Australian Government

Department of Infrastructure, Transport, Regional Development and Communications

Department of Infrastructure, Transport, Regional Development and Communications

Christmas Island Drainage Remediation Works

Technical Specification for Works

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1. General Requirements

1.1 Introduction

The Department of Infrastructure, Transport, Regional Development and Communications (DITRDC) have requested a review of the stormwater and drainage at the Drumsite on Christmas Island. There have been several landslips and significant flooding events resulting in damage to town site infrastructure over recent years especially in areas adjacent the Christmas Island District High School, Flying Fish Cove, Port and Kampong. The most significant of these events occurred in Flying Fish Cove towards the western end of the Kampong residential area and the nearby Port Managers office where the rock fall fence was flattened and large quantities of rock, soil and debris blocked the main access to the fuel farm along with the wastewater and water treatment facilities. The observed landslips have caused significant damage to down-gradient infrastructure. The flooding events have also resulted in some low-lying buildings becoming flooded along with erosion and deposition damage in several locations.

The anecdotal and observed evidence suggest that runoff from the Drumsite area has been significant contributor to these issues.

Due to the layout of the area in which work are being undertaken, the project has been split into three defined areas, Northern, Central and Southern Drumsite areas. Each of these areas have their own distinct catchments and will be referred to by these names throughout the document.

As a result of the flooding and landslip issues the DITRDC secured funding to undertake a study into the flooding in the Drumsite area. This study has recommended several changes and upgrades to the Drumsite stormwater management system design to reduce the potential impacts of flooding in the areas previously mentioned. Based on the study and in consultation with several stakeholders it was determined that a number of priority works needed to be undertaken. These works are detailed within the associated drawings and documentation. They form the focus of the documentation contained within this Specification.

1.2 Proposed Works

The Department of Infrastructure, Transport, Regional Development and Communications have confirmed the following *Works Under the Contract* (*WUC*) to be conducted as a part of the total stormwater and drainage package provided by GHD. The following works are conducted in the Northern, Central and Southern Drumsite's respectively along with works on the George Fam Incline adjacent to the Water Corporation Tank and George Fam Centre:

1.2.1 Northern Drumsite and Incline

Works within the Northern Drumsite comprise the construction of the following key elements of the design:

1. Undertake clearing and removal of vegetation throughout the works in adherence with the provided clearing permit for the Works.
2. Supply and install approximately 1,070 metres of stormwater drainage pipes and trench drains throughout the area to direct runoff from the Northern Drumsite area to compensation storages and structures adjacent and on the George Fam Incline. Pipework is to be installed along, within and adjacent roadways including Murray Road, Lam Lok Loh, Tong Yan Loh, Sung Miaw Loh and the Incline Access Road.
3. Supply and install approximately 60 stormwater structures including manholes, gully pits, combination side entry pits, high flow pits, headwalls and purpose built and designed pits

4. Construction of the Drive Over Diversion Structure (also referred to as Incline Diversion Structure) that includes a large trafficable grate, weirs, internal control pipes, structural walls, and footings.
5. At the Drive Over Structure temporary relocation/ protected and/or replaced of the existing gravity sewer, water main and underground electrical services directly adjacent the *WUC* is possible . The *Contractor* confirm if this is required and then develop and implement a construction methodology for the management of these assets in consultation with the relevant Authorises and *Superintendent's Representative*.
6. Construction of the Incline Drain and associated Incline Outlet Structure into the Incline Basin.
7. Construction of the Incline Basin including associated pipework, pits, headwalls, erosion protection and embankment protection works.
8. Undertake additional site preparation works and investigations for the Incline Diversion Drain and Incline Basin to confirm assumed design arrangements presented on the design drawings prior to construction of associated civil works.
9. Construction of the Northern Drumsite Basin 1 adjacent Lam Lok Loh and Murray Roads including lining, soft landscaping, and associated drainage infrastructure.
10. Construction of the Incline Bund and Incline Retaining Wall within the existing mining lease areas.
11. Removal of existing drainage infrastructure as detailed on the drawings.
12. Removal of approximately 15 metres length of the historical Incline Climbing Rail infrastructure for future reassembly for display in accordance with Heritage Requirements.
13. Undertake road reinstatement and resurfacing along Murray Road throughout the extent of the Works.
14. Undertake reshaping and resurfacing of the existing car parking on Tong Yan Loh, including installation of kerbing and drainage.
15. Undertake road reinstatement and partial width resurfacing of various roads throughout the extent of the Works.
16. Undertake kerb reinstatement and installation associated with the works along roadways through the Works.
17. Install security fencing and handrailing surrounding key open basins and drains associated with the Incline Drive Over, Drain, Outlet and Basin with allowance for crab migration and movement.

1.2.2 Central Drumsite

1. Supply and install approximately 390 metres of stormwater drainage pipe throughout the area to direct runoff from the Central Drumsite area to compensation storages and structures adjacent the George Fam incline. Pipework is to be installed along, within and adjacent roadways including Murray Road, Lam Lok Loh, Golden Bosen and Jalan Ketan Merah.
2. Supply and install approximately 20 stormwater pits including manholes, gully pits, combination side entry pits.
3. Removal of existing drainage infrastructure as detailed on the drawings.

4. Undertake road reinstatement and partial width resurfacing of various roads throughout the extent of the works.
5. Undertake kerb reinstatement and installation associated with the works along roadways through the Works.

1.2.3 Southern Drumsite

1. Undertake clearing and removal of vegetation throughout the works in adherence with the provided clearing permit for the Works.
2. Supply and install approximately 780 metres of stormwater drainage pipes throughout the area to direct runoff from the Southern Drumsite area to compensation storages and structures adjacent the Christmas Island District High School (CIDHS). Pipework is to be installed along, within and adjacent roadways including Murray Road, Lam Lok Loh and within the CIDHS.
3. Supply and install approximately 35 stormwater pits including manholes, gully pits, combination side entry pits, high flow pits, headwalls and purpose built and design pits
4. Removal of existing drainage infrastructure as detailed on the drawings.
5. Undertake reshaping and resurfacing of the existing entrances to the CIDHS including installation of kerbing, channels, and drainage.
6. Undertake road reinstatement and partial width resurfacing of various roads throughout the extent of the Works.
7. Undertake kerb reinstatement and installation associated with the works along roadways through the Works.
8. Install security fencing surrounding key open basins associated with the Southern Drumsite Basin with allowance for crab migration and movement.
9. Construction of a concrete speed and drainage diversion hump to the south of the CIDHS on Murray Road including all associated signage.

1.2.4 Northern George Fam Incline

Supply and install the proposed revised Incline Outlet Structure adjacent Murray Road including all associated earthwork, civil, structural and other modifications as detailed on the drawings.

1.3 Definitions

a. The Project Site is the site for drainage related works on Christmas Island.

b. The "*Client*" means The Department of Infrastructure, Transport, Regional Development and Communications or their authorised representative.

c. The "*Contractor*" means the company bound to execute the *WUC*.

d. "Tender" is the Contractual process devised by the *Client* to select a preferred *Contractor*.

e. "*Contract*" is the *Contract* between the *Contractor* and the *Client* for drainage works.

f. "*Superintendent's Representative*" is the appointed person/s or company representing the "*Client*" in relation to the *WUC*.

g. "*Superintendent's Representative*" where referred to in any documentation related to the WUC means *Superintendent's Representative.*

1.4 General Requirements

The *Contractor* shall construct the Works to the lines, levels, grades and in the locations using the material and methods as specified and as shown on the Drawings.

The *Contractor* shall carry out all aspects of the Works described in the Specification, including, but not limited to:

a. Satisfying all of the requirements and criteria of the *Contract* documents;

b. Providing temporary works for access, storage of construction materials and equipment and dealing with water;

c. Performing general *Contract* management tasks including programming, safety and environmental aspects;

d. Managing environmental issues at the site to minimise the impacts on the environment;

e. Carrying out all performance and commissioning testing in accordance with the Specification; and

f. Providing 'As-Constructed' records, asset register details and manuals for the Works as specified.

If insufficient detail or instruction is provided in the Specification and Drawings, the *Contractor* shall seek instruction from the *Superintendent's Representative* prior to commencement.

1.5 List of Abbreviations

The list of major abbreviations used within this document is detailed in Table 1-1. Should an abbreviation not be detailed here the *Contractor* should seek clarification from the *Superintendent's Representative*.

Table 1-1 List of Abbreviations

Abbreviation	Description
AAR	alkali aggregate reaction
ABS	Acrylonitrile butadiene styrene
ACM	Asbestos Cement Material
ARR	Australian Rainfall and Runoff
ASME	American Society for Mechanical Engineers
AS	Australian Standard
ASA	Acrylonitrile styrene acrylate
ASS	Acid Sulfate Soils
ASTM	American Society for Testing Materials
BM	Bench Marks
BMP	Borrow Management Plan
CBR	California Bearing Ratio
CC	Concrete Canvas
CCMP	*Contractor* Construction Management Plan
CCTV	Closed Circuit Television
CEMP	Contractor Environmental Management Plan
CI	Christmas Island
CIA	Concrete Institute of Australia
CIDHS	Christmas Island District High School
CIHD	Christmas Island Height Datum

Abbreviation	Description
CIP	Christmas Island Phosphate
CIV	Clegg Impact Value
CPS	Clearing Permit
CRS	Cationic Rapid Setting
D-Spec	Digital Standard Specification for Stormwater Drainage Information
DI	Density Index
DITRDC	Department of Infrastructure, Transport, Regional Development and Communications
DAWE	Department of Agriculture, Water and the Environment (Commonwealth)
DCP	Dynamic Cone Penetrometer
DPLH	Department of Planning. Lands and Heritage (Western Australia)
DS	Design Standard
DWER	Department of Water and Environmental Regulation (Western Australia)
DWG	Drawing Electrical Format
DXF	Drawing Exchange Format
EOS	Equivalent Opening Size
EP	Environmental Protection
FRC	Fibre Reinforced Cement
GB	General Builders (Cement)
GDA	Geocentric Datum of Australia
GP	General Purpose (Cement)
GPS	Global Positioning System
GPT	Gross Pollutant Trap
gsm	grams per square meter
HB	Handbook
HDPE	High Density Polyethylene
HDR	Hilf density ratio
HSE	Health Safety and Environment
IOTPS	Indian Ocean Territories Power Service
IPWEA	Institute of Public Works Engineers Australasia
ISO	International Organization for Standardization
ITP	Inspection Testing Plan
JSEA	Job Safety and Environmental Analysis
LH	Low Heat (Cement)
MGA	Mapping Grid of Australia
MMDD	Modified Maximum Dry Density
MPa	Mega pascals
mPVC / PVC-M	Modified Polyvinyl Chloride
MRWA	Main Roads Western Australia
NATA	National Associations of Testing Authorities
NOHSC	National Occupational Health and Safety Commission
NPK / N:P:K	Nitrogen Phosphorus Potassium
NZS	New Zealand Standard
OD or O.D.	Outside Diameter
OMC	Optimum Moisture Content
OSH	Occupational Safety and Health

Abbreviation	Description
PA	Parks Australia (Commonwealth)
PE	Polyethylene
PSD	Particle size distribution
PQP	Project Quality Plan
PQR	Project Quality Representative
PVC	Plasticised Polyvinyl Chloride
Q	Flow
QAR	Quality Assurance Representative
RL	Relative Level
RTK-GPS	Real time kinematic Global Positioning System
SA	Standards Australia
SDS	Safety Data Sheets
SoCI	Shire of Christmas Island
SMDD	Standard Maximum Dry Density
SS	Stainless Steel
SSM	Standard Survey Mark
SSSI	Surveying and Spatial Sciences Institute
SPT	Standard Penetration Test
TAFE	Technical and Further Education
TSS	Total Soluble Salts
UCS	Uniaxial compressive strength
uPVC . PVC-U	Unplasticised Polyvinyl Chloride
WA	Western Australia
WR	Water Reducer (Concrete)
WRRe	Water Reducing Set Retarding (Concrete)
WUC	*Work under Contract*
WAPC	Western Australian Planning Commission

1.6 Scope of Works

This document outlines the technical specifications for the construction of drainage (stormwater) and related earthworks, road modification and reinstatement of infrastructure as part of the Christmas Island Stormwater Remediation Works. The *WUC* are generally located within the Drumsite area of the Christmas Island residential area other than that detailed at the northern end of the George Fam Incline adjacent Murray Road.

The *works* to be executed under this *Contract* shall include all items of work set out or implied in the *Contract* documents including but not limited to:

a. The Scope of Works Document,

b. The Specifications,

c. The Drawings, and

d. Other Construction Management documents including Environmental Plans and all further work necessarily incidental to the proper completion of the *WUC*, including provision of all labour, supervision, administration, and management and supplying all materials, plant, equipment and services necessary.

The *WUC* included in this Specification shall include, but are not necessarily limited to the following:

1. Site preparation;
2. Civil earthworks;
3. Drainage works;
4. Structural works;
5. Geotechnical Investigations;
6. Road and footpath works; and
7. Landscaping works.

The *Contractor* must also produce a *Contractor* Construction Management Plan (CCMP) for the site and include the following management strategies/plans:

a. Borrow Management Plan;
b. Site Management Strategy;
c. Laydown area's Plan;
d. Shipping and Freight Plan/Strategy;
e. Traffic Management Plan/Strategy;
f. *Contractor* Environmental Management Plan (CEMP) containing but not limited to:
   - Control of noise and atmospheric pollution;
   - Flora and Fauna Management Strategy;
   - Control of erosion and sedimentation;
   - Surface Water Management Strategy;
   - Emergency Management Plan (flooding events);
   - Heritage Management Strategy
   - Waste Management Strategy;
   - Asbestos Management Strategy;
   - Land clearing strategy (including compliance with CPS 8472_1).
g. Compliance with all CIP mine site requirements;
h. Compliance with all other stakeholder requirements;

The following sections provide a general description of the *WUC*. Details of the *WUC* are provided in subsequent sections of the Specification and on the Drawings.

1.6.1 Site Preparation

Site preparation includes, but is not limited to the following:

a. Undertaking survey and demarcation of areas requiring clearing;
b. Clearing, stripping and grubbing of the site;
c. Removal of unsuitable material;
d. Removal and preservation of historical Incline Climbing Rail infrastructure;
e. Undertaking additional field testing;
f. Surface water management as per the CCMP.

1.6.2 Civil Earthworks

Civil earthworks include, but are not limited to the following:

a. Construction of temporary basins and bunds;

b. Preparation of site for construction works (access tracks etc.);

c. Excavation and backfill of trenches, including placement and compaction of bedding for pipes and/or reinstatement of pavement materials.

d. Excavation/construction of structures, drains, basin and bunds;

e. Placement and compaction of engineered fill to the lines, levels and grades shown on the Drawings;

- Trimming of placed fill to the tolerances contained in this Specification.
- Placement of embankment and erosion protection works.

All *WUC* associated with general earthworks of the site such as and including the shaping of the levels within drainage basins and swales is included within this Specification and the Drawings. Unless otherwise specified within the Drawings and Specification, earthworks associated with drainage infrastructure shall conform to AS 3798.

1.6.3 Drainage Works

Drainage *WUC* include, but are not limited to the following:

a. Supply and Installation of drainage pipework, including embankments, trenches and backfilling;

b. Supply and Installation of drainage structures including (but not limited to):

- weirs;
- gully pits;
- combination pits
- junction/manhole pits;
- insitu pits and structures;
- culverts;
- safety screens and trash racks
- endwalls/headwalls;
- erosion protect measures;
- low/high flow outlets; and
- other infrastructure as shown on the Drawings;

c. Connection of drainage *WUC* into existing drainage and where required replacement of the existing structures;

1.6.4 Roadworks

Roadworks *WUC* include, but are not limited to the following:

a. Foundation preparation;

b. Supply, placement and compaction of all pavement materials including construction of tie-ins, reinstatement and resurfacing;

c. Supply and install of all kerbing, channels, paths, and other associated infrastructure,

d. Supply and install all signage associated with the works as specified on the Drawings.

e. Supply and install all traffic calming measures detailed on the Drawings.

1.6.5 General *WUC*

General and ancillary *WUC* include, but are not limited to the following:

a. Protection and or relocation of existing services including but not limited to water, sewer, telecommunications and power supply;

b. Reconstruction and reinstatement of roadways, retaining walls, kerbs, safety barriers;

c. Installation of safety measures including fencing, barriers, signage; bollards and chains;

d. Other *WUC* as specified on the Drawings

1.6.6 Soft Landscaping *WUC*

Landscaping *WUC* include, but are not limited to the following:

a. Removal and stockpiling of existing topsoil for reuse;

b. Removal and reuse of existing turfed areas as detailed;

c. Supply and installation of topsoil as required across the site;

d. Supply and installation of plants or grasses;

e. Site preparation, including weed control; and

f. Plant maintenance during the plant establishment period.

1.7 *Client* Supplied Items

All materials for this project are to be supplied as part of the construction *Contract* unless otherwise specified in the Specification or on the Drawings.

1.8 Documentation

This Technical Specification addresses only the *WUC* that are not already addressed in the specifications listed below. General requirements, including, but not limited to site management, financials, liabilities, inspections, quality assurance, damage, safety, restoration, survey, and restoration, are addressed in the specifications listed below. Where this Specification references other related specification documents such as MRWA Specifications or Water Corporation Specifications these are to be read in conjunction with this Specification, where any conflict exists the following is to apply:

- With regards to the installation of water pipeline *WUC* the greater of this Specification or that of the applicable Water Corporation requirement are to be adopted for the water pipeline WUC.
- Typically the MRWA specification requirement to the specific element of the WUC being referenced is to follow the MRWA Specification requirement unless detailed otherwise.

1.9 Precedence

The order of precedence of the *Contract* documents shall be

1. The Conditions of Contract (Building Works Contract);
2. The current design Drawings;
3. The Specification (this document);
4. Local Government standards relevant to the work item being undertaken; and
5. Australian Standards relevant to the work item being undertaken.

1.9.1 Current Editions

Use referenced documents which are editions, with amendments, current 3 months before the closing date for tenders, except where other editions or amendments are required by statutory authorities. When requested by the *Superintendent's Representative*, the *Contractor* shall provide copies of referenced documents and keep them on site for the use of the *Contractor* and the *Superintendent's Representative*.

1.9.2 Contractual Relationships

Responsibilities and duties of the *Client*, *Contractor* and *Superintendent's Representative* are not altered by requirements in referenced documents.

1.9.3 Safety in Design Report

A Safety in Design Risk Assessment has been prepared that identifies residual risk items and issues. The report is in Appendix A.

1.9.4 Local, State and Industry Standards and Guidelines

The *WUC* are located within the Shire of Christmas Island (SoCI) and the current technical standards for civil work issued by the local authority apply to this Specification. Where not specified in the Drawings or the Specification, the current local authority standards shall be assumed.

For convenience, the relevant local, state and industry standards and guidelines that have been considered as part of the overall design of the *WUC* are detailed in Table 1-2 below.

Table 1-2 Local, State and Industry Standards and Guidelines

Author	Description	Date
Engineers Australia	Australian Rainfall and Runoff - A Guide to Flood Estimation Edition 3	1997
Engineer Australia	Australian Rainfall and Runoff: A Guide to Flood Estimation	2019
Department of Water	Stormwater Management Manual for Western Australia.	2007
Department of Water	Urban Water Management Plan: Guidelines for preparing plans and complying with subdivision conditions.	2008
WAPC	Better Urban Water Management	2008
Austroads	Guide to Road Design - Part 5: Drainage – General and Hydrology Considerations	2013
Austroads	Guide to Road Design - Part 5A: Drainage – Road Surface, Networks, Basins and Subsurface	2013
Austroads	Guide to Road Design - Part 5B: Drainage – Open Channels, Culverts and Floodways	2013
IPWEA Guideline	Local Government Guidelines for Subdivisional Development	2017
MRWA	Code of Practice Traffic Management for Works on Roads	2020
Utility Providers Services Committee	Utility Provider Code of Practice – Western Australia	2018
Safe Work Australia	Code of Practice Excavation Work	2018
Safe Work Australia	Code of Practice Construction Work	2018

Author	Description	Date
Safe Work Australia	Code of Practice How to Safely Remove Asbestos	2020
NOHSC	Code of Practice for the Safe Removal of Asbestos 2nd Edition	2005
Water Corporation	Design Standard DS 50 - Design and Construction Requirements for Gravity Sewers DN150 to DN600	2019
Water Corporation	Design Standard DS 60 - Water Supply Distribution Standard Pipelines Other than Reticulation	2018
Water Corporation	Design Standard DS 63 - Water Reticulation Standard Design and Construction Requirements for Water Reticulation Systems up to DN250	2020
Water Corporation	Design Standard DS 65 - Pipe Fittings Standard Drawings	2020
Water Corporation	Design Standard DS 80 - WCX CAD Standard Water Corporation eXternal (WCX) Manual	2015

Where this Specification or the associated Drawings do not detail specific requirements the above documents should be used as a guide.

1.9.5 Australian and International Standards

All workmanship and materials used in the *WUC* shall conform to the current edition of the appropriate Australian Standard.

Where the regulatory Authority's requirement differs from the Australian Standards for *WUC* in the CI Drainage project, the regulatory Authority's requirement shall prevail.

For convenience, the Australian Standards referred to in this document are listed in Table 1-3, below. Where an applicable Australian Standard does not exist various International Standards may be applied, these are listed in Table 1-4. Table 1-5 contains other guidance documents referenced within the Specification that are to be complied with unless otherwise agreed.

Except as otherwise specified or shown on the Drawings, all material shall conform to the requirements of the following listed specifications and standards: Should a discrepancy exist, consultation with the *Superintendent's Representative* will be required.

Table 1-3 Reference Australian Standards

Standard	Description
AS 1012.1	Methods of testing concrete - Sampling of concrete
AS 1012.3.1	Methods of testing concrete - Determination of properties related to the consistency of concrete - Slump test
AS 1012.9	Methods of testing concrete - Compressive strength tests - Concrete, mortar and grout specimens
AS 1100.401	Technical Drawing – Engineering survey and engineering survey design drawing
AS 1111.1	ISO metric hexagon bolts and screws - Product grade C - Bolts
AS 1141	Methods for Sampling and Testing Aggregates
AS 1141.11.1	Methods for sampling and testing aggregates - Particle size distribution - Sieving method
AS 1141.60.1	Methods for sampling and testing aggregates – Potential alkali-silica reactivity – Accelerated mortar bar method
AS 1141.60.2	Methods for sampling and testing aggregates – Potential alkali-silica reactivity – Concrete prism method
AS 1141.60.3	Methods for sampling and testing aggregates – Alkali aggregate reactivity – Qualitative petrological screening for potential alkali-silica reaction
AS 1214	Hot-dip galvanized coatings on threaded fasteners (ISO metric coarse thread series)

Standard	Description
AS 1237	Plain washers for metric bolts, screws and nuts for general purposes
AS 1289	Methods for Testing Soils for Engineering Purposes
AS 1289.3.1.1	Methods of testing soils for engineering purposes - Soil classification tests - Determination of the liquid limit of a soil - Four point Casagrande method
AS 1289.3.3.1	Methods of testing soils for engineering purposes - Soil classification tests - Calculation of the plasticity index of a soil
AS 1289.3.6.1	Methods of testing soils for engineering purposes - Soil classification tests - Determination of the particle size distribution of a soil - Standard method of analysis by sieving
AS 1289.5.1.1	Methods of testing soils for engineering purposes - Soil compaction and density tests - Determination of the dry density/moisture content relation of a soil using standard compactive effort
AS 1289.5.2.1	Methods of testing soils for engineering purposes - Soil compaction and density tests - Determination of the dry density/moisture content relation of a soil using modified compactive effort
AS 1289.5.3.1	Methods of testing soils for engineering purposes - Soil compaction and density tests - Determination of the field density of a soil - Sand replacement method using a sand-cone pouring apparatus
AS 1289.5.4.1	Methods of testing soils for engineering purposes - Soil compaction and density tests - Compaction control test - Dry density ratio, moisture variation and moisture ratio
AS 1289.5.7.1	Methods of testing soils for engineering purposes - Soil compaction and density tests - Compaction control test - Hilf density ratio and Hilf moisture variation (rapid method)
AS 1289.5.8.1	Methods of testing soils for engineering purposes - Soil compaction and density tests - Determination of field density and field moisture content of a soil using a nuclear surface moisture–Density gauge - Direct transmission mode
AS 1289.6.3.2	Methods of testing soils for engineering purposes Soil strength and consolidation tests - Determination of the penetration resistance of a soil - 9 kg dynamic cone penetrometer test
AS 1289.6.9.1	Methods of testing soils for engineering purposes - Soil strength and consolidation test Determination of stiffness of soil
AS 1379	Specification and Supply of Concrete
AS 1478	Chemical admixtures for concrete, mortar and grout
AS 1478.1	Chemical admixtures for concrete, mortar and grout - Admixtures for concrete
AS 1478.2	Chemical admixtures for concrete, mortar and grout - Methods of sampling and testing admixtures for concrete, mortar and grout
AS 1597.1	Precast Reinforced Concrete Box Culverts, Part 1: Small Culverts (not exceeding 1200 mm span and 1200 mm height)
AS 1597.2	Precast reinforced concrete box culverts - Large culverts (exceeding 1200 mm span or 1200 mm height and up to and including 4200 mm span and 4200 mm height)
AS 1646	Elastomeric Seals for Waterworks Purposes
AS 1725	Chain-link fabric security fences and gates
AS 1726	Geotechnical Site Investigations
AS 1742	Manual of uniform traffic control devices
AS 1742.3	Manual of uniform traffic control devices – Traffic control for works on roads
AS 1831	Ductile cast iron
AS 2124	General Conditions of *Contract*
AS 2439.1	Perforated plastics drainage and effluent pipe and fittings - Perforated drainage pipe and associated fittings
AS 2758.1	Aggregates and rock for engineering purposes-Concrete aggregates
AS 2865	Confined spaces

Standard	Description
AS 2876	Concrete kerbs and channels (gutters) – Manually or machine placed
AS 3582.1	Supplementary cementitious materials - Fly ash
AS 3582.2	Supplementary cementitious materials - Slag - Ground granulated blast-furnace
AS 3582.3	Supplementary cementitious materials - Amorphous silica
AS 3600	Concrete Structures
AS 3610	Formwork for Concrete
AS 3700	Masonry Structures
AS 3705	Geotextiles - Identification, marking and general data
AS 3706.1	Geotextiles - Methods of test-General requirements, sampling, conditioning, basic physical properties and statistical analysis
AS 3706.4	Geotextiles - Methods of test-Determination of burst strength - California bearing ratio (CBR) - Plunger method
AS 3706.5	Geotextiles - Methods of test - Determination of puncture resistance - Drop cone method
AS 3706.7	Geotextiles - Methods of test - Determination of pore-size distribution - Dry-sieving method
AS 3706.9	Geotextiles - Methods of test-Determination of permittivity, permeability and flow rate
AS 3706.11	Geotextiles - Methods of test-Determination of durability - Resistance to degradation by light, heat and moisture
AS 3743	Potting mixes
AS 3798	Guidelines on earthworks for commercial and residential developments
AS 3799	Liquid membrane-forming curing compounds for concrete
AS 3972	General Purpose and Blended Cements
AS 3996	Access Covers and Grates
AS 4100	Steel Structures
AS 4139	Fibre Reinforced Concrete Pipes and Fittings
AS 4198	Precast Concrete Access Chambers for Sewerage Applications
AS 4419	Soils for landscaping and garden use
AS 4454	Compost, soil conditioners and mulches
AS 4586	Slip resistance classification of new pedestrian surface materials
AS/NZS 1252	High strength steel bolts with associated nuts and washers for structural engineering
AS/NZS 1254	PVC-U pipes and fittings for stormwater and surface water applications
AS/NZS 1428.2	Design for access and mobility - Enhanced and additional requirements - Buildings and facilities
AS/NZS 1477	PVC Pipes and Fittings for Pressure Applications
AS/NZS 1547	On-site domestic wastewater management
AS/NZS 1554.1	Structural steel welding - Welding of steel structures
AS/NZS 1554.3	Structural steel welding - Welding of reinforcing steel
AS/NZS 1554.6	Structural steel welding-Welding stainless steels for structural purposes
AS/NZS 2032	Installation of PVC Pipe Systems
AS/NZS 2033	Installation of Polyethylene Pipe Systems
AS/NZS 2416	Water safety signs and beach safety flags
AS/NZS 2425	Bar chairs in reinforced concrete - Product requirements and test methods
AS/NZS 2566.1	Buried flexible pipelines Part 1: Structural design
AS/NZS 2566.2	Buried flexible pipelines Part 2: Installation
AS/NZS 3500.3	Plumbing and Drainage – Stormwater Drainage
AS/NZS 3678	Structural steel - Hot-rolled plates, floorplates and slabs

Standard	Description
AS/NZS 3679.1	Structural steel - Hot-rolled bars and sections
AS/NZS 3725	Design for Installation of Buried Concrete Pipes
AS/NZS 3879	Solvent Cements and Priming Fluids for PVC (PVC-U and PVC-M) and ABS and ASA Pipes and Fittings
AS/NZS 4058	Precast Concrete Pipes (Pressure & Non Pressure)
AS/NZS 4087	Metallic Flanges for Waterworks Purposes
AS/NZS 4129	Fittings for polyethylene (PE) pipes for pressure applications
AS/NZS 4130	Polyethylene (PE) Pipes for Pressure Applications
AS/NZS 4131	Polyethylene (PE) Compounds for Pressure Pipes and Fittings
AS/NZS 4455	Masonry Units, Pavers, Flags And Segmental Retaining Wall Units
AS/NZS 4671	Steel Reinforcing Materials
AS/NZS 4680	Hot-Dipped Galvanized (zinc) Coatings on Ferrous Articles
AS/NZS 4765	Modified PVC (PVC-M) pipes for pressure applications
AS/NZ 5065	Polyethylene and polypropylene pipes and fittings for drainage and sewerage applications
AS/NZS ISO 10005	Quality management systems - Guidelines for quality plans
AS/NZS ISO 3905.12	Quality system guidelines - Guide to AS/NZS ISO 9001 for architectural and engineering design practices
AS/NZS ISO 9001	Quality management systems - Requirements

Table 1-4 Other international Standards

Standard	Description
ASTM C295	Standard Guide for Petrographic Examination of Aggregates for Concrete
ASTM C1293	Standard Test Method for Determination of Length Change of Concrete Due to Alkali-Silica Reaction
ASTM C1074	Standard Practice for Estimating Concrete Strength by the Maturity Method

Table 1-5 References for Guidance

Standard	Description
CIA Z7/04	Good Practice through Design, Concrete Supply and Construction, Concrete Durability Series Recommended Practice
CIA Z7/06	Concrete Cracking and Crack Control, Concrete Durability Series Recommended Practice
CIA Z7/07	Performance Tests to Assess Concrete Durability, Concrete Durability Series Recommended Practice
CIA Z9	Curing of Concrete
HB 90.3-2000	The Construction Industry – Guide to ISO 9001.2000.
SA HB 79	Alkali Aggregate Reaction– Guidelines on Minimising the Risk of Damage to Concrete Structures in Australia

1.10 Drawings

Drawings made to larger scale (i.e. 1:100 is larger than 1:1000) and those showing particular parts of the *WUC* or detail views shall take precedence over Drawings made to smaller scales and those for more general purposes.

Where any discrepancy exists between figure and scaled dimensions, the figured dimensions shall prevail.

Spot levels shall take precedence over contour lines and batter profile lines.

The following is a list of the current Drawings prepared in relation to the stormwater drainage for the site related to this Specification.

Table 1-6 List of *WUC* Design Drawings

Drawing No	Title
61-35637-C201	COVER SHEET, LOCALITY PLAN
61-35637-C202	DRAWING LIST AND GENERAL CIVIL NOTES
61-35637-C204	NORTHERN DRUMSITE WORKS EXISTING SERVICES - PLAN - SHEET 1 OF 6
61-35637-C205	NORTHERN DRUMSITE WORKS EXISTING SERVICES - PLAN - SHEET 2 OF 6
61-35637-C206	CENTRAL DRUMSITE WORKS EXISTING SERVICES - PLAN - SHEET 3 OF 6
61-35637-C207	CENTRAL DRUMSITE WORKS EXISTING SERVICES - PLAN - SHEET 4 OF 6
61-35637-C208	SOUTHERN DRUMSITE WORKS EXISTING SERVICES - PLAN- SHEET 5 OF 6
61-35637-C209	SOUTHERN DRUMSITE WORKS EXISTING SERVICES - PLAN- SHEET 6 OF 6
61-35637-C210	NORTHERN DRUMSITE WORKS PLAN - SHEET 1
61-35637-C211	NORTHERN DRUMSITE WORKS PLAN - SHEET 2
61-35637-C212	NORTHERN DRUMSITE WORKS PLAN - SHEET 3
61-35637-C215	CENTRAL DRUMSITE WORKS PLAN - SHEET 1
61-35637-C216	CENTRAL DRUMSITE WORKS PLAN - SHEET 2
61-35637-C220	SOUTHERN DRUMSITE WORKS PLAN - SHEET 1
61-35637-C221	SOUTHERN DRUMSITE WORKS PLAN - SHEET 2
61-35637-C230	NORTHERN DRUMSITE WORKS - INCLINE BASIN PLAN AND TYPICAL SECTIONS
61-35637-C231	NORTHERN DRUMSITE WORKS - INCLINE BASIN LONGITUDINAL SECTION & TYPICAL SECTIONS & DETAILS
61-35637-C232	NORTHERN DRUMSITE WORKS - INCLINE DRAIN PLAN, LONGITUDINAL SECTIONS & TYPICAL SECTIONS
61-35637-C233	NORTHERN DRUMSITE WORKS - DRAINAGE LINE N17 PLAN AND LONGITUDINAL SECTION
61-35637-C234	NORTHERN DRUMSITE WORKS - DRIVE OVER PLAN, LONGITUDINAL SECTION & TYPICAL SECTIONS
61-35637-C235	NORTHERN DRUMSITE WORKS - INCLINE BUND PLAN, LONGITUDINAL SECTION & TYPICAL SECTIONS
61-35637-C236	NORTHERN DRUMSITE WORKS - BASIN 1 PLAN AND TYPICAL SECTIONS
61-35637-C245	SOUTHERN DRUMSITE WORKS - BASIN PLAN AND TYPICAL SECTIONS
61-35637-C250	NORTHERN DRUMSITE WORKS PIPELINE LONGITUDINAL SECTIONS - SHEET 1
61-35637-C251	NORTHERN DRUMSITE WORKS PIPELINE LONGITUDINAL SECTIONS - SHEET 2
61-35637-C252	NORTHERN DRUMSITE WORKS PIPELINE LONGITUDINAL SECTIONS - SHEET 3
61-35637-C253	NORTHERN DRUMSITE WORKS PIPELINE LONGITUDINAL SECTIONS - SHEET 4
61-35637-C254	NORTHERN DRUMSITE WORKS PIPELINE LONGITUDINAL SECTIONS - SHEET 5
61-35637-C255	NORTHERN DRUMSITE WORKS PIPELINE LONGITUDINAL SECTIONS - SHEET 6
61-35637-C260	CENTRAL DRUMSITE WORKS PIPELINE LONGITUDINAL SECTIONS - SHEET 1

Drawing No	Title
61-35637-C261	CENTRAL DRUMSITE WORKS PIPELINE LONGITUDINAL SECTIONS - SHEET 2
61-35637-C270	SOUTHERN DRUMSITE WORKS PIPELINE LONGITUDINAL SECTIONS - SHEET 1
61-35637-C271	SOUTHERN DRUMSITE WORKS PIPELINE LONGITUDINAL SECTIONS - SHEET 2
61-35637-C272	SOUTHERN DRUMSITE WORKS PIPELINE LONGITUDINAL SECTIONS - SHEET 3
61-35637-C273	SOUTHERN DRUMSITE WORKS PIPELINE LONGITUDINAL SECTIONS - SHEET 4
61-35637-C280	NORTHERN DRUMSITE - ROAD AND PAVEMENT DESIGN PAVEMENT REINSTATEMENT WORKS
61-35637-C281	NORTHERN DRUMSITE - ROAD AND PAVEMENT DESIGN TONG YAN LOH CAR PARK MODIFICATIONS
61-35637-C285	SOUTHERN DRUMSITE - ROAD AND PAVEMENT DESIGN CHRISTMAS ISLAND SCHOOL ENTRANCE MODIFICATIONS
61-35637-C286	SOUTHERN DRUMSITE - ROAD AND PAVEMENT DESIGN MURRAY ROAD SPEED REDUCTION HUMP
61-35637-C290	DRAINAGE STRUCTURES TYPICAL DETAILS - SHEET 1
61-35637-C291	DRAINAGE STRUCTURES TYPICAL DETAILS - SHEET 2
61-35637-C292	DRAINAGE STRUCTURES TYPICAL DETAILS - SHEET 3
61-35637-C293	KERBING AND FOOTPATH TYPICAL DETAILS
61-35637-C294	FENCING TYPICAL DETAILS
61-35637-C295	MISCELLANEOUS TYPICAL DETAILS
61-35637-C296	ROAD AND PAVEMENT DESIGN TYPICAL DETAILS
61-35637-C300	DN250 PVC WATER MAIN CONSTRUCTION NOTES
61-35637-C301	DN250 PVC WATER MAIN PLAN AND LONGITUDINAL SECTION
61-35637-C302	DN250 PVC WATER MAIN THRUST BLOCK AND BEND DETAILS
61-35637-C303	DN250 PVC WATER MAIN SCOUR DETAILS
61-35637-S002	STRUCTURAL NOTES
61-35637-S003	TYPICAL STRUCTURAL & HEADWALL GRATE DETAILS
61-35637-S005	NORTHERN DRUMSITE WORKS INCLINE MISCELLANEOUS STRUCTURES – PLANS & DETAILS
61-35637-S010	NORTHERN DRUMSITE WORKS INCLINE DIVERSION PIT & CHANNEL - GENERAL ARRANGEMENT
61-35637-S011	NORTHERN DRUMSITE WORKS INCLINE DIVERSION PIT & CHANNEL - REINF. DETAILS SHEET 1 OF 3
61-35637-S012	NORTHERN DRUMSITE WORKS INCLINE DIVERSION PIT & CHANNEL - REINF. DETAILS SHEET 2 OF 3
61-35637-S013	NORTHERN DRUMSITE WORKS INCLINE DIVERSION PIT & CHANNEL - REINF. DETAILS SHEET 3 OF 3
61-35637-S014	NORTHERN DRUMSITE WORKS INCLINE DIVERSION PIT & CHANNEL - STEELWORK SETOUT & DETAILS
61-35637-S020	NORTHERN DRUMSITE WORKS PIT N17-2 - SECTIONS & DETAILS
61-35637-S021	NORTHERN DRUMSITE WORKS HEADWALL N17-3 - SECTIONS & DETAILS
61-35637-S025	NORTHERN DRUMSITE WORKS INCLINE DRAIN OUTLET STRUCTURE - GENERAL ARRANGEMENT
61-35637-S026	NORTHERN DRUMSITE WORKS INCLINE DRAIN OUTLET STRUCTURE - REINF. DETAILS SHEET 1 OF 2
61-35637-S027	NORTHERN DRUMSITE WORKS INCLINE DRAIN OUTLET STRUCTURE - REINF. DETAILS SHEET 2 OF 2
61-35637-S030	SOUTHERN DRUMSITE WORKS PIT S01-7 - SECTIONS & DETAILS

Drawing No	Title
61-35637-S035	NORTHERN DRUMSITE WORKS - INCLINE TANK DRAIN HEADWALL MODIFICATIONS - GENERAL ARRANGEMENT
61-35637-S036	NORTHERN DRUMSITE WORKS - INCLINE TANK DRAIN HEADWALL MODIFICATIONS - REINFORCEMENT DETAILS

All current drawings for the *WUC* are included in the above list and within Appendix B however drawings may undergo revision post the issue of this documentation. The *Contractor* is to ensure that they have a current version of all design drawings prior to commencing *WUC*. Should any conflicts or omissions be noted by the *Contractor* these are to be brought to the attention of the *Client* and *Superintendent's Representative* prior to the construction commencing.

Where applicable manufacture drawings and documents have been referenced on the Drawings and within this Specification, a copy of these are contained in Appendix C, noting that these are only included as a guide. The *Contractor* is to ensure all manufacture requirements at the time of supply and install are meet.

The following Table 1-7 contains a list of drawings prepared to support the early works package of construction that was completed in 2018 within the site extent. These are 'For Construction Only' drawings only with as constructed drawings not available for the Works. However as constructed levels and survey has been used at interfaces with the *WUC*. A Copy of the drawings is contained in Appendix D

Table 1-7 List of Early Works Design Drawings

Drawing No	Title
61-35637-C002	COVER SHEET, LOCALITY PLAN AND DRAWING LIST – EARLY WORKS
61-35637-C005	NORTHERN DRUMSITE WORKS – EXISTING SERVICES – PLAN – SHEET 1 OF 5
61-35637-C006	NORTHERN DRUMSITE WORKS – EXISTING SERVICES – PLAN – SHEET 2 OF 5
61-35637-C007	NORTHERN DRUMSITE WORKS – EXISTING SERVICES – PLAN – SHEET 3 OF 5
61-35637-C008	NORTHERN DRUMSITE WORKS – EXISTING SERVICES – PLAN – SHEET 4 OF 5
61-35637-C009	NORTHERN DRUMSITE WORKS – EXISTING SERVICES – PLAN – SHEET 5 OF 5
61-35637-C013	CENTRAL DRUMSITE WORKS – PLAN – SHEET 2
61-35637-C015	CENTRAL DRUMSITE WORKS – PLAN & LONGITUDINAL SECTIONS – EARLY WORKS
61-35637-C016	NORTHERN & SOUTHERN DRUMSITE WORKS - PLAN & LONGITUDINAL SECTIONS – EARLY WORKS
61-35637-C017	CENTRAL DRUMSITE WORKS – PLAN & LONGITUDINAL SECTION – C01-14 TO C01-15 CULVERT – EARLY WORKS
61-35637-C018	SOUTHERN DRUMSITE WORKS – CIP ACCESS ROAD CULVERT DETAILS – EARLY WORKS
61-35637-C028	CENTRAL DRUMSITE WORKS – BUND & DRAIN – PLAN, LONGITUDINAL SECTION & TYPICAL SECTIONS – EARLY WORKS
61-35637-C040	STRUCTURAL NOTES
61-35637-C041	CENTRAL DRUMSITE WORKS – TYPICAL DETAILS – PIT ADJACENT CONVEYOR CROSSOVER
61-35637-C042	CENTRAL DRUMSITE WORKS – TYPICAL DETAILS – OUTLET ADJACENT CONVEYOR CROSSOVER
61-35637-C049	DRAINAGE STRUCTURES – TYPICAL DETAILS – SHEET 1
61-35637-C050	DRAINAGE STRUCTURES – TYPICAL DETAILS – SHEET 2

Drawing No	Title
61-35637-C051	DRAINAGE STRUCTURES – TYPICAL DETAILS – SHEET 3
61-35637-C052	DRAINAGE STRUCTURES – TYPICAL DETAILS – SHEET 4
61-35637-C101	SOUTHERN DRUMSITE WORKS – ROAD SIGNS AND GUIDEPOSTS – EARLY WORKS
61-35637-C102	TYPICAL DETAILS – EARLY WORKS – PROTECTIVE SCREENS

Previous survey information which has been used in the development of the design is included for information within Appendix E.

The *Contractor* prior to construction can request copies of the digital versions of all drawings for there understanding and use.

1.11 Discrepancies

All discrepancies between design assumptions or details and actual conditions (e.g. tie-in levels for embankments) shall be immediately notified in writing to the *Superintendent's Representative*. Where such a discrepancy or discrepancies occur, *WUC* shall not occur until the *Contractor* receives written instructions from the *Superintendent's Representative*.

1.12 Existing Services

The *Contractor* shall be responsible for coordination of the *WUC* with other service providers.

It shall be the *Contractor*'s responsibility to physically verify the position of underground and other services and identify them before commencing any *WUC*. The *Contractor* shall not rely on the indicative services locations shown on the Drawings. The *Contractor* shall obtain all necessary permits, such as electrical proximity or confined space permits, from the relevant Permit Authority before commencement of *WUC*.

Where existing services must be interrupted to enable carrying out of the *WUC*, such interruption shall be at a time agreed by the *Superintendent's Representative*. The *Contractor* shall organise with the responsible Authority so that the interruption shall be for the minimum practical time ensuring the order of *WUC* is set out in the response to tender.

Any damage to existing services is to be rectified by the *Contractor* at their own expense to the complete satisfaction of the *Superintendent's Representative*.

1.13 *Contractor*'s Work Area

The *Contractor* shall take all reasonable precautions to ensure that the site and other approved laydown areas, when unattended is in a secured and safe condition.

As far as reasonably practical, the *Contractor* shall keep the *WUC* site free of all loose and other items which may introduce additional hazards. Materials that are to be salvaged as part of the *WUC* shall be neatly stacked in a safe and secure location. Items that are to be disposed of as part of the *WUC* shall be removed from the site as soon as practical.

The *Contractor* is responsible for installing and maintaining appropriate site security to protect the *WUC*, materials, equipment, and general public on the site at all times. The *Contractor* may deem it necessary to employ an approved static guard service on the site, in which case all costs associated with the service shall be the responsibility of the *Contractor*.

If the *Contractor* cannot render the site secure and safe it shall not be left unattended.

1.14 Inclement Weather and Stormwater

The *Contractor* shall provide all plant, materials and labour necessary to protect the *WUC* from inclement weather and flooding from runoff and rainfall. Low points or excavations where water may collect shall be kept thoroughly drained by mechanical or gravitational means. The *Contractor* shall provide for the diversion and control of stormwater during construction and where necessary, provide secure and proper temporary pumping or fluming for conducting storm and subsoil water on and away from the Site. Drains utilised for this purpose shall be maintained in a satisfactory working order. The *Contractor* shall provide adequate means of disposing of water.

Construction material, including masonry, concrete, services, and the like, shall only be placed on ground from which water has been removed. Water flow over freshly laid work shall be prevented.

All work shall be protected from water immersion in whole or part and from rain and surface water related work delays and defects. Dewatering systems shall continue to operate until the *WUC* have been protected from the risk of flotation or displacement by ground or surface water. The health of personnel employed for the purposes of *WUC* and members of the public shall be protected from ground or surface water related injury.

1.15 Sequencing of the *WUC*

The *Contractor* shall ensure that all construction of drainage infrastructure is undertaken so as to not detrimentally impact on other works within the Project Site. Should construction sequencing be required this should be detailed within the *Contractor*'s submission so potential issues can be identified by the *Superintendent's Representative* and key project stakeholders be informed.

Where specific staging of construction of a work package has not been detailed it is assumed that the *Contractor* will determine a suitable sequencing of the *WUC* to minimise disruption to existing services on the island and provided details where required within their tender submission for the works.

1.16 Private Property Access

The *Contractor* shall liaise with owners/occupiers along the route and shall schedule the *WUC* to minimise disruption.

In particular, the *WUC* shall be planned and undertaken to minimise impacts to Christmas Island Phosphates (CIP) and CIDHS operations and access to existing facilities during the *WUC*.

Uncontrolled access to the properties affected by the *WUC* is not permitted. The occupier's property, access, privacy, security, and safety shall be paramount and respected at all times. The use of water and power from the private properties services shall not be permitted.

The *Contractor* shall continuously liaise and comply with the reasonable requests of the occupiers of properties required to be entered during the proper execution of WUC.

1.17 Setting Out of the *WUC*

The *Contractor* shall be responsible for supplying all assistance, labour, materials and equipment in setting out the *WUC*, in checking the levels, positions, requirements or gradients of completed or uncompleted *WUC*. This includes, but is not limited to stakes, templates, patterns, platforms and special labour that may be required in setting out any part of the *WUC*. The *Contractor* shall set out the *WUC* from coordinates as shown on the Drawings and shall

notify the *Superintendent's Representative* of any discrepancies at least one week prior to commencing construction.

Work shall be set out from Landgate Standard Survey Marks (SSMs). Landgate Bench Marks (BMs) may be used for vertical control. Marks to be spirit levelled with accuracies of 12 root k or better. Height datum shall be Christmas Island Height Datum (CIHD) and coordinates shall be MGA94 Zone 48. Set out of cadastral boundaries to be carried out by a licensed surveyor.

Upon completion of the Work under the *Contract*, the *Contractor* shall reinstate any cadastral survey marks that have been disturbed or destroyed by the construction. The reinstatement shall be undertaken by a licensed surveyor, (using the established control for the *WUC*) the relevant survey information recorded in the approved field book and lodged with Landgate.

The *Contractor* shall preserve (and if disturbed, pay for the replacement of) the survey set out stations for the whole period of the *Contract*. The *Contractor* shall be entirely responsible for setting out and constructing the *WUC* to the positions and levels shown and directed and shall construct the *WUC* to those levels.

1.18 Asbestos Management

The *Contractor* is to prepare and implement an Asbestos Management Action Plan at all times.

Should the *Contractor* encounter asbestos or asbestos pipes during the *WUC*, the *Contractor* shall cease *WUC* and evacuate the area of *WUC* immediately. The *Superintendent's Representative* as well as appropriate regulatory authorities shall be notified immediately if asbestos or asbestos pipe is encountered.

A barrier shall be erected around the suspect material (this barrier shall be as far as practical with a preferred distance of 10 metres) to isolate immediate area from un-authorised personnel from entering the contaminated zone. No person shall enter the barricaded area unless they are the holder of a licence issued by WorkSafe for such work or by and employee of a licence holder.

Sampling of the suspect material is to be carried out by an appropriately qualified person as approved by the *Superintendent's Representative*. The qualified person (in liaison with the *Superintendent's Representative* and relevant authorities) will determine further actions based on the sample test results and nominate an appropriate treatment/handling or disposal options and procedures. Permits to carry out remedial work are to be obtained prior to the commencement of any new *WUC* and the nominated Environmental Specialist must provide written clearance approval.

Work on or with asbestos based products shall comply with Part 5, Division 4, Subdivision 1 of the OSH Regulations 1996: OSH Regulation 5.42 to 5.52 and with the Code of Practice How to Remove Asbestos (2020) published by Safe Work Australia. In addition to legislative requirements that apply to asbestos related work, all such work shall be carried out in accordance with the Code of Practice for the Safe Removal of Asbestos as published by the National Occupational Health and Safety Commission. The encapsulation or removal and disposal of anything containing asbestos shall be carried out by a holder of a licence duly issued by WorkSafe for such work or by an employee of a licence holder. As a part of the removal works conducted, asbestos dust air monitoring will be undertaken in accordance with Guidance Note on the Membrane for Estimating Airborne Asbestos Fibres as published by the National Occupational Health and Safety Commission.

Once all the asbestos material has been removed, the barricade may then be removed and work activities may resume under the guidance of the *Superintendent's Representative*.

1.19 Contaminated Fill Management

Should the *Contractor* encounter contaminated fill during excavations *WUC*, the *Contractor* shall handle the unclean fill material in a safe manner in accordance with the relevant standard and procedures. The *Superintendent's Representative* shall be notified of contaminated fill encountered.

1.20 Protection of Existing Services and Plant

The *Contractor* shall ensure that existing services and plant are not damaged by WUC. The *Contractor* shall inform the *Superintendent's Representative* as soon as possible, of an impending clash with existing services.

Care shall be taken by the *Contractor* to avoid damage to all underground or overhead services and all stay poles, stay wires, brackets, posts and fittings in connection therewith. The *Contractor* shall ensure that all poles, pipes, cables, ducts and other services encountered are securely supported, and protected. The *Contractor* shall allow for excavating by hand in the close vicinity of all services.

The *Contractor* shall provide for any misaligned existing (*Client* and/or non-*Client*) property service connection and where any service is damaged, displaced or otherwise interfered with, the *Contractor* shall give notice immediately to the *Superintendent's Representative* and to the owner of the service and afford all facilities to the owner to assist in early inspection and repair. The *Contractor* shall accept responsibility for any claims arising from incidental damage caused to any utility or building because of WUC. The cost of the necessary repairs shall be borne by the *Contractor*.

The requirements of the Power Authority when working in the vicinity of overhead and underground power lines shall always be adhered to with the *Contractor* to seek all required permits and approvals.

A Job Safety and Environmental Analysis (JSEA) shall be conducted for each case where work occurs alongside or crosses beneath overhead power lines and a copy shall be provided to the *Superintendent's Representative* at least seven days prior to planned commencement of WUC. No construction work shall commence in the vicinity of power lines until the *Contractor* has provided the *Superintendent's Representative* with evidence that the JSEA has been undertaken.

If it is necessary for the *Contractor* to have any third party utility (such as Power Authority, Water Corporation or telecommunications provider) provide any temporary service, then the *Contractor* shall inform such third party utilities immediately such services are no longer required. The *Client* reserves the right, subject to agreement of the third party utility concerned, to have any poles, cable, or ducts, re sited or diverted where it considers it inadvisable to allow them to remain in their present position. The *Contractor* shall give every facility to the various third party utilities to enable them to carry out the alterations.

1.21 Reinstatement

Excavation shall be minimised in all established areas such as roadways, footpaths and other paved areas.

All existing services must be located prior to excavation commencing, as described in Section 1.12. The location of known underground services is shown indicatively on the Drawings. Site verification is required to be undertaken by the *Contractor*.

Unless otherwise specified or shown, all damage to existing surface structures or existing services caused by construction *WUC* shall be made good by the *Contractor*, to pre-existing conditions.

Where existing trees, shrubs, underground services or other permanent structures are required to be removed, relocated or temporarily interrupted, prior approval in writing from the *Superintendent's Representative* shall be obtained by the *Contractor*. Reinstatement works shall be carried out in accordance with this Specification.

The site shall always be left clean and tidy. Excess material shall be removed offsite to the satisfaction of the *Superintendent's Representative*.

1.22 Provision for Traffic

1.22.1 General

The *Contractor* shall provide such signing and undertake temporary works to comply with the all safety requirements.

All signs and method of traffic control shall be generally in accordance with AS 1742 and to the approval of the relevant Statutory Authority.

All damage to existing pavements and improvements shall be made good to the standard of the pre-existing conditions. These works shall comply with the SoCI requirements for works on public lands.

1.22.2 Traffic Management Plan

The *Contractor* shall prepare and submit to the *Superintendent's Representative* a Traffic Management Plan for all roads affected by *WUC* after consulting with CIP and the relevant Local Authorities and incorporating their requirements.

The *Contractor* shall submit to the *Superintendent's Representative*, within two weeks from possession of site, their plan for diverting traffic including the location and types of all signs required to control traffic. It is the sole responsibility of the *Contractor* to provide all standard signs required for traffic control including advisory type signs. The *Contractor* shall allow for all signing in the appropriate schedule item.

1.22.3 Traffic Control

Notwithstanding the requirements of the General Conditions of *Contract*, the *Contractor* shall provide a representative on *site* at all times who has successfully completed the MRWA accredited Basic Worksite Traffic Management training course and also provide written evidence of the engagement/sub-contracting for the services of a suitable person who has completed the Advanced Worksite Traffic Management training course and to whom the *Contractor* has access at all times. Both aforementioned courses are conducted by various Registered Training Organisations including WA WARP Training Australia and Perth Traffic Training.

The *Contractor* shall ensure that on public roadways and verges, there shall be no greater obstruction to traffic or vehicular traffic than is reasonably necessary nor shall any obstruction be of such extent as to prevent free and safe movement of the public.

Where *WUC* is likely to affect vehicular access to privately owned land (residential properties), every attempt shall be made to accommodate the needs of landowners with respect to entry and/or exit from the property. In addition, at the conclusion of construction activities in any given day, vehicular access shall be restored to privately owned land.

Unless approval has been obtained for temporary road closures and associated detours, the *Contractor* shall always maintain at least one lane of a single carriageway and one lane each side of a dual carriageway open for free and safe movement of traffic.

Where any trench crosses a road, the road shall always be open to traffic over a width of at least 3.5 m unless an approved road closure is in place. A safe footway suitable for perambulators (i.e. 'prams') shall be maintained wherever the depth of trenching permits.

The *Contractor* shall minimise the number of road closures operating at any one time, to the satisfaction of the *Superintendent's Representative*.

The *Contractor* shall utilise and conform to the MRWA July 2020 guidelines for traffic control, namely the Code of Practice Traffic Management for Works on Roads in conjunction with the AS 1742.3. The control signs and devices shall be selected and positioned to give unobscured, meaningful and sufficient warning to traffic. Sign sizes and legibility shall be in accordance with Clause 2.4.4 of AS 1742.3. The *Contractor* shall always have a copy of the MRWA guidelines on roadwork signage and AS 1742.3 readily available on site for reference.

The *Contractor* shall submit for noting by the *Superintendent's Representative* two (2) copies each of 1:2000 and 1:500 scale drawings of its proposed traffic control layout for all temporary road closures and detours and two (2) copies of 1:500 scale drawings of all other proposed traffic deviations. These drawings shall contain full details of sign dimensions and type (according to Standards Australia standards) as well as distances between signs on the *site*. The *Contractor* shall submit all drawings to the *Superintendent's Representative* at least seven (7) working days in advance of the commencement of the traffic deviation. The drawings shall be endorsed by the person holding the Advanced Worksite Traffic Management Certificate and shall be of a drafting standard satisfactory to the *Superintendent's Representative*.

No traffic deviation shall occur unless the traffic control drawings have been approved by the appropriate authorities and subsequently noted as such by the *Superintendent's Representative*.

The *Contractor* shall advertise the execution of all or any road closures or traffic detours and notify all affected property owners and occupiers in accordance with the requirements of the appropriate authorities.

A copy of proposed advertisements shall be submitted to the *Superintendent's Representative* along with the proposed traffic control drawings.

The *Contractor* shall carry out the daily routine tasks and record keeping as set out in Appendix B of AS 1742.3 and shall maintain on *site* such daily records that shall be made available to the *Superintendent's Representative* on demand. Upon *practical completion* the *Contractor* shall submit a bound copy of all such records.

1.23 Public Safety

The various sites are situated within public open space, therefore public access to the site is not generally limited. Public safety, amenity and site security is consequentially an important consideration in undertaking the *WUC*.

The *Contractor* shall employ the use of all appropriate methods of protection (including but not limited to temporary safety fencing and warning signage) that are deemed reasonably practicable and necessary to protect members of the public from hazards associated with the Works. Protection methods should comply with the recommendations contained in WorkSafe (2009). Where safety fences are used, they shall not exceed 1.8 m height.

1.24 Amenity

Potential effects of the *WUC* on amenity of the site and surrounding properties include the production of noise from construction activities and the generation of atmospheric pollution in the form of dust and odours. Management procedures for noise and atmospheric pollution are summarised below.

1.24.1 Noise and Atmospheric Pollution

The *Contractor* shall comply with relevant Regulator requirements for mitigating noise and atmospheric pollution. Mitigation strategies include, but are not limited to the following:

- Plant and construction equipment shall be operated such that it does not lead to the creation of undue noise (including compliance with relevant Regulator requirements for working hours) or atmospheric pollution. Plant and construction equipment shall be fitted with appropriate silencers or sound moderators as necessary;
- The *Contractor* shall conduct the *WUC* in accordance with an approved dust management strategy, that shall be prepared by the *Contractor* prior to commencement of the *WUC*; and
- The *Contractor* shall develop and implement an odour monitoring strategy to assess the extent of gaseous odours produced through the degradation of excavated and dewatered organic material present at the site. Where deemed necessary, actions shall be implemented to reduce the extent or impact of gaseous odours.

1.25 Safety Management

The *Contractor* is responsible for maintaining a safe site at all times in accordance with Worksafe requirements including compliance with the Code of Practice for Construction Work (2018)

All site staff shall be deemed to be employed by the *Contractor*. The Contactor shall arrange for all staff to meet the site safety requirements.

Possible hazards shall be addressed by the *Contractor* and managed to ensure that no significant hazard is overlooked and that all risks are properly assessed and adequately controlled.

Work in Access Chambers shall comply with AS 2865 “Confined Spaces”

Trenching shall be carried out in accordance with the Western Australian Occupational Health and Safety Regulations 1996 and the Australian Model Code of Practice for Excavation Work (2018). All excavation shall be fenced off with warning signs and lighting if required. The *Contractor* is responsible for the complete supply and maintenance of all such safety measures and costs for these works shall be deemed to have been included with the Tender.

Prior to undertaking any *WUC* on site, including mobilisation, the *Contractor* shall provide the *Superintendent’s Representative* a Safety Management Plan detailing compliance with all applicable laws, regulations and standards defined by the Occupational Health and Safety Act for works undertaken on this project prior to commencing *WUC* on-site.

1.26 Environmental and Heritage Requirements

The *Contractor* is to prepare a *Contractor* Environmental Management Plan (CEMP). The CEMP with details how the *Contractor* will ensure compliance with the requirements of the Environmental and Heritage clearances that have been provided for the project. A copy of the permits that have been sort by the *Client* are contained within Appendix F.

1.26.1 General Construction

The *Contractor* shall ensure that all personnel involved in construction works undergo a suitable induction program to ensure they are aware of potential environmental issues associated with the project. The induction shall be carried out prior to any works commencing and any newly arrived or local personnel shall be inducted before being allowed to undertake any construction works or access the construction site.

The induction program as a minimum will include information on the following issues:

a. the need to conserve the terrestrial environment of CI,

b. the risks of a spill to the environment, spill clean up techniques and procedures;

c. emergency procedures to follow in the event of a spill

d. protection of public and private property,

e. awareness of procedures to be followed if any material of cultural significance is uncovered,

f. noise, vibration and dust effects on the neighbouring community and environment,

g. awareness of water quality,

h. importance of good housekeeping,

i. potential historical contamination and stop work process,

The *Contractor* shall make sure that employees are sensitive to their cultural surroundings and establish codes of behaviour to make certain there is minimal disruption to the local communities.

The induction program shall be approved by the *Superintendent's Representative* prior to implementation and construction commencing on site. Approval of this program will be considered as a HOLD POINT for the project.

The *Contractor* shall note that inspection of work practices and/or results by Department of Agriculture, Water and the Environment (DAWE) or Department of Water and Environmental Regulation (DWER) may occur. This would normally occur in the presence of the *Superintendent's Representative* and any outcomes of the inspection resulting in changes to works practices will be communicated to the *Contractor* by the *Superintendent's Representative*.

1.26.2 Terrestrial Flora and Fauna

The *Contractor* must at all times ensure the following requirements related to the protection of Terrestrial Flora and Fauna are implemented:

a. Vehicles and equipment will not be parked or driven over tree roots as far as practicable.

b. The clearing envelope shall be clearly pegged out on site so that the allowable disturbance is clearly marked and delineated.

c. At the completion of the project, all materials will be removed and the area restored to existing condition unless otherwise agreed.

d. Vegetation that can be retained will be pruned in preference to clearing where possible.

e. Construction vehicles will remain within posted speed limits to minimise fauna collision.

f. Temporary construction purposes (e.g. tracks, stockpiling, lay down) are to be within the project development envelope.

g. During crab migration all construction vehicles will follow any additional requirements in place by the Shire of Christmas Island or National Parks Australia.

h. All personnel will be educated on the migration behaviours of crabs and methods to reduce their impact whilst they reside on the island.

i. All trees will be inspected for nesting birds prior to clearing. If any birds are found to be nesting, clearing works will cease until nesting is complete.

1.26.3 Soil and Water

The *Contractor* must always ensure the following requirements related to the protection of soil and water management are implemented:

a. All materials must be stockpiled away from water flows.

b. Erosion and sediment controls should be installed prior to or during disturbance as required.

c. These controls must remain in place until revegetation and stabilisation has occurred.

d. Topsoil shall be stripped and stockpiled for reuse in revegetation of disturbed areas.

e. All native vegetation shall be chipped and stockpiled for later reuse in rehabilitation.

1.26.4 Noise and Vibration

The *Contractor* must always ensure the following requirements related to the noise and vibration management are implemented:

a. All noise generating construction equipment will be appropriately muffled, housed or acoustically baffled in compliance with the installation standards and building codes to ensure compliance with the Western Australian Environmental Protection (Noise) Regulations 1997 (EP Noise Regulations).

b. The idling or unnecessary running of engines will be avoided.

c. All construction work will be carried out using equipment in good working order.

d. At least two weeks prior to the commencement of works, residents on CI will be notified via newspaper/newsletter and/or local radio advertisement.

e. Work is generally required to be carried out during daylight hours. If works are required to be undertaken between 7pm-7am Monday to Saturday, or anytime on a Sunday, a SoCI approved Noise Management Plan will be prepared by the *Contractor* for this activity with appropriate notice given to all residents.

f. The *Contractor* shall monitor noise levels associated with project construction and respond immediately to any noise complaints that may occur. Noise complaints will be entered into a Complaints Register that will be kept by the *Contractor* and will be made available to the *Superintendent's Representative*.

1.26.5 Heritage

The *Contractor* must always ensure the following requirements related to the heritage protection are implemented:

a. Any items of heritage related to the old railway (including that from the Drumsite Industrial Area), will be removed with care. The aim will be to preserve significant pieces for future use.

b. Items removed as per the point above will be stored until they are able to be put on display. This method chosen for display will be done in consultation with the Shire of Christmas Island. The intention will be to allow the public to view these pieces so that they can have an appreciation of the heritage values in the area, particularly those which are currently contained within the Christmas Island Phosphate area which restricts public access.

c. If any other items suspected to be of archaeological or historic nature are uncovered during constructions, work will immediately cease in the vicinity to avoid accidental disturbance.

d. Appropriate conservation of any items found with significant heritage value will be ensured.

e. Induction training for the *Contractor*s construction staff will include awareness of existing registered heritage places as well as procedures to be followed in the event that any material of cultural significance is uncovered.

1.26.6 Construction Waste

The *Contractor* must always ensure the following requirements related to the waste management are implemented:

a. The *Contractor*s induction of its workforce will outline the requirements for waste minimisation and management practices. All workers are to minimise waste production and to make sure that any waste produced is disposed of appropriately.

b. All staff working on project must not dispose of litter (including wrappings, plastic takeaway containers, drink cans, cigarette butts and construction waste) on the ground. All litter produced on site shall be disposed of in accordance with the SoCI waste disposal requirements.

c. Any waste produced (including construction) that is disposed of to landfills shall be done in accordance with the SoCI requirements. Waste that is disposed of at locations at CI other than licensed landfills shall be done so in accordance with the landowner and the *Superintendent's Representative* instructions.

d. -All materials imported on to the island will be required to have minimal packaging and where possible be constructed before shipment.

All costs associated with the disposal of waste are the responsibility of the *Contractor* and are to be included within the overall tendered price unless otherwise agreed.

1.27 Diverting Water and Dewatering

The *Contractor* shall undertake and complete all work necessary to drain and/or divert any water interfering with the progress of the *WUC*, keep the excavations free from water while the works are in progress and prevent any injury to the works by water due to floods or other causes. The cost of such work shall be deemed as having been included in the *Contractor*'s Tender Price. The *Superintendent's Representative* shall be notified of any dewatering or diversion works being required prior to the implementation with documentation of the works compliance with the Specification, in particular the environmental control measures being applied.

1.28 Testing

The *Contractor* shall be responsible for providing verification that all materials and work comply with the requirements of this Specification.

The *Contractor* shall allow within their price for all testing required by the Specification, including re-testing.

Where tests show the Works do not meet this Specification's requirements, the work shall be rectified and retested until the work falls within the specified tolerances to the satisfaction of the *Superintendent's Representative*.

The *Superintendent's Representative* may request additional testing at their sole discretion. The *Client* shall pay for such additional testing, unless the results demonstrate non-compliance with this Specification, in which case, such testing shall be at the *Contractor*s expense. All re-tests required shall be at the *Contractor*s expense.

1.29 Survey

1.29.1 Survey Control

The *Contractor* shall be responsible for all survey work required to set out the levels, lines, alignments and positions of all components of the *WUC*. A qualified Engineering Surveyor qualified in accordance with the clause below shall be responsible for the survey set out.

For survey requirements for set out refer to section 1.17 of this Specification.

Dimensioned scale plans that show divergence of existing physical structures, boundary fences and existing survey marks from the true cadastral positions shall be produced and retained on site and shall be readily accessible to the *Superintendent's Representative* for reference purposes on request.

The *Client* has carried out an initial survey of the site. The *Client* will make the original electronic survey file available upon request. Existing site contours are computer generated from spot heights and the *Contractor* shall make allowance for variations between drawn contours and actual contours on site.

1.29.2 Surveyors

Responsibility for surveying, setting out and As Constructed information pick-up work shall be assigned to a qualified Engineering Surveyor eligible for corporate membership of SSSI. Work that involves surveying and setting out of cadastral boundaries shall, as appropriate, be assigned to a Licensed Surveyor, as defined in the Licensed Surveyors Act, WA.

1.29.3 As Constructed Survey

The *Contractor* shall provide, at his own expense As Constructed records to be lodged with the *Superintendent's Representative* during the progress of the works as required.

The survey shall be completed by a qualified Engineering Surveyor who will mark up the information in ink or digitally on a copy of the plans provided by the *Superintendent's Representative*. The *Contractor* shall also provide a DXF copy of the As Constructed data in accordance with the SoCI and DITRDC requirements.

For drainage works intended to be buried, the *Contractor* shall undertake all required As Constructed survey as detailed within this Specification and notify the *Superintendent's Representative* prior to backfilling, that As Constructed measurements for buried services are available.

If the *Contractor* wishes to backfill immediately after testing and before As Constructed information has been obtained, the *Contractor* will be required to re-expose the line at any location for this information to be obtained, at their own cost and expense, inclusive of all materials, labour, dewatering, shoring up, notices, fees and all other payments.

Practical Completion shall not be issued until the As Constructed drawings have been checked and approved by the *Superintendent's Representative*.

As Constructed digital information shall be prepared by the *Contractor* and supplied to the DITRDC and SoCI in a form that is compliant with the requirements set out in the D-Spec specification requirements. Details of D-Spec requirements can be accessed on https://www.a-specstandards.com.au/d-spec .

All As Constructed plans are to be presented on a *Client* approved standard title block unless otherwise agreed. All As Constructed drainage plans are to show:

1. Any details required within the D-Spec;
2. Kerb alignment (change in kerb type is not necessary);
3. Drainage pipe diameter, material, invert levels and flow direction;
4. Drainage pits (manholes, gullies, side entry and overflow pits, and gross pollutant traps) with a central lid level shown and description of material and construction type;
5. All property connections to be shown. Any modified drainage and/or property connections to be shown in detail;
6. Any furniture that connects to drainage (drink fountains);
7. Drainage pipes and manholes to be on separate layers;
8. Modified / removed pits in a different colour to constructed pits;
9. Abandoned / removed pipes in a different colour to constructed pipes.

All As Constructed survey drafting is to meet the requirement of AS 1100.401 unless otherwise detailed by the local authority guidelines. All As Constructed drawings are to be supplied in a form acceptable to the *Superintendent's Representative* with full compliance with the *Client* Asset Handover Requirements. These include but are not limited to:

a. Supply of all documentation in DWG format, with height and level data in Christmas Island Height Datum (CIHD) and coordinate information to be is MGA 94 Zone 48 coordinates.

1.30 Progress Photographs

Where progress photographs are requested by the *Superintendent's Representative* or as a requirement of the Specification they shall be supplied as contained within the request. The supply of progress photographs shall adhere to the following general requirements:

1. Be provided as colour photographs so they can be easily viewed for the purposes of recording the overall progress of the *WUC* and detailing specific aspects of each stage of work, prior to, during and after completion;
2. The *Contractor* shall accurately record the works to the satisfaction of the *Superintendent's Representative*. There is no limitation to the number of photos to be taken;
3. The photographs are only to be of the areas/work in progress. Non-descriptive photographs will be rejected and are to be replaced;
4. Each set of photographs shall consist of .jpg electronic files;
5. Provide identification markings on the photo prints and/or appropriate sub-titles;

6. The camera used shall be of a type that shall automatically record onto the .jpg image the date a photograph is taken;

7. For remote works, the photographs are to be issued to the *Superintendent's Representative* to form part of the basis of approval for the *Contractor* to commence the next stage of *WUC* following a lot completion or as required as a HOLD or WITNESS POINTS;

8. The quality of photographs shall be to the satisfaction of the *Superintendent's Representative*;

9. Photos are to be supplied with suitable digital geotagging or a suitable map to confirm the location of each image or set of images.

1.31 Omissions

The *Client* and *Superintendent's Representative* does not represent that information made available shows completely the existing site conditions. The *Client* and *Superintendent's Representative* are not responsible for any interpretations, deductions and conclusions made by the *Contractor* from the information made available and the *Contractor* shall accept full responsibility for any such interpretations, deductions and conclusions.

As the information supplied to the *Contractor* could include errors or omissions or could be ambiguous or misleading, the *Contractor* shall advise the *Superintendent's Representative* of any discrepancies at the earliest possible time.

If the *Contractor* supplies information to anyone else, including a *Contractor* or Subcontractor, for any information supplied the *Contractor* shall indemnify the *Client* and *Superintendent's Representative* against any claim by that person arising out of errors or omission or the misleading nature of the advice.

2. Site Preparation

2.1 Scope

This section specifies the requirements for tree protection, site clearing, stripping and grubbing, as well as for the disposal of the materials produced by clearing, stripping and grubbing, within the limits specified as shown on the Drawings for the construction of the *WUC*.

All clearing and grubbing are to be undertaken in accordance with the already approved permit(s). A copy of this permit(s) is contained within Appendix F with the details of the extent of the permit(s) shown in the Drawings. Compliance with the requirements of the permit(s) is the responsibility of both the *Client* and the *Contractor*.

All works are to be undertaken in accordance with Section 1.26 of this Specification.

2.2 Clearing and Grubbing

2.2.1 General

Clearing and grubbing is the removal, within the extent of Work, of the following:

- Vegetation such as trees, tree stumps, tree roots, logs, brush, noxious weeds and decayed vegetable matter; and
- Refuse such as pole stumps and rubbish dumps on or protruding from the ground surface.

Known trees to be removed have been shown on the Drawings. All attempts are to be made to retain existing trees where possible. Should additional trees be requested or required to be removed, the *Contractor* shall seek written approval from the *Superintendent's Representative* before removing such trees.

2.2.2 Protection of Trees

The *Contractor* shall clearly mark all trees to be removed, using ribbon, marker tape or a similar approved method within the immediate vicinity of the *WUC*. The *Superintendent's Representative* shall inspect the site prior to construction to give approval on the removal of these trees.

When determining the clearing area, the following principles, set out in order of preference, must be considered:

- Avoid the clearing of native vegetation;
- Minimise the amount of native vegetation to be cleared; and
- Reduce the impact of clearing on any environmental value.

For trees to be retained a tree protection zone is to extend 2 metres past the drip line (extent of canopy) of the tree. All work to be carried out within this tree protection zone shall be done by hand methods such that root systems are preserved intact and undamaged. Canopy pruning can be undertaken using a chainsaw or handsaw, where no more than 50% of the canopy is taken. If more Canopy removal is required, approval is to be sort from the *Superintendent's Representative* before any pruning is undertaken. No root pruning is to be undertaken without prior approval of the *Superintendent's Representative*. Excavations under tree canopies shall be open for as short a period as possible. The *Contractor* shall not backfill around tree trunks to a height greater than the original ground surface.

a. Trees shall be protected in their entirety including roots, stems, trunks, bark, branches and foliage at all times;

b. No damage shall be caused to trees through physical means including cutting, breaking, bruising, heating or burning of plant parts or by compaction of removal of soil around roots; and

c. No damage shall be caused through chemical means including spraying of toxic materials, or emission of fumes or by contamination of soil.

2.2.3 Limits of Clearing, Stripping and Grubbing

The limits of clearing and grubbing shall comprise of the following:

a. The limits of *WUC* shown on the Drawings;

b. The areas defined in the Clearing Permit documentation contained within 0

c. Areas where the placement of fill is required as shown on the Drawings; and

d. Other areas as approved by the *Superintendent's Representative* subject to the need for clearing of native vegetation.

Within the work site, the extent of clearing, stripping and grubbing shall not be greater than the minimum practical extent required for the completion of the Work under the *Contract*.

The *Contractor* shall define the limits of clearing and stripping on the site by the erection of a clearly visible barrier or fence. Vegetation outside the barrier shall not be damaged or disturbed without the prior written permission of the *Superintendent's Representative*. Areas of significant vegetation and wildlife habitat, as directed by the *Superintendent's Representative*, shall not be disturbed by the *Contractor*'s activities.

2.2.4 Weed Control

When undertaking any clearing, the following measures are to be in place to minimise the risk of introducing and/or spreading of weeds:

a. Clean earth-moving machinery of soil and vegetation prior to entering and leaving the area to be cleared;

b. Ensure no known weed-affected soil, mulch, fill or other material is brought into the area to be cleared; and

c. Restrict the movement of machines and other vehicles to the limits of the areas to be cleared.

2.2.5 Clearing

Unless otherwise specified, the area within the limits of clearing shall be cleared of all vegetation, refuse, obstructions and equipment down to natural surface.

Trees shall be brought down in such manner as to avoid danger to third party property, personnel and plant, or damage to other trees, shrubs, structures or property outside the area being cleared or designated to be retained within the area being cleared.

2.2.6 Topsoil Stripping

Topsoil stripping applies to all natural ground areas within *WUC* areas, where it is necessary and required to place permanent or temporary structures.

The stripped surface level shall be nominally 200 mm below the cleared or natural surface level. Methods employed for stripping shall not increase the extent of unstable areas.

Stripped materials shall be placed in stockpiles at a location, outside the active work area or areas, at a location nominated by the *Superintendent's Representative*. Stripped material stockpiles shall be constructed to a measurable shape not more than 2 m in height.

2.2.7 Grubbing

Unless otherwise specified, the area within the limits of clearing shall be totally grubbed (i.e. of all vegetation, refuse and obstructions), or grubbed to a depth of not less than 0.3 m below the surface.

Holes resulting from grubbing shall be promptly backfilled with fill material as approved by the *Superintendent's Representative* to prevent the infiltration and pooling of water. The material shall be compacted to the same degree as the surrounding material.

2.2.8 Reuse of Turfed areas

Where areas that are currently turfed are to be disturbed the *Contractor* is to make every effort to preserve the turf (including stolons) for future reuse as detailed on the drawings and within this Specification. Key areas of turf reuse include the those adjacent and contained within the CIDHS and areas adjacent the proposed Basin 1 within the Northern Drumsite areas.

2.2.9 Removal of Obstructions

Where required, pits, pipes and other structures that are no longer required, shall be excavated and removed or broken back to a depth not less than 0.3 m below the final excavation levels.

Where required, disused structures, shall be demolished and removed.

Any trenches or holes resulting from removal of pits, pipes, conduits and structures shall be promptly backfilled with fill material as approved by the *Superintendent's Representative* to prevent the infiltration and pooling of water. The material shall be compacted to the same degree as the surrounding material.

2.2.10 Removal, Re-use and Disposal

Items that will remain the property of the *Client* but to be removed by the *Contractor* shall be carefully removed and transported to the *Contractor*'s works area for safe storage. The *Contractor* shall be liable for any damage to these items caused by carelessness in removal or transport. These items include in particular historic rail infrastructure proposed to be removed on the George Fam incline and any within the Drumsite. All removed items that are to be kept (excludes concrete) are planned to be kept for future display. The *Contractor* will be advised prior to removal the location to which the materials are to be taken for future assembly by others. The location will be within the overall settlement areas of the Island.

Material generated through clearing activities shall be stockpiled on-site in designated areas for re-use or disposal. The *Contractor* shall salvage and store the following items for re-use:

a. Existing site soil;

b. All tree logs deemed useable for placement on the site useable to create fauna and flora habitat;

c. All tree materials useable for mulching or brushing; and

d. Rocks larger than ~500 mm diameter encountered during clearing useable to create fauna and flora habitat.

Stockpiling strategies should keep materials separate and appropriately labelled, and site personnel should be clearly instructed on stockpile management to avoid soil contamination and maximise the reuse of salvaged material. Stockpiled material shall be assessed by the *Contractor* and discussed with the *Superintendent's Representative* prior to disposal or re-use.

Foliage, branches and tree trunks shall be mulched and neatly stockpiled by the *Contractor* for re-use. Mulch stockpiles shall be constructed and maintained in such a manner to minimise the potential for spontaneous combustion of the mulch.

Tree logs and rocks larger than 500 mm diameter should be stored on-site and re-use in location priory agreed with the *Superintendent's Representative*.

All other materials, equipment, structures or waste materials produced by clearing and grubbing shall become the property of the *Contractor* and shall be removed from the site and properly disposed of in the manner proposed by the *Contractor* in accordance with environmental requirements and accepted by the *Superintendent's Representative*. Burning off cleared or grubbed material shall not be permitted.

The *Contractor* shall submit a proposed method for disposal of trees and shrubs and all other materials to the *Superintendent's Representative* prior to commencement of the *WUC*.

2.2.11 Survey Marks and Equipment

During clearing and grubbing operations, care shall be taken not to disturb any existing structures, survey marks, monitoring bores or equipment that is to be retained. The *Contractor* shall repair any structures, reinstate any survey marks, and repair any equipment damaged during clearing and grubbing.

2.2.12 Erosion and Sedimentation Controls

The *Contractor* shall implement effective erosion and sedimentation control measures in accordance with the *Contractor* prepared CCMP and CEMP in advance of, or in conjunction with, clearing and grubbing operations. Refer to section 5.12 for further requirements.

2.2.13 Record Keeping

The *Contractor* is required to maintain the following records in relation to clearing works:

1. The location where clearing occurred, as surveyed by a licensed surveyor, using the Geocentric Datum Australia 1994 (GDA94), expressing the geographical coordinates in Eastings and Northings or decimal degrees;
2. The date(s) that clearing occurred;
3. Size of the area cleared (in hectares);
4. Actions taken to avoid, minimise and reduce the impacts and clearing extents (as per Section 2.2.2); and
5. Actions taken to minimise the risk of the introduction and spread of weeds (as per Section 2.2.4).

2.3 Demolition

2.3.1 Scope

This Specification covers the complete demolition of existing improvements (above and below ground) on the site and the complete removal of all demolished materials from the site.

2.3.2 Regulations

All *WUC* shall be completed in accordance with the relevant codes of practice, statutory regulations for health, safety, handling/disposal/transportation of waste and hazardous materials.

The *Contractor* shall be responsible for lodgement of notices to the SoCI, obtaining a Demolition License and payment of such fees in compliance with sections 8 and 13 of the WA Uniform Building By Laws.

If asbestos is encountered during the demolition works it shall be removed in accordance with the relevant sections of the Occupational Health, Safety and Welfare Regulations 1996. Tenderers are therefore required to hold or provide evidence that they are able to obtain the necessary asbestos removalist licence.

2.3.3 Disconnection of Utility Services

The *Contractor* shall submit applications for disconnection of power, water, gas and telecom services and any other relevant authorities.

The *Contractor* shall satisfy themselves that such disconnections have been completed by the respective authorities prior to commencement of work on site.

2.3.4 Demolition Works

The *Contractor* shall complete demolition and removal of such materials from the site as follows, except as otherwise detailed.

Pavements

Excavate and remove all existing bituminous pavements including gravel, rock base and limestone sub-basecourse, together with all concrete kerbing and concrete slabs.

The sand subgrade shall not be disturbed apart from that minimum required to neatly remove pavement material.

Any driveway crossover pavements shall be neatly and carefully removed without damage to existing road pavements.

Buildings and Structures

Demolish and remove all buildings and improvements within the site.

Slabs, footings and other subsoil structures shall be demolished and removed from site.

Fencing

The *Contractor* shall dismantle and remove from site any existing fences, fencing wire, posts and gates from site unless otherwise specified.

Drainage Structures

The *Contractor* shall include for location of all existing drainage pipework, pits, manholes and any other associated structures.

All drainage structures shall be removed from site and excavations backfilled with clean fill and compacted to 95% MMDD or agreed equivalent.

2.3.5 Disposal of Demolished Materials

All demolished materials shall become the property of the *Contractor*.

The *Contractor* shall be responsible for disposal of all such materials off site in accordance with the applicable statutory/local authority requirements.

2.3.6 Clean Up and Finish

On completion of demolition and removal of materials from the site, the *Contractor* shall trim and grade all disturbed areas to a uniform shape and grade, free from localised crests, troughs or ruts.

Any spillage of materials onto the existing nearby roads shall be promptly removed and surface cleaned.

2.4 Fencing

Install a heavy galvanised, security fence around the basin sites to the location shown on the drawing. The alignment shall be on the located to give a minimum of 3m clear area between the fence and the edge of the basin embankment to allow servicing equipment around the inside perimeter unless otherwise detailed on the drawings. The fence type to be used is to be in accordance with the drawings.

Install a gates with keepers, concrete sill, locking chain and Lockwood 234A padlock as detailed in the drawings.

All fencing to be in accordance with AS 1725.

3. Products and Materials

3.1 General

All materials supplied to the site shall be supplied with appropriate compliance certificates and testing. These documents shall be made available to the *Superintendent's Representative* prior to the installation of any product or material. The *Superintendent's Representative* shall be given the opportunity to inspect all products and materials prior to placement and at any specified hold points as detailed within this Specification or a *Contractor* prepared ITP documentation.

Details of some specific materials required for Earthworks and Roadworks are detailed within Sections 4.3 and 7 respectively. Material requirements associated with the installation of the proposed section of Water Corporation Potable water main are to be consistent with the requirements detailed in Section 6.

3.2 Pipes and Culverts

3.2.1 Pipes and Precast Components

All pipes and precast components incorporated in the *WUC* shall be in free of cracks, chips, surface voids and deformities. An inspection shall be undertaken prior to leaving the precast manufacturers' facility and also prior to installation on site with both inspections recorded. The *Superintendent's Representative* shall be afforded the opportunity to undertake such inspections and reject products if damaged. Any damaged items shall be rejected and shall be removed from the site at the *Contractor's* expense.

3.2.2 Concrete Pipes

All concrete pipes shall conform to AS/NZS 4058 and shall be rubber ring joint type, unless otherwise specified or authorised by the *Superintendent's Representative*. Strength class shall be 2 unless otherwise noted on the Drawings.

3.2.3 Polyvinyl Chloride Pipes

Unplasticised polyvinyl chloride (uPVC or PVC-U) pipes shall comply with the requirements of AS/NZS 1477 and be a minimum of 150 diameter nominal and with a pressure rating of PN6 unless otherwise detailed on the Drawings.

Modified polyvinyl chloride (mPVC or PVC-M) pipes shall comply with the requirements of AS/NZS 4765 and be a minimum of 150 diameter nominal and with a pressure rating of PN6 unless otherwise detailed on the Drawings.

All pipes shall also be compliant with AS/NZS 2566.1 where it applies.

All PVC-M pipe to be used for pressure applications within the *WUC* are to also be compliant with the requirements of the Water Corporation Specification PVC contained within Appendix G unless otherwise agreed.

3.2.4 Polypropylene Pipes

Polypropylene (PP) stormwater pipes shall comply with the requirements of AS/NZS 5065. Nominal pipe diameters and classes shall be as detailed on the Drawings and be installed as per the manufacturers' requirements.

3.2.5 Polyethylene Pipes

All polyethylene (PE) Pipe which is to be used for below ground drainage is to be supplied such that it is compliant with AS/NZS 2566.1 and AS/NZS 5065 where applicable. Where specified or authorised by the *Superintendent's Representative*, Enviropipe's HDPE Ribbed Pipe or approved equivalent, shall be supplied in accordance with AS 5065 and any manufacturers' requirements.

All polyethylene (PE) Pipe which is to be used for above ground drainage is to be supplied such that it is compliant with AS/NZS 2566.1 and AS/NZS 5065 where applicable. All pipe is to be compliant with the requirements of the Water Corporations Specification requirement PE contained within Appendix G unless otherwise agreed.

3.2.6 Fibre Reinforced Pipes

Not used for this Specification.

3.2.7 Precast Reinforced Concrete Box Culverts

Precast reinforced concrete box culverts shall comply with the requirements of AS 1597.1 and AS 1597.2.

Each batch of culvert section shall be subjected to the proof loading test as prescribed in AS 1597.1 and AS 1597.2.

Box culvert sections of size equal to or larger than 600 mm x 450 mm shall be fitted with suitable attachments for lifting gear.

3.2.8 Subsoil Pipes

Not used for this Specification

3.3 Pits, Covers and Headwalls

3.3.1 Precast Concrete Pit Liners

Precast concrete components shall be manufactured in accordance with the dimensions and details shown on the Drawings in accordance with the relevant Australian Standards, including AS/NZS 4058 and AS 4198. Proprietary components, where specified or shown on the Drawings, shall be in accordance with that manufacturers' latest published information.

Precast concrete liners for junction pits, grated gully pits and side entry pits, shall unless otherwise specified, be constructed of 1050 mm nominal diameter reinforced concrete pipe segments. The segments shall be of equivalent strength of Class 2 pipes and shall have interlocking joints. For pits exceeding 1.3 m depth and internal diameter exceeding 900 mm, the segments shall have cast-in holes to accept step-irons. Under no circumstances shall step-iron holes be made with a hammer and/or chisel.

3.3.2 Manhole, Gully and Pit Covers

Manhole and pit covers shall be manufactured from precast concrete and mild steel plates to the shapes and sizes shown in the Drawings, in accordance with AS 3996.

Manhole and pit covers should be flush with the frame with a maximum allowable vertical tolerance of ±3 mm.

Manhole and pit covers shall fit tightly within their frames with the total gap between the cover and their frame in any direction not to be greater than 5 mm.

All mild steel components shall be hot dipped galvanised after fabrication in accordance with AS/NZS 4680.

All manhole, gully and pit covers are to be equipped so as to allow the lids to be secured with either a lock or bolt down assembly.

3.3.3 Precast Concrete Pit and Headwall Components

Precast concrete components shall be manufactured in accordance with the dimensions and details shown on the Drawings in accordance with the relevant Australian Standards, including AS/NZS 4058. Precast concrete components shall be manufactured in accordance with the dimensions and details shown on the Drawings by reputable supplier(s) acceptable to the *Superintendent's Representative*. Proprietary components where shown on the Drawings or specified shall be in accordance with that manufacturers' latest published information.

3.4 Prefabricated Trenches

3.4.1 Surface or Trench Drains

All surface drainage system detailed on the drawings are to be *ACO Trafficdrain TD300* polymer concrete v-profile channel system with galvanised steel edge rails or approved equivalent.

Trench Drain channels shall be manufactured from polyester resin polymer concrete with an integrally cast-in galvanised steel edge rail.

Properties of polymer concrete will be as Table 1-1 with supporting documentation.

Further details in relation to the design and components of the trench drain system refer to the design drawings.

Table 3-1 Trench Drain Material Properties

Property	Value
Compressive Strength	98 MPa
Flexural Strength	26 MPa
Tensile Strength	14 MPa
Water Absorption	0.07%
Frost Proof	YES
Coefficient of Expansion/Contraction	2.02 x 10 -5/°C
Water Vapour Transmission	0.0364 g/m²
Non Flammable	YES
Coefficient of Roughness (mannings)	n = 0.011
Resistant to Weathering	YES
Dilute Acid and Alkali Resistance	YES
SF Sealant	YES

3.5 General Concrete

3.5.1 Concrete

Concrete used for in-situ work shall conform to AS 3600 and be provided by a pre-mix concrete supplier conforming with AS 1379, or mixed on site using materials as specified and plant to the approval of the *Superintendent's Representative*.

Concrete strength and characteristics for pits, headwalls, drainage structures, pipe encasements, mass concrete, footpaths, precast concrete, lean mix concrete, blinding and all other concrete elements shall be in accordance with the Drawings.

All concrete shall be compacted to be free of honeycombed or voided areas. Manufacture of precast components under intense compaction as defined in CIA Z7/04 Section 11.2.2 is preferred and referenced in AS 3600.

Maximum size of aggregate shall be 20 mm.

Concrete shall be cured in accordance with Clause 3.5.13 to Clause 3.5.16 inclusive.

Concrete for use in extruded kerbing shall be in accordance with Clause 7.10.

3.5.2 Cement

All cement used shall be Type GP, or LH where specified on the Drawings, in accordance with AS 3972 and obtained from an approved manufacturer.

Cement shall be delivered to the site fresh and in sealed bags and there stored in a weatherproof shed until such time that it is to be used. Any bag showing signs of deterioration or setting is to be rejected.

3.5.3 Lean Mix Concrete

Lean mix concrete for bedding and/or backfill (where required) shall be 5 MPa compacted concrete with a maximum particle size of 20 mm.

No density testing of lean mix concrete is required.

3.5.4 Mortar for Stormwater Pipes and Pits

Mortar when used shall be in accordance with AS 3700 or Main Roads WA specifications as listed in Table 3-2. Air-entraining admixture shall not be used.

Mortar mixed on site shall be used within 30 minutes of mixing the dry ingredients with water. Re-tempering of mortar will not be permitted. Any mortar which has begun to set shall be rejected.

Table 3-2 Mix Proportions for Mortar

Mortar type/location	Mix proportions by volume			Proportion of water
	Cement	Sand	Hydrated lime	
Mortar for jointing of conduits and jointing of conduits to structures MRWA Specification 405 (Appendix H)	1	3	0	Sufficient to produce a stiff mortar of workability that is satisfactory for each particular type of work
Mortar for bedding of box culverts MRWA Specification 404 (Appendix H)	1	3	0	
Mortar for masonry AS 3700 Class M4	1	4	0	

3.5.5 Aggregate Materials

Aggregates used for concrete shall comply with the provisions of AS 2758.1.

Aggregates used for mortars shall comply with the requirements of AS 3700.

Fine aggregate shall be well graded, clean, sharp and free from clay and organic impurities in accordance with AS 1141.

Coarse aggregate shall be crushed granite or diorite clean and free from all impurities and dust in accordance with AS 1141.

The maximum particle size shall not exceed 20 mm unless otherwise specified in the applicable standard

Testing of aggregates for concrete shall be carried out in accordance with AS 1141 and other appropriate methods as directed by this Specification.

Aggregates shall consist of hard, dense, durable, uncoated rock particles and shall be free from organic matter and injurious amounts of dust, clay lumps, soft or flaky particles, shale, alkali, loam or other deleterious substances. The aggregates shall consist substantially of particles of satisfactory shape. A particle of satisfactory shape is defined as a particle having a maximum dimension not greater than 3 times the minimum dimension.

3.5.6 Fine Aggregate

Fine aggregate for concrete and mortar shall be natural silica sands. The use of up to 20% manufactured sand as a percentage of total fine aggregate is permitted provided the source is approved by the *Superintendent's Representative*. It shall consist of hard, durable grains and shall be free from injurious amounts of dust, soft particles, alkali, organic matter, loam or other deleterious substances. When assessed in accordance with Clause 9 of AS 2758.1, the aggregate shall meet the requirements for Exposure Class C. Chert shall not be used as fine aggregate. The particles of sand shall be of a satisfactory shape. Fine aggregate producing a colour darker than the standard in the colorimetric test for organic impurities described in Section 34 of AS 1141 may be rejected. The fine aggregate shall be acceptably graded and supplied within the Limits of Deviation specified in Table 2 of AS 2758.1.

3.5.7 Coarse Aggregate

Coarse aggregate shall consist of crushed unweathered granite, diorite, basalt, other approved hard durable rock or approved screened river shingle which does not contain minerals known to react deleteriously with cement alkalis. When assessed in accordance with Clause 9 of AS 2758.1, the aggregate shall meet the requirements for Exposure Class C. Chert shall not be used as coarse aggregate. The coarse aggregate shall be obtained from a source approved by the *Superintendent's Representative*. To obtain an acceptable grading, the coarse aggregate shall be batched in at least two size designations. The coarse aggregate shall be acceptably graded in general accordance with Table B1 of AS 2758.1 and supplied in within the Limits of Deviation specified Table 1 of AS 2758.1.

3.5.8 Alkali-Aggregate Reaction (AAR)

The risk of alkali aggregate reaction (AAR) shall be controlled in accordance with the recommendations of SA HB-79 assuming High Risk Level. Any aggregate intended for use in concrete mixes should be assessed for potential alkali-silica reactions based on, but not limited to:

a. Fine and coarse aggregates shall be separately tested for potential alkali aggregate reactivity (AAR) using the Accelerated Mortar Bar Test, AS 1141.60.1 or similar approved method. An alternative test method is the Accelerated Concrete Prism Test, AS 1141.60.2 or similar approved method such as ASTM C1293.

b. Petrographic testing of aggregates shall be undertaken to provide information on alkali aggregate reactivity risk by ASTM C295 or other approved test method.

c. Recently completed laboratory test data not more than 12 months old may be accepted at the discretion of the *Superintendent's Representative*.

d. Aggregates shall be classified in accordance with AS 1141.60.1 Aggregate Reactivity Classification and the below.

   i. For aggregates classified as non-reactive by AS 1141.60.1 no action for control is required.

   ii. For aggregates classified as slowly reactive by AS 1141.60.1 the concrete mix shall either:

      1. Incorporate a proportion of fly ash that is 25% by mass of the total cementitious materials; or

      2. Be a blended cement (65% ground granulated iron blast-furnace slag + 35 % Type GP cement); or

      3. Incorporate a proportion of amorphous silica that is 8% by mass of the total cementitious material.

      4. Fly ash, ground granulated iron blast-furnace slag and amorphous silica shall comply with the requirements of AS 3582.1, AS 3582.2 and AS 3582.3 respectively.

   iii. Aggregates classified by AS 1141.60.1 or AS 1141.60.2 as reactive shall not be used.

   iv. Guidance is given in SA HB 79 on use of flyash, slag and silica fume as a mitigation measure for aggregates that would be reactive when using only Portland cement.

3.5.9 Concrete Admixtures

The Premix Supplier will generally need to use a water-reducing and likely a set-retarding, admixture to achieve the specified water/cement ratio and workability requirements. Where a water-reducing admixture is used, the Premix Supplier shall show by tests that the use of the admixture, in combination with the other materials to be used in the *WUC*, produces the desired effect without affecting the other qualities required for the concrete and without endangering the reinforcement.

The water-reducing and set-retarding admixture shall comply with the requirements for a Type WR, Type Re, or Type WRRe admixture (as appropriate) as specified in Section 2, AS 1478.1 as appropriate. The dosage used in each mix and section of the *WUC* shall be as approved by the *Superintendent's Representative*.

3.5.10 Formwork

Concrete forms and the use of formwork shall be in accordance with AS 3610.

The primary requirements for all formed concrete permanently exposed are that the concrete surface shall be durable, without any signs of dusting and true to line and level. The formed surface finish shall comply with the specified surface texture and have a uniform finish without voids, patching, plastering, cement washing or any treatment whatsoever after removal of the formwork.

All formwork made up from panels shall be so arranged that panel joints obvious in the formed concrete do not detract from the final appearance of the structure to the *Superintendent's Representative* approval.

Formwork shall be constructed so that it can be removed without damage to any permanent part of the *WUC*.

Joints between adjacent form facing panels shall be sealed and taped to prevent loss of concrete fine material during concrete placement.

Formwork shall be structurally adequate to support formwork, concrete, and reinforcement loads as well as all impact loads transmitted by concreting operations and equipment.

Formwork shall be designed, constructed and maintained so as to achieve finished surface tolerances as specified in the Specification.

Form linings may be steel, select grade tongued and grooved hardwood, or plywood.

Formwork for successive wall lifts shall not be supported by previously placed concrete until that concrete has achieved a minimum characteristic strength of 15 MPa.

Horizontal forms (for in-situ cast suspended slabs and beams) shall not be removed until a compressive strength of 25 MPa has been achieved.

Formwork system shall be nominated by the *Contractor* in the tender submission.

Use of tie wire passing from one face of a concrete form to another face shall not be permitted.

Only proprietary form spacers and ties shall be used. In drainage structures, only approved watertight form tie products such as Max Frank, Peri or approved equivalent shall be used.

The form tie product proposed for use will require prior approval by the *Superintendent's Representative*. The supply of such documentation is considered a **HOLD POINT** for construction of all concrete works on the site.

Bolts that fix or support formwork shall be greased and so arranged that they may easily be removed from the concrete without damage to the concrete

Block-outs, inserts, ducts and embedded items shall be located and fixed so that the construction tolerances specified are complied with.

Embedded metallic items shall be isolated from the reinforcement materials.

For all holes and ducts in walls that require reinforcement to be curtailed, an equal amount of reinforcing shall be placed either side of the hole with laps as specified.

Before concrete placing begins, the interiors of forms are to be inspected and any foreign material removed if found. Where the bottom of a form is inaccessible from within, temporary access panels shall be provided to permit thorough removal of debris immediately prior to placing concrete. Before placing concrete, close and seal these openings to prevent loss of slurry.

Where the formwork requires a release treatment, treat surfaces with form fluid designed to act as form release agent and to minimise the formation of bug holes and dusting. The form release agent shall be approved by the *Superintendent's Representative* and the method of application shall be in accordance with the manufacturers' instructions.

Ensure that no form fluid comes into contact with any steelwork or reinforcement, should this occur, thoroughly clean the steel with solvent prior to placing concrete.

Do not use form oils or releasing agents which will discolour concrete finish, or applied finishes.

Form release agents shall be non-residual and compatible with any subsequently applied durability or decorative coating, or readily removable prior to coating application.

Form oils or releasing agents shall be of a type that is stable, non-toxic and self-dissipating.

Formwork shall be subject to inspection and acceptance by the *Superintendent's Representative* at least 24 hours prior to any concrete placing operation, This is considered a **HOLD POINT**.

Should any forms show signs of bulging or sagging after the concrete has been placed, the concrete shall be removed as directed by the *Superintendent's Representative* and the formwork shall be reconstructed to the *Superintendent's Representative*'s satisfaction.

All formwork jointing shall be sufficiently tight to prevent the escape of any mortar, slurry or free water.

Formwork shall be so fabricated that, when stripped, the finished concrete shall conform to both AS 3610 (Table 3.4.2, based on the specified class of finish) and AS 3600 (Clause 17.5.2). The requirements of AS 3610 are to take precedence except where the requirements of AS 3600 are more stringent.

No tolerances specified shall permit encroachment of horizontal or vertical building lines or footings beyond the legal boundaries.

3.5.11 Placing Concrete

The placement of concrete shall be in accordance with AS 1379 and in general accordance of the guidelines in CIA Z7/04.

Water shall not be added to the concrete mix at the site unless specifically approved by the *Superintendent's Representative*. Water added on site shall not void any strength or durability requirements. Additional water may be added on site as long as the following is done:

e. Complies with AS 1379 Clause 4.2.3 and the below with the higher quality requirements taking precedence where differences occur.

f. Time from batching when water or admixture is added shall be no later than 75 minutes or 80% of an extended time approved as above.

g. Discharge from the batch when water is added shall only be a minimum quantity to allow a slump test or slump flow test including a second test as required.

h. Procedure is in accordance with a *Contractor's* method statement.

i. Slump or slump flow of the concrete is measured before and after the addition.

j. Samples for compressive strength testing are taken after the addition.

k. Approval is given by the *Superintendent's Representative* and the Concrete Supplier.

l. Additional water or admixture quantity is measured, recorded, and witnessed by the *Superintendent's Representative*.

m. Added water quantity is measured using a calibrated meter or container and mixed thoroughly prior to commencement of discharge.

n. Total water or admixture does not exceed the allowable additional water content recorded on the delivery docket as based on the specified maximum water cement/ratio.

o. Where autographic records exist, these shall be made available for inspection upon request.

Where concrete placing is delayed until the concrete is in danger of taking its initial set, the line of stoppage shall be formed into a construction joint. If the stoppage occurs in a position unsuitable for a construction joint, the concrete shall be removed from the forms back to a suitable location.

3.5.12 Maximum Temperature of Concrete

The placement temperature of all concrete shall not exceed 32°C. Concrete placement method start and finish pour times shall be selected to achieve the lowest possible concrete placement temperature to minimise the risk of concrete cracks.

The maximum temperature of all in situ and precast concrete elements shall not exceed 70°C for cement type GP and 80°C for approved cement systems with a minimum quantity of 40% slag, 20% fly ash or 8% silica fume (refer guidance in CIA Z7/04 Section 3.15.1).

3.5.13 Curing Concrete General

The *Contractor* shall submit to the *Superintendent's Representative* for approval their proposed curing regime within its Inspection and Testing Plans for all concrete work on this project a minimum of four weeks prior to any concrete construction. The supply of such documentation is considered a **HOLD POINT** for construction of all concrete works on the site.

3.5.14 Placement Concrete Curing

The concrete shall be protected from the sun, wind and rain by being kept moist from time of placement until surface finishing is completed by use of shading, windbreaks and spraying an evaporation retardant to prevent plastic shrinkage cracking and/or crusting. Re-apply the evaporation retardant as weather conditions justify and as specified on the evaporation retardant manufacturers' product data sheet.

3.5.15 Hardened Concrete Curing

Hardened concrete curing of exposed concrete surfaces commence as soon as surface finishing operations are completed when the concrete has hardened sufficiently to prevent damage. The concrete surface shall be kept continuously moist and the whole surface protected from the effects of wind and sun. Acceptable curing methods include:

a. Prevent moisture evaporation from the concrete surface by covering completely with polythene sheeting or equivalent covering material securely held in position. The covering shall be in full contact with the concrete surface. The edges of the sheeting shall be taped or shall be overlapped by at least 200 mm and the whole shall be securely held in position. Any damage to or displacement of the sheeting during construction operations shall immediately be made good. An additional measure for consideration is the top concrete surface shall be kept continuously moist by the use of an absorbent cover being saturated with water and then immediately being covered by the polythene sheet;

b. Apply an approved liquid curing compound to exposed concrete surfaces where approved by the *Superintendent's Representative*. Refer to CIA Z9 for guidance on curing of concrete and application of liquid-applied curing membranes.

c. Maintain formwork in position for curing period with no gaps between concrete and formwork at exposed surfaces that would allow moisture loss (e.g. apply polythene sheeting as mitigation measure).

d. Pond or continuously sprinkle the surface with water. Intermittent curing, such as spraying with water once a day, is not acceptable. Water can only be applied after sufficient surface hardening to avoid damage to the concrete surface and therefore other curing methods shall be applied immediately after surface finishing operations (e.g. polythene sheeting or curing compounds).

Curing shall be undertaken to satisfy short-term requirements to prevent plastic cracking and long-term requirements of ensuring continued cement hydration. Curing shall be continued until the requirements of Options 1, 2 or 3 described below are met:

6. Option 1: 7 days curing for GP cement;
7. Option 2: 14 days curing for GB or LH cement.
8. Option 3: Until the concrete in the cover zone achieves 60% of its characteristic strength that shall be determined by cover zone maturity monitoring in accordance with ASTM C1074 or strength testing of additional cylinders cast by the premix concrete supplier and cured in a similar manner to the cover zone concrete it represents.

No traffic shall be allowed to pass over, and no materials shall be deposited on, any concrete during its curing period without taking precautions to prevent damage to the concrete or impairment of the curing process.

If forms are removed during the curing period, one of the previously described curing methods shall be employed and continued for the remainder of the period.

3.5.16 Liquid Applied Curing Compounds

General and specific characteristics of curing compounds and testing thereof shall comply with the requirements of AS 3799. For each curing compound proposed for the *WUC* a current Certificate of Compliance from the supplier shall be provided.

For each batch delivered, the *Contractor* shall provide a Certificate of Uniformity from the supplier.

Only wax-based (AS 3799, Class A), resin based (AS 3799, Class B), and water-borne (AS 3799, Class Z) curing compounds that comply with the requirements of AS 3799 shall be used.

A pressurised sprayer to give uniform cover shall apply the curing compound. The sprayer shall incorporate a device for continuous agitation and mixing of the compound in its container during spraying. The curing compound shall be applied using a fine spray at the rate stated on the certificate of compliance.

The curing compound shall be applied to unformed surfaces immediately after completion of all finishing operations and disappearance of the sheen. Where curing of formed surfaces is to be continued by application of a liquid-applied membrane after removal of formwork, concrete surfaces are to be wetted to return to saturated/surface dry condition then the liquid membrane applied immediately that the surface sheen has disappeared. Refer to CIA Z9 for guidance.

The curing membrane shall be maintained intact after its initial application, for the required curing period. Any damage to the curing membrane shall be made good by re-spraying of the affected areas.

Any curing compound shall be compatible with both the concrete mix and the applied finishes and shall take account of all possible finishes (e.g. protective coatings) to be applied to the concrete, and consider concrete surface preparation for such finishes. If the curing membrane has an impact on the concrete surface preparation (e.g. requiring blast cleaning removal) alternative curing methods shall be considered. Wax based (AS 3799 Class A) curing membranes shall not be used where subsequent preparation by abrasive blast cleaning will be used, as they can be difficult to remove by this method.

Curing compounds shall not be used on surfaces against which fresh concrete is required to bond.

3.5.17 Concrete Impregnated Fabric

Concrete impregnated fabric shall be a canvas type product with a minimum of 8 mm thickness. The concrete impregnated fabric (concrete canvas) produced by CC8 or agreed equivalent shall be installed in the locations shown on the accepted drawings. All installation of product shall be undertaken in accordance with the manufacturers' requirements.

3.5.18 Concrete Additives - Pipes/Pits

The use of Xypex Admix C-5000 or a similar durability enhancement additive are permitted upon approval by both the manufacturer and the *Superintendent's Representative* prior to concrete manufacturer or construction including this admixture use designated for concrete on the Drawings.

3.5.19 Concrete Coatings - Pipes/Pits

Coating of the inside and outside of the concrete pipes as a measure for maintaining the life expectancy of the pipes can be used but requires approval by the *Superintendent's Representative* prior to installation.

3.5.20 Concrete Crack Inspection

A site crack inspection (including any minor gap opening at construction joints) shall be completed on all interior and exterior concrete surfaces as in accordance with the procedures and crack measuring devices in CIA Z7/07 and crack assessment in CIA Z7/06:

a. Detailed inspection after the concrete has cooled to ambient conditions (approximately 7 days after casting). This will identify any unexpected cracking and allow adjustments as needed for future concrete pours.

b. Inspection at times as required by project Quality Assurance/Quality Control.

c. Immediately after all construction activities are completed to document crack positions and measure the surface width of any cracks that have formed, prior to any backfilling of soil or water contact.

d. These inspections shall determine the presence of any cracks in insitu concrete greater than 0.2 mm width for drainage structures and 0.3 mm width for all other concrete elements. The *Superintendent's Representative* will decide the need for appropriate remedial Works.

All insitu concrete cracks greater than 0.2 mm width for drainage structures and 0.3 mm width for all other concrete elements shall be marked on plan and elevation drawings and issued as As Constructed Concrete Cracks drawings in a format acceptable to the *Superintendent's Representative*.

3.5.21 Repair of Concrete

All concrete that is defective in any way shall be liable for rejection by the *Superintendent's Representative*.

If the *Superintendent's Representative* is satisfied that the concrete in question can be properly and satisfactorily repaired, the concrete shall be repaired by the *Contractor* at the *Contractor's* expense to the satisfaction of the *Superintendent's Representative*.

The repairs shall be carried out as soon as practicable after the damage has been detected.

All repair material filling shall be acceptable bonded to the concrete substrate to be repaired and shall be sound and free of shrinkage cracks and drummy areas after the repair material has cured and dried.

Any repair shall be to the direction and approval from the *Superintendent's Representative*.

The *Contractor* shall repair the following imperfections (refer guidance on concrete defects in CIA Z6/06):

a. Concrete damaged from any cause;

b. Voided, honeycombed, fractured or otherwise defective concrete;

c. Concrete surface deviations beyond specified dimensional and/or finish tolerances;

d. Holes left by removal of form-ties and fittings;

e. Other defects identified by the *Superintendent's Representative*.

Concrete repair materials and procedures shall in each instance be subject to written approval by the *Superintendent's Representative* prior to commencement of repair work.

The *Contractor* shall provide the *Superintendent's Representative* with details of concrete repair proposals at least seven working days prior to commencement of any concrete repair operation. The supply of such documentation is considered a **HOLD POINT** for repair of all concrete works on the site.

3.5.22 Cementitious Grouting

Before placing grout, existing concrete surfaces on which the grout will be placed shall be roughened and shall be cleaned of all laitance, loose or defective concrete, coatings and other foreign material by effective means followed by thorough water washing.

The concrete surface shall be water wetted to achieve a saturated surface dry condition before placing the grout (e.g. kept moist for 24 hours immediately prior to grouting).

Potable water washing shall be used for grout that will be in contact with potable water.

All grout required to fill gaps in concrete elements (e.g. for precast cover installations) or for installation of metal elements (e.g. under base plates) shall be the thickness shown on the Drawings. Grout for this purpose shall be a proprietary cementitious shrinkage compensating grout such as Fosroc Conbextra GP, Conbextra HES, Conbextra HF or approved equivalent materials (e.g. by Sika, BASF, etc.) used strictly in accordance with manufacturers' recommendations (in particular, check present day recommended thickness applied).

The grout shall be applied using acceptable consistency (e.g. stiff, plastic, flowable, fluid, etc. to grout manufacturers' recommendations) for the specific requirements so the gap between concrete elements or under the metal elements is completely filled.

For precast concrete elements that are grouted below, they shall be levelled, plumbed and supported on non-metal shims while the grout is placed.

For metal base plates, the metal element shall be levelled, plumbed and lightly bolted with base plates supported on steel shims while the grout is placed.

Grout materials and procedures shall in each instance be subject to written approval by the *Superintendent's Representative* prior to commencement of repair work.

The supply of such documentation is considered a **HOLD POINT** for grout in the site.

3.5.23 Surface Finish of Concrete

Formed Surfaces

Unless otherwise specified formed surfaces shall be finished in accordance with Table 3-3.

Table 3-3 Concrete Finish – Formed Surfaces

Location	Type of Finish
All exposed vertical faces	Class 2 to AS 3610
All totally concealed formed faces	Class 5 to AS 3610

Surface colour control shall be Class B as defined in AS 3610.

Unformed Surfaces

Unless otherwise specified:

a. Unformed surfaces which are permanently concealed shall be of finish Class U1.

b. Trafficable surfaces shall be of finish Class U4.

c. Tops of walls shall be of finish Class U3.

d. Cover slabs to be U2 finish.

e. Kerbs and channels to be as per the requirements of section 7.10.4.

f. All other surfaces to be class U1.

Table 3-4 Concrete Finish – Unformed Surfaces

Finish Class	Finishing Procedure (Note 1)	Tolerance
Class U1	Screeded Finish This procedure shall consist of levelling and screeding the concrete to produce an even uniform surface.	5 mm abrupt or, 10 mm in 3 m
Class U2	Power-floated Finish This procedure shall consist of a floated finish using power-driven equipment. Floating work shall not commence until some stiffening of the concrete has taken place and the moisture film or shine on the concrete surface has disappeared. Floating work shall be the minimum necessary to produce a surface that is uniform in texture and free of screed marks. All necessary concrete surface cutting or filling shall be carried out during floating operations. Concrete element joints and edges shall be finished by means of approved edging tools.	Nil abrupt, or 5 mm in 3 m

Class U3	Trowelled Finish This procedure shall consist of steel trowelling work which shall commence only after the moisture film and shine have disappeared from the concrete surface and after the concrete has hardened sufficiently to prevent an excess of fine materials and water from being drawn to the surface. Steel trowelling shall produce a dense uniform surface free from visible blemishes and trowel marks.	Nil abrupt, or 5 mm in 3 m
Class U4	Broomed Finish This procedure shall apply to unformed horizontal or near horizontal concrete surfaces. It shall consist of slight roughening of the concrete surface by broom so as to produce a non-slip surface. Finishing operations, by wooden float only shall commence as soon as the screeded concrete has stiffened sufficiently to prevent the formation of laitance, and shall be the minimum necessary to produce a surface that is free from screed marks and is uniform in texture. Floating shall be followed by brooming with a bass broom until a regular but non smooth surface texture has been achieved.	2 mm abrupt, or 5 mm in 3 m
Note 1: Unless otherwise specified, finishing procedure shall be as specified in this table.		

3.6 Earthworks Materials

Refer to Section 4 for details.

3.7 Roadworks Materials

Refer to section 7 for details.

3.8 Water

The *Contractor* will be responsible for ensuring all water used is safe and appropriate for the intended use, and method of application. Where a significant health risk is posed, disinfection or filtration may be required.

The *Contractor* will be responsible for supplying a calibrated meter and providing weekly records of water used to the *Superintendent's Representative*.

3.8.1 Water for Concrete Works

Water for use in concrete and mortar manufacture and for curing shall be of a general potable quality, free from any impurities harmful to concrete, reinforcement, embedded items, mortar or steel. Water shall comply with the provisions of AS 1379.

3.8.2 Water for Pavements

Water added to the pavement material shall be clear and substantially free from sediments and detrimental impurities such as oils, salts, acids, alkalis and vegetable substances.

Water intended for use in pavement construction shall be potable, or shall contain not more than 3000 mg/L of Total Soluble Salts (TSS) when tested in accordance with Test Method WA 910.1, (or other authorised method).

3.8.3 Water for Other uses

Water used for dust suppression, moisture control and compaction shall be approval of the *Superintendent's Representative*. Suitable and approved water sources include:

- Water from the basin (dewatering or surface water); and
- Metered potable supply, which is managed by the Water Corporation.

3.9 Sand

3.9.1 Sand for Mortar

Sand for mortar shall be crushed stone or natural sand free from all deleterious substances and have a uniform grading.

3.9.2 Sand for Other Purposes

Sand for other purposes unless otherwise specified shall be natural sand with a percentage of fines not greater than 12% and free from organic material, rocks, stones, roots or other hard or sharp objects that would be retained on a 19 mm AS 1141.11.1 sieve.

3.10 Steel for Reinforcement

3.10.1 General

Steel reinforcing fabric and steel reinforcing bars for concrete shall comply with the requirements of AS/NZS 4671 and be free from loose rust or matter likely to impair the bond with concrete.

Structural steel shall comply with the requirements of AS 4100.

3.10.2 Preparation of Reinforcement

Reinforcement shall be cut and bent in accordance with AS 3600. Reinforcement shall be bent or straightened in a manner which will not damage it. Reinforcement shall be bent cold, except when approved by the *Superintendent's Representative*. Bending of reinforcement shall comply with the requirements of Section 17.2.3 of AS 3600. Re-bending of reinforcement or bending of reinforcement embedded in hardened concrete shall not be permitted unless specifically approved by the *Superintendent's Representative*..

Reinforcement shall, upon delivery to site, be stored on blocks which shall be raised above ground and to be well clear of sand, vegetation and other deleterious substances. It shall be handled in a manner so that it will not suffer any permanent deformation. Damaged bars shall not be made good by rebending.

Before the reinforcement is placed, the surfaces of the reinforcement and the surfaces of all reinforcement supports shall be cleaned of heavy rust, loose mill scale, dried mortar or grout, dirt, grease and other foreign substances which, in the opinion of the *Superintendent's Representative* are objectionable. Flaky rust which can be removed by firm rubbing with hessian or equivalent treatment shall not be acceptable. After being placed, the reinforcement shall be maintained in this clean condition until it is completely embedded in the concrete.

3.10.3 Placement of Reinforcement

Reinforcement shall be accurately placed and secured in position by steel tie wire so that it will not be displaced during the placing of the concrete. Reinforcement shall be adequately supported by approved spacers complying with AS/NZS 2425 to achieve the specified concrete cover. Chairs, hangers, spacers or other satisfactory supports made of metal or concrete may be furnished and used by the *Contractor* for supporting reinforcement however, metal supports shall not be used within the designated cover. Where concrete spacers are used, they shall be of equal or higher grade than the concrete being poured, and otherwise complaint with AS/NZS 2425.

In drainage structures, all spacers within the cover zone shall be proprietary high-durability fibre-cement such as Max Frank or similar to the approval of the *Superintendent's Representative*.

Tack welding of intersecting bars to secure reinforcement in position shall not be permitted. Any *Contractor* proposed tack welding of intersecting bars to secure reinforcement in position shall be in accordance with AS/NZS 1554.3, will require the *Superintendent's Representative* prior approval and be included in the *Contractor's* Inspection and Testing Plan.

Lifting of reinforcement into position during concreting operations is not permitted. The ends of the tie wire shall be directed away from the formwork and finished surfaces to avoid encroaching into the concrete cover.

Reinforcement shall be inspected in place and approved by the *Superintendent's Representative* prior to completion of the construction of the formwork. The *Contractor* shall give a minimum of two (2) working days notice to the *Superintendent's Representative* for inspection of in-place reinforcement.

3.10.4 Splicing of Reinforcement

Splicing of reinforcement shall be by lapping and shall be in accordance with Section 13 of AS 3600, unless otherwise shown on the accepted drawings or approved by the *Superintendent's Representative*. Splices shall be staggered so that splices in adjacent bars are not within the same lap length.

Where lapping lengths are not shown on the accepted drawings, or where additional splices are required, the lengths of lap splices shall be determined by detailed calculations of lengths required by AS 3600 made by the *Contractor* and approved by the *Superintendent's Representative*.

3.11 Soils

3.11.1 Topsoil Definitions

Topsoil is defined as soil which:

a. Contains organic matter;

b. Supports plant life;

c. Is free from unwanted matter such as:

- stones over 25 mm diameter;
- clay lumps;
- weeds and tree roots;
- sticks and rubbish;
- material toxic to plants; and

– is approved by the *Superintendent's Representative* for reuse on site as topsoil.

Site Topsoil

Site Topsoil must be topsoil won from stripping of the site of works and has the following characteristics:

a. free from stones or other material exceeding 25 mm in any dimension;

b. free from contaminants injurious to the establishment and growth of grass;

c. contains a proportion of organic matter conducive to the growth of grass; and

d. suitable for sowing, establishment and permanent growth of a full cover of grass.

Imported Topsoil

Imported Topsoil must be Fine Sandy Clay Loam to AS 4419.

3.11.2 Source

Site topsoil shall be used in preference to imported topsoil. The *Contractor* is responsible for creating a growing medium which will ensure satisfactory growth of the desired species and that it is in compliance with the Specification.

The *Contractor* shall notify the *Superintendent's Representative* of any topsoil characteristic found within the stockpiled site topsoil which may reduce the performance of any plant species or specified aquatic plant.

Import topsoil from an approved off-site local source where the site topsoil is not able to meet the Specification requirements. Imported topsoil should have a minimum of 20% organic matter.

3.11.3 Additives

There is no plan to undertake placement of additives in topsoil for this work package.

3.11.4 Bioretention Media

There is no plan to undertake placement of bioretention media for this work package.

3.12 Grates and Trash Racks

3.12.1 Galvanised Steel

After preparation, the items shall be galvanised in accordance with AS/NZS 4680, or AS 1214 as applicable.

The galvanising shall be adherent, clean, smooth, continuous and free from acid spots, cracks, laminations, blisters, gas-holes, runs or drips. The minimum finished coating thickness shall be the equivalent thickness specified in AS/NZS 4680 unless otherwise specified. After galvanising all items shall be free from distortion, or embrittlement and all traces of flux shall be completely removed.

3.12.2 Mild Steel Grates

All other grates are to confirm to the details as shown on the drawing with the metal used for the manufacture of fabricated steel grates shall comply with minimum Grade 250 structural steel of AS/NZS 3678 and AS/NZS 3679.1 or equivalent.

Welding shall comply with AS 1554.1. The fabricated grates shall be hot dip galvanised in accordance with AS/NZS 4680 after fabrication.

3.12.3 Trench Drain Grates

The grate shall be *ACO TD300 Iron Hi-Flo* with boltless locking system or approved equivalent. Supplier details are contained in Appendix C for information.

This grate (for TD300 Drain) has an overall width of 337 mm and overall length of 499 mm to suit the approved drain. Slot widths measure at a maximum of 80 mm.

Grates should be compliant with the following standard requirements:

a. Manufactured from ductile iron to AS 1831 Grade 500-7;

b. Certified to AS 3996 Load Class D (210kN)

c. Meets AS 3996 (Clause 3.3.6); and

d. Intake area of greater than 80,000 mm^2 per half metre of grate.

3.12.4 Stainless Steel

Except as otherwise specified or shown on the Drawings, all material shall conform to the requirements of the following listed specifications:

- Stainless steel material –Grade SS 316.

All stainless steel bolts shall be SS 316 with dimensions in accordance with AS 1111.1. Nickel anti-seize compound shall be applied to all stainless steel bolt threads before assembly.

All stainless steel nuts and washers shall be SS 316 with dimensions in accordance with AS/NZS 1252 and AS 1237.

Stainless steel welding shall comply with AS/NZS 1554.6. Weld consumables for stainless steel shall be with the same generic designation.

3.13 Plants

Refer to Section 10 for details.

3.14 Other Materials

3.14.1 Bricks

Bricks shall be hard well burnt, pressed or wire cut clay brick in accordance with AS/NZS 4455 and AS 3700. The minimum characteristic unconfined compressive strength of 20 MPa and absorbing when saturated, not more than 10% of their own weight of water.

Bricks shall be of uniform shape and size, carefully conveyed and unloaded at the site. No chipped or broken bricks shall be used, and no pieces of brick to be used except where necessary as closures.

3.14.2 Rock

Rock to be used for Mortared Rock Pitching shall be in accordance with Clause 3.14.3. The areas immediately adjacent wing walls and headwalls shall be rock pitched for a minimum distance of one (1) metre in all directions. Additional mortaring may be detailed on the accepted drawings however this minimum requirement must be adhered to at all times.

Rock for erosion protection in drains and around culverts shall comply with the following requirements, based upon those detailed in Table 406.1 of the Main Roads of Western Australia Specification 406 Rock Protection and summarised in Table 3-5. Unless otherwise specified on the Drawings rock should be of a minimum of a Facing class classification.

Table 3-5 Rock Size Distribution for Drainage

Rock Class (Typical Section Thickness)	Rock Size – assuming SG of 2.65 and Spherical Shape (mm)	Rock mass (kg)	Min % of Rocks larger than
Facing (500 mm)	400	100	0
	300	35	50
	150	2.5	90
Light (750 mm)	550	250	0
	400	100	50
	200	10	90
¼ Tonne (1000 mm)	750	500	0
	550	250	50
	300	35	90
½ Tonne (1250 mm)	900	1000	0
	700	450	50
	400	100	90

3.14.3 Mortared Stone/Rock Pitching

Stones shall generally weigh in excess of 10 kg each and the greatest dimension of any stone shall not exceed 1.5 times its least dimension.

3.14.4 Biodegradable Matting

Biodegradable matting shall be Coir Net (700 gsm) and TEC Mat™ Coir (700 gsm), or other agreed equivalent. The product shall to be suitable for placement over topsoiled areas on slopes in preparation for future rehabilitation by others. The product shall be installed in accordance with manufacturers' requirements.

3.14.5 Non-return Floodgates

All floodgates at ends of pipes as detailed on the Drawings are to be ring mounted type to the end of the pipes. All floodgates are to be manufactured of a suitable material to withstand high corrosive conditions as would be expected within a marine environment.

3.14.6 Geotextile

Geotextile lining shall be a non-woven fabric consisting of long chain synthetic polymer fibres, composed of at least 95% by mass of polyester or polyolefins (polypropylene, polyethylene) bonded by needle punching, heat or chemical processes or combinations thereof. Bonded fibres must be capable of retaining their relative position in the geotextile. The polymer fibres shall be rot proof, chemically stable and have low water absorbency.

The geotextile shall have a high ultraviolet resistance such that when tested in accordance with AS 3706.11 it shall have retained strength of at least 50% after 672 hours of test exposure. The geotextile shall be free of any flaws or defects that may adversely affect the mechanical or physical properties of the fabric.

Each roll of geotextile shall be provided with a suitable covering to prevent exposure of the fabric to moisture or ultraviolet radiation, and marked in conformance with AS 3705.

Prior to installation, the geotextile rolls shall be stored on site in the *Contractor*'s secure storage area. The *Contractor* shall take appropriate measures to protect the geotextile from damage.

This includes adhering to any other recommendations on method of storage set by the supplier/manufacturer.

Table 3-6 Geotextile Mechanical/Hydraulic Properties

Property	Subsoil Drains	Test Method
Minimum Geotextile Strength Rating, G[1] as defined in AUSTROADS "Part 4G: Geotextiles and Geogrids".	1700	AS 3706.4 & AS 3706.5
Maximum Equivalent Opening Size[2], (EOS) (µm)	200	AS 3706.7
Minimum Q_{100}[3] (l/m ²/s)	50	AS 3706.9

The *Contractor* shall certify that the geotextile delivered to Site meets the requirements of this Specification. Sampling, conditioning and statistical analysis of results for each batch of geotextile shall be carried out in accordance with AS 3706.1. Sampling frequency shall be in accordance with AS 3706.1 Appendix A. The conformance testing shall include determining the mean weight (mass per unit area) of the geotextile, in accordance with AS 3706.1.

