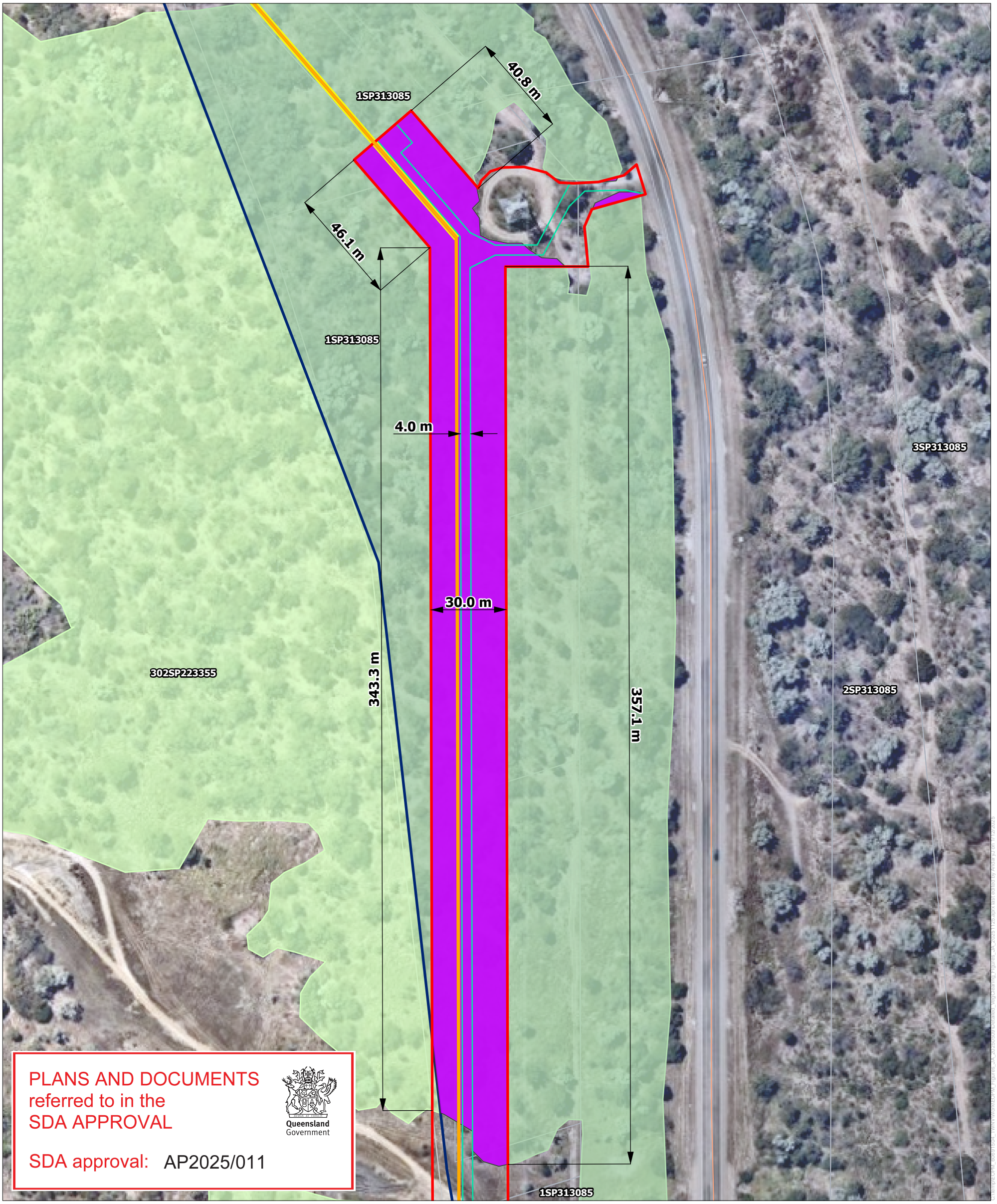


EOPM Replacement Project - SDA Development Application – Operational Work (Clearing of Native Vegetation)

Figure 5.1: Operational Work for clearing native vegetation within the TSDA

Legend

- Pipeline Alignment
- Disturbance Area
- Under-boring
- Permanent access tracks
- Lot parcels
- Roads
- Townsville SDA
- Ground-truthed Regional Ecosystem 11.2.5

Intersecting Disturbance Area

- Total Clearing Native Vegetation (17,674m^2)

Vegetation Clearance (m^2)	
Temporary Impact	**Permanent Impact**
14,837	2,837

AMENDMENTS IN RED

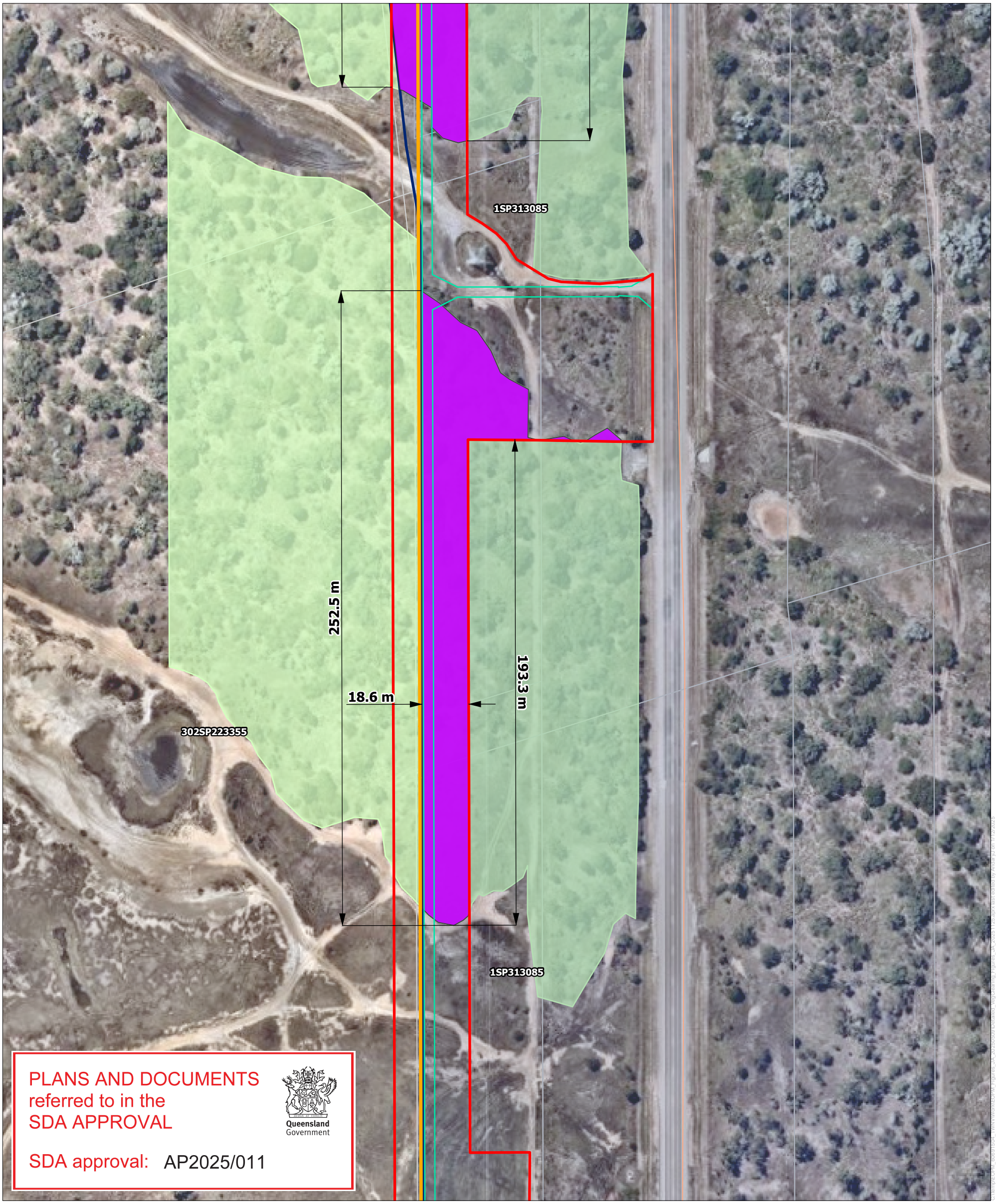
AECOM

N

0 20 40 m

A separate Development Approval for Clearing Native Vegetation is being sought for the Project's proposed vegetation clearing outside the TSDA in accordance with the Planning Act 2016. Only the vegetation clearing that is proposed within the TSDA area forms part of this Development Application

Revision 1, dated 17 December 2025



EOPM Replacement Project - SDA Development Application – Operational Work (Clearing of Native Vegetation)

Figure 5.2: Operational Work for clearing native vegetation within the TSDA

Legend

- Pipeline Alignment
- Disturbance Area
- Under-boring
- Permanent access tracks
- Lot parcels
- Roads
- Townsville SDA
- Ground-truthed Regional Ecosystem 11.2.5

Intersecting Disturbance Area

- Total Clearing Native Vegetation (17,674m^2)

Vegetation Clearance (m^2)	
Temporary Impact	**Permanent Impact**
14,837	2,837

AMENDMENTS IN RED

AECOM

N

0 20 40 m

A separate Development Approval for Clearing Native Vegetation is being sought for the Project's proposed vegetation clearing outside the TSDA in accordance with the Planning Act 2016. Only the vegetation clearing that is proposed within the TSDA area forms part of this Development Application

Revision 1, dated 17 December 2025

FOR CONSTRUCTION

LANDSCAPE NOTES

1. REFER CIVIL ENGINEER DRAWING SERIES FOR DESCRIPTION ON PIPE-RELATED INFRASTRUCTURE
2. ALL PLANS AND DETAILS ARE TO BE READ IN CONJUNCTION WITH THE LEGEND, SCHEDULES AND NOTES PROVIDED WITHIN THE LANDSCAPE PACKAGE.
3. ALL PLANS AND DETAILS ARE TO BE READ IN CONJUNCTION WITH RELEVANT ENGINEERING AND ENVIRONMENTAL DESIGN DOCUMENTATION PACKAGES.
4. LANDSCAPE WORKS TO BE UNDERTAKEN IN ACCORDANCE WITH TOWNSVILLE CITY COUNCIL STANDARDS.
5. ALL EXISTING AND RETAINED ELEMENTS ARE SHOWN INDICATIVELY ONLY. THE LOCATION OF THESE ELEMENTS ARE BASED ON SURVEY INFORMATION SUPPLIED BY THE CLIENT, ALL WORKS ARE TO BE SETOUT AND CONFIRMED ONSITE PRIOR TO CONSTRUCTION WORKS.
6. ALL UNDERGROUND SERVICES ARE TO BE CONFIRMED BY CONTRACTOR TO ENSURE INFRASTRUCTURE IS NOT DAMAGED OR INTERRUPTED BY WORKS. THE CONTRACTOR IS TO LIAISE WITH SERVICE PROVIDERS TO GAIN ALL APPROVALS/ PERMITS.
7. POTENTIAL SERVICES CONFLICTS, PROTECTION AND / OR RELOCATION WITH INITIAL WORKS SHALL BE DETERMINED PRIOR TO CONSTRUCTION USING CURRENT "DIAL BEFORE YOU DIG" INFORMATION, POT-HOLING AND CONSULTATION WITH RELEVANT SERVICES AUTHORITIES.

VEGETATION PROTECTION NOTES

1. ALL EXISTING TREES AND LANDSCAPE WORKS TO BE RETAINED ARE TO BE PROTECTED FROM IMPACT DURING CONSTRUCTION ACTIVITIES IN ACCORDANCE WITH AS4970-2009 PROTECTION OF TREES ON DEVELOPMENT SITES.
2. EXISTING VEGETATION THAT FALLS WITHIN SIGHTLINES, WILL BE ASSESSED ON SITE AND MAINTAINED AS REQUIRED.
3. ANY TREE PROTECTION FENCING TO BE INSTALLED IS TO BE INSTALLED AS PER AS4970-2009.
4. ALL WORKS TO BE UNDERTAKEN ADJACENT TO EXISTING VEGETATION IS TO BE CARRIED OUT IN ACCORDANCE WITH AS4970-2009 REQUIREMENTS. ALL EXCAVATION WORKS WITHIN THE TPZ (TREE PROTECTION ZONES) ARE TO BE DONE BY APPROVED HAND OR VACUUM METHODS. NO STOCKPILING OR STORAGE OF MATERIALS (INCLUDING EQUIPMENT) IS ALLOWED IN TPZ.
5. WEED MANAGEMENT IS TO BE IN ACCORDANCE WITH TOWNSVILLE CITY COUNCIL STANDARDS AND GUIDELINES.
6. EXTENT OF CLEARING FOR SITE ACCESS AND CONSTRUCTION ACTIVITIES TO BE CONFIRMED BY LANDSCAPE SUPERINTENDENT IN RELATION TO EXISTING VEGETATION AND HABITAT FOOTPRINTS BEING RETAINED AND PROTECTED. WORKS BEYOND THE LANDSCAPE TREATMENTS SHOWN ON PLANS TO BE CONFIRMED AND MITIGATED WHERE POSSIBLE.

LANDSCAPE EROSION CONTROL MEASURES

1. FOR ALL LANDSCAPE EARTHWORKS, STABILISATION AND SURFACE PREPARATION GUIDANCE, REFER TO TOWNSVILLE CITY COUNCIL STANDARDS AND GUIDELINES.
2. ALL OTHER EROSION AND SEDIMENT CONTROL MEASURES TO BE IN ACCORDANCE WITH CONSTRUCTION EROSION AND SEDIMENT CONTROL PLAN (ESCP).

EXTENT OF LANDSCAPING

1. THE EXTENT OF LANDSCAPING HAS BEEN DEFINED BY THE ADOPTED LIMITS FOR DISTURBANCE OF THE CORRIDOR AND OTHER AREAS FOR GENERAL ACCESS AND LAYDOWN.
2. THE CONTRACTOR SHALL MINIMISE DISTURBANCE WHERE POSSIBLE
3. SHOULD AN AREA NOMINATED FOR LANDSCAPING IN THESE PLANS NOT BE DISTURBED BY THE CONSTRUCTION WORKS, THE CONTRACTOR IS NOT REQUIRED TO REVEGETATE THE CONTRACTOR SHALL SURVEY THE EXTENTS OF THE DISTURBANCE AND REVEGETATION AREA AND CONFIRM WITH THE SUPERINTENDENT PRIOR TO COMMENCEMENT.

