



LACHLAN PIPELINE DUPLICATION DETAIL DESIGN TSS

Detail Design Report

Parkes Shire Council

30 November 2023

→ The Power of Commitment



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1. Introduction

GHD were engaged by Parkes Shire Council (PSC) to undertake the engineering design technical support services (TSS) for the Lachlan pipeline duplication (LPD).

1.1 Project description

The Lachlan duplication pipeline project involves the detailed design of a new pipeline from the New Eugowra Road Pump Station (NERPS) passing through Akuna Road Pump Station (ARPS) along the way, in addition to two break tanks one for each pump station location to the raw water supply lagoon (RWSL) and the Parkes Water Treatment Plant (WTP). The purpose of the new pipeline is to augment the existing raw water transfer capabilities and meet future demands and improve water security for the Parkes township.

The duplication pipeline is to transfer water from the NERPS to the ARPS, and on to RWSL at the Parkes WTP. The proposed pipeline is to be approximately 33.8 km in length, varying in pipe size/material along the alignment.

GHD's project scope includes the following:

- Pipeline design (including transient analysis)
- Site earthworks and storage lagoon design
- Pump station and reservoir design for Eugowra Road/Akuna Road
- Electrical design for the pump stations and reservoirs

1.2 Purpose of this report

This report outlines the detailed design for the proposed works. The purpose of the report is to:

- Document the key issues, constraints, and requirements for the detailed design.
- Summarise the methodologies used to develop the detailed design, including alternative solutions considered, and a brief narrative to justify selection of key details.
- Provide details of adopted design features.
- Identify key issues encountered throughout detailed design process.
- Provide detailed design information to allow stakeholders to understand the key risks and opportunities, and to review, comment, and eventually endorse the detailed design prior to construction.

This report documents the progression of the detail design to 80% complete.

1.3 Scope and limitations

This report: has been prepared by GHD for Parkes Shire Council and may only be used and relied on by Parkes Shire Council for the purpose agreed between GHD and Parkes Shire Council as set out in this report.

GHD otherwise disclaims responsibility to any person other than Parkes Shire Council arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report. GHD disclaims liability arising from any of the assumptions being incorrect.

Accessibility of documents

If this report is required to be accessible in any other format, this can be provided by GHD upon request and at an additional cost if necessary.

2. Background

Key background and data sources are discussed in this section.

2.1 Supporting documentation

The following supporting documentation was provided by PSC:

- PWSP Lachlan Pipeline Duplication Detail Design Technical Support Services Brief
- Eugowra to Parkes Water Upgrade Concept Design Report (GHD 2021)
- Eugowra to Parkes Water Upgrade Addendum Report (GHD 2022)
- Pre-treatment area drawings (KBR 2021)
- WAE drawings

2.2 Design information

The detailed design of the pipeline is based on the following:

- Survey and service location plans produced by Arndell Surveying
- Existing Services information from PSC, Jemena Gas, and APA
- Geotechnical information provided by PSC
- Flood studies completed for Akuna Road provided by PSC
- Pipeline size and material selection confirmed by PSC
- Pump station flow rate and staging requirements confirmed by PSC
- All associated and relevant RFI documents provided by Council at the time of writing
- Waterhammer/hydraulics assessment

GHD has reviewed this information and incorporated it into the design as appropriate.

2.3 Consultation

All other stakeholder consultation (including TfNSW, ARTC, communications utilities, Local Environmental Land Council (LALC) and landowners) is being managed PSC.

3. Design basis

The design will adopt the Water Services of Australia Associations (WSAA), Water Supply Code of Australia WSA03 NSW Regional 2011-3.1 Edition.

Hydraulic analysis conducted for the concept design phase of the project was utilised to inform the design basis for the detailed design stage.

3.1 Civil – pump station and pipeline

The detailed design of the transfer watermain was based on the Eugowra to Parkes Water Upgrade Concept Design Report prepared by GHD in June 2021, minor modifications made by GHD in 2022 and concept design drawings.

Listed below are documents, correspondence and other data used as input to the pipeline detailed design work.

Table 3.1 List of information

Source.	Created by	Title	Year	Document Type
PSC	GHD	12537204-Rep_Eugowra to Parkes Water Upgrade Concept Design Report	2021	Report
PSC	GHD	12537204-Rep_Eugowra to Parkes Water Upgrade Drawings	2021	Drawings (in pdf)
PSC	GHD	12537204-Rep-B_Eugowra to Parkes Water Upgrade Addendum Report	2022	Report
PSC		Survey files (miscellaneous)		CAD, kmz, kml and pdf
PSC		Geotech reports (miscellaneous)		Report
PSC		WAE drawings		Drawings (in pdf)
		DBYD (Telstra, NBN, Jemena, Essential Energy)	2022	Drawings (in pdf)
	GHD	12589773-LET-Pump comparison	2023	Letter
	GHD	12589773-MEM- GRP/DICL/HDPE comparison	January 2023	Technical memo

Relative to the concept design, the location of NERPS has moved by approximately 120 m south-east due to the change in the pre-treatment area layout as provided by Hunter H2O. It is noted that the pump station building needs to be raised above the PSC-advised flood level, which is at RL244.

During the 30% detail design PSC has noted that the NERPS pump is limited to a maximum of 315 kW, with subsequent advice received 7 October 2022 indicates that the maximum pump size is limited to 250 kW for the duty/assist/standby arrangement. This limitation has now been removed, this the pumps at NERPS 450 kW, refer to Section 5.4.3 for further details.

Relative to the concept design, Akuna Road pump station and reservoir moved by approximately 120 m to the south as recommended by Council during the site visit on 26 September 2022. The pump to be used is based on Concept Design Report, which is Flowserve horizontal axial split-case centrifugal type pump 250-LNN-600 with a 400 kW electric induction motor and impeller diameter of 581 mm, refer to Section 5.4.3 for further details.

The design basis for specific pipeline elements is nominated in Section 5.5.

3.2 Electrical

The following items outline the electrical design basis.

- Please refer to Electrical Technical Specification '12589773-SPC_Technical Specification D_Electrical'.
- The electrical design both the Pump Stations must adhere to the relevant Australian Standards. Additionally, compliance with specific Council guidelines, specifications and associated regulations, is mandatory.
- Power Supply, ASP3 and authority connection is to be completed by others. Substations at each pump station are assumed to be Kiosk type. NERPS and ARPS are to be 1.5 MVA.
- Solar has not been included in the design; however, a connection point to the future solar inverter has been included to connect to once it is installed.
- Generator connection is provided, but sizes of generator are yet to be determined.
- Following installation method and cable types were assumed:
 - Incomer cables from substation to MCC will be installed in underground conduits. The cables are single core, Copper, flexible, XHF-110 insulation, in trefoil configuration (inside each conduit) with 0.5 m spacing between conduits.
 - Motor cables from VSDs are to be installed in ladders and trays.
 - Within the pump station building, it is assumed all other cables will be installed in ladders/trays.
- Variable Speed Drives:
 - NERPS: ABB ACQ580-7-0880A-4 +C128+C130+H351+H353
 - ARPS: ABB ACQ580-7-0820A-4 +C128+C130+H351+H353
- The selected VSD units possess the capability to accommodate a 10% temperature derating, allowing for operation in environments with temperatures of up to 50 degrees Celsius. Despite the derating, these units can reliably provide the required power to drive the pumps effectively.
- The VSD feature external ventilation for exhaust and makeup air (options +C128 and +C130, respectively), ensuring that the air is not recirculated within the air-conditioned switchroom.
- The Switchroom is not proposed to include raised computer floors. Conduits are coming into a trench under the Switchboard incomer section and the MSB will sit on top of it on a plinth. The remaining cables will go out through the top of the MCC and go to the VSD etc using trays. Cable trays to the motors are also proposed rather than underground conduits.
- The motors are automatically controlled via the PLC utilising three level switches to determine the tank level and a flow meter to confirm pump operation. See Section 8 Balance Tanks for more information of level control utilising level switches.
- There are existing and future additional equipment (designed by others) that will need to be supplied from this MSB.

NERPS Feeders included:

- The existing Lachlan River Pump Station (LRPS) MCC has been supplied with a three-phase electrical feed with a 400 A MCCB.
- A future LRPTP MCC (designed by others) has been supplied with a three-phase electrical feed with a 400 A MCCB, however this could be lowered when design of this MCC is completed.
- A future Process DB (designed by others) has been supplied with a three-phase electrical feed with a 63 A MCCB.

ARPS Feeders included:

- A future Process DB (designed by others) has been supplied with a three-phase electrical feed with a 63 A MCCB.

3.3 Mechanical HVAC

The ventilation and cooling systems proposed for the pump room and adjacent switchroom are as follows:

- The pump station pump room is to be ventilated with mixed mode natural/mechanical ventilation via roof ventilators and low level building louvres to the pump room to target a nominated temperature above outdoor ambient. This will be chosen as 5 °C unless notified otherwise.
- The switchroom will be provided with cooling only temperature control. This is proposed to be achieved with air cooled packaged system with N+1 redundancy. The system will be designed to achieve 27 °C internal conditions for external critical conditions for the site unless notified otherwise.
- The exhaust discharges from the VSDs are to be ducted to outside via roof mounted exhaust fans. Make-up air for the VSDs is to be provided via low level louvres and ducted to the inlets located on the underside of the VSD units.

3.4 Structural

3.4.1 Pump stations

3.4.1.1 Overview

The pump station is a blockwork building containing pumps and a switchroom. The facility contains the following rooms:

- Pump room – houses water transfer pumps and pipework.
- Switchroom – houses switchgear and VSDs.

3.4.1.2 General

Overall, the building layouts have been designed to meet both the AS1657 requirements and the BCA for access and egress. The design assumes that the buildings are exempted from the AS1418 requirements for DDA access and movement. Concrete floors (smooth trowel finish) will be provided in all rooms other than the control building.

Generally, a 25 mm step down has been provided from the external doorways to the external concrete pavement for waterproofing purposes. Additional fall on the external pavement is provided to achieve an overall level difference of 50 mm between the internal floors and external areas. Where there is no external concrete pavement, we have provided at least 50 mm.

3.4.1.3 Wall and roof design

The structural system is proposed to be reinforced concrete blockwork walls supporting lightweight steel trusses. A clear coating to seal the blockwork should be considered to provide better moisture protection. Insulation of conditioned space electrical rooms should be considered for better energy efficiency.

3.4.1.4 Footing design

PSC will provide a geotechnical report for the pump station location to get the geotechnical parameters needed to design the footing. The building will be supported by raft concrete footings designed to be supported on control fill to meet a H2-D shrink-swell values provided in AS2870.

Lime stabilisation of the fill material won on the site will be required unless imported cohesionless material is used. The footing beams will be designed for site reactivity.

3.4.1.5 Monorail design

A monorails beam has been provided in the building to facilitate the removal of the pump equipment. Engaged piers will be provided along the wall to support the proposed monorail beam and supporting beams.

3.4.1.6 Design parameters

The following table outlines the structural design parameters and assumptions used in the design.

Table 3.2 *NERPS design parameters*

Element	Criteria	Comment
Design Life	50 years	As per AS3735 and AS1170 requirements
Importance level	Level II in accordance with AS1170.0	Normal structure
Concrete	Exposure Classification of B1, AS3600 Concrete Strength = 32 MPa Reinforcement Cover to structural notes page	
Metals	Galvanized steel design in accordance with AS4100 and AS4680.	
Masonry	Reinforced concrete block work. Design to meet AS3700 requirements	
Foundation	H2-D exposure classifications to AS2870 Controlled fill with an 100 kPa allowable vertical bearing capacity	Lime stabilisation will be required to maintain H2-D exposure classifications
Earthquake Loading	AS1170.4 Earthquake loading: Reoccurrence interval of 1/500 for service loads Probability Factor, $k_p = 1.00$ (AS 1170.4 Table 3.1) Hazard Design Factor, $Z = 0.09$ (AS 1170.4 Table 3.3)	
Wind Loads	AS 1170.2 Parameters Wind Region = A0 Reoccurrence Interval (SLS) = 1/25 Reoccurrence Interval (ULS) = 1/500 Wind Direction Multiplier, $M_d = 1$ Terrain Category, $TC = 2.0$ Terrain Category Multiplier, $M_{z,cat} = 0.91$ Shielding Multiplier, $M_s = 1$ Topographic Multiplier, $M_t = 1$ Design Wind Speed, SLS = 33.5 m/s Design Wind Speed, ULS = 45.9 m/s	
Permanent Loads	Self-weight of structure	
Imposed Loads	Imposed loads to AS1170.1 recommendation as follows: 5.0 kPa for Floors 0.25 kPa or 1.1 kN load for the roof	
Monorail beam	Pump room: 2-tonne working load limit to AS1418 requirements	
Load Combinations	Load combinations to AS1170.0 for roof Load combinations to AS5221.1 for the monorail and dynamic factors	

3.4.2 Reservoirs

3.4.2.1 Concrete walls and floors design

The reservoir will be designed as a reinforced concrete wall and floor in accordance with AS3735.

The concrete footing is to be shallow footing reinforced with allowable bearing capacity of 100kPa.

3.4.2.2 Roof and platform design

Aluminium purlins and beam roof systems will be designed to meet the specifications. The roof will be a two-way roof to simplify the fabrication of aluminium beams. The roof pitch of 2.5 degrees, meets AS1657 requirements, for the platform falls and therefore allows the roof platform to be located directly on the roof members without having elevated platforms or the platform cut into the profile. This will avoid the collection of debris and simplify flashing on the reservoir. The orientation of the access point is to be on the pump station side, also pipework will need to go through the base instead of the wall as shown in the concept design.

3.4.2.3 Design parameter

The following table outlines the design assumptions and parameters used in the reservoir design.

Table 3.3 Reservoir Structural Design Parameters

Element	Criteria	Comment
Design Life	50 years	As per AS3735 and AS1170 requirements
Importance level	Level III in accordance with AS1170.0	
Concrete	Concrete design to meet AS3735 Exposure Classification of B1, AS3735 Table 4.1 Concrete Strength = 40 MPa Reinforcement Cover, 50 mm, AS3735	Classification assumes the follow water properties: – Water pH level to be between 6.5 -7.5 pH – Chloride levels 2500 to 5000 mg/L
Metal Durability	Galvanized steel design in accordance with AS4100 and AS4680. 316S Stainless steel in accordance with AS/NZS 4673:2001. Cold formed Aluminium Alloy 5052 H36 C section purlins and beams to AS/NZS1664.	Roof design will be designed using aluminium and stainless metal to provide a strong and durable low-maintenance solution over the life of the structure.
Foundation	To be confirmed after receiving the geotechnical report.	
Earthquake Loading	AS1170.4 Earthquake loading: Reoccurrence interval of 1/1000 for service loads Probability Factor, $k_p = 1.35$ (AS 1170.4 Table 3.1) Hazard Design Factor, $Z = 0.09$ (AS 1170.4 Table 3.3)	Impulsive and convection loads design actions calculated using NZS3106.
Shrinkage/Swelling and Creep Effects	Design Strain = $110 \times 10^{-6} \epsilon$ – AS3735 Table 2.2 Base shrinkage strain = $700 \times 10^{-6} \epsilon$.	Base shrinkage is in accordance with recommendations from AS3735. The concrete to be specified is $650 \times 10^{-6} \epsilon$ and therefore acceptable.
Thermal Effects	+30 °C, -20 °C AS3735 Cl. 2.2.1 for filled tanks	
Wind Loads	AS 1170.2 Parameters Wind Region = A0 Reoccurrence Interval (SLS) = 1/25 Reoccurrence Interval (ULS) = 1/1000 Wind Direction Multiplier, $M_d = 1$ Terrain Category, $TC = 2.0$ Terrain Category Multiplier, $M_{z,cat} = 0.93$ Shielding Multiplier, $M_s = 1$ Topographic Multiplier, $M_t = 1$ Design Wind Speed, SLS = 34.4 m/s Design Wind Speed, ULS = 44.6 m/s	
Permanent Loads	Self-weight of structure	
Imposed Loads	Imposed loads to AS1170.1 recommendations are as follows: – 2.5 kPa or 1.3 kN concentrated load for walkways stairs and platforms – 0.25 kPa or 1.1 kN load 15 kN Ultimate load for single man davit are in accordance with AS1891.4	
Buoyancy effects	No allowance has been made for buoyancy effects.	It is assumed that the reservoir will be full during major flooding events.

Element	Criteria	Comment
Load Combinations	Load combinations to AS3735 Clause 2.4. for walls. Load combinations to AS1170.0 for roof and platform loads.	
Davit Points	A single person with an Ultimate load of 15 kN to AS/NZS1891.	
Stairs and platform	Stair treads, risers and goings to AS1657 (sizes to be confirmed).	

3.5 Raw water supply lagoon

A large balancing storage capacity requirement to manage the flows at Parkes WTP has driven the need for the raw water supply lagoon (RWSL). The design of RWSL is mainly based on Eugowra to Parkes Water Upgrade Concept Design Report (GHD, June 2021). The RWSL has a capacity of 20 ML and located at the north of the existing blower/ compressor building and inlet works at Parkes WTP.

The 20 m wide spillway which was indicatively shown in the concept design drawings is added in the model, which now gives a little variance in the cut and fill volume (refer to drawing 12589773-W301) from the concept design arrangement.

The table below summarises the parameters used in detail design.

Table 3.4 RWSL design parameter

Element	Criteria
Capacity	20 ML
Lagoon base elevation (lowest)	386 mAHD
Top water level (TWL)	388.95 mAHD
Overflow / spillway level	389 mAHD
Crest elevation	389.30 mAHD (with 300 mm freeboard)
Width of crest access	4.0 m
Batter slope	1:2.5 for inside batter and 1:3 for outside batter

4. Geotechnical Investigation

Geotechnical investigation carried out by D&N Geotechnical Pty Ltd (D&N) provides the following recommendations. Please refer to the Geotechnical Investigation Report dated 4 August 2023 for further details in Appendix E.

4.1 Excavation conditions

D&N noted that installation of the LPD using trenching methods (~1.5m depth) should be feasible across most of the alignment using conventional earthmoving equipment such as hydraulic excavators fitted with ripper teeth.

Similarly, deeper boreholes located at each of the respective under bore locations (TC01 to TC11) were all advanced to the nominated target depth of 10.45 m using solid flight auger techniques and SPT testing, which would indicate that were observed, under bore alignments should generally be within soil strength materials.

D&N also noted that the observed Quaternary Alluvial soils were variable at some locations, with the presence of cohesive and granular soils, the latter likely being problematic in terms of stability for uncased bores sections, launch/retrieve excavations and trenching more generally, particularly below standing water levels.

It is possible that shallower expressions of bedrock may occur between investigation locations. Based on the site investigation this likelihood is considered low, however Geophysical surveys would be required to verify this low likelihood.

4.2 Temporary excavation support

Formation of vertical excavations (if required) may be feasible in the short term within cohesive soils where depth of excavation is limited to 1.5 m maximum. However, provision should be made for placement of temporary shoring due to the possibly for low strength clay, or granular soils being encountered.

In the case of unsupported excavations, no surcharge loads (e.g., plant or stockpiles) should be placed within distance set back from the excavation crest, equal to 1.5 x the excavation depth.

Excavations to greater than 1.5 m depth, or excavations which encounter unsuitable materials (weakened soils, granular soils or groundwater) will require laying back or benching to allow for adequate stability.

Suggested temporary and permanent batter slopes that are not supported by retention of shoring are presented below:

- Unsupported temporary batter slopes 1V:2H (27°)
- Unsupported permanent batter slopes 1V:3H (18°)

The above batter slopes apply for batters greater than 1.3 m in vertical height, but not greater than 3 m in vertical height; in which case, temporary or permanent support measures will be required.

A retention system will be required if there is insufficient room to form the above recommended batters, excavations encounter groundwater/collapsible soils, or where excavations >3 m in vertical height are to be steeper than those suggested above.

Table 4.1 presents a summary of earth pressure coefficients which may be adopted for the assessment of temporary and permanent retention systems. Coefficients are provided for the following cases:

- Case 1 = active conditions, where deflections would be greater to mobilise active connections.
- Case 2 = at-rest conditions, where deflections are required to be reduced (e.g., below existing structures or settlement -sensitive features).

D&N recommended detailed geotechnical analysis be undertaken for the retention system at detailed design stage.

Table 4.1 Material parameters and earth pressure co-efficients for level ground above the retention

Geotechnical Unit	Mohr-Strength Envelope Material Properties		Value of lateral Earth Pressure Coefficient		Passive Earth Pressure Coefficient, Kp	Bulk Density (kN/m ³)	Modulus (MPa)
	Effective Cohesion	Effective Friction Angle	Case 1, K _a	Case 2, K ₀			
Quaternary Alluvium	0	26	0.39	0.56	2.56	19	20

4.3 Fill placement

All Engineered Fill and natural material at depths within 0.3 m of pavement subgrade level or foundation level for structures should be compacted to achieve a minimum Dry Density Ratio of 100% Maximum Dry Density (SMDD) and moisture conditioned to Standard Optimum Moisture Content (SOMC) ±2% at the time of compaction.

All Engineered fill at depths greater than 0.3m below pavement subgrade or foundation level for structures should be compacted to achieve a minimum Dry Density Ratio of 98% (SMDD) and moisture conditioned to SOMC ±2% at the time of compaction.

All compacted replacement fill and subgrade preparation should be constructed in accordance with AS3798-2007 and/or local GSC earthworks specifications.

4.4 Site trafficability

Removal of existing topsoil and fill materials is expected to result in exposure of predominately silty CLAY and/or clayey SAND Quaternary Alluvial soils, which are generally expected to behave poorly if subject to heavy construction traffic, particularly when wet. A platform of granular material such as road base or crushed concrete may be needed to support construction plant.

Where heavy plant such as piling rigs or mobile cranes are to traffic site, specific analysis of working platform requirements may be required to assess working platform equipment. Such assessment could include the use of DCP testing (or similar) to confirm bearing capacity. Working platform design shall be carried out to the UK Building Research Establishment (BRE) Guideline BR470.

To help reduce, but not eliminate trafficability issues associated with wet weather, exposed subgrades should be sealed with a smooth drum roller and graded such that they promote surface drainage and prevent ponding.

4.5 Material re-use

Where present. Existing topsoil should be stripped and stockpiled separately or disposed of offsite, with re-use generally limited to landscaped areas and revegetation of batters.

All remaining site soils should generally be suitable for use as engineered fill from a geotechnical perspective, provided unsuitable materials such as organics, waste and oversized particles are removed prior to placement. Re-used material should be screened for such physical contaminants, reworked and compacted as controlled fill.

4.6 Soil dispersion potential

Testing achieved a typical result of Class 2 for the observed site soils.

An observed Emerson Classification of between 1 to 3 would indicate that the soil is unfavourable with respect to dispersion, such that air dried soil samples (Class 1 and 2) or soils remoulded at the plastic limit (Class 3) disperse in water.

Emerson Class 4 to 6 would be favourable in the sense that the soils would not disperse on initial immersion (i.e., the clay fraction did not go into suspension on submersion), but dispersion would occur on agitation.

Emerson Class 7 & 8 would indicate that soils would not disperse on initial immersion (i.e., the clay fraction did not go into suspension on submersion) or on agitation. The distinction between Class 6 and Class 7 relates to the materials susceptibility to swell on immersion, the former indicating that such swelling would occur.

4.7 Thrust block footings

Lateral bearing capacities for thrust blocks are provided in Table 11 below for materials observed. The capacities are provided for limited overburden of min. 0.5 m below FSL.

Table 4.2 Lateral bearing capacities for thrust blocks

Unit	Allowable lateral bearing capacity
Topsoil, uncontrolled fill, organic soil, deleterious material	Do not use for thrust block support
Controlled cohesive fill	50 kPa
Controlled granular fill, $\phi' \geq 32^\circ$	60 kPa/m x depth (m)
Unit 2a Alluvial Soil (cohesive soil, stiff or better)	40 kPa at 0.5 m depth, increasing to 160 kPa at a depth below FSL of 5 times the bearing width
Unit 2b Alluvial Soil (granular soil, $\phi' \geq 28^\circ$)	45 kPa/m x depth (m)

Foundation exposures shall be inspected by a geotechnical engineer to confirm that founding conditions are consistent with design assumptions, with respect to base cleanliness and soil strength and stiffness.

Isolated layers/zones of weaker material may be encountered on exposure, which may require specific treatment such as removal and replacement with controlled fill, or localised deepening of footings, to be advised by the project geotechnical consultant during construction.

4.8 Soil aggressivity

Based on the test results the assessed aggressivity to direct buried structural elements is summarised in Table 4.3 using the terminology from AS2159-2007.

Table 4.3 Aggressivity to buried structural elements

Unit	Concrete	Steel
Fresh water contact	Mild	Moderate
Natural site soils	Mild	Mild

4.9 Under bore works

Boreholes advanced in the vicinity of the respective under bore launch/retrieve pits indicate that subsurface conditions are likely to comprise Quaternary Alluvial soils, observed as predominantly stiff to hard CLAY/SILT soils, with loose to medium dense SAND layers.

Thrust boring should be feasible but will require consideration regarding the presence of SAND soils, which were observed to be of variable density (loose to medium dense), and observed groundwater levels, both of which are likely to result in instability. The bore must be always supported using steel casing, suitably designed to withstand ground pressures.

Dependent upon the final proposed under bore depth, consideration should be given to groundwater conditions to reduce the potential for ground loss. Dewatering or groundwater control measures may be necessary to reduce the water pressure in the sand and enhance stability.

The works should be performed by experienced contractors who have proven track record in thrust boring in similar conditions. The contractor should be provided with a copy of the Geotechnical Investigation Report dated 4 August 2023 and be responsible for selection of appropriate equipment and methods.

5. Pipeline design

Drafting note: Section 5 to be further updated once pipeline design progresses to 80%. Section 5.1, 5.3 and 5.4 are updated to reflect the current status of the pipeline design.

5.1 Horizontal alignment

The pipeline route was selected based on GHD's Preliminary Constraint Memorandum (2020). Transfer pipeline alignment is detailed in drawings 12589773-W012 to 12589773-W033.

The pipeline will start on the delivery side of the new NERPS at the PSC Eugowra Road site, running east along The Escort Way. The underbore (trenchless construction of the casing/sleeve pipe) of The Escort Way is subject to a detail design by others, with GHD preparing the concept design – refer to drawings 12589773-W046 and 12589733-W047.



Figure 5.1 New Eugowra Road Pump Station Site

The transfer pipeline will then follow the alignment of The Escort Way southeast on the eastern side before crossing Fairview Road and changing direction 90 degrees to follow the alignment of the road on the eastern side.

It will follow the road alignment until it reaches the environmentally sensitive area at approximately Ch 1600 where it will then require trenchless crossing where it will exit within the private land.

The pipeline will continue traversing north, crossing twice Troubalgie Road and Back Yamma Road via open trenches. It will then turn 90 degrees east and another turn 90 degrees north at approximately Ch 8500 following the Rosella Road alignment on the western side and crossing Ashburnham Road via open trench. It will then turn 45 degrees northwest at approximately Ch 13100 until it reaches Dowling Lane. It will then follow the road alignment on the eastern side until it reaches Ernie Hodges Road and changing direction 90 degrees west to follow the alignment of the road on the western side of Back Yamma Road.

It will follow the road alignment and changes direction 90 degrees east at approximately Ch 18000 to follow the road alignment on the eastern side. From this point, it will follow the road alignment where it will then require trenchless bore under Crooked Creek where it will come out on the eastern side of Back Yamma Road.

The alignment will then follow the road alignment until it reaches Bartleys Creek where it will then require trenchless crossing where it will come out on the eastern side of Back Yamma Road avoiding an aboriginal heritage area. The pipeline will continue traversing northeast until it reaches the STP, where the pipeline will be on the eastern side of the bund around the STP and the solar array and connect to Akuna Road water pump station (refer Figure 5.2).

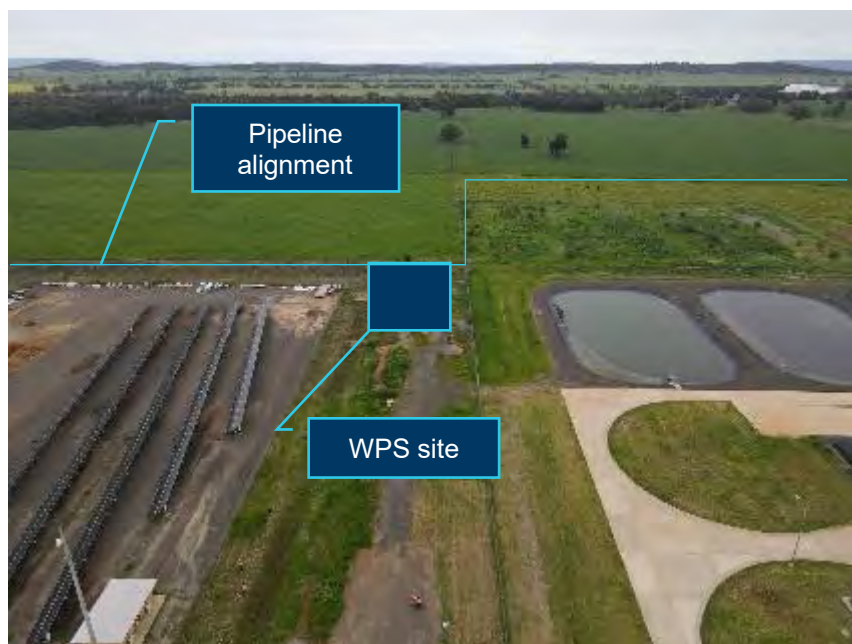


Figure 5.2 Drone photo of the Akuna Road Pump Station site

The pipeline alignment will continue traversing north to follow the alignment of Akuna Road on the eastern side before changing direction 45 degrees northwest at approximately Ch 28000. It will deviate into the paddock until it reaches the ARTC corridor where it will then require trenchless crossing where it will come out within the Eugowra Road reserve. It will then turn 90 degrees north to follow the road alignment on the western side of the road where it will then require trenchless crossing under Goobang Creek where it will come out on the western side of the road.

It will follow along the western side of Eugowra Road, then cross Clarinda Street where it will then require trenchless crossing to cross underneath the existing Jemena gas line and NBN where it will exit on the eastern side of Renshaw McGirr Way, parallel to the existing dam mains. It will follow the road alignment on the eastern side avoiding drains until it reaches approximately Ch 32700 where it will then turn 90 degrees northwest, traversing the paddock until it reaches Parkes Water Treatment Plant to connect to the proposed raw water supply lagoon.

There are a number of options for the proposed pipeline alignment to cross Clarinda/Henry Parkes Way, these are listed below and summarised in Figure 5.3:

- Blue alignment - As per the 30% design drawings and described above where the pipeline will cross Clarinda Street and follow Renshaw McGirr Way (Figure 5.4) from south to north. This is the preferred alignment to reduce impacts on the surrounding residents. The location of the crossing is dependent on the confirmation of existing services such as the gas main, dam mains and recycled water main. A review the recycled watermain as built drawings suggests that there is space as it is understood it runs just off the edge of bitumen and the dam mains run underneath the footpath/bike path. Positive identification of the existing services and site survey are critical to confirming if there is adequate room between these existing pipelines. The alternative is to run the new LPD pipeline on the eastern side of the footpath/bike path however, this would require some removal of the established vegetation.
- Orange alignment - From the western side of Eugowra Road through to Russell Street then along Russell Street before heading east out onto Renshaw McGirr Way (Figure 5.5 and Figure 5.6). This alignment would avoid paralleling the existing pipelines, however would require partial closure of Russell Street and cause more disruption to the local residents.

- Yellow alignment - From the eastern side of Eugowra Road along the western edge of the Lions Park through to Glenhaven Way the west out parallel to Renshaw McGirr Way (Figure 5.7 and Figure 5.8). This alignment north of Henry Parkes Way is less preferred from due to the impact on the local community as it would involve construction adjacent to the park area and through the middle of the Glenhaven Road. It is expected that there are numerous reticulation services for gas, NBN, Telstra, and power along Glenhaven Road requiring the proposed pipeline to be located within the bitumen rather than the standard watermain allocation. However, subject to confirmation of existing services and the potential congestion on the western side of Eugowra Road, crossing to the eastern side of Eugowra Road near the open space on the corner of Eugowra Road and Henry Parkes Way before crossing Henry Parkes Way may prove a viable alternative (shown by the orange dashed line).



Figure 5.3 Options for crossing Clarinda Street / Henry Parkes Way



Figure 5.4 Clarinda/Henry Parkes Way crossing – Renshaw McGirr Way



Figure 5.5 Clarinda/Henry Parkes Way crossing – Russell Street looking south



Figure 5.6 Clarinda/Henry Parkes Way crossing – Russell Street looking north



Figure 5.7 Clarinda/Henry Parkes Way crossing – Lions Park looking south



Figure 5.8 Clarinda/Henry Parkes Way crossing – Lions Park/Glenhaven Way looking north

5.2 Vertical alignment

The vertical alignment of the water main will be governed by the existing geotechnical conditions, utility services and obstructions. It is proposed the pipeline will have a minimum of 600 mm cover in non-trafficable areas including the following:

- Local road crossing – 600 mm cover.
- Major roadway crossing – 2400 mm cover.
- Railway crossing – 2000 mm cover (from top of lowest rail/track to top of encasing pipe).
- Creek / environmentally sensitive area crossing – 1500 mm cover (to be refined based on Geotechnical studies).
- Crossing cropped paddocks – 750 mm allowing for potential deep ploughing.

The location of air valves and scour valves are detailed in Sections 5.5.6 and 5.5.8 respectively.

5.3 Trenchless crossings

The crossings are to be designed in accordance with WSAA guidelines and drawings 12589773-W013 for environmentally sensitive area, 12589773-W023 for creeks, 12589773-W029 for railway and 12589773-W031 for roadway and gas line. The crossings are all to account for the geotechnical investigation results, the survey information and the pipe diameter/material selected.

