with *"Guidelines for Sampling and Analysis of Lowland Acid Sulfate Soils (ASS) in Queensland"* (Ahern et al., 1998), and *"Queensland Acid Sulfate Soil Technical Manual: Soil Management Guidelines v4.0"* (Dear et al., 2014), being the applicable guidelines for identification and management of ASS in Queensland.

5.1 Fieldwork and Laboratory Testing Methodology

Fieldwork was carried out on 9 February 2021 by experienced environmental scientist from Tectonic.

Nine boreholes (BH2 to BH10) were drilled to a depth of 2.0 m below ground level (BGL) using a 100 mm auger (with TC bit) mounted on a 4WD utility. Due to access limitations, borehole BH1 was hand augered to refusal in very stiff residual clay at 0.7 m BGL.

Proposed disturbance which exceeds 1.0 m deep only accounts for approximately 10% of the total area, thus an investigation depth of 2.0 m (1 m below the typical depth of disturbance) is considered appropriate to adequately assess the ASS risk for these works.

Borehole locations are illustrated in the Site Plan attached as Figure 1.

All boreholes were logged in accordance with the Unified Soil Classification system. Soil samples were collected at 0.25 m depth intervals from all boreholes for laboratory assessment. Selected soil samples were dispatched to Eurofins MGT, a NATA accredited analytical laboratory located in Brisbane. ASS sampling protocols in the field were observed to minimise potential for oxidation prior to laboratory testing and followed the guidelines.

Borehole logs, together with explanatory notes, are attached in Appendix B.

All ASS samples (75) were screened to assess field pH (pH_F) and pH after oxidation (pH_{FOX}). Using the pH screening testing results and borehole logs, a total of 20 samples were selected to undergo quantitative analysis by the Total Actual Acidity (TAA) and Chromium Reducible Sulfur (CRS) suite in accordance with ASS Method 23F (TAA) and 22B (CRS) laboratory procedures. Quantitative testing undertaken was specifically targeted at samples which indicated a high potential for occurrence of ASS based on pH field screen testing and was sufficient to quantify the ASS hazard across all soil profiles encountered. On this basis, the amount of testing undertaken is considered sufficient to provide an acceptable quantification of the ASS hazard present, with low level of uncertainty between test locations.

Where encountered, details of groundwater seepage and/or depth to the standing groundwater table was recorded on borehole logs. Opportunistic groundwater samples were recovered from boreholes BH3, BH7 and BH9 and were field tested for ASS related physio-chemical parameters including pH, electrical conductivity (EC) and reduction-oxidation (REDOX) potential.

pH screening and CRS laboratory test results are tabulated in Table C1 (Appendix C), where ASS laboratory test certificates are also presented. Laboratory test results are discussed in Section 5.5 and groundwater results are discussed in Section 5.4.

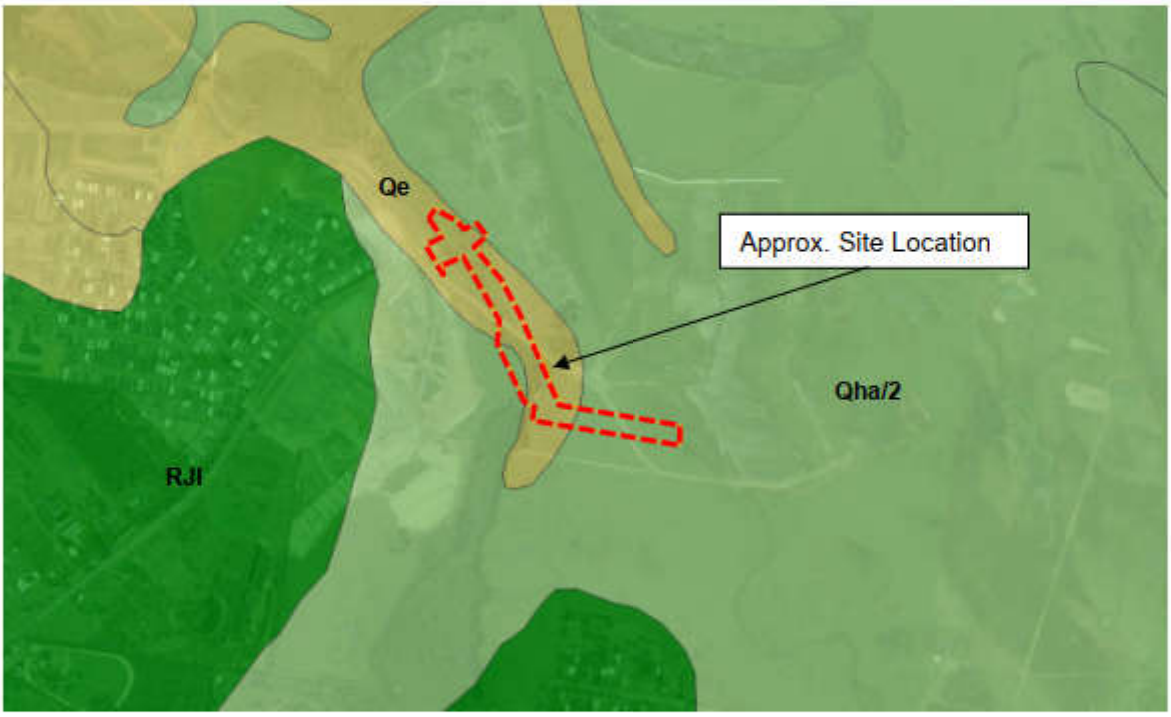
5.2 Desktop Assessment

5.2.1 Regional Geology

The 1:100,000 Series Caboolture Geological Map (Sheet 9443, First Edition 1979) indicates that surface geology across the site mostly comprises Quaternary age miscellaneous unconsolidated sediments (denoted **Qe**), comprising of estuarine and alluvial deposits of clay, silt and sand. These deposits are expected to be associated with the unconsolidated drainage corridor deposits and may be flanked or underlain by older Holocene age alluvium (denoted **Qha/2**), comprising of secondary river terrace deposits of sand, silt, clay and gravel.

It is inferred that these strata are underlain at depth by a basement of much older residual soils and weathered sedimentary rocks associated with the Landsborough Sandstone formation (**RJl**) which is indicated to be present to the west.

An extract from the map is shown in Text Figure 3.



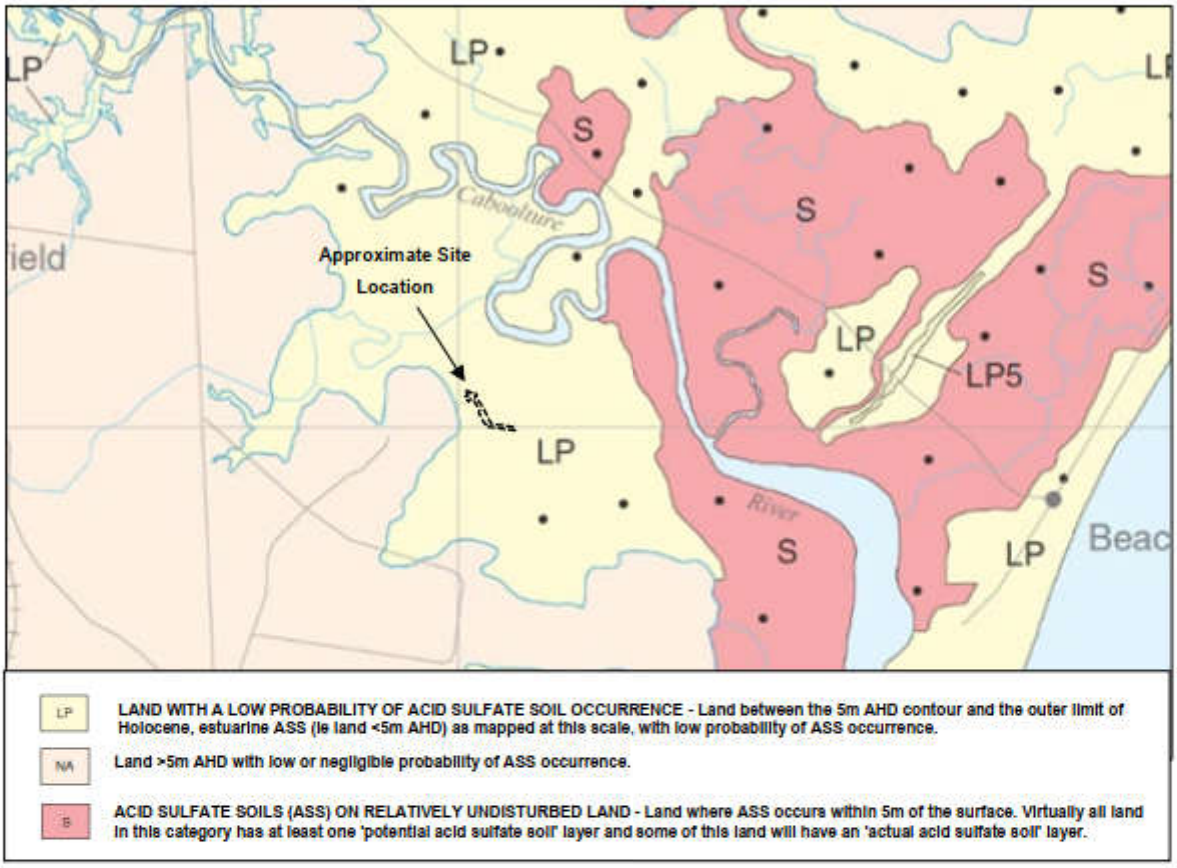
Text Figure 3: Extract from Caboolture geological map

5.2.2 Regional ASS Mapping

An extract from the Queensland Government's *Acid Sulfate Soils Redcliffe to Teewah Map 2* (NR&M-SEA-I-A0 3261) covering the region is shown in Text Figure 4 over page.

Mapping indicates the presence of primarily **Low Probability** "**LP**" land types across the subject site and surrounding land situated below RL 5 m contour. This description of the LP land type, especially across lower lying Quaternary estuarine alluvium located nearer Caboolture River, does not match with regional geological mapping discussed above in Section 5.2.1, or past site experience. Our experience is that some weak non-sulfuric acidity exists throughout the soil profile in these lower lying areas, and that some potential for AASS and PASS exists, where low strength estuarine sediments are encountered. It is noted that the established boundaries and risk probability have been established using ground contours and known geological boundaries with limited field checking. While ASS risk mapping does indicate a low probability of ASS being present across the site, some potential for ASS to exist would be likely across lower estuarine alluvial soils. The presence nor absence of ASS at a site based on broad-scale mapping alone is not

definitive and may only be confirmed by completion of a site investigation, involving site assessment and quantitative analyses.



Text Figure 4: Redcliffe - Teewah Acid Sulfate Soils Map 2 (NR&M-SEA-I-A0 3261)

5.3 Subsurface Conditions

Subsurface conditions encountered in the boreholes were relatively consistent with geology mapping, in general comprising of interlayered alluvial soil.

BH1 encountered approximately 0.5 m depth of stiff, dark brown, organic silty clay, underlain by stiff to very stiff pale brown/grey clay prior to hand auger refusal at 0.7 m BGL. Boreholes BH2 to BH6 encountered between 0.7 m to 1.6 m depth of medium dense, brown silty sand, overlying firm to very stiff, pale grey to white sandy clays, extending to the investigation depth of 2 m. Boreholes BH8 and BH9 encountered relatively 'clean' sands extending to the 2 m limit of investigation. Boreholes BH7 and BH10 intersected 0.7 m to 1.3 m depth of stiff sandy/silty clays and interlayered medium dense sand, overlying firm to stiff pale grey / pale brown sandy clay.

5.4 Groundwater

Groundwater seepage and/or standing groundwater levels were encountered in all boreholes, excluding BH1, at depths of between 0.5 m and 1.5 m BGL, with shallower depth to groundwater typically occurring in boreholes situated at lower elevations and in closer proximity to the drainage corridor.

Ponded surface water was observed within the existing drainage corridor (approx. RL 1 to 1.5 m), which is expected to be closely interconnected with surrounding unconfined groundwater conditions. Depth to standing groundwater level will vary with proximity to standing surface water and relative topography. Groundwater is expected to be present within the more permeable sandy layers, and may be either perched or confined, above and/or below less permeable clay layers. Groundwater levels are expected to fluctuate

with prevailing weather conditions. Groundwater seepage is likely to typically migrate towards the drainage corridor and Caboolture River to the north-west.

Opportunistic groundwater samples were recovered from boreholes BH3, BH7 and BH9 and were tested for ASS related physio-chemical parameters. Results are summarised in Table 1.

Table 1: Summary of Groundwater Monitoring

Parameter	Units	BH3	BH7	BH9
Depth (Standing Water Table)	m BGL	0.5	1.0	0.8
pH	pH unit	4.41	5.60	5.35
Electrical Conductivity	µS/cm	891	911	3610
REDOX Potential	mV	360	166	79

Groundwater pH values range from 4.4 to 5.6 indicate the groundwater to be acidic. This is similar to adjacent environments in Borrow Areas 3-2 and 4-1 to the east, monitored areas around North Harbour Residential West.

EC levels indicate that the groundwater is fresh (< 1500 µS/cm) to brackish (1500 to 45,000 µS/cm). Such groundwater may be present either due to entrapment of saline water during soil formation or due to inundation of the site by seawater (e.g. during extreme tidal events).

REDOX values of 79 mV to 260 mV indicate that the groundwater conditions tend towards chemically oxidative conditions. This is typical of naturally unconfined alluvial groundwater conditions, where the permeable sandy soil profile and variable groundwater conditions allow the presence and availability of *in situ* oxygen.

5.5 ASS Investigation Results

Site and laboratory investigation methods are described earlier in this report, with the ASS investigation component generally consisting of a total of 10 boreholes (2 No. per hectare), drilled to a depth of 2.0 m BGL or refusal across proposed development area. Based on the nature of the proposed disturbance, an action criteria of 0.03 %S (18 mol H+ per tonne) was adopted for comparison with the combined actual and potential acidity results. The investigation findings for soil analyses are discussed below.

5.5.1 Field Screen Analysis

A total of 75 samples were recovered and assessed by pH field screen analyses. Test results indicate that the soils tested generally have field pH (pH_F) values ranging from about 4.4 to 6.4, indicating naturally acidic to neutral *in situ* soil conditions.

Most of the oxidised pH (pH_{FOX}) test results (61 of 75) consistently recorded pH_{FOX} values of between 3 and 4, indicating a moderate, but generally inconclusive, likelihood for potential ASS to be present within the subsurface soil horizons. 8 of the 75 samples recorded pH_{FOX} below 3, indicating high likelihood for ASS. These locations were noted to be within 0.5 m of ground surface level (typically above the groundwater table), being counterintuitive to the occurrence of potential ASS. It is likely that the presence of organic material near surface may have skewed the oxidised pH results. A number of these samples were tested by quantitative analysis to confirm the absence or presence of ASS within this lithology.

It is noted that pH screen testing is indicative only and cannot definitively confirm the presence of ASS, nor can it quantify the nature or strength of any acidity present. Further quantitative laboratory testing was therefore carried out on a range of samples in order to assess the strength of any acidity present, and to quantify the oxidisable sulfur content present.

5.5.2 Quantitative Laboratory Analysis

Twenty of the 22 samples tested recorded no oxidisable sulfur (S_{CR}%) above the lowest recordable limit of 0.005%, with two samples (BH1 0.0-0.25 m and BH4 0.75-1.0 m) recording 0.018% and 0.011% respectively, also being below the 0.03% threshold limit defining potential ASS.

This lack of oxidisable sulfur confirms that soils within the proposed compensatory cut area do not contain potential ASS.

Fourteen of the 22 samples tested recorded actual acidity (TAA) values which were above the 18 mol H+ per tonne action criteria defining the presence of actual acidity. Levels of actual acidity recorded were between < 2 mol H+ per tonne and 210 mol H^+ per tonne, with an average acidity of 46 mol H+ per tonne.

Levels of soluble pre-oxidation sulfur (S_{KCl}) were below 0.02% for all samples, indicating a general lack of sulfuric based acidity.

Levels of Jarosite and similar acid-producing iron or aluminium hydroxy-sulfate minerals (S_{NAS}) were below 0.02% for all samples, indicating a general lack of retained acidity.

While significant actual acidity has been found to be present within the assessed soil profile, the nature of the acidity is deemed to be non-sulfuric. These soils are therefore classified as ANS soil and are not AASS.

5.6 ASS Risk Characterisation

Site investigation involving quantitative laboratory analysis confirms that the materials which will be disturbed by proposed compensatory cut, do not contain any significant levels of potential of actual ASS (non-ASS and Non-PASS). The overall risk associated with potential for oxidation of these soils is negligible.

Existing acidity, comprising predominantly of non-sulfuric based acidity is present within the soils, at strengths measured up to 210 mol H+ per tonne (averaging 46 mol H+ per tonne).

Based on an excavation volume of approximately 15,000 m^3, with an average net acidity of 46 mol H+ per tonne, these works are categorised as requiring an *"extra high level"* of treatment, per the categorisation guide set out in the *Queensland Acid Sulfate Soil Technical Manual*.

It is noted that this categorisation rating is principally due to the large volume of material to be disturbed, as opposed to strength and nature of acidity present and assumed the acidity to be associated with ASS.

Whilst it is noted that the project would fall within the extra high treatment category, it is expected that due to the lack of identified ASS hazard, these works can be managed through application of conventional environmental strategies for ANS soil, as detailed in the approved ASSMP for development works associated with North Harbour residential development (CG Report No. GEOTKPAR01976AC-D (Rev 8)), which are summarised herein.

6.0 ACIDIC SOIL MANAGEMENT STRATEGY

The following management recommendations provide a framework to allow the proposed works to proceed without risk of adverse environmental impacts related to the disturbance of acidic soil. To successfully achieve this objective, the following strategies shall be implemented:

- Minimisation of the spatial and temporal disturbance of areas where ASS may exist, and avoidance of significant changes to any areas outside the proposed works area;
- Mitigation of risk associated with existing acidity in disturbed soil, by treatment to neutralise any disturbed ANS soil;
- Containment, testing and treatment (where necessary) of any waters collected during the excavation and/or during the treatment processes; and
- Limitation of any alteration to the existing groundwater conditions and appropriate treatment of any collected groundwater before re-use, offsite discharge or disposal.

6.1 Management of Disturbed Material

To mitigate risk associated with existing acidity observed in ANS soil, all disturbed soil, including stripped organic topsoil, will be treated with fine grained agricultural lime to neutralise any leachate from the excavated materials.

As the risk posed by ANS soils is not as significant as ASS, neutralisation may be undertaken through placement of guard layers within placed fill, without the need for thorough mixing of treated soil, the inclusion of safety factors in liming rate calculations, or the use of a specifically contained treatment area. Where materials are not suitable for reuse as fill, materials will be treated prior to placement in temporary stockpile or removal from site.

Fine grained agricultural lime will be applied at a rate of **5 kg per cubic metre of disturbed soil**, as calculated from the available quantitative testing results. Lime shall be placed as guard layers between soil layers of ANS fill. The guard layers shall be placed at not more than 300 mm depth intervals within the fill profile. This treatment rate assumes the use of fine-grained agricultural lime with a purity of not less than 90%, a soil bulk density of 1.7 tonnes per cubic metre. A factor of safety, usually applied for treatment of ASS, to allow for incomplete mixing and the reactivity of the lime has not been included.

Please note, treatment of ASS requires the mixing of fine grained calcium carbonate (agricultural lime), which is an inert product. Other lime products such as hydrated lime, present their own health and safety and environmental risks, and must not be used for soil neutralisation purposes. Furthermore, ANS soils exist in an environment that is naturally acidic. The use of excessively high liming rates or inappropriate forms of like have the potential to alter that environment. The recommended liming rate has thus been calculated to mitigate the risk of possible acid leachate without excessively impacting the pH of the existing environment.

Runoff from any disturbed areas, including treatment areas, must be controlled and managed to mitigate potential effects on ground or surface waters. This will be undertaken by the Contractor through application of the Erosion and Sediment Control Plan.

Verification testing for confirmation of effective treatment of ANS soil is not necessary. It is recommended that details such as receipts for lime delivery and records of usage on site be recorded by The Contractor to show that treatment has been completed.

6.2 Water Quality Management

It is expected that the Contractor will provide a suitable construction methodology that ensures that upstream surface water conditions are maintained, and that stormwater throughflow can be facilitated during wet weather periods, to ensure that the proposed works can be carried out without undue risk of release of sediments or other contaminants to downstream waters and the Caboolture River.

Runoff generated from exposed excavation activities or treatment areas, will be controlled, contained, tested and treated (as necessary) prior to release or re-use onsite. Uncontrolled discharge of surface or groundwater from across excavation areas, ASS treatment areas or exposed works will not be allowed to occur.

If release of water is required, performance criteria detailed in the approved ASSMP (replicated in Table 2) must be met prior to release. The Contractor shall be responsible for ensuring relevant water quality criteria are met prior to discharge. The Contractor shall also be responsible for ensuring relevant water quality monitoring is undertaken and is appropriately recorded and reported.

Illustrated erosion and sediment control plans for proposed compensatory cut works are attached in Appendix A. These plans demonstrate how site water shall be managed during construction.

Table 2: Site Water Quality Release Criteria

Indicator	Release Limit	Criteria Type
pH	6.0 to 8.0 [1]	Range
Turbidity	To be determined by site specific correlation testing [2]	Maximum
Suspended Solids	< 50mg/L	Maximum
Dissolved Oxygen	85% - 110% saturation	Range
Electrical Conductivity	520µm/cm	Maximum
Dissolved Aluminium	55µg/L	Maximum
Dissolved Iron	300µg/L	Maximum
Hydrocarbons	No visible sheen or odour in release or receiving waters	Daily during releases
Litter/Gross Pollutants/ Unsightly flocs	No visible litter washed from the site nor any unsightly flocs deposited in waters downstream of any discharge	Daily during releases

Notes:

1. As releases of treated water occur to Raff Creek catchment which may host acid sensitive fauna such as acid frogs, a lower level of release pH of 6.0 has been adopted based on background pH levels.
2. Potential correlation may be investigated between turbidity and suspended solids concentration. Where a correlation coefficient of 0.9 or greater is demonstrated based on quality assured sampling and analysis, the corresponding value of turbidity may be used as an operational indicator of suspended solid compliance. Correlation results must be confirmed and approved by the Superintendent prior to implementation by the Contractor.
3. Water quality release limits requiring laboratory analysis shall be collected from stored water bodies and tested on a weekly basis during periods of discharge. Where no turbidity correlation has been achieved, an acceptable suspended solid test result must be obtained prior to commencement of release.
4. The dissolved iron and aluminium levels may be refined subject to further data on background conditions within the receiving environment. Refer to Section 4.5.3 of the approved ASSMP.

6.2.1 Surface Water Monitoring

A current surface water monitoring program designed to monitor water quality impacts associated with the wider North Harbour development area will continue to be carried out in accordance with the requirements of the approved ASSMP and associated development conditions.

To directly monitor works associated with the proposed compensatory cut, two additional surface water monitoring locations will be established, one 50 m upstream, and one 50 m downstream of proposed works, to observe potential impacts to surface water quality within the drainage corridor as a direct result of construction. These locations will be monitored for pH, electrical conductivity, dissolved oxygen, turbidity and temperature on a weekly basis throughout construction. Surface water monitoring upstream and downstream of the compensatory cut will be undertaken throughout the construction period, and for a period of 1 month following completion of landscaping works.

Parameters will be compared against the water quality objectives listed in Table 2 below. Water quality objectives are based on a combination of site-specific criteria and recommended water quality objective limits contained within the Environmental Protection (Water) Policy 2009 - Caboolture River environmental values and water quality objectives, dated July 2010.

Table 3: Water Quality Objectives for Compensatory Cut Surface Water Monitoring

Indicator	Objective Limit
pH	6.5 - 8.0 [1.] AND Variation between upstream and downstream pH levels shall not exceed 1 pH unit.
Electrical Conductivity	EC between monitoring sites may vary due to potential for occasional tidal influence at the downstream location. Objective limits for EC therefore cannot be defined. EC will be monitored to provide background information only.
Dissolved Oxygen	85 – 110 % Saturation. OR Within 20 % Sat. of upstream conditions.
Turbidity	< 50 NTU OR Increase in turbidity between upstream and downstream sites by a factor of 0.2 [2.]
Temperature	It is not possible to provide simple generic water quality objectives for Temperature. Temperature will be monitored to provide background information only.
Litter/Gross Pollutants/ Unsightly flocs	No visible litter washed from the site nor any unsightly flocs deposited in waters downstream of any discharge

Notes:

1. Incorporation of agricultural lime will be required as part of surface treatment for *in situ* acidity. Some increase in surface water pH may occur as a result. It is anticipated that exceedance of any water quality objective trigger individual assessment by an ASS specialist or appropriately experienced environmental consultant, to identify the cause of the issue, risk posed and proscribe specific management actions (where necessary).
2. It is noted that construction management prohibits release of construction runoff from disturbed sites greater than 50 mg/L.

Where water quality conditions exceed the stated water quality objectives, an ASS specialist shall be immediately engaged to assess the source of the variation and determine whether any significant impacts are occurring.

Should a significant issue be observed, the issue will be treated as a non-conformance against the ASSMP and immediately reported to the Contractor and Project Superintendent, who will inform the administering authority of the non-conformance if required.