LANDSCAPE LEGEND

LR01 LANDSCAPE REVEGETATION MIX 1 (LR01) - GENERAL AREAS - GRASS SPECIES - CONTAINERISED OR SEEDED TREATMENT AREA: WITHIN 3M OFFSET OF PIPE CENTRELINE

- AMELIORATE SUBSOIL - INCORPORATE AMELIORANT'S AT RATES AS PER THE SPECIFICATION
- ROUGHENING - 50mm DEEP (APPROX.)
- TOPSOIL - 75mm DEEP AMELIORATED TOPSOIL (MINIMUM)
- FERTILISER - INCORPORATE FERTILISER AT RATES AS PER THE SPECIFICATION
- PLANTING - REFER TO PLANTING SCHEDULE
- FIBRE - 4500kg/ha (MINIMUM) - RELEVANT ONLY IF SEEDING IS PREFERRED
- FINISHED FIBRE DEPTH - 5mm (MINIMUM) - RELEVANT ONLY IF SEEDING IS PREFERRED
- EXTENT - AS SHOWN ON DRAWING WITHIN 3M OF PIPE CENTERLINE AND WITHIN THE RELEVANT REGIONAL ECOSYSTEM EXTENTS

LR02 LANDSCAPE REVEGETATION MIX 2 (LR02) - OPEN FOREST AREAS - TREE, SHRUB AND GRASS SPECIES - CONTAINERISED OR SEEDED TREATMENT AREA: OUTSIDE 3M OFFSET OF PIPE CENTRELINE

- AMELIORATE SUBSOIL - INCORPORATE AMELIORANT'S AT RATES AS PER THE SPECIFICATION
- ROUGHENING - 50mm DEEP (APPROX.)
- TOPSOIL - 75mm DEEP AMELIORATED TOPSOIL (MINIMUM)
- FERTILISER - INCORPORATE FERTILISER AT RATES AS PER THE SPECIFICATION
- FIBRE - 4500kg/ha (MINIMUM) - RELEVANT ONLY IF SEEDING IS PREFERRED
- FINISHED FIBRE DEPTH - 5mm (MINIMUM) - RELEVANT ONLY IF SEEDING IS PREFERRED
- PLANTING - REFER TO PLANTING SCHEDULE
- EXTENT - AS SHOWN ON DRAWING OUTSIDE 3M OF PIPE CENTERLINE AND WITHIN THE RELEVANT REGIONAL ECOSYSTEM EXTENTS

NOTE:

1. THE TYPE OF LANDSCAPE TREATMENT (SEEDED OR CONTAINERIZED) IS TO BE DETERMINED PENDING DEVELOPMENT APPROVAL (DA). DETAILED REVEGETATION REQUIREMENTS WILL FORM PART OF THE APPROVED DA DOCUMENTATION.

GENERAL LEGEND

- EXTENT OF WORKS
- PROPOSED SEWAGE PRESSURE MAIN
- E E — EXISTING ELECTRICAL SERVICE (OVERHEAD)
- RM — EXISTING SEWER RISING MAIN
- EASEMENT EXTENTS
- FENCELINE
- EXISTING TREES
- PROPOSED ACCESS TRACK

PLANS AND DOCUMENTS referred to in the SDA APPROVAL

Queensland Government

SDA approval: AP2025/011

CAD REF:\\NA.AECOMNET.COM\LFS\APAC\TOWNSVILLE-AU1SV\LEGACY\PROJECTS\60691504\A900_CAD_GIS\900_CAD\20_SHEETS\60691504-36.DWG

LAST MODIFIED:12/12/2025 7:59 AM

This drawing is confidential and shall only be used for the purposes of this project.

REVISIONS

No.	BY	DATE	DESCRIPTION	APPD
A	RW	01.12.25	ISSUED FOR CONSTRUCTION	

Scale

THE SIGNING OF THIS TITLE BLOCK CONFIRMS THE DESIGN AND DRAFTING OF THIS PROJECT HAVE BEEN PREPARED AND CHECKED IN ACCORDANCE WITH THE AECOM QUALITY ASSURANCE SYSTEM TO ISO 9001

DESIGNED	R WHITE	CHECKED	E CASTILLO
DRAWN	R WHITE	CHECKED	E CASTILLO
APPROVED	E CASTILLO	DATE	01.12.25

AECOM

AECOM Australia Pty Ltd A.B.N. 20 093 846 925

City of Townsville

EASTERN OUTFALL PRESSURE MAIN REPLACEMENT

LANDSCAPE LEGEND AND NOTES

Status: CONSTRUCTION

Drg No.: 60691504-36

Rev.: A

FOR CONSTRUCTION

PLANTING SCHEDULE OPTION 1 - CONTAINERISED

LANDSCAPE REVEGETATION MIX 1 (LR01) - GENERAL AREAS - GRASS SPECIES - CONTAINERISED TREATMENT AREA: WITHIN 3M OFFSET OF PIPE

AREA (m^2)						=	35260
CODE	BOTANICAL NAME	COMMON NAME	CONTAINER SIZE	DENSITY (per m2)	MATURE HEIGHT (m)	MATURE SPREAD	QTY
GRASS SPECIES							
ALL sem	*Alloteropsis semialata*	Black Seed Grass	tubestock	3	1.5	0.5	8815
BOT bla	*Bothriochloa bladhii*	Forest Bluegrass	tubestock		1.5	0.5	8815
BOT ewa	*Bothriochloa ewartiana*	Desert Bluegrass	tubestock		0.8	0.5	8815
DIC ser	*Dichanthium sericeum*	Queensland Bluegrass	tubestock		1	0.5	8815
DIG bro	*Digitaria brownii*	Cotton Panic Grass	tubestock		1	0.3	8815
HET con	*Hetropogon contortus*	Black Speargrass	tubestock		1.5	1.5	8815
IMP cyl	*Imperata cylindrica*	Cogon Grass	tubestock		1.5	0.5	8815
PAN dec	*Panicum decompositum*	Native Millet	tubestock		1.5	0.5	8815
SAR plu	*Sarga plumosum*	Plume Sorghum	tubestock		2	1	8815
SET sur	*Setaria surgens*	Pigeon Grass	tubestock		0.5	1	8815
SPO vir	*Sporobolus virginicus*	Seashore Dropseed	tubestock		0.5	1	8815
THE tri	*Themeda triandra*	Kangaroo Grass	tubestock		1.5	0.5	8815
TOTAL						=	**105780**

LANDSCAPE REVEGETATION MIX 2 (LR02) - OPEN FOREST AREAS - TREE, SHRUB AND GRASS SPECIES - CONTAINERISED TREATMENT AREA: OUTSIDE 3M OFFSET OF PIPE

AREA (m^2)						=	17877
CODE	BOTANICAL NAME	COMMON NAME	CONTAINER SIZE	DENSITY (per m2)	MATURE HEIGHT (m)	MATURE SPREAD (m)	QTY
TREE SPECIES							
ACA cra	*Acacia crassicarpa*	Northern Wattle	tubestock	0.02	20	10	20
ACA fla	*Acacia flavescens*	Red Wattle	tubestock		20	10	20
ALP exc	*Alphitonia excelsa*	Red Ash	tubestock		20	10	20
CAS cun	*Casuarina*	River Oak	tubestock		30	10	20
COR cla	*Corymbia clarksoniana*	Grey Bloodwood	tubestock		20	12	20
COR dal	*Corymbia dallachiana*	Dallachy's Gum	tubestock		20	10	20
COR tes	*Corymbia tessellaris*	Moreton Bay Ash	tubestock		30	15	20
CUP ana	*Cupaniopsis*	Tuckeroo	tubestock		15	10	20
EUC cre	*Eucalyptus crebra*	Narrow-leaved Ironbark	tubestock		30	10	20
EUC pla	*Eucalyptus platyphylla*	Poplar Gum	tubestock		20	12	20
EUC ter	*Eucalytpus tereticomis*	Forest Red Gum	tubestock		30	15	20
EXO lat	*Exocarpos latifolius*	Broad Leaved Ballart	tubestock		8	5	20
MEL dea	*Melaleuca dealbata*	Blue Paperbark	tubestock		10	6	20
MEL leu	*Melaleuca leucadendra*	Weeping Paperbark	tubestock		15	8	20
MEL ner	*Melaleuca nervosa*	Fibrebark	tubestock		8	5	20
MEL vir	*Melaleuca viridoflora*	Broad-Leaved Paperba	tubestock		10	6	20
PLA car	*Planchonia careya*	Cocky Apple	tubestock		10	6	20
SEN sur	*Senna surattensis*	Glossy Shower	tubestock		5	4	20
TOTAL						=	**358**
SHRUB SPECIES							
ACA hol	*Acacia holsericea*	Soapbush Wattle	tubestock	0.05	8	4	179
ACA lep	*Acacia leptostachya*	Townsville Wattle	tubestock		6	4	179
ACA ora	*Acacia oraria*	Coastal Wattle	tubestock		6	4	179
ACA sim	*Acacia simsii*	Heathlands Wattle	tubestock		4	3	179
DOD vis	*Dodonaea viscosa*	Native Hops	tubestock		6	4	179
TOTAL						=	**894**
GRASS SPECIES							
ALL sem	*Alloteropsis semialata*	Black Seed Grass	tubestock	3	1.5	0.5	4125
BOT bla	*Bothriochloa bladhii*	Forest Bluegrass	tubestock		1.5	0.5	4125
BOT ewa	*Bothriochloa ewartiana*	Desert Bluegrass	tubestock		0.8	0.5	4125
CYM ref	*Cymbopogon refractus*	Barbed Wire Grass	tubestock		1.2	0.6	4125
DIC ser	*Dichanthium sericeum*	Queensland Bluegrass	tubestock		1	0.5	4125
DIG bro	*Digitaria brownii*	Cotton Panic Grass	tubestock		1	0.3	4125
HET con	*Hetropogon contortus*	Black Speargrass	tubestock		1.5	1.5	4125
IMP cyl	*Imperata cylindrica*	Cogon Grass	tubestock		1.5	0.5	4125
PAN dec	*Panicum decompositum*	Native Millet	tubestock		1.5	0.5	4125
SAR plu	*Sarga plumosum*	Plume Sorghum	tubestock		2	1	4125
SET sur	*Setaria surgens*	Pigeon Grass	tubestock		0.5	1	4125
SPO vir	*Sporobolus virginicus*	Seashore Dropseed	tubestock		0.5	1	4125
THE tri	*Themeda triandra*	Kangaroo Grass	tubestock		1.5	0.5	4125
TOTAL						=	**53631**

PLANTING SCHEDULE OPTION 2 - SEEDED

LANDSCAPE REVEGETATION MIX 1 (LR01) - GENERAL AREAS - GRASS SPECIES - SEEDED TREATMENT AREA: WITHIN 3M OFFSET OF PIPE - ENVIROSTRAW

AREA (m^2)			=	35260
CODE	BOTANICAL NAME	COMMON NAME		MINIMUM APPLICATION
TREE SPECIES				
ACA cra	*Acacia crassicarpa*	Northern Wattle		3
ACA fla	*Acacia flavescens*	Red Wattle		3
ALP exc	*Alphitonia excelsa*	Red Ash		3
CAS cun	*Casuarina*	River Oak		3
COR cla	*Corymbia clarksoniana*	Grey Bloodwood		3
COR dal	*Corymbia dallachiana*	Dallachy's Gum		3
COR tes	*Corymbia tessellaris*	Moreton Bay Ash		3
CUP ana	*Cupaniopsis*	Tuckeroo		3
EUC cre	*Eucalyptus crebra*	Narrow-leaved Ironbark		3
EUC pla	*Eucalyptus platyphylla*	Poplar Gum		3
EUC ter	*Eucalytpus tereticomis*	Forest Red Gum		3
EXO lat	*Exocarpos latifolius*	Broad Leaved Ballart		3
MEL dea	*Melaleuca dealbata*	Blue Paperbark		3
MEL leu	*Melaleuca leucadendra*	Weeping Paperbark		3
MEL ner	*Melaleuca nervosa*	Fibrebark		2
MEL vir	*Melaleuca viridoflora*	Broad-Leaved Paperbark		2
PLA car	*Planchonia careya*	Cocky Apple		2
SEN sur	*Senna surattensis*	Glossy Shower		2
TOTAL MINIMUM RATE			=	**50**
COVER CROP SPECIES				
Apr - Aug	50% Annual Rye and 50% Annual Millet		10g/ha	
Sep - Mar	100% Annual Millet			

LANDSCAPE REVEGETATION MIX 2 (LR02) - OPEN FOREST AREAS - TREE, SHRUB AND GRASS SPECIES - SEEDED TREATMENT AREA: OUTSIDE 3M OFFSET OF PIPE - ENVIROSTRAW

AREA (m^2)			=	17877
CODE	BOTANICAL NAME	COMMON NAME		MINIMUM APPLICATION
TREE SPECIES				
ACA cra	*Acacia crassicarpa*	Northern Wattle		0.25
ACA fla	*Acacia flavescens*	Red Wattle		0.25
ALP exc	*Alphitonia excelsa*	Red Ash		0.25
CAS cun	*Casuarina*	River Oak		0.25
COR cla	*Corymbia clarksoniana*	Grey Bloodwood		0.25
COR dal	*Corymbia dallachiana*	Dallachy's Gum		0.25
COR tes	*Corymbia tessellaris*	Moreton Bay Ash		0.25
CUP ana	*Cupaniopsis*	Tuckeroo		0.25
EUC cre	*Eucalyptus crebra*	Narrow-leaved Ironbark		0.25
EUC pla	*Eucalyptus platyphylla*	Poplar Gum		0.25
EUC ter	*Eucalytpus tereticomis*	Forest Red Gum		0.25
EXO lat	*Exocarpos latifolius*	Broad Leaved Ballart		0.25
MEL dea	*Melaleuca dealbata*	Blue Paperbark		0.25
MEL leu	*Melaleuca leucadendra*	Weeping Paperbark		0.25
MEL ner	*Melaleuca nervosa*	Fibrebark		0.25
MEL vir	*Melaleuca viridoflora*	Broad-Leaved Paperbark		0.25
PLA car	*Planchonia careya*	Cocky Apple		0.25
SEN sur	*Senna surattensis*	Glossy Shower		0.25
SHRUBS AND GROUNDCOVERS				
ACA hol	*Acacia holsericea*	Soapbush Wattle		2
ACA lep	*Acacia leptostachya*	Townsville Wattle		2
ACA ora	*Acacia oraria*	Coastal Wattle		2
ACA sim	*Acacia simsii*	Heathlands Wattle		3
DOD vis	*Dodonaea viscosa*	Native Hops		3
ALL sem	*Alloteropsis semialata*	Black Seed Grass		2
BOT bla	*Bothriochloa bladhii*	Forest Bluegrass		2
BOT ewa	*Bothriochloa ewartiana*	Desert Bluegrass		2
CYM ref	*Cymbopogon refractus*	Barbed Wire Grass		2
DIC ser	*Dichanthium sericeum*	Queensland Bluegrass		2
DIG bro	*Digitaria brownii*	Cotton Panic Grass		3
HET con	*Hetropogon contortus*	Black Speargrass		3
IMP cyl	*Imperata cylindrica*	Cogon Grass		3
PAN dec	*Panicum decompositum*	Native Millet		3
SAR plu	*Sarga plumosum*	Plume Sorghum		3
SET sur	*Setaria surgens*	Pigeon Grass		3
SPO vir	*Sporobolus virginicus*	Seashore Dropseed		3
THE tri	*Themeda triandra*	Kangaroo Grass		3
TOTAL MINIMUM RATE			=	**50**
COVER CROP SPECIES				
Apr - Aug	50% Annual Rye and 50% Annual Millet		10g/ha	
Sep - Mar	100% Annual Millet			