Prior to the use of the geotextile for drainage lining, the *Contractor* shall submit to the *Superintendent's Representative* certificates of compliance from the product supplier, showing that the geotextile complies with all the requirements of this Specification. Test results shall be reported on NATA endorsed documents.

[1] Geotextile Strength Rating, G = (L h_{50})$^{0.5}$ Geotextile survivability refers to the ability of the Geotextile to withstand the installation stresses during construction.
L (in Newtons) is the characteristic value of burst strength (CBR Plunger Method) for the batch tested determined in accordance with AS 3706.1 and AS 3706.4.
h_{50} (in mm) is the characteristic value of puncture resistance (Drop Cone Method) for the batch tested determined in accordance with AS 3706.1 and AS 3706.5. The characteristic values of L and h_{50} shall be calculated as the mean value less 0.83 standard deviation.
[2] Mean value at which 95% of the particles would be retained.
[3] Mean value which would meet the requirements of the 100mm constant head determined using the Perpendicular Flow Test

4. Civil Earthworks

4.1 Scope

This section specifies the requirements for excavation and placement of all engineered fill, within the limits specified on the Drawings for the construction of the *WUC*.

The *Contractor* shall provide all civil earthworks materials to be used for the *WUC* as required to meet the requirements of this Specification and shall demonstrate the material compliance as specified in this Specification.

4.2 Quality Assurance

The *Contractor* shall provide the following verification documentation to the *Superintendent's Representative*. The verification documentation shall be provided at intervals as stated in Table 4-1, unless otherwise agreed in writing with the *Superintendent's Representative*.

Table 4-1 Earthworks Quality Assurance Summary

Item No	Item	Requirement	Frequency/Timing	Photograph records required
1	Materials properties	NATA endorsed certificates for the proposed materials	Prior to delivery to site and/or at intervals determined by quantities prior to use in *WUC*	Yes of material to be used
2	Survey Data	Survey record information	Prior to clearing and stripping Subsequent to clearing and stripping Weekly compacted fill surfaces	No
3	Compacted fill	NATA endorsed compaction certificate compliance with Specification Requirements	As per Specification Section 4.6 and Drawings	Yes prior to and following each lift and/or each lot
4	As Constructed drawings	As per Specification and DITRDC requirements for Asset handover	Upon completion of *WUC*	No

4.3 Material Sources

4.3.1 General Requirements

The *Contractor* shall provide all construction materials to be used for the *WUC* as required to meet the requirements of this Specification and shall demonstrate the material compliance as stated in this Specification.

Geotechnical properties described in this Specification shall be determined in accordance with the most recently issued relevant Australian Standard.

Suitability and accessibility of the various required fill shall be agreed with the *Superintendent's Representative* at least seven days prior to material placement (**HOLD POINT**).

Any material that has been used for the *WUC* but is later found to not meet the requirements of this Specification and is therefore rejected by the *Superintendent's Representative*, shall be removed and replaced with suitable complying material at the *Contractor*'s expense.

4.3.2 Material Sources and Winning of Materials

The *Contractor* shall utilise natural material recovered from required earthworks as a construction material. Other sources of construction materials may be used, such as borrow pits or quarries where insufficient compliant natural materials can be won.

The *Contractor* shall provide a detailed Borrow Management Plan (BMP) to the *Superintendent's Representative* a minimum of 14 days prior to the planned commencement date of borrow operations.

The BMP shall detail the proposed borrow operation and conditioning method including the proposed construction equipment and planned daily production rates. All winning and borrow operations shall comply with the approved BMP. Any quarry operations proposed shall also comply with the approved BMP. Such operations are referred to collectively in this Specification as Borrow Operations. Areas where materials for construction purposes are obtained are referred to as Borrow Pits in this Specification, regardless of their nature as quarries, excavation sites or otherwise.

The *Contractor* shall not commence hauling of any construction material to the area of placement before the BMP is approved by the *Superintendent's Representative*. Borrow Operations outside approved excavation areas shall not occur unless approved in writing by the *Superintendent's Representative*.

All earthfill materials to be used for the *WUC* shall be conditioned (as required) and hauled to the area of placement by the *Contractor*. Conditioning may include excavation, stockpiling, breaking down the clods and soil structure to a fine tilth, mixing, blending, moisture conditioning, drying and curing to meet the requirements of this Specification.

The *Contractor* shall be responsible for providing and maintaining suitable access to the Borrow Operations, taking into consideration the terrain and topography. The *Contractor* shall be responsible for the establishment and maintenance of all construction access roads throughout the *Contract*.

The *Contractor* shall moisture condition clayey materials within the Borrow Pit or at a dedicated stockpile area approved by the *Superintendent's Representative*. The moisture content of clayey materials to be hauled to the area of their placement shall be within 2% of the required compaction moisture limits specified in Section 4.6.5.

Where unsuitable material is encountered, as determined by compliance testing or by the *Superintendent's Representative*, such material shall not be used as fill. This unsuitable material

shall be discarded or stockpiled separately for possible use in other areas of the *WUC* as directed by the *Superintendent's Representative*. The *Contractor* shall, where practicable and with the approval of the *Superintendent's Representative*, blend materials that do not comply with the acceptance criteria to ensure maximum usage of the borrow area materials.

Material for engineered fill includes but is not limited to:

- Natural material recovered from required earthworks;
- Chalk fill from a declared borrow pit or quarry;
- Crushed limestone from a declared borrow pit or quarry;
- Imported clean fill from a declared borrow pit or quarry.

All materials for engineered fill shall conform to the requirements of Section 4.4 of this Specification. Where the *Contractor* is proposing to use imported material, the source of imported material and laboratory certificates stating the relevant material properties shall be declared to the *Superintendent's Representative* in advance of importation.

Other materials that a *Contractor* considers potentially suitable for use as engineered fill must not be used without the written approval of the *Superintendent's Representative*.

Where natural material potentially suitable for engineered fill is won from various required excavations, it shall be shall be stockpiled and subject to visual inspection by the *Superintendent's Representative* prior to its use in the *WUC*.

4.4 Earthworks Materials

4.4.1 Engineering Fill

Engineered fill material shall satisfy the following criteria:

a. Free from stumps, roots, rubbish, topsoil and other unsuitable matter;

b. Composed of sound, hard and durable material;

c. Maximum particle dimension of no more than 37.5 mm;

d. No more than 10% material by weight which will pass a 0.075 mm AS 1141.11.1 sieve; and

e. Meet the material requires for construction of various layers and treatments as specified in the drawings.

4.4.2 Selected Core Fill

Material for the core of embankment shall consist of a selected impervious mixture of soil. Rock fragments having a maximum dimension of more than 19 mm will not be permitted in the select fill zone of the embankment. Should stones, cobbles, rock fragments or hard clay lumps that interfere with compaction be found in select fill core material, they shall be broken down or removed before being transported to the basin embankment.

The properties of the material when compacted in the embankment shall be as follows:

1. The gradation, as determined in accordance with AS 1289.3.6.1, shall be such that:
   - not less than 75 per cent, by weight, shall pass a 4.75 mm AS 1141.11.1 sieve;
   - not less than 30 percent, by weight, of the material passing the 4.75 mm AS 1141.11.1 sieve shall pass the 0.075 mm AS 1141.11.1 sieve;

2. The plasticity index, as determined in accordance with AS 1289.3.3.1, shall be not less than 15 per cent nor shall the liquid limit exceed 80 per cent when determined in accordance with AS 1289.3.1.1.

Unless otherwise approved by the *Superintendent's Representative*.

4.4.3 Earthfill

Unless otherwise specified or directed, the materials used for earthfill shall be obtained from required excavations. Earthfill shall be soil that is free from logs, stumps, weeds and other perishable matter, physical and chemical contaminants, waste, debris and other deleterious elements. Earthfill material shall have a maximum particle size equivalent to half the layer thickness being placed.

The *Superintendent's Representative* may direct that material unsuitable for road embankments or detention basins be used elsewhere on Site or run to spoil. If this should result in a deficiency of material available for filling, then additional material shall be obtained as the *Superintendent's Representative* directs.

The Contractor shall provide a methodology statement on how he proposes to achieve the design specification.

To document compliance with the requirements for earthfill material, the *Contractor* shall undertake material testing in accordance with Section 4.2 of this Specification.

Placement of earthfill material shall be in accordance with Section 4.6.5 of this Specification.

4.4.4 Limestone Fill

Limestone fill must comply with the requirements of engineering fill as detailed in Section 4.4.1 of this Specification as well as the requirements set out below. Limestone fill with a maximum size of 19 mm is also referred to as 'Acker' Crushed Limestone on the *Drawings*.

Limestone fill shall be obtained from an approved source, and shall be free from organic content and other deleterious material and conform to the following tables:

Table 4-2 Crushed Limestone – Particle Size Distribution

AS 1141.11.1 Sieve Size (mm)	Percentage Passing by mass (%)	
	75 mm	19 mm
75	100	
19	55 - 85	100
2.36	35 - 65	30-80
0.075	6-10	7-12

Table 4-3 Crushed Limestone – Other Limits

Test	Specification
Los Angeles Abrasion	% of wear of crushed limestone not to be less than 30% or exceed 55%

Test	Specification
Calcium Carbonate Content ($CaCO_3$)	shall not be less than 60% or greater than 80%.

4.4.5 Chalk

Chalk material shall consist of durable rock fragments, either naturally occurring or crushed, with the following requirements:

- The material shall be free of visible organic and deleterious material.
- The material shall be non-plastic.
- Chalk gravel material gradation shall comply with the grading limits provided in Table 4-4.

Table 4-4 Chalk – Particle Size Distribution

AS 1141.11.1 Sieve Size (mm)	Percentage Passing by mass (%)
150	100
37.5	80 (max)
4.75	50 (min)
0.075	2 (max)

To document compliance with the requirements for chalk material, the *Contractor* shall undertake material testing in accordance with Section 4.2 of this Specification.

Placement of chalk material shall be in accordance with Section 1.1 of this Specification.

4.4.6 Crushed Rock

Crushed rock shall be manufactured from hard, durable stone, free of clay, organic matter and other deleterious material. The crushed rock shall be freshly blended prior to delivery and conform to the following table:

Table 4-5 Crushed Rock – Particle Size Distribution

AS 1141.11.1 Sieve Size (mm)	Percentage Passing by mass (%)
26.50	100
19.00	95 - 100
13.20	78 - 92
9.500	63 - 83
4.750	44 - 64
2.360	30 - 48
0.425	14 - 22
0.075	6 - 10
Ratio of the portion passing the 0.075mm sieve to the portion passing the 0.425mm sieve shall fall within the range of 40-60%	

Table 4-6 Crushed Rock – Other Limits

Test	Specification
Liquid Limit	not greater than 25%
Plasticity Index	not greater than 5
Linear Shrinkage	not greater than 2%
Maximum Dry Compressive Strength	not less than 2 MPa
Los Angeles abrasion	loss not greater than 35%
Wet strength	not less than 100kN
Wet / Dry strength variation ratio	not greater than 40%
Flakiness index	not greater than 35
Soluble sulphate salt content	not greater than 0.1% (expressed as percentage sulphate by mass of crushed rock)

4.4.7 Bedding Material

Materials for the bedding zone for pipes, pits, culverts and other structures shall comply with the following. Bedding material shall also adhering to the manufacturers' recommendations, where specified. In the event of conflict between this Specification and the manufacturers' requirements, the more stringent of requirements shall apply.

- Bedding material shall be granular material of low plasticity (or non-plastic material) that can be compacted to provide a uniform firm bedding and can be shaped as specified hereinafter. The materials shall comply with the particle size distribution indicated in Table 4-7 when tested in accordance with AS 1289.3.6.1 using the wet preparation method.
- The fraction of the Bedding Materials passing the 0.075 mm AS 1141.11.1 sieve shall be of low plasticity as described in Figure 5 of AS 1726.
- Alternatively, select fill as defined in AS/NZS 3725 which does not conform with Table 4-7 grading limits may be used provided that it is cement stabilized. Where controlled low strength materials are used they should comply with Appendix A of AS/NZS 3725 to achieve 28 day compressive strength in the range of 0.6 to 3.0 MPa.

Table 4-7 Bedding Material - Particle Size Distribution

AS 1141.11.1 Sieve Size (mm)	Percentage Passing by mass (%)
19.0	100
2.36	50-100
0.60	90-20
0.30	60-10
0.15	25-0
0.075	10-0

4.4.8 Cement Stabilised Backfill

Cement stabilised backfill shall comply with the requirements of Main Roads WA Specification 404 and is only to be used for the construction of drainage under roadways or within basin walls.

4.5 Soft Ground

Soft ground is defined as ground with undrained shear strength of less than 25 kPa at depth greater than 300 mm below the stripped or prepared surface. Potential soft ground areas shall be brought to the attention of the *Superintendent's Representative* for confirmation. Potential soft ground shall not be removed without written instruction of the *Superintendent's Representative* (**HOLD POINT**). Photographic records are required of all areas identified as having this issue both following identification and following remediation.

The extent of the soft ground shall be surveyed by the *Contractor* and approved by the *Superintendent's Representative*, and the volume of the approved extent shall be recorded by the *Contractor*. Approved soft ground shall be removed within the approved limits using appropriate equipment as agreed with the *Superintendent's Representative* before removal.

Approved soft ground shall be disposed of or stockpiled as directed by the *Superintendent's Representative*. The soft ground stockpile area shall be protected from erosion by suitable sloping and windrowing during construction, to the dimensions designated by the *Superintendent's Representative*.

Material designated soft ground shall be replaced with earthfill, which shall be moisture conditioned and compacted in accordance with the requirements of Section 1.1.1. The excavated surface of the removed soft ground shall be proof rolled by a minimum of four (4) passes of a pad foot drum vibrating roller compactor (minimum weight 12 t) to confirm all soft materials have been removed as witnessed (**WITNESS POINT**) by the *Superintendent's Representative*.

4.6 Fill

4.6.1 General

The *Contractor* shall construct embankments, access roads, turning points and ramps to the lines and levels shown on the Drawings.

The *Contractor's* operations in handling and spreading of all earthfill materials required for the *WUC* shall result in an even distribution and gradation of the materials throughout the zone.

4.6.2 Foundation Preparation

The foundation of the Select Selected Core Fill in the cut off trench shall be prepared by excavating down to 2 metres below ground level or are detailed in the drawings, whichever is deeper. If bedrock is reached before these limits, the bedrock shall be the foundation of the cut off trench. Where the foundation is bedded on rock, the surface shall be cleaned by hand to allow good adhesion of the select fill.

The foundation for the Earthfill shall be the ground surface with topsoil and any vegetation roots removed. Compact the foundation with 6 passes of a 10 tonnes static weight vibrating roller, before placing any embankment fill.

4.6.3 Compaction Equipment

It is the *Contractor*s responsibility to assess the nature of the soil being cut or filled and to select the appropriate method and machinery to be used in order to achieve the specified results.

Based upon the *Contractor*'s assessment of the material, the *Contractor* shall propose specific compaction equipment, and methods, for Select Core Fill and Earthfill. The *Contractor* may elect to undertake compaction trials in accordance with these proposals to simulate construction of the embankment. The purpose of a trial is to establish the suitability or otherwise of the compaction equipment proposed, the number of roller passes required and determine the optimum layer thickness for each compactive plant proposed.

When compacting Selected Core Fill the *Contractor* shall use equipment with tamping feet or similar (e.g. sheep's foot roller). The tamping feet should penetrate through the full depth of the layer into the underlying previously compacted layer or foundation. The *Contractor* shall perform all operations as necessary, including testing in accordance with the requirements of this Clause, to determine the acceptability of the equipment and methods proposed.

During the operation of tamping rollers, the *Contractor* shall keep the spaces between the ends of the feet and the surface of the drum clear of accumulated soil. All rollers shall be properly maintained to ensure that they retain consistent compaction characteristics.

Particular care shall be taken in compacting fill around pipes. The *Contractor* is to demonstrate how it will ensure proper compaction to the haunching under the pipe.

4.6.4 Placement of Selected Core Fill

The *Contractor* shall handle and spread fill on the embankment and/ in the cut off trench so as to produce a uniform distribution and gradation of the select fill throughout the core. Clusters of rock that interfere with compaction shall be removed.

The *Contractor*'s operations in handling, spreading and compacting Select Core Fill material on the embankment shall result in an even distribution and gradation of the materials throughout the zone. The zone shall be free of lenses, streaks, laminations, layers of material differing substantially from the surrounding material in the zone or other discontinuity's and the density shall be uniform throughout each compacted layer.

The surface of any layer of Select Core Fill material shall be worked with harrow, scarifier or other suitable equipment, to a sufficient depth to provide a satisfactory bonding surface and moistened if necessary, before placing the next succeeding layer of Select Core Fill.

The Select Core Fill material shall be placed in continuous horizontal layers for the full width of the zone. The thickness of each compacted layer shall be not more than 150 mm.

Place and compact in uniform layers of appropriate thickness and using compaction equipment capable of achieving the level of compaction specified. Layers should extend for the full width of embankments. Each layer shall be compacted to the appropriate density prescribed in Table 4-8. Unless otherwise approved or directed by the *Superintendent's Representative*, the material in each layer of Selected Core Fill shall have a moisture content, during and after compaction, within the range of detailed in Table 4-8.

Except as otherwise specified, the moisture content shall be uniform throughout the layer. The moisture limits may be varied at the direction of the *Superintendent's Representative* but in general the permitted range of moisture content will be 2 per cent.

The optimum moisture content of the material shall be the moisture content that is required to achieve the standard maximum dry density when tested in accordance with the method given in AS 1289.5.1.1. If the moisture content does not fall within the required limits, the *Contractor*

shall treat the material in such a manner that the moisture content is brought to within the required limits.

Table 4-8 Moisture and Compaction Requirements for Selected Core Fill Materials

Specification element	Minimum requirement
Compaction control	In accordance with AS 1289.5.4.1
Compaction moisture content	-2% to +2% of Optimum Moisture Content
Density ratio	Greater than 95% SMDD according to AS 1289.5.4.1

The *Contractor* shall establish procedures for conditioning the Select Core Fill at its source so as to bring it within the range of moisture contents specified in this sub-clause prior to its haulage to the embankment. Such procedures shall include, but are not restricted to, well planned sequential development in borrow pits, effective drainage plan, and selective mixing and removal of the top most conditioned layers of soil, using if necessary lighter equipment to achieve this and conditioning in stockpiles.

If the surface of the prepared foundation or the surface of any layer of Selected Core Fill material is outside the moisture content limits specified in this clause or is too wet for proper compaction and bonding of the layer of material to be placed thereon, it shall be allowed to dry or be worked with harrow, scarifier or other suitable equipment to reduce the moisture content to the required range. The layer shall then be recompacted and a satisfactory bonding surface shall be provided before the next succeeding layer of material is placed.

If the Select Core Fill material cannot be brought conveniently to the specified moisture content it shall be removed from the embankment.

When each layer of material in a zone of fill has been conditioned to have the specified moisture content, it shall be compacted with the approved rollers until the standard dry density ratio determined in accordance with AS 1289.5.7.1 equals or is in excess of 95% of Standard Maximum Dry Density (SMDD). If the result of any test of the Density Ratio of a sample is less than 95% of SMDD, the *Contractor* shall scarify the layer, correct the moisture content and recompact the layer to meet the criteria set out in this Clause.

Layer thickness of Selected Core Fill shall be adjusted to suit the compaction plant available, to ensure sufficient compactive energy throughout the layer.

4.6.5 Placement of Earthfill

The *Contractor* shall work the earthfill materials during conditioning and placement to ensure that all large lumps or clods are broken down.

The *Contractor* shall minimise plant, particularly rubber tyred plant, travelling on the prepared and scarified surface of the earthfill material before placement of the overlying layer has been completed.

All earthworks shall be suitably maintained during the construction period to avoid excess drying or wetting up.

The thickness of loose earthfill material, before compaction, shall not exceed 300 mm.

In the event that, in the opinion of the *Superintendent's Representative*, unsuitable material has been placed, the *Contractor* shall remove the material identified by the *Superintendent's Representative* as unsuitable and replace it with suitable material at the *Contractor*'s expense.

The *Contractor* shall stockpile the noncompliant material at a location nominated by the *Superintendent's Representative*.

The moisture content and compaction requirements for earthfill materials, unless otherwise specified, are detailed in Table 4-9.

Table 4-9 Moisture and Compaction Requirements for Earthfill Materials

Specification element	Minimum requirement
Compaction control	In accordance with AS 1289.5.1.1
Compaction moisture content	-2% to +2% of Optimum Moisture Content
Density ratio	95% of SMDD according to AS 1289.5.1.1

The optimum moisture content of the earthfill materials shall be the moisture content that is required to achieve the peak dry density when tested in accordance with the method stated in AS 1289.5.1.1. Corrections for material with 20% oversize material may be required in accordance with AS 1289.5.2.1.

If the moisture content does not fall within the required limits specified Table 4-9, the *Contractor* shall treat the material in such a manner that the moisture content is brought to within the required limits as below.

If the moisture content of the compacted material is within -3% to +3% of the Optimum Moisture Content, the *Contractor* shall be permitted to adjust the moisture content of the placed material within the area of placement.

If the moisture content of the compacted material is outside -3% to +3% of the Optimum Moisture Content, the *Contractor* shall remove the materials from the non-complying lot and replace it with conforming materials.

When the specified moisture content is achieved, the earthfill materials shall be compacted with approved rollers until the field density, tested in accordance with Section 4.6.6, meets the criterion specified in Table 4-9.

If the specified moisture content is achieved but the result of any field density tests does not comply with the specifications in Table 4-9, the *Contractor* shall re-compact the layer to meet the compaction criteria set out in this Specification.

Each compacted layer shall be free of discontinuities such as lenses, streaks, laminations or pockets or zones of material differing substantially from the surrounding material and the density shall be uniform throughout the layer.

If the *Contractor* is unable to achieve the compaction specified, or lamination of the fill is observed, the *Contractor* shall treat the defective layers as defined in this Specification and the loose thickness of the layers shall be reduced as directed by the *Superintendent's Representative*.

4.6.6 Placement of Chalk

The *Contractor* shall place the chalk to the lines and levels as shown on the Drawings. Where used as a surface treatment on top of embankments, the final level of the chalk shall be measured at the centreline of the embankment.

The layer thickness for chalk material shall be no less than 150 mm and no greater than 300 mm when loose.

The compaction requirements for chalk materials, unless otherwise specified, are detailed in .

Table 4-10 Moisture and Compaction Requirements for Chalk

Specification element	Minimum requirement
Compaction control	In accordance with AS 1289.5.2.1
Compaction moisture content	-3% to +3% of Optimum Moisture Content
Density ratio	95% of MMDD according to AS 1289.5.2.1

If the result of any field density tests does not comply with the specifications in Table 4-10, the *Contractor* shall re-compact the layer to meet the compaction criteria set out in this Specification.

Each compacted layer shall be free of discontinuities such as lenses, streaks, laminations or pockets or zones of material differing substantially from the surrounding material and the density shall be uniform throughout the layer.

If the *Contractor* is unable to achieve the compaction specified in this Section, or lamination of the wearing course is observed, the *Contractor* shall treat the defective layers as specified in this Section and the loose thickness of the layers shall be reduced as directed by the *Superintendent's Representative*.

4.6.7 Placement of Limestone Fill

Shall be in accordance with the requirements of detailed in 4.6.5 unless otherwise detailed on the drawings.

4.6.8 Testing of Selected Core Fill and Earthfill

The *Contractor* shall undertake field testing to confirm that suitable compaction is achieved. Compliance testing shall be carried out in accordance with AS 1289.5.4.1, which outlines but is not limited to such methods as the Sand Replacement method (in accordance with AS 1289.5.3.1) or the Nuclear Densometer method (in accordance with AS 1289.5.8.1).

At least one (1) field density test shall be carried out every 1,000 m^3 of fill material placed, or every horizontal distance of 200 m, or every lift in every lot, whichever occurs more frequently.

At least one (1) field density test shall be carried out every 500 m^3 of selected core fill material placed, or every horizontal distance of 150 m, or every lift in every lot, whichever occurs more frequently.

Compaction testing shall be performed by a NATA registered laboratory, or a suitably qualified technician with NATA calibrated equipment, as agreed by the *Superintendent's Representative*. Test results shall be provided to the nearest 0.5% for density and 0.1% for moisture variation. Results that fall outside the requirements shall constitute a non-conformance.

The *Contractor* shall provide the *Superintendent's Representative* with a copy of the field density test original results, which shall include a test identifier, layer number, and three-dimensional GPS coordinates. The *Contractor* shall submit to the *Superintendent's Representative* updated compaction test reports within 24 hours of the test.

At the commencement of the *Contract* and at any other time as required by the *Superintendent's Representative*, the soil tester and NATA registered laboratory shall provide the *Superintendent's Representative* with copies of the calibration certificates for all testing equipment in use on the *WUC*.

Unless otherwise noted, the *Contractor* shall demonstrate compliance with this Specification using the latest revision of the tests required.

All compliance testing shall be performed by a NATA registered laboratory, or a suitably qualified technician with NATA calibrated equipment, as agreed by the *Superintendent's Representative*. All test reports shall be NATA endorsed by a current NATA signatory for the laboratory conducting the testing.

At the commencement of the *Contract* and at any other time as required by the *Superintendent's Representative*, the soil tester / current NATA signatory and NATA registered laboratory / NATA certified equipment shall provide the *Superintendent's Representative* with copies of the calibration certificates for all testing equipment in use on the *WUC*.

4.6.9 Testing of Chalk

The *Contractor* shall undertake field testing to confirm that suitable compaction is achieved. Compliance testing shall be carried out in accordance with AS 1289.5.4.1, which outlines but is not limited to such methods as the Sand Replacement method (in accordance with AS 1289.5.3.1) or the Nuclear Densometer method (in accordance with AS 1289.5.8.1).

At least one (1) field density test shall be carried out every horizontal distance of 200 m, or every lift in every lot, whichever occurs more frequently.

Compaction testing shall be performed by a NATA registered laboratory, or a suitably qualified technician with NATA calibrated equipment, as agreed by the *Superintendent's Representative*. Test results shall be provided to the nearest 0.5% for density and 0.1% for moisture variation. Results that fall outside the requirements shall constitute a non-conformance.

The *Contractor* shall provide the *Superintendent's Representative* with a copy of the field density test original results, which shall include a test identifier, layer number, and three-dimensional GPS coordinates. The *Contractor* shall submit to the *Superintendent's Representative* updated compaction test reports within 24 hours of the test.

At the commencement of the *Contract* and at any other time as required by the *Superintendent's Representative*, the soil tester and NATA registered laboratory shall provide the *Superintendent's Representative* with copies of the calibration certificates for all testing equipment in use on the *WUC*.

If the field density test indicates non-compliance of any chalk material, the *Contractor* shall treat the non-complying material in accordance with the Specification.

4.6.10 Protection of Earthfill and Selected Core Fill

The *Contractor* shall ensure that target minimum dry density and target moisture contents are achieved and maintained until the fill material is covered with the next layer of the fill.

Filled areas shall be sealed and shaped by the *Contractor* using appropriate plant to be free draining when rain is expected. The surface of the sealed area of fill material shall be worked with harrow, scarifier or other suitable equipment, as necessary to provide a satisfactory bonding surface and moistened if necessary, before the next layer of fill material is placed.

The *Contractor* shall suitably maintain the earthworks during the construction period to avoid excess drying or wetting.

If the surface layer of fill material is left exposed for any significant length of time resulting in the possibility of the underlying material drying out, as determined by the *Superintendent's Representative*, the *Contractor* shall prevent drying out of the underlying material by periodic watering, covering or other methods approved by the *Superintendent's Representative*. If, in the opinion of the *Superintendent's Representative*, excessive drying or wetting occurs, the

Contractor shall, at its own expense, rip, blade, level and re-compact the deficient fill materials in accordance with the Specification.

4.6.11 Final Grading of Earthfill and Selected Core Fill

The *Contractor* shall grade the final layer of fill to the upstream batter as shown on the Drawings prior to placement of any final upper surface treatment.

The *Contractor* shall grade the upstream and downstream batters of the embankment to the grades shown on the Drawings.

4.7 Excavation

4.7.1 General

Required excavations for civil earthworks are within the bunds, basin and for drainage structure installation. Required excavations also include trenching for installation of pipes.

The *Contractor* shall undertake all excavations to the minimum lines, levels and grades as shown on the Drawings or as directed by the *Superintendent's Representative*.

Excavation shall not commence in any area prior to inspection and approval of the *Contractor*'s survey markers in that area by the *Superintendent's Representative*.

Loose and unstable materials on any temporary cut batters shall be removed immediately. Any falls or slips of material that occur due to the *Contractor*'s negligence or use of inappropriate methods shall be removed and the area reinstated by the *Contractor*.

No mechanical ripping shall be undertaken within 300 mm of the back of any existing kerb or structure.

The *Contractor* shall remove any unsuitable material exposed when excavated areas have been trimmed to finished formation levels and remove all rocks, boulders etc which protrude above finished surfaces of subgrades.

4.7.2 Rock Excavation

Excavation in material that is defined as rock below, shall be paid for at a rate provided for in the contract. The rate shall be extra over normal excavation rates i.e. "other than rock".

The contract sum will include a provisional sum that is for the excavation of rock expected across the site for various works including excavation for installation of drainage infrastructure including but not limited to pipes, pits, basins and other embankments. The Contractor geotechnical testing detailed in Section 8 will be a point of review for these quantities.

The contract sum will be adjusted for the actual quantity of excavation in rock using the rate included in the Schedule of Prices. Rock in service trenches shall be measured as the pipe O.D. plus 400 mm width by the depth from rock surface to 150 mm below invert level. For combined services, the width shall be the outside width of services plus 400 mm. Rock for embankment construction in particular core placement shall be measured as the design width of the trench as per the drawings by the depth from base of the trench to the lowest height in the trench width.

Before removing any rock, obtain the *Superintendent's Representative* direction as to the finishing levels for rock excavation.

When rock is encountered, arrange for it to be inspected by the *Superintendent's Representative* to confirm it is rock. The *Contractor* shall arrange for the rock profile to be surveyed by licensed surveyor. The surveyor shall use a suitable computer program to calculate the rock volumes and provide survey information for checking of quantities to the

Superintendent's Representative. The contractor shall include all costs for survey work in his rate for rock excavation.

When necessary for the purpose of payment, the different kinds of material met within excavation shall be classified under the headings "Other than Rock" or "Rock", and where such words occur in the Contract Documents they shall have the following meanings:

1. "Other than Rock" generally shall means all kinds of materials which in the opinion of the *Superintendent's Representative* do not require blasting or removal by jackhammer or mechanical rock breaker.
2. "Rock" generally means hard rock which in the opinion of the *Superintendent's Representative* requires blasting and is in fact blasted, or removed by jackhammer or mechanical rock breaker.

"Other than rock" is specifically defined as the overlying layers of soil and highly and extremely weathered rock and rock with a low rock strength, together with loose rocks of less than 1.0 cubic metre in volume. "Rock" is specifically defined as all materials other than "Other than Rock". The interface between "Other than rock" and "Rock" is defined as the surface upon which the rock bucket of a 29 tonne excavator in good condition refuses, when the excavator is operated at full operating power by an experienced and competent operator.

4.7.3 Blasting

Explosives shall not be used in the work of this Contract.

4.7.4 Excavation for the Construction of the Basins and Bunds

This excavation includes stripping of all topsoil, and the removal of vegetable matter of all kinds including stumps, roots and all other materials unsuitable for engineered fill, together with weak, loose, friable, softened or permeable soils.

The *Superintendent's Representative* may direct additional excavation required to reach acceptable foundation conditions.

Final excavated surfaces shall not be loose or friable (loose blocks) and shall not have excessive desiccation cracking at the time of placement of any overlying material. Should foundation materials become desiccated or cracked due to excessive drying, eroded or softened due to excessive flows or ponding of water or damaged due to machinery the *Contractor* shall carry out excavation in such areas to expose acceptable material to the satisfaction of the *Superintendent's Representative*.

Excavation shall be carried out to the specified depth according to the lines and levels shown on the drawings, at which point the foundations will be inspected to determine the need for additional work (**HOLD POINT**).

Any other excavations performed at the option of the *Contractor* to ensure safe trench conditions, secure access to required work, or for any other purpose, shall be kept within limits approved by the *Superintendent's Representative*, and the costs deemed included in the tendered amounts for the work.

4.7.5 Treatment of Karst and Voids

A void created by the removal of unsuitable material during required excavation shall be backfilled with suitable material complying with the above material-type, or as directed by the *Superintendent's Representative* and compacted in accordance with the relevant clause.

Identification of natural voids (including karst), or suspected natural voids, during Works on site shall be brought to the immediate attention of the *Superintendent's Representative*. The *Superintendent's Representative* shall determine the need for additional work (**HOLD POINT**), which is likely to include:

a. Measurement of the size and extent of the void.

b. Placement of cement-stabilised sand or similar flowable material into the void until it is filled.

c. Removal of soil or rock overlying the void, followed by placement and compaction of engineered fill (of a type defined in Section 4.3.2) into the void until it is filled.

4.7.6 Groundwater

Where groundwater or seepage is encountered in any excavation, the *Contractor* is required to follow the requirements for management and disposal of such water as set out in their approved CCMP.

The *Contractor* shall ensure that water quality of the any receiving environment is not compromised. Should groundwater be encountered this shall constitute a **HOLD POINT** for work within that portion of the site affected by groundwater or seepage.

4.8 Site Restoration

Where existing ground surfaces are not required to be varied as part of the *WUC*, restore them to the condition existing at the commencement of the Work under the Contract.

4.9 Quality and Process Control

Due to the limited facilities and resources on site, an alternative testing methodology to facilitate construction is permitted. Indicative results provided by the in-situ compaction tests as specified in Section 4.10 and 4.11 are permitted for quality control of earthworks related to stormwater drainage, water pipeline and pavements. The *Contractor* must nominate the testing method (Relative Density or CIV and DCP) intended to validate conformance of the lot prior to commencing works for each lot. Where unsatisfactory results are obtained with the in-situ compaction indication tests, the affected lot shall be removed and reworked.

Testing shall be carried out upon the completion of each lot of pavement works at the earliest opportunity as well as at all agreed intervals with the *Superintendent's Representative* prior to commencement of construction to ensure compliance. It shall be noted that any remediation and rectification works required upon completion of construction shall be carried out at the cost of the *Contractor*.

The *Contractor* shall continuously monitor the processes used in the supply, filling, mixing, placing, compacting and finishing of construction works and shall continuously monitor the quality of all materials incorporated into the *WUC*. As part of the quality and process control, the *Contractor* shall undertake a program of inspection, testing and supervision with the aim of ensuring that all the materials incorporated in the *WUC* conform with the requirements of this Specification and the requirements of the Shire of Christmas Island and those of the *Client*.

Copies of all test results shall be supplied to the *Superintendent's Representative* within 48 hours of receiving the test results unless otherwise required / noted in this Specification. All test results shall include at least all the information listed in the following conformity tables.

4.10

4.10 Clegg Impact Soil Testing

4.10.1 General

Clegg Impact Soil Testing shall be carried out in accordance to Australian Standard AS 1289.6.9.1. Previous localised testing has provided a good indication of Clegg Impact Values (CIV) that are representative of soil behaviour for the locality. CIV values for the material at Optimum Moisture Content (OMC) and at dry back moisture condition have been provided. Dry back is not required for subgrade or embankment fills.

The minimum indicative CIV readings during construction are presented in Table 4-11 below. Where higher values are specified on the *Drawings*, the *Drawings* take precedence.

Table 4-11 Minimum Clegg Impact Test Values

Material Type	Usage	CIV at OMC	CIV at Dryback	Comments on Dryback
Brown Clayey Sand	Subgrade / In-situ foundation	15	NA	Not required
	Fill / embankment	15	NA	Not required
Limestone	Fill/embankment/embedment material	30	NA	Not required
	Subbase	45	60	85% OMC required
	Base	60	80	80% OMC required

Minimum CIV values at OMC shall be achieved for the in situ subgrade, fill, limestone subbase and limestone base. In addition, for pavement layers a minimum CIV value at dry back moisture condition (moisture content at specified %OMC) shall also be achieved.

Achievement of minimum CIV at dry back moisture condition alone is insufficient to demonstrate that the proposed material is suitable for use in the pavement structure.

Embankment / Fill Testing Frequency

Clegg tests shall be carried out at minimum testing frequency of six (6) per lot, or a maximum of 10 m intervals (whichever is the greater) to ensure uniformity of compaction of the material placed. Clegg testing shall be carried out on a random spacing to achieve representative coverage. Particular attention should be paid to edges of pavement where compaction is at risk.

Pavement Layers

Clegg tests shall be carried out at a minimum testing frequency of nine (9) per lot, or a maximum of 10 m intervals (whichever is the greater) to ensure uniformity of compaction of the material placed. Clegg testing shall be carried out on a random spacing to achieve representative coverage. Particular attention should be paid to edges of pavement where compaction is at risk.

4.10.2 Test Procedure

CIV testing shall be carried out for each layer prior to construction of the following layer. Pavement layers must be constructed in thin lifts of up to a maximum of 150 mm thickness per

lift. A suitable 12 tonne roller shall be utilised in achieving the minimum compaction requirements.

Visual identification on site of heaving or lateral cracking of the soil at any time will constitute a **HOLD POINT** and an investigation by the *Superintendent's Representative* will be required. Remedial works involving drying out of the subgrade and or removal and replacement with selected fill shall be carried out where required. All remedial, removal and replacement, and other associated works costs shall be borne by the *Contractor*. Permanent pavement works shall resume only when authorised by the *Superintendent's Representative*.

A **HOLD POINT** will be required for all wet weather events during construction, with *WUC* only resuming after satisfactory CIV tests are carried out on all exposed pavement layers to the satisfaction of the *Superintendent's Representative*.

4.10.3 Reporting of CIV Test Results

Lots representative of the dominant soil type in the locality shall be clearly defined and agreed with the *Superintendent's Representative*, with each layer tested and reported on. A plan detailing the proposed works for the shift shall be prepared and submitted to the *Superintendent's Representative* prior to the commencement of the shift. The plans and summary sheet for the tests must as a minimum include the following information:

- Start and End Chainages
- Depth of finished layer from finished road level
- Offset
- Layer and material description

The *Contractor* shall submit a preliminary Clegg Hammer Test sheet for approval by the *Superintendent's Representative*. Test sheets shall be submitted on a timely basis after completion of each layer to the *Superintendent's Representative*, certifying that compaction and checks have been completed.

4.11 Dynamic Cone Penetrometer Testing

4.11.1 General

Dynamic Cone Penetrometer (DCP) testing shall be carried out in accordance with Australian Standards AS 1289.6.3.2. DCP testing shall be carried out to determine as-constructed layer compaction of subgrade, fills and pavement layers.

The minimum DCP readings required are presented in the table below.

Table 4-12 Minimum Dense Cone Penetrometer Test Values

Soil Type	DCP Penetration Rate (Blows/50 mm Penetration)	Comments
Brown Sandy Clay	>10	At OMC
Limestone Fill and Subbase	>10	At OMC
Limestone Base	>20 to 24	At Dryback Moisture Content

Embankment / Fill

DCP testing shall be carried at every 400 mm of placed material. DCP tests shall be carried out at a maximum of 10 m intervals to ensure uniformity of compaction throughout material placed. DCP testing shall be carried out on a random spacing to achieve representative coverage. Particular attention should be paid to edges of pavement where compaction is at risk.

DCP testing is to be completed within the pipe bedding and haunch zone beside the pipe. DCP testing shall not be carried out above the pipe until there is sufficient depth of fill to avoid damage to the pipe.

Pavement Layers

DCP testing shall be carried out through the base and subbase as a single layer. DCP tests shall be carried out at a maximum of 10 m intervals to ensure uniformity of compaction throughout material placed. DCP testing shall be carried out on a random spacing to achieve representative coverage. Particular attention should be paid to edges of pavement where compaction is at risk.

4.11.2 Reporting of DCP Test Results

Lots representative of the dominant soil type in the locality shall be clearly defined and agreed with the *Superintendent's Representative*, with each layer tested and reported on. A plan detailing the proposed works for the shift shall be prepared and submitted to the *Superintendent's Representative* prior to the commencement of the shift. The plans and summary sheet for the tests must as a minimum include the following information:

- Number of tests
- Start and End Chainages
- Depth of finished layer from finished road level
- Offset
- Layer and material description

The *Contractor* shall submit a preliminary DCP Test sheet for approval by the *Superintendent's Representative*. Test sheets shall be submitted on a timely basis after completion of each layer to the *Superintendent's Representative*, certifying that compaction and checks have been completed.

DCP tests shall be recorded and included as per lot allocations agreed with the *Superintendent's Representative* prior to commencement of *WUC* on site.

4.12 Stabilisation

4.12.1 General

On completion of the earthworks as specified the areas with cut and/or fill batters shall be stabilised by grass seeding, covering with 75mm mulched vegetation and by placing Biodegradable matting over the areas as shown on the drawings. The disturbed area including the overflow channel shall be grass seeded as specified below.

The provision of these grassed surfaces is for general appearances, to prevent scour and generally stabilise the area from erosion.

The *Contractor* shall cultivate and clean the area prior to seeding and bring the surface to a smooth, even grade free from mounds and hollows and to the correct profile shown on the drawings. The area shall be consolidated by light rolling.

Stabilising and seeding shall consist of hand application of the mixture of seed, fertiliser or organic stabiliser as recommended by Park Australia (PA).

4.12.2 Materials

a. Mulched vegetation from clearing operations.

b. Matting shall be in accordance with Clause 3.14.4 or approved equivalent, installed in accordance with manufacturer's recommendations after seeding.

c. All grass seed shall be pre-packed commercially prepared mixture and a Certificate of Germination shall be submitted to the *Superintendent's Representative* prior to any seeding taking place.

d. Seed quality shall be of minimum purity 98%, minimum germination 90%, and fungicide dusted to resist rotting in the ground and damping off during establishment.

e. Fertiliser to be used shall be an approved lawn seed starter fertiliser with an NPK Ratio 5:15:5 or 10:9:8 plus trace elements.

4.12.3 Application

Apply seed by hand based casting to give an even distribution and then lightly raked to cover the seed.

4.12.4 Maintenance

The seed shall be kept moist until germination is completed and irrigated at intervals necessary until satisfactory growth is established.

The Contractor shall allow for making over the re-seeding all areas where the grass seed fails to germinate within one month from the date of original seeding.

Six weeks after germination 500 kg/hectare NPK 10:9:8 fertiliser or equivalent shall be applied. The fertiliser shall be evenly spread and thoroughly watered in after application.

The Contractor shall unless otherwise directed protect the newly sown areas against trespass and traffic until the grass is well established.

4.12.5 Seed Mixture

The seed mixture selected will of necessity depending on the time of planting and anticipated weather conditions.

The Contractor is to nominate for approval with their tender the type, rate per hectare and percentages of grass seed to produce the result required.

As a guide the following grass seeds will be considered. However, alternative grasses may be approved provided the Contractor achieves a healthy growth at the end of the maintenance period of the contract.

a. Bermuda couch or other native vegetation approved by PA.

5. Stormwater Drainage

5.1 General

All the *WUC* must be constructed in accordance with the Drawings and this Specification.

All drainage installations are to complete to a minimum standard in accordance with AS/NZS 3500.3 unless otherwise detailed on the drawings or in this Specification.

All concrete pipes must be installed in accordance with AS/NZS 3725 unless otherwise specified in the Drawings and this Specification.

All pipes must be laid and trenches backfilled prior to construction of basecourse of new roads.

5.2 Quality Assurance

The *Contractor* shall provide at weekly intervals, unless otherwise agreed in writing, to the *Superintendent's Representative* the following verification documentation.

Table 5-1 Drainage Quality Assurance Summary

Item No	Item	Requirement	Frequency/Timing	Photograph Requirement
1	Materials Specifications	Supplier Certification of compliance with Drawings, Specifications and Standards	Prior to Delivery to Site	No
2	Inspection of all manufactured products	Inspection for Defects in accordance with the Specification and drawings	Prior to departure from manufacturer Prior to installation on site	Yes (**WITNESS POINT**)
3	Drainage Set out	Survey Record prior to installation	Min 1 per drainage pipeline alignment	Yes (**WITNESS POINT**)
4	Pipework and Pits prior to Backfilling	Witness Point Survey of as Constructed details as described in Section 1.29 of this Specification	Min 1 per drainage pipeline alignment	Yes (**WITNESS POINT**)
5	Open Drains	Witness Point	Min 1 per location or alignment	Yes (prior/post to bedding/Rock placement)

Item No	Item	Requirement	Frequency/Timing	Photograph Requirement
6	Compacted backfill	Compaction Certification	As per Section 4 or Section 4.9	Yes (**WITNESS POINT**)
7	In-situ Concrete structures	Slump test to AS 1012.1 & as 1012.3.1	AS 1379 Cl 5.2.1.1 Additional test per 5 m3 load delivered as directed by *Superintendent's Representative*	Prior to and following each pour (**WITNESS POINT**)
		Compressive Strength to AS 1012.9	AS 1379 Cl 6.5	Yes (**WITNESS POINT**)
		Defect Inspections as specifications and drawings	As per Specification	Yes (**WITNESS POINT**)
8	As-constructed locations	As per Specification and drawings requirements	Upon completion of *WUC* unless otherwise specified	No
9	Operational procedure for maintenance of infrastructure	Operation Manual	Upon completion of defect period	Yes of each installed structure

The following table details the general requirements for compaction of various materials and areas in relation to Stormwater Drainage for this Specification.

Table 5-2 Stormwater Compaction Summary

Location	Material	Density Ratio	Density Index	Indicative Compaction	
				CIV	DCP
Reinstatement of over excavation	Earthfill Fill	93% MMDD	NA	15	
	Limestone Fill	93% MMDD	NA	30	
Bedding	Bedding Material	NA	70	30	
Haunch Zone	-19 mm Limestone Fill	NA	70	30	
Overlay Zone	Earthfill			15	
	Limestone Fill			30	

Location	Material	Density Ratio	Density Index	Indicative Compaction	
				CIV	DCP
Backfill / embankment	Earthfill	95% MMDD		15	
	Limestone Fill	95% MMDD		30	
Trench drain subgrade	In-situ	93% MMDD		15	

Minimum CIV values shall be determined at OMC for all Clegg Hammer Testing.

5.3 Existing Drainage Structures

5.3.1 Removal of Existing Drainage Structures

Where detailed on the Drawings, redundant drainage structures shall be removed and disposed of by the *Contractor* to an authorised waste disposal site as approved by the *Superintendent's Representative* in accordance with this Specification.

Voids left from the removal of drainage structures that are not intended to be replaced shall be backfilled and reinstated to the natural state prior to excavation of the structure. Backfill material shall be compacted as detailed in Table 5-2.

All reinforced concrete pipes and pits to be installed adjacent to or within 10 m of the final as constructed shoreline, as defined by mean sea level, shall be manufactured for use in marine and aggressive soil conditions in accordance with the manufacturers' recommendations, to achieve a design service life of at least 50 years without replacement or repair.

Where the required size is not available in a conventional marine grade, alternative methods for increasing resistance to corrosion and prolong the life of the structure must be used to ensure the life expectancy of the structure is maintained. All additives used must comply with the requirements of AS 1478.1 and AS 1478.2.

5.3.2 Breaking into Existing Structures

Where shown on the Drawings, existing structures shall be broken into and new pipes installed. When breaking into the structure, holes of sufficient size to accommodate the new pipes shall be cut or punched out without causing any unnecessary damage to the structure. The hole to accommodate the pipe shall be no greater than the pipe diameter plus 100 mm. Cement mortar or an approved epoxy mortar shall be used in sealing holes around the new pipe to affect a watertight closure.

Any damage to the structure during the installation of new pipes shall be repaired by the *Contractor* at no cost to the *Client*.

5.3.3 New Structure with Existing Pipes

Where shown on the Drawings, new drainage structures shall be constructed on existing drainage lines. When breaking into existing drainage lines, cutting of the existing pipes shall be made square to the pipe.

The reinforcement exposed at the ends of the cut pipes shall be treated with an approved epoxy mortar.

5.3.4 Damage to Existing Drainage Structures

If during construction of the *WUC*, the *Contractor* causes damage to any drainage structure that is not to be removed or disturbed, the *Contractor* shall repair the damage or replace the damaged structure to the requirements of the Specification at no cost to the *Client*.

5.3.5 Managing Existing Stormwater

The *Contractor* shall provide for the diversion and control of stormwater during construction and where necessary, provide secure and proper temporary fluming for conducting storm and subsoil water away from the Site.

The *Contractor* shall prevent, any deleterious materials/rubbish entering gullies, access chambers or pipes, and shall remove from the drainage system any such materials (from any source) which may be deposited in the drainage system up to the date of the completion of the *WUC*.

5.4 Setting Out

5.4.1 General

The Drawings show centre lines, grades, lengths, diameters, invert levels at entry and exit of drains and the location of pits.

The distances shown between pits are mostly scaled measurements and are for the *Contractor's* guidance only. In all instances pits are to be constructed in the locations shown. Centre lines and invert levels are to be strictly adhered to and no alterations shall be made except on the written authority of the *Superintendent's Representative*.

5.4.2 Setting Out of Drainage Lines

Centre lines and profile levels for fixing invert levels shall be set out by an Engineering Surveyor, arranged for by the *Contractor* at the *Contractor's* expense.

Profiles shall be set such that there are never less than three (3) profiles between pit locations or between a pit and a headwall or endwall.

5.4.3 Pegging of Pits

Each pit shall be pegged and levelled by the *Contractor*'s Engineering Surveyor.

The centre of each pit shall be pegged and at least two reference stakes at 5 metres offset on either side of the pit centreline shall be provided.

The *Contractor*'s Engineering Surveyor shall provide the *Contractor*'s Foreman with a copy of the survey record for each drain. The record shall indicate all reference pegs, offset pegs, RL's of dumpy pegs, pit-to-pit distance, and the height of boning rods. Records shall be retained by the Foreman on Site and shall be available for checking by the *Superintendent's Representative*.

5.5 Excavation

5.5.1 Trench Excavation

3. Trenching shall be carried out in accordance with the Western Australian Occupational Health and Safety Regulations 1996.
4. Trenches are to be cut to line and gradient.

5. The trench widths shall be kept to a minimum consistent with the bed width requirements and the requirements of adequate working space and timbering.

6. Tunnelling shall be only carried out where directed and to the approval of the *Superintendent's Representative*.

7. Should the bed of the trench be over excavated, then the over-excavated volume shall be replaced with a similar material used for the bedding and compacted to the minimum requirement detailed in Table 5-2.

8. The excavation of trenches with irregular shaped sides shall be avoided and, where this occurs or there is any danger of sides collapsing, then adequate timbering and strutting shall be placed to the approval of the *Superintendent's Representative*, at the *Contractor*'s expense.

9. Trenches shall be kept free from water, debris and falling earth.

10. The final trimming of the bottom 150 mm of trench excavation must not be carried out until immediately prior to concreting or placing of pipe bedding. Excavation must be completed for a minimum of 10 metres length ahead of pipe laying.

11. Adequate shoring to the approval of the *Superintendent's Representative* shall be used where the drain is within 2.0 metres plus the depth of the drain from a building, or load bearing structure, or where requested by the *Superintendent's Representative*. Details of the proposed method of shoring to be submitted to the *Superintendent's Representative* and approved prior to commencing excavation of this section of drain.

12. The *Superintendent's Representative* may at any time during the *Contract* stop any works they considers necessary, if in their opinion, any part of the work is in an unsafe condition.

13. All surplus or unsuitable materials resulting from trench excavation, pipe laying and backfill shall be removed from site at *Contractor's* cost.

5.5.2 Pit Excavation

Excavation for pits must be made to the correct depth and of sufficient dimensions to allow the base and walls to be constructed.

Where a firm pit foundation cannot be obtained, the *Contractor* shall place timber piles and raft. The depth of piles shall be as directed by the *Superintendent's Representative*.

The *Contractor* shall be responsible for safety at all times.

5.5.3 Blasting

Blasting is not permitted.

5.5.4 Measurement of Excavation

Measurement of excavation for the purpose of costing variations shall be in accordance with the trench dimensions shown on the Drawings.

5.5.5 Obstruction to Traffic

Excavation material shall be deposited in an area causing the least interference to vehicular and pedestrian traffic.

At all times when the *WUC* are left unattended, all excavation in public areas shall be fenced off with warning signs and lighting and the *Contractor* shall ensure that they remain in a safe condition.

These safety precautions shall be subject to the approval of the *Superintendent's Representative*.

5.5.6 Dewatering and Disposal of Dewatered Products

Proposals for the discharge of all dewatered products shall be submitted in a detailed Dewatering Management Plan, including disposal of dewatering products contaminated by exposure to Acid Sulphate Soil (ASS), for approval by the *Superintendent's Representative* at least 10 working days prior to the dewatering work.

Each proposal shall detail the location and size of sedimentation or recharge basins to be used for settlement of solids and turbidity prior to evaporation or final discharge of clarified effluent into a receiving water body.

The *Contractor* shall not discharge or cause to be discharged into any drain, lake, river or other receiving waters any dewatered products which are worse that the current water quality in the receiving water body.

Stormwater trenches and excavations where the groundwater level is above the bottom of the trench/excavation shall be dewatered to provide stable foundations for bedding materials. Dewatering shall continue until the trenches/excavations have been backfilled to a sufficient depth to prevent flotation of the pipes.

The *Contractor* shall allow within their Tender the cost of all dewatering and any additional construction costs due to wet ground conditions.

In the event of water being encountered, the *Contractor* shall make adequate provision to ensure that the excavation is kept free from water during the process of concrete pouring and for a period of at least 24 hours after the concrete pour. No bedding or pipes shall be laid in water and trenches are to be kept free from water until backfilling has commenced.

5.6 Pipe and Culvert Construction

5.6.1 Pipe Setting

All pipes shall be set in a straight line between pits. On inspection by the *Superintendent's Representative*, any pipe not placed in a straight line shall be replaced at the cost of the *Contractor*.

The acceptable tolerance of pipe setting shall be as specified in Inspection and Tolerances clause of this Specification.

Pipes shall be set in an upstream direction unless otherwise approved by the *Superintendent's Representative*.

Pipes shall be set using boning rods and profiles unless alternative methods are approved by the *Superintendent's Representative*.

5.6.2 Concrete Pipe Jointing

Spigot and socket pipes shall be jointed with the spigot fully home in the socket and rubber ring jointed, as shown on the drawings. Pipes shall be laid such that the sockets face upstream.

Externally flush interlocking pipe shall be jointed with the ends fully butting on the inside face of the pipe and caulked with a 3 part sand to 1 part cement mortar on the outer face of the joint. The mortar shall be neatly struck off flush with the outer surface of the pipe.

While waiting for backfilling, all mortar joints shall be covered with damp clean sand to prevent the mortar cracking.

5.6.3 PVC, PE and PP Pipe Installation and Jointing

All pipes shall be installed in accordance with AS/NZS 2566.2. All PVC pipes are to be joined in accordance with the relevant standard as applied to the pipe material and application.

5.6.4 FRC Pipe Jointing

Not used for this Specification

5.6.5 Box Culverts

Precast box culverts shall be manufactured from concrete of Grade 40 MPa or 50 MPa to comply with Main Roads WA Specification 404 (Appendix H) and AS 1597 as applicable to size.

Box culverts shall be placed on a reinforced concrete base slab to the details shown on the Drawings. The box culverts shall be butt jointed and caulked with mortar complying with Section 3.5.4 and Table 3-2 on the outer face of the joint. The lifting recesses shall be caulked in the same manner.

Tape for the banding of transverse butt joints between reinforced concrete box culvert units must be 225 mm wide Densopol 60 Tape or approved equivalent.

5.6.6 Pipe and Culvert Bedding

Bedding for pipes and culverts shall be strictly in accordance with the details on the Drawings and with AS/NZS 3725 or AS/NZS 2566 as appropriate. In the event that soft or unstable material is encountered in the trench base, the *Superintendent's Representative* may direct that this be removed and replaced with approved, compacted material.

The bed zone shall be placed with minimum thickness as specified in Table 5-3. Bed zone materials shall comply with the requirements of Section 4.4.7.

Table 5-3 Bed Zone Required Thickness

Pipe or Culvert Nominal Diameter	Minimum bed zone thickness (Plastic Pipes)	Minimum bed zone thickness (Concrete Pipes)
≤ 450 mm	100 mm	100 mm
450 mm ≤ 900 mm	150 mm	100 mm
900 mm ≤ 1500 mm	150 mm	100 mm
> 1500 mm	150 mm	150 mm

Where pipes or culverts are placed in a trench, the bed material shall be placed over the full width of the trench and shall be compacted by tamping, rolling and/or vibration to the minimum requirement detailed in Table 5-2 unless otherwise approved by the *Superintendent's Representative*.

Where pipes or culverts are placed on-grade, the bed material shall be placed over the width of the pipe plus a minimum of 25% of the pipe or culvert nominal diameter to each side of the pipe or culvert. The bed material shall then be compacted by tamping, rolling and/or vibration to the minimum requirement detailed in Table 5-2 unless otherwise approved by the *Superintendent's Representative*.

Where the *Contractor* elects density index to prove compliance with the compaction criteria, the density index obtained by compaction shall be monitored and reported by field testing in accordance with AS 1289. Field testing locations shall be selected by the testing authority at random. Test locations shall be undertaken at offsets to the centerline with a minimum of one field test for every 100 m of pipe or culvert length

The bed level shall be graded to provide for a uniform fall to the discharging end of the pipeline, with line and level as shown on the drawings.

For pipes with sockets protruding beyond the barrel outside surface, chases shall be dug into the bed and foundation if necessary, in the appropriate positions, so that each pipe is supported along the full length of the barrel and the socket is not subjected to point loading.

Where socket pipes are to be used small recesses shall be left under pipe joints to allow the barrels to bear evenly on foundations for their full length.

Slotted pipes shall be laid on a minimum to 150 mm of bedding material which shall rise to mid height of the barrel of the pipe, also in a minimum thickness of 150 mm. The crushed rock shall be a 'no fines', grading with maximum particle size of 14 mm unless otherwise specified.

Where shown on the drawings, subsoil drains and slotted pipes, shall be wrapped in an approved geofabric material, such as "Bidim® A14" and the trench backfilled with clean free draining sand.

5.6.7 Backfill

The *Contractor* shall manage the construction schedule such that pipe and culvert trenches are progressively backfilled, and aim to minimise the length of trench that is open at any point in time. Backfilling shall be carried out in three stages, defined below.

a. Haunch zone;

b. Overlay zone; and

c. Backfill or embankment fill.

The **haunch zone** is defined as extending vertically from the top of the bed zone to 0.1 times the pipe outside diameter. Material placed in the haunch zone shall be a cohesionless material with a maximum particle size of 19 mm, refer section 4.4.4 for local limestone material, and compliant with the requirements of AS/NZS 2566.2 and AS/NZ 3725. The contractor may propose an alternative material compliant with section 4.4.4 for approval from the *Superintendent's Representative*.

Material placed in the haunch zone shall be placed over the full width of the trench either:

- In layers not exceeding 150 mm compacted thickness and compacted by conventional methods, or
- Compacted in one operation by saturation and vibration to achieve the minimum requirement detailed in Table 5-2.

Where the *Contractor* elects density index to prove compliance with the compaction criteria, the density index obtained by compaction shall be monitored and reported by field testing in accordance with AS 1289. Field testing locations shall be selected by the testing authority at random. Test locations shall be undertaken at offsets to the centerline with a minimum of one field test for every 100 m of pipe or culvert length

The **overlay zone** is defined as extending vertically from the top of the haunch zone to 150 mm above the top of the pipe and around the pipe measured radially from any point. The fill material in the overlay zone shall be earthfill consisting of material from the excavation or elsewhere. It shall not contain any particles larger than 150 mm, nor more than 20% by mass with a size between 75 mm and 150 mm. Where overlay is placed directly above a pipe it shall not be compacted by rolling or other method that may damage the pipe.

Overlay zone materials shall be placed and compacted in layers with a loose thickness of 200 mm or less. Compaction shall be undertaken by rolling, tamping, vibration or other method necessary to produce a uniform and well-knit surface and achieve the minimum requirement detailed in Table 5-2. The *Superintendent's Representative* shall visually inspect the overlay zone at completion for compaction, and may inspect the overlay zone at any point during construction.

Backfill fill is defined as any required fill other than bedding, haunch support or overlay zone and should consist of any available suitable material up to finished levels as shown on the drawings compliant with the material requirements detailed within the Specification. Materials under roadways will need to conform to the requirements of Section 7. Materials within embankments shall conform to the requirements for the embankments they are penetrating, refer to Section 4. Material excavated from the trenches may be used provided that it is free from stone over 150 mm diameter, clay, organic or other deleterious matter. The backfilling shall be placed in 300 mm layers and be compacted to achieve the requirement detailed in Table 5-2.

Where trenches are sheeted, the following additional requirements for backfill apply:

1. No struts, walling or other supports shall be removed until the top of the compacted refilling has reached the level of these supports.
2. No wall sheeting is to totally removed from the trench until the level of the compacted refill is within 1500 mm of the surface.
3. No wall sheeting is to be removed, in dewatered trenches, until the level in water table between natural ground and refill material is less than 500 mm.
4. The wall sheeting is to be withdrawn or removed in such a manner that the pipe and compacted bed and haunch support are not disturbed during such withdrawal or removal.

Pipes shall not be backfilled until they have been inspected and approved by the *Superintendent's Representative*. Care shall be taken so as not to disturb the pipe.

The surfaces of trenches after backfill shall be graded level with the surrounding ground.

5.6.8 Trench Subsidence

If any subsidence of backfill occurs during the *Contract* period, including the Defects Liability Period, in any road, verge, footpath, pavement or elsewhere in the *WUC*, the *Contractor* shall at the *Contractor's* own expense, make it good immediately is appears.

In the event of the *Contractor*'s failure to make good such defects, the *Superintendent's Representative* may take action under the provisions of AS 2124.

5.7 Pits

Junction pits, grated pits and side entry pits, shall be constructed as shown on the Drawings. The pits shall be constructed with the tops of the covers laid to the slope of the surface, flush with the verge or the pavement in road reserves and other paved areas. Elsewhere, the covers are to be finished approximately 40 mm above the ground.

5.7.1 Precast Concrete Pits

Precast concrete pits shall be assembled accurately in strict accordance with the Drawings. It is important that the alignment of the pipe liners and the level and location of the matching pieces be accurately set in order that kerb level components can be properly constructed. If the pits are not constructed to the correct lines and levels, they shall be removed and rebuilt.

All joints between pit components shall be neatly grouted with mortar complying with Section 3.5.4 and Table 3-2. Pipes entering pits shall be finished to extend inside of the liners so as to ensure full penetration through the wall of the liner. Should the pipe be cut and contain reinforcement, the reinforcement trimmed back, and reinforcement protected in accordance with the drawings.

The lengths of pit liners shall be chosen with particular regard to the design of each pit. Generally, the number of joints should be minimised by the use of 0.9 m and 1.2 m lengths. Under no circumstances shall the top most section be broken down to a length of less than 300 mm. Any liners which are cracked shall be rejected.

5.7.2 Pit Bases

Bases shall be founded on a well compacted layer of granular material of minimum 150 mm thickness, meeting the requirements for bedding as described in Section 4.4.7. Bases may comprise either precast or cast-in-situ slabs constructed to the minimum dimensions shown on the Drawings.

5.7.3 Pit Covers

Standard rectangular or circular, reinforced concrete manhole covers for use on all manholes not under road pavements shall be as provided by a supplier, approved by the *Superintendent's Representative*.

Manholes under road pavements shall be fitted with trafficable Gatic® GM300S6D3 Cover or agreed equivalent.

Gully type entry pits shall have a standard gully grate large size with cycle friendly flat bars welded to the frame. The grates and surrounds shall be fabricated as shown in the detail drawings. The grate must be hinged in the frame.

For all covers, the lids shall be fitted with suitable lifting keyholes and rings.

5.7.4 Raised Entry and Exit Pits and Covers

All raised entry and exit pit or bubble ups into and out of basins and swales are to be constructed in accordance with Section 5.7.1 of this document.

All raised entry and exit pit or bubble ups into and out of basins and swales are to have bases constructed in accordance with section 5.7.2 of this document.

All grated covers are to be constructed in accordance with the details contained within the drawings from a suitable galvanised material. It is expected that the *Contractor* will prepare suitable shop drawings of proposed designs for approval from the *Superintendent's Representative* prior to manufacture. The *Contractor* should make suitable provision in the tender for the design and preparation of these non-standard covers or propose a suitable equivalent to suit.

5.7.5 Brickwork

All brickwork shall be carried out by competent tradesmen. The bricks shall be properly bedded and bounded true to line and level.

All joints shall be struck smooth. Mortar for brickwork shall be class M4 in accordance with AS 3700. Refer Table 3-2.

5.7.6 Step Irons

Where manhole or entry pits exceed 1.0 metres in depth, measured from top of cover to invert level of the lowest pipe, step irons consisting of 24 mm diameter hot dipped galvanised deformed steel bars shall be provided at 300 mm centres for the full depth of the manhole as detailed on the Drawings.

Stepping Irons are not to be installed within liner pits with nominal internal diameters of 600 mm or less unless otherwise specified on the drawings.

5.8 Surface Drains

5.8.1 General

The location of the surface drains are shown on the Drawings.

Surface drains shall be excavated to provide an even grade with no obstructions or hollows which would impede the flow of water.

Surface drains shall be constructed to conform to the cross-sections and levels as shown on the Drawings and shall be neatly finished to a standard obtainable with blade grader operations.

Batter slopes shall comply with the finishing of batters and ground surfaces as defined on the Drawings.

Material excavated from surface drains, which conforms to the requirements for material as specified in this Specification, may be utilised for backfilling.

Where access road embankments meet the existing surface drainage, protection works shall be provided in accordance with the Drawings.

Where indicated on the Drawings, the surface drains shall be lined with biodegradable geotextile, mortared rock pitching or stone pitching. Surface drains shall be placed to the dimensions, shape and extent as shown on the Drawings.

5.8.2 Contour Drains

The *Contractor* shall terminate all contour drains upslope unless otherwise noted. The *Contractor* shall install geotextile to the contour drains as per Clause 3.14.6.

The *Contractor* shall rip between all contour drains across slope with each run terminating upslope.

Where rills and gullies form between contour drains the area between the drains shall be hydro seeded after ripping with deep-rooted stoloniferous grass species for sediment retention.

5.8.3 Spoon Drains

The locations of spoon drains shall be as shown on the Drawings. They are generally located where water from the adjacent road will discharge down embankment slopes into the adjacent surface drains. Spoon drains shall be erosion protected and constructed in accordance with the Drawings.

Should concrete canvas be specified on the Drawings, it shall be anchored through the use of a number of methods as detailed by the manufacturer and on the accepted drawings including pegs and anchor trenching.

All concrete impregnated fabric (concrete canvas) shall be laid with the appropriate overlap at joints as specified in the manufacturers' installation guidelines. Deviation from this installation method can only be undertaken with the *Superintendent's Representative* approval. The preferred joint method is the use of a screwed overlapping joint combined with the application of a suitable sealant.

The bedding zone for the concrete impregnated fabric (concrete canvas) shall be smooth to ensure a solid interface with the bedding material. The bedding material shall extend over the full width of the drain location. Compaction achieved shall be monitored and reported by field testing in accordance with AS 1289. The Bed Zone shall be compacted by tamping, rolling and/or vibration to achieve the minimum requirement detailed in Table 5-2.

5.9 Trench Drains

An installed trench drain system should incorporate the following;

a. Correct grate type;

b. Correct channel type and size; and

c. Minimum grade 32 MPa compressive strength concrete surround.

If more than one pour is cast for the concrete surround, they must be adequately bonded to each other. This is for structural continuity. Specific site conditions may require an increase in these dimensions or reinforcement.

5.9.1 Excavation

The trench profile shall accommodate the channel pit width plus concrete surrounds. Excavations must be made about the centre line of proposed drainage run and pit. Following the removal of loose material, the base shall be compacted.

5.9.2 On – Site Fabrication / Installation

Where channels are laid in concrete pavements, an allowance shall be made for expansion / isolation joints to allow expansion and contraction movement. Where necessary, channels shall be cut with a masonry diamond disc saw, whilst grates should be cut with a band saw or similar

using a suitable blade. Channel bonding shall be achieved using a 2-part polymer concrete repair kit such as 'ACO Tuffstick' or a suitable proprietary sealant /adhesive.

5.9.3 Pipe Connections

Pipe connections shall made at preformed drill-outs, care should be exercised in removing drill-outs and hammering directly on the material should be avoided to prevent cracking.

5.9.4 Positioning of and Sealing of Channels

Common methods include the Patty method and the Hanging method. The patty method consists of placing patties made from a stiff /wet concrete mix at support joints with sufficient material to provide for the required concrete surround. Additional concrete shall be placed in the keys on the side of the channel to prevent movement or floating during the concrete pour. Channel ends are to be roughened prior to sealing with a flexible sealant.

5.9.5 Channel Bracing

To prevent channel wall and joints from distortion, sections of plywood shall be cut and placed in the channel grate rebate. If grates are used in lieu of plywood, they should laid to bridge joints to aid alignment. Grates shall be suitably protected using plastic wrap to prevent concrete contamination.

5.9.6 Pavement Finishing – Concrete

Concrete shall be trowelled flat and tapered down towards channel edge. The top of the adjacent pavement must be approximately 3 mm above the grate level to ensure liquids run into the channel.

5.9.7 Pavement Finishing – Asphalt

For applications up to Load Class D, asphalt can be applied directly up to the channel edge. As above, the top of the adjacent pavement must be approximately 3 mm above the grate level to ensure liquids run into the channel.

5.9.8 Pavement Finishing – Pavers

For applications up to Load Class D, pavers must be above grate level by approximately 3 mm to ensure liquids run into the channel. Pavers adjacent to channel must be fully bonded to concrete haunch to prevent movement of pavers and possible damage to the channel.

5.9.9 Expansion Joints

Longitudinal expansion/isolation joints should be continuous and flexible. They must be provided between the concrete surround and the surrounding slab and may be varied to suit concrete surround width by up to a metre from the channel. Transverse joints (cutting across channel haunch and base) to prevent surface cracking in the slab may be required. Ideally, such joints should be positioned at the channel joints. Alternatively, a cut may be made at the appropriate location along the channel and sealed with a flexible sealant. If the joint is dowelled, debonding should be provided.

5.9.10 Health and Safety

Polymer concrete products are manufactured using synthetic resin, mineral aggregates and curing agents. Hazards include;

1. Abrasive damage to hands;

2. Inhalation of dust from grinding, cutting, or drilling; and

3. Grinding, cutting projecting small fragments.

5.10 Headwalls and Endwalls

These are to be constructed using either concrete complying with section 3.5 of this Specification or mortared rock as detailed on the Drawings.

These are to be constructed using either concrete compressive strength or mortared stonework as detailed on the Drawings.

Where temporary or precast headwalls are specified, they shall be standard products as manufactured by *Superintendent's Representative* approved Australian manufacturers.

For mortared stonework the size and quality of the stone shall be as specified for Stone Pitching, elsewhere in this Specification.

5.11 Basins

The location of the various types of drainage basins shall be as shown on the Drawings.

Drainage basins shall be excavated to provide an even grade with no obstructions or hollows which would impede the flow of water.

Drainage basins shall be constructed to conform to the cross-sections and levels as shown in the Drawings, and shall be neatly finished to a standard obtainable with blade grader operations.

Batter slopes shall comply with the finishing of batters and ground surfaces as defined in the Drawings.

Material excavated from drainage basins, which conforms to the requirements for fill as specified in the Specification and may be utilised for backfilling as long as they meet the requires as specified in this Specification.

Where indicated on the Drawings, basins shall be lined with protection as specified in Section 5.12, placed to the dimensions, shape and extent as shown on the Drawings.

Basins and similar drainage features shall be excavated and formed to the dimensions, slopes and levels shown on the Drawings, in accordance with this Specification.

Suitable material from excavations for drainage basins shall be incorporated into the *WUC*. Unsuitable material shall be disposed of to the *Contractor*'s spoil sites.

5.12 Erosion Stabilisation

5.12.1 Rock Pitching

Where indicated on the Drawings, surfaces shall be protected by either mechanically placed rock pitching or hand-placed mortared pitching rocks.

The rocks shall be set on a geotextile fabric under layer, e.g. Bidim® A44 or a 150 mm aggregate rock layer or equivalent, in a close fitting pattern and rammed into position. Courses of stones shall be placed such that the bed is at right angles to the ground slope. The larger stones shall be used for the lower courses, with smaller stones used at the top. The weight of all stones shall be carried by the ground bedding and not adjacent stones.

The minimum thickness of the rock pitching, measured at right angles to the ground slope, shall be 500 mm unless otherwise noted on the accepted drawings.

The mortared rock pitching shall be of sound durable stones at least 0.002 to 0.01 cubic metres in volume. Low strength, friable stones will not be accepted. Rocks for mortar rock pitching shall generally weigh in excess of 15 kg each and the greatest dimension of any stone shall not exceed 1.5 times its least dimension.

Where specified as mortared rock pitching on the accepted drawings, the rocks shall be pressed into a wet 50 to 75 mm thick mortar bed (over the geotextile/drainage layer) made of 3 parts sand to 1 part Portland Cement. The joints between rocks shall filled so as to achieve an even level surrounding rocks. The minimum space between the rocks shall generally not exceed 25 mm.

The underlying geotextile and soil subgrade shall be dampened down before placing the mortar bed.

The finished pitching shall present an even surface of the required contour.

5.12.2 Biodegradable Matting

Biodegradable matting material is to be been placed in several locations across the site following the reinstatement of topsoil. Should biodegradable matting require disturbance as part of *WUC* it shall be reinstated to match existing.

Unless otherwise detailed on the accepted drawings biodegradable matting is to be installed to the following for stabilisation:

d. All contour, open or surface drains with longitudinal slopes greater that or equal to 3%;

e. Basin embankment or Cut slopes with slopes between 1V:4H and 1V:3H; and

f. Disturbed slopes with slopes greater than 1V:4H

The material used to replace the existing shall be of an appropriate grade and shall be pegged down and anchored in accordance with the manufacturers' requirements. Refer to section 4.12.2 for material requirements.

5.12.3 Hydromulching/Hydroseeding

Not used for this Specification

5.12.4 Stabilisation

The *Contractor* shall be responsible for maintaining all temporary stabilisation required prior to final stabilisation for dust and erosion control during the course of the WUC.

Where earthworked surfaces are exposed to or are likely to be exposed to winds or inclement weather, the *Contractor* shall take all steps necessary to stabilise those surfaces. Any stabilised areas damaged by wind, rain or the controlled movement of vehicles or pedestrians shall be made good by the *Contractor* at the *Contractor*'s expense.

The *Contractor* shall use suitable erosion and dust inhibitor such as "Dustex" or similar approved products for use as temporary stabilisation. There shall be enough of the product on site to cover the exposed area under works at that time.

All stabilisation shall comply with the requirements of the Dust Management Plan and any additional steps instructed by the *Superintendent's Representative*.

5.13 Inspection and Tolerances

No backfilling shall be commenced until the drainage lines have been approved by the *Superintendent's Representative*.

On completion of backfilling, the *Superintendent's Representative* shall again inspect the drainage lines for alignment, level and gradient and all pipes must be free from debris.

Pipelines and trench drains shall be within 20 mm of design line and level at all points where design grade exceeds 1% and within 10 mm of the line and level for grades flatter than 1%.

Pipelines and trench drains which have not been constructed within tolerance shall be excavated and relayed at the entire cost of the *Contractor*.

The invert levels of open drains and basins shall be within 50 mm vertically and 100 mm laterally of the position shown in the Drawings unless otherwise detailed in this Specification.

The *Contractor* shall test each section of the pipework that is not slotted prior to backfilling in accordance with the requirements of this Specification and AS / NZS 2032.

5.14 Water Safety Signage

All open water safety signage is to be installed in accordance with AS/NZS 2416 at all times.

5.15 Maintenance

The performance of the drains during and after a major storm event shall be examined to ensure that flows are contained within the designated flow paths and erosion is minimal. Where the flows are found to not be contained and/or erosion is found to occur, the *Contractor* shall repair any damages and make modifications to the drainage system necessary to rectify the situation.

5.15.1 Weed Control

The *Contractor* shall be responsible for ensuring that any areas seeded will establish and thrive. To achieve this, suitable weed control will be required. This may involve pre-spraying, scalping of weedy topsoil, weed matting or other options to remove or control weeds in planting zones.

5.15.2 Cleaning and Clearing

Immediately prior to demobilisation from site, after the majority of the *WUC* have been completed, the *Contractor* shall check and clean out where necessary drains, pipes, pits and drains, both pre-existing and those constructed as part of WUC.

6. Water Pipeline

6.1 General

The requirements for the supply and installation of the proposed DN250 PVC-M potable water supply pipeline to be installed in conjunction with the stormwater pipework along and adjacent Murray Road are to be undertaken in accordance with Water Corporation requirements detailed on the Drawings and specific requirements detailed within Appendix G. It is the responsibility of the *Contractor* to ensure that compliance to the current version of any Water Corporation Standard, Guideline, Product Specification or Procedure occurs. To gain a copy of the current version of these documents the *Contractor* can access these on the Water Corporation website by following the following link https://www.watercorporation.com.au/About-us/Suppliers-and-contractors/Resources/Design-standards.

The installation of the proposed above ground HDPE main between pits S13-1 and S13-7 detailed on Drawing 61-35637-C272 contained within Appendix B is to be undertaken in accordance with the requirements of document PE contained within Appendix G.

The requirements detailed within Appendix G are to be read in conjunction with the remainder of the Specification and Drawings.

6.2 Discrepancies

In the event the requirement relates to specific water pipeline construction the prevailing requirement will be that detailed in Appendix G. Should the Specification requirements contained within Appendix G conflict with the requirements of the greater Specification the *Contractor* is to inform the *Superintendent's Representative* of the conflict and propose their proposed resolution for consideration and acceptance or rejection.

6.3 Interpretation

Where documentation in Appendix G refers to the following, the following is to be the interpretation unless otherwise detailed in the Specification.

1. *Principal* is to be interpreted as the being the Department of Infrastructure, Transport, Regional Development and Communication.
2. *Client's Representative* is to be interpreted as the *Superintendent's Representative*.
3. *Superintendent* is to be interpreted as the *Superintendent's Representative*.
4. Water Corporation Representative is it be interpreted as detailed being a representative of Water Corporation either located on Christmas Island or elsewhere.

6.4 Other Water Corporation Documents

Should this Specification or the modular specification documents contained within Appendix G call on specific Water Corporation standards, specifications or Documents these can be provided to the *Contractor* upon request.

7. Roadworks

The work under this section of the Specification consists of the supply and use of materials for road and other associated works. The *WUC* shall include the supply, storage, transport, handling, placement and testing of materials.

The construction of the layer works does not require a NATA accredited on site laboratory to check compaction. Instead a Dynamic Cone Penetrometer as well as a Clegg Impact Hammer shall be used to check consistency (compaction) and adequate dry back. The testing shall be done frequently to demonstrate conformance, following a series of calibration check tests.

7.1 Quality Assurance

The *Contractor* shall provide at weekly intervals, unless otherwise agreed in writing, to the *Superintendent's Representative* the following verification documentation.

Table 7-1 Roadworks Quality Assurance Summary

Item No	Item	Requirement	Frequency/Timing
1	Materials Specifications	Supplier Certification of compliance with Drawings, Specifications and Standards	Prior to Delivery to Site
2	Survey Set Out	Survey Record prior to installation	Completed per pavement layer per designated Lot
3	Compacted pavement layers	Compaction Certification	As per the requirements of this Specification
4	As Constructed drawings	As per Specification and SoCI requirements for Asset handover	Upon completion of *WUC* unless otherwise specified

7.2 Preparation of Subgrade

The subgrade/foundation typically comprises brown clayey sand, and shall be compacted to the indicative consistency specified in Table 4-11 and Table 4-12 to a depth of 900 mm below the sub-base.

After compaction the subgrade shall be trimmed to the required level and profile. The *Contractor* shall submit consistency test results and finished survey levels to the *Superintendent's Representative*, demonstrating that the subgrade meets the Specification requirements.

The *Superintendent's Representative* may direct additional proof rolling of the sub-grade to ensure that soft or weak spots are eliminated. Proof rolling shall consist of no less than two (2) passes of a 12 tonne vibrating roller over the entire area of prepared sub-grade, witnessed by the *Superintendent's Representative* (**WITNESS POINT**). The cost of proof rolling, and reconstruction of any identified weak spots, shall be borne by the *Contractor*.

In subgrade areas identified to be heaving or moving, the material shall be dried or removed and replaced with a suitable crushed limestone material, witnessed by the *Superintendent's Representative* (**WITNESS POINT**). The cost of drying, removing and replacement of material and other associated works shall be borne by the *Contractor*.

Once approved by the *Superintendent's Representative*, the sub-grade shall be lightly watered prior to placing sub-base or basecourse material. A qualified nominated Engineer must witness and supervise the Clegg Impact Testing and Dynamic Cone Penetrometer testing as specified for **HOLD POINT** release.

Note the brown subgrade sands are moisture sensitive and have chemically bound water. Compaction releases the water rendering a moist sand to appear wet, leading to heaving of the layer.

7.3 Sub-base

7.3.1 General

The *Contractor* shall supply, transport, place, compact and trim sub-base material for pavements as shown on the Drawings.

7.3.2 Material

Sub-base material shall consist of locally available crushed limestone and shall be free from clay, roots and other foreign material, and shall not contain either oversize spalls or capstone or an excessive proportion of fine-grained material.

Sampling and testing of crushed limestone shall be in accordance with AS 1141.

Sub-base material shall comply with the grading requirements described in Table 4-2 and Table 4-3 when tested in accordance with AS 1289.

Table 7-2 Sub-base Particle Size Distribution

AS 1141.11.1 Sieve Size (mm)	Percentage Passing by Mass (%)
75 mm	100
19 mm	55-85
2.36 mm	35-65

Table 7-3 Crushed Limestone – Other Limits

Test	Specification
Los Angeles Abrasion	% of wear of crushed limestone not to be less than 30% or exceed 55%
Calcium Carbonate Content ($CaCO_3$)	shall not be less than 60% or greater than 80%.

A sample shall be taken and tested by the *Contractor* for calcium carbonate content, percentage of wear, grading and determination of the maximum dry density of the material. If the material varies in quality or is obtained from various quarries, each variation in quality, or material from each quarry, shall have this test performed by an approved Testing Authority and the *Contractor* shall maintain a record as to where the various materials have been placed.

Any material which does not meet the above requirements or which, in the opinion of the *Superintendent's Representative*, is composed of material which would break down with ageing or weathering to such an extent that it would then fall outside the limits of this Specification, shall be rejected.

7.3.3 Placement

Subbase material shall be spread and compacted in uniform layers of maximum 150 mm compacted thickness.

During compaction, the moisture content of the sub-base material shall be maintained within the range of OMC – 2% to OMC + 2%.

Oversize material discarded from the sub-base layer during construction shall be removed from the *WUC* and disposed of offsite.

7.3.4 Compaction

The sub-base shall be compacted to a density not less than 95% of Modified Maximum Dry Density or alternatively shall conform to the Clegg Impact Testing and Dynamic Cone Penetrometer Testing requirements as set out in Section 4.10 and 4.11. A qualified *Contractor* appointed Nominated Engineer must witness and supervise the Clegg Impact Testing and Dynamic Cone Penetrometer testing as specified for **HOLD POINT** release.

7.3.5 Dryback

The subbase must be dried back to a characteristic moisture content of 85% of optimum moisture content or lower prior to construction of the basecourse layer above the subbase and must be confirmed with the Clegg Hammer that increased CIV values specified in Section 4.10 have been achieved.

7.4 Basecourse

7.4.1 General

The *Contractor* shall blend, crush, screen or otherwise process basecourse material to ensure the achievement of the specified material properties.

Basecourse material shall not be placed unless the sub-base layer has been compacted, finished and approved in writing by the *Superintendent's Representative*.

7.4.2 Material

The basecourse shall consist of locally available crushed and screened limestone rock (rock base) and shall be free from clay, roots and other foreign material, and shall not contain either oversize spalls or capstone or an excessive proportion of fine grained material. Crushed Rock as defined in Section 4.4.6 can be used if it can be shown to meet the requirements of this section.

Sampling and testing of crushed limestone rock shall be in accordance with AS 1141. Material properties shall conform with the following tables.

Table 7-4 Basecourse Particle Size Distribution

AS 1141.11.1 Sieve Size (mm)	Percentage Passing by Mass
26.5	100
19.0	95-100
13.2	78-92
9.5	63-83
4.75	44-64

AS 1141.11.1 Sieve Size (mm)	Percentage Passing by Mass
2.36	30-48
0.425	14-22
0.075	6-10

Table 7-5 Basecourse - Other Limits

Test	Specification
Liquid Limit	not greater than 30%
Plasticity Index	not greater than 5%
Linear Shrinkage	not greater than 2%
Los Angeles abrasion	loss not greater than 35%
Flakiness index	not greater than 35
Wet / Dry strength variation ratio	not greater than 40%
Soluble sulphate salt content	not greater than 0.1% (expressed as percentage sulphate by mass of crushed rock)

Where the Plasticity Index is unobtainable or where the Linear Shrinkage is less than 1.0% a Maximum Dry Compressive Strength value of not less than 1700 kPa is required.

7.4.3 Placement

Basecourse shall be spread and compacted in uniform layers of maximum 150 mm compacted thickness. Where the existing surface is close to the design grade, the existing pavement shall be scarified to ensure that the resulting compacted thickness of the layer to be worked is greater than 100 mm.

Care must be taken to avoid segregation of material during tipping and spreading. The tipping of material shall be run over a minimum length of 25 m and not placed in heaps. If material becomes segregated it shall be mixed as directed using a rotary hoe or other suitable equipment.

Oversize material discarded from the basecourse layer during construction shall be removed from the *WUC* and disposed of offsite.

7.4.4 Compaction

The basecourse material shall be watered to optimum moisture content, mixed, shaped and compacted to a slightly higher level than shown on the drawings, in anticipation of final trimming. Moisture content shall be maintained within the range OMC – 2% to OMC + 1%.

Basecourse shall be compacted to a density not less than 98% of Modified Maximum Dry Density or alternatively the proposed material to be used shall conform to the Clegg Impact Testing and Dynamic Cone Penetrometer Testing requirements as set out in Section 4.10 and 4.11. A *Contractor* appointed qualified Nominated Engineer must witness and supervise the Clegg Impact Testing and Dynamic Cone Penetrometer testing as specified for **HOLD POINT** release.

7.4.5 Dryback

The basecourse must be dried back to a characteristic moisture content of 80% of optimal moisture content or lower prior to the sealing works on the basecourse. The dryback shall be confirmed by a marked increase in the Clegg Hammer CIV results as specified in Section 4.10.

7.4.6 Finished Surface

The surface must be swept clean of all loose sand, stones, dust and other foreign matter before sealing. It shall be heavily broomed to produce a rough angular surface to improve bond and shear resistance at the layer interface. The surface shall also be free of dust, loose stone or unbound material and be suitable to receive a bituminous surface.

The finished surface of the pavement shall not deviate above or below the levels shown on the Drawings by more than +10 mm, -0 mm. Additionally, the surface shall not deviate in excess of 7 mm from the testing edge of a 3 m straight edge. The *Contractor* shall supply a 3 m straight edge for the sole use of the *Superintendent's Representative* for the duration of the *Contract*.

Where a bituminous seal is to be applied, the *Contractor* shall maintain the finished surface in a condition that meets all Specification requirements until commencement of sealing works. The finished basecourse layer shall not be trafficked by any equipment other than that essential for bituminous sealing.

7.4.7 Matching to Existing Pavements

Where the pavement is to be joined to an existing pavement, remove a strip of the existing pavement at least 300 mm wide for its full depth and trim the edge at an angle of approximately 45 degrees in steps of maximum height 150 mm before placing new pavement material. If the existing pavement is sealed, trim the seal to a neat edge.

Onsite testing requirements to determine compaction requirements for subgrade and pavement layers consistency, indicative compaction and dry back.

The following tests facilitate construction in the absence of proper suitable testing facilities on site and shall constitute the basis of the site testing schedule. This section contains information pertinent to on site in-situ testing requirements that do not constitute a release from the other requirements set out in this Specification.

Laboratory testing of each completed section of *WUC* shall be carried out at the earliest opportunity in order to demonstrate compliance with this Specification. Where results from Laboratory testing have been deemed unsatisfactory, affected lots of work must be removed and replaced. All remedial, removal and replacement, and other associated works costs shall be borne by the *Contractor*.

The compaction of subgrade and pavement layers must be checked with Clegg Impact and Dynamic Cone Penetrometer tests. Both tests must be carried out immediately after completion of the layers at OMC and when it is believed dryback of the layer has been achieved. The Clegg Hammer shall be used to demonstrate an increase in CIV and dry back.

The requirements of each pavement layer must be complied with in full to the satisfaction of the nominated Engineer prior to placement of the subsequent layer.

7.5 Sealing Works

7.5.1 Surface Preparation

The pavement surface shall be swept clean of all loose sand, stones, dust and other foreign matter before surfacing. Adherent patches of foreign matter shall be removed by using hand

brooming and steel scrapers or similar methods. Loose material shall be swept a sufficient distance off the pavement to permit execution of the bituminous binder

Prior to the application of bituminous binder as an initial surfacing treatment, the *Contractor* shall certify to the *Superintendent's Representative* that the basecourse complies in all respects with the requirements of the Specification, including the surface finish as described in MRWA Specification 501 Pavements (Appendix H). Compliance with the specified requirements for Dryback, CIV Testing and DCP Testing as per Section 4.10 and 4.11 is also required.

At the completion of the basecourse surface being swept and prior to the application of the bituminous binder, the *Contractor* shall certify to the *Superintendent's Representative* that the basecourse complies with the surface finish requirements as described in MRWA Specification 501 Pavements and that the surface is suitable to receive the bituminous binder.

7.5.2 Bitumen

The bitumen proposed for use on site shall conform with the requirements of MRWA Specification 511 Materials for Bituminous Treatments (Appendix H).

Bitumen emulsion shall be manufactured as specified in AS 1160 and conforms to the properties specified in AS 1160. In addition, where CRS/170-72 emulsion is specified, it shall meet or exceed the following criteria when tested.

1. Dry Aggregate: 80% coated
2. Wet Aggregate: 60% coated

Water used to dilute bitumen shall be compatible with the emulsion. The water shall be added to the emulsion at a suitable temperature. Emulsion shall not be added to the water.

Bitumen emulsion shall be mixed by circulation in the mechanical sprayer for not less than ten minutes or such longer period as may be necessary to ensure a uniform and homogeneous mixture.

Any bitumen emulsion heated in excess of 80 degrees Celsius (60% or 70% standard emulsion) after leaving the place of manufacture, shall not be used and shall be removed from site. The quantity of bitumen emulsion heated shall be that quantity that is to be applied to the pavement within 6 hours of the heating being carried out. If bitumen emulsion is held in site storage for prolonged periods, then such heating as may be necessary to prevent the bitumen emulsion temperature from falling below 10 degrees Celsius shall be permitted.

Where a pressurised sprayer is used circulation in the site storage or road tanker shall be permitted as a substitute for circulation in the sprayer. Such circulation shall take place immediately prior to the loading of the sprayer.

Bitumen emulsion seals shall not be subject to any vehicular traffic until the emulsion has completely broken and cured to form a stable seal leaving no water in the binder.

Transport and Handling of Binder

The handling, transport and heating of binder (if required) shall comply with the requirements of MRWA Specification 511 Materials for Bituminous Treatments,

Application

The seal shall be applied on a light application of emulsion based prime (Ecoprime or similar).

The surface to be sealed shall be dry and no binder shall be applied during wet or rainy conditions, or when adverse weather conditions may prevail at any time during such work. When binder is applied and rain is forecast during the 24-hour period after application of the

seal the *Contractor* shall be responsible for any damage to or defects in the seal and action and cost to maintain or repair the seal.

The *Contractor* shall provide the *Superintendent's Representative* with safe and convenient access to the sprayer at all times for checking the volume before and after spraying by means of the dipstick.

Binder shall be applied only when the pavement temperature is between 10°C and 40°C. Application of emulsion at a temperature above 40°C shall only be done when it can be shown by demonstration that the emulsion will not form a skin or break rapidly.

The binder spraying temperature range shall be 35°C to 50°C for 60% emulsions, 50°C to 80°C for 67% or 70% high bitumen content emulsions or greater than 90°C for polymer modified emulsions.

The spraying of the binder for each run of the sprayer shall start and finish on protective paper. The sprayer shall start each run at least 10 m before the protective paper and shall cross the paper at its correct spraying speed. The paper so used and any spilt binder shall be removed and disposed of in an approved manner. All tapers and fillets shall be sprayed after masking with protective paper

7.5.3 Aggregates

Aggregates shall conform to the requirements of Section 511.10 Aggregates, of MRWA specification 511 Materials for Bituminous Treatments.

Crushed Aggregate for bitumen emulsion surfacing work shall not be precoated with a precoating fluid. However, the aggregate may be prewetted with water to assist adhesion of the binder.

Prior to the on-site delivery of crushed aggregate, the *Contractor* shall provide certification to the *Superintendent's Representative* that the aggregate conforms to specified requirements.

All cover material for sealing works supplied for this contract shall be organised into clearly identifiable stockpiles either at source or on site in order that they may be tested as required by the Quality Plan.

The aggregate stockpile sites shall be constructed and maintained in a tidy condition and the *Contractor's* operations shall not contaminate aggregate in the stockpiles. Surplus aggregate shall be removed from temporary stockpiles and the aggregate stockpile sites shall be fully cleaned and rehabilitated. The *Contractor* shall prepare a management plan for the stockpile sites detailing how contamination from precoating work (if required) is to be managed and cleaned after completion of *WUC*. Stockpile areas shall be of sufficient size to allow a 4 m clear margin around each stockpile.

Any contamination of aggregate after acceptance that is due in any way to the *Contractor's* activities shall be corrected at their own cost.

The damp aggregate shall be applied immediately after the emulsion has been sprayed and before it has broken, and the specified number of complete coverages with the roller shall be completed within 15 minutes of the application of the binder. The length of spray runs shall be limited to comply with this requirement.

Rolling and Drag Brooming

Immediately after application of the cover material, the surface shall be rolled with rubber tyred rollers to the minimum number of designed passes for the whole area. For the first 4 complete coverages, rollers shall be operated at speeds less than 7 km per hour. Drag brooming shall be

carried out after every second complete coverage of rolling or as deemed required by the *Superintendent's Representative.*

Public traffic shall not be allowed on the first coat of a double/double seal. Any damage to the first coat shall be repaired by the *Contractor* at no cost to the *Client* prior to spraying the binder for the second coat

7.5.4 Protective Paper

All protective paper used shall meet the requirements of MRWA Specification 511 Materials for Bituminous Treatments.

7.5.5 Disposal Sites

The *Contractor* shall dispose of bituminous products or other disposable items such as protective paper at an authorised waste disposal site.

Any area so used without the approval of the *Superintendent's Representative* shall be made good immediately at no cost to the *Client*.

7.6 Prevention of Damage to Road Surfaces

The *Contractor* shall take all reasonable precautions to prevent damage to existing or new sections of seal by the *Contractor's* workforce and subcontractors or suppliers either directly or indirectly employed by the *Contractor*.

7.7 Remedial Works for Damaged Road Surfaces

Where damage occurs to the existing road/driveway crossing surface, i.e. gouges, scrapes or potholes; the *Contractor* shall repair the surface to the previous condition.

The repair may involve the spraying/re-surfacing of the entire road pavement (lane) and/or the entire driveway crossing area at the discretion of the *Superintendent's Representative*.

The *Contractor* shall repair any subsidence within two days of the occurrence and/or notification of the defect. Immediate repairs shall be carried out by the *Contractor* as necessary to maintain the safety of the *Site* to the satisfaction of the *Superintendent's Representative* otherwise the SoCI shall be authorised to carry out remedial *WUC* at the *Contractor's* cost.

7.8 Remedial Works for Asphalt

The *Contractor* shall remove and replace areas of asphalt which show signs of either ravelling, fretting, cracking, deflection, subsidence, scabbing or instability, for any reason, at the discretion of the *Superintendent's Representative*.

Any bituminous mix that has become damaged or contaminated with foreign material shall be removed and replaced.

The extent of the defective area shall include all the asphalt in the area containing the failed *Test*(s). Further *Tests* may be required by the *Superintendent's Representative* to help isolate the failed area and therefore define the extent of remedial *WUC*. The *Contractor* shall be responsible for such additional *Tests*, including all costs.

Skin patching of an area that has been rolled shall not be permitted.

Defective areas shall be removed and replaced with fresh materials. Patches shall be prepared by cutting and removing the defective asphalt to the full depth of the course such that the sides of the area are at right angles or parallel to the direction of traffic and the edges are vertical. The internal edges and surfaces of the area to be patched shall be cleaned of all cutting residues by

flushing with water and all free water removed. The surfaces shall be tack coated with bituminous emulsion prior to placing of fresh material.

Notwithstanding the above where there are a number of repair patches in close proximity to one another and in the opinion of the *Superintendent's Representative* it is reasonable to do so, the patches may be replaced by a single large patch.

7.9 Remedial Works for Sealing

7.9.1 Incorrect Application Rate for Sealing

Payment for sealing work will only be made for application rates between 95% and 105% of that ordered.

7.9.2 Bleeding, Fatty Seals

The *Contractor* shall apply a blinding layer of clean fine aggregate or coarse sand as often as is necessary to soak up excess bitumen and to provide an acceptable wearing course consistent with a spray seal properly applied. If the extent of blinding is such that surface shape is affected the area shall be planed and resealed.

7.9.3 Stripping

The *Contractor* shall design and apply enrichment or overspray to affected areas to provide an acceptable wearing course consistent with a spray seal properly applied.

7.10 Extruded Kerbing

7.10.1 Scope

Kerb sections shall be installed in accordance with AS 2876 and as shown on the accepted drawings.

7.10.2 Concrete

Concrete for use in extruded kerbing shall be ready mixed concrete complying with all requirements of the current relevant Australian Standard and in accordance with MRWA Specification 407 Kerbing (Appendix H). The concrete mix shall be S32 in accordance with Drawings, MRWA Specification 407 and requirements in this Specification that take precedence. Kerbing *Contractor*s may submit alternative mix designs for *Superintendent's Representative* approval. The aggregate size shall be 10 mm nominal. The concrete cylinder compressive strength at 28 days shall be not less than 32 MPa, with a maximum slump of 50 mm.

7.10.3 Line and Level of Work

The kerbing shall be laid on the alignment, grades and to the levels shown on the accepted drawings. The top and face surface of the kerb shall be parallel to the ruling grade of the pavement and shall be free from depressions exceeding 3 mm when measured with a 3 m straight edge. The construction tolerance shall be such that when a 3 metre long straight edge is laid on the top or face of the kerb, the surface shall not vary more than 3 mm from the edge of the straight edge, except at grade changes or curves.

7.10.4 Construction Details

The surface to receive the kerb shall be a fully compacted and primed basecourse. The *Contractor* shall prepare the surface by removing free or loose material to the satisfaction of the

Superintendent's Representative immediately prior to the placing of the kerb. The *Contractor* shall give the *Superintendent's Representative* 24 hours notice of the start of the kerb laying operations in order that the *Superintendent's Representative* may have the opportunity of inspecting the work.

Whenever shown on the Drawings or required by the Local Council, kerbing shall be keyed into the base course on all radii less than 40 m.

The extruded kerb shall be finished whilst the concrete is still comparatively wet to give a smooth finish free of surface pits and depressions. The finished height of the kerb shall not vary by more than +10 mm and -10 mm from the design level.

Expansion joints shall be constructed and provided at intervals, to SoCI requirements or as shown on the Drawings. Expansion joints shall be sawn vertically at right angles to the longitudinal line of the kerb, to give a 10 to 12 mm wide cut for the full section of the kerb.

Expansion joints shall also be provided at all tangent points and adjacent to inlet structures and as shown on the Drawings.

When the joint preparation has been inspected and approved by the *Superintendent's Representative*, the expansion joints shall be sealed with a strip of foam to a depth of 25 mm to act as a backing for Butyl mastic seal. The seal shall finish 3 mm below the face of the kerb.

Contraction joints shall be inserted immediately after final finish, to SoCI requirements, or as shown on the Drawings. Joints shall be formed with a grooving tool, not fully fitting through the section of the kerb. Alternatively, the joint may be formed by cutting a 5 mm gap at least to 2/3 the depth of the kerb section. All contraction joints shall be sealed by approved means to prevent ingress of sand.

All joints where cutting is required, shall be cut not less than 24 hours following the laying of that section of kerb, with methods used to avoid staining the seal.

7.10.5 Curing

Within two hours of surface finishing, all exposed faces of the completed kerb shall be protected from moisture loss for a period of not less than four (4) days after extrusion by covering with plastic sheeting or spraying with an approved curing compound.

Curing compounds shall meet the requirements of the current relevant Australian Standard.

Kerbing shall be treated with a sprayed application of a SoCI approved membrane curing compound applied in accordance with manufacturers' specifications.

After the application of the curing compound, the kerb shall be covered with an approved polythene membrane for a minimum period of seven (7) days prior to:

a. Any road materials being placed adjacent to the kerb,

b. Any further work being done on the road, or

c. Any backfilling adjacent to kerb.

The membrane shall be replaced on completion of cutting and jointing operations.

7.10.6 Protection of Works

The *Contractor* shall be held solely responsible for the replacement as necessary of any kerbing during the course of *the WUC* of the *Contract* and for the *Defects Liability Period* as specified.

7.10.7 Kerb Protection

In areas where kerb protection has been specified on the accepted drawings, a spray on material such as Acromastic or similar approved shall be applied behind the kerb and basecourse to form a water proof seal. The product shall be applied to manufacturers' specifications.

8. Geotechnical Site Investigations

8.1 General

A geotechnical site investigation is required for the Southern Drumsite Basin and the Incline Basin. A preliminary site investigation was undertaken in 2018 by GHD, which is to be supplemented by additional fieldwork and laboratory testing. A copy of this report has been included with this Specification as Appendix I. This section describes the minimum scope of fieldwork, laboratory testing and reporting for the geotechnical investigation needing to be undertaken by the *Contractor* prior to the construction of a number of key areas within the *WUC*.

8.2 Southern Drumsite Basin

The Southern Drumsite Basin is located near the CIDHS adjacent to an existing drainage basin known as the School Basin. Drawing 61-35637-C245 shows the layout and general arrangement of the Southern Drumsite Basin.

The site investigation completed in 2018 comprised four hand auger boreholes and two test pits. The *Contractor* is to undertake as *WUC* additional testing to supplement this data which is to include but not be limited to one supplementary geotechnical borehole. The locations of the existing and proposed site investigation locations are shown on Drawing 61-35637-C245, which is included in Appendix B.

The target depth for the Southern Drumsite Basin borehole is 6.0 m. Further technical details for drilling is included in Section 8.8.

8.3 Incline Basin and Drain

The George Fam Incline Basin (Incline Basin) and Incline Drain are located near the Christmas Island Phosphate product storage silos. Drawing 61-35637-C230 shows the layout and general arrangement of the Incline Basin. Drawing 61-35637-C232 shows the layout and general arrangement of the Incline Drain.

The site investigation completed in 2018 comprised two hand auger boreholes at the basin site and a further one auger holes near the drain site. Access at the time of investigations was limited with no clearing permitted and several of the test auger holes did not reach the desired target depth. The *Contractor* is to undertake as *WUC* additional testing to supplement this data which is to include but not be limited to five supplementary geotechnical boreholes at the basin site and a further two additional boreholes at the drain site. The locations of the existing and proposed site investigation locations are shown on Drawing 61-35637-C245, which is included in Appendix B.

The target depth for all the Incline Basin boreholes is 15.0 m with those at the drain site being 6.0 m. Further technical details for drilling is included in Section 8.8.

8.4 Laboratory Testing

Laboratory testing shall be conducted on samples retrieved from the boreholes on the basis of the actual ground conditions encountered. The laboratory testing schedule shall be submitted the *Superintendent's Representative* for approval prior to the commencement of testing. All laboratory tests shall be undertaken by an organisation accredited by the National Association of Testing Authorities (NATA) for the relevant test(s).

Testing is expected to comprise the following:

- Particle size distribution (PSD).
- Atterberg Limits and Linear Shrinkage.
- Field density.
- Shear strength (direct shear, simple shear or triaxial as appropriate to sample).
- Permeability.
- Emerson class and pinhole dispersion.
- Point load index – rock core only.
- Uniaxial compressive strength (UCS) – rock core only.

8.5 Analysis and Reporting

Upon completion of the fieldwork, factual results consisting of preliminary logs and site layout plans of the investigation fieldwork shall be forwarded to the *Superintendent's Representative* within 1 week of completion of fieldwork.

On completion of the laboratory testing, the *Contractor* shall submit a factual geotechnical report providing:

- Factual results of the investigation, including finalised geotechnical logs;
- Laboratory test result sheets and a laboratory test summary table; and
- Plans and descriptions of the works carried out, together with detailed descriptions of the site geology and ground conditions encountered.

The *Contractor* shall allow a four week period in their schedule for review of the factual geotechnical report and incorporation of any design amendments that may be required.

8.6 Survey of Test Locations and Underground Services

Actual borehole locations shall be nominated by the *Contractor* and agreed with the *Superintendent's Representative*. Borehole locations may be altered during the course of the investigation to suit the ground and subsurface conditions encountered or the constraints of any particular site (e.g. proximity to underground utilities, safety of the drilling rig), subject to approval the *Superintendent's Representative*.

The *Contractor* shall determine the location of all underground services in the vicinity of the boreholes and ensure that proposed borehole locations are clear of underground services. Where boreholes are to be adjusted by 10 m or greater from agreed locations, approval shall be obtained from the *Superintendent's Representative* prior to commencing drilling.

The final position of boreholes shall be surveyed and recorded by the *Contractor*. The *Contractor* shall survey the position and ground surface level of each borehole using approved surveying methods, such as RTK-GPS. Survey shall be within the following limits of accuracy:

- Position: ± 0.5 mm
- Level: ± 0.1 m

Survey information is to be provided as soon as practical on completion of the survey and must be included within the factual geotechnical report.

8.7 Governing Standards and Procedures

Procedures used in the geotechnical investigation and reporting shall be consistent with sound engineering practice. Unless otherwise stated herein, all procedures used shall conform to the requirements of AS 1726-2017 – Geotechnical Site Investigations.

All laboratory testing shall be undertaken by a laboratory accredited by NATA for the test scheduled. Laboratory testing shall be undertaken in accordance with the latest versions of AS 1289 (for soil materials), or AS 4133 (for rock materials).

8.8 Borehole Drilling Technical Details

Borehole drilling shall be via rotary diamond drilling methods from surface, using a HQ3 core barrel or larger. Casing shall be provided by the *Contractor* where the soil is not self-supporting. As well as the specific log data obtained from drill core and standard penetration tests, all washings shall be observed, photographed and the logs noted at every change of stratum and/or significant hardness change.

The investigation and reporting of the boreholes shall include:

- Classification and detailed description of each soil strata to the full depth of the borehole.
- Soil consistency (cohesive soils), relative density (granular soils), rock strength, degree of weathering, defect spacing, defect characteristics, stratification spacing (natural rock).

Drilling shall be carried out with sufficient care to ensure that all changes of strata are observed and recorded. Techniques that cause disturbance of the material ahead of the bit, or which result in unreliable samples or test results, will not be permitted. In boreholes drilled with rotary equipment, drilling bits most sensitive to change in strata as indicated by drilling rates shall be used. The rate of progress of the drill bits in the various strata shall be recorded on the drilling logs and reported to the *Superintendent's Representative* on a daily basis while drilling is proceeding.

In rock strata, the method of drilling employed shall be selected to provide the most useful rock strength information. Core recovery shall average above 95%. In extremely weathered rock strata where very low core recovery rates are anticipated, reducing run lengths, switching to auger drilling and regular SPT testing may provide more useful rock strength information than rotary core drilling.

Recovered core shall be placed in core trays. Test intervals (for example SPT intervals) and intervals of core loss shall be represented in the core tray by polystyrene foam of the same length as the interval.

Photography of complete core trays shall take place in even lighting, perpendicular to the core tray and before disturbance of core has occurred from geotechnical logging and sampling.

8.9 Sampling and In-situ Testing

Standard Penetration Tests shall be carried out in accordance with AS 1289.6.3.1. SPT testing should be carried out at not more than 1.5 m depth intervals in soil and weak rock stratum. SPT sampling can be substituted for thin walled tube sampling (U63) at 1.5 m intervals where very soft to firm clayey soils are encountered. Shear vane testing should be performed on the ends of any thin walled tube samples recovered.

Samples shall be obtained from each soil stratum encountered. Sampling will be typically at 1.5 m intervals but will vary according to strata thicknesses and the variability encountered within each strata. Pocket penetrometer or hand vane shear readings are to be taken on recovered samples and results recorded on the borehole logs at the relevant locations.

Each sample shall be legibly labelled with the borehole number, the depth at which the sample is taken, the date of the sample, and any other data or relevant information.

For undisturbed and rotary core samples, the depth and length of the sample shall be given, and for bulk samples, the limits of the sampling zone shall be recorded.

Undisturbed sampling shall be carried out using 63 mm diameter thin walled tubes. The samples shall be securely sealed with end caps. The tubes shall be marked to show the borehole number and the depth of the sample.

Disturbed samples shall be packed in plastic bags with the exclusion of as much air as possible. The bags shall be indelibly marked or labelled on the outside. Samples shall be sealed and kept out of the sun in a cool place to ensure they do not dry out.

8.10 Logging

All boreholes shall be logged on site in accordance with AS 1726 - 2017 by an experienced geotechnical engineer or engineering geologist. The origin of all logged strata shall be identified on site, with particular care taken in assessing the depth of fill material as opposed to natural in situ materials.

8.11 Plant and Equipment

The *Contractor* shall be responsible for providing the suitable plant and equipment for the prevailing site conditions.

The provision, operation and maintenance of all plant and equipment shall be the responsibility of the *Contractor*.

8.12 Logistics and Health, Safety and Environment Planning

The *Contractor* (and its Subcontractors) shall be responsible for all logistical and Health Safety and Environment (HSE) planning and requirements. This includes applying for and receiving any permits (other than clearing) necessary for undertaking the site investigation, such as wide load permits, utility proximity permits and traffic management permits. The *Contractor* is also responsible for the supply of plant and equipment, personnel, accommodation and subsistence to their personnel and subcontractors, transport of personnel, equipment and subcontractors, flights to/from Christmas Island, fuel consumption and other matters of a logistical nature.

All personnel, including subcontractor personnel shall have construction industry Blue or White Cards, competency certification, qualifications, and be fit for work.

Prior to the commencement of any fieldwork, the *Contractor* shall prepare project specific HSE Management Plans (including Job Safety and Environmental Assessment and/or Safe Work Method Statements) for all tasks required for the project.

These documents shall be forwarded to the *Superintendent's Representative* for approval a minimum of ten (10) business days prior to the commencement of any site activity, Acceptance of these documents is considered a **HOLD POINT** for the investigation proceeding.

8.13 Fieldwork Site Supervision and Personnel

The *Contractor* shall ensure that appropriate degree qualified and experienced personnel are employed on the project at all times. The site *WUC* shall always be under the technical control and supervision of a geotechnical engineer or engineering geologist, with 10 years or greater of experience in geotechnical engineering, who is capable of taking full responsibility for the planning and execution of the *WUC*. The geotechnical engineer or engineering geologist shall be based on Christmas Island for the duration of the investigation.

9. Sewer Relocation

9.1 General Requirements

An existing DN 150 PVC-U sewer may need to be relocated adjacent to the proposed Incline Diversion Structure (Also known as the Drive Over Structure) as indicated on Drawings 61-35637-C234 and 61-35637-S010.

This service has not been positively identified during the design stage; existing services information indicates its presence; and above-ground sections of this pipeline and associated access chambers have been noted on site. The contractor shall locate the existing sewer at the commencement of the project and asses its location relative to the proposed excavation for the new chamber.

If a clash with the proposed construction for the new drainage *WUC,* the *Contractor* shall undertake the following in consultation with the Water Corporation Representative and *Superintendent's Representative*:

1. Undertake to install a temporarily diversion of the live sewer pipeline to the western side of the proposed excavation area to ensure continuity of the service.
2. Allow for a temporary connections as required from Access Chamber D03 (shown in drawing 61-35637-C235 into access chamber D02 as indicated on 61-35637-C234 including temporary rebenching of the access chamber and reinstatement of the chamber on removal of the diversion.
3. On completion of the new drainage structure reinstate and reconnect the service as permanent works in accordance with the requirements of the Specification.
4. The sewer is anticipated to be shallow and is likely to require protection (due to being shallow) in the form of a concrete bed and surround, all concrete works are to be undertaken in accordance with the Specification.
5. Cover to the pipeline (without protection) shall not be less than 900 mm unless otherwise agreed with the Water Corporation Representative.
6. The pipe shall be reinstated in a straight line with the existing sewer.
7. Should this not be possible additional access chambers shall be incorporated at change of direction or grade are required.

All the *WUC* shall be constructed in accordance with the Drawings (noting relocation of the sewer is currently not proposed only protection), the current version of the Water Corporation Design Standards, in particular but not limited to DS 50 (Design and Construction Requirements for Gravity Sewers DN150 to DN600) and this Specification and will be subject to inspection and approval of the Water Corporation Representative as well as the *Superintendent's Representative.* The specific requirements of this section of the Specification are intended to cover situations where the above Design Standards may not provide adequate definition. If there is any conflict between the above Design Standards and the specific requirements of this Specification, then the provisions of the Design Standards shall prevail.

9.2 Specific Requirements

9.2.1 Setting Out

The distances shown between access chambers are for the *Contractor*'s guidance only. In all instances access chambers are to be constructed in the locations shown. Alignments and invert levels are to be strictly adhered to and no alterations shall be made without the written approval of the *Superintendent's Representative*.

Unless otherwise shown, intersection points of sewer lines shall be positioned on the 3.5 metre alignment in road reserves and 1.0 metre alignment in lots. Centre lines and profile levels for fixing invert levels shall be set out by an Engineering Surveyor, arranged for by the *Contractor* and at his expense. Profiles shall be set such that there are never less than 3 profiles between access chamber locations or between an access chamber and an inspection opening. Alternatively, the contractor may use electronic instruments in setting out sewers for construction.

Each access chamber shall be pegged and levelled by the *Contractor*'s Engineering Surveyor.

Where the measured distance between two access chambers or between an access chamber and an inspection opening or inspection shaft varies more than 1.5 metres from the distance shown on the drawings, the *Superintendent's Representative* shall be advised so that the design may be revised if necessary. The *Superintendent's Representative* shall be advised before any excavation is commenced.

The *Contractor*'s engineering surveyor shall provide the *Contractor*'s Representative with a copy of his survey record for each sewer. The record shall indicate all reference pegs, offset pegs, reduced levels of dummy pegs, access chamber to access chamber distance, distance to house connections and the height of boning rods. Records shall be retained by the *Contractor*s Representative on Site and shall be available for checking by the *Superintendent's Representative* during working hours.

9.2.2 Trench Excavation

Should the bed of the trench be over excavated, then the over excavated volume shall be replaced with bedding material appropriate for the ground conditions encountered and compacted to the density of the backfill material

The excavation of trenches with irregular shaped sides shall be avoided and trenches shall always be kept free from debris and falling earth. Excavation must be completed for a minimum of 10 metres length ahead of pipe laying.

9.2.3 Bedding Conditions

The bedding condition of a sewer shall be governed by the worst condition of the sewer between access chambers. Except for piles and keels for unstable conditions, only one type of bedding condition shall be used for any sewer between access chambers.

Where the base of any sewer or access chamber is deemed to be unstable by the *Superintendent's Representative*, piles and keels (or raft) will be required in accordance with the drawings.

Typical details for individual Lot (or property or house) connections and brought up for property connection lines shall be the same as the bedding condition for the adjacent sewer.

Bedding material shall be 19 mm screened chalk.

9.2.4 Pipe Jointing

Jointing of unplasticised PVC pipelines shall be in accordance with AS 2032. Solvent cement and pipe cleaning fluid shall be dyed with contrasting colours and shall be in accordance with AS/NZS 3879.

Jointing of VC and cast iron pipes shall be by neoprene ring joints in accordance with Australian Standard AS 1646.

Jointing of RC pipes shall be by neoprene ring joints and plastic lining welded by an approved hot air welding process in accordance with Water Corporation requirements.

9.2.5 Concrete

Refer to Section 3.5 for details.

9.2.6 Concrete Encasement

Concrete encasements shall incorporate expansion joints comprising 12 mm compressible board at 12 m centres unless otherwise shown on the Drawings.

9.2.7 Existing Sewers

Where connections are made to existing sewers, access chambers or any other sewer facility, the connection and any necessary amendment or correction work to the existing sewer facility, shall be completed by the Water Corporation, at the *Contractor*s expense.

The *Contractor* shall provide reasonable notice to liaise with and arrange for this work to be carried out by the Water Corporation.

9.2.8 Access Chamber Construction

All bricks used in access chamber construction shall be well soaked in water and brushed free from all excess grit, prior to use. All brickworks shall be true to line, plumb, clean and free from mortar splashings. Mortar fill to cavity brickwork shall be rodded into place in lifts not exceeding 300mm in height.

Access chambers are shallow and shall be constructed using bricks unless otherwise agreed by the Water Corporation Representative.

9.2.9 Refilling

The contractor shall test the compaction in all trenches and produce a certificate from a NATA registered laboratory certifying the compaction is achieved. A minimum of 1 tests over the full depth of trench compaction are required on each length of sewer between access chambers, or 1 test per 20 metres whichever is greater.

Backfilling beneath road pavements, and within the 45 degree zone of influence adjacent to road pavements, shall consist of an approved 19 mm screened chalk free from clay material, organic matter or building debris.

All trench filling within 600 mm above the top of the pipe shall be 19 mm limestone fill free from clay material, organic matter or building debris, compacted in 150 mm layers with hand rammers weighing not less than 9 kg or other method as approved by the *Superintendent's Representative* and thereafter in 300 mm layers using mechanical compaction equipment.

All backfilling shall be compacted to a minimum of 95% SMDD for cohesive material, or 70% Density Index for non cohesive material, or to a density at least equal to that of the surrounding undisturbed ground, whichever is the greater.

The final 150 mm thickness of refilling shall consist of the original top soil material and shall be graded level with the surrounding ground.

9.2.10 Testing and Acceptance of Sewers

All pipes shall be cleared of any debris prior to testing. All sewer lines shall be tested and no trench backfill shall be allowed until the test results have been approved by the *Superintendent's Representative*. If the sides of the trench collapse and cover the pipe after testing, the collapsed material shall be removed and the line retested. Tests shall be repeated on all sewers after trench backfill, and all sewers are subject to testing at any time during the defects liability period.

The Water Corporation's Representative shall have access to the site. The *Superintendent's Representative* shall arrange for the visits of the Water Corporation's Representatives and for this purpose the *Contractor* shall advise the *Superintendent's Representative* of all tests 48 hours in advance.

The contractor shall produce and submit to the *Superintendent's Representative* prior to issue of the Certificate of Practical Completion:

a. Sewer test results indicating lengths tested with dates and by whom

b. As constructed records for sewers including property connections located by a licensed surveyor

c. Compaction results on sewer trenches certified by a NATA registered laboratory

d. Approvals from SoCI where appropriate for road reserves works

e. Certification from landowners or lease holder for acceptance of restoration in private lots and along verges.

9.2.11 Reinstatement

Where the sewer has been constructed in a private property, the final 300 mm depth of refill, shall be of a similar material to the natural soil adjacent to the trench. Excess spoil from the trench excavation must be removed and deposited on Site in an area approved by the *Superintendent's Representative*.

After refilling, trenches in road reserves or laneways are to be maintained in a safe condition for traffic and pedestrians. The final surface treatment shall be to the standard of the Local Corporation and the *Contractor* shall obtain a letter from the Local Corporation, indicating its approval of the final surface treatment, and submit a copy of this letter to the *Superintendent's Representative*.

Generally, after refilling, trenches are to finish flush with the surrounding surface and all lawns replanted, gardens reinstated and all buildings, services, fences, driveways, paths and any other private property shall be fully reinstated at the *Contractor*'s expense, to at least that item's original standard, or otherwise to the reasonable satisfaction of the owner of that property.

10. Landscape Works

10.1 General

Within the project site there is not expected to be significant requirements for landscaping across the site. Areas surrounding the proposed Incline and Southern Basins are to be rehabilitated in accordance with the requirements detailed within Section 4.12 of the Specification. The following requirements related to works within and adjacent Basin 1 within the Northern Drumsite and within the works associated with pipeline installation adjacent to and across the CIDHS oval. In both locations it is intended that a mown grassed surface be established following construction being completed. It is intended that the existing site topsoil and turf is reused where possible to rehabilitate the areas following construction.

10.2 Definitions

10.2.1 Imported Topsoil

Similar to local natural soil, suitable for the establishment and ongoing viability of the selected vegetation, free of weed propagules and of contaminants, and classified by texture to AS 4419 Appendix K Table K1, as follows:

1. Fine: Clay loam, fine sandy clay loam, sandy clay loam, silty loam, loam.
2. Medium: Sandy loam, fine sandy loam.
3. Coarse: Sand, loamy sand.

10.2.2 Plant Establishment Period

The period between the date of practical completion and the end of the defects liability period.

10.2.3 Site Topsoil

Natural soil, excavated from the site, that contains organic matter, supports plant life, conforms generally to the fine-to-medium texture classification to AS 4419 and is free from the following:

1. Stones more than 25 mm diameter.
2. Clay lumps more than 50 mm diameter.
3. Weeds and tree roots.
4. Sticks and rubbish.
5. Material toxic to plants.

10.3 Submission and Inspection

10.3.1 Subcontractors

Submit names and contact details of proposed suppliers and evidence of the following:

a. Experience in the required type of work.

b. Production capacity for material of the required type and quantity.

c. Lead times for delivery of materials to the site.

10.3.2 Inspection Requirements

Give notice in accordance with the contract so that inspection may be made of the following:

a. Subgrades cultivated or prepared for placing topsoil.

b. Topsoil spread before planting.

c. Grassing bed prepared before turfing, seeding, or temporary grassing.

d. Grassing or turfing completed.

e. Completion of planting establishment work.

10.4 Turf Supply and Installation

10.4.1 Stolons

Lay turfing prior to the wet season but not during dry season and watered to maintain moisture levels for the first 4 weeks after planting or until such time as watering is no longer required.

As a guide the following grass seeds will be considered suitable. However, alternative grasses may be approved provided the Contractor achieves a healthy growth at the end of the maintenance period of the contract.

a. Bermuda couch or other native vegetation approved by PA.

10.4.2 Supply

Deliver stolons to the site within 24 hours of harvesting, and plant them within 36 hours of arrival on site. Prevent them from drying out between harvesting and planting.

10.4.3 Preparation

Prepare the area to be planted by cultivating, fertilising and watering. Make sure topsoil is moistened to its full depth, loose, friable and weed free.

10.4.4 Fertilising

Mix the fertiliser thoroughly into the topsoil before planting the stolons.

10.4.5 Planting

Using a disk sprigger or row planter, mechanically sprig the stolons into the prepared soil to a minimum depth of half the stolon length, at maximum centre to centre spacings of 150 mm in both transverse directions over the whole of the planting area, and extending 1 m into adjacent grassed areas.

Alternative methods can be considered by the *Superintendent's Representative* however must meet the intent that is detailed within this Specification

10.4.6 Watering

General: Water thoroughly on completion of planting. Keep the topsoil moist to its full depth.

10.4.7 Stimulant

a. **General:** Three days after planting, spray with hormone root growth stimulant.

b. **Fertiliser:** Locally sourced suitable turf establishment fertiliser at the time of planting,

c. **Delivery:** Provide proprietary fertilisers, delivered to the site in sealed bags marked to show manufacturer or vendor, weight, fertiliser type, N:P:K ratio, recommended uses and application rates.

d. **Application rate:** Vary the application rate to allow for the plant available immediate fertilizer equivalence value of the soil conditioning compost.

10.5 Maintenance

10.5.1 Mowing and Trimming

a. **Litter:** Remove litter and fallen branches before mowing.

b. **Height:** Consistent with the growth habit of the grass variety and maintained at 25 mm to 40 mm throughout the year.

c. **Program:** Weekly during the mowing season, November to March, and at fortnightly intervals from April to October. Do not mow during wet conditions.

d. **Raking:** Once every month before mowing from November to March, rake the grass with a flexible rake. On alternate mowing's, adopt a north-south and east-west pattern.

e. **Edges:** At the same time as mowing, trim lawn edges to plant beds, pathways, base of trees and other obstacles. Do not damage trees and shrubs.

10.5.2 Topdressing

a. **Topdressing material for established lawns:** Weed-free imported sandy topsoil to a depth of 5 mm.

b. **Program:** The spring following establishment.

c. **Topdressing material for remediation of depressions or irregularities:** Apply coarse or medium soil to AS 4419 suitable for application to turf or grass seeded areas.

10.5.3 Fertilising

a. **Fertilising:** Apply lawn fertiliser at the completion of the first and last mowing's of the plant establishment period, and at other times as required to maintain healthy grass cover.

10.6 Weeding

10.6.1 General

Remove unwanted broadleaf plants and grasses considered invasive to the locality. Eradicate weeds using environmentally acceptable methods, such as a non-residual glyphosate herbicide in any of its registered formulae, at the maximum application rate. Regularly remove weed growth by hand throughout grassed, planted and mulched areas is also considered acceptable and preferred.

10.6.2 Program

a. **Lawns:** Quarterly, and as required to maintain the general lawn condition.

b. **Trees and shrubs:** As required for planted, paved and mulched areas to be weed free when observed at fortnightly intervals.

c. **Vigorous ground covers:** Keep 200 mm clear from the base of any shrub or tree. Remove as follows:

- Small areas: By hand.
- Large areas: Proprietary herbicides.

d. **Herbicide application:** Apply as follows:

- To the manufacturer's instructions and Safety Data Sheets (SDS).
- When the weather is humid with moderate temperatures and maximum sunlight.
- When the ground has recommended soil moisture.
- Avoid windy days or if rain is likely to follow within 12 hours.

11. Tolerances

11.1 General

Unless otherwise shown on the accepted drawings, or otherwise stated in the Specification, *the WUC* shall be constructed within the following tolerances:

11.1.1 Location in Plan

Tolerance for location in plan relative to the designated location shall be 10 mm.

11.1.2 Dimension in Plan

Tolerance for dimensions in plan between related components or features, relative to each other shall be as follows:

Table 11-1 Dimension in Plan

Distance Apart	Tolerance
Less than 5 m	10 mm
Between 5 m and 10 m	15 mm
More than 10 m	20 mm

11.1.3 Variation from Plumb

Variation of any two points on a surface from specified verticality, batter or curvature shall be as follows:

Table 11-2 Variation from Plumb

Distance Apart	Tolerance
Less than 3 m	5 mm
Between 3 m and 5 m	10 mm
Between 5 m and 10 m	15 mm
More than 10 m	20 mm

11.1.4 Level

Level of Components or Surface

a. The level of any component or surface relative to an established datum shall not deviate from the designated level by more than 10 mm.

b. Level of Related Components

The difference in level between any two related components that are designated as equal in level shall not exceed:

Table 11-3 Difference in Level – Two Related Components

Distance Apart	Tolerance
Less than 5 m	5 mm
Between 5 m and 10 m	10 mm
More than 10 m	20 mm

c. Levels on Same Surface

The difference in level between any two points on the same horizontal surface shall be as follows:

Table 11-4 Difference in Level – Two Points Same Surface

Distance Apart	Tolerance
Less than 5 m	5 mm
Between 5 m and 30 m	10 mm
More than 30 m	20 mm

11.2 Concealed Construction

In the case of construction work to be ultimately buried, and where the positions and levels of the buried work do not adversely affect the specified location of adjoining exposed work or the function of the structure, the tolerance values specified may be doubled.

11.3 Dimensions of Components

Tolerances for structural concrete component dimensions shall be as follows:

Table 11-5 Tolerance for Structural Concrete Dimensions

Structural Elements	Tolerances
Wall, slab and similar element Dimension:	-0 , + 5 mm
Sleeve, block out and opening Location: Size:	 -5 mm, + 5 mm -0 , + 5 mm
Cast-in fastener Location:	-2 mm, + 2 mm

11.4 Reinforcement

Tolerances for reinforcement work shall comply with the requirements of AS 3600.