6.2.2 Groundwater Management

Groundwater situated across and adjacent to the proposed compensatory cut is expected to be closely associated with surface waters within the existing drainage corridor. Most to the proposed works are not expected to have any impact on groundwater conditions. However, where surface waters will need to be contained, diverted or dewatered to completed proposed construction, the works would be likely to temporarily alter groundwater in areas adjacent the works.

Such temporary disturbances would not be expected to result in any significant long term change to groundwater conditions or creation of sulfuric acidity as no potential ASS is present in the soil profile. Additionally any potentially acid affected groundwater would be expected to be drawn towards the controlled works, where it would be effectively contained and managed as construction waters (as per Section 6.2) prior to release where meeting acceptable release criteria.

Due to the relatively short construction timeframe, implementation of surface water monitoring and lack of specific ASS hazard, groundwater monitoring is not considered necessary.

Where any visual indicators of groundwater impact (i.e. excessive groundwater seepage, mineral discolouration, or rapid change in pH of construction waters) is observed, a suitably qualified ASS expert shall be engaged to investigate, assess its likely causes and impacts, and recommend remediation actions or revised management strategies to mitigate potential environmental risk.

6.3 Site Rehabilitation

The completed surface of the compensatory cut area shall be rehabilitated in accordance with a vegetation restoration plan prepared for the works. Rehabilitation of the site will consist of appropriate surface soil amelioration followed by planting out with a range of trees, shrubs and groundcovers suited to "occasional" and "frequent" inundation events.

The revegetation will be monitored to ensure that it establishes successfully and is performing as expected. Progress towards rehabilitation success is to be measured against specified rehabilitation criteria.

Rehabilitation criteria after twelve months should include:

- At least 10 cm mulch cover maintained;
- 100 % survival of canopy trees, with at least 90 % to a minimum height of 70 cm;
- 100 % survival of shrubs, with at least 90 % to a minimum height of 35 cm;
- 100 % survival of ground cover, with growth to form; and
- Plant density and species diversity maintained.

Erosion and sediment control measures shall be maintained in a functioning condition until all construction activities are complete, and the site is stabilised.

7.0 LIMITATIONS

Your attention is drawn to the document *Limitations*, which is included in Appendix D of this report. The statements presented in this document are intended to advise you of what your realistic expectations of this report should be, and to present you with recommendations on how to minimise the risks associated with the services provided by Tectonic for this project.

Image: Nearmap - 6 November 2021

tectonic
geotechnical & environmental engineers

Tectonic Geotechnical Pty Ltd
PO Box 899
Buderim Qld 4556
Ph: 07 5478 9016

PROJECT:
PROPOSED COMPENSATORY CUT
UNNAMED DRAINAGE LINE

TITLE:
SITE PLAN

CLIENT:
NORTH HARBOUR HOLDINGS

DRAWN:	DATE:
MT	10/03/2021
CHECKED:	DATE:
ACD	10/03/2021

SCALE:
AS SHOWN

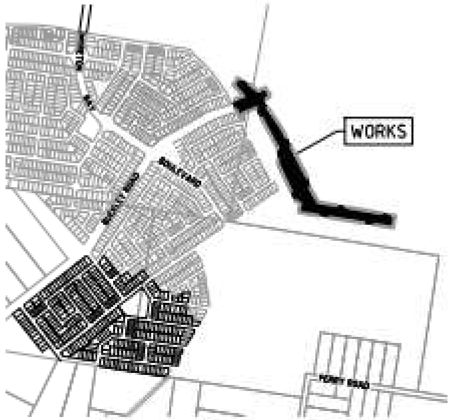
LEGEND:

- Borehole Locations
- Proposed Compensatory Cut Area

PROJECT NO.:	FIGURE:	REV:
21030-001	1	0

APPENDIX A

Bulk Earthworks Plans
KN Group, DWG No.: 20-185 01-09, Feb 2021

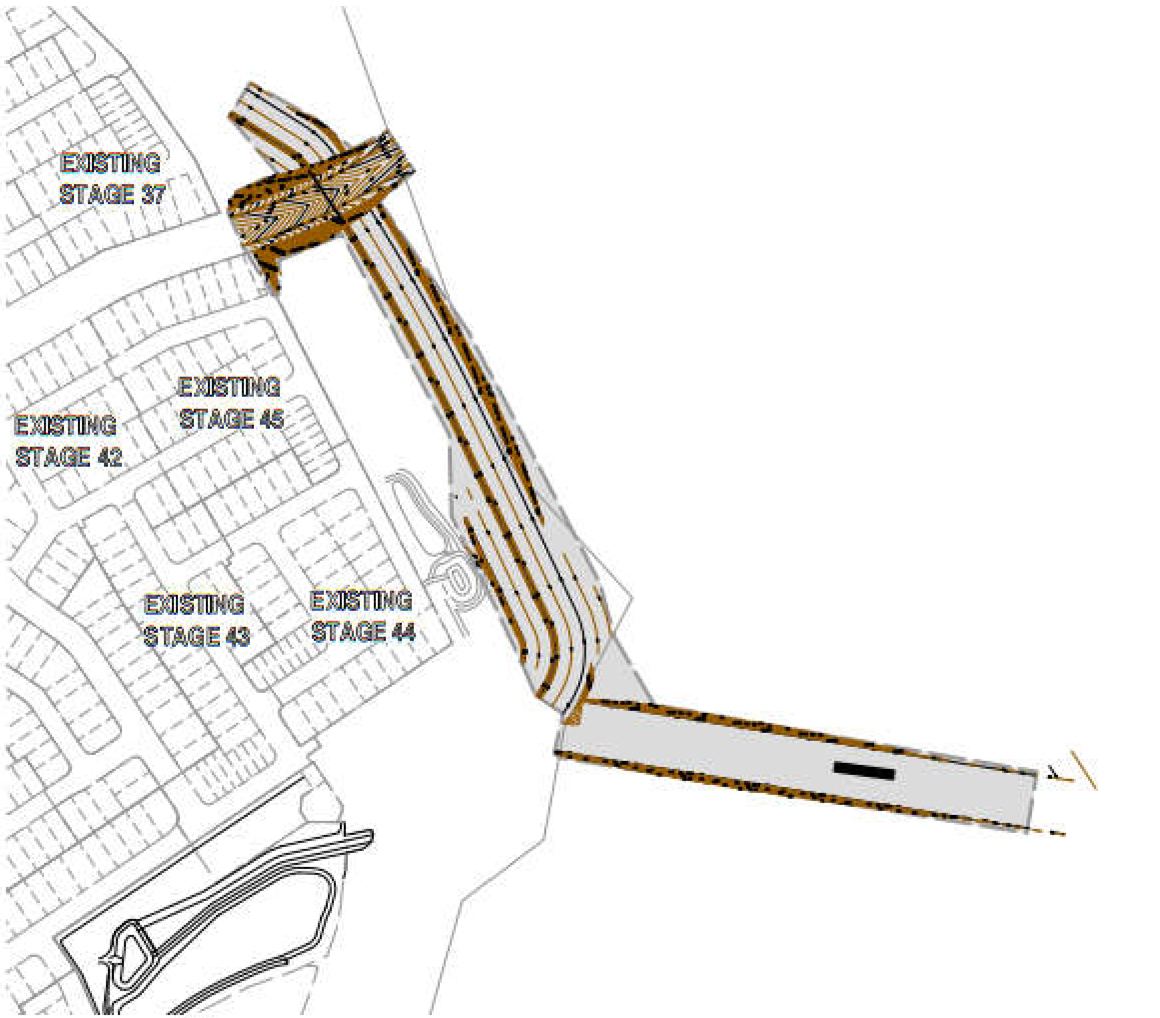


LOCALITY PLAN
SCALE 1:10000

DATUM A.H.D.
P.S.M. No 103504
E 497116.520
N 6998102.825
RL 19.282

![North Harbour — feel right at home]

BULK EARTHWOKS UNNAMED CREEK



PLAN
SCALE 1:2000

SCALE 1 : 2000 (A1 UNREDUCED)

SCALE 1 : 10000 (A1 UNREDUCED)

DRAWING INDEX

DRAWING NO.	DRAWING TITLE
20-185-01	LOCALITY PLAN, DRAWING INDEX
20-185-02	EARTHWORKS CONTOUR PLAN
20-185-03	CULVERT DETAILS SHEET 1
20-185-04	CULVERT DETAILS SHEET 2
20-185-05	SEDIMENT AND EROSION CONTROL PLAN
20-185-06	SEDIMENT AND EROSION CONTROL NOTES
20-185-07	SEDIMENT AND EROSION CONTROL DETAILS
20-185-08	SEDIMENT AND EROSION BASIN NOTES
20-185-09	SAFETY IN DESIGN

DO NOT SCALE THIS DRAWING
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REVISIONS

No	Description	Date	By
A	FOR APPROVAL	[illegible]	RW

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Client: North Harbour — feel right at home

BULK EARTHWORKS
UNNAMED CREEK

kn group

Drawing title: LOCALITY PLAN, DRAWING INDEX

Drawn	Designed	Checked	Date
RW	JB	MAS	FEB 21

Scale	Sheet
AS SHOWN	01 of XX

A1	20-185-01	A

EARTHWORKS CONTOUR PLAN
SCALE 1:1000

LEGEND

- STAGE BOUNDARY
- DESIGN SURFACE CONTOURS
- EXISTING SURFACE CONTOURS
- BATTER LINE
- EXTENT OF CUT
- EXTENT OF FILL

SCALE
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Drawing title
EARTHWORKS
CONTOUR PLAN

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RW	JB	MAS	FEB 21

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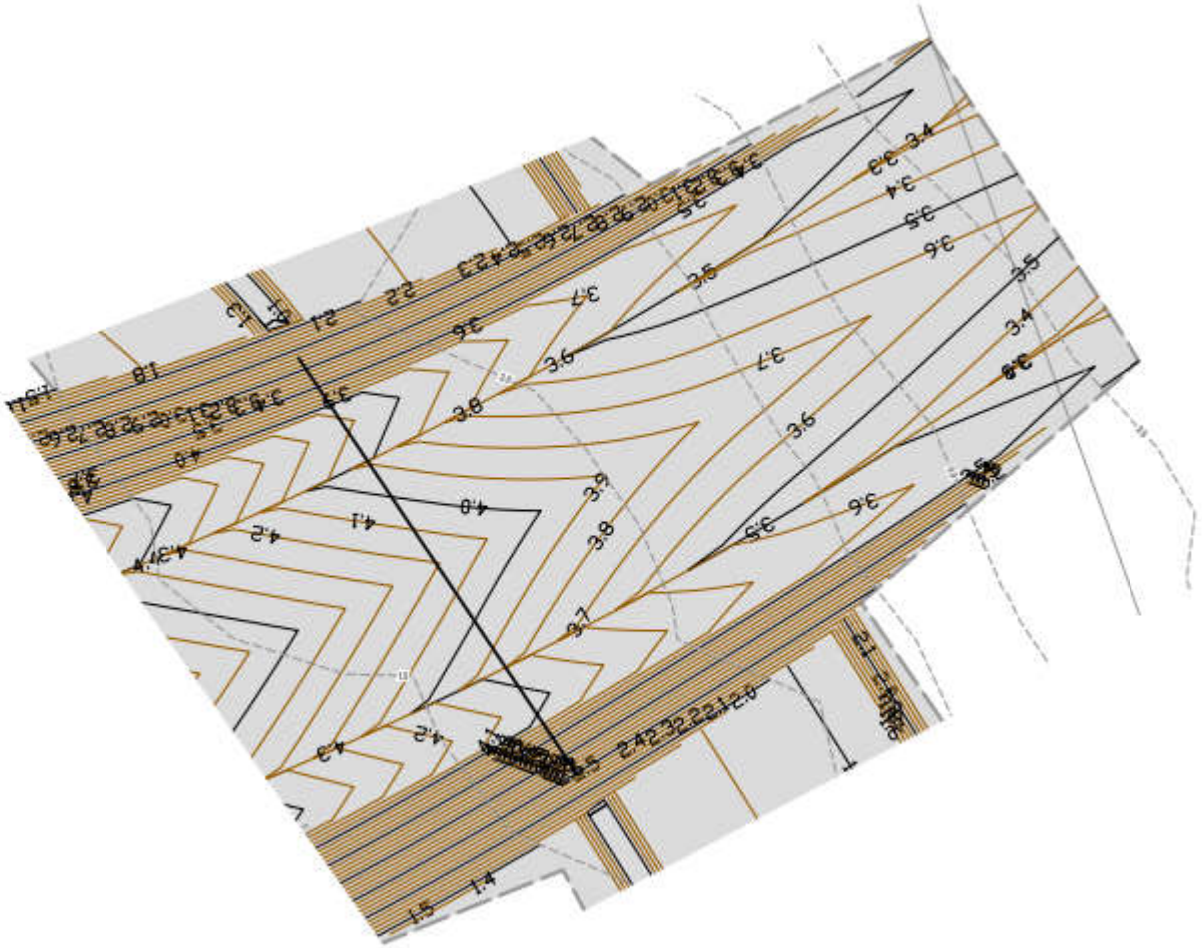

CULVERT DETAILS
SCALE 1:250

SCALE
1 : 250 (A1 UNREDUCED)

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REVISIONS

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CULVERT DETAILS
SHEET 1

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RW	JB	MAS	FEB 21

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AS SHOWN	03 of XX

Drawing size	Drawing no	Revision
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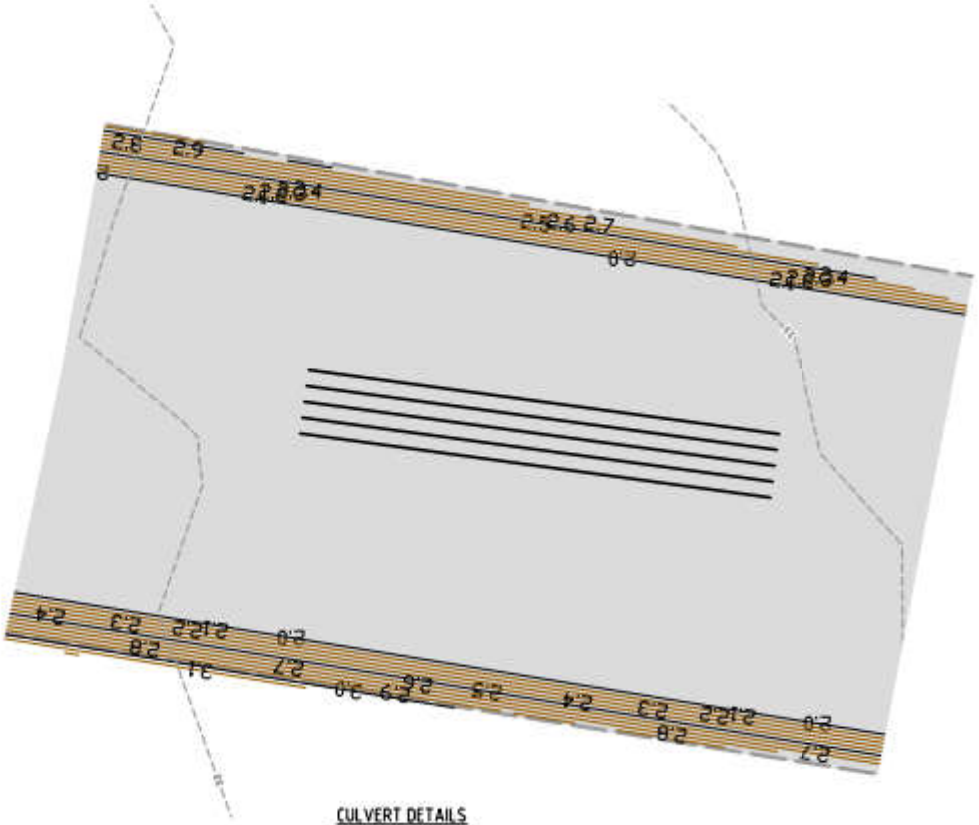

CULVERT DETAILS
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UNNAMED CREEK

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Drawing Title
CULVERT DETAILS
SHEET 2

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RW	JB	MAS	FEB 21

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Drawing Size	Drawing No	Revision
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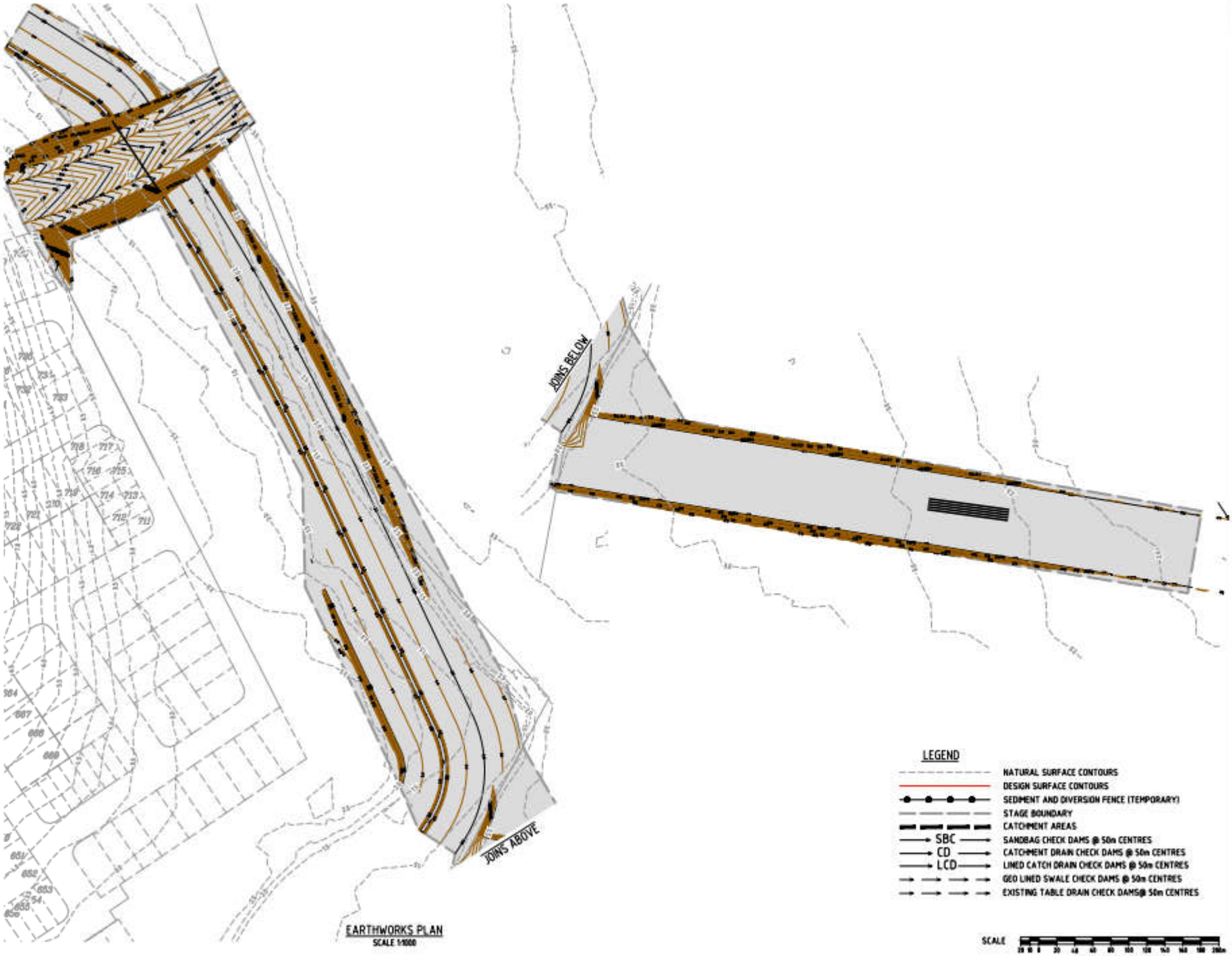

EARTHWORKS PLAN
SCALE 1:1000

LEGEND

- NATURAL SURFACE CONTOURS
- DESIGN SURFACE CONTOURS
- SEDIMENT AND DIVERSION FENCE (TEMPORARY)
- STAGE BOUNDARY
- CATCHMENT AREAS
- SBC — SANDBAG CHECK DAMS @ 50m CENTRES
- CD — CATCHMENT DRAIN CHECK DAMS @ 50m CENTRES
- LCD — LINED CATCH DRAIN CHECK DAMS @ 50m CENTRES
- GEO LINED SWALE CHECK DAMS @ 50m CENTRES
- EXISTING TABLE DRAIN CHECK DAMS@ 50m CENTRES

SCALE
1 : 2000 (A1 UNREDUCED)

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Drawing title
SEDIMENT AND EROSION
CONTROL PLAN

Drawn	Designed	Checked	Date
RW	JB	MAS	FEB 21

Scale	Sheet
AS SHOWN	05 of XX

Drawing size	Drawing number	Revision
A1	20-185- 05	A

EROSION AND SEDIMENT CONTROL PROGRAM

1. THIS PROGRAM AND ASSOCIATED PLANS SHOULD BE READ IN CONJUNCTION WITH THE SITE MANAGEMENT SPECIFICATION INCORPORATED IN THE CONTRACT DOCUMENTS. THE PROVISIONS OF THE SPECIFICATION ARE TO BE STRICTLY ADHERED TO.
2. THE BASIC OBJECTIVES OF THE EROSION AND SEDIMENT CONTROL ARE:
   I. IDENTIFY CRITICAL AREAS AND PROVIDE APPROPRIATE ATTENTION TO THOSE AREAS.
   II. PLAN SITE LAYOUTS SO THAT ACCESS TO ALL REQUIRED DRAINAGE EROSION AND SEDIMENT CONTROL MEASURE IS MAINTAINED.
   III. LIMIT EXPOSURE TIME BY PROGRAMMING TO MINIMISE THE AREA OF LAND EXPOSED TO POTENTIALLY ADVERSE WEATHER CONDITIONS AT ANY ONE TIME. I.E. PROGRESSIVELY CLEAR AND REVEGETATE.
   IV. PROVIDE CONTROL MEASURES INCLUDING TEMPORARY AND PERMANENT DRAINAGE, EROSION AND SEDIMENT CONTROLS.
3. THE EROSION AND SEDIMENT CONTROL SHALL COMPLY WITH BEST PRACTICE FOR EROSION AND SEDIMENT CONTROL, THE POLLUTION CONTROL MANUAL FOR URBAN STORMWATER MANAGEMENT, THE QUEENSLAND URBAN DRAINAGE MANUAL, THE SOIL EROSION AND SEDIMENT CONTROL - ENGINEERING GUIDELINES FOR QUEENSLAND (CURRENT EDITIONS) AND INTERNATIONAL EROSION CONTROL ASSOCIATION (ICEA).
4. CONSTRUCTION SEQUENCE THE CONSTRUCTION SEQUENCE WILL GENERALLY BE:
   I. OBTAIN ALL NECESSARY PERMITS AND APPROVALS BEFORE SITE ESTABLISHMENTS.
   II. HOLD A PRE-CONSTRUCTION CONFERENCE.
   III. STABILISE ALL CONSTRUCTION ACCESS ROUTES AND ENTRY/EXIT POINTS.
   IV. ESTABLISH SEDIMENT CONTROL STRUCTURES AND TEMPORARY DRAINAGE CONTROL MEASURES AS NECESSARY.
   V. CARRY OUT BULK EARTHWORKS.
   VI. MAINTAIN AND REPAIR DRAINAGE, EROSION AND SEDIMENT CONTROL MEASURES.
   VII. REMOVE SEDIMENT CONTROL MEASURES WHEN THE SITE IS STABILISED. I.E. >70% GROUND COVER
   VIII. THE CONTRACTOR SHALL PREPARE A SUPPLEMENTARY EROSION AND SEDIMENT CONTROL PLAN TO SUIT HIS/HER CONSTRUCTION METHODOLOGY, AND SUBMIT THIS PLAN FOR APPROVAL TO THE SUPERINTENDENT. IT SHOULD BE NOTED THAT ANY SIGNIFICANT VARIATION TO THIS PLAN MAY REQUIRE RESUBMISSION TO COUNCIL FOR APPROVAL. THE CLIENT SHALL NOT BE RESPONSIBLE FOR ANY SUCH ASSOCIATED DELAY.
5. ALL ESC DEVICES ARE TO BE INSPECTED WEEKLY, PRIOR TO EXPECTED AND AFTER RAINFALL ANY DAMAGE IS TO BE REPAIRED AS REQUIRED TO MAINTAIN THEIR EFFICACY.
6. ALL TEMPORARY EROSION AND SEDIMENT CONTROL (ESC) MEASURE TO BE MAINTAINED AND FULLY OPERATIONAL DURING THE MAINTENANCE PERIOD AND ARE TO BE REMOVED AFTER THE SATISFACTORY COMPLETION OF AN OFF-MAINTENANCE INSPECTION BY COUNCIL AND PRIOR TO FORMAL ACCEPTANCE "OFF MAINTENANCED BY COUNCIL.
7. PRIOR TO THE COMMENCEMENT OF CONSTRUCTION, THE CONTRACTOR IS TO PROVIDE A DETAILED PROGRAM TO THE SUPERINTENDENT SHOWING THE TIMING FOR ALL WORKS ASSOCIATED WITH THE PROJECT, NOMINATING, IN PARTICULAR, THE PROGRAM FOR INSTALLATION OF SOIL AND EROSION CONTROL SYSTEMS.
8. EARTHWORKS SHALL BE CARRIED OUT IN SUCH A MANNER THAT THE SITE IS MAINTAINED IN A WELL DRAINED CONDITION, AREAS OF LOOSE SOIL ARE MINIMISED AND CONCENTRATIONS OF STORMWATER ARE MINIMISED. BULK EARTHWORKS WILL BE CARRIED OUT OVER THE ENTIRE SITE IN ONE STAGE.
9. CONSTRUCTION AREAS SHALL BE AT ONE NOMINATED POINT ON SOUTH DEEBING CREEK ROAD. A SHAKE DOWN AS DETAILED ON THE PLAN COMPRISING FREE DRAINAGE GRAVEL SHALL BE LOCATED ADJACENT TO THE POINT OF ACCESS WHERE VEHICLES CAN BE WASHED DOWN PRIOR TO EXIT TO THE STREET SYSTEM IF REQUIRED. THE WASH DOWN AREA SHALL BE KEPT FREE OF MUD.
10. FOR DETAILS OF ENTRY/EXIT SEDIMENT PAD REFER TO BEST PRACTICE EROSION & SEDIMENT CONTROL BOOK 1, PAGE 2.48, FIGURE 2.6.
11. SUPPLEMENTARY EROSION AND SEDIMENT CONTROL DEVICES MAY BE REQUIRED AT THE DISCRETION OF THE SUPERINTENDENT.
12. SEDIMENTATION FENCES TO BE PLACED AS SHOWN. FOR DETAILS OF SEDIMENT FENCE REFER BEST PRACTICE EROSION & SEDIMENT CONTROL BOOK 1, PAGE 2.50, FIGURE 2.8.
13. WHERE SEDIMENT FENCES ARE SHOWN TO BE CONSTRUCTED IN AREAS OF SIGNIFICANT EARTHWORKS, ERECTION OF THE FENCE MAY BE DEFERRED UNTIL COMPLETION OF THE BULK EARTHWORKS, SUBJECT TO ABSENCE OF RAIN.