PLANS AND DOCUMENTS referred to in the SDA APPROVAL

SDA approval: AP2025/011

Queensland Government

NOTES:

1. SETOUT OF SPECIES IS INTENDED TO MIMIC THE NATURAL ENVIRONMENT. GROUP AND SCATTER INDIVIDUAL AND GROUPINGS OF SPECIES TO ENSURE A RANDOM PATTERN. VARY THE SIZE OF MASSES TO ADJACENT GROUPS. SOME SHOULD BE LONG AND NARROW, SOME SHORT AND WIDE, AND SOME CURVED, BUT ALL SHOULD HAVE AN ORGANIC, RATHER THAN GEOMETRIC SHAPE.
2. WHERE THE PLANTING MIX CONTAINS BOTH LARGE AND SMALL SPECIES, UNLESS OTHERWISE DIRECTED, LOCATE OR BIAS THE USE OF SMALLER SPECIES TOWARDS THE PERIMETER OF THE BED, PAYING PARTICULAR ATTENTION TO PLANTING OFFSETS SO AS TO PROVIDE ADEQUATE SPACE SUCH THAT SPECIES DO NOT ENCROACH UPON PATHS OR ROADWAYS.

REVISIONS

No.	BY	DATE	DESCRIPTION	APPD
A	RW	01.12.25	ISSUED FOR CONSTRUCTION	

Scale

THE SIGNING OF THIS TITLE BLOCK CONFIRMS THE DESIGN AND DRAFTING OF THIS PROJECT HAVE BEEN PREPARED AND CHECKED IN ACCORDANCE WITH THE AECOM QUALITY ASSURANCE SYSTEM TO ISO 9001

DESIGNED	R WHITE	CHECKED	E CASTILLO
DRAWN	R WHITE	CHECKED	E CASTILLO
APPROVED	E CASTILLO	DATE	01.12.25

AECOM

AECOM Australia Pty Ltd A.B.N. 20 093 846 925

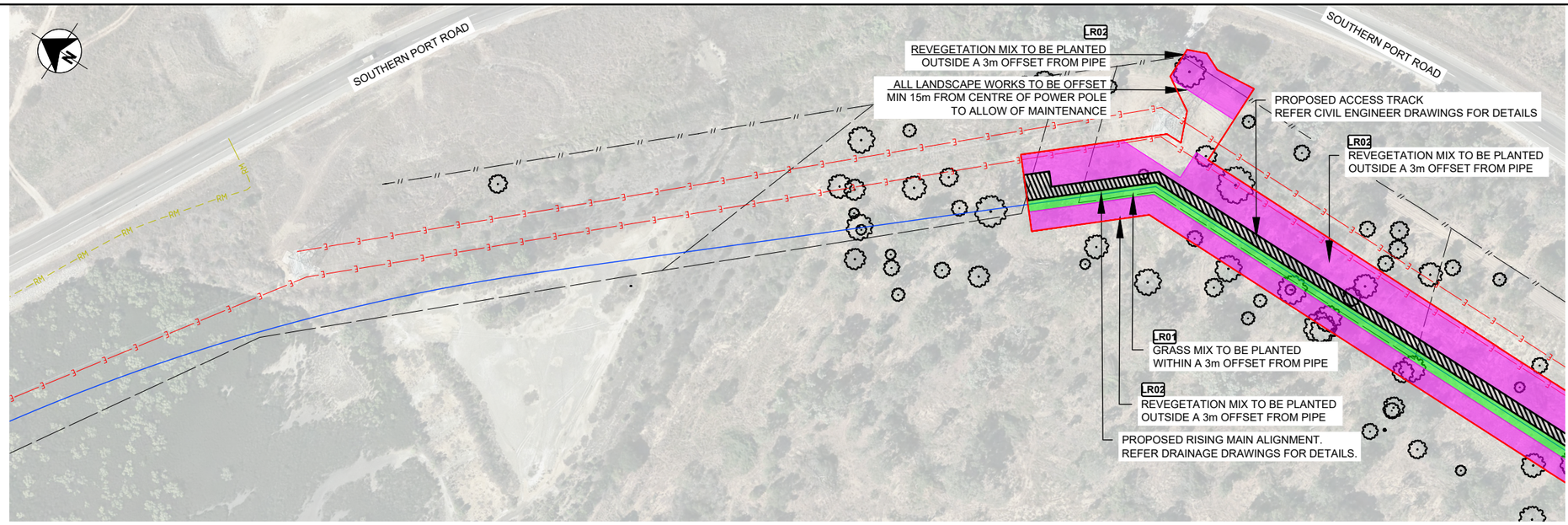
City of Townsville

EASTERN OUTFALL PRESSURE MAIN REPLACEMENT

PLANTING SCHEDULES

Status	Drg No.	Rev.
CONSTRUCTION	60691504-37	A

LAST MODIFIED: 01/12/2025 8:22 AM
CAD REF: \\NA.AECOMNET.COM\ES\APAC\TOWNSVILLE-AUTSVILLEGACY\PROJECTS\60691504\900_CAD_GIS\90_CAD\20_SHEETS\60691504-37.DWG



PLAN

NOTES

- REFER 60691504-36 FOR LANDSCAPE NOTES AND LEGEND.

LANDSCAPE LEGEND

LR01 LANDSCAPE REVEGETATION MIX 1 (LR01) - GENERAL AREAS - GRASS SPECIES - CONTAINERISED OR SEEDED TREATMENT AREA: WITHIN 3M OFFSET OF PIPE CENTRELINE

- AMELIORATE SUBSOIL - INCORPORATE AMELIORANT'S AT RATES AS PER THE SPECIFICATION
- ROUGHENING - 50mm DEEP (APPROX.)
- TOPSOIL - 75mm DEEP AMELIORATED TOPSOIL (MINIMUM)
- FERTILISER - INCORPORATE FERTILISER AT RATES AS PER THE SPECIFICATION
- PLANTING - REFER TO PLANTING SCHEDULE
- FIBRE - 4500kg/ha (MINIMUM) - RELEVANT ONLY IF SEEDING IS PREFERRED
- FINISHED FIBRE DEPTH - 5mm (MINIMUM) - RELEVANT ONLY IF SEEDING IS PREFERRED
- EXTENT - AS SHOWN ON DRAWING WITHIN 3M OF PIPE CENTERLINE AND WITHIN THE RELEVANT REGIONAL ECOSYSTEM EXTENTS

LR02 LANDSCAPE REVEGETATION MIX 2 (LR02) - OPEN FOREST AREAS - TREE, SHRUB AND GRASS SPECIES - CONTAINERISED OR SEEDED TREATMENT AREA: OUTSIDE 3M OFFSET OF PIPE CENTRELINE

- AMELIORATE SUBSOIL - INCORPORATE AMELIORANT'S AT RATES AS PER THE SPECIFICATION
- ROUGHENING - 50mm DEEP (APPROX.)
- TOPSOIL - 75mm DEEP AMELIORATED TOPSOIL (MINIMUM)
- FERTILISER - INCORPORATE FERTILISER AT RATES AS PER THE SPECIFICATION
- FIBRE - 4500kg/ha (MINIMUM) - RELEVANT ONLY IF SEEDING IS PREFERRED
- FINISHED FIBRE DEPTH - 5mm (MINIMUM) - RELEVANT ONLY IF SEEDING IS PREFERRED
- PLANTING - REFER TO PLANTING SCHEDULE
- EXTENT - AS SHOWN ON DRAWING OUTSIDE 3M OF PIPE CENTERLINE AND WITHIN THE RELEVANT REGIONAL ECOSYSTEM EXTENTS

GENERAL LEGEND

- EXTENT OF WORKS
- PROPOSED SEWAGE PRESSURE MAIN
- EXISTING ELECTRICAL SERVICE (OVERHEAD)
- EXISTING SEWER RISING MAIN
- EASEMENT EXTENTS
- FENCELINE
- EXISTING TREES
- PROPOSED ACCESS TRACK

PLANS AND DOCUMENTS referred to in the SDA APPROVAL

Queensland Government

SDA approval: AP2025/011

FOR CONSTRUCTION

No.	BY	DATE	DESCRIPTION	APPD
A	RW	01.12.25	ISSUED FOR CONSTRUCTION	

REVISIONS

Scale 1:2000 (A3) 1:1000 (A1) 0 10 20 30 40 50m

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DESIGNED	R WHITE	CHECKED	E CASTILLO
DRAWN	R WHITE	CHECKED	E CASTILLO
APPROVED	E CASTILLO	DATE	01.12.25

AECOM Australia Pty Ltd A.B.N. 20 093 846 925

City of Townsville

EASTERN OUTFALL PRESSURE MAIN REPLACEMENT

LANDSCAPE PLANS
SHEET 01 OF 04

Status	Drg No.	Rev.
CONSTRUCTION	60691504-38	A

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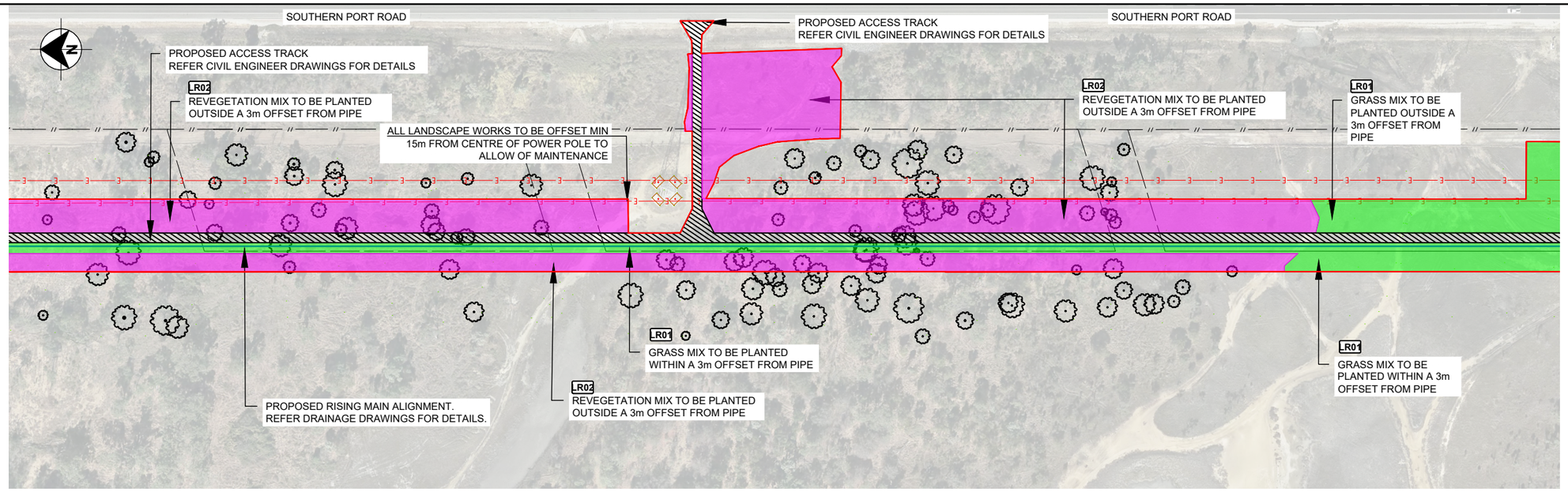

PLAN

NOTES

- REFER 60691504-36 FOR GENERAL NOTES AND LEGEND.

LANDSCAPE LEGEND

LR01 LANDSCAPE REVEGETATION MIX 1 (LR01) - GENERAL AREAS - GRASS SPECIES - CONTAINERISED OR SEEDED TREATMENT AREA: WITHIN 3M OFFSET OF PIPE CENTRELINE

- AMELIORATE SUBSOIL - INCORPORATE AMELIORANT'S AT RATES AS PER THE SPECIFICATION
- ROUGHENING - 50mm DEEP (APPROX.)
- TOPSOIL - 75mm DEEP AMELIORATED TOPSOIL (MINIMUM)
- FERTILISER - INCORPORATE FERTILISER AT RATES AS PER THE SPECIFICATION
- PLANTING - REFER TO PLANTING SCHEDULE
- FIBRE - 4500kg/ha (MINIMUM) - RELEVANT ONLY IF SEEDING IS PREFERRED
- FINISHED FIBRE DEPTH - 5mm (MINIMUM) - RELEVANT ONLY IF SEEDING IS PREFERRED
- EXTENT - AS SHOWN ON DRAWING WITHIN 3M OF PIPE CENTERLINE AND WITHIN THE RELEVANT REGIONAL ECOSYSTEM EXTENTS

LR02 LANDSCAPE REVEGETATION MIX 2 (LR02) - OPEN FOREST AREAS - TREE, SHRUB AND GRASS SPECIES - CONTAINERISED OR SEEDED TREATMENT AREA: OUTSIDE 3M OFFSET OF PIPE CENTRELINE

- AMELIORATE SUBSOIL - INCORPORATE AMELIORANT'S AT RATES AS PER THE SPECIFICATION
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GENERAL LEGEND

- EXTENT OF WORKS
- PROPOSED SEWAGE PRESSURE MAIN
- E E — EXISTING ELECTRICAL SERVICE (OVERHEAD)
- RM — EXISTING SEWER RISING MAIN
- EASEMENT EXTENTS
- FENCELINE
- EXISTING TREES
- PROPOSED ACCESS TRACK