5.3.1 The Escort Way trenchless crossings

The proposed trenchless crossing of The Escort Way comprises four pipes of 36 m length each perpendicular to the Escort Way. The northern three pipes are to be DN375 pipes, installed in three separate bores of about 600 mm diameter and spaced about 1 m from outside edge to outside edge. The fourth pipe is similarly spaced but DN800 in a nominally 1000 mm diameter bore. The invert of all four pipes is about 3.5 m below the road centerline, providing at least 2.4 m of cover above the bore crown to the road surface (eastern road edge lowest).

Available geotechnical subsurface information in this area comprises two shallow boreholes and four deeper boreholes at the locations shown in Figure 5.9. BH1_(mg) was drilled by Macquarie Geotech in December 2022 (Ref. B21615, 09/02/2023) to 1 m depth with a dynamic cone penetrometer to 1.5 m depth. P01 was drilled by D&N Geotechnical in April 2023 (Ref. C-1655.00 R1, 24/05/2023) to 0.8 m depth. BH01 to BH04 were drilled by D&N Geotechnical in June 2023 (Ref. C-1655.00 R2, 21/06/2023) each to 10.5 m depth.



Figure 5.9 Available borehole locations at Escort Way trenchless crossing

The shallow borehole logs (P01 and BH1_(mg)) indicate fill to 0.2 m to 0.3 m depth overlying firm to hard Sandy CLAY soil with trace of gravel to the limit of excavation. The P01 log indicates the soil origin is alluvial whereas the

BH01_(mg) indicates residual. The BH1_(mg) log is expected to be in error given that this portion of the Lachlan River is situated in a deep alluvial flood plain mapped as having near surface geology comprising Quaternary aged: “alluvial channel deposits – meander-plain facies” (NSW Seamless Geology access through MinView on 10/7/2023).

BH01 to BH04 logs indicate Stiff to Very Stiff Silty CLAY with trace of sand and of alluvial origin to about 5.5 m depth. Below this, the alluvial soils have increasing proportions of sand and gravel and at 7.0 to 7.5 m Clayey SAND is logged with groundwater inflow. The coarser grained material extends to 9.4 m to 10 m depth where Silty CLAY is again encountered. A Sandy Clayey GRAVEL material was encountered in BH03 at 10.2 m depth and in BH04 at 9.8 m depth.

The following inconsistencies on the logs above 5 m depth are noted:

- BH01 and BH02: pocket penetrometer results indicate Very Stiff to Hard soils to about 3.5 to 4 m depth whereas the log says Stiff to Very Stiff in this depth range.
- BH01: pocket penetrometer results indicate Hard soils to at least 2 m depth whereas the log says Stiff in this depth range.
- BH03: pocket penetrometer results indicate Stiff to Very Stiff soils from 3.5 m to 5.5 m depth whereas the log says Stiff in this depth range, reducing to Very Stiff and then Stiff below 5 m depth.
- BH04: pocket penetrometer results indicate Hard soils to 5 m depth whereas the log says Stiff to Very Stiff in this depth range.
- BH01: Silty CLAY from 3.5 to 5.5 m is given medium to high plasticity UCS symbols but the description says low plasticity. Laboratory testing of Atterberg Limits indicates the material is low plasticity.
- BH04: Silty CLAY from 2.5 to 6.3 m is given medium to high plasticity UCS symbols but the description says low plasticity. Laboratory testing of Atterberg Limits indicates the material is low plasticity.

A groundwater monitoring standpipe was installed in BH03 to 10.5 m depth. Data on water depths is noted in the D&N report as “not available at the time of preparing this report”.

The original design proposed underbores, constructed with either horizontal boring or pipe jacking methods from launch and receival pits. The encasing pipe being left in place and the product pipe being inserted and the annulus grouted. The design of the bores and construction methodology (by MCA Group) adopted horizontal boring with the details of the as built casing pipes shown on drawing 12589733-W047.

Regardless of the methodology, HDD and underboring comes with hazards on impacting the ground surface. These are dependent on ground conditions, depth of cover and methodology. Typical hazards are:

- Collapse of the uncased sections of bore (e.g. if the auger advances ahead too far into unsupported ground before the casing is advanced)
- Ground settlement if too much volume of ground is removed (e.g. through bore cave-in or squeezing)
- Ground heave if mud pressures exceed effective overburden stress
- Mud blowout where mud under pressure comes to the surface through some zone or weakness or high permeability (e.g. investigation borehole, backfilled trench, tree roots)

The ground conditions appear to be favorable and comprised of very stiff to hard alluvial sandy clays and silty clays with possible trace of gravel at the depth of boring. Flowing sand, groundwater inflows, bedrock and soft soils are not anticipated above 5 m depth. Under heavy rainfall / flood conditions, groundwater in sandy soils below about 7 to 7.5 m depth are likely to become pressurized by an elevated river level (artesian conditions) and would rise up boreholes and other zones / conduits of high permeability to levels matching or higher than the river.

The design of trenchless crossings and selection of construction methods is a specialist area and typically done in a ‘design and construct’ fashion with independent technical review at times. Good design and method selection is expected to be adequate to avoid such hazards impacting the ground surface.

As noted in the D&N geotechnical report (June 2023), TfNSW Technical Direction TS 02088: *Trenchless Excavation within the Easement of Roads and Maritime Infrastructure* (formerly GTD 2018 002 | RMS 18.906) provides requirements from TfNSW on the investigation and design of a trenchless crossing of this nature. Design of the trenchless crossing under the Escort Way should be in accordance with TS 02088. This document also provides requirements on instrumentation and monitoring.

Review by TfNSW is expected to be required. Submission requirements are provided in TS 02088.

The above identified hazards and the requirements for TfNSW and TS 02088 are also applicable to the Clarinda Road crossing.

5.4 Hydraulics

5.4.1 Modelling overview

A hydraulic and surge model was built in WANDA 4.6. The assumptions described in this section cover the inputs for the model and outlines the design methodology of the hydraulic system.

5.4.2 Pipe material and size

Following the Concept Design Report and Addendum Report by GHD in 2021, initial hydraulics were performed using DN500 and DN600 DICL, a pump power limited to 315 kW and a system capacity target of 200-300 L/s. Initial transience results showed significantly high positive surge overpressures. This prompted discussions with PSC resulting in the following system design changes that impacted the hydraulics:

1. Investigating of alternate pipe materials.
2. Works were performed to increase the pump station power capacity, thereby removing the pump motor power limitation.
3. System design flows increased to 450-500 L/s.

From the pipe material investigation (12589733-MEM-2_GRP_DICL_comparison.pdf, GHD, January 2023), HDPE was determined as the alternative material with pipe sizes DN800 and DN710 used due to the near equivalent internal diameter as compared to DN600 DICL.

5.4.3 Pump selection

5.4.3.1 Initial selection

Initial pump selection was performed following the GHD Concept Design Report nominated pumps. The Flowserve 315 kW and 450 kW pumps for NERPS and ARPS respectively with DN500-600 DICL had capacities of 225-530 L/s. However due to the change in pipe material and to more closely align flows, the pumps were reselected and two potential pump suppliers were proposed to PSC for final confirmation.

5.4.3.2 Final selection

Two potential pump units (one for NERPS and ARPS) from two pump supplier (Flowserve and Xylem) were compared and proposed to PSC. PSC confirmed on 17 March 2023 that Flowserve was the preferred supplier following GHD's recommendation via a comparison letter, attached in Appendix C, due to the following benefits.

- Better flow matching between NERPS and ARPS with the Flowserve pumps of 20 L/s disparity. Compared to Xylem pumps with a flow disparity of 40 L/s.
- An approximate 3-5% better maximum efficiency for the Flowserve pumps.
- A \$53K cheaper per pump unit cost for the Flowserve pumps which accumulates to a total \$318K saving.

The Flowserve pump details for both NERPS and ARPS are tabulated below. The data sheets for both pumps are attached in Appendix D.

Table 5.1 Pump details

	NERPS	ARPS
Pump model	250-LNN-600	250-LNN-600
Maximum flow (L/s)	364	350
Maximum head (m)	138	128
Impeller diameter (mm)	606	581
Power requirement (kW)	450	400
Rated pump speed (rpm)	1490	
Moment of inertia (kg m ²)	2.3	
Pump weight (kg)	2,940 (baseplate weight not included)	
Pump size: LxBxH (mm)	2981 x 1100 x 1135	
Best efficiency point	85.1%	87.2%
Cost (per pump)	\$125K	
Total cost (all six pumps)	\$750K	
Lead time	36 weeks	

5.4.4 Pipe allowable operating pressure

The maximum allowable operating pressure (MAOP) of a pipeline is the maximum pressure than can sustained during anticipated operating conditions. Following AS4130 guidelines was the MAOP of the pipe determined which informed the required pipe pressure rating. See below the conditions and applied factors source from AS4130 Appendix C and the calculated new MAOP values.

Table 5.2 Pipe MAOP calculation factors

Condition	Index	Typical factors	Non-typical, road factors	Non-typical, trenchless factors
Fluid	f0	1.25	1.25	1.25
Temperature	f1	1	1	1
Minimum depth requirement for location	f2	1	1.2	1
Installation method	f3	1	1	1.2

Table 5.3 Pipe MAOPs

Nominal pressure class	Typical MAOP (kPa)	Non-typical - road MAOP (kPa)	Non-typical - trenchless MAOP (kPa)
PN25	2500	2080	
PN20	2000	1670	
PN16	1600	1330	
PN12.5	1250	1040	
PN10	1000	830	

5.4.5 Pipe properties and lengths

Utilising the redefined pipe MAOPs the pipeline pressure boundaries were initially defined by a pump dead heading scenario. Following pipe boundaries were them refined for steady state conditions. The following table summarizes the pipe properties and chainage sections considering the new MAOP. The lengths can be visualised in Figure 5.12 and Figure 5.13.

Non-typical pipe sections, such as under road crossings or during sections of trenchless installation, are not identified. It is recommended for these sections a minimum PN20 is utilised. These sections are identified in the long section drawings attached in Appendix A.

Table 5.4 Summaries pipe details

Pipe material	Pipe size	Pressure Rating	ID (mm)	OD (mm)	Chainage sections (m)		Total pipe lengths (m)
					NERPS	ARPS	
HDPE	DN800	PN16	643.5	800	0 - 10,800	28,190 - 30,660	13,270
	DN710	PN12.5	603.4	710	10,800 - 16,390 21,260 - 24,380	30,660 - 32,840	7,770
		PN10	624.6	710	16,390 - 21,260 24,380 - 28,190	32,840 - 33,580	5,610

5.4.6 Pump performance

A roughness value of 0.03 mm has been assumed for the HDPE pipe. The system curves (Figure 5.10 and Figure 5.11) are overlaid with the respective pumps curves to visualise the pump performance. The pump performances, as well as the BWL and TWL values used are tabulated in Table 5.5 below. The system curve assume to pumps will be operating at their supplier rated speed of 1490 rpm.

Table 5.5 Pump performance

	NERPS	ARPS
Pump configuration	Duty/duty/standby	
Discharge RL	302.7 mAHD	388.95 mAHD
BWL	247 mAHD	298.2 mAHD
Pump duties at BWL	223 L/s @ 125 m	225 L/s @ 112 m
TWL	250.6 mAHD	301.8 mAHD
Pump duties at TWL	227 L/s @ 124 m	236 L/s @ 110 m
Total flow range	446 - 454 L/s	450 - 472 L/s

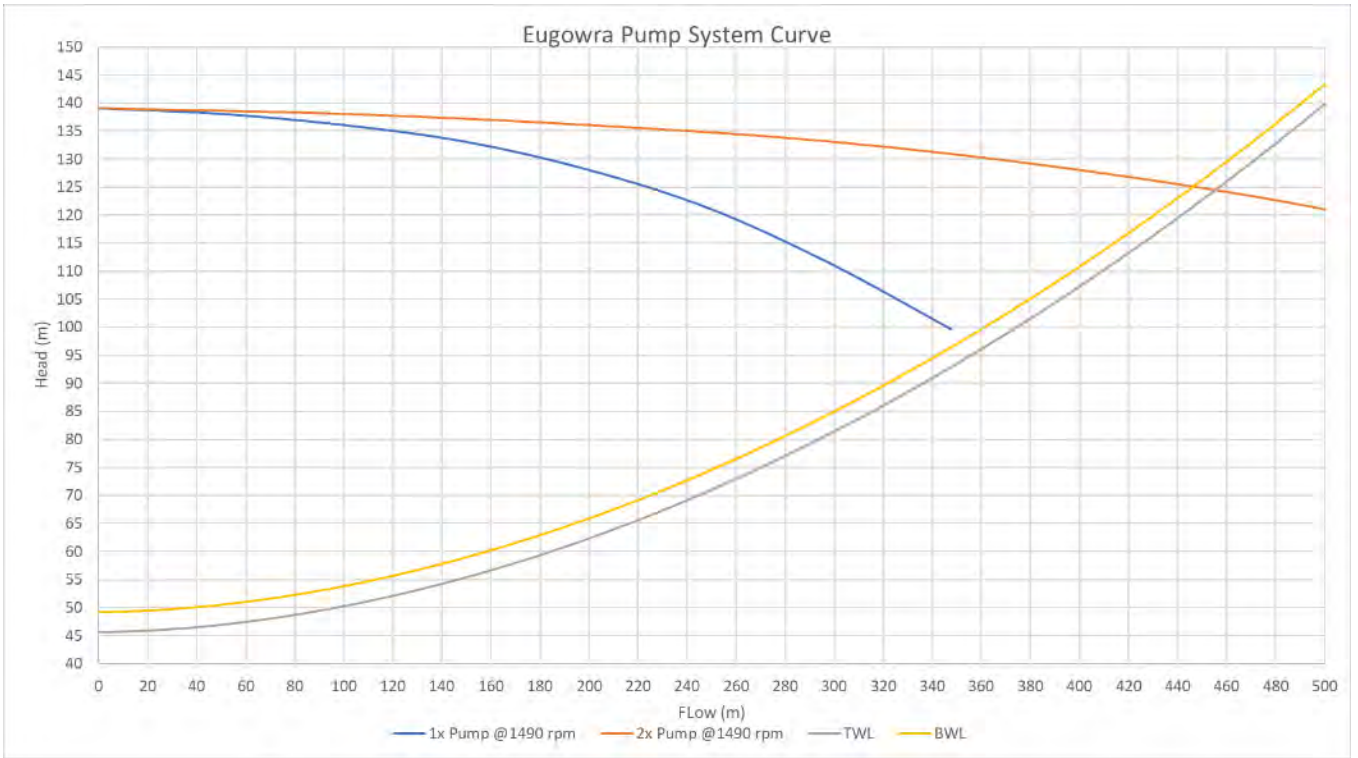


Figure 5.10 NRPS - 250-LNN-600 450 kW system curve

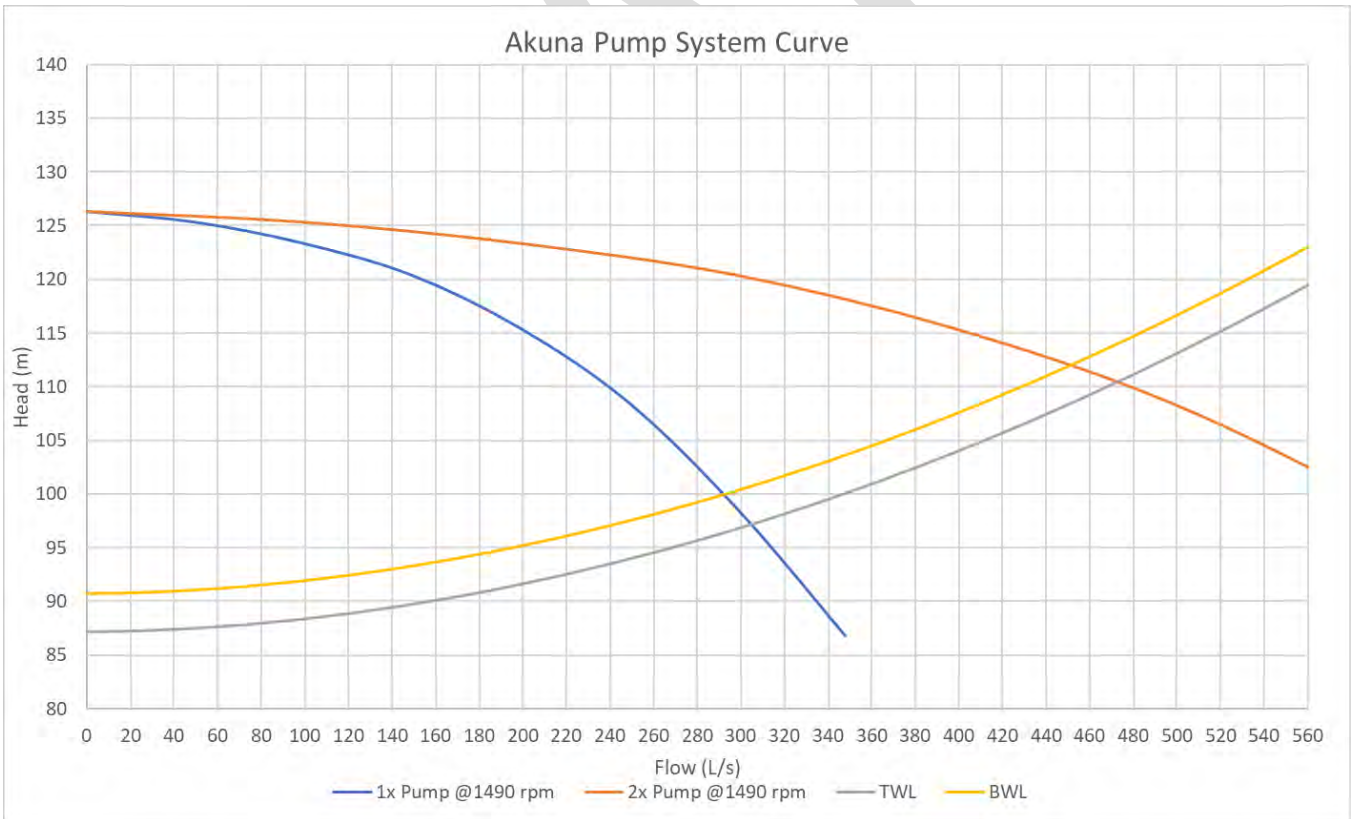


Figure 5.11 ARPS - 250-LNN-600 400 kW system curve

5.4.7 Hydraulic grade line and pressures profiles

The NERPS and ARPS steady state hydraulic grade lines (HGL) and pressure profiles when operating dual pumps at their respective BWL duty points (as noted in Table 5.5) are visualised below.

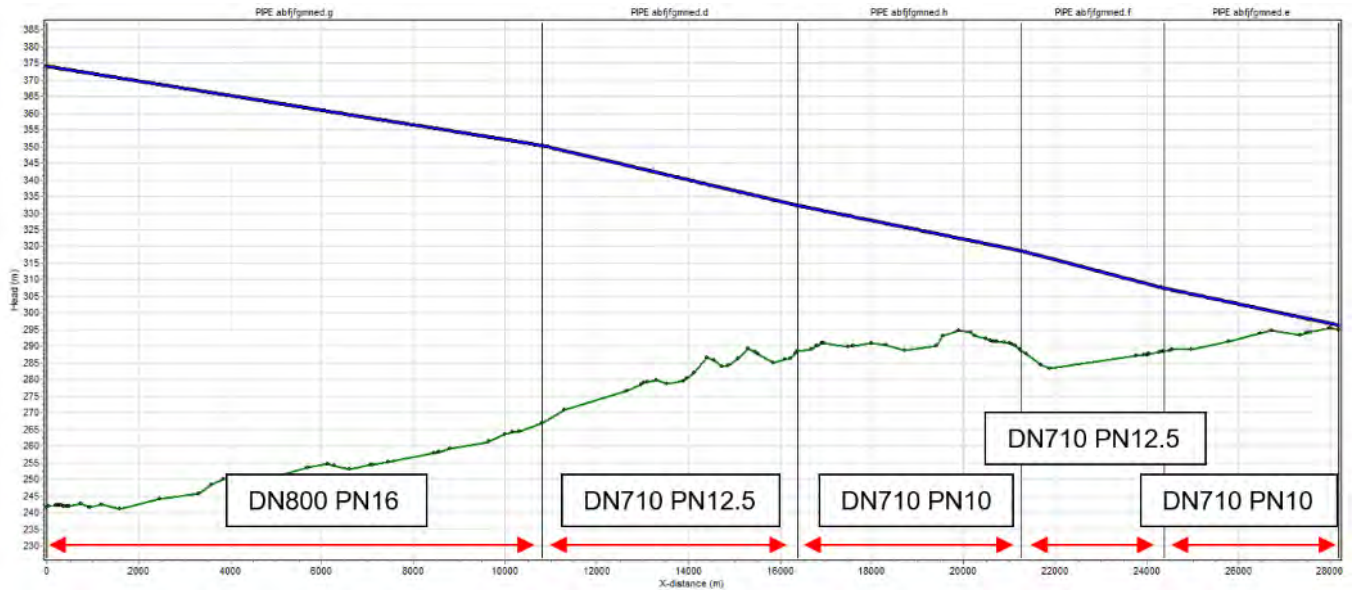


Figure 5.12 NERPS - steady state HGL and general pipe lengths

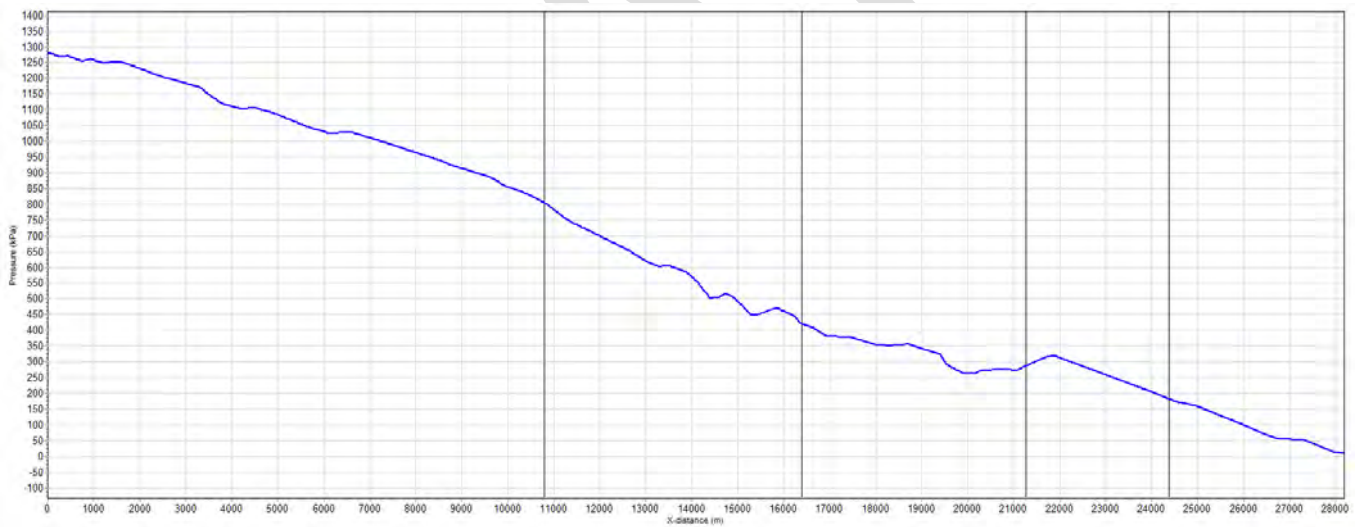


Figure 5.13 NERPS - steady state pressure profile

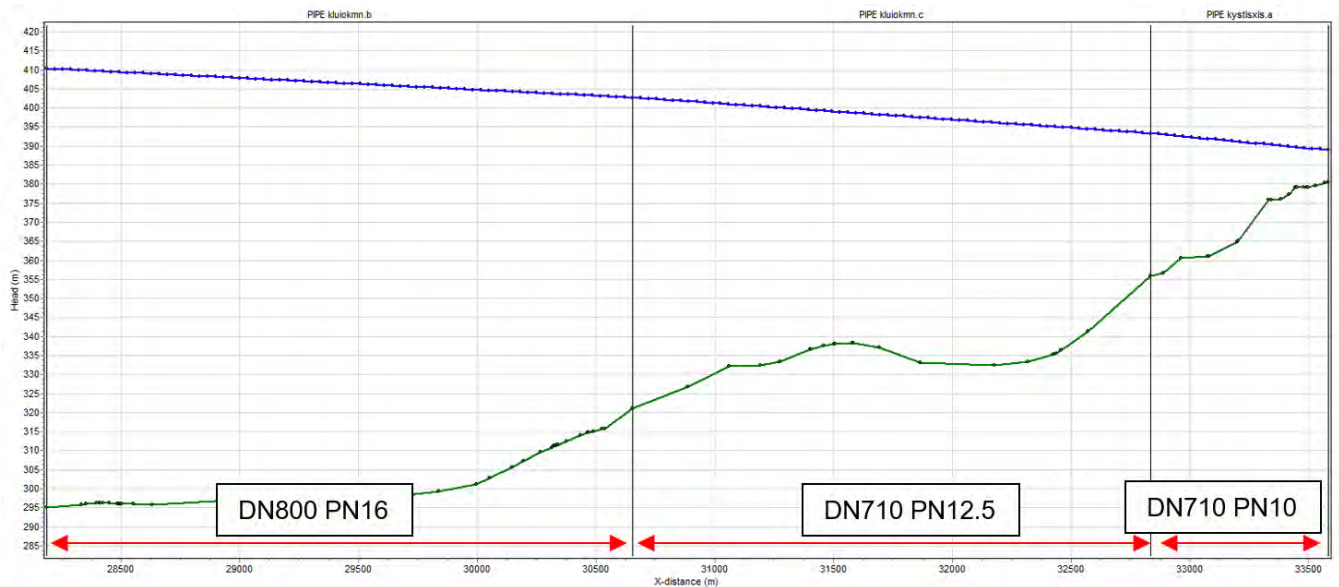


Figure 5.14 ARPS - steady state HGL and general pipe lengths

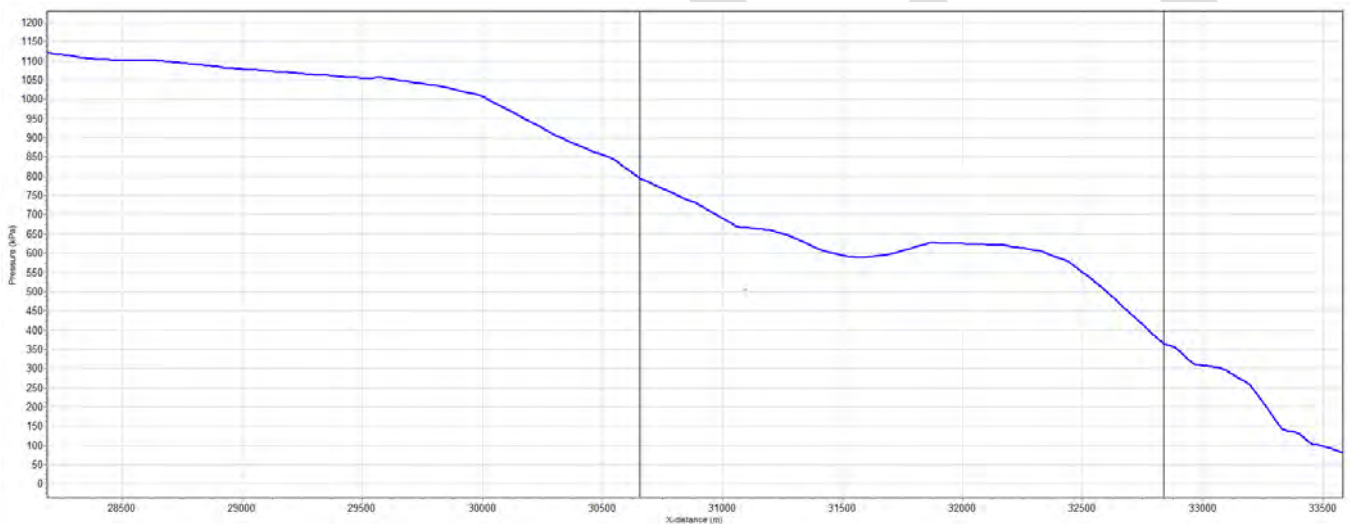


Figure 5.15 ARPS - steady state pressure profile

5.4.8 Surge analysis

5.4.8.1 Surge modelling overview

Two pipe sections were modelled (NERPS to ARPS and ARPS to Parkes WTP), both pipelines comprise of the pipe sections illustrated in Figure 5.12 and Figure 5.14. For both pipe sections, two surge scenarios were modelled. These include:

1. **Unprotected:** This scenario assumes no surge mitigation (e.g. air valves (AV) or surge vessel) active throughout the system. While it is understood there will likely be AVs along the pipeline, it is important to review the system without, given AV cannot be relied upon to open instantaneously upon the passing of a negative pressure wave (due to inertia effects, or potential clogging or isolation). These results therefore can indicate the worst-case extent of negative pressures from the initial trip wave, while the results with AVs would be expected to show certain locations where the AVs manage to somewhat mitigate negative pressures. AVs also have potential to introduce other pressure surges as a result of their opening and closure.

2. **Protected:** This scenario assumed surge mitigation is active. Initial surge analysis will assume only AVs are active to reduce negative pressures, if needed further surge mitigation will be investigated. The locations and number of the AVs are illustrated in Figure 5.21 and Figure 5.25.

Controlled pump start has not been assessed, as it is assumed that with the use of VSDs or suitable soft-starters, the pumps can be gently started with speed and pressure controls to prevent significant over-pressurisation of the main above the steady-state pressures. Controlled pump stop has not been modelled, as it typically is found that slowing the pumps and shutting them down from a low speed will cause a less significant result than that demonstrated in the event of pump trip.

5.4.8.2 Pipe celerity

A key aspect of surge analysis is the wave speed (also known as celerity) which is a measure of how quickly waves travel through a closed circuit and is a function of material and geometry. The celerity values used in the surge analysis were sourced from the Vinidex pipe supplier and are determined from the pipes standard dimension ratio (SDR). As noted on the Vinidex website, buried pipes should have an increased wave speed value of 7%. See Figure 5.17 and Table 5.6 for the non-buried and buried celerity values.

Material	SDR41	SDR33	SDR26	SDR21	SDR17	SDR13.6	SDR11	SDR9	SDR7.4
PE80	PN3.2	PN4	–	PN6.3	PN8	PN10	PN12.6	PN16	PN20
PE100	PN4	–	PN6.3	PN8	PN10	PN12.5	PN16	PN20	PN25

Figure 5.16 HDPE relationship between dimensions, material classification and working pressure (Vinidex)

SDR	PE 80	PE 100
	a (m/s)	a (m/s)
41	160	190
33	170	210
26	190	240
21	220	260
17	240	290
13.6	270	320
11	300	360
9	330	390
7.4	360	430

Figure 5.17 HDPE unburied celerity values (Vinidex)

Table 5.6 HDPE buried celerity values

Pipe nominal pressure class	Pipe SDR	Celerity (m/s)
PN10	17	310.3
PN12.5	13.6	342.4
PN16	11	385.2

5.4.8.3 Simulation period

For both pipelines, the pump trip (i.e. due to power outage) scenarios of the two pumps occurred when the pumps were each operating at the BWL duties noted in Table 5.5. The pumps were programmed to trip (without ramp-down) five seconds into the simulation to initialise the surge event.

The surge simulation time (post trip) was set to allow a minimum of three pressure cycles to occur. Where one cycle is the initial pressure wave, originating from the pump station, reaching the discharge location and the return wave reaching the pump station. A minimum simulation period was determined for each pipeline by using the equation, velocity equals distance over time to determine half a pressure cycle. Assuming a velocity equal to the wave speed of 310.3 m/s (lowest of the material used) and the distance between the respective pump station and discharge, the simulation period was estimated for both pipelines. The calculated period was then multiplied by six for the estimated minimum time for three pressure cycles are to occur. The largest required simulation time was applied to both pipelines surge simulations. See below the tabulated results to calculate the simulation period.

Table 5.7 Determining simulation time

	NERPS	ARPS
Minimum wave speed (m/s)	310.3	
Pipe distance (m)	28,190	5,390
Half pressure cycle time (sec)	91	18
Three pressure cycle time (sec)	552	108
Applied surge simulation period (sec)	552	
Estimated number of pressure cycles	6.0	30.7

5.4.8.4 Pump moment of inertia

A pump moment of inertia (MOI) value describes the amount of kinetic energy a pump continues to output once the motor stops driving the pump. The higher the value the longer the impeller and all rotating elements take to stop spinning and the longer period post trip is the fluid being continued to be moved. Pumps with a lower moment of inertia will spin down faster, more abruptly slowing the fluid at the pump outlet while fluid further downstream continues to flow due to momentum. This can potentially cause column separation, where a vacuum is formed between the stagnate fluid at the pump outlet and the fluid continuing to flow downstream.

The MOI values tabulated in Table 5.8 are sourced from pump and motor suppliers and has been used as inputs into surge analysis.

Table 5.8 Pump and motor MOI values

Pump station	Component	Moment of inertia (kg m ²)	Source	Applied MOI (kg m ²)
NERPS	Pump	2.3	Flowserve pump data sheet (Appendix D)	15.5
	Motor – 450 kW	13.2	WEG W50 technical catalogue	
ARPS	Pump	2.3	Flowserve pump data sheet (Appendix D)	16.1
	Motor – 400 kW	13.8	WEG W50 technical catalogue	

5.4.8.5 Surge air valves

For the purpose of surge analysis, the model assumes the AVs operate as intended and do not suffer from potential clogging or isolation. It is assumed DN100 CSA anti-surge fox 3F AVs are used. The performance curve of the AV can be seen below.