TREES

1. ENSURE COMPLIANCE WITH THE REQUIREMENTS OF AS4970 - TREES ON CONSTRUCTION SITES. THIS MAY REQUIRE CONSULTATION AND GUIDANCE FROM A CLASS V CERTIFIED ARBORIST AS TREES OUTSIDE THE IMMEDIATE WORK AREA MAY BE AFFECTED.

EROSION AND SEDIMENTATION CONTROL NOTES:

TOPSOIL

1. STRIP AND STOCKPILE AVAILABLE TOPSOIL (ASSUMED AVERAGE DEPTH 150MM) FROM ALL DISTURBED AREAS PRIOR TO BULK EARTHWORKS. GRADE EVENLY BETWEEN ALLOTMENT FINISHED SURFACE LEVELS AND ENSURE LOTS ARE FREE DRAINING.
2. MINIMUM SLOPE ACROSS ALLOTMENTS TO BE 1%.
3. ALL FOOTPATHS, BATTERS, AND EARTHWORKS AFFECTED ALLOTMENTS ARE TO BE TOPSOILED TO A MINIMUM DEPTH OF 150MM (LIGHTLY COMPACTED) AND TURFED WHERE SPECIFIED.
4. SEDIMENT FENCES TO BE PLACED AS SHOWN. FOR DETAILS OF SEDIMENT FENCE REFER BEST PRACTICE EROSION & SEDIMENT CONTROL BOOK 1, PAGE 2.50, FIGURE 2.7. SEDIMENT FENCED TO BE REPAIRED AND EXCESSIVE SEDIMENT DEPOSITS SHALL BE REMOVED ONCE CAPACITY FALLS BELOW 75%

SEDIMENT FENCES

1. FOR DETAILS OF SEDIMENT FENCE REFER BEST PRACTICE EROSION & SEDIMENT CONTROL BOOK 1, PAGE 2.50, FIGURE 2.8.
2. SEDIMENT FENCES TO BE REPAIRED AS REQUIRED AND EXCESSIVE SEDIMENT DEPOSITS SHOULD BE REMOVED.
3. INSTALL KERB INLETS WITH GRAVEL RANGING FROM 50MM TO 75MM IN SIZE SHALL BE INSTALLED AT ALL COMPLETED INLETS. REFER IPWEAQ STANDARD DRAWING D-8041. THESE SHALL BE MAINTAINED IN A CLEAN CONDITION. IN THE EVENT OF HEAVY RAIN THEY SHALL BE REMOVED TO MINIMISE THE POTENTIAL FOR FLOODING.
4. CHECKS OF SILT CONTROL DEVICES ARE TO BE MADE WEEKLY, OR AFTER ANY SIGNIFICANT STORM EVENT TO ENSURE INTEGRITY AND PERFORMANCE.

TURFING

1. PROVIDE TURFING TO ENTIRE WIDTH OF ALL SWALES, FOOTPATHS, AND 1 IN 4 CUT AND FILL BATTERS.
2. FOOTPATH BATTERS ARE TO BE STABILISED WITH TOPSOIL (AND TURFED) AS SOON AS PRACTICAL AFTER THE BATTERS HAVE BEEN COMPLETED.

DURING CONSTRUCTION SEQUENCE:

1. TOPSOIL STOCKPILES SHALL BE LESS THAN 1M DEEP AND UNCOMPACTED. A SEDIMENTATION FENCE SHALL BE CONSTRUCTED ON THE D/S SIDE, OR THE STOCKPILE STABILISED WITH VEGETATION, MULCH, OR A SOIL STABILISER.
2. SEDIMENTATION FENCES TO BE PLACED AS SHOWN.
3. REGULARLY INSPECT BANKS AND REPAIR ANY SLUMPS, WHEEL TRACK DAMAGE OR LOSS OF FREEBOARD.
4. REMOVE SEDIMENT TO AVOID PONDING FROM CATCH DRAINS.
5. REMOVE EXCESSIVE SEDIMENT FROM UPSTREAM OF CHECK DAM.
6. ROAD RESERVE TO BE USED AS HAUL ROAD.
7. A CATCH DRAINOR DIVERSION BANK IS TO BE PROVIDED ON THE TOP SIDE OF ALL CUTS, WITH DISCHARGE EITHER TO UNDISTURBED GRASS LANDS OR TO THE CROSS ROAD DRAINAGE.
8. SUPPLEMENTARY EROSION AND SEDIMENT CONTROL DEVISED MAY BE REQUIRED AT THE DISCRETION OF THE ENGINEER.
9. WATER QUALITY SAMPLES MUST BE TAKEN AND ANALYSED PRIOR TO THE RELEASE OF ANY WATER FROM THE SEDIMENT POND. WATER QUALITY MUST SATISFY THE FOLLOWING CRITERIA: TSS<50MG/L PH BETWEEN 6.5 AND 8.5.
10. ALL WATER QUALITY DATA INCLUDING DATES OF RAINFALL, TESTING AND WATER RELEASE MUST BE MAINTAINED IN AN ON-SITE REGISTER. THIS REGISTER IS TO BE MAINTAINED FOR THE DURATION OF THE APPROVED WORKS AND BE AVAILABLE ON SITE FOR INSPECTION BY COUNCIL OFFICERS ON REQUEST.
11. EXPOSED AREAS ON LOTS ARE TO BE SEEDED AND MULCHED (E.G. HYDROMULCHED). MULCH SHALL BE APPLIED AT A MINIMUM RATE OF 2.5T/HA. ALTERNATIVELY THEY SHALL BE DRILL-SEEDED AND IRRIGATED SO AS TO ENSURE >70% GROUND COVER WITHIN 14 DAYS FROM NOVEMBER TO APRIL, OR 30 DAYS FROM MAY TO OCTOBER.

FOLLOWING CONSTRUCTION:

1. SEDIMENTATION FENCES TO BE MAINTAINED UNTIL TURFING IS COMPLETED.
2. SEDIMENT BASINS TO BE CHECKED AFTER EVERY SIGNIFICANT STORM AND DESILTED ONCE THE SETTLEMENT LIMIT HAS BEEN REACHED.

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REVISIONS

No	Description	Date	By
A	FOR APPROVAL	MAR 2021	RW

DRAFT

NORTH

Client
North Harbour
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BULK EARTHWORKS
UNNAMED CREEK

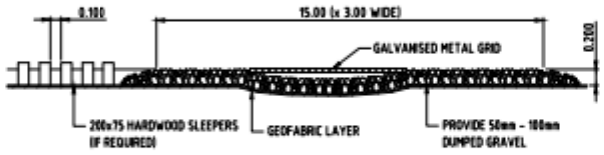
kn group

Drawing Title
SEDIMENT AND EROSION CONTROL NOTES

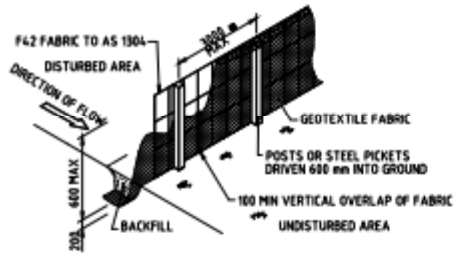
Drawn	Designed	Checked	Date
RW	JB	MAS	FEB 21

Scale	Sheet
AS SHOWN	06 of XX

Drawing No	Revision
A1 20-185- 06	A

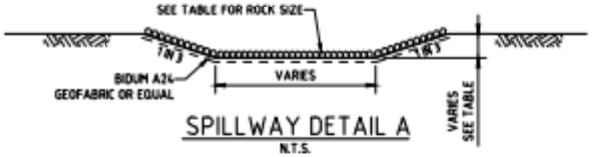


SITE ACCESS POINT SHAKEDOWN FACILITY
N.T.S.



SEDIMENT FENCE
N.T.S.

TYPE C BASIN DETAIL
N.T.S.



SPILLWAY DETAIL A
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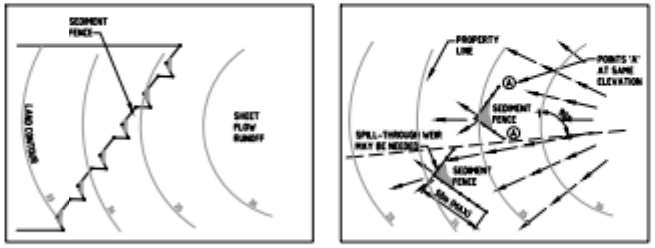
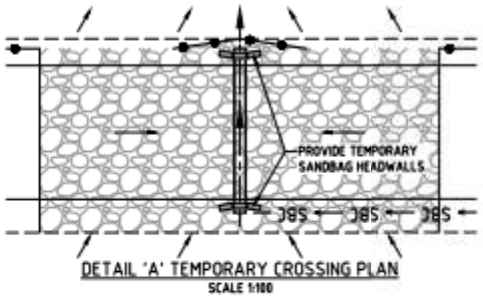


SILT FENCE DETAILS



DETAIL 'A' TEMPORARY CROSSING PLAN
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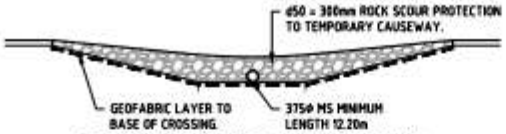

DETAIL 'A' TEMPORARY CROSSING SECTION
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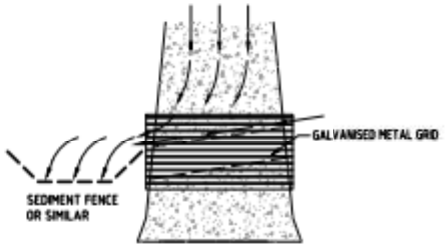

SITE ACCESS POINT ENTRY/EXIT PAD
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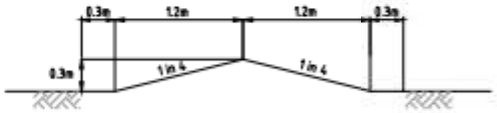

BUND SECTION
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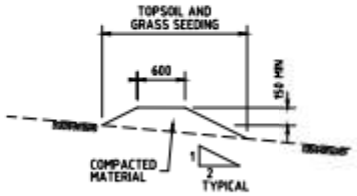
SANDBAG CHECK DAM
N.T.S.



DIVERSION DRAINAGE BANK
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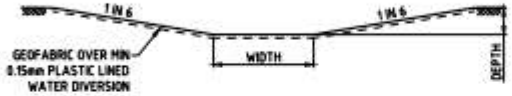
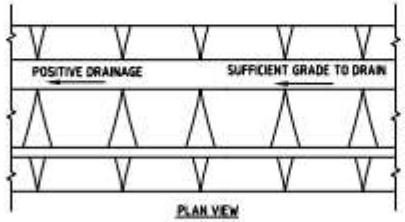
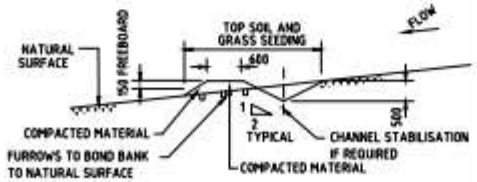


TYPICAL LINED CATCH DRAIN
SCALE 1:40

LCD NO.	WIDTH	DEPTH
1	1.500	0.450
2	1.500	0.450
3	1.500	0.300
4	1.500	0.250
5	1.500	0.300
6	1.500	0.300
7	1.500	0.250
8	1.500	0.200
9	1.500	0.350
10	1.500	0.300



PLAN VIEW



PLACE FILTER FABRIC ACROSS DRAIN AT 30m MAXIMUM INTERVALS AND AT OUTLET OF DRAIN, OR AS REQUIRED TO CONTROL SEDIMENT MOVEMENT ALONG DRAIN.

CROSS SECTION

CATCHMENT DRAIN
N.T.S.

DO NOT SCALE THIS DRAWING
IF IN DOUBT - ASK!

REVISIONS

No	Description	Date	By
A	FOR APPROVAL	MAR 2021	RW

DRAFT

NORTH

Client: North Harbour
feel right at home

BULK EARTHWORKS
UNNAMED CREEK

kn group

Drawing title:
SEDIMENT AND EROSION CONTROL DETAILS

Drawn	Designed	Checked	Date
RW	JB	MAS	FEB 21

Scale	Sheet
AS SHOWN	07 of XX

Paper size	Drawing number	Revision
A1	20-185- 07	A

BASIN NOTES

1. ALL BASINS SHALL BE CONSTRUCTED PRIOR TO THE COMMENCMENT OF MAJOR EARTHWORKS IN THE RELEVANT CATCHMENT.
2. AN APPROPRIATELY MARKED (E.G. PAINTED) DE-SILTING MARKER POST MUST BE INSTALLED IN THE BASIN TO INDICATE THE TOP OF THE SEDIMENT STORAGE ZONE. THE BASIN MUST BE DE-SILTED. IF THE SEDIMENT IS ALREADY ABOVE THIS MARKER POINT, OR IF THE NEXT STORM IS LIKELY TO CAUSE SEDIMENT TO SETTLE ABOVE THIS MARKER POINT.
3. PRIOR TO DISCHARGE OF WATER FROM A SEDIMENT BASIN, IT IS ESSENTIAL FOR THE WATER QUALITY TO COMPLY WITH ALL SPECIFIED WATER QUALITY OBJECTIVES (WQOS) IE.G. WATER PH IN THE RANGE OF 6.5 - 8.5).
4. THE RECOMMENDED WATER QUALITY STANDARD FOR SEDIMENT BASINS IS PRESENTED IN TABLE B18.

TABLE B18 - RECOMMENDED DISCHARGE STANDARD FOR DE-WATERING OPERATIONS

SITE CONDITIONS	DISCHARGE WATER QUALITY STANDARD
POST-STORM DE-WATERING OF SEDIMENT BASINS IE.G. TYPE F AND D BASINS, AND TYPE C BASINS OPERATING AS WET-BASINS).	90 PERCENTILE TOTAL SUSPENDED SOLIDS (TSS) CONCENTRATION NOT EXCEEDING 50MG/L.

TECHNICAL NOTES B5 - BASIN FLOCCULATION

THE CONTRACTOR SHALL, IN CONJUNCTION WITH THE SITE EROSION AND SEDIMENT CONTROL SPECIALIST, DETERMINE THE MOST APPROPRIATE FLOCCULANT FOR THE SITE. A PROCEDURE FOR THE MANUAL DOSING OF GYPSUM OR SIMILAR (DEVELOPED FROM LANDCOM, 2004) IS AS FOLLOWS:

1. PLACE REQUIRED GYPSUM QUANTITY (SAY 32KG/100M3 OF WATER) IN APPROXIMATELY 50L DRUM PERFORATED WITH 25MM HOLES AT 150MM SPACING.
2. SUSPEND THE SCREENED, RECIRCULATING PUMP INTAKE INTO THE DRUM.
3. LIFT THE DRUM INTO THE BASIN SUCH THAT BASIN WATER CAN ENTER AND CIRCULATED THROUGH THE DRUM.
4. USING THE PUMP, SPRAY THE GYPSUM-RICH SOLUTION EVENLY OVER THE SURFACE OF THE BASIN UNTIL THE GYPSUM IS FULLY REMOVED FROM THE DRUM. THE PUMP OUTLET MUST SPRAY THE MIXTURE OVER A WIDE AREA RATHER THAN JUST DISCHARGING AS A CONFINED "JET".
5. ALTERNATIVELY, IF TWO PUMPS ARE AVAILABLE, USE THE TWO PUMPS TO CIRCULATE BASIN WATER FIRST TO THE ON-SHORE TANK, AND THEN FROM THE TANK OVER THE SURFACE OF THE BASIN. A LARGE MIXING TANK WILL USUALLY BE REQUIRED.
6. ALTERNATIVE PRODUCTS INCLUDE POLYALUMINIUM CHLORIDE (PAC), POLYACRYLAMIDE (PAC).

B3 BASIN CONSTRUCTION AND MAINTENANCE

MATERIALS

- EARTH FILL: CLEAN SOIL WITH EMERSON CLASS 2(1), 3, 4, OR 5, AND FREE OF ROOTS, WOODY VEGETATION, ROCKS AND OTHER UNSUITABLE MATERIAL. SOIL WITH EMERSON CLASS 4 AND 5 MAY NOT BE SUITABLE DEPENDING ON PARTICLE SIZE AND DISTRIBUTION AND DEGREE OF DISPERSION. CLASS 2(1) SHOULD ONLY BE USED UPON RECOMMENDATION FROM GEOTECHNICAL SPECIALIST. (ALTERNATIVELY, SET A STANDARD BASED ON EXCHANGEABLE SODIUM PERCENTAGE - SEEK EXPERT ADVICE.)
- RISER PIPE: MINIMUM 250MM DIAMETER.
- SPILLWAY ROCK: HARD, ANGULAR, DURABLE, WEATHER RESISTANT AND EVENLY GRADED ROCK WITH 50% BY WEIGHT LARGER THAN THE SPECIFIED NOMINAL D50 ROCK SIZE. LARGER ROCK SHOULD DOMINATE, WITH SUFFICIENT SMALL ROCK TO FILL THE VOIDS BETWEEN THE LARGER ROCK. THE DIAMETER OF THE LARGEST ROCK SIZE SHOULD BE NO LARGER THAN 1.5 TIMES THE NOMINAL ROCK SIZE. THE SPECIFIC GRAVITY SHOULD BE AT LEAST 2.5.
- GEOTEXTILE FABRIC: HEAVY-DUTY, NEEDLE-PUNCHED, NON-WOVEN FILTER CLOTH, MINIMUM BIDIM A24 OR EQUIVALENT.

CONSTRUCTION

1. NOTWITHSTANDING ANY DESCRIPTION CONTAINED WITHIN THE APPROVED PLANS OR SPECIFICATIONS, THE CONTRACTOR SHALL BE RESPONSIBLE FOR SATISFYING THEMSELVES AS TO THE NATURE AND EXTENT OF THE SPECIFIED WORKS AND THE PHYSICAL AND LEGAL CONDITIONS UNDER WHICH THE WORKS WILL BE CARRIED OUT. THIS SHALL INCLUDE MEANS OF ACCESS, EXTENT OF CLEARING, NATURE OF MATERIAL TO BE EXCAVATED, TYPE AND SIZE OF MECHANICAL PLAN REQUIRED, LOCATION AND SUITABILITY OF WATER SUPPLY FOR CONSTRUCTION AND TESTING PURPOSES, AND ANY OTHER LIKE MATTERS AFFECTING THE CONSTRUCTION OF THE WORKS.
2. REFER TO APPROVED PLANS FOR LOCATION, DIMENSIONS, AND CONSTRUCTION DETAILS. IF THERE ARE QUESTIONS OR PROBLEMS WITH THE LOCATION, DIMENSIONS, OR METHOD OF INSTALLATION, CONTACT THE ENGINEER OR RESPONSIBLE ON-SITE OFFICER FOR ASSISTANCE.
3. BEFORE STARTING ANY CLEARING OR CONSTRUCTION, ENSURE ALL THE NECESSARY MATERIALS AND COMPONENTS ARE ON THE SITE TO AVOID DELAYS IN COMPLETING THE POND ONCE WORKS BEGIN.
4. INSTALL REQUIRED SHORT-TERM SEDIMENT CONTROL MEASURES DOWNSTREAM OF THE PROPOSED EARTHWORKS TO CONTROL SEDIMENT RUNOFF DURING CONSTRUCTION OF THE BASIN.
5. THE AREA TO BE COVERED BY THE EMBANKMENT, BORROW PITS AND INCIDENTAL WORKS, TOGETHER WITH AN AREA EXTENDING BEYOND THE LIMITS OF EACH FOR A DISTANCE NOT EXCEEDING FIVE (5) METRES ALL AROUND MUST BE CLEARED OF ALL TREES, SCRUB, STUMPS, ROOTS, DEAD TIMBER AND RUBBISH AND DISPOSED OF IN A SUITABLE MANNER. DELAY CLEARING THE MAIN POND AREA UNTIL THE EMBANKMENT IS COMPLETE. (MODIFY AS NECESSARY TO LIMIT TOTAL AREA OF DISTURBANCE AND ANY DAMAGE TO PROTECTED VEGETATION).
6. ENSURE ALL HOLES MADE BY GRUBBING WITHIN THE EMBANKMENT FOOTPRINT ARE FILLED WITH SOUND MATERIAL, ADEQUATELY COMPACTED, AND FINISHED FLUSH WITH THE NATURAL SURFACE.
7. IS SUITABLE AND IT IS PLACED IN THE CORRECT ZONE ACCORDING TO ITS CLASSIFICATION.

CUT-OFF TRENCH:

1. BEFORE CONSTRUCTION OF THE CUT-OFF TRENCH OR ANY ANCILLARY WORKS WITHIN THE EMBANKMENT FOOTPRINT, ALL GRASS GROWTH AND TOPSOIL MUST BE REMOVED FROM THE AREA TO BE OCCUPIED BY THE EMBANKMENT AND MUST BE DEPOSITED CLEAR OF THIS AREA AND RESERVED FOR TOPDRESSING THE COMPLETING EMBANKMENT.
2. EXCAVATE A CUT-OFF TRENCH ALONG THE CENTRE LINE OF THE EARTH FILL EMBANKMENT. CUT THE TRENCH TO STABLE SOIL MATERIAL, BUT IN NO CASE MAKE IT LESS THAN 600MM DEEP. THE CUT-OFF TRENCH MUST EXTEND INTO BOTH ABUTMENTS TO AT LEAST THE ELEVATION OF THE RISER PIPE CREST. MAKE THE MINIMUM BOTTOM WIDTH WIDE ENOUGH TO PERMIT OPERATION OF EXCAVATION AND COMPACTION EQUIPMENT, BUT IN NO CASE LESS THAN 600MM. MAKE THE SIDE SLOPES OF THE TRENCH NO STEEPER THAN 1:1 (H:V).
3. ENSURE ALL WATER, LOOSE SOIL, AND ROCK ARE REMOVED FROM THE TRENCH BEFORE BACKFILLING COMMENCES. THE CUT-OFF TRENCH MUST BE BACKFILLED WITH SELECTED EARTH-FILL OF THE TYPE SPECIFIED FOR THE EMBANKMENT, AND THIS SOIL MUST HAVE A MOISTURE CONTENT AND DEGREE OF COMPACTION THE SAME AS THAT SPECIFIED FOR THE SELECTED CORE ZONE.
4. MATERIAL EXCAVATED FROM THE CUT-OFF TRENCH MAY BE USED IN CONSTRUCTION OF THE EMBANKMENT PROVIDED IT IS SUITABLE AND IT IS PLACED IN THE CORRECT ZONE ACCORDING TO ITS CLASSIFICATION.