PLANS AND DOCUMENTS
referred to in the
SDA APPROVAL

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City of Townsville

EASTERN OUTFALL PRESSURE MAIN REPLACEMENT

LANDSCAPE PLANS
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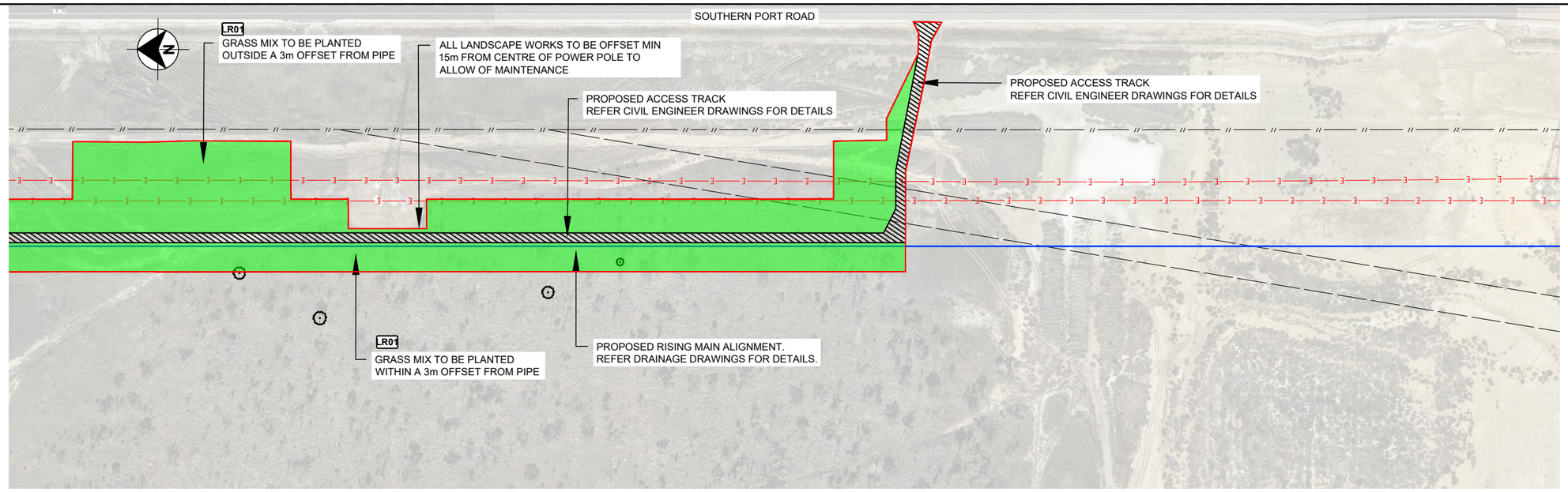

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NOTES

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LANDSCAPE LEGEND

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EASTERN OUTFALL PRESSURE MAIN REPLACEMENT

LANDSCAPE PLANS
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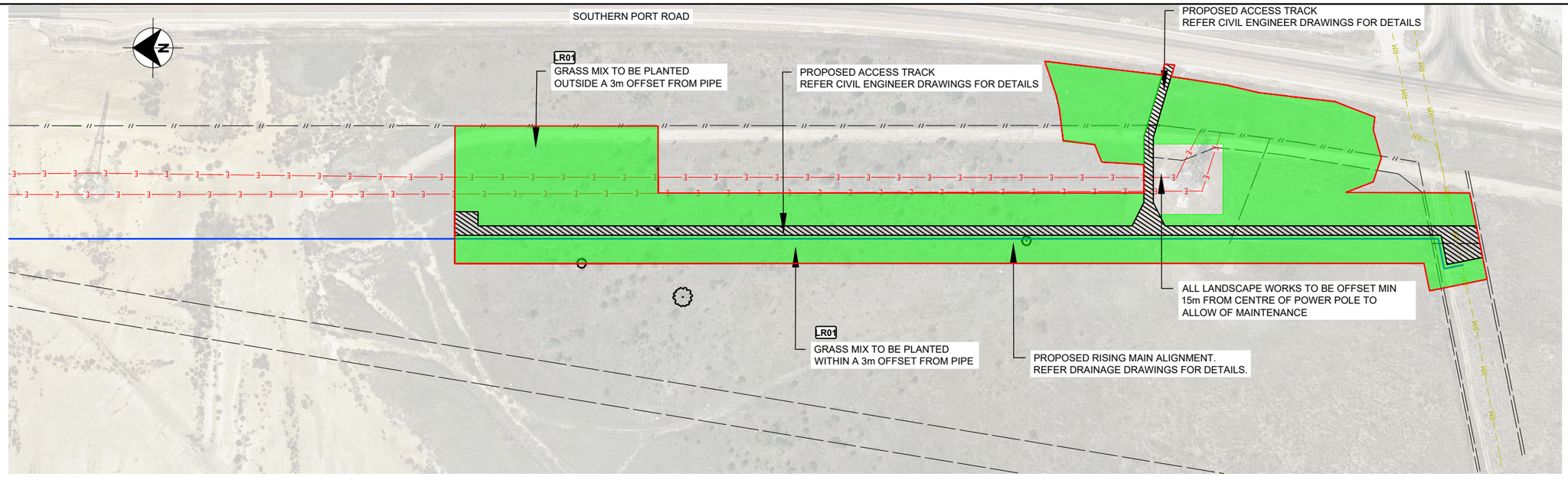

PLAN

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EASTERN OUTFALL PRESSURE MAIN REPLACEMENT

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Prepared for
Townsville City Council
ABN: 44 7419 920 72

Landscape and Revegetation Specification

Eastern Outfall Pressure Main (EOPM) Replacement Project

17-Dec-2025
Eastern Outfall Pressure Main (EOPM) Replacement Project
Spec No. 60691504-TS-LA-REV 1

PLANS AND DOCUMENTS
referred to in the
SDA APPROVAL

Queensland Government

SDA approval: AP2025/011

Specification No.: 60691504-TS-LA-REV 1

Client: Townsville City Council

ABN: 44 7419 920 72

Ref	60691504
Date	17-Dec-2025
Originator	Reilly White
Checker/s	Enrique Castillo
Verifier/s	Enrique Castillo

Revision History

Rev	Revision Date	Details	Approved	
			Name/Position	Signature
0	04-Dec-2025	Draft for Comment	Paul Lemcke Technical Director - Water Infrastructure	
1	17-Dec-2025	Update to address Regulator feedback	Paul Lemcke Technical Director - Water Infrastructure	

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Table of Contents

1.0 Introduction

1.1 General

This landscape performance specification has been prepared for Townsville City Council (Council) for the Eastern Outfall Pressure Main (EOPM) Replacement Project (the Project). This specification applies to the construction of landscape and revegetation treatments within the extent of works of the Project.

1.2 Project Description

The Project will replace the existing EOPM sewer pipeline that predominantly services Townsville's eastern suburbs. The existing pipeline runs from South Townsville, across the Ross River to the Cleveland Bay Purification Plant (CBPP) and forms a crucial part of the existing Townsville sewerage network. The Project is critical public utility infrastructure that will service continued residential expansion and urban consolidation within the 'Eastern' and 'Western' sewer systems in Townsville.

1.3 Table of Abbreviations

A list of terms, abbreviations and acronyms referred to throughout this report are included in Table 1 below:

Table 1 Acronyms

Terms, Abbreviations & Acronyms	Meaning
AS	Australia Standard
AS/NZS	Australian Standard / New Zealand Standard
CEMP	Construction Contractor's Construction Environmental Management Plan
Clearance	Measurement from the outer edge of a design component, road element to the perimeter of the vegetation's mature canopy.
TMR	Department of Transport and Main Roads
EOPM	Eastern Outfall Pressure Main
ISO	International Organization for Standardization
ITC	Inspection Test Checks
ITP	Inspection Test Plans
MRS	Main Roads Specification
MRTS	Main Roads Technical Specification
PDF	Portable Document Format
PUP	Public Utility Provider
QA	Quality Assurance
RE	Regional Ecosystem types (vegetation)
RPEQ	Registered Professional Engineer of Queensland
Setback	Measurement from outer edge of a design component, road element or object to the centre of the vegetation's trunk
SiD	Safety in Design
Council	Townsville City Council

1.4 Relevant Reference Material and Standards

The following documentation and guidelines were utilised in the preparation of this specification.

Table 2 Reference Material and Standards

Reference	Title
AS 2303	Tree Stock for Landscape Use
AS 4419	Soils for landscaping and garden use
AS 4454	Compost, soil conditioners and mulches

1.5 Design Intent and Summary of Revegetation Treatments

The Project seeks to address optimum revegetation outcomes from a local and state perspective. The key design approach is to create a resilient landscape through the selection of a hardy and robust plant palette which has the ability to be drought tolerant and low maintenance. Plant species' selection and location is to respect the landscape character of the local context and its surrounds. The landscape approach ensures diversity around the planting design through a varied local plant palette of species selected for broad, flat areas.

In areas subject to tidal inundation, particular attention is given to the selection of salt-tolerant and water-resilient species that can thrive under fluctuating saline conditions. These species are chosen based on their proven adaptability to intertidal zones, ensuring long-term viability and ecological function. The planting strategy incorporates hydrological modelling and site-specific tidal data to inform species placement, promoting stability, erosion control, and habitat value. This approach supports the creation of a robust coastal and riparian edge that can withstand periodic flooding, saline intrusion, and other dynamic environmental factors associated with tidal systems.

Two planting mixes have been proposed within the extents. These include:

Landscape Revegetation Mix 1 (LR01) - General Areas - Grass Species - Treatment Area: within 3m offset of pipe

The LR01 mix is composed exclusively of groundcover species suited to the site's soil conditions and designed for areas where trees and shrubs are not required. This mix will be installed directly over the pipeline and within ecosystems where existing vegetation does not necessitate taller plantings. Its purpose is to stabilize soil, maintain ecological integrity, and provide low-maintenance coverage without compromising infrastructure. Revegetation is to be undertaken progressively as areas become available. Priority should be made to revegetate areas where existing vegetation has been disturbed.

Landscape Revegetation Mix 2 (LR02) - Open Forest Areas - Tree, Shrub And Grass Species - Treatment Area: Outside 3m Offset Of Pipe

The LR02 mix consists of a diverse combination of trees, shrubs, and groundcovers selected for their ability to thrive in wet soils and tolerate tidal inundation. All species align with the local Regional Ecosystems (REs) to ensure ecological compatibility and resilience. This mix will be planted starting 3 meters from the pipeline's centreline to avoid interference with underground services and will extend to replace existing vegetation where necessary.

1.5.1 Landform

Civil earthworks have been completed and subgrade has been compacted to reduce runoff and scour potential. The following should be applied to each landscape treatment area:

- LR01 & LR02 – Generally flat areas (shallower than 1:4 grade) will require the following:

Item	Responsibility
Cultivate subsoil/subgrade	Revegetation Contractor
Incorporation of organics (stockpiled mulch with ameliorants)	Revegetation Contractor
Topsoil placement/reinstatement	Revegetation Contractor

Item	Responsibility
Proposed revegetation treatments – Containerised Planting	Revegetation Contractor

1.5.2 Revegetation

Revegetation will be undertaken through the application of containerised planting, with the below tables outlining plant species to be utilised.

The following should be undertaken:

- Weed management is to be undertaken prior to revegetation to treat any listed or undesirable weed species. The Contractor shall outline proposed weed management techniques to be undertaken, noting the sensitivity of the Project Site.
- Contact plant providers to ascertain the availability of species well in advance of commencement of rehabilitation.
- Rehabilitation planting works are to be scheduled during the dry season to maximise establishment success and reduce stress on young plants. As the project aligns with the wet season, sufficient time will be allowed for the wet season to conclude and for natural regrowth to occur where possible, supporting the resilience and integration of new plantings into the existing landscape.

1.5.3 Topsoil

1.5.3.1 Definitions

General: For the purposes of this section the definitions given below apply.

Bad ground: Ground unsuitable for the purposes of the works, including fill liable to subsidence, ground containing cavities, faults or fissures, ground contaminated by harmful substances and ground which is or becomes soft, wet or unstable.

Ameliorated site topsoil: Soil excavated from the site which contains organic matter, supports plant life, conforms generally to the fine to medium texture classification to AS 4419 (loam, silt, clay loam) and meets the minimum amelioration requirements, to be confirmed prior installation and use. Soil must also be free from:

Stones > 25 mm diameter.

Clay lumps > 75 mm diameter.

Weeds and tree roots.

Sticks and rubbish.

Material toxic to plants.

Natural soil: A soil that has been dug from the landscape and is presented for use with no more than minor amendment. This soil could be topsoil, subsoil, or a mixture of both and have a bulk density > 0.7 kg/L.

Organic soil: A general-purpose soil (normally an amended natural soil or soil blend) that has:

Bulk density: > 0.6 kg/L.

Organic matter: 15 % to 25 % by mass.

1.5.3.2 Soil Testing and Amelioration

The contractor shall include when tendering the works to undertake soil testing in accordance with AS4419-2003 to all site topsoil for use. For the purposes of tendering the works, contractors should include a Provisional Sum to supply and install topsoil ameliorants by suitable Contractor. In the absence of soil testing results, maximum application rates should be used for each of the below (extracted from DTMR MRTS16 Appendix):

Table 3 Topsoil amelioration rates

Ameliorant	Topsoil – Max. rate
Agricultural lime – CaCO3	10kg/m^3
Agricultural dolomite – CaMg (CO3)2	10kg/m^3
Agricultural gypsum – CaSO4.2H2O	10kg/m^3
Organic soil conditioner – by volume of topsoil	0.2 m3/m^3

The Revegetation contractor should allow for undertaking follow-up soil tests to the amended topsoil within 8-12 weeks following completion of the works to confirm soil complies with AS4419, Table 1.

1.5.4 Seeding and EnviroMulch

Seeded revegetation shall be carried out using an approved hydroseeding or broadcast method to ensure uniform coverage and successful establishment. Enviromulch shall be incorporated as a binding agent to stabilize the seed and soil surface, reduce erosion, and improve moisture retention. The application shall achieve a minimum fibre rate of 4,500 kg/ha with a fibre depth of 5 mm across all treated areas. All materials and methods must comply with relevant environmental and project standards, and the contractor shall ensure proper curing and maintenance until vegetation is established.

1.5.5 Plaing Topsoil

1.5.5.1 Cultivation

Cultivate the ground surface in preparation for placing topsoil by ripping to the depth nominated within the landscape plans, to loosen the compacted ground. Do not disturb services or tree roots; if necessary, cultivate these areas by hand. Trim after cultivation to shapes and levels such that the required depth of topsoil can be placed to the specified finished surface levels.

1.5.5.2 Herbicide

After cultivation and before placing topsoil treat the area to be topsoiled with an approved herbicide.