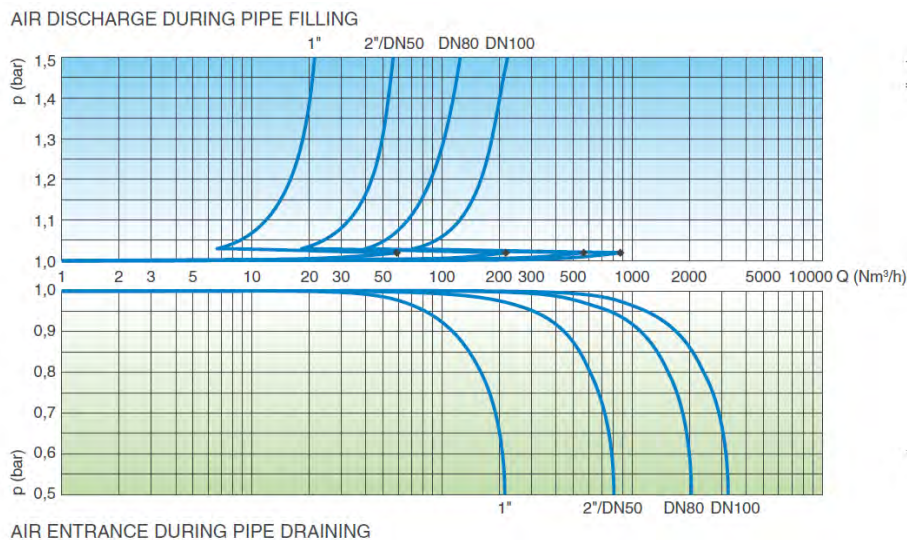


Figure 5.18 CSA anti-surge 3F AV performance curve

5.4.8.6 New Eugowra pump station surge results

The transient analysis showed that a simulated simultaneous two duty pump trip from 446 L/s causes.

Unprotected scenario (without active AVs):

1. Extensive negative pressures, with full vacuum conditions (-100 kPa.g) towards the end of the pipeline. Column separation and subsequent rejoin was not severe enough to trigger high pressure surges.
2. Relatively minor positive surge and overpressure (pressure greater than steady state pressure) occurring at the end of the pipeline, 100 kPa greater than steady state pressure. Throughout the rest of the pipeline surge pressures do not exceed steady state pressures.

Protected scenario (with active AVs):

1. Strong negative pressures with full vacuum conditions occurring at the very end of the pipeline. This is caused by the strong initial pressure wave as a result of the initial pump trip.
 - Potential negative pressure mitigation was investigated by increasing anti-slam AV sizes. The AVs were unable to mitigate the initial negatives and instead resulted in AV slam which resulted in an increase to the maximum overpressure.
2. Relatively minor positive surge and overpressure occurring at the end of the pipeline to 250 kPa (75 kPa greater than steady state pressure). Throughout the majority of the pipeline positive surge pressures are below steady state pressures.

The hydraulic grade envelopes and pressure envelopes for both scenarios are shown in Figure 5.19 to Figure 5.22 (green is the elevation profile, red is the maximum HGL or pressure depending on Y-axis, blue is steady state HGL or pressure and orange is the minimum HGL or pressure in the respective graphs).

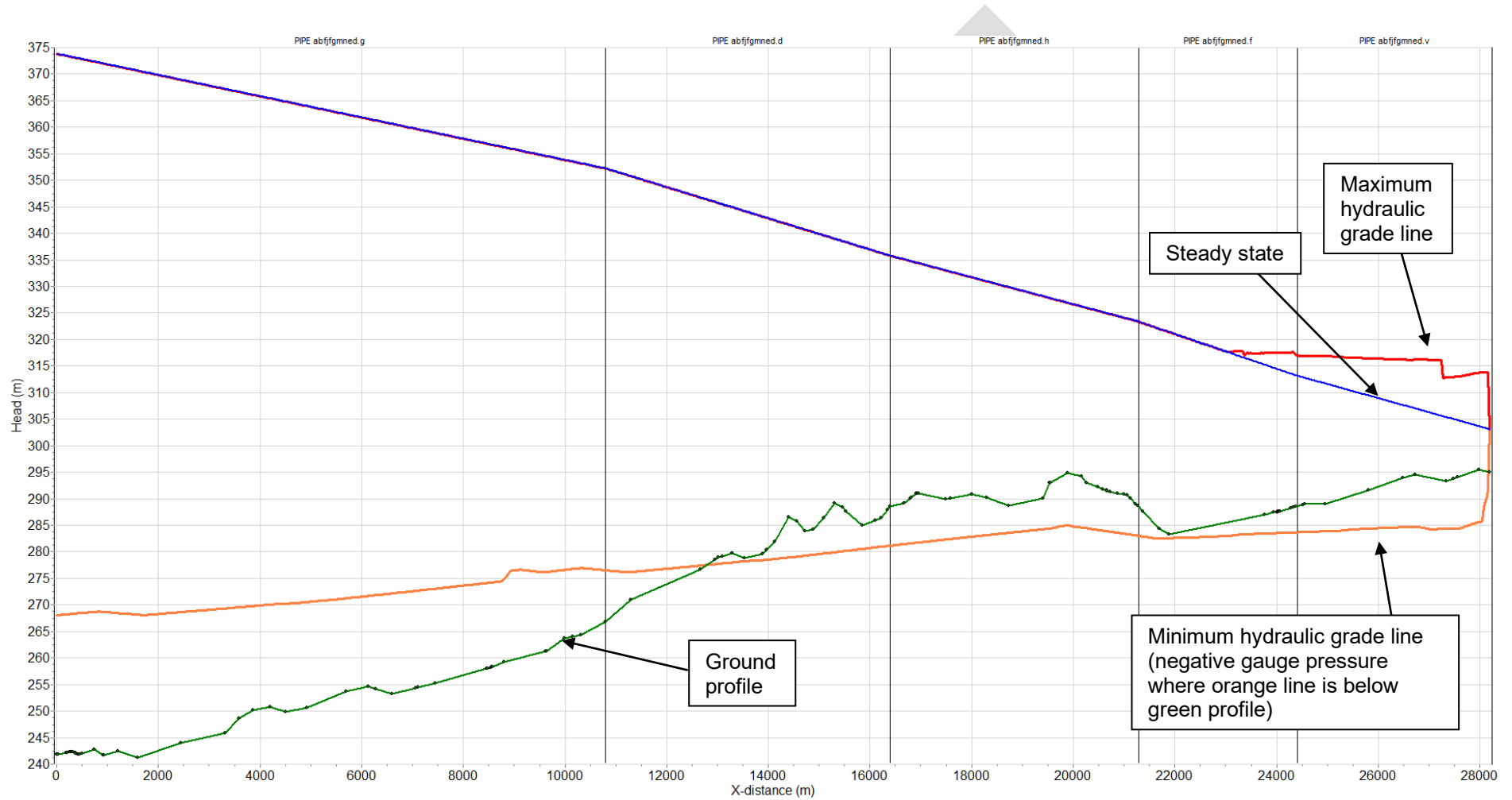


Figure 5.19 *NERPS unprotected hydraulic envelope*

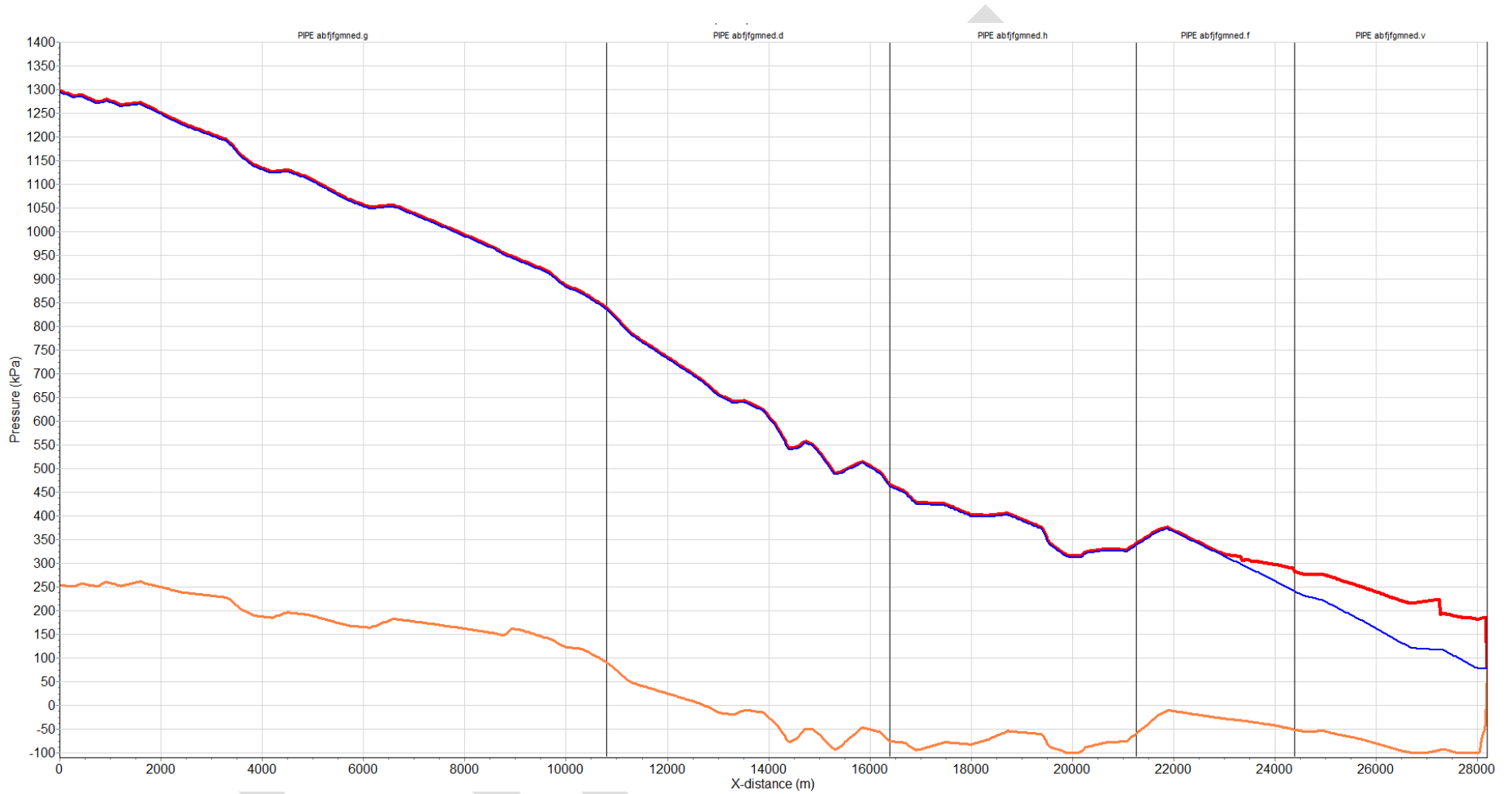


Figure 5.20 *NERPS unprotected pressure envelope*

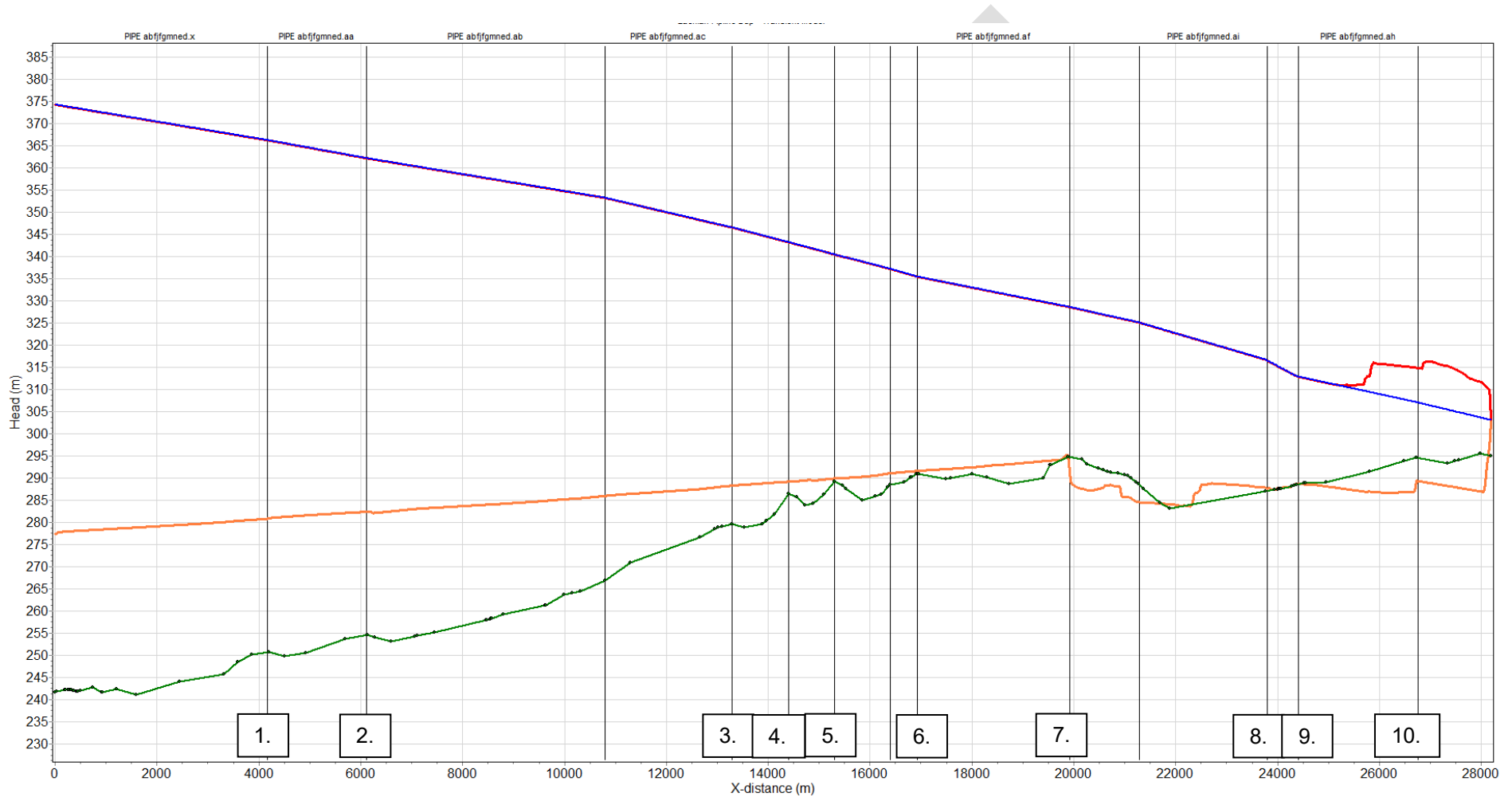


Figure 5.21 *NERPS protected hydraulic envelope (AV locations noted)*



Figure 5.22 *NERPS protected pressure envelope*

5.4.8.7 Akuna pump station surge results

The transient analysis showed that a simulated simultaneous two duty pump trip occurring at 450 L/s each causes:

Unprotected scenario (without active AVs):

- Strong negative pressures, with full vacuum conditions occurring in the last 800 m. Column separation and subsequent rejoin occurred, but was not severe enough to trigger high pressure surges.
- Large positive surges occurring throughout the pipeline. The largest pressures occurring at the start of the pipeline at 1600 kPa (450 kPa greater than steady state pressure).

Protected scenario (with active AVs):

- Negative pressures and full vacuum conditions occurring in the last 800 m. Column separation and subsequent rejoin occurred, but was not severe enough to trigger high pressure surges.
- Consistent positive surges occurring throughout the pipeline of 300 kPa greater than steady state. The largest pressures occurring at the start of the pipeline at 1400 kPa.

The hydraulic grade envelopes and pressure envelopes for both scenarios are shown in Figure 5.23 to Figure 5.26 (green is the elevation profile, red is the maximum HGL or pressure depending on Y-axis, blue is steady state HGL or pressure and orange is the minimum HGL or pressure in the respective graphs).



Figure 5.23 ARPS unprotected hydraulic envelope

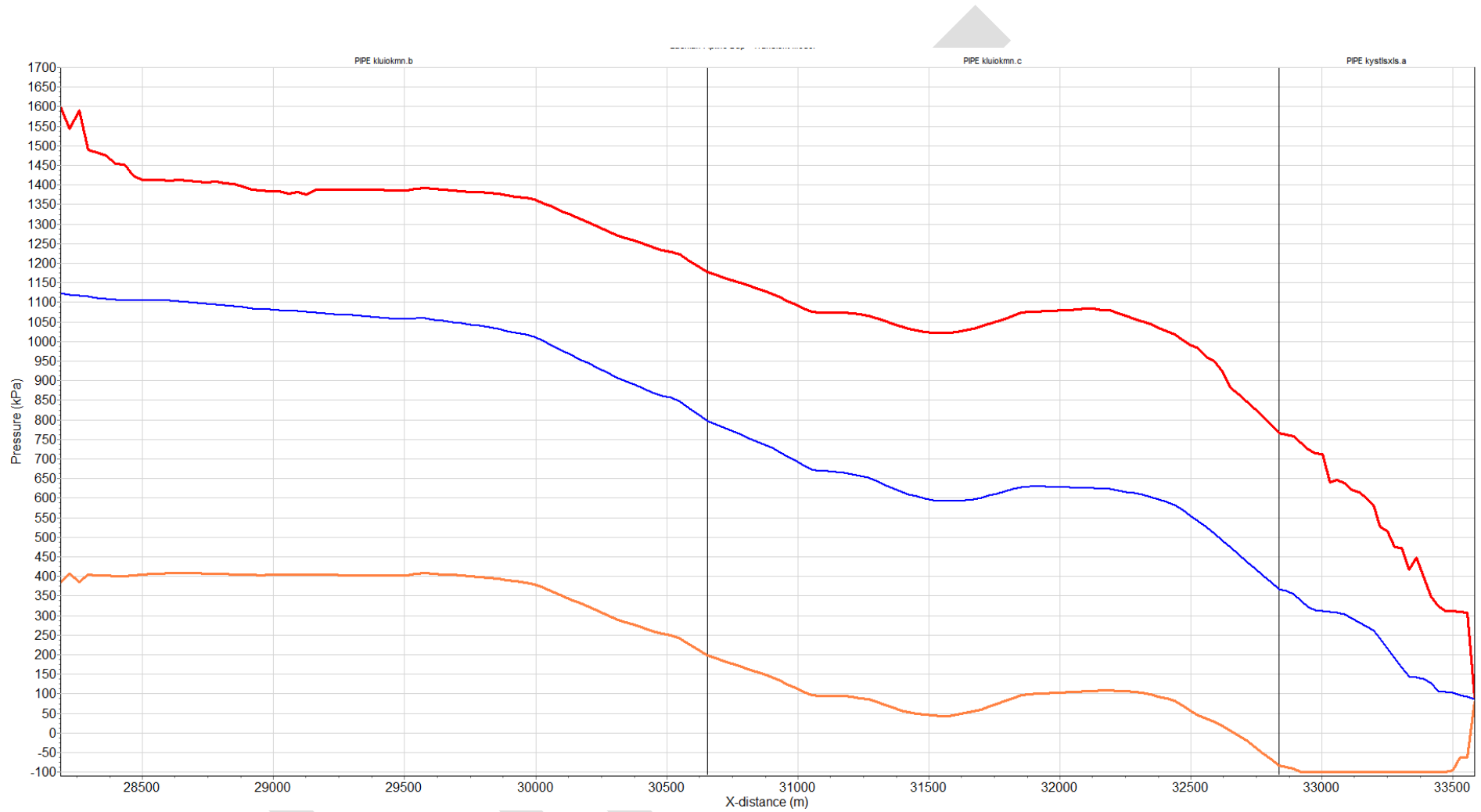


Figure 5.24 ARPS unprotected pressure envelope

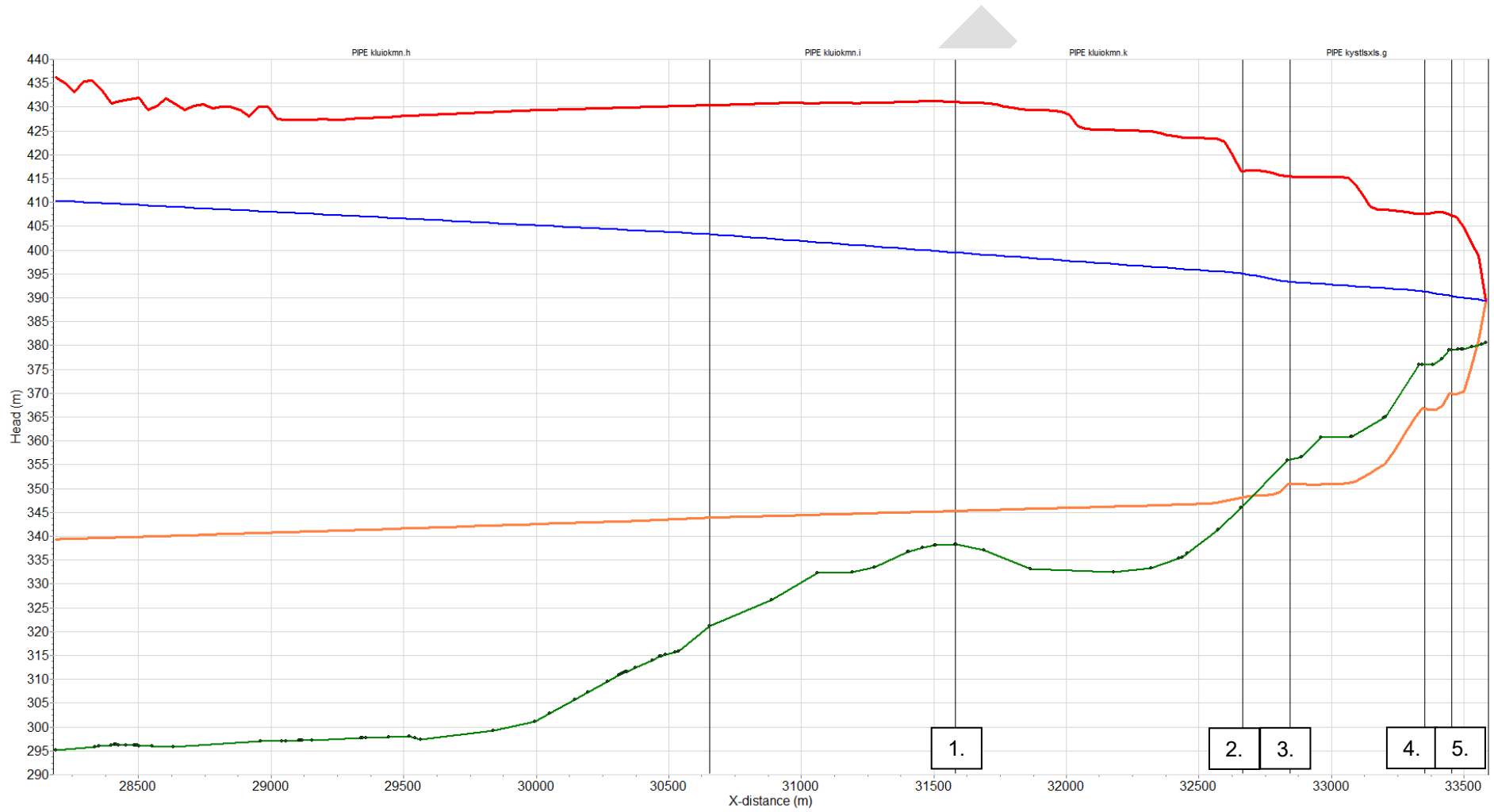


Figure 5.25 ARPS protected hydraulic envelope (with AV locations noted)



Figure 5.26 ARPS protected pressure envelope

5.4.8.8 Pipe cycle fatigue

As the pipe material is HDPE, it is potentially subject to fatigue following the fluctuations in stress from repetitive loads when the pumps cycle on and off. Over many thousands to millions of cycles through the lifetime of the pipe, the pipework may become weaker and potentially fail at pressures lower than the initial design or test pressure. Surge analysis results were reviewed with this in mind, to assist in correctly selecting the pipework pressure class.

Cyclic fatigue does not necessarily reduce the maximum pressure a pipe can handle, in practice it reduces the effective pressure range a pipeline can experience. For example, if a PN16 pipe's fatigue pressure range is 1500 kPa, and the pipeline experiences a minimum pressure of 400kPa and a maximum of 1600 kPa, the experienced pressure range is 1200 kPa. Provided the number of cycles of such a pressure range will not reduce this pipework to less than 75% of its initial strength (75% of 1600 is 1200), the cyclic pressure range of the PN16 pipe is considered sufficient.

Assuming a design life of 50 years the number of cycles (pump on and offs) was estimated totalling 525,600. Following the Plastic Industry Pipe Association of Australia (PIPA) guidelines POP010A, the total pump cycle count is doubled due to the exponential cycle pattern. Therefore, for design purposes, the total lifetime cycle count is 1,051,200 and the corresponding interpolated fatigue loading factor is 0.878.

The method to determine the design number of cycles and fatigue loading factor is tabulated below. The pipe cyclic fatigue loading factor is derived from Figure 5.27.

Table 5.9 Cycles over design life methodology

	Unit	Value
Average time to empty tanks at peak demand ^[1]	Min	20
Number of tank emptying cycles at peak day demand	Per day	72
Peak day factor		2.5
Pipe design life	Years	50
Average cycles	Per day	28.8
	Per year	10,512
	Over design life	525,600
Design cycles		1,051,200
Interpolated fatigue loading factor		0.878 (or 88% of original pipe strength)
1. Does not consider effects of simultaneous refilling of the balance tank.		

TOTAL CYCLES	APPROX. NO CYLCES/DAY FOR 100 YR LIFE	FATIGUE LOAD FACTORS PE80B AND PE100
36,500	1	1.00*
100,000	3	1.00
300,000	8	1.00
500,000	14	0.95
1,000,000	27	0.88
5,000,000	137	0.74
10,000,000	274	0.68
50,000,000	1370	0.57

Note: *Maximum allowable factor for fatigue loading pressure cycles

Figure 5.27 PIPA POP010A fatigue derating factor

Table 5.10 Fatigue derated pipe pressures

Pipe pressure rating	Design pressure (m)	Derated fatigue pressure range (m)	Derated fatigue pressure range* (kPa)
PN20	200	175.6	1756
PN16	160	140.5	1405
PN12.5	125	109.8	1098
PN10	100	87.8	878

5.4.8.8.1 Pipe experienced surge range

Using the derated fatigue pressure ranges tabulated above, the simulated surge pressure range are compared for both unprotected and protected pipe scenarios. As can be seen below, all scenarios have a pressure range below the derated fatigue ranges and therefore pipe pressures are considered sufficient for this factor of design.

Table 5.11 Surge pressure range results

Pump station	Pipe section	Derated fatigue pressure range* (kPa)	Unprotected maximum pressure range (kPa)	Protected maximum pressure range (kPa)
NERPS	DN800 PN16	1405	1043	955
	DN710 PN12.5	1098	746	786
	DN710 PN10	878	541	541
ARPS	DN800 PN16	1405	1213	957
	DN710 PN12.5	1098	980	854
	DN710 PN10	878	849	640

5.4.8.9 Pipe vacuum competency

From the figures in Section 5.4.8.6 and 5.4.8.7, large lengths of pipe experience vacuum conditions during surge events. Typically, HDPE in the pressure classes and sizes under consideration will be vacuum competent if installed using best practices. However due to the additional soil or potential vehicle load that may be experienced by the pipe, the pipeline vacuum competency was reassessed according to AS2566.1.

5.4.8.9.1 AS2566.1 assumptions

The AS2566.1 calculations were compiled based on data within the Macquarie Geotech Geotechnical Investigation report for the Lachlan River pre-treatment plant. The following conditions and loading cases summarised below are assumed to be identical to the conditions and load cases experienced by the Lachlan Duplication pipelines. Additionally the AS2566.1 references are included. The results below investigate an assumed minimum pipe cover of 750 mm. Further detailed investigation (including the the maximum allowable cover) will be performed in the 80% design stage.

Table 5.12 AS2566.1 conditions and assumptions

Condition	Value	Source
Minimum pipe cover	750 mm	Assumed
Vacuum conditions	-100 kPa	from surge analysis
Water level	At ground level	Assumed
Factor of safety – buckling	1.25	AS2566.1 Section 5.4
Factor of safety – bending	2	AS2566.1 Table 2.1
Allowable long term ring bending	4%	AS2566.1 Table 2.1
Emedment soil modulus	3 MPa	Assumed
Native soil modulus	1 MPa	Based on available geotechnical data
Trench width	1400 mm	AS2566.1 Figure 3.1
Vehicle load condition	Unsealed road	Assumed
Vehicle load type and load	T44 Truck – 142 kPa	Assumed

5.4.8.9.2 AS2566.1 results

Based on the assumptions and conditions stated in Section 5.4.8.9.1, all pipe sizes and pressure rating passed AS2566.1 buckling stability requirements. If conditions experienced are outside the those noted above (including if pipework is laid shallower or deeper), it is recommended to reassess AS2566.1 competencies.

5.4.8.10 Surge analysis conclusion and recommendations

For both the NRPS to ARPS, and ARPS to Parkes WTP transfer mains, based on the modelled surge results, the following recommendations are made:

- With regards to negative pressures, the pipelines are expected to be capable of withstanding negative pressures (down to full vacuum of -100 kPa) for brief periods, within the parameters discussed above. Full vacuum conditions appear likely to occur at the end of the pipeline both with and without AVs.
- The pipework, including thrust restraints, for each section of the pipeline should be designed to accommodate the larger test pressure between the maximum unprotected modelled pressure plus a recommended allowance for unassessed surge conditions of 25%, or the dead head pressure for the respective section. The test pressure though be no more than 125% of the pipe's nominal pressure class. See below the tabulated pressures with the recommended minimum test pressures boldened.

Table 5.13 Maximum pressures for thrust restraints

Pipe	NRPS: 125% of the maximum unprotected modelled pressure (kPa)	NRPS: Maximum dead head pressure (km)	ARPS: 125% of the maximum unprotected modelled pressure (kPa)	ARPS: Maximum dead head pressure (km)	125% Nominal pressure (kPa)
DN800 PN16	1625	1450	2000	1300	2000
DN710 PN12.5	1062.5	1200	1375	1050	1562.5
DN710 PN10	593.8	980	937.5	700	1250

Controlled pump start and stop have not been assessed, as it is assumed that with the use of VSDs or suitable soft-starters, the pumps can be slowly started or slowed prior to stopping to prevent significant over-pressurisation of the main. These controlled scenarios will need to be assessed at a later stage of design, to define the VSD control requirements.

5.5 Pipeline requirements

5.5.1 Jointing

Pipe jointing proposed for the project is:

- Butt fusion welding for the HDPE material along the transfer pipeline and the initial pipework from the delivery side of the new WPS at Eugowra will require butt fusion welds to nominal stub flanges with metal backing rings. The use of HDPE removes the need for thrust restraint along the majority of the transfer main.
- NERPS and ARPS transfer pipes will utilise DICL fittings for pipe jointing either flanged or socketed with conventional thrust blocks. The adopted type of DICL is to be confirmed by PSC.

5.5.2 Pipe bedding material

The pipe bedding surround for the majority of the transfer water mains is Type B, refer to WAT-1202 and WAT-1203. Refinement will be carried out as required once the pipeline alignment is confirmed.

5.5.3 Thrust block and welded restraint support

To be completed for 80% submission upon provision of geotechnical data.

5.5.4 Structural design check

To be completed for 80% submission. An initial AS2566.1 vacuum competence check is discussed in Section 5.4.8.9 which passed with a 750 mm cover.

5.5.5 Concrete encasement

To be completed for 80% submission, noting that this will only be specified where minimum cover cannot be cost-effectively achieved or for non-trenchless road crossings as agreed with Council.

5.5.6 Air valves

Air valves are located at high points along the alignment to release trapped air and admit air in the case of a downstream main break. The proposed valves are highlighted on the detail design drawings.

5.5.7 Isolation valves

Spacing of isolation valves to be confirmed by Council but proposed to be located every 1 km to limit the size of the isolation volume when the transfer main is taken out of service for operational purposes or when repairing a break.

5.5.8 Scour valves

Scour valves have been included at the low points along the transfer watermain for draining down during maintenance or to repair main breaks in accordance with Water Services of Australia Associations (WSAA), Water Supply Code of Australia WSA03 NSW Regional 2011-3.1 Edition.



6. New Eugowra Road Pump Station

6.1 Scope

New Eugowra Road pump station (NERPS) is to be constructed within the infrastructure pad at the pre-treatment area. The infrastructure pad will consist of a pump station building, switchroom, 500 kL balance tank and a settled water pump station (by others).

NERPS will operate to transfer raw water from Lachlan River Pre-treatment Area to Akuna Road pump station (ARPS).

6.2 Location

NERPS is to be constructed beside the Lachlan River Pre-treatment lagoons adjacent to The Escort Way. Refer Figure 6.1 and drawings 12589773-W100 to 12589773-W107 for further details.



Figure 6.1 New Eugowra Road Pump Station Layout

6.3 Civil – earthworks

The infrastructure pad design of NERPS is mainly incorporated in the design of Lachlan River Pre-treatment Area. The key points considered in the design are:

- Access to the site is from The Escort Way is through the ring road of the pre-treatment area.
- Concrete driveway is proposed to branch off from the pre-treatment area ring road towards the infrastructure pad between the pump station building and the reservoir.
- The design vehicle used to assess the swept paths is 12.50 m long single-unit truck.
- The infrastructure pad is to be raised above the 1% AEP flood level of RL244.07 mAHD. The finished surface level to be RL 245.05 mAHD.
- An overview of the site layout is shown in Figure 6.1.
- Site fencing is proposed around the balance tank as a minimum in addition to the pre-treatment area fencing.