EMBANKMENT:

1. SCARIFY AREAS ON WHICH FILL IS TO BE PLACED BEFORE PLACING THE FILL.
2. ENSURE ALL FILL MATERIAL USED TO FORM THE EMBANKMENT MEETS THE SPECIFICATIONS CERTIFIED BY A GEOTECHNICAL SPECIALIST.
3. THE FILL MATERIAL MUST CONTAIN SUFFICIENT MOISTURE SO IT CAN BE FORMED BY HAND INTO A BALL WITHOUT CRUMBLING. IF WATER CAN BE SQUEEZED OUT OF THE BALL, IT IS TOO WET FOR PROPER COMPACTION. PLACE FILL MATERIAL IN 150 TO 250MM CONTINUOUS LAYERS OVER THE ENTIRE LENGTH OF THE FILL AREA THEN COMPACT BEFORE PLACEMENT OF FURTHER FILL.
4. PLACE RISER PIPE OUTLET SYSTEM, IF SPECIFIED, IN APPROPRIATE SEQUENCE WITH THE EMBANKMENT FILLING. REFER TO SPECIFICATIONS SUPPLIED BELOW.
5. UNLESS OTHERWISE SPECIFIED ON THE APPROVED PLANS, COMPACT THE SOIL AT ABOUT 1% TO 2% WET OF OPTIMUM AND TO 95% MODIFIED OR 100% STANDARD COMPACTION.
6. WHERE BOTH DISPERSIVE AND NON-DISPERSIVE CLASSIFIED EARTH-FILL MATERIALS ARE AVAILABLE, NON-DISPERSIVE EARTH-FILL MUST BE USED IN THE CORE ZONE. THE REMAINING CLASSIFIED EARTH-FILL MATERIALS MUST ONLY BE USED AS DIRECTED BY [INSERT TITLE].
7. WHERE SPECIFIED, CONSTRUCT THE EMBANKMENT TO AN ELEVATION 10% HIGHER THAN THE DESIGN HEIGHT TO ALLOW FOR SETTLING; OTHERWISE FINISHED DIMENSIONS OF THE EMBANKMENT AFTER SPREADING OF TOPSOIL MUST CONFORM TO THE DRAWING WITH A TOLERANCE OF 75MM FORM THE SPECIFIED DIMENSIONS.
8. ENSURE DEBRIS AND OTHER UNSUITABLE BUILDING WASTE IN NOT PLACED WITHIN THE EARTH EMBANKMENT.
9. AFTER COMPLETION OF THE EMBANKMENT ALL LOOSE UNCOMPACTED EARTH-FILL MATERIAL OF THE UPSTREAM AND DOWNSTREAM BATTER MUST BE REMOVED PRIOR TO SPREADING OF TOPSOIL.
10. TOPSOIL AND REVEGETATE/STABILISED ALL EXPOSED EARTH AS DIRECTED WITHIN THE APPROVED PLANS.
11. WHERE THE SITE IS TO BE REVEGETATED, THE TOPSOIL AND UPPER 500MM OF THE SUBSOIL SHALL MEET THE SPECIFICATIONS SET BY A SOIL SCIENTIST.

ESTABLISHMENT OF SETTLING POND:

1. THE AREA TO BE COVERED BY THE STORED WATER OUTSIDE THE LIMITS OF THE BORROW PITS MUST BE CLEARED OF ALL SCRUB AND RUBBISH. TREES MUST BE CUT DOWN STUMP HIGH AND REMOVED FROM THE IMMEDIATE VICINITY OF THE WORK.
2. ESTABLISH ALL REQUIRED INFLOW CHUTES AND INLET BAFFLES, IF SPECIFIED, TO ENABLE WATER TO DISCHARGE INTO THE BASIN IN A MANNER THAT WILL NOT CAUSE SOIL EROSION NOR THE RE-SUSPENSION OF SETTLED SEDIMENT.
3. INSTALL A SEDIMENT STORAGE LEVEL MARKER POST WITH A CROSS MEMBER SET JUST BELOW THE TOP OF THE SEDIMENT STORAGE ZONE (AS SPECIFIED ON THE APPROVED PLANS). USE AT LEAST A 75MM WIDE POST FIRMLY SET INTO THE BASIN FLOOR.
4. IF SPECIFIED, INSTALL INTERNAL SETTLING POND BAFFLES. ENSURE THE CREST OF THESE BAFFLES IS SET LEVEL WITH OR JUST BELOW, THE ELEVATION OF THE EMERGENCY SPILLWAY CREST.
5. INSTALL ALL APPROPRIATE MEASURE TO MINIMISE SAFETY RISK TO ON-SITE PERSONNEL AND THE PUBLIC CAUSED BY THE PRESENCE OF THE SETTLING POND. AVOID STEEP, SMOOTH INTERNAL SLOPES. APPROPRIATELY FENCE THE SETTLING POND AND POST WARNING SIGNS IF UNSUPERVISED ACCESS IS LIKELY OR THERE IS CONSIDERED TO BE AN UNACCEPTABLE RISK TO THE PUBLIC.

SPILLWAY CONSTRUCTION:

1. THE SPILLWAY MUST BE EXCAVATED AS SHOWN ON THE PLANS, AND THE EXCAVATED MATERIAL IF CLASSIFIED AS SUITABLE, MUST BE USED IN THE EMBANKMENT, AND IF NOT SUITABLE IT MUST BE DISPOSED OF INTO SPOIL HEAPS.
2. ENSURE EXCAVATED DIMENSIONS ALLOW ADEQUATE BOXING-OUT SUCH THAT THE SPECIFIED ELEVATIONS, GRADES, CHUTE WIDTH, AND ENTRANCE AND EXIT SLOPES FOR THE EMERGENCY SPILLWAY WILL BE ACHIEVED AFTER PLACEMENT OF THE ROCK OR OTHER SCOUR PROTECTION MEASURES AS SPECIFIED IN THE PLANS.
3. PLACE SPECIFIED SCOUR PROTECTION MEASURES ON THE EMERGENCY SPILLWAY. ENSURE THE FINISHED GRADE BLENDS WITH THE SURROUNDING AREA TO ALLOW A SMOOTH FLOW TRANSITION FROM SPILLWAY TO DOWNSTREAM CHANNEL.
4. IF A SYNTHETIC FILTER FABRIC UNDERLAY IS SPECIFIED, PLACE THE FILTER FABRIC DIRECTLY ON THE PREPARED FOUNDATION. IF MORE THAN 1 SHEET OF FILTER FABRIC IS REQUIRED, OVERLAP THE EDGES BY AT LEAST 300MM AND PLACE ANCHOR PINS AT MINIMUM 1M SPACING ALONG THE OVERLAP. BURY THE UPSTREAM END OF THE FABRIC A MINIMUM 300MM BELOW GROUND AND WHERE NECESSARY, BURY THE LOWER END OF THE FABRIC OR OVERLAP A MINIMUM 300MM OVER THE NEXT DOWNSTREAM SECTION AS REQUIRED. ENSURE THE FILTER FABRIC EXTENDS AT LEAST 1000MM UPSTREAM OF THE SPILLWAY CREST.
5. TAKE CARE NOT TO DAMAGE THE FABRIC DURING OR AFTER PLACEMENT. IF DAMAGE OCCURS, REMOVE THE ROCK AND REPAIR THE SHEET BY ADDING ANOTHER LAYER OF FABRIC WITH A MINIMUM OVERLAP OF 300MM AROUND THE DAMAGED AREA. IF EXTENSIVE DAMAGE IS SUSPECTED, REMOVE AND REPLACE THE ENTIRE SHEET.
6. WHERE LARGE ROCK IS USED, OR MACHINE PLACEMENT IS DIFFICULT, A MINIMUM 100MM LAYER OF FINE GRAVEL, AGGREGATE, OR SAND MAY BE NEEDED TO PROTECT THE FABRIC.
7. PLACEMENT OF ROCK SHOULD FOLLOW IMMEDIATELY AFTER PLACEMENT OF THE FILTER FABRIC. PLACE ROCK SO THAT IF FORMS A DENSE, WELL-GRADED MASS OF ROCK WITH A MINIMUM OF VOIDS. THE DESIRED DISTRIBUTION OF ROCK THROUGHOUT THE MASS MAY BE OBTAINED BY SELECTIVE LOADING AT THE QUARRY AND CONTROLLED DUMPING DURING FINAL PLACEMENT.
8. THE FINISHED SLOPE SHOULD BE FREE OF POCKETS OF SMALL ROCK OR CLUSTERS OF LARGE ROCKS. HAND PLACING MAY BE NECESSARY TO ACHIEVE THE PROPER DISTRIBUTION OF ROCK SIZES TO PRODUCE A RELATIVELY SMOOTH, UNIFORM SURFACE. THE FINISHED GRADE OF THE ROCK SHOULD BLEND WITH THE SURROUNDING AREA. NO OVERFALL OR PROTRUSION OF ROCK SHOULD BE APPARENT.
9. ENSURE THAT THE FINAL ARRANGEMENT OF THE SPILLWAY CREST WILL NOT PROMOTE EXCESSIVE FLOW THROUGH THE ROCK SUCH THAT THE WATER CAN BE RETAINED WITHIN THE SETTLING BASIN AN ELEVATION NO LESS THAN 50MM ABOVE OR BELOW THE NOMINATED SPILLWAY CREST ELEVATION.

MAINTENANCE OF SEDIMENT BASIN

1. INSPECT THE SEDIMENT BASIN DURING THE FOLLOWING PERIODS:
   (i) DURING CONSTRUCTION TO DETERMINE WHETHER MACHINERY, FALLING TREES, OR CONSTRUCTION ACTIVITY HAS DAMAGED ANY COMPONENTS OF THE SEDIMENT BASIN. IF DAMAGE HAS OCCURRED, REPAIR IT.
   (ii) AFTER EACH RUNOFF EVENT. INSPECT THE EROSION DAMAGE AT FLOW ENTRY AND EXIT POINTS. IF DAMAGE HAS OCCURRED, MAKE THE NECESSARY REPAIRS.
   (iii) AT LEAST WEEKLY DURING THE NOMINATED WET SEASON OF ANY) OTHERWISE AT LEAST FORTNIGHTLY.
   (i) PRIOR TO, AND IMMEDIATELY AFTER, PERIOD OF "STOP WORK) OR SITE "SHUTDOWN).
2. CLEAN OUT ACCUMULATED SEDIMENT WHEN IT REACHES THE MARKER BOARD/POST, AND RESTORE THE ORIGINAL STORAGE VOLUME. PLACE SEDIMENT IN A DISPOSABLE AREA OR, IF APPROPRIATE, MIX WITH DRY SOIL ON THE SITE.
3. DO NOT DISPOSE OF SEDIMENT IN A MANNER THAT WILL CREATE AN EROSION OR POLLUTION HAZARD.
4. CHECK ALL VISIBLE PIPE CONNECTIONS FOR LEAKS, AND REPAIR AS NECESSARY.
5. CHECK FILL MATERIAL IN THE DAM FOR EXCESSIVE SETTLEMENT, SLUMPING OF THE SLOPES OR PIPING BETWEEN THE CONDUIT AND THE EMBANKMENT; MAKE ALL NECESSARY REPAIRS.
6. REMOVE ALL TRASH AND OTHER DEBRIS FROM THE BASIN AND RISER.
7. SUBMERGED INFLOW PIPES MUST BE INSPECTED AND DE-SILTED (AS REQUIRED) AFTER EACH INFLOW EVENT.

REMOVAL OF SEDIMENT BASIN

1. WHEN GRADING AND CONSTRUCTION IN THE DRAINAGE AREA ABOVE A TEMPORARY SEDIMENT BASIN IS COMPLETED AND THE DISTURBED AREAS ARE ADEQUATELY STABILISED (>70% GROUND COVER) WITH HYDROMULCH OR MULCHIN 6 AS APPROVED BY MBRC, THE BASIN MUST BE REMOVED OR OTHERWISE INCORPORATED INTO THE PERMANENT STORMWATER DRAINAGE SYSTEM. IN EITHER CASE, SEDIMENT SHOULD BE CLEARED AND PROPERLY DISPOSED OF AND THE BASIN AREA STABILISED.
2. BEFORE STARTING ANY MAINTENANCE WORK ON THE BASIN OR SPILLWAY, INSTALL ALL NECESSARY SHORT-TERM SEDIMENT CONTROL MEASURES DOWNSTREAM OF THE SEDIMENT BASIN.
3. ALL WATER AND SEDIMENT MUST BE REMOVED FROM THE BASIN PRIOR TO THE DAM'S REMOVAL. DISPOSE OF SEDIMENT AND WATER IN A MANNER THAT WILL NOT CREATE AN EROSION OR POLLUTION HAZARD.
4. BRING THE DISTURBED AREA TO A PROPER GRADE, THEN SMOOTH, COMPACT, AND STABILISE AND/OR REVEGETATE AS REQUIRED TO ESTABLISH A STABLE LAND SURFACE.

DO NOT SCALE THIS DRAWING
IF IN DOUBT - ASK!

REVISIONS

No	Description	Date	By
A	FOR APPROVAL	MAR 2021	RW

NORTH

DRAFT

Client: North Harbour
feel right at home

BULK EARTHWORKS
UNNAMED CREEK

kn group

Drawing title:
SEDIMENT AND EROSION
BASIN NOTES

Drawn	Designed	Checked	Date
RW	JB	MAS	FEB 21

Scale	Sheet
AS SHOWN	08 of XX

Paper size	Drawing no.	Revision
A1	20-185- 08	A

Client: NORTH EAST BUSINESS PARK

Project: NORTH HARBOUR RESIDENTAIL WEST
BULK EARTHWORKS UNNAMED CREEK

Prepared By: Mark Shaw — Date: 18th December 2020
Reviewed By: Robert Allander — Date: 18th December 2020

Safety in Design Analysis

- Complete Safety in Design Analysis by populating the table where applicable with all of the relevant safety issues for the project. For example:

☐ Positioning of new services adjacent to existing live services	☒ Slope Stability
☐ Construction adjacent to existing road carriageways	☒ Dust Control
☐ Pedestrians	☒ Erosion and Sediment Control/Management
☒ Civil Construction Workers	☒ Sediment Basin Construction
☒ Maintenance Workers	☒ Wetland Construction
☒ Work Place Health and Safety Constraints	☒ Working under traffic
☐ Unusual material handling	
☐ Falls from heights	Project Specific Design Elements:
☐ Underground Services (existing)	
☐ Electrical Service Installation	
☐ Gas Service Installation	
☐ Communication Installation	
☐ Traffic Signal Installation	
☒ Landscape Workers	
☐ Line marking Workers	
☒ Excavation – open cut trenching - Trench excavation depths	
☐ Tunnel Boring	
☒ Confined Spaces	
☒ Lifting of loads	
☒ Unloading of materials and storage	
☐ Storage of hazardous materials	
☒ Geotechnical investigation – works	
☒ Bulk Earthworks	

☐ List all relevant safety studies

The following table summarises the safety in design issues considered.

Section of Works	Identify any Potential Incident or Hazard	Consequence	Likelihood	Risk Rating	Risk Control Measures	Consequence	Likelihood	Residual Risk Rating (after design applied)	Risk Manager
Earthworks Material Investigation	Geotechnical Investigation	C	3	S	SWMS required by Contractor	D	3	M	Contractor
Road Works	Pedestrians injury	D	3	M	TMP to be provided by Contractor to exclude pedestrians from work site	E	3	L	Contractor
	Civil Construction Workers – Injury	A	4	H	TMP and SWMS required for all activities	C	3	S	Contractor
	Maintenance Workers	A	4	H	TMP and SWMS required for all activities	C	3	S	Contractor
	Underground Services (Existing)	A	3	H	DBYD information to be sort prior to design. Existing to be located by survey if applicable to design. All existing services to be located and depths confirmed prior to commencement. SWMS to be provided by Contractor	C	3	S	Designer/ Contractor
Working adjacent to existing infrastructure	Conflict between construction equipment / personnel and live infrastructure in particular Power lines	B	4	S	All existing services highlighted in the documentation. Contractor to complete DBYD search before commencing works. SWMS to be provided by Contractor	C	4	M	Designer/ Contractor
Service trench/ pipe installation	Location of all trenches to provide clearance to all other services and all structures or battered embankments	A	4	H	Mains located with safe working clearance to existing pressure mains, structures and battered embankments	C	4	M	Designer
	Trench depth	A	4	M	Depth of trenches minimised for both safety and cost efficiency	C	4	M	Designer
Works within Confined Spaces	Construction of manholes structures	A	4	M	Contractor to ensure works undertaken in a manner complying with safe work method statements	D	5	L	Contractor
Silt and Erosion Control	Public access to water retaining temporary sediment basins	A	5	S	Protection measures – that is fencing of all water retaining structures with side slopes greater than 1 in 5 as described in International Erosion Control Association (Australasian) Table 09	C	4	M	Designer/ Contractor

RISK ASSESSMENT AND CONTROL

Risk Assessment

Select **one** category from each of the columns below that best represents the likely outcome if the potential hazard actually did occur. For each consequence consider the **most likely outcome** and **not** the 'absolute worst' case.

Consequence		Likelihood	
A	Death – major environmental damage	1	Certain
B	Permanent Disability – severe environmental damage	2	Probable
C	Lost Time Injury – moderate environmental damage	3	Possible
D	Medical Treatment Injury – minor environmental damage	4	Unlikely
E	First Aid Treatment	5	Very Unlikely

RISK RATING

Certain - means an event or situation that is happening more or less all the time, including continuous situations
Permanent Disability – means a disability, such as loss of a limb or eyesight, loss of hearing, chronic skin disorder, chronic back disorder, emphysema, and the like

H: High Risk **S: Significant Risk**

M: Moderate Risk **L: Low Risk**

Read the Risk Rating from the matrix below:

Risk Assessment Matrix	A	B	C	D	E
1	H	H	H	S	S
2	H	H	S	S	M
3	H	H	S	M	L
4	H	S	M	L	L
5	S	S	M	L	L

Probable – means an event or situation that occurs or is likely to occur about ten times or more per year
Possible – means an event or situation that occurs or is likely to occur about once per year
Unlikely – means an event or situation that occurs or is likely to occur less frequently than once every ten years

Issued 18th December 2020 Rev - A

DO NOT SCALE THIS DRAWING
IF IN DOUBT - ASK!

REVISIONS

No	Description	Date	By
A	FOR APPROVAL	[illegible]	RW

DRAFT

Client: North Harbour
feel right at home

BULK EARTHWORKS
UNNAMED CREEK

kn group

Drawing Title: SAFETY IN DESIGN

Drawn	Designed	Checked	Date
RW	JB	MAS	FEB 21

Scale	Sheet
AS SHOWN	09 of XX

Drawing No	Revision
A1	20-185- 09	A

APPENDIX B

Borehole Reports and Explanatory Notes

tectonic
geotechnical & environmental engineers

Borehole No.
BH1
Page 1 of 1

Engineering Log - Borehole

Project No.: 21030

Client:	North Harbour Holdings	Commenced:	09/02/2021
Project Name:	Compensation Cut	Completed:	09/02/2021
Hole Location:		Logged By:	MT
Hole Position:	499978.0 m E 7000306.0 m N MGA94 Zone 56	Checked By:	MT

Drill Model and Mounting:	Hand Auger	Inclination:	-90°	RL Surface:	No survey		
Hole Diameter:	100 mm	Bearing:	360°	Datum:	AHD	Operator:	Contract Drilling

Drilling Information							*Soil Description*						*Observations*
Method	Penetration	Water	Samples Tests Remarks	Recovery	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description soil type: plasticity or particle characteristics, secondary and minor components, colour	Moisture Condition	Consistency Relative Density	Pocket Penetrometer UCS (kPa) 100 200 300 400 500	Structure and Additional Observations
HA		Not Encountered	ASS 0.0-0.25m					CI	Silty CLAY, medium plasticity, dark brown, with organics and fine to medium grained sand	M	St		
			ASS 0.25-0.5m										
			ASS 0.5-0.7m			0.5		CH	CLAY, high plasticity, pale brown to grey, trace of fine to medium grained sand		St to VSt		0.50: RESIDUAL SOIL
									Hole Terminated at 0.70 m Target depth				
						1.0							
						1.5							
						2.0							
						2.5							
						3.0							

Method
AD/T- Auger Drilling TC Bit
RR - Rock Roller
RD - Rotary Drilling
NMLC - Rock Core
HA - Hand Auger

Penetration
No resistance ranging to refusal

Water
Level (Date)
Inflow
Partial Loss
Complete Loss

Graphic Log/Core Loss
Core recovered (hatching indicates material)
Core loss

Samples and Tests
U - Undisturbed Sample
D - Disturbed Sample
SPT - Standard Penetration Test

Classification Symbols and Soil Descriptions
Based on Unified Soil Classification System

Moisture Condition
D - Dry
M - Moist
W - Wet

Plastic Limit
< PL
≈ PL
< PL

Consistency/Relative Density
VS - Very Soft
S - Soft
F - Firm
VSt - Very Stiff
H - Hard
VL - Very Loose
L - Loose
MD - Medium Dense
D - Dense
VD - Very Dense

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Borehole No.
BH2
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Engineering Log - Borehole

Project No.: 21030

Client:	North Harbour Holdings	Commenced:	09/02/2021
Project Name:	Compensation Cut	Completed:	09/02/2021
Hole Location:		Logged By:	MT
Hole Position:	500024.0 m E 7000385.0 m N MGA94 Zone 56	Checked By:	MT

Drill Model and Mounting:	4WD Auger	Inclination:	-90°	RL Surface:	No survey		
Hole Diameter:	100 mm	Bearing:	360°	Datum:	AHD	Operator:	Contract Drilling

Drilling Information							Soil Description						Observations
Method	Penetration	Water	Samples Tests Remarks	Recovery	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description soil type: plasticity or particle characteristics, secondary and minor components, colour	Moisture Condition	Consistency Relative Density	Pocket Penetrometer UCS (kPa) 100 200 300 400 500	Structure and Additional Observations
AD/T		09/02/21, Groundwater level at 0.6m	ASS at 0.25m Intervals to 2.0m			0.0		SM	Silty SAND, fine to coarse grained, dark brown	M	MD		
						0.3			becoming grey	M to W			
						0.6				W			
						1.1		CH	Sandy CLAY, high plasticity, brown to grey, fine to medium grained sand	M	F to St		
						1.5			becoming pale grey to white				
						2.0			Hole Terminated at 2.00 m Target depth				

Depth scale: 0.5, 1.0, 1.5, 2.0, 2.5, 3.0

Method
AD/T - Auger Drilling TC Bit
RR - Rock Roller
RD - Rotary Drilling
NMLC - Rock Core
HA - Hand Auger

Penetration
No resistance ranging to refusal

Water
Level (Date)
Inflow
Partial Loss
Complete Loss

Samples and Tests
U - Undisturbed Sample
D - Disturbed Sample
SPT - Standard Penetration Test

Moisture Condition
D - Dry
M - Moist
W - Wet

Plastic Limit
< PL
= PL
< PL

Consistency/Relative Density
VS - Very Soft
S - Soft
F - Firm
VSt - Very Stiff
H - Hard
VL - Very Loose
L - Loose
MD - Medium Dense
D - Dense
VD - Very Dense

Graphic Log/Core Loss
Core recovered (hatching indicates material)
Core loss

Classification Symbols and Soil Descriptions
Based on Unified Soil Classification System

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Borehole No.
BH3
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Engineering Log - Borehole

Project No.: 21030

Client:	North Harbour Holdings	Commenced:	09/02/2021
Project Name:	Compensation Cut	Completed:	09/02/2021
Hole Location:		Logged By:	MT
Hole Position:	500059.0 m E 7000342.0 m N MGA94 Zone 56	Checked By:	MT

Drill Model and Mounting:	4WD Auger	Inclination:	-90°	RL Surface:	No survey		
Hole Diameter:	100 mm	Bearing:	360°	Datum:	AHD	Operator:	Contract Drilling

Drilling Information | **Soil Description** | **Observations**

Method	Penetration	Water	Samples Tests Remarks	Recovery	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description soil type: plasticity or particle characteristics, secondary and minor components, colour	Moisture Condition	Consistency Relative Density	Pocket Penetrometer UCS (kPa) 100 200 300 400 500	Structure and Additional Observations
AD/T		09/02/21, Groundwater level at 0.5m	ASS at 0.25m Intervals to 2.0m			0.0 – 1.2		SM	Silty SAND, fine to medium grained, dark brown	M (0.0–0.5); W (0.5–1.2)	MD		
						1.2 – 1.5		CH	CLAY, high plasticity, pale grey, trace of fine to medium grained sand	M	St		
						1.5 – 2.0			becoming white	M	VSt		
						2.0			Hole Terminated at 2.00 m Target depth				

Depth scale: 0.5, 1.0, 1.5, 2.0, 2.5, 3.0

Method
AD/T - Auger Drilling TC Bit
RR - Rock Roller
RD - Rotary Drilling
NMLC - Rock Core
HA - Hand Auger

Penetration
No resistance ranging to refusal

Water
Level (Date)
Inflow
Partial Loss
Complete Loss

Graphic Log/Core Loss
Core recovered (hatching indicates material)
Core loss

Samples and Tests
U - Undisturbed Sample
D - Disturbed Sample
SPT - Standard Penetration Test

Classification Symbols and Soil Descriptions
Based on Unified Soil Classification System

Moisture Condition
D - Dry
M - Moist
W - Wet

Plastic Limit
< PL
= PL
< PL

Consistency/Relative Density
VS - Very Soft
S - Soft
F - Firm
VSt - Very Stiff
H - Hard
VL - Very Loose
L - Loose
MD - Medium Dense
D - Dense
VD - Very Dense

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Borehole No.
BH4

Engineering Log - Borehole

Project No.: 21030

Client:	North Harbour Holdings	Commenced:	09/02/2021
Project Name:	Compensation Cut	Completed:	09/02/2021
Hole Location:		Logged By:	MT
Hole Position:	500070.0 m E 7000273.0 m N MGA94 Zone 56	Checked By:	MT

Drill Model and Mounting:	4WD Auger	Inclination:	-90°	RL Surface:	No survey		
Hole Diameter:	100 mm	Bearing:	360°	Datum:	AHD	Operator:	Contract Drilling