1.5.5.3 Placing

Place topsoil from the site stockpiles to the depths as required. Spread and grade evenly.

1.5.5.4 Surplus

Unless otherwise directed, dispose of surplus topsoil remaining on site by spreading evenly over the areas already placed.

1.5.5.5 Compaction

Lightly compact topsoil so that the finished surface is smooth, free from lumps of soil, at the required level, ready for cultivation and planting.

1.5.5.6 Finishing

Finish topsoil flush with adjacent surfaces. Feather edges into adjoining undisturbed ground.

1.5.6 Regional Ecosystem (RE) mapping

Refer to plant schedules below. Vegetation Communities identified on site based on Regional Ecosystem (RE) Mapping include the following:

- 11.1.1 – Tussock Grassland
- 11.1.2 – Open Succulent Shrubland
- 11.1.4 – Mangrove low open forest and/or woodland on marine clay plains

- 11.2.2 HVR – Low Woodland
- 11.2.5 – Woodland.

1.5.7 Planting Treatments

Containerised planting is proposed in areas subject to tidal inundation to support faster vegetation establishment and improve resilience against environmental stressors such as scour and saline intrusion. This method is particularly suited to locations within low lying areas throughout the Project alignment, where the risk of erosion and water movement is elevated. The use of full native tubes strikes a balance between cost efficiency and rapid establishment, ensuring plants have sufficient root development to withstand tidal fluctuations.

1.5.7.1 Landscape Revegetation Mix 1 (LR01) – General Areas – Grass Species –Treatment Area: Within 3m Offset of Pipe

Full native tube grasses will be planted within 3 m of the pipe centreline alignment and provide a suitable ground cover treatment once established. Limited to grasses only, this will ensure no conflicts with the proposed sewer pipeline.

LANDSCAPE REVEGETATION MIX 1 (LR01) - GENERAL AREAS - GRASS SPECIES - TREATMENT AREA: WITHIN 3M OFFSET OF PIPE							
CODE	**BOTANICAL NAME**	**COMMON NAME**	**CONTAINER SIZE**	**DENSITY (per m2)**	**MATURE HEIGHT (m)**	**MATURE SPREAD (m)**	**QTY**
GRASS SPECIES							
ALL sem	*Alloteropsis semialata*	Black Seed Grass	Tubestock	4	1.5	0.5	
BOT bla	*Bothriochloa bladhii*	Forest Bluegrass			1.5	0.5	
BOT ewa	*Bothriochloa ewartiana*	Desert Bluegrass			0.8	0.5	
DIC ser	*Dichanthium sericeum*	Queensland Bluegrass			1	0.5	
DIG bro	*Digitaria brownii*	Cotton Panic Grass			1	0.3	
HET con	*Hetropogon contortus*	Black Speargrass			1.5	1.5	
IMP cyl	*Imperata cylindrica*	Cogon Grass			1.5	0.5	
PAN dec	*Panicum decompositum*	Native Millet			1.5	0.5	
SAR plu	*Sarga plumosum*	Plume Sorghum			2	1	
SET sur	*Setaria surgens*	Pigeon Grass			0.5	1	
SPO vir	*Sporobolus virginicus*	Seashore Dropseed			0.5	1	
THE tri	*Themeda triandra*	Kangaroo Grass			1.5	0.5	

1.5.7.2 Landscape Revegetation Mix 1 (LR01) – Open Forest Areas – Tree, Shrub and Grass Species – Treatment Area: Outside 3m Offset of Pipe

Species in this mix have been chosen for their ability to cope with both wet and dry conditions and where the Project alignment will be exposed to tidal inundation in the wet season. This includes both grass, shrub and tree species to assist with stabilising the corridor.

LANDSCAPE REVEGETATION MIX 2 (LR02) - OPEN FOREST AREAS - TREE, SHRUB AND GRASS SPECIES - TREATMENT AREA: OUTSIDE 3M OFFSET OF PIPE							
CODE	**BOTANICAL NAME**	**COMMON NAME**	**CONTAINER SIZE**	**DENSITY (per m2)**	**MATURE HEIGHT (m)**	**MATURE SPREAD (m)**	**QTY**
TREE SPECIES							
ACA cra	*Acacia crassicarpa*	Northern Wattle	Tubestock	2	20	10	
ACA fla	*Acacia flavescens*	Red Wattle			20	10	
ALP exc	*Alphitonia excelsa*	Red Ash			20	10	
CAS cun	*Casuarina cunninghamiana*	River Oak			30	10	
COR cla	*Corymbia clarksoniana*	Grey Bloodwood			20	12	
COR dal	*Corymbia dallachiana*	Dallachy's Gum			20	10	
COR tes	*Corymbia tessellaris*	Moreton Bay Ash			30	15	
CUP ana	*Cupaniopsis anacardioides*	Tuckeroo			15	10	
EUC cre	*Eucalyptus crebra*	Narrow-leaved Ironbark			30	10	
EUC pla	*Eucalyptus platyphylla*	Poplar Gum			20	12	
EUC ter	*Eucalytpus tereticomis*	Forest Red Gum			30	15	
EXO lat	*Exocarpos latifolius*	Broad Leaved Ballart			8	5	
MEL dea	*Melaleuca dealbata*	Blue Paperbark			10	6	
MEL leu	*Melaleuca leucadendra*	Weeping Paperbark			15	8	
MEL ner	*Melaleuca nervosa*	Fibrebark			8	5	
MEL vir	*Melaleuca viridoflora*	Broad-Leaved Paperbark			10	6	
PLA car	*Planchonia careya*	Cocky Apple			10	6	
SEN sur	*Senna surattensis*	Glossy Shower			5	4	
SHRUB SPECIES							
ACA hol	*Acacia holsericea*	Soapbush Wattle	Tubestock	3	8	4	
ACA lep	*Acacia leptostachya*	Townsville Wattle			6	4	
ACA ora	*Acacia oraria*	Coastal Wattle			6	4	
ACA sim	*Acacia simsii*	Heathlands Wattle			4	3	
DOD vis	*Dodonaea viscosa*	Native Hops			6	4	
GRASS SPECIES							
ALL sem	*Alloteropsis semialata*	Black Seed Grass	Tubestock	4	1.5	0.5	
BOT bla	*Bothriochloa bladhii*	Forest Bluegrass			1.5	0.5	
BOT ewa	*Bothriochloa ewartiana*	Desert Bluegrass			0.8	0.5	
CYM ref	*Cymbopogon refractus*	Barbed Wire Grass			1.2	0.6	
DIC ser	*Dichanthium sericeum*	Queensland Bluegrass			1	0.5	
DIG bro	*Digitaria brownii*	Cotton Panic Grass			1	0.3	
HET con	*Hetropogon contortus*	Black Speargrass			1.5	1.5	
IMP cyl	*Imperata cylindrica*	Cogon Grass			1.5	0.5	
PAN dec	*Panicum decompositum*	Native Millet			1.5	0.5	
SAR plu	*Sarga plumosum*	Plume Sorghum			2	1	
SET sur	*Setaria surgens*	Pigeon Grass			0.5	1	
SPO vir	*Sporobolus virginicus*	Seashore Dropseed			0.5	1	
THE tri	*Themeda triandra*	Kangaroo Grass			1.5	0.5	

1.5.8 Mulch

1.5.8.1 General:

Provide mulch which is free of deleterious and extraneous matter such as soil, weeds and sticks. Mulch materials should be spread evenly throughout the whole planting bed; shrubs and groundcovers, to a depth no less than 100 mm.

Standard: To AS 4454.

Mulch is to be certified as weed free by supplier. Certification and sample to be provided prior to installation for approval by the landscape architect.

Organic mulches: Free of stones.

Site mulches: Double tub-ground mulch.

1.5.8.2 Placing mulch

General: Place mulch to the required depth, clear of plant stems. Spread and roll mulch so that after settling it is smooth and evenly graded between design surface levels sloped towards the base of plant stems, and not closer to the stem than 50 mm. Mulch all trees located within grass areas with a mulch ring to base of tree, as indicated within the landscape documentation. Ensure trunk is clear of mulch.

In mass planted areas: Place after the preparation of the planting bed but before planting and other work.

1.5.8.3 Warranty

Prior to installing mulch, provide a warranty to the Superintendent that the material has been tested in accordance with Appendix K of AS 4454 – Method for Determination of Nitrogen Drawdown Index, and shall not have a nitrogen draw down effect on the planted areas to which it is placed.

1.5.9 Tree Guards

1.5.9.1 Type:

‘Mallee Flute’. Dimensions 600 mm x 200 mm sides (Product code TSCOR6020)

1.5.9.2 Fixing

Fixed using 11x38 mm rectangular hardwood stake.

1.5.9.3 Supplier

Arborgreen (or approved equivalent by Superintendent).

1.5.10 Establishment and maintenance

1.5.10.1 General

Maintain and establish the contact area during the required period as noted in the Contract.

1.5.10.2 Plant Establishment and Maintenance

The Plant Establishment Period is the time subsequent to Practical Completion during which the Contractor has specific responsibilities for the maintenance and establishment of the plant material.

At the end of the Plant Establishment Period, all plant material shall be in good health and have grown at a rate deemed acceptable by the Landscape Superintendent. Plants shall be capable of independent growth.

1.5.10.3 During Establishment and Maintenance Period

During the Plant Establishment and/or Maintenance Period, the Contractor will be required to replace plants deemed by the Superintendent or Superintendent’s Representative to be stressed or deteriorating. Replacement plants will be of the same species and of an equivalent size to that of the specified plant size in the contract after the stipulated establishment growth period has occurred. Replacement costs will be at the contractor’s expense.

1.5.10.4 Completion of Establishment and Maintenance Period

At the end of the Plant Establishment and/or Maintenance Period, the Contractor will be required to replace plants deemed by the Superintendent to have shown insignificant signs of growth. Replacement plants will be of the same species and of an equivalent size to that of the specified plant size in the contract after the stipulated establishment growth period has occurred. Replacement costs will be at the contractor's expense.

1.5.10.5 Planting

Ensure the general appearance and presentation of the landscape and the quality of plant material at the date of practical completion is maintained for the full planting establishment period.

Existing plant material: Maintain existing planting and grass within the landscape contract area as specified for the corresponding classifications of new planting.

Replacements: Replace failed, dead and/or damaged plants at maximum 3-week intervals as necessary throughout the full plant establishment period.

1.5.10.6 Fertilising

Soil tests: Take samples from planting beds and conduct tests.

Fertilising: Base the fertilisation program on the soil testing results. Generally apply an all-purpose fertiliser of N:P:K (nitrogen:phosphorus:potassium) 10:4:6 at recommended rates. Alternatively apply 12 month slow release fertiliser (such as Nutricote) at the manufacturer's recommended rate.

1.5.10.7 Insect and disease control

Responsibility for insect and disease control: Contractor

Period for treatment: Until the problem has been eliminated.

Chemical spray: Apply within working hours in low wind conditions.

1.5.11 Watering

1.5.11.1 Establishment

Water quality:

- pH between 5.5 and 7.5.
- Total soluble salts less than 1000 mg/litre.
- No substances that would be toxic to plant growth.

Watering program: As per DTMR's Standard watering rate applications for BFM Hydromulch and tubestock plant as per MRTS16 minimum watering schedule and watering rates of Table 9.1.1.1(a) and Table 9.1.1.1(b).

Water restrictions: Coordinate the water supply and confirm the watering regime against State and Territory legislation and restrictions at the time.

2.0 Preliminaries

2.1 Extent of Work

The work to be performed under this Contract comprises the provision of materials, plant and labour and the performance of all operations of whatever kind necessary for the complete and proper construction of the Works associated with the Project as indicated in this specification and associated landscape and revegetation drawings.

Works under the Contract (WuC) are for construction of landscape and revegetation works, as defined, and include but are not limited to:

- Notification of all appropriate property owners adjoining the Works in accordance with the Principal's Communication protocol, access protocol and in association with the relevant Communications Manager.
- Setting out the works.
- Site establishment and de-establishment
- Completion of the works to the specified requirements
- Submission of detailed methodologies, work method statements, contingency plans, inspection test plans (ITP) and inspection test checks (ITC) for all WuC.
- Services location, potholing, and survey pickup of existing services within the construction area and confirm adequate clearances between the existing services and the proposed works.
- Dilapidation survey pre and post construction.
- Disposal offsite of excess excavated material (if required).
- Management of land holders and their assets including access tracks
- Final restoration of ground surfaces and final site clean-up
- Final survey and preparation of handover documentation.

2.2 Storage on site

Storage of plant, equipment, and laydown areas for materials on site shall be subject to approval by the Superintendent.

The Contactor shall prepare and maintain a site plan for the site showing locations and outlines of revegetation area, laydown/storage area, materials stockpile, site offices and temporary access routes within the construction area and submit to the Superintendent for approval. The Contractor will update and resubmit the site plan to the Superintendent as the site conditions change.

2.3 Disposal of surplus excavated material

Any surplus excavated material is to be disposed of by the Contractor at locations agreed with Townsville City Council and the Superintendent.

2.4 Construction standard of work

Where applicable, all construction works shall be carried out in accordance with the latest version of the Technical Specification, Drawings and the applicable Australian Standards and Codes.

Use referenced documents which are the editions, with amendments, current 3 months before the closing date for tenders, except where other editions or amendments are required by statutory authorities.

The Contractor is fully responsible for choosing the appropriate plant, equipment and work methods for the purpose and environment for which they are to be used. The Contractor shall be fully responsible for the construction and supervision of the works and ensure acceptable work practices are used.

2.5 Protection of the environment

2.5.1 General requirements

The Contractor shall prepare a Construction Environmental Management Plan (CEMP) to cover all site construction works and submit to the Superintendent for approval.

The Contractor's CEMP shall comply with the following documents provided by the Principal:

- Cultural Heritage Management Agreement (CHMA) between Townsville City Council and the Bindal People #2.

The Contractor is to fully inform themselves with all requirements detailed in the Project's environmental and planning reporting and conditions of approval. Should the Contractor wish to depart from these requirements, they shall be required to undertake all associated environmental approvals required for the departure.