6.4 Pumps and pipework

NERPS is to be on a duty-duty-standby configuration. Pump selection is discussed on Section 5.4.3. Refer to design drawings for further pipework details.

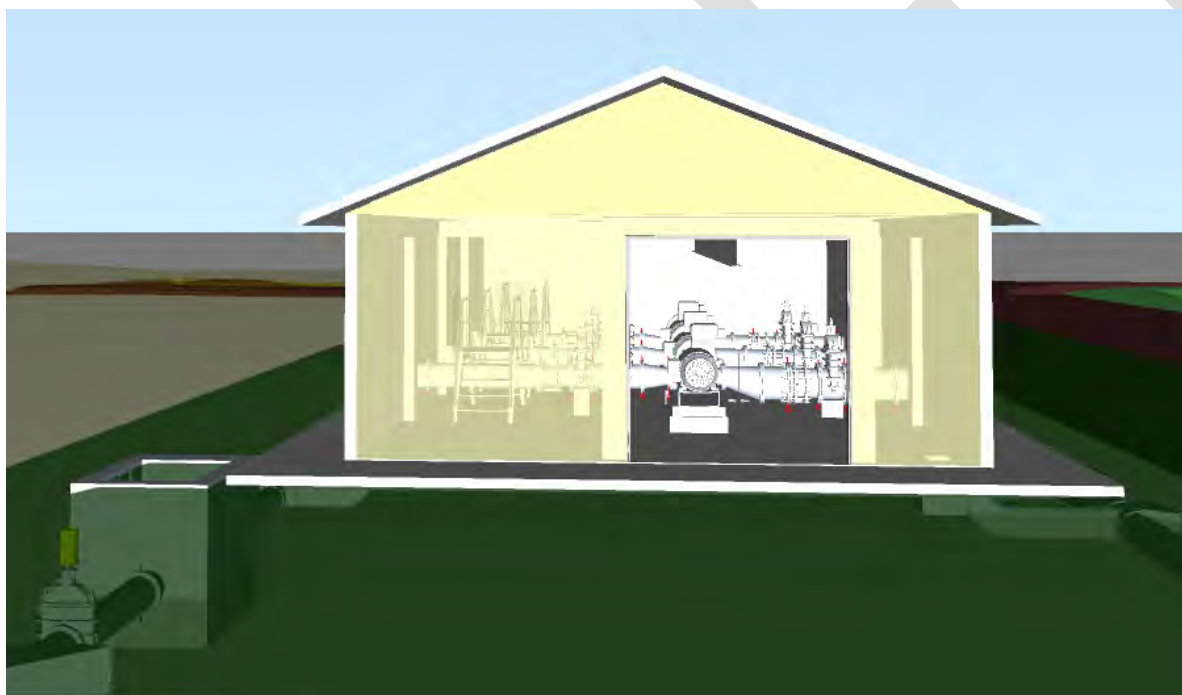


Figure 6.2 Navisworks model screenshot of NERPS building from the north-west side

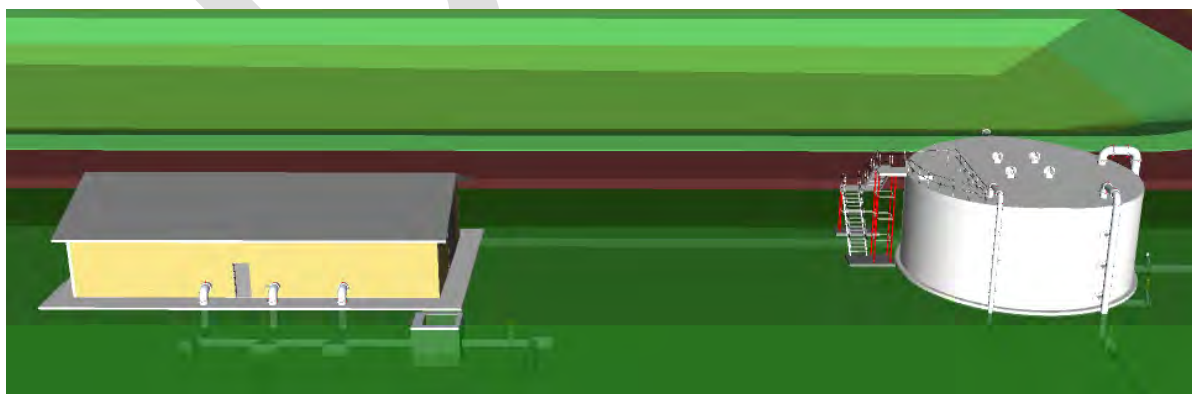


Figure 6.3 Navisworks model screenshot of NERPS building and balance tank taken from north-east side

6.5 Electrical

See electrical design drawings, 12589773-E001 to E033.

- Power Supply, ASP3 and authority connection completed by others.
- The pad mounted transformer is proposed adjacent to The Escort Way to provide adequate access by the energy provider. The conduits from the transformer run underground before entering the switchroom.
- Supply within the site utilizes underground cables outside the Pump Station, including instrumentation cabling for the level switches and flowmeter, which are routed underground outside the pump station. Inside the Pump Station, cable trays are employed to support both supply and control cabling.
- The switchroom is utilising overhead cable tray with top entry and top exit for the VSD supply and control cabling. The cable tray will extend through the switchroom wall to enter the pump room to provide access to the pumps.
- The three pumps are to be utilised in a duty/duty/standby scenario alternating which pumps are utilised to share usage and prevent a single pump remaining idle for an extended period of time. This cycle will rotate in a start-up event as well as when pumps have been running continuously for a specified period. When maximum pump run time has expired, all pumps will stop to rotate duty cycle before starting new required pumps.
- The pumps shall also have a SCADA manual and Local manual mode, with the pumps being able to be controlled via SCADA or locally respectively. Local manual mode is selected via selector switch within the switchroom, SCADA manual mode will be restricted by password on SCADA.
- Each pump has a local control station (LCS) consisting of an Emergency Stop as well as start and stop push buttons. The LCS Start & Stop buttons would only be functional when selector switch located in the switchroom is set to local. The emergency stop button will work in all cases (local manual, SCADA manual and auto).
- Communications, PLC programming, and SCADA controls integration into new or existing control systems to be done by others.

6.6 Mechanical HVAC

The ventilation and cooling systems proposed for the pump room, adjacent switchroom and pump room are based on the following codes and standards as listed below:

- National Construction Code 2022 (NCC 2022) including relevant parts of the Section J
- AS 1668.2 2012
- AS 4254.1 & AS 4254.2
- AS 1668.4:2012
- AS/NZS 4859.

6.6.1 Pump station

The nearest weather station to the pump station is located at the Parkes Airport AWS weather station, where the average annual temperature is below 30 CDB for most of the year and 40 CDB at maximum during hot summer days. Fan assisted roof ventilators with motorised control dampers were chosen over an air conditioning system to condition the pump station due to the location's ambient conditions, construction expenses, and operating costs.

As agreed with the client, the design and sizing of roof ventilators was based on a delta T of 5 degrees Celsius. It should be noted that the pump station cannot be cooled below the ambient air temperature. The heat load calculations and required air flows are tabulated below.

Table 6.1 HVAC calculations for NERPS

Design element	Value	Unit
Total Heat Load	42.4	kW
Temperature rise (Delta T)	5	deg C
Air Volume required	7.7	m ³ /s
Airflow out of Pump Hall	7.7	m ³ /s
No. of roof ventilators	6	N/A
Minimum free area required	7.4	m ²

The details of the roof ventilators serving the pumpstation are outlined in the table below. The roof ventilators shall be mounted on the roof as per manufacturer's instructions. The roof ventilators are to be fitted with egg crate grilles sized to facilitate the required air flow rates with minimal pressure drop. See mechanical services legends and schedule sheet (12589773-M003) for more details on the equipment. Roof flashing to suit roof profile shall be the responsibility of the builder.

Table 6.2 Fan assisted roof ventilators provided for NERPS

Roof ventilator	Make/Model	Airflow (l/s)	Power Supply (V/ph/A)
RV.1	Airocle 5AV.0600/050-4	2000	240/1/3
RV.2	Airocle 5AV.0600/050-4	2000	240/1/3
RV.3	Airocle 5AV.0600/050-4	2000	240/1/3
RV.4	Airocle 5AV.0600/050-4	2000	240/1/3
RV.5	Airocle 5AV.0600/050-4	2000	240/1/3
RV.6	Airocle 5AV.0600/050-4	2000	240/1/3

Make-up air to the pump room shall be provided via six (6x) intake louvres with a combined free area not less than 7.4m². The details of the intake louvres are outlined in the table below.

Table 6.3 Ventilation openings provided for NERPS

Vent Type	Dimensions (mm x mm)	Comments
Louvre	1200 x 2000	51% free area

HVAC Controls for the Pump room

Contractor shall supply and install temperature controller within the pumpstation. The sensor to be positioned in close proximity to the duty pumps and away from intake louvres. The ventilation system controls to be achieved using factory modified control panels capable of incorporating the following steps:

- All roof ventilators to operate on wind and stack effect whilst the internal room temperature remains below 40° CDB. When the internal room temperature exceeds 40° CDB:
 - Motorised dampers of the standby roof ventilators (RV5 and RV6) to shut.
 - The booster fans of the duty roof ventilators RV1, RV 2, RV 3 and RV 4 to start and run at 2000 L/s.
 - Booster fans to stop when internal room temperature drops below 38° CDB for at least 30 minutes.
- The duty/standby configuration to swap on a weekly basis. Fan control to be achieved using factory modified control panel.
- Fan run cycle time to be adjustable. fan and damper control to be achieved using third party Innotech control panel or similar. Duty/stand-by operation of roof ventilators without shut off dampers to be avoided due to potential short-circuiting of air into the pumpstation through the standby units.

6.6.2 Switchroom

The switchroom is to be provided with suitable air conditioning units to maintain a stable internal setpoint of 27 deg C.

Design considerations:

- Heat dissipated by the VSDs shall be ducted to outside.
- Heat gains within the switchroom are based on all electrical equipment except for the VSDs. The heat loads breakdown is tabulated in the table below.

Table 6.4 *NERPS Heat load Gains*

Load Type	Load	Unit
Fabrics, Lighting and Solar Load	3.43	kW
Internal Equipment Loads	23.07	kW
Total Heat Gain	26.5	kW

Switchroom Controls

Two (2) packaged AC units were selected to serve the switchrooms and shall run on duty-standby mode to ensure continuous operation (see mechanical schedule sheet for more details).

- The package unit is to be controlled via wall mounted control panel (proprietary controller) that allows standard fan, mode & temperature settings.
- When packaged unit is in cooling mode and the outdoor ambient temperature is less than 27°C (adjustable) economy cycle shall be engaged. The relief dampers are to open and the return air damper to shut in order to provide a relief air path & avoid excessive pressurisation of the space when outside air volumes are high.

6.6.3 VSD Ventilation

VSDs shall be provided with separate and independent mechanical ventilation systems. Dedicated roof mounted fans shall be provided to exhaust the heat rejected from the VSD units. Make up air shall be provided by low-level louvre ducted to the VSD's intake located underneath the unit. G4 rated filters are to be attached directly behind the louvres to prevent ingress of dust and dirt into the VSD units.

Table 6.5 *Roof Mounted Fans for NERPS VSDs*

Equipment Tag	Flow Rate	Units
EF-1	0.73	m ³ /s
EF-2	0.73	m ³ /s
EF-3	0.73	m ³ /s

Table 6.6 *NERPS Louvre Selection*

Equipment Tag	Flow Rate (LPS)	Dimension (WXH)
LV1	1300	2600 x 400
LV2	200	400 x 400

6.6.4 Pump room

The pump room is to be provided with wind assisted roof ventilators which allows hot air from the room escape naturally. Roof cowls however are provided to replace air that are removed from the space. Ventilators are sized based on the flow rate required per metre square area of the water tank room.

Table 6.7 Air flow requirement for NERPS pump room

Parameters	Value	Units
Floor Area	167.42	m ²
Flow Rate required per m ²	3.05	LPS/m ²
Total Air Flow Required	510	LPS
Number of Roof Ventilator	2	n/a
Air Flow Rate per Ventilator Required	255	LPS

From the above calculated air flow required, the roof ventilator has been selected as shown in table below:

Table 6.8 Fan assisted roof ventilators provided for NERPS – pump room

Roof ventilator	Make/Model	Airflow (l/s)	Power Supply (V/ph/A)
RV-WT-01	Airocle 5AV.0400/050-4	271	240/1/0.43
RV-WT-02	Airocle 5AV.0600/050-4	271	240/1/0.43

Pump room control

All roof ventilators are to operate on wind and stack effect simultaneously and continuously.

7. Akuna Road Pump Station

7.1 Scope

Akuna Road pump station (ARPS) compound will consist of a pump station building, switchroom and a 500 kL reservoir. ARPS will deliver raw water to Parkes WTP raw water supply lagoon or alternatively directly to the WTP is Council have the RWSL offline for maintenance.

7.2 Location

ARPS is to be constructed north of the existing Parkes Sewage Treatment Plant (STP). Access will be via Akuna Road. Refer to Figure 7.1 and drawings 12589773-W200 to 12589773-W207 for further details.



Figure 7.1 Akuna Road Pump Station Layout

7.3 Civil – earthworks

To provide access to ARPS, the existing STP road will be extended to the east by approximately 170 m going to the ARPS compound. The main points considered in the design are:

- Finished surface level of the building and reservoir pad is RL296.20 mAHD.
- The design vehicle used to assess the swept paths is 12.50 m long single-unit truck.
- Concrete hardstand and pavement is proposed adjacent to the pump station building and the 500 kL balance tank.

- An overview of the site layout is shown in Figure 7.1.
- Site fencing is proposed around the ARPS site tying into the adjoining Parkes STP site fencing.

7.4 Pumps

ARPS is to be on a duty-duty-standby configuration. Pump selection is discussed on Section 5.4.3. Refer to design drawings for further pipework details.

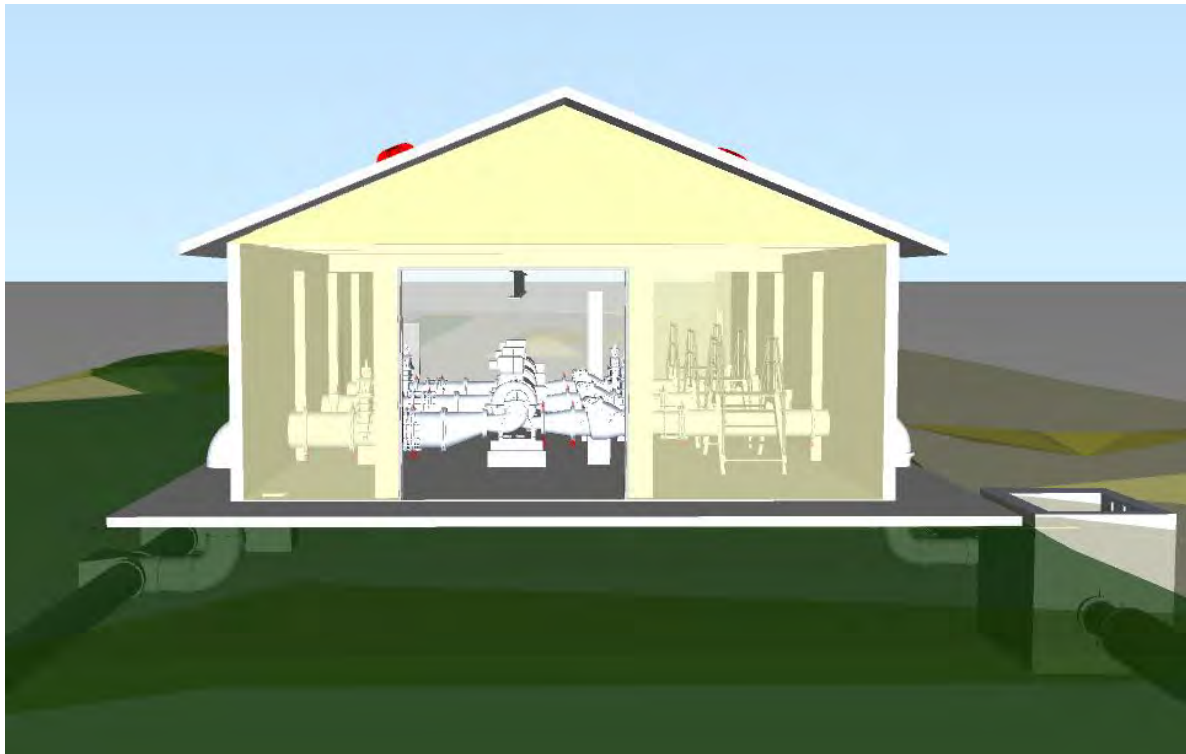


Figure 7.2 Navisworks model screenshot of ARPS building from the eastern side



Figure 7.3 Navisworks model screenshot of ARPS building and balance tank taken from the southern side

7.5 Electrical

See electrical design drawings, 12589773-E001 to E002 and 12589773-E106 to E133.

- Power Supply, ASP3 and authority connection completed by others.
- The pad mounted transformer location has yet to be confirmed. The conduits from the transformer , Power Supply, ASP3 and authority connection completed by others.
- Supply within the site utilizes underground cables outside the Pump Station, including instrumentation cabling for the level switches and flowmeter, which are routed underground outside the pump station. Inside the Pump Station, cable trays are employed to support both supply and control cabling.

- The switchroom is utilising overhead cable tray with top entry and top exit for the VSD supply and control cabling. The cable tray will extend through the switchroom wall to enter the pump room to provide access to the pumps.
- The three pumps are to be utilised in a duty/duty/standby scenario alternating which pumps are utilised to share usage and prevent a single pump remaining idle for an extended period of time. This cycle will rotate in a start-up event as well as when pumps have been running continuously for a specified period. When maximum pump run time has expired, all pumps will stop to rotate duty cycle before starting new required pumps.
- The pumps shall also have a SCADA manual and Local manual mode, with the pumps being able to be controlled via SCADA or locally respectively. Local manual mode is selected via selector switch within the switchroom, SCADA manual mode will be restricted by password on SCADA.
- Each pump has a local control station (LCS) consisting of an Emergency Stop as well as start and stop push buttons. The LCS Start & Stop buttons would only be functional when selector switch located in the switchroom is set to local. The emergency stop button will work in all cases (local manual, SCADA manual and auto).
- Communications, PLC programming, and SCADA controls integration into new or existing control systems to be done by others.

7.6 Mechanical HVAC

The ventilation and cooling systems proposed for the pump room, adjacent switchroom and water tank room are based on the following codes and standards as listed below:

- National Construction Code 2022 (NCC 2022) including relevant parts of the Section J
- AS 1668.2 2012
- AS 4254.1 & AS 4254.2
- AS 1668.4:2012
- AS/NZS 4859.

7.6.1 Pump station

The nearest weather station to the pump station is located at the Parkes Airport AWS weather station, where the average annual temperature is below 30 CDB for most of the year and 40 CDB at maximum during hot summer days. Fan assisted roof ventilators with motorised control dampers were chosen over an air conditioning system to condition the pump station due to the location's ambient conditions, construction expenses, and operating costs.

As agreed with the client, the design and sizing of roof ventilators was based on a delta T of 5 degrees Celsius. It should be noted that the pump station cannot be cooled below the ambient air temperature. The heat load calculations and required air flows are tabulated below:

Table 7.1 HVAC calculations for ARPS

Design element	Value	Unit
Total Heat Load	42.4	kW
Temperature rise (Delta T)	5	deg C
Air Volume required	7.7	m3/s
Airflow out of Pump Hall	7.7	m3/s
No. of roof ventilators	6	N/A
Minimum free area required	7.4	m2

The details of the roof ventilators serving the pumpstation are outlined in the table below. The roof ventilators shall be mounted on the roof as per manufacturer's instructions. The roof ventilators are to be fitted with egg crate grilles sized to facilitate the required air flow rates with minimal pressure drop. See mechanical services legends and schedule sheet (12589773-M003) for more details on the equipment. Roof flashing to suit roof profile shall be the responsibility of the builder.

Table 7.2 Fan assisted roof ventilators provided for ARPS

Roof ventilator	Make/Model	Airflow (l/s)	Power Supply (V/ph/A)
RV.1	Airocle 5AV.0600/050-4	2000	240/1/3
RV.2	Airocle 5AV.0600/050-4	2000	240/1/3
RV.3	Airocle 5AV.0600/050-4	2000	240/1/3
RV.4	Airocle 5AV.0600/050-4	2000	240/1/3
RV.5	Airocle 5AV.0600/050-4	2000	240/1/3
RV.6	Airocle 5AV.0600/050-4	2000	240/1/3

Make-up air to the pump room shall be provided via six (6x) intake louvres with a combined free area not less than 7.4m². The details of the intake louvres are outlined in the table below:

Table 7.3 Ventilation openings provided for ARPS.

Vent Type	Dimensions (mm x mm)	Comments
Louvre	1200 x 2000	51% free area

HVAC Controls for the Pump room

Contractor shall supply and install temperature controller within the pumpstation. The sensor to be positioned in close proximity to the duty pumps and away from intake louvres. The ventilation system controls to be achieved using factory modified control panels capable of incorporating the following steps:

- All roof ventilators to operate on wind and stack effect whilst the internal room temperature remains below 40° CDB. When the internal room temperature exceeds 40° CDB:
 - Motorised dampers of the standby roof ventilators (RV5 and RV6) to shut.
 - The booster fans of the duty roof ventilators RV1, RV 2, RV 3 and RV 4 to start and run at 2000 L/s.
 - Booster fans to stop when internal room temperature drops below 38° CDB for at least 30 minutes.
- The duty/standby configuration to swap on a weekly basis. Fan control to be achieved using factory modified control panel.
- Fan run cycle time to be adjustable. fan and damper control to be achieved using third party Innotech control panel or similar. Duty/stand-by operation of roof ventilators without shut off dampers to be avoided due to potential short-circuiting of air into the pumpstation through the standby units.

7.6.2 Switchroom

The switchroom is to be provided with suitable air conditioning units to maintain a stable internal setpoint of 27 deg C.

Design considerations:

- Heat dissipated by the VSDs shall be ducted to outside.
- Heat gains within the switchroom are based on all electrical equipment except for the VSDs. The heat loads breakdown is tabulated in the table below.

Table 7.4 Heat load Gains - ARPS

Load Type	Load	Unit
Fabrics, Lighting and Solar Load	3.43	kW
Internal Equipment Loads	23.07	kW
Total Heat Gain	26.5	kW

Switchroom Controls

Two (2) packaged AC units were selected to serve the switchrooms and shall run on duty-standby mode to ensure continuous operation (see mechanical schedule sheet for more details).

- The package unit is to be controlled via wall mounted control panel (proprietary controller) that allows standard fan, mode & temperature settings.
- When packaged unit is in cooling mode and the outdoor ambient temperature is less than 27°C (adjustable) economy cycle shall be engaged. The relief dampers are to open and the return air damper to shut in order to provide a relief air path & avoid excessive pressurisation of the space when outside air volumes are high.

7.6.3 VSD Ventilation

VSD's shall be provided with separate and independent mechanical ventilation systems. Dedicated roof mounted fans shall be provided to exhaust the heat rejected from the VSD units. Make up air shall be provided by low-level louvre ducted to the VSD's intake located underneath the unit. G4 rated filters are to be attached directly behind the louvres to prevent ingress of dust and dirt into the VSD units.

Table 7.5 Roof Mounted Fans for ARPS VSDs

Equipment Tag	Flow Rate	Units
EF-1	0.73	m ³ /s
EF-2	0.73	m ³ /s
EF-3	0.73	m ³ /s

Table 7.6 ARPS Louvre Selection

Equipment Tag	Flow Rate (LPS)	Dimension (WXH)
LV1	1300	2600 x 400
LV2	200	400 x 400

7.6.4 Pump room

The pump room is to be provided with wind assisted roof ventilators which allows hot air from the room escape naturally. Roof cowls however are provided to replace air that are removed from the space. Ventilators are sized based on the flow rate required per meter square area of the water tank room.

Table 7.7 Air flow requirement for ARPS pump room

Parameters	Value	Units
Floor Area	167.42	m ²
Flow Rate required per m ²	3.05	LPS/m ²
Total Air Flow Required	510	LPS
Number of Roof Ventilator	2	n/a
Air Flow Rate per Ventilator Required	255	LPS

From the above calculated air flow required, the roof ventilator has been selected as shown in table below.

Table 7.8 Fan assisted roof ventilators provided for ARPS – pump room

Roof ventilator	Make/Model	Airflow (l/s)	Power Supply (V/ph/A)
RV-WT-01	Airocle 5AV.0400/050-4	271	240/1/0.43
RV-WT-02	Airocle 5AV.0600/050-4	271	240/1/0.43

Pump Room Control

All roof ventilators are to operate on wind and stack effect simultaneously and continuously.

8. Balance Tanks

The tanks will require level monitoring equipment to assist the operation of both pump stations and the operation of the incoming source waters. The level equipment assumed will include level switches in the tanks to monitor the following control levels.

Table 8.1 Control philosophy

Command	Control levels
NERPS start	Akuna Road tank is at LWL
	Eugowra Road tank is at BWL
NERPS shut down	Akuna Road tank is at overflow level
	Eugowra Road tank is at LWL
ARPS start	Raw water storage lagoon is at LWL
	Akuna Road tank is at BWL
ARPS shut down	Akuna Road tank is at LWL
	Raw water storage lagoon is at overflow level
Settled water pump station (pre-treatment area) shut down	Eugowra Road tank is at overflow level

8.1 Eugowra Road balance tank

Eugowra Road balance tank will be top fed by three sources, mainly by the settled water pump station in the pre-treatment area and other two sources from river or bores pipeline. The Eugowra Road balance tank will feed NERPS through a DN600 outlet pipe. Table 8.2 below summarises the tank operational levels. Refer to drawing 12589773-W101 for details.

Table 8.2 Eugowra Road balance tank sizing

Item	Value
Capacity	558 kL
Diameter	14 m
Height	6.20 m
Tank floor level	245.25 mAHD
BWL / Pump start	247.25 mAHD
LWL / Pump stop	247.05 mAHD
Overflow level	251.15 mAHD
Freeboard	300 mm

8.2 Akuna Road balance tank

Akuna Road balance tank will be top fed by the DN710 transfer main from NERPS and it will then feed ARPS through a DN600 outlet pipe. Table 8.3 below summarises the tank operational levels. Refer to drawing 12589773-W201 for details.

Table 8.3 Akuna Road balance tank sizing

Item	Value
Capacity	558 kL
Diameter	14 m
Height	6.20 m
Tank floor level	296.40 mAHD
Pump start	298.40 mAHD
Pump stop	298.20 mAHD
Overflow level	302.30 mAHD
Freeboard	300 mm

9. Safety in Design

9.1 Introduction

The aim of this Safety in Design chapter is to identify potential occupational health and safety hazards associated with the project or design element described in this report as a Workplace during its construction, operational life, and maintenance and to identify the mitigation measures that can be put in place through the preparation of the design, documentation and (where applicable) operational and maintenance procedures to effectively manage the risks.

9.2 Process for identification of risks

GHD addresses Safety in Design (SiD) through the following process that is compliant with recent changes to this legislation:

- The risk register is maintained and updated throughout the design process to assess how safety risks can be mitigated throughout the design. A matrix approach with likelihood and consequence is used to identify the initial risk and what residual risk remains after appropriate mitigation measures are proposed (i.e. adopting a different option to eliminate the risk).
- Residual risks that cannot be mitigated below a moderate or significant risk are advised to the client so that this information can be passed onto the construction contractor (to feed into their risk assessments). We also encourage the client to require the construction contractor to pass the residual risks after their assessment back to PSC so that they can be passed onto their operations teams to cover O&M safety at the upgraded site.

9.2.1 Design risks

The first step of the SiD procedure identifies the risk presented by the design component of the job. Several potential safety hazards have been identified that relate to the construction and maintenance expected to be associated with this project. Using the tables below from the SiD procedure it was determined that there is a 'Significant' risk associated with the design component of the job. This was based on the highest risk consequence being a fatality ('E- Catastrophic' consequence) with an associated likelihood of '3-Possible'.

Table 9.1 Risk assessment matrix

Risk assessment matrix		Consequence				
		Minor	Major	Severe	Critical	Catastrophic
Likelihood		A	B	C	D	E
Almost certain	5	Low	Moderate	Significant	Extreme	Extreme
Likely	4	Low	Low	Moderate	Significant	Extreme
Possible	3	Negligible	Low	Moderate	Significant	Extreme
Unlikely	2	Negligible	Negligible	Low	Moderate	Significant
Very unlikely	1	Negligible	Negligible	Low	Moderate	Moderate

Table 9.2 Consequence descriptors

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 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 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 environment damage not required to be notified under jurisdiction requirements.

Table 9.3 Likelihood descriptors

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 sometime 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.

9.2.2 Desktop hazard identification

SiD desktop hazard identification (HAZID) occurs in the early stages of design to identify potential construction, maintenance, repair and demolition safety risks that could potentially adversely impact on design objectives. Hazard identification is an on-going task during the design.

During the HAZID process, a set of SiD Guidewords are used, which the design is considered against. Job specific hazards not included in the guidewords are added to ensure all potential design hazards are assessed for their risk potential. Outcomes from the HAZID process are to be recorded in the final design or risk register.

9.2.3 SiD Risk Register

The key document in communicating the hazards and risks associated with the design is the design risk register, which documents hazards and identifies pre-existing control measures in place and residual risks passed on to the relevant stakeholders.

Hazards identified, either in workshops, desktop review, discussions or generally during the design process are detailed in the Safety in Design Risk Register. This also includes initial risk rating, control measures implemented and residual risk ratings. Actions resulting from the HAZID are to be assigned to individuals to ensure mitigating controls are implemented.

The Project Safety in Design Risk Register was a live document and was reviewed and maintained throughout the Project. A copy of the risk register will be developed as the design progresses and be included in Appendix B.

9.2.4 Regular monitoring

The Project Safety in Design Risk Register was monitored throughout the design process to confirm the status of issues and completeness of the register. This monitoring involved a review to determine that actions were implemented.

9.2.5 Documenting SiD outcomes

SiD issues identified during this process are detailed in the Risk Register.

Throughout the project the Project Safety in Design Risk Register was maintained and updated regularly during the design by GHD. This should be continued by Council where required during construction and commissioning phases.

In addition to the Project Safety in Design Risk Register, safety related design decisions, including justifications for why potential control measures were or were not selected is recorded in the design report.

Key actions that may require further work beyond the design of the project are identified in the risk register and are to be progressed/ tracked by Council prior, during and after construction.

Appendix A

Detail Drawings

NOTES:

1. INSTALL FLOW METER TO MANUFACTURER'S RECOMMENDATIONS.
2. INSTALL FLOODLIGHTING TO PUMP STATION AND SUCTION PIPEWORK.
3. NO CRANE LIFTS NEAR DAM.
4. PROVIDE CRANE PAD, CONSIDER LARGER CRANE AT SAFE LOCATION WITH LONGER REACH.
5. CRANE PADS AND LOAD BEARING LOCATIONS NEAR DAMS AND RIVER MUST BE APPROVED BY PRINCIPAL.
6. CONTRACTOR TO INSTALL SECURITY SYSTEMS, LOCKED COVERS, SOLAR POWERED INTRUDER LIGHTING, FENCING AND GATES, AND TO IMPLEMENT SECURITY PATROLS.
7. THESE DRAWINGS MUST BE READ IN CONJUNCTION WITH THE PARKES WATER TREATMENT PLANT - LACHLAN RIVER PRE-TREATMENT AREA DESIGN.