Drilling Information							Soil Description						Observations
Method	Penetration	Water	Samples Tests Remarks	Recovery	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description soil type: plasticity or particle characteristics, secondary and minor components, colour	Moisture Condition	Consistency Relative Density	Pocket Penetrometer UCS (kPa) 100 200 300 400 500	Structure and Additional Observations
AD/T		Groundwater inflow at 0.5m	ASS at 0.25m Intervals to 2.0m			0.0		SM	Silty SAND, fine to medium grained, dark brown, silt/clay fines, with organic fines	M	MD		
									organics cease				
		▷				0.5				W			0.50: Perched Water
								CI	Silty CLAY, medium plasticity, brown to pale brown	M	St		0.70: Partially Cemented
						1.0		CH	CLAY, high plasticity, pale grey, trace of fine grained sand				
						1.5			becoming pale grey mottled orange		St to VSt		
						2.0			Hole Terminated at 2.00 m Target depth				
						2.5							
						3.0							

Method
AD/T - Auger Drilling TC Bit
RR - Rock Roller
RD - Rotary Drilling
NMLC - Rock Core
HA - Hand Auger

Penetration
No resistance ranging to refusal

Water
Level (Date)
Inflow
Partial Loss
Complete Loss

Samples and Tests
U - Undisturbed Sample
D - Disturbed Sample
SPT - Standard Penetration Test

Moisture Condition
D - Dry
M - Moist
W - Wet

Consistency/Relative Density
VS - Very Soft
S - Soft
F - Firm
VSt - Very Stiff
H - Hard
VL - Very Loose
L - Loose
MD - Medium Dense
D - Dense
VD - Very Dense

Graphic Log/Core Loss
Core recovered (hatching indicates material)
Core loss

Classification Symbols and Soil Descriptions
Based on Unified Soil Classification System

Plastic Limit
< PL
= PL
< PL

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Borehole No.
BH5
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Engineering Log - Borehole

Project No.: 21030

Client:	North Harbour Holdings	Commenced:	09/02/2021
Project Name:	Compensation Cut	Completed:	09/02/2021
Hole Location:		Logged By:	MT
Hole Position:	500131.0 m E 7000131.0 m N MGA94 Zone 56	Checked By:	MT

Drill Model and Mounting:	4WD Auger	Inclination:	-90°	RL Surface:	No survey		
Hole Diameter:	100 mm	Bearing:	360°	Datum:	AHD	Operator:	Contract Drilling

Drilling Information | **Soil Description** | **Observations**

Method	Penetration	Water	Samples Tests Remarks	Recovery	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description soil type: plasticity or particle characteristics, secondary and minor components, colour	Moisture Condition	Consistency Relative Density	Pocket Penetrometer UCS (kPa) 100 200 300 400 500	Structure and Additional Observations
AD/T		Groundwater inflow at 0.5m	ASS at 0.25m Intervals to 2.0m			0.0–0.3		SM	Silty SAND, fine to medium grained, dark brown, with organics (root fibres)	M	MD		
						0.3–0.9		SP	SAND, fine to medium grained, brown, with silt/clay fines	M (to 0.5) / W	MD		
						0.9–2.0		CH	Sandy CLAY, high plasticity, pale grey to white mottled orange, fine to medium grained sand	M	St to VSt		
						2.0			Hole Terminated at 2.00 m Target depth				

Depth scale: 0.5, 1.0, 1.5, 2.0, 2.5, 3.0

Method
AD/T - Auger Drilling TC Bit
RR - Rock Roller
RD - Rotary Drilling
NMLC - Rock Core
HA - Hand Auger

Penetration
No resistance ranging to refusal

Water
Level (Date)
Inflow
Partial Loss
Complete Loss

Samples and Tests
U - Undisturbed Sample
D - Disturbed Sample
SPT - Standard Penetration Test

Moisture Condition
D - Dry
M - Moist
W - Wet

Consistency/Relative Density
VS - Very Soft
S - Soft
F - Firm
VSt - Very Stiff
H - Hard
VL - Very Loose
L - Loose
MD - Medium Dense
D - Dense
VD - Very Dense

Graphic Log/Core Loss
Core recovered (hatching indicates material)
Core loss

Classification Symbols and Soil Descriptions
Based on Unified Soil Classification System

Plastic Limit
< PL
= PL
< PL

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Borehole No.
BH6
Page 1 of 1

Engineering Log - Borehole

Project No.: 21030

Client:	North Harbour Holdings	Commenced:	09/02/2021
Project Name:	Compensation Cut	Completed:	09/02/2021
Hole Location:		Logged By:	MT
Hole Position:	500208.0 m E 7000062.0 m N MGA94 Zone 56	Checked By:	MT

Drill Model and Mounting:	4WD Auger	Inclination:	-90°	RL Surface:	No survey		
Hole Diameter:	100 mm	Bearing:	360°	Datum:	AHD	Operator:	Contract Drilling

Drilling Information							*Soil Description*						*Observations*
Method	Penetration	Water	Samples Tests Remarks	Recovery	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description soil type: plasticity or particle characteristics, secondary and minor components, colour	Moisture Condition	Consistency Relative Density	Pocket Penetrometer UCS (kPa) 100 200 300 400 500	Structure and Additional Observations
AD/T		09/02/21, Groundwater level at 1.5m	ASS at 0.25m Intervals to 2.0m			0.0		SP	SAND, fine to medium grained, dark brown, with organic silt fines	M	MD		
						0.3			becomign pale brown to white, fines cease				0.30: Clean Sand
						1.6		CH	Sandy CLAY, high plasticity, pale grey to pale brown, fine to coarse grained sand	W	St		
						2.0			Hole Terminated at 2.00 m Target depth				

Depth scale: 0.5, 1.0, 1.5, 2.0, 2.5, 3.0

Method
AD/T - Auger Drilling TC Bit
RR - Rock Roller
RD - Rotary Drilling
NMLC - Rock Core
HA - Hand Auger

Penetration
No resistance ranging to refusal

Water
Level (Date)
Inflow
Partial Loss
Complete Loss

Samples and Tests
U - Undisturbed Sample
D - Disturbed Sample
SPT - Standard Penetration Test

Moisture Condition
D - Dry
M - Moist
W - Wet

Consistency/Relative Density
VS - Very Soft
S - Soft
F - Firm
VSt - Very Stiff
H - Hard
VL - Very Loose
L - Loose
MD - Medium Dense
D - Dense
VD - Very Dense

Graphic Log/Core Loss
Core recovered (hatching indicates material)
Core loss

Classification Symbols and Soil Descriptions
Based on Unified Soil Classification System

Plastic Limit
< PL
= PL
> PL

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Borehole No.
BH7

Engineering Log - Borehole

Project No.: 21030

Client:	North Harbour Holdings	Commenced:	09/02/2021
Project Name:	Compensation Cut	Completed:	09/02/2021
Hole Location:		Logged By:	MT
Hole Position:	500205.0 m E 6999949.0 m N MGA94 Zone 56	Checked By:	MT

Drill Model and Mounting:	4WD Auger	Inclination:	-90°	RL Surface:	No survey		
Hole Diameter:	100 mm	Bearing:	360°	Datum:	AHD	Operator:	Contract Drilling

Drilling Information							Soil Description							Observations
Method	Penetration	Water	Samples Tests Remarks	Recovery	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description soil type: plasticity or particle characteristics, secondary and minor components, colour	Moisture Condition	Consistency Relative Density	Pocket Penetrometer UCS (kPa) 100 200 300 400 500		Structure and Additional Observations
AD/T			ASS at 0.25m Intervals to 2.0m			0.0		CI	Silty CLAY, medium plasticity, dark brown, with organics (root fibres), trace of	M	F to St			
								CH	CLAY, high plasticity, red to brown, trace of fine to coarse grained sand	M	St to VSt			
						0.5			becoming pale brown	M	St			
		Level (09/02/2021)				1.0								
								SP	SAND, fine to coarse grained, pale grey, trace of some clay fines	W	MD			
						1.5		CH	Sandy CLAY, high plasticity, grey, fine to coarse grained sand	M	St			
						2.0			Hole Terminated at 2.00 m Target depth					
						2.5								
						3.0								

Method
AD/T - Auger Drilling TC Bit
RR - Rock Roller
RD - Rotary Drilling
NMLC - Rock Core
HA - Hand Auger

Penetration
No resistance ranging to refusal

Water
Level (Date)
Inflow
Partial Loss
Complete Loss

Samples and Tests
U - Undisturbed Sample
D - Disturbed Sample
SPT - Standard Penetration Test

Moisture Condition
D - Dry
M - Moist
W - Wet

Plastic Limit
< PL
= PL
< PL

Consistency/Relative Density
VS - Very Soft
S - Soft
F - Firm
VSt - Very Stiff
H - Hard
VL - Very Loose
L - Loose
MD - Medium Dense
D - Dense
VD - Very Dense

Graphic Log/Core Loss
Core recovered (hatching indicates material)
Core loss

Classification Symbols and Soil Descriptions
Based on Unified Soil Classification System

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Borehole No.
BH8
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Engineering Log - Borehole

Project No.: 21030

Client:	North Harbour Holdings	Commenced:	09/02/2021
Project Name:	Compensation Cut	Completed:	09/02/2021
Hole Location:		Logged By:	MT
Hole Position:	500301.0 m E 6999915.0 m N MGA94 Zone 56	Checked By:	MT

Drill Model and Mounting:	4WD Auger	Inclination:	-90°	RL Surface:	No survey		
Hole Diameter:	100 mm	Bearing:	360°	Datum:	AHD	Operator:	Contract Drilling

Drilling Information / Soil Description / Observations

Method	Penetration	Water	Samples Tests Remarks	Recovery	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description (soil type: plasticity or particle characteristics, secondary and minor components, colour)	Moisture Condition	Consistency Relative Density	Pocket Penetrometer UCS (kPa) 100 200 300 400 500	Structure and Additional Observations
ADT			ASS Samples at 0.25m Intervals to 2.0m			0.0		SP	SAND, fine to medium grained, grey, trace of silt fines and trace of organics				
						0.2			becoming pale brown, organics cease				0.20: Clean Sand!
						0.5				M			
						1.0					MD		
		09/02/21, Groundwater level at 1.1m				1.1							
						1.5							
						2.0			becoming dark brown, with silt fines	W			2.00: Possible Very Low Strength Induration?
						2.5					D		
						3.0			Hole Terminated at 3.00 m Target depth				

Method
ADT - Auger Drilling TC Bit
RR - Rock Roller
RD - Rotary Drilling
NMLC - Rock Core
HA - Hand Auger

Penetration
No resistance ranging to refusal

Water
Level (Date)
Inflow
Partial Loss
Complete Loss

Samples and Tests
U - Undisturbed Sample
D - Disturbed Sample
SPT - Standard Penetration Test

Moisture Condition
D - Dry
M - Moist
W - Wet

Consistency/Relative Density
VS - Very Soft
S - Soft
F - Firm
VSt - Very Stiff
H - Hard
VL - Very Loose
L - Loose
MD - Medium Dense
D - Dense
VD - Very Dense

Graphic Log/Core Loss
Core recovered (hatching indicates material)
Core loss

Classification Symbols and Soil Descriptions
Based on Unified Soil Classification System

Plastic Limit
< PL
= PL
< PL

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Borehole No.
BH9
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Engineering Log - Borehole

Project No.: 21030

Client:	North Harbour Holdings	Commenced:	09/02/2021
Project Name:	Compensation Cut	Completed:	09/02/2021
Hole Location:		Logged By:	MT
Hole Position:	500399.0 m E 6999922.0 m N MGA94 Zone 56	Checked By:	MT

Drill Model and Mounting:	4WD Auger	Inclination:	-90°	RL Surface:	No survey		
Hole Diameter:	100 mm	Bearing:	360°	Datum:	AHD	Operator:	Contract Drilling

Drilling Information | ***Soil Description*** | ***Observations***

Method	Penetration	Water	Samples Tests Remarks	Recovery	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description soil type: plasticity or particle characteristics, secondary and minor components, colour	Moisture Condition	Consistency Relative Density	Pocket Penetrometer UCS (kPa) 100 200 300 400 500	Structure and Additional Observations
AD/T		09/02/21, Groundwater level at 0.8m	ASS at 0.25m Intervals to 2.0m			0.0		SP	SAND, fine to medium grained, brown, trace of silt/clay fines	M	MD		
						0.5			becoming pale brown				
						1.0			becoming pale grey	W			
						1.5			becoming grey, with clay fines				
						1.8		SM	Silty SAND, fine to medium grained, dark brown	M	D		1.80: Low Strength Induration
						2.0			Hole Terminated at 2.00 m Target depth				
						2.5							
						3.0							

Method
AD/T - Auger Drilling TC Bit
RR - Rock Roller
RD - Rotary Drilling
NMLC - Rock Core
HA - Hand Auger

Penetration
No resistance ranging to refusal

Water
Level (Date)
Inflow
Partial Loss
Complete Loss

Graphic Log/Core Loss
Core recovered (hatching indicates material)
Core loss

Samples and Tests
U - Undisturbed Sample
D - Disturbed Sample
SPT - Standard Penetration Test

Classification Symbols and Soil Descriptions
Based on Unified Soil Classification System

Moisture Condition
D - Dry
M - Moist
W - Wet

Plastic Limit
< PL
= PL
< PL

Consistency/Relative Density
VS - Very Soft
S - Soft
F - Firm
VSt - Very Stiff
H - Hard
VL - Very Loose
L - Loose
MD - Medium Dense
D - Dense
VD - Very Dense

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Borehole No.
BH10
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Engineering Log - Borehole

Project No.: 21030

Client:	North Harbour Holdings	Commenced:	09/02/2021
Project Name:	Compensation Cut	Completed:	09/02/2021
Hole Location:		Logged By:	MT
Hole Position:	500517.0 m E 6999858.0 m N MGA94 Zone 56	Checked By:	MT

Drill Model and Mounting:	4WD Auger	Inclination:	-90°	RL Surface:	No survey		
Hole Diameter:		Bearing:	360°	Datum:	AHD	Operator:	Contract Drilling

Drilling Information							*Soil Description*						*Observations*
Method	Penetration	Water	Samples Tests Remarks	Recovery	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description soil type: plasticity or particle characteristics, secondary and minor components, colour	Moisture Condition	Consistency Relative Density	Pocket Penetrometer UCS (kPa) 100 200 300 400 500	Structure and Additional Observations
AD/T		09/02/21, Groundwater level at 0.8m	ASS at 0.25m Intervals to 2.0m					CI	Silty CLAY, medium plasticity, dark brown, with organics (root fibres)	M	F		
						0.5		CH	CLAY, high plasticity, red to grey	M	St		
						1.0		CH	Sandy CLAY, high plasticity, grey to brown, fine to medium grained sand	W	F to St		
						1.5				W	St		
						2.0			Hole Terminated at 2.00 m Target depth				
						2.5							
						3.0							

Method
AD/T - Auger Drilling TC Bit
RR - Rock Roller
RD - Rotary Drilling
NMLC - Rock Core
HA - Hand Auger

Penetration
No resistance ranging to refusal

Water
Level (Date)
Inflow
Partial Loss
Complete Loss

Graphic Log/Core Loss
Core recovered (hatching indicates material)
Core loss

Samples and Tests
U - Undisturbed Sample
D - Disturbed Sample
SPT - Standard Penetration Test

Classification Symbols and Soil Descriptions
Based on Unified Soil Classification System

Moisture Condition
D - Dry
M - Moist
W - Wet

Plastic Limit
< PL
= PL
< PL

Consistency/Relative Density
VS - Very Soft
S - Soft
F - Firm
VSt - Very Stiff
H - Hard
VL - Very Loose
L - Loose
MD - Medium Dense
D - Dense
VD - Very Dense

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METHOD OF SOIL DESCRIPTION USED ON LOGS

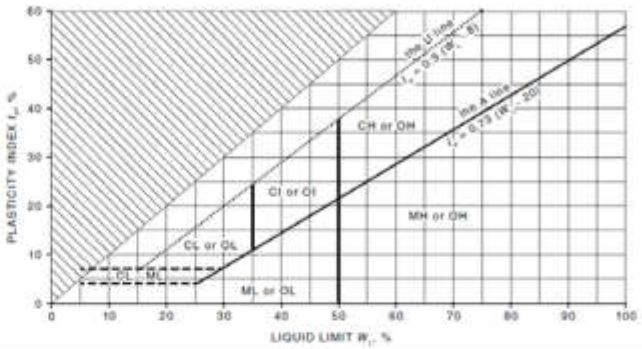
CLASSIFICATION AND INFERRED STRATIGRAPHY

Soil is classified and described in borehole and test pit logs using the preferred method given in AS1726 – 2017.
The material properties are assessed in the field by visual/tactile methods.

Particle Size

Major Division	Sub Division	Particle Size
BOULDERS		> 200 mm
COBBLES		63 to 200 mm
GRAVEL	Coarse	19 to 63 mm
	Medium	6.7 to 19 mm
	Fine	2.36 to 6.7 mm
SAND	Coarse	0.6 to 2.36 mm
	Medium	0.21 to 0.6 mm
	Fine	0.075 to 0.21
SILT		0.002 to 0.075
CLAY		< 0.002 mm

Plasticity Properties



NOTE: The U line is an approximate upper bound for most materials. Data which plot above the U line may represent unusual/problem soil behavior, or unreliable data and should be considered carefully.

MOISTURE CONDITION

AS1726 - 2017

Symbol	Term	Description
D	Dry	Sands and gravels are free flowing. Clays & Silts may be brittle or friable and powdery.
M	Moist	Soils are darker than in the dry condition & may feel cool. Sands and gravels tend to cohere.
W	Wet	Soils exude free water. Sands and gravels tend to cohere.

CONSISTENCY AND DENSITY

AS1726 - 2017

Symbol	Term	Undrained Shear Strength		Symbol	Term	Density Index %	SPT "N" #
VS	Very Soft	0 to 12 kPa		VL	Very Loose	Less than 15	0 to 4
S	Soft	12 to 25 kPa		L	Loose	15 to 35	4 to 10
F	Firm	25 to 50 kPa		MD	Medium Dense	35 to 65	10 to 30
St	Stiff	50 to 100 kPa		D	Dense	65 to 85	30 to 50
VSt	Very Stiff	100 to 200 kPa		VD	Very Dense	Above 85	Above 50
H	Hard	Above 200 kPa					

In the absence of test results, consistency and density may be assessed from correlations with the observed behaviour of the material.
SPT correlations are not stated in AS1726 – 2017, and may be subject to corrections for overburden pressure and equipment type.

APPENDIX C

Table C1 – Results Summary

Acid Sulfate Soils Laboratory Test Certificates

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Table C1 - Summary of ASS Laboratory Testing

Ref: 21030

Location & Depth (m)		Soil Type	pH_F	AASS likelihood[1]	pH_{FOX}	PASS likelihood[2]	Reaction	pH KCl	Titratable Actual Acidity	S_{KCl}	Chromium Reducible Sulfur		S_{NAS}	ANC_bt	Net Acidity (Existing + Potential)	Indicative Lime Rate	
			pH Unit		pH Unit		1 to 4	pH Unit	mole H+ / t	%S	%S	mole H+ / t	mole H+ / t	mole H+ / t	mole H+ / t	kg $CaCO_3$/t	kg $CaCO_3$/m^3
BH1	0.0-0.25	Silty CLAY	5.0	L	3.0	M	4	4.2	210	0.02	0.018	11	< 10	n/a	221	11	18
	0.25-0.5		5.1	L	2.7	H	4										
	0.5-0.7	CLAY (Residual)	4.8	M	3.6	M	4	4.5	77	< 0.02	< 0.005	< 3	< 10	n/a	77	4	6
BH2	0.0-0.25	Silty SAND	4.5	M	2.2	H	4	4.8	28	< 0.02	< 0.005	< 3	n/a	n/a	28	1	2
	0.25-0.5		4.7	M	2.7	H	4										
	0.5-0.75		4.9	M	3.3	M	2										
	0.75-1.0	Sandy CLAY	4.6	M	3.2	M	2	5.2	17	< 0.02	0.011	6.9	n/a	n/a	23.9	1	2
	1.0-1.25		5.0	L	3.4	M	4										
	1.25-1.5		4.9	M	3.4	M	4										
	1.5-1.75		5.1	L	3.7	M	4										
	1.75-2.0		5.3	L	3.8	M	4										
BH3	0.0-0.25		4.6	M	2.7	M	4										
	0.25-0.5	Silty SAND	4.4	M	2.4	H	4	4.8	27	< 0.02	< 0.005	< 3	n/a	n/a	27	1	2
	0.5-0.75		4.6	M	2.7	M	4										
	0.75-1.0		5.2	L	2.7	H	4										
	1.0-1.25		5.1	L	2.7	H	4										
	1.25-1.5	CLAY	5.2	L	3.6	M	4	4.3	94	< 0.02	< 0.005	< 3	< 10	n/a	94	5	8
	1.5-1.75		5.0	L	4.1	L	4										
	1.75-2.0		5.0	L	4.3	L	4										
BH4	0.0-0.25		4.7	M	2.4	H	4	4.7	43	< 0.02	< 0.005	< 3	n/a	n/a	43	2	3
	0.25-0.5	Silty SAND	4.4	M	2.8	M	4										
	0.5-0.75		4.4	M	2.8	M	4										
	0.75-1.0	Silty CLAY	5.1	L	4.2	L	4	4.6	150	< 0.02	0.007	4.2	n/a	n/a	150	8	12
	1.0-1.25		5.2	L	4.0	L	4										
	1.25-1.5	CLAY	5.2	L	3.6	M	4										
	1.5-1.75		5.2	L	4.0	L	4										
	1.75-2.0		5.2	L	4.1	L	4										
BH5	0.0-0.25	Silty SAND	5.0	L	2.8	H	4										
	0.25-0.5		4.8	M	3.0	M	3	5.2	8.5	< 0.02	< 0.005	< 3	n/a	n/a	8.5	N/R	N/R
	0.5-0.75	SAND	4.8	M	3.8	M	4										
	0.75-1.0		4.8	M	3.0	M	3										
	1.0-1.25		5.0	L	3.3	M	3	4.5	65	< 0.02	< 0.005	< 3	n/a	n/a	65	3	5
	1.25-1.5	Sandy CLAY	5.0	L	3.6	M	4										
	1.5-1.75		4.8	M	3.7	M	4										
	1.75-2.0		4.8	M	3.7	M	4										
BH6	0.0-0.25		6.4	L	3.2	M	4										
	0.25-0.5		6.1	L	3.8	M	1										
	0.5-0.75	SAND	5.9	L	3.7	M	1	5.6	4.9	< 0.02	< 0.005	< 3	n/a	n/a	4.9	N/R	N/R
	0.75-1.0		5.5	L	3.4	M	1										
	1.0-1.25		5.4	L	3.2	M	1										
	1.25-1.5		5.5	L	3.6	M	2	5.7	3.1	< 0.02	< 0.005	< 3	n/a	n/a	3.1	N/R	N/R
	1.5-1.75	Sandy CLAY	5.3	L	3.6	M	2										
	1.75-2.0		5.3	L	3.6	M	2										

Location & Depth (m)		Soil Type	pH_F	AASS likelihood[1]	pH_{FOX}	PASS likelihood[2]	Reaction	pH KCl	Titratable Actual Acidity	S_{KCl}	Chromium Reducible Sulfur		S_{NAS}	ANC_bt	Net Acidity (Existing + Potential)	Indicative Lime Rate	
			pH Unit		pH Unit		1 to 4	pH Unit	mole H+ / t	%S	%S	mole H+ / t	mole H+ / t	mole H+ / t	mole H+ / t	kg $CaCO_3$/t	kg $CaCO_3$/m^3
BH7	0.0-0.25	Silty CLAY	6.2	L	3.0	M	4										
	0.25-0.5	CLAY	5.7	L	3.3	M	4	4.6	54	< 0.02	< 0.005	< 3	n/a	n/a	54	3	4
	0.5-0.75		5.1	L	3.4	M	2										
	0.75-1.0		5.0	L	3.5	M	2	4.3	74	< 0.02	< 0.005	< 3	< 10	n/a	74	4	6
	1.0-1.25	SAND	5.5	L	3.5	M	4										
	1.25-1.5	Sandy CLAY	5.7	L	3.1	M	4										
	1.5-1.75		5.7	L	3.1	M	4										
	1.75-2.0		5.7	L	3.3	M	4										
BH8	0.0-0.25	SAND	6.0	L	3.0	M	4										
	0.25-0.5		6.1	L	3.4	M	4	5.6	3.7	< 0.02	< 0.005	< 3	n/a	n/a	3.7	N/R	N/R
	0.5-0.75		6.0	L	3.8	M	4										
	0.75-1.0		6.0	L	4.3	L	2										
	1.0-1.25		6.0	L	4.4	L	2										
	1.25-1.5		6.5	L	4.8	L	2	5.5	2	< 0.02	< 0.005	< 3	n/a	n/a	< 3	N/R	N/R
	1.5-1.75		6.1	L	4.6	L	1										
	1.75-2.0		6.1	L	4.2	L	1										
BH9	0.0-0.25	SAND	5.9	L	2.9	H	4	5.4	7.9	< 0.02	< 0.005	< 3	n/a	n/a	7.9	N/R	N/R
	0.25-0.5		6.2	L	3.3	M	4										
	0.5-0.75		5.8	L	3.7	M	4	5.5	5.4	< 0.02	< 0.005	< 3	n/a	n/a	5.4	N/R	N/R
	0.75-1.0		5.6	L	4.0	L	4										
	1.0-1.25		5.8	L	4.3	L	1										
	1.25-1.5		5.9	L	4.2	L	1										
	1.5-1.75		5.7	L	3.8	M	4	4.9	22	< 0.02	< 0.005	< 3	n/a	n/a	22	1	3
	1.75-2.0	Silty SAND	5.8	L	3.9	M	4	5.0	17	< 0.02	< 0.005	< 3	n/a	n/a	17	N/R	N/R
BH10	0.0-0.25	Silty CLAY	5.8	L	2.8	H	4	4.7	52	< 0.02	< 0.005	< 3	n/a	n/a	52	3	4
	0.25-0.5	CLAY	5.4	L	4.0	L	4	4.5	65	< 0.02	< 0.005	< 3	< 10	n/a	65	3	5
	0.5-0.75		5.5	L	3.2	M	4										
	0.75-1.0	Sandy CLAY	5.7	L	3.3	M	4										
	1.0-1.25		5.5	L	4.1	L	4										
	1.25-1.5		5.3	L	4.4	L	4										
	1.5-1.75		5.7	L	4.1	L	4										
	1.75-2.0		5.7	L	4.2	L	1										