11.5 Earthworks

On completion of cutting, filling and all incidental operations, and before the placement of covering materials, finished surfaces shall conform to the tolerances in level and shape itemised in

Table 11-6 Tolerances for Earthworks

Item	Description	Tolerances
1	Clearing and grubbing (width of design earthworks plus 2 m)	-0 m + 1 m
2	Earthworks - Level	-0 mm + 50 mm
3	Topsoiling Thickness	± 20 mm

12. Quality Assurance

12.1 Introduction

1. The *Contractor* shall control the quality of the work and fully implement quality management system under the *Contract* in accordance, as a minimum, with the requirements of:

   (1) Standards Australia AS/NZS ISO 9001 Quality Management Systems –Requirements; and

   (2) HB 90.3-2000 The Construction Industry – Guide to ISO 9001.2000.

2. Notwithstanding any statements to the contrary in the *Contractor*'s Quality System, no part of the Quality System shall be used to pre-empt, preclude or otherwise negate the requirements of any part of the *Contract* Documents. Quality System elements shall be used as an aid to achieve compliance with the *Contract* Documents and documenting such compliance, and in no way shall they relieve the *Contractor* of responsibility to comply with the *Contract* Documents.

3. Valid current copies of the following shall be submitted no later than two (2) weeks after the date of acceptance of tender:

   (1) Certificate of approval of management system compliance with AS/NZS ISO 9001;

   (2) Management system quality manual (for review and return to the *Contractor*);

   (3) Proposed project quality plan, for control as part of the management system, in duplicate; and

   (4) Proposed schedule for compliance auditing for the management system and its implementation.

4. The *Superintendent's Representative* shall be authorised to view all management system procedures that apply to the *WUC*.

12.2 Definitions

12.2.1 Project Quality Representative

The Project Quality Representative (PQR) must be a person nominated by the *Contractor* and independent of the overall construction management function and must be responsible for ensuring the requirements of the approved Project Quality Plan (PQP) are implemented. The *Contractor's* PQR must have the authority to resolve all quality matters in conjunction with the *Contractor's* Project Manager and/or the *Contractor's* Quality Manager. The *Contractor's* PQR must have authority to reject non-conforming work and the responsibility to ensure remedial measures are implemented to curtail further non-conformances.

12.2.2 Lot

For the purposes of the *Contract*, a lot is an essentially homogeneous section of the *WUC*, the limits of which must be chosen by the *Contractor* but must be subject to the requirements elsewhere in this Specification and to the approval of the *Superintendent's Representative*. A lot, for the purposes of the work under this *Contract*, must not be greater than one (1) day's work.

12.2.3 Hold Point

A Hold Point is defined as a position in the progress of the *WUC*, beyond which further work shall not proceed without mandatory verification by the PQR and the *Superintendent's Representative*. Approval must be in written form by the designated person/s.

12.2.4 Witness Point

A Witness Point is defined as a position or point in the progress of the *WUC,* where the *Contractor* must notify its PQR and the *Superintendent's Representative* prior to proceeding and the option for attendance for witnessing of inspection and test may be exercised. If any do not attend, then work may nevertheless proceed, unless otherwise instructed.

12.2.5 *Contractor*

The *Contractor* is the contractor or supplier contracted to the *Client*.

12.2.6 Subcontractor

A Subcontractor is a subcontractor or supplier contracted to the *Contractor*.

12.3 QA Management Representative

The *Contractor* shall be required to nominate a suitably qualified PQR who is at a management level with appropriate authority to effectively control the complete quality assurance process. For construction works the PQR shall be site based.

12.4 Quality System Documentation

The *Contractor* shall submit to the *Superintendent's Representative* a copy of the following documents within 14 days of the award of the *Contract*:

a. Certificate of Approval to AS/NZS ISO 9001;

b. Corporate Quality Manual (for review and return to the *Contractor*); and

c. Two controlled copies of the Project Quality Plan.

The *Contractor* shall also provide the *Superintendent's Representative* with access to inspect Corporate Quality Procedures applicable to this *Contract*.

The Project Quality Plan shall follow the guidelines of AS/NZS ISO 10005 Guidelines provided by AS/NZS ISO 3905.12 shall also apply.

The Project Quality Plan shall cover all quality system elements required by the appropriate Quality Systems Standard as specified, that are applicable to this *Contract*.

As a minimum, the Project Quality Plan shall contain the following information:

d. A Project Organisation Chart or list of nominated Project Personnel showing their positions, lines of communication and details of the responsibilities of the positions.

e. Details of the qualifications and experience of the following positions:

- Project Manager;
- Construction Manager;
- Project Engineer;
- Project Quality Representative (PQR);
- Surveyor; and
- Foreman, Supervisor(s).

f. Inspection and Test Plans for the various phases during design, manufacture, construction and commissioning, as applicable to the project, to be submitted at least 14 days prior to commencement of relevant activity.

A copy of the NATA Terms of Registration for the *Contractor*'s Compliance Testing Laboratory (Internal or Sub-Contract).

Project specific operating procedures or descriptions outlining as a minimum, details of activities, who is responsible for implementation/verification, identification of relevant Quality Records and distribution and of such records, to be submitted at least 7 days prior to commencement of relevant activities.

A Register of all intended Quality Records to be used on the project, together with proformas.

12.5 Project Quality Plan

The *Contractor* must prepare a draft PQP as specified in the Conditions of the *Contract*. The draft PQP must cover all *WUC* (both on-site and off-site) and include:

a. The Quality Policy

b. Quality Manual(s), and

c. A schedule and program of all quality documentation to be prepared during the progress of the *WUC*.

d. Other documents which must comprise the System Element Procedures and Descriptions and associated Technical Procedures such as: system implementation, management responsibilities, organisation structure, ITPs, Hold Points, Witness Points and planned audits to satisfy the quality requirements of the Specification.

The Hold Points and Witness Points nominated in the Specification must be incorporated in the draft PQP. The *Contractor* must include additional Hold Points and Witness Points as determined by the *Contractor* in accordance with the Quality System and as required to ensure conformance with the requirements of the Specification.

The *Contractor* must submit the draft PQP to the *Superintendent's Representative* for examination and review. The *Superintendent's Representative* will examine and review the draft PQP and, if necessary, provide comments on the contents to the *Contractor*.

Within three (3) working days of the draft PQP being finalised in accordance with the *Contract*, the *Contractor* must submit a bound pdf electronic copy of the final PQP to the *Superintendent's Representative*.

The PQP is a Project Plan and must be submitted and updated in accordance with the requirements of the *Contract*.

12.6 Inspection and Test Plans

Inspection and Test Plans shall contain at least the following information for each significant activity identified in the relevant process:

a. Description of activity;

b. Specification requirements/reference;

c. Person responsible for activity (title);

d. Hold Points and Witness Points;

e. Activity checklists;

f. Inspection and test type;

g. Tolerances or other acceptance criteria;

h. Identification of relevant procedure and quality records;

i. Test/inspection frequency; and

j. Work item or work lot identification.

Inspection and Test Plans and examples of their relevant activities checklists established for this *Contract* shall be submitted to the *Superintendent's Representative* for review. Where considered necessary the *Superintendent's Representative* may request the *Contractor* to insert additional Hold Points or Witness Points. Provisions shall be made for the *Contractor* and *Superintendent's Representative* to sign off at these points.

12.7 Identification and Traceability

All work under this *Contract* including construction and commissioning, shall be subdivided into distinct work lots or work items.

Work lots or work items shall be chosen by the *Contractor*, consistent with any specified requirements, but shall be subject to approval by the *Superintendent's Representative*.

Each work lot or work item shall be assigned a unique identification number.

The *Contractor* shall maintain a register of all allocated work lot or work item numbers.

This register shall contain as a minimum, the following information:

a. Brief description of the work lot or work item;

b. Location reference (3 dimensional where applicable); and

c. Lot or item status (conforming or non-conforming).

The *Contractor* shall ensure that traceability is maintained throughout all documented records under this *Contract*.

All test results where applicable under this *Contract* shall be positively identified with their respective work lot or work item number.

The *Contractor* shall notify the *Superintendent's Representative* in writing 24 hours prior to commencing a new work lot or work item.

12.8 Conformance Reports

Conformance Reports shall be forwarded to the *Superintendent's Representative* for each designated work lot or work item, within 24 hours of completion of the work lot or work item.

Conformance Reports shall include a verification statement certifying that the relevant work lots or work items have been inspected and/or tested in accordance with the *Contractor*'s Inspection and Test Plan(s) applicable to this *Contract* and that they comply with the specified requirements of the *Contract* Documents.

Conformance Reports shall be accompanied by the following documents:

a. All relevant signed off Inspection and Test Plans and associated Checklists;

b. NATA certified compliance test results (where applicable); and

***Note: In cases where test results are not available within this period (eg. 28 day concrete compressive strengths), the *Contractor* shall submit preliminary results or previous analytical data of the same mix type which statistically indicates a high probability of conformance. Submission of such information does not absolve the *Contractor* from the *Contractor's* responsibilities under this *Contract* should actual results subsequently identify non-conformance of the work lot or work item.**

c. Survey and measurement compliance data ie. As constructed information (where applicable) as detailed in the Specification.

d. Progress Photographs.

12.9 Non-conformance Reports

The *Contractor* shall submit a Non-conformance Report to the *Superintendent's Representative* within 24 hours of detecting nonconforming work.

The *Contractor*'s Non-conformance Report shall clearly detail but not be limited to the following items:

a. The nature and extent of the non-conformance;

b. The work lot or work item number it relates to including the precise boundaries of the nonconforming work;

c. Any relevant information, data, test results and/or measurements (as applicable);

d. The corrective and preventive actions the *Contractor* proposes to take; and

e. The time frame within which the non-conformance will be rectified.

The method of isolating/identifying nonconforming work, applying and releasing hold points, etc, shall be clearly stated in the Project Quality Plan.

The proposed corrective action shall be subject to approval by the *Superintendent's Representative*.

12.10 Default by the *Contractor*

Failure by the *Contractor* to submit either a Conformance Report or a Non-conformance Report within the nominated time frame shall constitute a substantial breach of the *Contract* and may, at the *Superintendent's Representatives* discretion, be subject to a **stop work order**. As a result of such action by the *Superintendent's Representative*, and in addition to the *Contractor*'s responsibility to rectify the nonconforming work, the *Contractor* shall be responsible for its own costs for any time delays due to such breach of *Contract*.

12.11 Hold Points and Witness Points

Hold Points must apply at the points in the construction process identified in the Specification and other points identified by the Contractor to ensure compliance with the intent of the designs and with other specified requirements . All such Hold Points must be included in the *Contractor's* Project Quality Plan. A Hold Point must also apply to any point in the construction process at which a non-conformance has been detected to ensure that critical and/or irreversible activities are not constructed incorrectly.

Witness Points also apply at the points in the construction process identified in the Specification and other points identified by the *Contractor*. All such Witness Points must be included in the

Contractor's PQP. Witness Points shall apply to verify compliance of the constructed works with the approved design drawings.

All Hold Points and Witness Points can be accepted, at their sole discretion, by the *Superintendent's Representative* through the supply of photographic evidence by the *Contractor* (as detailed in Section 1.30 or as agreed at the time with the *Superintendent's Representative*) and other suitable documentation may be used where site access is limited due to unforeseen circumstances.

To obtain the *Superintendent's Representative* approval to proceed, the *Contractor* shall ensure the following:

a. That all work(s) subject to the Hold Point(s)/ Witness Point(s) are conforming; and

b. That all Conformance Reports (including photographic documentation) for work(s) subject to the Hold Point(s)/Witness Point(s) have been submitted at least 72 hours prior to the time (or as otherwise agreed with the *Superintendent's Representative*) the *Contractor* intends to proceed with the work(s) subject to the Hold Point(s)/Witness Point(s), thus ensuring that defective works are not built-in prior to approval being granted.

12.12 Compliance Inspections and Testing

All compliance inspections and tests shall be based on work lots or work items unless otherwise specified in the *Contract* documents. The costs for all such inspections and tests shall be borne by the *Contractor* and included in the tender price submitted.

All compliance testing shall be carried out by a NATA registered laboratory certified for the tests specified in this *Contract*.

The *Contractor* shall advise the *Superintendent's Representative* of the work lot or work item number and the location within the lot or item, prior to any testing of the lot or item.

The *Contractor* shall submit a Non-conformance Report and the proposed corrective action for any nonconforming test result. No further testing shall be permitted until approval by the *Superintendent's Representative*.

For compliance inspections the *Contractor* shall nominate responsible persons, who are not directly involved in performing the work.

The frequency of compliance testing shall be in accordance with the minimum requirements of the *Contract* Documents, or as specified.

The *Contractor* shall submit to the *Superintendent's Representative* any preliminary results on compliance tests carried out for each work lot or work item within 24 hours of completion of tests.

12.13 Subcontracted Work

The *Contractor* shall ensure that subcontracted works and procured supplies are subject to appropriate quality assurance standards, when incorporated into the works to comply with the requirements of this *Contract*.

If requested by the *Superintendent's Representative*, the *Contractor* shall provide evidence of appropriate quality assurance for subcontracted work or procured items incorporated into the *WUC*. This shall include verification by the *Contractor*.

12.14 Quality Records

The *Contractor*'s quality system shall include sufficient quality records to provide objective evidence that the requirements of the *Contract* are met. This shall include Design Consultants, Subcontractors and Suppliers records relevant to this *Contract*.

The *Contractor* shall, when requested by the *Superintendent's Representative*, provide access to all quality records relevant to the *Contractor*'s quality system under this *Contract*.

Within 28 days of the Date of Completion, the *Contractor* shall forward a complete and bound clean copy of at least the following records to the *Superintendent's Representative*. Previously submitted documents may be selected as appropriate.

a. The Work Lot or Work Item Register for the *Contract*;

b. All Conformance and Non-conformance Reports;

c. All Inspection and Test Plans and associated Checklists;

d. All Test Results, analyses, reports, measurements, appropriate supply documents and observations; and

e. The original Project Quality Plan and any changes made to the *Contractor*'s Quality System.

Records shall be maintained by the *Contractor* for a minimum period of two years from the Date of Completion or in accordance with the *Contractor*'s statutory requirements if the latter exceeds the minimum period required for this *Contract*.

Records for equipment and parts subject to inspection and approval by the relevant regulatory authority shall be made available on site at the time of arrival of all relevant items at site, or after inspections have been carried out on site (if applicable).

12.15 Quality Audits

The *Contractor* shall submit an audit schedule to the *Superintendent's Representative* at the time of submission of the *Contractor*'s Quality System documentation. This shall include internal audits and external audits on Design Consultants, Suppliers and Subcontractors.

The *Contractor* shall carry out at least two (2) audit on each of these groups, over the duration of the *Contract*, and submit all audit records including objective evidence for any necessary follow up corrective actions attached to close out corrective action reports.

12.16 Certifications

12.16.1 To Accompany Each Payment Claim

Each Payment Claim shall be accompanied by a Conformance Report from the *Contractor* in respect of the *WUC* completed to the date of the claim and the subject of the claim, certifying that the *WUC* as constructed are in full accordance with the *Contract* requirements.

Appendices

Appendix A – Safety in Design Assessment

CHRISTMAS ISLAND - DEPARTMENT OF INFRASTRUCTURE & REGIONAL DEVELOPMENT

HS 040 SAFETY IN DESIGN RISK REGISTER

Design Life Cycle:	Investigation and Design	Setup, Construction and Commissioning	[illegible]	Overarching Project Risk	Setup, Construction and Commissioning / Operation and

ID	Design Reference	Hazards	Design Life Cycle Stage	Risk	Existing Control Measures	Initial Risk Rating C	L	RR	Potential Control Measures (Consider Hierarchy of Control - Elimination, Substitution, Isolation, Engineering Controls, Administrative Controls, PPE)	Responsibility	By When	Decision / Status	Residual Risk Rating C	L	RR	Comments
1	All areas	Walking on uneven ground	Investigation and Design	Slips, trips, falls, resulting in injury.	Wear safety footwear capable of being laced above the ankle. Walk, do not run. Use caution when walking on uneven or sloping ground. Do not take photographs or write notes while walking - stop moving.	C	2	Medium	During site visits be aware of high risk areas (cliff faces and drop offs) and do not go within 5m of these areas	Site Staff	Prior to site inspection		C	1	Medium	
	Northern & Central Drumsites	Out of sequence construction resulting in flooding of areas	Setup, Construction and Commissioning	land slides and floods	Design has assumed that a sequence is followed to manage potential risk Construction Sequence requirements manages water flows Specific included temporary works requirements Existing landslide warning system	E	3	High	Develop and emergency management plan for high rainfall events Detailed construction planning and procurement plan Time high risk works for Dry season Ensure materials are available prior to need	Contractor	Prior to construction		E	2	High	ENSURE SPECIFICATION CONTAINS NECESSARY DOCUMENTS
2	All areas	Snake bites, ticks, spiders, other insects.	Overarching Project Risk	Poisoning	Take first aid kit with broad bandages / triangular bandages. Wear long clothing, enclosed boots, thick socks and long trousers. Stay clear of likely habitats such as areas of long grass or undergrowth (Where possible). Avoid lifting debris, such as rocks or corrugated iron. If you must lift them, always use gloves. Avoid putting your hands in cracks, under logs etc. Wear insect repellent and check for ticks regularly. Keep emergency telephone numbers close at hand. When walking in bush make plenty of noise. Do not step over fallen logs without checking what is on the other side.	D	2	Medium		Site Staff	Prior to site inspection					Review with environmental advisor if any animals with high venom exist on the island If none, change C to B and L to 2.

ID	Design Reference	Hazards	Design Life Cycle Stage	Risk	Existing Control Measures	Initial Risk Rating C	L	RR	Potential Control Measures (Consider Hierarchy of Control - Elimination, Substitution, Isolation, Engineering Controls, Administrative Controls, PPE)	Responsibility	By When	Decision / Status	Residual Risk Rating C	L	RR	Comments
3	Health & Hygiene	Mosquitos	Overarching Project Risk	Mosquito borne diseases	Basins designed to meet DOH guideline for mosquito and midge control (recommended)	B	2	Low	Monitoring water quality and insects present. Minimise standing water (quantity and duration)	Client Designer	After commissioning During design					Assuming no major mosquito diseases (ie, Ross River virus, Dengue fever, Malaria)
4	All areas	Walking in still shallow water and mud - soft ground.	Overarching Project Risk	Getting stuck in soft ground - soft tissue injury		B	3	Medium	Undertake prework assessment Do not enter shallow running water				B	1	Low	
5	Off road areas, especially adjacent incline and south of school	Rolling and bogging of equipment	Overarching Project Risk	Cause vehicle instability resulting in tipping leading to crushing of persons		E	2	High	Mud mats to be used. Drilling equipment to be track mounted. Restrict access to boggy areas to specific compliant plant machinery. Selection of locations for drilling to minimise the potential for bogging.	All	At all times	Ongoing	E	1	Medium	
6	All areas, particularly roads and minesite	Working around mobile plant used during investigations.	Overarching Project Risk	Personal injury due to crush or collision	Mine site safety plan	D	2	Medium	Conform to CIP mining operational procedures when in their areas	contractor	Prior to construction	Pending	D	1	Medium	
7	Northern Drumsite	Current area as is. Significant rainfall event, causing flooding, fast moving flood waters of varying depths, landslips	Overarching Project Risk	Cutting off road access Loss of life if people are caught in flood or landslips Injury to people or infrastructure	Rock fall barriers Landslide warning system Emergency management plan	C	3	High	Design and construction of drainage diversion infrastructure	Client			E	1	Medium	Initial risk based on likelihood Residual risk based on consequence
8	Central Drumsite	Current area as is. Significant rainfall event, causing flooding, fast moving flood waters of varying depths, landslips	Overarching Project Risk	Cutting off road access Loss of life if people are caught in flood or landslips Injury to people or infrastructure Water and landslips may restrict access along Murray Road Residential areas at Flying Fish Cove may be caught in flooding or landslips Water over Murray Road may cause vehicles to lose traction and crash	Rock fall barriers Landslide warning system Emergency management plan	C	4	High	Design and construction of drainage diversion infrastructure	Client			E	1	Medium	Initial risk based on likelihood Residual risk based on consequence

ID	Design Reference	Hazards	Design Life Cycle Stage	Risk	Existing Control Measures	Initial Risk Rating C	L	RR	Potential Control Measures (Consider Hierarchy of Control - Elimination, Substitution, Isolation, Engineering Controls, Administrative Controls, PPE)	Responsibility	By When	Decision / Status	Residual Risk Rating C	L	RR	Comments
9	Southern Drumsite	Current area as is Significant rainfall event, causing flooding, fast moving flood waters of varying depths, landslips	Overarching Project Risk	Cutting off road access Loss of life if people are caught in flood or landslips Injury to people or infrastructure School is flooded, resulting in damage to buildings and equipment; cancelling of classes.	Landslide warning system Emergency management plan	E	3	High	Design and construction of drainage diversion infrastructure Develop or revise evacuation plan for school for flooding event	Client		Pending	D	1	Medium	Initial risk and residual risk based on consequence
10	All areas	Walking in to running water	Investigation and Design	Washed away causing death or serious injury		E	3	High	Minimum of two people on site Do not enter shallow running water especially on incline or adjacent drainage structures (ie, culverts, open drains) Prior to site inspection confirm weather conditions are predicted to be suitable for work to proceed	All	At all times	Ongoing	E	1	Medium	
11	Northern Drumsite basin	General rubbish and construction waste, dumped hazardous substances	Investigation and Design	Infection due to open wounds	Do not touch or lift rubbish and waste. If you must lift, use appropriate gloves. Hazards contained within sediments, not water. Current concentrations are not considered a health hazard	B	2	Low	Provide information to field staff teams of the hazard and its management. Consider wellington boots/wet waders. Personal checks for wounds before and after entering water	Designer						
12	Northern and Central Drumsites Murray Road	Steep cliff adjacent to Murray Road Walking adjacent to steep slopes and drops, both stabilised and unstabilised	Investigation and Design	Slips, trips, falls, resulting in injury.	Wear safety footwear capable of being laced above the ankle. Walk, do not run. Use caution when walking on uneven or sloping ground. Do not take photographs or write notes while walking - stop moving. Do not stand close to the edge or base of unstabilised ground	D	2	Medium	Check for hazards at each stop during site inspections.	Designer	Prior to Site Inspection and during design	Ongoing	D	1	Medium	
13	All areas	Inspection of existing drainage structures	Investigation and Design	Fall into drainage structures, e.g. manhole, resulting in injury	Do not enter drainage structures unless qualified to do so (confined spaces permit). Stand clear of steep slopes or drops and drainage when open. Do not stand and lean over manhole to look inside .	C	3	High		Site Staff	Prior to site inspection					

ID	Design Reference	Hazards	Design Life Cycle Stage	Risk	Existing Control Measures	Initial Risk Rating C	L	RR	Potential Control Measures (Consider Hierarchy of Control - Elimination, Substitution, Isolation, Engineering Controls, Administrative Controls, PPE)	Responsibility	By When	Decision / Status	Residual Risk Rating C	L	RR	Comments
14	All areas	Under estimating Intensity Frequency Duration (IFD)	Investigation and Design	Under sizing the structures resulting in continual flood risks	Based off location with similar monsoonal climate, latitude and orographic influences. IFD developed using AR&R 1987 methodologies based on actual Christmas Island (CI) rainfall data	D	2	Medium	Request BOM to undertake development of IFD data for CI Undertake site flow and rainfall monitoring as per recommendations	DIRD	ASAP	Pending	D	1	Medium	DIRD currently requesting additional funds to support undertaking of onsite monitoring of flow and quality, along with a request to BOM for support
15	All areas	Assumptions around existing drainage infrastructure	Investigation and Design	Gaps in existing documentation about the size and standard of existing drainage infrastructure	Site visit to view structures in person Undertake survey of major drainage infrastructure linked to upgrades	C	2	Medium	Potential survey of additional areas based on design	Designer	Prior to design finalisation	Pending	C	1	Medium	
16	All areas	Walking in to running water	Setup, Construction and Commissioning / Operation and Maintenance	Washed away causing death or serious injury		E	2	High	Minimum of two people on site Do not enter shallow running water or areas expected to receive water especially on incline or adjacent drainage structures (ie, culverts, open drains) Prior to site inspection confirm weather conditions are predicted to be suitable for work to proceed Use of mechanical equipment which results in workers not needing to enter structures where possible CONSTRUCTION SEQUENCE PROPOSAL TO BE PREPARED FOR THE WORK ESPECIALLY FOR INCLINE WORKS Ensure Contractor prepares a suitable Construction sequencing Stop work and conduct new risk assessment if weather changes	All	At all times	Ongoing	C	2	Medium	
17	Northern Drumsite basin	General rubbish and construction waste, dumped hazardous substances	Setup, Construction and Commissioning	Infection due to open wounds	Do not touch or lift rubbish and waste. If you must lift, use appropriate gloves. Hazards contained within sediments, not water. Current concentrations are not considered a health hazard	B	3	Medium	Under taking investigations to determine extent and nature of hazardous waste Removal and treatment of any identified hazardous waste	Designer/Client (DIRD) Contractor	Prior to construction Commencement of construction	Pending Pending				
18	Northern Drumsite basin	Asbestos found during construction	Setup, Construction and Commissioning	Asbestosis		B	3	Medium	Under taking further investigations Removal and disposal of any identified hazardous waste Develop asbestos management plan Educate site staff on how to identify potential asbestos	Contractor Designer/Client (DIRD)	Prior to construction Commencement of construction Commencement of construction	Pending Pending Pending				

ID	Design Reference	Hazards	Design Life Cycle Stage	Risk	Existing Control Measures	Initial Risk Rating C	L	RR	Potential Control Measures (Consider Hierarchy of Control - Elimination, Substitution, Isolation, Engineering Controls, Administrative Controls, PPE)	Responsibility	By When	Decision / Status	Residual Risk Rating C	L	RR	Comments
19	Live drainage connections	Direct exposure to runoff water	Setup, Construction and Commissioning	Drowning	Include the need to divert water during commissioning in the Technical Specification and on drawings. Where possible, existing drainage in place to remain operational until construction is complete	D	2	Medium	Don't undertake work during wet weather. Contractor to provide OH&S plan Need a preliminary construction sequencing plan.	Contractor	Prior to construction	Future	D	1	Medium	
20	Sitewide	Existing water pipes are broken during construction	Setup, Construction and Commissioning	Water supply to significant area of the town site is disrupted resulting in high risk people becoming ill	Design stormwater drainage above or below existing pipes Take care when constructing not to hit these pipes. Pothole for accurate depths prior to construction.	B	3	Medium	Ensure Water Corporation representative present during disturbance works at pipe crossing	Contractor	During construction	Pending	B	1	Low	Need to confirm with Water Corporation the dependence of lines in this area
21	Sitewide	Existing underground telco crossed during construction	Setup, Construction and Commissioning	Telecommunications to significant area of the town site is disrupted resulting in high risk people becoming ill	Design stormwater drainage above or below existing services. Take care when constructing not to hit these services. Pothole for accurate depths prior to construction.	B	3	Medium	Ensure service provider representative present during disturbance works at pipe crossing	Contractor	During construction	Pending	B	1	Low	Need to confirm with service provider the dependence of lines in this area
22	Sitewide	Existing underground power crossed during construction	Setup, Construction and Commissioning	Electrocution due to equipment striking power resulting in death of worker	Design stormwater drainage above or below existing services. Take care when constructing not to hit these services. Pothole for accurate depths prior to construction.	E	2	High	Ensure service provider representative present during disturbance works at pipe crossing	Contractor	During construction	Pending	E	1	Medium	Need to confirm with service provider the dependence of lines in this area
23	Northern Drumsite Near incline	Existing HV overhead power during construction above bund and pipe work	Setup, Construction and Commissioning	Electrocution due to equipment striking power resulting in death of worker	The bund design to minimise need for large equipment The proposed pipeline construction using inert and lightweight HDPE Pits located away from power lines Consultation with power authority has occurred to confirm their requirements	E	2	High	Ensure service provider representative present during disturbance works at pipe crossing Compliance with CIP and power authority work instructions De-energising of power during high risk construction work, ie lifting of equipment	Contractor	During construction	Pending	E	1	Medium	Need to confirm with service provider the dependence of lines in this area
25	Pipe lines along Murray Road in central and northern drum sites General Works	Steep slope and sharp drop on same side of Murray Road as drain is to be constructed.	Setup, Construction and Commissioning	Falls, construction machinery tipping off edge of cliff resulting in injury or loss of life	Design targets placement of pipeline as near to the road as possible. Use of light weight pipe materials The design assumes partial road closures during construction	E	3	High	Establish safe working distances Contractor to provide OH&S plan No people to work downhill from machinery Stabilise slopes Install temp barriers Traffic management PPE	Contractor	During construction	Pending	E	1	Medium	

ID	Design Reference	Hazards	Design Life Cycle Stage	Risk	Existing Control Measures	Initial Risk Rating C	L	RR	Potential Control Measures (Consider Hierarchy of Control - Elimination, Substitution, Isolation, Engineering Controls, Administrative Controls, PPE)	Responsibility	By When	Decision / Status	Residual Risk Rating C	L	RR	Comments
26	Pipe lines along Murray Road in central and northern drum sites General Works	W Beam road crash barrier system and footings unknown, could be impacted on by excavation of pipeline	Setup, Construction and Commissioning	W Beam foundation destabilised, resulting in not working effectively during a crash incident, with vehicle potentially going over the cliff and fatality resulting.	Pipeline positioned as far away from W Beam as practical.	E	2	High	Consult with local authority to determine design of W Beam footings Undertake potholing of footings to confirm foundations Survey of W Beam post locations Protect W beam footing during works Inspect W Beams for stability after works Replace damaged W Beam footing	Designer	Prior to design finalisation	Pending	D	1	Medium	Could result in a need to alter position of main trunk line and pits of these sections to avoid interface.
27	General Works	UG Power throughout much of the site	Setup, Construction and Commissioning	Electrocution	Maintain safe distances between equipment Undertake potholing of known service location adjacent to proposed works prior to construction Design where possible offsets the proposed drainage from existing services	E	2	High	Undertake GPR prior to construction	Client	With CIP GPR work	ASAP	E	1	Medium	
28	Basin	Through bank pipe work leaks over time and results in geotech instability	Setup, Construction and Commissioning	Embankment failure resulting in down stream failure and potential loss of life		E	2	High	Continuous pipe Concrete encasement	Designer	Prior to IFC	Pending	E	1	Medium	Need to determine which approach prior to 90% design and include in drawings
29	Basins	Steep sides and significant depths	Setup, Construction and Commissioning	Injury to public and children during construction		D	3	High	Contractor to prepare traffic and pedestrian management plan Minimise construction occurring during peak foot traffic times Requirement for construction fencing around all excavations during non-work hours Temporary fencing	Contractor	During construction	Pending	D	2	Medium	
30	All areas, particularly around school/ Southern Drumsite	Low visibility of small children whilst in machinery	Setup, Construction and Commissioning	Injury to children	Majority of drainage works positioned on the alternate side of roadway to school	E	2	High	Contractor to prepare traffic and pedestrian management plan Minimise construction occurring during peak foot traffic times Temporary fencing	Contractor	During construction	Pending	E	1	Medium	
31	Site Establishment & Management	Neighbours (buildings, industry, natural environment)	Setup, Construction and Commissioning	Noise, dust		C	3	High	Contractor to have dust control procedures in place. Technical specification needs to include noise and dust control requirements.	Contractor Designer	During construction During design	Pending Ongoing	C	1	Medium	
32	All areas	Excavation and disturbance of underground services	Setup, Construction and Commissioning	Electrocution of workers during construction	Site survey shows known underground services	D	2	Medium	Contractor to engage service locator in areas of potential conflict. Undertake GPR.	Contractor	Prior to construction	Pending	D	1	Medium	GHD currently seeking further information from power authority to confirm location of existing underground power

ID	Design Reference	Hazards	Design Life Cycle Stage	Risk	Existing Control Measures	Initial Risk Rating C	L	RR	Potential Control Measures (Consider Hierarchy of Control - Elimination, Substitution, Isolation, Engineering Controls, Administrative Controls, PPE)	Responsibility	By When	Decision / Status	Residual Risk Rating C	L	RR	Comments
33	Work Environment	Manual Handling	Setup, Construction and Commissioning	Injury to personnel	Design maximises use of mechanical handling.	C	2	Medium	Personnel to be trained appropriately Use lifting equipment where possible PPE	Contractor	Prior to and during construction					
34	All areas	Working during bad weather	Setup, Construction and Commissioning	Injury to personnel due to poor visibility	Contract to specify requirements regarding what is deemed bad weather	D	2	Medium	Cease work during bad weather conditions.	Contractor	During construction	Ongoing	D	1	Medium	GHD to include in contract a specific requirement regarding site inspections prior to work following bad weather
35	All areas	Surrounding Terrain	Setup, Construction and Commissioning	Personnel falling during construction of slopes		B	3	Medium	Personnel to be briefed on risk of slipping. Adequate footwear to be worn. Construction management plan. Mark and adequately fence boundaries	Contractor	Prior to and during construction	Ongoing				
36	All areas	Noise/ Vibration	Setup, Construction and Commissioning	Injury to personnel	No blasting to occur.	C	3	High	Personnel to be trained appropriately PPE - ear protection Vibration and noise exposure controls.	Contractor	Prior to and during construction	Ongoing				
37	All areas	Vehicles (access, traffic management, road conditions, load and dimensions).	Setup, Construction and Commissioning	Vehicular incident		E	3	High	Contractor to have Traffic Management Plan	Contractor	Prior to and during construction	Pending	E	2	High	
38	All areas	Power and hand tools	Setup, Construction and Commissioning	Injury to personnel		C	3	High	Personnel to be trained appropriately PPE.	Contractor	Prior to and during construction	Ongoing	C	2	Medium	
39	All areas	Mobile plant & equipment	Setup, Construction and Commissioning	Death of personnel whilst working around machines and mobile equipment.	Design consulting with applicable contractors as to appropriate work area requirements	E	3	High	Contractor to provide OH&S plan	Contractor	Prior to and during construction	Ongoing	E	1	Medium	
40	All areas	Working at height	Setup, Construction and Commissioning	Workers falling into open excavation	Design minimises work at height.	D	2	Medium	Contractor to provide OH&S plan for all excavations, including manholes and basins. Fencing to identify edges of excavation and drop offs.	Contractor	Prior to and during construction	Ongoing	D	1	Medium	

ID	Design Reference	Hazards	Design Life Cycle Stage	Risk	Existing Control Measures	Initial Risk Rating C	L	RR	Potential Control Measures (Consider Hierarchy of Control - Elimination, Substitution, Isolation, Engineering Controls, Administrative Controls, PPE)	Responsibility	By When	Decision / Status	Residual Risk Rating C	L	RR	Comments
41	All areas	Working at depths/confined space operations (pits, excavations, pipe trenches, etc)	Setup, Construction and Commissioning	Asphyxiation	Confined space work and trenching is minimised in design.	D	3	High	Contractor to provide OH&S plan including confined spaces, pipe installation, working near batter slopes. Personnel to be trained appropriately. Construction methodology recommended in the design. Labels/Signage on manholes warning about the confined space Use of tripod setup	Contractor Designer Client Contractor	Prior to and during construction Prior to design finalisation During construction During construction	Ongoing Pending	D	1	Medium	
42	Manhole installation, whole site	Dropped/ falling objects	Setup, Construction and Commissioning	Head injury		D	3	High	Contractor to provide OH&S plan for construction of manholes.	Contractor	Prior to and during construction	Ongoing	D	2	Medium	
43	Work in Northern Drumsite and Incline	Dropped/ falling objects from Conveyor Belt	Setup, Construction and Commissioning	Head injury	Crossing of conveyor minimised in design.	D	3	High	Contractor to provide OH&S plan for working under conveyor. Consultation with CIP to undertake works when conveyor is not operational	Contractor	Prior to and during construction	Ongoing	D	2	Medium	
44	Construction of Pipeline N1 and N17 Line	Collapse of Conveyor Belt. Pipeline construction under conveyor parallel	Setup, Construction and Commissioning	Head injury	Crossing of conveyor minimised in design.	D	3	High	Contractor to provide OH&S plan for construction of manholes. Contractor to provide adequate support of the conveyor belt structure during works. Consultation with CIP to undertake works when conveyor is not operational	Contractor	Prior to and during construction	Ongoing	D	2	Medium	
45	Construction Near conveyor in Operation	Dust	Setup, Construction and Commissioning	Short duration expose to dust to have potential time off work from inhale of dust		D	3	High	Contractor to target construction during none operation periods. If not, ensure appropriate PPE. Consultation with CIP regarding plant operations	Contractor	Prior to and during construction	Ongoing	D	2	Medium	
46	Construction of Pipeline N1 and N17 Line	Damage to conveyor and footings during construction	Setup, Construction and Commissioning	Conveyor footings and foundation destabilised, resulting in collapse of conveyor and injury or fatality Mine losing money while conveyor is fixed	Design notes that existing conveyor footings are to be supported during construction and/or reinstated following culvert installation. Design minimises pipeline within conveyor footprint	D	3	High	Existing conveyor footings to be supported during construction and/or reinstated following culvert installation	Contractor	Prior to and during construction	Ongoing	D	2	Medium	
47	General Works Incline Basin	Open basin, 5 m depth Unauthorised access	Setup, Construction and Commissioning	Drowning	Low grades for slopes to make it safe to get out Bunding and fencing to prevent unauthorised access by pedestrians and vehicles	E	2	High	Temporary fencing during construction Life rings installed Install safe egress point with a rope	Contractor	Prior to and during construction	Ongoing	E	1	Medium	
48	All areas	Heavy lifting	Setup, Construction and Commissioning	Injury	Use of lightweight materials where possible	D	3	High	Contractor to use suitable crane and experienced personnel to install heavy infrastructure such as pipes.	Contractor	During construction	Ongoing	D	1	Medium	

ID	Design Reference	Hazards	Design Life Cycle Stage	Risk	Existing Control Measures	Initial Risk Rating C	L	RR	Potential Control Measures (Consider Hierarchy of Control - Elimination, Substitution, Isolation, Engineering Controls, Administrative Controls, PPE)	Responsibility	By When	Decision / Status	Residual Risk Rating C	L	RR	Comments
49	All areas	Electricity	Setup, Construction and Commissioning	Electrocution		E	2	High	Contractor to develop OHS plan for electrical hazards during commissioning.	Contractor	Prior to and during construction	Pending	E	1	Medium	
50	Abnormal Events	Flood	Setup, Construction and Commissioning	Drowning when basin site fills with water.	Construction sequence to prevent connection to upstream intake of water until construction completed.	E	1	Medium	Suitable emergency egress are still available							
51	Abnormal Events	Connection to existing system	Setup, Construction and Commissioning	Flooding of basins due to a rainfall flash event.		E	3	High	Contractor to provide OH&S plan Construction needs to ensure that the commissioning of pit is not connected until the end, and when there is 3 days of clear weather. **Include this in the Technical Specification.**	Contractor	Prior to and during construction	Pending	E	1	Medium	
52	Abnormal Events	Fire	Setup, Construction and Commissioning	Inhalation, loss or damage to vegetation	Local Fire Brigade Local fire bans	E	3	High	Reduction of vegetation bio load prior to construction.	Client	Prior to construction	Pending	E	1	Medium	
53	Abnormal Events	Natural forces (lightning, storm, coastal)	Setup, Construction and Commissioning	Injury and death either directly or indirectly.		E	3	High	Contractor to provide OH&S plan	Contractor	Prior to and during construction	Pending	E	1	Medium	
54	All areas	Public access (Hash House Harriers especially)	Setup, Construction and Commissioning	Injury to public as a result of unauthorised access.		E	3	High	Contractor to have Traffic Management Plan and Security Plan Temporary fencing Public awareness of work through local publications and notice boards	Contractor	Prior to and during construction	Pending	E	1	Medium	
55	All areas	Damage/stolen items due to malicious human activities	Setup, Construction and Commissioning	Equipment failure during operation leading to personal injury/delay.		B	3	Medium	Contractor to have security plan. Pre-work checks on equipment.	Contractor	Prior to and during construction	Pending	B	1	Low	
56	Drive Over for George Fam Incline General Works	Several services (overhead power, sewer, water supply) in close proximity to proposed drainage	Setup, Construction and Commissioning	Water supply pipe is broken during construction, loss or contamination of water supply Electrocution due to equipment striking power resulting in death of worker Loss of telecommunications in town	Maintain safe distances between equipment Undertake potholing of known service location adjacent to proposed works prior to construction Design where possible offsets the proposed drainage from existing services	C	3	High	Ensure service provider representative present during disturbance works at pipe crossing Compliance with CIP and power authority work instructions De-energising of power during high risk construction work, ie lifting of equipment	Contractor	During construction	Pending	C	1	Medium	Need to confirm with service provider the dependence of lines in this area
57	George Fam Incline General Works	Steep incline	Setup, Construction and Commissioning	Injury as a result of vehicle tip over or fall	Design includes signage indicating edges and steep slope along George Fam Incline	D	3	High	Establish safe working distances Contractor to provide OH&S plan No people to work downhill from machinery Stabilise slopes	Contractor	During construction	Pending	D	1	Medium	

ID	Design Reference	Hazards	Design Life Cycle Stage	Risk	Existing Control Measures	Initial Risk Rating C	L	RR	Potential Control Measures (Consider Hierarchy of Control - Elimination, Substitution, Isolation, Engineering Controls, Administrative Controls, PPE)	Responsibility	By When	Decision / Status	Residual Risk Rating C	L	RR	Comments
58	General Works Incline Basin	Open basin, 5 m depth Unauthorised access	Operation and Maintenance	Drowning	Low grades for slopes to make it safe to get out Bunding and fencing to prevent unauthorised access by pedestrians and vehicles	E	2	High	Access procedures for maintenance personnel Prior to maintenance and access confirm weather conditions are predicted to be suitable for work to proceed	Shire	Prior to completion of construction At all times	Pending Ongoing	E	1	Medium	
59	General Works Incline Drain	Open drain, unauthorised access	Operation and Maintenance	Drowning	Low grades for slopes to make it safe to get out Bunding and fencing to prevent unauthorised access by pedestrians and vehicles Step-irons included on headwall for access	E	3	High	Access procedures for maintenance personnel Prior to maintenance and access confirm weather conditions are predicted to be suitable for work to proceed	Shire	Prior to completion of construction At all times	Pending Ongoing	E	1	Medium	
60	General Works Incline Drain	Open drain, erosion in high rainfall events	Operation and Maintenance	Washing away of drain, water floods to either side and areas downstream	Mortared rock at lower end of open drain to prevent erosion Start and end elevations tied into natural surface levels	C	2	Medium	Maintenance plan designates when and how maintenance can occur. PPE when working over water.	Shire	Prior to completion of construction		C	1	Medium	
61	General Works Incline Basin	Outlet pipe becomes blocked and causes overtopping of the basin	Operation and Maintenance	Flooding of downstream residential areas, erosion of surrounding environment, landslips. Potential for injury	Design uses combination pits to reduce likelihood of blockage where possible	D	3	High	Develop a maintenance plan for basin. Keep free of debris with regular scheduled maintenance during dry days	Designer/Client Shire	Prior to completion of construction At all times	Pending Ongoing	D	1	Medium	
62	General Works	Blockage of drainage pits by debris	Operation and Maintenance	Overland flow, causing land slips and damage to properties in Flying Fish Cove	Design uses combination pits to reduce likelihood of blockage where possible	D	3	High	Develop a maintenance plan for basin. Keep free of debris with regular scheduled maintenance during dry days	Designer/Client Shire	Prior to completion of construction At all times	Pending Ongoing	D	1	Medium	
63	General Works Southern Basin	Public access of the basin, particularly children as it is next to the school	Operation and Maintenance	Injury or drowning	Low grades for slopes to make it safe to get out. Shallow maximum depth of basin. Bunding and to prevent unauthorised access by vehicles	E	3	High	Develop a maintenance plan for basin. Keep free of debris with regular scheduled maintenance during dry days	Designer/Client Shire	Prior to completion of construction At all times	Pending Ongoing	E	1	Medium	
64	Southern Drumsite General Works	Existing school basin	Operation and Maintenance	Public access the basin, particularly children as it is next to the school, injury or drowning (review existing safety)	Fencing to prevent unauthorised access by pedestrians and vehicles	E	1	Medium								
65	Northern Drumsite	High velocity discharge from pipe due to steep grade (47%)	Operation and Maintenance	Erosion, slipping in fast moving water	Pipes connected by covered manhole Design involves a pipe to replace open drain	C	2	Medium								
66	Sitewidw	Low level of cover of pipe Unauthorised vehicles driving over and breaking pipes. Cover of pipe washed away during rainfall event.	Operation and Maintenance	Fast moving water causes erosion and destabilises ground, resulting in landslips and damage to infrastructure		C	3	High	Geofabrics to stabilise ground and reduce erosion. Check pipe cover as part of routine maintenance, include in maintenance procedure	Designer/Client Shire	Prior to completion of construction At all times	Pending Ongoing	C	2	Medium	

ID	Design Reference	Hazards	Design Life Cycle Stage	Risk	Existing Control Measures	Initial Risk Rating C	L	RR	Potential Control Measures (Consider Hierarchy of Control - Elimination, Substitution, Isolation, Engineering Controls, Administrative Controls, PPE)	Responsibility	By When	Decision / Status	Residual Risk Rating C	L	RR	Comments
67	Near Southern Drumsite basin and oval	Steep slopes for open drain	Operation and Maintenance	Maintenance personnel hurt by falling in, tripping during maintenance e.g. removal of debris. Drowning if person inside during flood event, unable to climb walls to get out.		E	3	High	Fencing or other access restricting measures around basin. Pipes grated or similar on inlet and outlet to prevent access. Regular maintenance including removal of debris to reduce chance of blockage and subsequent filling during rainfall events	Designer/Client Shire	Prior to completion of construction Prior to design finalisation At all times	Pending Ongoing	E	1	Medium	
68	Sitewide	Blockage of main pipelines	Operation and Maintenance	Drowning if person inside during flood event due to depth of water. Flow over Murray Road due to blockage causing basin to fill with water. Loss of vehicle access across Murray Road or accident caused by water on the road, resulting in injury.		D	3	High	Develop a maintenance plan for basin. Keep free of debris with regular scheduled maintenance during dry days	Designer/Client Shire	Prior to completion of construction At all times	Pending Ongoing	D	1	Medium	
69	Manholes, Headwalls and other steep infrastructure	Slip, trips or falls during maintenance. Slip trip or fall from a significant height at end of culverts. Slipping on surface sloping into trash rack (Pit adjacent Incline)	Operation and Maintenance	Injury or death	Step irons to assist with access Railing provided along the slope that enters the trash rack	D	3	High	Develop a maintenance plan for manholes, headwalls and other infrastructure. Keep free of debris with regular scheduled maintenance during dry days	Designer/Client Shire	Prior to completion of construction At all times	Pending Ongoing	D	1	Medium	
70	General Works North Basin 1	Driving along Lam Lok Loh; unauthorised vehicles entering Northern basin drumsite causing fatalities	Operation and Maintenance	Injury and damage to infrastructure. Flooding due to damage to infrastructure followed by a rainfall event	Bunding around basins. Low slopes in basin to allow exiting.	C	2	Medium								
71	All pipework	Insufficient cover of pipes due to erosion, area is known for unstable soils	Operation and Maintenance	Injury and damage to infrastructure. Flooding due to damage to infrastructure followed by a rainfall event	Design states earthworks to include backfilling over pipe to achieve minimum cover	D	3	High	Check pipe cover as part of routine maintenance. Include in maintenance procedure	Shire Designer/Client	At all times Prior to completion of construction	Ongoing Pending	D	1	Medium	
72	General Works North Basin 1	Public access	Operation and Maintenance	Drowning	Designed to drain, rather than hold standing water. Low grades for slopes to make it safe to get out (1 in 6). Shallow maximum depth of basin (1m). Bunding and to prevent unauthorised access by vehicles	E	2	High	Life rings adjacent to sediment area (maximum depth) and other direct contact locations. Artificial lighting. Appropriate signage. Restrict able access (walking access) to walking public.	Designer/Client	Prior to completion of design	Pending	E	1	Medium	

ID	Design Reference	Hazards	Design Life Cycle Stage	Risk	Existing Control Measures	Initial Risk Rating C	L	RR	Potential Control Measures (Consider Hierarchy of Control - Elimination, Substitution, Isolation, Engineering Controls, Administrative Controls, PPE)	Responsibility	By When	Decision / Status	Residual Risk Rating C	L	RR	Comments
73	General Works	Steep slopes may result in fast flows through pipe, also steep land above may be eroded in rainfall events	Operation and Maintenance	Loss of cover of pipes resulting in damage of pipes Fast water exiting the outlet onto the Incline at N10-9	Design states earthworks to include backfilling over pipe to achieve minimum cover	D	3	High	Check pipe cover as part of routine maintenance, include in maintenance procedure	Shire	At all times	Ongoing	D	1	Medium	
74	All areas	Working in, on or over water	Operation and Maintenance	Risk of falling into open water and/or water in adjacent	Minimise tripping hazards by use of gentle slopes. Minimise depth of water during normal operations. Low through flow velocities of water.	D	2	Medium	Maintenance plan designates when and how maintenance can occur. PPE when working over water. Overwater structures should have rails.	Designer Client	Prior to commissioning At all times	Pending Ongoing	D	1	Medium	
75	All areas	Working at height	Operation and Maintenance	Workers falling into manhole while accessing/cleaning	Manholes equipped with step irons.	D	3	High	During access use of appropriate temporary barricading is required. Tether workers to a control system to prevent falling	Shire	Prior to commissioning Prior to maintenance	Pending Ongoing	D	1	Medium	
76	All areas	Manholes	Operation and Maintenance	Unauthorised access into manholes resulting in fall resulting in injury or death.	All manhole lids are heavy - reduces potential for access.	E	2	High	Bolt down lids/key entry lids	Designer/Client	During design	Pending	E	1	Medium	
77	All areas	Confined space	Operation and Maintenance	Asphyxiation during maintenance of manhole pits.	All manhole lids are heavy - reduces potential for unauthorised access. Manholes equipped with Step irons.	E	2	High	Appropriate confined space OHS plan to be developed. Labels/Signage on manholes warning about the confined space Use of tripod setup	Designer/Client Client Contractor	Prior to maintenance prior to commissioning During maintenance	Pending	E	1	Medium	
78	Abnormal Events	Flood	Operation and Maintenance	Drowning	Basins designed with outlets and high flow weirs Design managed to minimise water level in basins Minimised velocity of water in basins and pipes to prevent suction Security grates to be included. Screens included on outlet pipes (greater than 225mm) Stormwater system considers effects of 1 in a 100 year ARI flood event. Design considers high tide conditions.	E	2	High	Review Emergency Management Plan for Flood Events	Client/Shire	Prior to commissioning	Pending	E	1	Medium	

ID	Design Reference	Hazards	Design Life Cycle Stage	Risk	Existing Control Measures	Initial Risk Rating C	L	RR	Potential Control Measures (Consider Hierarchy of Control - Elimination, Substitution, Isolation, Engineering Controls, Administrative Controls, PPE)	Responsibility	By When	Decision / Status	Residual Risk Rating C	L	RR	Comments
79	Basins (general)	Public access of basins	Operation and Maintenance	Drowning	Basins have outlets Design managed to minimise water levels in basins Minimised velocity of water in basins and pipes to prevent suction Security grates to be included. Screens included on outlet pipes (greater than 225mm) Stormwater system considers effects of 1 in a 100 year ARI flood event. Design considers high tide conditions. Gentle slopes on embankments.	E	3	High	Life rings adjacent to sediment area (maximum depth) and other direct contact locations. Artificial lighting. Appropriate signage. Restrict able access (walking access) to walking public.	Designer/Client	Prior to completion of design	Pending	E	1	Medium	
80	Drainage (general)	Upstream erosion, sediment and detritus fills drainage and causes blockages	Operation and Maintenance	Flooding, causing landslips		C	4	High	Develop maintenance procedure. Carry out cleaning of drainage system on a regular basis.	Designer/Client Shire						
81	Drainage (general)	Upstream contamination event	Operation and Maintenance	Loss of flora and fauna around outlet points (ocean outfall) Illness or injury to public if they go in open basins while contaminated water is inside.		C	2	Medium								
82	Drainage (general)	High pressure water during cleaning of hard infrastructure (potentially 1000 kPa).	Operation and Maintenance	Injury due to exposure to high pressure water		C	3	High	Develop safe working procedure	Shire	Prior to maintenance	Pending	C	1	Medium	
83	Drive Over for George Fam Incline General Works	large weights in Driverover grate	Setup, Construction and Commissioning	Crush injury to worker												
84	Drive Over for George Fam Incline General Works	Signifcant fall risk into Chambers	Setup, Construction and Commissioning	Worker Falls into concreete structure over 1.2m												
85	Drive Over for George Fam Incline General Works	Signifcant fall risk into Chambers	Operation and Maintenance	Worker Falls into concreete structure over 1.2m												

JM Name & Signature: Simon Cleary

Staff Involved in Risk Assessment: Simon Cleary,

CHRISTMAS ISLAND - PROJECT AND SAFETY IN DESIGN RISK REGISTER

CONSEQUENCE CRITERIA

No	Health & Safety	Environment	Regulatory	Image & Reputation	Financial Impacts	Project Performance
E CATASTROPHIC	Fatality of staff, contractor or the public	Long term environmental damage (5 years or longer), requiring >$5 million to study or correct or in penalties	Regulatory intervention and prosecution possible	Damage to the Department's reputation at international level; raised in international media. Major loss of political or community support	Direct loss or increased cost > $5 million	Failure to achieve critical KPI or performance goals
D CRITICAL	Serious injury or occupational illness (non-recoverable) or permanent major disabilities (acute or chronic)	Medium-term (1-5 yr) environmental damage, requiring $1 to 5 million to study or correct	Breach of licenses, legislation, regulation or City - mandated standards	Design impacts on the hydraulic efficiency of the drain are too great. GHD do not adequately assess the operations and safety aspects of the diversion structure which results in Water Corp objecting to the design.	Water Corporation guidelines. Water Corp are being consulted on the design as it progresses. Water Corp focus is more on flood mitigation rather than on the design of smaller structure.	Failure to achieve some critical KPI or performance goals
C SEVERE	Lost time or restricted duties injury or occupational illness (recoverable)	Short-term (<1 yr) environmental damage, requiring up to $1 million to correct	Breach of standards, guidelines or impending legislation, or subject raised as a corporate concern through audit findings or voluntary agreements	Inability to demonstrate and document that the flood mitigation is effective and does not impact the environment. Fail to set clear expectations on what can be achieved with the site.	Direct loss or increased cost of $.5 – 1 million	Some reduction in performance
B MAJOR	Medical Treatment or First Aid Injury No lost time or occupational illness	Environmental damage, requiring up to $500K to study or correct	Breach of internal procedures or guidelines	Adverse news in local media. Concerns on performance raised by political or the community	Direct loss or increased cost of $100K – 500K	Minor performance degradation
1 MINOR	No Injury	Negligible environmental impact, managed within operating budgets	No breach of licenses, standards, guidelines or related audit findings	Reference to community consultation group. Public awareness may exist, but there is no public concern	Direct loss or increased cost below $100,000	Negligible performance impact

		Basis of Rating	
		Judgment	**Frequency**
5	Almost certain	Expected to occur	Very High, may occur at least once during the life of the project
4	Likely	More likely to occur than not occur.	High, likely to occur during the life of the project
3	Possible	As likely to occur as not to occur.	Possible, may occur during the life of the project
2	Unlikely	Not impossible, more likely not to occur than to occur.	Not impossible but unlikely to occur during the life of the project
1	Very Unlikely	Very unlikely to occur.	Very low, very unlikely during the next twenty five years

RISK MATRIX

		CONSEQUENCE				
		MINOR	MAJOR	SEVERE	CRITICAL	CATASTROPHIC
LIKELIHOOD		A	B	C	D	E
VERY UNLIKELY	1	Low	Low	Medium	Medium	Medium
UNLIKELY	2	Low	Low	Medium	Medium	High
POSSIBLE	3	Low	Medium	High	High	High
LIKELY	4	Medium	Medium	High	High	Extreme
ALMOST CERTAIN	5	Medium	High	High	Extreme	Extreme

GHD RISK ASSESSMENT MATRIX

Risk Assessment Matrix		CONSEQUENCE				
		MINOR	MAJOR	SEVERE	CRITICAL	CATASTROPHIC
LIKELIHOOD		A	B	C	D	E
VERY UNLIKELY	1	Low	Low	Medium	Medium	Medium
UNLIKELY	2	Low	Low	Medium	Medium	High
POSSIBLE	3	Low	Medium	High	High	High
LIKELY	4	Medium	Medium	High	High	Extreme
ALMOST CERTAIN	5	Medium	High	High	Extreme	Extreme

ALARP MODEL ACTIONS

Extreme Residual Risk	Notify SGM to gain OCM Approval
	Do not proceed with design until level of risk has been reduced.
High Residual Risk	Refer to relevant Safety in Design Control Package
Medium Residual Risk	Refer to relevant Safety in Design Control Package

GHD SAFE
CONSEQUE

Select the **MOST LIKELY/PRC**

Risk Consequence
E- Catastrophic
D – Critical
C- Severe
B - Major
A – Minor

Select the best likelihood descr

Likelihood Descriptor
5 – Almost Certain

FORM HS 040
C = Consequence, L = Likelihood, RR = Risk Ranking
NB: Consequence should be assessed first so that the likelihood rating is the likelihood of the selected consequence occurring.

25/01/2010

Low Residual Risk	Refer to relevant Safety in Design Control Package

4 – Likely
3 – Possible
2 – Unlikely
1 – Very Unlikely

TY IN DESIGN RISK ASSESSMENT
ENCE & LIKELIHOOD DESCRIPTORS

GHD CONSEQUENCE DESCRIPTORS

)BABLE consequence descriptor for the information available).

Design Consequence Descriptors
Could result in fatality or irreversible severe environmental damage required to be notified under jurisdiction requirements.
Could result in permanent total disability or reversible environmental damage required to be notified under jurisdiction requirements.
Could result in permanent partial disability, injuries or illness that may result in hospitalisation of persons or mitigatiable environmental damage required to be notified under jurisdiction requirements.
Could result in injury or illness resulting in one or more lost work day(s) or mitigatiable environmental damage not required to be notified under jurisdiction requirements where restoration activities can be accomplished.
Could result in injury or illness not resulting in a lost work day or minimal environmental damage not required to be notified under jurisdiction requirements.

GHD LIKELIHOOD DESCRIPTORS

'iptor for the information available).

Design Likelihood Descriptors
Industry experience suggests design failure is almost certain to occur during the life of the product.

Industry experience suggests design failure is likely to occur during the life of the product.
Industry experience suggests design failure is possible some time during the life of the design.
Industry experience suggests design failure is unlikely to occur in the life of design.
Industry experience suggests design failure is very unlikely. It can be assumed failure occurrence may not be experienced,

GHD SAFETY IN DESIGN RISK ASSESSMENT CONSEQUENCE & LIKELIHOOD DESCRIPTORS

GHD CONSEQUENCE DESCRIPTORS

Select the **MOST LIKELY/PROBABLE** consequence descriptor for the information available).

Risk Consequence	Design Consequence Descriptors
E- Catastrophic	Could result in fatality or irreversible severe environmental damage required to be notified under jurisdiction requirements.
D – Critical	Could result in permanent total disability or reversible environmental damage required to be notified under jurisdiction requirements.
C- Severe	Could result in permanent partial disability, injuries or illness that may result in hospitalisation of persons or mitigatiable environmental damage required to be notified under jurisdiction requirements.
B - Major	Could result in injury or illness resulting in one or more lost work day(s) or mitigatiable environmental damage not required to be notified under jurisdiction requirements where restoration activities can be accomplished.
A – Minor	Could result in injury or illness not resulting in a lost work day or minimal environmental damage not required to be notified under jurisdiction requirements.

GHD LIKELIHOOD DESCRIPTORS

Select the best likelihood descriptor for the information available).

Likelihood Descriptor	Design Likelihood Descriptors
5 – Almost Certain	Industry experience suggests design failure is almost certain to occur during the life of the product.
4 – Likely	Industry experience suggests design failure is likely to occur during the life of the product.
3 – Possible	Industry experience suggests design failure is possible some time during the life of the design.
2 – Unlikely	Industry experience suggests design failure is unlikely to occur in the life of design.
1 – Very Unlikely	Industry experience suggests design failure is very unlikely. It can be assumed failure occurrence may not be experienced,

HIERARCHY OF CONTROLS

Having established a level of risk for a hazard, it is then necessary to determine and implement an appropriate control (or combination of controls if no single measure is sufficient). Below is a guide from most preferred to least preferred control measures.

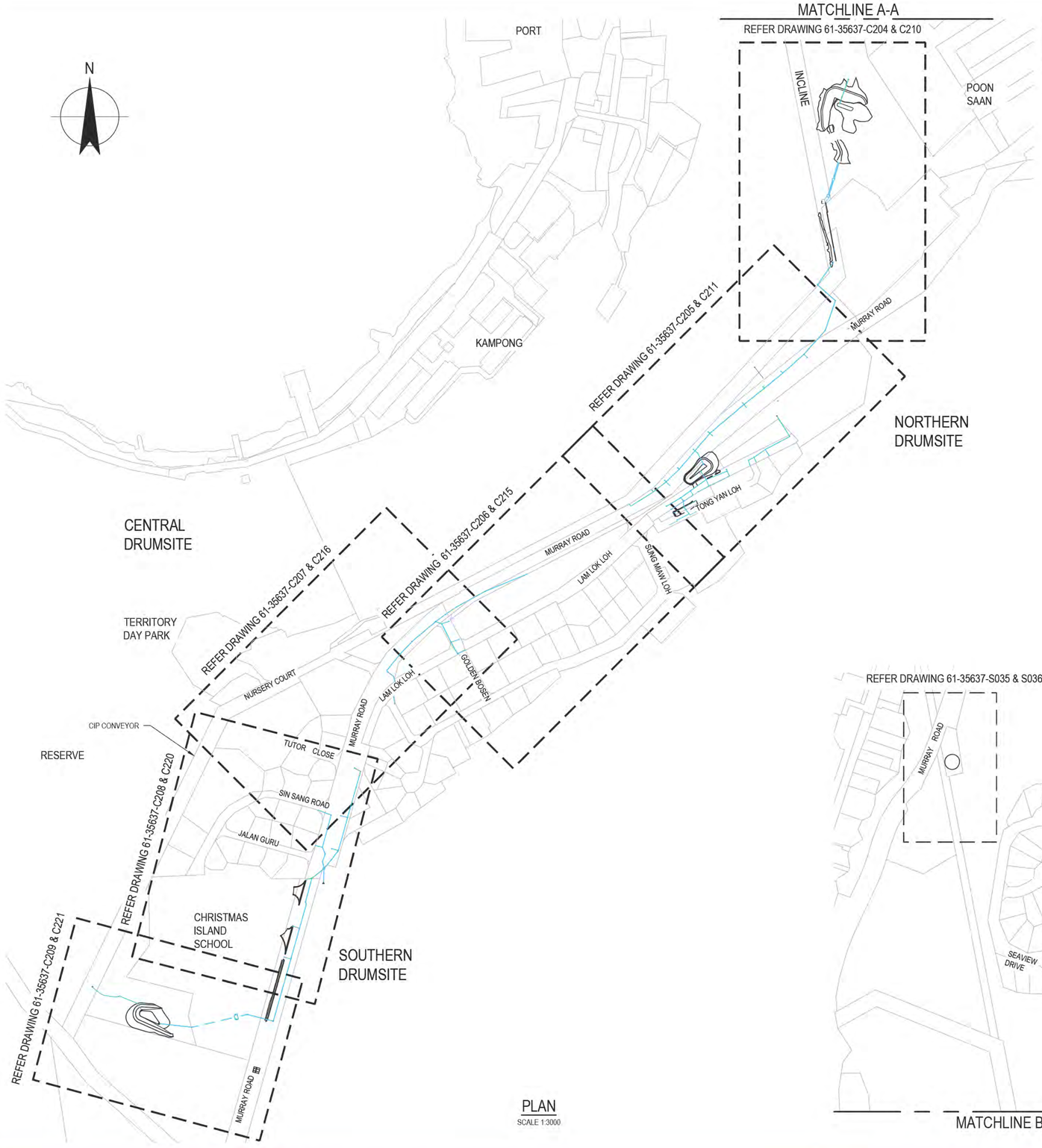
ELIMINATE THE HAZARD	***ELIMINATE*** - Get rid of the hazard out of the workplace.	◗ Redesign the work process to remove the hazard	
		◗ Redesign of the work process to eliminate exposure	
CHANGE THE WAY WORK IS DONE	***SUBSTITUTE*** - Try to replace or change plant, substances or materials to lower the risk from the hazard.	◗ Consider using air-powered instead of electric powered tools	
		◗ Consider using water based paints rather than solvent based ones.	
	Try to ***ISOLATE*** the hazard	◗ Insulation (i.e. sound proofing or insulation from the heat)	
		◗ Guarding on machines.	
	ENGINEERING **CONTROL** - Design and install equipment to counteract the hazard	◗ Lifting devices	
		◗ Exhaust ventilation system to extract dangerous fumes or dust.	
	ADMINISTRATIVE **CONTROL** Arrange work so people spend less time around the hazard and monitor their understanding of the hazard and the controls	◗ Health and safety related Training;	
		◗ Develop Service Line JSEA for staff to follow	
		◗ Restricted access to certain work areas, i.e. confined space	
		◗ Operator certification for plant	
		◗ Job rotation.	
PPE	**PPE** Have people wear protective equipment and clothing while near the hazard	◗ Is it appropriate for the staff member?	◗ Examples of PPE
		◗ Does it control the risk for that staff member?	◗ Clothes
		◗ Does it control the risk?	◗ Respirator
		◗ Is the staff member informed of any limitations?	◗ Gloves
		◗ Has the staff member been given instruction and training on the proper use of PPE?	◗ Helmets
			◗ Wide-brimmed hats Goggles
			◗ Safety Footwear
			◗ High visibility vests
			◗ Ear plugs and ear muffs

Appendix B – Design Drawings

MATCHLINE A-A

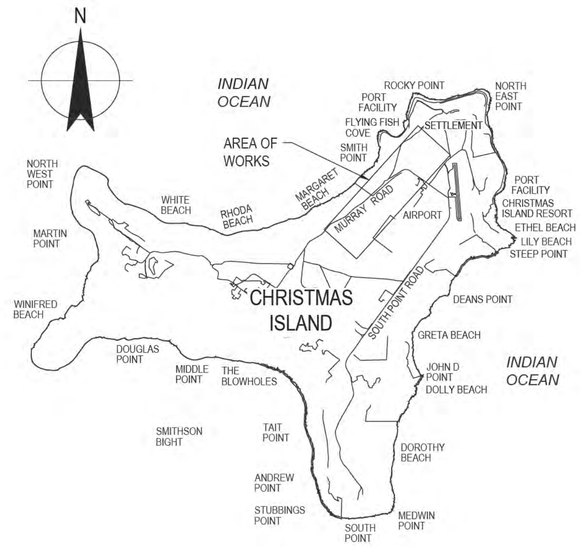
REFER DRAWING 61-35637-C204 & C210

THIS DRAWING IS TO BE PRINTED IN COLOUR



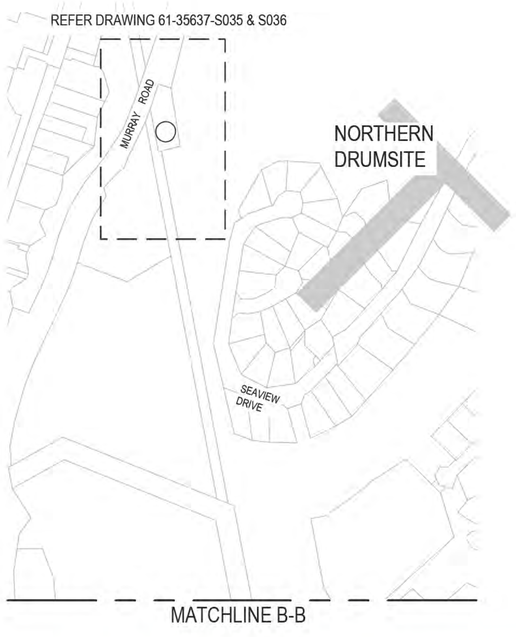
PLAN

SCALE 1:3000



LOCALITY PLAN

N.T.S



NOTES:

1. FOR FURTHER SURVEY INFORMATION, REFER TO DRAWINGS 61-35637-V01 SHEETS 1-3.
2. INDICATIVE EXISTING SERVICES INFORMATION IS PRESENTED ON DRAWINGS 61-35637-C204 TO C209. IT MUST BE NOTED THAT THESE ARE INDICATIVE AND REQUIRE VERIFICATION BY THE CONTRACTOR PRIOR TO COMMENCING CONSTRUCTION.

0 30 60 90 120 150m

SCALE 1:3000 AT ORIGINAL SIZE

PRELIMINARY

No	Revision	Note: * indicates signatures on original issue of drawing or last revision of drawing	Drawn	Job Manager	Project Director	Date
B	REISSUED FOR 90% DESIGN - CLIENT COMMENT		GT	JM*	PS*	20/11/20
A	ISSUED FOR 90% DESIGN - CLIENT COMMENT		JO	JM*	PS*	30/09/20

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Ohino Roces Ave corner EDSA

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Drawn	J.OVERHEU	Designer	J.OVERHEU
Drafting Check	S.HORTON*	Design Check	S.CLEARY*
Approved (Project Director)			
Date			
Scale	1:3000	This Drawing must not be used for Construction unless signed as Approved	

Client: DEPT OF INFRASTRUCTURE, TRANSPORT, REGIONAL DEVELOPMENT & COMMUNICATIONS
Project: CHRISTMAS ISLAND STORMWATER REMEDIAL WORKS
Title: COVER SHEET AND LOCALITY PLAN

Original Size: A1
Drawing No: 61-35637-C201
Rev: B

Plot Date: 19 November 2020 - 4:38 PM Plotted by: Jess Overheu
Cad File No: \\ghdnet.internal\ghd\AU\Perth\Projects\61\35637\CADD\Drawings\61-35637-C201.dwg

DRAWING LIST:

CIVIL DRAWINGS

61-35637-C201	COVER SHEET AND LOCALITY PLAN
61-35637-C202	DRAWING LIST & GENERAL CIVIL NOTES
61-35637-C204	NORTHERN DRUMSITE WORKS - EXISTING SERVICES - PLAN - SHEET 1 OF 6
61-35637-C205	NORTHERN DRUMSITE WORKS - EXISTING SERVICES - PLAN - SHEET 2 OF 6
61-35637-C206	CENTRAL DRUMSITE WORKS - EXISTING SERVICES - PLAN - SHEET 3 OF 6
61-35637-C207	CENTRAL DRUMSITE WORKS - EXISTING SERVICES - PLAN - SHEET 4 OF 6
61-35637-C208	SOUTHERN DRUMSITE WORKS - EXISTING SERVICES - PLAN - SHEET 5 OF 6
61-35637-C209	SOUTHERN DRUMSITE WORKS - EXISTING SERVICES - PLAN - SHEET 6 OF 6
61-35637-C210	NORTHERN DRUMSITE WORKS - PLAN - SHEET 1
61-35637-C211	NORTHERN DRUMSITE WORKS - PLAN - SHEET 2
61-35637-C212	NORTHERN DRUMSITE WORKS - PLAN - SHEET 3
61-35637-C215	CENTRAL DRUMSITE WORKS - PLAN - SHEET 1
61-35637-C216	CENTRAL DRUMSITE WORKS - PLAN - SHEET 2
61-35637-C220	SOUTHERN DRUMSITE WORKS - PLAN - SHEET 1
61-35637-C221	SOUTHERN DRUMSITE WORKS - PLAN - SHEET 2
61-35637-C230	NORTHERN DRUMSITE WORKS - INCLINE BASIN - PLAN AND TYPICAL SECTIONS
61-35637-C231	NORTHERN DRUMSITE WORKS - INCLINE BASIN - LONGITUDINAL SECTION AND TYPICAL SECTIONS
61-35637-C232	NORTHERN DRUMSITE WORKS - INCLINE DRAIN - PLAN, LONGITUDINAL SECTION & TYPICAL SECTIONS
61-35637-C233	NORTHERN DRUMSITE WORKS - DRAINAGE LINE N17 - PLAN AND LONGITUDINAL SECTION
61-35637-C234	NORTHERN DRUMSITE WORKS - DRIVE OVER - PLAN, LONGITUDINAL SECTION & TYPICAL SECTIONS
61-35637-C235	NORTHERN DRUMSITE WORKS - INCLINE BUND - PLAN, LONGITUDINAL SECTION & TYPICAL SECTIONS
61-35637-C236	NORTHERN DRUMSITE WORKS - BASIN 1 - PLAN AND TYPICAL SECTIONS
61-35637-C245	SOUTHERN DRUMSITE BASIN - PLAN AND TYPICAL SECTIONS
61-35637-C250	NORTHERN DRUMSITE WORKS - LONGITUDINAL SECTIONS SHEET 1
61-35637-C251	NORTHERN DRUMSITE WORKS - LONGITUDINAL SECTIONS SHEET 2
61-35637-C252	NORTHERN DRUMSITE WORKS - LONGITUDINAL SECTIONS SHEET 3
61-35637-C253	NORTHERN DRUMSITE WORKS - LONGITUDINAL SECTIONS SHEET 4
61-35637-C254	NORTHERN DRUMSITE WORKS - LONGITUDINAL SECTIONS SHEET 5
61-35637-C255	NORTHERN DRUMSITE WORKS - LONGITUDINAL SECTIONS SHEET 6
61-35637-C260	CENTRAL DRUMSITE WORKS - LONGITUDINAL SECTIONS SHEET 1
61-35637-C261	CENTRAL DRUMSITE WORKS - LONGITUDINAL SECTIONS SHEET 2
61-35637-C270	SOUTHERN DRUMSITE WORKS - LONGITUDINAL SECTIONS SHEET 1
61-35637-C271	SOUTHERN DRUMSITE WORKS - LONGITUDINAL SECTIONS SHEET 2
61-35637-C272	SOUTHERN DRUMSITE WORKS - LONGITUDINAL SECTIONS SHEET 3
61-35637-C280	NORTHERN DRUMSITE ROAD AND PAVEMENT DESIGN - PAVEMENT REINSTATEMENT EXTENTS
61-35637-C281	NORTHERN DRUMSITE ROAD AND PAVEMENT DESIGN - TONG YAN LOH CAR PARK MODIFICATIONS
61-35637-C285	SOUTHERN DRUMSITE ROAD AND PAVEMENT DESIGN - CHRISTMAS ISLAND SCHOOL ENTRANCE MODIFICATIONS
61-35637-C286	SOUTHERN DRUMSITE ROAD AND PAVEMENT DESIGN - MURRAY ROAD SPEED REDUCTION HUMP
61-35637-C290	DRAINAGE STRUCTURES - TYPICAL DETAILS - SHEET 1
61-35637-C291	DRAINAGE STRUCTURES - TYPICAL DETAILS - SHEET 2
61-35637-C292	DRAINAGE STRUCTURES - TYPICAL DETAILS - SHEET 3
61-35637-C293	KERBING AND FOOTPATH - TYPICAL DETAILS
61-35637-C294	FENCING - TYPICAL DETAILS
61-35637-C296	ROAD AND PAVEMENT DESIGN

WATER MAIN DRAWINGS

61-35637-C300	DN250 PVC WATER MAIN - CONSTRUCTION NOTES
61-35637-C301	DN250 PVC WATER MAIN - PLAN AND LONGITUDINAL SECTION
61-35637-C302	DN250 PVC WATER MAIN - THRUST BLOCK AND BEND DETAILS
61-35637-C303	DN250 PVC WATER MAIN - SCOUR VALVE DETAILS

STRUCTURAL DRAWINGS

61-35637-S002	STRUCTURAL NOTES
61-35637-S003	TYPICAL STRUCTURAL DETAILS
61-35637-S005	NORTHERN DRUMSITE WORKS - INCLINE MISCELLANEOUS STRUCTURES - SECTIONS AND DETAILS
61-35637-S010	NORTHERN DRUMSITE WORKS - INCLINE DIVERSION PIT & CHANNEL - GENERAL ARRANGEMENT
61-35637-S011	NORTHERN DRUMSITE WORKS - INCLINE DIVERSION PIT & CHANNEL - REINF. DETAILS OF SHEET 1 OF 3
61-35637-S012	NORTHERN DRUMSITE WORKS - INCLINE DIVERSION PIT & CHANNEL - REINF. DETAILS OF SHEET 2 OF 3
61-35637-S013	NORTHERN DRUMSITE WORKS - INCLINE DIVERSION PIT & CHANNEL - REINF. DETAILS OF SHEET 3 OF 3
61-35637-S014	NORTHERN DRUMSITE WORKS - INCLINE DIVERSION PIT & CHANNEL - STEEL WORK SETOUT & DETAILS
61-35637-S020	NORTHERN DRUMSITE WORKS - PIT N17-2 - SECTIONS AND DETAILS
61-35637-S021	NORTHERN DRUMSITE WORKS - HEADWALL N17-3 - SECTIONS & DETAILS
61-35637-S025	NORTHERN DRUMSITE WORKS - INCLINE DRAIN OUTLET STRUCTURE - GENERAL ARRANGEMENT
61-35637-S026	NORTHERN DRUMSITE WORKS - INCLINE DRAIN OUTLET STRUCTURE - REINF. DETAILS OF SHEET 1 OF 2
61-35637-S027	NORTHERN DRUMSITE WORKS - INCLINE DRAIN OUTLET STRUCTURE - REINF. DETAILS OF SHEET 2 OF 2
61-35637-S030	SOUTHERN DRUMITSITE WORKS - PIT S01-7 - SECTIONS & DETAILS
61-35637-S035	NORTHERN DRUMSITE WORKS - INCLINE TANK DRAIN - HEADWALL MODIFICATIONS - GENERAL ARRANGEMENT
61-35637-S036	NORTHERN DRUMSITE WORKS - INCLINE TANK DRAIN -HEADWALL MODIFICATIONS - REINFORCEMENT DETAILS

GENERAL NOTES:

1. ALL DRAWINGS TO BE PRINTED IN COLOUR.
2. ALL DIMENSIONS IN METRES U.N.O. PIT LOCATIONS TO BE CONFIRMED UPON FINALISATION OF EARTHWORKS AND ROAD SETOUT.
3. ALL CONSTRUCTION TO BE IN ACCORDANCE WITH THE SPECIFICATION REQUIREMENTS.
4. THE CONTRACTOR SHALL LIAISE WITH ALL RELEVANT AUTHORITIES TO LOCATE ALL EXISTING SERVICES WITHIN THE CONTRACT AREA PRIOR TO THE COMMENCEMENT OF WORK. WHERE EXISTING AND PROPOSED WORKS INTERSECT, LEVELS ARE TO BE TAKEN AND SUPPLIED TO THE CLIENT'S REPRESENTATIVE.
5. THE CONTRACTOR SHALL LOCATE ALL LEVELS FROM ESTABLISHED BENCH MARKS.
6. ALL BENCH MARKS ARE TO BE PROTECTED AND PRESERVED.
7. THE CONTRACTOR SHALL LIAISE WITH TELSTRA, VOCUS AND SHIRE OF CHRISTMAS ISLAND, WATER CORPORATION, CHRISTMAS ISLAND PHOSPHATE AND INDIAN OCEAN POWER AUTHORITY TO GAIN ALL REQUIRED APPROVALS AND PERMITS.
8. ALL CONSTRUCTION SHALL MAKE SMOOTH CONNECTION TO EXISTING WORK.
9. STORMWATER PIPE ALIGNMENT SHALL BE AS INDICATED ON THE PLANS.
10. STORMWATER PIPES MATERIALS VARY ON THE SITE (REFER TO DETAILED PLANS AND LONG SECTIONS FOR REQUIREMENTS).
11. JUNCTION AND ENTRY PITS ARE TO BE LOCATED IN POSITIONS SHOWN, IRRESPECTIVE OF THE INDICATED PIPE LENGTHS .
12. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE SUPPORT OF ALL EXISTING SERVICES. WHERE SERVICES CROSS, THE UPPER SERVICE SHALL BE PROVIDED WITH A SUITABLE SUPPORT AS REQUIRED, BY THE RELEVANT SERVICE AUTHORITY MANUAL.
13. WHERE CONNECTING INTO EXISTING DRAINAGE, THE CONTRACTOR SHALL PICK UP UPSTREAM AND DOWNSTREAM INVERT LEVELS OF EXISTING DRAINAGE LINE IMMEDIATELY DOWNSTREAM OF PROPOSED CONNECTION. THE CONTRACTOR TO SUPPLY THIS SURVEY INFORMATION TO THE CLIENT'S REPRESENTATIVE PRIOR TO THE COMMENCEMENT OF ANY DRAINAGE CONSTRUCTION. THE CONTRACTOR TO THEN AWAIT NOTIFICATION FROM THE PRINCIPAL THAT DRAINAGE CONSTRUCTION MAY COMMENCE.
14. ALL PLAN DRAWINGS ARE TO BE READ IN CONJUNCTION WITH TYPICAL CROSS SECTION DETAILS TYPICAL DRAWINGS DETAILS.
15. ALL TRENCH DRAINS ARE TO BE ACO KLASSIK DRAIN WITH SLOPED CHANNEL OR APPROVED EQUIVALENT UNLESS OTHERWISE NOTED ON THE DRAWINGS.
16. WHERE AN EXISTING PIT IS TO BE RETAINED WITHIN THE SITE, LEVELS ARE TO BE ADJUSTED TO MATCH WITH REVISED GROUND LEVELS. ADJUSTED LEVELS SPECIFIED IN LONG SECTION DRAWINGS AND INCLUDE REFERENCE.
17. ACO GRATED PIT TYPE 45 WITH RISER AND GALVANISED CLASS D GRATE OR EQUIVALENT TO BE INSTALLED TO MANUFACTURERS SPECIFICATION.
18. ALL DRAWINGS TO BE READ IN CONJUNCTION WITH STRUCTURAL NOTES CONTAINED ON DRAWING 61-35637-S002.
19. ALL DRAWINGS TO BE READ IN CONJUNCTION WITH WATER MAIN CONSTRUCTION NOTES CONTAINED ON DRAWING 61-35637-C300.
20. ALL DRAWINGS PREPARED IN MGA COORDINATES BASED ON ZONE 48.
21. ALL DRAWINGS PREPARED IN CIHD (CHRISTMAS ISLAND HEIGHT DATUM).
22. LOCATIONS AND POSITIONS OF EXISTING SERVICES AND INFRASTRUCTURE BASED UPON A VARIETY OF SITE SURVEY AND SERVICE PROVIDER INFORMATION.
23. OVERHEAD CONVEYOR TO BE PROTECTED DURING CONSTRUCTION. ALL REQUIRED CHRISTMAS ISLAND PHOSPHATE REQUIREMENTS TO BE ADHERED TO AT ALL TIMES.

PIPE FOUNDATION MATERIAL SPECIAL NOTE:

CHRISTMAS ISLAND GEOLOGICAL FEATURES INCLUDE LIMESTONE LAYERS. LIMESTONE MATERIAL CAN BE AFFECTED BY KARSTIFICATION PROCESSES WHEREBY AQUEOUS SOLUTIONS DISSOLVE CALCITE RESULTING IN THE FORMATION OF CAVES, SINKHOLES AND OTHER VOIDS.

PIPE TRENCH FOUNDATION SHALL BE MONITORED FOR SIGNS OF KARSTIFICATION, WHERE KARSTIFICATION IS OBSERVED THE CONTRACTOR SHALL NOTIFY THE CLIENT'S REPRESENTATIVE FOR FURTHER DIRECTION.

PRELIMINARY

No	Revision	Drawn	Job Manager	Project Director	Date
B	REISSUED FOR 90% DESIGN - CLIENT COMMENT	GT	JM*	PS*	20/11/20
A	ISSUED FOR 90% DESIGN - CLIENT COMMENT	JO	JM*	PS*	30/09/20

Note: * indicates signatures on original issue of drawing or last revision of drawing

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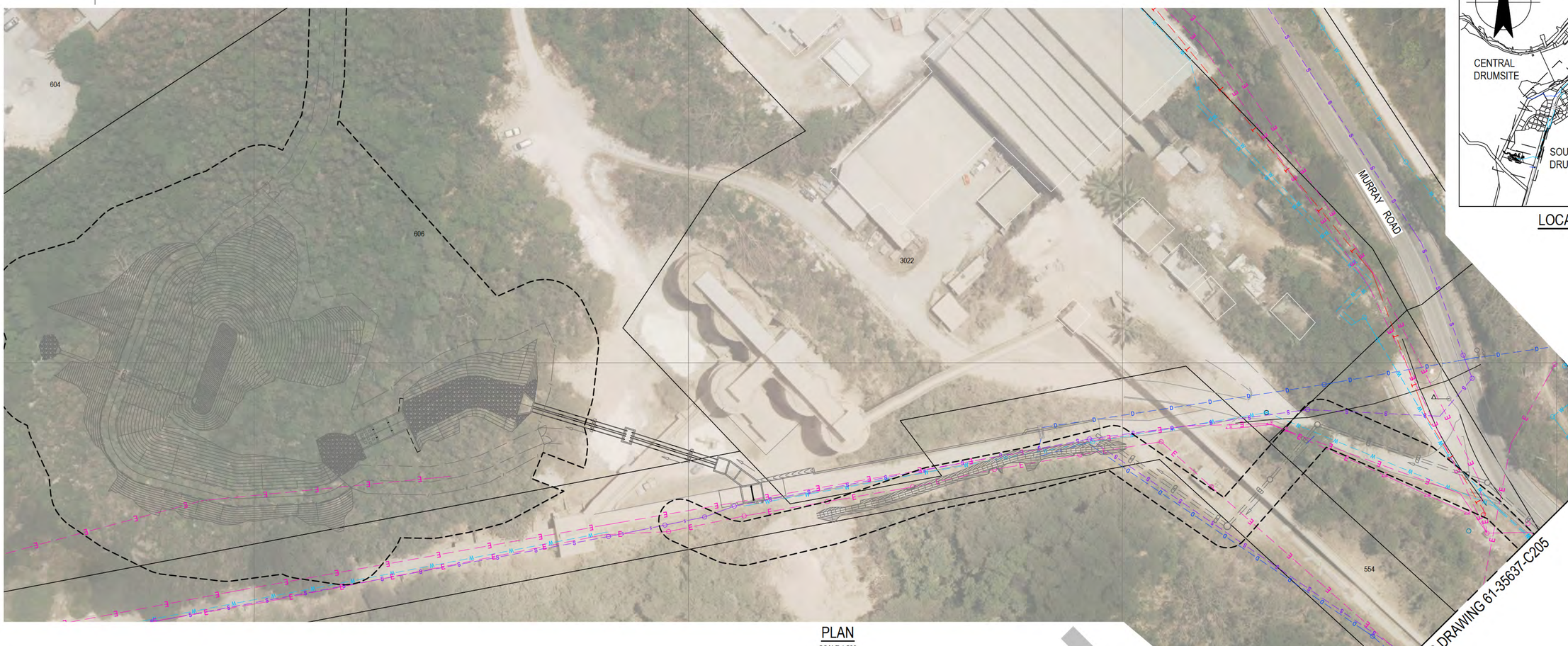
Drawn	J.OVERHEU	Designer	J.OVERHEU
Drafting Check	S.HORTON*	Design Check	S.CLEARY*
Approved (Project Director)			
Date			
Scale	NTS	This Drawing must not be used for Construction unless signed as Approved	

Client: DEPT OF INFRASTRUCTURE, TRANSPORT, REGIONAL DEVELOPMENT & COMMUNICATIONS
Project: CHRISTMAS ISLAND STORMWATER REMEDIAL WORKS
Title: DRAWING LIST AND GENERAL CIVIL NOTES

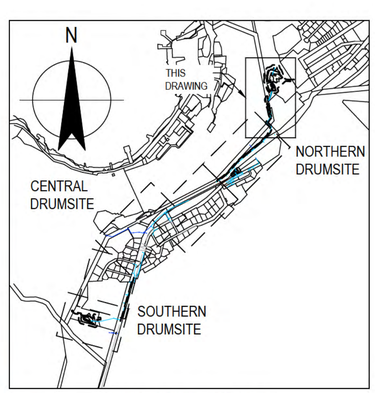
Original Size: A1
Drawing No: 61-35637-C202
Rev: B

Plot Date: 19 November 2020 - 1:36 PM Plotted by: Jess Overheu Cad File No: \\ghdnet internal\ghd\AU\Perth\Projects\61\35637\CADD\Drawings\61-35637-C202.dwg

THIS DRAWING IS TO BE PRINTED IN COLOUR



PLAN
SCALE 1:500



LOCALITY PLAN
N.T.S.

NOTES:

1. FOR FURTHER SURVEY INFORMATION, REFER TO DRAWINGS 61-35637-V01 SHEETS 1-3.
2. EXISTING SERVICES LOCATIONS ARE INDICATIVE ONLY. CONTRACTOR TO CONFIRM LOCATION, SIZE AND LEVEL PRIOR TO COMMENCING CONSTRUCTION, SHOULD ANY CLASHES BE IDENTIFIED WITH PROPOSED WORKS THE CONTRACTOR IS TO IMMEDIATELY NOTIFY THE CLIENT'S REPRESENTATIVE.
3. EXTENT OF CLEARING PERMITTED. REFER TO SPECIFICATION FOR FURTHER DETAILS AND SETOUT REQUIREMENTS.
4. FOR OTHER NOTES, REFER DRAWING 61-35637-C202.

LEGEND:

- PROPOSED DRAINAGE
- EXISTING CADASTRAL BOUNDARY
- PERMITTED CLEARING EXTENT
- EXISTING DRAINAGE
- EXISTING ELECTRICAL CABLE
- EXISTING FUEL LINE
- EXISTING SEWER LINE
- EXISTING TELCO CABLE
- EXISTING WATER PIPE

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SCALE 1:500 AT ORIGINAL SIZE

PRELIMINARY

No	Revision	Note: * indicates signatures on original issue of drawing or last revision of drawing	Drawn	Job Manager	Project Director	Date
B	REISSUED FOR 90% DESIGN - CLIENT COMMENT		GT	JM*	PS*	20/11/20
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Drafting Check	S.HORTON*	Design Check	S.CLEARY*
Approved (Project Director)			
Date			
Scale	1:500	This Drawing must not be used for Construction unless signed as Approved	

Client: DEPT OF INFRASTRUCTURE, TRANSPORT, REGIONAL DEVELOPMENT & COMMUNICATIONS
Project: CHRISTMAS ISLAND STORMWATER REMEDIAL WORKS
Title: NORTHERN DRUMSITE WORKS
EXISTING SERVICES - PLAN - SHEET 1 OF 6

Original Size A1
Drawing No: 61-35637-C204
Rev: B

Plot Date: 19 November 2020 - 2:08 PM Plotted by: Jess Overheu Cad File No: \\ghdnet.internal\ghd\AU\Perth\Projects\61\35637\CADD\Drawings\61-35637-C204.dwg

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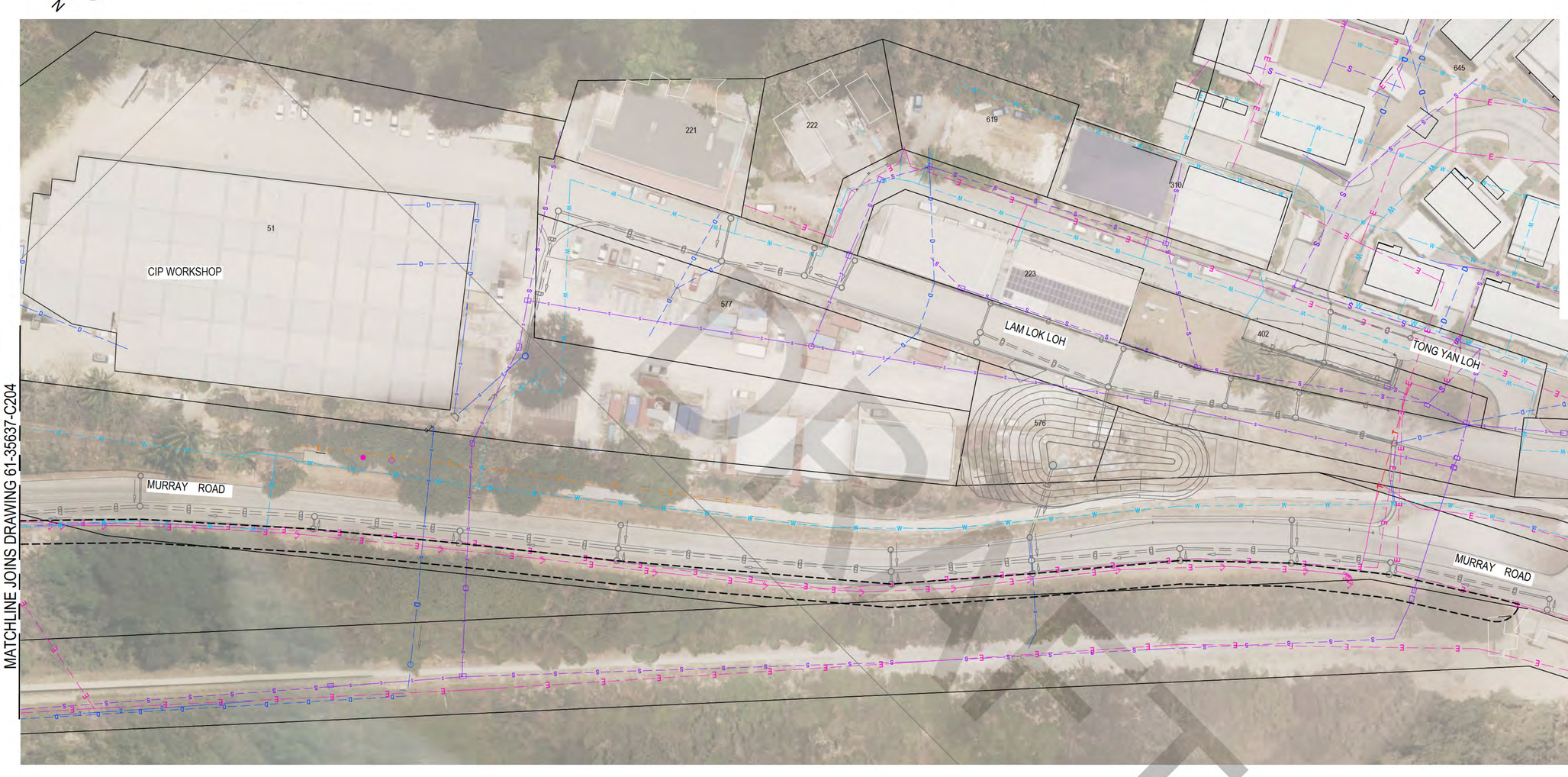

PLAN
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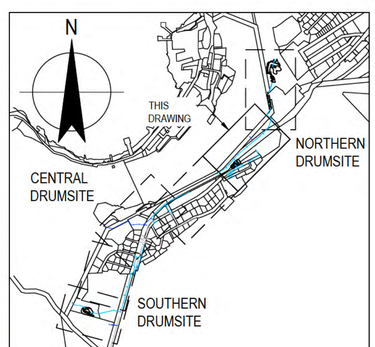

LOCALITY PLAN
N.T.S.

LEGEND:

- PROPOSED DRAINAGE
- PERMITTED CLEARING EXTENT
- EXISTING CADASTRAL BOUNDARY
- EXISTING DRAINAGE
- EXISTING ELECTRICAL CABLE
- EXISTING FUEL LINE
- EXISTING SEWER LINE
- EXISTING TELCO CABLE
- EXISTING WATER PIPE

NOTES:

1. FOR FURTHER SURVEY INFORMATION, REFER TO DRAWINGS 61-35637-V01 SHEETS 1-3.
2. EXISTING SERVICES LOCATIONS ARE INDICATIVE ONLY. CONTRACTOR TO CONFIRM LOCATION, SIZE AND LEVEL PRIOR TO COMMENCING CONSTRUCTION, SHOULD ANY CLASHES BE IDENTIFIED WITH PROPOSED WORKS THE CONTRACTOR IS TO IMMEDIATELY NOTIFY THE CLIENT'S REPRESENTATIVE.
3. EXTENT OF CLEARING PERMITTED. REFER TO SPECIFICATION FOR FURTHER DETAILS AND SETOUT REQUIREMENTS.
4. FOR OTHER NOTES, REFER DRAWING 61-35637-C202.

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SCALE 1:500 AT ORIGINAL SIZE

PRELIMINARY

No	Revision	Note: * indicates signatures on original issue of drawing or last revision of drawing	Drawn	Job Manager	Project Director	Date
B	REISSUED FOR 90% DESIGN - CLIENT COMMENT		GT	JM*	PS*	20/11/20
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Drafting Check	S.HORTON*	Design Check	S. CLEARY*
Approved (Project Director)			
Date			
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Client: DEPT OF INFRASTRUCTURE, TRANSPORT, REGIONAL DEVELOPMENT & COMMUNICATIONS
Project: CHRISTMAS ISLAND STORMWATER REMEDIAL WORKS
Title: NORTHERN DRUMSITE WORKS
EXISTING SERVICES - PLAN - SHEET 2 OF 6

Original Size A1 | Drawing No: 61-35637-C205 | Rev: B

Plot Date: 19 November 2020 - 2:11 PM Plotted by: Jess Overheu Cad File No: \\ghdnet.internal\ghd\AU\Perth\Projects\61\35637\CADD\Drawings\61-35637-C205.dwg

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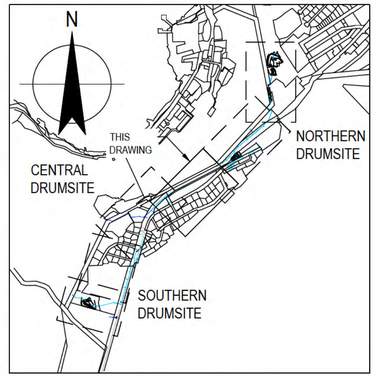
PLAN
SCALE 1:500



LOCALITY PLAN
N.T.S.

NOTES:

1. FOR FURTHER SURVEY INFORMATION, REFER TO DRAWINGS 61-35637-V01 SHEETS 1-3.
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3. FOR OTHER NOTES, REFER DRAWING 61-35637-C202.

LEGEND:

- PROPOSED DRAINAGE
- EXISTING CADASTRAL BOUNDARY
- EXISTING DRAINAGE
- EXISTING ELECTRICAL CABLE
- EXISTING FUEL LINE
- EXISTING SEWER LINE
- EXISTING TELCO CABLE
- EXISTING WATER PIPE
- PROPOSED WATER

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0 5 10 15 20 25m
SCALE 1:500 AT ORIGINAL SIZE

PRELIMINARY

No	Revision	Note: * indicates signatures on original issue of drawing or last revision of drawing	Drawn	Job Manager	Project Director	Date
B	REISSUED FOR 90□ DESIGN - CLIENT COMMENT		GT	JM*	PS*	20/11/20
A	ISSUED FOR 90□ DESIGN - CLIENT COMMENT		JO	JM*	PS*	30/09/20

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Approved (Project Director)			
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Scale	1:500	This Drawing must not be used for Construction unless signed as Approved	

Client: DEPT OF INFRASTRUCTURE, TRANSPORT, REGIONAL DEVELOPMENT & COMMUNICATIONS
Project: CHRISTMAS ISLAND STORMWATER REMEDIAL WORKS
Title: CENTRAL DRUMSITE WORKS
EXISTING SERVICES - PLAN - SHEET 3 OF 6

Original Size: A1
Drawing No: 61-35637-C206
Rev: B

Plot Date: 16 November 2020 - 11:43 AM Plotted by: Giselle Tayam
Cad File No: N:\AU\Perth\Projects\61\35637\CADD\Drawings\61-35637-C206.dwg

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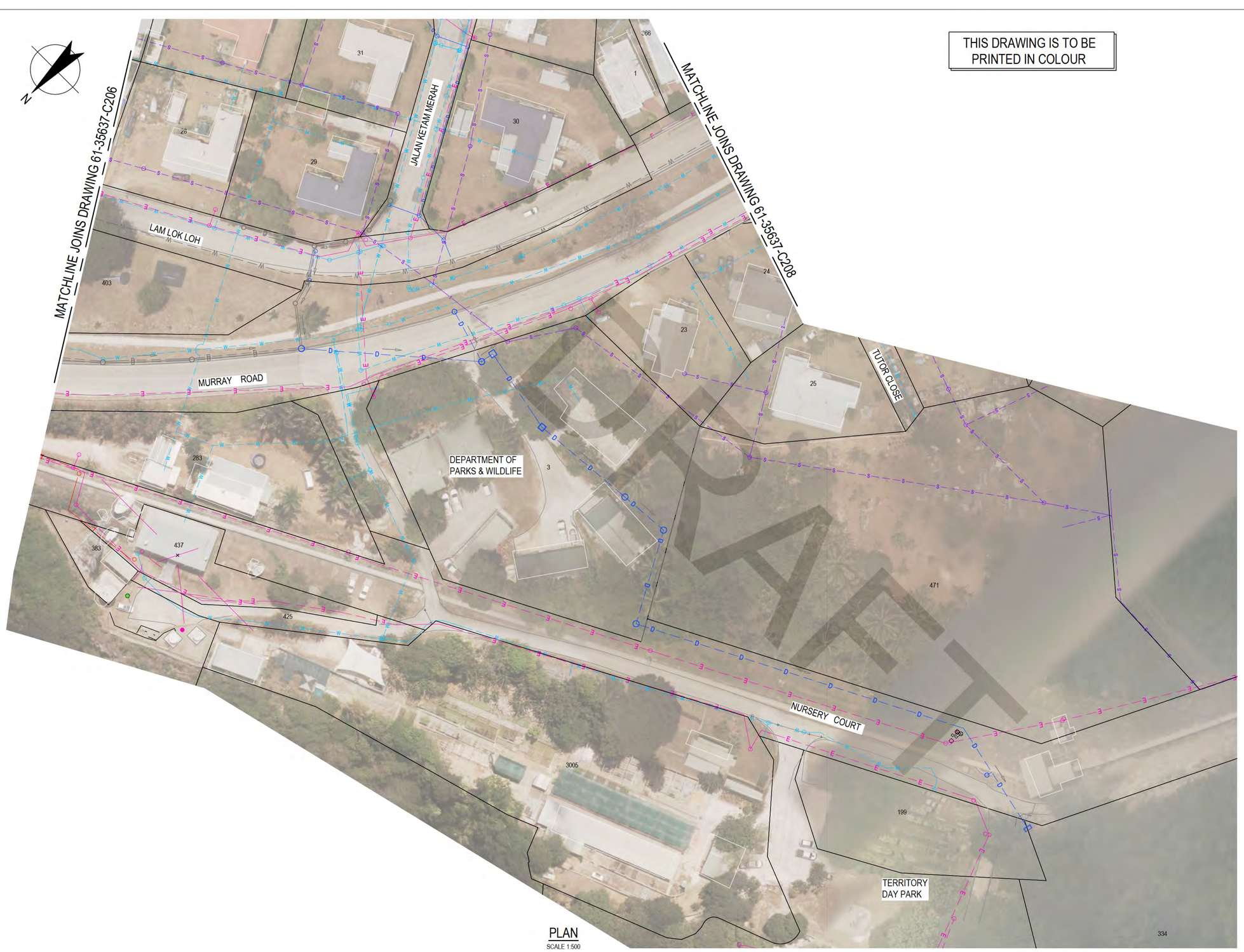
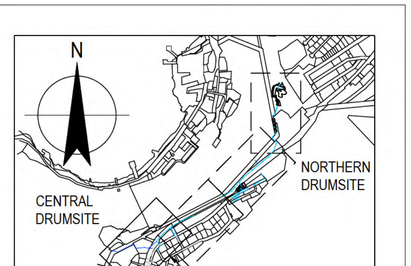


PLAN
SCALE 1:500



LOCALITY PLAN
N.T.S.

NOTES:

1. FOR FURTHER SURVEY INFORMATION, REFER TO DRAWINGS 61-35637-V01 SHEETS 1-3.
2. EXISTING SERVICES LOCATIONS ARE INDICATIVE ONLY. CONTRACTOR TO CONFIRM LOCATION, SIZE AND LEVEL PRIOR TO COMMENCING CONSTRUCTION, SHOULD ANY CLASHES BE IDENTIFIED WITH PROPOSED WORKS THE CONTRACTOR IS TO IMMEDIATELY NOTIFY THE CLIENT'S REPRESENTATIVE.
3. FOR OTHER NOTES, REFER DRAWING 61-35637-C202.

LEGEND:

- D — PROPOSED DRAINAGE
- EXISTING CADASTRAL BOUNDARY
- D — EXISTING DRAINAGE
- E — EXISTING ELECTRICAL CABLE
- F — EXISTING FUEL LINE
- S — EXISTING SEWER LINE
- T — EXISTING TELCO CABLE
- W — EXISTING WATER PIPE
- W — PROPOSED WATERMAIN

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SCALE 1:500 AT ORIGINAL SIZE

PRELIMINARY

No	Revision	Note: * indicates signatures on original issue of drawing or last revision of drawing	Drawn	Job Manager	Project Director	Date
B	REISSUED FOR 90□ DESIGN - CLIENT COMMENT		GT	JM*	PS*	20/11/20
A	ISSUED FOR 90□ DESIGN - CLIENT COMMENT		JO	JM*	PS*	30/09/20

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Drawn	J.OVERHEU	Designer	J.OVERHEU
Drafting Check	S.HORTON*	Design Check	S.CLEARY*
Approved (Project Director)			
Date			
Scale	1:500	This Drawing must not be used for Construction unless signed as Approved	

Client: DEPT OF INFRASTRUCTURE, TRANSPORT, REGIONAL DEVELOPMENT & COMMUNICATIONS
Project: CHRISTMAS ISLAND STORMWATER REMEDIAL WORKS
Title: CENTRAL DRUMSITE WORKS
EXISTING SERVICES - PLAN - SHEET 4 OF 6

Original Size: A1 | Drawing No: 61-35637-C207 | Rev: B

Plot Date: 16 November 2020 - 11:48 AM Plotted by: Giselle Tayam Cad File No: N:\AU\Perth\Projects\61\35637\CADD\Drawings\61-35637-C207.dwg

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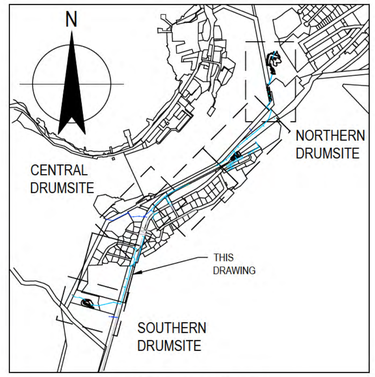
MATCHLINE JOINS DRAWING 61-35637-C207

MATCHLINE JOINS DRAWING 61-35637-C209

PLAN
SCALE 1:500



LOCALITY PLAN
N.T.S.

NOTES:

1. FOR FURTHER SURVEY INFORMATION, REFER TO DRAWINGS 61-35637-V01 SHEETS 1-3.
2. EXISTING SERVICES LOCATIONS ARE INDICATIVE ONLY. CONTRACTOR TO CONFIRM LOCATION, SIZE AND LEVEL PRIOR TO COMMENCING CONSTRUCTION. SHOULD ANY CLASHES BE IDENTIFIED WITH PROPOSED WORKS THE CONTRACTOR IS TO IMMEDIATELY NOTIFY THE CLIENT'S REPRESENTATIVE.
3. EXTENT OF CLEARING PERMITTED. REFER TO SPECIFICATION FOR FURTHER DETAILS AND SETOUT REQUIREMENTS.
4. FOR OTHER NOTES, REFER DRAWING 61-35637-C202.

LEGEND:

- PROPOSED DRAINAGE
- PERMITTED CLEARING EXTENT
- EXISTING CADASTRAL BOUNDARY
- EXISTING DRAINAGE
- EXISTING ELECTRICAL CABLE
- EXISTING FUEL LINE
- EXISTING SEWER LINE
- EXISTING TELCO CABLE
- EXISTING WATER PIPE
- PROPOSED WATER MAIN

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0 5 10 15 20 25m
SCALE 1:500 AT ORIGINAL SIZE

PRELIMINARY

No	Revision	Drawn	Job Manager	Project Director	Date
B	REISSUED FOR 90% DESIGN - CLIENT COMMENT	GT	JM*	PS*	20/11/20
A	ISSUED FOR 90% DESIGN - CLIENT COMMENT	JO	JM*	PS*	30/09/20

Note: * indicates signatures on original issue of drawing or last revision of drawing

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E permail@ghd.com.au W www.ghd.com

DO NOT SCALE

Drawn J.OVERHEU | Designer J.OVERHEU
Drafting Check S.HORTON* | Design Check S.CLEARY*
Approved (Project Director)
Date
Scale 1:500
This Drawing must not be used for Construction unless signed as Approved

Client DEPT OF INFRASTRUCTURE, TRANSPORT, REGIONAL DEVELOPMENT & COMMUNICATIONS
Project CHRISTMAS ISLAND STORMWATER REMEDIAL WORKS
Title SOUTHERN DRUMSITE WORKS
EXISTING SERVICES - PLAN - SHEET 5 OF 6

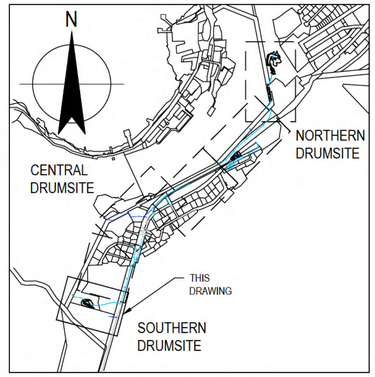
Original Size A1
Drawing No: 61-35637-C208
Rev: B

Plot Date: 19 November 2020 - 2:22 PM Plotted by: Jess Overheu
Cad File No: \\ghdnet.internal\ghd\AU\Perth\Projects\61\35637\CADD\Drawings\61-35637-C208.dwg

N

THIS DRAWING IS TO BE PRINTED IN COLOUR

PLAN
SCALE 1:500



LOCALITY PLAN
N.T.S.

NOTES:

1. FOR FURTHER SURVEY INFORMATION, REFER TO DRAWINGS 61-35637-V01 SHEETS 1-3.
2. EXISTING SERVICES LOCATIONS ARE INDICATIVE ONLY. CONTRACTOR TO CONFIRM LOCATION, SIZE AND LEVEL PRIOR TO COMMENCING CONSTRUCTION. SHOULD ANY CLASHES BE IDENTIFIED WITH PROPOSED WORKS THE CONTRACTOR IS TO IMMEDIATELY NOTIFY THE CLIENT'S REPRESENTATIVE.
3. EXTENT OF CLEARING PERMITTED. REFER TO SPECIFICATION FOR FURTHER DETAILS AND SETOUT REQUIREMENTS.
4. FOR OTHER NOTES, REFER TO DRAWING 61-35637-C202.

LEGEND:

- PROPOSED DRAINAGE
- PERMITTED CLEARING EXTENT
- EXISTING CADASTRAL BOUNDARY
- EXISTING DRAINAGE
- EXISTING ELECTRICAL CABLE
- EXISTING FUEL LINE
- EXISTING SEWER LINE
- EXISTING TELCO CABLE
- EXISTING WATER PIPE
- PROPOSED WATER MAIN

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0 5 10 15 20 25m
SCALE 1:500 AT ORIGINAL SIZE

PRELIMINARY

No	Revision	Note: * indicates signatures on original issue of drawing or last revision of drawing	Drawn	Job Manager	Project Director	Date
B	REISSUED FOR 90% DESIGN - CLIENT COMMENT		GT	JM*	PS*	20/11/20
A	ISSUED FOR 90% DESIGN - CLIENT COMMENT		JO	JM*	PS*	30/09/20

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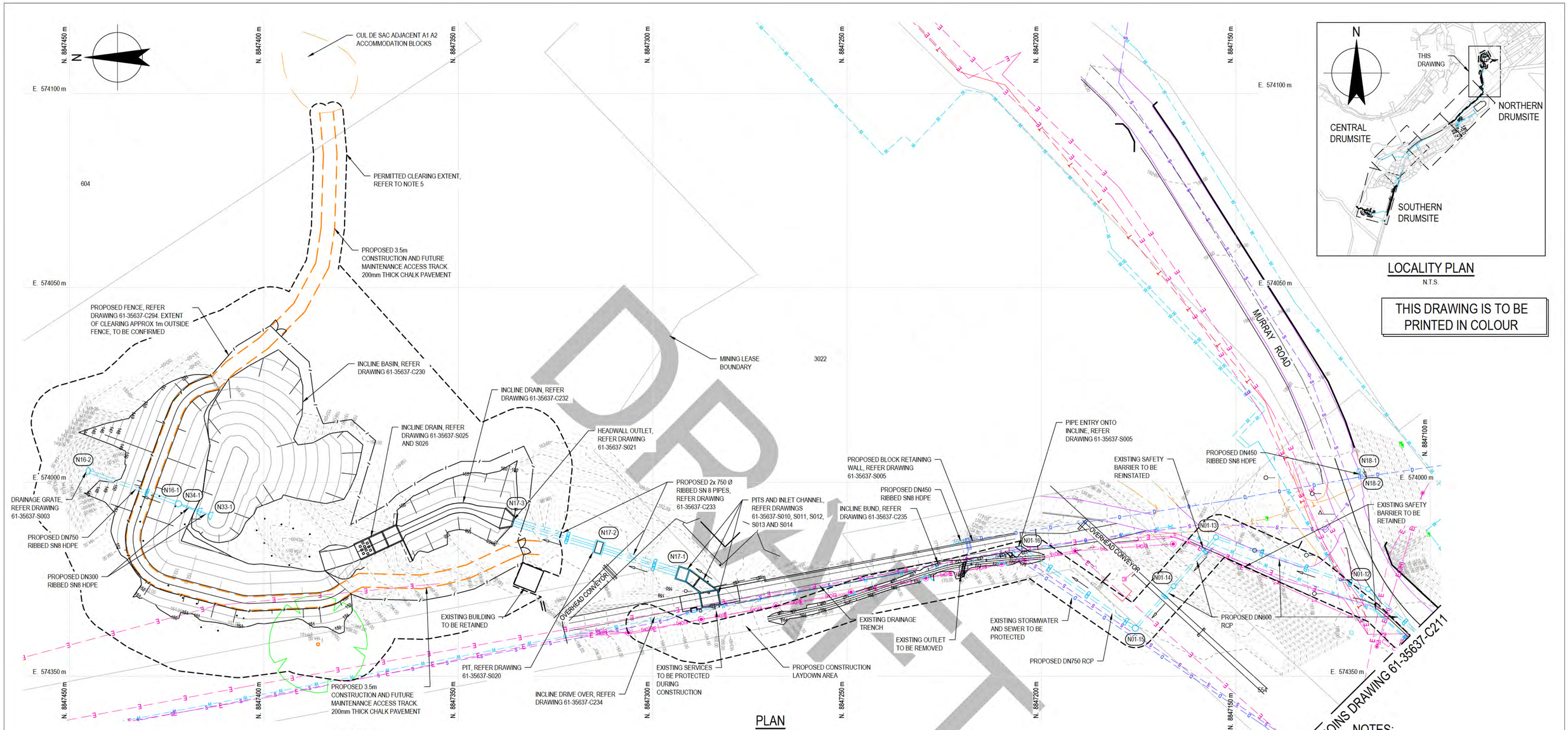
DO NOT SCALE

Drawn	J.OVERHEU	Designer	J.OVERHEU
Drafting Check	S.HORTON*	Design Check	S.CLEARY*
Approved (Project Director)			
Date			
Scale	1:500	This Drawing must not be used for Construction unless signed as Approved	

Client	DEPT OF INFRASTRUCTURE, TRANSPORT, REGIONAL DEVELOPMENT & COMMUNICATIONS
Project	CHRISTMAS ISLAND STORMWATER REMEDIAL WORKS
Title	SOUTHERN DRUMSITE WORKS EXISTING SERVICES - PLAN - SHEET 6 OF 6
Original Size	A1
Drawing No:	61-35637-C209
Rev:	B

Plot Date: 19 November 2020 - 2:25 PM Plotted by: Jess Overheu Cad File No: \\ghdnet.internal\ghd\AU\Perth\Projects\61\35637\CADD\Drawings\61-35637-C209.dwg



LOCALITY PLAN

N.T.S.

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PLAN

SCALE 1:500

LEGEND:

- EXISTING DRAINAGE INFRASTRUCTURE
- EXISTING WATER INFRASTRUCTURE
- EXISTING TREE
- EXISTING COMMS INFRASTRUCTURE
- EXISTING OPTICAL FIBRE MARKER
- EXISTING POWER INFRASTRUCTURE
- EXISTING DRAINAGE GULLY/SEP/MANHOLE
- EXISTING COMMUNICATIONS MANHOLE
- EXISTING SEWER MANHOLE
- EXISTING WATER SERVICE MANHOLE
- EXISTING BOLLARD
- EXISTING GUIDE POST
- EXISTING SIGN
- PROPOSED DRAINAGE
- EXISTING CADASTRAL BOUNDARY
- EXISTING BUILDING
- EXISTING KERB
- EXISTING RETAINING WALL
- PROPOSED FENCE
- EXISTING FENCE LOW
- EXISTING FENCE HIGH
- SETOUT POINT
- EXISTING TOP OF BANK
- EXISTING BOTTOM OF BANK
- EXISTING CHANGE OF GRADE
- EXISTING EDGE OF CONCRETE
- EXISTING EDGE OF BITUMEN
- EXISTING EDGE OF TRACK
- PROPOSED EDGE OF TRACK
- EXISTING ROCK OUTCROP
- EXISTING FOOTPATH
- EXISTING ROAD SHOULDER
- EXISTING ROAD CENTRELINE
- EXISTING DRAIN CENTRELINE
- EXISTING DRAINAGE PIPE
- EXISTING SEWER LINE
- EXISTING ELECTRICAL SERVICE
- EXISTING OVERHEAD POWER
- EXISTING WATER PIPE
- EXISTING TELECOM
- EXISTING CONTOURS
- PROPOSED CONTOURS
- PROPOSED CONCRETE ENCASEMENT
- EXISTING BUSHLINE
- EXISTING TREE
- PERMITTED CLEARING EXTENT
- EMBANKMENT CORE
- PAVEMENT REINSTATEMENT EXTENT & DRIVEWAY ACCESS
- ROCK PROTECTION
- CHALK LINER
- FOOTPATH REINSTATED
- ROCK SCOUR PROTECTION
- BIODEGRADABLE MATTING PROTECTION
- N01-1 DRAINAGE PIT LABEL
- SMH SEWER PIT LABEL
- PREVIOUS SITE INVESTIGATION LOCATION (APPROX.)
- PROPOSED ADDITIONAL BOREHOLES
- PREVIOUS TEST PITS (APPROX.)

DRAINAGE STRUCTURE SET OUT

STRUCTURE NUMBER	NORTHING (m)	EASTING (m)	PIT SIZE (mm) & TYPE
N01-12	8847115.95	573972.42	1200 MANHOLE
N01-13	8847155.11	573985.79	1200 MANHOLE
N01-14	8847166.05	573973.17	1200 MANHOLE
N01-15	8847175.86	573962.40	1500 MANHOLE
N01-16	8847206.01	573983.46	REFER DRAWING S005
N16-1	8847421.98	573994.40	1500 HIGH FLOW PIT
N16-2	8847444.83	574002.65	HEADWALL
N17-1	8847292.35	573976.31	REFER DRAWING S010
N17-2	8847313.88	573983.19	REFER DRAWING S020
N17-3	8847336.62	573990.04	REFER DRAWING S021
N18-1	8847117.84	574001.36	1200 COMBINATION PIT
N18-2	8847118.34	574002.92	EXISTING PIT
N33-1	8847414.19	573991.59	HEADWALL
N34-1	8847417.02	573992.61	HEADWALL

NOTES:

1. REFER TO PIPE LONGITUDINAL SECTION DRAWINGS FOR DETAILS OF PIT AND PIPE LEVELS.
2. FOR FURTHER SURVEY INFORMATION, REFER TO DRAWINGS 61-35637-V01 SHEETS 1-3.
3. EXISTING SERVICES LOCATIONS ARE INDICATIVE ONLY. CONTRACTOR TO CONFIRM LOCATION, SIZE AND LEVEL PRIOR TO COMMENCING CONSTRUCTION, SHOULD ANY CLASHES BE IDENTIFIED WITH PROPOSED WORKS THE CONTRACTOR IS TO IMMEDIATELY NOTIFY THE CLIENT'S REPRESENTATIVE.
4. EXISTING COMMUNICATIONS INFORMATION IS INCOMPLETE. VERIFICATION OF PRESENCE THROUGHOUT SITE REQUIRED PRIOR TO COMMENCING CONSTRUCTION.
5. EXTENT OF CLEARING PERMITTED. REFER TO SPECIFICATION FOR FURTHER DETAILS AND SETOUT REQUIREMENTS.

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0 5 10 15 20 25m

SCALE 1:500 AT ORIGINAL SIZE

PRELIMINARY

No	Revision	Note: * indicates signatures on original issue of drawing or last revision of drawing	Drawn	Job Manager	Project Director	Date
B	REISSUED FOR 90% DESIGN - CLIENT COMMENT		GT	JM*	PS*	20/11/20
A	ISSUED FOR 90% DESIGN - CLIENT COMMENT		JO	JM*	PS*	30/09/20

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DO NOT SCALE

Drawn	J.OVERHEU	Designer	A.PARAMESWARAN
Drafting Check	S.HORTON*	Design Check	S.CLEARY*
Approved (Project Director)			
Date			
Scale	1:500	This Drawing must not be used for Construction unless signed as Approved	

Client: DEPT OF INFRASTRUCTURE, TRANSPORT, REGIONAL DEVELOPMENT & COMMUNICATIONS
Project: CHRISTMAS ISLAND STORMWATER REMEDIAL WORKS
Title: NORTHERN DRUMSITE WORKS
PLAN - SHEET 1

Original Size A1 | Drawing No: 61-35637-C210 | Rev: B

Plot Date: 19 November 2020 - 1:50 PM | Plotted by: Jess Overheu | Cad File No: \\ghdnet.internal\ghd\AU\Perth\Projects\61\35637\CADD\Drawings\61-35637-C210.dwg

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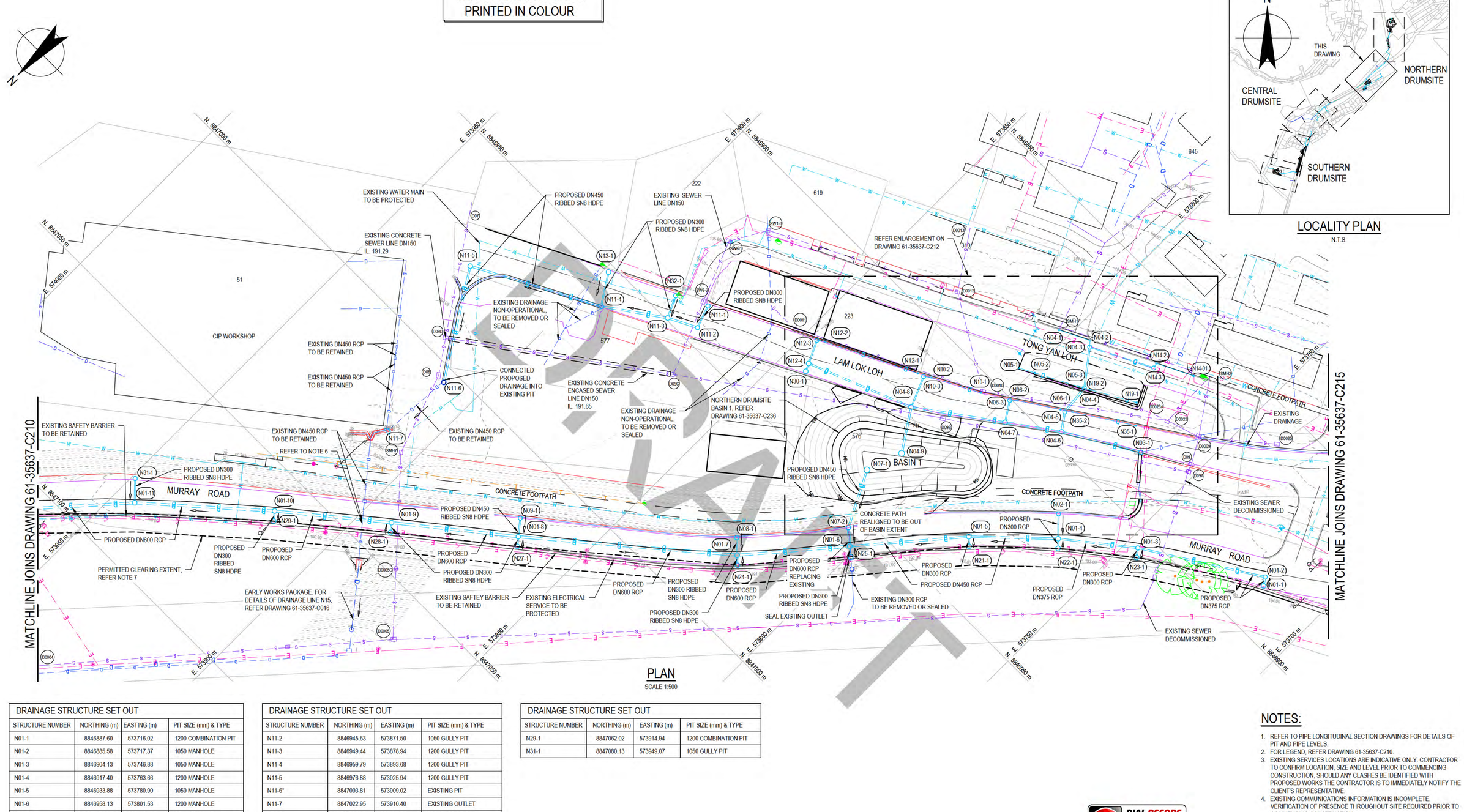

LOCALITY PLAN
N.T.S.

PLAN
SCALE 1:500

DRAINAGE STRUCTURE SET OUT			
STRUCTURE NUMBER	NORTHING (m)	EASTING (m)	PIT SIZE (mm) & TYPE
N01-1	8846887.60	573716.02	1200 COMBINATION PIT
N01-2	8846885.58	573717.37	1050 MANHOLE
N01-3	8846904.13	573746.88	1050 MANHOLE
N01-4	8846917.40	573763.66	1200 MANHOLE
N01-5	8846933.88	573780.90	1050 MANHOLE
N01-6	8846958.13	573801.53	1200 MANHOLE
N01-7	8846981.08	573821.08	1200 MANHOLE
N01-8	8847018.85	573865.86	1200 MANHOLE
N01-9	8847040.11	573892.43	1200 MANHOLE
N01-10	8847059.95	573916.64	1200 MANHOLE
N01-11	8847084.81	573944.59	1200 MANHOLE
N08-1	8846977.83	573824.46	1050 GULLY PIT
N09-1	8847014.94	573868.99	1050 GULLY PIT
N11-1	8846939.54	573873.59	1050 GULLY PIT

DRAINAGE STRUCTURE SET OUT			
STRUCTURE NUMBER	NORTHING (m)	EASTING (m)	PIT SIZE (mm) & TYPE
N11-2	8846945.63	573871.50	1050 GULLY PIT
N11-3	8846949.44	573878.94	1200 GULLY PIT
N11-4	8846959.79	573893.68	1200 GULLY PIT
N11-5	8846976.88	573925.94	1200 GULLY PIT
N11-6*	8847003.81	573909.02	EXISTING PIT
N11-7	8847022.95	573910.40	EXISTING OUTLET
N13-1	8846951.91	573898.73	1050 GULLY PIT
N21-1	8846935.67	573779.07	1200 COMBINATION PIT
N22-1	8846919.27	573761.82	1200 COMBINATION PIT
N23-1	8846906.13	573745.32	1200 COMBINATION PIT
N24-1	8846982.91	573819.12	1200 COMBINATION PIT
N25-1*	8846959.99	573799.35	1200 COMBINATION PIT
N27-1	8847020.88	573864.22	1200 COMBINATION PIT
N28-1	8847042.12	573890.75	1200 COMBINATION PIT

DRAINAGE STRUCTURE SET OUT			
STRUCTURE NUMBER	NORTHING (m)	EASTING (m)	PIT SIZE (mm) & TYPE
N29-1	8847062.02	573914.94	1200 COMBINATION PIT
N31-1	8847080.13	573949.07	1050 GULLY PIT

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NOTES:

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2. FOR LEGEND, REFER DRAWING 61-35637-C210.
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4. EXISTING COMMUNICATIONS INFORMATION IS INCOMPLETE. VERIFICATION OF PRESENCE THROUGHOUT SITE REQUIRED PRIOR TO COMMENCING CONSTRUCTION.
5. * EXISTING PIT TO BE REPLACE IF REQUIRED.
6. PROPOSED CROSSING OF EXISTING MAIN WITHOUT CONNECTION. LEVELS OF EXISTING TO BE CONFIRMED PRIOR TO N1 PIPELINE CONSTRUCTION COMMENCING.
7. EXTENT OF CLEARING PERMITTED. REFER TO SPECIFICATION FOR FURTHER DETAILS AND SETOUT REQUIREMENTS.