The Contractor must:

- obtain, keep current and comply with the requirements of any environmental licenses, permits or authorities required under legislative requirements in relation to WuC;
- identify all potential sources of and take all reasonable care to minimise waste and prevent pollution;
- undertake a safety and environmental risk assessment for the WUC and provide these to the Superintendent;
- report all incidents of environmental contamination or disturbance to the Superintendent within 12 hours of the occurrence of such an event;
- instruct all personnel in relevant environmental procedures prior to any WUC being undertaken by those personnel;
- nominate a competent employee to act as an environmental officer for the Contract;
- exercise due diligence in all activities carried out on behalf of the Principal;
- take all other reasonable steps to prevent the occurrence of any environmental damage or pollution, including noise pollution, as a result of the carrying out of the WUC;
- undertake, and ensure that its personnel undertake the Principal's environmental induction training prior to the commencement of WUC if directed to do so by the Superintendent;
- rectify and make good at its own cost any loss or damage caused as a result of the Contractor's failure to comply with its obligations under this clause; and
- In the event of any inconsistency, ambiguity, discrepancy or conflict between any of the standards or obligations of the Contractor or its personnel, promptly notify the Superintendent of the inconsistency, ambiguity, discrepancy or conflict, and, unless otherwise directed by the Superintendent, adopt the higher or more onerous standard or obligation.
- unless directed otherwise by the Superintendent, monitor and review the Contractor's CEMP:
  - at weekly intervals during the carrying out of the WuC;
  - at monthly intervals during the first quarter of the defect liability period; and
  - at quarterly intervals until the issuing of a final certificate;

1. reviews the overall environmental management process;
2. provides recommendations in relation to the need for any further monitoring;
3. provides recommendations in relation to any changes to the environmental management process;

a. provide a copy of any document produced or obtained by the Contractor in connection with this subclause to the Principal or Superintendent on request.

The Contractor's CEMP must:

1. at a minimum, be consistent with the Contract and demonstrate how the Contractor will comply with its obligations.
2. where relevant, address:

a. management of stockpiles;

b. water management;

c. revegetation;

d. erosion and sediment control plan;

e. acid sulphate soils;

f. waste management;

g. air and noise quality management; and

h. applying for, gaining and maintaining all approvals, permits and licenses required under the Contract.

2.5.2 Dust suppression

It is the responsibility of the Contractor to ensure dust suppression is controlled over the whole route of the works in accordance with the CEMP and to the satisfaction of the Superintendent.

The following measures, where applicable, are to be conducted to minimise this risk to the environment:

- Spraying of earthwork formations and roads with water or other suitable liquids approved by the Superintendent.
- Removal of mud from the wheels and bodies of equipment before it enters public roads or other sealed pavements.
- Establishment of suitable cover crop or provision of other covering over topsoil stockpiles.
- Erection of dust screens around and/or spraying of stockpiles with suitable stabilising agents.
- Stopping dust generating activities which cannot be adequately controlled by water or other means.
- Transportation of materials which are suitably covered and loaded in a manner that will prevent dropping of materials.
- Maintaining dust control equipment so that this equipment is available when required, including periods of dust generating activities or high wind speed.

2.5.3 Diverting water (including “dewatering”)

The Contractor shall do all work necessary to divert any water interfering with the progress of the works, keep the excavations free from water while the works are in progress, and prevent any damage to the works by water due to floods or other causes. The Contractor shall provide, where considered necessary by the Superintendent, sand traps on the discharge line of any drainage pump to prevent the deposit of material in channels and stormwater drains.

Where water is diverted from the site it shall be confined to existing drainage paths and away from adjacent private property.

All costs associated with the above shall be included as part of the Contractors Lump Sum price.

2.5.4 Flora and Fauna

The Contractor shall make every practicable effort to prevent the spread of weeds.

The Contractor must make the appropriate notifications and acquire the appropriate permits or approvals prior to clearing vegetation. Native flora shall only be cleared by the Contractor if necessary for the works, and, if a permit/license is in place, shall take place under the requirements set by the permit/license.

Before any land clearing commences, and if requested by the Superintendent, the contractor shall arrange for a vegetation and fauna survey to be conducted at the site. Prior to commencement of land clearing, records of the survey report shall be provided to the Superintendent.

The Contractor shall minimise disturbance and injury of native fauna. If any native fauna is injured the Contractor must notify the Superintendent and lodge an incident report. All injured native wildlife shall be taken to a vet or carer.

Costs incurred for relocating any wildlife or treatment by a professional are to be incurred by the Contractor.

2.6 Water

2.6.1 Sources

The Contractor is responsible for supplying its own construction water and potable water (if required), including all associated costs for supply, treatment and management.

2.7 Restoration

2.7.1 General

All surfaces shall be restored in such a manner that they conform generally with the levels, grades, and type of surface material existing before the work was commenced. Restored surfaces shall be maintained in such a way as to avoid any hazard or inconvenience.

The Contractor shall, from time to time, as required, provide, and place any pavement material, topsoil and other material that may be necessary to make good any subsidence and shall ensure that the restored surfaces are maintained throughout the duration of the Contract in conformity with the level of the adjoining surfaces to allow the safe and convenient passage of traffic.

All restoration work shall be to the satisfaction of the Superintendent. Initial cleaning up shall be carried out as soon as work is complete, and restoration shall be completed (excluding maintenance) within 28 days after each area of work is complete.

The Contractor will be responsible for maintaining all erosion and sediment control devices and repair any erosion or remove any sediment build up within the works corridor for a 3-month period following Practical Completion of the works.

2.7.2 Land Generally

For general land areas of the site, the top 75 mm of backfilling shall be carried out with topsoil material approved by the Superintendent as equivalent to that removed. Where, in the opinion of the Superintendent, the organic content of the backfill material is not equivalent to that removed, then an imported topsoil to the approval of the Superintendent shall be used for backfill.

2.7.3 As-Constructed Documents

As-constructed drawings shall include submission of an updated vegetation and planting plan.

All As-Constructed plans and documents shall include details of any variations or approved amendments made during the contract and include site directions, service locations, variations, hidden works and the like. Further to this where an as-built condition requires a drawing to be amended then all related drawings influenced by this amendment shall be similarly amended.

Once completed, a draft copy of the As-constructed drawings shall be submitted to the Superintendent for approval. The Contractor shall provide one electronic copy of each drawing in PDF format for this purpose. Any changes shall be duly executed and resubmitted for approval.

Once approved, the as-constructed drawings prepared pursuant to the requirements of this Contract, shall be clearly marked "As-Constructed drawing" and signed by the Contractor adjacent to the title block. These shall be delivered to the Superintendent in both PDF and AutoCAD 2016 format.

Should it be found subsequent to the issue of the Certificate of Practical Completion that the Contractor has failed to amend all or some of the drawings as required above, then the Superintendent at his discretion may proceed to have the necessary amendments carried out without further reference to the Contractor. All costs associated with obtaining information and carrying out these amendments will be deducted from any monies otherwise owing to the Contractor under the terms of this Contract.

2.7.4 Maintenance and call out during Defects Liability Period

The Contractor shall inspect, monitor, and maintain the works throughout the Defects Liability Period. All damage, subsidence or deterioration of the revegetated areas shall be made good to the satisfaction of the Superintendent, including but not limited to:

- Sediment and erosion control
- Tubestock mortality
- Weed identification and management
- Any subsidence or depressions
- Any erosion, undermining or scouring of Ross River / Creek crossing embankments and water course / water way crossings
- The Contractor shall respond to call outs during the Defects Liability Period.

2.8 Weeds and Seed Protection and Vehicle Wash Downs

The Contractor shall make provisions to ensure that weeds are not introduced or transferred across private properties as part of the Contractor's CEMP. The Contractor shall provide construction vehicle wash down facilities, along with inspection regimes to prevent weed contamination.

Washdown locations shall not be located within 200 m of a watercourse/waterway in accordance with the environmental reports and plansand such facility locations will be required to be confirmed on site by the Contractor at the time of construction.

All declared weed plants within the Project area shall be treated in accordance with the CEMP.

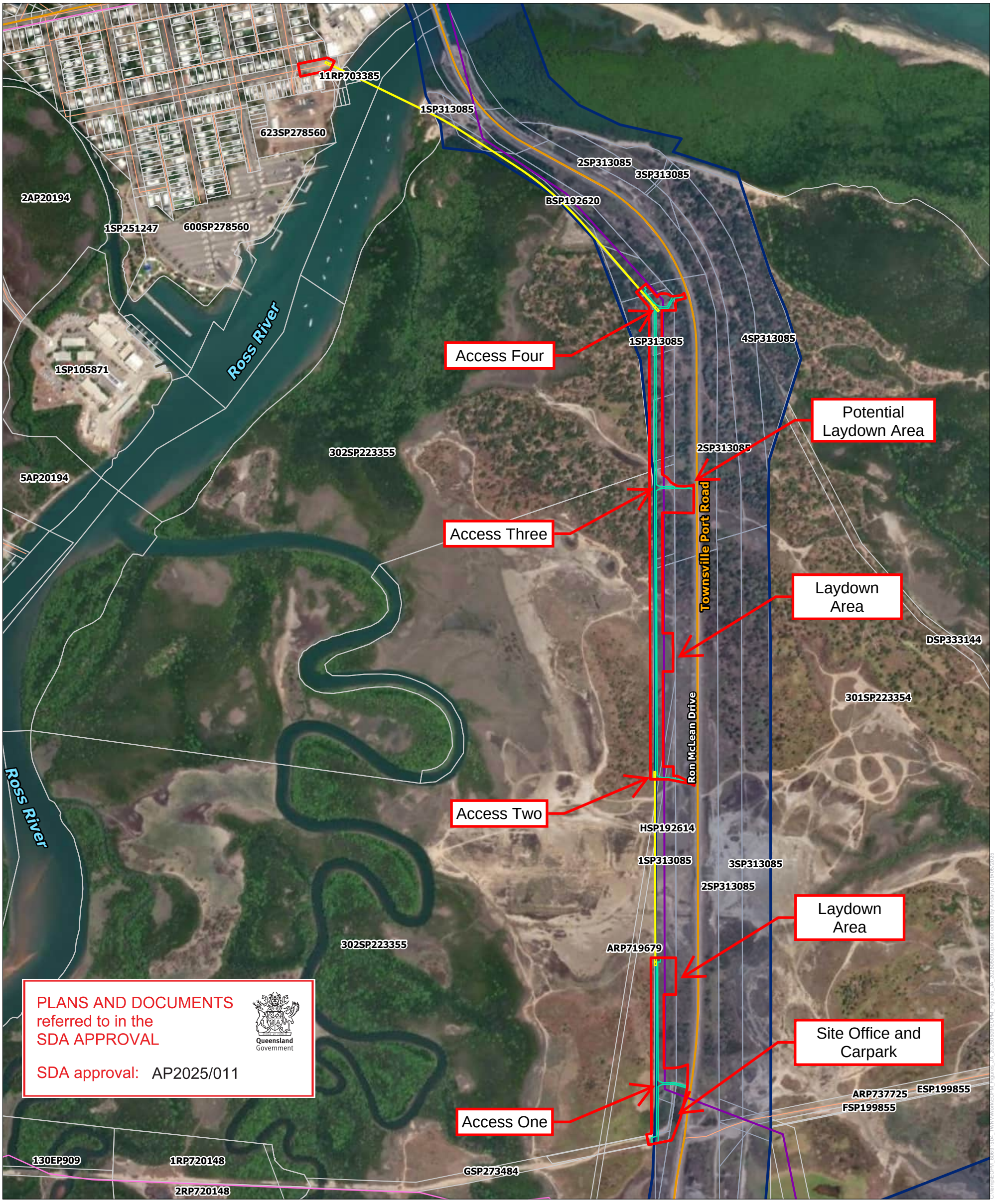
The Contractor shall use clean-down procedures shall be in accordance with the Queensland Department of Primary Industries requirements.

https://www.daf.qld.gov.au/__data/assets/pdf_file/0011/58178/cleandown-procedures.pdf

2.9 Access by Council

During replanting efforts, the Contractor shall ensure that access to Project corridor is maintained and available for Council operations and maintenance staff.

Access to the site will be required for Council (or Council's representatives) in order for various construction management tasks to be undertaken, such as, quality assurance and verifications inspections, responding to RFI's and other requirements.



Eastern Outfall Pressure Main (EOPM) Replacement Project
Figure 17

AECOM

N

0 140 280 m

Legend

- Under-boring
- Entry and exit pits
- Project area
- Permanent access tracks
- Townsville SDA
- Lot parcels
- Roads
- State Controlled Road
- Electricity Transmission Line (66kV)
- Electricity Transmission Line (132kV)

Date: 04/02/2026

AMENDMENTS IN RED

Prepared for
Townsville City Council
ABN: 44 741 992 072

DRAFT

Acid Sulfate Soils Management Considerations

04-Aug-2025
EOPM Replacement Pipeline

PLANS AND DOCUMENTS
referred to in the
SDA APPROVAL

Queensland
Government

SDA approval: AP2025/011

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Acid Sulfate Soils Management Considerations

Client: Townsville City Council

ABN: 44 741 992 072

Prepared by

AECOM Australia Pty Ltd
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04-Aug-2025

Job No.: 60691504

AECOM in Australia and New Zealand is certified to ISO9001, ISO14001 and ISO45001.

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Quality Information

Document	Acid Sulfate Soils Management Considerations
Ref	60691504
Date	04-Aug-2025
Originator	Johannes Erland
Checker/s	Ona Kanas
Verifier/s	Lee Taylor

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Rev	Revision Date	Details	Approved	
			Name/Position	Signature
A	04-Aug-2025	Draft for Client Review	Paul Lemcke Technical Director	

D R A F T

Table of Contents

1.0 Project Context

The Townsville City Council (TCC) is replacing a section of the existing Eastern Outfall Pressure Main (EOPM or the Project). The proposed alignment of the EOPM is from Sixth Street in South Townsville, across the Ross River south of the Southern Port Road bridge, to the intersection of Racecourse Road where it will connect to the Southern Suburbs Rising Main.

The Project footprint is presented in **Figure 1, Appendix A** and some portions of the alignment are mapped as likely Acid Sulfate Soil (ASS) as shown in **Figure 2, Appendix A**. The EOPM project layout plan intersects with Ak(p4), Aa(p4), Ab(p3), Ac(p3)h, and Ad(p3)o soils which are classified as high probability of ASS occurrence (>70%). According to the Queensland Globe, no necessary analytical data are available, however confidence is fair, based on a knowledge of similar soils in similar environments. A further investigation on ASS was conducted by Douglas Partners in 2023 and reported potential acid sulfate soil (PASS) is present within the maximum investigation depths. Summary of ASS investigation is presented in Table 1.

As part of the State Assessment and Referral Agency (SARA) pre-lodgement advice (SARA reference number: 2501-44467 SPL), ASS will require consideration during design and construction to avoid acid generation through soil and/or groundwater disturbance. It is noted that the EOPM passes through sensitive ecological receptors such as surface water features and groundwater dependent ecosystems (GDEs), which will require protection under the *Environmental Protection Act 1994*.