Notes:

1. Actual Acid Sulfate Soil (AASS) likelihood is indicated by Low (L & no shading)(pHF > 5), Medium (M & yellow shade)(pHF 5 ≤ pHF < 4) and High (H & red shade)(pHF ≤ 4).
2. Potential Acid Sulfate Soil (PASS) likelihood is indicated by Low (L & no shading, where pHFOX is > 4 and Δ pH from pHF to pHFOX is < 2 pH units), Medium (M & yellow shade, where Δ pH from pHF to pHFOX is ≥ 2 pH units OR pHFOX is <4)) and High (H and red shade)(change from pHF to pHFOX is ≥2 pH units AND pHFOX is <3)
3. Reaction 1 = Nil to slight reaction, 2 = Moderate reaction, 3 = Strong reaction (persistant froth), 4 = Extreme reaction.
4. Shaded TAA & SCR results are those exceeding the CASSIT action levels of 18 mol H+/t or 0.03 %S. (Strength of Acidity: < 0.1%S Yellow, 0.1-1.0%S Orange, > 1%S Red)
5. Required Lime Rate is calculated from the net Acid-Base Account (utilising 50% of existing ANC, where present), with a factor of safety = 1.5 for ASS material and bulk density of 1.7 t/m^3. N/R = Not Required

Tectonic Geotechnical Pty Ltd
40A Glen Vista Place
Chevalum
Qld 4555

Attention: **Mark Thomson**

Report **773118-S-V2**
Project name COMPENSATORY CUT - UNNAMED CREEK
Project ID 21030
Received Date Feb 10, 2021

Client Sample ID			BH1 - 0.0-0.25	BH1 - 0.25-0.5	BH1 - 0.5-0.71	BH2 - 0.0-0.25
Sample Matrix			Soil	Soil	Soil	Soil
Eurofins Sample No.			B21-Fe20769	B21-Fe20770	B21-Fe20771	B21-Fe20772
Date Sampled			Feb 09, 2021	Feb 09, 2021	Feb 09, 2021	Feb 09, 2021
Test/Reference	LOR	Unit				
Acid Sulfate Soils Field pH Test						
pH-F (Field pH test)*	0.1	pH Units	5.0	5.1	4.8	4.5
pH-FOX (Field pH Peroxide test)*	0.1	pH Units	3.0	2.7	3.6	2.2
Reaction Ratings*[305]	-	comment	4.0	4.0	4.0	4.0
Chromium Suite (SKCl)						
pH-KCL	0.1	pH Units	4.2	-	4.5	4.8
Acid trail - Titratable Actual Acidity	2	mol H+/t	210	-	77	28
sulfidic - TAA equiv. S% pyrite	0.003	% pyrite S	0.34	-	0.12	0.044
Chromium Reducible Sulfur[304]	0.005	% S	0.018	-	< 0.005	< 0.005
Chromium Reducible Sulfur -acidity units	3	mol H+/t	11	-	< 3	< 3
Sulfur - KCl Extractable	0.02	% S	0.02	-	< 0.02	< 0.02
HCl Extractable Sulfur Correction Factor	1	factor	2.0	-	2.0	2.0
HCl Extractable Sulfur	0.02	% S	0.07	-	< 0.02	n/a
Net Acid soluble sulfur	0.02	% S	0.05	-	< 0.02	n/a
Net Acid soluble sulfur - acidity units	10	mol H+/t	22	-	< 10	n/a
Net Acid soluble sulfur - equivalent S% pyrite[302]	0.02	% S	0.04	-	< 0.02	n/a
Acid Neutralising Capacity (ANCbt)	0.01	% CaCO3	n/a	-	n/a	n/a
Acid Neutralising Capacity - acidity (a-ANCbt)	2	mol H+/t	n/a	-	n/a	n/a
Acid Neutralising Capacity - equivalent S% pyrite (s-ANCbt)[303]	0.02	% S	n/a	-	n/a	n/a
ANC Fineness Factor		factor	1.5	-	1.5	1.5
CRS Suite - Net Acidity (Sulfur Units)	0.02	% S	0.39	-	0.12	0.04
CRS Suite - Net Acidity (Acidity Units)	10	mol H+/t	240	-	77	28
CRS Suite - Liming Rate[301]	1	kg CaCO3/t	18	-	5.8	2.1
<2mm Fraction	0.005	g	32	-	30	110
>2mm Fraction	0.005	g	< 0.005	-	< 0.005	< 0.005
Analysed Material	0.1	%	100	-	100	100
Extraneous Material	0.1	%	< 0.1	-	< 0.1	< 0.1
% Moisture	1	%	27	30	25	15

Client Sample ID			BH2- 0.25-0.5	BH2 - 0.5-0.75	BH2 - 0.75-1.0	BH2 - 1.0-1.25
Sample Matrix			Soil	Soil	Soil	Soil
Eurofins Sample No.			B21-Fe20773	B21-Fe20774	B21-Fe20775	B21-Fe20776
Date Sampled			Feb 09, 2021	Feb 09, 2021	Feb 09, 2021	Feb 09, 2021
Test/Reference	LOR	Unit				
Acid Sulfate Soils Field pH Test						
pH-F (Field pH test)*	0.1	pH Units	4.7	4.9	4.6	5.0
pH-FOX (Field pH Peroxide test)*	0.1	pH Units	2.7	3.3	3.2	3.4
Reaction Ratings*[305]	-	comment	4.0	2.0	2.0	4.0
Chromium Suite (SKCl)						
pH-KCL	0.1	pH Units	-	-	5.2	-
Acid trail - Titratable Actual Acidity	2	mol H+/t	-	-	17	-
sulfidic - TAA equiv. S% pyrite	0.003	% pyrite S	-	-	0.027	-
Chromium Reducible Sulfur[304]	0.005	% S	-	-	0.011	-
Chromium Reducible Sulfur -acidity units	3	mol H+/t	-	-	6.9	-
Sulfur - KCl Extractable	0.02	% S	-	-	< 0.02	-
HCl Extractable Sulfur Correction Factor	1	factor	-	-	2.0	-
HCl Extractable Sulfur	0.02	% S	-	-	n/a	-
Net Acid soluble sulfur	0.02	% S	-	-	n/a	-
Net Acid soluble sulfur - acidity units	10	mol H+/t	-	-	n/a	-
Net Acid soluble sulfur - equivalent S% pyrite[302]	0.02	% S	-	-	n/a	-
Acid Neutralising Capacity (ANCbt)	0.01	% CaCO3	-	-	n/a	-
Acid Neutralising Capacity - acidity (a-ANCbt)	2	mol H+/t	-	-	n/a	-
Acid Neutralising Capacity - equivalent S% pyrite (s-ANCbt)[303]	0.02	% S	-	-	n/a	-
ANC Fineness Factor		factor	-	-	1.5	-
CRS Suite - Net Acidity (Sulfur Units)	0.02	% S	-	-	0.04	-
CRS Suite - Net Acidity (Acidity Units)	10	mol H+/t	-	-	24	-
CRS Suite - Liming Rate[301]	1	kg CaCO3/t	-	-	1.8	-
<2mm Fraction	0.005	g	-	-	54	-
>2mm Fraction	0.005	g	-	-	1.3	-
Analysed Material	0.1	%	-	-	98	-
Extraneous Material	0.1	%	-	-	2.3	-
% Moisture	1	%	-	-	11	-

Client Sample ID			BH2 - 1.25-1.5	BH2 - 1.5-1.75	BH2 - 1.75-2.0	BH3 - 0.0-0.25
Sample Matrix			Soil	Soil	Soil	Soil
Eurofins Sample No.			B21-Fe20777	B21-Fe20778	B21-Fe20779	B21-Fe20780
Date Sampled			Feb 09, 2021	Feb 09, 2021	Feb 09, 2021	Feb 09, 2021
Test/Reference	LOR	Unit				
Acid Sulfate Soils Field pH Test						
pH-F (Field pH test)*	0.1	pH Units	4.9	5.1	5.3	4.6
pH-FOX (Field pH Peroxide test)*	0.1	pH Units	3.4	3.7	3.8	2.7
Reaction Ratings*[305]	-	comment	4.0	4.0	4.0	4.0

Client Sample ID			BH3 - 0.25-0.5	BH3 - 0.5-0.75	BH3 - 0.75-1.0	BH3 - 1.0-1.25
Sample Matrix			Soil	Soil	Soil	Soil
Eurofins Sample No.			B21-Fe20781	B21-Fe20782	B21-Fe20783	B21-Fe20784
Date Sampled			Feb 09, 2021	Feb 09, 2021	Feb 09, 2021	Feb 09, 2021
Test/Reference	LOR	Unit				
Acid Sulfate Soils Field pH Test						
pH-F (Field pH test)*	0.1	pH Units	4.4	4.6	5.2	5.1
pH-FOX (Field pH Peroxide test)*	0.1	pH Units	2.4	2.7	2.7	2.7
Reaction Ratings*[305]	-	comment	4.0	4.0	4.0	4.0
Chromium Suite (SKCl)						
pH-KCL	0.1	pH Units	4.8	-	-	-
Acid trail - Titratable Actual Acidity	2	mol H+/t	27	-	-	-
sulfidic - TAA equiv. S% pyrite	0.003	% pyrite S	0.044	-	-	-
Chromium Reducible Sulfur[304]	0.005	% S	< 0.005	-	-	-
Chromium Reducible Sulfur -acidity units	3	mol H+/t	< 3	-	-	-
Sulfur - KCl Extractable	0.02	% S	< 0.02	-	-	-
HCl Extractable Sulfur Correction Factor	1	factor	2.0	-	-	-
HCl Extractable Sulfur	0.02	% S	n/a	-	-	-
Net Acid soluble sulfur	0.02	% S	n/a	-	-	-
Net Acid soluble sulfur - acidity units	10	mol H+/t	n/a	-	-	-
Net Acid soluble sulfur - equivalent S% pyrite[302]	0.02	% S	n/a	-	-	-
Acid Neutralising Capacity (ANCbt)	0.01	% CaCO3	n/a	-	-	-
Acid Neutralising Capacity - acidity (a-ANCbt)	2	mol H+/t	n/a	-	-	-
Acid Neutralising Capacity - equivalent S% pyrite (s-ANCbt)[303]	0.02	% S	n/a	-	-	-
ANC Fineness Factor		factor	1.5	-	-	-
CRS Suite - Net Acidity (Sulfur Units)	0.02	% S	0.04	-	-	-
CRS Suite - Net Acidity (Acidity Units)	10	mol H+/t	27	-	-	-
CRS Suite - Liming Rate[301]	1	kg CaCO3/t	2.1	-	-	-
<2mm Fraction	0.005	g	130	-	-	-
>2mm Fraction	0.005	g	< 0.005	-	-	-
Analysed Material	0.1	%	100	-	-	-
Extraneous Material	0.1	%	< 0.1	-	-	-
% Moisture	1	%	14	-	-	-

Client Sample ID			BH3 - 1.25-1.5	BH3 - 1.5-1.75	BH3 - 1.75-2.0	BH4 - 0.0-0.25
Sample Matrix			Soil	Soil	Soil	Soil
Eurofins Sample No.			B21-Fe20785	B21-Fe20786	B21-Fe20787	B21-Fe20788
Date Sampled			Feb 09, 2021	Feb 09, 2021	Feb 09, 2021	Feb 09, 2021
Test/Reference	LOR	Unit				
Acid Sulfate Soils Field pH Test						
pH-F (Field pH test)*	0.1	pH Units	5.2	5.0	5.0	4.7
pH-FOX (Field pH Peroxide test)*	0.1	pH Units	3.6	4.1	4.3	2.4
Reaction Ratings*[305]	-	comment	4.0	4.0	4.0	4.0
Chromium Suite (SKCl)						
pH-KCL	0.1	pH Units	4.3	-	-	4.7
Acid trail - Titratable Actual Acidity	2	mol H+/t	94	-	-	43
sulfidic - TAA equiv. S% pyrite	0.003	% pyrite S	0.15	-	-	0.069
Chromium Reducible Sulfur[304]	0.005	% S	< 0.005	-	-	< 0.005
Chromium Reducible Sulfur -acidity units	3	mol H+/t	< 3	-	-	< 3
Sulfur - KCl Extractable	0.02	% S	< 0.02	-	-	< 0.02
HCl Extractable Sulfur Correction Factor	1	factor	2.0	-	-	2.0
HCl Extractable Sulfur	0.02	% S	< 0.02	-	-	n/a

Client Sample ID			BH3 - 1.25-1.5	BH3 - 1.5-1.75	BH3 - 1.75-2.0	BH4 - 0.0-0.25
Sample Matrix			Soil	Soil	Soil	Soil
Eurofins Sample No.			B21-Fe20785	B21-Fe20786	B21-Fe20787	B21-Fe20788
Date Sampled			Feb 09, 2021	Feb 09, 2021	Feb 09, 2021	Feb 09, 2021
Test/Reference	LOR	Unit				
Chromium Suite (SKCl)						
Net Acid soluble sulfur	0.02	% S	< 0.02	-	-	n/a
Net Acid soluble sulfur - acidity units	10	mol H+/t	< 10	-	-	n/a
Net Acid soluble sulfur - equivalent S% pyrite[302]	0.02	% S	< 0.02	-	-	n/a
Acid Neutralising Capacity (ANCbt)	0.01	% CaCO3	n/a	-	-	n/a
Acid Neutralising Capacity - acidity (a-ANCbt)	2	mol H+/t	n/a	-	-	n/a
Acid Neutralising Capacity - equivalent S% pyrite (s-ANCbt)[303]	0.02	% S	n/a	-	-	n/a
ANC Fineness Factor		factor	1.5	-	-	1.5
CRS Suite - Net Acidity (Sulfur Units)	0.02	% S	0.15	-	-	0.07
CRS Suite - Net Acidity (Acidity Units)	10	mol H+/t	94	-	-	43
CRS Suite - Liming Rate[301]	1	kg CaCO3/t	7.0	-	-	3.2
<2mm Fraction	0.005	g	90	-	-	100
>2mm Fraction	0.005	g	< 0.005	-	-	< 0.005
Analysed Material	0.1	%	100	-	-	100
Extraneous Material	0.1	%	< 0.1	-	-	< 0.1
% Moisture	1	%	24	-	-	17

Client Sample ID			BH4 - 0.25-0.5	BH4 - 0.5-0.75	BH4 - 0.75-1.0	BH4 - 1.0-1.25
Sample Matrix			Soil	Soil	Soil	Soil
Eurofins Sample No.			B21-Fe20789	B21-Fe20790	B21-Fe20791	B21-Fe20792
Date Sampled			Feb 09, 2021	Feb 09, 2021	Feb 09, 2021	Feb 09, 2021
Test/Reference	LOR	Unit				
Acid Sulfate Soils Field pH Test						
pH-F (Field pH test)*	0.1	pH Units	4.4	4.4	5.1	5.2
pH-FOX (Field pH Peroxide test)*	0.1	pH Units	2.8	2.8	4.2	4.0
Reaction Ratings*[305]	-	comment	4.0	4.0	4.0	4.0
Chromium Suite (SKCl)						
pH-KCL	0.1	pH Units	-	-	4.6	-
Acid trail - Titratable Actual Acidity	2	mol H+/t	-	-	150	-
sulfidic - TAA equiv. S% pyrite	0.003	% pyrite S	-	-	0.25	-
Chromium Reducible Sulfur[304]	0.005	% S	-	-	0.007	-
Chromium Reducible Sulfur -acidity units	3	mol H+/t	-	-	4.2	-
Sulfur - KCl Extractable	0.02	% S	-	-	< 0.02	-
HCl Extractable Sulfur Correction Factor	1	factor	-	-	2.0	-
HCl Extractable Sulfur	0.02	% S	-	-	n/a	-
Net Acid soluble sulfur	0.02	% S	-	-	n/a	-
Net Acid soluble sulfur - acidity units	10	mol H+/t	-	-	n/a	-
Net Acid soluble sulfur - equivalent S% pyrite[302]	0.02	% S	-	-	n/a	-
Acid Neutralising Capacity (ANCbt)	0.01	% CaCO3	-	-	n/a	-
Acid Neutralising Capacity - acidity (a-ANCbt)	2	mol H+/t	-	-	n/a	-
Acid Neutralising Capacity - equivalent S% pyrite (s-ANCbt)[303]	0.02	% S	-	-	n/a	-
ANC Fineness Factor		factor	-	-	1.5	-
CRS Suite - Net Acidity (Sulfur Units)	0.02	% S	-	-	0.25	-
CRS Suite - Net Acidity (Acidity Units)	10	mol H+/t	-	-	160	-
CRS Suite - Liming Rate[301]	1	kg CaCO3/t	-	-	12	-
<2mm Fraction	0.005	g	-	-	86	-

Client Sample ID			BH4 - 0.25-0.5	BH4 - 0.5-0.75	BH4 - 0.75-1.0	BH4 - 1.0-1.25
Sample Matrix			Soil	Soil	Soil	Soil
Eurofins Sample No.			B21-Fe20789	B21-Fe20790	B21-Fe20791	B21-Fe20792
Date Sampled			Feb 09, 2021	Feb 09, 2021	Feb 09, 2021	Feb 09, 2021
Test/Reference	LOR	Unit				
Chromium Suite (SKCl)						
>2mm Fraction	0.005	g	-	-	< 0.005	-
Analysed Material	0.1	%	-	-	100	-
Extraneous Material	0.1	%	-	-	< 0.1	-
% Moisture	1	%	-	-	29	-

Client Sample ID			BH4 - 1.25-1.5	BH4 - 1.5-1.75	BH4 - 1.75-2.0	BH5 - 0.0-0.25
Sample Matrix			Soil	Soil	Soil	Soil
Eurofins Sample No.			B21-Fe20793	B21-Fe20794	B21-Fe20795	B21-Fe20796
Date Sampled			Feb 09, 2021	Feb 09, 2021	Feb 09, 2021	Feb 09, 2021
Test/Reference	LOR	Unit				
Acid Sulfate Soils Field pH Test						
pH-F (Field pH test)*	0.1	pH Units	5.2	5.2	5.2	5.0
pH-FOX (Field pH Peroxide test)*	0.1	pH Units	3.6	4.0	4.1	2.8
Reaction Ratings*[305]	-	comment	4.0	4.0	4.0	4.0

Client Sample ID			BH5 - 0.25-0.5	BH5 - 0.5-0.75	BH5 - 0.75-1.0	BH5 - 1.0-1.25
Sample Matrix			Soil	Soil	Soil	Soil
Eurofins Sample No.			B21-Fe20797	B21-Fe20798	B21-Fe20799	B21-Fe20800
Date Sampled			Feb 09, 2021	Feb 09, 2021	Feb 09, 2021	Feb 09, 2021
Test/Reference	LOR	Unit				
Acid Sulfate Soils Field pH Test						
pH-F (Field pH test)*	0.1	pH Units	4.8	4.8	4.8	5.0
pH-FOX (Field pH Peroxide test)*	0.1	pH Units	3.0	3.8	3.0	3.3
Reaction Ratings*[305]	-	comment	3.0	4.0	3.0	3.0
Chromium Suite (SKCl)						
pH-KCL	0.1	pH Units	5.2	-	-	4.5
Acid trail - Titratable Actual Acidity	2	mol H+/t	8.5	-	-	65
sulfidic - TAA equiv. S% pyrite	0.003	% pyrite S	0.014	-	-	0.10
Chromium Reducible Sulfur[304]	0.005	% S	< 0.005	-	-	< 0.005
Chromium Reducible Sulfur -acidity units	3	mol H+/t	< 3	-	-	< 3
Sulfur - KCl Extractable	0.02	% S	< 0.02	-	-	< 0.02
HCl Extractable Sulfur Correction Factor	1	factor	2.0	-	-	2.0
HCl Extractable Sulfur	0.02	% S	n/a	-	-	n/a
Net Acid soluble sulfur	0.02	% S	n/a	-	-	n/a
Net Acid soluble sulfur - acidity units	10	mol H+/t	n/a	-	-	n/a
Net Acid soluble sulfur - equivalent S% pyrite[302]	0.02	% S	n/a	-	-	n/a
Acid Neutralising Capacity (ANCbt)	0.01	% CaCO3	n/a	-	-	n/a
Acid Neutralising Capacity - acidity (a-ANCbt)	2	mol H+/t	n/a	-	-	n/a
Acid Neutralising Capacity - equivalent S% pyrite (s-ANCbt)[303]	0.02	% S	n/a	-	-	n/a
ANC Fineness Factor		factor	1.5	-	-	1.5
CRS Suite - Net Acidity (Sulfur Units)	0.02	% S	< 0.02	-	-	0.10
CRS Suite - Net Acidity (Acidity Units)	10	mol H+/t	< 10	-	-	65
CRS Suite - Liming Rate[301]	1	kg CaCO3/t	< 1	-	-	4.8
<2mm Fraction	0.005	g	130	-	-	99
>2mm Fraction	0.005	g	< 0.005	-	-	1.6

Client Sample ID			BH5 - 0.25-0.5	BH5 - 0.5-0.75	BH5 - 0.75-1.0	BH5 - 1.0-1.25
Sample Matrix			Soil	Soil	Soil	Soil
Eurofins Sample No.			B21-Fe20797	B21-Fe20798	B21-Fe20799	B21-Fe20800
Date Sampled			Feb 09, 2021	Feb 09, 2021	Feb 09, 2021	Feb 09, 2021
Test/Reference	LOR	Unit				
Chromium Suite (SKCl)						
Analysed Material	0.1	%	100	-	-	98
Extraneous Material	0.1	%	< 0.1	-	-	1.5
% Moisture	1	%	12	-	-	17

Client Sample ID			BH5 - 1.25-1.5	BH5 - 1.5-1.75	BH5 - 1.75-2.0	BH6 - 0.0-0.25
Sample Matrix			Soil	Soil	Soil	Soil
Eurofins Sample No.			B21-Fe20801	B21-Fe20802	B21-Fe20803	B21-Fe20804
Date Sampled			Feb 09, 2021	Feb 09, 2021	Feb 09, 2021	Feb 09, 2021
Test/Reference	LOR	Unit				
Acid Sulfate Soils Field pH Test						
pH-F (Field pH test)*	0.1	pH Units	5.0	4.8	4.8	6.4
pH-FOX (Field pH Peroxide test)*	0.1	pH Units	3.6	3.7	3.7	3.2
Reaction Ratings*[305]	-	comment	4.0	4.0	4.0	4.0

Client Sample ID			BH6 - 0.25-0.5	BH6 - 0.5-0.75	BH6 - 0.75-1.0	BH6 - 1.0-1.25
Sample Matrix			Soil	Soil	Soil	Soil
Eurofins Sample No.			B21-Fe20805	B21-Fe20806	B21-Fe20807	B21-Fe20808
Date Sampled			Feb 09, 2021	Feb 09, 2021	Feb 09, 2021	Feb 09, 2021
Test/Reference	LOR	Unit				
Acid Sulfate Soils Field pH Test						
pH-F (Field pH test)*	0.1	pH Units	6.1	5.9	5.5	5.4
pH-FOX (Field pH Peroxide test)*	0.1	pH Units	3.8	3.7	3.4	3.2
Reaction Ratings*[305]	-	comment	1.0	1.0	1.0	1.0
Chromium Suite (SKCl)						
pH-KCL	0.1	pH Units	-	5.6	-	-
Acid trail - Titratable Actual Acidity	2	mol H+/t	-	4.9	-	-
sulfidic - TAA equiv. S% pyrite	0.003	% pyrite S	-	0.008	-	-
Chromium Reducible Sulfur[304]	0.005	% S	-	< 0.005	-	-
Chromium Reducible Sulfur -acidity units	3	mol H+/t	-	< 3	-	-
Sulfur - KCl Extractable	0.02	% S	-	< 0.02	-	-
HCl Extractable Sulfur Correction Factor	1	factor	-	2.0	-	-
HCl Extractable Sulfur	0.02	% S	-	n/a	-	-
Net Acid soluble sulfur	0.02	% S	-	n/a	-	-
Net Acid soluble sulfur - acidity units	10	mol H+/t	-	n/a	-	-
Net Acid soluble sulfur - equivalent S% pyrite[302]	0.02	% S	-	n/a	-	-
Acid Neutralising Capacity (ANCbt)	0.01	% CaCO3	-	n/a	-	-
Acid Neutralising Capacity - acidity (a-ANCbt)	2	mol H+/t	-	n/a	-	-
Acid Neutralising Capacity - equivalent S% pyrite (s-ANCbt)[303]	0.02	% S	-	n/a	-	-
ANC Fineness Factor		factor	-	1.5	-	-
CRS Suite - Net Acidity (Sulfur Units)	0.02	% S	-	< 0.02	-	-
CRS Suite - Net Acidity (Acidity Units)	10	mol H+/t	-	< 10	-	-
CRS Suite - Liming Rate[301]	1	kg CaCO3/t	-	< 1	-	-
<2mm Fraction	0.005	g	-	110	-	-
>2mm Fraction	0.005	g	-	0.71	-	-
Analysed Material	0.1	%	-	99	-	-
Extraneous Material	0.1	%	-	0.7	-	-