0 5 10 15 20 25m
SCALE 1:500 AT ORIGINAL SIZE

PRELIMINARY

No	Revision	Note: * indicates signatures on original issue of drawing or last revision of drawing	Drawn	Job Manager	Project Director	Date
B	REISSUED FOR 90% DESIGN - CLIENT COMMENT		GT	JM*	PS*	20/11/20
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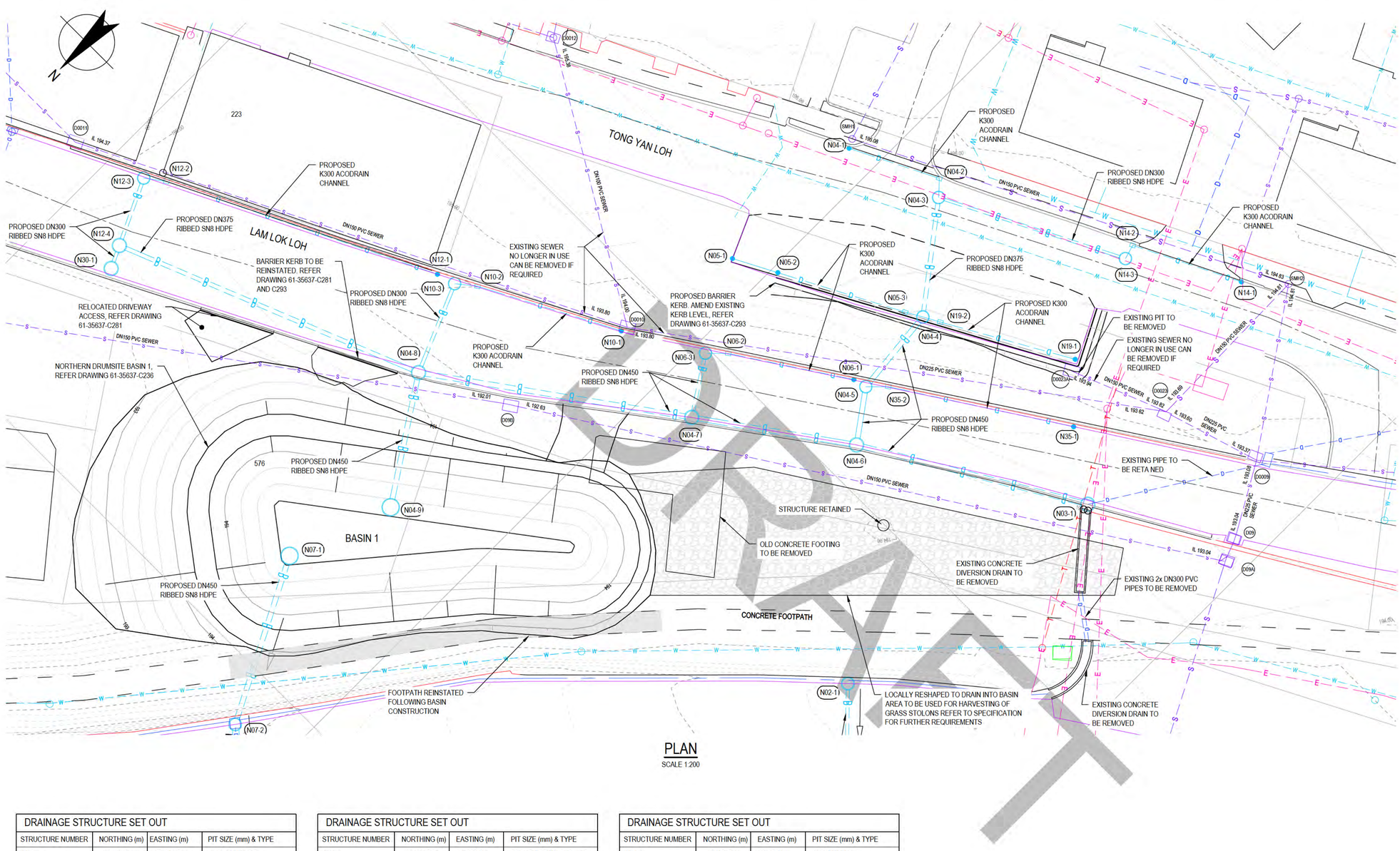
DO NOT SCALE

Drawn	J.OVERHEU	Designer	A.PARAMESWARAN
Drafting Check	S.HORTON*	Design Check	S.CLEARY*
Approved (Project Director)			
Date			
Scale	1:500	This Drawing must not be used for Construction unless signed as Approved	

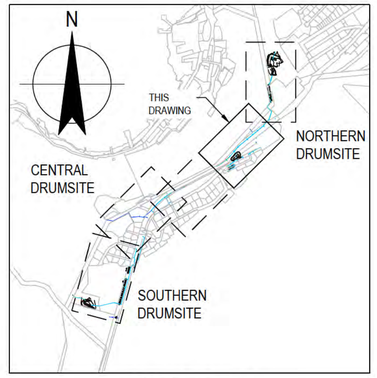
Client: DEPT OF INFRASTRUCTURE, TRANSPORT, REGIONAL DEVELOPMENT & COMMUNICATIONS
Project: CHRISTMAS ISLAND STORMWATER REMEDIAL WORKS
Title: NORTHERN DRUMSITE WORKS PLAN - SHEET 2

Original Size A1 | Drawing No: 61-35637-C211 | Rev: B

Plot Date: 19 November 2020 - 1:51 PM | Plotted by: Jess Overheu | Cad File No: \\ghdnet.internal\ghd\AU\Perth\Projects\61\35637\CADD\Drawings\61-35637-C211.dwg



PLAN
SCALE 1:200



LOCALITY PLAN
N.T.S.

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DRAINAGE STRUCTURE SET OUT			
STRUCTURE NUMBER	NORTHING (m)	EASTING (m)	PIT SIZE (mm) & TYPE
N02-1	8846912.64	573768.28	1050 GULLY PIT
N03-1*	8846885.52	573764.36	1200 COMBINATION PIT
N04-1	8846877.92	573802.85	TRENCH DRAIN END CAP
N04-2	8846874.03	573795.05	TRENCH DRAIN INLINE PIT
N04-3	8846875.32	573793.86	1050 MANHOLE
N04-4	8846883.81	573787.15	1200 COMBINATION PIT
N04-5	8846892.27	573786.33	1050 MANHOLE
N04-6	8846896.63	573783.16	1200 COMBINATION PIT
N04-7	8846905.52	573795.60	1200 COMBINATION PIT
N04-8	8846920.30	573816.18	1200 COMBINATION PIT
N04-9	8846930.81	573809.27	1500 HIGH FLOW PIT
N05-1	8846892.61	573803.25	TRENCH DRAIN END CAP
N05-2	8846890.58	573799.40	SETOUT POINT
N05-3	8846884.90	573788.61	TRENCH DRAIN INLINE PIT

DRAINAGE STRUCTURE SET OUT			
STRUCTURE NUMBER	NORTHING (m)	EASTING (m)	PIT SIZE (mm) & TYPE
N06-1	8846892.58	573787.56	TRENCH DRAIN END CAP
N06-2	8846899.02	573797.38	TRENCH DRAIN INLINE PIT
N06-3	8846900.47	573798.87	1050 GULLY PIT
N07-1	8846940.50	573812.67	1500 HIGH FLOW PIT
N07-2*	8846954.93	573805.28	1050 GULLY PIT
N10-1	8846904.48	573805.76	TRENCH DRAIN END CAP
N10-2	8846910.88	573817.96	TRENCH DRAIN INLINE PIT
N10-3	8846912.21	573819.60	1050 MANHOLE
N12-1	8846912.71	573821.33	TRENCH DRAIN END CAP
N12-2	8846924.30	573844.87	TRENCH DRAIN INLINE PIT
N12-3	8846925.49	573846.55	1050 GULLY PIT
N12-4	8846931.43	573843.76	1200 MANHOLE
N14-1	8846861.18	573768.81	TRENCH DRAIN END CAP
N14-2	8846865.85	573778.21	TRENCH DRAIN INLINE PIT

DRAINAGE STRUCTURE SET OUT			
STRUCTURE NUMBER	NORTHING (m)	EASTING (m)	PIT SIZE (mm) & TYPE
N14-3	8846867.18	573777.81	1050 MANHOLE
N19-1	8846876.95	573774.55	TRENCH DRAIN END CAP
N19-2	8846883.26	573785.70	TRENCH DRAIN INLINE PIT
N30-1	8846933.45	573842.81	1200 COMBINATION PIT
N35-1	8846881.41	573770.29	TRENCH DRAIN END CAP
N35-2	8846890.82	573784.87	TRENCH DRAIN INLINE PIT

NOTES:

1. REFER TO PIPE LONGITUDINAL SECTION DRAWINGS FOR DETAILS OF PIT AND PIPE LEVELS.
2. FOR LEGEND, REFER DRAWING 61-35637-C210.
3. EXISTING SERVICES LOCATIONS ARE INDICATIVE ONLY. CONTRACTOR TO CONFIRM LOCATION, SIZE AND LEVEL PRIOR TO COMMENCING CONSTRUCTION, SHOULD ANY CLASHES BE IDENTIFIED WITH PROPOSED WORKS THE CONTRACTOR IS TO IMMEDIATELY NOTIFY THE CLIENT'S REPRESENTATIVE.
4. EXISTING COMMUNICATIONS INFORMATION IS INCOMPLETE. VERIFICATION OF PRESENCE THROUGHOUT SITE REQUIRED PRIOR TO COMMENCING CONSTRUCTION.
5. * EXISTING PIT TO BE REPLACE IF REQUIRED.
6. LOCATION OF EXISTING ELECTRICAL LINE TO BE CONFIRMED PRIOR TO CONSTRUCTION POSITION SHOWN INDICATIVE ONLY.

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0 2 4 6 8 10m
SCALE 1:200 AT ORIGINAL SIZE

PRELIMINARY

No	Revision	Note: * indicates signatures on original issue of drawing or last revision of drawing	Drawn	Job Manager	Project Director	Date
B	REISSUED FOR 90□ DESIGN - CLIENT COMMENT		GT	JM*	PS*	20/11/20
A	ISSUED FOR 90□ DESIGN - CLIENT COMMENT		JO	JM*	PS*	30/09/20

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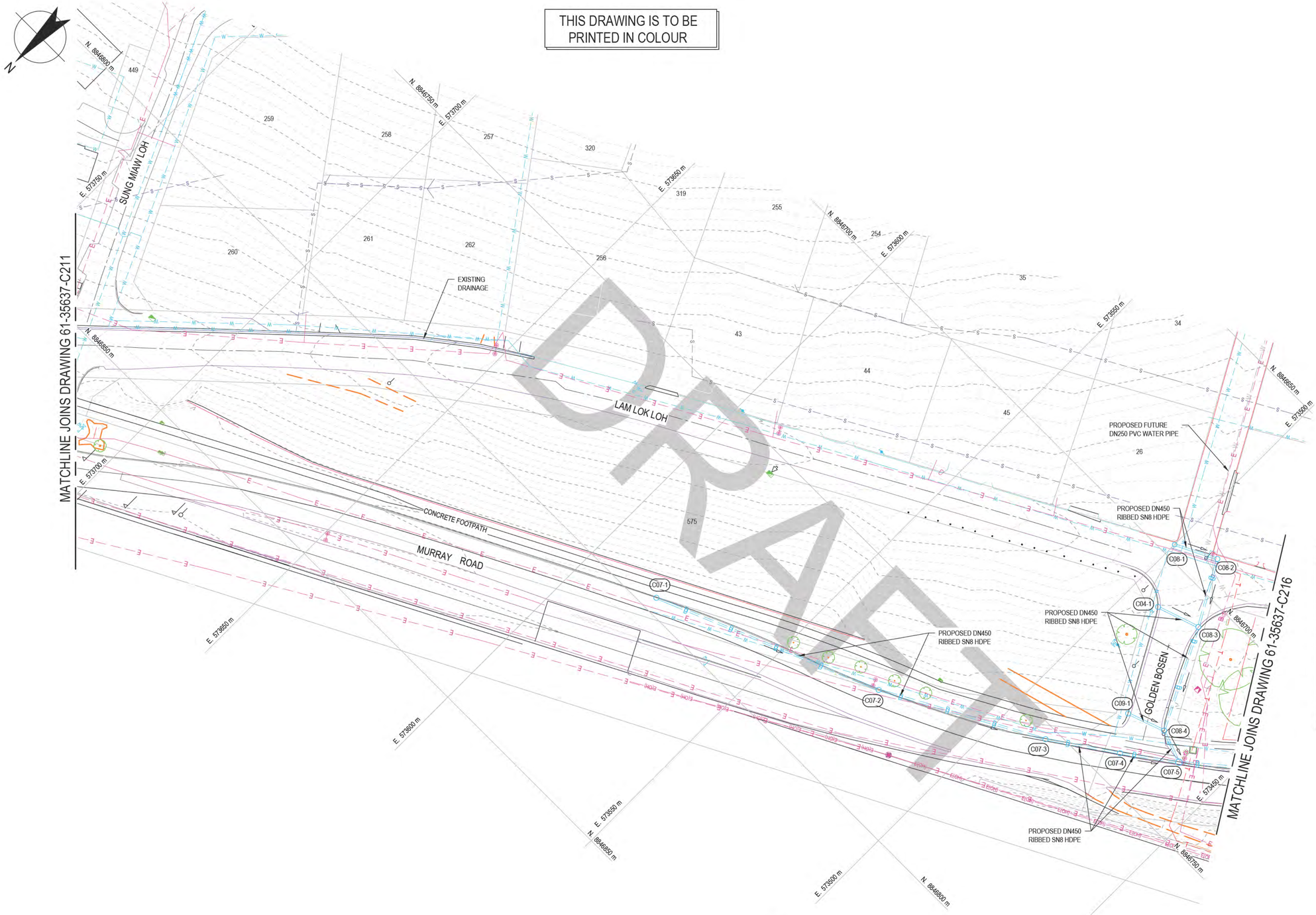
Drawn	J.OVERHEU	Designer	A.PARAMESWARAN
Drafting Check	S.HORTON*	Design Check	S.CLEARY*
Approved (Project Director)			
Date			
Scale	1:200	This Drawing must not be used for Construction unless signed as Approved	

Client: DEPT OF INFRASTRUCTURE, TRANSPORT, REGIONAL DEVELOPMENT & COMMUNICATIONS
Project: CHRISTMAS ISLAND STORMWATER REMEDIAL WORKS
Title: NORTHERN DRUMSITE WORKS PLAN - SHEET 3

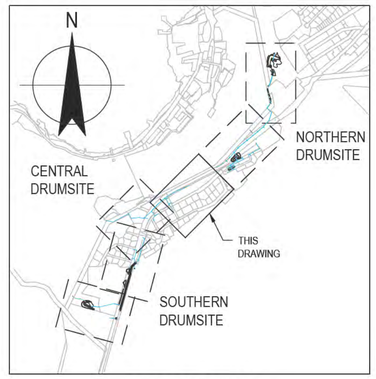
Original Size: A1
Drawing No: 61-35637-C212
Rev: B

Plot Date: 18 November 2020 - 8:02 AM Plotted by: Giselle Tayam
Cad File No: N:\AU\Perth\Projects\61\35637\CADD\Drawings\61-35637-C212.dwg

THIS DRAWING IS TO BE PRINTED IN COLOUR



PLAN
SCALE 1:500



LOCALITY PLAN
N.T.S.

DRAINAGE STRUCTURE SET OUT			
STRUCTURE NUMBER	NORTHING (m)	EASTING (m)	PIT SIZE (mm) & TYPE
C07-1	8846796.37	573580.95	1200 COMBINATION PIT
C07-2	8846773.69	573526.19	1200 COMBINATION PIT
C07-3	8846753.21	573488.52	1200 COMBINATION PIT
C07-4	8846742.69	573473.11	1200 GULLY PIT
C07-5	8846733.99	573461.27	1500 COMBINATION
C08-1	8846696.82	573499.94	1050 GULLY PIT
C08-2	8846691.88	573490.00	1050 GULLY PIT
C08-3	8846707.04	573481.44	1200 COMBINATION PIT
C08-4	8846731.07	573469.37	1200 COMBINATION PIT
C04-1	8846710.58	573491.95	1200 COMBINATION PIT
C09-1	8846734.34	573478.63	1200 COMBINATION PIT

NOTES:

1. REFER TO PIPE LONGITUDINAL SECTION DRAWINGS FOR DETAILS OF PIT AND PIPE LEVELS.
2. FOR LEGEND, REFER DRAWING 61-35637-C210.
3. EXISTING SERVICES LOCATIONS ARE INDICATIVE ONLY. CONTRACTOR TO CONFIRM LOCATION, SIZE AND LEVEL PRIOR TO COMMENCING CONSTRUCTION, SHOULD ANY CLASHES BE IDENTIFIED WITH PROPOSED WORKS THE CONTRACTOR IS TO IMMEDIATELY NOTIFY THE CLIENT'S REPRESENTATIVE.
4. EXISTING COMMUNICATIONS INFORMATION IS INCOMPLETE. VERIFICATION OF PRESENCE THROUGHOUT SITE REQUIRED PRIOR TO COMMENCING CONSTRUCTION.

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ALL COORDINATES SHOWN ON THIS DRAWING SHALL BE VERIFIED BY CONTRACTOR PRIOR TO COMMENCEMENT OF WORKS. ANY DISCREPANCIES TO BE REPORTED TO THE ENGINEER IMMEDIATELY.

0 5 10 15 20 25m
SCALE 1:500 AT ORIGINAL SIZE

PRELIMINARY

No	Revision	Note: * indicates signatures on original issue of drawing or last revision of drawing	Drawn	Job Manager	Project Director	Date
B	REISSUED FOR 90□ DESIGN - CLIENT COMMENT		GT	JM*	PS*	20/11/20
A	ISSUED FOR 90□ DESIGN - CLIENT COMMENT		JO	JM*	PS*	30/09/20

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DO NOT SCALE

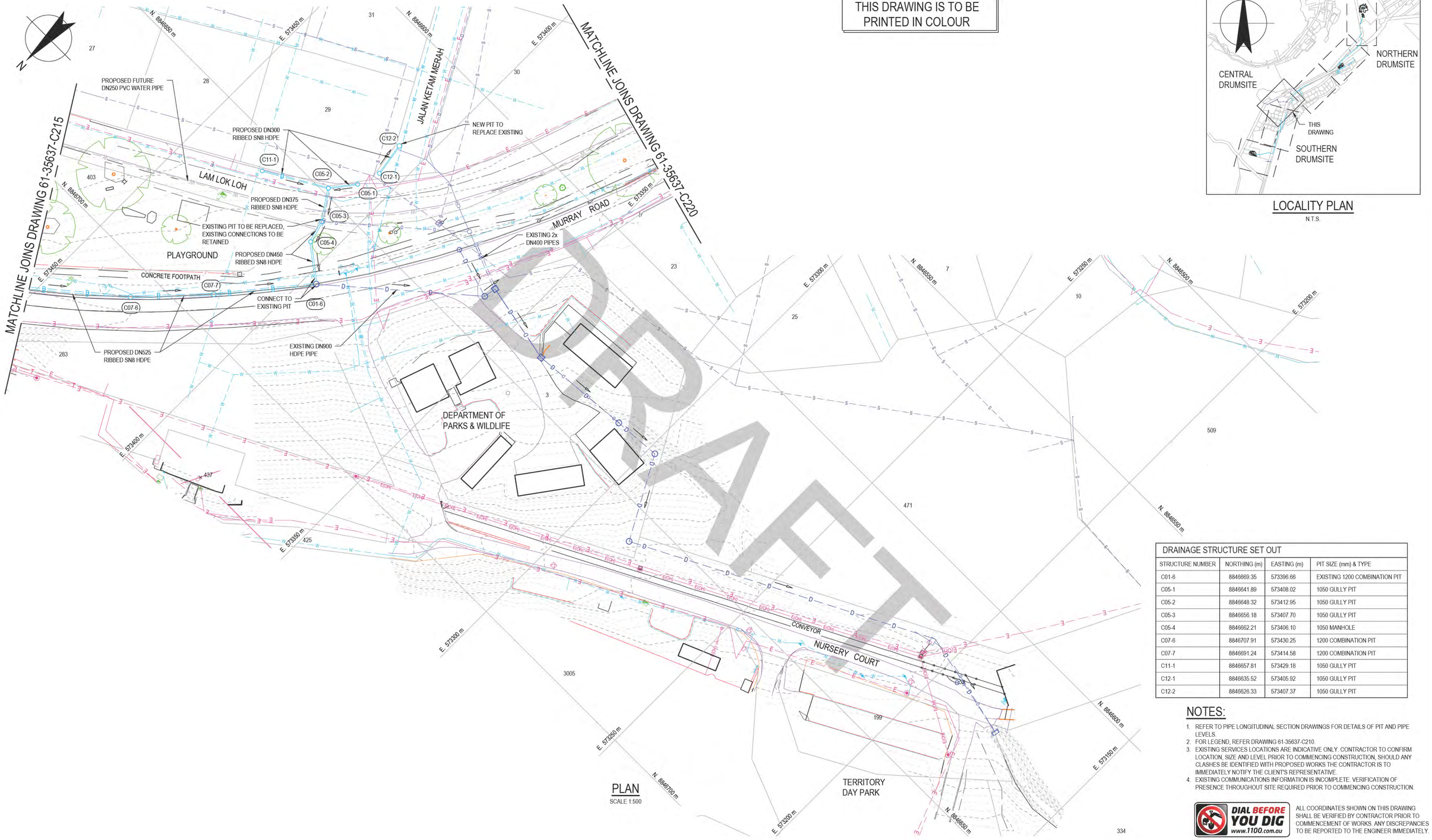
Drawn	J.OVERHEU	Designer	A.PARAMESWARAN
Drafting Check	S.HORTON*	Design Check	S.CLEARY*
Approved (Project Director)			
Date			
Scale	1:500	This Drawing must not be used for Construction unless signed as Approved	

Client: DEPT OF INFRASTRUCTURE, TRANSPORT, REGIONAL DEVELOPMENT & COMMUNICATIONS
Project: CHRISTMAS ISLAND STORMWATER REMEDIAL WORKS
Title: CENTRAL DRUMSITE WORKS
PLAN - SHEET 1

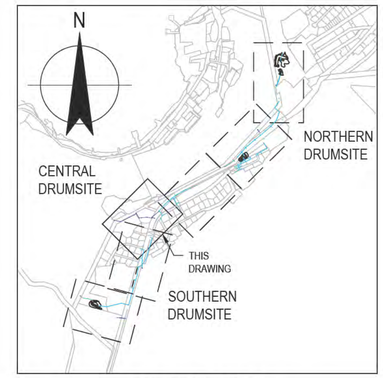
Original Size: A1
Drawing No: 61-35637-C215
Rev: B

Plot Date: 17 November 2020 - 4:02 AM Plotted by: Giselle Tayam Cad File No: \\ghdnet\ghd\PH\Manila\Projects\61\35637\CADD\Drawings\61-35637-C215.dwg

THIS DRAWING IS TO BE PRINTED IN COLOUR



PLAN
SCALE 1:500



LOCALITY PLAN
N.T.S.

DRAINAGE STRUCTURE SET OUT			
STRUCTURE NUMBER	NORTHING (m)	EASTING (m)	PIT SIZE (mm) & TYPE
C01-6	8846669.35	573396.66	EXISTING 1200 COMBINATION PIT
C05-1	8846641.89	573408.02	1050 GULLY PIT
C05-2	8846648.32	573412.95	1050 GULLY PIT
C05-3	8846656.18	573407.70	1050 GULLY PIT
C05-4	8846662.21	573406.10	1050 MANHOLE
C07-6	8846707.91	573430.25	1200 COMBINATION PIT
C07-7	8846691.24	573414.58	1200 COMBINATION PIT
C11-1	8846657.81	573429.18	1050 GULLY PIT
C12-1	8846635.52	573405.92	1050 GULLY PIT
C12-2	8846626.33	573407.37	1050 GULLY PIT

NOTES:

1. REFER TO PIPE LONGITUDINAL SECTION DRAWINGS FOR DETAILS OF PIT AND PIPE LEVELS.
2. FOR LEGEND, REFER DRAWING 61-35637-C210.
3. EXISTING SERVICES LOCATIONS ARE INDICATIVE ONLY. CONTRACTOR TO CONFIRM LOCATION, SIZE AND LEVEL PRIOR TO COMMENCING CONSTRUCTION, SHOULD ANY CLASHES BE IDENTIFIED WITH PROPOSED WORKS THE CONTRACTOR IS TO IMMEDIATELY NOTIFY THE CLIENT'S REPRESENTATIVE.
4. EXISTING COMMUNICATIONS INFORMATION IS INCOMPLETE. VERIFICATION OF PRESENCE THROUGHOUT SITE REQUIRED PRIOR TO COMMENCING CONSTRUCTION.

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0 5 10 15 20 25m
SCALE 1:500 AT ORIGINAL SIZE

PRELIMINARY

No	Revision	Note: * indicates signatures on original issue of drawing or last revision of drawing	Drawn	Job Manager	Project Director	Date
B	REISSUED FOR 90% DESIGN - CLIENT COMMENT		GT	JM*	PS*	20/11/20
A	ISSUED FOR 90% DESIGN - CLIENT COMMENT		JO	JM*	PS*	30/09/20

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E permail@ghd.com.au W www.ghd.com

DO NOT SCALE

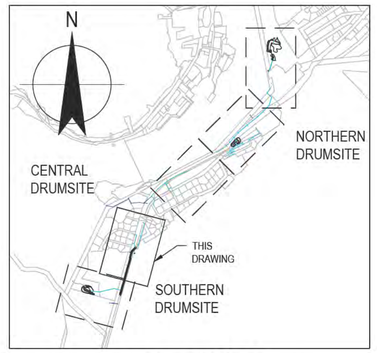
Drawn	J.OVERHEU	Designer	A.PARAMESWARAN
Drafting Check	S.HORTON*	Design Check	S.CLEARY*
Approved (Project Director)			
Date			
Scale	1:500	This Drawing must not be used for Construction unless signed as Approved	

Client: DEPT OF INFRASTRUCTURE, TRANSPORT, REGIONAL DEVELOPMENT & COMMUNICATIONS
Project: CHRISTMAS ISLAND STORMWATER REMEDIAL WORKS
Title: CENTRAL DRUMSITE WORKS PLAN - SHEET 2

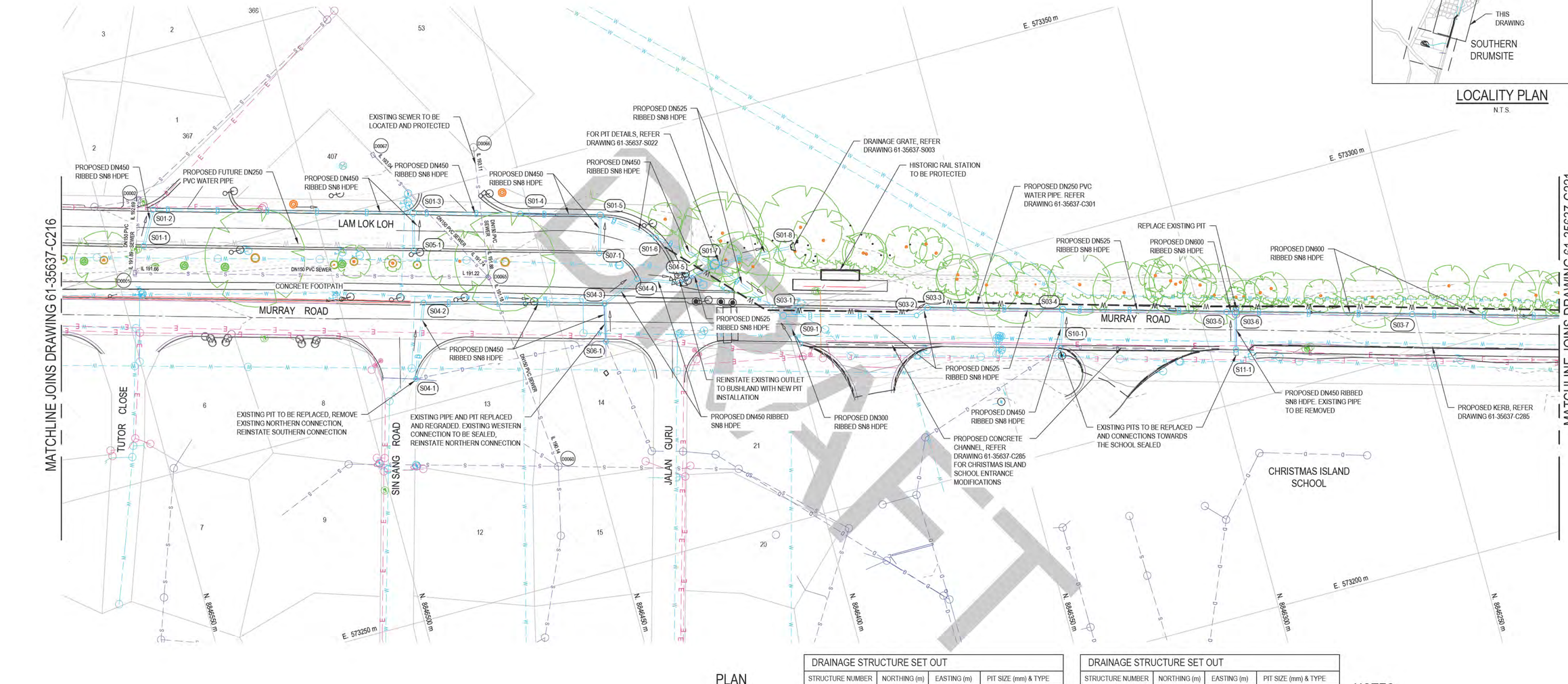
Original Size A1 | Drawing No: 61-35637-C216 | Rev: B

Plot Date: 19 November 2020 - 9:53 AM Plotted by: Jess Overheu Cad File No: \\ghdnet\ghd\PH\Manila\Projects\61\35637\CADD\Drawings\61-35637-C216.dwg

THIS DRAWING IS TO BE PRINTED IN COLOUR



LOCALITY PLAN
N.T.S.



PLAN
SCALE 1:500

DRAINAGE STRUCTURE SET OUT			
STRUCTURE NUMBER	NORTHING (m)	EASTING (m)	PIT SIZE (mm) & TYPE
S01-1	8846541.95	573354.89	1200 COMBINATION PIT
S01-2	8846537.50	573362.78	1200 COMBINATION PIT
S01-3	8846475.90	573345.41	1500 GULLY PIT
S01-4	8846452.22	573338.93	1200 COMBINATION PIT
S01-5	8846433.64	573333.52	1500 COMBINATION PIT
S01-6	8846422.07	573324.84	1200 COMBINATION PIT
S01-7	8846409.97	573314.92	2100 MANHOLE
S01-8	8846391.15	573314.15	HEADWALL
S03-1	8846397.23	573298.75	1500 MANHOLE
S03-2	8846366.13	573290.44	1050 MANHOLE
S03-3	8846363.08	573291.53	1200 COMBINATION PIT
S03-4	8846331.68	573282.65	1500 COMBINATION PIT
S03-5	8846293.70	573271.91	1200 COMBINATION PIT

DRAINAGE STRUCTURE SET OUT			
STRUCTURE NUMBER	NORTHING (m)	EASTING (m)	PIT SIZE (mm) & TYPE
S03-6	8846291.57	573271.35	1200 COMBINATION PIT
S03-7	8846250.56	573259.77	1500 COMBINATION PIT
S04-1	8846486.72	573306.91	1050 GULLY PIT
S04-2	8846480.27	573324.16	1200 COMBINATION PIT
S04-3	8846438.11	573312.72	1200 COMBINATION PIT
S04-4	8846429.00	573316.43	1200 GULLY PIT
S04-5	8846419.33	573312.84	1200 GULLY PIT
S05-1	8846478.64	573336.82	1200 COMBINATION PIT
S06-1	8846440.17	573303.76	1200 COMBINATION PIT
S07-1	8846436.21	573324.78	1200 COMBINATION PIT
S09-1	8846395.04	573291.16	1200 COMBINATION PIT
S10-1	8846334.70	573273.88	1200 COMBINATION PIT
S11-1	8846293.82	573262.59	1200 COMBINATION PIT

NOTES:

1. REFER TO PIPE LONGITUDINAL SECTION DRAWINGS FOR DETAILS OF PIT AND PIPE LEVELS.
2. FOR LEGEND, REFER DRAWING 61-35637-C210.
3. EXISTING SERVICES LOCATIONS ARE INDICATIVE ONLY. CONTRACTOR TO CONFIRM LOCATION, SIZE AND LEVEL PRIOR TO COMMENCING CONSTRUCTION. SHOULD ANY CLASHES BE IDENTIFIED WITH PROPOSED WORKS THE CONTRACTOR IS TO IMMEDIATELY NOTIFY THE PRINCIPAL'S REPRESENTATIVE.
4. EXISTING COMMUNICATIONS INFORMATION IS INCOMPLETE. VERIFICATION OF PRESENCE THROUGHOUT SITE REQUIRED PRIOR TO COMMENCING CONSTRUCTION.

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0 5 10 15 20 25m
SCALE 1:500 AT ORIGINAL SIZE

PRELIMINARY

No	Revision	Note: * indicates signatures on original issue of drawing or last revision of drawing	Drawn	Job Manager	Project Director	Date
A	ISSUED FOR 90□ DESIGN - CLIENT COMMENT		JO	JM*	PS*	30/09/20

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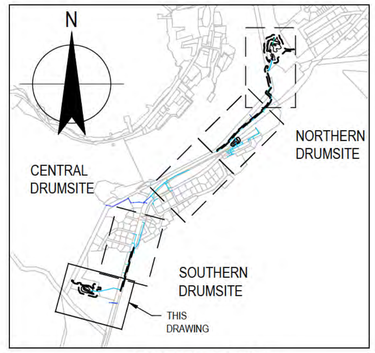
Drawn	J.OVERHEU	Designer	A.PARAMESWARAN
Drafting Check	S.HORTON*	Design Check	S.CLEARY*
Approved (Project Director)			
Date			
Scale	1:500	This Drawing must not be used for Construction unless signed as Approved	

Client: DEPT OF INFRASTRUCTURE, TRANSPORT, REGIONAL DEVELOPMENT & COMMUNICATIONS
Project: CHRISTMAS ISLAND STORMWATER REMEDIAL WORKS
Title: SOUTHERN DRUMSITE WORKS
PLAN - SHEET 1

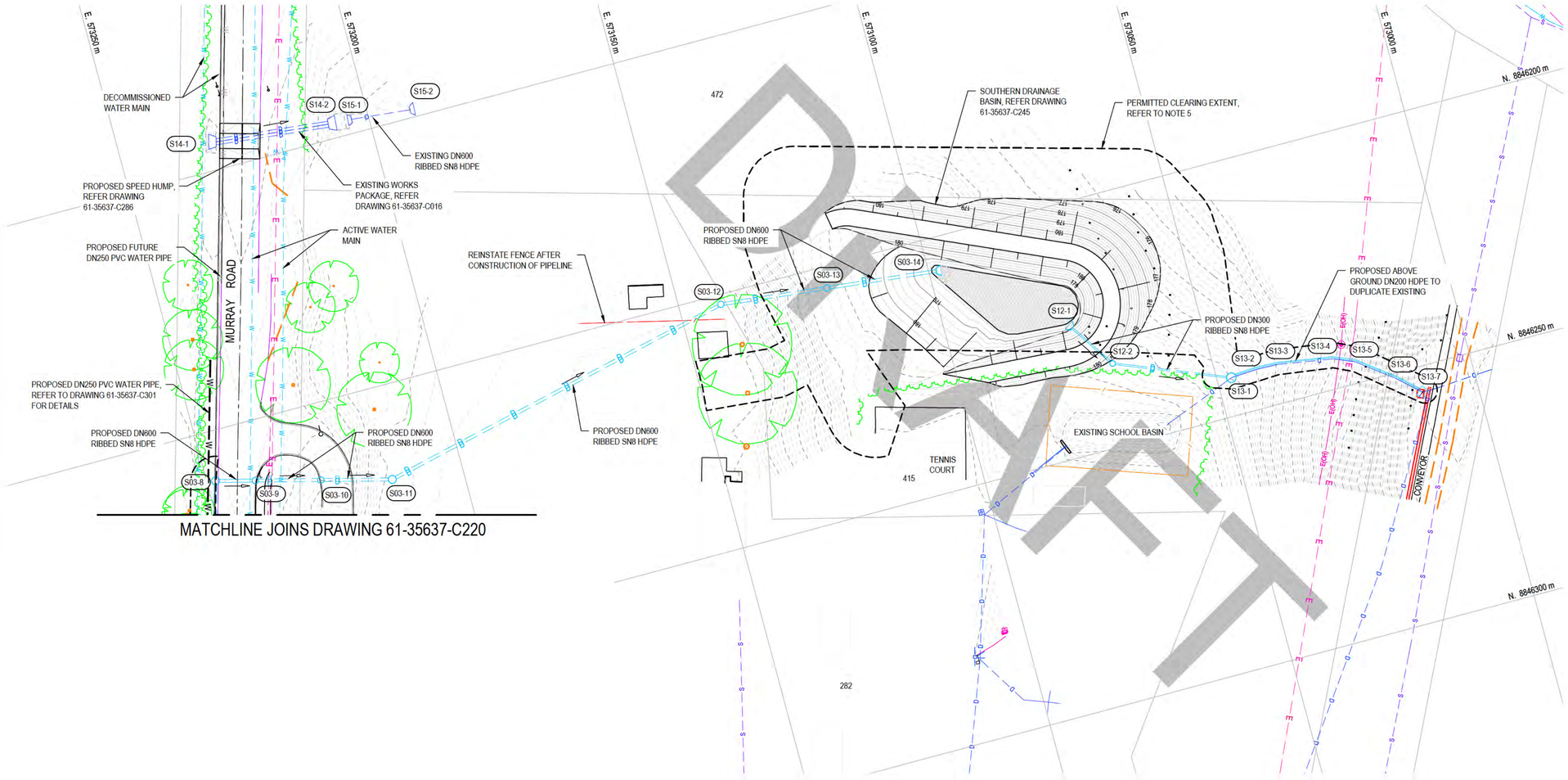
Original Size: A1
Drawing No: 61-35637-C220
Rev: A

Plot Date: 1 October 2020 - 11:04 AM Plotted by: Giselle Tayam Cad File No: N:\AU\Perth\Projects\61\35637\CADD\Drawings\61-35637-C220.dwg

THIS DRAWING IS TO BE PRINTED IN COLOUR



LOCALITY PLAN
N.T.S.



PLAN
SCALE 1:500

NOTES:

1. REFER TO PIPE LONGITUDINAL SECTION DRAWINGS FOR DETAILS OF PIT AND PIPE LEVELS.
2. FOR LEGEND, REFER DRAWING 61-35637-C210.
3. EXISTING SERVICES LOCATIONS ARE INDICATIVE ONLY. CONTRACTOR TO CONFIRM LOCATION, SIZE AND LEVEL PRIOR TO COMMENCING CONSTRUCTION, SHOULD ANY CLASHES BE IDENTIFIED WITH PROPOSED WORKS THE CONTRACTOR IS TO IMMEDIATELY NOTIFY THE CLIENT'S REPRESENTATIVE.
4. EXISTING COMMUNICATIONS INFORMATION IS INCOMPLETE. VERIFICATION OF PRESENCE THROUGHOUT SITE REQUIRED PRIOR TO COMMENCING CONSTRUCTION.
5. EXTENT OF CLEARING PERMITTED. REFER TO SPECIFICATION FOR FURTHER DETAILS AND SETOUT REQUIREMENTS.

DRAINAGE STRUCTURE SET OUT

STRUCTURE NUMBER	NORTHING (m)	EASTING (m)	PIT SIZE (mm) & TYPE
S03-8	8846209.85	573248.25	1500 COMBINATION PIT
S03-9	8846211.84	573240.57	1200 COMBINATION PIT
S03-10	8846215.10	573227.93	1200 COMBINATION PIT
S03-11	8846218.70	573214.12	1500 MANHOLE
S03-12	8846201.94	573141.73	1200 MANHOLE
S03-13	8846204.27	573120.45	1200 MANHOLE
S03-14	8846206.67	573098.42	HEADWALL
S12-1	8846224.61	573075.28	HEADWALL
S12-2	8846233.58	573069.27	1050 MANHOLE
S13-1	8846242.44	573047.12	1800 MANHOLE
S13-2	8846242.12	573041.88	DEFLECTION
S13-3	8846242.26	573037.65	DEFLECTION
S13-4	8846244.08	573026.41	DEFLECTION
S13-5	8846245.74	573022.49	DEFLECTION
S13-6	8846251.04	573015.48	DEFLECTION
S13-7	8846255.10	573011.03	EXISTING PIT
S15-1	8846147.29	573204.01	PROPOSED PIT
S15-2	8846148.41	573191.14	PROPOSED PIT

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0 5 10 15 20 25m
SCALE 1:500 AT ORIGINAL SIZE

PRELIMINARY

No	Revision	Note: * indicates signatures on original issue of drawing or last revision of drawing	Drawn	Job Manager	Project Director	Date
B	REISSUED FOR 90% DESIGN - CLIENT COMMENT		GT	JM*	PS*	20/11/20
A	ISSUED FOR 90% DESIGN - CLIENT COMMENT		JO	JM*	PS*	30/09/20

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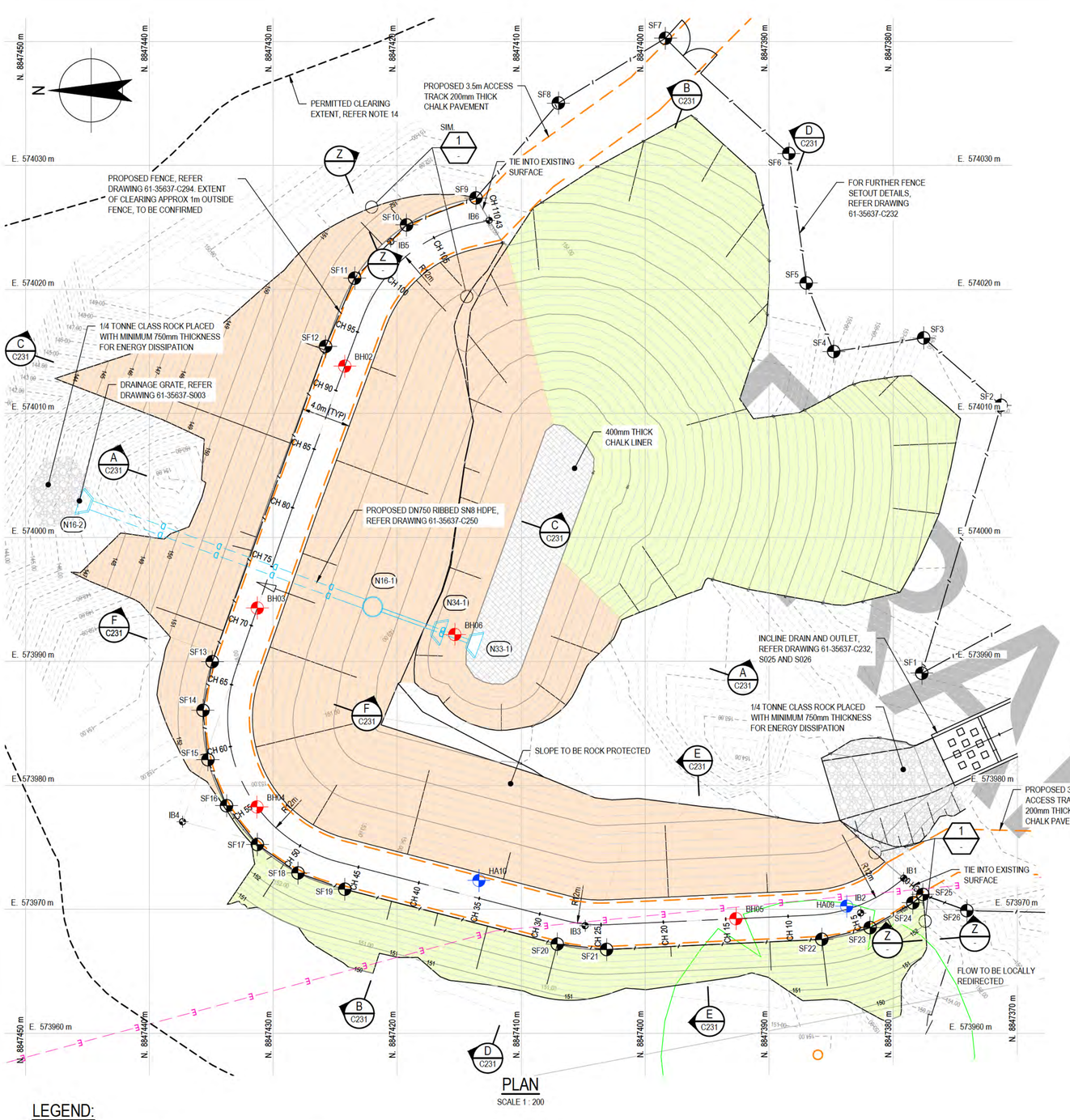
DO NOT SCALE

Drawn	J.OVERHEU	Designer	A.PARAMESWARAN
Drafting Check	S.HORTON*	Design Check	S.CLEARY*
Approved (Project Director)			
Date			
Scale	1:500	This Drawing must not be used for Construction unless signed as Approved	

Client: DEPT OF INFRASTRUCTURE, TRANSPORT, REGIONAL DEVELOPMENT & COMMUNICATIONS
Project: CHRISTMAS ISLAND STORMWATER REMEDIAL WORKS
Title: SOUTHERN DRUMSITE WORKS PLAN - SHEET 2

Original Size: A1
Drawing No: 61-35637-C221
Rev: B

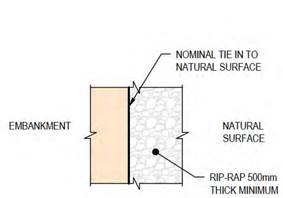
Plot Date: 19 November 2020 - 2:33 PM Plotted by: Jess Overheu Cad File No: \\ghdnet.internal\ghd\AU\Perth\Projects\61\35637\CADD\Drawings\61-35637-C221.dwg



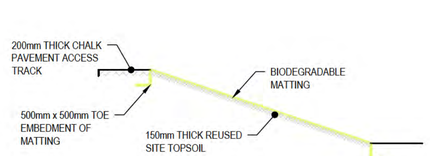
PLAN
SCALE 1 : 200

LEGEND:

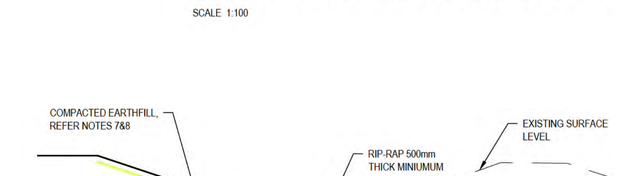
- ROCK SCOUR PROTECTION, REFER NOTE 11
- BIODEGRADABLE MATTING PROTECTION, REFER NOTE 12
- CHALK LINER
- ROCK PROTECTION
- PREVIOUS SITE INVESTIGATION LOCATION (APPROX.)
- PROPOSED ADDITIONAL BOREHOLES



1 - DETAIL
N.T.S



TYPICAL ARRANGEMENT
BIODEGRADABLE MATTING PROTECTION DETAIL
SCALE 1:100



Z - TYPICAL ABUTMENT TOE SECTION
SCALE 1:100

THIS DRAWING IS TO BE PRINTED IN COLOUR

GEOTECHNICAL TEST LOCATIONS

SETOUT POINT	NORTHING (m)	EASTING (m)
BH02	8847424.23	574013.82
BH03	8847431.29	573994.30
BH04	8847431.31	573978.26
BH05	8847392.68	573969.25
BH06	8847416.36	573992.17
HA09	8847383.75	573970.26
HA10	8847413.41	573972.33

SECURITY FENCE SET OUT

SETOUT POINT	NORTHING (m)	EASTING (m)
SF1	8847377.68	573989.04
SF2	8847371.29	574010.66
SF3	8847377.53	574016.09
SF4	8847384.79	574014.99
SF5	8847387.00	574020.52
SF6	8847388.41	574030.96
SF7	8847398.36	574040.26
SF8	8847407.00	574035.04
SF9	8847413.65	574027.38
SF10	8847419.24	574025.20
SF11	8847423.43	574020.91
SF12	8847425.78	574015.41
SF13	8847434.92	573989.97
SF14	8847435.67	573986.05
SF15	8847435.27	573982.07
SF16	8847433.77	573978.36
SF17	8847431.28	573975.23
SF18	8847428.01	573972.93
SF19	8847424.23	573971.62
SF20	8847407.09	573967.20
SF21	8847403.11	573966.76
SF22	8847385.75	573967.58
SF23	8847381.86	573968.53
SF24	8847378.40	573970.53
SF25	8847377.60	573971.20
SF26	8847374.05	573969.90

NOTES:

1. SETOUT POINTS ARE FOR REFERENCE ONLY, REFER TO 12D MODEL.
2. FOR LEGEND, REFER DRAWING 61-35637-C210.
3. ALL DIMENSIONS ARE IN METRES (m) UNO.
4. ALL RLs ARE IN METRES TO CHRISTMAS ISLAND HEIGHT DATUM (m CIHD)
5. ALL WORKS SHALL BE UNDERTAKEN IN ACCORDANCE WITH THE LATEST EDITION OF CURRENT STANDARDS, SPECIFICATIONS AND DRAWINGS.
6. DRAWINGS SHALL NOT BE SCALED.
7. EARTHFILL COMPACTED TO MIN 95% SMDD, VERIFIED BY NUCLEAR DENSIMETER (NDM) OR SAND REPLACEMENT TEST.
8. EARTHFILL TO COMPRISE EXCAVATED MATERIAL FROM BASIN, AND/OR IMPORTED MATERIALS (REFER SPECIFICATION).
9. BASE OF EXCAVATION COMPACTED TO MINIMUM 95% SMDD, VERIFIED BY NDM OR SAND REPLACEMENT TEST.
10. FOR LOCATION OF BASIN, REFER DRAWING 61-35637-C210.
11. ROCK PROTECTION NOMINAL STONE SIZE 200-300mm WITH GEOFABRIC BIDIM A44 OR EQUIVALENT UNDERLAY.
12. BIODEGRADABLE MATTING PROTECTION PLACED ON EXCAVATED SLOPE AFTER PLACEMENT OF 150mm OF TOPSOIL.
13. ADDITIONAL GEOTECHNICAL INVESTIGATION REQUIRED TO BE COMPLETED PRIOR TO CONSTRUCTION COMMENCING. REFER SPECIFICATIONS FOR DETAILS.
14. EXTENT OF CLEARING PERMITTED. REFER TO SPECIFICATION FOR FURTHER DETAILS AND SETOUT REQUIREMENTS.

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DRAINAGE STRUCTURE SET OUT

SETOUT POINT	NORTHING (m)	EASTING (m)
IB1	8847379.14	573972.52
IB2	8847382.62	573969.71
IB3	8847404.84	573968.68
IB4	8847437.32	573977.07
IB5	8847420.52	574023.86
IB6	8847412.58	574025.58

0 2 4 6 8 10m
SCALE 1:200 AT ORIGINAL SIZE

PRELIMINARY

No	Revision	Note: * indicates signatures on original issue of drawing or last revision of drawing	Drawn	Job Manager	Project Director	Date
B	REISSUED FOR 90% DESIGN - CLIENT COMMENT		GT	JM*	PS*	20/11/20
A	ISSUED FOR 90% DESIGN - CLIENT COMMENT		JO	JM*	PS*	30/09/20

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E permail@ghd.com.au W www.ghd.com

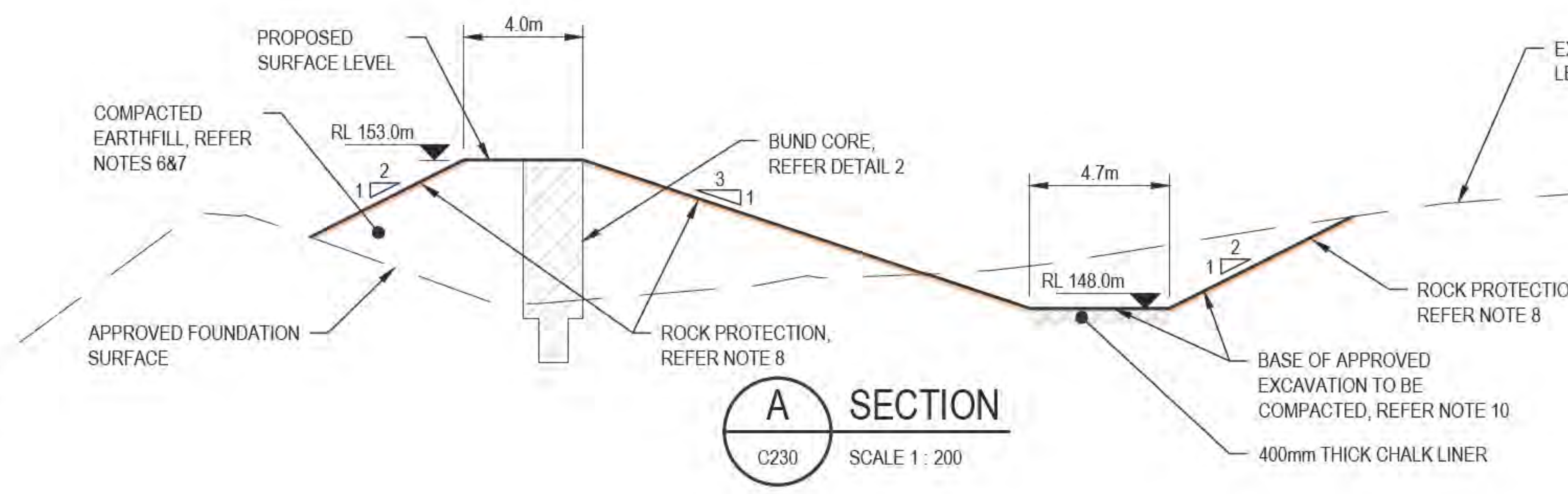
DO NOT SCALE

Drawn	J.OVERHEU	Designer	J.VALE
Drafting Check	S.HORTON*	Design Check	S. CLEARY*
Approved (Project Director)			
Date			
Scale	1:200	This Drawing must not be used for Construction unless signed as Approved	

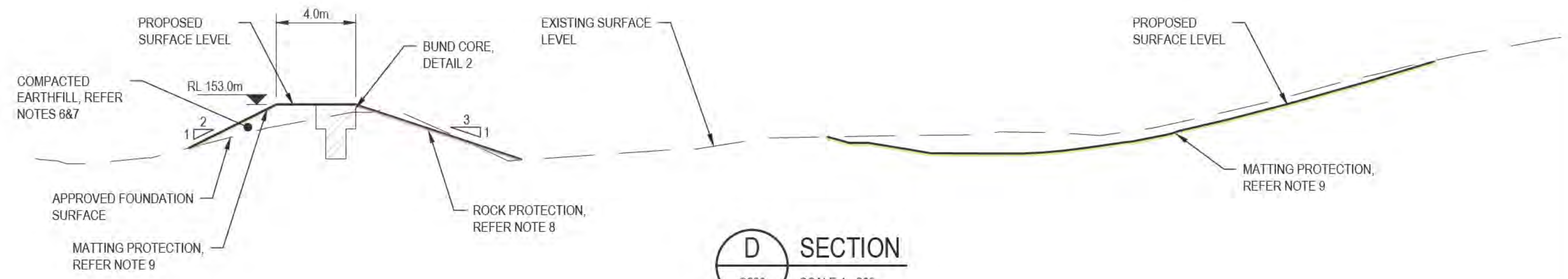
Client: DEPT OF INFRASTRUCTURE, TRANSPORT, REGIONAL DEVELOPMENT & COMMUNICATIONS
Project: CHRISTMAS ISLAND STORMWATER REMEDIAL WORKS
Title: NORTHERN DRUMSITE WORKS - INCLINE BASIN PLAN AND TYPICAL SECTIONS

Original Size A1 | Drawing No: 61-35637-C230 | Rev: B

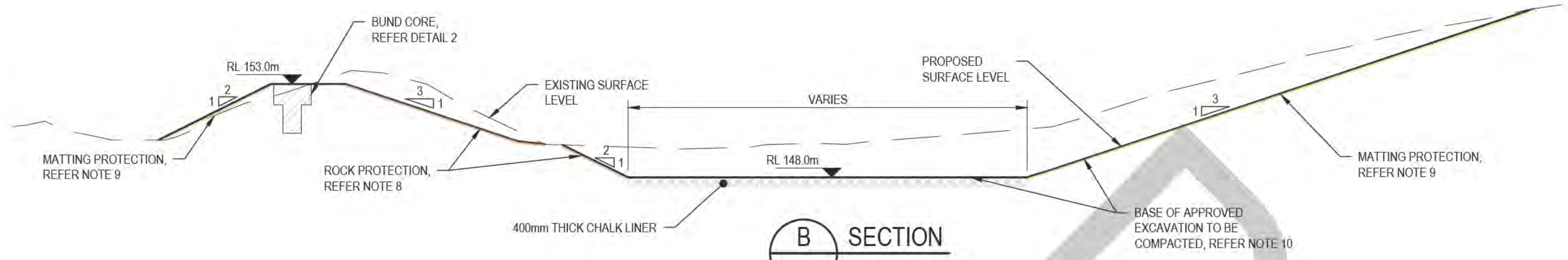
Plot Date: 19 November 2020 - 2:36 PM | Plotted by: Jess Overheu | Cad File No: \\ghdnet.internal\ghd\AU\Perth\Projects\61\35637\CADD\Drawings\61-35637-C230.dwg



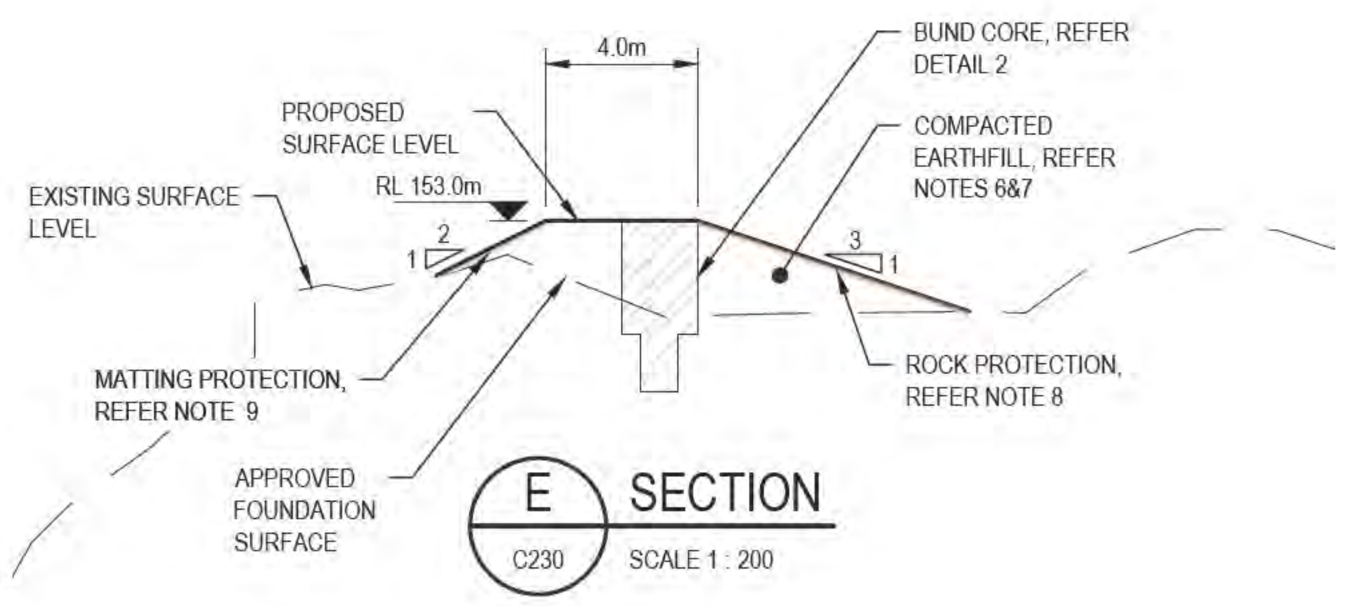
A SECTION
C230 SCALE 1 : 200



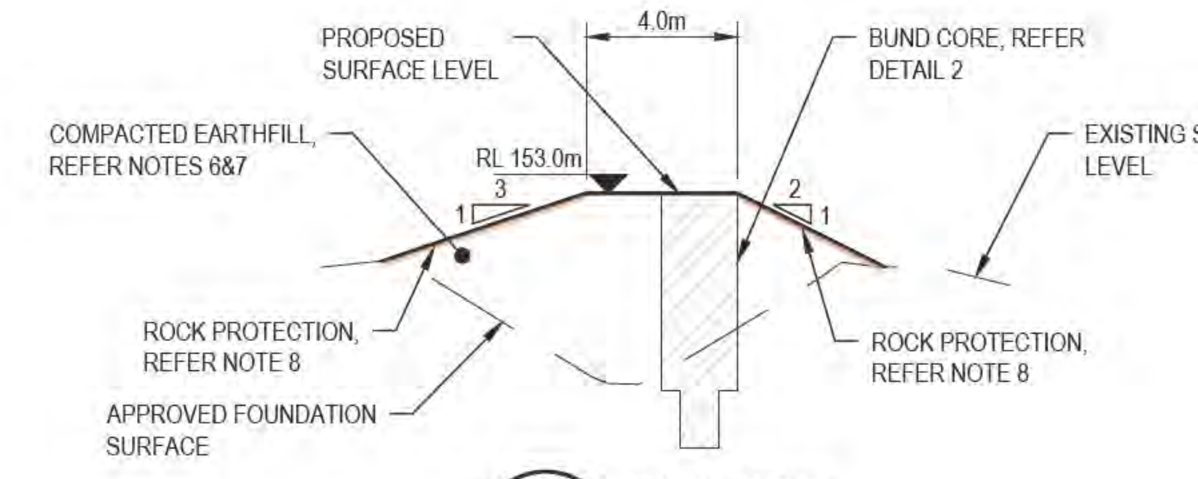
D SECTION
C230 SCALE 1 : 200



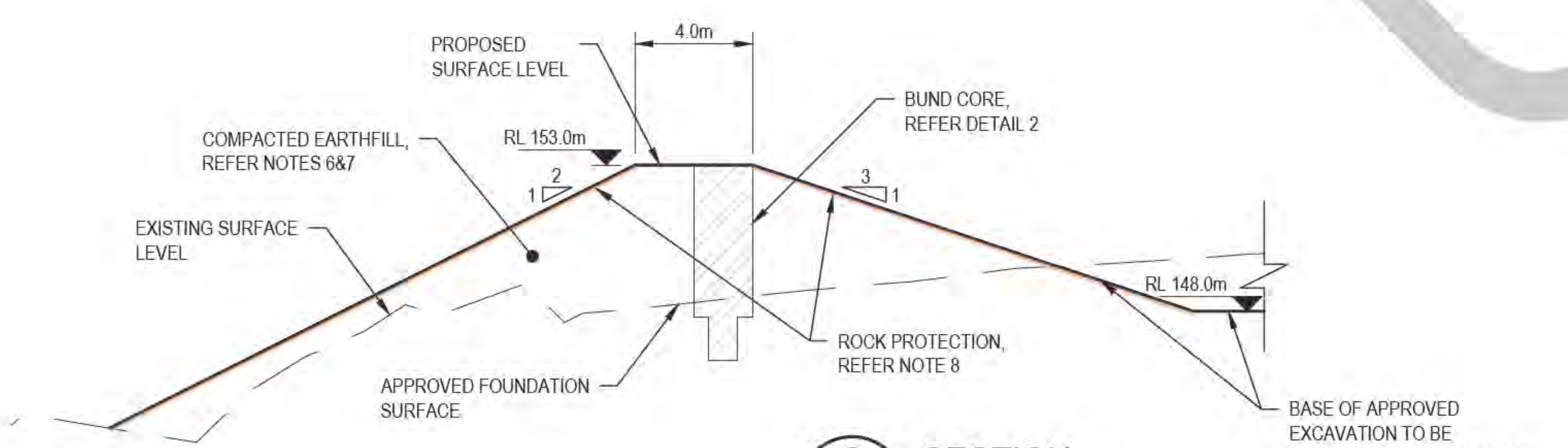
B SECTION
C230 SCALE 1 : 200



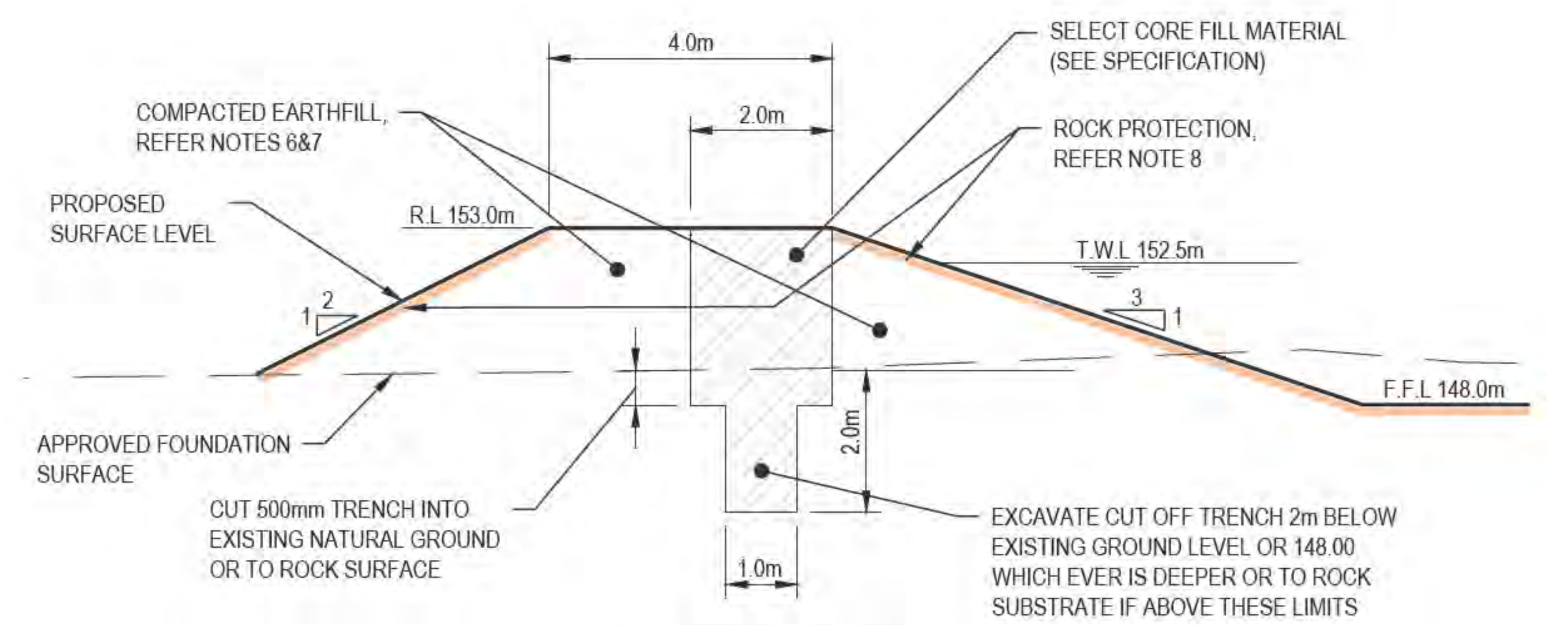
E SECTION
C230 SCALE 1 : 200



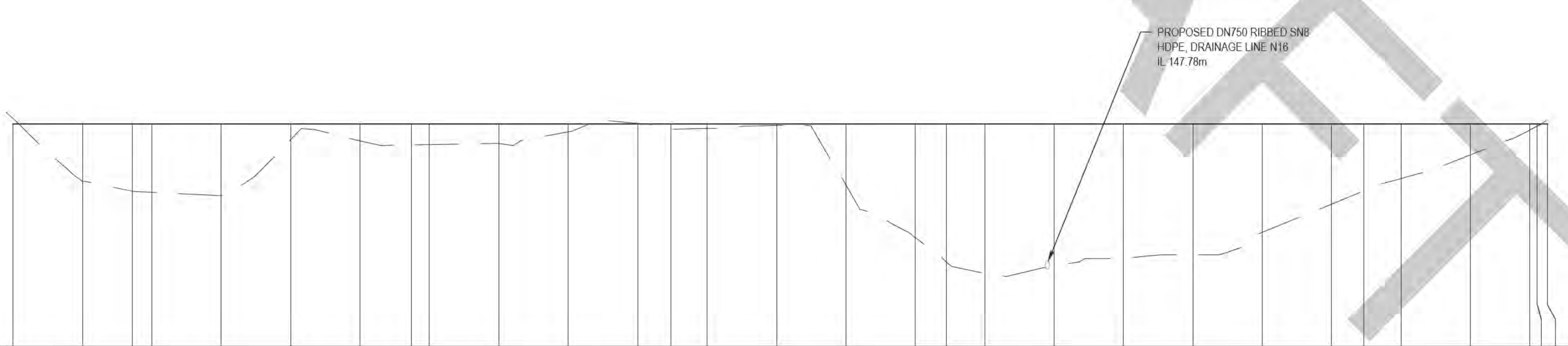
F SECTION
C230 SCALE 1 : 200



C SECTION
C230 SCALE 1 : 200



2 DETAIL
SCLAE 1:100



DATUM RL. 145.0m

VERTICAL ALIGNMENT

HORIZONTAL ALIGNMENT: L=0.29m; L=8.30m R=12.00m; L=16.53m; L=3.59m R=12.00m; L=18.68m; L=19.86m R=12.00m; L=14.00m; L=16.06m; L=11.95m R=12.00m; L=1.64m

CHAINAGE	EXISTING SURFACE LEVEL	INCLINE BASIN
0.00	153.42	
5.00	151.12	153.00
8.59	150.63	153.00
10.00	150.56	153.00
15.00	150.44	153.00
20.00	152.19	153.00
25.00	152.45	153.00
28.72	152.25	153.00
30.00	152.26	153.00
35.00	152.30	153.00
40.00	152.67	153.00
45.00	153.05	153.00
47.40	152.81	153.00
50.00	152.84	153.00
55.00	152.94	153.00
60.00	151.25	153.00
65.00	149.11	153.00
67.26	148.24	153.00
70.00	147.68	153.00
75.00	147.86	153.00
80.00	148.16	153.00
85.00	148.30	153.00
90.00	149.01	153.00
95.00	150.02	153.00
97.32	150.50	153.00
100.00	150.97	153.00
105.00	151.80	153.00
109.28	152.66	153.00
110.00	152.93	153.00
110.43	153.00	153.00

INCLINE BASIN BUND - LONGITUDINAL SECTION

HORIZONTAL SCALE 1:250
VERTICAL SCALE 1:125

THIS DRAWING IS TO BE PRINTED IN COLOUR

NOTES:

1. FOR LAYOUT OF INCLINE BASIN BUND, REFER DRAWING 61-35637-C230.
2. ALL DIMENSIONS ARE IN METRES (m) UNO.
3. ALL RLs ARE IN METRES TO CHRISTMAS ISLAND HEIGHT DATUM (m CIHD).
4. ALL WORKS SHALL BE UNDERTAKEN IN ACCORDANCE WITH THE LATEST EDITION OF CURRENT STANDARDS, SPECIFICATIONS AND DRAWINGS.
5. DRAWINGS SHALL NOT BE SCALED.
6. EARTHFILL COMPACTED TO MIN 95% SMDD, VERIFIED BY NUCLEAR DENSIMETER (NDM) OR SAND REPLACEMENT TEST.
7. EARTHFILL TO COMPRISE EXCAVATED MATERIAL FROM BASIN, AND/OR IMPORTED MATERIALS (REFER SPECIFICATION).
8. ROCK PROTECTION NOMINAL STONE SIZE 200-300mm WITH GEOFABRIC BIDIM A44 OR EQUIVALENT UNDERLAY.
9. BIODEGRADABLE MATTING PROTECTION PLACED ON EXCAVATED SLOPE AFTER PLACEMENT OF 150mm OF TOPSOIL.
10. BASE OF EXCAVATION COMPACTED TO MINIMUM 95% SMDD, VERIFIED BY NDM OR SAND REPLACEMENT TEST.

0 2.5 5 7.5 10 12.5m — SCALE 1:250 AT ORIGINAL SIZE
0 2 4 6 8 10m — SCALE 1:200 AT ORIGINAL SIZE
0 1.25 2.5 3.75 5 6.25m — SCALE 1:125 AT ORIGINAL SIZE
0 1 2 3 4 5m — SCALE 1:100 AT ORIGINAL SIZE

PRELIMINARY

No	Revision	Drawn	Job Manager	Project Director	Date
B	REISSUED FOR 90% DESIGN - CLIENT COMMENT	GT	JM*	PS*	20/11/20
A	ISSUED FOR 90% DESIGN - CLIENT COMMENT	JO	JM*	PS*	30/09/20

Note: * indicates signatures on original issue of drawing or last revision of drawing

Australian Government
Department of Infrastructure, Transport, Regional Development and Communications

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DO NOT SCALE

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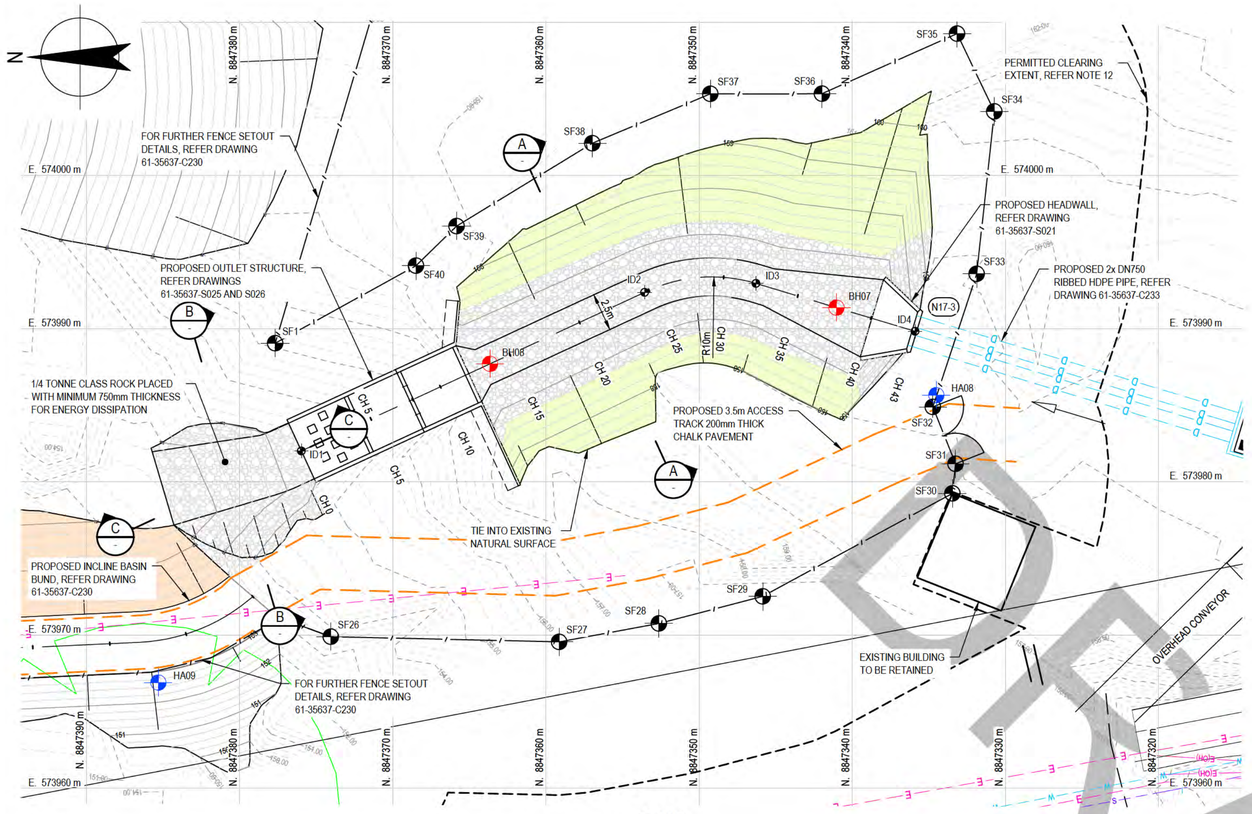
Drawn J.OVERHEU | Designer J.VALE
Drafting Check S.HORTON* | Design Check S.CLEARY*
Approved (Project Director)
Date
Scale AS SHOWN — This Drawing must not be used for Construction unless signed as Approved

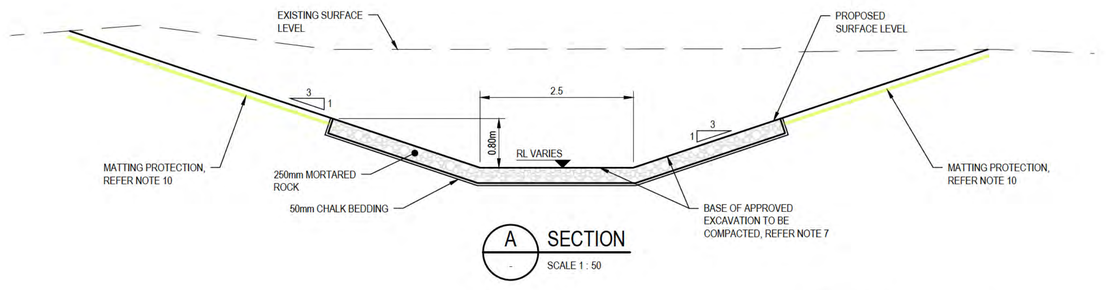
Client: DEPT OF INFRASTRUCTURE, TRANSPORT, REGIONAL DEVELOPMENT & COMMUNICATIONS
Project: CHRISTMAS ISLAND STORMWATER REMEDIAL WORKS
Title: NORTHERN DRUMSITE WORKS
LONGITUDINAL SECTION, TYPICAL SECTIONS & DETAILS

Original Size A1 Drawing No: 61-35637-C231 Rev: B

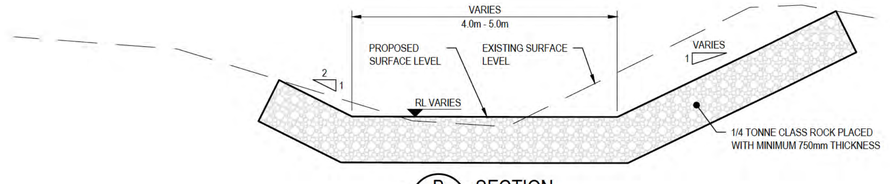
Plot Date: 19 November 2020 - 2:47 PM Plotted by: Jess Overheu Cad File No: \\ghdnet.internal\ghd\AU\Perth\Projects\61\35637\CADD\Drawings\61-35637-C231.dwg



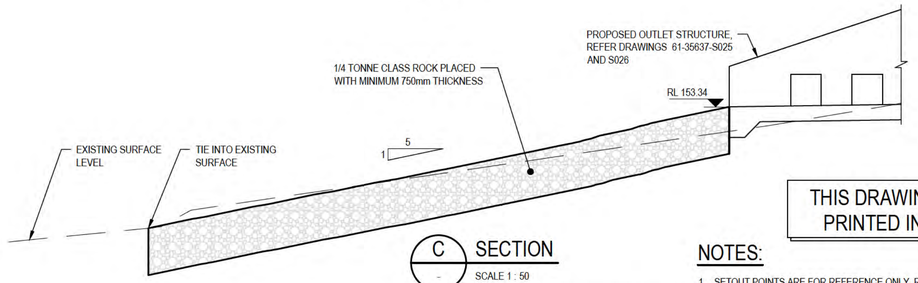
PLAN
SCALE 1 : 200



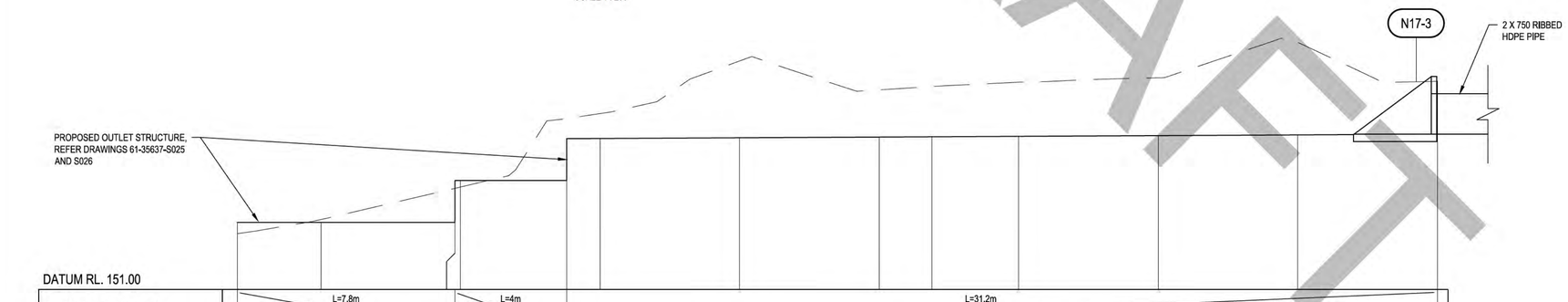
A SECTION
SCALE 1 : 50



B SECTION
SCALE 1 : 50



C SECTION
SCALE 1 : 50



DATUM RL. 151.00

VERTICAL ALIGNMENT	L=7.8m G=0%				L=4m G=0%		L=31.2m G=-0.5%															
HORIZONTAL ALIGNMENT	L=24.90m														L=7.25m R=-10.00m		L=10.85m					
LEVEL DIFFERENCE CUT - / FILL + (m)	0.40	-0.10	-0.62	0.28	0.23	-2.22	-0.89	-2.74	-1.69	-1.80	-1.94	-2.07	-3.31	-1.90								
DESIGN SURFACE LEVEL (m)	153.40	153.40	154.00	154.90	154.90	154.90	156.41	156.43	156.46	156.47	156.48	156.51	156.53	156.55								
EXISTING SURFACE LEVEL (m)	153.00	153.51	154.62	154.67		157.12	157.30	159.17	158.14	158.26	158.42	158.57	159.84	158.45								
CHAINAGE (m)	0.00	3.00	7.50	8.00		11.8	13.00	18.00	23.00	24.90	28.00	33.00	38.00	43.00								

INCLINE DRAIN - LONGITUDINAL SECTION
HORIZONTAL SCALE 1:100
VERTICAL SCALE 1:100

GEOTECHNICAL TEST LOCATIONS

SETOUT POINT	NORTHING (m)	EASTING (m)
BH07	8847341.03	573991.37
BH08	8847363.65	573987.70
HA08	8847334.51	573985.66
HA09	8847385.30	573966.90

SECURITY FENCE SET OUT

SETOUT POINT	NORTHING (m)	EASTING (m)
SF1	8847377.68	573989.04
SF26	8847374.05	573969.90
SF27	8847359.13	573969.56
SF28	8847352.63	573970.75
SF29	8847345.85	573972.53
SF30	8847333.46	573979.25
SF31	8847333.26	573981.17
SF32	8847334.73	573984.89
SF33	8847331.87	573993.57
SF34	8847330.72	574004.17
SF35	8847333.16	574009.25
SF36	8847341.98	574005.33
SF37	8847349.26	574005.33
SF38	8847356.97	574002.10
SF39	8847365.83	573996.69
SF40	8847368.48	573994.11

DRAINAGE STRUCTURE SET OUT

SETOUT POINT	NORTHING (m)	EASTING (m)
ID1	8847375.97	573982.01
ID2	8847353.56	573992.37
ID3	8847346.29	573992.95
ID4	8847335.90	573989.82

THIS DRAWING IS TO BE PRINTED IN COLOUR

NOTES:

1. SETOUT POINTS ARE FOR REFERENCE ONLY, REFER TO 12D MODEL.
2. FOR LEGEND, REFER DRAWING 61-35637-C210.
3. ALL DIMENSIONS ARE IN METRES (m) UNO.
4. ALL RLs ARE IN METRES TO CHRISTMAS ISLAND HEIGHT DATUM (m CIHD)
5. ALL WORKS SHALL BE UNDERTAKEN IN ACCORDANCE WITH THE LATEST EDITION OF CURRENT STANDARDS, SPECIFICATIONS AND DRAWINGS.
6. DRAWINGS SHALL NOT BE SCALED.
7. BASE OF EXCAVATION COMPACTED TO MINIMUM 95% SMDD, VERIFIED BY NDM OR SAND REPLACEMENT TEST.
8. FOR LOCATION OF DRAIN, REFER DRAWING 61-35637-C210.
9. ROCK PROTECTION NOMINAL STONE SIZE 200-300mm WITH GEOFABRIC BIDIM A44 OR EQUIVALENT UNDERLAY.
10. BIODEGRADABLE MATTING PROTECTION PLACED ON EXCAVATED SLOPE AFTER PLACEMENT OF 150mm OF TOPSOIL.
11. ADDITIONAL GEOTECHNICAL INVESTIGATION REQUIRED TO BE COMPLETED PRIOR TO CONSTRUCTION COMMENCING REFER (SPECS) FOR DETAILS.
12. EXTENT OF CLEARING PERMITTED. REFER TO SPECIFICATION FOR FURTHER DETAILS AND SETOUT REQUIREMENTS.

LEGEND:

ROCK SCOUR PROTECTION, REFER NOTE 9

BIODEGRADABLE MATTING PROTECTION, REFER NOTE 10

PREVIOUS SITE INVESTIGATION LOCATION (APPROX.)

PROPOSED ADDITIONAL BOREHOLES

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0 1 2 3 4 5m SCALE 1:100 AT ORIGINAL SIZE
0 2 4 6 8 10m SCALE 1:200 AT ORIGINAL SIZE
0 0.5 1.0 1.5 2.0 2.5m SCALE 1:50 AT ORIGINAL SIZE
0 10 20 30 40 50m SCALE 1:1000 AT ORIGINAL SIZE

PRELIMINARY

No	Revision	Note: * indicates signatures on original issue of drawing or last revision of drawing	Drawn	Job Manager	Project Director	Date
B	REISSUED FOR 90% DESIGN - CLIENT COMMENT		GT	JM*	PS*	20/11/20
A	ISSUED FOR 90% DESIGN - CLIENT COMMENT		JO	JM*	PS *	30/09/20

Australian Government
Department of Infrastructure, Transport, Regional Development and Communications

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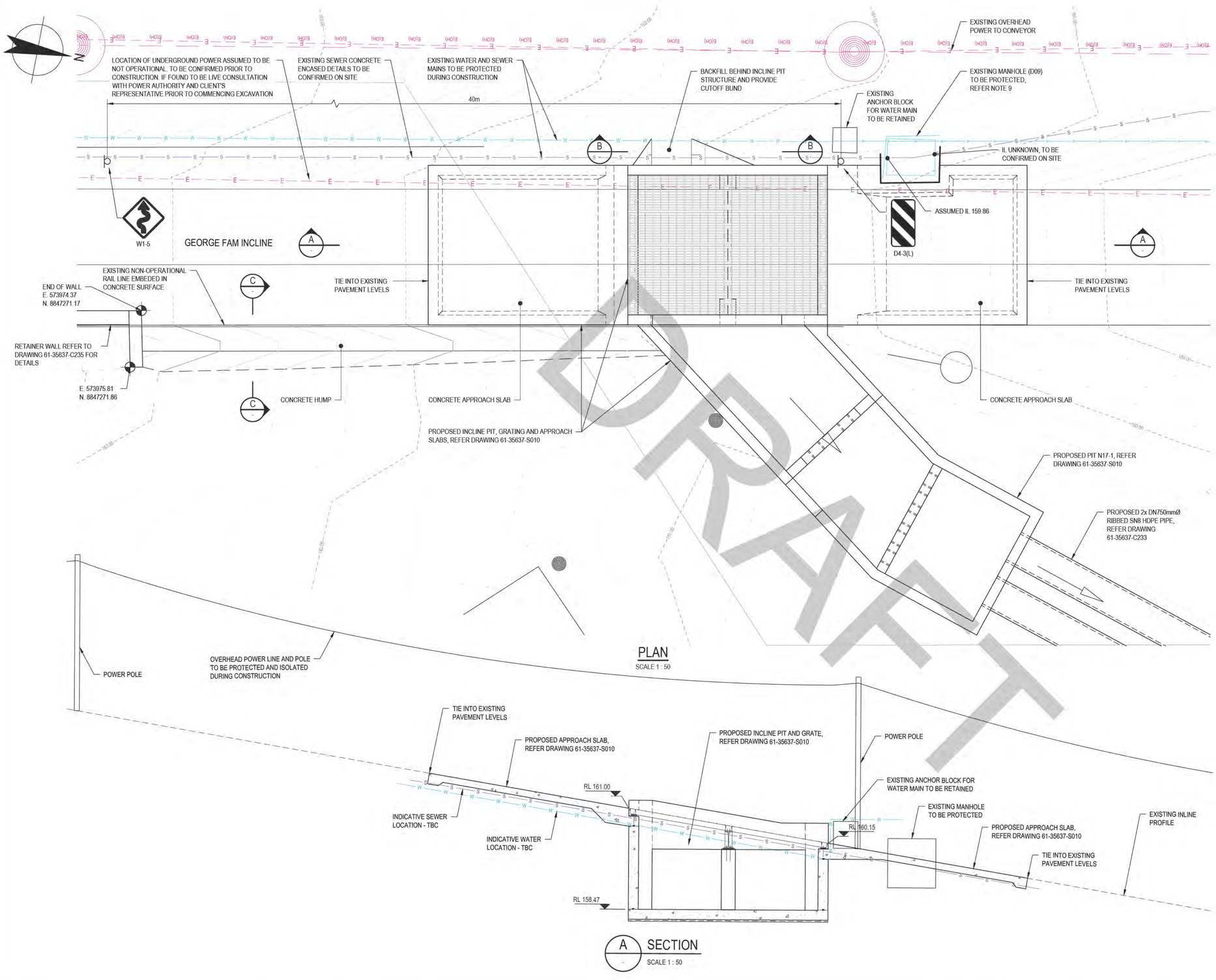
DO NOT SCALE

Drawn	J.OVERHEU	Designer	J.VALE
Drafting Check	S.HORTON*	Design Check	S.CLEARY*
Approved (Project Director)			
Date			
Scale	AS SHOWN	This Drawing must not be used for Construction unless signed as Approved	

Client: DEPT OF INFRASTRUCTURE, TRANSPORT, REGIONAL DEVELOPMENT & COMMUNICATIONS
Project: CHRISTMAS ISLAND STORMWATER REMEDIAL WORKS
Title: NORTHERN DRUMSITE WORKS - INCLINE DRAIN PLAN, LONGITUDINAL SECTIONS & TYPICAL SECTIONS

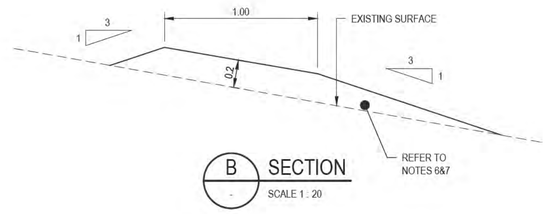
Original Size A1 | Drawing No: 61-35637-C232 | Rev: B

Plot Date: 19 November 2020 - 2:37 PM | Plotted by: Jess Overheu | Cad File No: \\ghdnet.internal\ghd\AU\Perth\Projects\61\35637\CADD\Drawings\61-35637-C232.dwg

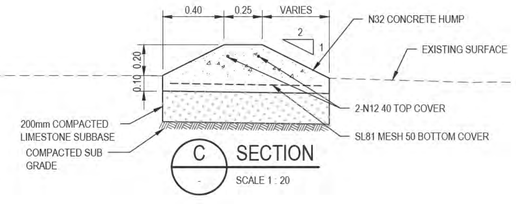


PLAN
SCALE 1 : 50

A SECTION
SCALE 1 : 50



B SECTION
SCALE 1 : 20



C SECTION
SCALE 1 : 20

THIS DRAWING IS TO BE PRINTED IN COLOUR

NOTES:

1. FOR LEGEND, REFER DRAWING 61-35637-C210.
2. ALL DIMENSIONS ARE IN METRES (m) UNO.
3. ALL RLs ARE IN METRES TO CHRISTMAS ISLAND HEIGHT DATUM (m CIHD).
4. ALL WORKS SHALL BE UNDERTAKEN IN ACCORDANCE WITH THE LATEST EDITION OF CURRENT STANDARDS, SPECIFICATIONS AND DRAWINGS.
5. DRAWINGS SHALL NOT BE SCALED.
6. EARTHFILL COMPACTED TO MIN 95% SMDD, VERIFIED BY NUCLEAR DENSIMETER (NDM) OR SAND REPLACEMENT TEST.
7. EARTHFILL TO COMPRISE EXCAVATED MATERIAL FROM BASIN, AND/OR IMPORTED MATERIALS (REFER SPECIFICATION).
8. FOR LOCATION OF DRIVE OVER, REFER DRAWING 61-35637-C210.
9. EXISTING MANHOLE LID AND SURROUNDS TO BE ADJUSTED TO SUIT REVISED ROAD SURFACE LEVEL. LID TO BE REPLACED WITH WATER CORPORATION COMPLIANT 2 PART TRAFFICABLE LID
10. OVERHEAD CONVEYOR TO BE PROTECTED DURING CONSTRUCTION. ALL REQUIRED CHRISTMAS ISLAND PHOSPHATE REQUIREMENTS TO BE ADHERED TO AT ALL TIMES.
11. PRIOR TO CONSTRUCTION OF PIT COMMENCES, EXISTING SERVICES TO BE LOCATED. IF A CLASH WITH THE PROPOSED EXCAVATION IS FOUND, THE CONTRACTOR IS TO DEVELOP A SUITABLE CONSTRUCTION APPROACH FOR APPROVAL OF THE RELEVANT AUTHORITY AND THE CLIENT'S REPRESENTATIVE.

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ALL COORDINATES SHOWN ON THIS DRAWING SHALL BE VERIFIED BY CONTRACTOR PRIOR TO COMMENCEMENT OF WORKS. ANY DISCREPANCIES TO BE REPORTED TO THE ENGINEER IMMEDIATELY.

0 0.2 0.4 0.6 0.8 1.0m
SCALE 1:20 AT ORIGINAL SIZE

0 0.5 1.0 1.5 2.0 2.5m
SCALE 1:50 AT ORIGINAL SIZE

PRELIMINARY

No	Revision	Note: * indicates signatures on original issue of drawing or last revision of drawing	Drawn	Job Manager	Project Director	Date
A	REISSUED FOR 90% DESIGN - CLIENT COMMENT		GT	JM*	PS*	20/11/20
A	ISSUED FOR 90% DESIGN - CLIENT COMMENT		JO	JM*	PS*	30/09/20

Australian Government
Department of Infrastructure, Transport, Regional Development and Communications

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E mnlmail@ghd.com W www.ghd.com

Drawn	J.OVERHEU	Designer	J.VALE
Drafting Check	S.HORTON*	Design Check	S.CLEARY*
Approved (Project Director)			
Date			
Scale	AS SHOWN	This Drawing must not be used for Construction unless signed as Approved	

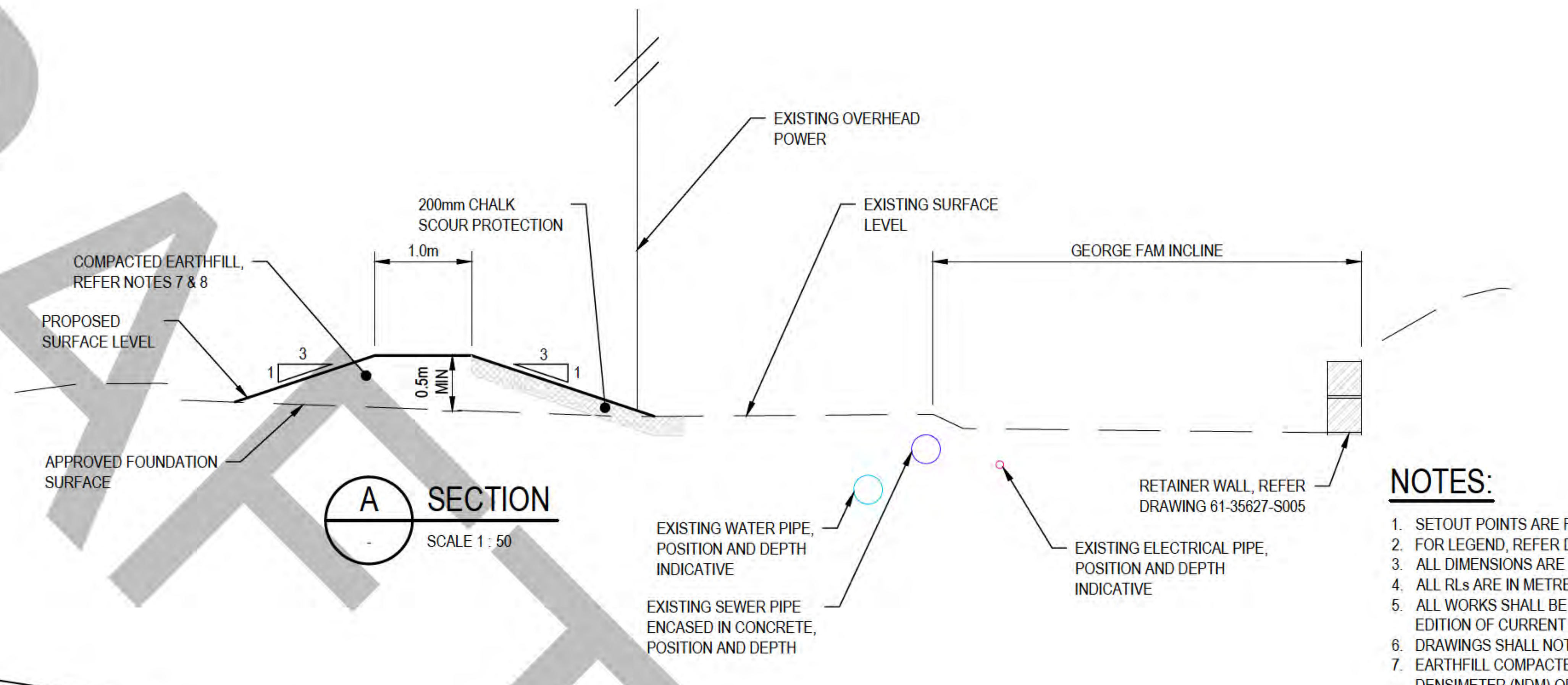
Client: DEPT OF INFRASTRUCTURE, TRANSPORT, REGIONAL DEVELOPMENT & COMMUNICATIONS
Project: CHRISTMAS ISLAND STORMWATER REMEDIAL WORKS
Title: NORTHERN DRUMSITE WORKS - DRIVE OVER PLAN, LONGITUDINAL SECTION & TYPICAL SECTIONS

Original Size: A1
Drawing No: 61-35637-C234
Rev: B

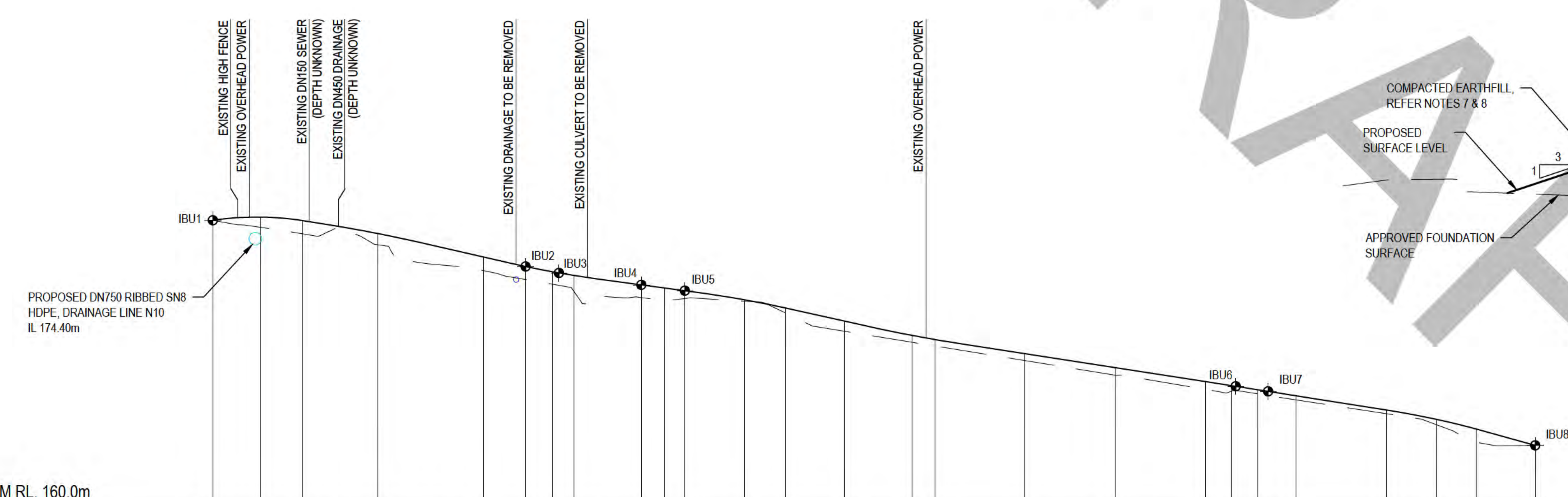
Plot Date: 19 November 2020 - 2:49 PM Plotted by: Jess Overheu Cad File No: \\ghdnet.internal\ghd\AU\Perth\Projects\61\35637\CADD\Drawings\61-35637-C234.dwg

THIS DRAWING IS TO BE PRINTED IN COLOUR

PLAN
SCALE 1 : 100



A SECTION
SCALE 1 : 50



DATUM RL. 160.0m

VERTICAL ALIGNMENT: L=0.15m G=13.82% | K=0.17 L=5m | L=1.49m G=-16.32% | K=0.76 L=5m | L=4.66m G=-22.87% | K=0.54 L=5m | L=5.65m G=-13.53% | K=0.57 L=5m | L=4.28m G=-22.25% | K=0.74 L=5m | L=14.15m G=-15.47% | K=14.65 L=5m | L=4.92m G=-15.81% | K=0.42 L=5m | L=2.96m G=-27.79%

HORIZONTAL ALIGNMENT: L=17.33m | L=1.86m R=-20.00m | L=4.55m | L=2.41m R=-20.00m | L=5.57m | L=0.45m R=-20.00m | L=24.28m | L=1.99m R=20.00m | L=14.81m

CHAINAGE (m)	LEVEL DIFFERENCE CUT - / FILL + (m)	DESIGN SURFACE LEVEL (m)	EXISTING SURFACE LEVEL (m)
0.00	0.00	175.766	175.77
2.65	0.57	175.944	175.38
5.00	0.74	175.748	175.01
9.14	0.62	175.032	174.41
15.00	0.76	173.733	172.98
17.33	0.72	173.210	172.49
18.80	0.69	172.921	172.23
20.00	0.88	172.717	171.84
23.74	0.70	172.195	171.49
25.00	0.69	172.025	171.33
26.15	0.43	171.869	171.44
29.46	0.07	171.367	171.29
31.72	0.28	170.917	170.64
35.00	0.56	170.188	169.62
38.74	0.38	169.398	169.02
40.00	0.36	169.171	168.81
45.00	0.38	168.387	168.01
50.00	0.42	167.613	167.20
55.00	0.43	166.840	166.41
56.46	0.29	166.614	166.33
57.89	0.23	166.391	166.16
60.00	0.23	166.059	165.83
65.00	0.20	165.268	165.07
67.81	0.30	164.750	164.45
70.00	0.73	164.213	163.48
73.26	0.00	163.308	163.31

INCLINE BUND - LONGITUDINAL SECTION

HORIZONTAL SCALE 1:200
VERTICAL SCALE 1:200

NOTES:

1. SETOUT POINTS ARE FOR REFERENCE ONLY, REFER TO 12D MODEL.
2. FOR LEGEND, REFER DRAWING 61-35637-C210.
3. ALL DIMENSIONS ARE IN METRES (m) UNO.
4. ALL RLs ARE IN METRES TO CHRISTMAS ISLAND HEIGHT DATUM (m CIHD).
5. ALL WORKS SHALL BE UNDERTAKEN IN ACCORDANCE WITH THE LATEST EDITION OF CURRENT STANDARDS, SPECIFICATIONS AND DRAWINGS.
6. DRAWINGS SHALL NOT BE SCALED.
7. EARTHFILL COMPACTED TO MIN 95% SMDD, VERIFIED BY NUCLEAR DENSIMETER (NDM) OR SAND REPLACEMENT TEST.
8. EARTHFILL TO COMPRISE EXCAVATED MATERIAL FROM BASIN, AND/OR IMPORTED MATERIALS (REFER SPECIFICATION).
9. FOR LOCATION OF BUND, REFER DRAWING 61-35637-C210.
10. EXTENT OF CLEARING PERMITTED. REFER TO SPECIFICATION FOR FURTHER DETAILS AND SETOUT REQUIREMENTS.
11. PRIOR TO CONSTRUCTION OF PIT COMMENCES, EXISTING SERVICES TO BE LOCATED. IF A CLASH WITH THE PROPOSED EXCAVATION IS FOUND, THE CONTRACTOR IS TO DEVELOP A SUITABLE CONSTRUCTION APPROACH FOR APPROVAL OF THE RELEVANT AUTHORITY AND THE CLIENT'S REPRESENTATIVE.

GEOTECHNICAL TEST LOCATIONS

SETOUT POINT	NORTHING (m)	EASTING (m)
HA05	8847236.55	573972.71
HA06	8847210.23	573976.16

DRAINAGE STRUCTURE SET OUT

SETOUT POINT	NORTHING (m)	EASTING (m)
IBU1	8847199.17	573980.74
IBU2	8847216.44	573979.36
IBU3	8847218.29	573979.13
IBU4	8847222.77	573978.35
IBU5	8847225.11	573977.79
IBU6	8847254.16	573968.43
IBU7	8847255.90	573967.96
IBU8	8847270.35	573964.78

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0 0.5 1.0 1.5 2.0 2.5m SCALE 1:50 AT ORIGINAL SIZE
0 1 2 3 4 5m SCALE 1:100 AT ORIGINAL SIZE
0 2 4 6 8 10m SCALE 1:200 AT ORIGINAL SIZE

PRELIMINARY

No	Revision	Drawn	Job Manager	Project Director	Date
B	REISSUED FOR 90% DESIGN - CLIENT COMMENT	GT	JM*	PS*	20/11/20
A	ISSUED FOR 90% DESIGN - CLIENT COMMENT	JO	JM*	PS*	30/09/20

Note: * indicates signatures on original issue of drawing or last revision of drawing

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Drafting Check S.HORTON* | Design Check S.CLEARY*
Approved (Project Director)
Date
Scale AS SHOWN
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Client: DEPT OF INFRASTRUCTURE, TRANSPORT, REGIONAL DEVELOPMENT & COMMUNICATIONS
Project: CHRISTMAS ISLAND STORMWATER REMEDIAL WORKS
Title: NORTHERN DRUMSITE WORKS - INCLINE BUND PLAN, LONGITUDINAL SECTION & TYPICAL SECTIONS

Original Size A1 Drawing No: 61-35637-C235 Rev: B

Plot Date: 19 November 2020 - 2:51 PM Plotted by: Jess Overheu Cad File No: \\ghdnet.internal\ghd\AU\Perth\Projects\61\35637\CADD\Drawings\61-35637-C235.dwg

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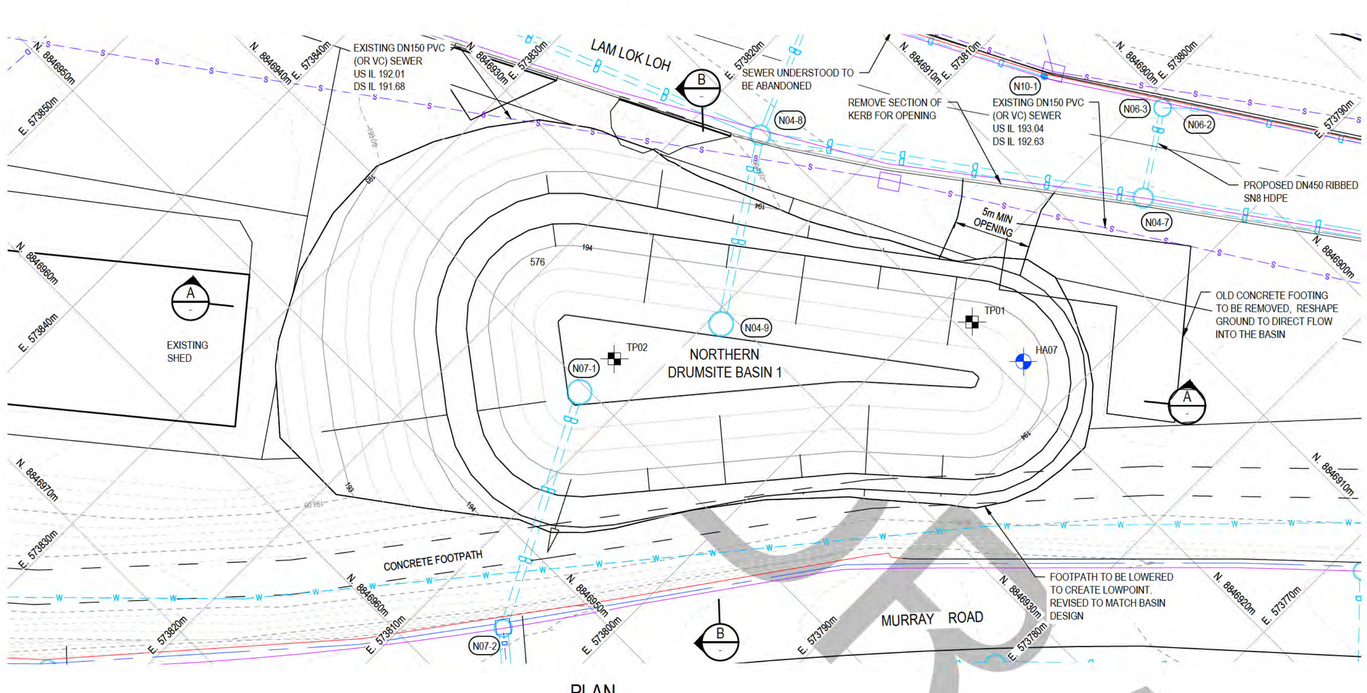
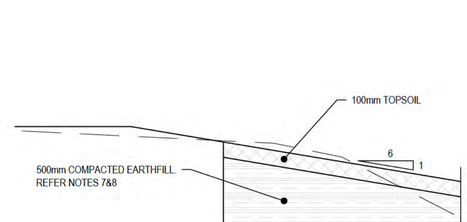
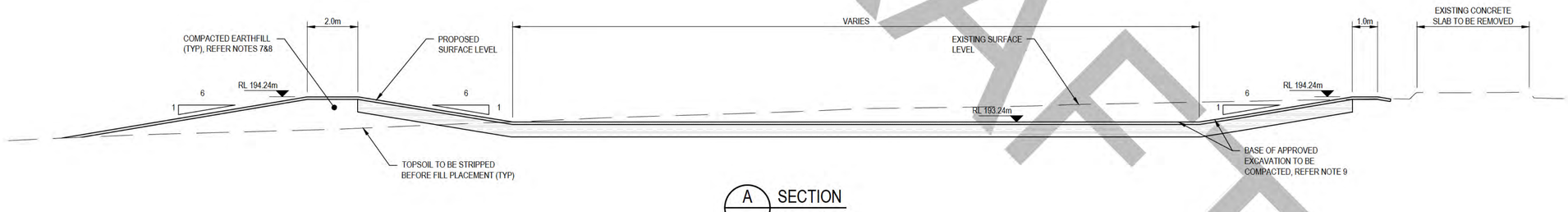


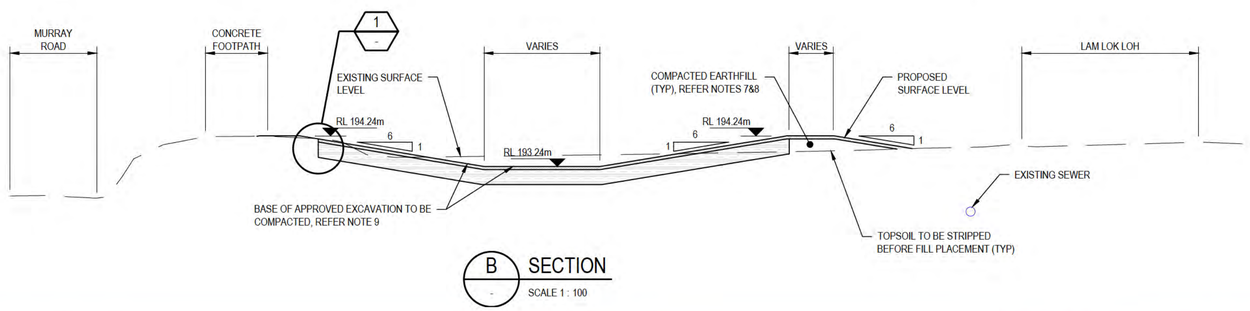
PLAN
SCALE 1:200



1 DETAIL
SCALE 1:20



A SECTION
SCALE 1 : 100



B SECTION
SCALE 1 : 100

GEOTECHNICAL TEST LOCATIONS		
SETOUT POINT	NORTHING (m)	EASTING (m)
HA07	8846918.61	573793.59
TP01	8846919.15	573797.78
TP02	8846937.36	573812.60

NOTES:

1. SETOUT POINTS ARE FOR REFERENCE ONLY, REFER TO 12D MODEL.
2. FOR LEGEND, REFER DRAWING 61-35637-C210.
3. ALL DIMENSIONS ARE IN METRES (m) UNO.
4. ALL RLs ARE IN METRES TO CHRISTMAS ISLAND HEIGHT DATUM (m AHD)
5. ALL WORKS SHALL BE UNDERTAKEN IN ACCORDANCE WITH THE LATEST EDITION OF CURRENT STANDARDS, SPECIFICATIONS AND DRAWINGS.
6. DRAWINGS SHALL NOT BE SCALED.
7. EARTHFILL COMPACTED TO MIN 95% SMDD, VERIFIED BY NUCLEAR DENSIMETER (NDM) OR SAND REPLACEMENT TEST.
8. EARTHFILL TO COMPRISE EXCAVATED MATERIAL FROM BASIN, AND/OR IMPORTED MATERIALS (REFER SPECIFICATION).
9. BASE OF EXCAVATION COMPACTED TO MINIMUM OF 95% SMDD, VERIFIED BY NUCLEAR DENSIMETER (NDM) OR SAND REPLACEMENT TEST.
10. CONTRACTOR IS RESPONSIBLE FOR FIELD IDENTIFICATION AND PROTECTION OF ALL EXISTING SERVICES.
11. EXISTING SERVICE ALIGNMENTS SHOWN ARE INDICATIVE ONLY.
12. FOR LOCATION OF DRAIN, REFER DRAWING 61-35637-C011.
13. BASIN SETOUT POINTS ARE FOR REFERENCE ONLY, REFER TO 12D MODEL.
14. ALL FINISH SURFACES OF BASIN TO BE SEADED WITH SUITABLE EROSION PREVENTING GRASSES.

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0 1 2 3 4 5m
SCALE 1:100 AT ORIGINAL SIZE

0 2 4 6 8 10m
SCALE 1:200 AT ORIGINAL SIZE

0 0.2 0.4 0.6 0.8 1.0m
SCALE 1:20 AT ORIGINAL SIZE

PRELIMINARY

No	Revision	Note: * indicates signatures on original issue of drawing or last revision of drawing	Drawn	Job Manager	Project Director	Date
B	REISSUED FOR 90% DESIGN - CLIENT COMMENT		GT	JM*	PS*	20/11/20
A	ISSUED FOR 90% DESIGN - CLIENT COMMENT		JO	JM*	PS*	30/09/20

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Drafting Check	S.HORTON*	Design Check	S.CLEARY*
Approved (Project Director)			
Date			
Scale	AS SHOWN	This Drawing must not be used for Construction unless signed as Approved	

Client: DEPT OF INFRASTRUCTURE, TRANSPORT, REGIONAL DEVELOPMENT & COMMUNICATIONS
Project: CHRISTMAS ISLAND STORMWATER REMEDIAL WORKS
Title: NORTHERN DRUMSITE WORKS - BASIN 1 PLAN AND TYPICAL SECTIONS

Original Size: A1
Drawing No: 61-35637-C236
Rev: B

Plot Date: 19 November 2020 - 2:46 PM Plotted by: Jess Overheu Cad File No: \\ghdnet.internal\ghd\AU\Perth\Projects\61\35637\CADD\Drawings\61-35637-C236.dwg

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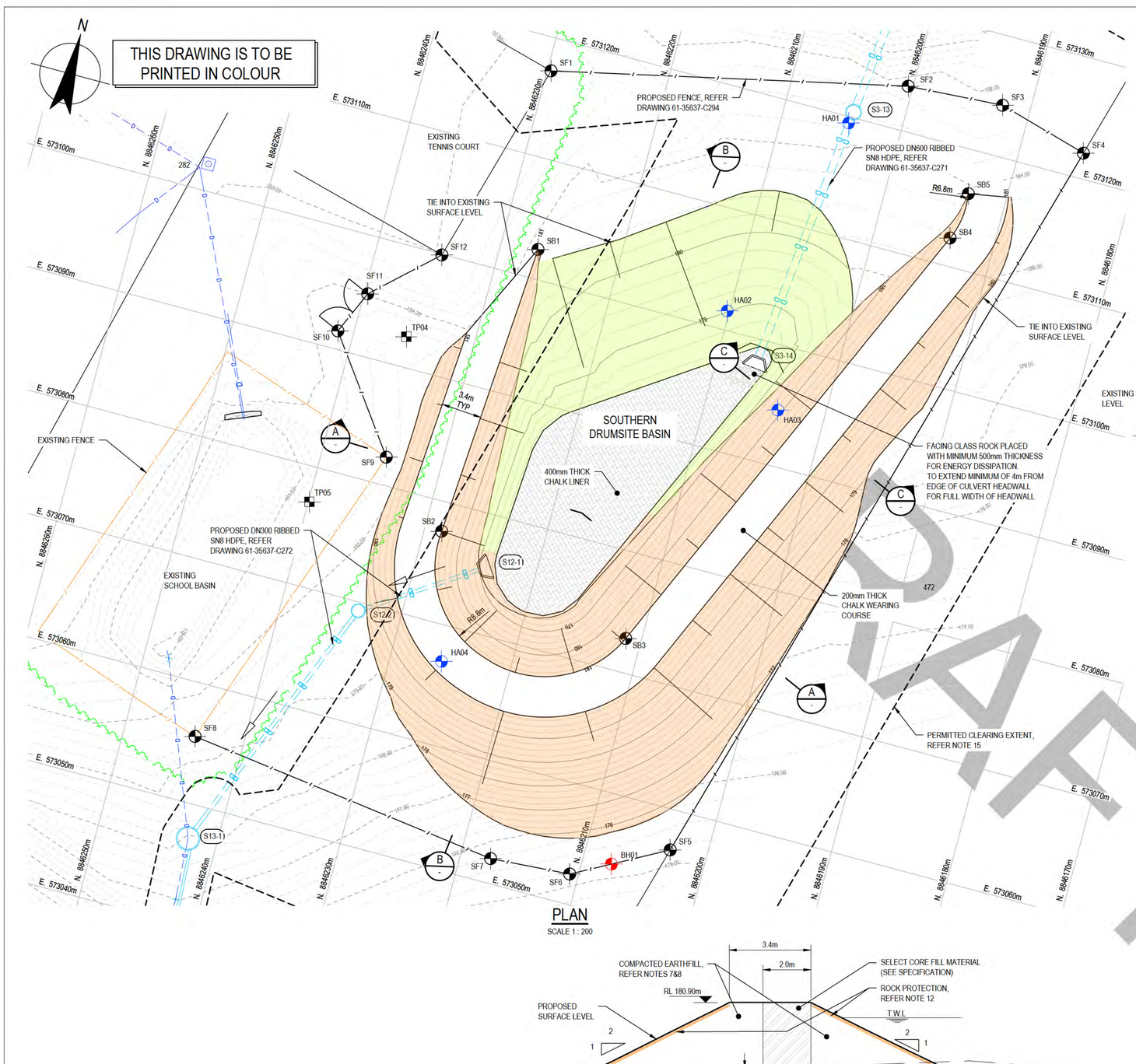
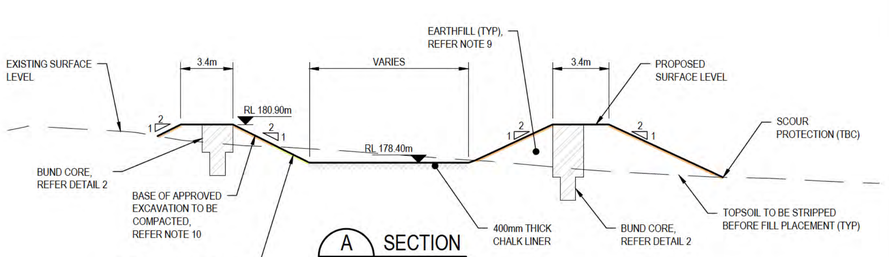
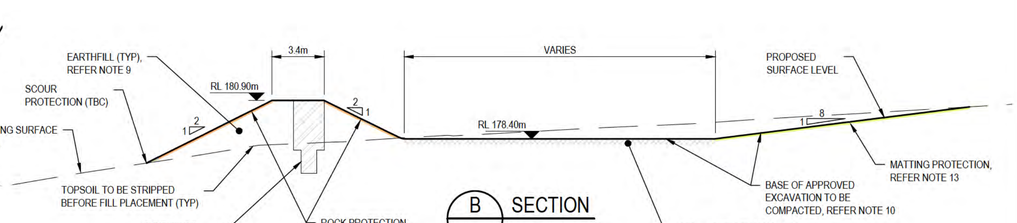


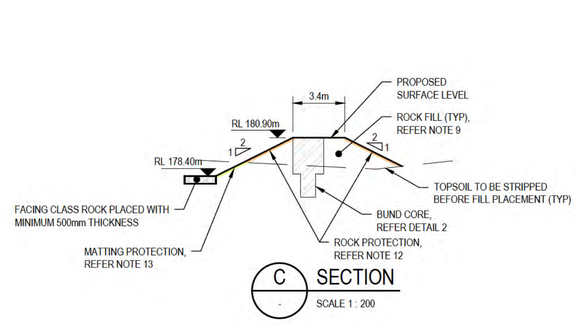
PLAN
SCALE 1 : 200



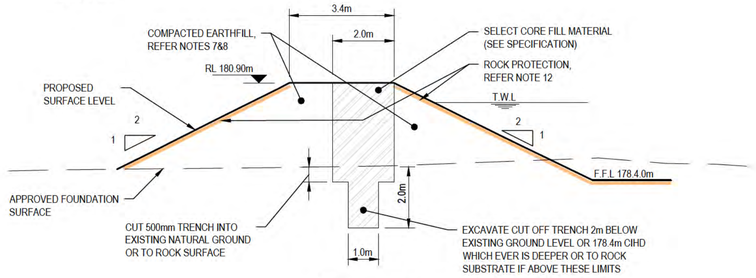
A SECTION
SCALE 1 : 200



B SECTION
SCALE 1 : 200



C SECTION
SCALE 1 : 200



2 DETAIL
SCALE 1:100

SECURITY FENCE SET OUT

SETOUT POINT	NORTHING (m)	EASTING (m)
SF1	8846229.69	573117.24
SF2	8846200.41	573123.75
SF3	8846192.33	573124.26
SF4	8846184.74	573122.13
SF5	8846203.10	573056.66
SF6	8846210.73	573052.53
SF7	8846217.47	573052.06
SF8	8846244.08	573055.55
SF9	8846244.06	573055.60
SF10	8846234.64	573082.33
SF11	8846241.32	573091.52
SF12	8846239.70	573095.18

GEOTECHNICAL TEST LOCATIONS

SETOUT POINT	NORTHING (m)	EASTING (m)
BH01	8846207.57	573054.24
HA01	8846204.44	573119.47
HA02	8846210.19	573101.61
HA03	8846203.94	573094.66
HA04	8846225.74	573066.98
TP04	8846235.64	573092.54
TP05	8846239.91	573077.04

LEGEND:

- ROCK SCOUR PROTECTION, REFER NOTE 12
- BIODEGRADABLE MATTING PROTECTION, REFER NOTE 13
- PREVIOUS SITE INVESTIGATION LOCATION (APPROX.)
- PROPOSED ADDITIONAL BOREHOLES
- PREVIOUS TEST PITS (APPROX.)

DRAINAGE STRUCTURE SET OUT

SETOUT POINT	NORTHING (m)	EASTING (m)
SB1	8846226.86	573102.48
SB2	8846228.55	573077.54
SB3	8846211.29	573072.88
SB4	8846193.71	573112.35
SB5	8846193.20	573116.34

NOTES:

1. SETOUT POINTS ARE FOR REFERENCE ONLY, REFER TO 12D MODEL.
2. FOR LEGEND, REFER DRAWING 61-35637-C210.
3. ALL DIMENSIONS ARE IN METRES (m) UNO.
4. ALL RLs ARE IN METRES TO CHRISTMAS ISLAND HEIGHT DATUM (m CIHD).
5. ALL WORKS SHALL BE UNDERTAKEN IN ACCORDANCE WITH THE LATEST EDITION OF CURRENT STANDARDS, SPECIFICATIONS AND DRAWINGS.
6. DRAWINGS SHALL NOT BE SCALED.
7. EARTHFILL COMPACTED TO MIN 95% SMDD, VERIFIED BY NUCLEAR DENSIMETER (NDM) OR SAND REPLACEMENT TEST.
8. EARTHFILL TO COMPRISE EXCAVATED MATERIAL FROM BASIN, AND/OR IMPORTED MATERIALS (REFER SPECIFICATION).
9. EARTHFILL TO COMPLY WITH GRADING AND PLACEMENT REQUIREMENTS FOR SPECIFICATION.
10. BASE OF EXCAVATION COMPACTED TO MINIMUM OF 95% SMDD, VERIFIED BY NUCLEAR DENSIMETER (NDM) OR SAND REPLACEMENT TEST.
11. FOR LOCATION OF BASIN, REFER DRAWING 61-35637-C221.
12. ROCK PROTECTION NOMINAL STONE SIZE 200-300mm WITH GEOFABRIC BIDIM A44 OR EQUIVALENT UNDERLAY.
13. BIODEGRADABLE MATTING PROTECTION PLACED ON EXCAVATED SLOPE AFTER PLACEMENT OF 150mm OF TOPSOIL.
14. ADDITIONAL GEOTECHNICAL INVESTIGATION REQUIRED TO BE COMPLETED PRIOR TO CONSTRUCTION COMMENCING REFER. SPECIFICATIONS FOR DETAILS.
15. EXTENT OF CLEARING PERMITTED. REFER TO SPECIFICATION FOR FURTHER DETAILS AND SETOUT REQUIREMENTS.