AECOM has delivered the detailed design for the EOPM, and as the Project moves toward construction tendering and execution, this ASS technical briefing note has been prepared for consideration by the Construction Contractor. This document aims to provide the Construction Contractor a summary of their obligations for the assessment and management of ASS, surface water and groundwater during all phases of construction, and mitigation of adverse effects on sensitive environmental values during the planning and delivery of this Project.

This document does not replace the Construction Contractor's requirements to develop and implement management plans for ASS, surface water and groundwater.

2.0 Existing Background Data

A detailed summary of the existing knowledge base specific to ASS and groundwater quality is included in Table 1 below. It is expected that the Contractor will complete infill sampling based on works completed to date to inform the ASSMP and construction schedule.

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Table 1 Technical Report Summary & Data Gap Analysis

Report Title & Version	Project Ref, Author & Date	Objectives & Scope of Work	Findings & Conclusions
Limited Stage 1 Preliminary Site Investigation	60691504 AECOM Australia Pty Ltd. 28 March 2023	The objective of the Limited Stage 1 PSI was to understand the risk of encountering existing contamination and ASS during construction and the likely management requirements and implications for design and construction methodology. Scope of works: • Desktop review publicly available information including ASS mapping. • Identification of contaminants of potential concern (COPC) and areas requiring further investigation following completion of the desktop study and review of available information. • Completion of a site walkover and inspection following the desktop study • Tabulate a preliminary conceptual site model (CSM)	• Topography: Predominantly flat, ranging between 8.0 metres Australian Height Datum (mAHD) at the northern end of the alignment and 2.0 mAHD at the southern section of the alignment. • ASS: The ASRIS map indicates that the majority of the alignment has a high probability (with low confidence) of the occurrence of acid sulfate soils. The Ross River is mapped as high probability of occurrence (with confidence unknown). The southern portion has low probability (with low confidence) of the occurrence of acid sulfate soils. • Hydrology: Ross River is located at the Project footprint. • Hydrogeology: One groundwater bore (listed for domestic use and is potable quality) is identified approximately 240m west-northwest of the EOPM alignment. • Groundwater Dependant Ecosystems: The alignment is intersected by a known high potential aquatic GDE associated with the Ross River and a separate low potential aquatic GDE further to the south-east within wetlands. The majority of the central portion of the alignment intersects high potential terrestrial GDE.
Report on Limited Site Investigation (Contamination) Eastern Outfall Pressure Main Replacement. R.002.rev0.	221217.00 Douglas Partners 27 June 2023	• Combined geotechnical and environmental investigations associated with the proposed EOPM replacement spread along an alignment of approximately 3km. • Soil investigation for contamination assessment purposes from two soil bores and seven pits to a maximum depth of 2.5m below ground. • Samples for assessment of ASS were collected at 0.25 m depth intervals for the full depth of every second investigation location to a maximum depth of 3.5 m (TS01, TS03, TS05, TS07 and TS09). In addition, one sample of suspected monosulfidic black ooze (MBO)	• Groundwater levels ranged from 0.6 (TS03) to 2.5 (TS08). • All pHF test results were equal to or greater than pH 4.5 and, therefore, that actual acid sulfate soil (AASS) is unlikely to be present. • A pH_{FOX} condition less than or equal to pH 3 was observed in 23 of the samples tested, with nine of them also exhibiting more than one pH unit below pH_F, and a strong or extreme reaction with hydrogen peroxide (ie reaction rate 3 or 4). These results provide a preliminary indication that potential acid

Report Title & Version	Project Ref, Author & Date	Objectives & Scope of Work	Findings & Conclusions
		was collected from the vicinity of TS05. The MBO sample was tested for; - Chromium suite ASS test; - Particle size analysis; - 15 metals (1M HCl extractable); - Nutrient content (NH3, NOx, phosphate); - Water extractable (major) anions (e.g. sulfate and chloride); - Disulfide content (part of the Cr Suite results); and - Elemental sulfur content.	sulfate soil (PASS) is present within the investigation depths. • 21 samples were selected for the 'existing plus potential' acidity calculation. The results reported 10 samples were above the adopted threshold of 0.03%S for chromium suite testing. All of the observed exceedances were in samples collected from the southern side of Ross River. No ASS/PASS was observed in the samples tested from the northern side of Ross River. • It was recommended by Douglas Partners that an ASSMP be prepared for any excavations extending approximately 1 m below ground level (bgl) on the southern side of Ross River. Based on a neutralising value (NV) of 95% the suggested liming rate ranges from approximately 1.5 kg/tonne of soil to 100 kg/tonne of soil.
SARA Pre-Lodgement Advice (SARA reference: 2501-44467 SPL)	Queensland Government. 14 April 2025.	Provide pre-lodgement advice for the development of the DA for the Project	• Elevation data along the alignment indicates the majority of the project occurs on land that is at or below an elevation of 5 m AHD. Vegetation in the project area (e.g. mangrove communities, samphire flats, etc.) are strongly correlated to the presence of ASS. Large portions of the alignment are mapped as 'high probability of occurrence of ASS' under the National ASS mapping program. • Prior to any works, an additional ASS investigation must be undertaken to identify the extent and severity of any ASS on site. The investigation must be carried out as per the current 'National ASS Guidance material'. • For details on relevant references for ASS investigations and management plans and dewatering mitigation measures refer to Section 3.0.

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3.0 Relevant Guidelines

In Queensland, all works with the potential to impact the receiving environment must be undertake in accordance with the *Environmental Protection Act 1994*. This includes where construction works have the potential to disturb ASS. In addition, the following State and Federal legislation must be considered when working with ASS:

- *Planning Act 2016 (*including the Qld State Planning Policy 2017, State interest – emissions and hazardous activities);
- *Vegetation Management Act 1999;*
- *Fisheries Act 1994*;
- *State Development and Public Works Organisation Act 1971*; and
- *Environment Protection and Biodiversity Conservation Act 1999*.

Relevant references for ASS investigations (sampling and laboratory methods) include:

- Sullivan L, Ward N, Toppler N and Lancaster G (2018a). National Acid Sulfate Soils Guidance: National acid sulfate soils sampling and identification methods manual. Department of Agriculture and Water Resources, Canberra ACT.
- Ward N, Toppler N and Lancaster G (2018b). National Acid Sulfate Soils Guidance: National Acid Sulfate Soils Identification and Laboratory Methods Manual, Department of Agriculture and Water Resources, Canberra OR the Australian Standard 4969;
- Dear SE, Williams KM, McElnea AE, Ahern CR, Dobos SK, Moore NG and O'Brien LE (2024). Queensland Acid Sulfate Soil Technical Manual, Soil Management Guidelines, Version 5.1. Department of Resources and Department of Environment, Science and Innovation, Queensland.

If any dewatering is proposed during trenching, this must be managed in accordance with:

- Shand, P, Appleyard, S, Simpson, SL, Degens, B, Mosley, LM (2018a), National Acid Sulfate Soils Guidance: Guidance for the dewatering of acid sulfate soils in shallow groundwater environments, Department of Agriculture and Water Resources, Canberra, ACT.
- Simpson, SL, Mosley, L, Batley, GE and Shand, P (2018b). National Acid sulfate soils guidance: Guidelines for the dredging of acid sulfate soil sediments and associated dredge spoil management, Department of Agriculture and Water Resources, Canberra, ACT

For advice on MBOs (where encountered):

- Sullivan, LA, Ward, NJ, Bush, RT, Toppler, NR, Choppala, G (2018), National Acid Sulfate Soils Guidance: Overview and management of monosulfidic black ooze (MBO) accumulations in waterways and wetlands, Department of Agriculture and Water Resources, Canberra, ACT.

4.0 Management and Mitigation Measures Incorporated into Design

4.1 Horizontal Directional Drilling

The design and construction methodology has incorporated avoidance strategies wherever practical. In areas identified as having a higher probability of encountering ASS, particularly those within or adjacent to tidally influenced or low-lying coastal environments, horizontal directional drilling (HDD) has been adopted. This methodology is proposed in order to:

- Significantly reduce direct soil disturbance within high-risk ASS zones, thereby minimising oxidation of sulfidic materials.
- Significantly reduce dewatering requirements, which can otherwise lower the water table and expose potential ASS to air, triggering acidification.

- Reduce volume of excavated material requiring treatment, stockpiling, or disposal.
- Minimise disturbance to hydrologically and ecologically sensitive receptors, such as mangroves, estuarine zones, and tidal wetlands.

4.2 Nominated Laydown Areas

AECOM has proposed two laydown areas which may be used for stockpiling/treatment of ASS materials and may also be used for mobile water treatment facilities (if required). These areas are strategically located along the southern alignment of the Project footprint. The selection of these laydown sites was based on their logistical accessibility, reduced proximity to environmentally sensitive receptors (e.g. waterways, wetlands), and geotechnical suitability for temporary stockpiling operations. The proposed laydown areas are presented in **Figures 60691504-06** and **60691504-07** in **Appendix A**.

5.0 Further Considerations for Construction

In preparing the ASSMP, the Construction Contractor will need to consider the design aspects presented in Section 4, as well as additional management measures specific to constructability and schedule, based on its construction methodology and program.

It is noted that the level of ASS investigation completed to date will need to be supplemented to enable characterisation at a level sufficient to develop the ASSMP.

5.1 ASS Supplementary Investigation

As part of the preparation of the ASSMP, the Construction Contractor will be required to complete a supplementary ASS Investigation, to collect sufficient data to inform construction risk and management. This review should infill data gaps remaining from the initial ASS investigations, in accordance with sample densities outlined in the National Acid Sulfate Soils Guidance: National acid sulfate soils sampling and identification methods manual (2018a).

5.2 Dewatering and Tidal Influence

Douglas Partners (2023) intersected shallow groundwater levels ranging from approximately 0.6 m to 2.5 m bgl. These shallow ranging conditions suggest that tidal groundwater influence may be present, especially in zones closer to the river and estuarine areas. Tidal groundwater ingress (if occurring) poses several potential risks during trench excavation, including:

- Mobilisation and oxidation of sulfidic materials due to fluctuating water levels and oxygen exposure.
- Increased requirement for dewatering, leading to greater volumes of water requiring treatment.
- Potential for acidified water generation and movement within or beyond the Project footprint.

To minimise the risks associated with tidal groundwater intrusion into excavation zones, the following measures can be put into considerations:

- Timing of excavation activities
  - Where practicable, trench excavation will be scheduled to occur during low tide periods and dry weather windows to reduce groundwater inflow.
  - Shorter open-trench lengths and rapid backfilling to limit the exposure duration of potential ASS to air and water fluctuation.
- Controlled dewatering and treatment (where required). Samples to be collected at intervals in line with the ASSMP during the dewatering operation. If analytical monitoring confirms water is suitable for discharge without treatment, this can be undertaken in accordance with the ASSMP. A mobile water treatment facility could also be considered for construction, groundwater ingress and incidental waters. Subject to meeting required discharge water quality, it is expected that treated

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water will be able to be discharged to environment provided that localised discharge impacts are managed.

- Rapid reinstatement and backfilling
- Excavated trenches could be backfilled promptly with either treated material or inert suitable fill to minimise the exposure of ASS.
- Reinstatement materials should be backfilled sequentially to reduce permeability and recreate post construction groundwater conditions regarding tidal water infiltration post-construction.

The design of the dewatering capture process, transport paths and staged treatment requirements and monitoring should be detailed in a Dewatering Management Plan (DMP).

5.3 Stockpile Management and Treatment of ASS

The Contractor will be responsible for assessing whether onsite reuse or offsite disposal is the most appropriate option for excavated ASS material and water, considering project logistics, environmental constraints, regulatory approvals, and cost-effectiveness.

It will be the responsibility of the Construction Contractor to assess the final liming rates based on completion of suitable soil testing to infill analytical data gaps.

Onsite treatment of ASS should be undertaken in accordance with industry standards, including a suitably designed and hydraulically isolated treatment pad, adoption of a mixing strategy appropriate for soil texture, staged works to limit open trenches, validation sampling and appropriate backfilling process. The design of the treatment pad, including stormwater/ construction water capture process, transport paths and staged treatment areas should be detailed in the ASSMP.

5.4 Onsite Reuse/ Offsite Disposal

It will be the responsibility of the Construction Contractor to determine whether spoil is suitable for reuse (either due to the absence of ASS, via strategic reburial and/or via validation of treatment with lime).

The strategic reburial aims to place the PASS in anoxic, preferably anaerobic (reducing) conditions at the base of a void. This environment will eliminate the sulfide oxidation and preclude the acid generation.
Voids for strategic reburial may be created through the excavation of areas containing non-ASS material or soils that can be effectively treated by alternative means. These voids can be located at depth, such as within the base of a excavations, and subsequently inundated with low or no-flow surface water. Alternatively, reburial voids may be placed at a depth safely below the seasonally lowest groundwater table, and encapsulated beneath compacted non-ASS or appropriately neutralised material to minimise oxygen ingress and prevent acid generation.

In the application of strategic reburial, it is critical to recognise that oxygen can be introduced into the soil profile via both atmospheric diffusion and oxygenated water. Oxygen ingress may occur through several pathways, including:

- Physical disturbance of the soil during excavation, handling, or transport, which exposes it to atmospheric oxygen.
- Stockpiling, which enhances drainage and creates pore spaces within the soil, facilitating both advective and diffusive oxygen movement.
- Burial below the water table where groundwater flow, particularly in permeable or uncompacted soils, may continuously deliver oxygenated water. This risk is elevated in sloped terrain or areas with preferential groundwater pathways, such as palaeochannels.

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A verification testing protocol must be implemented to confirm that materials containing Actual and/or Retained Acidity are not being reburied. Throughout the reburial process, regular monitoring of water pH should be undertaken to detect any potential oxidation of PASS or dissolution of acid salts. A drop in pH below 6.5 should trigger the immediate suspension of excavation and reburial activities, as it may indicate the presence of untreated acidity. In such cases, representative soil samples should be collected for laboratory analysis to quantify Actual and/or Retained Acidity. If the material repeatedly fails to meet performance criteria, it may require re-excavation and further treatment, and the site may ultimately be deemed unsuitable for strategic reburial.

Regardless of the strategy adopted, there a portion of the excavated material that will need to be disposed offsite due to the trench volume taken up by the new pipe and imported embedment material.

On that basis, it is considered unlikely that an reburial procedure will be able to be implemented on this project.

If considered more practicable given space or other logistical considerations, the Construction Contractor may choose to liaise with both Townsville City Council and a suitably licenced landfill to develop a program to accept material (either treated or untreated). If landfill disposal for some material is required, pre-treatment of material prior to disposal may prove a more cost effective and streamlined option. Off-site disposal of materials confirmed as contaminated from land parcels recorded on the QLD Environmental Management Register (EMR) will require a DETSI approved Soil Disposal Permit (SDP).