LEGEND:

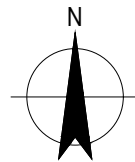
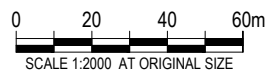
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- NEW POWER LINE
- NEW LRPT PIPEWORK (BY OTHERS)
- W — EXISTING WATER PIPELINE
- T — EXISTING TELSTRA
- E(OH) — EXISTING ELECTRICAL OVER HEAD
- E — EXISTING ELECTRICAL
- IR — EXISTING IRRG
- / — EXISTING FENCE
- ELECTRICAL CORRIDOR
- ROAD EDGE
- EXISTING MAJOR CONTOUR
- - - EXISTING MINOR CONTOUR
- TREE



PLAN
SCALE 1:2000

Rev	Description	Checked	Approved	Date
B	80% DETAILED DESIGN	-	-	20.10.23
A	30% DETAILED DESIGN	-	-	07.10.22

Author J. REGLAMOS Drafting Check -
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Project No.
12589773

Client **PARKES SHIRE COUNCIL**
Project **LACHLAN PIPELINE DUPLICATION
DETAIL DESIGN TSS**
Status **PRELIMINARY**

Drawing Title **NEW EUGOWRA ROAD PUMP STATION
OVERALL SITE LAYOUT**
Drawing No. **12589773-W100**
Rev **B**

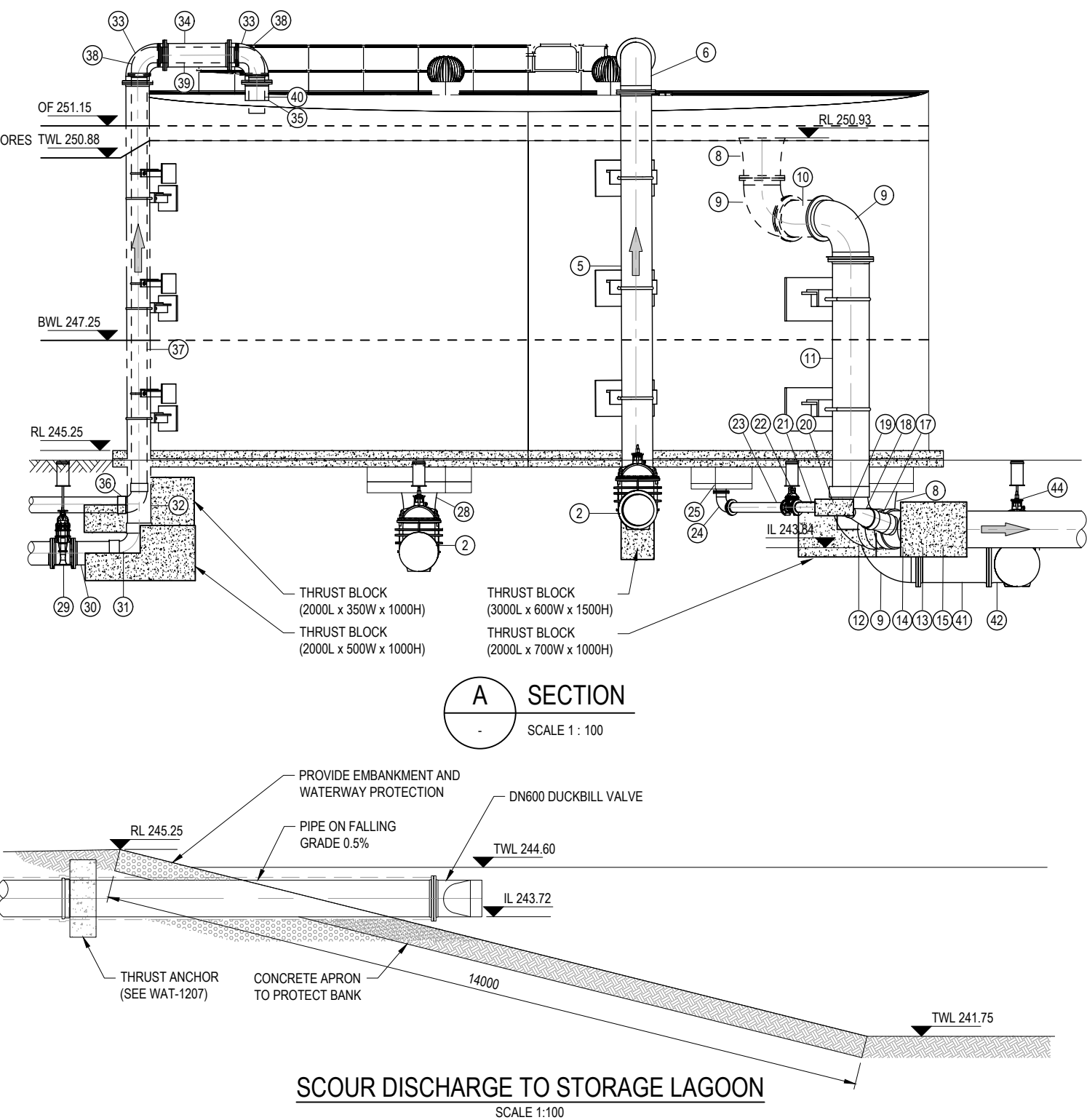
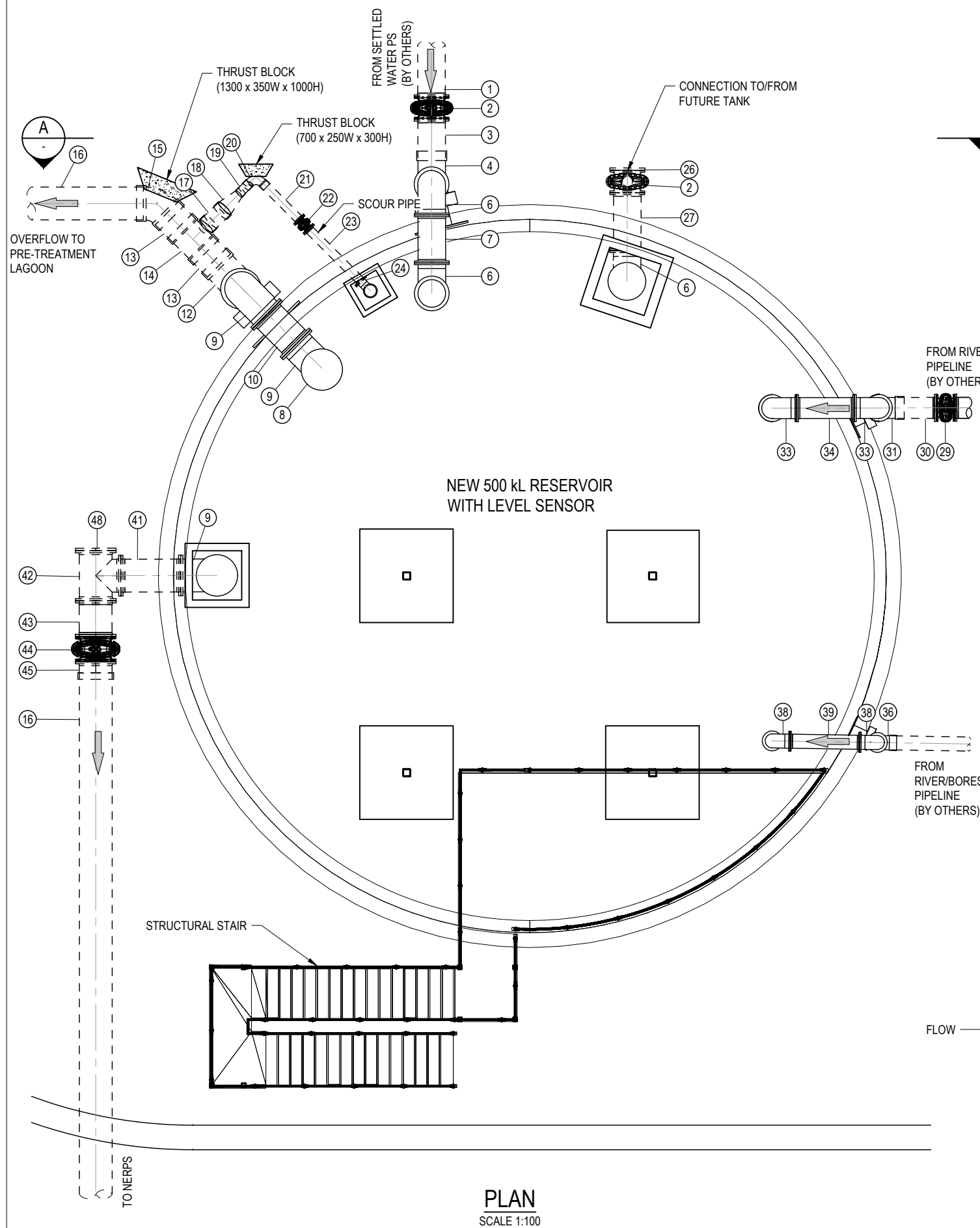
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NOTE:

- REFER TO SHEET 12589773-W107 FOR SCHEDULE OF PIPES AND FITTINGS.

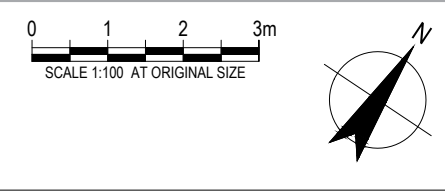
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- ABOVE GROUND PIPEWORK
- - - UNDERGROUND PIPEWORK



Rev	Description	Checked	Approved	Date
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A	30% DETAILED DESIGN	-	-	07.10.22

Author J. REGLAMOS Drafting Check -
 Designer L. CEDILLA Design Check F. DOMINGUEZ



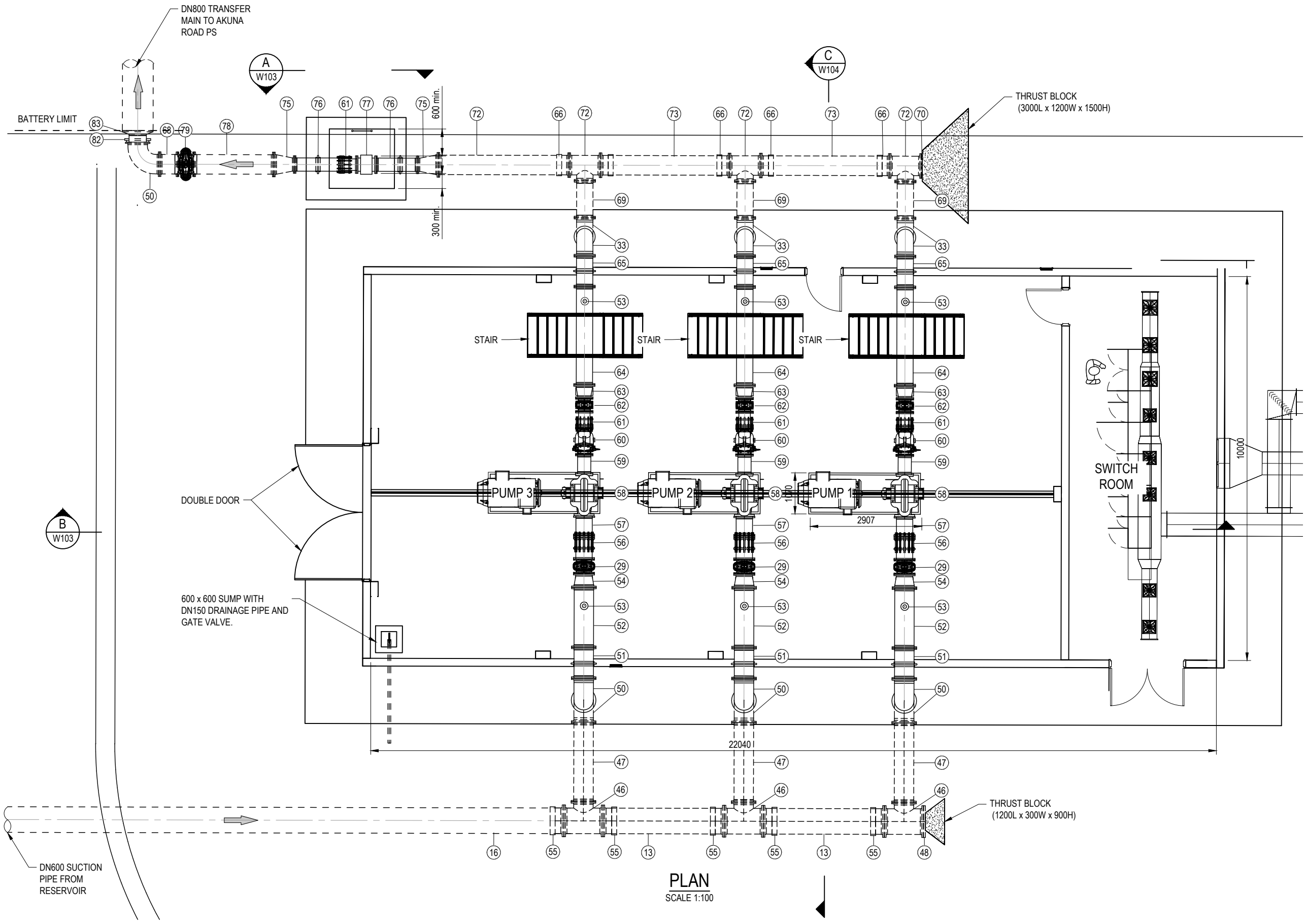
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 Status **PRELIMINARY**

Drawing Title **NEW EUGOWRA RESERVOIR
 DETAILED PLAN AND SECTION**
 Drawing No. **12589773-W101**
 Rev **B**



- NOTES:**
1. INSTALL RUNWAY BEAM WITH CRANE IN BUILDING.
 2. FLOWMETER INSTALLED TO MANUFACTURER'S RECOMMENDATIONS.
 3. FLOODLIGHT LIGHTING TO BE CONFIRMED BY CONTRACTOR.
 4. REFER TO SHEET 12589773-W107 FOR SCHEDULE OF PIPES AND FITTINGS.
 5. HORIZONTAL BEARING CAPACITY OF 100 kPa ADOPTED FOR THRUST BLOCK DESIGN TO BE CONFIRMED ON SITE BY A QUALIFIED GEOTECHNICAL ENGINEER.

- LEGEND:**
- ABOVE GROUND PIPEWORK
 - - - - UNDERGROUND PIPEWORK

PLAN
SCALE 1:100

Rev	Description	Checked	Approved	Date
B	80% DETAILED DESIGN	-	-	20.10.23
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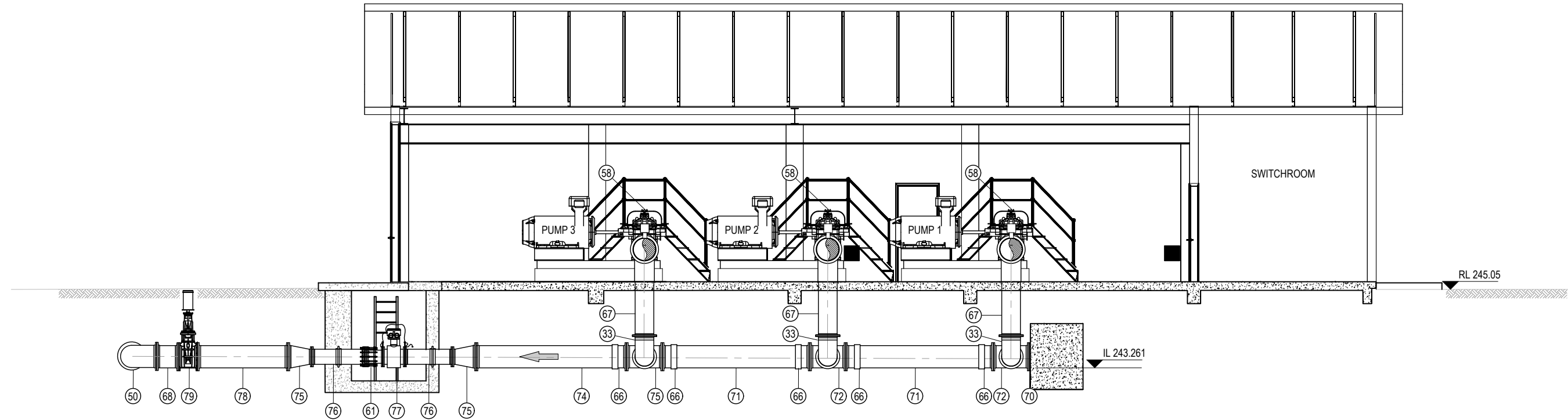
Client **PARKES SHIRE COUNCIL**
 Project **LACHLAN PIPELINE DUPLICATION
 DETAIL DESIGN TSS**
 Status **PRELIMINARY**

Drawing Title **NEW EUGOWRA ROAD PUMP STATION
 DETAILED PLAN**

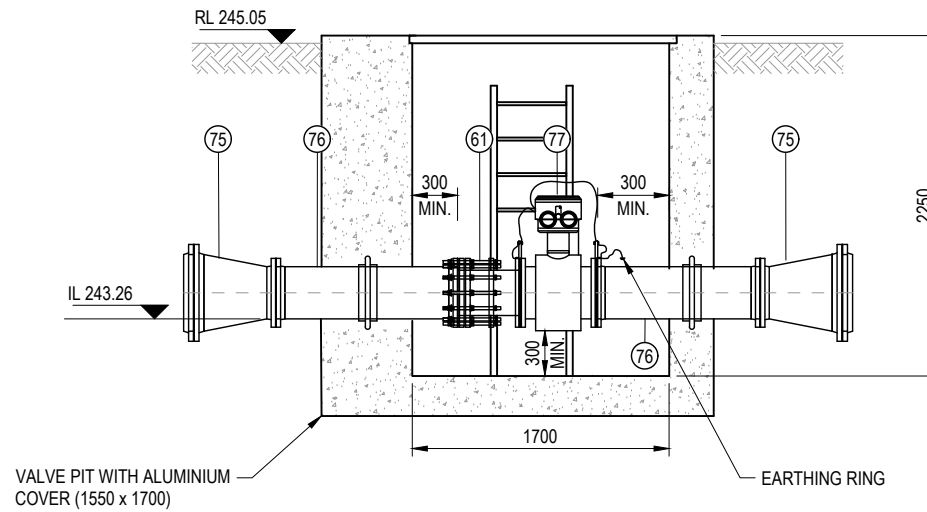
Drawing No. **12589773-W102**
 Rev **B**

NOTES:

1. FLOWMETER INSTALLED TO MANUFACTURER'S RECOMMENDATIONS.
2. REFER TO SHEET 12589773-W107 FOR SCHEDULE OF PIPES AND FITTINGS.



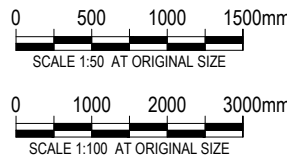
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W102 SCALE 1 : 100



A SECTION
W102 SCALE 1 : 50

Rev	Description	Checked	Approved	Date
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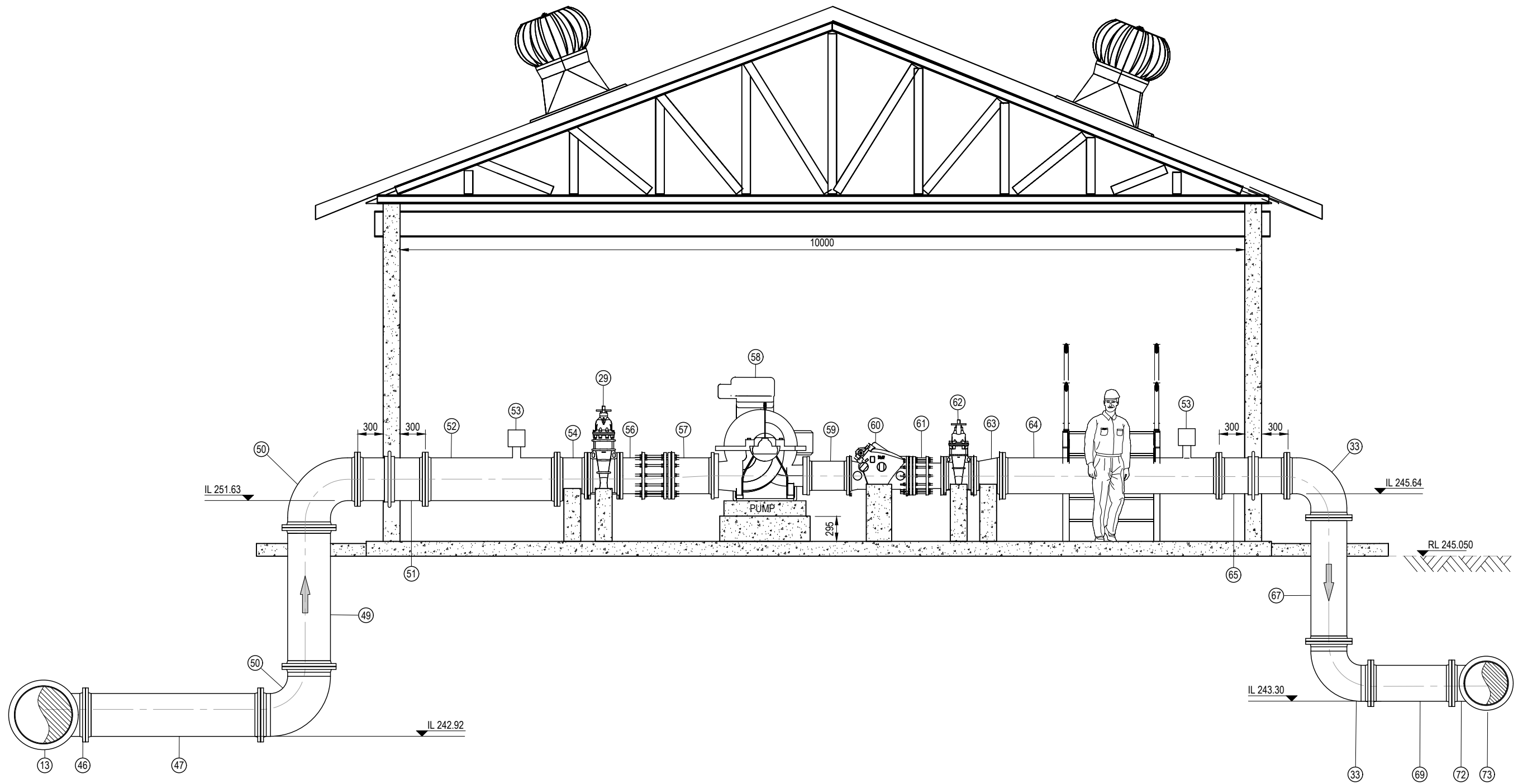
Client **PARKES SHIRE COUNCIL**
Project **LACHLAN PIPELINE DUPLICATION
DETAIL DESIGN TSS**
Status **PRELIMINARY**

Drawing Title **NEW EUGOWRA ROAD PUMP STATION
SECTION 1 OF 2**

Project No. **12589773**
Status Code **-**
Drawing No. **12589773-W103**
Rev **B**

NOTE:

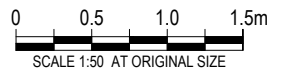
1. REFER TO SHEET 12589773-W107 FOR SCHEDULE OF PIPES AND FITTINGS.



C SECTION
SCALE 1 : 50

Rev	Description	Checked	Approved	Date
B	80% DETAILED DESIGN	-	-	20.10.23
A	30% DETAILED DESIGN	-	-	07.10.22

Author J. REGLAMOS Drafting Check -
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Client **PARKES SHIRE COUNCIL**
Project **LACHLAN PIPELINE DUPLICATION
DETAIL DESIGN TSS**
Status **PRELIMINARY**

Drawing Title **NEW EUGOWRA ROAD PUMP STATION
SECTION 2 OF 2**

Drawing No. **12589773-W104**

Size **A3**
Rev **B**

SCHEDULE OF PIPES AND FITTINGS			
ITEM No.	DESCRIPTION	MATERIAL	LENGTH
1	DN500 FL-SO CONNECTOR	DICL	
2	DN500 GATE VALVE		
3	DN500 PIPE FL-SP	DICL	LTS
4	DN500 BEND 90° SO-SO	DICL	
5	DN500 PIPE SP-FL	DICL	LTS
6	DN500 BEND 90° FL-FL	DICL	
7	DN500 PIPE FL-FL	DICL	970
8	DN600 BELLMOUTH FL	DI	
9	DN600 BEND 90° FL-FL	DICL	
10	DN600 PIPE FL-FL	DICL	850
11	DN600 PIPE FL-SP	DICL	LTS
12	DN600 BEND 90° SO-SO	DICL	
13	DN600 PIPE SP-SP	DICL	LTS
14	DN600 x DN600 x DN300 TEE SO-SO-SO	DI	
15	DN600 BEND 45° SO-SO	DICL	
16	DN600 PIPE SP-SO	DICL	LTS
17	DN300 PIPE SP-SP	DICL	LTS
18	DN300 x DN150 REDUCER SO-SO	DI	
19	DN150 PIPE SP-SP	DICL	LTS
20	DN150 BEND 90° SO-SO	DICL	
21	DN150 PIPE SP-FL	DICL	LTS
22	DN150 SCOUR VALVE		
23	DN150 PIPE FL-FL	DICL	1400
24	DN150 BEND 90° FL-FL	DICL	
25	DN150 BELLMOUTH FL	DI	
26	DN500 BLANK FLANGE	DI	
27	DN500 PIPE FL-FL	DICL	1180

SCHEDULE OF PIPES AND FITTINGS			
ITEM No.	DESCRIPTION	MATERIAL	LENGTH
28	DN500 BELLMOUTH FL	DI	
29	DN375 GATE VALVE		
30	DN375 PIPE FL-SP	DICL	LTS
31	DN375 BEND 90° SO-SO	DICL	
32	DN375 PIPE SP-SP	DICL	LTS
33	DN375 BEND 90° FL-FL	DICL	
34	DN375 PIPE FL-FL	DICL	1175
35	DN450 x DN300 REDUCER FL-FL	DICL	LTS
36	DN250 BEND 90° SO-SO	DICL	
37	DN250 PIPE SP-FL	DICL	LTS
38	DN250 BEND 90° FL-FL	DICL	
39	DN250 PIPE FL-FL	DICL	1420
40	DN300 STOP VALVE	DICL	LTS
41	DN600 PIPE FL-FL	DICL	1285
42	DN600 x DN600 x DN600 EQUAL TEE FL-FL-FL	DI	
43	DN600 PIPE FL-FL	DICL	725
44	DN600 GATE VALVE		
45	DN600 FL-SO CONNECTOR	DI	
46	DN600 x DN600 x DN450 TEE FL-FL-FL	DI	
47	DN450 PIPE FL-FL	DICL	2070
48	DN600 BLANK FLANGE	DI	
49	DN450 PIPE FL-FL	DICL	1640
50	DN450 BEND 90° FL-FL	DICL	
51	DN450 SPOOL WITH PUDDLE FLANGE FL-FL	DICL	
52	DN450 PIPE FL-FL	DICL	1560
53	DN80 AIR VALVE		
54	DN450 x DN375 REDUCER FL-FL	DI	

SCHEDULE OF PIPES AND FITTINGS			
ITEM No.	DESCRIPTION	MATERIAL	LENGTH
55	DN600 FL-SO CONNECTOR		
56	DN375 DISMANTLING JOINT (THRUST TYPE)	DI	
57	DN375 PIPE FL-FL	DICL	500
58	FLOWSERVE PUMP 250-LNN-600		
59	DN300 PIPE FL-FL	DICL	500
60	DN300 NON-RETURN VALVE	DI	
61	DN300 DISMANTLING JOINT (THRUST TYPE)	DI	
62	DN300 STOP VALVE		
63	DN300 x DN375 REDUCER FL-FL	DI	
64	DN375 PIPE FL-FL	DICL	2560
65	DN375 SPOOL WITH PUDDLE FLANGE FL-FL	DICL	
66	DN450 FL-SO CONNECTOR	DICL	
67	DN450 PIPE FL-FL	DICL	1460
68	DN450 PIPE FL-FL	DICL	460
69	DN375 PIPE FL-FL	DICL	955
70	DN450 BLANK FLANGE		
72	DN450 x DN450 x DN375 TEE FL-FL-FL	DI	
73	DN450 PIPE SP-SP	DICL	LTS
74	DN450 PIPE SP-FL	DICL	LTS
76	DN300 SPOOL WITH PUDDLE FLANGE FL-FL	DI	
77	DN300 ABB FLOWMETER OR APPROVED EQUIVALENT WITH EARTHING RINGS		
78	DN450 PIPE FL-FL	DICL	2070
79	DN450 STOP VALVE		
80	DN450 PIPE FL-SP	DICL	LTS
82	DN450 STUB FLANGE WITH BACKING RING	PE	
83	DN800 x DN450 PE REDUCER	DI	

Rev	Description	Checked	Approved	Date
B	80% DETAILED DESIGN	-	-	20.10.23
A	30% DETAILED DESIGN	-	-	07.10.22

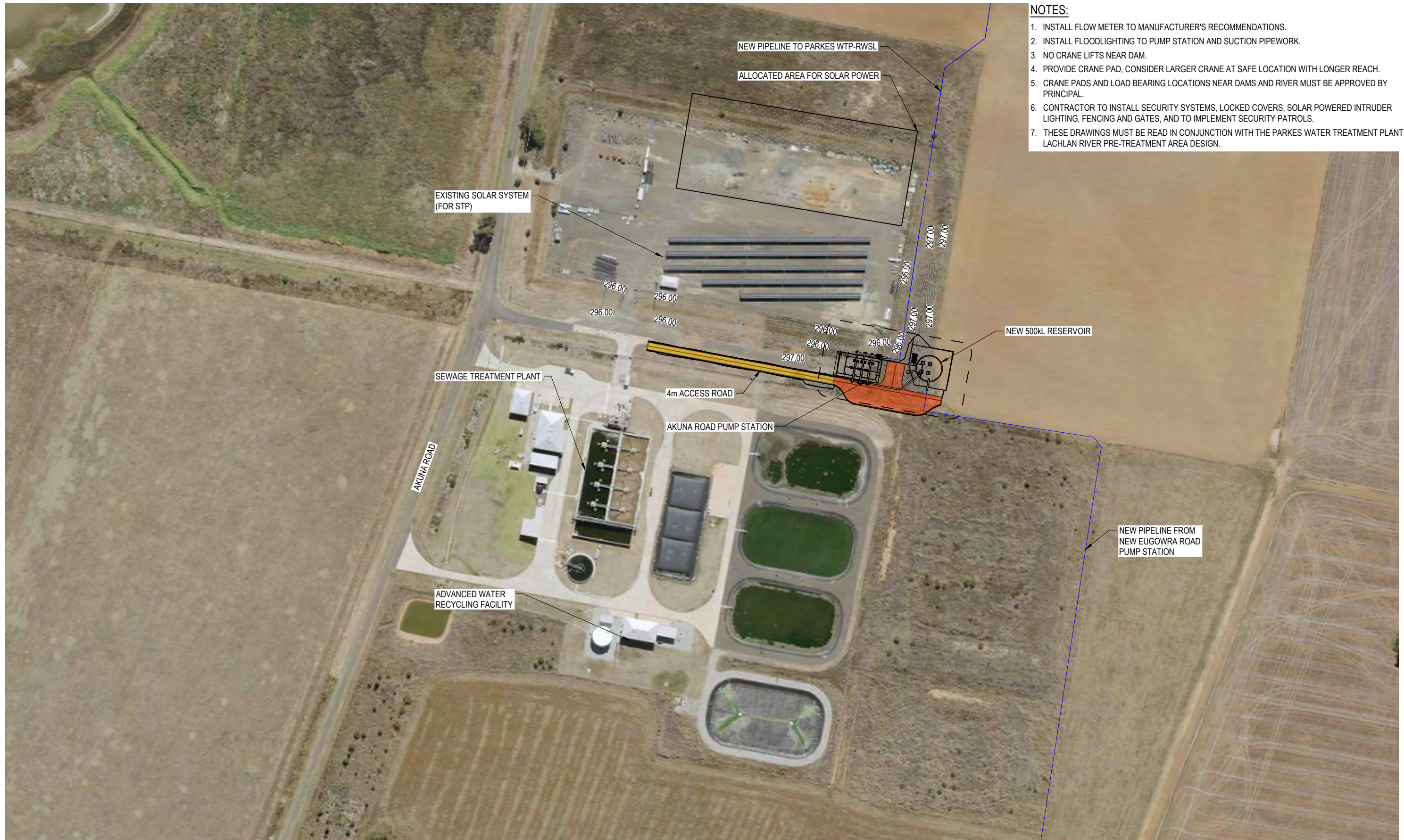
Author J. REGLAMOS Drafting Check -
 Designer L. CEDILLA Design Check F. DOMINGUEZ



Project No.
12589773

Client	PARKES SHIRE COUNCIL
Project	LACHLAN PIPELINE DUPLICATION DETAIL DESIGN TSS
Status	PRELIMINARY

Drawing Title	NEW EUGOWRA ROAD PUMP STATION SCHEDULE OF PIPE AND FITTINGS	Size	A3
Drawing No.	12589773-W107	Rev	B

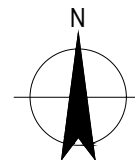
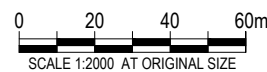


NOTES:

1. INSTALL FLOW METER TO MANUFACTURER'S RECOMMENDATIONS.
2. INSTALL FLOODLIGHTING TO PUMP STATION AND SUCTION PIPEWORK.
3. NO CRANE LIFTS NEAR DAM.
4. PROVIDE CRANE PAD, CONSIDER LARGER CRANE AT SAFE LOCATION WITH LONGER REACH.
5. CRANE PADS AND LOAD BEARING LOCATIONS NEAR DAMS AND RIVER MUST BE APPROVED BY PRINCIPAL.
6. CONTRACTOR TO INSTALL SECURITY SYSTEMS, LOCKED COVERS, SOLAR POWERED INTRUDER LIGHTING, FENCING AND GATES, AND TO IMPLEMENT SECURITY PATROLS.
7. THESE DRAWINGS MUST BE READ IN CONJUNCTION WITH THE PARKES WATER TREATMENT PLANT - LACHLAN RIVER PRE-TREATMENT AREA DESIGN.