0 1 2 3 4 5m
SCALE 1:100 AT ORIGINAL SIZE

0 2 4 6 8 10m
SCALE 1:200 AT ORIGINAL SIZE

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PRELIMINARY

No	Revision	Note: * indicates signatures on original issue of drawing or last revision of drawing	Drawn	Job Manager	Project Director	Date
B	REISSUED FOR 90% DESIGN - CLIENT COMMENT		GT	JM*	PS*	20/11/20
A	ISSUED FOR 90% DESIGN - CLIENT COMMENT		JO	JM*	PS*	30/09/20

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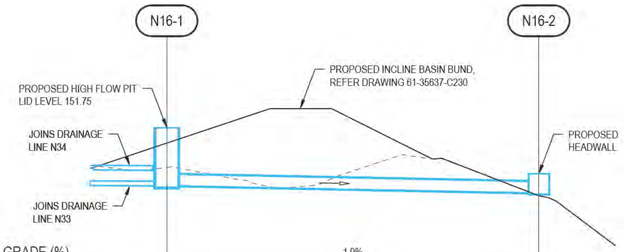
Drawn	J.OVERHEU	Designer	J.VALE
Drafting Check	S.HORTON*	Design Check	S.CLEARY*
Approved (Project Director)			
Date			
Scale	1:200	This Drawing must not be used for Construction unless signed as Approved	

Client: DEPT OF INFRASTRUCTURE, TRANSPORT, REGIONAL DEVELOPMENT & COMMUNICATIONS
Project: CHRISTMAS ISLAND STORMWATER REMEDIAL WORKS
Title: SOUTHERN DRUMSITE WORKS - BASIN PLAN AND TYPICAL SECTIONS
Original Size: A1
Drawing No: 61-35637-C245
Rev: B

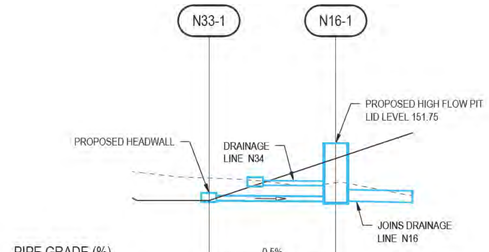
Plot Date: 19 November 2020 - 2:40 PM Plotted by: Jess Overheu Cad File No: \\ghdnet.internal\ghd\AU\Perth\Projects\61\35637\CADD\Drawings\61-35637-C245.dwg



PIPE GRADE (%)		1.9%	
PIPE SLOPE (1 in X)		53.0	
PIPE SIZE (mm)		750	
PIPE CLASS		RIBBED SN8 HDPE	
DATUM R.L. 136.0m			
DESIGN SURFACE LEVEL (m)	150.75		148.75
EXISTING SURFACE LEVEL (m)	149.16		148.75
INVERT LEVEL (m)	147.86 / 147.96		147.50 / 147.40
DEPTH TO INVERT FROM DESIGN SURFACE (m)	3.89 / 3.79		1.25 / 1.35
CHAINAGE (m)	0.0	24.3	24.3

DRAINAGE LINE N16 - LONGITUDINAL SECTION NORTHERN DRUMSITE

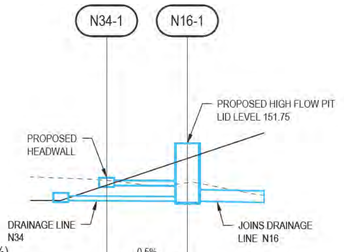
HORIZONTAL SCALE 1:200
VERTICAL SCALE 1:200



PIPE GRADE (%)		0.5%	
PIPE SLOPE (1 in X)		197.3	
PIPE SIZE (mm)		300	
PIPE CLASS		RIBBED SN8 HDPE	
DATUM R.L. 137.0m			
DESIGN SURFACE LEVEL (m)	148.0		150.75
EXISTING SURFACE LEVEL (m)	149.47		149.16
INVERT LEVEL (m)	147.90 / 148.00		147.96 / 147.86
DEPTH TO INVERT FROM DESIGN SURFACE (m)	0.60 / 0.50		3.79 / 3.89
CHAINAGE (m)	0.0	8.3	8.3

DRAINAGE LINE N33 - LONGITUDINAL SECTION NORTHERN DRUMSITE

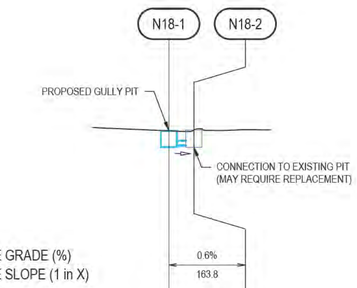
HORIZONTAL SCALE 1:200
VERTICAL SCALE 1:200



PIPE GRADE (%)		0.5%	
PIPE SLOPE (1 in X)		195.5	
PIPE SIZE (mm)		300	
PIPE CLASS		RIBBED SN8 HDPE	
DATUM R.L. 137.0m			
DESIGN SURFACE LEVEL (m)	149.00		150.75
EXISTING SURFACE LEVEL (m)	149.31		149.16
INVERT LEVEL (m)	148.90 / 149.00		148.87 / 147.96
DEPTH TO INVERT FROM DESIGN SURFACE (m)	0.60 / 0.50		2.78 / 3.69
CHAINAGE (m)	0.0	5.3	5.3

DRAINAGE LINE N34 - LONGITUDINAL SECTION NORTHERN DRUMSITE

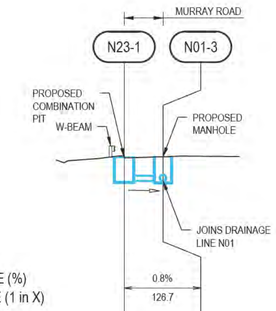
HORIZONTAL SCALE 1:200
VERTICAL SCALE 1:200



PIPE GRADE (%)		0.6%	
PIPE SLOPE (1 in X)		163.8	
PIPE SIZE (mm)		300	
PIPE CLASS		RIBBED SN8 HDPE	
DATUM R.L. 172.0m			
DESIGN SURFACE LEVEL (m)	187.76		187.81
EXISTING SURFACE LEVEL (m)	187.76		187.81
INVERT LEVEL (m)	186.70 / 186.80		186.79 / 186.69
DEPTH TO INVERT FROM DESIGN SURFACE (m)	1.06 / 0.96		1.02 / 1.12
CHAINAGE (m)	0.0	1.6	1.6

DRAINAGE LINE N18 - LONGITUDINAL SECTION NORTHERN DRUMSITE

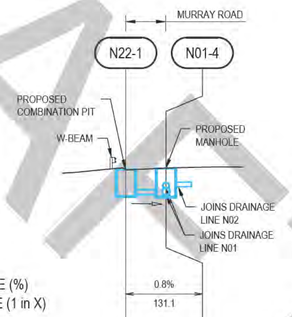
HORIZONTAL SCALE 1:200
VERTICAL SCALE 1:200



PIPE GRADE (%)		0.8%	
PIPE SLOPE (1 in X)		126.7	
PIPE SIZE (mm)		300	
PIPE CLASS		RIBBED SN8 HDPE	
DATUM R.L. 178.0m	178.00		
DESIGN SURFACE LEVEL (m)	193.54		193.57
EXISTING SURFACE LEVEL (m)	193.54		193.57
INVERT LEVEL (m)	191.92 / 192.02		192.00 / 191.89
DEPTH TO INVERT FROM DESIGN SURFACE (m)	1.62 / 1.52		1.57 / 1.68
CHAINAGE (m)	0.0	2.5	2.5

DRAINAGE LINE N23 - LONGITUDINAL SECTION NORTHERN DRUMSITE

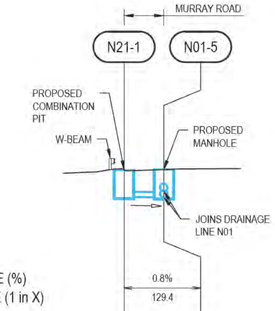
HORIZONTAL SCALE 1:200
VERTICAL SCALE 1:200



PIPE GRADE (%)		0.8%	
PIPE SLOPE (1 in X)		131.1	
PIPE SIZE (mm)		300	
PIPE CLASS		RIBBED SN8 HDPE	
DATUM R.L. 178.0m	178.00		
DESIGN SURFACE LEVEL (m)	193.14		193.22
EXISTING SURFACE LEVEL (m)	193.14		193.22
INVERT LEVEL (m)	191.40 / 191.50		191.48 / 191.37
DEPTH TO INVERT FROM DESIGN SURFACE (m)	1.74 / 1.64		1.74 / 1.85
CHAINAGE (m)	0.0	2.6	2.6

DRAINAGE LINE N22 - LONGITUDINAL SECTION NORTHERN DRUMSITE

HORIZONTAL SCALE 1:200
VERTICAL SCALE 1:200



PIPE GRADE (%)		0.8%	
PIPE SLOPE (1 in X)		129.4	
PIPE SIZE (mm)		300	
PIPE CLASS		RIBBED SN8 HDPE	
DATUM R.L. 178.0m	178.00		
DESIGN SURFACE LEVEL (m)	192.71		192.73
EXISTING SURFACE LEVEL (m)	192.71		192.73
INVERT LEVEL (m)	190.86 / 190.96		190.94 / 190.83
DEPTH TO INVERT FROM DESIGN SURFACE (m)	1.85 / 1.75		1.79 / 1.90
CHAINAGE (m)	0.0	2.6	2.6

DRAINAGE LINE N21 - LONGITUDINAL SECTION NORTHERN DRUMSITE

HORIZONTAL SCALE 1:200
VERTICAL SCALE 1:200

NOTES:

1. FOR PIPELINE ALIGNMENTS, REFER DRAWINGS 61-35637-C210 AND C211.
2. FOR LEGEND, REFER DRAWING 61-35637-C210.
3. FOR OTHER NOTES, REFER DRAWING 61-35637-C202.

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0 2 4 6 8 10m
SCALE 1:200 AT ORIGINAL SIZE

0 2.5 5 7.5 10 12.5m
SCALE 1:250 AT ORIGINAL SIZE

0 5 10 15 20 25m
SCALE 1:500 AT ORIGINAL SIZE

PRELIMINARY

No	Revision	Note: * indicates signatures on original issue of drawing or last revision of drawing	Drawn	Job Manager	Project Director	Date
B	REISSUED FOR 90□ DESIGN - CLIENT COMMENT		GT	JM*	PS*	20/11/20
A	ISSUED FOR 90□ DESIGN - CLIENT COMMENT		GT	JM*	PS*	30/09/20

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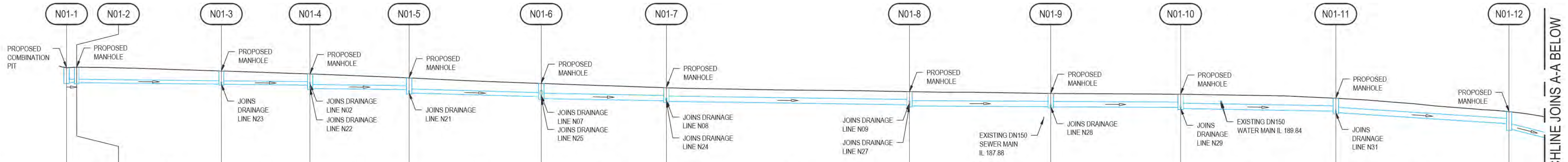
Drawn	G.TAYAM	Designer	D.DOMINGO
Drafting Check	S.HORTON*	Design Check	S.CLEARY*
Approved (Project Director)			
Date			
Scale	AS SHOWN	This Drawing must not be used for Construction unless signed as Approved	

Client: DEPT OF INFRASTRUCTURE, TRANSPORT, REGIONAL DEVELOPMENT & COMMUNICATIONS
Project: CHRISTMAS ISLAND STORMWATER REMEDIAL WORKS
Title: NORTHERN DRUMSITE WORKS LONGITUDINAL SECTIONS - SHEET 1
Original Size: A1
Drawing No: 61-35637-C250
Rev: B

Plot Date: 18 November 2020 - 8:05 AM Plotted by: Giselle Tayam
Cad File No: N:\AU\Perth\Projects\61\35637\CADD\Drawings\61-35637-C250.dwg



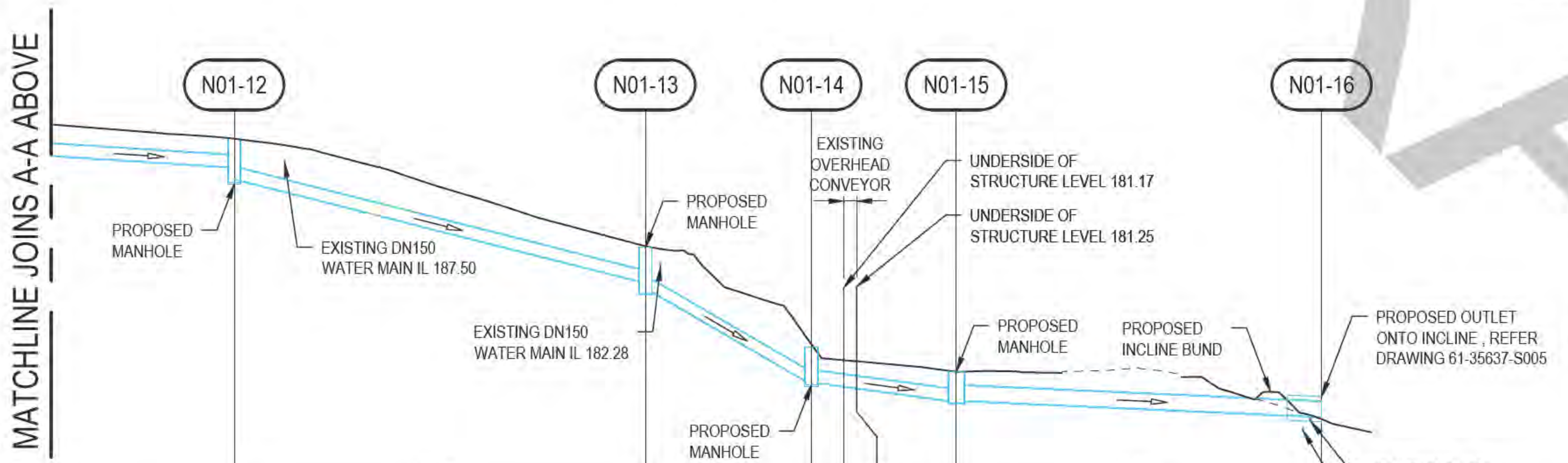
From	To	PIPE GRADE (%)	PIPE SLOPE (1 in X)	PIPE SIZE (mm)	PIPE CLASS	Length (m)
N01-1	N01-2	0.4%	242.2	375	RIBBED SN8 HDPE	2.4
N01-2	N01-3	0.5%	193.7	375	RIBBED SN8 HDPE	34.9
N01-3	N01-4	0.5%	213.9	375	RIBBED SN8 HDPE	21.4
N01-4	N01-5	0.5%	187.3	450	RIBBED SN8 HDPE	23.9
N01-5	N01-6	1.4%	74.0	450	RIBBED SN8 HDPE	31.8
N01-6	N01-7	0.9%	111.7	600	RIBBED SN8 HDPE	30.1
N01-7	N01-8	0.7%	142.4	600	RIBBED SN8 HDPE	58.6
N01-8	N01-9	0.2%	425.3	600	RIBBED SN8 HDPE	34.0
N01-9	N01-10	0.2%	447.1	600	RIBBED SN8 HDPE	31.3
N01-10	N01-11	0.8%	120.3	600	RIBBED SN8 HDPE	37.4
N01-11	N01-12	3.1%	31.8	600	RIBBED SN8 HDPE	41.8

DATUM R.L. 172.0m

Node	DESIGN SURFACE LEVEL (m)	EXISTING SURFACE LEVEL (m)	INVERT LEVEL (m) (incoming)	INVERT LEVEL (m)	DEPTH TO INVERT FROM DESIGN SURFACE (m) (incoming)	DEPTH TO INVERT FROM DESIGN SURFACE (m)	CHAINAGE (m)
N01-1	193.96	193.96	192.10	192.20	1.86	1.76	0.0
N01-2	194.03	194.03	192.19 / 192.08	192.18	1.84 / 1.95	1.85	2.4
N01-3	193.57	193.57	191.89	191.99	1.68	1.58	37.3
N01-4	193.22	193.22	191.89 / 191.37	191.47	1.33 / 1.85	1.75	58.7
N01-5	192.73	192.73	191.34 / 190.83	190.93	1.39 / 1.90	1.80	82.5
N01-6	192.06	192.06	190.50 / 190.17	190.27	1.56 / 1.89	1.79	114.4
N01-7	191.55	191.55	190.00 / 189.83	189.93	1.55 / 1.71	1.61	144.5
N01-8	191.08	191.08	189.52 / 189.28	189.38	1.56 / 1.80	1.70	203.1
N01-9	190.87	190.87	189.30 / 189.18	189.28	1.57 / 1.69	1.59	237.1
N01-10	190.77	190.77	189.21 / 188.97	189.07	1.56 / 1.80	1.70	268.4
N01-11	190.29	190.29	188.76 / 188.47	188.57	1.53 / 1.82	1.72	305.8
N01-12	188.68	188.68	187.26 / 186.48	186.58	1.42 / 2.20	2.10	347.6

DRAINAGE LINE N01 - LONGITUDINAL SECTION
NORTHERN DRUMSITE

HORIZONTAL SCALE 1:500
VERTICAL SCALE 1:250



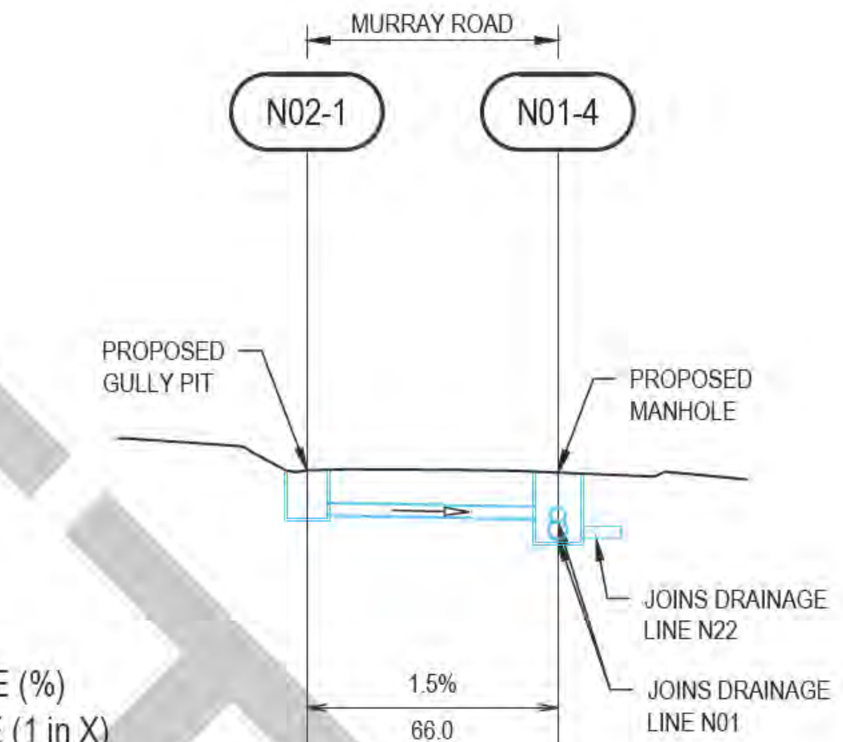
From	To	PIPE GRADE (%)	PIPE SLOPE (1 in X)	PIPE SIZE (mm)	PIPE CLASS	Length (m)
N01-12	N01-13	12.3%	8.1	600	RIBBED SN8 HDPE	41.4
N01-13	N01-14	27.0%	3.7	600	RIBBED SN8 HDPE	16.7
N01-14	N01-15	6.2%	16.2	600	RIBBED SN8 HDPE	14.6
N01-15	N01-16	2.2%	46.0	750	RIBBED SN8 HDPE	36.8

DATUM R.L. 162.0m

Node	DESIGN SURFACE LEVEL (m)	EXISTING SURFACE LEVEL (m)	INVERT LEVEL (m) (incoming)	INVERT LEVEL (m)	DEPTH TO INVERT FROM DESIGN SURFACE (m) (incoming)	DEPTH TO INVERT FROM DESIGN SURFACE (m)	CHAINAGE (m)
N01-12	188.68	188.68	187.26 / 186.48	186.58	1.42 / 2.20	2.10	347.6
N01-13	183.22	183.22	181.50 / 180.90	181.00	1.72 / 2.32	2.22	389.0
N01-14	178.18	178.18	176.50 / 176.30	176.40	1.68 / 1.88	1.78	405.7
	177.54	177.54		176.22		1.32	408.9
	177.48	177.48		176.13		1.35	412.3
N01-15	176.96	176.96	175.50 / 175.40	175.50	1.46 / 1.56	1.46	420.2
N01-16	175.45	175.45	174.70	174.50	0.75	0.95	35.65 / 457.0

DRAINAGE LINE N01 - LONGITUDINAL SECTION
NORTHERN DRUMSITE

HORIZONTAL SCALE 1:500
VERTICAL SCALE 1:250



From	To	PIPE GRADE (%)	PIPE SLOPE (1 in X)	PIPE SIZE (mm)	PIPE CLASS	Length (m)
N02-1	N01-4	1.5%	66.0	300	RIBBED SN8 HDPE	6.6

DATUM R.L. 180.0m

Node	DESIGN SURFACE LEVEL (m)	EXISTING SURFACE LEVEL (m)	INVERT LEVEL (m) (incoming)	INVERT LEVEL (m)	DEPTH TO INVERT FROM DESIGN SURFACE (m) (incoming)	DEPTH TO INVERT FROM DESIGN SURFACE (m)	CHAINAGE (m)
N02-1	193.27	193.27	191.99	192.09	1.28	1.18	0.0
N01-4	193.22	193.22	191.99 / 191.37	191.47	1.22 / 1.85	1.75	6.6

DRAINAGE LINE N02 - LONGITUDINAL SECTION
NORTHERN DRUMSITE

HORIZONTAL SCALE 1:200
VERTICAL SCALE 1:200

DRAFT

NOTES:

1. FOR PIPELINE ALIGNMENTS, REFER DRAWINGS 61-35637-C210 AND C211.
2. FOR LEGEND, REFER DRAWING 61-35637-C210.
3. FOR OTHER NOTES, REFER DRAWING 61-35637-C202.

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0 2 4 6 8 10m — SCALE 1:200 AT ORIGINAL SIZE

0 2.5 5 7.5 10 12.5m — SCALE 1:250 AT ORIGINAL SIZE

0 5 10 15 20 25m — SCALE 1:500 AT ORIGINAL SIZE

PRELIMINARY

No	Revision	Drawn	Job Manager	Project Director	Date
A	ISSUED FOR 90□ DESIGN - CLIENT COMMENT	GT	JM*	PS*	30/09/20

Note: * indicates signatures on original issue of drawing or last revision of drawing

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Drawn G.TAYAM | Designer D.DOMINGO
Drafting Check S.HORTON* | Design Check S.CLEARY*
Approved (Project Director)
Date
Scale AS SHOWN
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Client: DEPT OF INFRASTRUCTURE, TRANSPORT, REGIONAL DEVELOPMENT & COMMUNICATIONS
Project: CHRISTMAS ISLAND STORMWATER REMEDIAL WORKS
Title: NORTHERN DRUMSITE WORKS LONGITUDINAL SECTIONS - SHEET 2

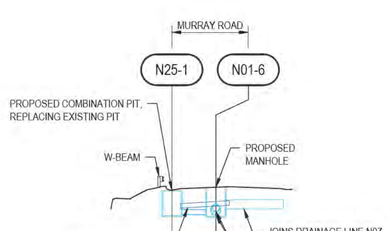
Original Size A1 | Drawing No: 61-35637-C251 | Rev: A

Plot Date: 30 September 2020 - 2:37 AM Plotted by: Giselle Tayam Cad File No: N:\AU\Perth\Projects\61\35637\CADD\Drawings\61-35637-C251.dwg

THIS DRAWING IS TO BE PRINTED IN COLOUR

NOTES:

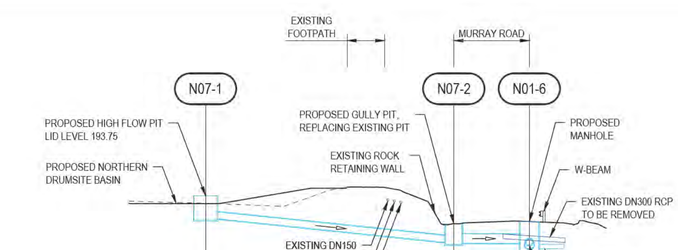
1. FOR PIPELINE ALIGNMENTS, REFER DRAWINGS 61-35637-C211 AND C212.
2. FOR LEGEND, REFER DRAWING 61-35637-C210.
3. FOR OTHER NOTES, REFER DRAWING 61-35637-C202.



PIPE GRADE (%)		0.7%		
PIPE SLOPE (1 in X)		143.5		
PIPE SIZE (mm)		300		
PIPE CLASS		RIBBED SN8 HDPE		
DATUM R.L. 177.0m				
DESIGN SURFACE LEVEL (m)	191.85			192.06
EXISTING SURFACE LEVEL (m)	191.85			192.06
INVERT LEVEL (m)	190.20 / 190.30		190.28 / 190.17	190.27
DEPTH TO INVERT FROM DESIGN SURFACE (m)	1.65 / 1.55		1.78 / 1.89	1.79
CHAINAGE (m)	0.0	2.9		2.9

DRAINAGE LINE N25- LONGITUDINAL SECTION NORTHERN DRUMSITE

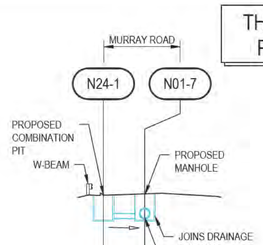
HORIZONTAL SCALE 1:200
VERTICAL SCALE 1:200



PIPE GRADE (%)		9.6%	0.4%	
PIPE SLOPE (1 in X)		10.5	246.7	
PIPE SIZE (mm)		450	600	
PIPE CLASS		RIBBED SN8 HDPE	RIBBED SN8 HDPE	
DATUM R.L. 178.m				
DESIGN SURFACE LEVEL (m)	193.24		191.92	192.06
EXISTING SURFACE LEVEL (m)	193.26		191.92	192.06
INVERT LEVEL (m)	192.15 / 192.25		190.70 / 190.55 / 190.66	190.64 / 190.17 / 190.27
DEPTH TO INVERT FROM DESIGN SURFACE (m)	1.60 / 1.50		1.22 / 1.36 / 1.26	1.42 / 1.89 / 1.79
CHAINAGE (m)	0.0	16.2	12.76 / 16.2	4.9 / 21.1

DRAINAGE LINE N07 - LONGITUDINAL SECTION NORTHERN DRUMSITE

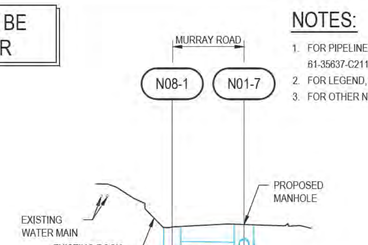
HORIZONTAL SCALE 1:200
VERTICAL SCALE 1:200



PIPE GRADE (%)		0.7%	
PIPE SLOPE (1 in X)		134.2	
PIPE SIZE (mm)		300	
PIPE CLASS		RIBBED SN8 HDPE	
DATUM R.L. 176.0m			
DESIGN SURFACE LEVEL (m)	191.47		191.55
EXISTING SURFACE LEVEL (m)	191.47		191.55
INVERT LEVEL (m)	189.86 / 189.96		189.84 / 189.93
DEPTH TO INVERT FROM DESIGN SURFACE (m)	1.61 / 1.51		1.61 / 1.71
CHAINAGE (m)	0.0	2.7	2.7

DRAINAGE LINE N24 - LONGITUDINAL SECTION NORTHERN DRUMSITE

HORIZONTAL SCALE 1:200
VERTICAL SCALE 1:200



PIPE GRADE (%)		1.1%	
PIPE SLOPE (1 in X)		93.7	
PIPE SIZE (mm)		300	
PIPE CLASS		RIBBED SN8 HDPE	
DATUM R.L. 178.0m			
DESIGN SURFACE LEVEL (m)	191.38		191.55
EXISTING SURFACE LEVEL (m)	191.38		191.55
INVERT LEVEL (m)	190.02 / 190.12		190.07 / 189.93
DEPTH TO INVERT FROM DESIGN SURFACE (m)	1.36 / 1.26		1.48 / 1.71 / 1.61
CHAINAGE (m)	0.0	4.7	4.7

DRAINAGE LINE N08 - LONGITUDINAL SECTION NORTHERN DRUMSITE

HORIZONTAL SCALE 1:200
VERTICAL SCALE 1:200

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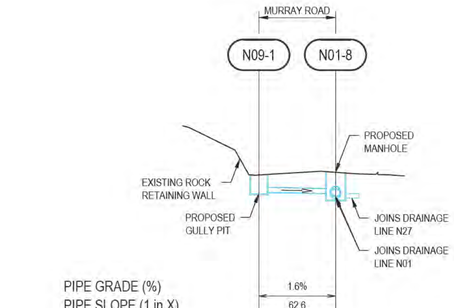
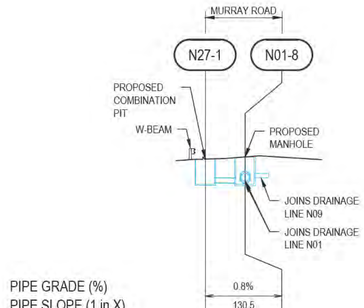


PIPE GRADE (%)		1.6%	
PIPE SLOPE (1 in X)		62.6	
PIPE SIZE (mm)		300	
PIPE CLASS		RIBBED SN8 HDPE	
DATUM R.L. 176.0m			
DESIGN SURFACE LEVEL (m)	190.90		191.08
EXISTING SURFACE LEVEL (m)	190.90		191.08
INVERT LEVEL (m)	189.68 / 189.78		189.70 / 189.28 / 189.38
DEPTH TO INVERT FROM DESIGN SURFACE (m)	1.22 / 1.12		1.38 / 1.80 / 1.70
CHAINAGE (m)	0.0	5.0	5.0

DRAINAGE LINE N09 - LONGITUDINAL SECTION NORTHERN DRUMSITE

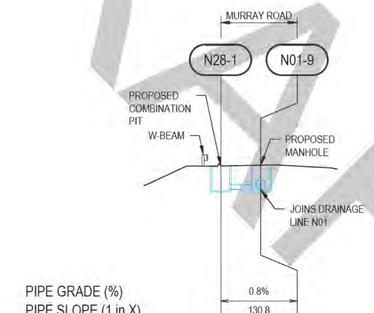
HORIZONTAL SCALE 1:200
VERTICAL SCALE 1:200



PIPE GRADE (%)		0.8%	
PIPE SLOPE (1 in X)		130.5	
PIPE SIZE (mm)		300	
PIPE CLASS		RIBBED SN8 HDPE	
DATUM R.L. 175.0m			
DESIGN SURFACE LEVEL (m)	190.94		191.08
EXISTING SURFACE LEVEL (m)	190.94		191.08
INVERT LEVEL (m)	189.30 / 189.40		189.38 / 189.28 / 189.38
DEPTH TO INVERT FROM DESIGN SURFACE (m)	1.64 / 1.54		1.70 / 1.80 / 1.70
CHAINAGE (m)	0.0	2.6	2.6

DRAINAGE LINE N27- LONGITUDINAL SECTION NORTHERN DRUMSITE

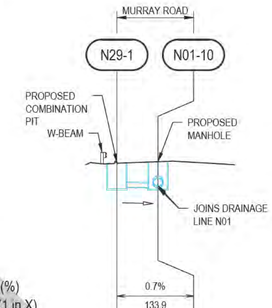
HORIZONTAL SCALE 1:200
VERTICAL SCALE 1:200



PIPE GRADE (%)		0.8%	
PIPE SLOPE (1 in X)		130.8	
PIPE SIZE (mm)		300	
PIPE CLASS		RIBBED SN8 HDPE	
DATUM R.L. 175.0m			
DESIGN SURFACE LEVEL (m)	190.84		190.87
EXISTING SURFACE LEVEL (m)	190.84		190.87
INVERT LEVEL (m)	189.20 / 189.30		189.28 / 189.18 / 189.28
DEPTH TO INVERT FROM DESIGN SURFACE (m)	1.64 / 1.54		1.59 / 1.69 / 1.59
CHAINAGE (m)	0.0	2.6	2.6

DRAINAGE LINE N28 - LONGITUDINAL SECTION NORTHERN DRUMSITE

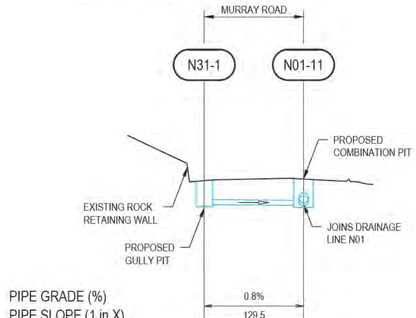
HORIZONTAL SCALE 1:200
VERTICAL SCALE 1:200



PIPE GRADE (%)		0.7%	
PIPE SLOPE (1 in X)		133.9	
PIPE SIZE (mm)		300	
PIPE CLASS		RIBBED SN8 HDPE	
DATUM R.L. 175.0m			
DESIGN SURFACE LEVEL (m)	190.69		190.77
EXISTING SURFACE LEVEL (m)	190.69		190.77
INVERT LEVEL (m)	189.00 / 189.10		189.08 / 188.97 / 189.07
DEPTH TO INVERT FROM DESIGN SURFACE (m)	1.69 / 1.59		1.69 / 1.80 / 1.70
CHAINAGE (m)	0.0	2.7	2.7

DRAINAGE LINE N29 - LONGITUDINAL SECTION NORTHERN DRUMSITE

HORIZONTAL SCALE 1:200
VERTICAL SCALE 1:200



PIPE GRADE (%)		0.8%	
PIPE SLOPE (1 in X)		129.5	
PIPE SIZE (mm)		300	
PIPE CLASS		RIBBED SN8 HDPE	
DATUM R.L. 175.0m			
DESIGN SURFACE LEVEL (m)	190.18		190.29
EXISTING SURFACE LEVEL (m)	190.18		190.29
INVERT LEVEL (m)	188.53 / 188.63		188.58 / 188.47 / 188.57
DEPTH TO INVERT FROM DESIGN SURFACE (m)	1.65 / 1.55		1.71 / 1.82 / 1.72
CHAINAGE (m)	0.0	6.5	6.5

DRAINAGE LINE N31- LONGITUDINAL SECTION NORTHERN DRUMSITE

HORIZONTAL SCALE 1:200
VERTICAL SCALE 1:200

0 2 4 6 8 10m
SCALE 1:200 AT ORIGINAL SIZE

PRELIMINARY

No	Revision	Note: * indicates signatures on original issue of drawing or last revision of drawing	Drawn	Job Manager	Project Director	Date
B	REISSUED FOR 90□ DESIGN - CLIENT COMMENT		GT	JM*	PS*	20/11/20
A	ISSUED FOR 90□ DESIGN - CLIENT COMMENT		GT	JM*	PS*	30/09/20

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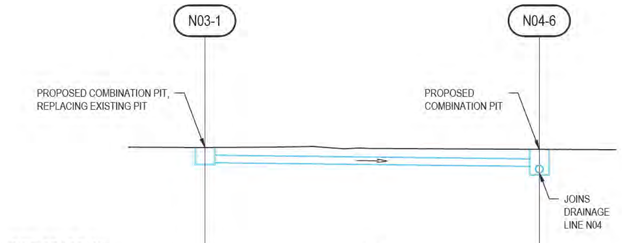
Drawn	G.TAYAM	Designer	D.DOMINGO
Drafting Check	S.HORTON*	Design Check	S.CLEARY*
Approved (Project Director)			
Date			
Scale	AS SHOWN	This Drawing must not be used for Construction unless signed as Approved	

Client: DEPT OF INFRASTRUCTURE, TRANSPORT, REGIONAL DEVELOPMENT & COMMUNICATIONS
Project: CHRISTMAS ISLAND STORMWATER REMEDIAL WORKS
Title: NORTHERN DRUMSITE WORKS LONGITUDINAL SECTIONS - SHEET 3

Original Size A1
Drawing No: 61-35637-C252
Rev: B

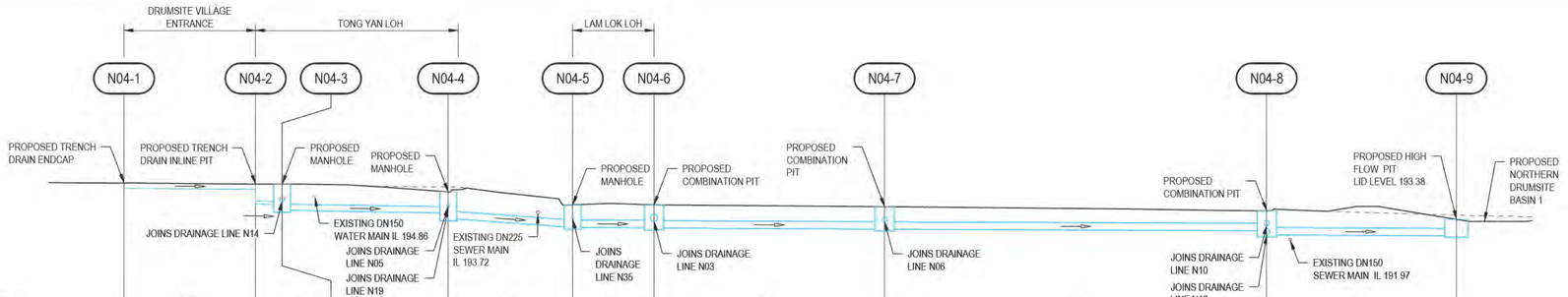
Plot Date: 17 November 2020 - 10:24 AM Plotted by: Giselle Tayam
Cad File No: N:\AU\Perth\Projects\61\35637\CADD\Drawings\61-35637-C252.dwg



PIPE GRADE (%)	1.1%		
PIPE SLOPE (1 in X)	91.0		
PIPE SIZE (mm)	450		
PIPE CLASS	RIBBED SN8 HDPE		
DATUM R.L. 180.0m			
DESIGN SURFACE LEVEL (m)	194.46		194.34
EXISTING SURFACE LEVEL (m)	194.46		194.34
INVERT LEVEL (m)	193.39 193.49		193.25 193.22 192.82
DEPTH TO INVERT FROM DESIGN SURFACE (m)	1.07 0.97		1.09 1.12 1.52
CHAINAGE (m)	0.0	21.8	21.8

DRAINAGE LINE N03 - LONGITUDINAL SECTION
NORTHERN DRUMSITE

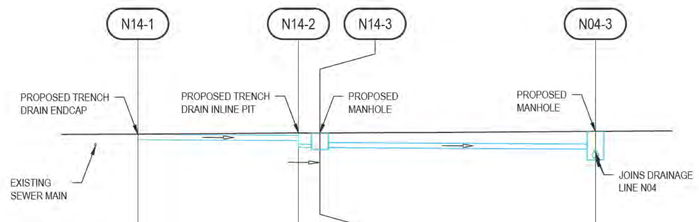
HORIZONTAL SCALE 1:200
VERTICAL SCALE 1:200



PIPE GRADE (%)	0.8%	1.7%	1.5%	6.4%	0.4%	0.4%	0.4%	0.4%	
PIPE SLOPE (1 in X)	124.5	58.5	68.9	15.6	269.4	254.9	281.4	251.6	
PIPE SIZE (mm)	300x350	200	375	450	450	450	450	450	
PIPE CLASS	CHANNEL	PVC	RIBBED SN8 HDPE	RIBBED SN8 HDPE	RIBBED SN8 HDPE	RIBBED SN8 HDPE	RIBBED SN8 HDPE	RIBBED SN8 HDPE	
DATUM R.L. 180.0m									
DESIGN SURFACE LEVEL (m)	195.79	195.72	195.72	195.20	194.34	194.34	194.22	193.94	193.38
EXISTING SURFACE LEVEL (m)	195.79	195.72	195.72	195.54	194.34	194.34	194.22	193.94	193.66
INVERT LEVEL (m)	195.34 195.44	195.37 194.30 194.40	194.37 193.89 193.99	193.83 193.33 193.43	192.90 192.76 192.86	192.84 192.72 192.82	192.76 192.64 192.74	192.65 192.26 192.36	192.31 192.21
DEPTH TO INVERT FROM DESIGN SURFACE (m)	0.45 0.35	0.35 1.42 1.32	1.35 1.83 1.73	1.37 1.87 1.77	1.44 1.58 1.48	1.50 1.62 1.52	1.46 1.58 1.48	1.29 1.68 1.58	1.07 1.17
CHAINAGE (m)	-8.2	8.7	0.6 1.8	2.3 11.0	13.3 8.3	21.6 5.4	27.0 15.3	42.3 25.3	67.6 12.6	80.2

DRAINAGE LINE N04 - LONGITUDINAL SECTION
NORTHERN DRUMSITE

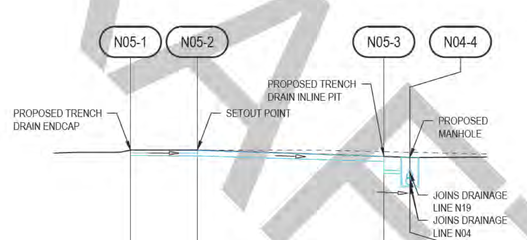
HORIZONTAL SCALE 1:200
VERTICAL SCALE 1:200



PIPE GRADE (%)	0.6%	2.2%	0.5%	
PIPE SLOPE (1 in X)	174.9	46.4	189.4	
PIPE SIZE (mm)	300x350	200	300	
PIPE CLASS	CHANNEL	PVC	RIBBED SN8 HDPE	
DATUM R.L. 180.0m				
DESIGN SURFACE LEVEL (m)	195.55	195.62	195.61	195.72
EXISTING SURFACE LEVEL (m)	195.55	195.62	195.61	195.72
INVERT LEVEL (m)	195.08 195.18	195.12 194.60 194.70	194.67 194.57 194.68	194.58 193.89 193.99
DEPTH TO INVERT FROM DESIGN SURFACE (m)	0.47 0.37	0.50 1.02 0.92	0.94 1.04 0.93	1.14 1.83 1.73
CHAINAGE (m)	-10.5	10.5 0.0	1.4 1.4	18.0 19.4

DRAINAGE LINE N14 - LONGITUDINAL SECTION
NORTHERN DRUMSITE

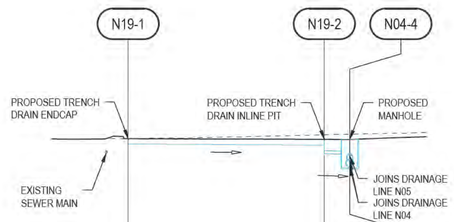
HORIZONTAL SCALE 1:200
VERTICAL SCALE 1:200



PIPE GRADE (%)	0.5%	3.0%	2.7%	
PIPE SLOPE (1 in X)	217.7	32.9	36.6	
PIPE SIZE (mm)	300x350	300x350	200	
PIPE CLASS	CHANNEL	CHANNEL	PVC	
DATUM R.L. 180.0m				
DESIGN SURFACE LEVEL (m)	195.68	195.68	195.26	195.20
EXISTING SURFACE LEVEL (m)	195.68	195.68	195.58	195.54
INVERT LEVEL (m)	195.22 195.32	195.30 195.20 195.30	194.93 194.07 194.17	194.12 193.33 193.43
DEPTH TO INVERT FROM DESIGN SURFACE (m)	0.46 0.36	0.38 0.48 0.38	0.33 1.19 1.09	1.08 1.87 1.77
CHAINAGE (m)	0.0	4.4 4.4	12.2 16.5	1.7 18.2

DRAINAGE LINE N05 - LONGITUDINAL SECTION
NORTHERN DRUMSITE

HORIZONTAL SCALE 1:200
VERTICAL SCALE 1:200



PIPE GRADE (%)	0.6%	2.4%	
PIPE SLOPE (1 in X)	160.1	41.4	
PIPE SIZE (mm)	300x350	200	
PIPE CLASS	CHANNEL	PVC	
DATUM R.L. 180.0m			
DESIGN SURFACE LEVEL (m)	196.24	196.20	195.20
EXISTING SURFACE LEVEL (m)	196.24	196.50	195.54
INVERT LEVEL (m)	194.80 194.90	194.82 194.77 194.27	194.23 193.33 193.43
DEPTH TO INVERT FROM DESIGN SURFACE (m)	0.44 0.34	0.38 1.03 0.93	0.97 1.87 1.77
CHAINAGE (m)	0.0	12.8 12.8	1.7 14.5

DRAINAGE LINE N19 - LONGITUDINAL SECTION
NORTHERN DRUMSITE

HORIZONTAL SCALE 1:200
VERTICAL SCALE 1:200

NOTES:

1. FOR PIPELINE ALIGNMENTS, REFER DRAWING 61-35637-C212.
2. FOR LEGEND, REFER DRAWING 61-35637-C210.
3. FOR OTHER NOTES, REFER DRAWING 61-35637-C202.

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0 2 4 6 8 10m
SCALE 1:200 AT ORIGINAL SIZE

PRELIMINARY

No	Revision	Note: * indicates signatures on original issue of drawing or last revision of drawing	Drawn	Job Manager	Project Director	Date
B	REISSUED FOR 90□ DESIGN - CLIENT COMMENT		GT	JM*	PS*	20/11/20
A	ISSUED FOR 90□ DESIGN - CLIENT COMMENT		GT	JM*	PS*	30/09/20

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Department of Infrastructure, Transport, Regional Development and Communications

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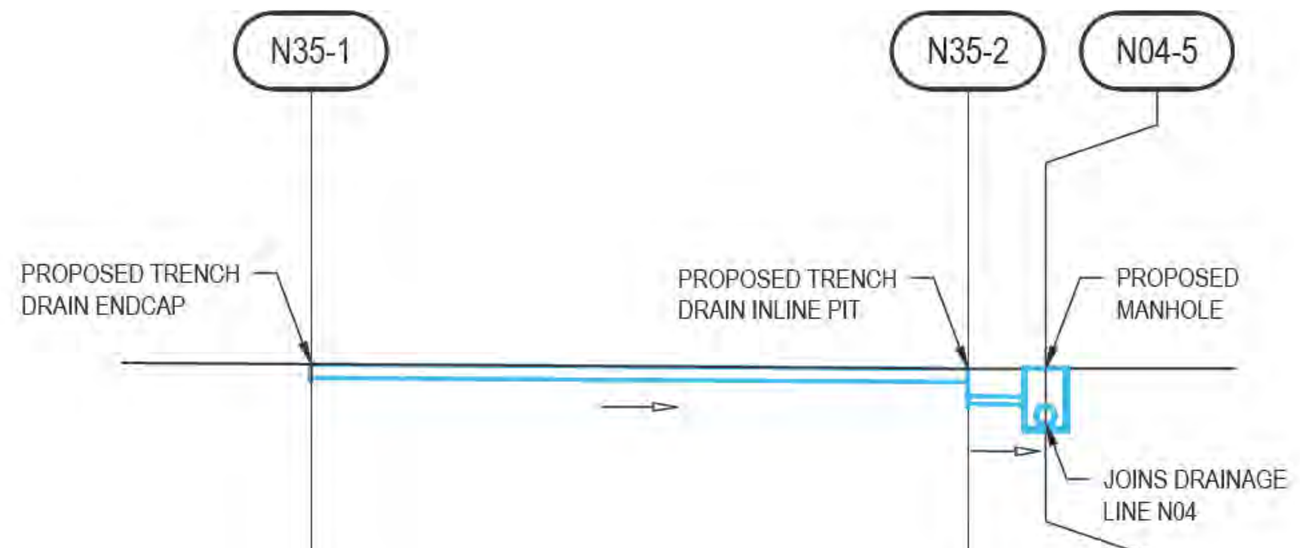
DO NOT SCALE

Drawn	G.TAYAM	Designer	D.DOMINGO
Drafting Check	S.HORTON*	Design Check	S.CLEARY*
Approved (Project Director)			
Date			
Scale	AS SHOWN	This Drawing must not be used for Construction unless signed as Approved	

Client: DEPT OF INFRASTRUCTURE, TRANSPORT, REGIONAL DEVELOPMENT & COMMUNICATIONS
Project: CHRISTMAS ISLAND STORMWATER REMEDIAL WORKS
Title: NORTHERN DRUMSITE WORKS
LONGITUDINAL SECTIONS - SHEET 4

Original Size: A1
Drawing No: 61-35637-C253
Rev: B

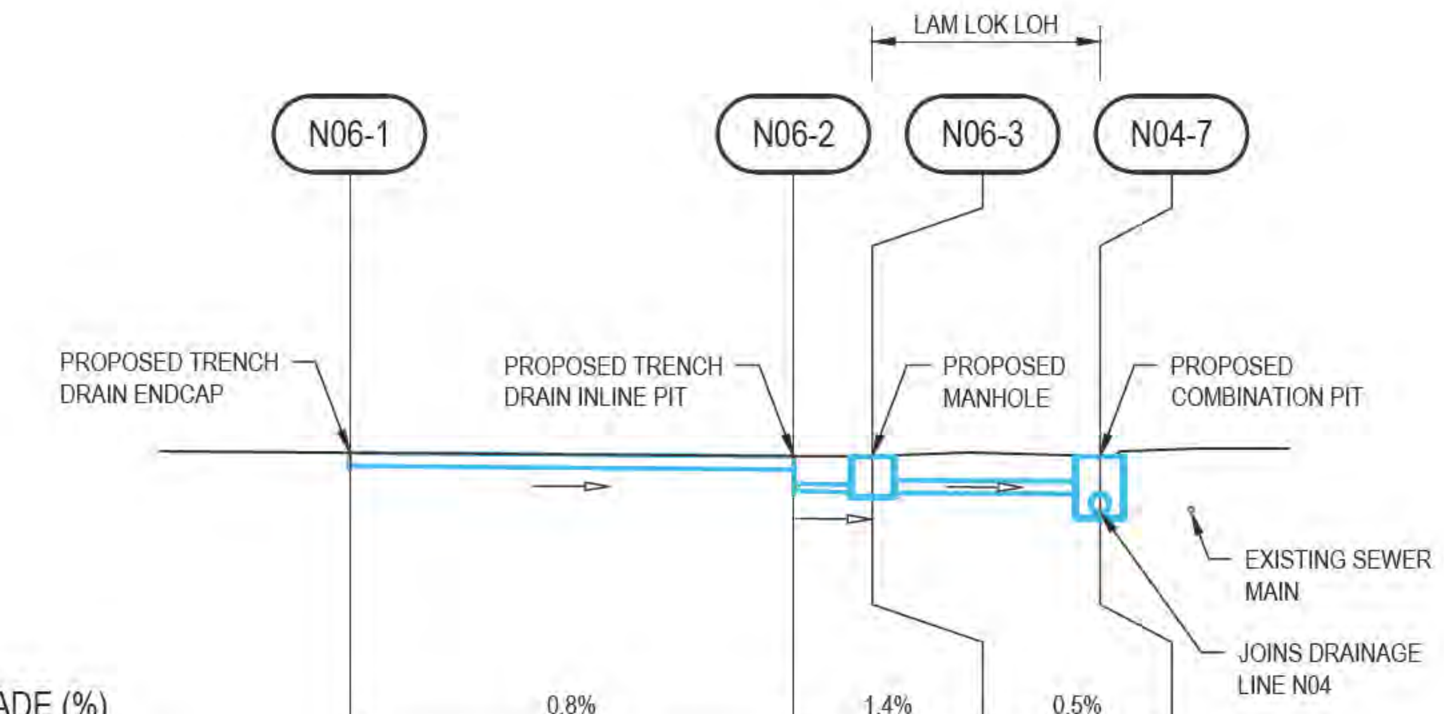
Plot Date: 17 November 2020 - 10:30 AM Plotted by: Giselle Tayam
Cad File No: N:\AU\Perth\Projects\61\35637\CADD\Drawings\61-35637-C253.dwg



	N35-1	N35-1 to N35-2	N35-2	N35-2 to N04-5	N04-5
PIPE GRADE (%)		0.6%		1.5%	
PIPE SLOPE (1 in X)		157.8		68.4	
PIPE SIZE (mm)		300x350		200	
PIPE CLASS		CHANNEL		PVC	
DATUM R.L. 180.0m					
DESIGN SURFACE LEVEL (m)	194.46		194.34		194.34
EXISTING SURFACE LEVEL (m)	194.46		194.34		194.34
INVERT LEVEL (m)	194.00 / 194.10	193.99 / 193.32	193.42	193.39 / 192.76	192.86
DEPTH TO INVERT FROM DESIGN SURFACE (m)	0.46 / 0.36	0.35 / 1.02	0.92	0.95 / 1.58	1.48
CHAINAGE (m)	-17.4	17.4	-0.0	2.1	2.0

DRAINAGE LINE N35 - LONGITUDINAL SECTION NORTHERN DRUMSITE

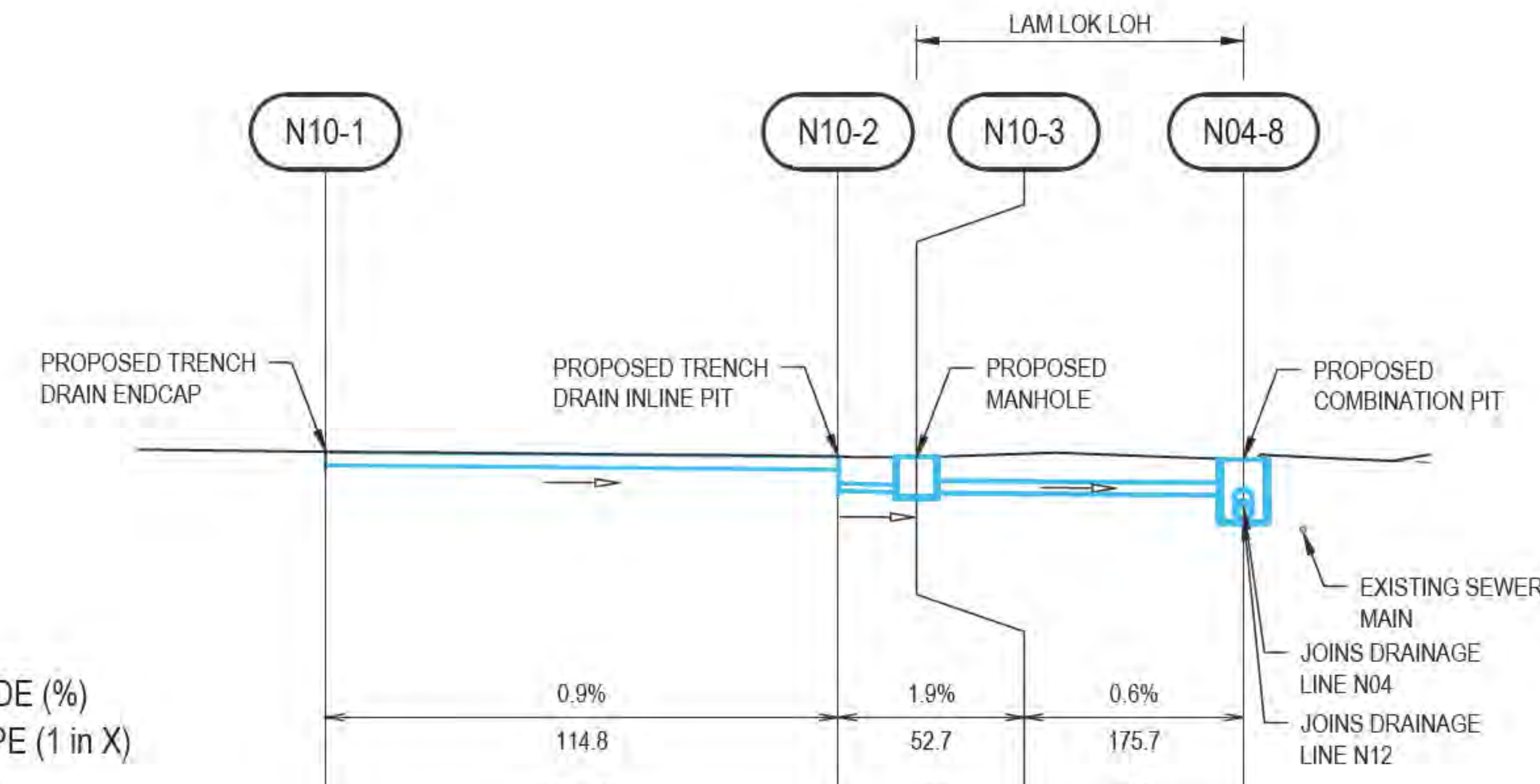
HORIZONTAL SCALE 1:200
VERTICAL SCALE 1:200



	N06-1	N06-1 to N06-2	N06-2	N06-2 to N06-3	N06-3	N06-3 to N04-7	N04-7
PIPE GRADE (%)		0.8%		1.4%		0.5%	
PIPE SLOPE (1 in X)		130.4		69.5		200.5	
PIPE SIZE (mm)		300x350		200		300	
PIPE CLASS		CHANNEL		PVC		RIBBED SN8 HDPE	
DATUM R.L. 180.0m							
DESIGN SURFACE LEVEL (m)	194.31		194.22		194.22		194.22
EXISTING SURFACE LEVEL (m)	194.31		194.22		194.22		194.22
INVERT LEVEL (m)	193.86 / 193.96	193.87 / 193.20	193.30	193.27 / 193.17	193.27	193.24 / 192.64	192.74
DEPTH TO INVERT FROM DESIGN SURFACE (m)	0.45 / 0.35	0.35 / 1.02	0.92	0.95 / 1.05	0.95	0.98 / 1.58	1.48
CHAINAGE (m)	-13.6	11.7	-1.9	2.1	0.2	6.0	6.2

DRAINAGE LINE N06 - LONGITUDINAL SECTION NORTHERN DRUMSITE

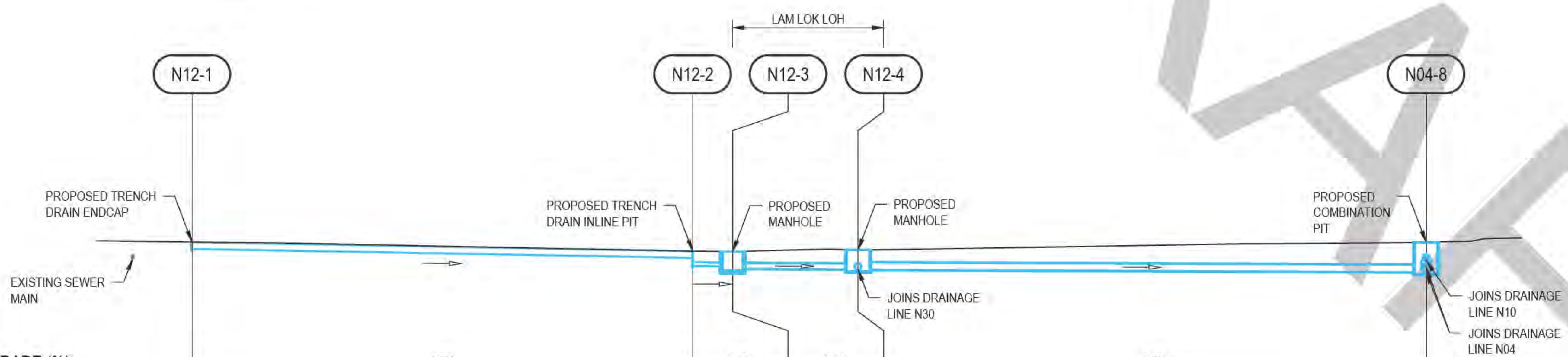
HORIZONTAL SCALE 1:200
VERTICAL SCALE 1:200



	N10-1	N10-1 to N10-2	N10-2	N10-2 to N10-3	N10-3	N10-3 to N04-8	N04-8
PIPE GRADE (%)		0.9%		1.9%		0.6%	
PIPE SLOPE (1 in X)		114.8		52.7		175.7	
PIPE SIZE (mm)		300x350		200		300	
PIPE CLASS		CHANNEL		PVC		RIBBED SN8 HDPE	
DATUM R.L. 180.0m							
DESIGN SURFACE LEVEL (m)	194.14		194.01		193.99		193.94
EXISTING SURFACE LEVEL (m)	194.14		194.01		193.99		193.94
INVERT LEVEL (m)	193.68 / 193.78	193.66 / 192.99	193.09	193.05 / 192.94	193.04	192.99 / 192.26	192.36
DEPTH TO INVERT FROM DESIGN SURFACE (m)	0.46 / 0.36	0.35 / 1.02	0.92	0.94 / 1.05	0.95	0.95 / 1.68	1.58
CHAINAGE (m)	-94.3	13.8	-80.5	2.1	-78.4	8.8	-69.7

DRAINAGE LINE N10 - LONGITUDINAL SECTION NORTHERN DRUMSITE

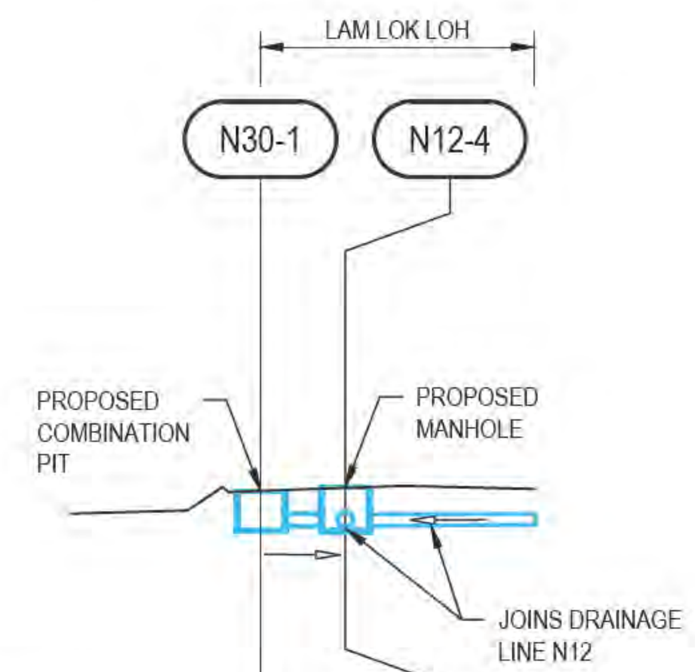
HORIZONTAL SCALE 1:200
VERTICAL SCALE 1:200



	N12-1	N12-1 to N12-2	N12-2	N12-2 to N12-3	N12-3	N12-3 to N12-4	N12-4	N12-4 to N04-8	N04-8
PIPE GRADE (%)		1.8%		1.4%		0.5%		0.4%	
PIPE SLOPE (1 in X)		55.8		69.9		218.7		247.9	
PIPE SIZE (mm)		300x350		200		300		375	
PIPE CLASS		CHANNEL		PVC		RIBBED SN8 HDPE		RIBBED SN8 HDPE	
DATUM R.L. 180.0m									
DESIGN SURFACE LEVEL (m)	193.95		193.47		193.45		193.52		193.94
EXISTING SURFACE LEVEL (m)	193.95		193.47		193.45		193.52		193.94
INVERT LEVEL (m)	193.49 / 193.59	193.12 / 192.60	192.70	192.67 / 192.45	192.55	192.52 / 192.40	192.50	192.38 / 192.26	192.36
DEPTH TO INVERT FROM DESIGN SURFACE (m)	0.46 / 0.36	0.35 / 0.87	0.77	0.78 / 1.00	0.90	1.00 / 1.12	1.02	1.56 / 1.68	1.58
CHAINAGE (m)	-28.3	26.2	-2.1	2.1	0.0	6.6	6.6	29.7	36.3

DRAINAGE LINE N12 - LONGITUDINAL SECTION NORTHERN DRUMSITE

HORIZONTAL SCALE 1:200
VERTICAL SCALE 1:200



	N30-1	N30-1 to N12-4	N12-4
PIPE GRADE (%)		0.4%	
PIPE SLOPE (1 in X)		223.2	
PIPE SIZE (mm)		300	
PIPE CLASS		RIBBED SN8 HDPE	
DATUM R.L. 180.0m			
DESIGN SURFACE LEVEL (m)	193.44		193.52
EXISTING SURFACE LEVEL (m)	193.44		193.52
INVERT LEVEL (m)	192.43 / 192.53	192.52 / 192.40	192.50
DEPTH TO INVERT FROM DESIGN SURFACE (m)	1.01 / 0.91	1.00 / 1.12	1.02
CHAINAGE (m)	0.0	2.2	2.2

DRAINAGE LINE N30 - LONGITUDINAL SECTION NORTHERN DRUMSITE

HORIZONTAL SCALE 1:200
VERTICAL SCALE 1:200

NOTES:

1. FOR PIPELINE ALIGNMENTS, REFER DRAWING 61-35637-C212.
2. FOR LEGEND, REFER DRAWING 61-35637-C210.
3. FOR OTHER NOTES, REFER DRAWING 61-35637-C202.

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0 2 4 6 8 10m
SCALE 1:200 AT ORIGINAL SIZE

PRELIMINARY

No	Revision	Drawn	Job Manager	Project Director	Date
A	ISSUED FOR 90 DESIGN - CLIENT COMMENT	GT	JM*	PS*	30/09/20

Note: * indicates signatures on original issue of drawing or last revision of drawing

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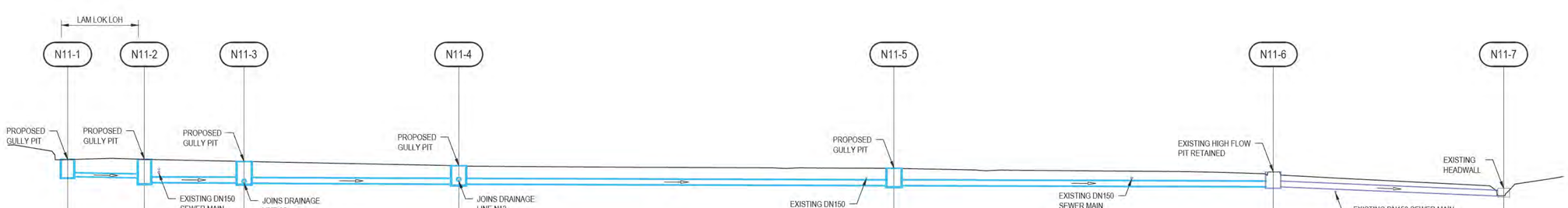
Drawn G.TAYAM | Designer D.DOMINGO
Drafting Check S.HORTON* | Design Check S.CLEARY*
Approved (Project Director)
Date
Scale AS SHOWN — This Drawing must not be used for Construction unless signed as Approved

Client: DEPT OF INFRASTRUCTURE, TRANSPORT, REGIONAL DEVELOPMENT & COMMUNICATIONS
Project: CHRISTMAS ISLAND STORMWATER REMEDIAL WORKS
Title: NORTHERN DRUMSITE WORKS LONGITUDINAL SECTIONS - SHEET 5

Original Size A1 | Drawing No: 61-35637-C254 | Rev: A

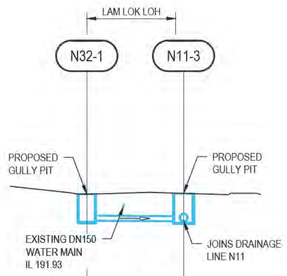
Plot Date: 30 September 2020 - 2:46 AM Plotted by: Giselle Tayam Cad File No: N:\AU\Perth\Projects\61\35637\CADD\Drawings\61-35637-C254.dwg



PIPE GRADE (%)	1.6%	0.4%	0.4%	0.3%	0.3%	4.0%
PIPE SLOPE (1 in X)	64.4	278.6	225.2	304.2	318.1	25.1
PIPE SIZE (mm)	300	450	450	450	450	450
PIPE CLASS	RIBBED SN8 HDPE	RIBBED SN8 HDPE	RIBBED SN8 HDPE	RIBBED SN8 HDPE	RIBBED SN8 HDPE	EXISTING RCP
DATUM R.L. 179.0m						
DESIGN SURFACE LEVEL (m)	192.92	192.94	192.76	192.40	192.19	191.88 / 190.50
EXISTING SURFACE LEVEL (m)	192.92	192.94	192.76	192.40	192.19	191.88 / 190.50
INVERT LEVEL (m)	191.40 / 191.50	191.40 / 190.90 / 191.00	190.97 / 190.85 / 190.95	190.87 / 190.77 / 190.87	190.75 / 190.65 / 190.75	190.65 / 190.55 / 190.65 / 189.88 / 189.78
DEPTH TO INVERT FROM DESIGN SURFACE (m)	1.52 / 1.42	1.54 / 2.04 / 1.94	1.79 / 1.91 / 1.81	1.53 / 1.63 / 1.53	1.44 / 1.54 / 1.44	1.23 / 1.33 / 1.23 / 0.62 / 0.72
CHAINAGE (m)	-9.0	6.4 / -2.6	8.4 / 5.8	18.0 / 23.8	36.5 / 60.3	31.8 / 92.1 / 19.3 / 111.4

DRAINAGE LINE N11 - LONGITUDINAL SECTION
NORTHERN DRUMSITE

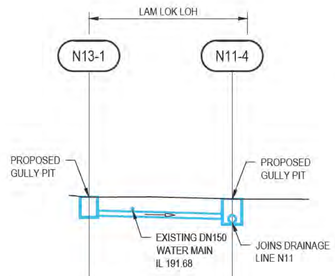
HORIZONTAL SCALE 1:200
VERTICAL SCALE 1:200



PIPE GRADE (%)	0.6%	
PIPE SLOPE (1 in X)	158.0	
PIPE SIZE (mm)	300	
PIPE CLASS	RIBBED SN8 HDPE	
DATUM R.L. 179.0m		
DESIGN SURFACE LEVEL (m)	192.71	192.76
EXISTING SURFACE LEVEL (m)	192.71	192.76
INVERT LEVEL (m)	190.90 / 191.00	190.96 / 190.85 / 190.95
DEPTH TO INVERT FROM DESIGN SURFACE (m)	1.81 / 1.71	1.80 / 1.91 / 1.81
CHAINAGE (m)	-9.0	6.3 / -2.7

DRAINAGE LINE N32 - LONGITUDINAL SECTION
NORTHERN DRUMSITE

HORIZONTAL SCALE 1:200
VERTICAL SCALE 1:200



PIPE GRADE (%)	2.2%	
PIPE SLOPE (1 in X)	44.9	
PIPE SIZE (mm)	300	
PIPE CLASS	RIBBED SN8 HDPE	
DATUM R.L. 179.0m		
DESIGN SURFACE LEVEL (m)	192.52	192.40
EXISTING SURFACE LEVEL (m)	192.52	192.40
INVERT LEVEL (m)	191.22 / 191.32	191.11 / 190.77 / 190.87
DEPTH TO INVERT FROM DESIGN SURFACE (m)	1.30 / 1.20	1.29 / 1.63 / 1.53
CHAINAGE (m)	0.0	9.4

DRAINAGE LINE N13 - LONGITUDINAL SECTION
NORTHERN DRUMSITE

HORIZONTAL SCALE 1:200
VERTICAL SCALE 1:200

NOTES:

1. FOR PIPELINE ALIGNMENTS, REFER DRAWING 61-35637-C211.
2. FOR LEGEND, REFER DRAWING 61-35637-C210.
3. FOR OTHER NOTES, REFER DRAWING 61-35637-C202.

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0 2 4 6 8 10m
SCALE 1:200 AT ORIGINAL SIZE

PRELIMINARY

No	Revision	Note: * indicates signatures on original issue of drawing or last revision of drawing	Drawn	Job Manager	Project Director	Date
A	ISSUED FOR 90□ DESIGN - CLIENT COMMENT		GT	JM*	PS*	30/09/20

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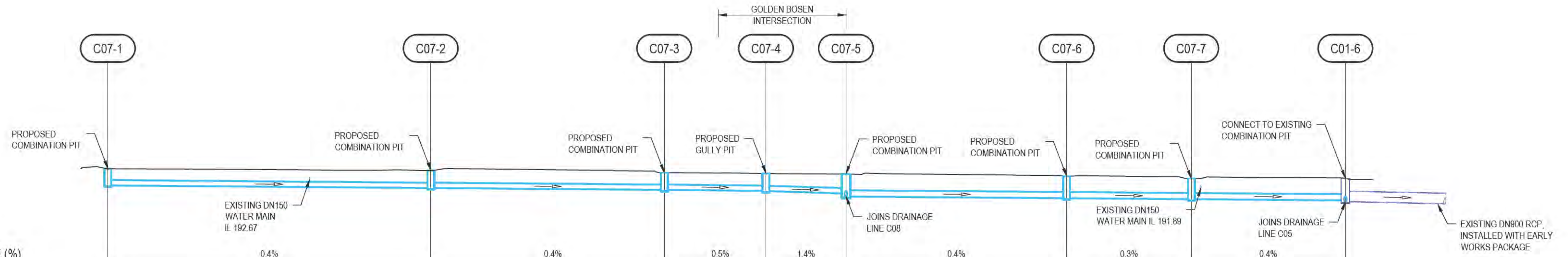
Drawn	G.TAYAM	Designer	D.DOMINGO
Drafting Check	S.HORTON*	Design Check	S.CLEARY*
Approved (Project Director)			
Date			
Scale	AS SHOWN	This Drawing must not be used for Construction unless signed as Approved	

Client: DEPT OF INFRASTRUCTURE, TRANSPORT, REGIONAL DEVELOPMENT & COMMUNICATIONS
Project: CHRISTMAS ISLAND STORMWATER REMEDIAL WORKS
Title: NORTHERN DRUMSITE WORKS LONGITUDINAL SECTIONS - SHEET 6

Original Size A1 | Drawing No: 61-35637-C255 | Rev: A

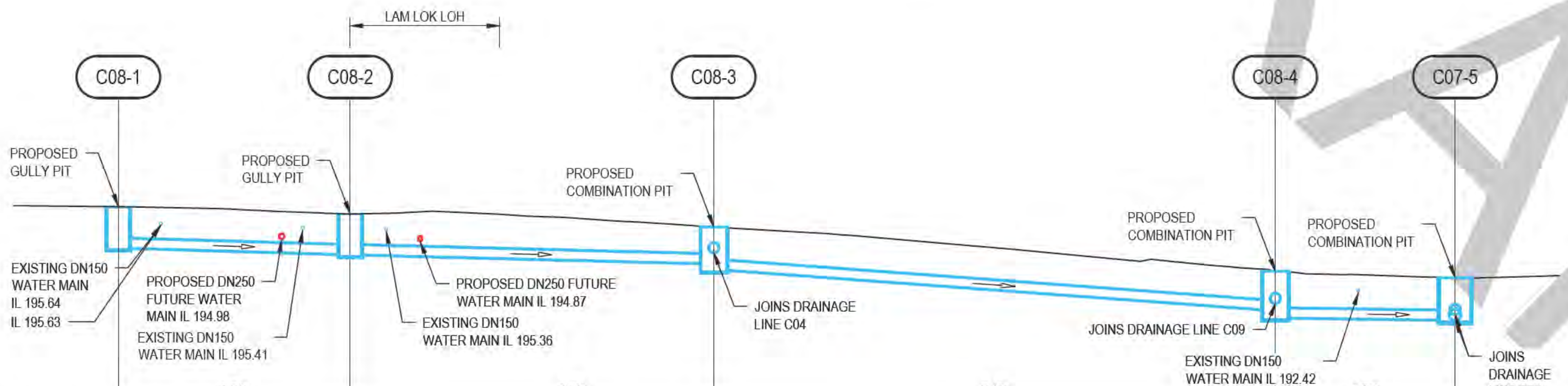
Plot Date: 30 September 2020 - 2:48 AM Plotted by: Giselle Tayam Cad File No: N:\AU\Perth\Projects\61\35637\CADD\Drawings\61-35637-C255.dwg



	C07-1		C07-2		C07-3		C07-4		C07-5		C07-6		C07-7		C01-6
PIPE GRADE (%)		0.4%		0.4%		0.5%		1.4%		0.4%		0.3%		0.4%	
PIPE SLOPE (1 in X)		248.3		250.3		198.2		70.0		270.2		285.9		282.9	
PIPE SIZE (mm)		450		450		450		450		525		525		525	
PIPE CLASS		RIBBED SN8 HDPE		RIBBED SN8 HDPE		RIBBED SN8 HDPE		RIBBED SN8 HDPE		RIBBED SN8 HDPE		RIBBED SN8 HDPE		RIBBED SN8 HDPE	
DATUM R.L. 170.0m															
DESIGN SURFACE LEVEL (m)	193.62		193.46		193.26		193.19		193.13		192.92		192.72		192.73
EXISTING SURFACE LEVEL (m)	193.62		193.46		193.26		193.19		193.13		192.92		192.72		192.73
INVERT LEVEL (m)	192.01 192.11		191.87 191.77 191.87		191.70 191.60 191.70		191.60 191.48 191.58		191.37 190.99 191.09		190.94 190.83 190.93		190.85 190.74 190.84		190.74 190.50 190.63
DEPTH TO INVERT FROM DESIGN SURFACE (m)	1.61 1.51		1.59 1.69 1.59		1.56 1.66 1.56		1.58 1.70 1.60		1.75 2.14 2.04		1.98 2.09 1.99		1.87 1.98 1.88		1.99 2.23 2.10
CHAINAGE (m)	0.0	59.3	59.3	42.9	102.1	18.7	120.8	14.7	135.5	40.5	176.0	22.9	198.9	28.3	227.2

DRAINAGE LINE C07 - LONGITUDINAL SECTION
CENTRAL DRUMSITE

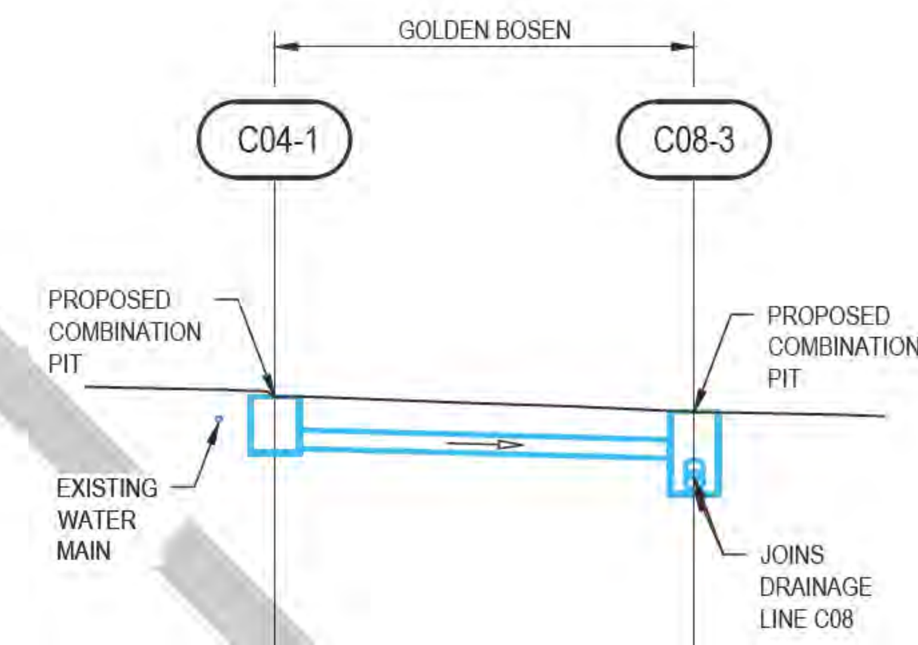
HORIZONTAL SCALE 1:500
VERTICAL SCALE 1:250



	C08-1		C08-2		C08-3		C08-4		C07-5
PIPE GRADE (%)		2.7%		2.4%		7.1%		1.2%	
PIPE SLOPE (1 in X)		37.0		41.5		14.2		86.1	
PIPE SIZE (mm)		450		450		450		450	
PIPE CLASS		RIBBED SN8 HDPE		RIBBED SN8 HDPE		RIBBED SN8 HDPE		RIBBED SN8 HDPE	
DATUM R.L. 180.0m									
DESIGN SURFACE LEVEL (m)	196.52		196.17		195.55		193.43		193.13
EXISTING SURFACE LEVEL (m)	196.52		196.17		195.55		193.43		193.13
INVERT LEVEL (m)	194.45 194.55		194.25 194.13 194.23		193.81 193.40 193.50		191.60 191.10 191.20		191.10 190.99 191.09
DEPTH TO INVERT FROM DESIGN SURFACE (m)	2.07 1.97		1.92 2.04 1.94		1.74 2.15 2.05		1.83 2.33 2.23		2.03 2.14 2.04
CHAINAGE (m)	0.0	11.1	11.1	17.4	28.5	26.9	55.4	8.6	64.0

DRAINAGE LINE C08 - LONGITUDINAL SECTION
CENTRAL DRUMSITE

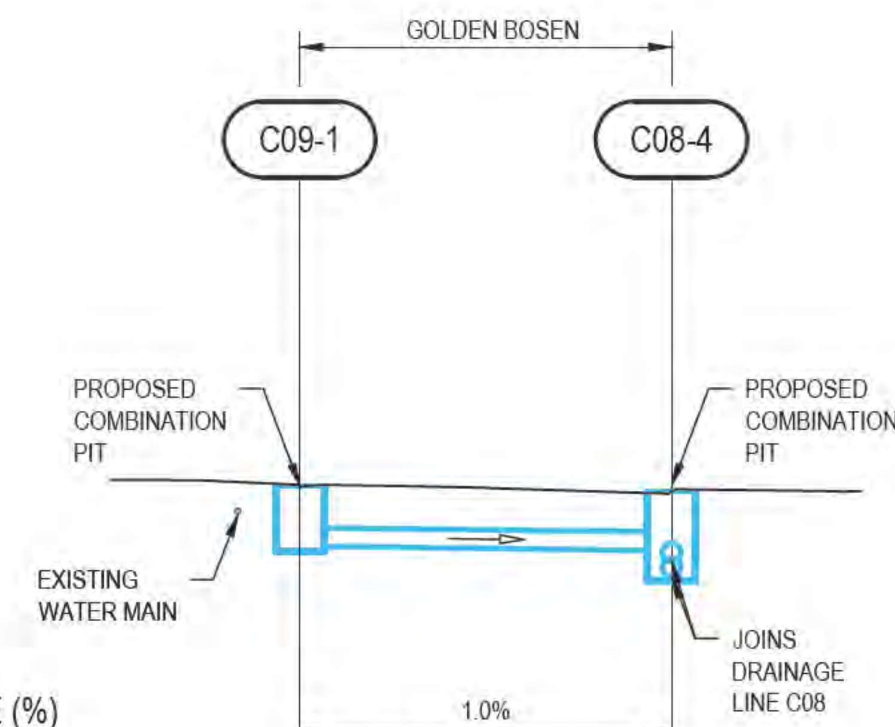
HORIZONTAL SCALE 1:200
VERTICAL SCALE 1:200



	C04-1		C08-3
PIPE GRADE (%)		2.4%	
PIPE SLOPE (1 in X)		41.7	
PIPE SIZE (mm)		450	
PIPE CLASS		RIBBED SN8 HDPE	
DATUM R.L. 180.0m			
DESIGN SURFACE LEVEL (m)	195.94		195.55
EXISTING SURFACE LEVEL (m)	195.94		195.55
INVERT LEVEL (m)	194.50 194.60		193.50 193.40 194.33
DEPTH TO INVERT FROM DESIGN SURFACE (m)	1.44 1.34		2.05 2.15 1.21
CHAINAGE (m)	11.1	11.1	0.0

DRAINAGE LINE C04 - LONGITUDINAL SECTION
CENTRAL DRUMSITE

HORIZONTAL SCALE 1:200
VERTICAL SCALE 1:200



	C09-1		C08-4
PIPE GRADE (%)		1.0%	
PIPE SLOPE (1 in X)		98.2	
PIPE SIZE (mm)		450	
PIPE CLASS		RIBBED SN8 HDPE	
DATUM R.L. 180.0m			
DESIGN SURFACE LEVEL (m)	193.58		193.43
EXISTING SURFACE LEVEL (m)	193.58		193.43
INVERT LEVEL (m)	191.90 192.00		191.90 191.10 191.20
DEPTH TO INVERT FROM DESIGN SURFACE (m)	1.68 1.58		1.53 2.33 2.23
CHAINAGE (m)	0.0	9.8	9.8

DRAINAGE LINE C09 - LONGITUDINAL SECTION
CENTRAL DRUMSITE

HORIZONTAL SCALE 1:200
VERTICAL SCALE 1:200

NOTES:

1. FOR PIPELINE ALIGNMENTS, REFER DRAWINGS 61-35637-C215 AND C216.
2. FOR LEGEND, REFER DRAWING 61-35637-C210.
3. FOR OTHER NOTES, REFER DRAWING 61-35637-C202.

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0 2.5 5 7.5 10 12.5m — SCALE 1:250 AT ORIGINAL SIZE
0 5 10 15 20 25m — SCALE 1:500 AT ORIGINAL SIZE
0 2 4 6 8 10m — SCALE 1:200 AT ORIGINAL SIZE

PRELIMINARY

No	Revision	Drawn	Job Manager	Project Director	Date
A	ISSUED FOR 90□ DESIGN - CLIENT COMMENT	GT	JM*	PS*	30/09/20

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Drawn G.TAYAM | Designer D.DOMINGO
Drafting Check S.HORTON* | Design Check S.CLEARY*
Approved (Project Director)
Date
Scale AS SHOWN
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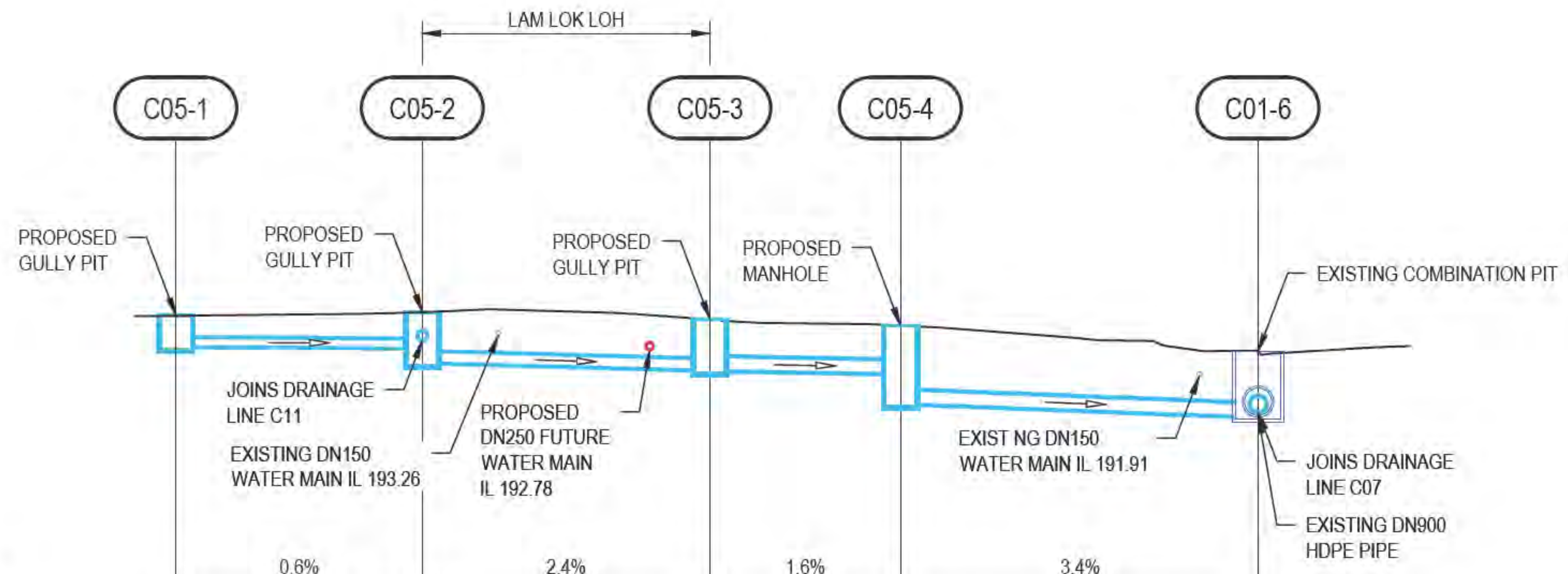
Client: DEPT OF INFRASTRUCTURE, TRANSPORT, REGIONAL DEVELOPMENT & COMMUNICATIONS
Project: CHRISTMAS ISLAND STORMWATER REMEDIAL WORKS
Title: CENTRAL DRUMSITE WORKS LONGITUDINAL SECTIONS - SHEET 1

Original Size A1 Drawing No: 61-35637-C260 Rev: A

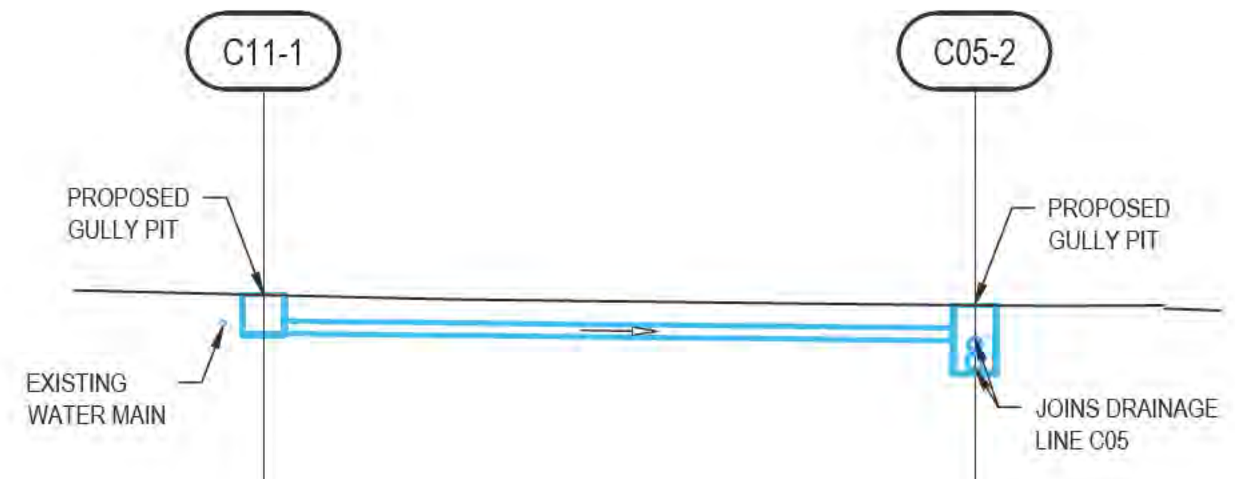
Plot Date: 1 October 2020 - 5:17 AM Plotted by: Giselle Tayam Cad File No: N:\AU\Perth\Projects\61\35637\CADD\Drawings\61-35637-C260.dwg



	C05-1		C05-2		C05-3		C05-4		C01-6
PIPE GRADE (%)		0.6%		2.4%		1.6%		3.4%	
PIPE SLOPE (1 in X)		162.1		41.1		62.7		29.4	
PIPE SIZE (mm)		300		375		450		450	
PIPE CLASS		RIBBED SN8 HDPE		RIBBED SN8 HDPE		RIBBED SN8 HDPE		RIBBED SN8 HDPE	
DATUM R.L. 178.0m									
DESIGN SURFACE LEVEL (m)	193.91		194.02		193.79		193.58		192.73
EXISTING SURFACE LEVEL (m)	193.91		194.02		193.79		193.58		192.73
INVERT LEVEL (m)	192.79 192.89	192.84 192.25	192.35	192.12 192.00	192.10	192.00 190.90	191.00	190.60 190.50	190.63
DEPTH TO INVERT FROM DESIGN SURFACE (m)	1.12 1.02	1.18 1.77	1.67	1.67 1.79	1.69	1.58 2.68	2.58	2.13 2.23	2.10
CHAINAGE (m)	-23.1	8.1	-15.0	9.5	-5.6	6.3	0.7	11.8	12.4

DRAINAGE LINE C05 - LONGITUDINAL SECTION
CENTRAL DRUMSITE

HORIZONTAL SCALE 1:200
VERTICAL SCALE 1:200



	C11-1		C05-2
PIPE GRADE (%)		1.0%	
PIPE SLOPE (1 in X)		99.0	
PIPE SIZE (mm)		300	
PIPE CLASS		RIBBED SN8 HDPE	
DATUM R.L. 178.0m			
DESIGN SURFACE LEVEL (m)	194.30		194.02
EXISTING SURFACE LEVEL (m)	194.30		194.02
INVERT LEVEL (m)	193.29	193.10 192.25	192.35
DEPTH TO INVERT FROM DESIGN SURFACE (m)	1.01	0.92 1.77	1.67
CHAINAGE (m)	-46.2	18.8	-27.4

DRAINAGE LINE C11 - LONGITUDINAL SECTION
CENTRAL DRUMSITE

HORIZONTAL SCALE 1:200
VERTICAL SCALE 1:200

NOTES:

1. FOR PIPELINE ALIGNMENTS, REFER DRAWINGS 61-35637-C216.
2. FOR LEGEND, REFER DRAWING 61-35637-C210.
3. FOR OTHER NOTES, REFER DRAWING 61-35637-C202.

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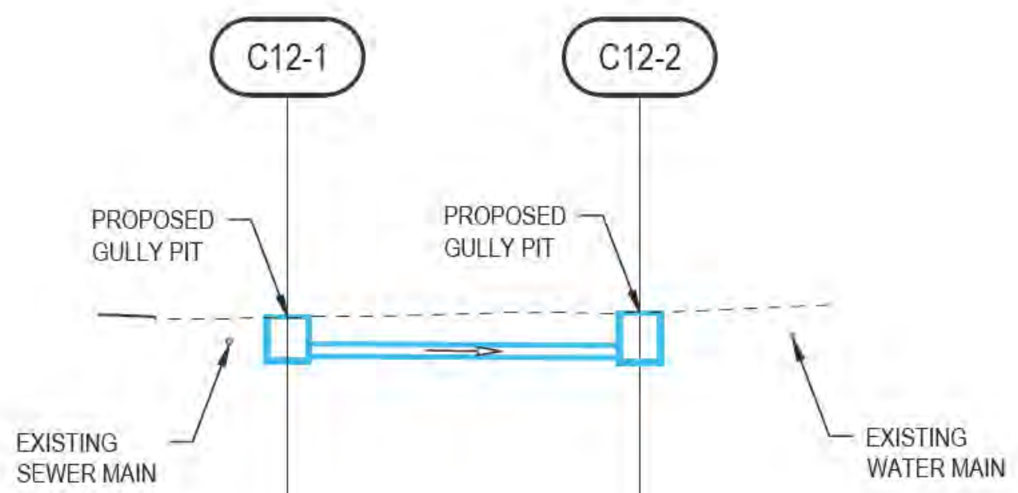

	C12-1		C12-2
PIPE GRADE (%)		0.4%	
PIPE SLOPE (1 in X)		250.0	
PIPE SIZE (mm)		300	
PIPE CLASS		RIBBED SN8 HDPE	
DATUM R.L. 178.0m			
DESIGN SURFACE LEVEL (m)	193.87		193.98
EXISTING SURFACE LEVEL (m)	193.87		193.98
INVERT LEVEL (m)	192.74 192.84	192.81	192.71
DEPTH TO INVERT FROM DESIGN SURFACE (m)	1.12 1.02	1.17	1.27
CHAINAGE (m)	0.0	9.3	9.3

DRAINAGE LINE C12 - LONGITUDINAL SECTION
CENTRAL DRUMSITE

HORIZONTAL SCALE 1:200
VERTICAL SCALE 1:200

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0 2 4 6 8 10m
SCALE 1:200 AT ORIGINAL SIZE

PRELIMINARY

No	Revision	Drawn	Job Manager	Project Director	Date
A	ISSUED FOR 90 DESIGN - CLIENT COMMENT	GT	JM*	PS*	30/09/20

Note: * indicates signatures on original issue of drawing or last revision of drawing

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Drafting Check S.HORTON* | Design Check S.CLEARY*
Approved (Project Director)
Date
Scale AS SHOWN
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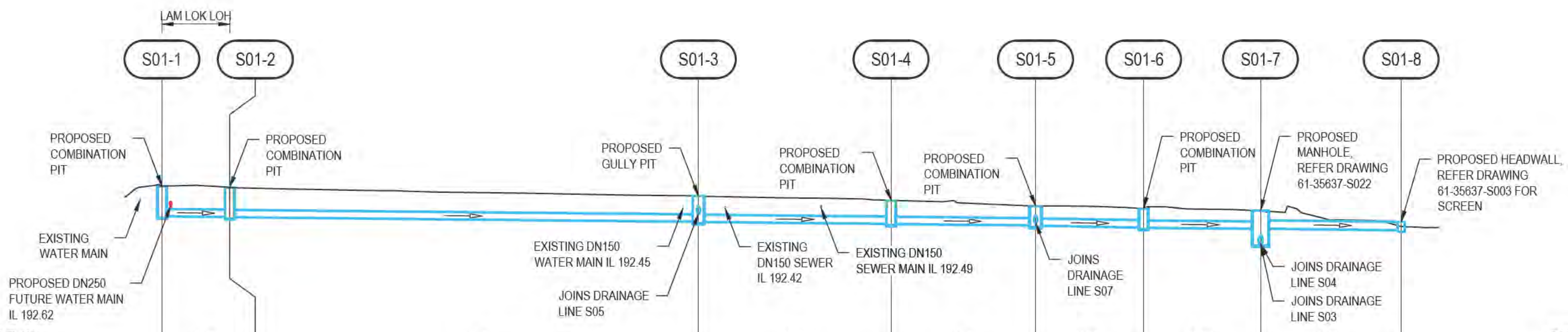
Client DEPT OF INFRASTRUCTURE, TRANSPORT, REGIONAL DEVELOPMENT & COMMUNICATIONS
Project CHRISTMAS ISLAND STORMWATER REMEDIAL WORKS
Title CENTRAL DRUMSITE WORKS
LONGITUDINAL SECTIONS - SHEET 2

Original Size A1 Drawing No: 61-35637-C261 Rev: A

Plot Date: 30 September 2020 - 3:00 AM Plotted by: Giselle Tayam Cad File No: N:\AU\Perth\Projects\61\35637\CADD\Drawings\61-35637-C261.dwg



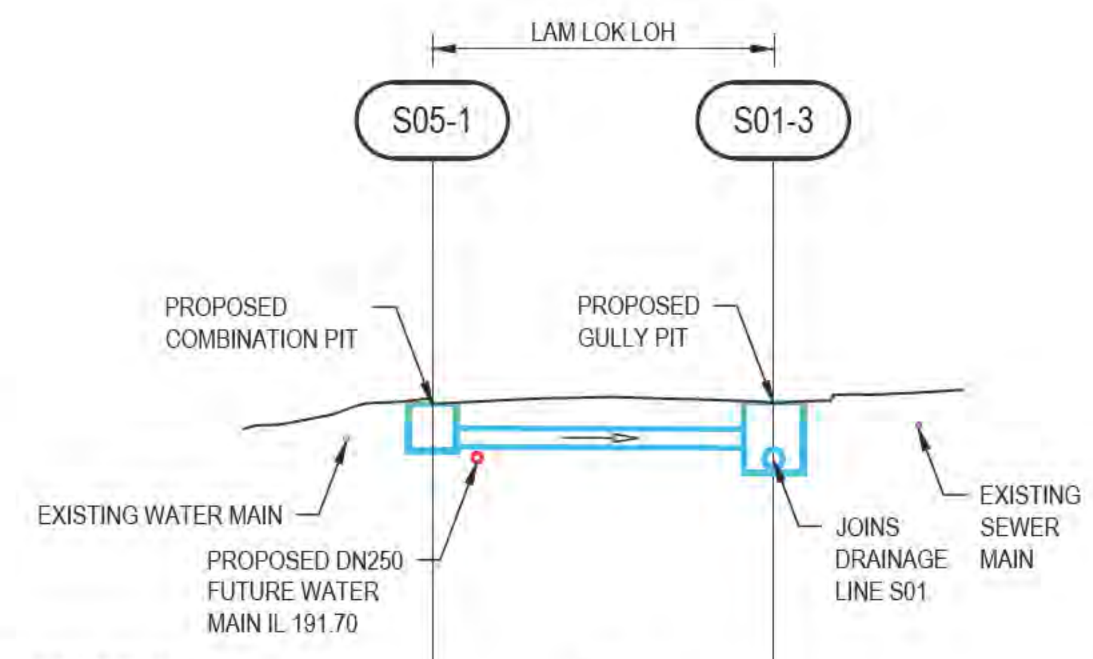
	S01-1 to S01-2	S01-2 to S01-3	S01-3 to S01-4	S01-4 to S01-5	S01-5 to S01-6	S01-6 to S01-7	S01-7 to S01-8
PIPE GRADE (%)	0.4%	0.5%	0.5%	0.5%	0.8%	0.4%	0.5%
PIPE SLOPE (1 in X)	226.3	209.2	214.9	215.0	120.5	260.8	188.4
PIPE SIZE (mm)	450	450	450	450	450	450	525
PIPE CLASS	RIBBED SN8 HDPE	RIBBED SN8 HDPE	RIBBED SN8 HDPE	RIBBED SN8 HDPE	RIBBED SN8 HDPE	RIBBED SN8 HDPE	RIBBED SN8 HDPE
CHAINAGE (m)	9.1	62.8	25.8	19.3	14.5	15.6	18.8

DATUM R.L. 174.0m

	S01-1	S01-2	S01-3	S01-4	S01-5	S01-6	S01-7	S01-8
DESIGN SURFACE LEVEL (m)	193.93	193.84	193.26	192.97	192.59	192.43	192.28	191.53
EXISTING SURFACE LEVEL (m)	193.93	193.84	193.26	192.97	192.59	192.43	192.28	191.53
INVERT LEVEL (m)	191.83 / 191.93	191.89 191.77 / 191.87	191.57 191.45 / 191.55	191.43 191.31 / 191.41	191.32 191.20 / 191.30	191.18 191.06 / 191.16	191.10 189.96 / 191.10	191.00 / 190.90
DEPTH TO INVERT FROM DESIGN SURFACE (m)	2.10 / 2.00	1.95 2.07 / 1.97	1.69 1.81 / 1.71	1.54 1.66 / 1.56	1.27 1.39 / 1.29	1.25 1.37 / 1.27	1.18 2.32 / 1.18	0.53 / 0.63
CHAINAGE (m)	0.0	9.1	60.70 / 71.8	97.6	117.0	131.4	147.1	165.9

DRAINAGE LINE S01 - LONGITUDINAL SECTION
SOUTHERN DRUMSITE

HORIZONTAL SCALE 1:500
VERTICAL SCALE 1:250



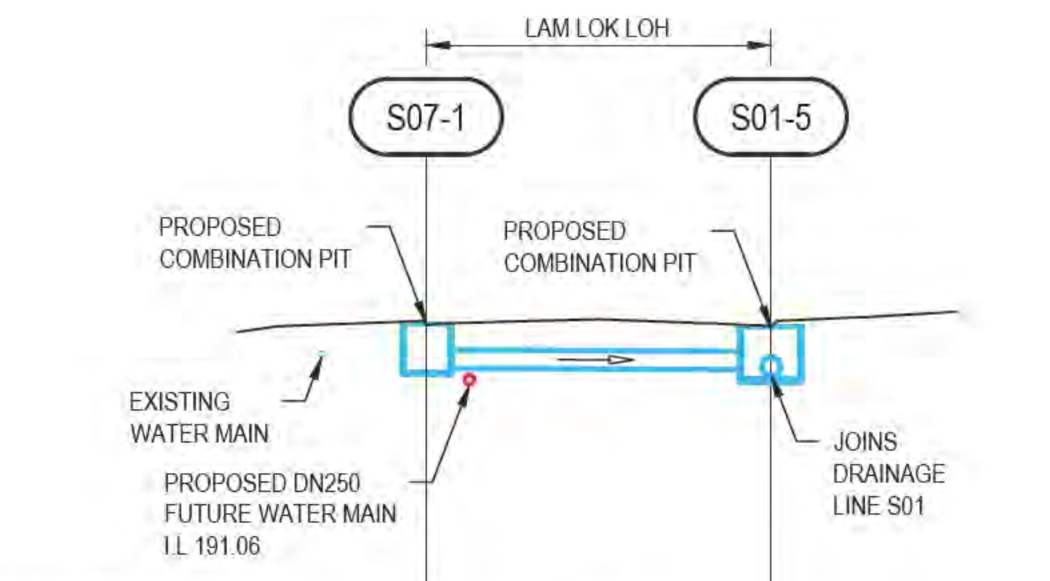
	S05-1 to S01-3
PIPE GRADE (%)	0.3%
PIPE SLOPE (1 in X)	300.5
PIPE SIZE (mm)	450
PIPE CLASS	RIBBED SN8 HDPE
CHAINAGE (m)	9.0

DATUM R.L. 178.0m

	S05-1	S01-3
DESIGN SURFACE LEVEL (m)	193.23	193.26
EXISTING SURFACE LEVEL (m)	193.23	193.26
INVERT LEVEL (m)	192.03 / 192.13	192.10 191.45 / 191.55
DEPTH TO INVERT FROM DESIGN SURFACE (m)	1.20 / 1.10	1.16 1.81 / 1.71
CHAINAGE (m)	-11.4	-2.4

DRAINAGE LINE S05 - LONGITUDINAL SECTION
SOUTHERN DRUMSITE

HORIZONTAL SCALE 1:200
VERTICAL SCALE 1:200



	S07-1 to S01-5
PIPE GRADE (%)	0.3%
PIPE SLOPE (1 in X)	303.6
PIPE SIZE (mm)	450
PIPE CLASS	RIBBED SN8 HDPE
CHAINAGE (m)	9.1

DATUM R.L. 177.0m

	S07-1	S01-5
DESIGN SURFACE LEVEL (m)	192.66	192.59
EXISTING SURFACE LEVEL (m)	192.66	192.59
INVERT LEVEL (m)	191.40 / 191.50	191.47 191.20 / 191.30
DEPTH TO INVERT FROM DESIGN SURFACE (m)	1.26 / 1.16	1.12 1.39 / 1.29
CHAINAGE (m)	-17.0	-7.9

DRAINAGE LINE S07 - LONGITUDINAL SECTION
SOUTHERN DRUMSITE

HORIZONTAL SCALE 1200
VERTICAL SCALE 1:200

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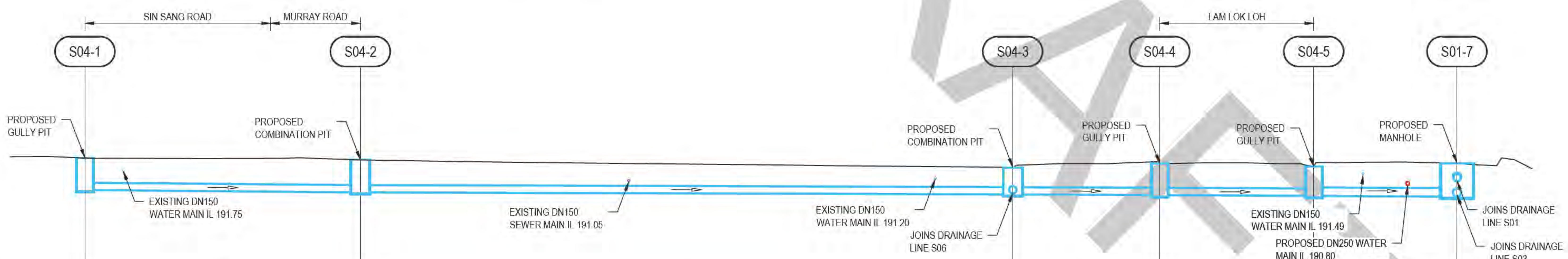


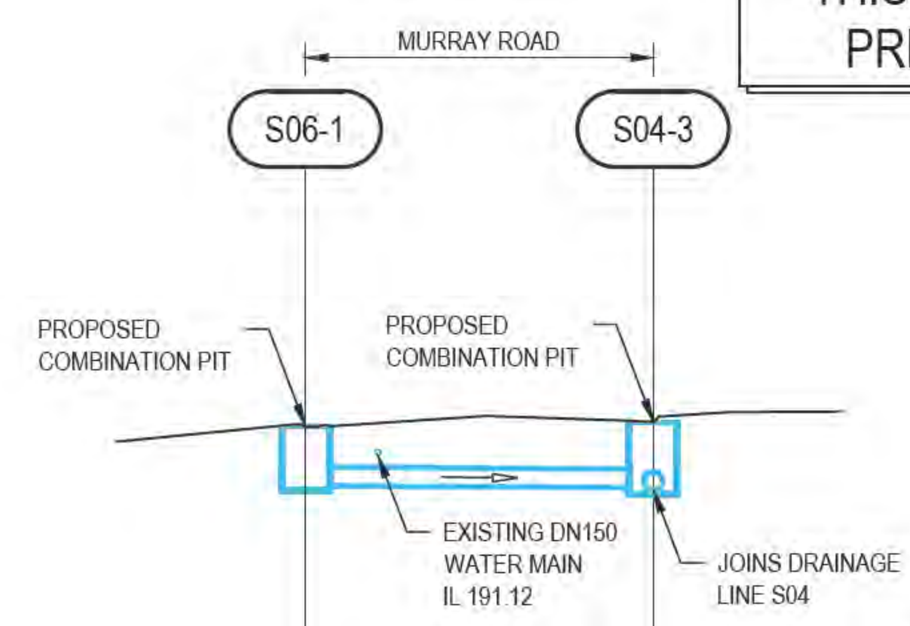
	S04-1 to S04-2	S04-2 to S04-3	S04-3 to S04-4	S04-4 to S04-5	S04-5 to S01-7
PIPE GRADE (%)	0.8%	0.3%	0.3%	0.4%	0.3%
PIPE SLOPE (1 in X)	122.9	312.1	328.0	258.0	319.7
PIPE SIZE (mm)	450	450	450	450	525
PIPE CLASS	RIBBED SN8 HDPE	RIBBED SN8 HDPE	RIBBED SN8 HDPE	RIBBED SN8 HDPE	RIBBED SN8 HDPE
CHAINAGE (m)	18.4	43.7	9.8	10.3	9.6

DATUM R.L. 177.0m

	S04-1	S04-2	S04-3	S04-4	S04-5	S01-7
DES GN SURFACE LEVEL (m)	192.62	192.50	192.00	192.25	192.06	192.28
EXISTING SURFACE LEVEL (m)	192.62	192.50	192.00	192.25	192.06	192.28
INVERT LEVEL (m)	190.40 / 190.50	190.35 190.25 / 190.35	190.21 190.10 / 190.20	190.17 190.06 / 190.16	190.12 190.00 / 190.10	190.07 189.96 / 191.10
DEPTH TO INVERT FROM DESIGN SURFACE (m)	2.22 / 2.12	2.15 2.25 / 2.15	1.79 1.90 / 1.80	2.08 2.19 / 2.09	1.94 2.06 / 1.96	2.21 2.32 / 1.18
CHAINAGE (m)	0.0	18.4	62.1	72.0	82.3	91.9

DRAINAGE LINE S04 - LONGITUDINAL SECTION
SOUTHERN DRUMSITE

HORIZONTAL SCALE 1:200
VERTICAL SCALE 1:200



	S06-1 to S04-3
PIPE GRADE (%)	0.5%
PIPE SLOPE (1 in X)	183.9
PIPE SIZE (mm)	450
PIPE CLASS	RIBBED SN8 HDPE
CHAINAGE (m)	9.2

DATUM R.L. 177.0m

	S06-1	S04-3
DESIGN SURFACE LEVEL (m)	191.88	192.00
EXISTING SURFACE LEVEL (m)	191.88	192.00
INVERT LEVEL (m)	190.23 / 190.33	190.28 190.10 / 190.20
DEPTH TO INVERT FROM DESIGN SURFACE (m)	1.65 / 1.55	1.72 1.90 / 1.80
CHAINAGE (m)	0.0	9.2

DRAINAGE LINE S06 - LONGITUDINAL SECTION
SOUTHERN DRUMSITE

HORIZONTAL SCALE 1:200
VERTICAL SCALE 1:200

NOTES:

1. FOR PIPELINE ALIGNMENTS, REFER DRAWING 61-35637-C220.
2. FOR LEGEND, REFER DRAWING 61-35637-C210.
3. FOR OTHER NOTES, REFER DRAWING 61-35637-C202.

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0 5 10 15 20 25m — SCALE 1:500 AT ORIGINAL SIZE

0 2.5 5 7.5 10 12.5m — SCALE 1:250 AT ORIGINAL SIZE

0 2 4 6 8 10m — SCALE 1:200 AT ORIGINAL SIZE

PRELIMINARY

No	Revision	Drawn	Job Manager	Project Director	Date
A	ISSUED FOR 90 DESIGN - CLIENT COMMENT	GT	JM*	PS*	30/09/20

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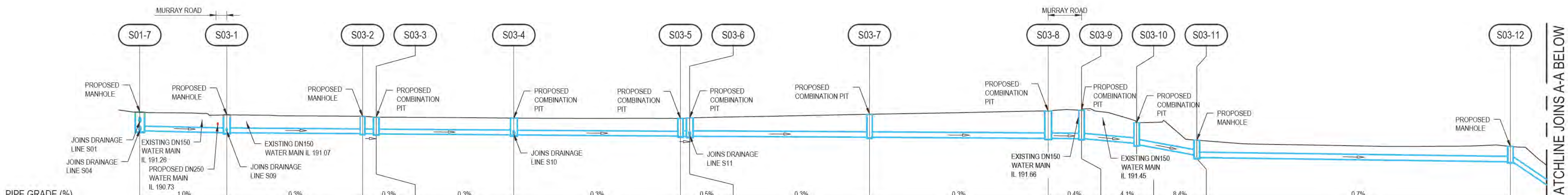
Drafting Check S.HORTON* | Design Check S.CLEARY*
Approved (Project Director)
Date
Scale AS SHOWN — This Drawing must not be used for Construction unless signed as Approved

Client: DEPT OF INFRASTRUCTURE, TRANSPORT, REGIONAL DEVELOPMENT & COMMUNICATIONS
Project: CHRISTMAS ISLAND STORMWATER REMEDIAL WORKS
Title: SOUTHERN DRUMSITE WORKS LONGITUDINAL SECTIONS - SHEET 1

Original Size A1 Drawing No: 61-35637-C270 Rev: A

Plot Date: 1 October 2020 - 5:21 AM Plotted by: Giselle Tayam Cad File No: N:\AU\Perth\Projects\61\35637\CADD\Drawings\61-35637-C270.dwg



DATUM R.L. 173.0m

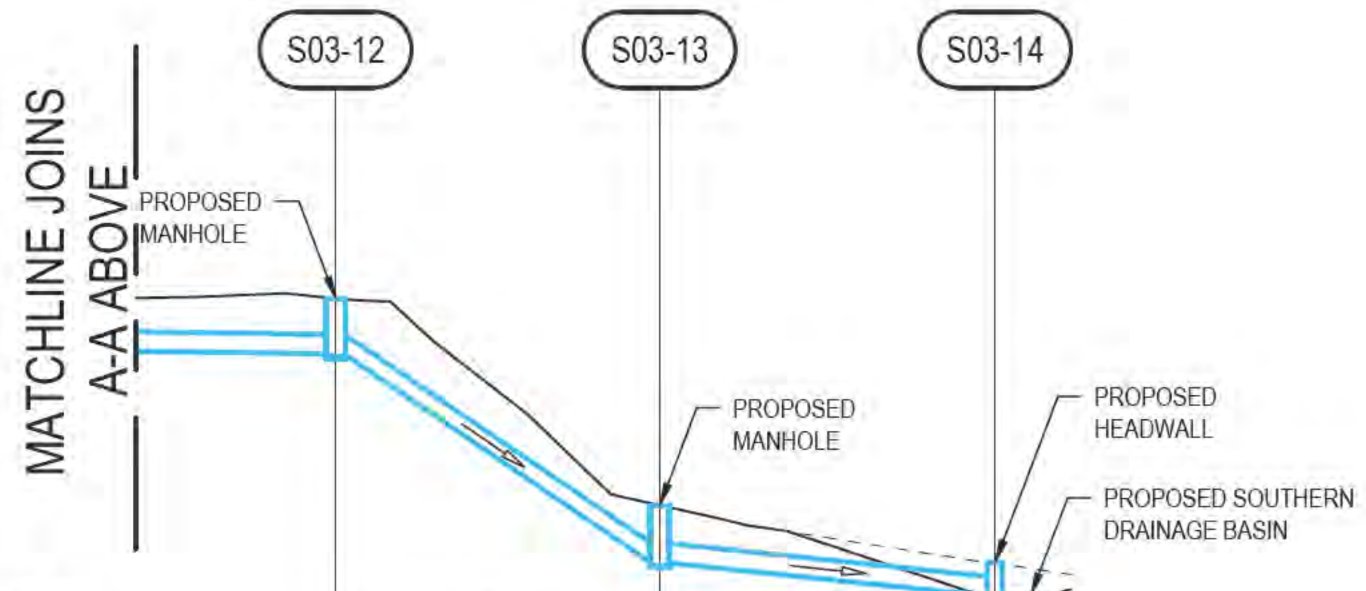
Pipe section	PIPE GRADE (%)	PIPE SLOPE (1 in X)	PIPE SIZE (mm)	PIPE CLASS	Length (m)
S01-7 – S03-1	1.0%	98.0	525	RIBBED SN8 HDPE	20.6
S03-1 – S03-2	0.3%	321.9	525	RIBBED SN8 HDPE	32.2
S03-2 – S03-3	0.3%	324.0	525	RIBBED SN8 HDPE	3.2
S03-3 – S03-4	0.3%	326.3	525	RIBBED SN8 HDPE	32.6
S03-4 – S03-5	0.3%	303.6	525	RIBBED SN8 HDPE	39.5
S03-5 – S03-6	0.5%	220.0	600	RIBBED SN8 HDPE	2.2
S03-6 – S03-7	0.3%	387.4	600	RIBBED SN8 HDPE	42.6
S03-7 – S03-8	0.3%	325.4	600	RIBBED SN8 HDPE	42.3
S03-8 – S03-9	0.4%	264.3	600	RIBBED SN8 HDPE	7.9
S03-9 – S03-10	4.1%	24.6	600	RIBBED SN8 HDPE	13.1
S03-10 – S03-11	8.4%	11.9	600	RIBBED SN8 HDPE	14.3
S03-11 – S03-12	0.7%	148.6	600	RIBBED SN8 HDPE	74.3

Pit	DESIGN SURFACE LEVEL (m)	EXISTING SURFACE LEVEL (m)	INVERT LEVEL (m) (upstream side)	INVERT LEVEL (m)	DEPTH TO INVERT FROM DESIGN SURFACE (m) (upstream side)	DEPTH TO INVERT FROM DESIGN SURFACE (m)	CHAINAGE (m)
S01-7	192.28	192.28	189.96	190.06	2.32	2.22	0.0
S03-1	191.94	191.94	189.85 189.74	189.84	2.09 2.20	2.10	18.45 / 20.6
S03-2	191.78	191.78	189.74 189.63	189.73	2.04 2.15	2.05	52.8
S03-3	191.66	191.66	189.72 189.60	189.70	1.94 2.06	1.96	56.0
S03-4	191.56	191.56	189.60 189.48	189.58	1.96 2.08	1.98	88.6
S03-5	191.52	191.52	189.45 189.34	189.44	2.07 2.18	2.08	128.1
S03-6	191.59	191.59	189.43 189.33	189.43	2.16 2.26	2.16	130.3
S03-7	192.01	192.01	189.32 189.21	189.31	2.69 2.80	2.70	172.9
S03-8	192.42	192.42	189.18 189.07	189.17	3.24 3.35	3.25	215.2
S03-9	192.49	192.49	189.14 189.03	189.13	3.35 3.46	3.36	223.2
S03-10	191.01	191.01	188.60 188.30	188.40	2.41 2.71	2.61	236.2
S03-11	188.94	188.94	187.20 186.80	186.90	1.74 2.14	2.04	250.5
S03-12	188.20	188.20	186.40 186.28	186.38	1.80 1.92	1.82	324.8

DRAINAGE LINE S03 - LONGITUDINAL SECTION
SOUTHERN DRUMSITE

HORIZONTAL SCALE 1:500
VERTICAL SCALE 1:250

THIS DRAWING IS TO BE PRINTED IN COLOUR



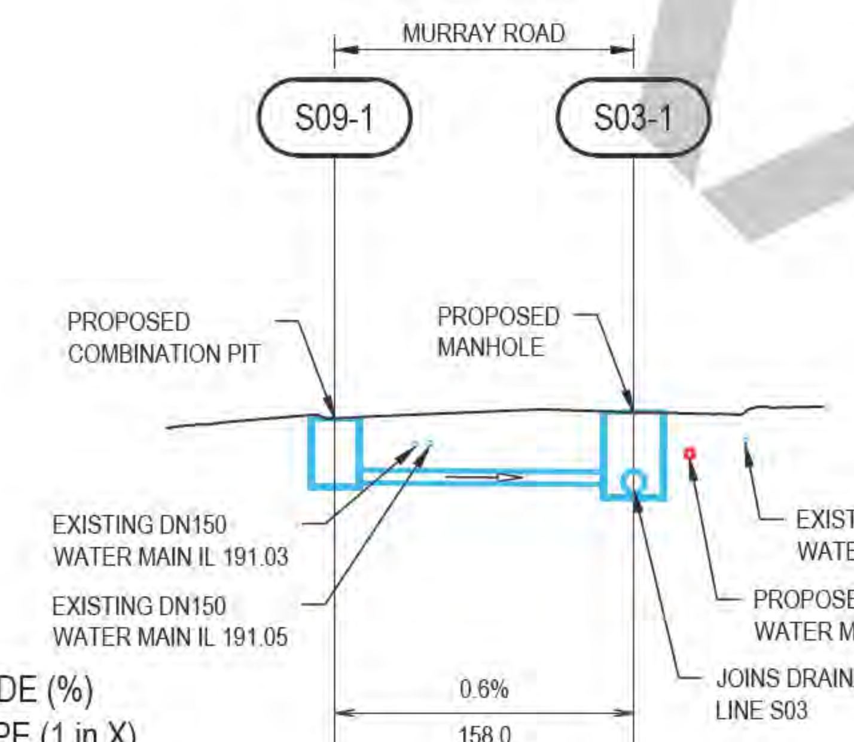
DATUM R.L. 168.0m

Pipe section	PIPE GRADE (%)	PIPE SLOPE (1 in X)	PIPE SIZE (mm)	PIPE CLASS	Length (m)
S03-12 – S03-13	32.1%	3.1	600	RIBBED SN8 HDPE	21.4
S03-13 – S03-14	4.9%	20.3	600	RIBBED SN8 HDPE	22.2

Pit	DESIGN SURFACE LEVEL (m)	EXISTING SURFACE LEVEL (m)	INVERT LEVEL (m) (upstream side)	INVERT LEVEL (m)	DEPTH TO INVERT FROM DESIGN SURFACE (m) (upstream side)	DEPTH TO INVERT FROM DESIGN SURFACE (m)	CHAINAGE (m)
S03-12	188.20	188.20	186.40 186.28	186.38	1.80 1.92	1.82	324.8
S03-13	181.37	181.37	179.50 179.39	179.49	1.87 1.98	1.88	346.2
S03-14	179.50	179.50	178.40	178.30	1.10	1.20	368.4

DRAINAGE LINE S03 - LONGITUDINAL SECTION
SOUTHERN DRUMSITE

HORIZONTAL SCALE 1:500
VERTICAL SCALE 1:250



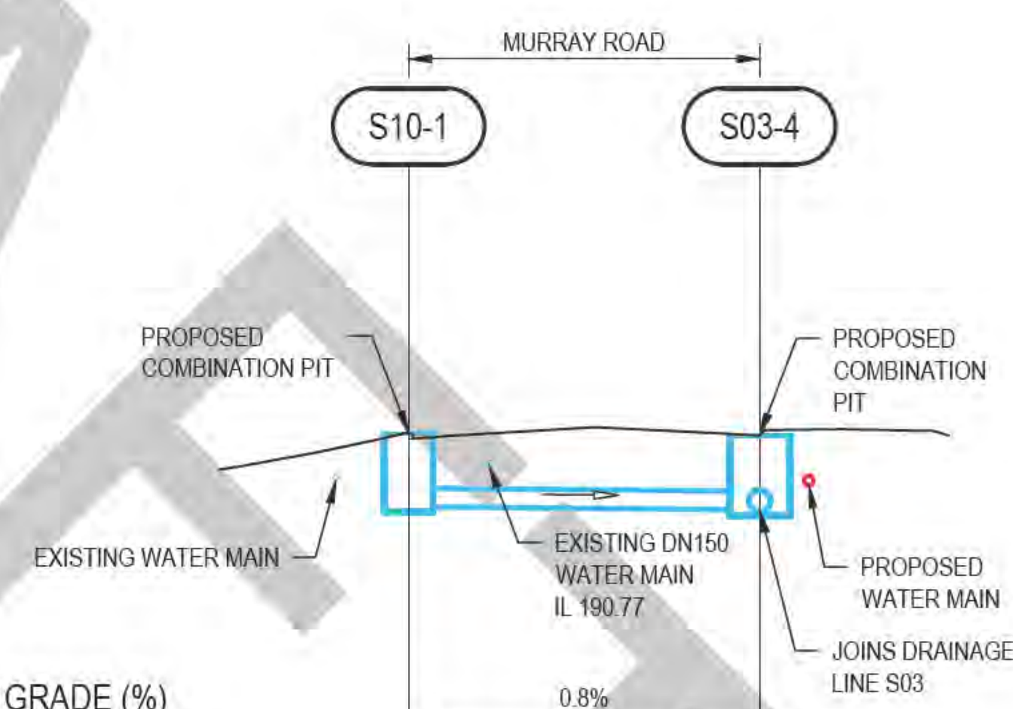
DATUM R.L. 177.0m

Pipe section	PIPE GRADE (%)	PIPE SLOPE (1 in X)	PIPE SIZE (mm)	PIPE CLASS	Length (m)
S09-1 – S03-1	0.6%	158.0	300	RIBBED SN8 HDPE	7.9

Pit	DESIGN SURFACE LEVEL (m)	EXISTING SURFACE LEVEL (m)	INVERT LEVEL (m) (upstream side)	INVERT LEVEL (m)	DEPTH TO INVERT FROM DESIGN SURFACE (m) (upstream side)	DEPTH TO INVERT FROM DESIGN SURFACE (m)	CHAINAGE (m)
S09-1	191.78	191.78	190.00	190.10	1.78	1.68	0.0
S03-1	191.94	191.94	190.05 189.74	189.84	1.89 2.20	2.10	7.9

DRAINAGE LINE S09 - LONGITUDINAL SECTION
SOUTHERN DRUMSITE

HORIZONTAL SCALE 1:200
VERTICAL SCALE 1:200



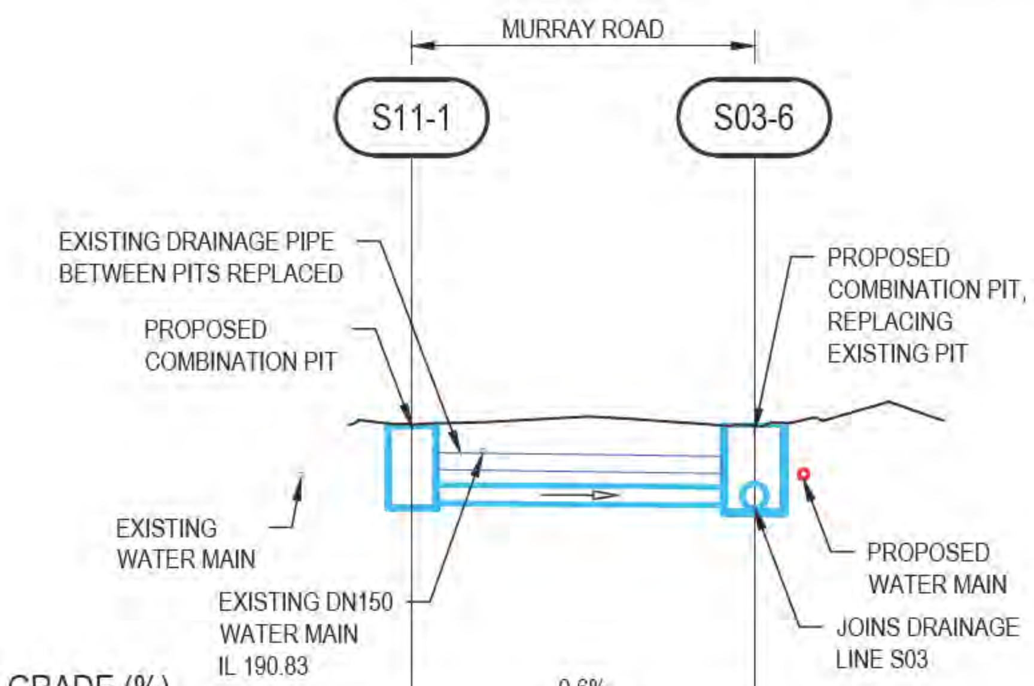
DATUM R.L. 177.0m

Pipe section	PIPE GRADE (%)	PIPE SLOPE (1 in X)	PIPE SIZE (mm)	PIPE CLASS	Length (m)
S10-1 – S03-4	0.8%	132.5	450	RIBBED SN8 HDPE	9.3

Pit	DESIGN SURFACE LEVEL (m)	EXISTING SURFACE LEVEL (m)	INVERT LEVEL (m) (upstream side)	INVERT LEVEL (m)	DEPTH TO INVERT FROM DESIGN SURFACE (m) (upstream side)	DEPTH TO INVERT FROM DESIGN SURFACE (m)	CHAINAGE (m)
S10-1	191.62	191.62	189.60	189.70	2.02	1.92	0.0
S03-4	191.56	191.56	189.63 189.48	189.58	1.93 2.08	1.98	9.3

DRAINAGE LINE S10 - LONGITUDINAL SECTION
SOUTHERN DRUMSITE

HORIZONTAL SCALE 1:200
VERTICAL SCALE 1:200



DATUM R.L. 177.0m

Pipe section	PIPE GRADE (%)	PIPE SLOPE (1 in X)	PIPE SIZE (mm)	PIPE CLASS	Length (m)
S11-1 – S03-6	0.6%	180.8	450	RIBBED SN8 HDPE	9.0

Pit	DESIGN SURFACE LEVEL (m)	EXISTING SURFACE LEVEL (m)	INVERT LEVEL (m) (upstream side)	INVERT LEVEL (m)	DEPTH TO INVERT FROM DESIGN SURFACE (m) (upstream side)	DEPTH TO INVERT FROM DESIGN SURFACE (m)	CHAINAGE (m)
S11-1	191.57	191.57	189.45	189.55	2.12	2.02	0.0
S03-6	191.59	191.59	189.50 189.33	189.43	2.09 2.26	2.16	9.0

DRAINAGE LINE S11 - LONGITUDINAL SECTION
SOUTHERN DRUMSITE

HORIZONTAL SCALE 1:200
VERTICAL SCALE 1:200

NOTES:

1. FOR PIPELINE ALIGNMENTS, REFER DRAWINGS 61-35637-C220 AND C221.
2. FOR LEGEND, REFER DRAWING 61-35637-C210.
3. FOR OTHER NOTES, REFER DRAWING 61-35637-C202.