Client Sample ID			BH6 - 0.25-0.5	BH6 - 0.5-0.75	BH6 - 0.75-1.0	BH6 - 1.0-1.25
Sample Matrix			Soil	Soil	Soil	Soil
Eurofins Sample No.			B21-Fe20805	B21-Fe20806	B21-Fe20807	B21-Fe20808
Date Sampled			Feb 09, 2021	Feb 09, 2021	Feb 09, 2021	Feb 09, 2021
Test/Reference	LOR	Unit				
% Moisture	1	%	-	4.3	-	-

Client Sample ID			BH6 - 1.25-1.5	BH6 - 1.5-1.75	BH6 - 1.75-2.0	BH7 - 0.0-0.25
Sample Matrix			Soil	Soil	Soil	Soil
Eurofins Sample No.			B21-Fe20809	B21-Fe20810	B21-Fe20811	B21-Fe20812
Date Sampled			Feb 09, 2021	Feb 09, 2021	Feb 09, 2021	Feb 09, 2021
Test/Reference	LOR	Unit				
Acid Sulfate Soils Field pH Test						
pH-F (Field pH test)*	0.1	pH Units	5.5	5.3	5.3	6.2
pH-FOX (Field pH Peroxide test)*	0.1	pH Units	3.6	3.6	3.6	3.0
Reaction Ratings*[305]	-	comment	2.0	2.0	2.0	4.0
Chromium Suite (SKCl)						
pH-KCL	0.1	pH Units	5.7	-	-	-
Acid trail - Titratable Actual Acidity	2	mol H+/t	3.1	-	-	-
sulfidic - TAA equiv. S% pyrite	0.003	% pyrite S	0.005	-	-	-
Chromium Reducible Sulfur[304]	0.005	% S	< 0.005	-	-	-
Chromium Reducible Sulfur -acidity units	3	mol H+/t	< 3	-	-	-
Sulfur - KCl Extractable	0.02	% S	< 0.02	-	-	-
HCl Extractable Sulfur Correction Factor	1	factor	2.0	-	-	-
HCl Extractable Sulfur	0.02	% S	n/a	-	-	-
Net Acid soluble sulfur	0.02	% S	n/a	-	-	-
Net Acid soluble sulfur - acidity units	10	mol H+/t	n/a	-	-	-
Net Acid soluble sulfur - equivalent S% pyrite[302]	0.02	% S	n/a	-	-	-
Acid Neutralising Capacity (ANCbt)	0.01	% CaCO3	n/a	-	-	-
Acid Neutralising Capacity - acidity (a-ANCbt)	2	mol H+/t	n/a	-	-	-
Acid Neutralising Capacity - equivalent S% pyrite (s-ANCbt)[303]	0.02	% S	n/a	-	-	-
ANC Fineness Factor		factor	1.5	-	-	-
CRS Suite - Net Acidity (Sulfur Units)	0.02	% S	< 0.02	-	-	-
CRS Suite - Net Acidity (Acidity Units)	10	mol H+/t	< 10	-	-	-
CRS Suite - Liming Rate[301]	1	kg CaCO3/t	< 1	-	-	-
<2mm Fraction	0.005	g	120	-	-	-
>2mm Fraction	0.005	g	2.9	-	-	-
Analysed Material	0.1	%	98	-	-	-
Extraneous Material	0.1	%	2.4	-	-	-
% Moisture	1	%	10	-	-	-

Client Sample ID			BH7 - 0.25-0.5	BH7 - 0.5-0.75	BH7 - 0.75-1.0	BH7 - 1.0-1.25
Sample Matrix			Soil	Soil	Soil	Soil
Eurofins Sample No.			B21-Fe20813	B21-Fe20814	B21-Fe20815	B21-Fe20816
Date Sampled			Feb 09, 2021	Feb 09, 2021	Feb 09, 2021	Feb 09, 2021
Test/Reference	LOR	Unit				
Acid Sulfate Soils Field pH Test						
pH-F (Field pH test)*	0.1	pH Units	5.7	5.1	5.0	5.5
pH-FOX (Field pH Peroxide test)*	0.1	pH Units	3.3	3.4	3.5	3.5
Reaction Ratings*[305]	-	comment	4.0	2.0	2.0	4.0
Chromium Suite (SKCl)						
pH-KCL	0.1	pH Units	4.6	-	4.3	-
Acid trail - Titratable Actual Acidity	2	mol H+/t	54	-	74	-
sulfidic - TAA equiv. S% pyrite	0.003	% pyrite S	0.086	-	0.12	-
Chromium Reducible Sulfur[304]	0.005	% S	< 0.005	-	< 0.005	-
Chromium Reducible Sulfur -acidity units	3	mol H+/t	< 3	-	< 3	-
Sulfur - KCl Extractable	0.02	% S	< 0.02	-	< 0.02	-
HCl Extractable Sulfur Correction Factor	1	factor	2.0	-	2.0	-
HCl Extractable Sulfur	0.02	% S	n/a	-	< 0.02	-
Net Acid soluble sulfur	0.02	% S	n/a	-	< 0.02	-
Net Acid soluble sulfur - acidity units	10	mol H+/t	n/a	-	< 10	-
Net Acid soluble sulfur - equivalent S% pyrite[302]	0.02	% S	n/a	-	< 0.02	-
Acid Neutralising Capacity (ANCbt)	0.01	% CaCO3	n/a	-	n/a	-
Acid Neutralising Capacity - acidity (a-ANCbt)	2	mol H+/t	n/a	-	n/a	-
Acid Neutralising Capacity - equivalent S% pyrite (s-ANCbt)[303]	0.02	% S	n/a	-	n/a	-
ANC Fineness Factor		factor	1.5	-	1.5	-
CRS Suite - Net Acidity (Sulfur Units)	0.02	% S	0.09	-	0.12	-
CRS Suite - Net Acidity (Acidity Units)	10	mol H+/t	54	-	74	-
CRS Suite - Liming Rate[301]	1	kg CaCO3/t	4.0	-	5.6	-
<2mm Fraction	0.005	g	110	-	81	-
>2mm Fraction	0.005	g	< 0.005	-	< 0.005	-
Analysed Material	0.1	%	100	-	100	-
Extraneous Material	0.1	%	< 0.1	-	< 0.1	-
% Moisture	1	%	22	-	20	-

Client Sample ID			BH7 - 1.25-1.5	BH7 - 1.5-1.75	BH7 - 1.75-2.0	BH8 - 0.0-0.25
Sample Matrix			Soil	Soil	Soil	Soil
Eurofins Sample No.			B21-Fe20817	B21-Fe20818	B21-Fe20819	B21-Fe20820
Date Sampled			Feb 09, 2021	Feb 09, 2021	Feb 09, 2021	Feb 09, 2021
Test/Reference	LOR	Unit				
Acid Sulfate Soils Field pH Test						
pH-F (Field pH test)*	0.1	pH Units	5.7	5.7	5.7	6.0
pH-FOX (Field pH Peroxide test)*	0.1	pH Units	3.1	3.1	3.3	3.0
Reaction Ratings*[305]	-	comment	4.0	4.0	4.0	4.0

Client Sample ID			BH8 - 0.25-0.5	BH8 - 0.5-0.75	BH8 - 0.75-1.0	BH8 - 1.0-1.25
Sample Matrix			Soil	Soil	Soil	Soil
Eurofins Sample No.			B21-Fe20821	B21-Fe20822	B21-Fe20823	B21-Fe20824
Date Sampled			Feb 09, 2021	Feb 09, 2021	Feb 09, 2021	Feb 09, 2021
Test/Reference	LOR	Unit				
Acid Sulfate Soils Field pH Test						
pH-F (Field pH test)*	0.1	pH Units	6.1	6.0	6.0	6.0
pH-FOX (Field pH Peroxide test)*	0.1	pH Units	3.4	3.8	4.3	4.4
Reaction Ratings*[305]	-	comment	4.0	4.0	2.0	2.0
Chromium Suite (SKCl)						
pH-KCL	0.1	pH Units	5.6	-	-	-
Acid trail - Titratable Actual Acidity	2	mol H+/t	3.7	-	-	-
sulfidic - TAA equiv. S% pyrite	0.003	% pyrite S	0.006	-	-	-
Chromium Reducible Sulfur[304]	0.005	% S	< 0.005	-	-	-
Chromium Reducible Sulfur -acidity units	3	mol H+/t	< 3	-	-	-
Sulfur - KCl Extractable	0.02	% S	< 0.02	-	-	-
HCl Extractable Sulfur Correction Factor	1	factor	2.0	-	-	-
HCl Extractable Sulfur	0.02	% S	n/a	-	-	-
Net Acid soluble sulfur	0.02	% S	n/a	-	-	-
Net Acid soluble sulfur - acidity units	10	mol H+/t	n/a	-	-	-
Net Acid soluble sulfur - equivalent S% pyrite[302]	0.02	% S	n/a	-	-	-
Acid Neutralising Capacity (ANCbt)	0.01	% CaCO3	n/a	-	-	-
Acid Neutralising Capacity - acidity (a-ANCbt)	2	mol H+/t	n/a	-	-	-
Acid Neutralising Capacity - equivalent S% pyrite (s-ANCbt)[303]	0.02	% S	n/a	-	-	-
ANC Fineness Factor		factor	1.5	-	-	-
CRS Suite - Net Acidity (Sulfur Units)	0.02	% S	< 0.02	-	-	-
CRS Suite - Net Acidity (Acidity Units)	10	mol H+/t	< 10	-	-	-
CRS Suite - Liming Rate[301]	1	kg CaCO3/t	< 1	-	-	-
<2mm Fraction	0.005	g	96	-	-	-
>2mm Fraction	0.005	g	0.81	-	-	-
Analysed Material	0.1	%	99	-	-	-
Extraneous Material	0.1	%	0.8	-	-	-
% Moisture	1	%	4.1	-	-	-

Client Sample ID			BH8 - 1.25-1.5	BH8 - 1.5-1.75	BH8 - 1.75-2.0	BH9 - 0.0-0.25
Sample Matrix			Soil	Soil	Soil	Soil
Eurofins Sample No.			B21-Fe20825	B21-Fe20826	B21-Fe20827	B21-Fe20828
Date Sampled			Feb 09, 2021	Feb 09, 2021	Feb 09, 2021	Feb 09, 2021
Test/Reference	LOR	Unit				
Acid Sulfate Soils Field pH Test						
pH-F (Field pH test)*	0.1	pH Units	6.5	6.1	6.1	5.9
pH-FOX (Field pH Peroxide test)*	0.1	pH Units	4.8	4.6	4.2	2.9
Reaction Ratings*[305]	-	comment	2.0	1.0	1.0	4.0
Chromium Suite (SKCl)						
pH-KCL	0.1	pH Units	5.5	-	-	5.4
Acid trail - Titratable Actual Acidity	2	mol H+/t	< 2	-	-	7.9
sulfidic - TAA equiv. S% pyrite	0.003	% pyrite S	< 0.003	-	-	0.013
Chromium Reducible Sulfur[304]	0.005	% S	< 0.005	-	-	< 0.005
Chromium Reducible Sulfur -acidity units	3	mol H+/t	< 3	-	-	< 3
Sulfur - KCl Extractable	0.02	% S	< 0.02	-	-	< 0.02
HCl Extractable Sulfur Correction Factor	1	factor	2.0	-	-	2.0
HCl Extractable Sulfur	0.02	% S	n/a	-	-	n/a

Client Sample ID			BH8 - 1.25-1.5	BH8 - 1.5-1.75	BH8 - 1.75-2.0	BH9 - 0.0-0.25
Sample Matrix			Soil	Soil	Soil	Soil
Eurofins Sample No.			B21-Fe20825	B21-Fe20826	B21-Fe20827	B21-Fe20828
Date Sampled			Feb 09, 2021	Feb 09, 2021	Feb 09, 2021	Feb 09, 2021
Test/Reference	LOR	Unit				
Chromium Suite (SKCl)						
Net Acid soluble sulfur	0.02	% S	n/a	-	-	n/a
Net Acid soluble sulfur - acidity units	10	mol H+/t	n/a	-	-	n/a
Net Acid soluble sulfur - equivalent S% pyrite[302]	0.02	% S	n/a	-	-	n/a
Acid Neutralising Capacity (ANCbt)	0.01	% CaCO3	n/a	-	-	n/a
Acid Neutralising Capacity - acidity (a-ANCbt)	2	mol H+/t	n/a	-	-	n/a
Acid Neutralising Capacity - equivalent S% pyrite (s-ANCbt)[303]	0.02	% S	n/a	-	-	n/a
ANC Fineness Factor		factor	1.5	-	-	1.5
CRS Suite - Net Acidity (Sulfur Units)	0.02	% S	< 0.02	-	-	< 0.02
CRS Suite - Net Acidity (Acidity Units)	10	mol H+/t	< 10	-	-	< 10
CRS Suite - Liming Rate[301]	1	kg CaCO3/t	< 1	-	-	< 1
<2mm Fraction	0.005	g	110	-	-	76
>2mm Fraction	0.005	g	4.2	-	-	< 0.005
Analysed Material	0.1	%	96	-	-	100
Extraneous Material	0.1	%	3.7	-	-	< 0.1
% Moisture	1	%	15	-	-	7.0

Client Sample ID			BH9 - 0.25-0.5	BH9 - 0.5-0.75	BH9 - 0.75-1.0	BH9 - 1.0-1.25
Sample Matrix			Soil	Soil	Soil	Soil
Eurofins Sample No.			B21-Fe20829	B21-Fe20830	B21-Fe20831	B21-Fe20832
Date Sampled			Feb 09, 2021	Feb 09, 2021	Feb 09, 2021	Feb 09, 2021
Test/Reference	LOR	Unit				
Acid Sulfate Soils Field pH Test						
pH-F (Field pH test)*	0.1	pH Units	6.2	5.8	5.6	5.8
pH-FOX (Field pH Peroxide test)*	0.1	pH Units	3.3	3.7	4.0	4.3
Reaction Ratings*[305]	-	comment	4.0	4.0	4.0	1.0
Chromium Suite (SKCl)						
pH-KCL	0.1	pH Units	-	5.5	-	-
Acid trail - Titratable Actual Acidity	2	mol H+/t	-	5.4	-	-
sulfidic - TAA equiv. S% pyrite	0.003	% pyrite S	-	0.009	-	-
Chromium Reducible Sulfur[304]	0.005	% S	-	< 0.005	-	-
Chromium Reducible Sulfur -acidity units	3	mol H+/t	-	< 3	-	-
Sulfur - KCl Extractable	0.02	% S	-	< 0.02	-	-
HCl Extractable Sulfur Correction Factor	1	factor	-	2.0	-	-
HCl Extractable Sulfur	0.02	% S	-	n/a	-	-
Net Acid soluble sulfur	0.02	% S	-	n/a	-	-
Net Acid soluble sulfur - acidity units	10	mol H+/t	-	n/a	-	-
Net Acid soluble sulfur - equivalent S% pyrite[302]	0.02	% S	-	n/a	-	-
Acid Neutralising Capacity (ANCbt)	0.01	% CaCO3	-	n/a	-	-
Acid Neutralising Capacity - acidity (a-ANCbt)	2	mol H+/t	-	n/a	-	-
Acid Neutralising Capacity - equivalent S% pyrite (s-ANCbt)[303]	0.02	% S	-	n/a	-	-
ANC Fineness Factor		factor	-	1.5	-	-
CRS Suite - Net Acidity (Sulfur Units)	0.02	% S	-	< 0.02	-	-
CRS Suite - Net Acidity (Acidity Units)	10	mol H+/t	-	< 10	-	-
CRS Suite - Liming Rate[301]	1	kg CaCO3/t	-	< 1	-	-
<2mm Fraction	0.005	g	-	110	-	-

Client Sample ID			BH9 - 0.25-0.5	BH9 - 0.5-0.75	BH9 - 0.75-1.0	BH9 - 1.0-1.25
Sample Matrix			Soil	Soil	Soil	Soil
Eurofins Sample No.			B21-Fe20829	B21-Fe20830	B21-Fe20831	B21-Fe20832
Date Sampled			Feb 09, 2021	Feb 09, 2021	Feb 09, 2021	Feb 09, 2021
Test/Reference	LOR	Unit				
Chromium Suite (SKCl)						
>2mm Fraction	0.005	g	-	3.4	-	-
Analysed Material	0.1	%	-	97	-	-
Extraneous Material	0.1	%	-	2.9	-	-
% Moisture	1	%	-	14	-	-

Client Sample ID			BH9 - 1.25-1.5	BH9 - 1.5-1.75	BH9 - 1.75-2.0	BH10 - 0.0-0.25
Sample Matrix			Soil	Soil	Soil	Soil
Eurofins Sample No.			B21-Fe20833	B21-Fe20834	B21-Fe20835	B21-Fe20836
Date Sampled			Feb 09, 2021	Feb 09, 2021	Feb 09, 2021	Feb 09, 2021
Test/Reference	LOR	Unit				
Acid Sulfate Soils Field pH Test						
pH-F (Field pH test)*	0.1	pH Units	5.9	5.7	5.8	5.8
pH-FOX (Field pH Peroxide test)*	0.1	pH Units	4.2	3.8	3.9	2.8
Reaction Ratings*[S05]	-	comment	1.0	4.0	4.0	4.0
Chromium Suite (SKCl)						
pH-KCL	0.1	pH Units	-	4.9	5.0	4.7
Acid trail - Titratable Actual Acidity	2	mol H+/t	-	22	17	52
sulfidic - TAA equiv. S% pyrite	0.003	% pyrite S	-	0.035	0.027	0.083
Chromium Reducible Sulfur[S04]	0.005	% S	-	< 0.005	< 0.005	< 0.005
Chromium Reducible Sulfur -acidity units	3	mol H+/t	-	< 3	< 3	< 3
Sulfur - KCl Extractable	0.02	% S	-	< 0.02	< 0.02	< 0.02
HCl Extractable Sulfur Correction Factor	1	factor	-	2.0	2.0	2.0
HCl Extractable Sulfur	0.02	% S	-	n/a	n/a	n/a
Net Acid soluble sulfur	0.02	% S	-	n/a	n/a	n/a
Net Acid soluble sulfur - acidity units	10	mol H+/t	-	n/a	n/a	n/a
Net Acid soluble sulfur - equivalent S% pyrite[S02]	0.02	% S	-	n/a	n/a	n/a
Acid Neutralising Capacity (ANCbt)	0.01	% CaCO3	-	n/a	n/a	n/a
Acid Neutralising Capacity - acidity (a-ANCbt)	2	mol H+/t	-	n/a	n/a	n/a
Acid Neutralising Capacity - equivalent S% pyrite (s-ANCbt)[S03]	0.02	% S	-	n/a	n/a	n/a
ANC Fineness Factor		factor	-	1.5	1.5	1.5
CRS Suite - Net Acidity (Sulfur Units)	0.02	% S	-	0.04	0.03	0.08
CRS Suite - Net Acidity (Acidity Units)	10	mol H+/t	-	22	17	52
CRS Suite - Liming Rate[S01]	1	kg CaCO3/t	-	1.7	1.3	3.9
<2mm Fraction	0.005	g	-	130	150	50
>2mm Fraction	0.005	g	-	13	9.2	< 0.005
Analysed Material	0.1	%	-	91	94	100
Extraneous Material	0.1	%	-	9.2	5.9	< 0.1
% Moisture	1	%	-	14	13	15

Client Sample ID			BH10 - 0.25-0.5	BH10 - 0.5-0.75	BH10 - 0.75-1.0	BH10 - 1.0-1.25
Sample Matrix			Soil	Soil	Soil	Soil
Eurofins Sample No.			B21-Fe20837	B21-Fe20838	B21-Fe20839	B21-Fe20840
Date Sampled			Feb 09, 2021	Feb 09, 2021	Feb 09, 2021	Feb 09, 2021
Test/Reference	LOR	Unit				
Acid Sulfate Soils Field pH Test						
pH-F (Field pH test)*	0.1	pH Units	5.4	5.5	5.7	5.5
pH-FOX (Field pH Peroxide test)*	0.1	pH Units	4.0	3.2	3.3	4.1
Reaction Ratings*[305]	-	comment	4.0	4.0	4.0	4.0
Chromium Suite (SKCl)						
pH-KCL	0.1	pH Units	4.5	-	-	-
Acid trail - Titratable Actual Acidity	2	mol H+/t	65	-	-	-
sulfidic - TAA equiv. S% pyrite	0.003	% pyrite S	0.10	-	-	-
Chromium Reducible Sulfur[304]	0.005	% S	< 0.005	-	-	-
Chromium Reducible Sulfur -acidity units	3	mol H+/t	< 3	-	-	-
Sulfur - KCl Extractable	0.02	% S	< 0.02	-	-	-
HCl Extractable Sulfur Correction Factor	1	factor	2.0	-	-	-
HCl Extractable Sulfur	0.02	% S	0.03	-	-	-
Net Acid soluble sulfur	0.02	% S	0.02	-	-	-
Net Acid soluble sulfur - acidity units	10	mol H+/t	< 10	-	-	-
Net Acid soluble sulfur - equivalent S% pyrite[302]	0.02	% S	< 0.02	-	-	-
Acid Neutralising Capacity (ANCbt)	0.01	% CaCO3	n/a	-	-	-
Acid Neutralising Capacity - acidity (a-ANCbt)	2	mol H+/t	n/a	-	-	-
Acid Neutralising Capacity - equivalent S% pyrite (s-ANCbt)[303]	0.02	% S	n/a	-	-	-
ANC Fineness Factor		factor	1.5	-	-	-
CRS Suite - Net Acidity (Sulfur Units)	0.02	% S	0.10	-	-	-
CRS Suite - Net Acidity (Acidity Units)	10	mol H+/t	74	-	-	-
CRS Suite - Liming Rate[301]	1	kg CaCO3/t	5.6	-	-	-
<2mm Fraction	0.005	g	44	-	-	-
>2mm Fraction	0.005	g	< 0.005	-	-	-
Analysed Material	0.1	%	100	-	-	-
Extraneous Material	0.1	%	< 0.1	-	-	-
% Moisture	1	%	14	-	-	-

Client Sample ID			BH10 - 1.25-1.5	BH10 - 1.5-1.75	BH10 - 1.75-2.0
Sample Matrix			Soil	Soil	Soil
Eurofins Sample No.			B21-Fe20841	B21-Fe20842	B21-Fe20843
Date Sampled			Feb 09, 2021	Feb 09, 2021	Feb 09, 2021
Test/Reference	LOR	Unit			
Acid Sulfate Soils Field pH Test					
pH-F (Field pH test)*	0.1	pH Units	5.3	5.7	5.7
pH-FOX (Field pH Peroxide test)*	0.1	pH Units	4.4	4.1	4.2
Reaction Ratings*[305]	-	comment	4.0	4.0	1.0

Sample History

Where samples are submitted/analysed over several days, the last date of extraction and analysis is reported.
A recent review of our LIMS has resulted in the correction or clarification of some method identifications. Due to this, some of the method reference information on reports has changed. However, no substantive change has been made to our laboratory methods, and as such there is no change in the validity of current or previous results.

If the date and time of sampling are not provided, the Laboratory will not be responsible for compromised results should testing be performed outside the recommended holding time.