PLAN
SCALE 1:2000

B	80% DETAILED DESIGN	-	20.10.23	
A	30% DETAILED DESIGN	-	07.10.22	
Rev	Description	Checked	Approved	Date
Author	J. REGLAMOS	Drafting	Check	-
Designer	L. CEDILLA	Design	Check	-



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Project No.
12589773

Client **PARKES SHIRE COUNCIL**

Project **LACHLAN PIPELINE DUPLICATION
DETAIL DESIGN TSS**

Status **PRELIMINARY**

Drawing Title **AKUNA ROAD PUMP STATION
OVERALL SITE PLAN**

Status Code
12589773-W200

Size
A3

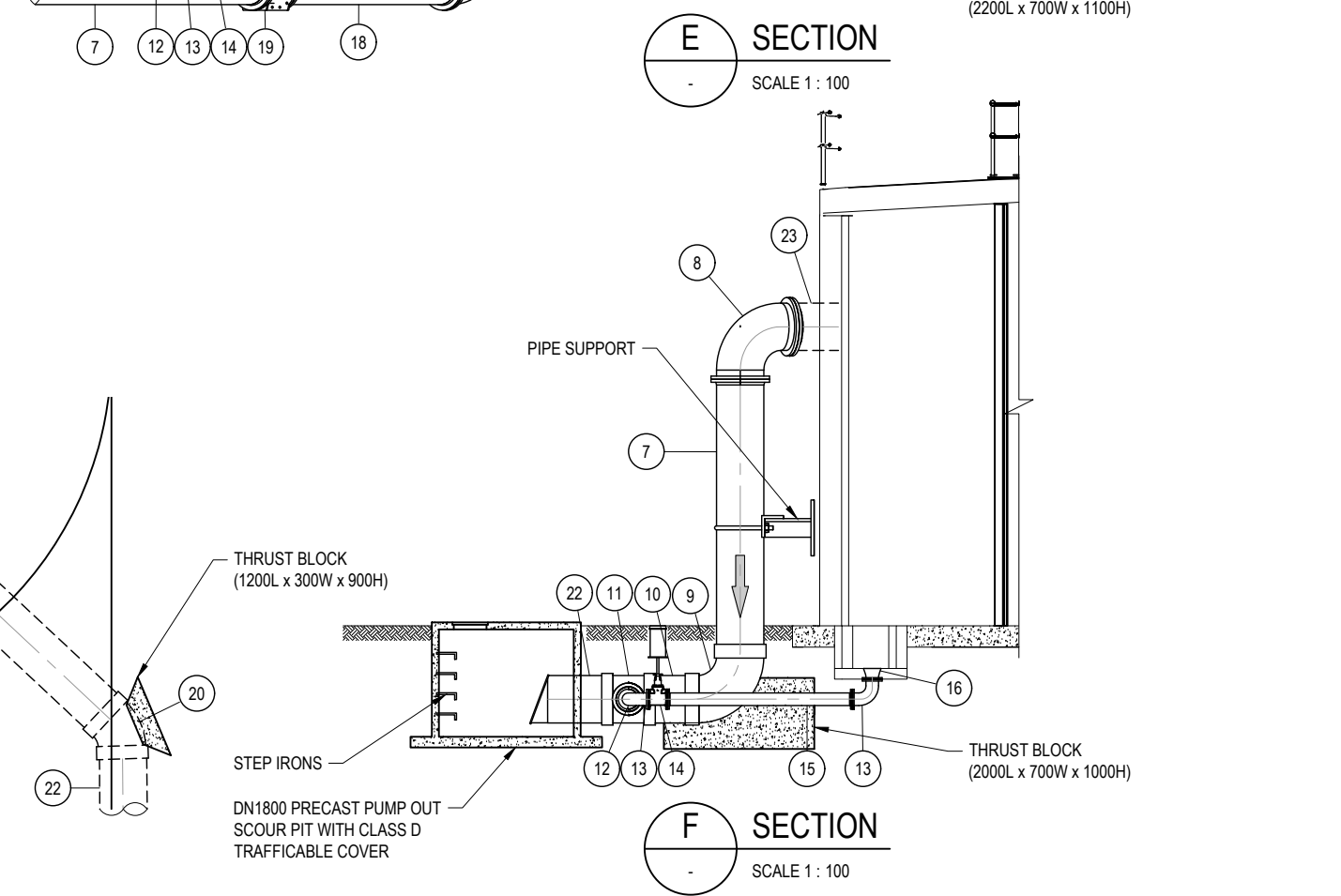
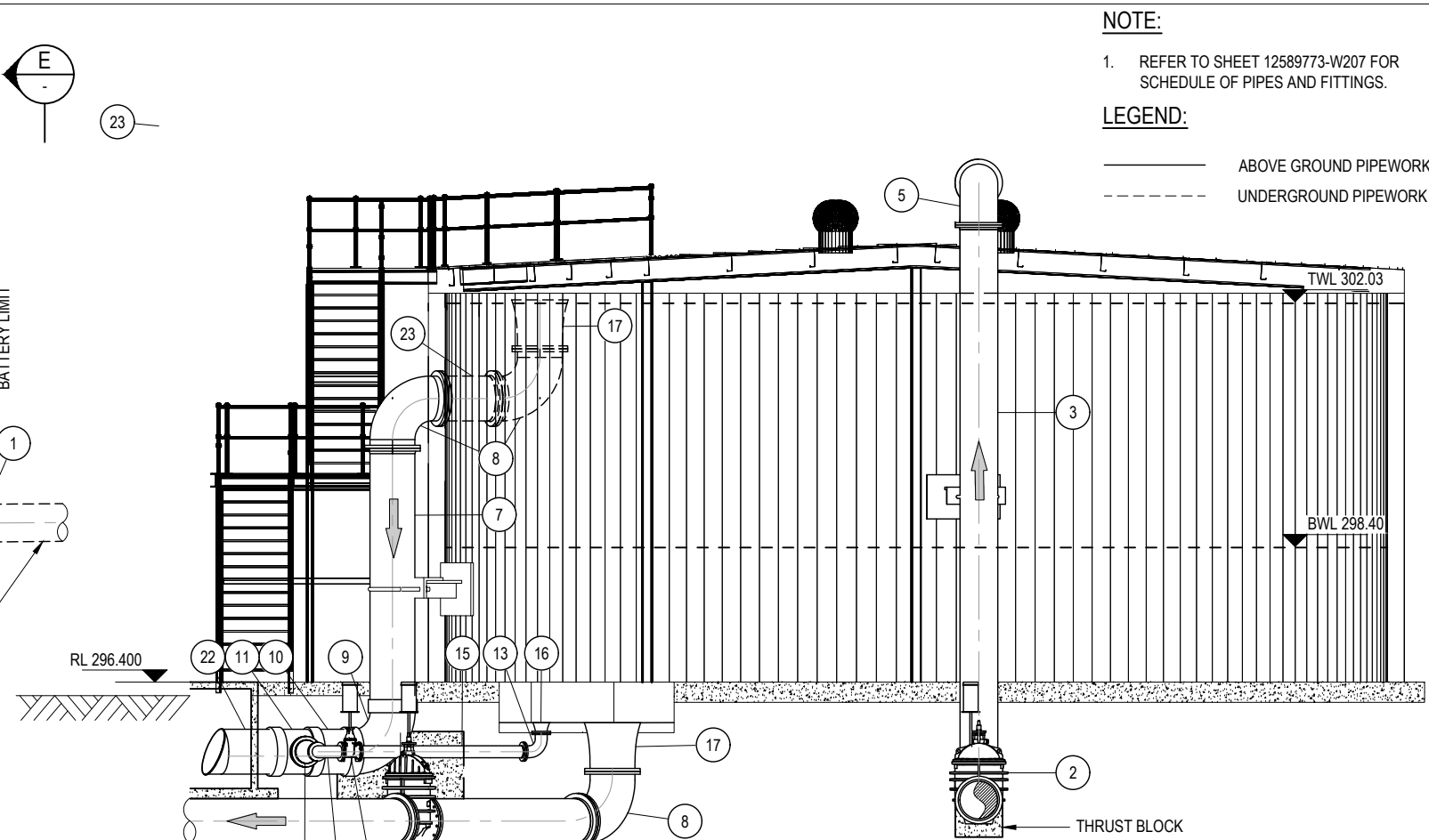
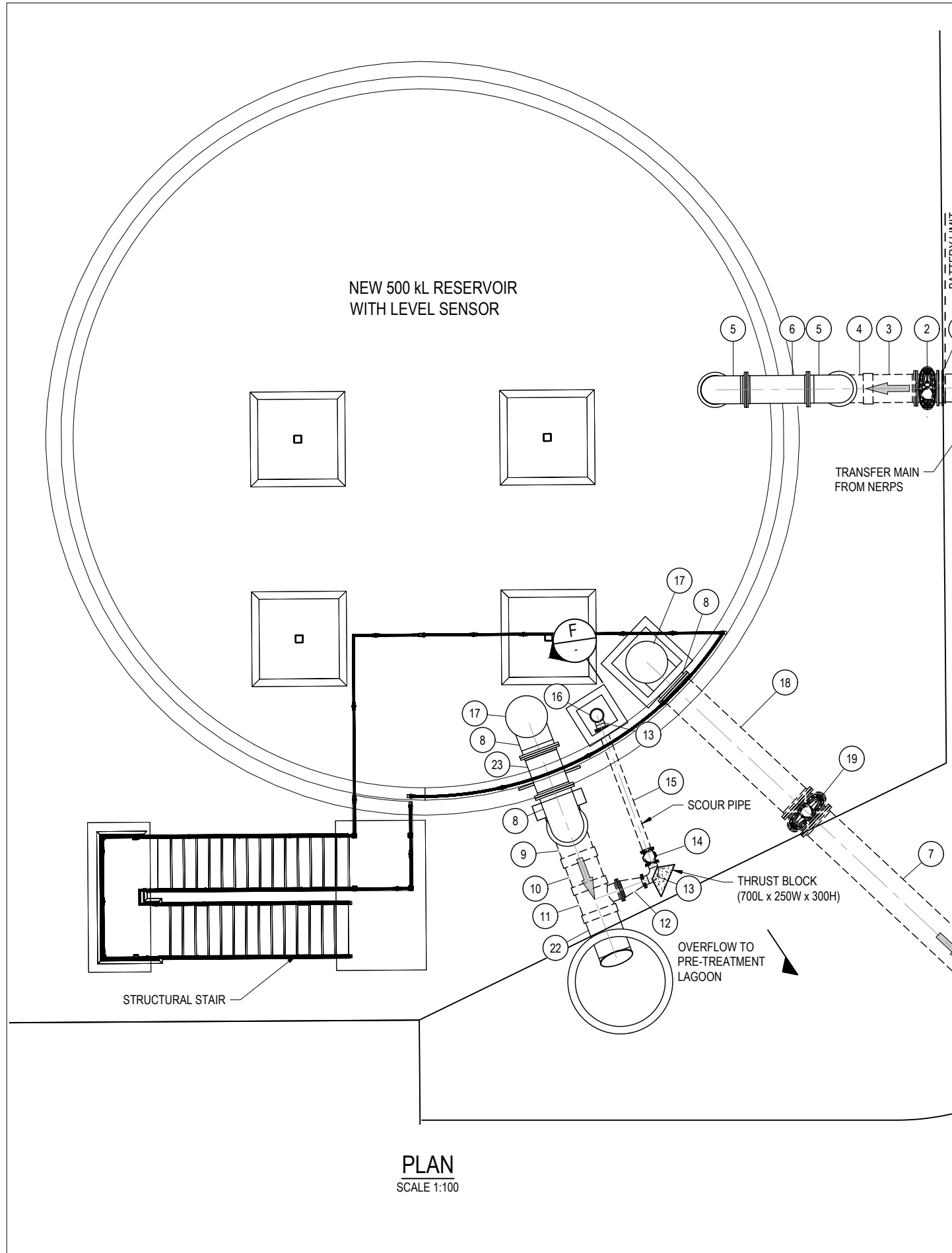
Rev
B

NOTE:

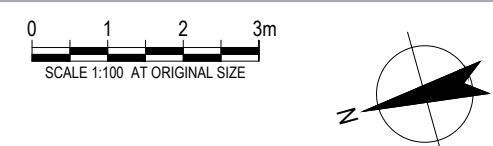
- REFER TO SHEET 12589773-W207 FOR SCHEDULE OF PIPES AND FITTINGS.

LEGEND:

- ABOVE GROUND PIPEWORK
- - - UNDERGROUND PIPEWORK



Rev	Description	Checked	Approved	Date
B	80% DETAILED DESIGN	-	-	20.10.23
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Author J. REGLAMOS Drafting Check -				
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Client **PARKES SHIRE COUNCIL**

Project **LACHLAN PIPELINE DUPLICATION
DETAIL DESIGN TSS**

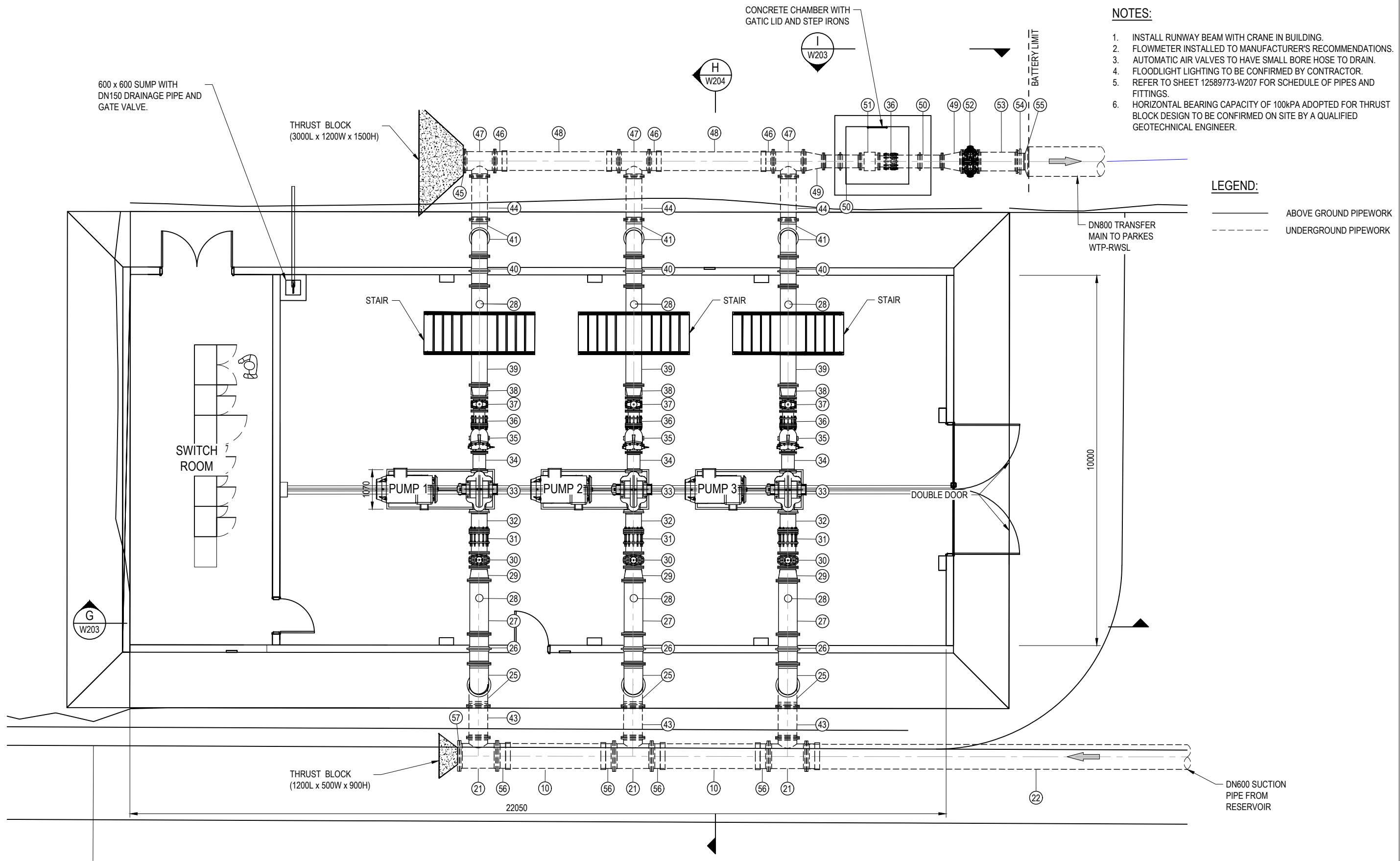
Status **PRELIMINARY**

Drawing Title **AKUNA ROAD RESERVOIR
DETAILED PLAN AND SECTION**

Drawing No. **12589773-W201**

Size **A3**

Rev **B**



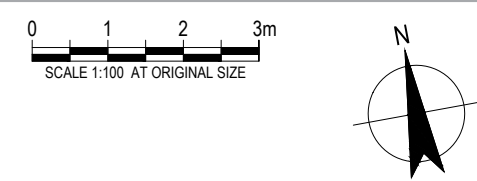
- NOTES:**
1. INSTALL RUNWAY BEAM WITH CRANE IN BUILDING.
 2. FLOWMETER INSTALLED TO MANUFACTURER'S RECOMMENDATIONS.
 3. AUTOMATIC AIR VALVES TO HAVE SMALL BORE HOSE TO DRAIN.
 4. FLOODLIGHT LIGHTING TO BE CONFIRMED BY CONTRACTOR.
 5. REFER TO SHEET 12589773-W207 FOR SCHEDULE OF PIPES AND FITTINGS.
 6. HORIZONTAL BEARING CAPACITY OF 100kPA ADOPTED FOR THRUST BLOCK DESIGN TO BE CONFIRMED ON SITE BY A QUALIFIED GEOTECHNICAL ENGINEER.

- LEGEND:**
- ABOVE GROUND PIPEWORK
 - - - UNDERGROUND PIPEWORK

PLAN
SCALE 1:100

Rev	Description	Checked	Approved	Date
B	80% DETAILED DESIGN	-	-	20.10.23
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Author J. REGLAMOS Drafting Check -
 Designer L. CEDILLA Design Check F. DOMINGUEZ



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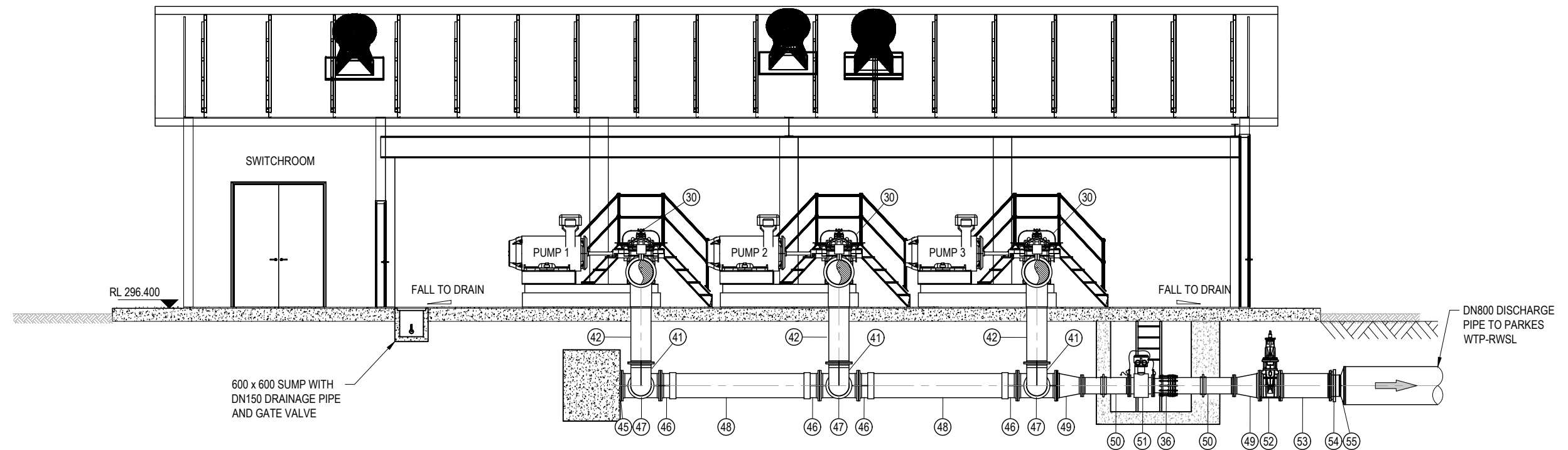
Project No. 12589773

Client **PARKES SHIRE COUNCIL**
 Project **LACHLAN PIPELINE DUPLICATION
 DETAIL DESIGN TSS**
 Status **PRELIMINARY**

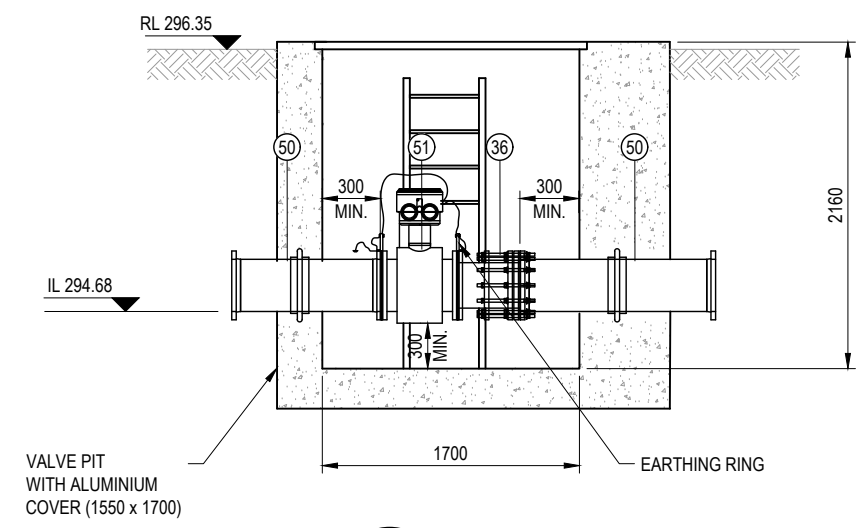
Drawing Title **AKUNA ROAD PUMP STATION
 DETAILED PLAN**
 Drawing No. **12589773-W202**
 Rev **B**

NOTES:

1. FLOWMETER INSTALLED TO MANUFACTURER'S RECOMMENDATIONS.
3. REFER TO SHEET 12589773-W207 FOR SCHEDULE OF PIPES AND FITTINGS.



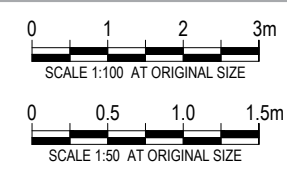
G SECTION
W202 SCALE 1 : 100



I SECTION
W102 SCALE 1 : 50

Rev	Description	Checked	Approved	Date
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Author J. REGLAMOS Drafting Check -
Designer L. CEDILLA Design Check F. DOMINGUEZ



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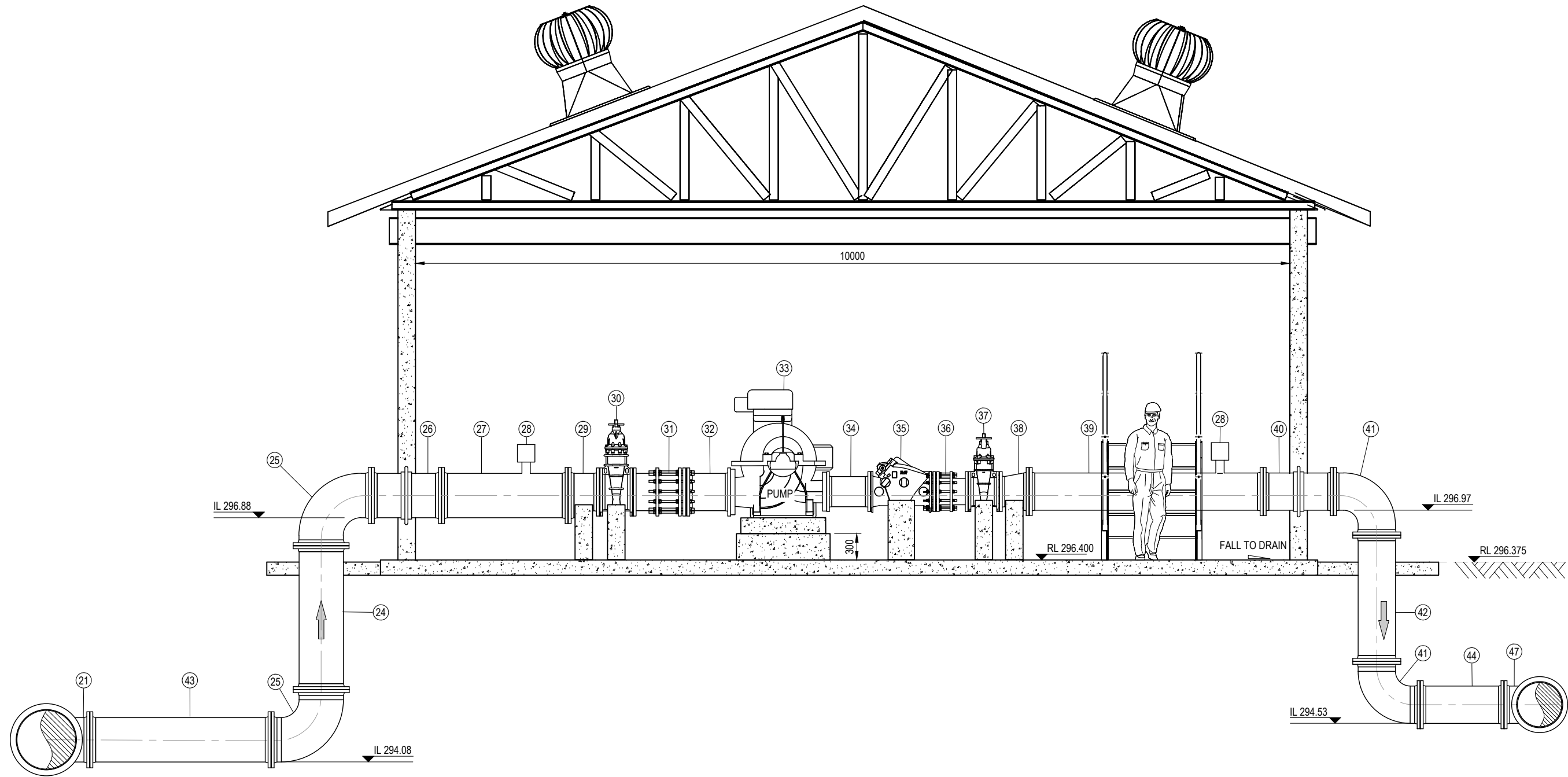
Client **PARKES SHIRE COUNCIL**
Project **LACHLAN PIPELINE DUPLICATION
DETAIL DESIGN TSS**
Status **PRELIMINARY**

Drawing Title **AKUNA ROAD PUMP STATION
SECTION 1 OF 2**

Project No. **12589773**
Status Code
Drawing No. **12589773-W203**
Rev **B**

NOTE:

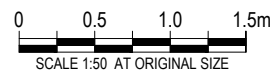
- REFER TO SHEET 12589773-W207 FOR SCHEDULE OF PIPES AND FITTINGS.



H SECTION
W202 SCALE 1 : 50

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B	80% DETAILED DESIGN	-	-	20.10.23
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Author J. REGLAMOS Drafting Check -
 Designer L. CEDILLA Design Check F. DOMINGUEZ



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Project No.
12589773

Client PARKES SHIRE COUNCIL

Project LACHLAN PIPELINE DUPLICATION
DETAIL DESIGN TSS

Status PRELIMINARY

Drawing Title AKUNA ROAD PUMP STATION
SECTION 2 OF 2

Size
A3

Drawing No.
12589773-W204

Rev
B

SCHEDULE OF PIPES AND FITTINGS			
ITEM No.	DESCRIPTION	MATERIAL	LENGTH
1	DN500 STUB FLANGE WITH BACKING RING	PE	
2	DN500 GATE VALVE		
3	DN500 PIPE FL-SP	DICL	LTS
4	DN500 BEND 90° SO-SO	DICL	
5	DN500 BEND 90° FL-FL	DICL	
6	DN500 PIPE FL-FL	DICL	1240
7	DN600 PIPE FL-SP	DICL	
8	DN600 BEND 90° FL-FL	DICL	
9	DN600 BEND 90° SO-SO	DICL	
10	DN600 PIPE SP-SP	DICL	LTS
11	DN600 x DN600 x DN300 TEE SO-SO-FL	DI	
12	DN300 x DN150 REDUCER FL-FL	DI	
13	DN150 BEND 90° FL-FL	DICL	
14	DN150 SCOUR VALVE		
15	DN150 PIPE FL-FL	DICL	2600
16	DN150 BELLMOUTH FL	DI	
17	DN600 BELLMOUTH FL	DI	
18	DN600 PIPE FL-FL	DICL	3395
19	DN600 GATE VALVE		
20	DN600 BEND 45° SO-SO	DICL	
21	DN600 x DN600 x DN450 TEE FL-FL-FL	DI	
22	DN450 PIPE SP-SO	DICL	
23	DN600 PIPE FL-FL	DICL	855
24	DN450 PIPE FL-FL	DICL	1640
25	DN450 BEND 90° FL-FL	DI	
26	DN450 SPOOL WITH PUDDLE FLANGE FL-FL	DICL	
27	DN450 PIPE FL-FL	DICL	1450
28	DN80 AIR VALVE		
29	DN450 x DN375 REDUCER FL-FL	DI	

SCHEDULE OF PIPES AND FITTINGS			
ITEM No.	DESCRIPTION	MATERIAL	LENGTH
30	DN375 GATE VALVE		
31	DN375 DISMANTLING JOINT (THRUST TYPE)		
32	DN375 PIPE FL-FL	DICL	500
33	FLOWSERVE PUMP 250-LNN-600		
34	DN300 PIPE FL-FL	DICL	500
35	DN300 NON-RETURN VALVE		
36	DN300 DISMANTLING JOINT (THRUST TYPE)		
37	DN300 STOP VALVE		
38	DN300 x DN375 REDUCER FL-FL	DI	
39	DN375 PIPE FL-FL	DICL	2670
40	DN375 SPOOL WITH PUDDLE FLANGE FL-FL		
41	DN375 BEND 90° FL-FL	DICL	
42	DN375 PIPE FL-FL	DICL	1440
43	DN450 BEND 90° FL-FL	DICL	2070
44	DN375 PIPE FL-FL	DICL	955
45	DN450 BLANK FLANGE	DI	
46	DN450 CONNECTOR FL-SO	DI	
47	DN450 x DN450 x DN375 TEE FL-FL-FL	DI	
48	DN450 PIPE SP-SP	DICL	LTS
49	DN450 x DN300 REDUCER FL-FL	DI	
50	DN300 SPOOL WITH PUDDLE FLANGE FL-FL	DICL	
51	DN300 ABB FLOWMETER OR APPROVED EQUIVALENT WITH EARTHING RINGS		
52	DN450 STOP VALVE		
53	DN450 PIPE FL-FL	DICL	1070
54	DN450 STUB FLANGE WITH BACKING RING	DICL	
55	DN800 x DN450 PE REDUCER	DI	
56	DN600 CONNECTOR FL-SO	DI	
57	DN600 BLANK FLANGE	DI	

Rev	Description	Checked	Approved	Date
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Author	J. REGLAMOS	Drafting Check	-	
Designer	L. CEDILLA	Design Check	F. DOMINGUEZ	



Project No.
12589773

Client	PARKES SHIRE COUNCIL
Project	LACHLAN PIPELINE DUPLICATION DETAIL DESIGN TSS
Status	PRELIMINARY

Drawing Title
NEW EUGOWRA ROAD PUMP STATION
SCHEDULE OF PIPE AND FITTINGS

Size
A3

Drawing No.
12589773-W207

Rev
B

GENERAL

- READ THESE NOTES IN CONJUNCTION WITH OTHER ENGINEERING DRAWINGS AND SPECIFICATIONS, AND WITH SUCH OTHER WRITTEN INSTRUCTIONS ISSUED. IN CASE OF DISCREPANCY, PRECEDENCE IS GIVEN TO DRAWINGS, THEN NOTES, THEN SPECIFICATION.
- CARRY OUT WORK IN A SAFE MANNER IN ACCORDANCE WITH APPLICABLE LEGISLATION, STATUTORY REGULATIONS, BY-LAWS OR RULES. CONTRACTOR IS RESPONSIBLE FOR OCCUPATIONAL HEALTH AND SAFETY OF SITE PERSONNEL AND GENERAL PUBLIC IN ACCORDANCE WITH ALL CURRENT WORK HEALTH AND SAFETY ACTS, LEGISLATIVE REQUIREMENTS, ASSOCIATED REGULATIONS AND CODES OF PRACTICE, INDUSTRIAL AGREEMENTS AND ACCEPTED INDUSTRY PRACTICE. REFER DISCREPANCIES TO SUPERINTENDENT BEFORE PROCEEDING WITH WORK.
- REFER DISCREPANCIES TO SUPERINTENDENT BEFORE PROCEEDING WITH WORK.
- SUBMIT DETAILS OF PROPOSED CHANGES TO SCOPE, WORK METHODS OR MATERIALS, SECTION SIZES, PROFILES etc FOR APPROVAL BEFORE PROCEEDING. APPROVAL DOES NOT AUTHORISE A VARIATION TO THE CONTRACT.
- CHECK STRUCTURAL DRAWINGS AGAINST ARCHITECTURAL, MECHANICAL, ELECTRICAL SERVICES AND OTHER DRAWINGS FOR REQUIREMENTS FOR PENETRATIONS, CONDUITS, DUCTS, PIPES, etc.
- NOMINATION OF PROPRIETARY ITEMS DOES NOT INDICATE EXCLUSIVE PREFERENCE, BUT INDICATES REQUIRED PROPERTIES OF ITEM. SIMILAR ALTERNATIVES HAVING REQUIRED PROPERTIES MAY BE OFFERED FOR APPROVAL. APPROVAL DOES NOT AUTHORISE A VARIATION TO THE CONTRACT. INSTALL PROPRIETARY ITEMS IN ACCORDANCE WITH MANUFACTURER'S REQUIREMENTS AND RECOMMENDATIONS.
- OBTAIN NECESSARY PERMITS AND APPROVALS FROM RELEVANT AUTHORITIES BEFORE COMMENCING WORK ON SITE. NOTIFY RELEVANT SERVICE AUTHORITIES BEFORE COMMENCING WORK ON SITE.
- GIVE TWO WORKING DAYS' (48 HOURS) NOTICE SO THAT INSPECTION MAY BE MADE OF CRITICAL STAGES OF WORK.
- ALLOW FOR INSPECTION BY DESIGNER AT LEAST AT FOLLOWING STAGES:
 - BEFORE DEMOLITION
 - CUT SURFACE OF CONCRETE PRIOR TO AND AFTER TREATMENT
 - WHEN HIDDEN EXISTING / AS-BUILT CONDITIONS ARE REVEALED
 - WHENEVER DEFECTS ARE DISCOVERED, INCLUDING LEAKS
 - FOUNDATION PREPARATION COMPLETE BEFORE PLACING CONCRETE
 - REINFORCEMENT, DOWELS AND OTHER CAST-IN ITEMS IN PLACE BEFORE PLACING CONCRETE
 - ELECTRICAL CONTINUITY OF REINFORCEMENT BEFORE PLACING CONCRETE
 - BEARING SHELVES AND BEARINGS IN PLACE BEFORE PLACING PRE-FABRICATED ITEMS
 - INSTALLATION OF PRE-FABRICATED ITEMS (PRECAST CONCRETE AND STEEL)
 - SURFACE PREPARATION PRIOR TO APPLICATION OF COATINGS AND REPAIRS
 - BEFORE STRUCTURAL WORK IS HIDDEN BY CLADDING OR LINING.
- INSPECTIONS AND REVIEWS UNDERTAKEN BY SUPERINTENDENT OR OTHERS DO NOT RELIEVE CONTRACTOR OF RESPONSIBILITY FOR COMPLIANCE WITH DRAWINGS AND SPECIFICATIONS.
- DO NOT OBTAIN DIMENSIONS BY SCALING FROM DRAWINGS.
- DIMENSIONS ARE IN MILLIMETRES, LEVELS ARE IN METRES UNO, CHAINAGES ARE IN METRES UNO.
- DATUM FOR LEVELS IS AHD (AUSTRALIAN HEIGHT DATUM).
- HAVE SURVEY AND SETTING OUT UNDERTAKEN BY A REGISTERED SURVEYOR.
- VERIFY ON SITE SETTING OUT DIMENSIONS AND EXISTING MEMBER SIZES SHOWN ON DRAWINGS BEFORE SHOP DRAWINGS, CONSTRUCTION AND FABRICATION IS COMMENCED. EXISTING STRUCTURES SHOWN ON DRAWINGS ARE IN APPROXIMATE LOCATIONS ONLY.
- USE STANDARD BOLT PATTERNS etc THROUGHOUT THE WORKS TO AVOID CONFUSION OR AMBIGUITY.
- TAKE CARE OF HAZARDS ASSOCIATED WITH BURIED, CONCEALED OR OVERHEAD SERVICES. CONTACT RELEVANT AUTHORITIES TO IDENTIFY PRESENCE OF SERVICES. TAKE PRECAUTIONS AND UNDERTAKE EXPLORATION TO ESTABLISH LOCATION OF AND PROTECT EXISTING SERVICES AT SITE. SERVICES SHOWN ON DRAWINGS ARE IN APPROXIMATE LOCATIONS ONLY. SERVICES OTHER THAN THOSE SHOWN MAY EXIST ON SITE. MARK LOCATIONS OF SERVICES CLEARLY ON SITE, AND ON AS-BUILT DRAWINGS. HAND EXCAVATE WITHIN ONE METRE OF IN-GROUND SERVICES.
- DISPOSE OF SURPLUS MATERIAL OFF SITE IN ACCORDANCE WITH LOCAL AUTHORITY WASTE REGULATIONS.
- IMPLEMENT SOIL AND WATER MANAGEMENT PROCEDURES TO AVOID EROSION, SOFTENING, SATURATION, CONTAMINATION AND SEDIMENTATION OF SITE, SURROUNDING AREAS AND DRAINAGE SYSTEMS.
- PROVIDE SITE WATER CONTROL MEASURES, WHICH MAY INCLUDE:
 - CONSTRUCTION OF TEMPORARY DRAINS.
 - PUMPING AND/OR DEWATERING OF EXCAVATIONS.
 - DIVERSION OF CONCENTRATED FLOWS.
 - CONSTRUCTION AND MAINTENANCE OF SILT TRAPS.
 - STAGING OF EARTHWORKS.
 - PROGRESSIVE RESTORATION OF DISTURBED AREAS THROUGHOUT THE PROJECT.
- WORKMANSHIP AND MATERIALS TO COMPLY WITH REQUIREMENTS OF AUSTRALIAN STANDARDS, NATIONAL CONSTRUCTION CODE (NCC) AND BY-LAWS AND ORDINANCES OF RELEVANT BUILDING AUTHORITIES. ALL STANDARDS REFERRED TO ARE THOSE CURRENT (AS AMENDED) AT COMMENCEMENT OF CONTRACT.
- OBTAIN REQUIREMENTS FOR SERVICES, ADJOINING ELEMENTS etc TO BE EMBEDDED IN, FIXED TO OR SUPPORTED ON WORK AND PROVIDE FOR REQUIRED FIXINGS. PROVIDE FOR TEMPORARY SUPPORT OF ADJOINING ELEMENTS DURING CONSTRUCTION. DRAWINGS DO NOT SHOW DETAILS OF ALL REQUIRED FIXTURES, INSERTS, SLEEVES, RECESSES OR OPENINGS etc.