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0 5 10 15 20 25m — SCALE 1:500 AT ORIGINAL SIZE

0 2.5 5 7.5 10 12.5m — SCALE 1:250 AT ORIGINAL SIZE

0 2 4 6 8 10m — SCALE 1:200 AT ORIGINAL SIZE

DRAFT

PRELIMINARY

No	Revision	Drawn	Job Manager	Project Director	Date
A	ISSUED FOR 90% DESIGN - CLIENT COMMENT	GT	JM*	PS*	30/09/20

Note: * indicates signatures on original issue of drawing or last revision of drawing

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DO NOT SCALE

Drawn G.TAYAM | Designer D.DOMINGO
Drafting Check S.HORTON* | Design Check S.CLEARY*
Approved (Project Director)
Date
Scale AS SHOWN
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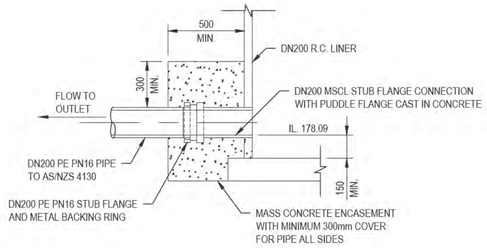
Client: DEPT OF INFRASTRUCTURE, TRANSPORT, REGIONAL DEVELOPMENT & COMMUNICATIONS
Project: CHRISTMAS ISLAND STORMWATER REMEDIAL WORKS
Title: SOUTHERN DRUMSITE WORKS LONGITUDINAL SECTIONS - SHEET 2

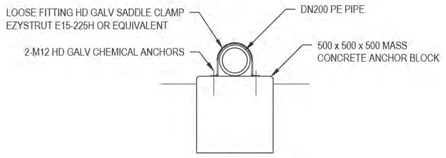
Original Size A1 | Drawing No: 61-35637-C271 | Rev: A

Plot Date: 30 September 2020 - 3:12 AM Plotted by: Giselle Tayam Cad File No: N:\AU\Perth\Projects\61\35637\CADD\Drawings\61-35637-C271.dwg

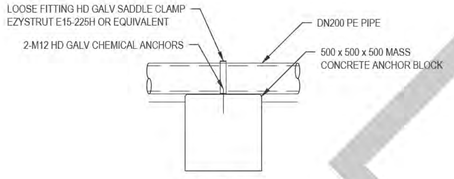


DN200 PE ANCHOR DETAIL

SCALE 1:20



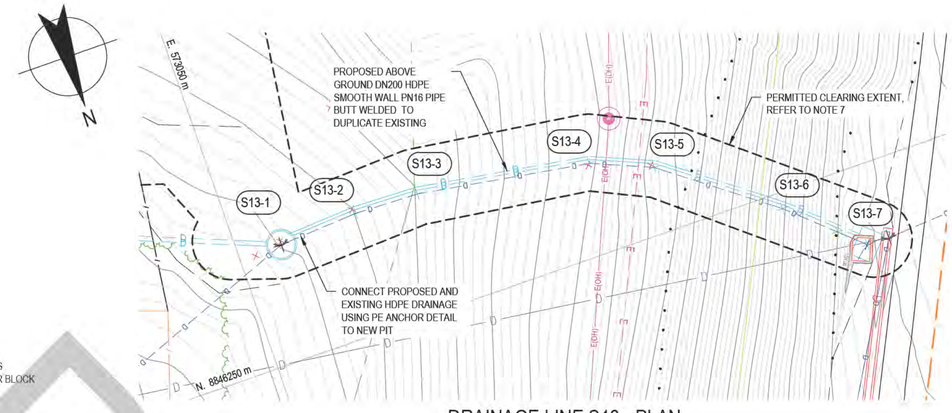
FRONT VIEW



SIDE VIEW

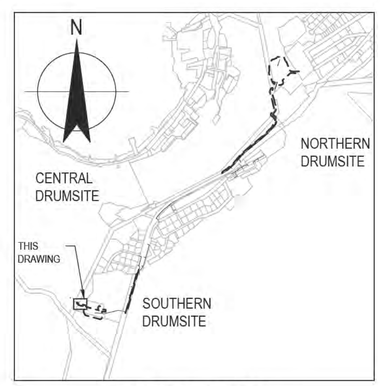
DN200 PE GUIDE SUPPORT TYPICAL DETAIL

SCALE 1:20



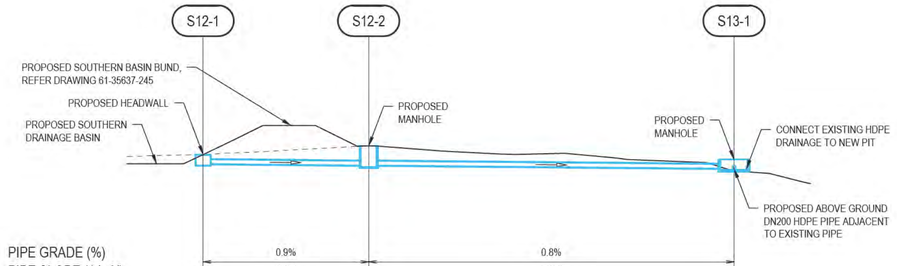
DRAINAGE LINE S13 - PLAN

SCALE 1:200



LOCALITY PLAN

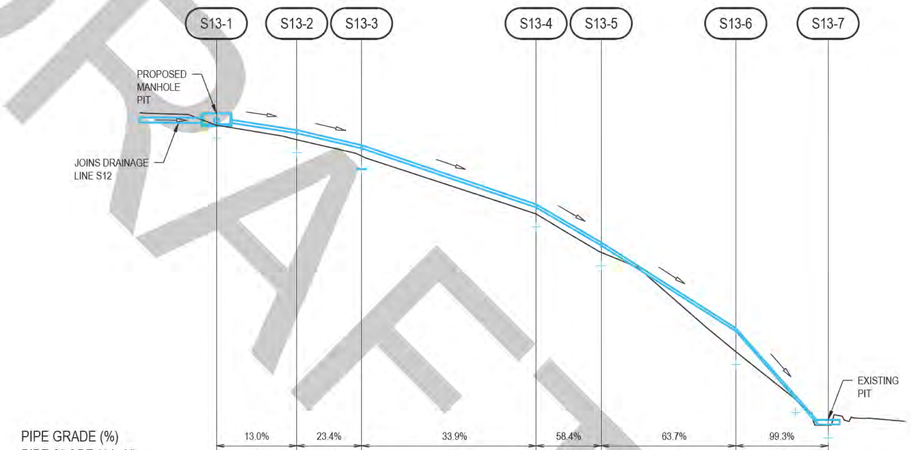
N.T.S.



PIPE GRADE (%)		0.9%	0.8%
PIPE SLOPE (1 in X)		108.0	119.3
PIPE SIZE (mm)		300	300
PIPE CLASS		RIBBED SN8 HDPE	RIBBED SN8 HDPE
DATUM R.L. 165.0m			
DESIGN SURFACE LEVEL (m)	179.00	179.58	178.69
EXISTING SURFACE LEVEL (m)	179.00	179.58	178.69
INVERT LEVEL (m)	178.29 178.39	178.29 178.19	178.29 178.09
DEPTH TO INVERT FROM DESIGN SURFACE (m)	0.71 0.61	1.29 1.39	0.60 0.70
CHAINAGE (m)	0.0	10.8	34.7
	10.8	23.9	

DRAINAGE LINE S12 - LONGITUDINAL SECTION SOUTHERN DRUMSITE

HORIZONTAL SCALE 1:200
VERTICAL SCALE 1:200



PIPE GRADE (%)		13.0%	23.4%	33.9%	58.4%	63.7%	99.3%
PIPE SLOPE (1 in X)		7.7	4.3	3.0	1.7	1.6	1.0
PIPE SIZE (mm)		200	200	200	200	200	200
PIPE CLASS		HDPE PIPE SN16	HDPE PIPE SN16	HDPE PIPE SN16	HDPE PIPE SN16	HDPE PIPE SN16	HDPE PIPE SN16
DATUM R.L. 150.0m							
DESIGN SURFACE LEVEL (m)	178.69	177.61	176.62	172.76	170.28	164.68	158.70
EXISTING SURFACE LEVEL (m)	178.69	177.61	176.62	172.76	170.28	164.68	158.70
INVERT LEVEL (m)	177.99 178.09	177.41 177.31	176.42 176.32	172.56 172.46	170.08 169.98	164.48 164.38	158.50 158.40
DEPTH TO INVERT FROM DESIGN SURFACE (m)	0.70 0.60	0.20 0.30	0.20 0.30	0.20 0.30	0.20 0.30	0.20 0.30	0.20 0.30
CHAINAGE (m)	-15.9	-10.7	-6.4	5.0	9.2	18.0	24.0
	5.2	4.2	11.4	4.2	8.8	6.0	

DRAINAGE LINE S13 - LONGITUDINAL SECTION SOUTHERN DRUMSITE

HORIZONTAL SCALE 1:200
VERTICAL SCALE 1:200

NOTES:

1. FOR PIPELINE ALIGNMENTS, REFER DRAWING 61-35637-C221.
2. FOR LEGEND, REFER DRAWING 61-35637-C210.
3. FOR OTHER NOTES, REFER DRAWING 61-35637-C202.
4. CLEARING OF TREES TO BE MINIMISED AT ALL TIMES.
5. DN200 PE ANCHOR TO BE INSTALLED ON BOTH NEW AND EXISTING PIPE ON EXIT OF PIT S13-1
6. PE GUIDE SUPPORTS TO BE INSTALLED AT MAXIMUM OF 12m INTERVALS AND BE LOCATED TO NOT BE COLOCATED WITH PIPE WELDED JOINT AND OFFSET A MINIMUM OF 2m.
7. EXTENT OF CLEARING PERMITTED. REFER TO SPECIFICATION FOR FURTHER DETAILS AND SETOUT REQUIREMENTS.

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DRAINAGE STRUCTURE SET OUT		
STRUCTURE NUMBER	NORTHING (m)	EASTING (m)
S13-1	8846242.44	573047.12
S13-2	8846242.12	573041.88
S13-3	8846242.26	573037.65
S13-4	8846244.08	573026.41
S13-5	8846245.74	573022.49
S13-6	8846251.04	573015.48
S13-7	8846255.10	573011.03

0 0.2 0.4 0.6 0.8 1.0m
SCALE 1:20 AT ORIGINAL SIZE

0 2 4 6 8 10m
SCALE 1:200 AT ORIGINAL SIZE

PRELIMINARY

No	Revision	Note: * indicates signatures on original issue of drawing or last revision of drawing	Drawn	Job Manager	Project Director	Date
B	REISSUED FOR 90% DESIGN - CLIENT COMMENT		GT	JM*	PS*	20/11/20
A	ISSUED FOR 90% DESIGN - CLIENT COMMENT		GT	JM*	PS*	30/09/20

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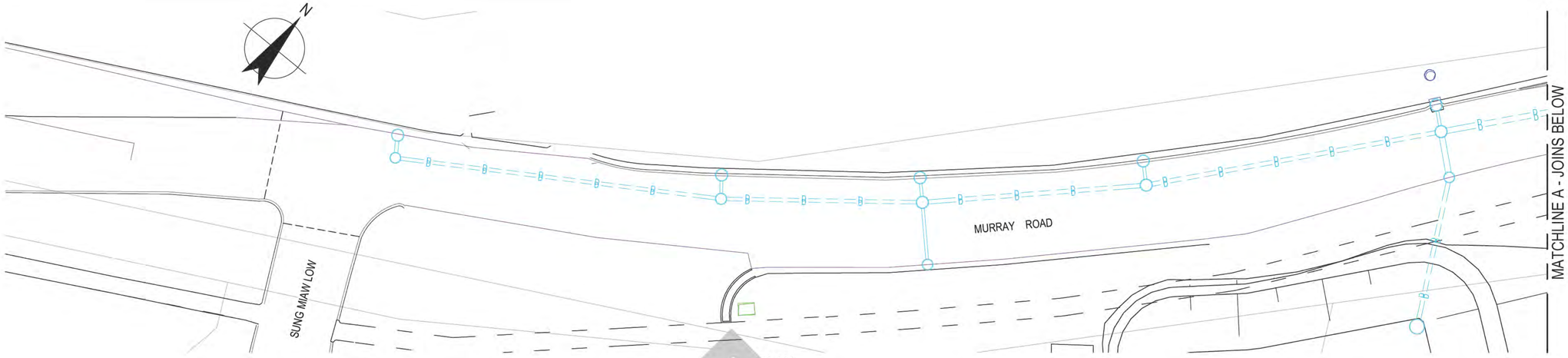
Drawn	G.TAYAM	Designer	D.DOMINGO
Drafting Check	S.HORTON*	Design Check	S.CLEARY*
Approved (Project Director)			
Date			
Scale	AS SHOWN	This Drawing must not be used for Construction unless signed as Approved	

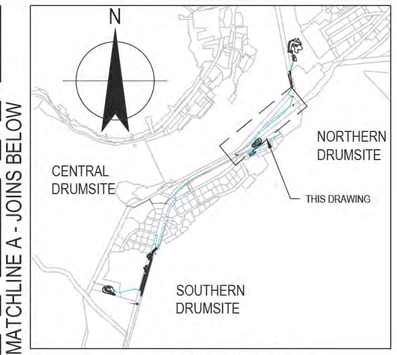
Client: DEPT OF INFRASTRUCTURE, TRANSPORT, REGIONAL DEVELOPMENT & COMMUNICATIONS
Project: CHRISTMAS ISLAND STORMWATER REMEDIAL WORKS
Title: SOUTHERN DRUMSITE WORKS LONGITUDINAL SECTIONS - SHEET 3

Original Size: A1
Drawing No: 61-35637-C272
Rev: B

Plot Date: 19 November 2020 - 2:42 PM Plotted by: Jess Overheu Cad File No: \\ghdnet.internal\ghd\AU\Perth\Projects\61\35637\CADD\Drawings\61-35637-C272.dwg



PLAN
SCALE 1:250



LOCALITY PLAN
N.T.S.

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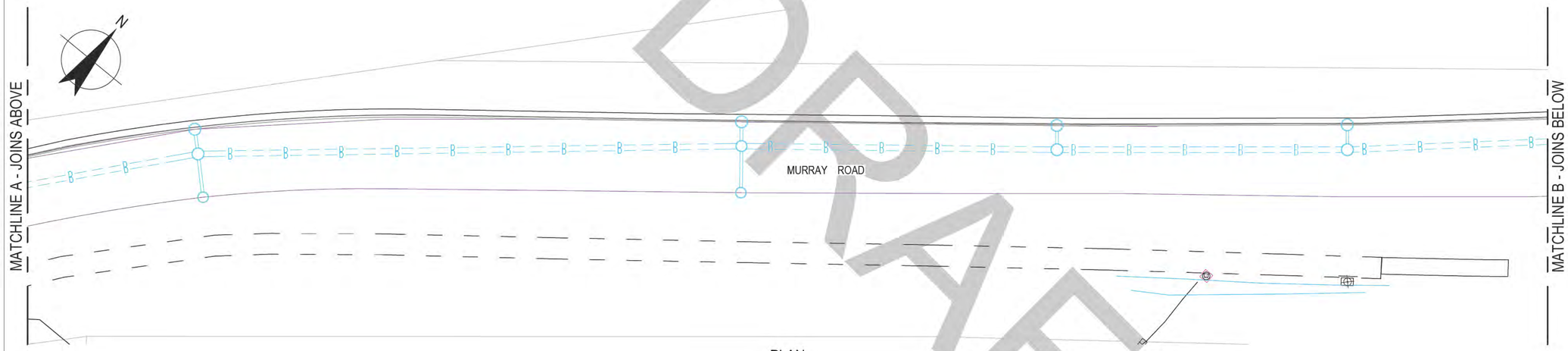

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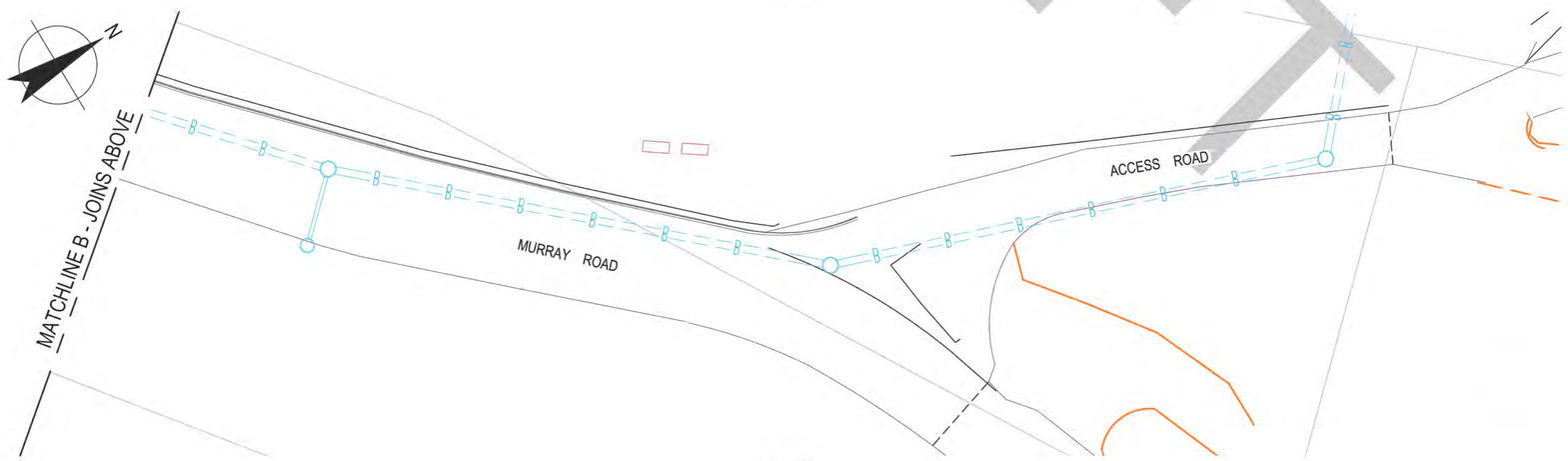
SCALE 1:250



PLAN
SCALE 1:250

LEGEND:

EXTENT OF PAVEMENT RESURFACING

NOTES:

1. FOR LEGEND, REFER DRAWING 61-35637-C210.
2. PAVEMENT MARKING TO BE REINSTATED AS PER EXISTING FOLLOWING PAVEMENT RESURFACING.
3. FOR TYPICAL DETAIL OF THE PAVEMENT RECONSTRUCTION AND RESEAL, REFER DETAIL 1 ON DRAWING 61-35637-C296.

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0 2.5 5 7.5 10 12.5m
SCALE 1:250 AT ORIGINAL SIZE

PRELIMINARY

No	Revision	Note: * indicates signatures on original issue of drawing or last revision of drawing	Drawn	Job Manager	Project Director	Date
A	ISSUED FOR 90□ DESIGN - CLIENT COMMENT		SDC	JM*	PS*	30/09/20

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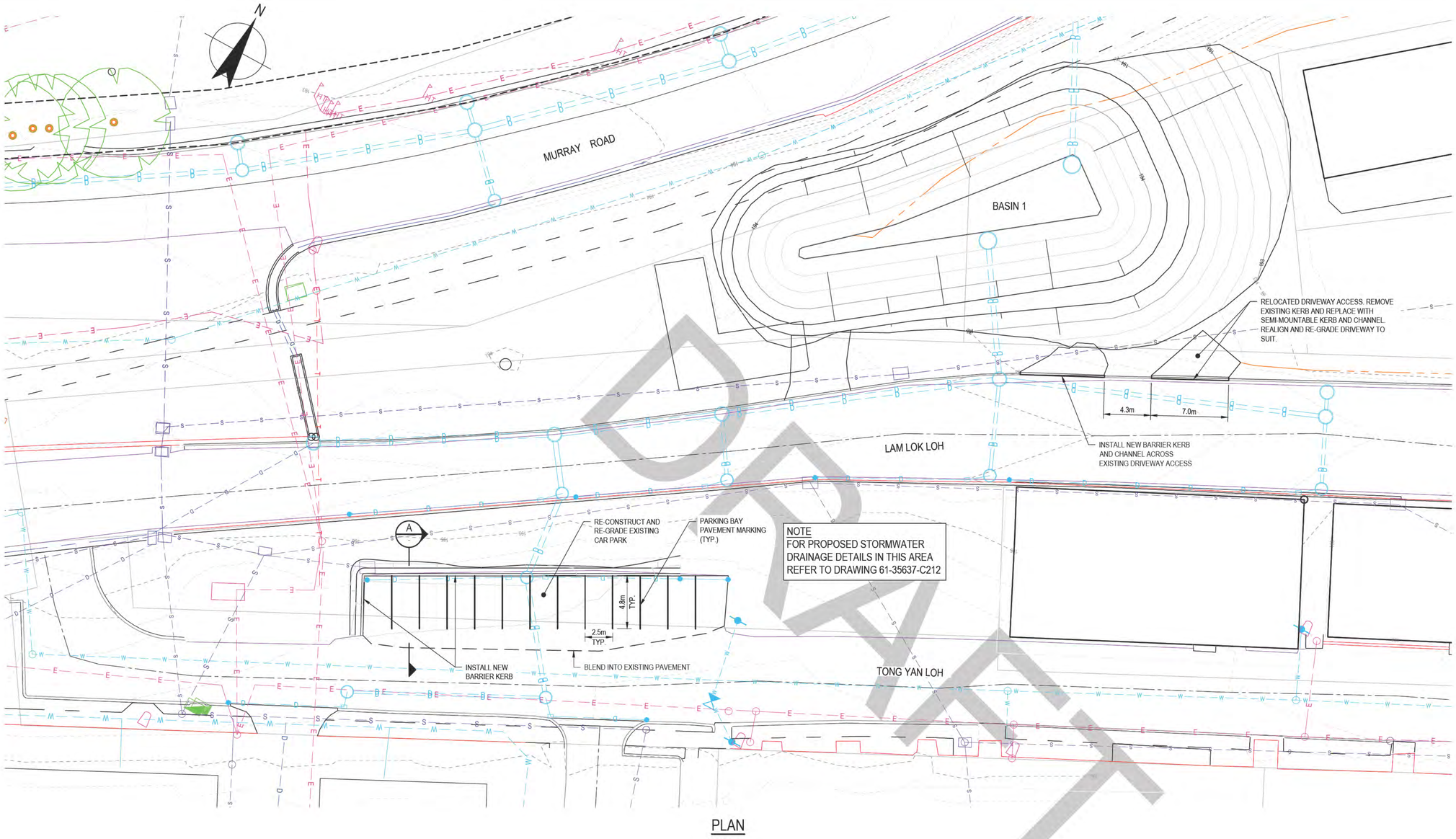
Drawn	S.DE CEGLIE	Designer	S.DE CEGLIE
Drafting Check	S.HORTON*	Design Check	S.CLEARY*
Approved (Project Director)			
Date			
Scale	1:250	This Drawing must not be used for Construction unless signed as Approved	

Client: DEPT OF INFRASTRUCTURE, TRANSPORT, REGIONAL DEVELOPMENT & COMMUNICATIONS
Project: CHRISTMAS ISLAND STORMWATER REMEDIAL WORKS
Title: NORTHERN DRUMSITE - ROAD AND PAVEMENT DESIGN PAVEMENT REINSTATEMENT WORKS

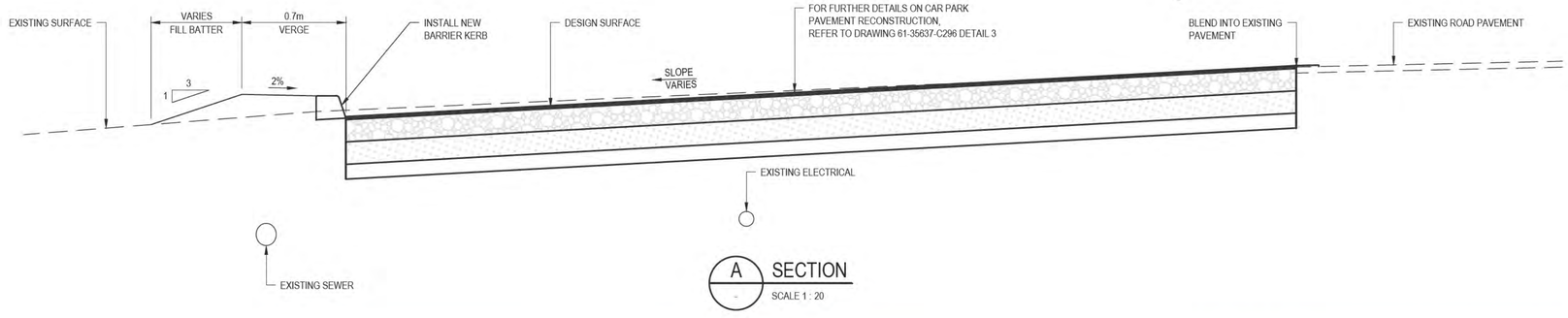
Original Size: A1
Drawing No: 61-35637-C280
Rev: A

Plot Date: 1 October 2020 - 1:35 PM Plotted by: Giselle Tayam Cad File No: N:\AU\Perth\Projects\61\35637\CADD\Drawings\61-35637-C280.dwg



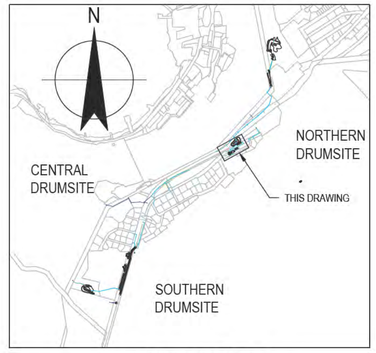
PLAN

SCALE 1:200



A SECTION

SCALE 1 : 20



LOCALITY PLAN

N.T.S.

THIS DRAWING IS TO BE PRINTED IN COLOUR

NOTES:

1. FOR LEGEND, REFER DRAWING 61-35637-C210.
2. EXISTING SERVICES LOCATIONS ARE INDICATIVE ONLY. CONTRACTOR TO CONFIRM LOCATION, SIZE AND LEVEL PRIOR TO COMMENCING CONSTRUCTION, SHOULD ANY CLASHES BE IDENTIFIED WITH PROPOSED WORKS THE CONTRACTOR IS TO IMMEDIATELY NOTIFY THE CLIENT'S REPRESENTATIVE.
3. EXISTING COMMUNICATIONS INFORMATION IS INCOMPLETE. VERIFICATION OF PRESENCE THROUGHOUT SITE REQUIRED PRIOR TO COMMENCING CONSTRUCTION.
4. FOR KERB DETAILS, REFER TO DRAWING 61-35637-C293.
5. FOR CAR PARK SETOUT AND DESIGN LEVELS REFER TO 12D MODEL.

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0 0.2 0.4 0.6 0.8 1.0m
SCALE 1:20 AT ORIGINAL SIZE

0 2 4 6 8 10m
SCALE 1:200 AT ORIGINAL SIZE

PRELIMINARY

No	Revision	Note: * indicates signatures on original issue of drawing or last revision of drawing	Drawn	Job Manager	Project Director	Date
B	REISSUED FOR 90□ DESIGN - CLIENT COMMENT		GT	JM*	PS*	20/11/20
A	ISSUED FOR 90□ DESIGN - CLIENT COMMENT		SDC	JM*	PS*	30/09/20

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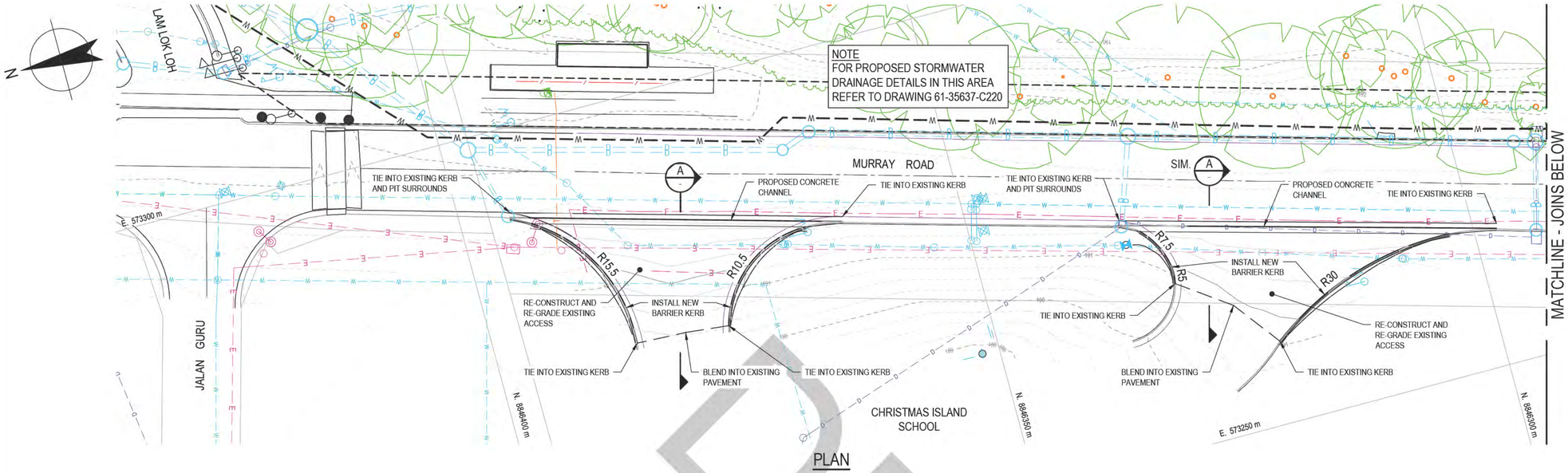
Drawn	S.DE CEGLIE	Designer	S.DE CEGLIE
Drafting Check	S.HORTON*	Design Check	S.CLEARY*
Approved (Project Director)			
Date			
Scale	AS SHOWN	This Drawing must not be used for Construction unless signed as Approved	

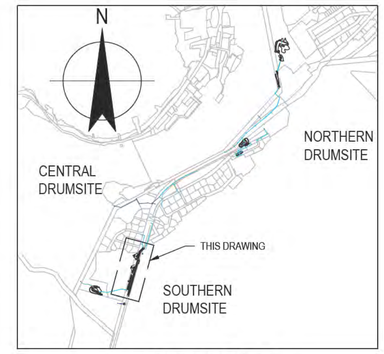
Client: DEPT OF INFRASTRUCTURE, TRANSPORT, REGIONAL DEVELOPMENT & COMMUNICATIONS
Project: CHRISTMAS ISLAND STORMWATER REMEDIAL WORKS
Title: NORTHERN DRUMSITE - ROAD AND PAVEMENT DESIGN TONG YAN LOH CAR PARK MODIFICATIIONS

Original Size A1 | Drawing No: 61-35637-C281 | Rev: B

Plot Date: 18 November 2020 - 5:56 AM | Plotted by: Giselle Tayam | Cad File No: N:\AU\Perth\Projects\61\35637\CADD\Drawings\61-35637-C281.dwg



PLAN
SCALE 1:250



LOCALITY PLAN
N.T.S.

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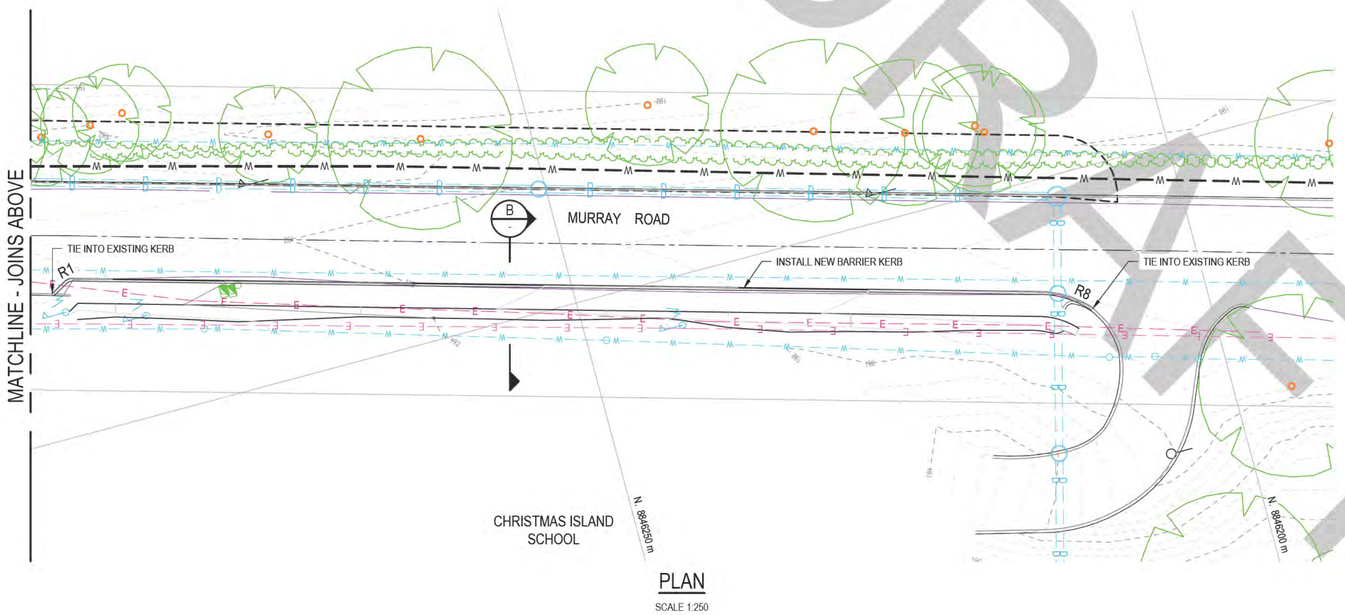

PLAN
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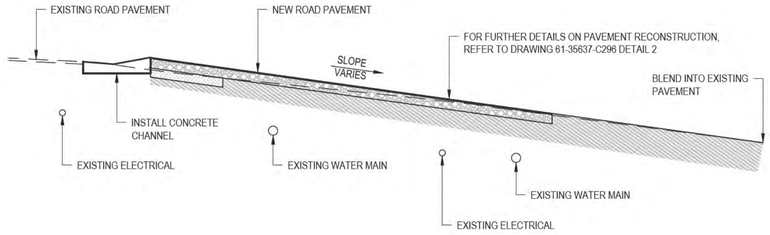
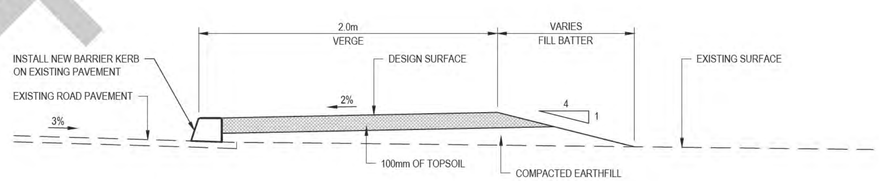
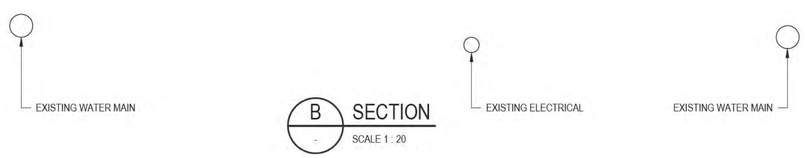


A SECTION
SCALE 1 : 50





B SECTION
SCALE 1 : 20

NOTES:

1. FOR LEGEND, REFER DRAWING 61-35637-C210.
2. EXISTING SERVICES LOCATIONS AND DEPTHS ARE INDICATIVE ONLY. CONTRACTOR TO CONFIRM LOCATION, SIZE AND LEVEL PRIOR TO COMMENCING CONSTRUCTION. SHOULD ANY CLASHES BE IDENTIFIED WITH PROPOSED WORKS THE CONTRACTOR IS TO IMMEDIATELY NOTIFY THE CLIENT'S REPRESENTATIVE.
3. EXISTING COMMUNICATIONS INFORMATION IS INCOMPLETE. VERIFICATION OF PRESENCE THROUGHOUT SITE REQUIRED PRIOR TO COMMENCING CONSTRUCTION.
4. FOR KERB AND CONCRETE CHANNEL DETAILS, REFER TO DRAWING 61-35637-C293.
5. FOR ROADWORKS AND KERB SETOUT AND DESIGN LEVELS REFER TO 12D MODEL.

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0 0.2 0.4 0.6 0.8 1.0m SCALE 1:20 AT ORIGINAL SIZE
0 0.5 1.0 1.5 2.0 2.5m SCALE 1:50 AT ORIGINAL SIZE
0 2.5 5 7.5 10 12.5m SCALE 1:250 AT ORIGINAL SIZE

PRELIMINARY

No	Revision	Note: * indicates signatures on original issue of drawing or last revision of drawing	Drawn	Job Manager	Project Director	Date
B	REISSUED FOR 90□ DESIGN - CLIENT COMMENT		GT	JM*	PS*	20/11/20
A	ISSUED FOR 90□ DESIGN - CLIENT COMMENT		SDC	JM*	PS*	30/09/20

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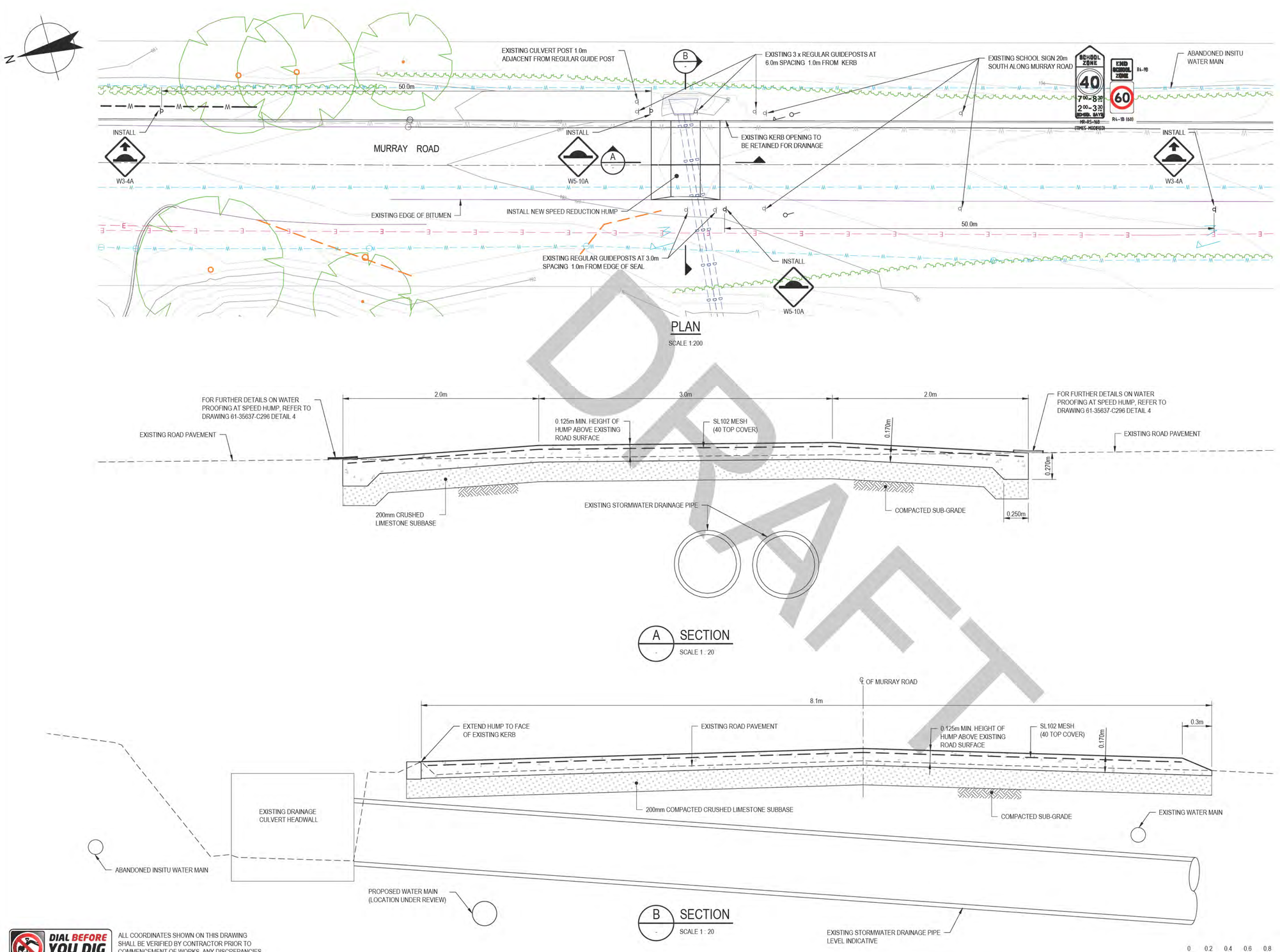
Drawn	S.DE CEGLIE	Designer	S.DE CEGLIE
Drafting Check	S.HORTON*	Design Check	S.CLEARY*
Approved (Project Director)			
Date			
Scale	AS SHOWN	This Drawing must not be used for Construction unless signed as Approved	

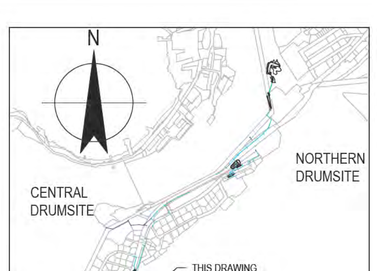
Client: DEPT OF INFRASTRUCTURE, TRANSPORT, REGIONAL DEVELOPMENT & COMMUNICATIONS
Project: CHRISTMAS ISLAND STORMWATER REMEDIAL WORKS
Title: SOUTHERN DRUMSITE - ROAD AND PAVEMENT DESIGN
CHRISTMAS ISLAND SCHOOL ENTRANCE MODIFICATIONS

Original Size A1 | Drawing No: 61-35637-C285 | Rev: B

Plot Date: 18 November 2020 - 6:00 AM Plotted by: Giselle Tayam Cad File No: N:\AU\Perth\Projects\61\35637\CADD\Drawings\61-35637-C285.dwg



PLAN
SCALE 1:200



LOCALITY PLAN
N.T.S.

THIS DRAWING IS TO BE PRINTED IN COLOUR

A SECTION
SCALE 1 : 20

B SECTION
SCALE 1 : 20

NOTES:
1. FOR LEGEND, REFER DRAWING 61-35637-C210.
2. EXISTING SERVICES LOCATIONS AND LEVELS ARE INDICATIVE ONLY. CONTRACTOR TO CONFIRM LOCATION, SIZE AND LEVEL PRIOR TO COMMENCING CONSTRUCTION, SHOULD ANY CLASHES BE IDENTIFIED WITH PROPOSED WORKS THE CONTRACTOR IS TO IMMEDIATELY NOTIFY THE CLIENT'S REPRESENTATIVE.
3. EXISTING COMMUNICATIONS INFORMATION IS INCOMPLETE. VERIFICATION OF PRESENCE THROUGHOUT SITE REQUIRED PRIOR TO COMMENCING CONSTRUCTION
4. FOR HUMP SETOUT AND DESIGN LEVELS REFER TO 12D MODEL.
5. DRAWING TO BE READ IN CONJUNCTION WITH STRUCTURAL DRAWING NOTES ON DRAWING 61-35637-S002.

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0 0.2 0.4 0.6 0.8 1.0m
SCALE 1:20 AT ORIGINAL SIZE

0 2 4 6 8 10m
SCALE 1:200 AT ORIGINAL SIZE

PRELIMINARY

No	Revision	Drawn	Job Manager	Project Director	Date
B	REISSUED FOR 90% DESIGN - CLIENT COMMENT	GT	JM*	PS*	20/11/20
A	ISSUED FOR 90% DESIGN - CLIENT COMMENT	SDC	JM*	PS*	30/09/20

Note: * indicates signatures on original issue of drawing or last revision of drawing

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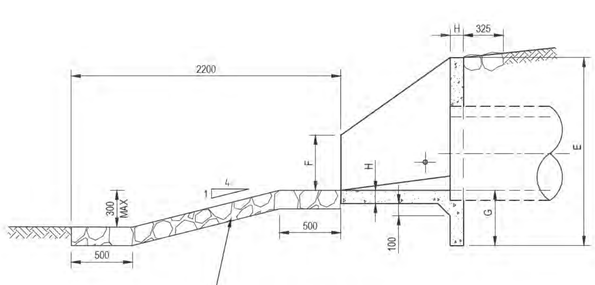
Drafting Check	S.HORTON*	Design Check	S.CLEARY*
Approved (Project Director)			
Date			
Scale	AS SHOWN	This Drawing must not be used for Construction unless signed as Approved	

Client: DEPT OF INFRASTRUCTURE, TRANSPORT, REGIONAL DEVELOPMENT & COMMUNICATIONS
Project: CHRISTMAS ISLAND STORMWATER REMEDIAL WORKS
Title: SOUTHERN DRUMSITE - ROAD AND PAVEMENT DESIGN
MURRAY ROAD SPEED REDUCTION HUMP

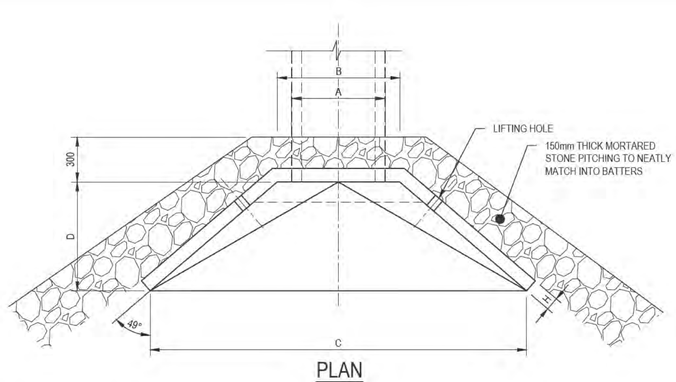
Original Size: A1
Drawing No: 61-35637-C286
Rev: B

Plot Date: 19 November 2020 - 11:31 AM Plotted by: Jess Overheu
Cad File No: \\ghdnet.internal\ghd\AU\Perth\Projects\61\35637\CADD\Drawings\61-35637-C286.dwg

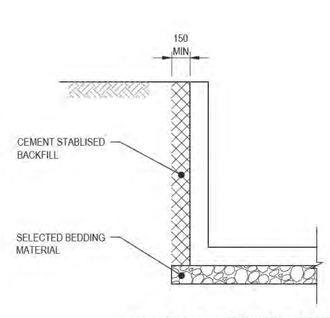


NOM 150mm SIZE MORTARED STONE PITCHING FOR WIDTH OF APRON PLUS 600mm EACH SIDE AND TO BASE OF SUMP, TO OUTLET ONLY

END ELEVATION

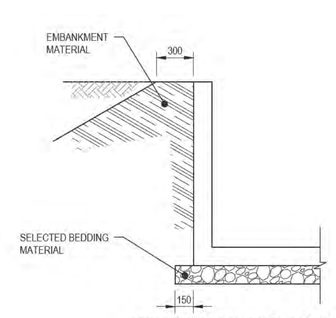


PLAN



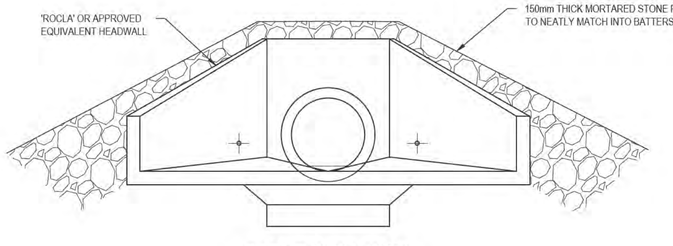
WINGWALLS AND APRON

N.T.S.
TRENCH METHOD



WINGWALLS AND APRON

N.T.S.
EMBANKMENT METHOD



FRONT ELEVATION

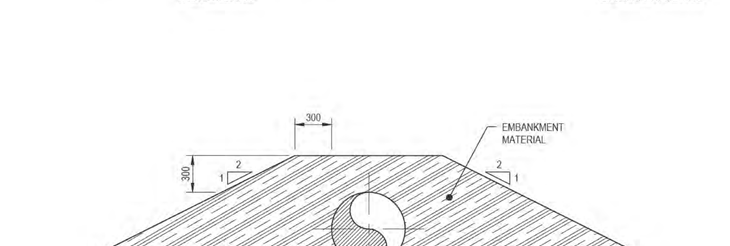
HEADWALL SCHEDULE

NOM. PIPE SIZE	MASS kg	DIMENSION IN (mm)							
		A	B	C	D	E	F	G	H
300	415	367	650	1850	600	920	270	250	65
375	400	450	650	1850	600	920	270	250	65
450	395	538	650	1850	600	920	270	250	65
525	690	620	800	2300	750	1070	320	250	75
600	680	702	800	2300	750	1070	320	250	75
675	1050	786	1000	3000	1000	1320	320	300	75
750	1030	870	1000	3000	1000	1320	320	300	75
900	940	1050	1060	2040	850	1340	570	380	100
1050	1325	1215	1225	2370	1005	1500	640	380	100

* FOR 825mm PIPE, USE 900 NOM PIPE SIZE HEADWALL

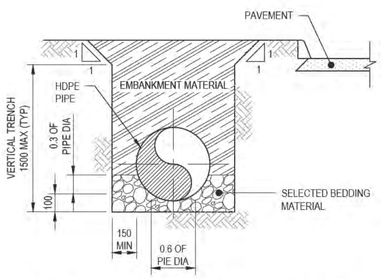
TYPICAL HEADWALL DETAILS

SCALE 1:25



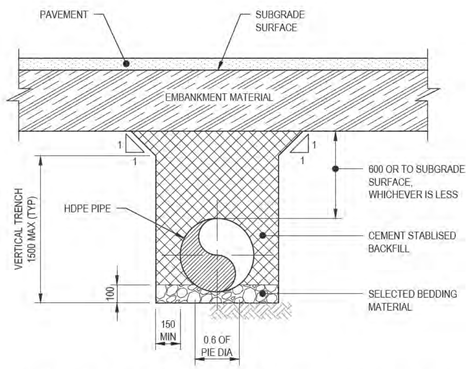
BACKFILL - EMBANKMENT METHOD - SINGLE BARREL

N.T.S.
APPLICABLE IN ALL TRAFFIC ENVIRONMENTS



TRENCH METHOD (TRAFFICABLE) - SINGLE BARREL

N.T.S.



TRENCH METHOD (TRAFFICABLE) - SINGLE BARREL

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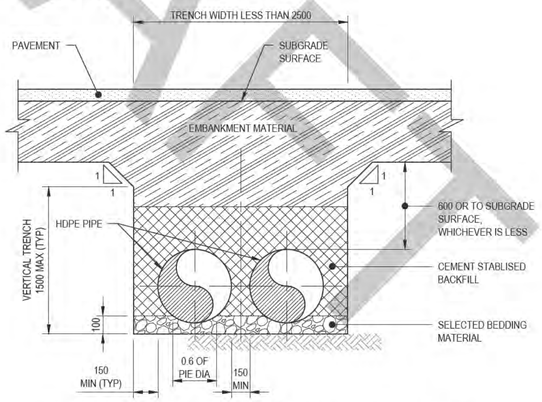
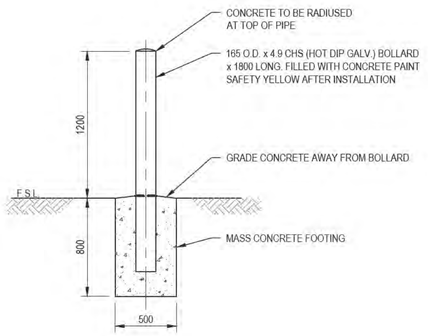


TRENCH METHOD (TRAFFICABLE) - MULTI BARREL

N.T.S.



BOLLARD DETAIL

SCALE 1:25

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0 0.25 0.5 0.75 1.0 1.25m

SCALE 1:25 AT ORIGINAL SIZE

PRELIMINARY

No	Revision	Note: * indicates signatures on original issue of drawing or last revision of drawing	Drawn	Job Manager	Project Director	Date
A	ISSUED FOR 90□ DESIGN - CLIENT COMMENT		JO	JM*	PS*	30/09/20

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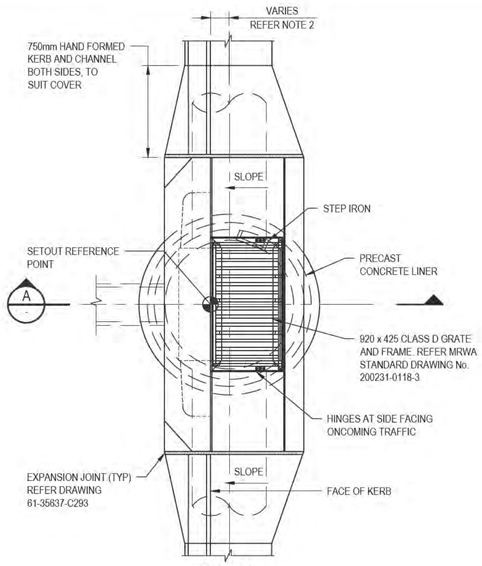
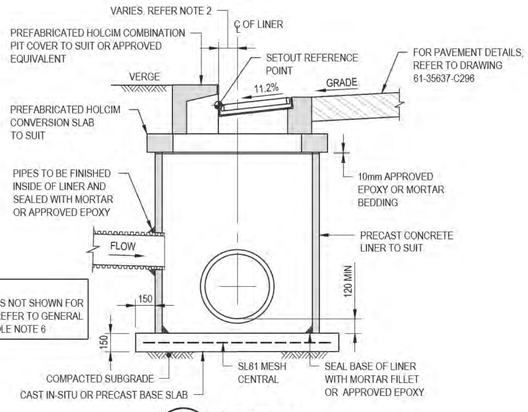
Drawn	J.OVERHEU	Designer	J.OVERHEU
Drafting Check	S.HORTON*	Design Check	S.CLEARY*
Approved (Project Director)			
Date			
Scale	AS SHOWN	This Drawing must not be used for Construction unless signed as Approved	

Client	DEPT OF INFRASTRUCTURE, TRANSPORT, REGIONAL DEVELOPMENT & COMMUNICATIONS
Project	CHRISTMAS ISLAND STORMWATER REMEDIAL WORKS
Title	DRAINAGE STRUCTURES TYPICAL DETAILS - SHEET 1
Original Size	A1
Drawing No:	61-35637-C290
Rev:	A

Plot Date: 30 September 2020 - 9:05 AM Plotted by: Giselle Tayam Cad File No: N:\AU\Perth\Projects\61\35637\CADD\Drawings\61-35637-C290.dwg

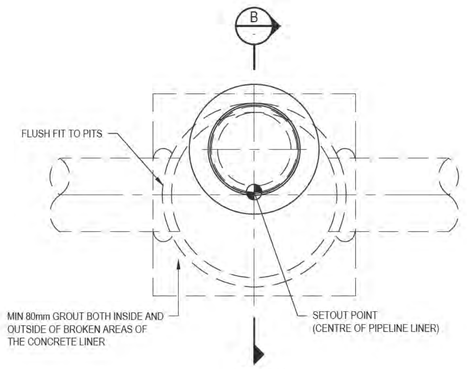


PLAN
SCALE 1:25

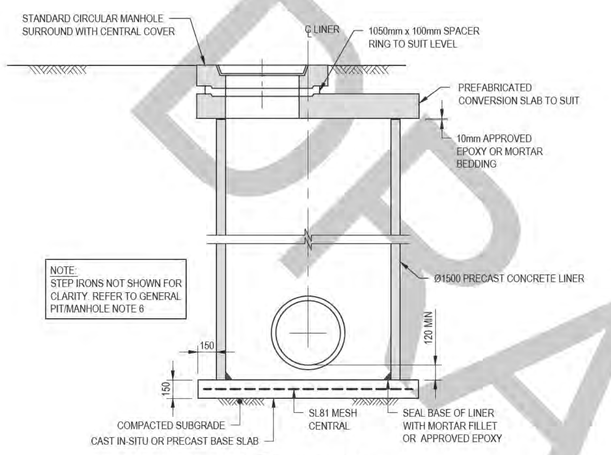


A SECTION
SCALE 1 : 25

TYPICAL COMBINATION SIDE ENTRY PIT

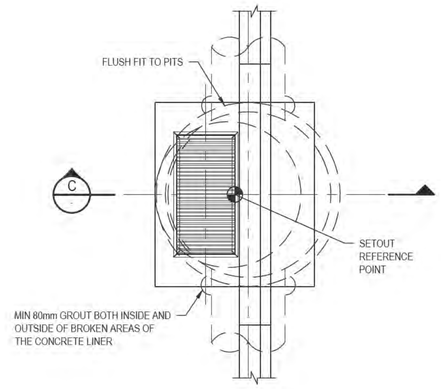


PLAN
SCALE 1:25

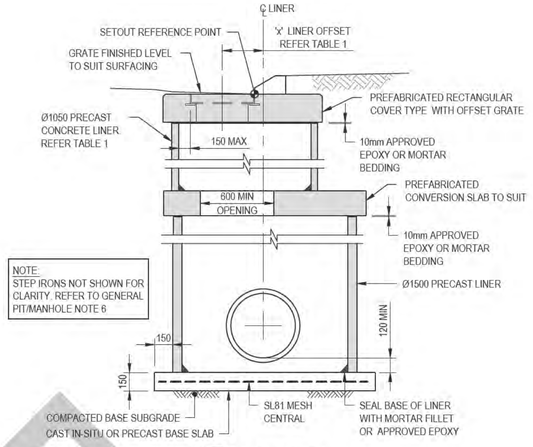


B SECTION
SCALE 1 : 25

MANHOLE DETAIL TYPE 1500 DIA.

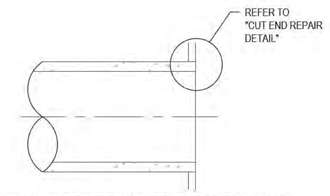


PLAN
SCALE 1:25

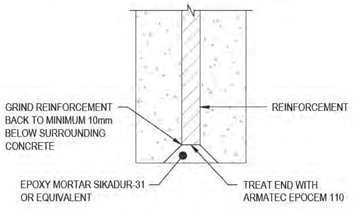


C SECTION
SCALE 1 : 25

TYPICAL GULLY PIT DETAIL TYPE 1500 DIA.



TYPICAL CONCRETE CUT PIPE OR LINER



CUT END REPAIR

GENERAL PIT/MANHOLE NOTES:

1. FOR PIT SIZES SMALLER THAN 1500ND A STANDARD CONTINUOUS MANHOLE AS PER MRWA STANDARD DRAWINGS ARE TO BE USED.
2. WHERE POSSIBLE THE COVER FOR ALL MANHOLES SHOULD BE POSITIONED TO AVOID BEING PLACED IN THE NORMAL WHEEL PATH OF VEHICLES.
3. PITS, INCLUDING COVERS, LINERS AND CONVERSION SLABS, LOCATED WITHIN THE ROAD RESERVE OR OTHER TRAFFICABLE AREAS SHALL BE RATED FOR CLASS D LOADING. OTHERWISE THEY SHALL BE RATED FOR CLASS B LOADS.
4. REFER TO COMBINATION PIT NOTES FOR OTHER REQUIREMENTS.
5. REFER TO DRAWING 61-35637-S002 FOR GENERAL STRUCTURAL NOTES.
6. STEP IRONS SHALL BE PROVIDE WHEN THE DEPTH FROM THE FINISHED PAVEMENT LEVEL TO THE BASE OF THE PIT IS GREATER THAN 1m. STEP IRONS TO COMPLY WITH AS1657.

COMBINATION PIT NOTES:

1. CONCRETE SURROUNDS AND GRATE TO BE HUMES 2400 ROAD GULLY UNIT EITHER RIGHT, CENTRAL OR LEFT TO SUIT. CENTRAL SHOWN IN DETAIL ONLY. REFER TO HUMES STANDARD DRAWINGS PP-GN-2400RGU-RWLP-WA-P (RIGHT), PP-GN-2400RGU-LWLP-WA-P (LEFT) AND PP-GN-2400RGU-CWLP-WA-P (CENTRAL) FOR FULL DETAILS.
2. THE CENTRE OF THE PIT LINER VARIES DEPENDING ON SIZE OF LINER, 152.5mm FOR 1200 LINER AND 1050 LINER, OFFSET FROM THE FACE OF KERB.
3. ALL PIPE JOINTS WITHIN 1000mm OF THE PIT ARE TO BE SEALED
4. THE SUBGRADE AT THE BASE OF THE PIT IS TO BE COMPACTED TO 95% SMDD PRIOR TO PLACING OF THE BASE, OR AS DETAILED IN THE SPECIFICATION.
5. ALL BACKFILL SURROUNDING THE PIT IS TO BE COMPACTED TO 95% SMDD, OR AS DETAILED IN THE SPECIFICATION.
6. ALL PITS ARE TO HAVE A CENTRALLY LOCATED 150mm WEEPHOLE IN THE BASE FILLED WITH 20mm AGGREGATE EXCEPT IN AREAS OF HIGH GROUND WATER OR EXCESSIVELY HEAVY CLAY SOILS. WHERE PREDICTED MAXIMUM GROUNDWATER LEVEL IS LESS THAN 150mm BELOW PIT NO WEEPHOLE IS TO BE INSTALLED.
7. ALL KERBS TO BE TREATED BY CONSTRUCTING A HAND FORMED SECTION AND GRADED TO COVER TOP OF FRAME LEVEL.
8. PIPES ARE TO BE FINISHED INSIDE OF LINER AND SEALED WITH MORTAR OR APPROVED EPOXY.

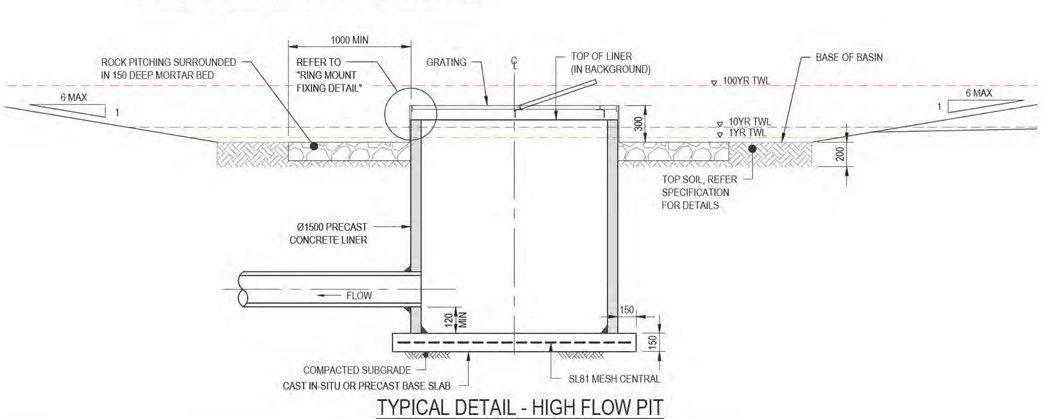
GRATED GULLY NOTES:

1. REFER TO SPECIFICATION FOR FURTHER TECHNICAL DETAILS.
2. COVER TYPE EDGE MAY NOT QUITE COVER WALL EDGE OF LINERS GREATER THAN 1050Ø. GROUT GAP IF NECESSARY.
3. ALL GRATES ON PITS TO BE MAIN ROADS STANDARD OR SIMILAR.
4. REFER TO COMBINATION PIT NOTES FOR OTHER GENERAL REQUIREMENTS.

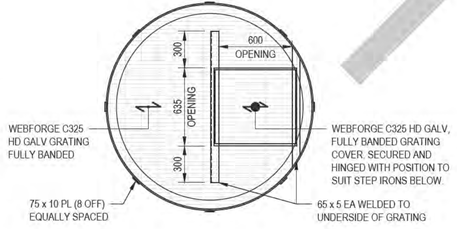
TABLE 1 - UPPER PIT DETAIL			
LINER NOM. Ø	LINER OUTSIDE Ø	MAX. Ø PIPE CONNECTING TO LINER	"X" LINER OFFSET
NOM. 1050Ø	1190Ø	NOM. 525Ø	397.5
NOM. 1200Ø	* 1360Ø	NOM. 600Ø	482.5

NOTES:

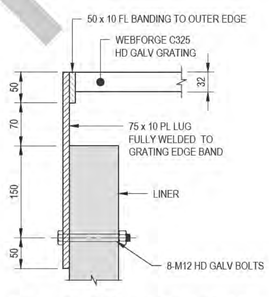
1. BEDDING MATERIAL, FOUNDATION COMPACTION AND BACKFILL COMPACTION TO BE AS PER SPECIFICATION.
2. CEMENT STABILISED BACKFILL MIX TO BE AS PER SPECIFICATION.
3. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS NOTED OTHERWISE.
4. COVER AND TOP OF PIPE MATERIAL DEPENDENT. REFER TO MANUFACTURER'S REQUIREMENTS.



TYPICAL DETAIL - HIGH FLOW PIT
SCALE 1:25



HIGH FLOW PIT COVER PLAN
SCALE 1:25



RING MOUNT FIXING DETAIL
SCALE 1:5

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0 0.05 0.1 0.15 0.2 0.25m
SCALE 1:5 AT ORIGINAL SIZE

0 0.25 0.5 0.75 1.0 1.25m
SCALE 1:25 AT ORIGINAL SIZE

PRELIMINARY

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B	REISSUED FOR 90% DESIGN - CLIENT COMMENT		GT	JM*	PS*	20/11/20
A	ISSUED FOR 90% DESIGN - CLIENT COMMENT		JO	JM*	PS*	30/09/20

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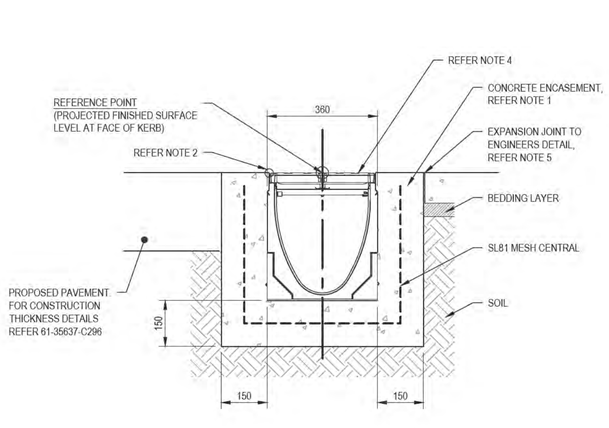
Drafting Check	S.HORTON*	Design Check	S.CLEARY*
Approved (Project Director)			
Date			
Scale	AS SHOWN	This Drawing must not be used for Construction unless signed as Approved	

Client: DEPT OF INFRASTRUCTURE, TRANSPORT, REGIONAL DEVELOPMENT & COMMUNICATIONS
Project: CHRISTMAS ISLAND STORMWATER REMEDIAL WORKS
Title: DRAINAGE STRUCTURES TYPICAL DETAILS - SHEET 2

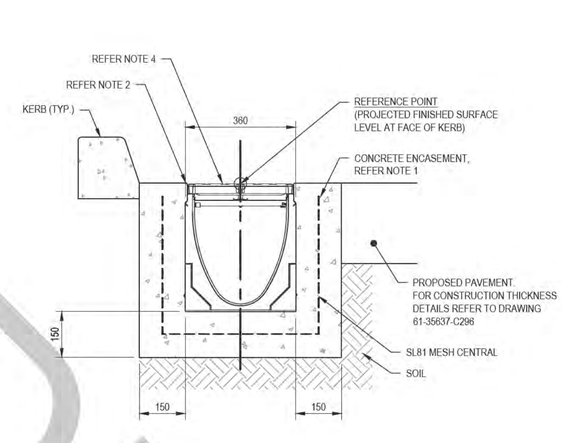
Original Size: A1
Drawing No: 61-35637-C291
Rev: B

Plot Date: 19 November 2020 - 3:26 PM Plotted by: Jess Overheu
Cad File No: \\ghdnet internal\ghd\AU\Perth\Projects\61\35637\CADD\Drawings\61-35637-C291.dwg



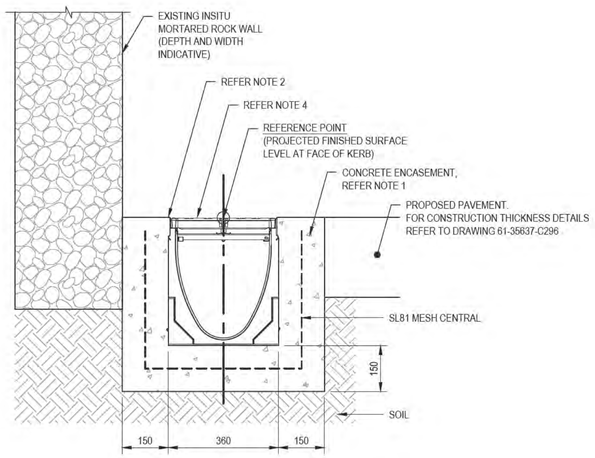
TRENCH DRAIN DETAIL IN CONCRETE SLAB

SCALE 1:10



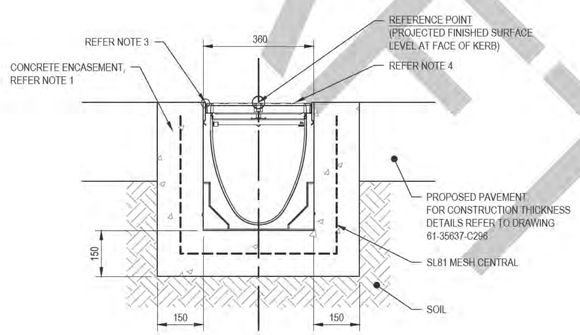
TRENCH DRAIN DETAIL ADJACENT KERB

SCALE 1:10



TRENCH DRAIN DETAIL ADJACENT EXISTING RETAINING WALL

SCALE 1:10



TRENCH DRAIN DETAIL IN PAVEMENT

SCALE 1:10

NOTES:

1. A MINIMUM CONCRETE STRENGTH, REFER TO DRAWING 61-35637-S002.
2. THE FINISHED LEVEL OF THE CONCRETE ENCASEMENT MUST BE APPROXIMATELY 3mm ABOVE THE TOP OF THE CHANNEL EDGE.
3. THE FINISHED LEVEL OF THE PAVEMENT MUST BE APPROXIMATELY 3mm ABOVE THE TOP OF THE CHANNEL EDGE.
4. ALL TRENCH GRATE COVERS ARE TO BE THE INTERLOCKING BOLTLESS SYSTEM WITH CLASS D COVER TYPE 880D UNLESS OTHERWISE NOTED.
5. EXPANSION AND CRACK CONTROL JOINTS ARE REQUIRED TO BE INSTALLED AS PER THE REQUIREMENTS OF MRWA SPECIFICATION 407-KERBING.
6. ALL DRAINAGE STRUCTURES BOTH IN-SITU AND PRE-FABRICATED ARE TO BE SUPPLIED IN ACCORDANCE WITH CIVIL SPECIFICATION. THE CONCRETE SHOULD BE VIBRATED TO ELIMINATE AIR POCKETS AND THE IN SITU GROUND WELL COMPACTED (95% SMDD OR EQUIVALENT AS DETAILED IN THE SPECIFICATION) PRIOR TO CONCRETE ENCASEMENT BEING POURED.
7. ALL OUTLET PITS TO BE K3-903G TO SUIT DRAIN.
8. DN200 KNOCKOUT (BOTTOM OF DRAIN) CONNECTS VIA PVC PIPE AND ELBOW TO DRAINAGE PIT UNLESS OTHERWISE DETAILED.
9. ALL TRENCH GRATE COVERS ARE TO BE THE INTERLOCKING BOLTLESS SYSTEM WITH CLASS D COVER TYPE 880D UNLESS OTHERWISE NOTED.

DRAFT

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0 0.1 0.2 0.3 0.4 0.5m

SCALE 1:10 AT ORIGINAL SIZE

PRELIMINARY

No	Revision	Note: * indicates signatures on original issue of drawing or last revision of drawing	Drawn	Job Manager	Project Director	Date
B	REISSUED FOR 90% DESIGN - CLIENT COMMENT		GT	JM*	PS*	20/11/20
A	ISSUED FOR 90% DESIGN - CLIENT COMMENT		GT	JM*	PS*	30/09/20

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Department of Infrastructure, Transport, Regional Development and Communications

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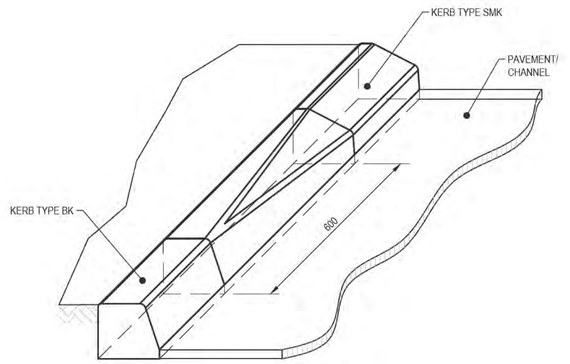
E permail@ghd.com.au W www.ghd.com

DO NOT SCALE

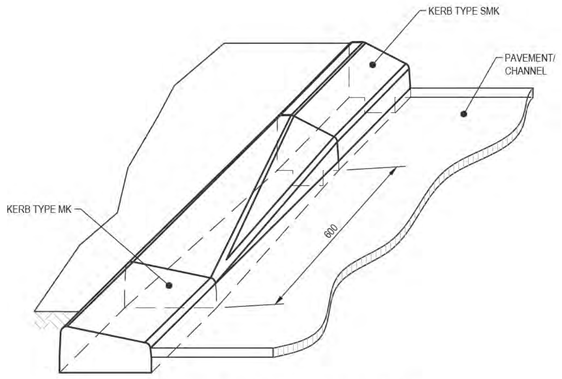
Drawn	G.TAYAM	Designer	D.DOMINGO
Drafting Check	S.HORTON*	Design Check	S.CLEARY*
Approved (Project Director)			
Date			
Scale	1:10	This Drawing must not be used for Construction unless signed as Approved	

Client	DEPT OF INFRASTRUCTURE, TRANSPORT, REGIONAL DEVELOPMENT & COMMUNICATIONS
Project	CHRISTMAS ISLAND STORMWATER REMEDIAL WORKS
Title	DRAINAGE STRUCTURES TYPICAL DETAILS - SHEET 3
Original Size	A1
Drawing No:	61-35637-C292
Rev:	B

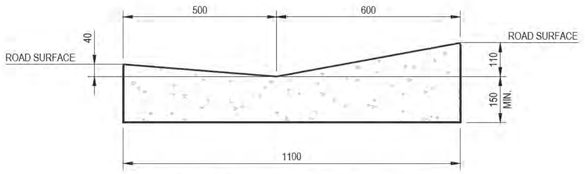
Plot Date: 19 November 2020 - 2:58 PM Plotted by: Jess Overheu Cad File No: \\ghdnet.internal\ghd\AU\Perth\Projects\61\35637\CADD\Drawings\61-35637-C292.dwg



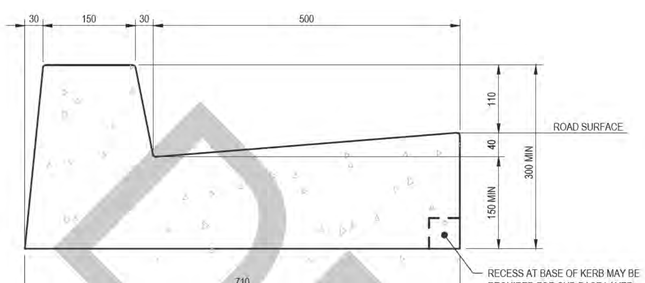
KERB TYPE BK TO SMK TRANSITION
SCALE 1:10



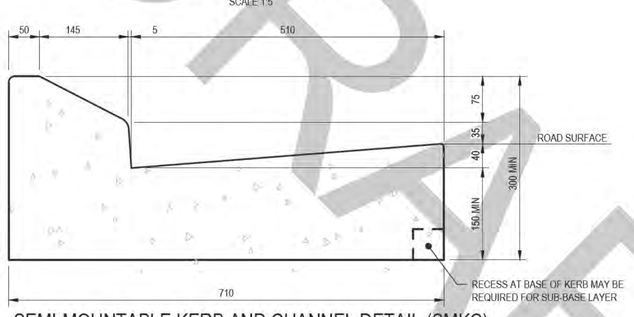
KERB TYPE MK TO SMK TRANSITION
SCALE 1:10



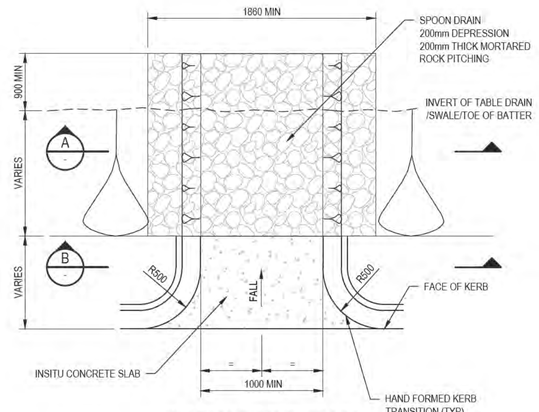
CONCRETE CHANNEL DETAIL
SCALE 1 : 10



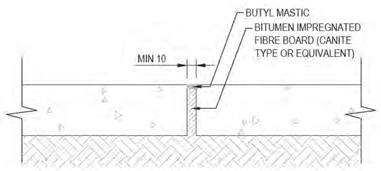
KERB AND CHANNEL DETAIL (KC)
SCALE 1:5



SEMI-MOUNTABLE KERB AND CHANNEL DETAIL (SMKC)
SCALE 1:5



KERB OPENING DETAIL
SCALE 1:25



FOOTPATH EXPANSION JOINT
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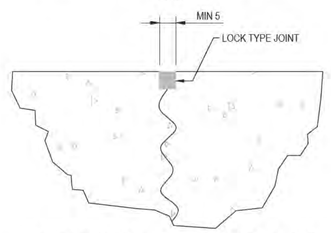
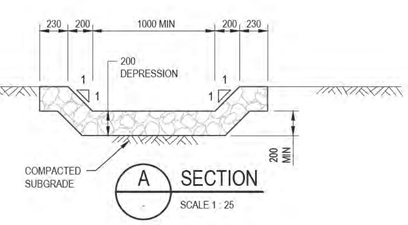
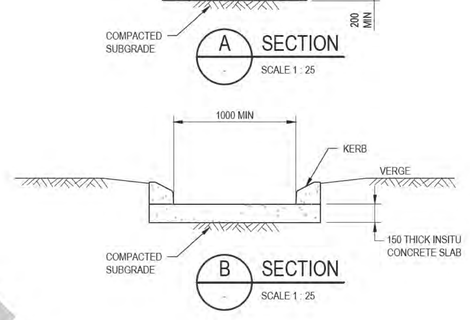
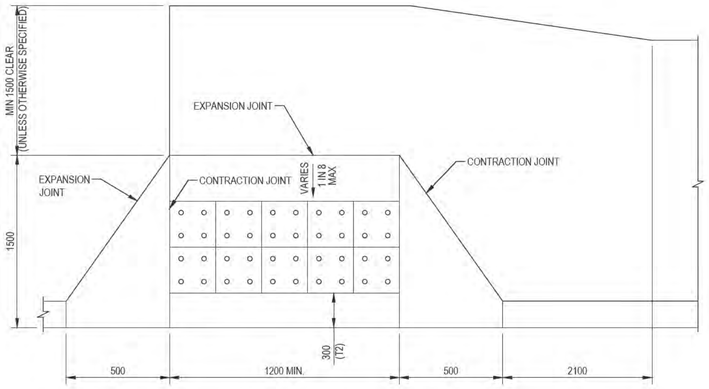


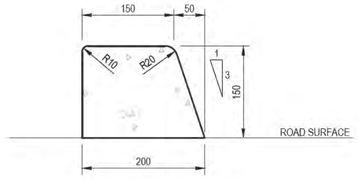
FOOTPATH CONTRACTION JOINT
N.T.S.



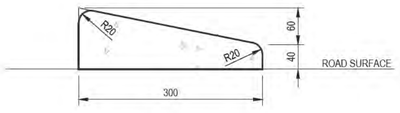




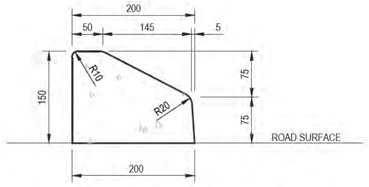
TYPICAL RAMP APRON DETAIL
N.T.S.



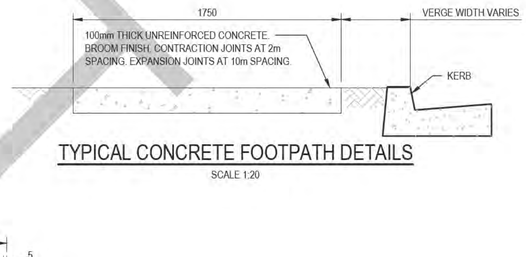
BARRIER KERB DETAIL (BK)
SCALE 1:5



MOUNTABLE KERB DETAIL (MK)
SCALE 1:5



SEMI - MOUNTABLE KERB DETAIL (SMK)
SCALE 1:5



TYPICAL CONCRETE FOOTPATH DETAILS
SCALE 1:20

NOTES:

1. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE SHOWN.
2. PAVEMENT WIDENING TO BLEND SMOOTHLY TO EXISTING.
3. SURFACE OVERLAP TO BE CONFIRMED ON SITE BASED ON CONDITIONS OF EXISTING SOIL.
4. EDGE OF RAMP SHALL BE FLUSH WITH ROAD PAVEMENT (ASPHALT OR SEAL).
5. ALL CONCRETE SHALL CONTAIN WASHED AGGREGATE AND BE BROOMED FINISHED ACROSS THE DIRECTION OF PEDESTRIAN TRAFFIC TO PROVIDE A NON-SLIP SURFACE.
6. CONCRETE CLASS SHALL BE 32 MPa. NOMINAL THICKNESS 100mm MIN THICKNESS ON EDGES TO BE 150mm FOR PEDESTRIAN ACCESS AREAS.
7. ALL VERGE AREAS SURROUNDING PRAM RAMP (EG FOOTPATH, PAVING, GRASS) TO BE REINSTATED TO NEW LEVELS FLUSH WITH RAMP EDGES.
8. WINGS TO APRON TO BE A MAX SLOPE OF 1 IN 10. IF 1 IN 10 SLOPE NOT POSSIBLE DUE TO OBSTRUCTION, SLOPE CAN BE INCREASED WITH APPROVAL.
9. RAMP (INCLUDING WINGS) CONCRETE COLOUR SHOULD CONTRAST WITH SURROUNDING SURFACES.
10. ALL EXPOSED EDGES TO BE ROUNDED TO 5mm RADIUS MAXIMUM UNLESS NOTED OTHERWISE.
11. REFER TO SPECIFICATION FOR MATERIAL AND CONSTRUCTION DETAILS.
12. KERBS (INCLUDING THE CONCRETE CHANNEL) SHALL BE INSTALLED IN ACCORDANCE WITH MRWA SPECIFICATION 407 - KERBING. FOR KERB TRANSITIONS FROM KC TO SMKC THE SAME APPROACH AS DETAILED FOR BK TO SMK TRANSITIONS IS TO BE ADOPTED REGARDING THE TRANSITION DISTANCES.

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0 50 100 150 200 250mm
SCALE 1:5 AT ORIGINAL SIZE

0 100 200 300 400 500mm
SCALE 1:10 AT ORIGINAL SIZE

0 200 400 600 800 1000mm
SCALE 1:20 AT ORIGINAL SIZE

0 250 500 750 1000 1250mm
SCALE 1:25 AT ORIGINAL SIZE

PRELIMINARY

No	Revision	Note: * indicates signatures on original issue of drawing or last revision of drawing	Drawn	Job Manager	Project Director	Date
B	REISSUED FOR 90□ DESIGN - CLIENT COMMENT		GT	JM*	PS*	20/11/20
A	ISSUED FOR 90□ DESIGN - CLIENT COMMENT		JO	JM*	PS*	30/09/20

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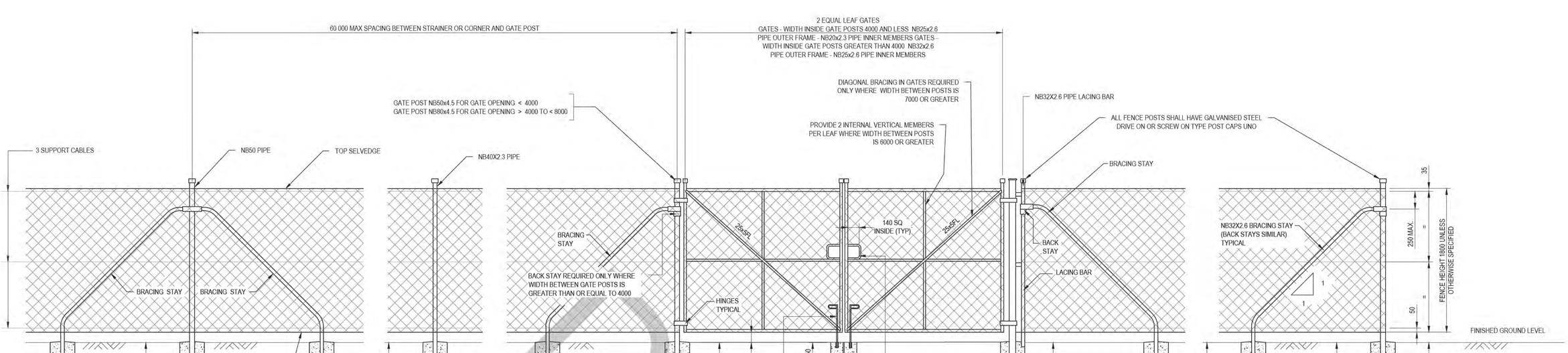
Drawn	J.OVERHEU	Designer	J.OVERHEU
Drafting Check	S.HORTON*	Design Check	S.CLEARY*
Approved (Project Director)			
Date			
Scale	AS SHOWN	This Drawing must not be used for Construction unless signed as Approved	

Client: DEPT OF INFRASTRUCTURE, TRANSPORT, REGIONAL DEVELOPMENT & COMMUNICATIONS
Project: CHRISTMAS ISLAND STORMWATER REMEDIAL WORKS
Title: KERBING AND FOOTPATH TYPICAL DETAILS

Original Size: A1
Drawing No: 61-35637-C293
Rev: B

Plot Date: 16 November 2020 - 5:26 PM Plotted by: Giselle Tayam Cad File No: N:\AU\Perth\Projects\61\35637\CADD\Drawings\61-35637-C293.dwg



STRAINER POST

REQUIRED AT EACH CHANGE OF DIRECTION OR GRADE GREATER THAN 10° OR 60 000 MAX SPACING SHALL NOT BE USED IMMEDIATELY ADJACENT TO ROADS.

INTERMEDIATE POST

4000 MAX SPACING BETWEEN POSTS EVENLY SPACED

GATE POST

TYPICAL ARRANGEMENT FOR OTHER THAN DN50 GATE POST

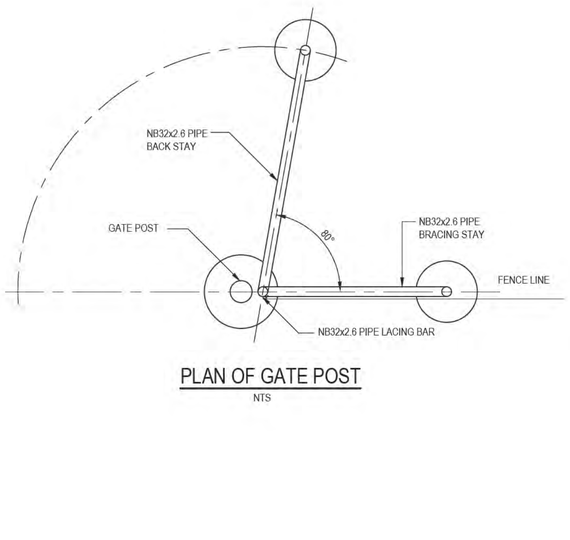
DOUBLE GATES

FOR VEHICLE ACCESS

GATE POST

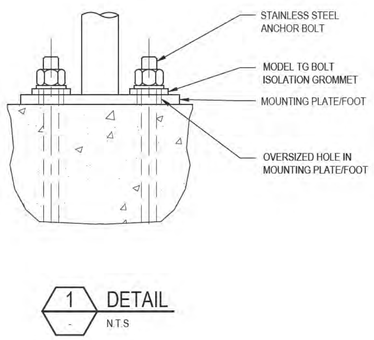
TYPICAL ARRANGEMENT FOR DN80 GATE POST

CORNER POST

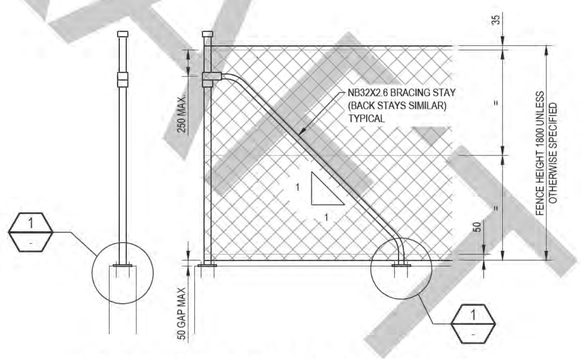


PLAN OF GATE POST

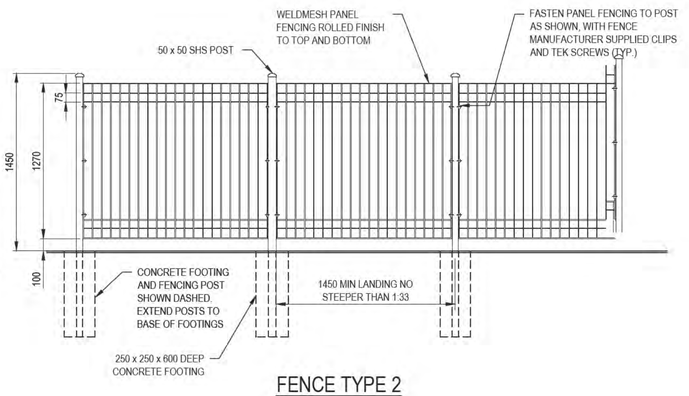
NTS



1 DETAIL
N.T.S



FENCE ATTACHED TO DIVE STRUCTURE WALL



FENCE TYPE 2

NOTES

1. FENCING MESH TO BE BLACK PLASTIC COATED AND POSTS TO BE BLACK POWDERCOATED.
2. FENCING AND GATES TO BE SUPPLIED AND INSTALLED IN ACCORDANCE WITH AS1725.1
3. TOP OF ALL FOOTINGS TO HAVE A FALL AWAY FROM PIPE OF 10mm
4. ALL DIMENSIONS IN MILLIMETRES UNLESS NOTED OTHERWISE.
5. CONTRACTOR TO PHYSICALLY CONFIRM THE LOCATION OF ALL EXISTING SERVICES PRIOR TO THE COMMENCEMENT OF ANY WORKS ON SITE.
6. ALL GALVANISED STEELWORK FENCING AND CONCRETE TO BE IN ACCORDANCE WITH SPECIFICATION.
7. ALL FENCES AROUND BASINS ARE TO MAINTAIN THE REQUIRED MINIMUM GROUND CLEARANCE AT ALL TIMES TO PROVIDE EGRESS FOR MIGRATORY CRABS.

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0 0.25 0.5 0.75 1.0 1.25m
SCALE 1:25 AT ORIGINAL SIZE

PRELIMINARY

No	Revision	Note: * indicates signatures on original issue of drawing or last revision of drawing	Drawn	Job Manager	Project Director	Date
B	REISSUED FOR 90% DESIGN - CLIENT COMMENT		GT	JM*	PS*	20/11/20
A	ISSUED FOR 90% DESIGN - CLIENT COMMENT		JO	JM*	PS*	30/09/20

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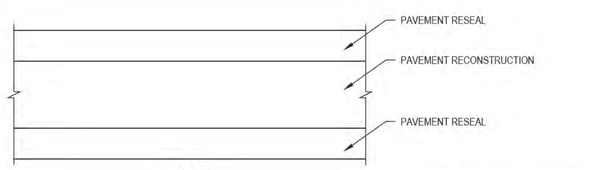
Drawn	J.OVERHEU	Designer	J.OVERHEU
Drafting Check	S.HORTON*	Design Check	S.CLEARY*
Approved (Project Director)			
Date			
Scale	AS SHOWN	This Drawing must not be used for Construction unless signed as Approved	

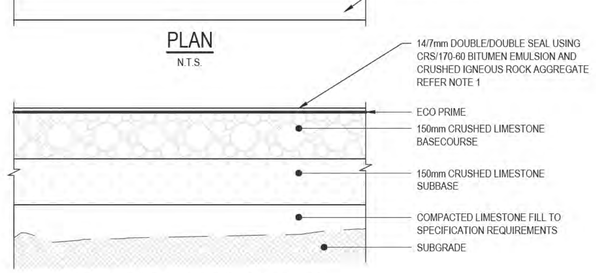
Client: DEPT OF INFRASTRUCTURE, TRANSPORT, REGIONAL DEVELOPMENT & COMMUNICATIONS
Project: CHRISTMAS ISLAND STORMWATER REMEDIAL WORKS
Title: FENCING
TYPICAL DETAILS

Original Size A1 | Drawing No: 61-35637-C294 | Rev: B

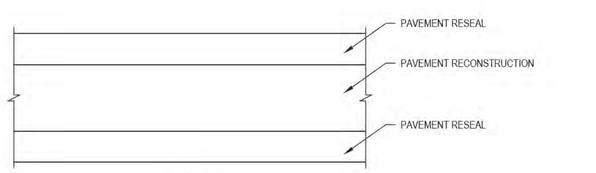
Plot Date: 19 November 2020 - 11:42 AM Plotted by: Jess Overheu
Cad File No: \\ghdnet.internal\ghd\AU\Perth\Projects\61\35637\CADD\Drawings\61-35637-C294.dwg



PLAN
N.T.S.



PAVEMENT RECONSTRUCTION
SCALE 1:10



PLAN
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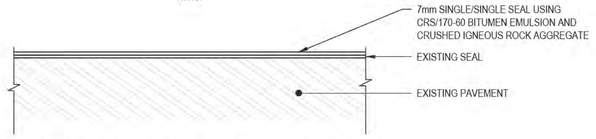
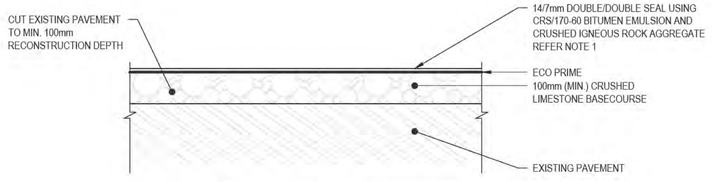
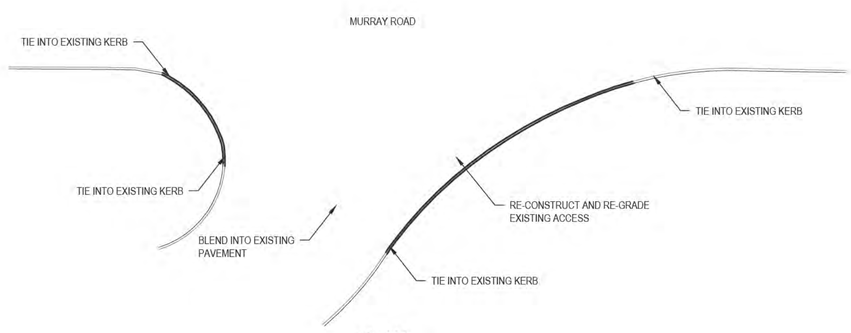


PAVEMENT RESEAL (NO SHAPE CORRECTION)
SCALE 1:10



PAVEMENT RESEAL (SHAPE CORRECTION)
SCALE 1:10

DETAIL 1



PLAN
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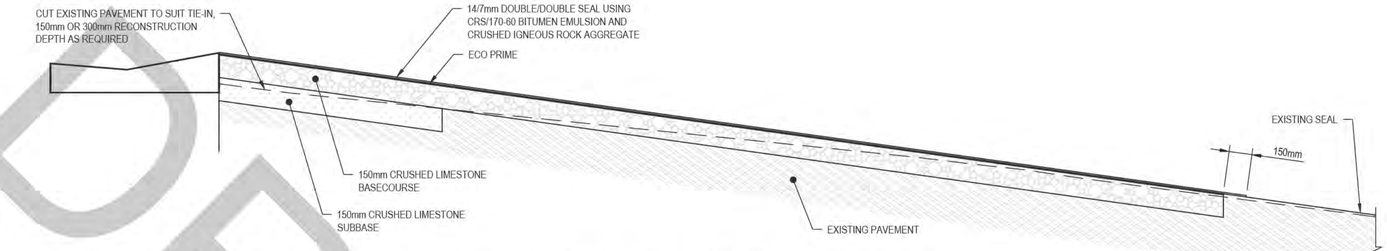
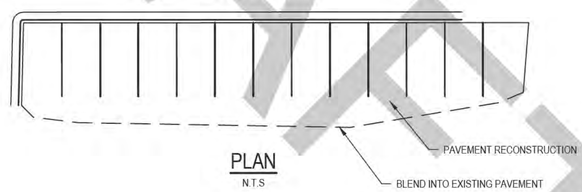
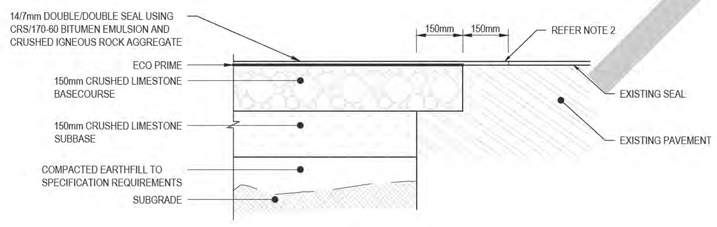


SCHOOL ACCESS - PAVEMENT RECONSTRUCTION
SCALE 1:20

DETAIL 2

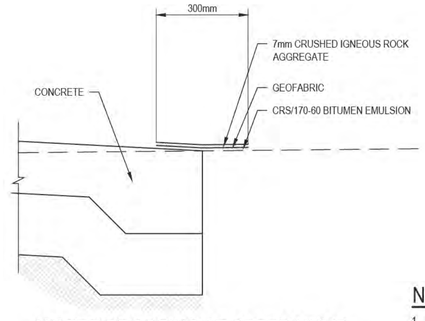


PLAN
N.T.S



TIE-IN DETAIL AT CAR PARK
SCALE 1:10

DETAIL 3



WATER PROOFING AT SPEED HUMP
SCALE 1:10

DETAIL 4

NOTES:

1. WHERE PAVEMENT RESEAL (NO SHAPE CORRECTION) OPTION IS USED, APPLICATION OF 7mm TO BE DELAYED AND 7mm TO BE PLACED AS A SINGLE APPLICATION ACROSS ALL PAVEMENT AREAS (PAVEMENT RECONSTRUCTION AND PAVEMENT RESEAL).
2. SEAL AND BASECOURSE JOINT LOCATION SHOULD BE ADJUSTED WHERE NECESSARY TO AVOID WHEELPATH.
3. FOR OTHER NOTES, REFER DRAWING 61-35637-C202.

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0 0.2 0.4 0.6 0.8 1.0m
SCALE 1:20 AT ORIGINAL SIZE

0 0.1 0.2 0.3 0.4 0.5m
SCALE 1:10 AT ORIGINAL SIZE

PRELIMINARY

No	Revision	Drawn	Job Manager	Project Director	Date
B	REISSUED FOR 90% DESIGN - CLIENT COMMENT	GT	JM*	PS*	20/11/20
A	ISSUED FOR 90% DESIGN - CLIENT COMMENT	GT	JM*	PS*	30/09/20

Note: * indicates signatures on original issue of drawing or last revision of drawing

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Drawn G.TAYAM		Designer C.MAEKIVI	
Drafting Check S.HORTON*		Design Check S.CLEARY*	
Approved (Project Director)			
Date			
Scale AS SHOWN	This Drawing must not be used for Construction unless signed as Approved		

Client: DEPT OF INFRASTRUCTURE, TRANSPORT, REGIONAL DEVELOPMENT & COMMUNICATIONS
Project: CHRISTMAS ISLAND STORMWATER REMEDIAL WORKS
Title: ROAD AND PAVEMENT DESIGN

Original Size A1 | Drawing No: 61-35637-C296 | Rev: B

Plot Date: 19 November 2020 - 3:21 PM | Plotted by: Jess Overheu | Cad File No: \\ghdnet.internal\ghd\AU\Perth\Projects\61\35637\CADD\Drawings\61-35637-C296.dwg

GENERAL:

1. THESE DRAWINGS SHALL BE READ IN CONJUNCTION WITH THE SPECIFICATIONS.
2. CLEARANCE TO WORK PERMIT REQUIRED PRIOR TO START OF WORKS. ISOLATION PERMIT REQUIRED FOR CUT-INS.
3. UNDERGROUND FEATURES ARE ESTIMATED ONLY AND NOT EXPOSED DURING SURVEY. THE IDENTITY AND LOCATION OF CRITICAL UNDERGROUND FEATURES NEED TO BE CONFIRMED, PRIOR TO COMMENCING WORK.
4. ALL PRODUCTS USED TO BE APPROVED OR ACCEPTED FOR USE WITHIN THE WATER CORPORATION'S STRATEGIC PRODUCTS REGISTER.
5. THE CONTRACTOR SHALL VERIFY ON SITE LEVELS AND DIMENSIONS BEFORE COMMENCING WORK.
6. FOR PROPOSED DRAINAGE DESIGN INFORMATION REFER TO DRAWINGS 61-35637-C220 AND C221 FOR FURTHER INFORMATION.
7. FOR OVERALL DESIGN INFORMATION OF FULL PROPOSED PIPELINE REFER TO DRAWINGS WITHIN THE MH59 DRAFTING SET.
8. DESIGN AS DETAILED FOR THE PIPELINE ASSUMES PREVIOUS DESIGN BY ENGINEERING AND CONSTRUCTION CONTRACT CONSULTING SERVICES HAS BEEN PREPARED TO MEET WATER CORPORATION REQUIREMENTS.
9. DESIGN MODIFICATIONS UNDERTAKEN HAVE BEEN TO ADJUST ALIGNMENT AND LEVELS THROUGH DRAINAGE WORKS AREA ONLY. FURTHER DESIGN DEVELOPMENT MAY BE REQUIRED BY WATER CORPORATION.
10. ALL PIPEWORK IS TO BE PRESSURE TESTED ONLY NO DISINFECTION IS TO BE UNDERTAKEN UNLESS DIRECTED BY WATER CORPORATION REPRESENTATIVE.

DESIGN CRITERIA:

1. THE PIPEWORK HAS BEEN DESIGNED FOR AN ALLOWABLE OPERATING PRESSURE (AOP) OF 120m HEAD.
2. THRUST SUPPORTS ARE INTENDED TO RESIST AN ASSUMED 1200 kPa MAXIMUM THRUST AGAINST COMPACT UNDISTURBED SOIL OR WELL COMPACTED FILL MATERIAL.
3. THE PIPELINE HAS BEEN DESIGNED FOR FATIGUE ASSUMING 100,000 CYCLES OVER A 100 YEAR LIFE.
4. THE TIME WEIGHTED 12 MONTH AVERAGE TEMPERATURE HAS BEEN ASSUMED TO BE 25°C

GENERAL PIPEWORK:

1. THE PIPEWORK SHALL BE SET OUT FROM CADASTRAL BOUNDARIES, FENCE LINES AND EXISTING STRUCTURES AS APPROPRIATE.
2. PIPEWORK 'AS CONSTRUCTED' INFORMATION IS TO BE RECORDED PRIOR TO BACKFILL.
3. TOPSOIL TO BE STOCKPILED AND REPLACED AFTER PIPELINE CONNECTION WHERE APPLICABLE.
4. DUCTILE IRON FITTINGS SHALL BE IN ACCORDANCE WITH AS2280 AND SPS106.
5. PIPELINE SYSTEMS SHALL BE LOADED, TRANSPORTED, UNLOADED, STACKED AND HANDLED USING THE METHODS, MATERIALS, TOOLS AND EQUIPMENT IN ACCORDANCE WITH THE MANUFACTURER'S AND/OR SUPPLIERS INSTRUCTIONS AND RECOMMENDATIONS, AND TO THE RELEVANT AUSTRALIAN STANDARDS UNLESS SPECIFIED OTHERWISE.

PVC PIPE:

1. PVC PIPE TO BE SERIES 2 MPVC PIPE PN16 TO AS4765 AND SPS116.
2. PVC PIPE TO BE PALE BLUE COLOUR.
3. DUCTILE IRON FITTINGS SHALL BE SERIES 2 AND IN ACCORDANCE WITH AS2281 AND SPS106.

PRESSURE TESTING:

1. PIPELINE SHALL BE SUBJECT TO A PRESSURE TEST TO 1200kPa
2. PVC PIPEWORK SHALL BE PRESSURE TESTED IN ACCORDANCE WITH AS/NZS 2566.2. THE TEST SHALL BE IN ACCORDANCE WITH APPENDIX M M4, BASED UPON THE CONSTANT PRESSURE (WATER LOSS) TEST METHOD.
3. PIPELINE TO BE TESTED SHALL BE PHYSICALLY ISOLATED FROM THE 'LIVE' SYSTEM.
4. PRESSURE TESTING SHALL BE WITNESSED BY THE WATER CORPORATION.
5. THE WATER CORPORATION SHALL BE NOTIFIED AT LEAST 5 WORKING DAYS IN ADVANCE OF ALL OFFICIAL PRESSURE TESTS. WHEREVER POSSIBLE, PRIOR NOTICE OF THE CANCELLATION OF A TEST SHALL BE GIVEN. IF NO NOTICE OF CANCELLATION IS GIVEN IT WILL BE TREATED AS A FAILED TEST.
6. ANY VISIBLE OR DETECTED LEAK SHALL BE RECTIFIED IN ACCORDANCE WITH THE MANUFACTURER'S RECOMMENDATION AND TO THE APPROVAL OF THE WATER CORPORATION.
7. THE USE OF SEALANT OR SIMILAR PRODUCTS TO CORRECT LEAKAGE AS A RESULT OF MATERIAL OR CONSTRUCTION FAULT IS NOT PERMITTED.

BEDDING AND BACKFILL NOTES FOR PIPELINES:

1. UNDERLAY, SIDE SUPPORT AND OVERLAY TO BE A CLEAN GRADED SAND FREE FROM ANY HARD OR SHARP OBJECTS.
2. COMPACTION TESTING SHALL BE CARRIED OUT IN ACCORDANCE WITH AS1289. THE FREQUENCY OF COMPACTION TESTING SHALL BE:
   - FOR TRAFFICABLE AREAS: 1 TEST PER 20m OF TRENCH PLUS 1 TEST FOR EACH CARRIAGE WAY OVER THE FULL DEPTH OF BACKFILL.
   - FOR NON-TRAFFICABLE AREAS: 1 TEST PER 30m OF TRENCH PLUS 1 TEST ADJACENT TO EACH VALVE INSTALLATION.
3. COVER, BEDDING AND BACKFILL SHALL BE IN ACCORDANCE WITH THE EMBEDMENT/TRENCH FILL DETAIL AND SPECIFICATIONS. CONTRACTOR TO VERIFY EXISTING PIPE DEPTH FOR TIE IN OF EXISTING WATER MAIN TO PROPOSED WATER MAIN.

BACKFILL AND EARTHWORKS TESTING:

1. IN SITU DENSITY OF BACKFILL AND EARTHWORKS SHALL BE MEASURED USING A CLEGG IMPACT HAMMER IN ACCORDANCE WITH AS1289.6.9.1.
2. BOTH BACKFILL AND EARTHWORKS COMPACTION SHALL BE TESTED TO DETERMINE THE SOIL STIFFNESS IN ACCORDANCE WITH AS1289.6.9.1. THE VALIDITY OF THE ASSIGNED SOIL STIFFNESS AND OPTIMUM MOISTURE CONTENT SHALL BE VERIFIED FOR CONFORMANCE WITH THE STANDARD ON A CONTINUAL BASIS.

USE OF CLEGG IMPACT HAMMER:

1. WHEN THE CLEGG IMPACT HAMMER CAN BE CALIBRATED AND IS SUITABLE FOR THE PARTICULAR SOILS ON THE SITE, IT SHALL BE USED AS THE TEST FOR THE PURPOSE OF CONFORMANCE JUDGEMENT OF EMBEDMENT MATERIAL, SUBGRADE AND TRENCH BACKFILL.
2. THE METHOD USED TO DETERMINE THE STIFFNESS OF THE SOIL USING A CLEGG IMPACT HAMMER SHALL BE IN ACCORDANCE WITH AS1289.6.9.1.
3. THE CONTRACTOR SHALL PERFORM AN OPERATIONAL CHECK IN ACCORDANCE WITH AS1289.6.9.1. THE OPERATIONAL CHECK SHALL BE UNDERTAKEN DAILY, PRIOR TO USE OR IF RESULTS ARE SUSPECT.

THRUST BLOCK NOTES:

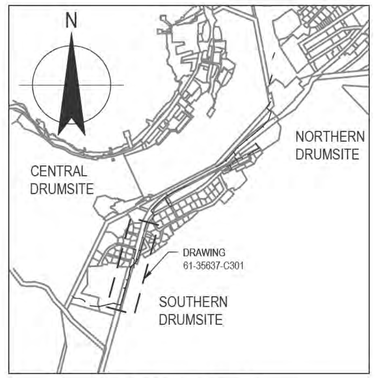
1. WELL COMPACTED FILL SHALL PROVIDE A MINIMUM CLEGG IMPACT VALUE (CIV) OF 40 WHEN TESTED IN ACCORDANCE WITH AS1289.6.9.1.
2. PIPELINE FITTINGS TO BE PROVIDED WITH CONCRETE THRUST SUPPORT SHALL BE OVER-WRAPPED WITH A BOND-BREAKING MEMBRANE OF ACCEPTABLE DESIGN PRIOR TO CONCRETING.
3. PIPELINE JOINTS SHALL NOT BE WHOLLY OR PARTIALLY ENCASED IN CONCRETE.
4. CONCRETE SHALL BE GRADE N25.
5. BEARING CAPACITY CALCULATIONS OF SOIL TAKEN AS:
   $Q_{allowable}$ = 61kPa (AFTER APPLICATION OF SAFETY FACTOR)

CONCRETE:

1. ALL CONCRETE SHALL COMPLY WITH AS3600, AS1379, AS1478, AS3972 AND THE SPECIFICATION.
2. CEMENT USED IN ALL CONCRETE SHALL BE NORMAL PORTLAND CEMENT (TYPE GP).
3. CONCRETE QUALITY:
   - GRADE - N32 MPa
   - MAXIMUM AGGREGATE SIZE - 20mm
   - SLUMP - 80mm
   - MINIMUM CEMENT CONTENT - 380kg/m3
4. NOTIFY CLIENT'S REPRESENTATIVE BEFORE PLACING CONCRETE.
5. COMPACT CONCRETE BY USING APPROVED IMMERSION VIBRATORS.
6. CURE ALL CONCRETE BY KEEPING MOIST FOR 7 DAYS IN ACCORDANCE WITH THE SPECIFICATION.

REINFORCEMENT:

1. SYMBOLS:
   - 'L' DENOTES HARD DRAWN WIRE REINFORCING FABRIC TO AS/NZS4671.
   - MINIMUM LAP LENGTHS (UNLESS NOTED OTHERWISE):
   - FABRIC - 250mm.
3. SPLICES TO BE PLAIN LAPPED THROUGHOUT AND STAGGERED WHERE POSSIBLE.
4. CLEAR COVER TO REINFORCEMENT TO BE 50mm.

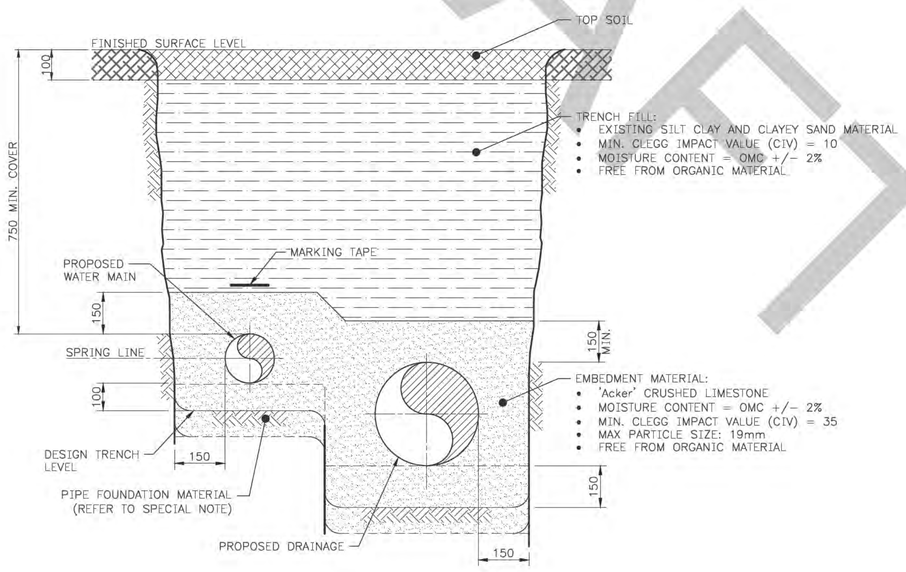


LOCALITY PLAN

N.T.S.

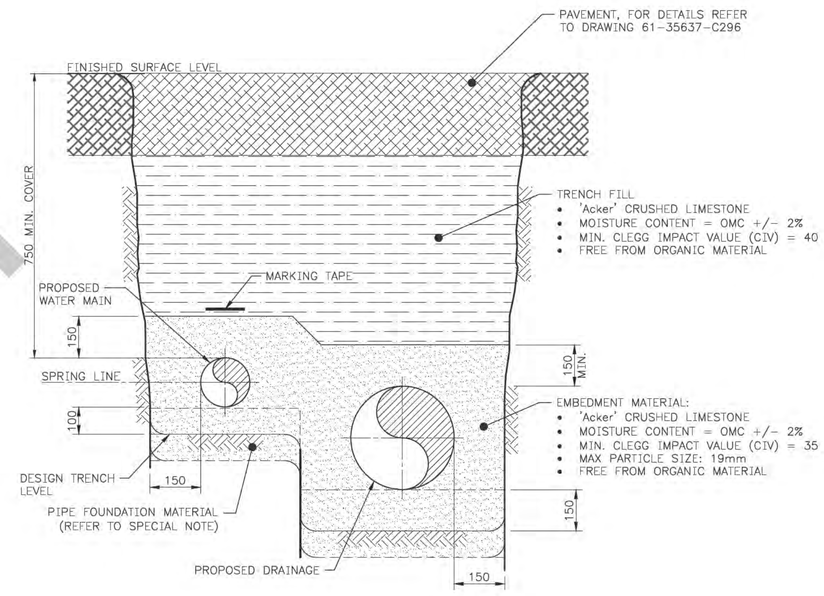
PIPE FOUNDATION MATERIAL SPECIAL NOTE:
CHRISTMAS ISLAND GEOLOGICAL FEATURES INCLUDE LIMESTONE LAYERS. LIMESTONE MATERIALS CAN BE AFFECTED BY KARSTIFICATION PROCESSES WHEREBY AQUEOUS SOLUTIONS DISSOLVE CALCITE RESULTING IN THE FORMATION OF CAVES, SINKHOLES AND OTHER VOIDS.

PIPE TRENCH FOUNDATION SHALL BE MONITORED FOR SIGNS OF KARSTIFICATION. WHERE KARSTIFICATION IS OBSERVED THE CONTRACTOR SHALL NOTIFY THE CLIENT'S REPRESENTATIVE FOR FURTHER DIRECTION.



EMBEDMENT/TRENCH FILL DETAIL (NON-TRAFFICABLE)

SCALE: DIAGRAMMATIC



EMBEDMENT/TRENCH FILL DETAIL (TRAFFICABLE)

SCALE: DIAGRAMMATIC

PRELIMINARY

No	Revision	Drawn	Job Manager	Project Director	Date
B	REISSUED FOR 90% DESIGN - CLIENT COMMENT	GT	JM*	PS*	20/11/20
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Drawn G.TAYAM		Designer D.DOMINGO	
Drafting Check C. BAGSHAW*		Design Check OTHERS	
Approved (Project Director)			
Date			
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Client: DEPT OF INFRASTRUCTURE, TRANSPORT, REGIONAL DEVELOPMENT & COMMUNICATIONS
Project: CHRISTMAS ISLAND STORMWATER REMEDIAL WORKS
Title: DN250 PVC WATER MAIN CONSTRUCTION NOTES

Original Size A1 | Drawing No: 61-35637-C300 | Rev: B

Plot Date: 19 November 2020 - 11:48 AM Plotted by: Jess Overheu

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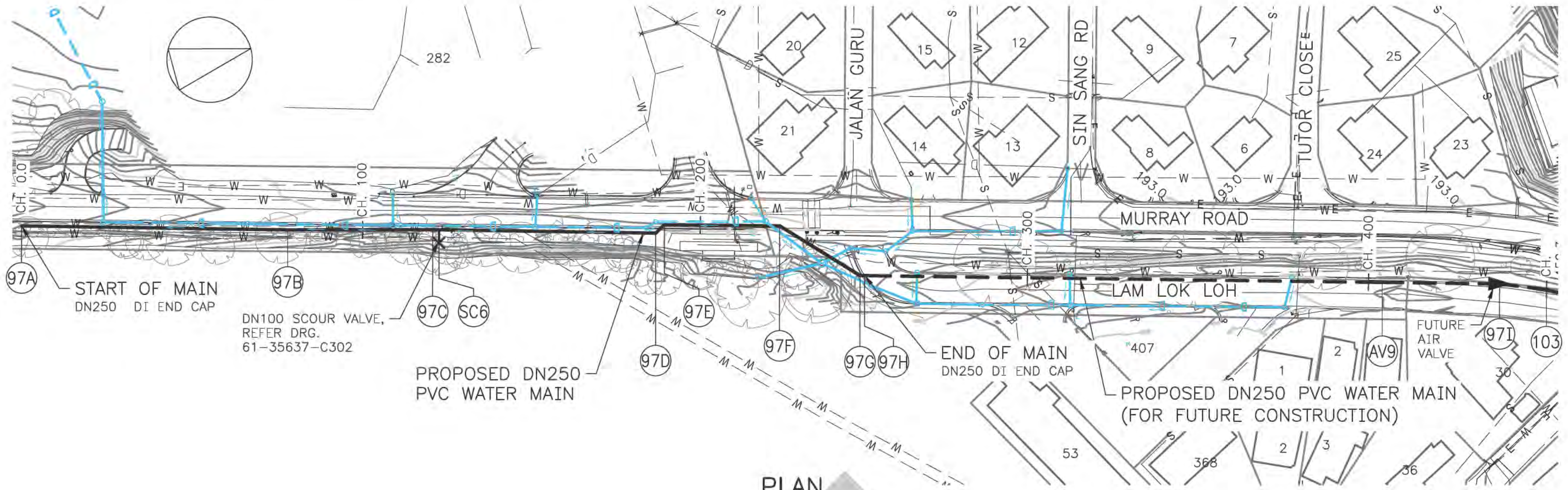
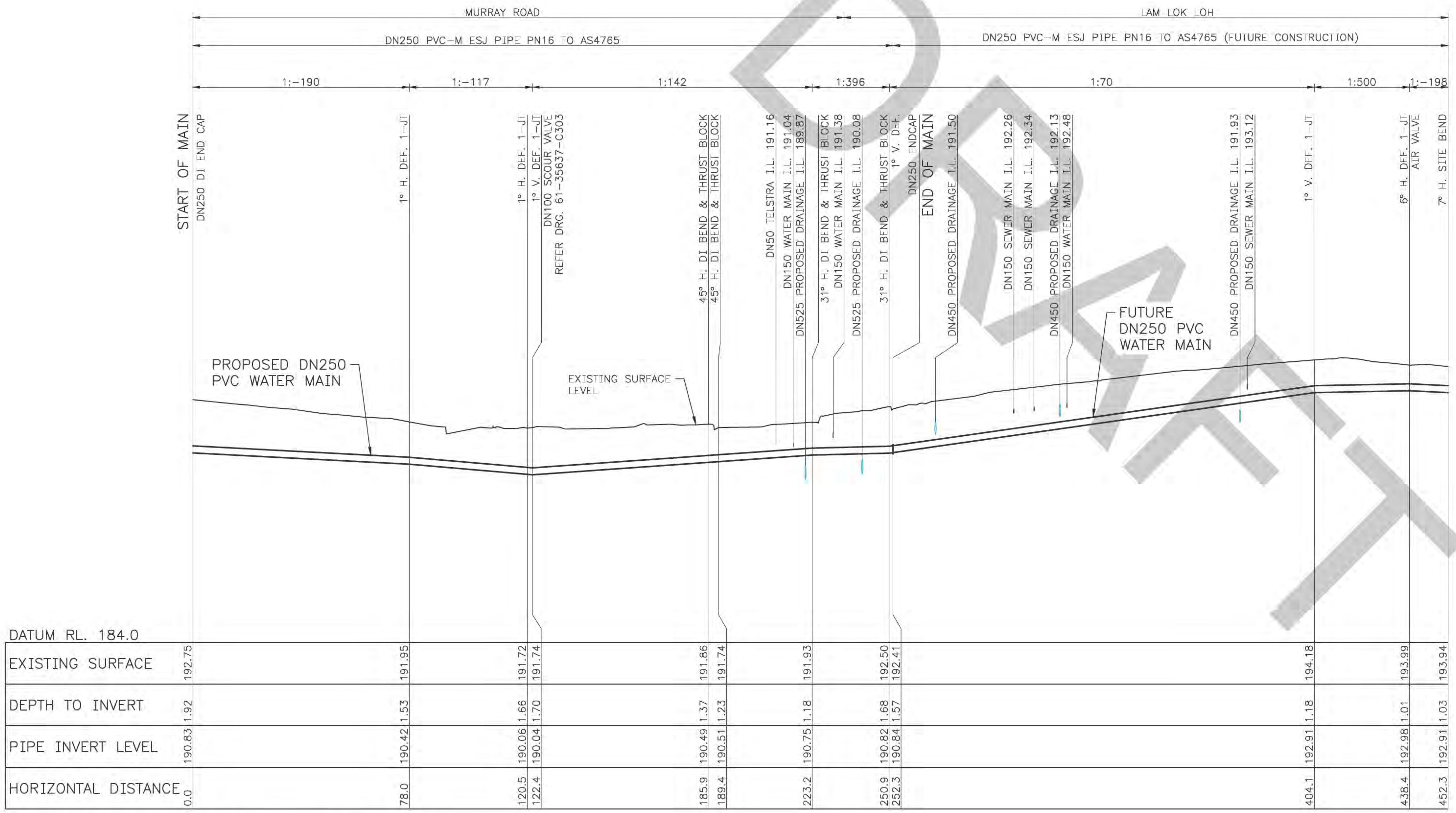


PLAN
SCALE 1:1000



LONGITUDINAL SECTION
HORIZONTAL SCALE 1:1000
VERTICAL SCALE 1:100

LEGEND:

EXISTING DRAINAGE INFRASTRUCTURE
EXISTING WATER INFRASTRUCTURE
EXISTING TREE
EXISTING COMMS INFRASTRUCTURE
EXISTING OPTICAL FIBRE MARKER
EXISTING POWER INFRASTRUCTURE
EXISTING DRAINAGE GULLY/SEP/MANHOLE
EXISTING COMMUNICATIONS MANHOLE
EXISTING SEWER MANHOLE
EXISTING WATER SERVICE MANHOLE
EXISTING BOLLARD
EXISTING GUIDE POST
EXISTING SIGN
PROPOSED WATER MAIN
PROPOSED FUTURE WATER MAIN
PROPOSED DRAINAGE
EXISTING CADASTRAL BOUNDARY
EXISTING BUILDING
EXISTING KERB
EXISTING RETAINING WALL
PROPOSED FENCE
EXISTING FENCE LOW
EXISTING FENCE HIGH
EXISTING TOP OF BANK
EXISTING BOTTOM OF BANK
EXISTING CHANGE OF GRADE
EXISTING EDGE OF CONCRETE
EXISTING EDGE OF BITUMEN
EXISTING EDGE OF TRACK
PROPOSED EDGE OF TRACK
EXISTING ROCK OUTCROP
EXISTING FOOTPATH
EXISTING ROAD SHOULDER
EXISTING ROAD CENTRELINE
EXISTING DRAIN CENTRELINE
EXISTING DRAINAGE PIPE
EXISTING SEWER LINE
EXISTING CONDUIT
EXISTING OVERHEAD POWER
EXISTING WATER PIPE
EXISTING TELECOM
EXISTING CONTOURS
PROPOSED CONTOURS
EXISTING BUSHLINE
EXISTING TREE

SETOUT POINTS – MGA94-48

POINT	CHAINAGE (m)	EASTING	NORTHING	COMMENTS
97A	0	573243.068	8846186.403	1° HORIZONTAL DEFLECTION
97B	78.0	573264.589	8846261.366	1° HORIZONTAL DEFLECTION
97C	120.5	573275.611	8846302.447	1° HORIZONTAL DEFLECTION
SC6	122.4	573276.122	8846304.233	1° HORIZONTAL DEFLECTION
97D	185.9	573293.646	8846365.271	45° H. DI BEND & THRUST BLOCK
97E	189.4	573291.930	8846368.372	45° H. DI BEND & THRUST BLOCK
97F	223.2	573301.086	8846400.888	31° H. 22.5 & 11.25 FL-FL DI BEND & THRUST BLOCK
97G	250.9	573321.315	8846419.855	31° H. 22.5 & 11.25 FL-FL DI BEND & THRUST BLOCK
97H	252.3	573321.684	8846421.153	DN250 ENDCAP – END OF MAIN
AV9	404.1	573363.229	8846567.117	DN250 DI PN16 SOC-SOC
97I	438.4	573372.645	8846600.198	DN250 DI PN16 SOC-SOC 6° BEND
103	452.3	573377.838	8846613.040	DN250 DI PN16 SOC-SOC 7° BEND

NOTES:

1. EXISTING SERVICES LOCATIONS ARE INDICATIVE ONLY. CONTRACTOR TO CONFIRM LOCATION, SIZE AND LEVEL PRIOR TO COMMENCING CONSTRUCTION, SHOULD ANY CLASHES BE IDENTIFIED WITH PROPOSED WORKS THE CONTRACTOR IS TO IMMEDIATELY NOTIFY THE CLIENT'S REPRESENTATIVE.
2. EXISTING COMMUNICATIONS INFORMATION IS INCOMPLETE. VERIFICATION OF PRESENCE THROUGHOUT SITE REQUIRED PRIOR TO COMMENCING CONSTRUCTION.
3. FOR CONSTRUCTION NOTES, REFER TO DRAWING 61-35637-C300.
4. FOR DETAILS OF PROPOSED DRAINAGE PIPEWORK, REFER TO DRAWING 61-35637-C221.