Some landfills are able to accept and treat ASS, this would need to be agreed to in advance as part of the material acceptance process and would incur a higher disposal cost. This option does not negate the need for the Construction Contractor to prepare the ASSMP as this would form part of the disposal acceptance documentation.
Depending on the nature of the waste requiring disposal, certain management, transport and tracking obligations may be applicable and will be required to be complied with.

5.5 Environmental Monitoring

The ASSMP prepared by the Construction Contractor will include provision for environmental monitoring during and for a period immediately post construction to confirm that no impact to the surrounding environment has occurred. Performance criteria and verification testing requirements will vary based on the specific management strategies adopted. Monitoring should be undertaken in accordance with the technical ASS guidance provided in Section 3.0.

5.6 Emergency Management and Unexpected Finds

The ASSMP is to also address incidental releases or erosion associated with unexpected events such as inclement weather or other unforeseen circumstances. This should be completed in conjunction with the Project CEMP.

6.0 Limitations

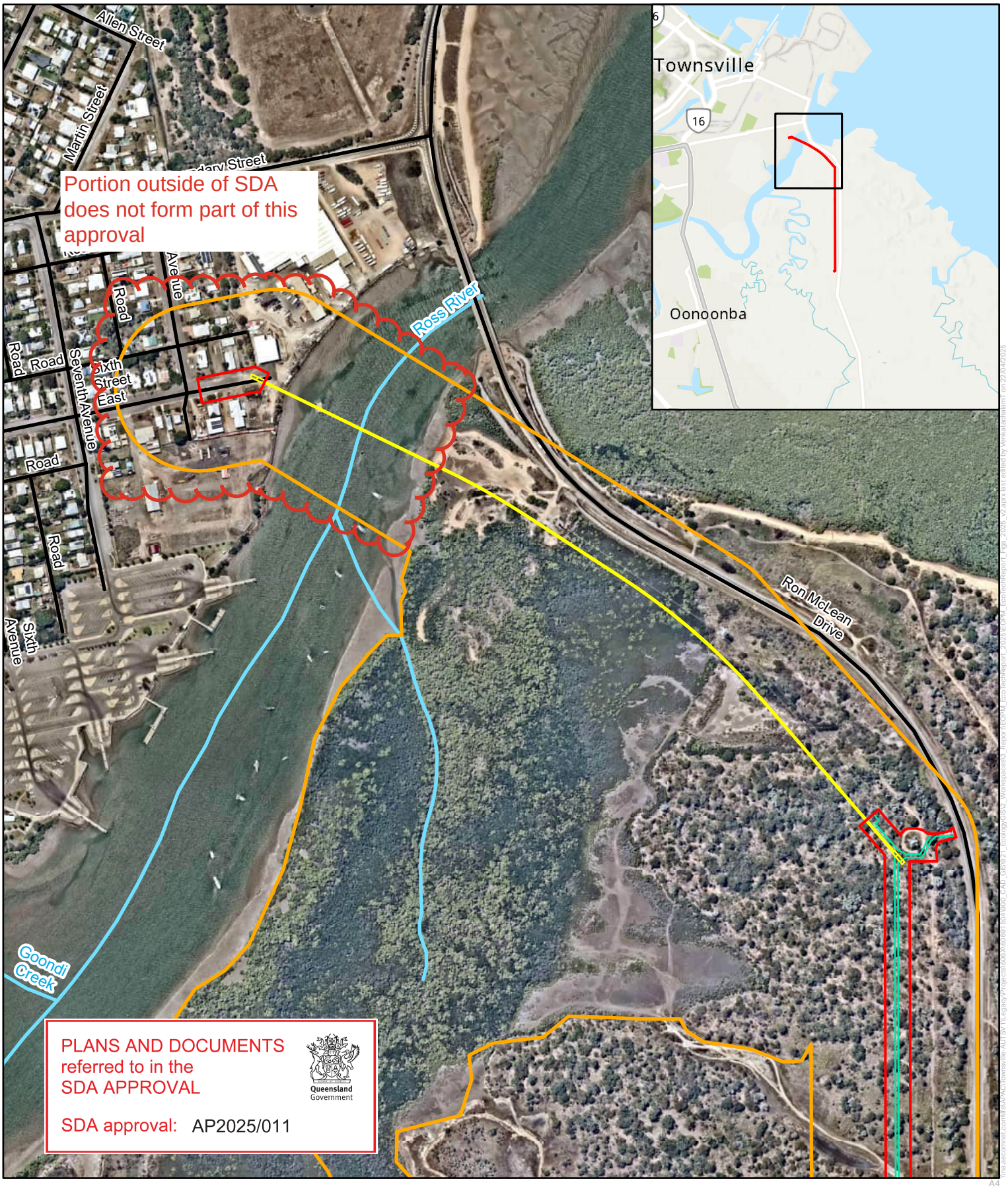
The information provided in this document is considered as guidance only for design and construct considerations related to ASS as part of the EOPM Project. It is provided in the interests of fostering project success and protection of sensitive environmental values within and adjacent to the Project disturbance footprint. The Construction Contractor will be responsible for management of all environmental risk during construction.

The information and advice contained within this guidance document should be considered preliminary in nature and has been prepared with consideration to the technical reports listed in this Report only. As

such, other relevant technical ground investigation reports may exist which are the subject of the land in which the Project footprint is situated. Should other relevant data or documentation be available, this should also be considered in line with the advice in this guidance document and, where appropriate and scientifically robust, be incorporated into future design and construct considerations, in the context of ASS occurrence, anticipated extent of disturbance and groundwater vulnerability to acidification.

This report does not consider the presence of potential or actual contamination.

Where any additional relevant ground investigation reports are, or become, available and which encompass some, or all, of the recommended scopes of work to be undertaken in this document, the scope, methodologies, data validity, and findings of these additional reports should be assessed against existing data. Any residual knowledge or data gaps which remain, should be addressed in accordance with the advice in this guidance document.



AECOM

N

0 100 200
metres

Eastern Outfall Pressure Main
Figure 1-1

Project Area

Legend

- Project area
- Permanent access tracks
- Under-boring
- Entry and exit pits
- Study area
- Roads
- Watercourses

Date: 04/02/2026

AMENDMENTS IN RED

Project: 60691504
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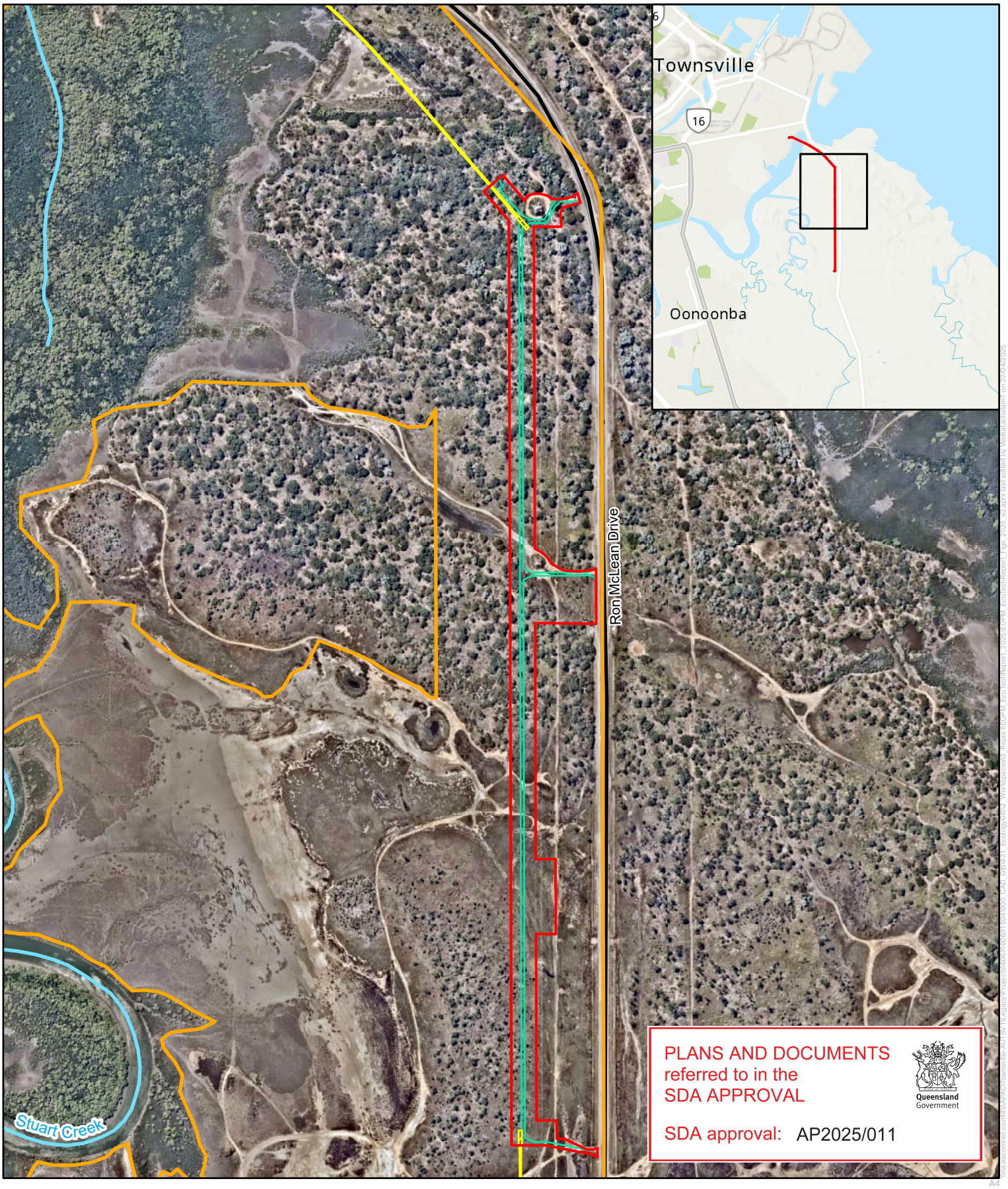

PLANS AND DOCUMENTS referred to in the SDA APPROVAL

Queensland Government

SDA approval: AP2025/011

AECOM

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0 100 200
metres

Eastern Outfall Pressure Main
Figure 1-2

Project Area

Legend

- Project area
- Permanent access tracks
- Under-boring
- Entry and exit pits
- Study area
- Roads
- Watercourses

Date: 04/02/2026

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Project: 60691504
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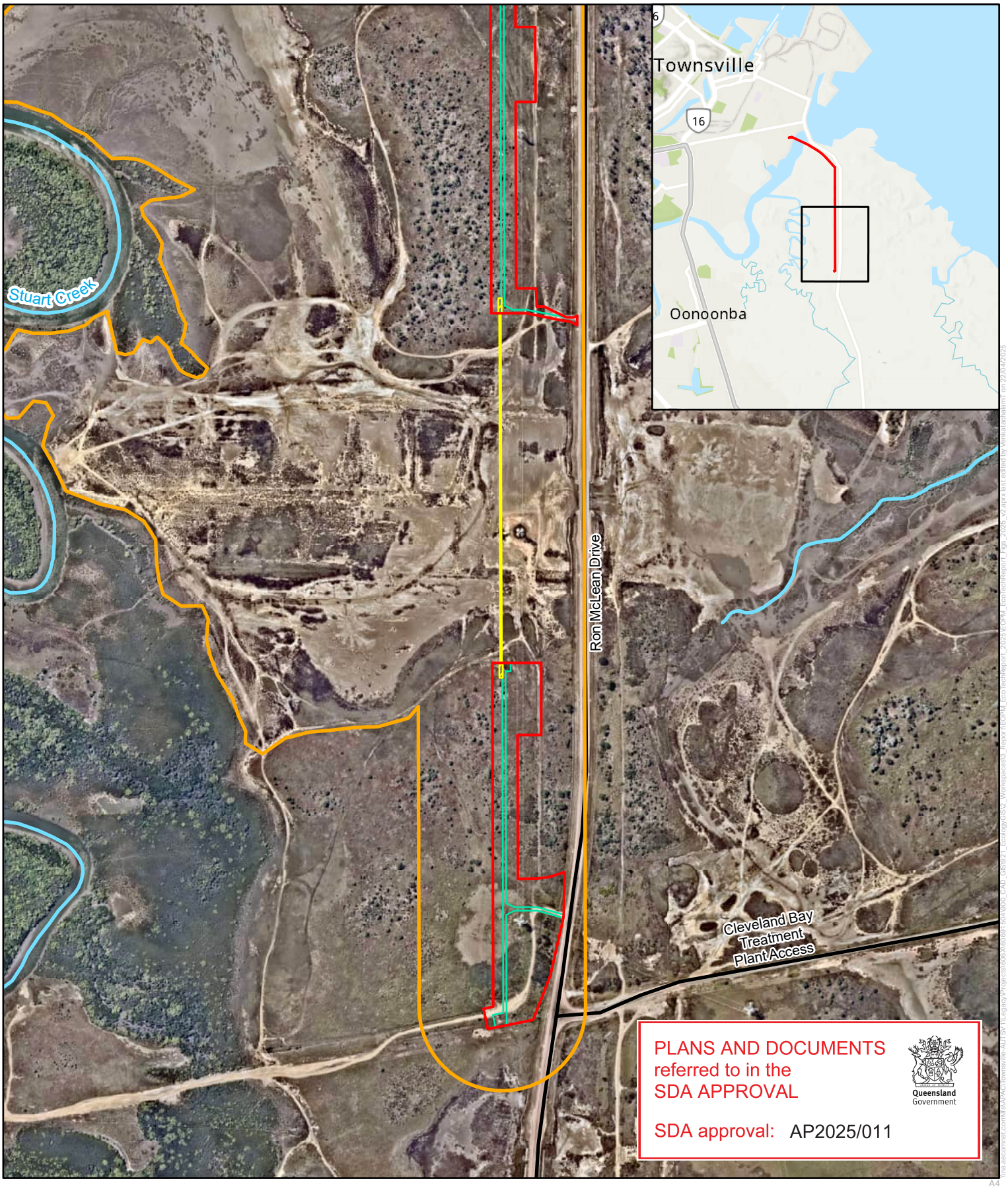

AECOM

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0 100 200
metres

Eastern Outfall Pressure Main
Figure 1-3

Project Area

Legend

- Project area
- Permanent access tracks
- Under-boring
- Entry and exit pits
- Study area
- Roads
- Watercourses

Date: 04/02/2026

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