- PROTECT EXISTING STRUCTURES FROM DAMAGE OR CRACKING. MAKE GOOD ANY DAMAGE TO EXISTING ELEMENTS AT COMPLETION OF WORKS OR AS DIRECTED BY SUPERINTENDENT.
- WHERE NEW WORK ABUTS EXISTING, PROVIDE SMOOTH TRANSITIONS FREE OF ABRUPT CHANGES.
- STRUCTURAL MEMBER SIZES GIVEN ARE INDICATIVE AND PROVIDED ONLY FOR TENDER PURPOSES. UNDERTAKE DESIGN TO ENSURE WORKS ARE IN ACCORDANCE WITH THESE NOTES AND PROJECT DESIGN BRIEF. CONFIRM DESIGN ASSUMPTIONS AND PARAMETERS.
- STRUCTURAL DESIGN WORK MUST BE CARRIED OUT BY A SUITABLY QUALIFIED AND EXPERIENCED ENGINEER WITH EXPERTISE IN THE RELEVANT ENGINEERING DISCIPLINE AND PROVIDE DESIGN CALCULATIONS AND INDEPENDENTLY CHECKED DESIGN CERTIFICATE TO SUPERINTENDENT.
- NEATLY CUT BACK CONCRETE TO BE REMOVED TO A CLEAN TRUE FACE USING A DIAMOND SAW.
- HAVE TESTING PERFORMED BY AN INDEPENDENT NATA (NATIONAL ASSOCIATION OF TESTING AUTHORITIES) ACCREDITED AUTHORITY, AND PROVIDE TEST REPORTS TO SUPERINTENDENT.
- SEPARATE METALS FROM INCOMPATIBLE MATERIALS (eg STAINLESS STEEL, GALVANIZED STEEL, UNGALVANIZED STEEL AND TREATED TIMBER etc) BY CONCEALED LAYERS OF SUITABLE INERT MATERIALS OF SUITABLE THICKNESSES. USE PLASTIC SLEEVES AND WASHERS FOR BOLTS, etc.
- EXTERNAL ELEMENTS ARE THOSE EXPOSED TO WEATHER, RAIN AND WATER PENETRATION IN FINAL WORKS.
- FOR EXTERNAL HORIZONTAL SURFACES, PROVIDE ADEQUATE GRADIENT TO DRAIN WATER.
- SUPPLY RELEVANT NOTES, DRAWINGS AND SPECIFICATIONS etc TO SUB-CONTRACTORS.
- UNO=UNLESS NOTED OTHERWISE, SLS=SERVICEABILITY LIMIT STATE, ULS=ULTIMATE LIMIT STATE, NSL=NATURAL SURFACE LEVEL, FSL=FINISHED SURFACE LEVEL.
- SUPERINTENDENT=SUPERINTENDENT NOMINATED IN CONTRACT.
- BUILD, FABRICATE AND PROCURE ONLY FROM DRAWINGS 'ISSUED FOR CONSTRUCTION'.
- KEEP ON SITE A COMPLETE SET OF CONTRACT DOCUMENTS (INCLUDING DRAWINGS AND SPECIFICATIONS) AND SITE INSTRUCTIONS.

TEMPORARY WORKS

- THESE DRAWINGS DO NOT DETAIL TEMPORARY WORKS. CONSTRUCTION METHODS AND TEMPORARY WORKS ARE RESPONSIBILITY OF THE CONTRACTOR.
- PROVIDE SCAFFOLDING, BARRIERS, FALL RESTRAINT, HAND-MID RAILS AND TOE BOARDS FOR WORK AT HEIGHT. ERECT ACCESS STAIRS AT EARLIEST OPPORTUNITY TO REDUCE OPEN SHAFT HAZARDS AND FACILITATE ACCESS. MAINTAIN SAFETY MESH AND BARRIERS TO ALL OPENINGS AND ELEVATED EDGES.
- MAINTAIN STRUCTURE IN A STABLE CONDITION DURING CONSTRUCTION AND PROVIDE TEMPORARY BRACING AND/OR SUPPORT AS REQUIRED. SHOW TEMPORARY MEMBERS ON SHOP DRAWINGS. PROVIDE SPREADERS AT LOADS AND/OR LIFTING POINTS WHERE REQUIRED. ENSURE NO PART IS OVERSTRESSED. DO NOT PLACE OR STORE BUILDING MATERIALS ON, SUPPORT FORMWORK OR PROP FROM STRUCTURAL MEMBERS WITHOUT SUPERINTENDENT'S APPROVAL. PROVIDE CALCULATIONS BY SUITABLY QUALIFIED STRUCTURAL ENGINEER TO PROVE ADEQUACY OF STRUCTURE FOR PROPOSED CONSTRUCTION SEQUENCE, METHODS AND LOADS INCLUDING PROPPING, CRANE LIFTS, ETC.
- PROVIDE TEMPORARY BRACING WHERE REQUIRED FOR STRUCTURAL ELEMENTS OR FRAMES STABILIZED BY MASONRY, PRECAST CONCRETE OR OTHER ELEMENTS CONSTRUCTED AFTER ERECTION OF THE STRUCTURAL ELEMENT OR FRAME, AND SHOW ON SHOP DRAWINGS.

DESIGN ASSUMPTIONS

- STRUCTURAL WORK HAS BEEN DESIGNED FOR FOLLOWING LOADS:
 - PERMANENT DEAD LOAD OF STRUCTURE AS SHOWN ON DRAWINGS
 - SUPERIMPOSED PERMANENT LOAD: 0.8 kPa FOR FLOOR FINISHES / CEILINGS
 - LIVE LOADS TO AS/NZS1170.1: 0.25 kPa ON ROOF
 - IMPOSED "SURCHARGE" LOAD ON GROUND 20 kPa
 - SOIL DENSITY: 20 kN/m³
 - AT REST LATERAL EARTH PRESSURE COEFFICIENT ko: 0.6
 - BUILDING DESIGN WORKING LIFE 50 years
 - BUILDING IMPORTANCE LEVEL 2
 - WIND LOADS TO AS/NZS1170.2:
 - REGION A2
 - AVERAGE RECURRENCE INTERVAL, R 500 years
 - ULTIMATE REGIONAL WIND SPEED V_R (3 sec GUST) 45 m/s
 - SERVICEABILITY REGIONAL WIND SPEED V₂₅ (3 sec) 37 m/s
 - DIRECTIONAL MULTIPLIER 1.0
 - TERRAIN CATEGORY 2
 - DESIGN BUILDING HEIGHT AS PER BUILDING ELEVATION, 5.17 m max.
 - TERRAIN / HEIGHT MULTIPLIER (Mz,cat) 0.91
 - SHIELDING MULTIPLIER (Ms) 1.0
 - TOPOGRAPHIC MULTIPLIER (Mt) 1.0
 - ULS DESIGN WIND SPEED V_{des,q} ULS 42.27 m/s
 - SLS DESIGN WIND SPEED V_{des,q} SLS 33.93 m/s

- STRUCTURAL ELEMENTS HAVE BEEN DESIGNED FOR FOLLOWING FIRE RESISTANCE LEVELS (EXPRESSED IN MINUTES):

ELEMENT	FIRE RESISTANCE PERIOD STRUCTURAL ADEQUACY / INTEGRITY / INSULATION
CEILING	120/120/120
WALLS	120/120/120

DELIVERABLES

- RECORD ADOPTED CHANGES TO WORKING DRAWINGS AND SHOP DRAWINGS. ON COMPLETION OF WORKS SUBMIT A FULL SET OF "AS CONSTRUCTED" DRAWINGS.
- PREPARE WORKSHOP DRAWINGS, CALCULATIONS etc FOR PREFABRICATED COMPONENTS, INCLUDING STRUCTURAL STEELWORK, LIGHTWEIGHT STEELWORK, PRECAST CONCRETE, PRESTRESSING, FABRICATED TIMBER FRAMES etc AND SUBMIT ELECTRONIC PDF'S OR THREE PAPER COPIES OF EACH FOR SUPERINTENDENT'S REVIEW OF GENERAL COMPLIANCE WITH DESIGN CONCEPT.
- DO NOT ORDER OR PROCURE MATERIALS OR COMMENCE FABRICATION UNTIL SHOP DRAWINGS AND CALCULATIONS HAVE BEEN REVIEWED. ALLOW 14 DAYS FOR SUPERINTENDENT'S REVIEW.
- SUPPLY APPROVED SHOP DRAWINGS TO THE SUPERINTENDENT. DO NOT VARY CONSTRUCTION FROM APPROVED SHOP DRAWINGS WITHOUT SUPERINTENDENT'S WRITTEN APPROVAL.
- SUPERINTENDENT'S REVIEW OF SHOP DRAWINGS AND CALCULATIONS IS OF GENERAL CONFORMANCE WITH DESIGN CONCEPT AND GENERAL COMPLIANCE WITH CONTRACT DOCUMENTS ONLY, AND DOES NOT INCLUDE CHECKING OF DIMENSIONS. CONTRACTOR IS RESPONSIBLE FOR CONFIRMING AND CORRELATING QUANTITIES AND DIMENSIONS, SELECTING FABRICATION PROCEDURES AND CONSTRUCTION TECHNIQUES, AND PERFORMING WORK IN A SAFE MANNER. CORRECTIONS OR COMMENTS MADE ON SHOP DRAWINGS AND CALCULATIONS DO NOT RELIEVE CONTRACTOR FROM RESPONSIBILITY FOR COMPLIANCE WITH REQUIREMENTS OF CONTRACT DRAWINGS AND SPECIFICATION.

SAFETY IN DESIGN

- THE SAFETY RISK MITIGATION ITEMS BELOW ARE BASED ON GHD'S DESIGN OFFICE EXPERIENCE AND DO NOT NECESSARILY ACCOUNT FOR ALL CONSTRUCTION, OPERATION, MAINTENANCE AND DEMOLITION SAFETY RISKS. BASED ON INFORMATION AVAILABLE WHEN THIS DRAWING WAS MADE, IN ITS CAPACITY AS DESIGNER ONLY, GHD HAS TRIED TO IDENTIFY SAFETY RISKS PERTAINING TO CONSTRUCTION, OPERATION, MAINTENANCE AND DEMOLITION PHASES OF THE ASSET. INCLUSION (OR NOT) OF ANY ITEM DOES NOT REDUCE OR LIMIT OBLIGATIONS OF CONSTRUCTOR, USER, MAINTAINER AND DEMOLISHER TO UNDERTAKE APPROPRIATE RISK MANAGEMENT ACTIVITIES TO REDUCE RISK AND IS NOT AN ADMISSION BY GHD THAT INCLUSION OF ANY ITEM IS DESIGNER'S RESPONSIBILITY.
- CONSTRUCT BUILDING ELEMENTS THAT CONTRIBUTE TO SAFETY, SUCH AS HANDRAILS AND TOE BOARDS, FALL ARREST SYSTEMS, ACCESS STAIRS, etc AS EARLY AS POSSIBLE.
- PROVIDE SAFETY BARRIERS AT EDGES OF OPENINGS AND ELEVATED AREAS. ENSURE EXCAVATIONS ARE ADEQUATELY FENCED, SECURE, WELL LIT AND SIGNED TO ENSURE PERSONNEL SAFETY.
- REVIEW ADEQUACY OF WORKING SPACE AVAILABLE FOR CONSTRUCTION ACTIVITIES. ENSURE SEPARATION OF PLANT AND PERSONNEL ON SITE, INCLUDING MOVEMENTS OF BOTH.
- LOCATE LIFTING SLEW AND LAY DOWN AREAS AWAY FROM REGULAR CONSTRUCTION TRAFFIC.
- PROVIDE PROTECTION TO PERSONNEL FROM PLANT AND EQUIPMENT.
- ENSURE ISOLATION SAFE SYSTEMS OF WORK OR PROTECTIVE MEASURES ARE INSTALLED BEFORE WORKING NEAR LIVE ELECTRICAL INFRASTRUCTURE. PROVIDE PROTECTION OF ELECTRICAL OVERHEAD WIRING SYSTEMS DURING CONSTRUCTION.
- WRITTEN RISK ASSESSMENTS ARE RECOMMENDED FOR ACCESS TO OPEN EXCAVATIONS.
- PROVIDE SAFE ACCESS AND EGRESS TO EXCAVATIONS APPROPRIATE IN CASE OF INUNDATION, COLLAPSE OR ENGULFMENT.
- LOCATE STOCKPILES AND HEAVY EQUIPMENT INCLUDING CRANES AWAY FROM BURIED SERVICES AND BUILDING BOUNDARIES AND WHERE ADJACENT BASEMENTS ARE PRESENT.
- SEEK ADVICE FROM SUITABLY QUALIFIED GEOTECHNICAL OR STRUCTURAL ENGINEER PRIOR TO OPERATION OF HEAVY SURFACE PLANT AND EQUIPMENT OR STOCKPILING MATERIAL NEAR OPEN EXCAVATIONS OR EXISTING RETAINING STRUCTURES.
- DO NOT STOCKPILE MATERIALS BEHIND OR EXCAVATE IN FRONT OF EXISTING RETAINING WALLS UNTIL WALL STABILITY HAS BEEN REVIEWED BY SUITABLY QUALIFIED STRUCTURAL ENGINEER.
- SEEK ADVICE FROM SUITABLY QUALIFIED STRUCTURAL ENGINEER BEFORE LAYING SERVICES BELOW EXISTING FOOTING LEVELS.
- HAVE LOAD CAPACITY OF STRUCTURES VERIFIED BY SUITABLY QUALIFIED STRUCTURAL ENGINEER BEFORE LOADING OR STORING MATERIALS ON EXISTING OR PARTIALLY COMPLETED STRUCTURAL ELEMENTS.

- SEEK ADVICE FROM SUITABLY QUALIFIED STRUCTURAL ENGINEER IF PLANNING CRANE LIFTS OR HOIST INSTALLATION ON PARTIALLY ERECTED OR SUSPENDED STRUCTURES.
- SEEK ADVICE FROM SUITABLY QUALIFIED STRUCTURAL ENGINEER BEFORE CORING, CHASING, CUTTING OR REMOVAL OF EXISTING CONCRETE AND REINFORCEMENT.
- HAVE SUITABLY QUALIFIED STRUCTURAL ENGINEER UNDERTAKE STRUCTURAL CHECK OF EXISTING CONCRETE, MASONRY AND STUD WALLS WHERE FIXINGS OR EQUIPMENT IS TO BE ATTACHED.
- INSTRUCT SERVICES CONTRACTORS UNDER NO CIRCUMSTANCES CAN STRUCTURAL MEMBERS BE CUT, NOTCHED OR DRILLED TO ACCOMMODATE SERVICES.
- ESTABLISH LOCATIONS OF LIVE EMBEDDED SERVICES BEFORE CUTTING THROUGH SLABS, WALLS etc.
- DEVELOP STEELWORK / PRECAST / TILT UP INSTALLATION SAFE WORK METHOD STATEMENT TO ELIMINATE AND MINIMISE INSTALLATION RISKS, AND HAVE REVIEWED BY SUITABLY QUALIFIED STRUCTURAL ENGINEER PRIOR TO ERECTION.
- DO NOT CUT OR UNBOLT ANY STRUCTURAL MEMBERS WITHOUT SEEKING REVIEW BY SUITABLY QUALIFIED STRUCTURAL ENGINEER.
- PROVIDE BUCKLING STABILITY TO LONG SPAN BEAMS, TRUSSES etc DURING ERECTION. IF UNSURE, CHECK WITH SUITABLY QUALIFIED STRUCTURAL ENGINEER PRIOR TO LIFTING AND INSTALLATION.
- MINIMISE SITE BASED TREATMENTS (eg WELDING, CUTTING, SPRAY PAINTING, GRIT BLASTING, etc). PROVIDE ADEQUATE PROTECTION, SCREENING AND VENTILATION TO MINIMISE HAZARDS TO PERSONNEL IF SITE BASED TREATMENT IS UNAVOIDABLE.
- AVOID WORKING IN CONFINED SPACES WHENEVER POSSIBLE. IF CONFINED SPACES WORK CANNOT BE AVOIDED, PROVIDE SAFE WORK METHOD STATEMENT ADDRESSING MITIGATION OF RISKS. PROVIDE ADEQUATE SIGNAGE TO TEMPORARY AND PERMANENT CONFINED SPACES TO AS2865.
- AVOID HOT WORKS ON SITE PARTICULARLY IN TIMBER FRAMED STRUCTURES. HOT WORKS TO COMPLY WITH CLIENT PROCEDURES FOR APPLICABLE "HOT WORKS PERMITS".
- DETERMINE APPROPRIATE METHOD OF PAINT REMOVAL AND DISPOSAL BEFORE STRIPPING PAINT, PARTICULARLY ON HISTORIC STRUCTURES. COATINGS CONTAINING COAL TAR EPOXIES, BITUMENS AND ASPHALTS, ZINC CHROMATE AND LEAD PRESENT A HEALTH RISK. PROVIDE SCREENING TO PUBLIC AND ENVIRONMENT FOR PAINT REMOVAL AND CLEANING OPERATIONS. USE ENVIRONMENTALLY APPROPRIATE RESTORATION METHODS DURING MAINTENANCE AND REPAIR WORK.
- MAKE WORK AREAS SAFE WHERE STRUCTURAL ELEMENTS ARE DAMAGED, CRACKED OR HAVE SUFFERED SIGNIFICANT SECTION LOSS BEFORE ALLOWING GENERAL CONSTRUCTION OR REPAIR ACCESS.
- REPORT SIGNIFICANT SECTION LOSS OR CORROSION FLAKING BEFORE STARTING PAINTING OR REPAIRS. CONSULT SUITABLY QUALIFIED STRUCTURAL ENGINEER IF SECTION LOSS OR EXTENSIVE CORROSION FLAKING PRESENT BEFORE PROCEEDING WITH WORK.
- DEVELOP AND IMPLEMENT RISK MITIGATION STRATEGIES BEFORE ALLOWING ACCESS OVER SUSPENDED CLADDING FINISHES THAT MAY BECOME BRITTLE OVER TIME.
- REPORT LOOSE OR MISSING BOLTS etc IN CONNECTIONS ENCOUNTERED DURING DAY-TO-DAY OPERATIONS.
- REMOVE MATERIAL FROM WITHIN STORAGE STRUCTURES BEFORE UNDERTAKING MAINTENANCE WORK.

EARTHWORKS, FOUNDATION AND FOOTINGS

EARTHWORKS

- EARTHWORKS TO BE TO AS3798 AND AS2870.
- REMOVE TOPSOIL, MATERIAL CONTAINING GRASS ROOTS OR OTHER ORGANIC MATTER, REFUSE, PUTRESCIBLE AND FLAMMABLE MATERIAL, TIMBER, CONCRETE, RUBBLE AND / OR DEBRIS AND ALL UNSUITABLE MATERIAL BELOW SLABS AND FOOTINGS AND WHERE SHOWN ON DRAWINGS.
- STOCKPILE SUITABLE TOPSOIL FOR RE-USE TO 1500 mm MAXIMUM HEIGHT.
- DO NOT STOCKPILE MATERIAL AGAINST RETAINING WALLS, BUILDINGS, FENCES OR TREES etc. DO NOT OBSTRUCT THE FREE FLOW OF WATER.
- SITE IS CLASSIFIED AS CLASS H1-D TO AS2870. EARTHWORKS UNDERTAKEN ON THE SITE SHALL BE CARRIED OUT TO MAINTAIN SITE CLASSIFICATION EITHER THROUGH THE IMPORTING OF FILL WITH LOW SHRINK SWELL VALUE OR LIME STABILISATION OF SITE WON SOIL.
- REFER TO GEOTECHNICAL INVESTIGATION REPORT No. C-1655.00 R1 PREPARED BY D&N GEOTECHNICAL PTY LTD DATED 04 AUGUST 2023. NOTIFY SUPERINTENDENT IF CONDITIONS ENCOUNTERED DIFFER FROM THOSE DESCRIBED IN THE REPORT AND SEEK DIRECTIONS.
- NOTIFY SUPERINTENDENT IF GROUND WATER ENCOUNTERED.
- DESIGN IS BASED ON DATA FROM DISCRETE LOCATIONS AS RECORDED IN GEOTECHNICAL INVESTIGATION REPORT. SUBSURFACE CONDITIONS SHOWN ON DRAWINGS IS INFERRED FROM DATA IN GEOTECHNICAL INVESTIGATION REPORT AND IS GIVEN AS A GUIDE ONLY. ACTUAL GROUND CONDITIONS MAY VARY FROM THOSE SHOWN.
- PROVIDE TEMPORARY SUPPORT TO FACES OF EXCAVATIONS AS REQUIRED.
- HAVE SAFETY OF PROPOSED EXCAVATIONS INCLUDING ANY TEMPORARY WORKS ASSESSED BY SUITABLY QUALIFIED GEOTECHNICAL / STRUCTURAL ENGINEER.

A	80% DETAIL DESIGN			
Rev	Description	Checked	Approved	Date
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Project	LACHLINE PIPELINE DUPLICATION DETAIL DESIGN TSS	Drawing Title	STRUCTURAL GENERAL NOTES - SHEET 1
Status	PRELIMINARY	Status Code	
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EARTHWORKS, FOUNDATIONS AND FOOTINGS (CON.T)

- PLACE FILL MATERIAL UNDER BUILDINGS AND OTHER FOOTINGS IN LAYERS NOT EXCEEDING 150 mm THICK AND COMPACT TO AT LEAST 98% MAXIMUM STANDARD DRY DENSITY (MSDD) TO AS1289.
- ADJUST MOISTURE CONTENT OF FILL AT TIME OF COMPACTION WITHIN THE RANGE OF 100-103% OF OPTIMUM MOISTURE CONTENT DETERMINED BY AS1289 TO ACHIEVE REQUIRED DENSITY.
- SAMPLE AND TEST COMPACTION AS PER SPECIFICATION.
- PROTECT FINISHED EARTHWORKS FROM TRAFFIC, WEATHER AND EROSION AND KEEP WORKS FREE OF RUBBISH AND DEBRIS. REPAIR AND RE-ESTABLISH GRADES IN SETTLED, ERODED AND RUTTED AREAS. WHERE COMPLETED COMPACTED AREAS ARE DISTURBED BY SUBSEQUENT CONSTRUCTION OPERATIONS OR ADVERSE WEATHER, SCARIFY THE SURFACE, RESHAPE AND COMPACT TO THE REQUIRED DENSITY PRIOR TO FURTHER CONSTRUCTION.

FOUNDATIONS

- FOUNDATION LEVELS SHOWN ARE CONTRACT LEVELS. FINAL LEVELS TO BE AS DIRECTED BY SUPERINTENDENT.
- AVOID OVER EXCAVATION. BACKFILL OVER EXCAVATION WITH GRADE N7 BLINDING CONCRETE.
- 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.
- ENSURE EXCAVATIONS ARE STABLE AND PROTECT SURROUNDING PROPERTY AND SERVICES FROM ADVERSE EFFECTS OF GROUND WORKS. PROVIDE TEMPORARY WORKS AS REQUIRED. PROVIDE SHORING CERTIFIED BY SUITABLY QUALIFIED STRUCTURAL ENGINEER TO ALL DEEP EXCAVATIONS.
- DO NOT UNDERMINE EXISTING FOOTINGS.
- DEEPEN FOOTINGS BY THICKENING BLINDING CONCRETE AS REQUIRED NEAR EXISTING SERVICE TRENCHES (EVEN IF BACKFILLED), EXCAVATIONS, BATTERS etc, SO INFLUENCE LINE (AT 30° TO HORIZONTAL) FROM FOOTING IS BELOW ADJACENT EXCAVATION.
- PROVIDE SAFETY MESH AND OTHER PROTECTION TO PREVENT EXPOSURE OF PERSONNEL TO EXCAVATIONS DURING FOUNDATION CONSTRUCTION.
- USE SUITABLE CONSTRUCTION TECHNIQUES AND EQUIPMENT FOR BACKFILLING ADJACENT TO STRUCTURES TO PREVENT OVERSTRESS AND DAMAGE. PROVIDE SUPPORT TO RETAINING WALLS IF CONSTRUCTION METHODS IMPOSE COMPACTION LOADS GREATER THAN ALLOWED (SEE DESIGN LOADS IN GENERAL NOTES). BACKFILL EVENLY TO AVOID DIFFERENTIAL SOIL PRESSURES ON STRUCTURES. BACKFILL AGAINST RETAINING WALLS ONLY AFTER SPECIFIED CONCRETE STRENGTH IS ACHIEVED, AND PERMANENT SUPPORTS INSTALLED.
- BACKFILL FOR RETAINING WALLS TO BE FREE DRAINING GRANULAR MATERIAL UNO. PROVIDE DRAINAGE BEHIND RETAINING WALLS COMPRISING CONTINUOUS SLOTTED DRAIN WITH GRANULAR SURROUND, OR NYLEX "COREDRAIN" CONNECTED TO RETICULATED STORMWATER DRAINAGE SYSTEM. PROVIDE 50 mm DIAMETER WEEPHOLES AT 1500 mm MAXIMUM CENTRES AT BASE OF WALL.
- SLOPE SERVICES TRENCHES AWAY FROM BUILDING. BED SERVICES ON COMPACTED MATERIAL COMPATIBLE WITH NATURAL MATERIAL ON SITE. BACKFILL TOP 300 mm OF TRENCHES WITH HAND-COMPACTED CLAY WITHIN 1500 mm OF BUILDING. WHERE SERVICES PASS THROUGH MIDDLE THIRD OF FOOTING, SLEEVE SERVICES OR PROVIDE 40 mm THICK CLOSED-CELL POLYETHYLENE LAGGING.
- FOR SITES CLASSIFIED M OR GREATER REACTIVITY; WHERE SERVICES PASS UNDER FOOTINGS BACKFILL TRENCHES WITH HAND-COMPACTED CLAY OR BLINDING CONCRETE FOR 1500 mm EACH SIDE OF FOOTING AGAINST CLEAN, DRY, UNDISTURBED NATURAL MATERIAL. BACKFILL TRENCHES WITH HAND-COMPACTED CLAY WITHIN 1500 mm OF BUILDING. PROVIDE FLEXIBLE JOINTS IN STORMWATER AND WASTEWATER SERVICES AT EXTERIOR OF BUILDING.
- FOLLOWING COMPLETION OF CONSTRUCTION, FOUNDATION MAINTENANCE TO BE IN ACCORDANCE WITH CSIRO BUILDING TECHNOLOGY FILE 18 "FOUNDATION MAINTENANCE AND FOOTING PERFORMANCE: A HOMEOWNER'S GUIDE", INCLUDING CONSTRAINTS ON TREE LOCATIONS.

SLABS AND FOOTINGS

- FOOTINGS HAVE BEEN DESIGNED FOR A SAFE WORKING BEARING PRESSURE OF 100 kPa IN UNDISTURBED NATURAL.
- CONSTRUCT FOOTINGS FOUNDED IN SPECIFIED MATERIALS (AS ABOVE, OR IN GEOTECHNICAL REPORT). REMOVE TOPSOIL, SOFTENED OR LOOSE MATERIAL AND MATERIAL THAT DOES NOT ACHIEVE THESE PRESSURES. ENSURE FORMATION IS CLEAN AND LEVEL. PROVIDE FORMWORK WHERE SIDES OF EXCAVATIONS ARE NOT STABLE.
- PROOF ROLL FORMATION WITH HEAVY DUTY ROLLER.
- OBTAIN APPROVAL OF FOUNDATION MATERIAL FOR THE DESIGN PRESSURES FROM SUITABLY QUALIFIED GEOTECHNICAL ENGINEER / SUPERINTENDENT / BUILDING AUTHORITY BEFORE FIXING REINFORCEMENT OR PLACING CONCRETE.
- SLAB PANELS TO BE FOUNDED ON UNDISTURBED NATURAL SOIL WITH ALLOWABLE BEARING CAPACITY OF NOT LESS THAN 100 kPa. REMOVE SOFT SPOTS AND REPLACE WITH COMPACTED CRUSHED ROCK. WHERE SLAB PANELS AND INTERNAL BEAMS ARE FOUNDED ON CONTROLLED FILL, CONTROLLED FILL MUST CONTINUE AT LEAST ONE METRE PAST BUILDING.
- LOCATE FOOTINGS CENTRALLY UNDER WALLS AND COLUMNS UNO.
- PROVIDE 0.2 mm HIGH IMPACT-RESISTANT VIRGIN POLYETHYLENE FILM DAMP PROOF MEMBRANE TO AS2870 ON 50 mm SAND BLINDING WHERE SHOWN ON DRAWINGS. LAP 200 mm AND SEAL DAMP PROOF MEMBRANES, TAPE AT PENETRATIONS, etc TO ENSURE A COMPLETE VAPOUR BARRIER IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS AND AS2870. PREVENT PUNCTURING OR DAMAGE BY PLACING A PLASTIC PLATE UNDER REINFORCEMENT SUPPORTS.

- TOP OF CONCRETE SLAB TO BE AT LEAST 150 mm ABOVE ADJACENT GROUND LEVELS.
- SLOPE GROUND SURROUNDING STRUCTURE SO WATER WILL DRAIN AWAY TO SUITABLE DISCHARGE POINTS WITHOUT PONDING. WHERE ACHIEVED BY FILLING, FILL TO BE LESS PERMEABLE THAN UNDERLYING MATERIAL.