DIAL BEFORE YOU DIG www.1100.com.au

ALL COORDINATES SHOWN ON THIS DRAWING SHALL BE VERIFIED BY CONTRACTOR PRIOR TO COMMENCEMENT OF WORKS. ANY DISCREPANCIES TO BE REPORTED TO THE ENGINEER IMMEDIATELY.

1 0.5 0 1 2 3 4 5 6 7 m (1:100)
10 5 0 10 20 30 40 50 60 70 m (1:1000)

PRELIMINARY

No	Revision	Drawn	Job Manager	Project Director	Date
B	REISSUED FOR 90□ DESIGN - CLIENT COMMENT	GT	JM*	PS*	20/11/20
A	ISSUED FOR 90□ DESIGN - CLIENT COMMENT	GT	JM*	PS*	30/09/20

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Drafting Check C.BAGSHAW* | Design Check OTHERS
Approved (Project Director)
Date
Scale AS SHOWN
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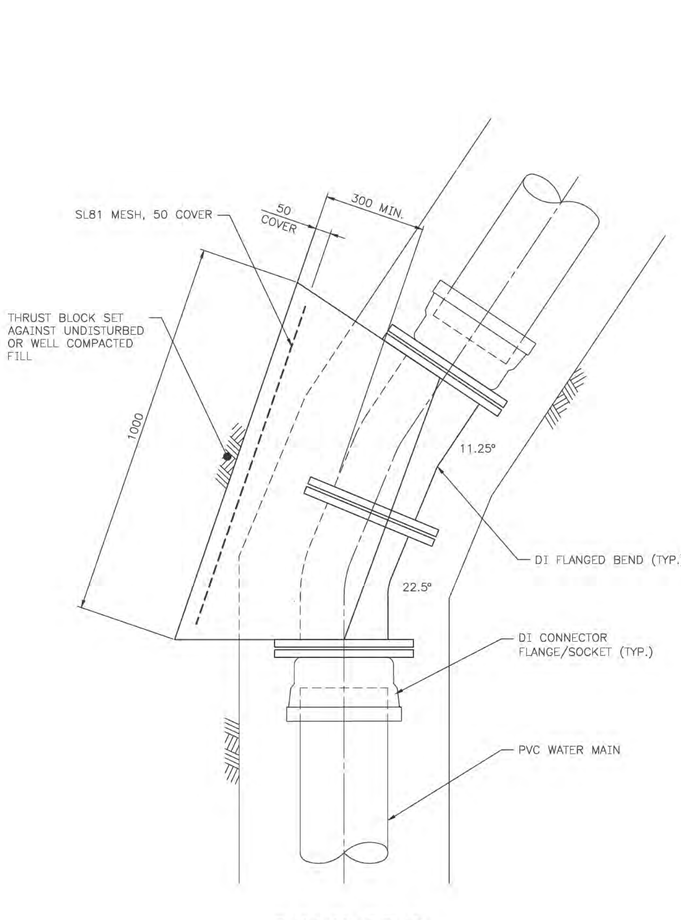
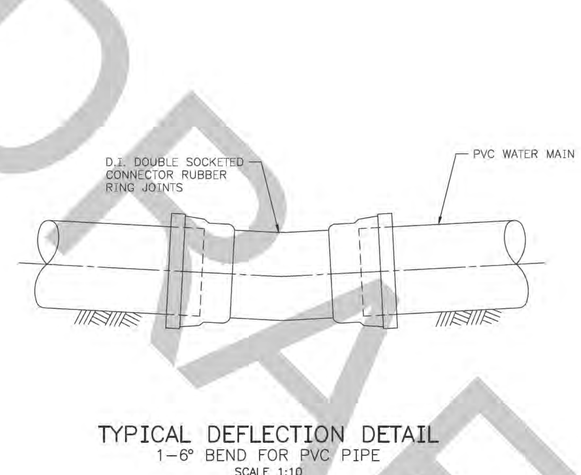
Client DEPT OF INFRASTRUCTURE, TRANSPORT, REGIONAL DEVELOPMENT & COMMUNICATIONS
Project CHRISTMAS ISLAND STORMWATER REMEDIAL WORKS
Title DN250 PVC WATER MAIN
PLAN AND LONGITUDINAL SECTION

Original Size A1 Drawing No: 61-35637-C301 Rev: B

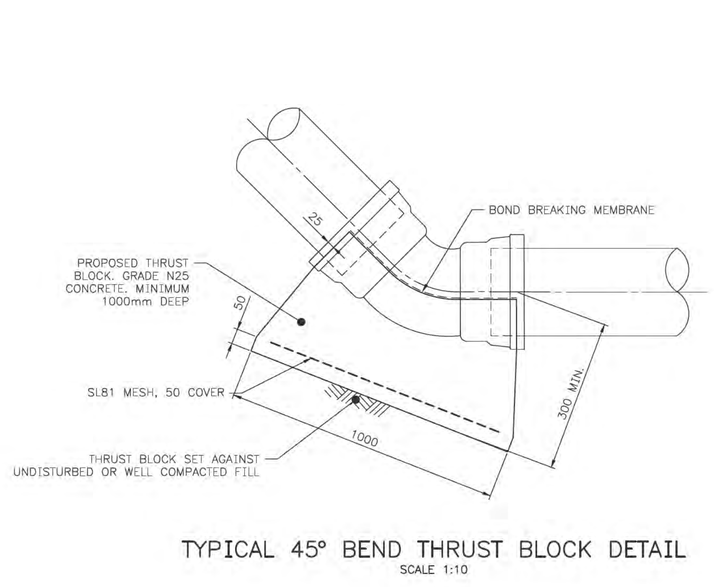
Plot Date: 16 November 2020 - 2:42 PM Plotted by: Giselle Tayam Cad File No: N:\AU\Perth\Projects\61\35637\CADD\Drawings\61-35637-C301.dwg



34°± 6° BEND
SCALE 1:10



TYPICAL DEFLECTION DETAIL
1–6° BEND FOR PVC PIPE
SCALE 1:10



TYPICAL 45° BEND THRUST BLOCK DETAIL
SCALE 1:10

NOTES:

1. ALL DIMENSIONS IN MILLIMETRES UNLESS SHOWN OTHERWISE.
2. FOR CONSTRUCTION NOTES, REFER TO DRAWING 61–35637–C300.
3. FOR GENERAL LOCATION OF TRUST BLOCKS AND BEND DETAILS, REFER TO LONGITUDINAL SECTION ON DRAWING 61–35637–C301.

100 50 0 100 200 300 400 500 600 700 mm (1:10)

PRELIMINARY

No	Revision	Drawn	Job Manager	Project Director	Date
A	ISSUED FOR 90% DESIGN - CLIENT COMMENT	GT	JM*	PS*	30/09/20

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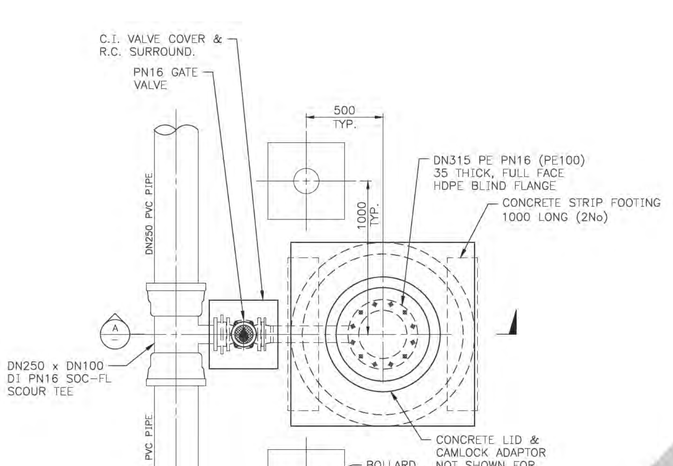
Drafting Check	C.BAGSHAW*	Design Check	S.CLEARY*
Approved (Project Director)			
Date			
Scale	1:10	This Drawing must not be used for Construction unless signed as Approved	

Client: DEPT OF INFRASTRUCTURE, TRANSPORT, REGIONAL DEVELOPMENT & COMMUNICATIONS
Project: CHRISTMAS ISLAND STORMWATER REMEDIAL WORKS
Title: DN250 PVC WATER MAIN THRUST BLOCK AND BEND DETAILS

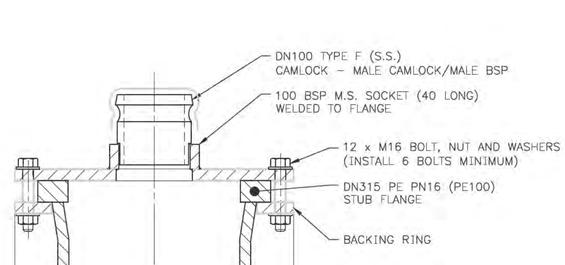
Original Size: A1
Drawing No: 61-35637-C302
Rev: A

Plot Date: 1 October 2020 - 3:47 AM Plotted by: Giselle Tayam Cad File No: \\ghdnet\ghd\AU\Perth\Projects\61\35637\CADD\Drawings\61-35637-C302.dwg



SCOUR VALVE DETAIL – PLAN VIEW

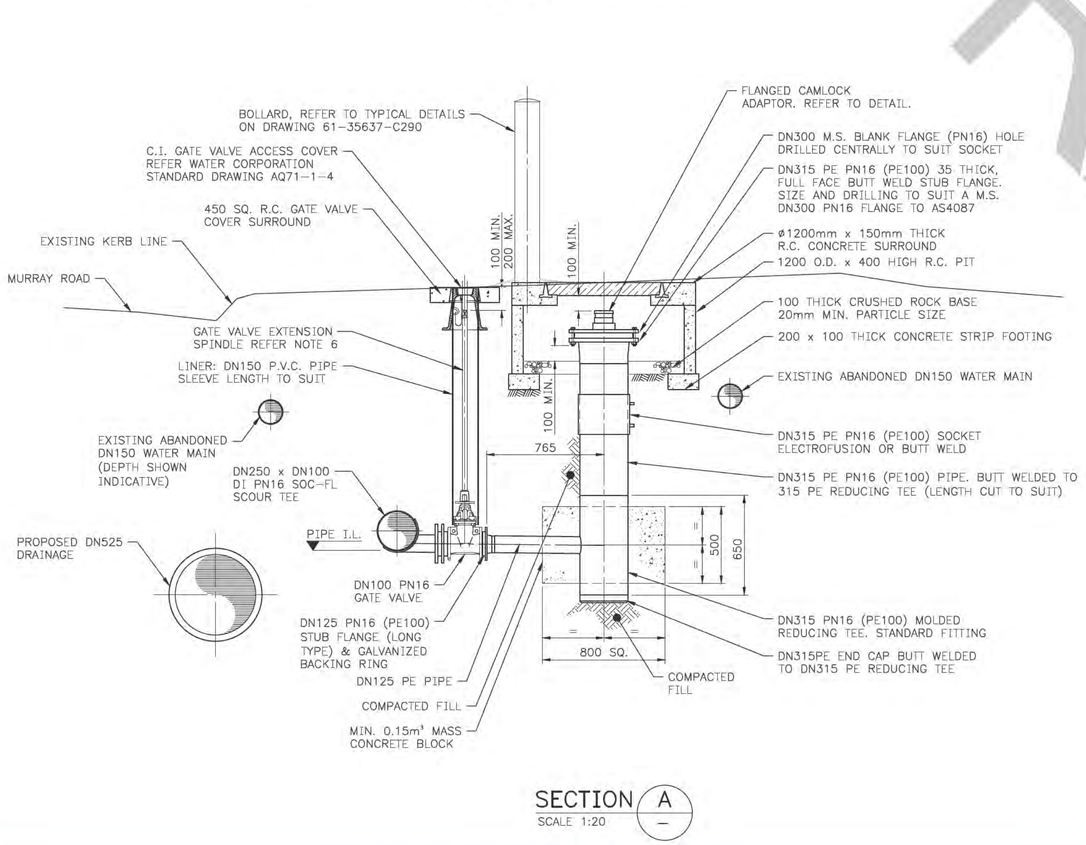
SCALE 1:20



CAMLOCK ADAPTOR

DETAIL 1

SCALE 1:5



SECTION A

SCALE 1:20

SCOUR VALVE LOCATIONS	
ITEM	CHAINAGE
SC6	122.4

NOTES:

1. ALL DIMENSIONS IN MILLIMETRES UNLESS SHOWN OTHERWISE.
2. FOR GENERAL LOCATION OF SCOUR VALVES SEE PLAN AND LONGITUDINAL SECTION DRAWING 61-35637-300 (EXACT LOCATION OF VALVES TO DETERMINED ON SITE).
3. ALL CONCRETE TO BE GRADE N32 AND IN ACCORDANCE WITH AS3600.
4. ALL STUB FLANGES TO HAVE GALVANISED STEEL BACKING FLANGES DRILLED TO BE COMPATIBLE WITH AS4087 CLASS 16 FLANGES.
5. RESILIENT SEATED GATE VALES SHALL BE TO WATER CORPORATION SPECIFICATION SPS 272.
6. SPINDLE EXTENSIONS TO COMPLY WITH WATER CORPORATION STANDARD DRAWING AQ71-3-1 (LENGTH TO SUIT) AND FIXED WITH M12 SET SCREW TO VALVE SPINDLE.
7. REFER TO DRAWING 61-35637-C300 FOR FURTHER NOTES.

100 50 0 100 200 300 mm (1:5)

500 0 500 1000 mm (1:20)

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No	Revision	Note: * indicates signatures on original issue of drawing or last revision of drawing	Drawn	Job Manager	Project Director	Date
B	REISSUED FOR 90□ DESIGN - CLIENT COMMENT		GT	JM*	PS*	20/11/20
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Drawn	G.TAYAM	Designer	D.DOMINGO
Drafting Check	C.BAGSHAW*	Design Check	OTHERS
Approved (Project Director)			
Date			
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Client: DEPT OF INFRASTRUCTURE, TRANSPORT, REGIONAL DEVELOPMENT & COMMUNICATIONS
Project: CHRISTMAS ISLAND STORMWATER REMEDIAL WORKS
Title: DN250 PVC WATER MAIN SCOUR VALVE DETAILS

Original Size A1 | Drawing No: 61-35637-C303 | Rev: B

Plot Date: 16 November 2020 - 2:55 PM | Plotted by: Giselle Tayam | Cad File No: N:\AU\Perth\Projects\61\35637\CADD\Drawings\61-35637-C303.dwg

GENERAL

G1. THESE DRAWINGS SHALL BE READ IN CONJUNCTION WITH ALL OTHER DRAWINGS, THE SPECIFICATIONS AND WITH OTHER SUCH WRITTEN INSTRUCTIONS AS MAY BE ISSUED DURING THE COURSE OF THE WORKS BY THE CLIENT'S REPRESENTATIVE. ANY DISCREPANCIES OR VARIATIONS SHALL BE REFERRED TO THE CLIENT'S REPRESENTATIVE FOR RESOLUTION BEFORE PROCEEDING WITH THE AFFECTED WORK.

G2. ALL DIMENSIONS RELEVANT TO SETTING OUT AND OFF-SITE WORK SHALL BE VERIFIED BY THE CONTRACTOR BEFORE CONSTRUCTION AND FABRICATION IS COMMENCED.

G3. DIMENSIONS SHALL NOT BE DETERMINED FROM THE DRAWINGS BY SCALING.

G4. ALL DIMENSIONS ARE IN MILLIMETRES AND ALL LEVELS, CHAINAGES AND CO-ORDINATES ARE EXPRESSED IN METRES, UNLESS STATED OTHERWISE.

G5. DURING CONSTRUCTION THE CONTRACTOR SHALL BE RESPONSIBLE FOR MAINTAINING THE STRUCTURES IN A STABLE CONDITION AND ENSURING NO PART SHALL BE OVER STRESSED UNDER CONSTRUCTION ACTIVITIES. TEMPORARY BRACING, PROPPING OR OTHER TEMPORARY WORKS SHALL BE PROVIDED BY THE CONTRACTOR AS REQUIRED. WORKMANSHIP AND MATERIALS SHALL BE IN ACCORDANCE WITH THE RELEVANT CODES.

G6. PROVIDE ADEQUATE TEMPORARY PROPPING AND/OR BRACING TO ALL PARTS OF THE WORK, WHETHER SHOWN ON THE DRAWINGS OR NOT, DURING ALL STAGES OF CONSTRUCTION AS REQUIRED. CHECK WITH THE SUPERINTENDENT IF THERE ARE ANY QUERIES REGARDING WORK THAT MAY REQUIRE TEMPORARY PROPPING/BRACING/ SHORING ETC.

G7. THE LEVEL DATUM REFERRED TO IN THESE DRAWINGS IS THE CHRISTMAS ISLAND HEIGHT DATUM (CIHD).

G8. THE SETOUT LOCATIONS REFERRED TO IN THESE DRAWINGS ARE BASED ON A MGA ZONE 48 COORDINATE SYSTEM.

G9. STRUCTURAL NOTES TO BE READ IN CONJUNCTION WITH CIVIL NOTES. REFER TO DRAWING 61-35637-C002 FOR FURTHER INFORMATION.

FOUNDATIONS

F1. SITE CONSTRUCTION WORKS TO BE PRECEDED BY APPROPRIATE PREPARATION OF THE GROUND SURFACE IN THE AREAS PROPOSED FOR DEVELOPMENT. PREPARATION TO INCLUDE THE FOLLOWING AS APPLICABLE:
- IDENTIFICATION OF AND DIVERSION/PROTECTION OF ANY BURIED SERVICES WITHIN WORK AREAS.
- INITIAL CLEARING INCLUDING BUILDING DEBRIS, OLD STRUCTURES, FOOTINGS, SLABS AND REFUSE.
- GRUBBING OF ANY TREES ROOTS TO A MINIMUM DEPTH OF 1m BELOW FINAL FINISHED GRADE.
- REMOVAL OF TOPSOIL (IF ENCOUNTERED) CONTAINING SIGNIFICANT QUANTITIES OF ORGANIC MATERIAL (E.G. PLANT ROOTS).
- EXCAVATION AND REMOVAL OF ANY REFUSE, AND/OR LOCALISED SOFTENED ZONES IDENTIFIED BY VISUAL EXAMINATION OF THE STRIPPED GROUND SURFACE.
- CONTOURING/SHAPING OF GROUND SURFACE TO ENSURE ANY SURFACE RUNOFF DRAINS FROM THE SITE.

F2. ALL SOIL BELOW FOOTINGS AND SLABS ON GRADE SHALL BE COMPACTED AS DETAILED IN THE SPECIFICATION OR AS AGREED WITH THE CLIENT'S REPRESENTATIVE.

F3. FOUNDATION MATERIALS/FILL SHALL BE COMPACTED TO A MINIMUM DENSITY OF 95% OF THE STANDARD MAXIMUM DRY DENSITY (SMDD) WHEN TESTED IN ACCORDANCE WITH AS1289 TO A MINIMUM DEPTH OF 300mm.

F4. TEST ALL COMPACTION AND ARRANGE CERTIFICATION OF ALL EARTHWORKS UNDER STRUCTURES.

F5. KEEP EXCAVATIONS FREE OF WATER. PROVIDE ADEQUATE DRAINAGE TO ENSURE FORMATION IS NOT AFFECTED BY MOISTURE. PREVENT FOUNDATION DRYING OUT DUE TO EXPOSURE. PLACE BLINDING, FOOTINGS, PILES AND BACKFILL AS SOON AS PRACTICABLE AFTER EXCAVATION.

F6. USE SUITABLE CONSTRUCTION TECHNIQUES AND EQUIPMENT FOR BACKFILLING ADJACENT TO STRUCTURES TO PREVENT OVERSTRESS AND DAMAGE. BACKFILL EVENLY TO AVOID DIFFERENTIAL SOIL PRESSURES ON STRUCTURES. BACKFILL AGAINST RETAINING WALLS ONLY AFTER SPECIFIED CONCRETE STRENGTH IS ACHIEVED, AND PERMANENT SUPPORT INSTALLED WHERE APPLICABLE.

CONCRETE

C1. ALL CONCRETE WORKMANSHIP AND MATERIALS SHALL BE IN ACCORDANCE WITH AS 3600 CONCRETE STRUCTURES CODE AND CONCRETE SPECIFICATION (SOME DETAILS GIVEN BELOW).

C2. CONCRETE CHARACTERISTICS BELOW WITH FULL DETAILS IN CONCRETE SPECIFICATION

ELEMENT	CONCRETE GRADE (MPa)	MAX AGGREGATE SIZE (mm)	CEMENT TYPE	SLUMP
INCLINE DIVERSION PIT, PIT N17-2, HEADWALL N17-3, INCLINE TANK HEADWALL, PRECAST CONCRETE AND PRECAST CONCRETE FOR STANDARD DRAINAGE STRUCTURES.	S40	20	GP	100±20 150±30 FOR WALLS IN-SITU
MURRAY ROAD SPEED REDUCTION HUMP (WITH XYPEX C5000 AT 0.5-0.6% BY WEIGHT OF TOTAL CEMENT CONTENT).	S40	20	GP	100±20
UNREINFORCED (MASS) CONCRETE, FOOTPATHS, PIPE ENCASEMENTS, IN-SITU CONCRETE FOR STANDARD DRAINAGE STRUCTURES AND OTHER ELEMENTS NOT LISTED IN THIS TABLE.	S32	20	GP	100±20
INCLINE TANK HEADWALL MASS CONCRETE (WITH DRAMIX STEEL FIBRES 3D 65/60 AT 30 kg/m³ AND XYPEX C5000 AT 0.5-0.6% BY WEIGHT TOTAL CEMENT CONTENT)	S40	20	LH	100±20
KERBING (REFER MRWA SPECIFICATION 407)	S32	10	GP	50 MAX
BLINDING	S15	20	GP	100±20
LEAN MIX CONCRETE	S5	20	GP	100±20

C3. CHECK WITH OTHER DISCIPLINE DRAWINGS AND REPORT ANY DISCREPANCIES. CONFIRM LOCATIONS OF ANY CAST-IN ITEMS SUCH AS BOLTS, ANGLES, TIES FLASHING, PLUMBING AND ELECTRICAL FITTINGS ETC.

C4. NOTIFY THE CLIENT'S REPRESENTATIVE AT LEAST 48 HOURS BEFORE PLACING CONCRETE.

C5. PROVIDE 0.2mm POLYTHENE SHEET UNDER ALL SLABS ON GROUND.

C6. ALL FORMWORK TO COMPLY WITH AS3610 WITH SURFACE FINISH CLASS AS FROM TABLE 3.3.1. FOR VISUALLY IMPORTANT SURFACES OF CLASS 1, 2 OR 3, SET OUT FORMWORK TO GIVE A REGULAR ARRANGEMENT OF PANELS, JOINTS, BOLT HOLES AND SIMILAR VISIBLE ELEMENTS IN THE FORMED SURFACE.

C7. FINISHES TO CONCRETE MEMBERS:
UNLESS OTHERWISE NOTED ON DRAWINGS ALL FORMED CONCRETE FINISHES SHALL BE IN ACCORDANCE WITH AS3610 AND THE SPECIFICATION.

C8. ABBREVIATIONS USED: No ╲╱ FORMED FINISH UNo ╲╱ UNFORMED FINISH

C9. ALL EXPOSED CORNERS AND EDGES TO HAVE 12x12 CHAMFERS UNLESS NOTED OTHERWISE.

C10. NO HOLES OR CHASES OTHER THAN THOSE SHOWN ON THE STRUCTURAL DRAWINGS SHALL BE MADE IN CONCRETE MEMBERS WITHOUT THE PRIOR WRITTEN APPROVAL OF THE CLIENT'S REPRESENTATIVE.

C11. CONSTRUCTION JOINTS SHALL BE MADE WHERE SHOWN ON THE DRAWINGS OR AT LOCATIONS APPROVED BY THE CLIENT'S REPRESENTATIVE PRIOR TO CONCRETE WORKS. THE SURFACE ONTO WHICH A CONSTRUCTION JOINT IS CAST SHALL BE DELIBERATELY ROUGHENED AND WETTED WITH POTABLE WATER TO ACHIEVE A SATURATED SURFACE DRY CONDITION BEFORE PLACING CONCRETE.

C12. REINFORCEMENT, ANCHOR BOLTS AND CAST-IN ITEMS SHALL BE RIGIDLY CONSTRAINED TO PREVENT MOVEMENT DURING THE CONCRETE PLACEMENT. ANCHOR BOLTS TO BE TACK WELDED TO REINFORCEMENT AT LOWER END. BOLTS TO BE GREASED AND TAPED UP BEFORE CONCRETE POUR.

C13. CUT OR BEND BARS AROUND OPENINGS. REINFORCEMENT AND EXPOSED CAST-IN METAL ITEMS MUST NOT BE IN CONTACT WITH PIPE FITTINGS.

C14. REMOVAL OF FORMWORK SHALL BE IN ACCORDANCE WITH THE CONCRETE SPECIFICATION, EXCEPT FOR LH CEMENT MIXES WHERE FORMWORK SHALL BE RETAINED FOR A MINIMUM OF 7 DAYS.

C15. CONCRETE SHALL NOT BE PLACED IF THE SLUMP IS NOT WITHIN THE ACCEPTANCE CRITERIA. WATER SHALL NOT BE ADDED AT THE SITE UNLESS IN ACCORDANCE WITH THE CONCRETE SPECIFICATION.

C16. COMPACT CONCRETE USING APPROVED IMMERSION VIBRATORS (REFER COMPACTION GUIDANCE IN CIA Z7-04).

C17. CURE CONCRETE BY KEEPING MOIST FOR 7 DAYS FOR GP CEMENT OR 14 DAYS FOR TYPE GB OF LH CEMENT. CURING MATERIALS AND METHOD TO BE IN ACCORDANCE WITH THE SPECIFICATION. USE EVAPORATION RETARDANT ON SLAB TOP SURFACES AND RE-APPLY AS HOT WEATHER CONDITIONS JUSTIFY. CURING MEMBRANES SHALL COMPLY WITH AS3799 AND SHALL TAKE ACCOUNT OF ALL POSSIBLE FINISHES TO THE CONCRETE SURFACE.

C18. PROGRESSIVELY BACKPROP SUSPENDED SLABS IMMEDIATELY AFTER STRIPPING AT TYPICALLY THIRD POINTS OF BEAM SPANS AND AT 2400mm CENTRES FOR SUSPENDED SLABS.

C19. WHERE CONCRETE IS DAMAGED AND/OR INADEQUATELY COMPACTED, NOTIFY THE CLIENT'S REPRESENTATIVE FOR REMEDIAL MEASURES, WITH ALL INSPECTION FOR DEFECTS AND REPAIR IN ACCORDANCE WITH THE CONCRETE SPECIFICATION.

C20. STEELWORK CAST IN THE CONCRETE THAT IS SURFACE EXPOSED SHALL BE STAINLESS STEEL GRADE 316, INCLUDING FERRULES, INSERTS, DOWEL BARS, ANGLE CLEATS, BOLTS, NUTS, WASHERS AND PACKERS ETC.

C21. ALL GROUT NAMED ON DRAWINGS SHALL BE A PROPRIETARY CEMENTITIOUS SHRINKAGE COMPENSATING GROUT OF STRENGTH AND DURABILITY AT LEAST EQUIVALENT TO THE ADJACENT CONCRETE TO BE APPROVED BY THE CLIENT'S REPRESENTATIVE INCLUDING ACCEPTABLE THICKNESS AND CONSISTENCY (I.E. STIFF, PLASTIC, FLOWABLE, FLUID TO GROUT MANUFACTURER'S RECOMMENDATIONS) SO GAP BETWEEN ELEMENTS IS COMPLETELY FILLED.

PRECAST CONCRETE

P1 PRECAST CONCRETE UNITS HAVE BEEN DESIGNED FOR INSTALLED CONDITIONS ONLY.

P2 PRECAST UNITS AND CONNECTIONS HAVE NOT BEEN DESIGNED FOR VEHICLE IMPACT.

P3 PRECAST UNITS TO BE SUPPLIED BY A SPECIALIST SUB-CONTRACTOR.

P4 SUPPLIER TO DESIGN PRECAST CONCRETE UNITS, CONNECTIONS, FIXING DETAILS AND JOINTS ETC TO PROVIDE SATISFACTORY PERFORMANCE FOR STABILITY, FIRE RESISTANCE (WHERE REQUIRED AS NOTED IN DRAWINGS), SERVICEABILITY AND STRENGTH REQUIREMENTS DURING MANUFACTURE, HANDLING, LIFTING, TRANSPORT, ERECTION AND INSTALLATION OPERATIONS.

P5 USE CAST IN FERRULES FOR STRUCTURAL FIXINGS, NOT MECHANICAL OR CHEMICAL ANCHORS.

P6 SUBMIT WORKSHOP DRAWINGS SHOWING PROPOSED DETAILS FOR DESIGN, MANUFACTURE, ASSEMBLY, TRANSPORT AND INSTALLATION OF PRECAST CONCRETE ELEMENTS, INCLUDING FOLLOWING:
- INFORMATION SPECIFIED IN AS3850 CLAUSE 3.10
- CAST IN ITEMS INCLUDING LOCATIONS, SIZES, DETAILS, MATERIALS, CORROSION PROTECTION AND GRADE OF FERRULES, PLATES, CUT-OUTS AND OPENINGS, ANCHORS, LIFTING DEVICES, PLUGS FOR SEALING RECESSES ETC.
- EQUIPMENT AND METHODS OF HANDLING. LIFTING, TRANSPORT INCLUDING LOCATION OF LIFTING POINTS, MAXIMUM LOADS ON LIFTING AND BRACING POINTS
- EVIDENCE OF LOAD CAPACITY OF LIFTING AND BRACING INSERTS AND ATTACHMENTS IN FORM OF TEST REPORTS OR CALCULATIONS
- CONCRETE MIX DESIGN
- FORMWORK TYPE
- SURFACE FINISH CLASS AND SURFACE TREATMENT
- EQUIPMENT AND METHODS FOR HANDLING, TRANSPORT AND INSTALLATION.

P7 SUBMIT DESIGN CALCULATIONS OF DESIGN FOR MANUFACTURE, HANDLING, LIFTING, TRANSPORT, ERECTION AND INSTALLATION CONDITIONS. SUBMIT EVIDENCE OF LOAD CAPACITY OF LIFTING AND BRACING INSERTS AND ATTACHMENTS (TEST REPORTS OR CALCULATIONS).

P8 HOT DIP GALVANIZE CAST IN STEELWORK INCLUDING FERRULES, INSERTS, DOWEL BARS, ANGLE CLEATS, BOLTS, NUTS WASHERS AND PACKERS ETC.

P9 PRECAST UNIT TOLERANCES TO BE TO AS3600 AND AS3850 EXCEPT WHERE VARIED BY SPECIFICATION.

P10 CAST UNITS WITH OUTER FACE OFF FORM.

P11 PROVIDE 12x12 CHAMFERS OR FILLETS AT EDGES AND CORNERS OF PRECAST UNITS.

P12 WHERE PRECAST UNITS ARE TO BE SUPPORTED BY CONCRETE MEMBERS, DO NOT ERECT UNITS UNTIL 28 DAY STRENGTH HAS BEEN ACHIEVED.

P13 USE PVC OR FIBROUS CEMENT SHEET LEVELLING PADS.

REINFORCEMENT

R1. REINFORCEMENT SHALL COMPLY WITH AS/NZS4671

R2. ALL REINFORCEMENT TO BE FREE OF SCALE, RUST AND OTHER FOREIGN MATTER.

R3. STEEL REINFORCEMENT IS DESIGNATED AS FOLLOWS:
N - DENOTES NORMAL DUCTILITY GRADE 500N DEFORMED BARS TO AS/NZS4671
R - DENOTES GRADE 230R HOT ROLLED PLAIN BARS TO AS/NZS4671
L - DENOTES HARD DRAWN WIRE REINFORCEMENT FABRIC TO AS/NZS4671
W - DENOTES HARD DRAWN PLAIN WIRE TO AS/NZS4671

R4. ABBREVIATIONS USED ON DRAWINGS:

T = TOP	ES = EQUALLY SPACED	UT = UPPER TOP
LT = LOWER TOP	NF = NEAR FACE	LB = LOWER BOTTOM
B = BOTTOM	FF = FAR FACE	LV = LENGTH VARIES
UB = UPPER BOTTOM	EF = EACH FACE	
CP = CENTRALLY PLACED	EW = EACH WAY	

R5. SPLICE REINFORCEMENT ONLY AT LOCATIONS SHOWN ON DRAWINGS OR AS APPROVED BY THE CLIENT'S REPRESENTATIVE. STAGGER LAPS WHERE POSSIBLE. LAPPED SPLICE LENGTHS TO COMPLY WITH AS 3600. CLEAR SPACING BETWEEN LAPPED SPLICE BARS TO BE LESS THAN THREE (3) TIMES BAR DIAMETER.

R6. COVER TO REINFORCEMENT SHALL BE 50mm UNLESS NOTED OTHERWISE.

R7. LAPPED SPLICE LENGTHS FOR HORIZONTAL BARS WITH MORE THAN 300mm CONCRETE CAST BELOW THE BAR AND SPACED AT ≥125mm CENTRES TO COMPLY WITH THE FOLLOWING UNO:

COVER	f'c	N12	N16	N20	N24	N28	N32
⩾ 25	⩾ 20	770	1150	1570	-	-	-
⩾ 30	⩾ 25	630	980	1350	-	-	-
⩾ 40	⩾ 32	510	770	1100	1440	1810	2220
⩾ 50	⩾ 40	460	630	890	1200	1540	1920

DO NOT INTERPOLATE INTERMEDIATE VALUES FOR SPLICE LENGTHS.
LAPPED SPLICE LENGTHS FOR BARS IN COLUMNS - REFER TO AS3600 OR THE CLIENT'S REPRESENTATIVE.
EPOXY COATED BARS, BARS IN LIGHTWEIGHT CONCRETE AND SLIP FORMED CONCRETE WILL REQUIRE LONGER SPLICE LENGTHS - REFER TO AS3600 OR THE SUPERINTENDENT.

R8. LAPPED SPLICE LENGTHS FOR VERTICAL BARS (AND HORIZONTAL BARS WITH LESS THAN 300mm CONCRETE CAST BELOW THE BAR) SPACED AT ≥125mm CENTRES TO COMPLY WITH THE FOLLOWING UNO:

COVER	f'c	N12	N16	N20	N24	N28	N32
⩾ 25	⩾ 20	590	890	1210	-	-	-
⩾ 30	⩾ 25	490	750	1040	1340	-	-
⩾ 40	⩾ 32	390	600	840	1110	1400	1710
⩾ 50	⩾ 40	350	480	690	920	1190	1480

NOT APPLICABLE FOR BARS IN COLUMNS.
DO NOT INTERPOLATE INTERMEDIATE VALUES FOR SPLICE LENGTHS.
LAPPED SPLICE LENGTHS FOR BARS IN COLUMNS - REFER TO AS3600 OR THE CLIENT'S REPRESENTATIVE.
EPOXY COATED BARS, BARS IN LIGHTWEIGHT CONCRETE AND SLIP CONCRETE WILL REQUIRE LONGER SPLICE LENGTHS - REFER TO AS3600 OR THE SUPERINTENDENT.

R9. LAY MESH REINFORCEMENT SO THAT MINIMUM COVER IS TO MAIN WIRES UNO.

R10. PROVIDE MINIMUM MESH LAPS TO CROSS WIRES OF REINFORCING MESH, SO THAT TWO OUTERMOST WIRES OF ONE SHEET OVERLAP TWO OUTERMOST WIRES OF ADJACENT SHEET BY AT LEAST 25 MM, THUS:

	END LAP	SIDE LAP
RECTANGULAR MESHES	225	125
SQUARE MESHES SL102 TO SL42	225	225
SL81	125	125
TRENCH MESH	500	N/A

R11. DO NOT LAP MORE THAN THREE SHEETS AT ANY ONE POINT.

R12. ALL HOOKS AND COGS SHALL BE IN ACCORDANCE WITH AS3600.
WRAPPING, CUTTING AND BENDING OF REINFORCEMENT SHALL BE IN ACCORDANCE WITH AS3600.

R13. ALL REINFORCEMENT, INCLUDING FABRIC REINFORCEMENT, SHALL BE FIRMLY SUPPORTED ON APPROVED BAR SPACERS.

R14. SUPPORT ALL REINFORCEMENT ADEQUATELY AND ACCURATELY ON APPROVED CHAIRS.

R.15 REINFORCING TO BE ISOLATED FROM CAST-IN METAL ITEMS.

R16. UNLESS SHOWN ON DRAWINGS, REPOSITION REINFORCEMENT PASSING THROUGH SMALL PENETRATIONS EITHER SIDE OF THE OPENING WITH APPROPRIATE COVER AND LAP.

STRUCTURAL STEELWORK

S1. WORKMANSHIP AND MATERIALS TO COMPLY WITH AS4100, AS/NZS4600, AS/NZS1554 AND AS4673 FOR STAINLESS STEEL.

S2. STEEL SHALL BE THE FOLLOWING GRADE UNLESS NOTED OTHERWISE:
PLATE TO AS3678............C250
UNIVERSAL BEAMS, COLUMNS, PARALLEL
FLANGE CHANNELS AND ANGLES TO AS3679.1.........GRADE 300 or BHP GRADE 300 Plus
SQUARE AND RECTANGULAR
HOLLOW SECTIONS TO AS1163............C350/C450
CIRCULAR HOLLOW SECTIONS TO AS1163............C350/C250
PURLINS AND GIRTS TO AS1397............GRADE G450

S3. STAINLESS STEEL SHALL BE GRADE 316L FOR HOT ROLLED PLATE AND SECTIONS OR GRADE 316 OTHERWISE.

S4. STRUCTURAL STEEL WORK WELDS TO BE MINIMUM 6mm, FULLY SEALED, CONTINUOUS FILLET, STRUCTURAL PURPOSE TO AS1554.1.

S5. STAINLESS STEEL WORK WELDS TO BE MINIMUM 6mm, FULLY SEALED, CONTINUOUS FILLET, STRUCTURAL PURPOSE TO AS1554.6 CLASS 2.

S6. BUTT WELDS TO BE FULL (COMPLETE) PENETRATION UNO.

S7. BOLT TYPES AND DESIGNATIONS SHALL BE AS FOLLOWS:-
4.6/S - COMMERCIAL BOLTS TO AS1111, SNUG TIGHTENED
8.8/S - HIGH STRENGTH STRUCTURAL BOLTS, NUTS AND HARDENED WASHERS TO AS1252, SNUG TIGHTENED.
8.8/TB - HIGH STRENGTH STRUCTURAL BOLTS AS ABOVE, FULLY TENSIONED TO AS4100 IN A BEARING TYPE JOINT.
8.8/TF - HIGH STRENGTH STRUCTURAL BOLTS AS ABOVE, FULLY TENSIONED TO AS4100 IN A FRICTION TYPE JOINT.

S8. STAINLESS STEEL FASTENERS SHALL COMPRISE OF BOLTS PRODUCT GRADE A TO AS1110.1 AND ISO3506.1 AND NUTS PRODUCT GRADE A TO AS1112.1 AND ISO3506.2. BOLT AND NUT STAINLESS STEEL GRADE AND PROPERTY CLASS SHALL BE A4 AND 80 RESPECTIVELY. WASHERS SHALL BE PRODUCT GRADE A TO AS1237.1 AND GRADE 316 STAINLESS STEEL.

S9. WHERE 8.8 BOLTS ARE SHOWN AS TORQUED (TB or TF) THEY SHALL BE ASSEMBLED IN ACCORDANCE WITH AS4100 USING "CORONET" LOAD INDICATING WASHERS.

S10. M16 AND LARGER BOLTS TO BE HIGH STRENGTH SNUG TIGHTENED (8.8/S) UNLESS NOTED OTHERWISE.

S11. USE BOLT LENGTHS SO THAT PROJECTION BEYOND NUT IS AT LEAST TWO THREADS, AND NOT MORE THAN 10mm.

S12. PROVIDE DOCUMENTARY EVIDENCE (INCLUDING TEST RESULTS) OF COMPLIANCE WITH RELEVANT AUSTRALIAN STANDARD FOR EACH BATCH OF FASTENERS USED.

S13. HOT DIP GALVANISE BOLTS, SCREWS, NUTS AND WASHERS TO AS1214. TAP GALVANISED NUTS 0.4 mm OVERSIZE TO SUIT GALVANISED THREADS TO AS1214 AND OIL FOR PROTECTION. INSTALL WASHERS UNDER BOLT HEAD AND NUT. USE TAPERED WASHERS AS REQUIRED.

S14. ALL HOLDING DOWN BOLTS SHALL BE COMMERCIAL BOLTS OR TO BE FABRICATED FROM GRADE 250 ROD WITH THREADS TO AS1275 UNLESS NOTED OTHERWISE. SUPPLY HOLDING DOWN BOLTS WITH TWO CLASS 5 HEXAGONAL HEAD NUTS AND TWO EXTRA LARGE FLAT WASHERS. HOT DIP GALVANISE HOLDING DOWN BOLTS, NUTS AND WASHERS TO AS1214. TIE HOLDING DOWN BOLT GROUPS RIGIDLY TOGETHER PRIOR TO INSTALLATION (eg. TACK WELD WITH 10mm DIAMETER REINFORCING BAR TO FORM A RIGID CAGE) TO ENSURE CORRECT BOLT LOCATIONS.

S15. HOLES IN PURLINS AND OTHER COLD FORMED SECTIONS TO BE ONLY IN MIDDLE THIRD OF WEB. DO NOT MAKE HOLES IN FLANGES OF PURLINS OR OTHER COLD FORMED SECTIONS.

S16. DRILL BOLT HOLES FULL SIZE OR REAM TO FULL SIZE AFTER SUB-DRILLING OR SUB-PUNCHING. FLAME CUTTING OF HOLES IS NOT PERMITTED. BOLT HOLE SIZE TO BE:
- BOLT DIAMETER PLUS 2mm FOR STEEL TO STEEL CONNECTIONS.
- BOLT DIAMETER PLUS 4mm FOR STEEL TO CONCRETE CONNECTIONS.
- BOLT DIAMETER PLUS 6mm FOR HOLDING DOWN BOLTS.

S17. SLOTTED HOLES TO BE 2.5xBOLT DIAMETER LONG UNO. BOLTS TO BE SET CENTRAL IN SLOT. USE OVERSIZED WASHERS AT SLOTTED HOLES.

S18. GROUT BASE PLATES, HOLDING-DOWN BOLTS BEFORE COLUMNS ARE LOADED. USE AN APPROVED HIGH-STRENGTH SHRINKAGE COMPENSATED PRE-MIXED GROUT.

S19. PROVIDE STEEL MEMBERS MADE FROM WHOLE LENGTHS WHEREVER POSSIBLE. IF NECESSARY, MAKE LENGTHS UP OF SECTIONS JOINED BY COMPLETE PENETRATION FULL STRENGTH BUTT WELDS GROUND FLUSH. WHERE PROPOSED, SHOW JOINTS ON SHOP DRAWINGS.

S20. CROP INTERNAL CORNERS OF CLEATS AND STIFFENERS, ETC. TO FACILITATE DRAINAGE.

S21. PROVIDE 3mm CAP PLATES SEAL WELDED TO HOLLOW SECTIONS UNO. PROVIDE DRILLED VENT/DRAIN HOLES AT TOP AND BOTTOM EXTREMITIES FOR HOLLOW SECTIONS TO BE HOT DIPPED GALVANISED. PROVIDE RUBBER SEALS OR PLUG WELD VENT/DRAIN HOLES THAT REMAIN EXPOSED. PROVIDE DRILLED SUSPENSION HOLES IN END PLATES, ETC FOR ITEMS TO BE HOT DIPPED GALVANISED.

S22. IN ALL CASES WHERE THE WALL THICKNESS OF RECTANGULAR AND SQUARE HOLLOW SECTIONS IS LESS THAN 8mm AND TO WHICH A FIN PLATE IS WELDED, PROVIDE A 10mm PLATE STIFFENER, WIDTH TO BE 15mm LESS THAN FACE OF SECTION, WELDED ALL ROUND.

S23. INSTALL BEAMS WITH NATURAL CAMBER UPWARD.

S24. MAKE BOLTED STRUCTURAL CONNECTIONS WITH 10mm THICK CLEAT PLATES AND 2 M16 8.8/S BOLTS UNO.

S25. PREPARE WORKSHOP DRAWINGS TO SHOW RELEVANT DETAILS OF EACH ASSEMBLY, COMPONENT AND CONNECTION, TOGETHER WITH INFORMATION RELATIVE TO FABRICATION, SURFACE TREATMENT AND ERECTION, INCLUDING IDENTIFICATION, STEEL TYPE AND GRADE, DIMENSIONS OF ITEMS, REQUIRED CAMBER (WHERE APPLICABLE), LOCATION, TYPE AND SIZE OF WELDS OR BOLTS, WELD CATEGORIES AND BOLTING CATEGORIES, SURFACE PREPARATION METHODS AND COATING SYSTEM, VENT/DRAIN HOLES FOR HOT DIP GALVANISING, PROPOSED JOINTS IN STEEL MEMBERS, etc.

S26. SHOP DRAWINGS SHALL BE REVIEWED BY THE CLIENT'S REPRESENTATIVE. ALLOW 14 DAYS FOR REVIEW. REVIEW DOES NOT INCLUDE CHECKING OF DIMENSIONS, AND DOES NOT RELIEVE THE CONTRACTOR OF THEIR RESPONSIBILITY FOR COMPLIANCE WITH DRAWINGS AND SPECIFICATIONS.

S27. USE IDENTIFICATION MARKS COMPATIBLE WITH AND VISIBLE THROUGH PAINT SYSTEM.

S28. AFTER COMPLETION OF FABRICATION, PREPARATION FOR SURFACE TREATMENT TO BE: ROUND OFF ROUGH WELDS, SHARP EDGES, BURRS, ARRISES, WELD SPLATTER AND SLAG, etc. REMOVE GREASE, OIL AND OTHER CONTAMINANTS TO AS1627.1. REMOVE RUST, MILLSCALE, OXIDE DEPOSITS, OLD PAINT FILMS, etc. BY ABRASIVE BLAST CLEANING TO AS1627.4. REMOVE ALL DUST BY BRUSHING OR VACUUM CLEANING.

S29. ALL STEELWORK, FLOOR GRATING AND GUARDRAILS SHALL BE HOT DIP GALVANISED IN ACCORDANCE WITH AS4680 AFTER FABRICATION.

S30. HOT-DIP GALVANISED COATING SHALL BE REINSTATED IN ACCORDANCE WITH AS/NZS 4680 AND AS/NZS 2312.2.
THE REPAIRED SURFACES SHALL THEN BE OVERSPRAYED WITH AN ALUMINIUM PIGMENTED ('SILVER') TOPCOAT.

S31. INORGANIC ZINC SILICATE COATING SHALL BE REINSTATED TO A MINIMUM DRY FILM THICKNESS OF 100 MICRONS BY THE APPLICATION OF AN AUSTRALIAN PAINT APPROVAL SCHEME APPROVED ORGANIC ZINC RICH COATING OVER A CLEAN SURFACE APPLIED IN ACCORDANCE WITH THE COATING MANUFACTURER'S RECOMMENDATIONS.

S32. IN ADDITION TO THE FINISH SPECIFIED, GALVANISED STEELWORK IN CONTACT WITH THE GROUND SHOULD BE PAINTED USING A 2-PACK ZINC PHOSPHATE PRIMER TO 50 MICRONS AND 2-PACK EPOXY TOP COAT(S) TO 250 MICRONS IN ACCORDANCE WITH REQUIREMENTS OF AS/NZS 4680.

S33. FLOOR GRATING TO HAVE EDGE TRIMMING BARS ALL ROUND UNO. SECURE GRATINGS TO STEELWORK WITH PROPRIETARY CLAMPING SYSTEM INSTALLED IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS.

S34. ENSURE METAL DECKING, FLOOR PLATE AND FLOOR GRATING IS SECURELY FIXED IN POSITION BEFORE ALLOWING GENERAL CONSTRUCTION ACCESS.

S35. PURLINS AND GIRTS TO BE CONNECTED USING AN 8PL CLEAT WITH 2-M12 BOLTS U.N.O.

S36. ALL GUARDRAILS ARE TO BE FITTED WITH TOE BOARDS (100x6FL OR EQUIVALENT) U.N.O.

S37. GUARDRAIL BALL JOINTS SHALL BE FULLY SEAL WELDED ALL ROUND.

S38. GUARDRAILS SHALL BE CONTINUOUS UNLESS SHOWN OTHERWISE ON THE DESIGN DRAWINGS, MODULAR UNITS ARE NOT TO BE INSTALLED UNLESS APPROVED BY THE CLIENT'S REPRESENTATIVE.

S39. DISSIMILAR METALS (ie MILD STEEL AND STAINLESS STEEL) SHALL BE ELECTRICALLY ISOLATED USING SUITABLE PLASTIC SLEEVES AND/OR WASHERS.

MASONRY

M1. BRICKWORK TO COMPLY WITH AS 3700 MASONRY CODE.

M2. BRICKWORK TO BE LAID IN M4 MORTAR UNLESS NOTED OTHERWISE.

M3. BRICKS ARE TO BE CUT USING A MASONRY SAW.

M4. CHASING OF WALLS IS NOT PERMITTED WITHOUT THE PRIOR APPROVAL OF THE CLIENT'S REPRESENTATIVE.

M5. BRICKWORK SHALL BE 230x110x76 NOMINAL SIZE, SOUND, HARD, WELL BURNT AND TRUE TO SHAPE AND DIMENSIONS AND SHALL BE OF 'EXPOSURE' DURABILITY CLASS IN ACCORDANCE WITH AS4455.

M6. BRICKWORK SHALL BE SOLID AND HAVE A MINIMUM COMPRESSIVE STRENGTH OF 20 MPa IN ACCORDANCE WITH AS4455.

PRELIMINARY

No	Revision	Drawn	Job Manager	Project Director	Date
B	RE-ISSUED FOR 90% DESIGN - CLIENT COMMENT	LR	JM*	PS*	20/11/20
A	ISSUED FOR 90% DESIGN - CLIENT COMMENT	LR	JM*	PS*	30/09/20

Note: * indicates signatures on original issue of drawing or last revision of drawing

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DO NOT SCALE

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Approved (Project Director)
Date
Scale N/A
This Drawing must not be used for Construction unless signed as Approved

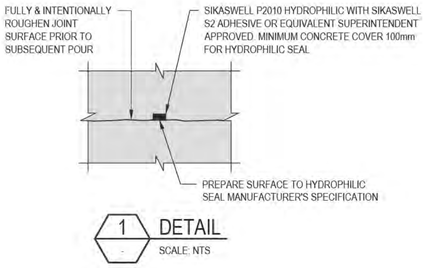
Client: DEPT OF INFRASTRUCTURE, TRANSPORT, REGIONAL DEVELOPMENT & COMMUNICATIONS
Project: CHRISTMAS ISLAND STORMWATER REMEDIAL WORKS
Title: STRUCTURAL NOTES

Original Size A1 Drawing No: 61-35637-S002 Rev: B

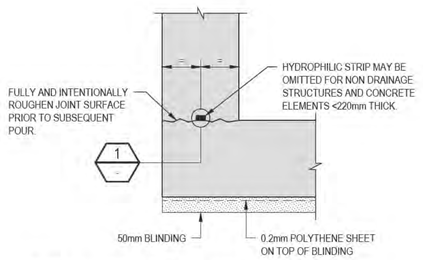
Plot Date: 19 November 2020 - 12:59 PM Plotted by: Luke Radici Cad File No: \\ghdnet.internal\ghd\AU\Perth\Projects\61\35637\CADD\Drawings\61-35637-S002.dwg

NOTES:

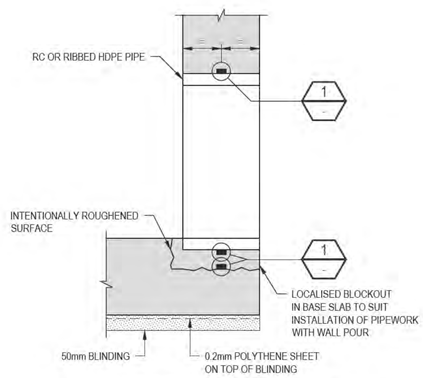
1. REFER DRG 61-35637-S002 FOR GENERAL STRUCTURAL NOTES.
2. REFER DRGs 61-35637-C210 AND C220 FOR HEADWALL LOCATIONS.
3. REFER DRG 61-35637-C290 FOR HEADWALL DIMENSIONS.
4. EACH GRATE IS TO BE SUPPLIED WITH 2 x 0.5m LONG GALVANISED 8mm CHAINS WITH MASTER LOCK 1174D PRO SERIES COMBINATION OR EQUIVALENT TO SECURE THE GRATE TO THE SUPPORT MEMBER TO PREVENT ACCESS BY THE PUBLIC.



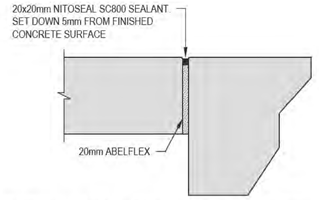
1 DETAIL
SCALE: NTS



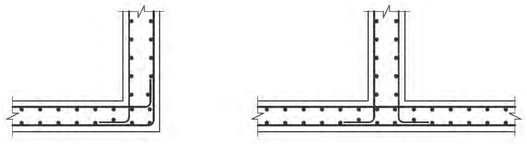
TYPICAL CONSTRUCTION JOINT DETAIL
SCALE 1:10



TYPICAL PIPE PENETRATION DETAIL
SCALE 1:10

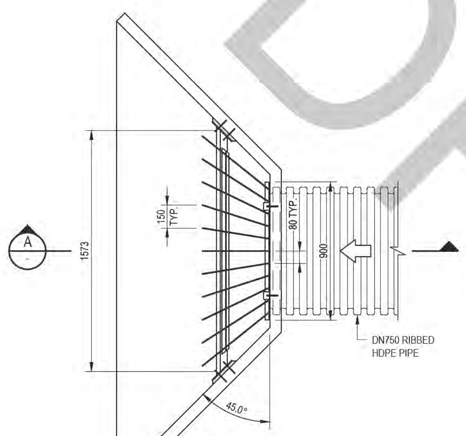


TYPICAL ISOLATION JOINT (IJ) DETAIL
SCALE 1:10

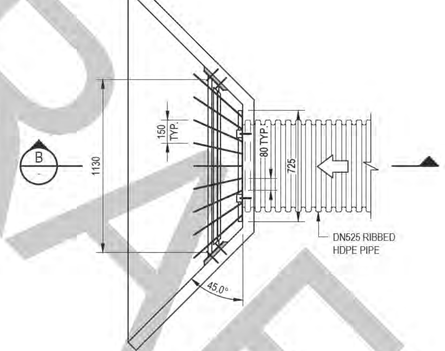


TYPICAL HORIZONTAL REINFORCEMENT DETAILS
SCALE 1:25

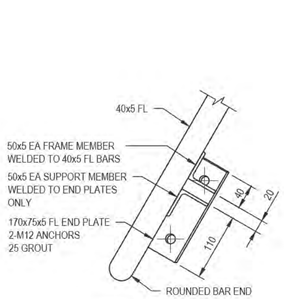
ALTERNATIVE HORIZONTAL REINFORCEMENT DETAILS
SCALE 1:25



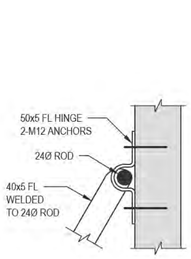
HEADWALL N16-2 PLAN
SCALE 1:20



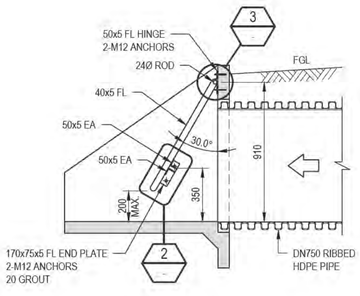
HEADWALL S01-8 PLAN
SCALE 1:20



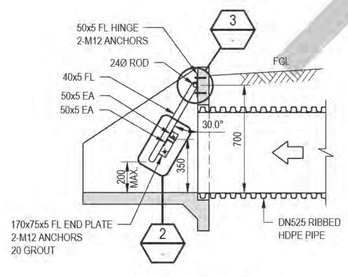
2 DETAIL
SCALE 1 : 5



3 DETAIL
SCALE 1 : 5



A SECTION
SCALE 1 : 20



B SECTION
SCALE 1 : 20

0 0.05 0.10 0.15 0.20 0.25m
SCALE 1:5 AT ORIGINAL SIZE

0 0.2 0.4 0.6 0.8 1.0m
SCALE 1:20 AT ORIGINAL SIZE

0 0.1 0.2 0.3 0.4 0.5m
SCALE 1:10 AT ORIGINAL SIZE

0 0.25 0.5 0.75 1.0 1.25m
SCALE 1:25 AT ORIGINAL SIZE

PRELIMINARY

No	Revision	Note: * indicates signatures on original issue of drawing or last revision of drawing	Drawn	Job Manager	Project Director	Date
B	RE-ISSUED FOR 90% DESIGN - CLIENT COMMENT		LR	JM*	PS*	20/11/20
A	ISSUED FOR 90% DESIGN - CLIENT COMMENT		LR	JM*	PS*	30/09/20

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Drawn	L.RADICI	Designer	P.HULCUP
Drafting Check	L.ORREAL*	Design Check	E.BOSUSTOW*
Approved (Project Director)			
Date			
Scale	AS SHOWN	This Drawing must not be used for Construction unless signed as Approved.	

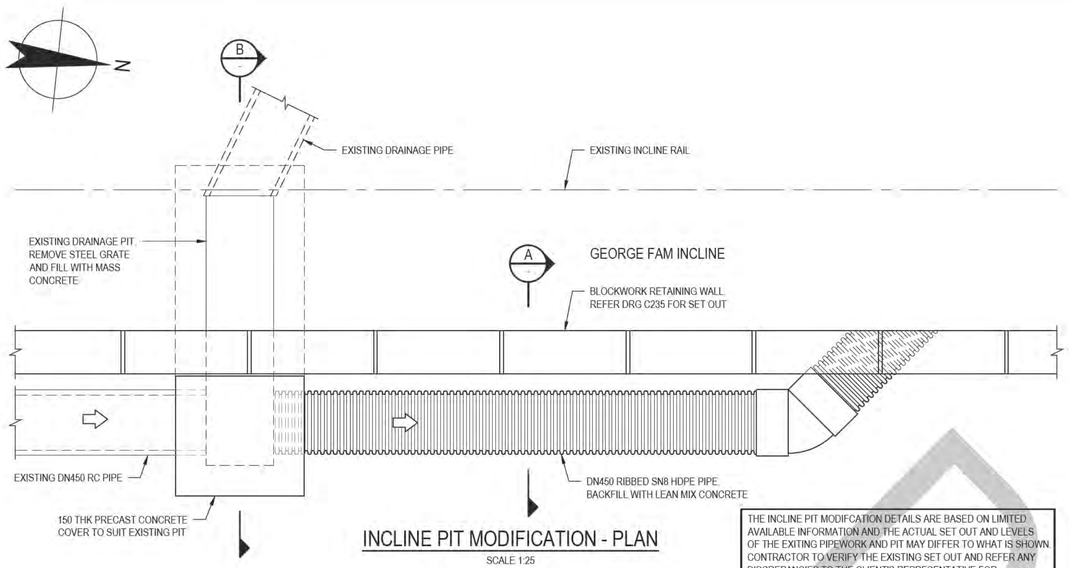
Client: DEPT OF INFRASTRUCTURE, TRANSPORT, REGIONAL DEVELOPMENT & COMMUNICATIONS
Project: CHRISTMAS ISLAND STORMWATER REMEDIAL WORKS
Title: TYPICAL STRUCTURAL & HEADWALL GRATE DETAILS

Original Size: A1
Drawing No: 61-35637-S003
Rev: B

Plot Date: 19 November 2020 - 1:00 PM Plotted by: Luke Radici Cad File No: \\ghdnet.internal\ghd\AU\Perth\Projects\61\35637\CADD\Drawings\61-35637-S003.dwg

NOTES:

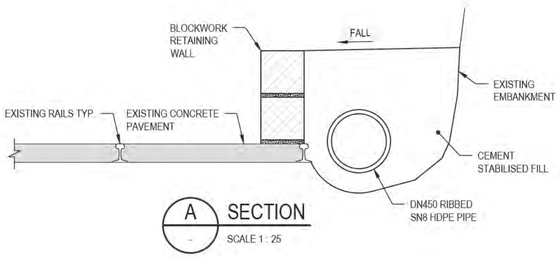
1. REFER DRG 61-35637-S002 FOR GENERAL STRUCTURAL NOTES.
2. REFER DRG 61-35637-S003 FOR TYPICAL STRUCTURAL DETAILS.
3. REFER DRGs 61-35637-C210 AND C235 FOR LOCATION AND SET OUT.
4. BLOCKWORK RETAINING WALLS TO BE CONSTRUCTED FROM NOMINAL 350mm x 350mm x 1000mm LIMESTONE BLOCKS.
5. BLOCKS TO HAVE A MINIMUM DENSITY OF 1800kg/m^3 (DRY).
6. BLOCKWORK TO BE LAID IN M3 MORTAR WITH A MAXIMUM JOINT THICKNESS OF 30mm.
7. PROVIDE CONTROL JOINTS IN THE BLOCKWORK WALL AT MAXIMUM 20m SPACING AND AT CHANGES OF WALL HEIGHT/CROSS SECTION (ie PIPE PENETRATION)



INCLINE PIT MODIFICATION - PLAN

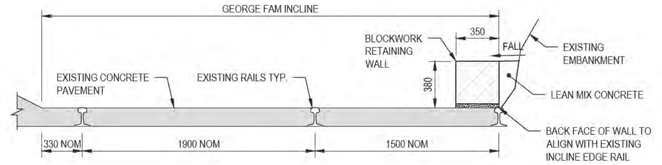
SCALE 1:25

THE INCLINE PIT MODIFCATION DETAILS ARE BASED ON LIMITED AVAILABLE INFORMATION AND THE ACTUAL SET OUT AND LEVELS OF THE EXITING PIPEWORK AND PIT MAY DIFFER TO WHAT IS SHOWN. CONTRACTOR TO VERIFY THE EXISTING SET OUT AND REFER ANY DISCREPANCIES TO THE CLIENT'S REPRESENTATIVE FOR RESOLUTION BEFORE PROCEEDING WITH THE AFFECTED WORK.



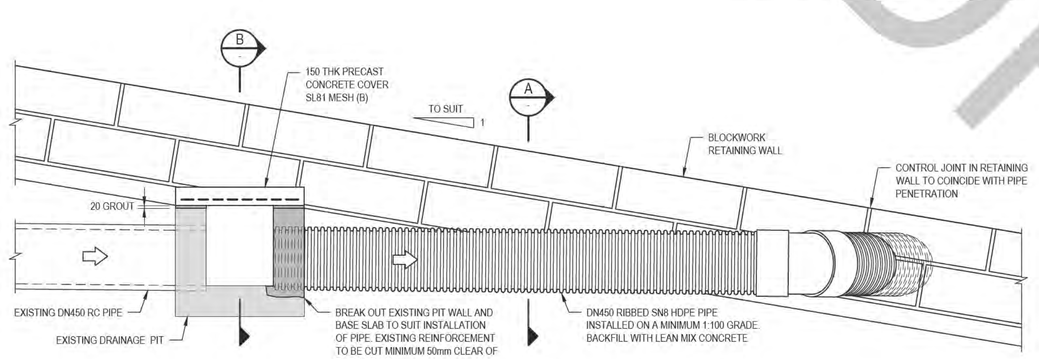
A SECTION

SCALE 1 : 25



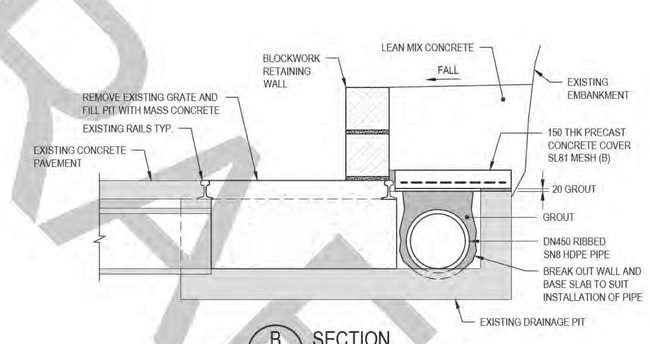
BLOCKWORK RETAINING WALL - TYPE 1

SCALE 1:25



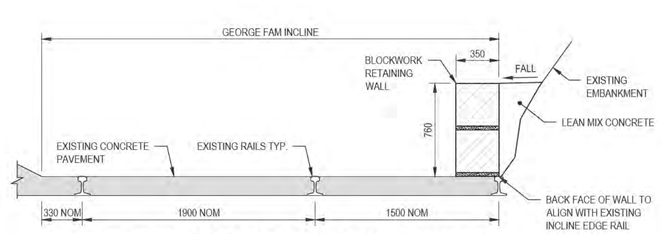
INCLINE PIT MODIFICATION - ELEVATION

SCALE 1:25



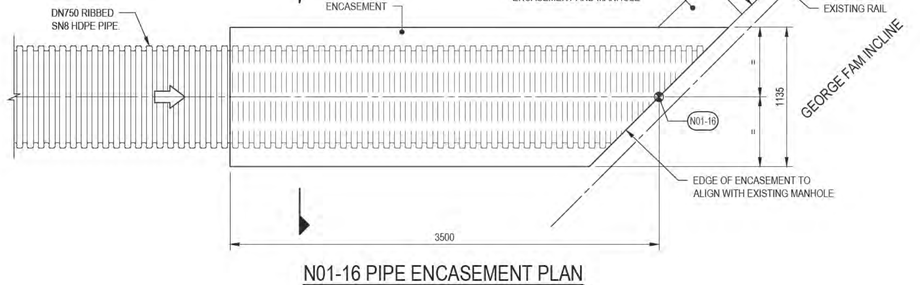
B SECTION

SCALE 1 : 25



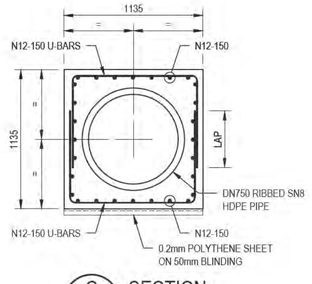
BLOCKWORK RETAINING WALL - TYPE 2

SCALE 1:25



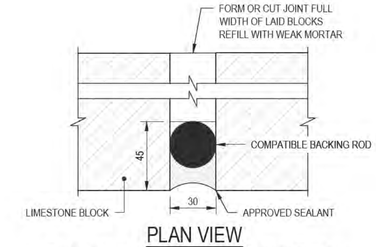
N01-16 PIPE ENCASEMENT PLAN

SCALE 1:25



C SECTION

SCALE 1 : 25



PLAN VIEW
BLOCK WALL CONTROL JOINT (CJ)

SCALE 1:2

0 20 40 60 80 100mm
SCALE 1:2 AT ORIGINAL SIZE

0 250 500 750 1000 1250mm
SCALE 1:25 AT ORIGINAL SIZE

PRELIMINARY

No	Revision	Drawn	Job Manager	Project Director	Date
B	RE-ISSUED FOR 90% DESIGN - CLIENT COMMENT	LR	JM*	PS*	20/11/20
A	ISSUED FOR 90% DESIGN - CLIENT COMMENT	LR	JM*	PS*	30/09/20

Note: * indicates signatures on original issue of drawing or last revision of drawing

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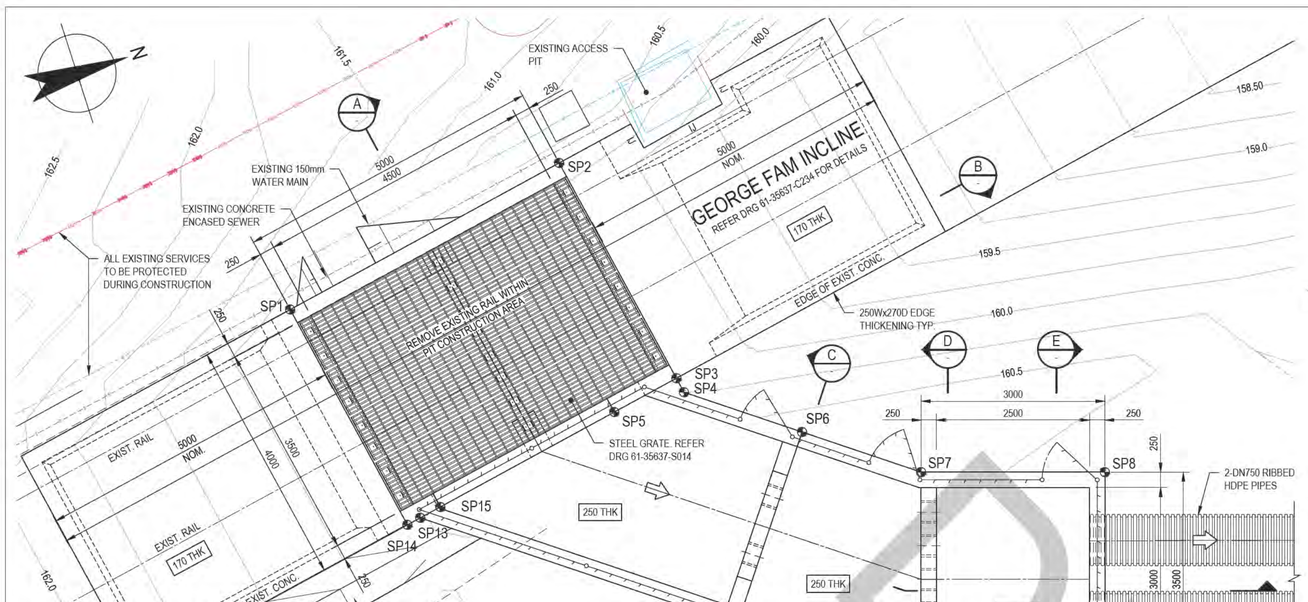
DO NOT SCALE

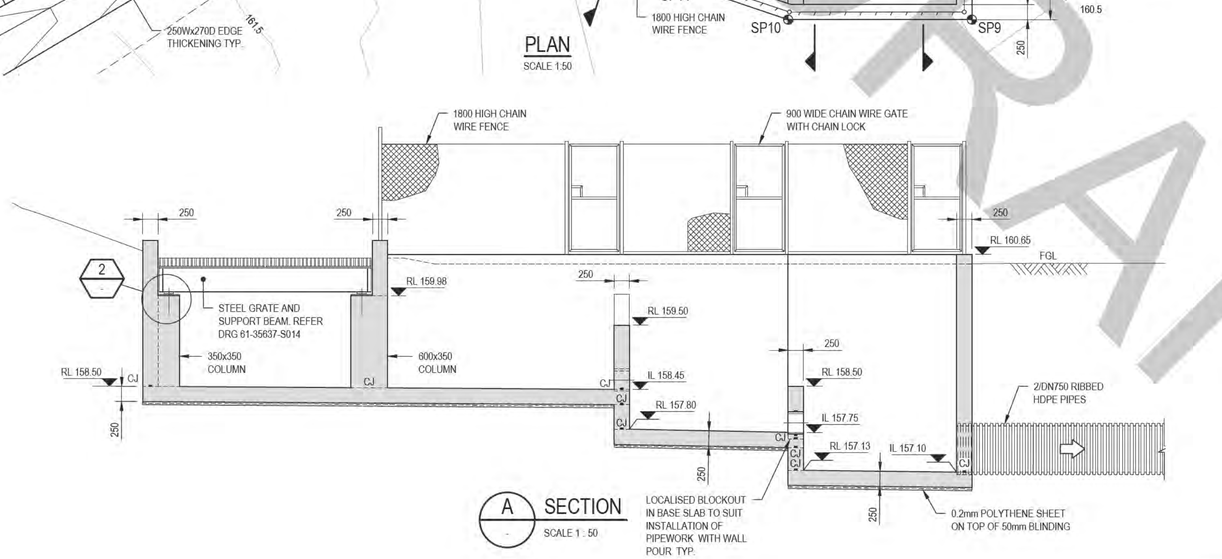
Drawn	L.RADICI	Designer	P.HULCUP
Drafting Check	L.ORREAL*	Design Check	E.BOSUSTOW*
Approved (Project Director)			
Date			
Scale	AS SHOWN	This Drawing must not be used for Construction unless signed as Approved	

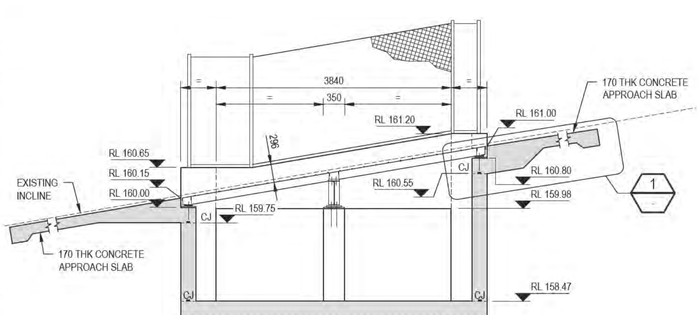
Client: DEPT OF INFRASTRUCTURE, TRANSPORT, REGIONAL DEVELOPMENT & COMMUNICATIONS
Project: CHRISTMAS ISLAND STORMWATER REMEDIAL WORKS
Title: NORTHERN DRUMSITE WORKS
INCLINE MISCELLANEOUS STRUCTURES - PLANS & DETAILS

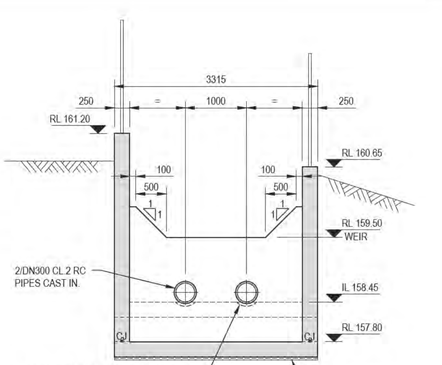
Original Size: A1
Drawing No: 61-35637-S005
Rev: B

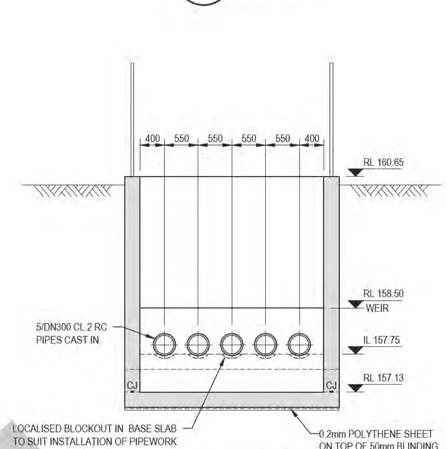
Plot Date: 19 November 2020 - 1:00 PM Plotted by: Luke Radici
Cad File No: \\ghdnet.internal\ghd\AU\Perth\Projects\61\35637\CADD\Drawings\61-35637-S005.dwg

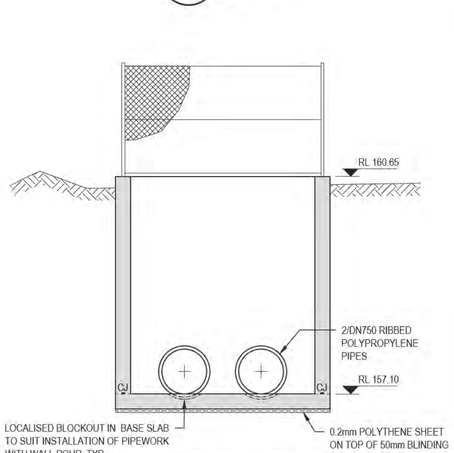


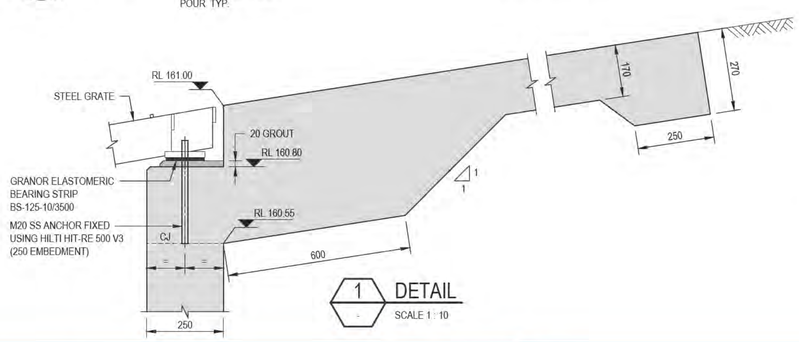


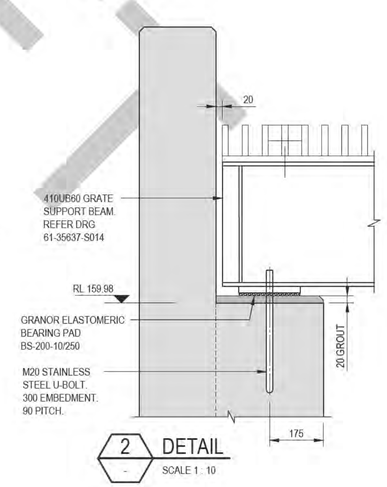












THIS DRAWING IS TO BE PRINTED IN COLOUR

NOTES:

1. REFER DRGs 61-35637-C210, C233 AND C234 FOR PIT LOCATION AND LEGEND.
2. EXISTING SERVICES LOCATIONS ARE INDICATIVE ONLY. CONTRACTOR TO CONFIRM LOCATION, SIZE AND LEVEL PRIOR TO COMMENCING CONSTRUCTION, SHOULD ANY CLASHES BE IDENTIFIED WITH PROPOSED WORKS THE CONTRACTOR IS TO IMMEDIATELY NOTIFY THE CLIENT'S REPRESENTATIVE.
3. EXISTING COMMUNICATIONS INFORMATION IS INCOMPLETE. VERIFICATION OF PRESENCE THROUGHOUT SITE REQUIRED PRIOR TO COMMENCING CONSTRUCTION.
4. REFER DRG 61-35637-S002 FOR GENERAL STRUCTURAL NOTES.
5. REFER DRG 61-35637-S003 FOR TYPICAL STRUCTURAL DETAILS.
6. REFER DRGs 61-35637-S011, S012 AND S013 FOR REINFORCEMENT DETAILS.
7. REFER DRG 61-35637-S014 FOR STEELWORK DETAILS.
8. BEDDING MATERIAL, FOUNDATION COMPACTION AND BACKFILL COMPACTION TO BE AS PER SPECIFICATION.
9. THE DRAINAGE GRATE IS TRAFFICABLE AND HAS BEEN DESIGNED FOR W80 WHEEL LOAD, A160 AXLE LOAD AND M1600 MOVING TRAFFIC LOAD IN ACCORDANCE WITH AS 5100.2.
10. THE PIT WALLS HAVE BEEN DESIGNED FOR VEHICLE SURCHARGE LOADING IN ACCORDANCE WITH CL14.2 OF AS 5100.2. 'HIGHWAY TRAFFIC' VEHICLES MAY BE OPERATED UP TO THE BACK OF THE WALLS.

SETOUT

POINT	EASTING (m)	NORTHING (m)	RL TOP OF WALL
SP1	573968.511	8847282.466	161.30
SP2	573967.577	8847287.378	160.45
SP3	573971.507	8847288.125	160.65
SP4	573971.763	8847288.174	160.65
SP5	573971.722	8847286.992	160.65
SP6	573972.970	8847289.810	160.65
SP7	573974.188	8847291.459	160.65
SP8	573975.105	8847294.316	160.65
SP9	573978.438	8847293.245	160.65
SP10	573977.520	8847290.389	160.65
SP11	573976.287	8847288.718	160.65
SP12	573975.639	8847287.840	161.20
SP13	573972.396	8847283.447	161.20
SP14	573972.441	8847283.213	161.20
SP15	573972.328	8847283.814	161.20

0 0.5 1.0 1.5 2.0 2.5m
SCALE 1:50 AT ORIGINAL SIZE

0 0.1 0.2 0.3 0.4 0.5m
SCALE 1:10 AT ORIGINAL SIZE

PRELIMINARY

No	Revision	Note: * indicates signatures on original issue of drawing or last revision of drawing	Drawn	Job Manager	Project Director	Date
B	RE-ISSUED FOR 90% DESIGN - CLIENT COMMENT		LR	JM*	PS*	20/11/20
A	ISSUED FOR 90% DESIGN - CLIENT COMMENT		LR	JM*	PS*	30/09/20

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DO NOT SCALE

Drawn	L.RADICI	Designer	P.HULCUP
Drafting Check	L.ORREAL*	Design Check	E.BOSUSTOW*
Approved (Project Director)			
Date			
Scale	AS SHOWN	This Drawing must not be used for Construction unless signed as Approved	

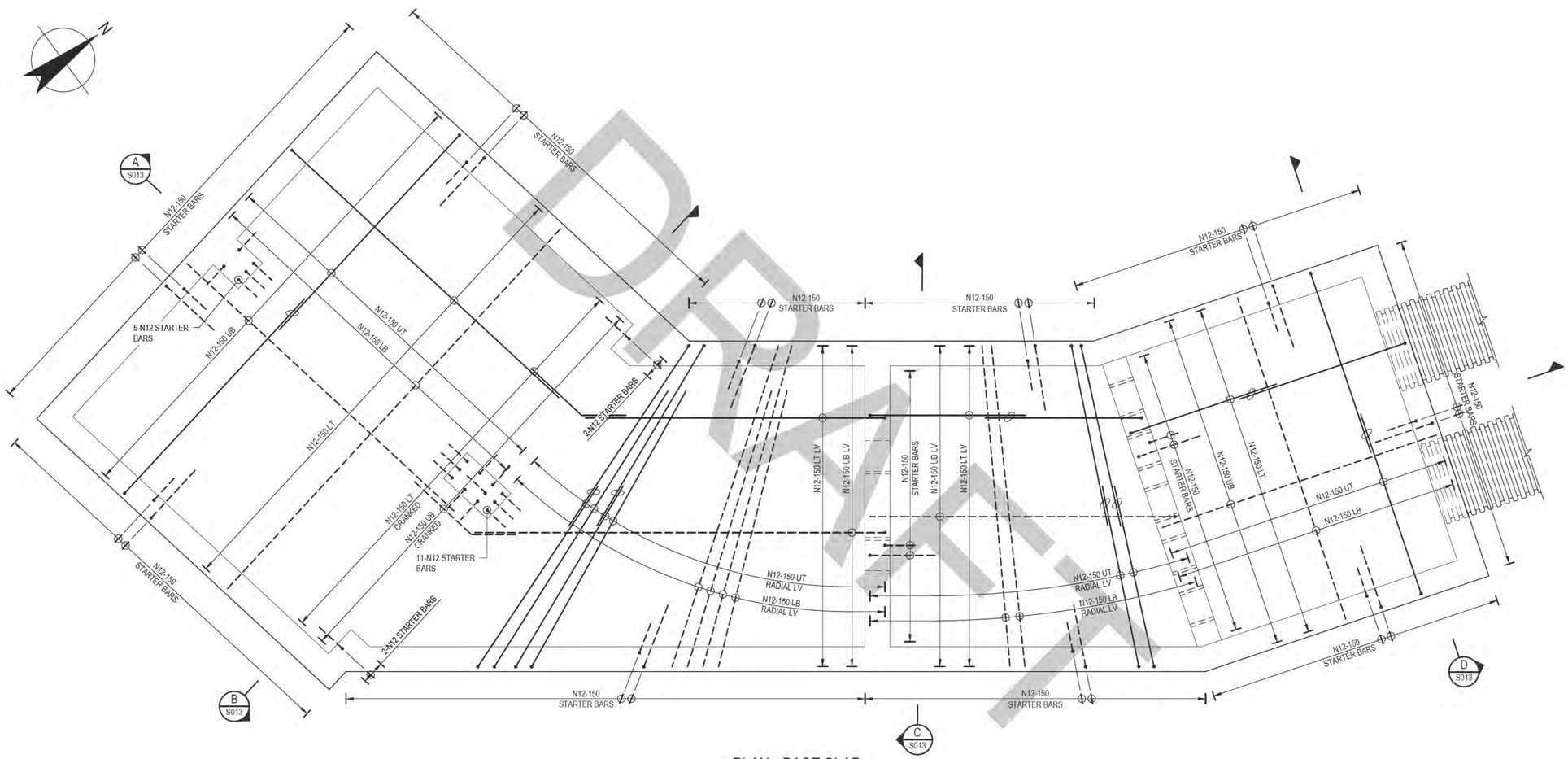
Client: DEPT OF INFRASTRUCTURE, TRANSPORT, REGIONAL DEVELOPMENT & COMMUNICATIONS
Project: CHRISTMAS ISLAND STORMWATER REMEDIAL WORKS
Title: NORTHERN DRUMSITE WORKS
INCLINE DIVERSION PIT & CHANNEL - GENERAL ARRANGEMENT

Original Size: A1
Drawing No: 61-35637-S010
Rev: B

Plot Date: 19 November 2020 - 1:01 PM Plotted by: Luke Radici Cad File No: \\ghdnet.internal\ghd\AU\Perth\Projects\61\35637\CADD\Drawings\61-35637-S010.dwg

NOTES:

1. REFER DRGs 61-35637-C210, C233 AND C234 FOR PIT LOCATION.
2. REFER DRG 61-35637-S002 FOR GENERAL STRUCTURAL NOTES.
3. REFER DRG 61-35637-S003 FOR TYPICAL STRUCTURAL DETAILS.
4. REFER DRG 61-35637-S010 FOR GENERAL ARRANGEMENT.
5. REFER DRG 61-35637-S012 FOR REINFORCEMENT DETAILS SHEET 2 OF 3.
6. REFER DRG 61-35637-S013 FOR REINFORCEMENT DETAILS SHEET 3 OF 3.
7. REFER DRG 61-35637-S014 FOR STEELWORK DETAILS.



PLAN - BASE SLAB

SCALE 1:25

0 0.25 0.5 0.75 1.0 1.25m

SCALE 1:25 AT ORIGINAL SIZE

PRELIMINARY

No	Revision	Note: * indicates signatures on original issue of drawing or last revision of drawing	Drawn	Job Manager	Project Director	Date
A	ISSUED FOR 90□ DESIGN - CLIENT COMMENT		LR	JM*	PS*	30/09/20

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Department of Infrastructure, Transport, Regional Development and Communications

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Drawn	L.RADICI	Designer	P.HULCUP
Drafting Check	L.ORREAL*	Design Check	E.BOSUSTOW*
Approved (Project Director)			
Date			
Scale	1:25	This Drawing must not be used for Construction unless signed as Approved	

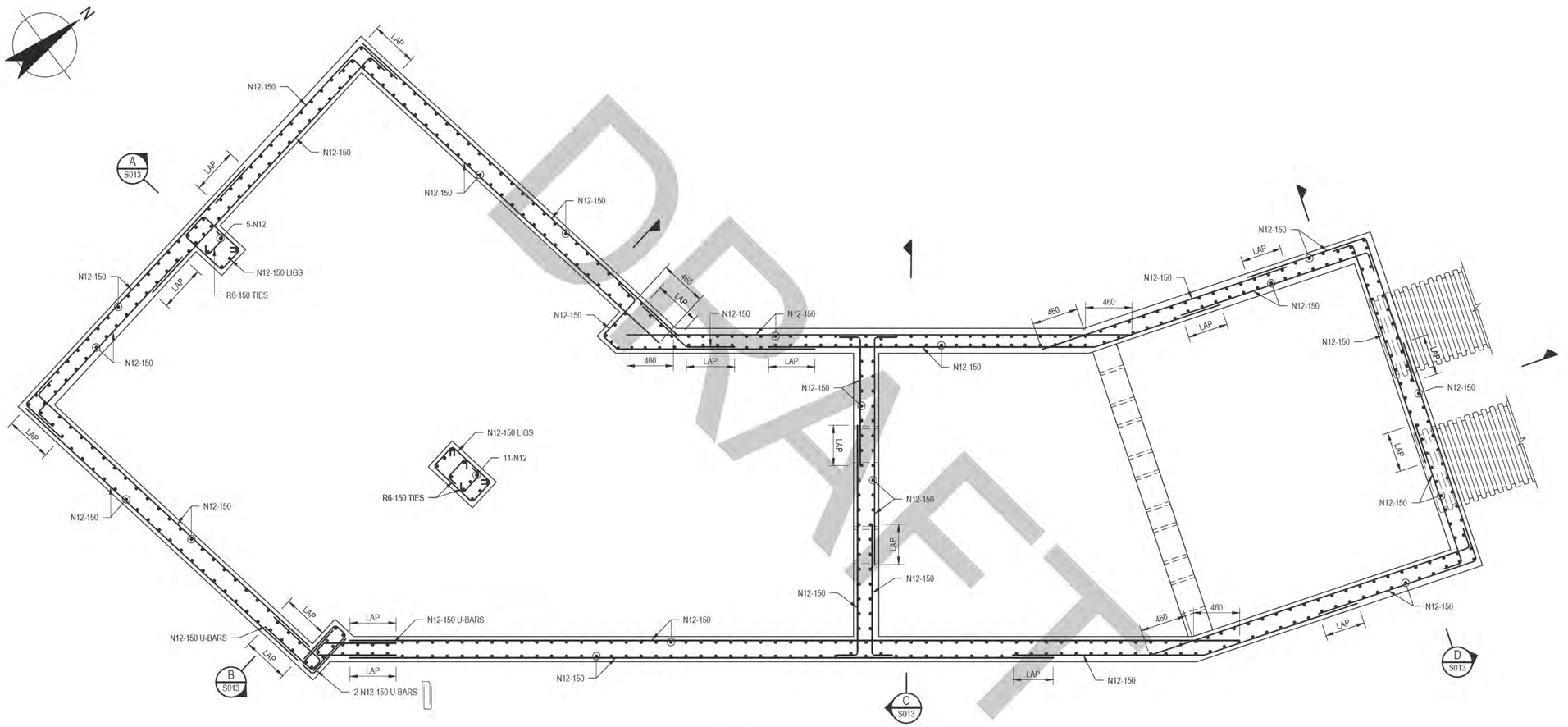
Client: DEPT OF INFRASTRUCTURE, TRANSPORT, REGIONAL DEVELOPMENT & COMMUNICATIONS
Project: CHRISTMAS ISLAND STORMWATER REMEDIAL WORKS
Title: NORTHERN DRUMSITE WORKS
INCLINE DIVERSION PIT & CHANNEL - REINF. DETAILS SHEET 1 OF 3

Original Size A1 | Drawing No: 61-35637-S011 | Rev: A

Plot Date: 1 October 2020 - 1:31 PM | Plotted by: Luke Radici | Cad File No: \\ghdnet.internal\ghd\AU\Perth\Projects\61\35637\CADD\Drawings\61-35637-S011.dwg

NOTES:

1. REFER DRGs 61-35637-C210, C233 AND C234 FOR PIT LOCATION.
2. REFER DRG 61-35637-S002 FOR GENERAL STRUCTURAL NOTES.
3. REFER DRG 61-35637-S003 FOR TYPICAL STRUCTURAL DETAILS.
4. REFER DRG 61-35637-S010 FOR GENERAL ARRANGEMENT.
5. REFER DRG 61-35637-S011 FOR REINFORCEMENT DETAILS SHEET 1 OF 3.
6. REFER DRG 61-35637-S013 FOR REINFORCEMENT DETAILS SHEET 3 OF 3.
7. REFER DRG 61-35637-S014 FOR STEELWORK DETAILS.



PLAN - WALLS AT RL 159.00

SCALE 1:25

0 0.25 0.5 0.75 1.0 1.25m

SCALE 1:25 AT ORIGINAL SIZE

PRELIMINARY

No	Revision	Note: * indicates signatures on original issue of drawing or last revision of drawing	Drawn	Job Manager	Project Director	Date
A	ISSUED FOR 90□ DESIGN - CLIENT COMMENT		LR	JM*	PS*	30/09/20

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Drawn	L.RADICI	Designer	P.HULCUP
Drafting Check	L.ORREAL*	Design Check	E.BOSUSTOW*
Approved (Project Director)			
Date			
Scale	1:25	This Drawing must not be used for Construction unless signed as Approved	

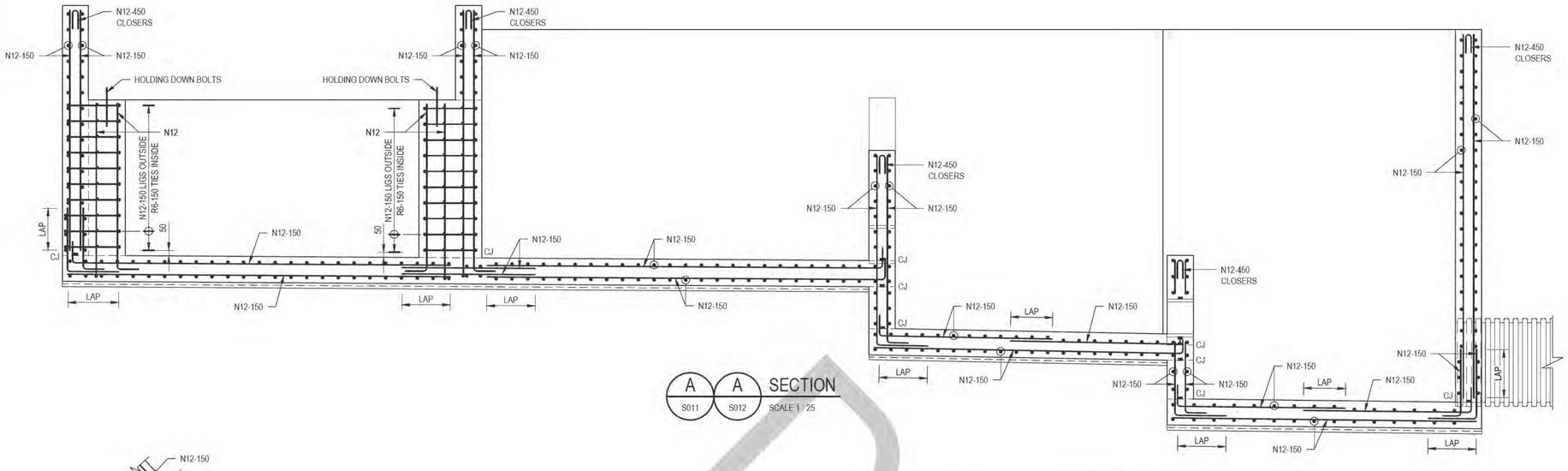
Client: DEPT OF INFRASTRUCTURE, TRANSPORT, REGIONAL DEVELOPMENT & COMMUNICATIONS
Project: CHRISTMAS ISLAND STORMWATER REMEDIAL WORKS
Title: NORTHERN DRUMSITE WORKS
INCLINE DIVERSION PIT & CHANNEL - REINF. DETAILS SHEET 2 OF 3

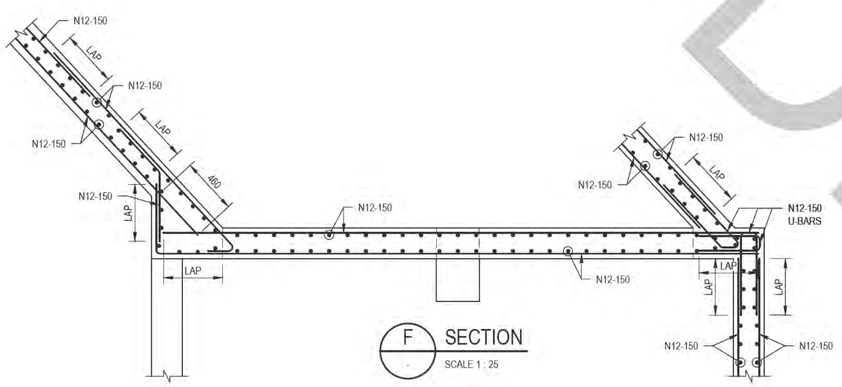
Original Size A1 | Drawing No: 61-35637-S012 | Rev: A

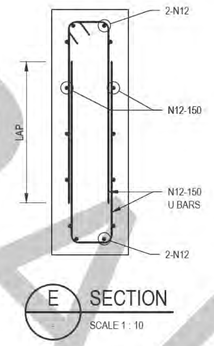
Plot Date: 1 October 2020 - 1:31 PM | Plotted by: Luke Radici | Cad File No: \\ghdnet.internal\ghd\AU\Perth\Projects\61\35637\CADD\Drawings\61-35637-S012.dwg

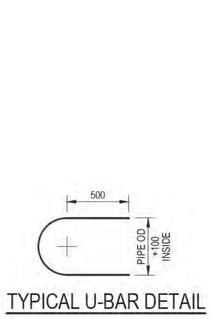
NOTES:

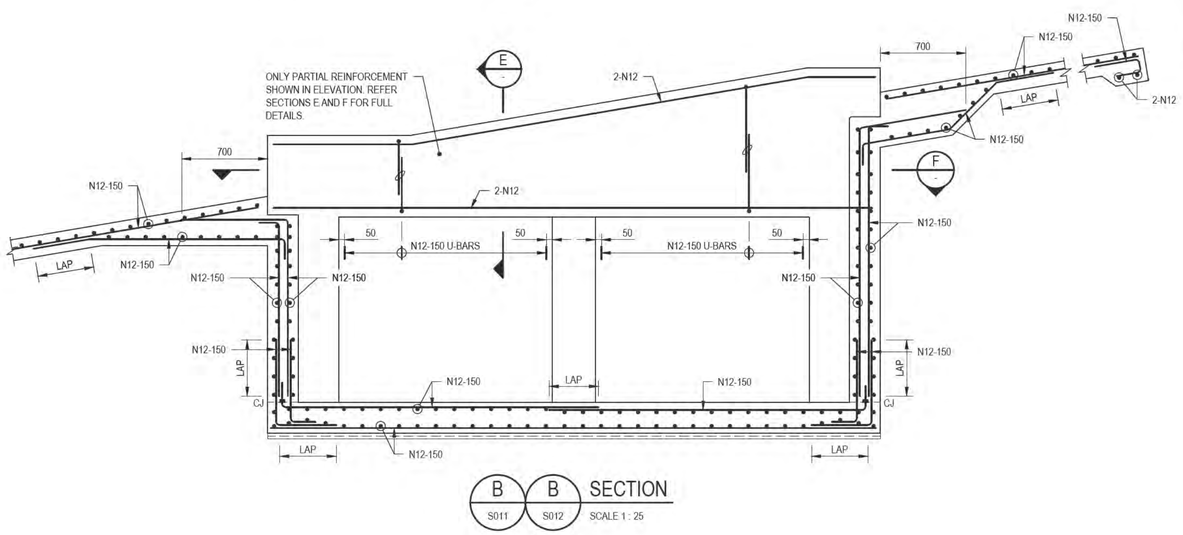
1. REFER DRGs 61-35637-C210, C233 AND C234 FOR PIT LOCATION.
2. REFER DRG 61-35637-S002 FOR GENERAL STRUCTURAL NOTES.
3. REFER DRG 61-35637-S003 FOR TYPICAL STRUCTURAL DETAILS.
4. REFER DRG 61-35637-S010 FOR GENERAL ARRANGEMENT.
5. REFER DRG 61-35637-S011 FOR REINFORCEMENT DETAILS SHEET 1 OF 3.
6. REFER DRG 61-35637-S012 FOR REINFORCEMENT DETAILS SHEET 2 OF 3.
7. REFER DRG 61-35637-S014 FOR STEELWORK DETAILS.

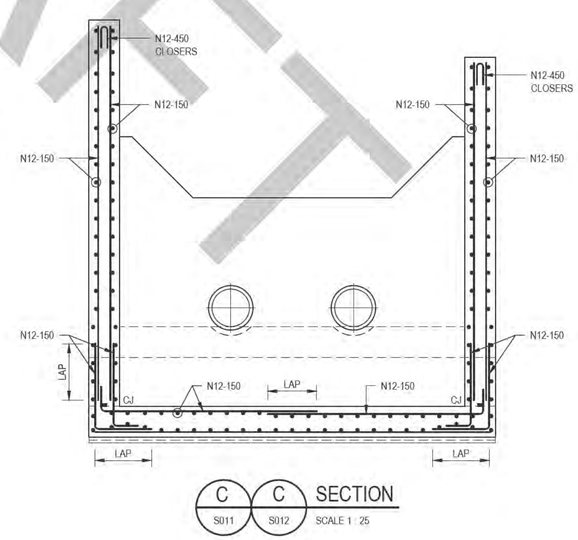


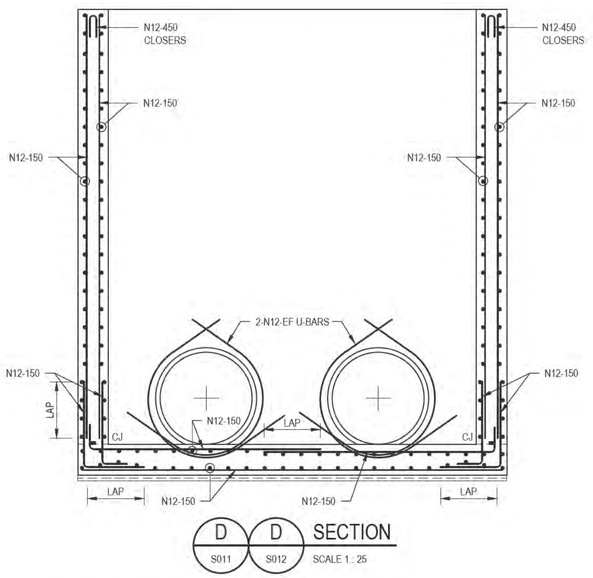












0 0.25 0.5 0.75 1.0 1.25m — SCALE 1:25 AT ORIGINAL SIZE

0 0.1 0.2 0.3 0.4 0.5m — SCALE 1:10 AT ORIGINAL SIZE

PRELIMINARY

No	Revision	Drawn	Job Manager	Project Director	Date
A	ISSUED FOR 90□ DESIGN - CLIENT COMMENT	LR	JM*	PS*	30/09/20

Note: * indicates signatures on original issue of drawing or last revision of drawing

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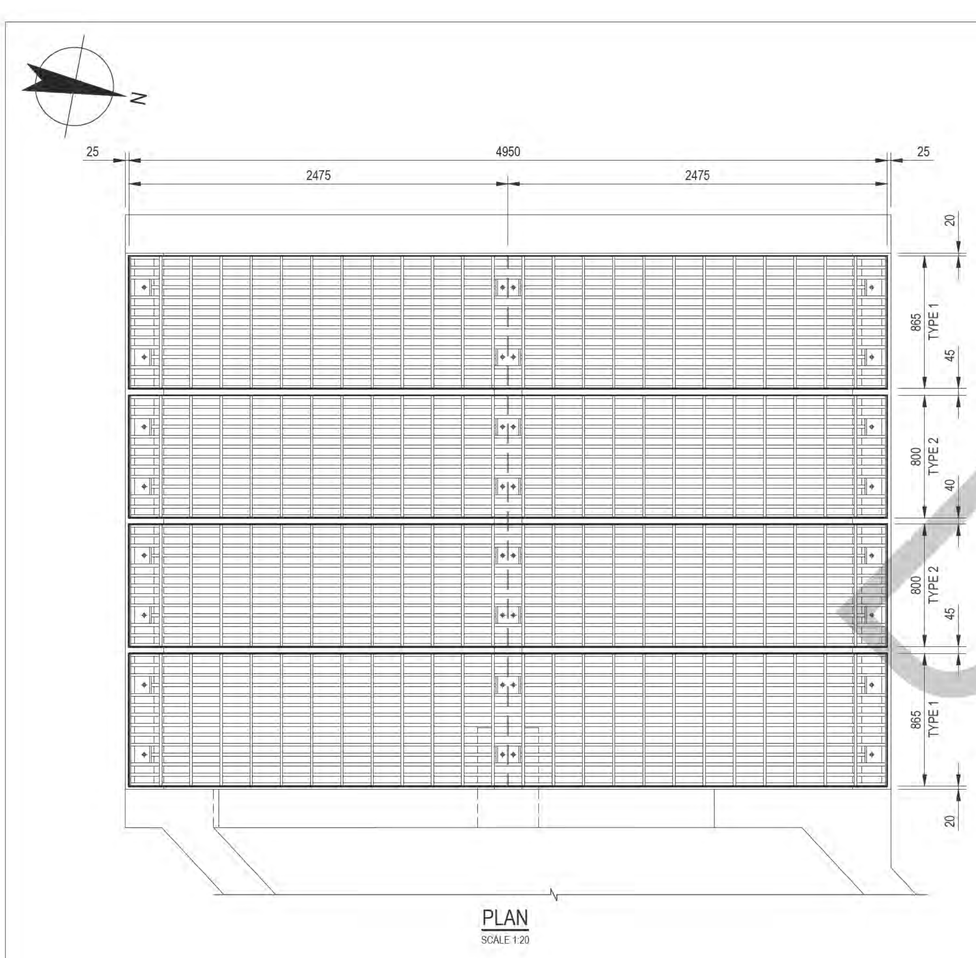
DO NOT SCALE

Drawn	L.RADICI	Designer	P.HULCUP
Drafting Check	L.ORREAL*	Design Check	E.BOSUSTOW*
Approved (Project Director)			
Date			
Scale	AS SHOWN	This Drawing must not be used for Construction unless signed as Approved	

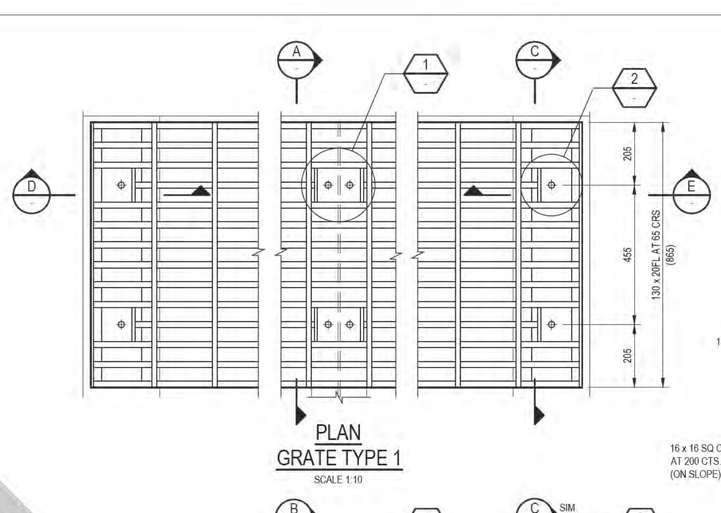
Client: DEPT OF INFRASTRUCTURE, TRANSPORT, REGIONAL DEVELOPMENT & COMMUNICATIONS
Project: CHRISTMAS ISLAND STORMWATER REMEDIAL WORKS
Title: NORTHERN DRUMSITE WORKS
INCLINE DIVERSION PIT & CHANNEL - REINF. DETAILS SHEET 3 OF 3

Original Size: A1
Drawing No: 61-35637-S013
Rev: A

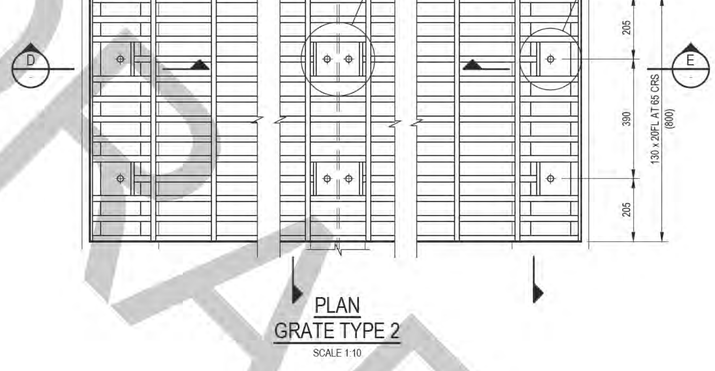
Plot Date: 30 September 2020 - 9:06 AM Plotted by: Luke Radici
Cad File No: \\ghdnet.internal\ghd\AU\Perth\Projects\61\35637\CADD\Drawings\61-35637-S013.dwg



PLAN
SCALE 1:20



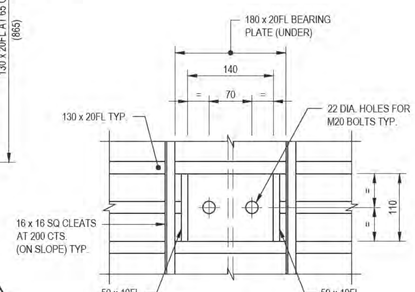
PLAN
GRATE TYPE 1
SCALE 1:10



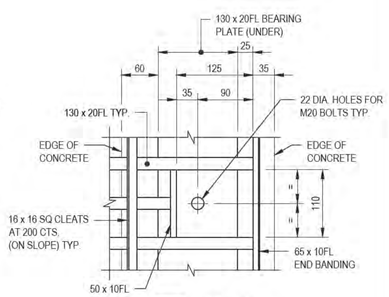
PLAN
GRATE TYPE 2
SCALE 1:10

NOTES:

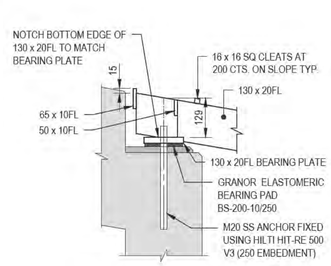
1. REFER DRGs 61-35637-C210, C233 AND C234 FOR PIT LOCATION.
2. REFER DRG 61-35637-S002 FOR GENERAL STRUCTURAL NOTES.
3. REFER DRG 61-35637-S003 FOR TYPICAL STRUCTURAL DETAILS.
4. REFER DRG 61-35637-S010 FOR GENERAL ARRANGEMENT.
5. REFER DRG 61-35637-S011 FOR REINFORCEMENT DETAILS SHEET 1 OF 3.
6. REFER DRG 61-35637-S012 FOR REINFORCEMENT DETAILS SHEET 2 OF 3.
7. REFER DRG 61-35637-S013 FOR REINFORCEMENT DETAILS SHEET 3 OF 3.
8. FLAT BAR SHALL BE GRADE 300 TO AS3679.1.
9. DISSIMILAR METALS (ie MILD STEEL AND STAINLESS STEEL) SHALL BE ELECTRICALLY ISOLATED USING SUITABLE PLASTIC SLEEVES AND/OR WASHERS.



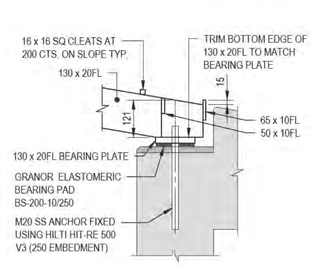
1 DETAIL
SCALE 1 : 5



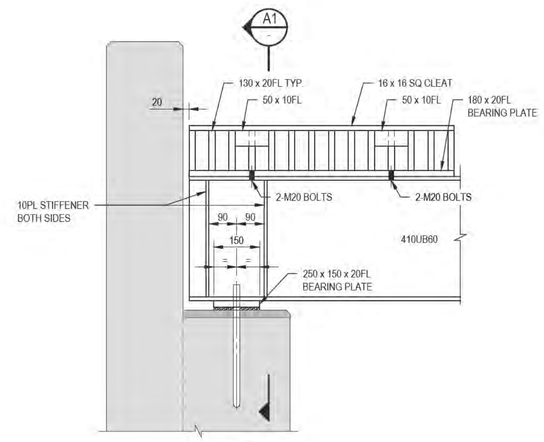
2 DETAIL
SCALE 1 : 5



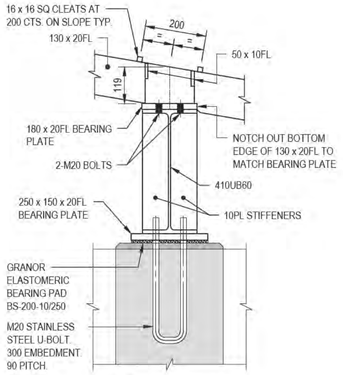
D SECTION
SCALE 1 : 10



E SECTION
SCALE 1 : 10



A SECTION
SCALE 1 : 10



A1 SECTION
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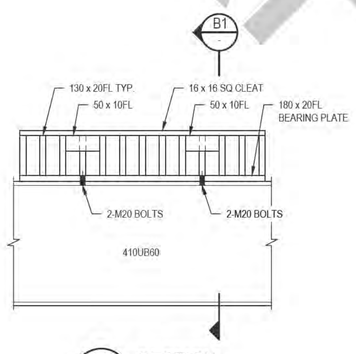
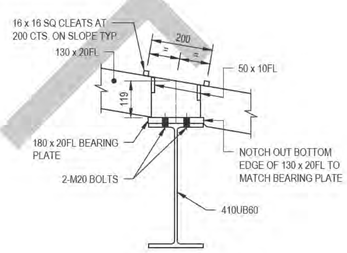
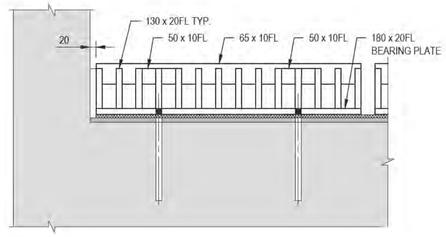


B SECTION
SCALE 1 : 10



B1 SECTION
SCALE 1 : 10



C SECTION
SCALE 1 : 10

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SCALE 1:20 AT ORIGINAL SIZE

0 0.1 0.2 0.3 0.4 0.5m
SCALE 1:10 AT ORIGINAL SIZE

0 0.05 0.10 0.15 0.20 0.25m
SCALE 1:5 AT ORIGINAL SIZE

PRELIMINARY

No	Revision	Note: * indicates signatures on original issue of drawing or last revision of drawing	Drawn	Job Manager	Project Director	Date
A	ISSUED FOR 90□ DESIGN - CLIENT COMMENT		LR	JM*	PS*	30/09/20

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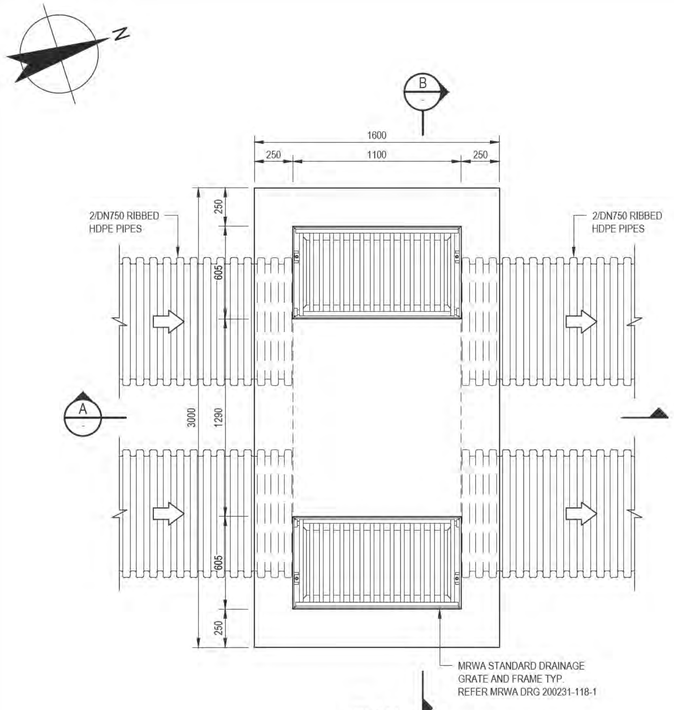
DO NOT SCALE

Drawn	L.RADICI	Designer	P.HULCUP
Drafting Check	L.ORREAL*	Design Check	E.BOSUSTOW*
Approved (Project Director)			
Date			
Scale	AS SHOWN	This Drawing must not be used for Construction unless signed as Approved	

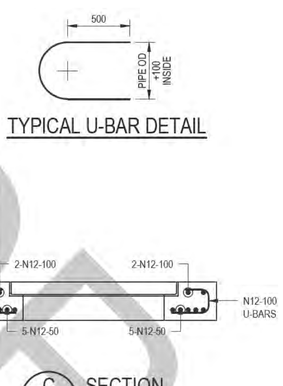
Client: DEPT OF INFRASTRUCTURE, TRANSPORT, REGIONAL DEVELOPMENT & COMMUNICATIONS
Project: CHRISTMAS ISLAND STORMWATER REMEDIAL WORKS
Title: NORTHERN DRUMSITE WORKS
INCLINE DIVERSION PIT & CHANNEL - STEELWORK SETOUT & DETAILS

Original Size: A1
Drawing No: 61-35637-S014
Rev: A

Plot Date: 30 September 2020 - 9:06 AM Plotted by: Luke Radici
Cad File No: \\ghdnet.internal\ghd\AU\Perth\Projects\61\35637\CADD\Drawings\61-35637-S014.dwg



PLAN
SCALE 1:20

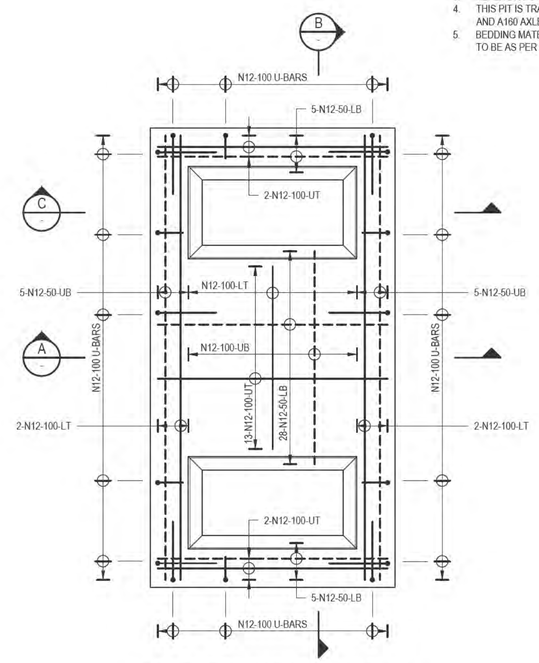


TYPICAL U-BAR DETAIL

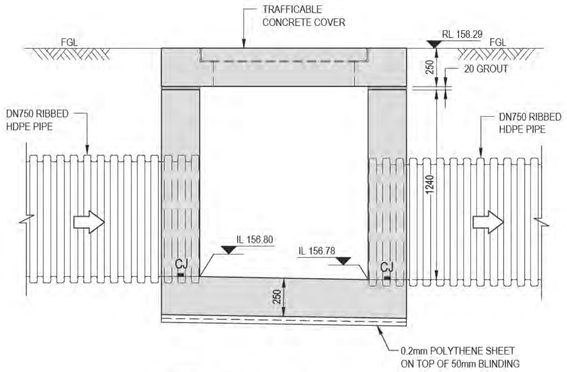
SECTION
SCALE 1 : 20

NOTES:

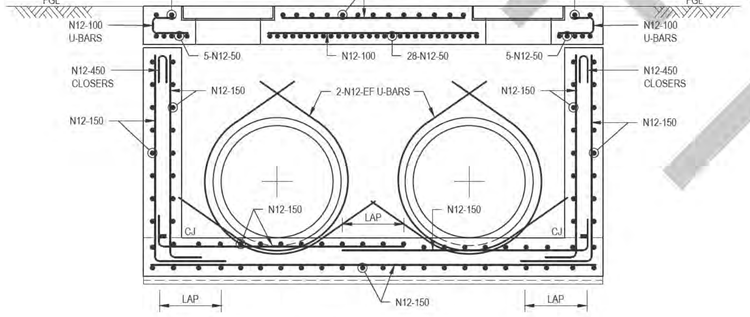
1. REFER DRGs 61-35637-C210 AND C233 FOR DRAINAGE SET OUT INFORMATION.
2. REFER DRG 61-35637-S002 FOR GENERAL STRUCTURAL NOTES.
3. REFER DRG 61-35637-S003 FOR TYPICAL STRUCTURAL DETAILS.
4. THIS PIT IS TRAFFICABLE AND HAS BEEN DESIGNED FOR W80 WHEEL LOAD AND A160 AXLE LOAD IN ACCORDANCE WITH AS5100.2.
5. BEDDING MATERIAL FOUNDATION COMPACTION AND BACKFILL COMPACTION TO BE AS PER SPECIFICATION.



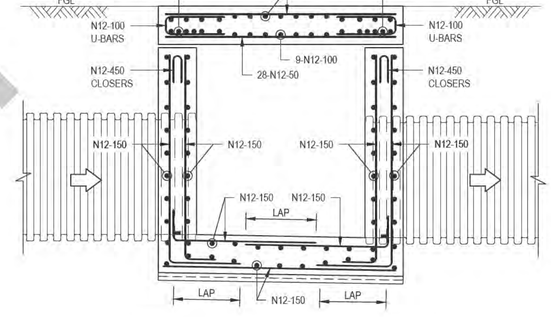
COVER REINFORCEMENT PLAN
SCALE 1:20



A SECTION - CONCRETE
SCALE 1 : 20



B SECTION
SCALE 1 : 20



A SECTION - REINFORCEMENT
SCALE 1 : 20

0 0.2 0.4 0.6 0.8 1.0m
SCALE 1:20 AT ORIGINAL SIZE

PRELIMINARY

No	Revision	Note: * indicates signatures on original issue of drawing or last revision of drawing	Drawn	Job Manager	Project Director	Date
A	ISSUED FOR 90□ DESIGN - CLIENT COMMENT		LR	JM*	PS*	30/09/20

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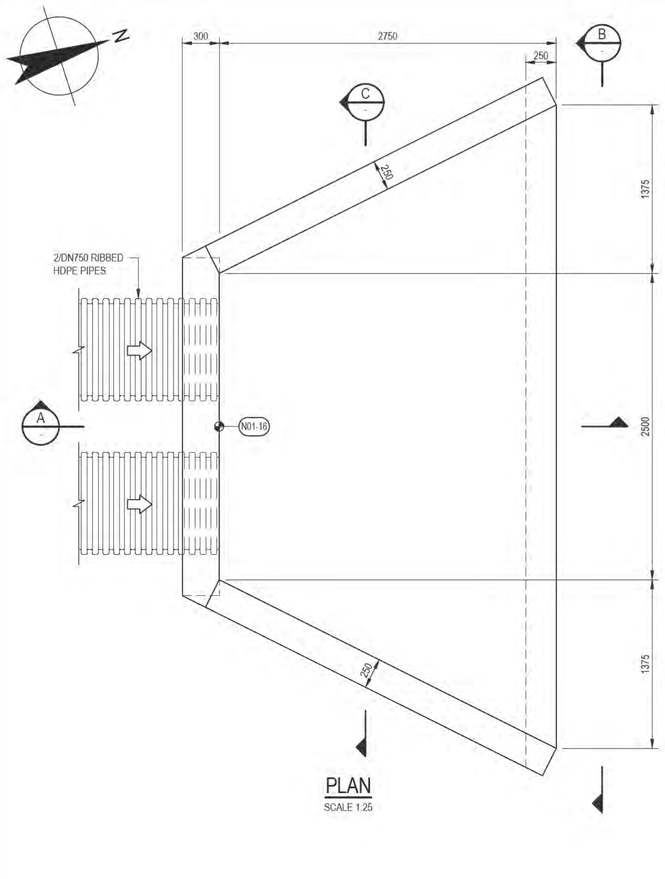
DO NOT SCALE

Drawn	L.RADICI	Designer	P.HULCUP
Drafting Check	L.ORREAL*	Design Check	E.BOSUSTOW*
Approved (Project Director)			
Date			
Scale	1:20	This Drawing must not be used for Construction unless signed as Approved	

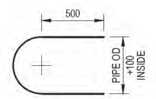
Client: DEPT OF INFRASTRUCTURE, TRANSPORT, REGIONAL DEVELOPMENT & COMMUNICATIONS
Project: CHRISTMAS ISLAND STORMWATER REMEDIAL WORKS
Title: NORTHERN DRUMSITE WORKS
PIT N17-2 - SECTIONS & DETAILS

Original Size: A1
Drawing No: 61-35637-S020
Rev: A

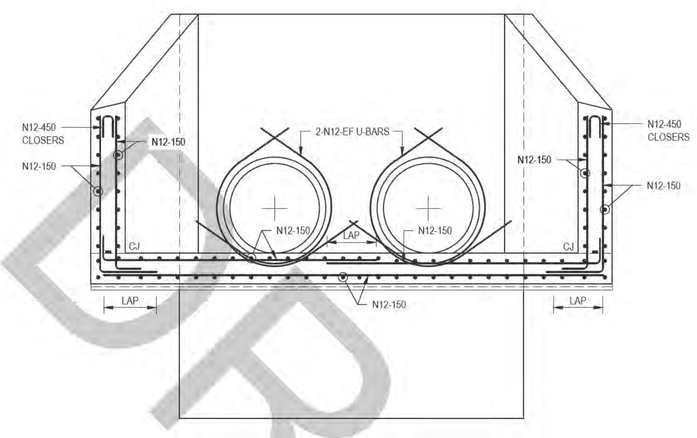
Plot Date: 1 October 2020 - 1:31 PM Plotted by: Luke Radici Cad File No: \\ghdnet.internal\ghd\AU\Perth\Projects\61\35637\CADD\Drawings\61-35637-S020.dwg



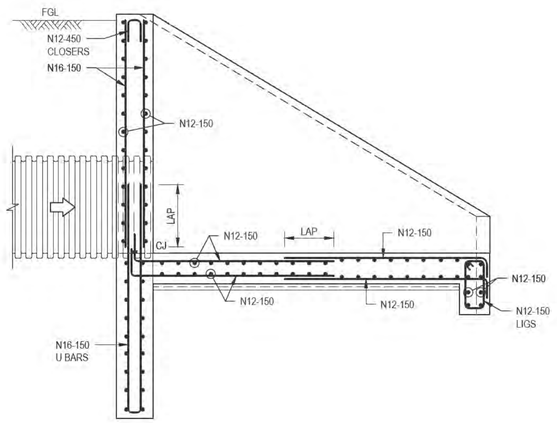
PLAN
SCALE 1:25



TYPICAL U-BAR DETAIL



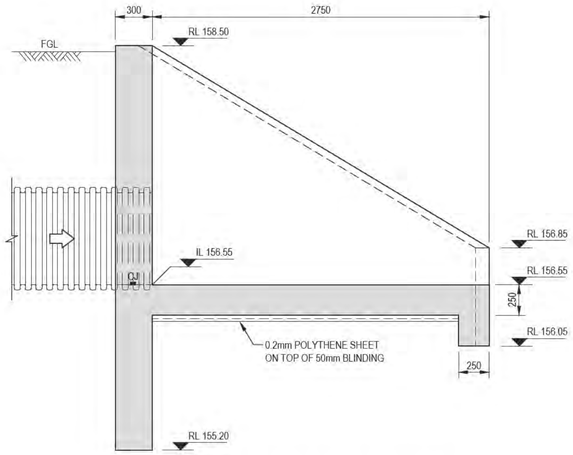
C SECTION
SCALE 1 : 25



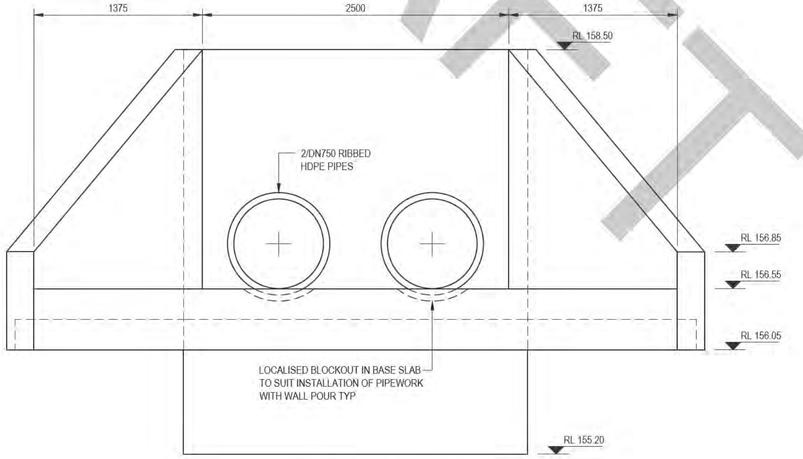
A SECTION - REINFORCEMENT
SCALE 1 : 25

NOTES:

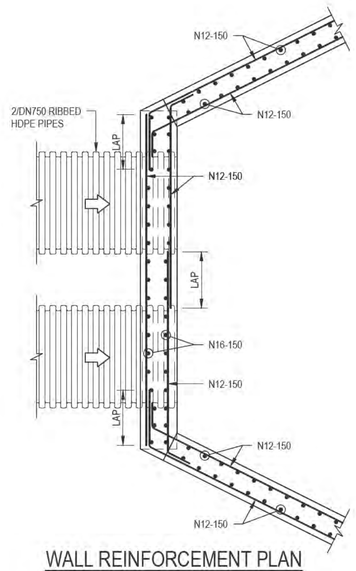
1. REFER DRGs 61-35637-C210, C232 AND C233 FOR LOCATION AND SET OUT.
2. REFER DRG 61-35637-S002 FOR GENERAL STRUCTURAL NOTES.
3. REFER DRG 61-35637-S003 FOR TYPICAL STRUCTURAL DETAILS.
4. THE HEADWALL HAS BEEN DESIGNED FOR VEHICLE SURCHARGE LOADING IN ACCORDANCE WITH CL14.2 OF AS 5100.2. 'HIGHWAY TRAFFIC' VEHICLES MAY BE OPERATED UP TO THE BACK OF THE WALL.
5. BEDDING MATERIAL FOUNDATION COMPACTION AND BACKFILL COMPACTION TO BE AS PER SPECIFICATION.