Description	Testing Site	Extracted	Holding Time
Acid Sulfate Soils Field pH Test	Brisbane	Feb 12, 2021	7 Days
- Method: LTM-GEN-7060 Determination of field pH (pHF) and field pH peroxide (pHFOX) tests			
Chromium Suite (SKCl)	Brisbane	Mar 05, 2021	6 Week
- Method: LTM-GEN-7070			
% Moisture	Brisbane	Mar 08, 2021	14 Days
- Method: LTM-GEN-7080 Moisture			

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Company Name: Tectonic Geotechnical Pty Ltd
Address: 40A Glen Vista Place
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Qld 4555

Project Name: COMPENSATORY CUT - UNNAMED CREEK
Project ID: 21030

Order No.:
Report #: 773118
Phone: 07 5478 9642
Fax:

Received: Feb 10, 2021 9:00 AM
Due: Feb 18, 2021
Priority: 5 Day
Contact Name: Mark Thomson

Eurofins Analytical Services Manager : Ryan Gilbert

Sample Detail						Acid Sulfate Soils Field pH Test	Moisture Set	Chromium Suite (SKCl)
Melbourne Laboratory - NATA Site # 1254 & 14271								
Sydney Laboratory - NATA Site # 18217								
Brisbane Laboratory - NATA Site # 20794						X	X	X
Perth Laboratory - NATA Site # 23736								
Mayfield Laboratory								
External Laboratory								
No	Sample ID	Sample Date	Sampling Time	Matrix	LAB ID			
1	BH1 - 0.0-0.25	Feb 09, 2021		Soil	B21-Fe20769	X	X	X
2	BH1 - 0.25-0.5	Feb 09, 2021		Soil	B21-Fe20770	X	X	
3	BH1 - 0.5-0.71	Feb 09, 2021		Soil	B21-Fe20771	X	X	X
4	BH2 - 0.0-0.25	Feb 09, 2021		Soil	B21-Fe20772	X	X	X
5	BH2- 0.25-0.5	Feb 09, 2021		Soil	B21-Fe20773	X		
6	BH2 - 0.5-0.75	Feb 09, 2021		Soil	B21-Fe20774	X		
7	BH2 - 0.75-1.0	Feb 09, 2021		Soil	B21-Fe20775	X	X	X
8	BH2 - 1.0-1.25	Feb 09, 2021		Soil	B21-Fe20776	X		
9	BH2 - 1.25-1.5	Feb 09, 2021		Soil	B21-Fe20777	X		

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Company Name:	Tectonic Geotechnical Pty Ltd	**Order No.:**	**Received:** Feb 10, 2021 9:00 AM
Address:	40A Glen Vista Place Chevalum Qld 4555	**Report #:** 773118 **Phone:** 07 5478 9642 **Fax:**	**Due:** Feb 18, 2021 **Priority:** 5 Day **Contact Name:** Mark Thomson
Project Name:	COMPENSATORY CUT - UNNAMED CREEK		
Project ID:	21030		

Eurofins Analytical Services Manager : Ryan Gilbert

Sample Detail						Acid Sulfate Soils Field pH Test	Moisture Set	Chromium Suite (SKCl)
Melbourne Laboratory - NATA Site # 1254 & 14271								
Sydney Laboratory - NATA Site # 18217								
Brisbane Laboratory - NATA Site # 20794						X	X	X
Perth Laboratory - NATA Site # 23736								
Mayfield Laboratory								
External Laboratory								
10	BH2 - 1.5-1.75	Feb 09, 2021		Soil	B21-Fe20778	X		
11	BH2 - 1.75-2.0	Feb 09, 2021		Soil	B21-Fe20779	X		
12	BH3 - 0.0-0.25	Feb 09, 2021		Soil	B21-Fe20780	X		
13	BH3 - 0.25-0.5	Feb 09, 2021		Soil	B21-Fe20781	X	X	X
14	BH3 - 0.5-0.75	Feb 09, 2021		Soil	B21-Fe20782	X		
15	BH3 - 0.75-1.0	Feb 09, 2021		Soil	B21-Fe20783	X		
16	BH3 - 1.0-1.25	Feb 09, 2021		Soil	B21-Fe20784	X		
17	BH3 - 1.25-1.5	Feb 09, 2021		Soil	B21-Fe20785	X	X	X
18	BH3 - 1.5-1.75	Feb 09, 2021		Soil	B21-Fe20786	X		
19	BH3 - 1.75-2.0	Feb 09, 2021		Soil	B21-Fe20787	X		
20	BH4 - 0.0-0.25	Feb 09, 2021		Soil	B21-Fe20788	X	X	X

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Company Name:	Tectonic Geotechnical Pty Ltd	**Order No.:**	**Received:** Feb 10, 2021 9:00 AM
Address:	40A Glen Vista Place Chevalum Qld 4555	**Report #:** 773118 **Phone:** 07 5478 9642 **Fax:**	**Due:** Feb 18, 2021 **Priority:** 5 Day **Contact Name:** Mark Thomson
Project Name:	COMPENSATORY CUT - UNNAMED CREEK		
Project ID:	21030		

Eurofins Analytical Services Manager : Ryan Gilbert

Sample Detail						Acid Sulfate Soils Field pH Test	Moisture Set	Chromium Suite (SKCl)
Melbourne Laboratory - NATA Site # 1254 & 14271								
Sydney Laboratory - NATA Site # 18217								
Brisbane Laboratory - NATA Site # 20794						X	X	X
Perth Laboratory - NATA Site # 23736								
Mayfield Laboratory								
External Laboratory								
21	BH4 - 0.25-0.5	Feb 09, 2021		Soil	B21-Fe20789	X		
22	BH4 - 0.5-0.75	Feb 09, 2021		Soil	B21-Fe20790	X		
23	BH4 - 0.75-1.0	Feb 09, 2021		Soil	B21-Fe20791	X	X	X
24	BH4 - 1.0-1.25	Feb 09, 2021		Soil	B21-Fe20792	X		
25	BH4 - 1.25-1.5	Feb 09, 2021		Soil	B21-Fe20793	X		
26	BH4 - 1.5-1.75	Feb 09, 2021		Soil	B21-Fe20794	X		
27	BH4 - 1.75-2.0	Feb 09, 2021		Soil	B21-Fe20795	X		
28	BH5 - 0.0-0.25	Feb 09, 2021		Soil	B21-Fe20796	X		
29	BH5 - 0.25-0.5	Feb 09, 2021		Soil	B21-Fe20797	X	X	X
30	BH5 - 0.5-0.75	Feb 09, 2021		Soil	B21-Fe20798	X		
31	BH5 - 0.75-1.0	Feb 09, 2021		Soil	B21-Fe20799	X		

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Project Name:	COMPENSATORY CUT - UNNAMED CREEK		
Project ID:	21030		

Eurofins Analytical Services Manager : Ryan Gilbert

Sample Detail						Acid Sulfate Soils Field pH Test	Moisture Set	Chromium Suite (SKCl)
Melbourne Laboratory - NATA Site # 1254 & 14271								
Sydney Laboratory - NATA Site # 18217								
Brisbane Laboratory - NATA Site # 20794						X	X	X
Perth Laboratory - NATA Site # 23736								
Mayfield Laboratory								
External Laboratory								
32	BH5 - 1.0-1.25	Feb 09, 2021		Soil	B21-Fe20800	X	X	X
33	BH5 - 1.25-1.5	Feb 09, 2021		Soil	B21-Fe20801	X		
34	BH5 - 1.5-1.75	Feb 09, 2021		Soil	B21-Fe20802	X		
35	BH5 - 1.75-2.0	Feb 09, 2021		Soil	B21-Fe20803	X		
36	BH6 - 0.0-0.25	Feb 09, 2021		Soil	B21-Fe20804	X		
37	BH6 - 0.25-0.5	Feb 09, 2021		Soil	B21-Fe20805	X		
38	BH6 - 0.5-0.75	Feb 09, 2021		Soil	B21-Fe20806	X	X	X
39	BH6 - 0.75-1.0	Feb 09, 2021		Soil	B21-Fe20807	X		
40	BH6 - 1.0-1.25	Feb 09, 2021		Soil	B21-Fe20808	X		
41	BH6 - 1.25-1.5	Feb 09, 2021		Soil	B21-Fe20809	X	X	X
42	BH6 - 1.5-1.75	Feb 09, 2021		Soil	B21-Fe20810	X		

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Project Name:	COMPENSATORY CUT - UNNAMED CREEK		
Project ID:	21030		

Eurofins Analytical Services Manager : Ryan Gilbert

Sample Detail						Acid Sulfate Soils Field pH Test	Moisture Set	Chromium Suite (SKCl)
Melbourne Laboratory - NATA Site # 1254 & 14271								
Sydney Laboratory - NATA Site # 18217								
Brisbane Laboratory - NATA Site # 20794						X	X	X
Perth Laboratory - NATA Site # 23736								
Mayfield Laboratory								
External Laboratory								
43	BH6 - 1.75-2.0	Feb 09, 2021		Soil	B21-Fe20811	X		
44	BH7 - 0.0-0.25	Feb 09, 2021		Soil	B21-Fe20812	X		
45	BH7 - 0.25-0.5	Feb 09, 2021		Soil	B21-Fe20813	X	X	X
46	BH7 - 0.5-0.75	Feb 09, 2021		Soil	B21-Fe20814	X		
47	BH7 - 0.75-1.0	Feb 09, 2021		Soil	B21-Fe20815	X	X	X
48	BH7 - 1.0-1.25	Feb 09, 2021		Soil	B21-Fe20816	X		
49	BH7 - 1.25-1.5	Feb 09, 2021		Soil	B21-Fe20817	X		
50	BH7 - 1.5-1.75	Feb 09, 2021		Soil	B21-Fe20818	X		
51	BH7 - 1.75-2.0	Feb 09, 2021		Soil	B21-Fe20819	X		
52	BH8 - 0.0-0.25	Feb 09, 2021		Soil	B21-Fe20820	X		
53	BH8 - 0.25-0.5	Feb 09, 2021		Soil	B21-Fe20821	X	X	X

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Address:	40A Glen Vista Place Chevalum Qld 4555	**Report #:** 773118 **Phone:** 07 5478 9642 **Fax:**	**Due:** Feb 18, 2021 **Priority:** 5 Day **Contact Name:** Mark Thomson
Project Name:	COMPENSATORY CUT - UNNAMED CREEK		
Project ID:	21030		

Eurofins Analytical Services Manager : Ryan Gilbert

Sample Detail						Acid Sulfate Soils Field pH Test	Moisture Set	Chromium Suite (SKCl)
Melbourne Laboratory - NATA Site # 1254 & 14271								
Sydney Laboratory - NATA Site # 18217								
Brisbane Laboratory - NATA Site # 20794						X	X	X
Perth Laboratory - NATA Site # 23736								
Mayfield Laboratory								
External Laboratory								
54	BH8 - 0.5-0.75	Feb 09, 2021		Soil	B21-Fe20822	X		
55	BH8 - 0.75-1.0	Feb 09, 2021		Soil	B21-Fe20823	X		
56	BH8 - 1.0-1.25	Feb 09, 2021		Soil	B21-Fe20824	X		
57	BH8 - 1.25-1.5	Feb 09, 2021		Soil	B21-Fe20825	X	X	X
58	BH8 - 1.5-1.75	Feb 09, 2021		Soil	B21-Fe20826	X		
59	BH8 - 1.75-2.0	Feb 09, 2021		Soil	B21-Fe20827	X		
60	BH9 - 0.0-0.25	Feb 09, 2021		Soil	B21-Fe20828	X	X	X
61	BH9 - 0.25-0.5	Feb 09, 2021		Soil	B21-Fe20829	X		
62	BH9 - 0.5-0.75	Feb 09, 2021		Soil	B21-Fe20830	X	X	X
63	BH9 - 0.75-1.0	Feb 09, 2021		Soil	B21-Fe20831	X		
64	BH9 - 1.0-1.25	Feb 09, 2021		Soil	B21-Fe20832	X		

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Company Name:	Tectonic Geotechnical Pty Ltd	**Order No.:**	**Received:** Feb 10, 2021 9:00 AM
Address:	40A Glen Vista Place Chevalum Qld 4555	**Report #:** 773118 **Phone:** 07 5478 9642 **Fax:**	**Due:** Feb 18, 2021 **Priority:** 5 Day **Contact Name:** Mark Thomson
Project Name:	COMPENSATORY CUT - UNNAMED CREEK		
Project ID:	21030		

Eurofins Analytical Services Manager : Ryan Gilbert

Sample Detail						Acid Sulfate Soils Field pH Test	Moisture Set	Chromium Suite (SKCl)
Melbourne Laboratory - NATA Site # 1254 & 14271								
Sydney Laboratory - NATA Site # 18217								
Brisbane Laboratory - NATA Site # 20794						X	X	X
Perth Laboratory - NATA Site # 23736								
Mayfield Laboratory								
External Laboratory								
65	BH9 - 1.25-1.5	Feb 09, 2021		Soil	B21-Fe20833	X		
66	BH9 - 1.5-1.75	Feb 09, 2021		Soil	B21-Fe20834	X	X	X
67	BH9 - 1.75-2.0	Feb 09, 2021		Soil	B21-Fe20835	X	X	X
68	BH10 - 0.0-0.25	Feb 09, 2021		Soil	B21-Fe20836	X	X	X
69	BH10 - 0.25-0.5	Feb 09, 2021		Soil	B21-Fe20837	X	X	X
70	BH10 - 0.5-0.75	Feb 09, 2021		Soil	B21-Fe20838	X		
71	BH10 - 0.75-1.0	Feb 09, 2021		Soil	B21-Fe20839	X		
72	BH10 - 1.0-	Feb 09, 2021		Soil	B21-Fe20840	X		

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Brisbane Laboratory - NATA Site # 20794						X	X	X
Perth Laboratory - NATA Site # 23736								
Mayfield Laboratory								
External Laboratory								
	1.25							
73	BH10 - 1.25-1.5	Feb 09, 2021		Soil	B21-Fe20841	X		
74	BH10 - 1.5-1.75	Feb 09, 2021		Soil	B21-Fe20842	X		
75	BH10 - 1.75-2.0	Feb 09, 2021		Soil	B21-Fe20843	X		
Test Counts						75	23	22

Internal Quality Control Review and Glossary

General

1. Laboratory QC results for Method Blanks, Duplicates, Matrix Spikes, and Laboratory Control Samples follows guidelines delineated in the National Environment Protection (Assessment of Site Contamination) Measure 1999, as amended May 2013 and are included in this QC report where applicable. Additional QC data may be available on request.
2. All soil/sediment/solid results are reported on a dry basis, unless otherwise stated.
3. All biota/food results are reported on a wet weight basis on the edible portion, unless otherwise stated.
4. Actual LORs are matrix dependant. Quoted LORs may be raised where sample extracts are diluted due to interferences.
5. Results are uncorrected for matrix spikes or surrogate recoveries except for PFAS compounds.
6. SVOC analysis on waters are performed on homogenised, unfiltered samples, unless noted otherwise.
7. Samples were analysed on an 'as received' basis.
8. Information identified on this report with blue colour, indicates data provided by customer, that may have an impact on the results.
9. This report replaces any interim results previously issued.

Holding Times

Please refer to 'Sample Preservation and Container Guide' for holding times (QS3001).

For samples received on the last day of holding time, notification of testing requirements should have been received at least 6 hours prior to sample receipt deadlines as stated on the SRA.

If the Laboratory did not receive the information in the required timeframe, and regardless of any other integrity issues, suitably qualified results may still be reported.

Holding times apply from the date of sampling, therefore compliance to these may be outside the laboratory's control.

For VOCs containing vinyl chloride, styrene and 2-chloroethyl vinyl ether the holding time is 7 days however for all other VOCs such as BTEX or C6-10 TRH then the holding time is 14 days.

**NOTE: pH duplicates are reported as a range NOT as RPD

Units

mg/kg: milligrams per kilogram
mg/L: milligrams per litre
ug/L: micrograms per litre
ppm: Parts per million
ppb: Parts per billion
%: Percentage
org/100mL: Organisms per 100 millilitres
NTU: Nephelometric Turbidity Units
MPN/100mL: Most Probable Number of organisms per 100 millilitres

Terms

Dry	Where a moisture has been determined on a solid sample the result is expressed on a dry basis.
LOR	Limit of Reporting.
SPIKE	Addition of the analyte to the sample and reported as percentage recovery.
RPD	Relative Percent Difference between two Duplicate pieces of analysis.
LCS	Laboratory Control Sample - reported as percent recovery.
CRM	Certified Reference Material - reported as percent recovery.
Method Blank	In the case of solid samples these are performed on laboratory certified clean sands and in the case of water samples these are performed on de-ionised water.
Surr - Surrogate	The addition of a like compound to the analyte target and reported as percentage recovery.
Duplicate	A second piece of analysis from the same sample and reported in the same units as the result to show comparison.
USEPA	United States Environmental Protection Agency
APHA	American Public Health Association
TCLP	Toxicity Characteristic Leaching Procedure
COC	Chain of Custody
SRA	Sample Receipt Advice
QSM	US Department of Defense Quality Systems Manual Version 5.3
CP	Client Parent - QC was performed on samples pertaining to this report
NCP	Non-Client Parent - QC performed on samples not pertaining to this report, QC is representative of the sequence or batch that client samples were analysed within.
TEQ	Toxic Equivalency Quotient

QC - Acceptance Criteria

RPD Duplicates: Global RPD Duplicates Acceptance Criteria is 30% however the following acceptance guidelines are equally applicable:

Results <10 times the LOR : No Limit

Results between 10-20 times the LOR : RPD must lie between 0-50%

Results >20 times the LOR : RPD must lie between 0-30%

Surrogate Recoveries: Recoveries must lie between 20-130% Phenols & 50-150% PFASs

PFAS field samples that contain surrogate recoveries in excess of the QC limit designated in QSM 5.3 where no positive PFAS results have been reported have been reviewed and no data was affected.

WA DWER (n=10): PFBA, PFPeA, PFHxA, PFHpA, PFOA, PFBS, PFHxS, PFOS, 6:2 FTSA, 8:2 FTSA

QC Data General Comments

1. Where a result is reported as a less than (<), higher than the nominated LOR, this is due to either matrix interference, extract dilution required due to interferences or contaminant levels within the sample, high moisture content or insufficient sample provided.
2. Duplicate data shown within this report that states the word "BATCH" is a Batch Duplicate from outside of your sample batch, but within the laboratory sample batch at a 1:10 ratio. The Parent and Duplicate data shown is not data from your samples.
3. Organochlorine Pesticide analysis - where reporting LCS data, Toxaphene & Chlordane are not added to the LCS.
4. Organochlorine Pesticide analysis - where reporting Spike data, Toxaphene is not added to the Spike.
5. Total Recoverable Hydrocarbons - where reporting Spike & LCS data, a single spike of commercial Hydrocarbon products in the range of C12-C30 is added and it's Total Recovery is reported in the C10-C14 cell of the Report.
6. pH and Free Chlorine analysed in the laboratory - Analysis on this test must begin within 30 minutes of sampling.Therefore laboratory analysis is unlikely to be completed within holding time. Analysis will begin as soon as possible after sample receipt.
7. Recovery Data (Spikes & Surrogates) - where chromatographic interference does not allow the determination of Recovery the term "INT" appears against that analyte.
8. Polychlorinated Biphenyls are spiked only using Aroclor 1260 in Matrix Spikes and LCS.
9. For Matrix Spikes and LCS results a dash " -" in the report means that the specific analyte was not added to the QC sample.
10. Duplicate RPDs are calculated from raw analytical data thus it is possible to have two sets of data.

Quality Control Results

Test			Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
LCS - % Recovery									
Chromium Suite (SKCl)									
pH-KCL			%	98			80-120	Pass	
Acid trail - Titratable Actual Acidity			%	97			80-120	Pass	
Chromium Reducible Sulfur			%	96			80-120	Pass	
Acid Neutralising Capacity (ANCbt)			%	97			80-120	Pass	
Test	**Lab Sample ID**	**QA Source**	**Units**	**Result 1**			**Acceptance Limits**	**Pass Limits**	**Qualifying Code**
Duplicate									
Acid Sulfate Soils Field pH Test				Result 1	Result 2	RPD			
pH-F (Field pH test)*	B21-Fe20769	CP	pH Units	5.0	4.9	pass	30%	Pass	
Duplicate									
Acid Sulfate Soils Field pH Test				Result 1	Result 2	RPD			
pH-F (Field pH test)*	B21-Fe20779	CP	pH Units	5.3	5.3	pass	30%	Pass	
Duplicate									
Acid Sulfate Soils Field pH Test				Result 1	Result 2	RPD			
pH-F (Field pH test)*	B21-Fe20789	CP	pH Units	4.4	4.4	pass	30%	Pass	
Duplicate									
				Result 1	Result 2	RPD			
% Moisture	B21-Fe20791	CP	%	29	28	4.0	30%	Pass	
Duplicate									
Acid Sulfate Soils Field pH Test				Result 1	Result 2	RPD			
pH-F (Field pH test)*	B21-Fe20799	CP	pH Units	4.8	4.8	pass	30%	Pass	
Duplicate									
Acid Sulfate Soils Field pH Test				Result 1	Result 2	RPD			
pH-F (Field pH test)*	B21-Fe20809	CP	pH Units	5.5	5.5	pass	30%	Pass	
Duplicate									
Chromium Suite (SKCl)				Result 1	Result 2	RPD			
pH-KCL	B21-Fe20809	CP	pH Units	5.7	5.7	<1	30%	Pass	
Acid trail - Titratable Actual Acidity	B21-Fe20809	CP	mol H+/t	3.1	3.0	4.9	30%	Pass	
sulfidic - TAA equiv. S% pyrite	B21-Fe20809	CP	% pyrite S	0.005	0.005	5.0	30%	Pass	
Chromium Reducible Sulfur	B21-Fe20809	CP	% S	< 0.005	< 0.005	<1	30%	Pass	
Chromium Reducible Sulfur -acidity units	B21-Fe20809	CP	mol H+/t	< 3	< 3	<1	30%	Pass	
Sulfur - KCl Extractable	B21-Fe20809	CP	% S	< 0.02	< 0.02	<1	30%	Pass	
Net Acid soluble sulfur	B21-Fe20809	CP	% S	n/a	n/a	n/a	30%	Pass	
Net Acid soluble sulfur - acidity units	B21-Fe20809	CP	mol H+/t	n/a	n/a	n/a	30%	Pass	
Net Acid soluble sulfur - equivalent S% pyrite	B21-Fe20809	CP	% S	n/a	n/a	n/a	30%	Pass	
Acid Neutralising Capacity (ANCbt)	B21-Fe20809	CP	% CaCO3	n/a	n/a	n/a	30%	Pass	
Acid Neutralising Capacity - equivalent S% pyrite (s-ANCbt)	B21-Fe20809	CP	% S	n/a	n/a	n/a	30%	Pass	
ANC Fineness Factor	B21-Fe20809	CP	factor	1.5	1.5	<1	30%	Pass	
CRS Suite - Net Acidity (Sulfur Units)	B21-Fe20809	CP	% S	< 0.02	< 0.02	<1	30%	Pass	
CRS Suite - Net Acidity (Acidity Units)	B21-Fe20809	CP	mol H+/t	< 10	< 10	<1	30%	Pass	
CRS Suite - Liming Rate	B21-Fe20809	CP	kg CaCO3/t	< 1	< 1	<1	30%	Pass	
Duplicate									
Acid Sulfate Soils Field pH Test				Result 1	Result 2	RPD			
pH-F (Field pH test)*	B21-Fe20819	CP	pH Units	5.7	5.7	pass	30%	Pass	
Duplicate									
				Result 1	Result 2	RPD			
% Moisture	B21-Fe20830	CP	%	14	14	<1	30%	Pass	

Duplicate									
Acid Sulfate Soils Field pH Test				Result 1	Result 2	RPD			
pH-F (Field pH test)*	B21-Fe20832	CP	pH Units	5.8	5.8	pass	30%	Pass	
Duplicate									
Acid Sulfate Soils Field pH Test				Result 1	Result 2	RPD			
pH-F (Field pH test)*	B21-Fe20839	CP	pH Units	5.7	5.6	pass	30%	Pass	

Comments

Sample Integrity

Custody Seals Intact (if used)	N/A
Attempt to Chill was evident	No
Sample correctly preserved	No
Appropriate sample containers have been used	Yes
Sample containers for volatile analysis received with minimal headspace	Yes
Samples received within HoldingTime	Yes
Some samples have been subcontracted	No

Qualifier Codes/Comments

Code	Description
S01	Liming rate is calculated and reported on a dry weight basis assuming use of fine agricultural lime (CaCO3) and using a safety factor of 1.5 to allow for non-homogeneous mixing and poor reactivity of lime. For conversion of Liming Rate from 'kg/t dry weight' to 'kg/m3 in-situ soil' multiply 'reported results' x 'wet bulk density of soil in t/m3'
S02	Retained Acidity is Reported when the pHKCl is less than pH 4.5
S03	Acid Neutralising Capacity is only required if the pHKCl if greater than or equal to pH 6.5
S04	Acid Sulfate Soil Samples have a 24 hour holding time unless frozen or dried within that period
S05	Field Screen uses the following fizz rating to classify the rate the samples reacted to the peroxide: 1.0; No reaction to slight. 2.0; Moderate reaction. 3.0; Strong reaction with persistent froth. 4.0; Extreme reaction.

Authorised by:

Myles Clark — Senior Analyst-SPOCAS (QLD)

Glenn Jackson
General Manager

- Indicates Not Requested

* Indicates NATA accreditation does not cover the performance of this service

Measurement uncertainty of test data is available on request or please click here.

APPENDIX D

Limitations

tectonic
geotechnical & environmental engineers

LIMITATIONS

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APPENDIX 5 – EXAMPLE OF CORRECTIVE ACTION REPORT FORM

CORRECTIVE ACTION REPORT			
Report No.			
Prepared By:		**Position:**	
Date		**Time:**	
Details Of Non-Conformance:			
Date:		**Time:**	
Location:			
Inspected By:		**Position:**	
Description of Event:			
Likely Causes:			
Details of Corrective Action/s:			
Proposed Corrective Action/s:			
Dated Submitted to Developer:		**Reply Required By:**	
Dated Submitted to Regulator:		**Reply Required By:**	
Consultant/Expert/Regulator Advice (if required):			
Date Corrective Action Required By:			
Person Responsible for Corrective Action:			
Corrective Action Authorised By:		**Date/Signed:**	
Date Corrective Action/s Implemented:			
Corrective Action Follow-up Required/Completed:			
Circulation:			
	Developer		**Commonwealth DAWE**
	Moreton Bay Regional Council		**Other**