A SECTION - CONCRETE
SCALE 1 : 25



B ELEVATION
SCALE 1 : 25



WALL REINFORCEMENT PLAN
SCALE 1:25

0 0.25 0.5 0.75 1.0 1.25m
SCALE 1:25 AT ORIGINAL SIZE

PRELIMINARY

No	Revision	Note: * indicates signatures on original issue of drawing or last revision of drawing	Drawn	Job Manager	Project Director	Date
A	ISSUED FOR 90□ DESIGN - CLIENT COMMENT		LR	JM*	PS*	30/09/20

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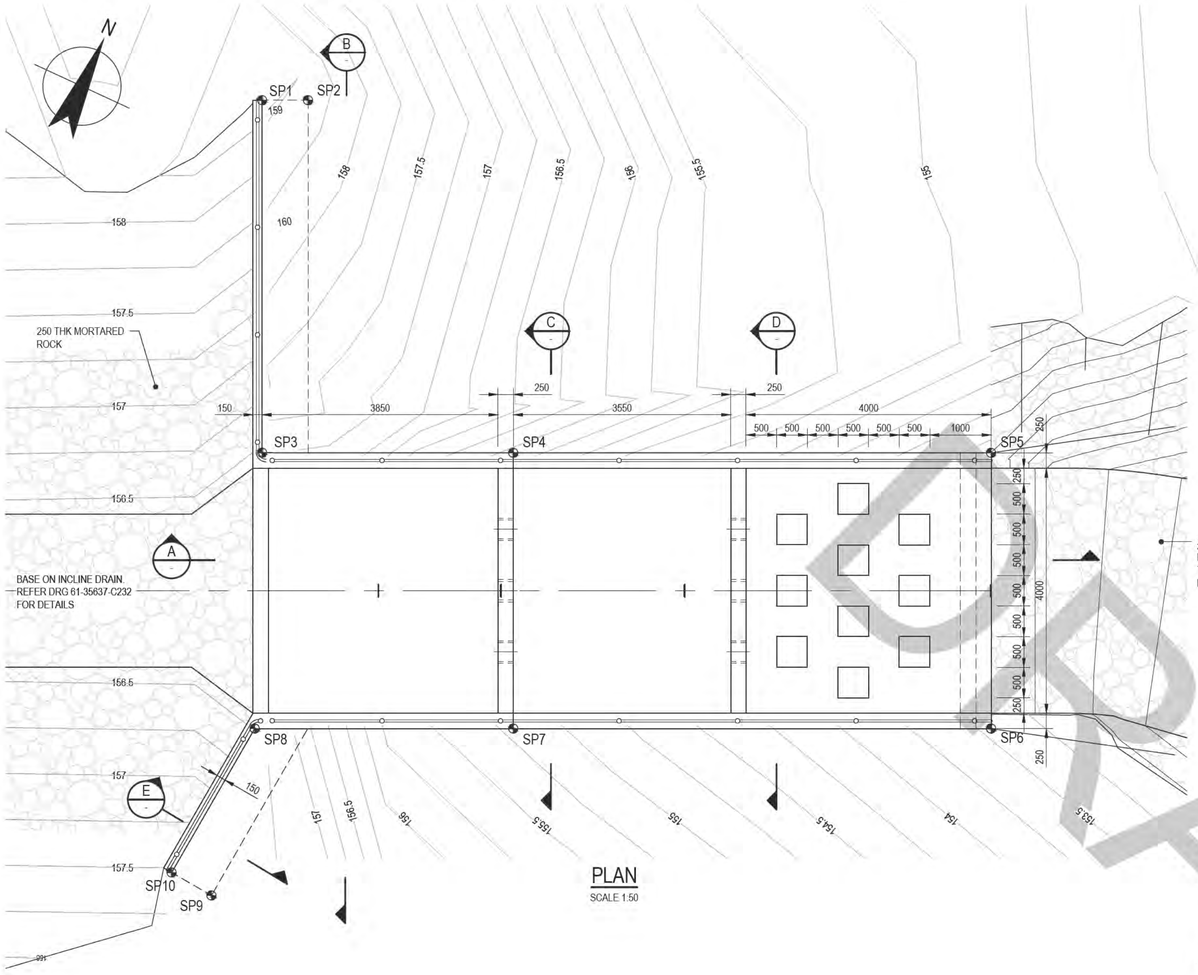
Drawn	L.RADICI	Designer	P.HULCUP
Drafting Check	L.ORREAL*	Design Check	E.BOSUSTOW*
Approved (Project Director)			
Date			
Scale	1:25	This Drawing must not be used for Construction unless signed as Approved	

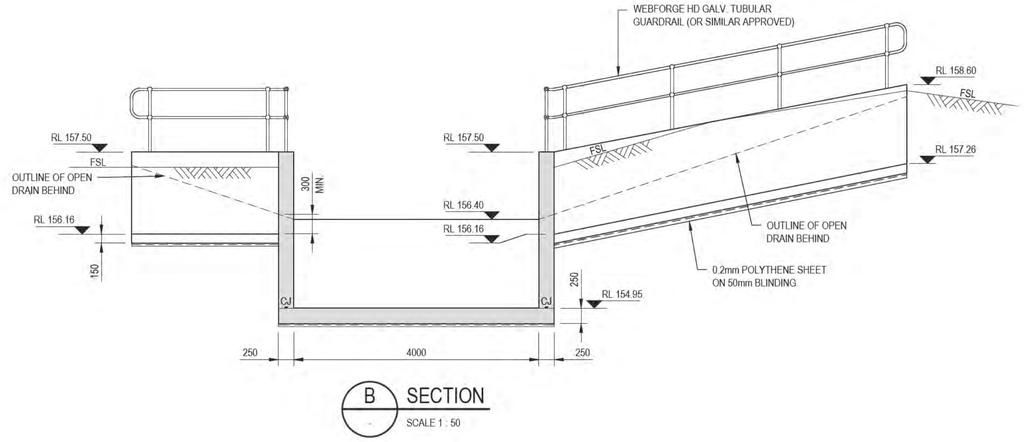
Client: DEPT OF INFRASTRUCTURE, TRANSPORT, REGIONAL DEVELOPMENT & COMMUNICATIONS
Project: CHRISTMAS ISLAND STORMWATER REMEDIAL WORKS
Title: NORTHERN DRUMSITE WORKS
HEADWALL N17-3 - SECTIONS & DETAILS

Original Size: A1
Drawing No: 61-35637-S021
Rev: A

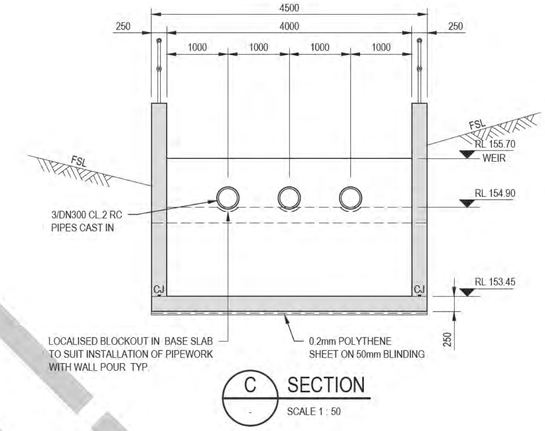
Plot Date: 1 October 2020 - 1:30 PM Plotted by: Luke Radici Cad File No: \\ghdnet.internal\ghd\AU\Perth\Projects\61\35637\CADD\Drawings\61-35637-S021.dwg



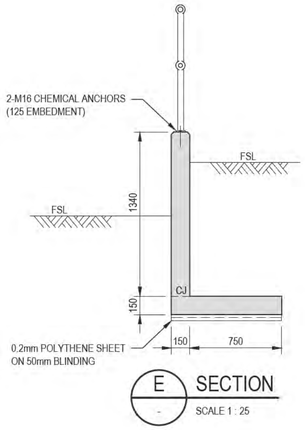
PLAN
SCALE 1:50



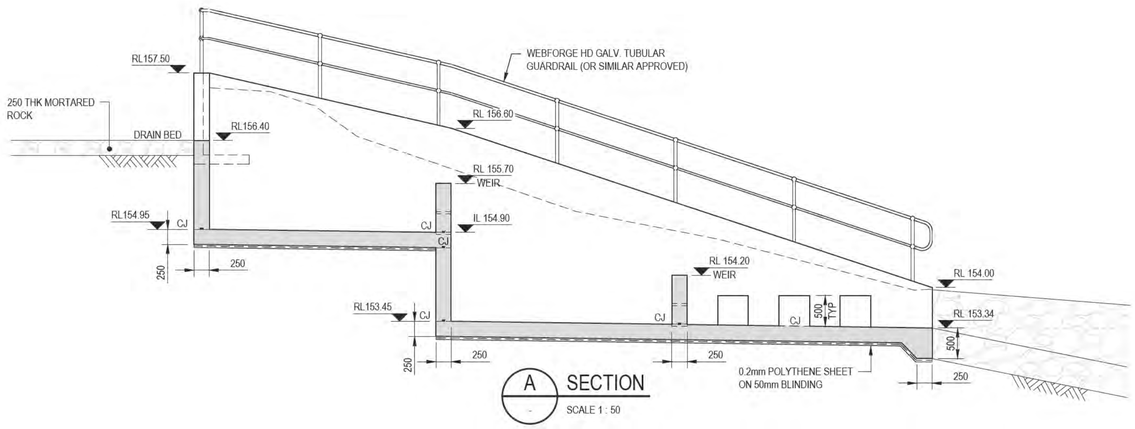
B SECTION
SCALE 1 : 50



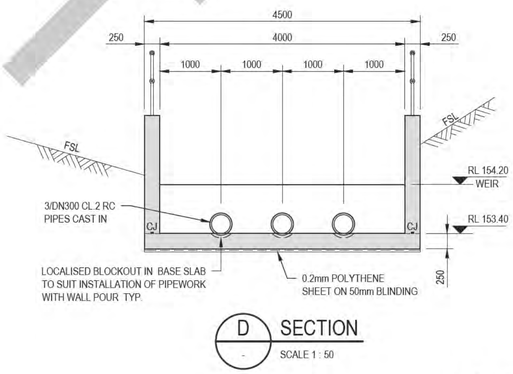
C SECTION
SCALE 1 : 50



E SECTION
SCALE 1 : 25



A SECTION
SCALE 1 : 50



D SECTION
SCALE 1 : 50

SETOUT				
POINT	EASTING (m)	NORTHING (m)	RL TOP OF WALL	RL TOP OF CONC.
SP1	573979.738	8847361.808	158.60	
SP2	573979.423	8847362.488		157.26
SP3	573984.960	8847364.221	157.50	
SP4	573983.241	8847367.942	156.60	
SP5	573979.970	8847375.023	154.00	
SP6	573984.055	8847376.911	154.00	
SP7	573987.326	8847369.830	156.60	
SP8	573989.097	8847365.998	157.50	
SP9	573991.866	8847368.499		156.16
SP10	573991.798	8847365.752	157.50	

NOTES:

1. REFER DRGs 61-35637-C210 AND C232 FOR OUTLET LOCATION.
2. REFER DRG 61-35637-S002 FOR GENERAL STRUCTURAL NOTES.
3. REFER DRG 61-35637-S003 FOR TYPICAL STRUCTURAL DETAILS.
4. REFER DRG 61-35637-S026 FOR REINFORCEMENT DETAILS SHEET 1 OF 2.
5. REFER DRG 61-35637-S027 FOR REINFORCEMENT DETAILS SHEET 2 OF 2.
6. BEDDING MATERIAL, FOUNDATION COMPACTION AND BACKFILL COMPACTION TO BE AS PER SPECIFICATION.

0 0.5 1.0 1.5 2.0 2.5m
SCALE 1:50 AT ORIGINAL SIZE

0 0.25 0.5 0.75 1.0 1.25m
SCALE 1:25 AT ORIGINAL SIZE

PRELIMINARY

No	Revision	Note: * indicates signatures on original issue of drawing or last revision of drawing	Drawn	Job Manager	Project Director	Date
B	RE-ISSUED FOR 90% DESIGN - CLIENT COMMENT		LR	JM*	PS*	20/11/20
A	ISSUED FOR 90% DESIGN - CLIENT COMMENT		LR	JM*	PS*	30/09/20

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Drawn	L.RADICI	Designer	P.HULCUP
Drafting Check	L.ORREAL*	Design Check	E.BOSUSTOW*
Approved (Project Director)			
Date			
Scale	AS SHOWN	This Drawing must not be used for Construction unless signed as Approved	

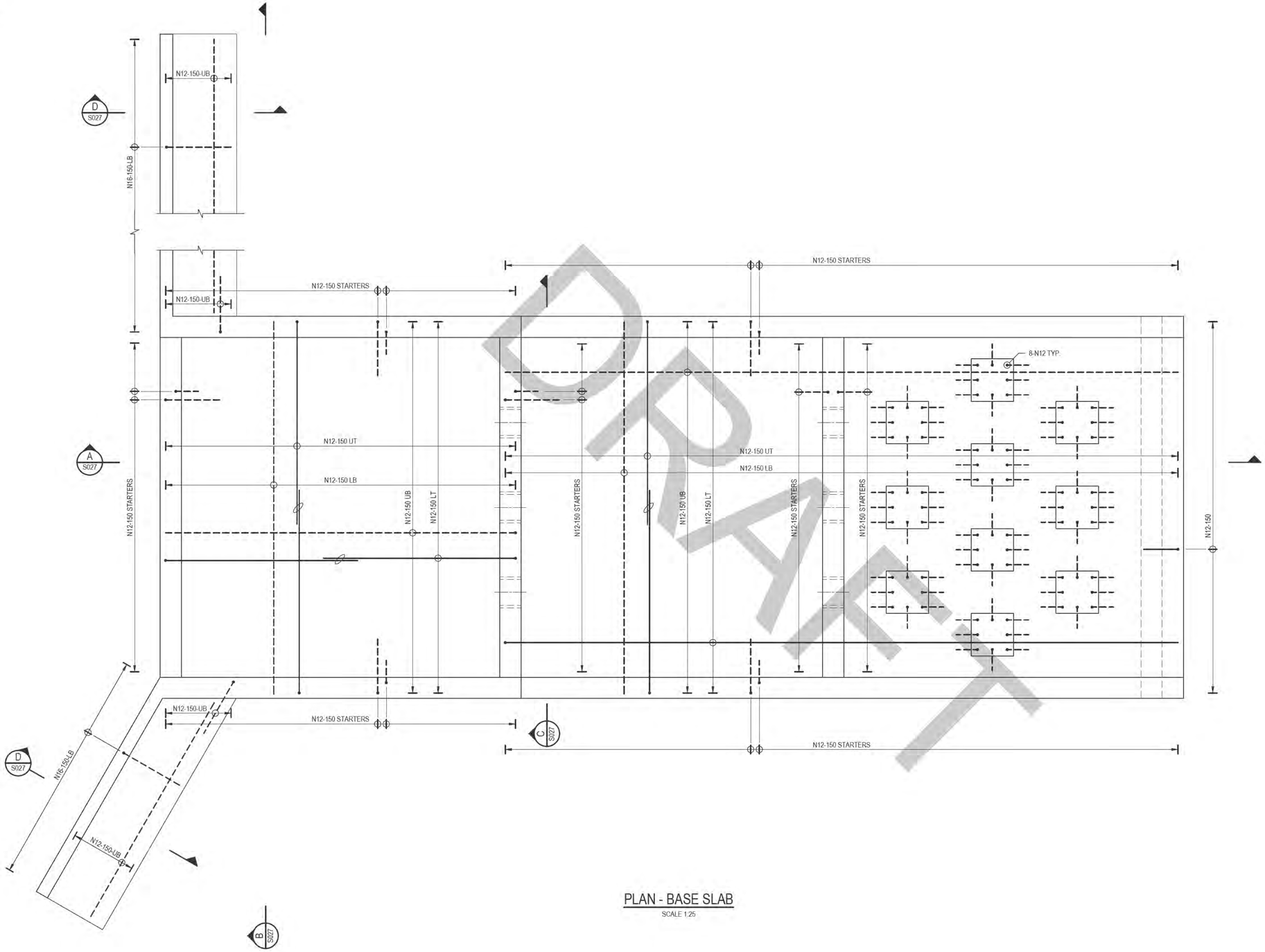
Client: DEPT OF INFRASTRUCTURE, TRANSPORT, REGIONAL DEVELOPMENT & COMMUNICATIONS
Project: CHRISTMAS ISLAND STORMWATER REMEDIAL WORKS
Title: NORTHERN DRUMSITE WORKS
INCLINE DRAIN OUTLET STRUCTURE - GENERAL ARRANGEMENT

Original Size A1
Drawing No: 61-35637-S025
Rev: B

Plot Date: 19 November 2020 - 1:01 PM Plotted by: Luke Radici Cad File No: \\ghdnet.internal\ghd\AU\Perth\Projects\61\35637\CADD\Drawings\61-35637-S025.dwg

NOTES:

1. REFER DRGs 61-35637-C210 AND C232 FOR OUTLET LOCATION.
2. REFER DRG 61-35637-S002 FOR GENERAL STRUCTURAL NOTES.
3. REFER DRG 61-35637-S003 FOR TYPICAL STRUCTURAL DETAILS.
4. REFER DRG 61-35637-S025 FOR GENERAL ARRANGEMENT.
5. REFER DRG 61-35637-S027 FOR REINFORCEMENT DETAILS SHEET 2 OF 2.
6. BEDDING MATERIAL, FOUNDATION COMPACTION AND BACKFILL COMPACTION TO BE AS PER SPECIFICATION.



PLAN - BASE SLAB
SCALE 1:25

0 0.25 0.5 0.75 1.0 1.25m
SCALE 1:25 AT ORIGINAL SIZE

PRELIMINARY

A	ISSUED FOR 90□ DESIGN - CLIENT COMMENT	LR	JM*	PS*	30/09/20
No	Revision Note: * indicates signatures on original issue of drawing or last revision of drawing	Drawn	Job Manager	Project Director	Date

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E permail@ghd.com.au W www.ghd.com

DO NOT SCALE

Drawn	L.RADICI	Designer	P.HULCUP
Drafting Check	L.ORREAL*	Design Check	E.BOSUSTOW*
Approved (Project Director)			
Date			
Scale	1:25	This Drawing must not be used for Construction unless signed as Approved	

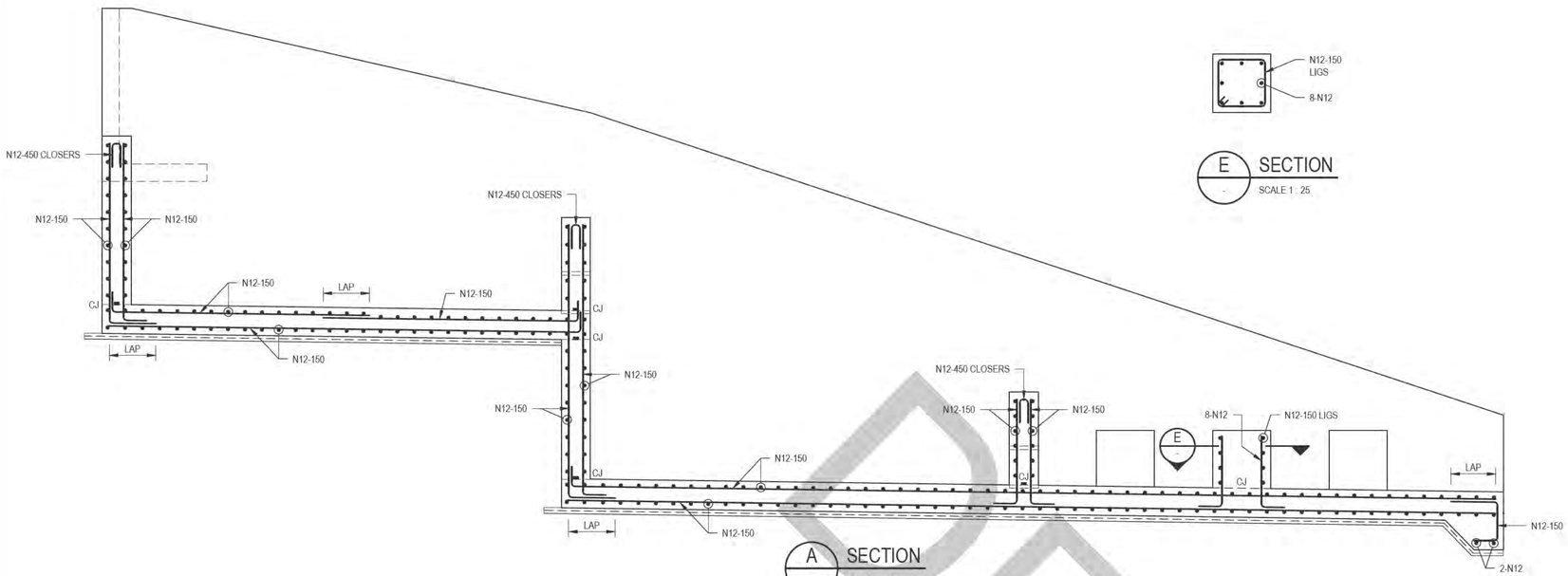
Client: DEPT OF INFRASTRUCTURE, TRANSPORT, REGIONAL DEVELOPMENT & COMMUNICATIONS
Project: CHRISTMAS ISLAND STORMWATER REMEDIAL WORKS
Title: NORTHERN DRUMSITE WORKS
INCLINE DRAIN OUTLET STRUCTURE - REINF. DETAILS SHEET 1 OF 2

Original Size: A1
Drawing No: 61-35637-S026
Rev: A

Plot Date: 1 October 2020 - 1:30 PM Plotted by: Luke Radici Cad File No: \\ghdnet.internal\ghd\AU\Perth\Projects\61\35637\CADD\Drawings\61-35637-S026.dwg

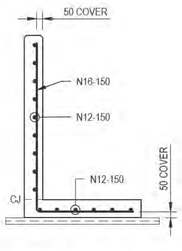
NOTES:

1. REFER DRGs 61-35637-C210 AND C232 FOR OUTLET LOCATION.
2. REFER DRG 61-35637-S002 FOR GENERAL STRUCTURAL NOTES.
3. REFER DRG 61-35637-S003 FOR TYPICAL STRUCTURAL DETAILS.
4. REFER DRG 61-35637-S025 FOR GENERAL ARRANGEMENT.
5. REFER DRG 61-35637-S026 FOR REINFORCEMENT DETAILS SHEET 1 OF 2.
6. BEDDING MATERIAL, FOUNDATION COMPACTION AND BACKFILL COMPACTION TO BE AS PER SPECIFICATION.

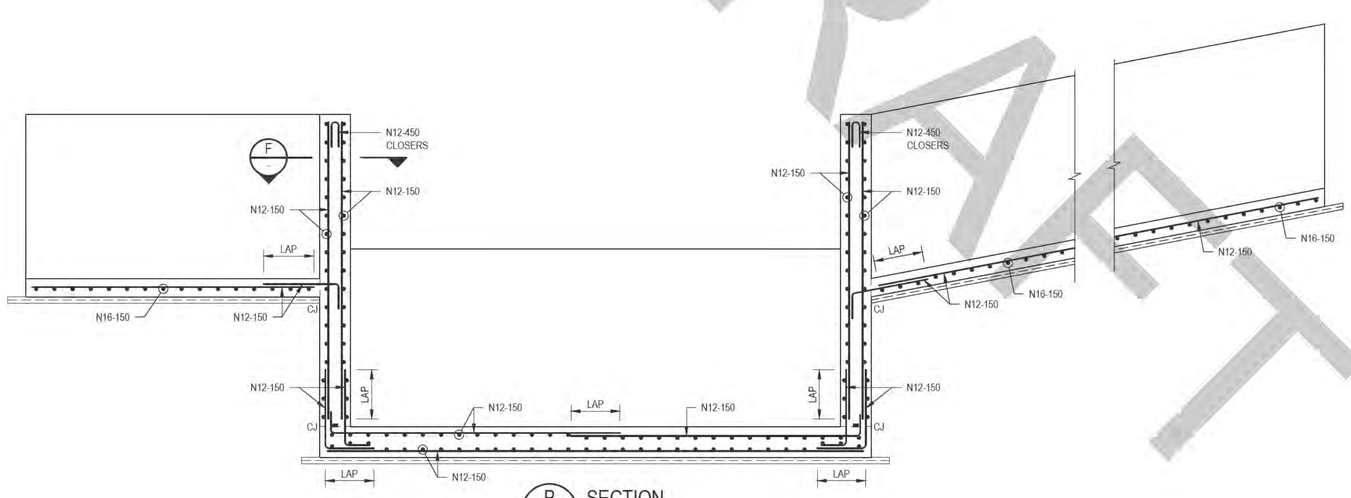


A SECTION
S026 SCALE 1 : 25

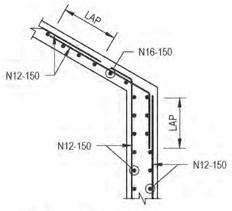
E SECTION
SCALE 1 : 25



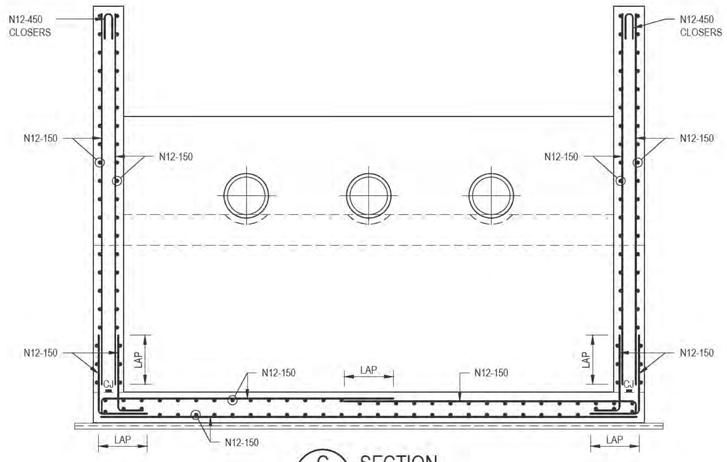
D SECTION
S026 SCALE 1 : 25



B SECTION
S026 SCALE 1 : 25



F SECTION
SCALE 1 : 25



C SECTION
S026 SCALE 1 : 25

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SCALE 1:25 AT ORIGINAL SIZE

PRELIMINARY

No	Revision	Note: * indicates signatures on original issue of drawing or last revision of drawing	Drawn	Job Manager	Project Director	Date
A	ISSUED FOR 90□ DESIGN - CLIENT COMMENT		LR	JM*	PS*	30/09/20

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DO NOT SCALE

Drawn	L.RADICI	Designer	P.HULCUP
Drafting Check	L.ORREAL*	Design Check	E.BOSUSTOW*
Approved (Project Director)			
Date			
Scale	1:25	This Drawing must not be used for Construction unless signed as Approved	

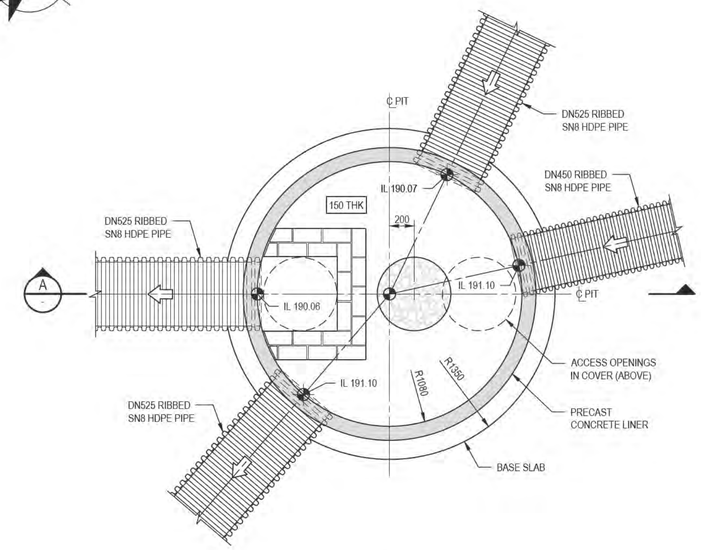
Client: DEPT OF INFRASTRUCTURE, TRANSPORT, REGIONAL DEVELOPMENT & COMMUNICATIONS
Project: CHRISTMAS ISLAND STORMWATER REMEDIAL WORKS
Title: NORTHERN DRUMSITE WORKS
INCLINE DRAIN OUTLET STRUCTURE - REINF. DETAILS SHEET 2 OF 2

Original Size: A1
Drawing No: 61-35637-S027
Rev: A

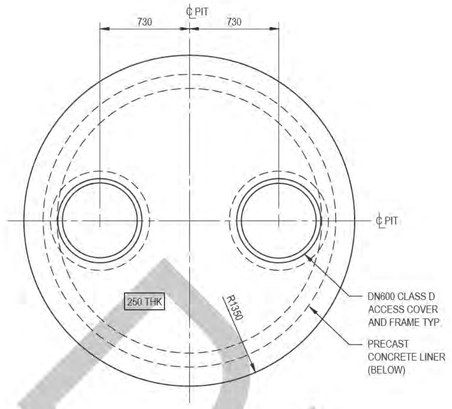
Plot Date: 1 October 2020 - 1:30 PM Plotted by: Luke Radici Cad File No: \\ghdnet.internal\ghd\AU\Perth\Projects\61\35637\CADD\Drawings\61-35637-S027.dwg

NOTES:

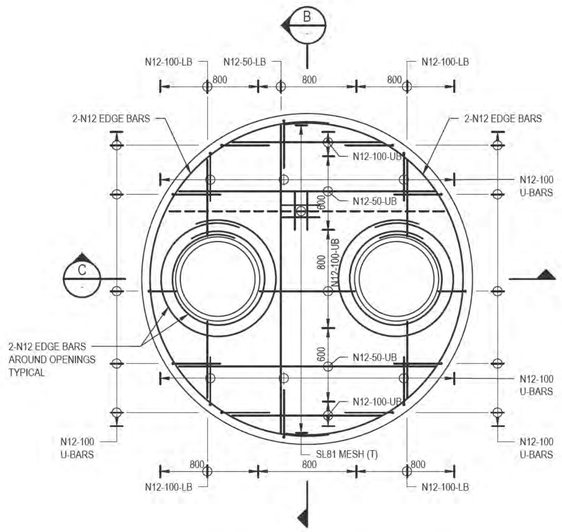
1. REFER DRG 61-35637-C220 FOR LOCATION AND SET OUT.
2. REFER DRG 61-35637-S002 FOR GENERAL STRUCTURAL NOTES.
3. REFER DRG 61-35637-S003 FOR TYPICAL STRUCTURAL DETAILS.
4. MORTAR TO BE CLASS M4.
5. THIS PIT IS TRAFFICABLE AND HAS BEEN DESIGNED FOR W80 WHEEL LOAD AND A160 AXLE LOAD IN ACCORDANCE WITH AS5100.2.



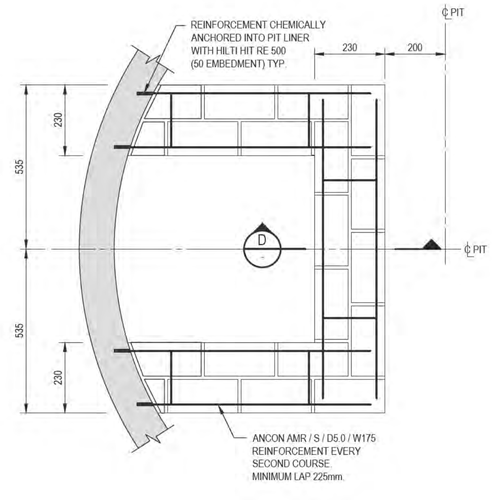
PLAN
SCALE 1:25



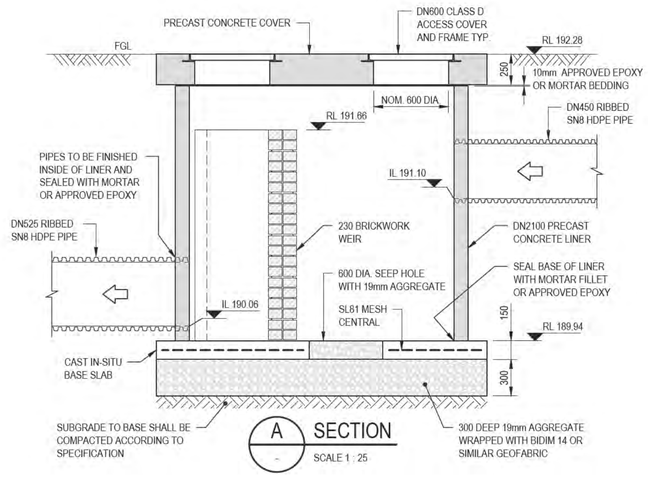
COVER PLAN
SCALE 1:25

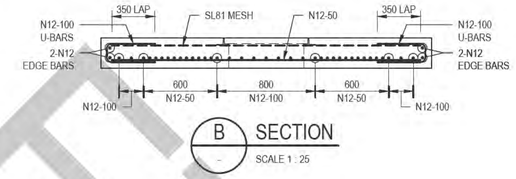


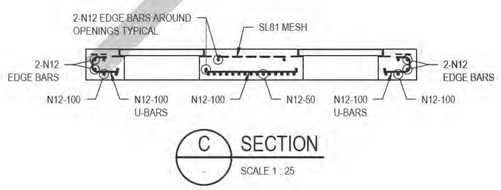
COVER REINFORCEMENT PLAN
SCALE 1:25

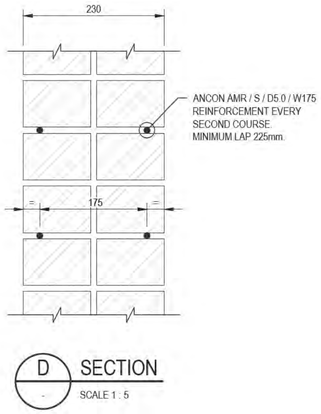


BRICKWORK REINFORCEMENT PLAN
SCALE 1:10









0 0.05 0.1 0.15 0.2 0.25m
SCALE 1:5 AT ORIGINAL SIZE

0 0.1 0.2 0.3 0.4 0.5m
SCALE 1:10 AT ORIGINAL SIZE

0 0.25 0.5 0.75 1.0 1.25m
SCALE 1:25 AT ORIGINAL SIZE

PRELIMINARY

No	Revision	Note: * indicates signatures on original issue of drawing or last revision of drawing	Drawn	Job Manager	Project Director	Date
B	RE-ISSUED FOR 90% DESIGN - CLIENT COMMENT		LR	JM*	PS*	20/11/20
A	ISSUED FOR 90% DESIGN - CLIENT COMMENT		LR	JM*	PS*	30/09/20

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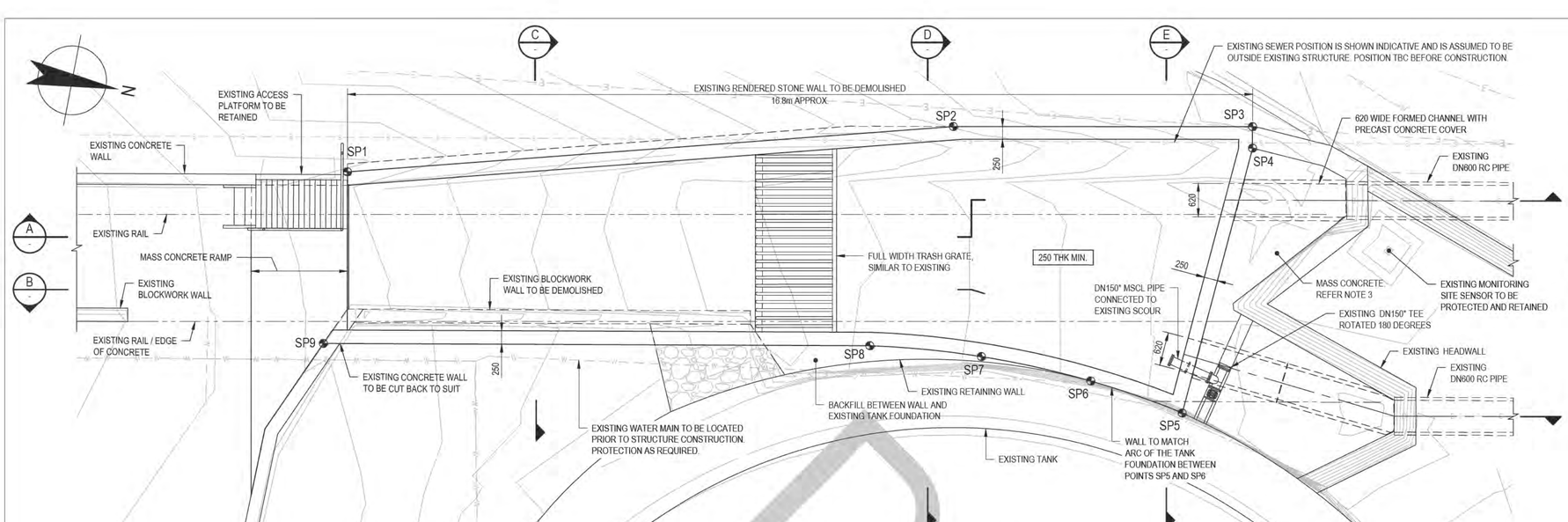
DO NOT SCALE

Drawn	L.RADICI	Designer	P.HULCUP
Drafting Check	L.ORREAL*	Design Check	E.BOSUSTOW*
Approved (Project Director)			
Date			
Scale	AS SHOWN	This Drawing must not be used for Construction unless signed as Approved	

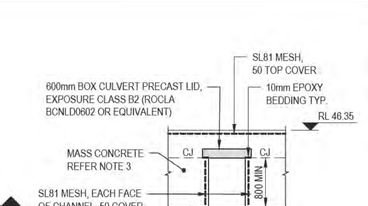
Client: DEPT OF INFRASTRUCTURE, TRANSPORT, REGIONAL DEVELOPMENT & COMMUNICATIONS
Project: CHRISTMAS ISLAND STORMWATER REMEDIAL WORKS
Title: SOUTHERN DRUMSITE WORKS
PIT S01-7 - SECTIONS & DETAILS

Original Size: A1
Drawing No: 61-35637-S030
Rev: B

Plot Date: 19 November 2020 - 1:01 PM Plotted by: Luke Radici
Cad File No: \\ghdnet.internal\ghd\AU\Perth\Projects\61\35637\CADD\Drawings\61-35637-S030.dwg



PLAN
SCALE 1:50



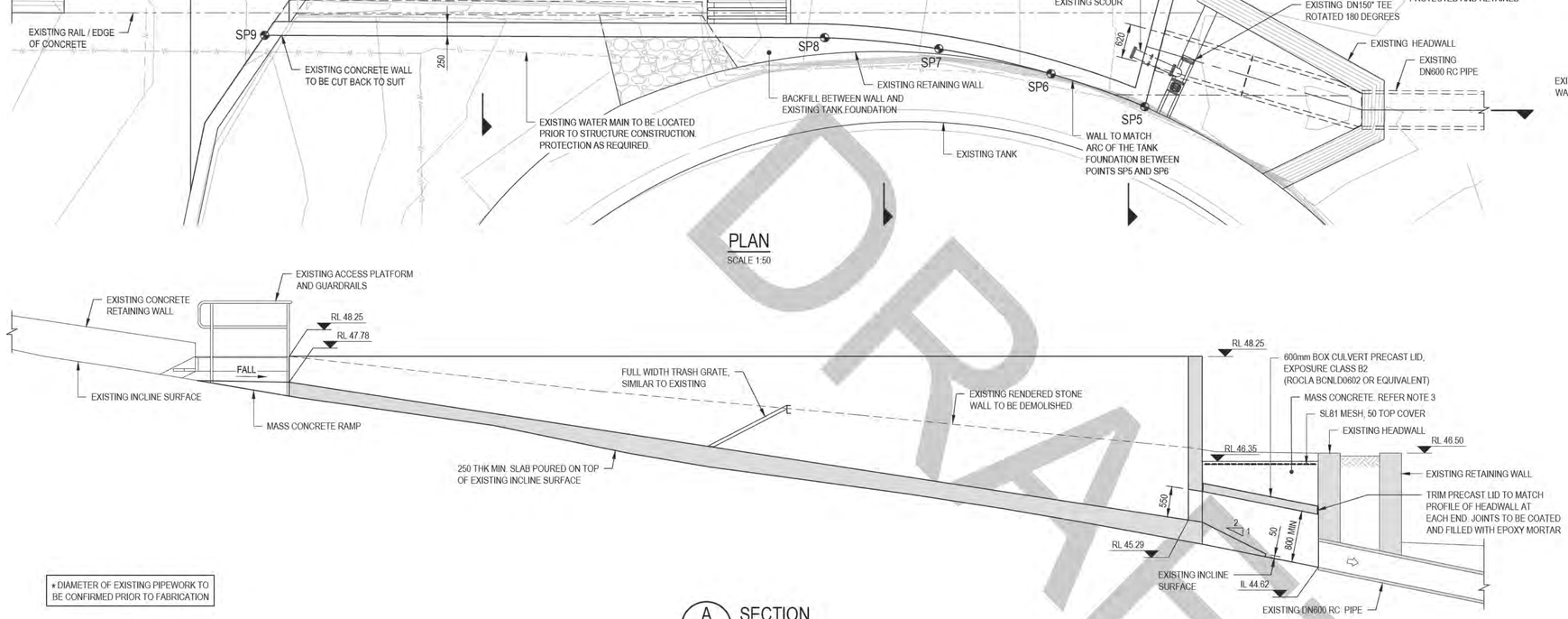
FORMED CHANNEL TYPICAL SECTION
SCALE 1:50

NOTES:

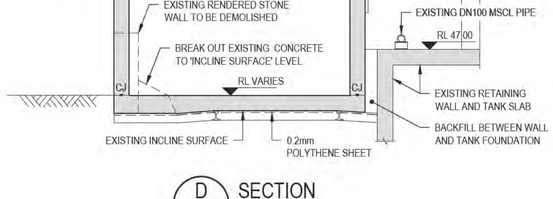
1. REFER DRG 61-35637-S002 FOR GENERAL STRUCTURAL NOTES.
2. REFER DRG 61-35637-S003 FOR TYPICAL STRUCTURAL DETAILS.
3. MASS CONCRETE TO INCLUDE STEEL FIBRES AND XYPEX. REFER CONCRETE CHARACTERISTICS TABLE ON DRG 61-35637-S002.
4. EXISTING MONITORING SITE SENSORS AND CONDUITS TO BE REMOVED AND REINSTATED BY SUITABILITY QUALIFIED INSTALLER.
5. THE SETOUT POINTS DETAILED ARE INDICATIVE AND BASED UPON AVAILABLE INFORMATION. THE FINAL SETOUT OF THE STRUCTURE IS TO BE UNDERTAKEN TO MATCH WITH EXISTING STRUCTURE EXTENT UNLESS SHOWN OTHERWISE.

SETOUT		
POINT	EASTING (m)	NORTHING (m)
SP1	573838.559	8847966.207
SP2	573835.582	8847977.078
SP3	573834.521	8847982.528
SP4	573834.913	8847982.604
SP5	573839.985	8847982.263
SP6	573839.725	8847980.486
SP7	573839.669	8847978.407
SP8	573839.869	8847976.336
SP9	573841.768	8847966.377

C SECTION
SCALE 1 : 50

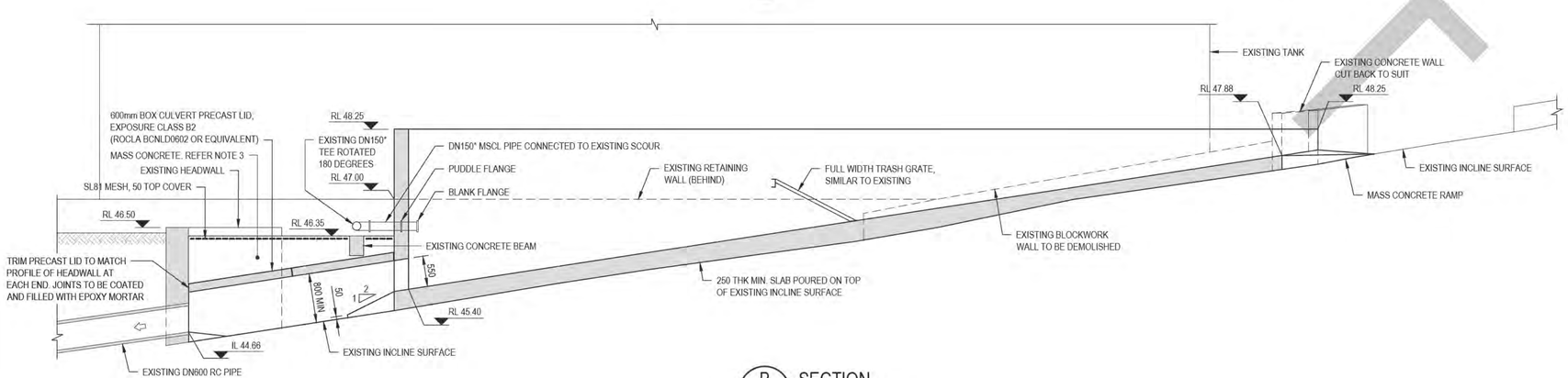


A SECTION
SCALE 1 : 50

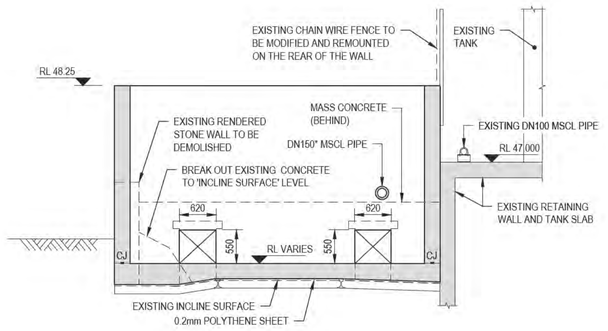


D SECTION
SCALE 1 : 50

* DIAMETER OF EXISTING PIPEWORK TO BE CONFIRMED PRIOR TO FABRICATION



B SECTION
SCALE 1 : 50



E SECTION
SCALE 1 : 50

0 0.5 1.0 1.5 2.0 2.5m
SCALE 1:50 AT ORIGINAL SIZE

PRELIMINARY

No	Revision	Note: * indicates signatures on original issue of drawing or last revision of drawing	Drawn	Job Manager	Project Director	Date
B	RE-ISSUED FOR 90% DESIGN - CLIENT COMMENT		LR	JM*	PS*	20/11/20
A	ISSUED FOR 90% DESIGN - CLIENT COMMENT		LR	JM*	PS*	30/09/20

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E permail@ghd.com.au W www.ghd.com

DO NOT SCALE

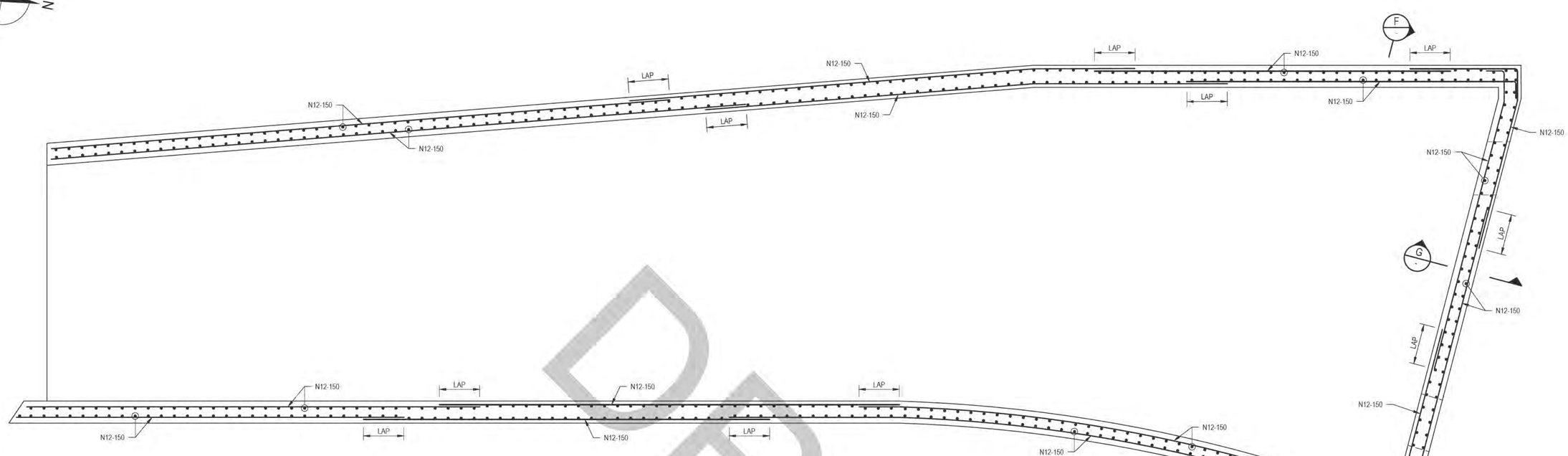
Drawn	L.RADICI	Designer	P.HULCUP
Drafting Check	L.ORREAL*	Design Check	E.BOSUSTOW*
Approved (Project Director)			
Date			
Scale	1:50	This Drawing must not be used for Construction unless signed as Approved	

Client	DEPT OF INFRASTRUCTURE, TRANSPORT, REGIONAL DEVELOPMENT & COMMUNICATIONS
Project	CHRISTMAS ISLAND STORMWATER REMEDIAL WORKS
Title	NORTHERN DRUMSITE WORKS - INCLINE TANK DRAIN HEADWALL MODIFICATIONS - GENERAL ARRANGEMENT
Original Size	A1
Drawing No:	61-35637-S035
Rev:	B

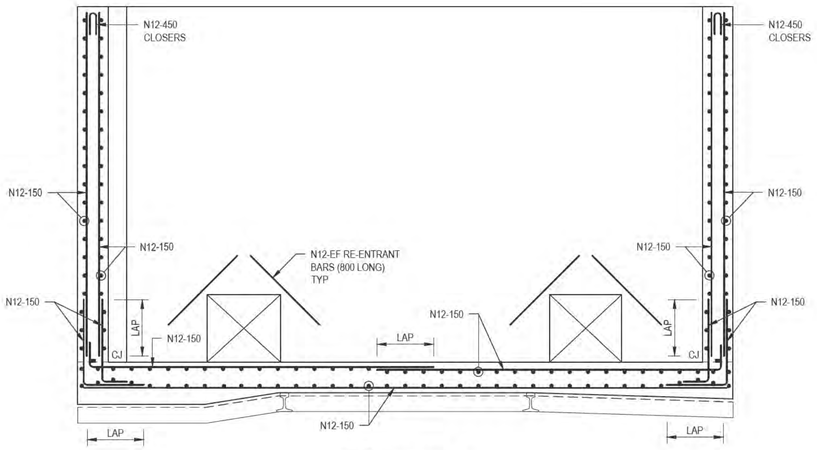
Plot Date: 19 November 2020 - 1:02 PM Plotted by: Luke Radici Cad File No: \\ghdnet.internal\ghd\AU\Perth\Projects\61\35637\CADD\Drawings\61-35637-S035.dwg

NOTES:

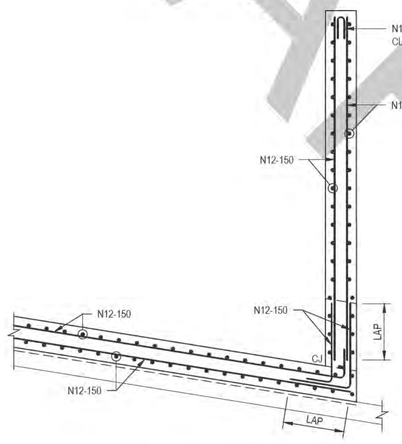
1. REFER DRG 61-35637-S002 FOR GENERAL STRUCTURAL NOTES.
2. REFER DRG 61-35637-S003 FOR TYPICAL STRUCTURAL DETAILS.



PLAN - WALL REINFORCEMENT
SCALE 1:25



F SECTION
SCALE 1 : 25



G SECTION
SCALE 1 : 25

0 0.25 0.5 0.75 1.0 1.25m
SCALE 1:25 AT ORIGINAL SIZE

PRELIMINARY

No	Revision	Drawn	Job Manager	Project Director	Date
B	RE-ISSUED FOR 90% DESIGN - CLIENT COMMENT	LR	JM*	PS*	20/11/20
A	ISSUED FOR 90% DESIGN - CLIENT COMMENT	LR	JM*	PS*	30/09/20

Note: * indicates signatures on original issue of drawing or last revision of drawing

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Department of Infrastructure, Transport, Regional Development and Communications

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E permail@ghd.com.au W www.ghd.com

DO NOT SCALE

Drawn	L.RADICI	Designer	P.HULCUP
Drafting Check	L.ORREAL*	Design Check	E.BOSUSTOW*
Approved (Project Director)			
Date			
Scale	1:25	This Drawing must not be used for Construction unless signed as Approved	

Client: DEPT OF INFRASTRUCTURE, TRANSPORT, REGIONAL DEVELOPMENT & COMMUNICATIONS
Project: CHRISTMAS ISLAND STORMWATER REMEDIAL WORKS
Title: NORTHERN DRUMSITE WORKS - INCLINE TANK DRAIN HEADWALL MODIFICATIONS - REINFORCEMENT DETAILS

Original Size: A1
Drawing No: 61-35637-S036
Rev: B

Plot Date: 19 November 2020 - 1:02 PM
Plotted by: Luke Radici
Cad File No: \\ghdnet.internal\ghd\AU\Perth\Projects\61\35637\CADD\Drawings\61-35637-S036.dwg

Appendix C – Supplier Drawings and Information

enviropipes

EDITION 3

PRODUCT CATALOGUE

enviropipes.com.au

ENVIROSEWER® & ENVIROPIPES STORMWATER PIPE

TELEPHONE: WA +61 (8) 9352 8444, | VIC +61 (3) 9357 8163, | QLD +61 (7) 3260 1416
AFTERHOURS: +61 407 729 899

enviropipes.com.au

ENVIROPIPES STORMWATER PIPES

In recent years the specification and use of dual wall High Density Polyethylene (HDPE) corrugated pipe for storm water has increased dramatically. Advantages, such as the pipe's strength, durability and joint integrity increase the long-term cost-effectiveness.

Results show that forward-thinking municipalities are realising the future of storm water management relies on the best available technology. HDPE (PE100) corrugated pipes are manufactured from the highest quality materials and are the most technologically advanced product available to move storm water and waste water.

HDPE (PE100) corrugated pipe is the proven, reliable, cost-effective and safe solution for your long-term drainage needs.

Storm water management is a critical component to ensure the long-term viability of public and private economic investments. Enviropipes offers a range of products to meet the critical demands of engineering design and contractor communities.

HDPE (PE100) corrugated pipes are manufactured with a co-extruded twin wall. The end product is a smooth bore inner layer and a corrugated outer layer which provides a high stiffness to weight ratio for non-pressure applications.

Enviropipes Stormwater Pipes are manufactured in accordance with AS/NZS 5065.

ENVIROSEWER® PIPES

EnviroSewer® Pipes provide economical and high performing solutions to meet the growing demands of sewer networks. EnviroSewer® Pipes are manufactured from High Density Polyethylene (PE100) which gives more options when designing a sewer system. Enviropipes introduces a wide array of innovations for the trunk line market and provides unparalleled resistance to the combination of hydrogen sulphide attack, abrasion and corrosion.

EnviroSewer® Pipes are manufactured in accordance with AS/NZS 5065.

TELEPHONE: WA +61 (8) 9352 8444 | VIC +61 (3) 9357 8163 | QLD + 61 (7) 3260 1416
AFTERHOURS: +61 407 729 899

DIMENSIONS

POLYETHYLENE (PE100) CORRUGATED PIPE SIZES

NOMINAL DIAMETER (DN)	OUTSIDE DIAMETER (mm)	INTERNAL DIAMETER (mm)	NOMINAL OVERALL LENGTH (mm) WA	LENGTH (SP/SO) EFFECTIVE LENGTH (mm) WA	NOMINAL OVERALL LENGTH (mm) QLD & VIC	LENGTH (SP/SO) EFFECTIVE LENGTH (mm) QLD & VIC	STIFFNESS CLASS (SN)	JOINTING METHOD
100	110	95	6000	6000	NA	NA	8	Rubber Ring
150	160	138	6000	6000	NA	NA	8	Rubber Ring
225	257	223	6070	5950	6340	6200	8	Rubber Ring
300	339	294	6060	5915	6340	6165	8	Rubber Ring
375	425	371	6020	5840	6280	6060	8	Rubber Ring
450	508	438	6030	5830	6300	6065	8	Rubber Ring
525	595	514	6000	5735	6240	5970	8	Rubber Ring
600	672	591	6040	5750	6140	5815	8	Rubber Ring
750	835	731	6050	5750	6180	5820	8	Rubber Ring
900	995	869	6040	5750	6260	5900	8	Rubber Ring
1050	1228	1057	NA	NA	6270	5910	8	Rubber Ring
1050*	1216	1050	6160	6000	NA	NA	8	Rubber Ring
1200*	1370	1200	6160	6000	NA	NA	8	Rubber Ring
1500*	1686	1500	6160	6000	NA	NA	8	Rubber Ring
1600*	1794	1600	6160	6000	NA	NA	8	Rubber Ring
1800*	1982	1800	6160	6000	NA	NA	8	Rubber Ring
2000*	2170	2000	6160	6000	NA	NA	8	Rubber Ring
2500	2694	2500	5960	5800	NA	NA	2	Electro Fusion
3000	3214	3000	5660	5500	NA	NA	1.7	Electro Fusion
3500	3714	3500	5660	5500	NA	NA	1.1	Electro Fusion
4000	4214	4000	5660	5500	NA	NA	0.7	Electro Fusion

Overall and effective lengths may change without notice

Measurements are approximate and subject to change without notice

*Also Available with an electro-fusion joint (WA only)

From 1050-4000 different stiffness ratings can be manufactured (WA only)

*Measurements are in millimetres *Measurements are approximate

APPLICATIONS

SUBDIVISION STORM WATER MANAGEMENT

Enviropipes manufactures storm water pipe systems (Enviropipes Stormwater Pipes) in diameters from 100mm up to 4000mm which provide outstanding storm water management capacity as well as out performing other storm water systems. High Density Polyethylene (HDPE) pipes collect storm water runoff through a surface inlet and drain it to an appropriate outlet. Storm water systems can be small and simple, such as that used for a modest housing development, to complex systems used in metropolitan areas serving a combination of residential, commercial, and industrial developments.

SUB DRAINS

A sub-drain system is an underground network of piping used to remove water from areas that collect or retain surface water or groundwater. The network can be small, such as those used to drain a limited area, or large draining a sizable number of acres.

Surface water can be collected into the sub-drain system by installing a surface inlet or catch basin. Groundwater is collected by allowing water into the pipe through perforations. Both surface water and groundwater can be discharged to an appropriate outlet.

LNG, WASTE WATER TREATMENT PLANTS AND MINE SITES

Enviropipes Stormwater Pipes can be used for site drainage and underground water storage. The use of Enviropipes Stormwater Pipe is advantageous as the rubber ring jointed pipes require no further welding or couplings. Our pipe offers high resistance to abrasion and corrosion which is important when considering installing into aggressive soils.

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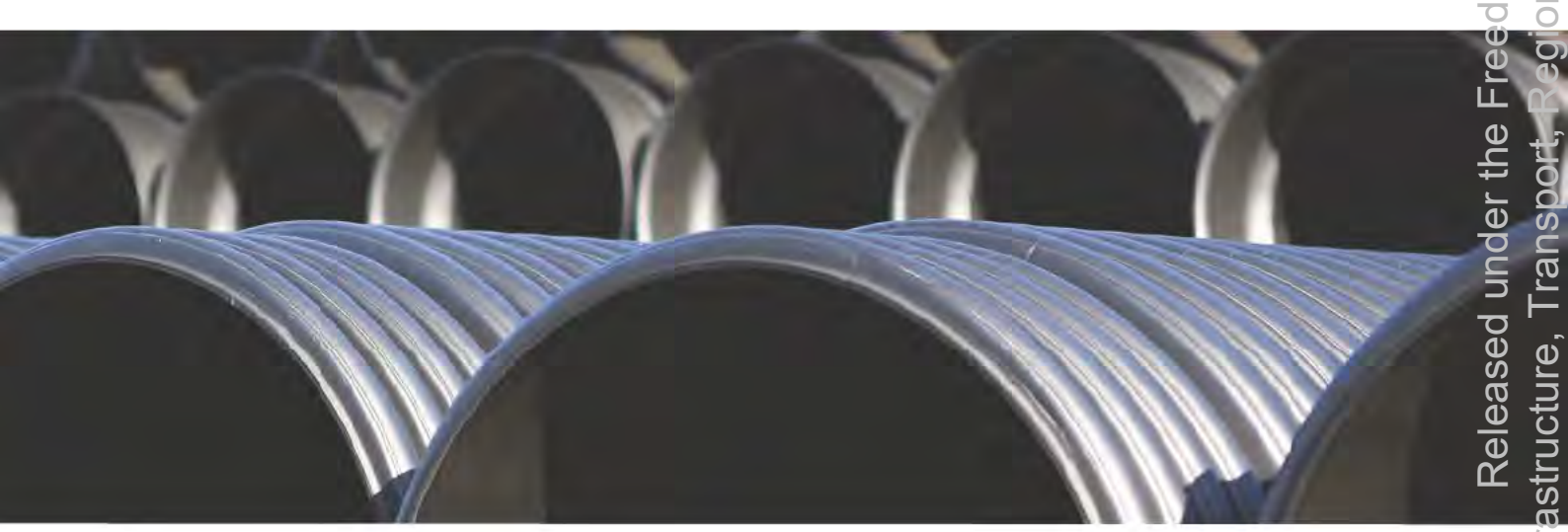
ADVANTAGES

PIPE WEIGHT

The extremely low weight of Enviropipes Stormwater Pipes and EnviroSewer® pipes allows simpler and faster installation. Most cases no heavy machinery is necessary for the installation and handling of the pipes. Most of the handling can be done by an excavator on site or even by hand.

COST EFFECTIVE SOLUTIONS

Storm water and sewer applications demand high performance and minimised cost. Enviropipes Stormwater Pipes and EnviroSewer® pipe is a competitively priced solution compared to alternate systems. Installation costs of High Density Polyethylene (HDPE) systems are generally lower than other pipe materials, due to its light weight and jointing systems. Fast installation minimises traffic disruption and other nuisance factors associated with underground installations.



ADVANTAGES

LONG LIFE

HDPE (PE100) pipes have proven reliability across a range of applications of around 50 years. The Water Services Association of Australia (WSAA) Polyethylene Pipeline Code predicts a life in excess of 100 years before major rehabilitation is required.

INSTALLATION

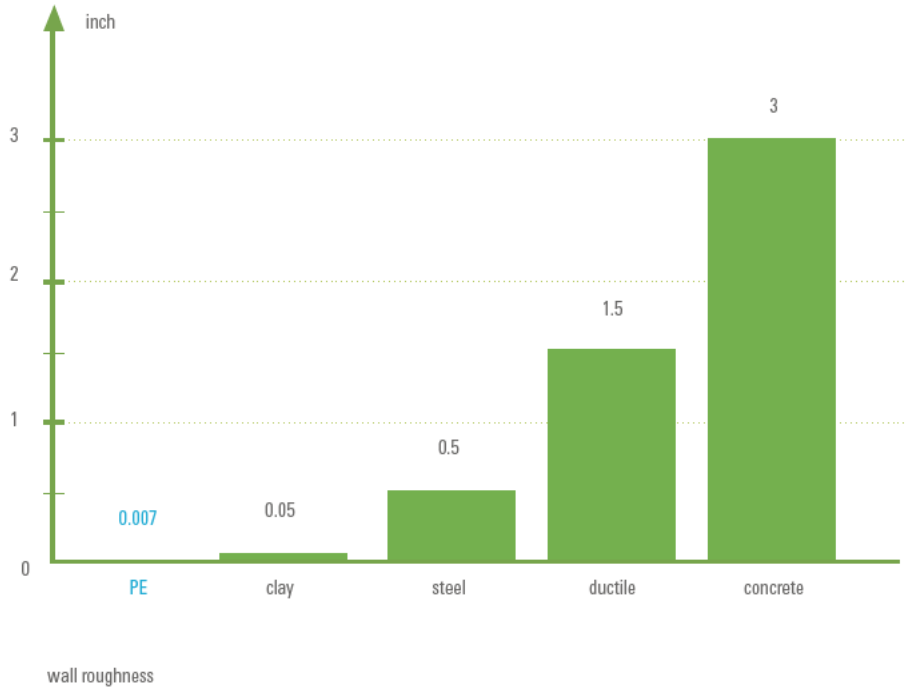
The installation time is shorter than other materials as the standard pipe lengths are between 5.5 to 6 meters long. Fewer lifts mean unloading and loading the pipes into position saves even more time. Longer lengths can be shop fabricated on request.

CHEMICAL CORROSION RESISTANCE

Enviropipes Stormwater Pipes are manufactured from HDPE (PE100) material and have excellent resistance internally and externally to protect against aggressive soils, chemicals and corrosion.

EFFECTIVE ROUGHNESS

Due to its low roughness as shown in the graph below there is almost no accumulation on the pipe bottom, Enviropipes Stormwater Pipes and EnviroSewer® pipes have the ability to self purify. Low roughness has an important economic advantage as maintenance expenditure is kept to a minimum. Due to the low roughness the hydraulic properties are improved and smaller diameters are required compared to conventional pipe materials with the same flow rate. Enviropipes Stormwater Pipes and EnviroSewer® pipes convey flows up to 17% greater than concrete pipes, and up to 60% greater than corrugated steel pipes.



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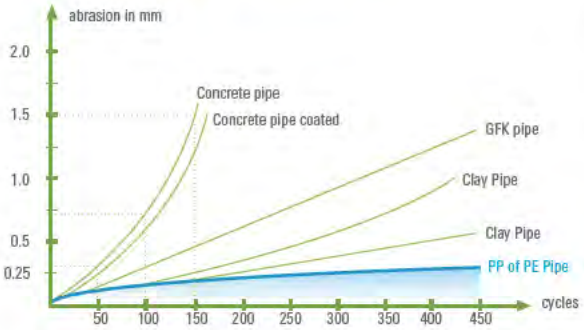
ADVANTAGES

ABRASION RESISTANCE



Abrasion curve of various pipe materials according to the Darmstadt procedure

Polyethylene pipes are among the most abrasion resistant pipes in the world. This has been tested in the Darmstadt procedure and the results are shown in the diagram to the left and supports the quality of polyethylene pipes.

UV-RESISTANCE

Commonly most natural materials and other plastics are degraded by weathering effects, particularly by the combined impact of short-wave ultraviolet radiation in sunlight and atmospheric oxygen.

Black polyethylene pipes are permanently resistant to atmospheric corrosion and UV radiation, as the polyethylene used contains carbon black which acts as both a pigment and an ultra violet stabiliser. Thus the pipes can be used and stored outside without the pipe material being damaged.

RESISTANCE TO MICRO-ORGANISMS

Polyethylene is not nutrient media for bacteria, fungi and spores, so that the material is resistant to all forms of microbial attack as well as both sulphurous acid and sulphates.

JOINTING

The following step by step procedure is recommended when joining corrugated pipes.

STEP 1

Clean both the pipe socket and spigot, making sure they are free from any debris.

STEP 4

Apply joining lubricant.

STEP 2

Apply the rubber ring by stretching it over the spigot so that it rests between the first and second corrugations.

STEP 5

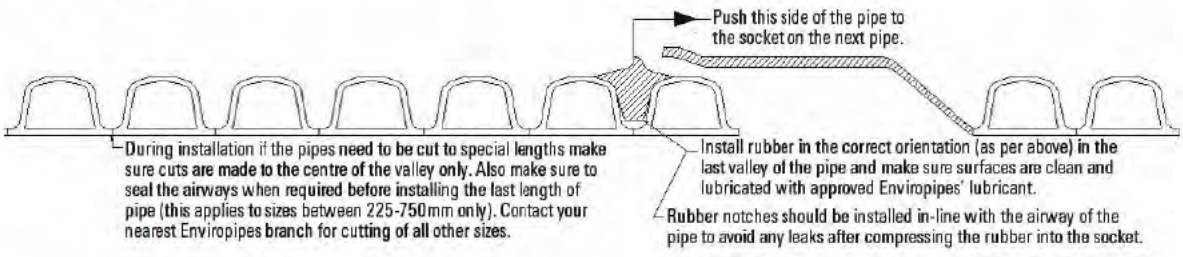
Apply an even joining force until the spigot end comes into contact with the inner wall of the socket (A timber glut and crowbar may be used if circumstances permit).

STEP 3

Ensure that the rubber ring is fitted by running your fingers around it.

Important information for rubber orientation and cutting of Enviropipes Corrugated pipe from 225-750mm (Please contact your nearest Enviropipes branch for cutting of all other sizes)

- During installation if the pipes need to be cut to special lengths make sure cuts are made to the centre of the valley only, also make sure to seal the airways when required before installing the last length of pipe (this applies to sizes between 225-750mm only). Contact your nearest Enviropipes branch for cutting of all other sizes.
- Install rubber in the correct orientation (as per below picture) in the last valley of the pipe and make sure surfaces are clean and lubricated with approved Enviropipes lubricant.
- Rubber notches should be installed in line with the airway of the pipe to avoid any leaks after compressing the rubber into the socket.



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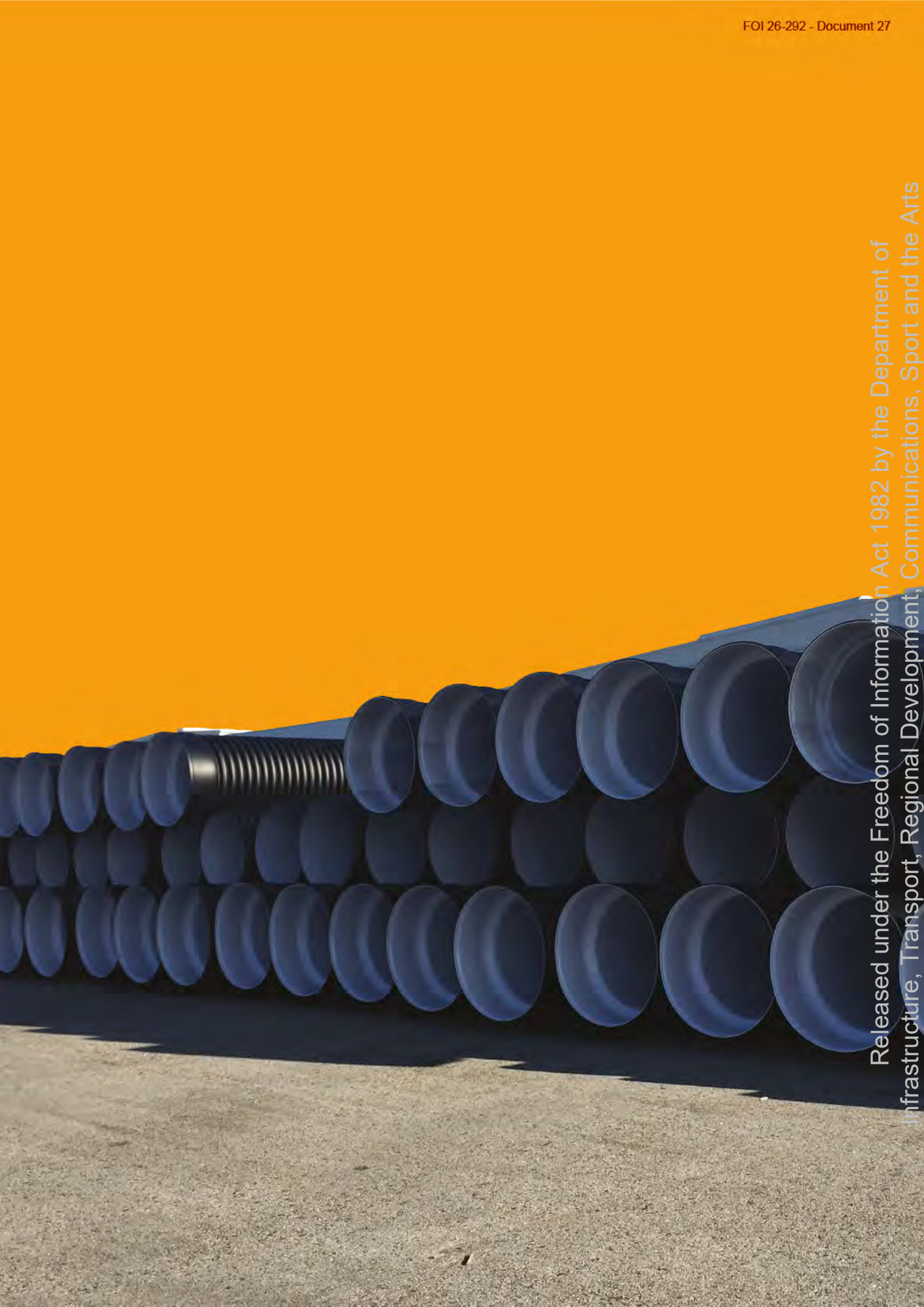

CORRUGATED **FITTINGS**

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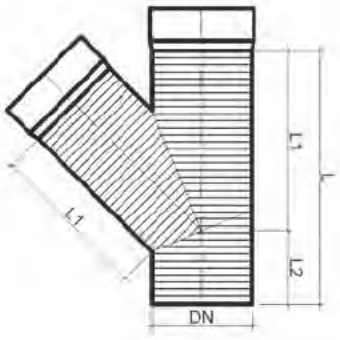
JUNCTION 45/60° WELDED

For use with corrugated pipe



DN	PART NUMBER	L	L1	L2
225	CJ225..	1415	940	475
300	CJ300..	1455	980	475
375	CJ375..	1505	1020	485
450	CJ450..	1535	1050	485
525	CJ525..	1740	1200	540
600	CJ600..	1740	1200	540
750	CJ750..	2530	1800	730
900	CJ900..	3070	2000	1070

..Degree to be specified

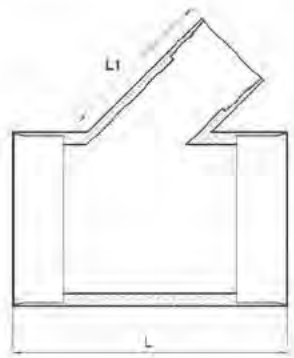
**Dimensions up to 4000mm can be manufactured upon request

Note: Off takes can also be offered to adapt to DWV, if further information is required contact your nearest Enviropipes branch

JUNCTION 45° (ADAPTED OFF TAKE)

Junction 45° to 160mm Corrugated or DN150 DWV

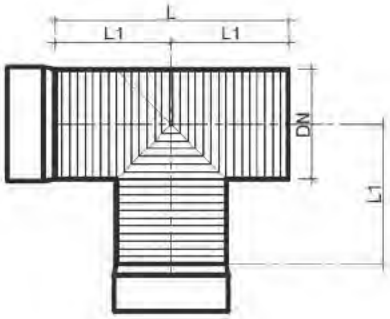
Main line for use with corrugated pipe



DN	PART NUMBER	L	L1
225	CJ22545DWV	535	330
300	CJ30045DWV	565	330
375	CJ37545DWV	625	330
450	CJ45045DWV	715	330
525	CJ52545DWV	775	330
600	CJ60045DWV	855	330
750	CJ75045DWV	887	330
900	CJ90045DWV	875	330
1050	CJ105045DWV	845	330

EQUAL TEE 90°

For use with corrugated pipe



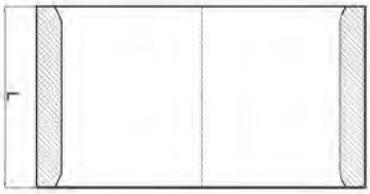
DN	PART NUMBER	L1	L
225	CT225PE	475	960
300	CT300PE	570	1020
375	CT375PE	590	1180
450	CT450PE	650	1300
525	CT525PE	680	1360
600	CT600PE	700	1400
750	CT750PE	1000	2000
900	CT900PE	1270	2540

**Dimensions up to 4000mm can be manufactured upon request

Note: Off takes can also be offered to adapt to DWV, if further information is required contact your nearest Enviropipes branch

REPAIR COUPLING

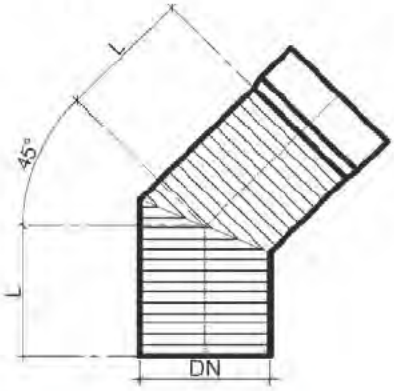
For use with corrugated pipe



DN	PART NUMBER	L
225	CRC225	200
300	CRC300	250
375	CRC375	300
450	CRC450	400
525	CRC525	450
600	CRC600	500
750	CRC750	550

SEGMENTED BEND 30/45⁰ WELDED

For use with corrugated pipe



DN	PART NUMBER	L
225	CSB225..PE	475
300	CSB300..PE	475
375	CSB375..PE	485
450	CSB450..PE	485
525	CSB525..PE	540
600	CSB600..PE	540
750	CSB750..PE	720
900	CSB900..PE	1070

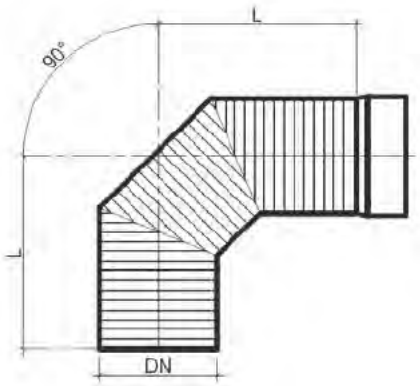
..Degree to be specified

**Dimensions up to 4000mm can be manufactured upon request

Note: Off takes can also be offered to adapt to DWV, if further information is required contact your nearest Enviropipes branch

SEGMENTED BEND 60/90⁰ WELDED

For use with corrugated pipe



DN	PART NUMBER	L	L1	L2
225	CSB225..PE	800	475	465
300	CSB300..PE	800	475	465
375	CSB375..PE	810	485	470
450	CSB450..PE	810	485	470
525	CSB525..PE	910	540	520
600	CSB600..PE	910	540	520
750	CSB750..PE	1200	720	680
900	CSB900..PE	1800	1070	1030

..Degree to be specified

**Dimensions up to 4000mm can be manufactured upon request

Note: Off takes can also be offered to adapt to DWV, if further information is required contact your nearest Enviropipes branch

Certified System
Quality
ISO 9001
SAI GLOBAL

WaterMark

ISO 9001 Certified ApprovalMark

JAS-ANZ

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WESTERN AUSTRALIA

WSAA
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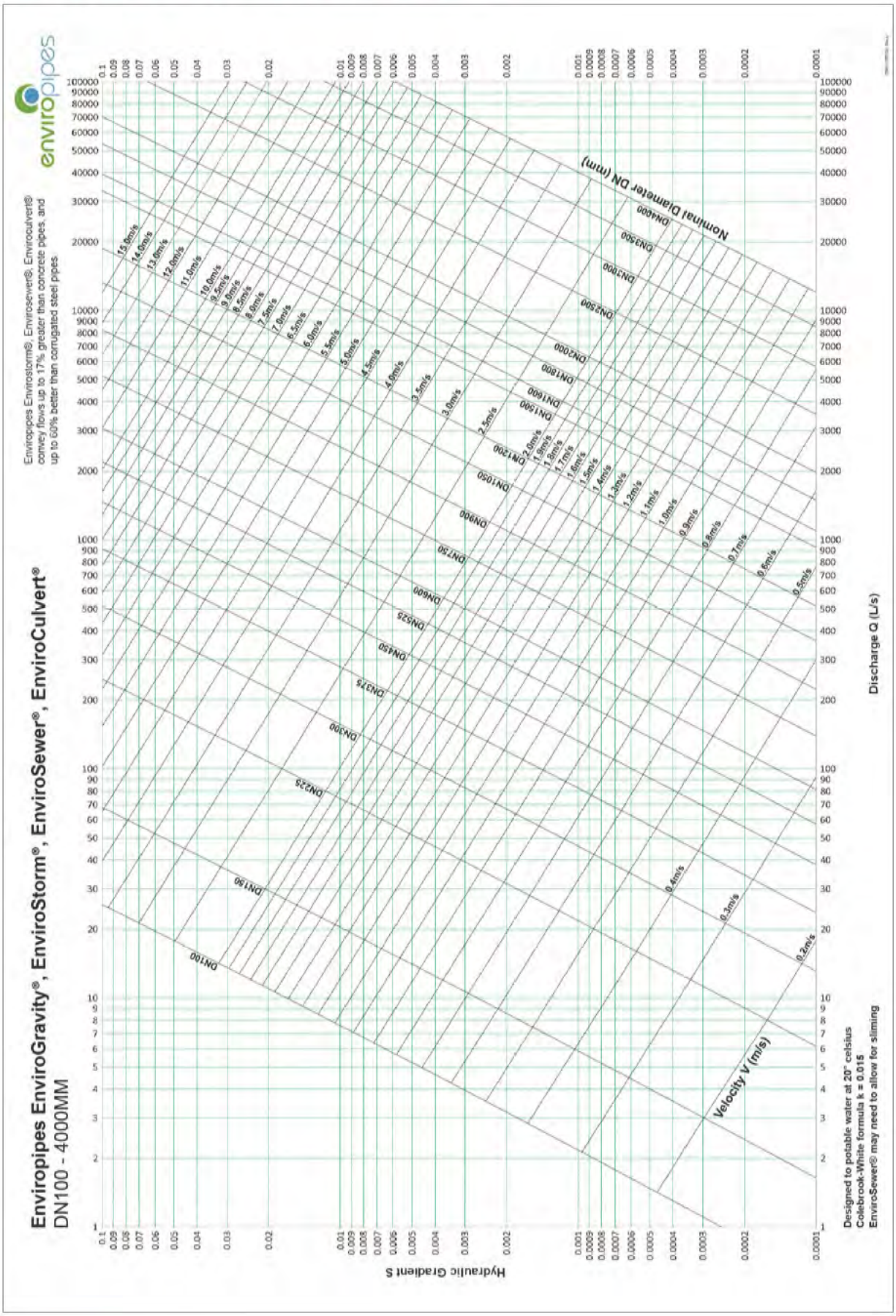
CORRUGATED **TECHNICAL**

NAMOGRAM - GRAVITY PIPE



BACKFILL – CEMENT STABILISED

Minimum & Maximum Cover in meters

				Minimum Cover			
Pipe Size	SN rating	Min. Trench Width	Multi Barrel Min Spacing From outside edge of pipe	Traffic Load - AS5100.2 SM1600 Load *See note 4	Construction Equipment - Cat 793F Wheel Load *See note 6	Railway Load - AS4799-2000 Table A1 (Average Intensity Railway Load) *See note 3	Maximum Cover
225	8	0.8	0.15	0.5	0.9	0.7	13.2
300	8	0.9	0.15	0.5	1.0	0.7	11.7
375	8	1.0	0.15	0.5	1.0	0.7	10.9
450	8	1.3	0.15	0.5	1.0	0.7	12.1
525	8	1.5	0.20	0.5	1.0	0.7	12.1
600	8	1.6	0.20	0.5	1.0	0.7	11.3
750	8	1.9	0.20	0.5	1.1	0.7	10.5
900	8	2.1	0.20	0.5	1.2	0.7	9.6
1050	8	2.3	0.20	0.5	1.3	0.7	9.0
1200	8	2.5	0.20	0.5	1.3	0.7	8.8
1500	8	2.8	0.20	0.5	1.4	0.7	8.0
1600	8	3.0	0.20	0.5	1.4	0.7	7.0
1800	4	3.2	0.20	0.6	1.9	1.5	5.0
2000	4	3.6	0.20	0.7	1.9	2.8	5.0

Minimum covers in accordance to AS2566.1-1998	
Not subject to vehicular loading	0.3 m
Subject to vehicular loading -	
not in roadways	0.45 m
in sealed roadways	0.60 m
under unsealed roadways	0.75 m
Subject to construction equipment loading	0.75 m

Conditions to the above:

1. Based on a native soil (surrounding cement stabilised backfill) having a compaction of 90% MMDD, consisting of coarse-grained soil with more than 12% fines.
2. Backfill material shall be a cement stabilised granular soil, achieving a minimum moduli of 25MPa, mixed in accordance to Appendix L of AS2566.2-Buried flexible pipelines Part 2: Installation.
3. Minimum cover for rail installations has been specified from top of pipe to top of sub-ballast.
4. SM1600 loading incorporates W80, A160, M1600, and S1600 traffic design loads detailed in AS5100.2-2004:
   A160 traffic loads have an axle load of 160kN
   M1600 traffic loads have an axle load of 120kN
   S1600 traffic loads have an axle load of 80kN
5. Railway loads have been designed for a single axle weight of 240kN
6. Construction Cat 793F loads have been designed for a single axle weight of 2500kN, with maximum vehicle weight of 390 tonnes
7. Minimum covers presented in the table are only suited to EnviroCulvert, EnviroGravity, EnviroSewer, and Enviropipes Stormwater Pipes and have been calculated through detailed design and require advanced installation methods to be achieved.

BACKFILL - SAND AND COARSE GRAINED SOILS

Minimum & Maximum Cover of Enviroculvert (in metres)

				Minimum Cover			
Pipe Size	SN rating	Min. Trench Width	Multi Barrel Min Spacing From outside edge of pipe	Traffic Load - AS5100.2 SM1600 Load *See note 4	Construction Equipment - Cat 793F Wheel Load *See note 6	Railway Load - AS4799-2000 Table A1 (Average Intensity Railway Load) *See note 3	Maximum Cover
225	8	0.8	0.20	0.5	1.3	0.7	8.0
300	8	0.9	0.20	0.5	1.3	0.7	8.0
375	8	1.0	0.20	0.5	1.4	0.7	8.0
450	8	1.3	0.20	0.5	1.4	0.7	8.0
525	8	1.5	0.30	0.5	1.4	0.7	8.0
600	8	1.6	0.30	0.5	1.4	0.7	8.0
750	8	2.3	0.30	0.5	1.4	0.7	7.0
900	8	2.7	0.30	0.5	1.4	0.7	7.0
1050	8	4.2	0.35	0.5	1.4	0.7	7.0
1200	8	4.3	0.35	0.5	1.4	0.7	7.0
1500	8	6.1	0.35	0.5	1.4	0.7	7.0
1600	8	6.1	0.40	0.5	1.4	0.7	7.0
1800	4	6.5	0.45	0.6	1.7	1.3	6.0
2000	4	6.5	0.50	0.7	1.8	1.4	6.0

Minimum covers in accordance to AS2566.1-1998	
Not subject to vehicular loading	0.3 m
Subject to vehicular loading -	
not in roadways	0.45 m
in sealed roadways	0.60 m
under unsealed roadways	0.75 m
Subject to construction equipment loading	0.75 m

Conditions to the above:

1. Based on a native soil (surrounding sand and coarse-grained backfill) having a compaction of 90% MMDD, consisting of coarse-grained soil with more than 12% fines.
2. Backfill material shall be sand and coarse-grained soil with less than 12% fines, achieving a minimum compaction of 90% MMDD.
3. Minimum cover for rail installations has been specified from top of pipe to top of sub-ballast.
4. SM1600 loading incorporates W80, A160, M1600, and S1600 traffic design loads detailed in AS5100.2-2004:
   A160 traffic loads have an axle load of 160kN
   M1600 traffic loads have an axle load of 120kN
   S1600 traffic loads have an axle load of 80kN
5. Railway loads have been designed for a single axle weight of 240kN
6. Construction Cat 793F loads have been designed for a single axle weight of 2500kN, with maximum vehicle weight of 390 tonnes
7. Minimum covers presented in the table are only suited to EnviroCulvert, EnviroGravity, EnviroSewer, and Enviropipes Stormwater Pipe and have been calculated through detailed design and require advanced installation methods to be achieved.

CORRUGATED TO RCP COMPARISON

RCP Size	Enviropipes Corrugated Size	Class 2	Allowable Depths (m)	Class 3	Allowable Depths (m)	Class 4	Allowable Depths (m)	Class 6	Allowable Depths (m)	Class 8	Allowable Depths (m)	Class 8	Allowable Depths (m)
225	225	SN4	ALL	SN8	0.6 - 7.3	SN8	0.6 - 7.3	-	-	-	-	-	-
300	300	SN2	ALL	SN6	ALL	SN8	0.6 - 7.3	SN8	0.6 - 7.3	SN8	0.6 - 7.3	SN8	0.6 - 7.3
375	375	SN2	ALL	SN6	ALL	SN8	0.6 - 7.2	SN8	0.6 - 7.2	SN8	0.6 - 7.2	SN8	0.6 - 7.2
450	450	SN2	ALL	SN4	ALL	SN8	ALL	SN8	0.6 - 7.2	SN8	0.6 - 7.2	SN8	0.6 - 7.2
525	525	SN2	ALL	SN4	ALL	SN8	ALL	SN8	0.6 - 7.1	SN8	0.6 - 7.1	SN8	0.6 - 7.1
600	600	SN2	ALL	SN4	ALL	SN8	ALL	SN8	0.6 - 7.1	SN8	0.6 - 7.1	SN8	0.6 - 7.1
750	750	SN2	ALL	SN4	ALL	SN8	ALL	SN8	0.6 - 6.8	SN8	0.6 - 6.8	SN8	0.6 - 6.8
900	900	SN2	ALL	SN4	ALL	SN8	ALL	SN8	0.6 - 6.9	SN8	0.6 - 6.9	SN8	0.6 - 6.9
1050	1050	SN2	ALL	SN4	ALL	SN8	ALL	SN8	0.6 - 6.6	SN8	0.6 - 6.6	SN8	0.6 - 6.6
1200	1200	SN2	ALL	SN4	ALL	SN6	ALL	SN8	0.6 - 6.6	SN8	0.6 - 6.6	SN8	0.6 - 6.6
1500	1500	SN2	ALL	SN4	ALL	SN6	ALL	SN8	0.6 - 6.6	SN8	0.6 - 6.6	SN8	0.6 - 6.6
1650	1650	SN2	ALL	SN4	ALL	SN6	ALL	SN8	0.6 - 6.5	SN8	0.6 - 6.5	SN8	0.6 - 6.5
1800	1800	SN2	ALL	SN4	ALL	SN6	ALL	SN8	0.6 - 6.5	SN8	0.6 - 6.5	SN8	0.6 - 6.5
1950	2000	SN2	ALL	SN4	ALL	SN6	ALL	SN8	0.6 - 6.5	SN8	0.6 - 6.5	SN8	0.6 - 6.5

NOTES:

1. This table should be used for reference only, detailed design is required based on site conditions and pipe types.
2. Pipe strength comparisons are for buried pipes only, as the design relies upon the surrounding soil to achieve their design capacities.
3. Refer to the Enviroculvert minimum and maximum load tables to determine the required SN rating for the applied load and design covers.
4. Enviroculvert bedding assumptions:

   Based on a native soil (surrounding cement stabilised backfill) having a compaction of 90% MMDD, consisting of coarse-grained soil with more than 12% fines.

   Backfill material shall be sand and coarse-grained soil with less than 12% fines, achieving a minimum compaction of 90% MMDD.
5. Concrete pipe bedding assumed to be sand and gravel in trench conditions
6. Live loads are based on SM1600 loading criteria, and incorporate W80, A160, M1600, and S1600 traffic design loads detailed in AS5100.2-2004

ENDORSEMENTS AND POLICIES

QUALITY POLICY

Enviropipes Pty Ltd is an Australian owned company which specialises in the manufacture and supply of Polypropylene and Polyethylene Pipes and Fittings up to and including 4000mm internal diameter. EnviroPipes manufactures its products to Australian & International Standards as well as client requirements and specifications.

ENVIROPIPES MANAGEMENT AND EMPLOYEES:

- Are committed to providing customers with quality products and service which meet their expectations, in a timely manner and in conformance with AS/NZS ISO9001:2016.
- Work to continually improve the processes and products and identifying opportunities to improve business performance.
- Are committed to achieving clearly defined company objectives which are reviewed on a regular basis.
- Promote the quality management systems and ensure implementation is achieved by internal auditing, management review, corrective and preventive action.
- Regularly communicate the quality policy throughout the business and review for its continued suitability.

Our vision is to become a leading manufacturer of Polypropylene & Polyethylene Pipes & Fittings by providing customers with quality products and service.

Joe Horvat
Director

Belmiro Da Silva Jorge
Director

ENVIRONMENTAL POLICY

Enviropipes Pty Ltd is a privately owned company specialising in the manufacture of Pressure and Non-Pressure Piping Systems. Enviropipes is committed to ensuring its personnel understand the environmental responsibilities and minimise environmental impacts of its operations at the Enviropipes facility and the surrounding area, safeguarding the environment and its natural resources.

TO ACHIEVE THIS, ENVIROPIPES WILL:

- Prevent pollution and the risk of pollution wherever possible;
- Understand the potential environmental risks through regular site and operational risk assessments;
- Minimise identified environmental risks through implementation of appropriate control measures;
- Ensure compliance with all legal and other requirements applicable to the organisation;
- Aim to continually improve environmental performance at the facility through the development and implementation of Environmental Performance Objectives.

Joe Horvat
Director

Belmiro Da Silva Jorge
Director

OCCUPATIONAL SAFETY & HEALTH POLICY

Enviropipes Pty Ltd recognises its moral and legal responsibility to provide and maintain a work environment in which employees, contractors, customers and visitors are not exposed to hazards. This commitment extends to ensuring that the organisations operations do not place local community at risk of injury, illness or property damage.

Enviropipes will:

- Provide and maintain safe work practices, safe plant and safe systems of work.
- Provide written procedures and instructions to ensure safe systems of work.
- Provide information, instruction, training and supervision to employees, contractors and customers to ensure that they are not exposed to hazards.
- Ensure compliance with legislative requirements and current industry standards.
- Provide support and assistance to employees.

All levels of management shall be responsible for implementing this policy in their respective areas.

MANAGEMENT RESPONSIBILITIES INCLUDE THE FOLLOWING:

- The provision and maintenance of the workplace in a safe condition.
- Involvement in the development, promotion and implementation of safety and health policies and procedures.
- Training employees in the safe performance of assigned tasks.
- The provision of resources to meet the safety and health commitment.

EMPLOYEES ARE TO:

- Follow all the safety and health policies and procedures.
- Report all known and observed hazards to their immediate Supervisor.

This Policy is applicable to Enviro Pipes in all its operations and functions including those situations where employees are required to work off site.

Joe Horvat
Director

Belmiro Da Silva Jorge
Director

MAIN ROADS ENDORSEMENT

Enquiries: Michael Vujcich on
Our Ref: 04/10104-02
Your Ref:

6 September 2011

Mr J Simpson
Business Development Manager
Enviropipes Pty Ltd
1220 Abernethy Road
HIGH WYCOMBE WA 6057

ATTENTION: JASON SIMPSON

Dear Mr Simpson

MRWA ENDORSMENT OF ENVIROPIPE PE100 FLEXIBLE PIPE

I refer to your email dated 25th August 2011 Seeking approval of the Enviropipes PE100 range of pipe and fittings to be used on the MRWA network.

As part of Main Roads assessment the following documentation was reviewed:
*Enviropipes PE100 pipe brochure
*Enviropipes pipe joining document
*Enviropipes pipe installation guide
*Enviropipes specifications document
*Abrasion resistance: polyethylene vs polypropylene, PVC, Clay, Concrete Coated and Concrete document
*Wall Roughness Polyethylene vs Clay, Steel, Ductile and Concrete document
*HDPE Chemical Resistance document
*AS/NZS 5065 Australian / New Zealand standard specification for polyethylene pipes and fittings for drainage applications
*Independent NATA Test Results for Ring Stiffness According to ISO 9969
*Test Certificate of Analysis of PE100 Material
*ISO9080:2003 MRS Test Results for PE100 Material

Based on this documentation Main Roads approves the use of Enviropipe PE100 product on the following conditions

1. That Enviropipe PE100 only be used on the Main Roads network as a culvert, where the term culvert is defined in AS 1348 - 2002. Main Roads are yet to approve use of flexible pipe in stormwater piped networks and at this stage are unable to provide a definitive time frame as to when this may occur.
2. Any changes that may adversely affect structural features, durability, operational or maintenance characteristics of Enviropipes PE100 will require a new acceptance letter.
3. Should Main Roads discover that the information provided was incorrect, that in-service performance is unacceptable, or that the plastic flexible pipes being marketed are significantly different from the information provided, it reserves the right to modify or revoke its acceptance.
4. Enviropipes Pty Ltd will be expected to supply potential users with sufficient information on design and installation requirements to ensure proper performance.
5. All product supplied as Enviropipes PE100 must have essentially the same chemistry, mechanical properties, and geometry as that submitted for approval.
6. To prevent misunderstanding by others, this letter of acceptance, designated as document number D11#213833, shall not be reproduced except in full. This letter and the documentation upon which this letter is based is public information. All such letters and documentation may be reviewed at our office upon request.

The clauses that related to the installation requirements for Enviropipe PE100 pipe shall be located in the Guidance Notes section of Main Roads standard specification 404 titled 'Culverts'. Where the Main Roads Project Manager elects to use plastic flexible culverts then these clauses shall be added under the Contract Specific Requirements section in the standard specification. Note that the Specification will require an amendment to reflect this newly approved product. In the interim this letter of endorsement may be used as evidence that Main Roads accept use of Enviropipe PE100 as of the date above.

If you require any further information then please contact Michael Vujcich on 9323 4640 or myself on 9323 4277. In reply please quote file reference 04-10104-02.

Yours sincerely

Rob Grove
MANAGER ROAD & TRAFFIC ENGINEERING

AS4129 CERTIFICATE

CERTIFICATE OF CONFORMITY

ApprovalMark International hereby grants:

Enviro Pipes Pty Ltd
1180 Abernethy Rd
Perth Airport 6105
AUSTRALIA

WaterMark Certificate of Conformity – Level 1
Evaluated to:

AS/NZS 4129: 2008 – Fittings for polyethylene (PE) pipes for pressure applications

The WaterMark licensee shall comply with all the terms and conditions as stipulated by the governance of the operating rules of WaterMark, and shall comply with standard requirement at all times including when standard is amended. The WaterMark license only covers the product which is identified in the product schedule.

This certificate is issued by a JAS-ANZ accredited certification body. The NBCB and JAS-ANZ do not in any way warrant, guarantee or represent that the use of the subject of this Certificate conforms to the WaterMark Certification Scheme Rules, nor accepts any liability arising out of the use of the product. The NBCB disclaims to the extent permitted by law, all liability (including negligence) for claims of losses, expenses, damages and costs arising as a result of the use of the product(s) referred to in the certificate.

This certificate must only be reproduced in its entirety.

Certificate No. WM 72309

Issued: 2nd May 2018 — Originally Certified: 10th December 2012

Expires: 10th December 2022 — Current Certification: 10th December 2017

John PRASAD
Director
ApprovalMark International Pty Ltd
20/33 Holbeche Road, Arndell Park 2148, Australia
www.approvalmark.com

JAS-ANZ — ApprovalMark Certification — WaterMark

ApprovalMark

AS4130 CERTIFICATE

CERTIFICATE OF CONFORMITY

ApprovalMark International hereby grants:

Enviro Pipes Pty Ltd
1180 Abernethy Road
Perth Airport, 6105
AUSTRALIA

WaterMark Certificate of Conformity – Level 1
Evaluated to:

AS/NZS 4130: 2009 – Polyethylene (PE) pipes for pressure applications

The WaterMark licensee shall comply with all the terms and conditions as stipulated by the governance of the operating rules of WaterMark, and shall comply with standard requirement at all times including when standard is amended. The WaterMark license only covers the product which is identified in the product schedule.

This certificate is issued by a JAS-ANZ accredited certification body. The NBCB and JAS-ANZ do not in any way warrant, guarantee or represent that the use of the subject of this Certificate conforms to the WaterMark Certification Scheme Rules, nor accepts any liability arising out of the use of the product. The NBCB disclaims to the extent permitted by law, all liability (including negligence) for claims of losses, expenses, damages and costs arising as a result of the use of the product(s) referred to in the certificate.

This certificate must only be reproduced in its entirety.

Certificate No. WM 72303

Issued: 2nd May 2018 — Originally Certified: 5th October 2012

Expires: 5th October 2022 — Current Certification: 5th October 2017

John PRASAD
Director
ApprovalMark International Pty Ltd
20/33 Holbeche Road, Arndell Park 2148, Australia
www.approvalmark.com

JAS-ANZ — ApprovalMark Certification — WaterMark

ApprovalMark

ISO TYPE 5 CERTIFICATE AS4130

ISO TYPE 5

CERTIFICATE OF CONFORMITY

Certified Product ApprovalMark

ApprovalMark International hereby grants:

ENVIRO PIPES PTY LTD
1180 Abernethy Road
Perth Airport 6105
AUSTRALIA

Evaluated to:
AS/NZS 4130:2009 Polyethylene (PE) pipes for pressure applications

The ISO Type 5 licensee shall comply with all the terms and conditions as stipulated by the governance of the operating rules of ISO Type 5 scheme, and shall comply with standard requirement at all times including when standard is amended. The ISO Type 5 license only covers the product which is identified in the product schedule.

Certificate No. AMI 72303

Issued: 5th October 2017 — Original Issue: 5th October 2012

Expires: 5th October 2022

John PRASAD
Director

ApprovalMark International — JAS-ANZ

Registered by: ApprovalMark International Pty Ltd (ABN 59 143 259 974) Unit 20, 33 Holbeche Road Arndell Park NSW 2148 Australia. The assessment was carried with appropriate skill and assessment by ApprovalMark International Pty Ltd; however it will only accept its responsibility for proven negligence. The certificate remains the property of ApprovalMark International Pty Ltd.

ApprovalMark

ISO TYPE 5 CERTIFICATE AS5065

ISO TYPE 5

CERTIFICATE OF CONFORMITY

Certified Product ApprovalMark

ApprovalMark International hereby grants:

ENVIRO PIPES PTY LTD
1180 Abernethy Road
Perth Airport 6105
Perth, Western Australia

Evaluated to:
AS/NZS 5065: 2005 - Polyethylene and polypropylene pipes and fittings for drainage and sewerage applications

The ISO Type 5 licensee shall comply with all the terms and conditions as stipulated by the governance of the operating rules of ISO Type 5 scheme, and shall comply with standard requirement at all times including when standard is amended. The ISO Type 5 license only covers the product which is identified in the product schedule.

Certificate No. AMI 72302

Re-issued: 5th October 2017 — Issued: 5th October 2012

Expired: 5th October 2022

John PRASAD
Certification Manager

ApprovalMark International — JAS-ANZ

Registered by: ApprovalMark International Pty Ltd (ABN 59 143 259 974) Unit 20, 33 Holbeche Road, Arndell Park NSW 2148 Australia. The assessment was carried with appropriate skill and assessment by ApprovalMark International Pty Ltd; however it will only accept its responsibility for proven negligence. The certificate remains the property of ApprovalMark International Pty Ltd.

ApprovalMark

AS5065 CERTIFICATE

CERTIFICATE OF CONFORMITY

ApprovalMark International harvey grants

Enviro Pipes Pty Ltd
1180 Abernethy Road
Perth Airport, 6105
WESTERN AUSTRALIA

WaterMark Certificate of Conformity – WMCS 2016
Evaluated to:

AS/NZS 5065:2005 – Polyethylene and Polypropylene pipes and fittings for drainage and sewerage applications

This WaterMark licensee must comply with all the terms and conditions as stipulated by the governance of the operating rules of WaterMark, and shall comply with standard requirements at all times including when standard is amended. The WaterMark licence only covers the product details as specified in the product schedule.

This certificate is issued by a JAS-ANZ accredited certification body. The ABCB and JAS-ANZ do not in any way warrant, guarantee or represent that the product the subject of this Certificate conforms to the WaterMark Certification Scheme Rules, nor accepts any liability arising out of the use of the product. The ABCB disclaims to the extent permitted by law, all ability (including negligence) for claims/all losses expenses, damages and costs arising as a result of the use of the product(s) referred to in this certificate.

*This certificate may only be reproduced in its entirety

Certificate No. WM 72302

Issued: 5th October 2018 — OriginallyCertified: 5th October 2011

Expires: 5th October 2023 — Current Certification: 5th October 2018

John PRASAD
Director
ApprovalMark International Pty Ltd
20/32 Hodsche Road, Arncliffe Park 2148, Australia
www.approvalmark.com

JAS-ANZ

ApprovalMark Certification

WaterMark

ApprovalMark

ISO 9001 CERTIFICATE

CERTIFICATE OF REGISTRATION

This is to certify that:

Enviropipes Pty Ltd
ABN 81 130 696 618

1180 Abernethy Road Perth Airport WA 6105 AUSTRALIA

operates a
QUALITY MANAGEMENT SYSTEM

which complies with the requirements of
ISO 9001:2015

for the following scope

The manufacture, sales and supply of plastic piping systems, pipe extrusion of polyethylene and polypropylene piping, fittings and associated components, including the processes of plastic welding and fabrication, plastic forming and machining.

Certificate No: QEC29623

Issued: 21 December 2017 — Originally Certified: 22 February 2012

Expires: 21 February 2021 — Current Certification: 15 December 2017

Nicole Grantham
General Manager SAI Global Certification Services

JAS-ANZ

ISO 9001

SAI GLOBAL

Perth Head Office
1180 Abernethy Road
Perth Airport WA 6105

PO Box 2454
High Wycombe
Perth Western Australia 6057

Ph: +61 (8) 9352 8444
Fax: +61 (8) 9352 8400

Email sales@enviropipes.com.au

Brisbane Branch Office
A4 692 Curtin Ave East
Pinkenba QLD 4008

Ph: +61 (7) 3260 1416
Fax: +61 (7) 3260 1409

Email: salesQLD@enviropipes.com.au

Melbourne Branch Office
33 Glenbarry Road
Campbellfield VIC 3061

Ph: +61 (3) 9357 8163
Fax: +61 (3) 9357 9920

Email: salesVIC@enviropipes.com.au

Afterhours (All locations)
+61 407 729 899

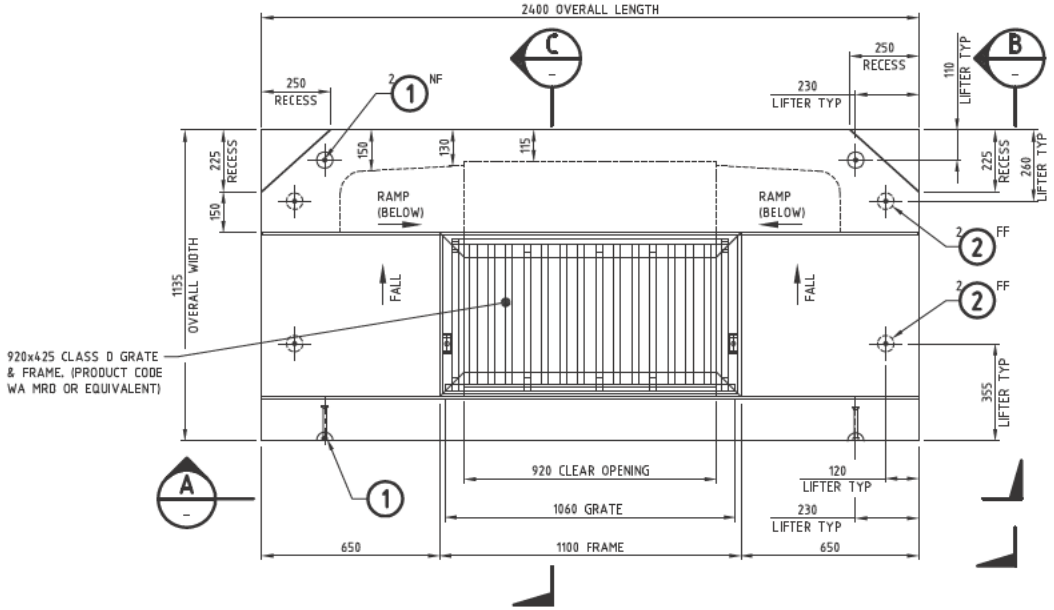
enviropipes.com.au

Planned Location: Darwin

INDEX No.	PART NAME	DESCRIPTION & SIZE	No OFF	COMMENTS
1	"UNILIFT" CONE ANCHORS	1.3t - 120 Lg	4	SITE LIFT
2	"UNILIFT" CONE ANCHORS	1.3t - 120 Lg	4	DEMOULDING

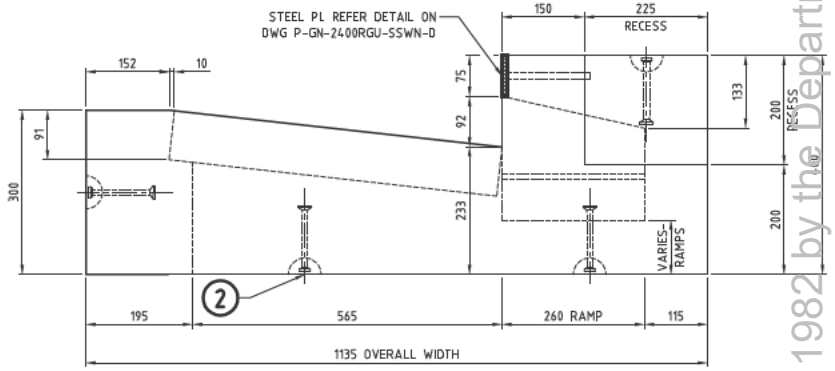
UNCONTROLLED COPY WHEN PRINTED

ISSUE	DETAILS OF ALTERATIONS	DWN	DATE	CHD
0	ISSUED FOR MANUFACTURE	JPN	19-12-25	CKH
1	GENERAL REVISION. RE-ISSUED FOR MANUFACTURE.	JPN	19-11-26	CKH



PLAN - AS INSTALLED

SCALE 1:10



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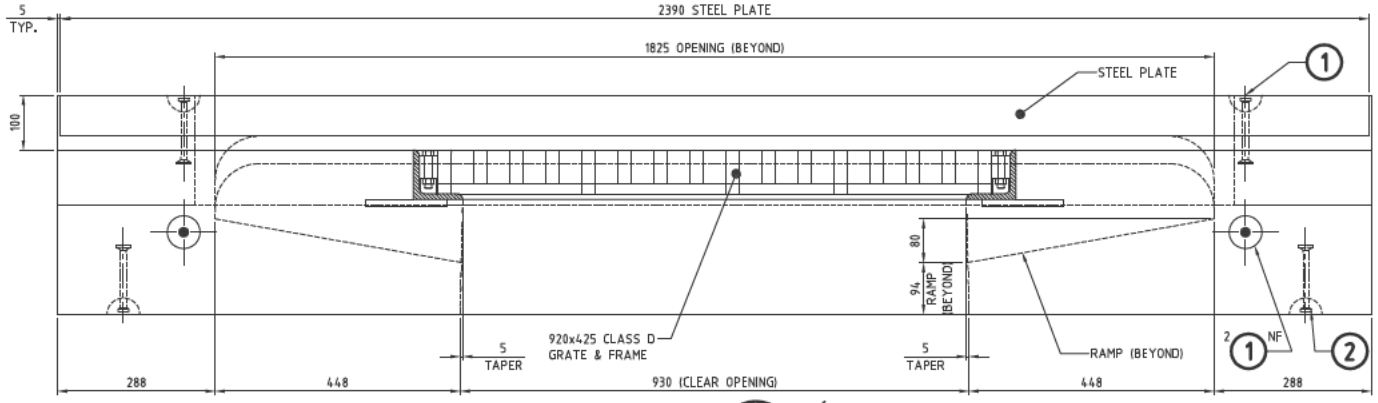
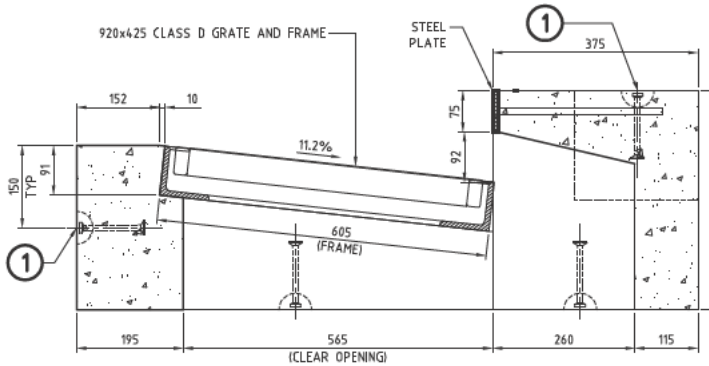
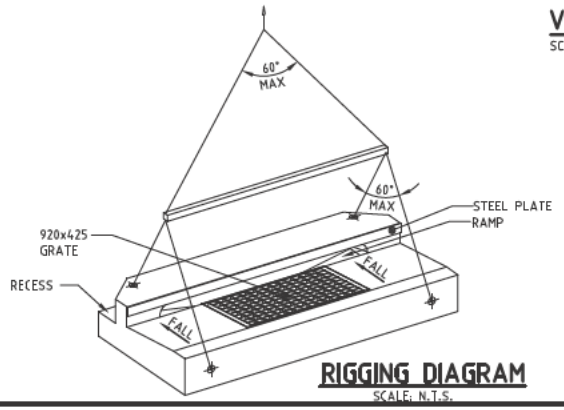


VIEW A SCALE 1:5 AS INSTALLED



SECTION C SCALE 1:5 AS INSTALLED



RIGGING DIAGRAM

SCALE: N.T.S.

HUMES HEALTH SAFETY & ENVIRONMENT

1. LIFTERS TO BE PLACED IN LOCATIONS SHOWN BY DRAWINGS ONLY. LIFTERS FOR SINGLE UNIT LIFT ONLY.
2. ALL PRECAST UNITS SHALL BE HANDLED AND ERECTED IN ACCORDANCE WITH HUMES RECOMMENDATIONS IN THE SPECIFIC HANDLING AND INSTALLATION GUIDES

APPROVAL OF THIS DRAWING PROVIDES AN UNDERTAKING THAT SAFETY IN DESIGN HAS BEEN CONSIDERED FOR ALL ASSOCIATED DRAWINGS AND WHERE APPROPRIATE INCORPORATED INTO THE DESIGN. IDENTIFIED SAFETY RISKS WHICH COULD NOT BE MITIGATED THROUGH DESIGN HAVE BEEN HIGHLIGHTED ABOVE. THESE DO NOT INCLUDE RISKS THAT AN EXPERIENCED OPERATOR WOULD TYPICALLY BE AWARE OF AND FURTHER HSE RISK ASSESSMENTS ARE TO BE UNDERTAKEN AS REQUIRED.

PRODUCT NOTES:

1. MANUFACTURED IN ACCORDANCE WITH AS3600.
2. DESIGN LIFE = 50 YEARS
3. EXPOSURE CLASSIFICATION: B2
4. NOMINAL COVR TO REINFORCEMENT = 35 mm UNO
5. CONCRETE GRAGE: S50/20
6. STEEL FORMWORK AND SUPERWORKABLE CONCRETE TO BE USED FOR CASTING.
7. REFER TO DRAWING PP-GN-2400RGU-CWLP-WA-R FOR REINFORCEMENT DETAILS.
8. REFER TO DRAWING PP-GN-2400RGU-SSWN-0 FOR STEEL PLATE DETAILS.
9. 920x425 GRATE AND FRAME TO BE CLASS D RATED TO AS3996. HOT DIPPED GALVANISED TO AS4680.
10. APPROXIMATE UNIT MASS = 1.52 t

LIFTING NOTES:

1. LIFTING DESIGN IN ACCORDANCE WITH AS3850.
2. MINIMUM FACTOR OF SAFETY = 2.25
3. MINIMUM CONCRETE STRENGTH AT TIME OF INITIAL LIFT = 20MPa.
4. SPREADER BEAM TO BE USED FOR LIFTING AND HANDLING.
5. MOULD SUCTION FACTOR = 1.2 (SMOOTH, OILED STEEL MOULD).
6. DYNAMIC IMPACT FACTOR = 2.0 (MOBILE CRANE ON PREPARED EVEN SURFACE).

LEGACY PROJECT No. 24605

Humes TECHNICAL SERVICES BRISBANE, QUEENSLAND

Holcim (Australia) Pty Ltd ABN 87 009 752 297

2020 ©

DSN.	-	
DSN CHK.	-	
DWN.	JPN	19-12-25
CHK.	CKH	19-12-25
APP.	MJE	19-12-25
SUPERSEDES		
PLOT SCALE	1:1	

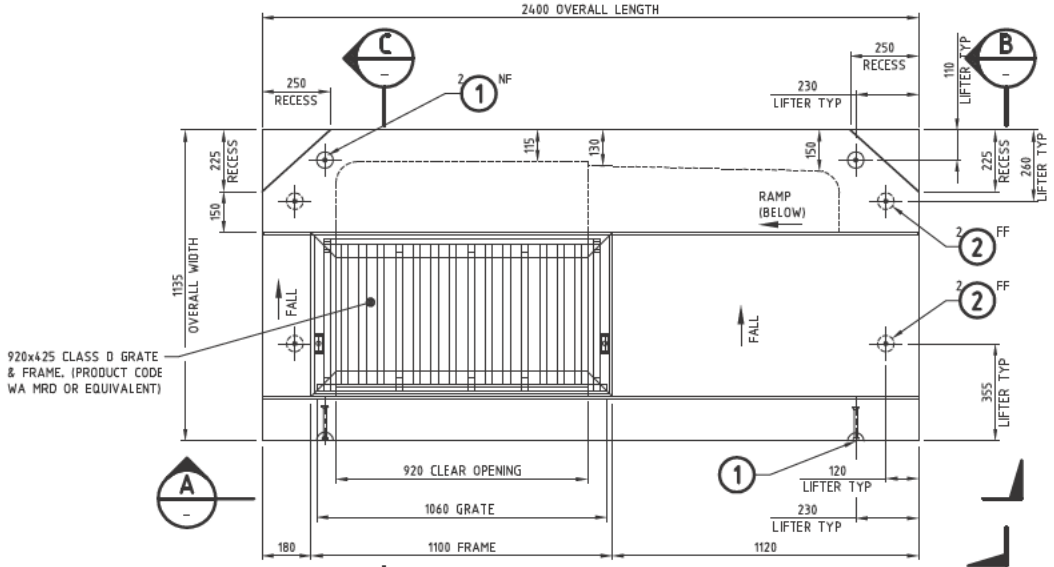
HUMES WELSHPOOL
HUMES STANDARD DRAWINGS
PIPES - GENERIC
2400 ROAD GULLY UNIT - CENTER
PRODUCT DETAILS

SIZE A1 | DWG. NO. PP-GN-2400RGU-CWLP-WA-P | ISSUE 1

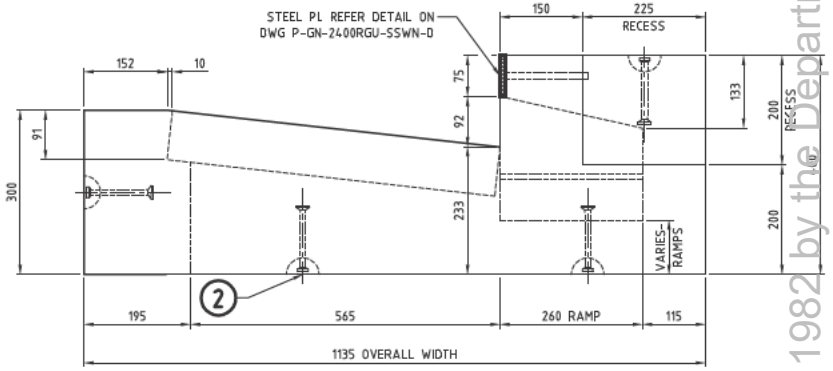
INDEX No.	PART NAME	DESCRIPTION & SIZE	No OFF	COMMENTS
1	"UNILIFT" CONE ANCHORS	1.3t - 120 Lg	4	SITE LIFT
2	"UNILIFT" CONE ANCHORS	1.3t - 120 Lg	4	DEMOULDING

UNCONTROLLED COPY WHEN PRINTED

ISSUE	DETAILS OF ALTERATIONS	DWN	DATE	CHD
0	ISSUED FOR MANUFACTURE.	JPN	19-11-20	CKH
1	GENERAL REVISION. RE-ISSUED FOR MANUFACTURE.	JPN	19-11-20	CKH



PLAN - AS INSTALLED
SCALE 1:10



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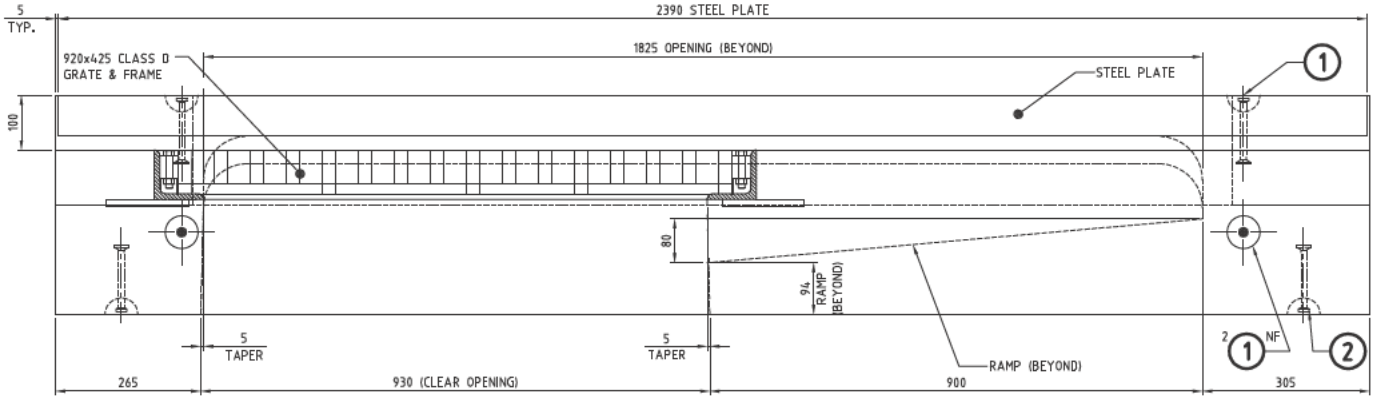
SCALE 1:5



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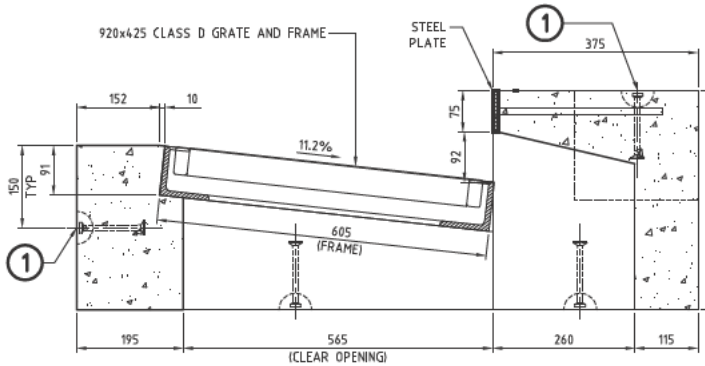
SCALE 1:5



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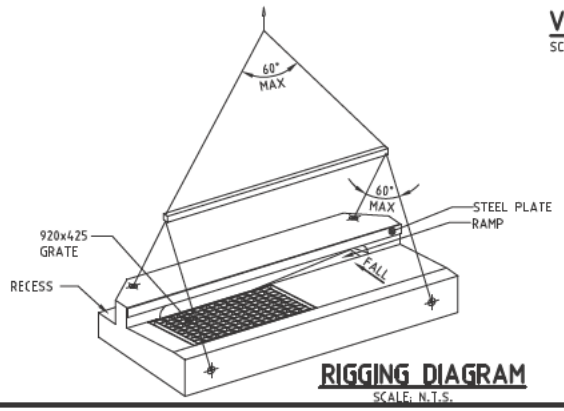

RIGGING DIAGRAM
SCALE: N.T.S.

HUMES HEALTH SAFETY & ENVIRONMENT

1. LIFTERS TO BE PLACED IN LOCATIONS SHOWN BY DRAWINGS ONLY. LIFTERS FOR SINGLE UNIT LIFT ONLY.
2. ALL PRECAST UNITS SHALL BE HANDLED AND ERECTED IN ACCORDANCE WITH HUMES RECOMMENDATIONS IN THE SPECIFIC HANDLING AND INSTALLATION GUIDES

APPROVAL OF THIS DRAWING PROVIDES AN UNDERTAKING THAT SAFETY IN DESIGN HAS BEEN CONSIDERED FOR ALL ASSOCIATED DRAWINGS AND WHERE APPROPRIATE INCORPORATED INTO THE DESIGN. IDENTIFIED SAFETY RISKS WHICH COULD NOT BE MITIGATED THROUGH DESIGN HAVE BEEN HIGHLIGHTED ABOVE. THESE DO NOT INCLUDE RISKS THAT AN EXPERIENCED OPERATOR WOULD TYPICALLY BE AWARE OF AND FURTHER HSE RISK ASSESSMENTS ARE TO BE UNDERTAKEN AS REQUIRED.

PRODUCT NOTES:

1. MANUFACTURED IN ACCORDANCE WITH AS3600.
2. DESIGN LIFE = 50 YEARS
3. EXPOSURE CLASSIFICATION: B2
4. NOMINAL COVR TO REINFORCEMENT = 35 mm UNO
5. CONCRETE GRAGE: S50/20
6. STEEL FORMWORK AND SUPERWORKABLE CONCRETE TO BE USED FOR CASTING.
7. REFER TO DRAWING PP-GN-2400RGU-LWLP-WA-R FOR REINFORCEMENT DETAILS.
8. REFER TO DRAWING PP-GN-2400RGU-SSWN-D FOR STEEL PLATE DETAILS.
9. 920x425 GRATE AND FRAME TO BE CLASS D RATED TO AS3996. HOT DIPPED GALVANISED TO AS4680.
10. APPROXIMATE UNIT MASS = 1.51 t

LIFTING NOTES:

1. LIFTING DESIGN IN ACCORDANCE WITH AS3850.
2. MINIMUM FACTOR OF SAFETY = 2.25
3. MINIMUM CONCRETE STRENGTH AT TIME OF INITIAL LIFT = 20MPa.
4. SPREADER BEAM TO BE USED FOR LIFTING AND HANDLING.
5. MOULD SUCTION FACTOR = 1.2 (SMOOTH, OILED STEEL MOULD).
6. DYNAMIC IMPACT FACTOR = 2.0 (MOBILE CRANE ON PREPARED EVEN SURFACE).

LEGACY PROJECT No. 24605

Humes — TECHNICAL SERVICES BRISBANE, QUEENSLAND

Holcim (Australia) Pty Ltd — ABN 87 009 752 297

DSN.	-	
DSN CHK.	-	
DWN.	JPN	19-11-20
CHK.	CKH	19-11-20
APP.	MJE	19-11-20
SUPERSEDES		
PLOT SCALE	1:1	

HUMES WELSHPOOL
HUMES STANDARD DRAWINGS
PIPES - GENERIC
2400 ROAD GULLY UNIT - LIFT
PRODUCT DETAILS

SIZE A1 — DWG. NO. PP-GN-2400RGU-LWLP-WA-P — ISSUE 1