STEEL

- WORKMANSHIP, FABRICATION AND MATERIALS TO COMPLY WITH AS4100, AS/NZS4600, TO AS/NZS5131, AS/NZS1554, AS/NZS5131.
- FABRICATORS TO BE CERTIFIED BY ASI *NATIONAL STRUCTURAL STEELWORK COMPLIANCE SCHEME (NSSCS)*.
- CONSTRUCTION CATEGORY FOR FABRICATION IN ACCORDANCE WITH AS/NZS5131 TO BE AS FOLLOWS UNO:
 - IMPORTANCE LEVEL: IL2
 - SERVICE CATEGORY: SC2
 - FABRICATION CATEGORY: FC1
 - CONSTRUCTION CATEGORY: CC3
- INSPECTION, TESTING AND CORRECTION TO AS/NZS5131. PREPARE INSPECTION AND TEST (ITP) PLANS FOR MATERIALS AND COMPONENTS, PREPARATION AND ASSEMBLY, WELDING, MECHANICAL FASTENING, SURFACE TREATMENT, PROTECTIVE COATINGS, GALVANISING AND ERECTION.
- PROVIDE STEEL IN ACCORDANCE WITH:
 - AS1163 GRADE C350 OR C450 FOR RECTANGULAR AND SQUARE HOLLOW SECTIONS, AS NOTED ON DRAWINGS
 - AS1163 GRADE C250 OR C350 FOR CIRCULAR HOLLOW SECTIONS, AS NOTED ON DRAWINGS
 - AS1397 GRADE G450 FOR PURLINS AND GIRTS,
 - AS1443 FOR COLD-FINISHED BARS
 - AS/NZS1594 GRADE 300 HOT-ROLLED STEEL FLAT PRODUCTS
 - AS/NZS3678 GRADE 300 FOR PLATES AND FLOOR PLATE
 - AS/NZS3679 PART 2 GRADE 300 FOR WELDED BEAMS AND WELDED COLUMNS
 - AS/NZS3679 PART 1 GRADE 300 OR BHP GRADE 300 PLUS FOR UNIVERSAL BEAMS, UNIVERSAL COLUMNS, PARALLEL FLANGE CHANNELS, ANGLES, FLATS, BARS AND RODS,
 - AS/NZS1554.2 GRADE 380 FOR SHEAR STUDS,
 - OTHERWISE TO COMPLY WITH AS/NZS3678 OR AS/NZS3679 GRADE 250 UNO.
- SUPPLY EVIDENCE THAT MATERIALS AND PARTS CONFORM WITH TESTS REQUIRED BY THE STANDARDS AND SPECIFICATIONS REFERRED TO HEREIN AND / OR AS REQUIRED BY SUPERINTENDENT. PROVIDE TEST CERTIFICATES TO SHOW RESULTS OF MECHANICAL TESTS AND CHEMICAL ANALYSES OF THE MATERIALS OR PARTS USED.
- CARRY OUT SUPPLEMENTARY ULTRASONIC TESTING TO AS2207 AND AS/NZS1554.1 FOR PLATES ≥ 40 THICK.
- JOINTS DETAILS SUSCEPTIBLE TO LAMELLAR TEARING (LT) ARE NOTED ON DRAWINGS. SUPPLY ULTRASONICALLY TESTED PLATE TO AS1710 CLASS 1 WITH SPECIFIED Z VALUE FOR LT SUSCEPTIBLE PLATES.
- MANUFACTURERS AND PROCESSORS OF STRUCTURAL STEEL MUST HOLD A VALID CERTIFICATE OF APPROVAL ISSUED BY ACRS (AUSTRALASIAN CERTIFICATION AUTHORITY FOR REINFORCING AND STRUCTURAL STEELS). PROVIDE ACRS CERTIFICATION OF COMPLIANCE WITH RELEVANT STANDARDS, PRODUCT TAGS AND SUPPORTING DOCUMENTATION FOR ALL STRUCTURAL STEELWORK. ALTERNATIVE SOURCING OF THIRD-PARTY CERTIFIED STRUCTURAL STEEL TO BE SUBMITTED FOR REVIEW AND APPROVED IN WRITING PRIOR TO PROCUREMENT.
- MARK STEEL GRADES ON STRUCTURAL MEMBERS IN NON-CRITICAL AREAS. USE IDENTIFICATION MARKS COMPATIBLE WITH AND VISIBLE THROUGH PAINT SYSTEM.
- ENSURE METAL DECKING, FLOOR PLATE AND FLOOR GRATING SECURELY FIXED IN POSITION BEFORE ALLOWING GENERAL CONSTRUCTION ACCESS.
- PROVIDE 3 mm CAP PLATES SEAL WELDED TO HOLLOW SECTIONS UNO.
- CARRY OUT FABRICATION AND ERECTION OF STEELWORK IN ACCORDANCE WITH AS/NZS5131 GUIDELINES WITH CLASS 1 TOLERANCES. WORK MUST BE UNDERTAKEN BY COMPETENT PERSONNEL – FOR REQUIREMENTS AND QUALIFICATIONS REFER AS5131. WHEN REQUESTED SUBMIT ERECTION SEQUENCE METHODOLOGY FOR SUPERINTENDENT'S APPROVAL.
- METHODS OF FABRICATION TO ACHIEVE REQUIRED SHAPES WITHOUT DISTORTION OR LOSS OF STEEL STRENGTH IS RESPONSIBILITY OF CONTRACTOR.
- BEFORE COMMENCING FABRICATION, PLATES ARE TO BE MADE FLAT AND BARS AND SECTIONS MADE STRAIGHT AND FREE FROM TWIST SO THAT WHEN ASSEMBLED ADJACENT SURFACES ARE IN CLOSE CONTACT THROUGHOUT WITHOUT CAUSING DAMAGE.
- USE MEMBER SIZES SHOWN ON DRAWINGS. SUBSTITUTION NOT PERMITTED WITHOUT ENGINEER'S WRITTEN APPROVAL.
- PROTECT STEELWORK FROM DAMAGE DURING HANDLING, TRANSPORT, STORAGE AND ERECTION. SUBMIT PROPOSED METHOD TO REPAIR DAMAGE FOR APPROVAL. PROTECT STEELWORK STORED ON SITE FROM CORROSION OR DETERIORATION.
- PLUMB COLUMNS WITH METAL PACKERS OR SHIMS.
- SEQUENCE ERECTION WORKS TO AVOID PINCH POINTS AND SITE CONGESTION.
- INSTALL BEAMS WITH NATURAL CAMBER UPWARD. PROVIDE BEAMS WITH AN UPWARDS PRECAMBER AS SHOWN ON DRAWINGS.
- CUTTING, HOLING AND SHAPING OF STEELWORK TO BE TO AS/NZS5131. PENETRATIONS OR CUT-OUTS NOT SHOWN ON DRAWINGS ARE NOT PERMITTED.
- STEELWORK MAY BE CUT BY FLAME CUTTING, SAWING OR SHEARING UNO. SURFACES TO BE FINISHED SQUARE, TRUE TO THE REQUIRED DIMENSIONS AND FREE OF DEFECTS eg EXCESSIVE ROUGHNESS THAT COULD IMPAIR SERVICE PERFORMANCE OR INTERFERE WITH FABRICATION AND PROTECTIVE TREATMENT.

- SHEARING IS NOT PERMITTED FOR MAIN PLATES, REINFORCING PLATES, MAIN GUSSETS, SPLICE PLATES AND DIAPHRAGMS EXCEPT IN A DIRECTION PERPENDICULAR TO THE DIRECTION OF MAIN STRESS.
- GRIND OR MACHINE CUT EDGES TO SUPERINTENDENT'S APPROVAL OF FINISH. ROLLED EDGES NEED NOT BE GROUND IF SQUARE AND STRAIGHT.
- ALL CORNERS OF EXPOSED EDGES TO BE ROUNDED TO A RADIUS OF 2 mm.
- FLAME CUTTING TO USE MECHANICALLY GUIDED MACHINES MOVING AT UNIFORM SPEED. HAND CUTTING OF SECONDARY CUTS, HOLE PREPARATION, REPAIRS AND WORK WHERE MACHINE CUTTING IS NOT POSSIBLE IS ACCEPTABLE WHERE APPROVED BY SUPERINTENDENT.
- RE-ENTRANT CORNERS TO BE SMOOTHLY ROUNDED TO 20 mm RADIUS.
- FLAME CUT SURFACES COMPLETELY FUSED IN WELDING TO HAVE:
 - SURFACE ROUGHNESS LESS THAN 25 µm Ra (ie AWRA ROUGHNESS CLASS 3 AS SHOWN IN AUSTRALIAN WELDING RESEARCH ASSOCIATION TECHNICAL NOTE 5).
 - DEPTH OF ISOLATED GOUGES LESS THAN 2 mm.
 - EDGES FREE OF EXCESSIVE ROUGHNESS AND THICK / LOOSE SCALE.
 - SURFACE QUALITY TO PERMIT SATISFACTORY WELDING.
- FLAME CUTTING OF PLATES, SECTIONS AND OTHER COMPONENTS USED IN "AS-CUT" CONDITION TO BE CARRIED OUT WITH PROCEDURES GIVING MINIMUM REDUCTION IN PROPERTIES AT CUT SURFACE, AND MACHINED OR GROUND TO DEPTH OF AT LEAST 3 mm.
- USE METHODS APPROVED BY SUPERINTENDENT FOR CAMBERING (AND ADJUSTMENT OF CAMBER) OF ROLLED AND BUILT-UP SECTIONS. IF HOT BENDING USED, STEEL TEMPERATURE MUST NOT EXCEED 650°C. AFTER HOT BENDING, ALLOW STEEL TO COOL SLOWLY IN AIR TO AMBIENT TEMPERATURE. WHILE COOLING, PROTECT STEEL FROM DRAUGHTS OR OTHER RAPID AIR MOVEMENTS. ALLOW FOR DEFLECTION DUE TO SELF WEIGHT IN MEASUREMENT OF CAMBER.
- PROVIDE STEEL MEMBERS MADE FROM WHOLE LENGTHS WHEREVER POSSIBLE. SEEK SUPERINTENDENT'S APPROVAL IN WRITING TO MAKE LENGTHS UP OF SECTIONS JOINED BY COMPLETE PENETRATION FULL STRENGTH BUTT WELDS GROUND FLUSH WHERE REQUIRED. WHERE PROPOSED, SHOW JOINTS ON SHOP DRAWINGS.
- ENSURE MEMBERS ARE CONCENTRIC AT CONNECTIONS (GRAVITY- OR GAUGE-LINES TO INTERSECT) UNO. ACCURATELY PRE-FORM PARTS TO AVOID FORCE AND / OR RESTRAINT DURING JOINING.
- SHOP SPLICES IN COMPONENT PARTS OF WELDED MEMBERS TO BE MADE BEFORE PARTS ASSEMBLED.
- DRILL HOLES FULL SIZE OR REAM TO FULL SIZE AFTER SUB-DRILLING OR SUB-PUNCHING. SUB-DRILLED OR SUB-PUNCHED HOLES TO BE AT LEAST 3 mm UNDERSIZE. "OXY" OR FLAME CUTTING OF HOLES IS NOT PERMITTED. BOLT HOLE SIZE TO BE:
 - BOLT DIAMETER PLUS 2 mm FOR STEEL TO STEEL CONNECTIONS.
 - BOLT DIAMETER PLUS 4 mm FOR STEEL TO CONCRETE CONNECTIONS.
 - BOLT DIAMETER PLUS 4 mm FOR HOLDING DOWN BOLTS UP TO M20.
 - BOLT DIAMETER PLUS 6 mm FOR HOLDING DOWN BOLTS M24 OR LARGER.

WELDING

- DEVELOP WELD PROCEDURES TO SUIT JOINT DETAILS AND SHOW ON SHOP DRAWINGS. USE PREQUALIFIED WELD PROCEDURES AND CONSUMABLES TO AS/NZS1554.1 CLAUSE 4.3 OR DEVELOP QUALIFICATION OF WELD PROCEDURE AND CONSUMABLES BY TESTING TO AS/NZS1554.1 CLAUSE 4.2. LIST APPLICABLE PARAMETERS ON WELDING PROCEDURE QUALIFICATION RECORD AND MAKE RECORD AVAILABLE FOR INSPECTION.
- WELDING TO BE UNDERTAKEN BY QUALIFIED AND SUITABLY EXPERIENCED WELDER UNDER THE ACTIVE SUPERVISION OF QUALIFIED WELDING SUPERVISOR. WELDER AND WELDING SUPERVISOR QUALIFICATIONS TO AS/NZS1554.
- CARRY OUT WELDING TO AS/NZS1554: ALL INTERFACES BETWEEN STEEL SECTIONS TO BE CONNECTED WITH 6 mm CONTINUOUS FILLET WELDS ALL ROUND, BOTH SIDES UNO.
 - WELDS TO BE SHOP WELDED UNO
 - WELDS TO BE CATEGORY SP UNO
 - BUTT WELDS TO BE FULL (COMPLETE) PENETRATION UNO
- SITE WELDS TO BE CATEGORY GP UNO.
- ELECTRODES TO BE LOW HYDROGEN PRE-APPROVED TO AS/NZS1554. IMPACT RATING OF ELECTRODES TO BE NOT LESS THAN THAT OF PARENT METAL.
- NOMINAL TENSILE STRENGTH OF WELD METAL *fm* TO BE:
 - 430 MPa FOR STEEL WITH GRADE < 300 MPa
 - 490 MPa FOR STEEL WITH 300 ≤ GRADE < 450 MPa
 - 760 MPa FOR QUENCH AND TEMPERED STEEL TO GRADE 690 MPa
- APPLY WELD PREHEAT IN ACCORDANCE WITH RECOMMENDATIONS OF AS/NZS 1554.1
- WELD TESTING TO REQUIREMENTS AND RECOMMENDATIONS OF AS/NZS5131.
- EXTENT OF WELD INSPECTION / TESTING TO BE:
 - VISUAL SCANNING: 100% OF WELDS
 - VISUAL EXAMINATION: 100% OF BUTT WELDS IN TENSION MEMBERS AND 20% OF OTHER WELDS
 - MAGNETIC PARTICLE TESTING FOR EARTHQUAKE DESIGN CATEGORIES D AND E: 100% OF BUTT WELDS IN TENSION MEMBERS AND 10% OF OTHER WELDS. MAGNETIC PARTICLE TESTING TO BE REPLACED WITH DYE PENETRANT TESTING FOR STAINLESS STEEL.
 - RADIOGRAPHIC OR ULTRASONIC: 10% OF BUTT WELDS IN TENSION MEMBERS AND 5% OF OTHER WELDS. RADIOGRAPHY TO BE USED FOR THICKNESSES LESS THAN 10 mm, OR ULTRASONIC SHALL BE SUPPLEMENTED BY MAGNETIC PARTICLE TO DETECT SUB SURFACE DEFECTS.
 - DEFECT ACCEPTANCE LEVELS AS SPECIFIED IN AS/NZS 1554.

- GRIND WELDS SMOOTH AND FLUSH WITH PARENT METAL WHERE NOMINATED ON DRAWINGS. GRIND ONLY IN LONGITUDINAL DIRECTION OF MEMBER.
- FINISHED SURFACE PROFILE OF WELDS TO BE SMOOTH AND FREE OF SHARP EDGES OR CREVICES. COMPLETELY REMOVE SPLATTER AND SLAG.
- REPAIR FAULTY WELDS AND DEFECTS REVEALED BY WELD INSPECTION / TESTING AND REPEAT THE EXAMINATION.
- WELDS TO BE INSPECTED BY INDEPENDENT NATA ACCREDITED QUALIFIED WELDING INSPECTOR TO AS/NZS1554 CLAUSE 7.1. PROVIDE WELDING INSPECTOR'S REPORT TO SUPERINTENDENT.
- WELDING SYMBOLS ARE TO AS1101.3. "CFW" INDICATES CONTINUOUS FILLET WELD. "FSBW" INDICATES FULL STRENGTH BUTT WELD WHICH IS EQUIVALENT TO CPBW. "CPBW" INDICATES COMPLETE PENETRATION BUTT WELD.
- WELDS BETWEEN DISSIMILAR METALS TO AS/NZS 1554.6, WITH CONSIDERATION OF PREHEAT REQUIREMENTS FOR STEEL AS PER AS/NZS 1554.1 AND MAXIMUM HEAT INPUT AND INTERPASS TEMPERATURE FOR STAINLESS STEEL AS PER TABLE 5.10.

BOLTS

- M16 AND LARGER BOLTS TO BE HIGH STRENGTH STRUCTURAL BOLTS, 8.8/S PROCEDURE AND M12 SIZE BOLTS SHALL BE COMMERCIAL BOLTS, 4.6/S PROCEDURE UNO.
- FOR BOLTS MANUFACTURED OUTSIDE AUSTRALIA, PROVIDE LOCAL INDEPENDENT NATA-ACCREDITED LABORATORY COMPLIANCE CERTIFICATE BASED ON APPROPRIATE TESTING AND VERIFICATION.
- USE BOLTS WITH THREADS IN COMPLIANCE WITH AS1275. BOLTS OF STRENGTH GRADE 4.6 TO BE COMMERCIAL GRADE BOLTS TO AS1111 AND AS1112. BOLTS OF STRENGTH GRADE 8.8 AND STRENGTH GRADE 10.9 TO BE HIGH STRENGTH STRUCTURAL BOLTS, NUTS AND WASHERS TO AS/NZS1252. MECHANICAL PROPERTIES OF BOLTS, NUTS, SCREWS AND STUDS TO COMPLY WITH AS/NZS4291. WASHERS TO COMPLY WITH AS1237.
- TIGHTENING PROCEDURE TO BE PART TURN OR DIRECT TENSION INDICATOR METHOD TO COMPLY WITH AS/NZS5131:
 - S SNUG TIGHT.
 - TB BEARING MODE JOINT, BOLTS FULLY TENSIONED.
 - TF FRICTION MODE JOINT, BOLTS FULL TENSIONED. (CONTACT SURFACES OF FRICTION CONNECTIONS TO BE UNCOATED, FREE OF MILL SCALE AND PREPARED TO AS/NZS5131.)
- BOLT TYPE AND TIGHTENING PROCEDURE ARE DESIGNATED: NUMBER, SIZE STRENGTH GRADE / TIGHTENING PROCEDURES. eg 4-M24 8.8/TB = 4 OFF 24 DIAMETER METRIC HIGH STRENGTH STRUCTURAL BOLTS FULLY TENSIONED IN BEARING MODE.
- HIGH STRENGTH BOLTS TO BE VERIFIED TO AS/NZS1252.2. PROVIDE REQUIRED DOCUMENTATION (INCLUDING 'SUPPLIER DECLARATION OF CONFORMITY (SDoC)') TO SUPERINTENDENT.
- USE BOLT LENGTHS SO THAT PROJECTION BEYOND NUT IS AT LEAST TWO THREADS, AND NOT MORE THAN 10 mm.
- ALL BOLTS, HOLDING DOWN BOLTS, CAST IN FERRULES AND POST-INSTALLED ANCHORS, SCREWS, NUTS AND WASHERS TO BE HOT DIP GALVANIZED BY MANUFACTURER TO AS1214 AND AS/NZS5131. TAP GALVANIZED NUTS 0.4 mm OVERSIZE TO SUIT GALVANIZED THREADS TO AS1214 AND OIL FOR PROTECTION. INSTALL WASHERS UNDER BOLT HEAD OR NUT, WHICHEVER PART IS ROTATED. USE HARDENED OR PLATE WASHERS UNDER BOTH HEAD AND NUT FOR OVERSIZED AND SLOTTED HOLES TO AS4100. USE TAPERED WASHERS AS REQUIRED UNDER NON-ROTATING PART.
- SLOTTED HOLES TO BE 2.5 x BOLT DIAMETER LONG UNO. BOLTS TO BE SET CENTRAL IN SLOT UNO. USE 8 mm PLATE WASHERS UNDER BOLT HEAD AND NUT TO COMPLETELY COVER HOLE.

CONNECTIONS

- STEEL CONNECTION DETAILS TO BE IN ACCORDANCE WITH AS4100 AND AUSTRALIAN STEEL INSTITUTE (ASI) STRUCTURAL STEEL CONNECTION SERIES OF MANUALS AND GUIDES UNO.
- MAKE BOLTED STRUCTURAL CONNECTIONS WITH 10 mm THICK CLEAT PLATES AND 2 M16 8.8/S BOLTS UNO. USE M12 4.6/S BOLTS FOR PURLINS UP TO 250 DEEP UNO. STIFFENERS, PURLIN AND GIRT CLEATS AND FLY BRACE CLEATS TO BE 8 mm THICK UNO. ROD BRACING TO HAVE TURNBUCKLES WITH FULL CAPACITY OF ROD UNO.
- PROVIDE CLEATS AND DRILL HOLES NECESSARY FOR FIXING OTHER ELEMENTS TO STEELWORK. SHOW ON SHOP DRAWINGS.
- PROVIDE RADIUS CORNERS ON EXPOSED CLEATS TO REDUCE RISK OF IMPALEMENT AND LACERATIONS.
- PROVIDE BOLTED CLEAT CONNECTIONS TO SITE WELDED CONNECTIONS CAPABLE OF BEING LOADED BEFORE OR WHILE CONNECTIONS ARE WELDED TOGETHER.
- CROP INTERNAL CORNERS OF CLEATS AND STIFFENERS, etc TO FACILITATE DRAINAGE. PROVIDE DRAINAGE HOLES TO PREVENT WATER PONDING ON STRUCTURAL ELEMENTS DURING CONSTRUCTION. SHOW PROPOSED HOLES ON SHOP DRAWINGS.
- CLEARLY MARK CONNECTIONS SUBJECT TO VIBRATION. USE NEW, UNUSED NYLON LOCK NUTS CLASS 04 TO AS4291.2 FOR BOLTS SUBJECT TO VIBRATION. CHECK NYLON IS SMOOTH AND UNDAMAGED BEFORE INSTALLING. INSTALL WASHER UNDER LOCK NUT. SCREW LOCK NUT BY HAND UNTIL FULLY ENGAGED ON THREAD. TIGHTEN USING WRENCH ONTO WASHER. INSTALL STRUCTURAL NUT AFTER LOCK NUT AND TIGHTEN WHILE RESTRAINING LOCK NUT WITH SPANNER.

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STEEL (CON.T)

BASEPLATES AND HOLDING DOWN BOLTS

66. HOLDING DOWN BOLTS TO BE GRADE 4.6 UNO. SUPPLY HOLDING DOWN BOLTS WITH TWO CLASS 5 HEXAGONAL HEAD NUTS AND EXTRA LARGE HARDENED OR 4 mm PLATE WASHER. HOT DIP GALVANIZE HOLDING DOWN BOLTS, NUTS AND WASHERS TO AS1214. TIE HOLDING DOWN BOLT GROUPS RIGIDLY TOGETHER PRIOR TO INSTALLATION (eg. TACK WELD WITH 10 mm DIAMETER REINFORCING BAR TO FORM A RIGID CAGE FOR GRADE 4.6 BOLTS ONLY, FOR HIGHER GRADE BOLTS TIE TOGETHER WITHOUT WELDING) TO ENSURE CORRECT BOLT LOCATIONS, AND SET OUT USING A 3 mm MILD STEEL TEMPLATE SUPPLIED BY STEELWORK FABRICATOR. PROVIDE 4 N12 LIGATURES TO FIX HOLDING DOWN BOLT CAGE SECURELY TO SLAB / FOOTING REINFORCEMENT.
67. INSTALLATION OF POST-INSTALLED MECHANICAL AND CHEMICAL ANCHORS TO AS/NZS5131 CL8.8. UNDERTAKE SITE TESTING TO VALIDATE CORRECT INSTALLATION (PROOF TESTING) ON 2.5% ANCHORS (MINIMUM THREE). IF AN ANCHOR FAILS TEST 5% (MINIMUM FIVE) ANCHORS. IF TWO ANCHORS FAIL TEST ALL ANCHORS. PROOF TESTING TO AEFAC TECHNICAL NOTE – *SITE TESTING GUIDELINES* VOLUMES 1 TO 4.
68. GROUT BASE PLATES, HOLDING-DOWN BOLTS, REBATES etc BEFORE LOADING COLUMNS OR ERECTING WALLS. USE APPROVED HIGH-STRENGTH (40 MPa AT 7 DAYS) NON-SHRINK PRE-MIXED RAMMED GROUT TO AS/NZS5131. GROUT THICKNESS 15 mm MINIMUM, 40 mm MAXIMUM UNO. CHAMFER GROUT EDGES AT 45 DEGREES UNO. DO NOT LOAD GROUT UNTIL FULL STRENGTH ACHIEVED.

LIGHTWEIGHT / COLD-FORMED STEEL

69. WORKMANSHIP AND MATERIALS TO COMPLY WITH AS1397, AS3623, AS4600 AS/NZS5131 AND MANUFACTURERS' RECOMMENDATIONS.
70. USE BHP (LYSAGHT'S) PURLINS, GIRTS, HOOK-LOK II BRIDGING AND ACCESSORIES UNO. BOTH FLANGES TO BE LIPPED UNO.
71. LIGHTWEIGHT STEEL WALL AND FLOOR FRAMING, FIXINGS etc TO BE BY RONDO BUILDING SERVICES PTY LTD UNO.
72. PROVIDE PURLINS AND GIRTS WITH GALVANIZED COATING OF 350 g/m² (OR 450 g/m²) = MINIMUM COATING MASS TO AS1397 UNO.
73. PROVIDE CEILING AND WALL FRAMING WITH GALVANIZED COATING OF 275 g/m² = MINIMUM COATING MASS TO AS1397 UNO. CLEAN AND TREAT WELDS USING ZINC-RICH PAINT.
74. PROVIDE BOLTS TO PURLINS TO SUPPORT ROOF BRACING MIDSPAN. SUPPORT WALL BRACING AT EVERY SECOND STUD.
75. HOLES IN PURLINS AND OTHER COLD FORMED SECTIONS TO BE IN ACCORDANCE WITH PURLIN MANUFACTURER'S RECOMMENDATIONS, OR ONLY IN MIDDLE THIRD OF WEB. DO NOT MAKE HOLES IN FLANGES OF PURLINS OR OTHER COLD FORMED SECTIONS.
76. SUPPORT FOR SUSPENDED ELEMENTS (CEILINGS, SERVICES ETC) TO BE POSITIONED SO LOAD TRANSFER IS TO WEB OF PURLINS ONLY (AND OTHER COLD FORMED SECTIONS). LIGHTWEIGHT LOADS MAY BE CONNECTED WITHIN 25 mm OF THE WEB. DO NOT ATTACH LOADS TO PURLIN LIPS. LOADS ARE NOT TO BE SUSPENDED FROM WALL GIRTS.
77. AT WALL / ROOF INTERSECTIONS, DIAGONAL RIDGES, HIPS, VALLEYS etc PROVIDE DIAGONAL TRIMMERS (PURLINS AND / OR ANGLES) TO SUPPORT CLADDING AND FLASHING UNO.
78. PROVIDE NECESSARY SUPPORT FRAMES, TRIMMERS etc FOR BUILDING SERVICES, MECHANICAL AND ELECTRICAL EQUIPMENT AND ARCHITECTURAL FEATURES UNO.
79. LIGHTWEIGHT STEEL WALL AND FLOOR FRAMING (INCLUDING ROOF AND WALL BRACING, TRIMMERS, NOGGINGS, HEADERS, TIE DOWNS TO RESIST UPLIFT, etc) TO BE DESIGNED TO AS/NZS4600 BY A SUITABLY QUALIFIED CHARTERED ENGINEER. CO-ORDINATE ARCHITECTURAL, STRUCTURAL, SERVICES AND OTHER ENGINEERING DRAWINGS AND ALLOW FOR NECESSARY CONNECTIONS, SERVICES etc. PROVIDE WORKSHOP DRAWINGS AND DESIGN CALCULATIONS.
80. FIX SHEETING TO ALL PURLINS AND GIRTS. PURLIN AND GIRT DETAILS INCLUDING FIXINGS, CONNECTIONS, BRIDGING, LAPS AND INSTALLATION TO BE IN ACCORDANCE WITH BHP (LYSAGHT) GUIDES AND RECOMMENDATIONS OR AS SHOWN ON DRAWINGS UNO.

DURABILITY & PROTECTIVE COATINGS

81. HOT DIP GALVANIZE GRATING, HANDRAILS, LADDERS AND STEP IRONS etc TO AS/NZS4680 AND AS/NZS5131. PROVIDE STAIRS, LADDERS, PLATFORMS, WALKWAYS AND HANDRAILS, etc TO AS1657.
82. AFTER COMPLETION OF FABRICATION, PREPARATION FOR SURFACE TREATMENT TO BE: ROUND OFF ROUGH WELDS, SHARP EDGES (ROUND TO 2 mm RADIUS) etc. SURFACE TO BE FREE OF WELDING SPATTER, SLAG, UNDERCUTS, VISIBLE PORES PITS AND CRATERS, VISIBLE SLIVERS, ROLL-OVERS, LAMINATIONS, ROLLED-IN EXTRANEOUS MATTER, GROOVES (RADIUS OF GOUGES TO BE LESS THAN 4 mm), INDENTATIONS, ROLL MARKS, BURRS, ARISES, CRACKS, etc. PREPARE WELDS, EDGES AND OTHER AREAS WITH SURFACE IMPERFECTIONS TO ISO 8501-3 PREPARATION GRADE P3.
83. STEEL TREATMENT PREPARATION TO BE AT LEAST GRADE P2 TO AS/NZS5131 UNO. MINIMUM SURFACE TREATMENT TO AS/NZS5131. COATING QUALITY LEVEL TO BE PC2 TO AS/NZS5131 UNO.
84. SURFACE PREPARATION: REMOVE OIL, GREASE AND OTHER CONTAMINANTS TO AS1627.1. ABRASIVE BLAST CLEAN TO AS1627.4 CLASS SA 2½ WITH SURFACE PROFILE 40 TO 70 MICRONS OR AS SPECIFIED BY COATINGS MANUFACTURER FOR THE SERVICE CONDITIONS. ASSESS ABRASIVE BLAST CLEANED SURFACE TO AS1627.9 AND SURFACE PROFILE TO AS3894.5. FOR SMALL AREAS WHERE ABRASIVE BLAST CLEANING IS NOT POSSIBLE OBTAIN APPROVAL FROM SUPERVISOR TO USE POWER TOOL CLEANING TO AS1627.2 CLASS ST 3 / PST 3 AS DEFINED IN ISO 8501.1 FOR STEEL CLEANED TO A METALLIC FINISH WITH MINIMUM 25 MICRON SURFACE PROFILE. REMOVE DUST BY BRUSHING OR VACUUM CLEANING.

85. APPLY PROTECTIVE COATINGS AS SOON AS PRACTICABLE AFTER PREPARATION, WITHIN FOUR HOURS AND BEFORE FLASH RUST OR RUST BLOOM APPEARS. APPLICATION OF PROTECTIVE COATINGS TO COMPLY WITH MANUFACTURER'S RECOMMENDATIONS.
86. COATING REPAIRS: REINSTATE COATING TO DAMAGED AREAS TO PROTECTIVE COATINGS SPECIFICATION. FIELD WELD REPAIRS: DO NOT WELD THROUGH EXISTING GALVANIZING OR COATINGS. REMOVE WELD SPLATTER, RESIDUAL FLUX etc BY CHIPPING, GRINDING OR ABRASIVE BLAST CLEANING. GRIND FLUSH ROUGH WELD BEADS. PREPARE SURFACE FOR PAINTING AS PER COATING SPECIFICATION. REMOVE RUST, LOOSE AND BURNT PAINT AND SUFFICIENT SOUND COATING SO PAINT EDGE IS FEATHERED AND SMOOTH. STRIPE COAT ALL WELDS, EDGES AND ROUGH SURFACES USING A BRUSH. REINSTATE COATING AS PER PROTECTIVE COATINGS SPECIFICATION.
87. UNLESS NOTED OTHERWISE ALL STEELWORK SHALL BE HOT DIPPED GALVANIZED TO AS/NZS4680, AS/NZS5131 AND AS1214 FOR FASTENERS. THICKNESS OF GALVANIZED COATINGS TO AS/NZS4680. ZINC IN GALVANIZING BATH TO BE NOT LESS THAN 98% PURE. BATH TEMPERATURE, TIME OF IMMERSION AND WITHDRAWAL SPEED TO BE AS REQUIRED TO ACHIEVE SPECIFIED COATING THICKNESS AND FINISH. ZINC COATING TO BE CONTINUOUS, ADHERENT, FREE FROM LUMPS, SPIKES, DAGS, RUNS, BLISTERS, ROUGHNESS, GRITTY AREAS, UNCOATED SPOTS, ACID AND BLACK SPOTS, DROSS, FLUX AND OTHER IMPERFECTIONS.
88. DO NOT USE HIGH STRENGTH LOW ALLOY STEELS CONTAINING HIGH SILICONE (>0.04% Si) THAT CAN PRODUCE THICKER AND / OR BRITTLE GALVANIZED COATINGS. REFER TO GALVANIZER FOR ACCEPTABLE STEEL COMPOSITIONS.
89. BUTT WELD END PLATES ON HOLLOW SECTIONS TO BE HOT DIPPED GALVANIZED IN LIEU OF FILLET WELD TO AVOID RISK OF CREVICE CORROSION. DO NOT USE A BACKING PLATE.
90. PASSIVATE GALVANIZED STEEL TO BE IN CONTACT WITH CONCRETE BY DIPPING IN 0.2% SODIUM DICHROMATE SOLUTION.
91. STRAIGHTEN MEMBERS DISTORTED DURING FABRICATION AND / OR GALVANIZING PROCESS USING AN APPROVED METHOD.
92. ANNEAL COLD WORKED ITEMS TO 650°C PRIOR TO GALVANIZING.
93. REPAIR DAMAGE TO GALVANIZED COATING TO AS/NZS4680 SECTION 8 –REPAIR AFTER GALVANIZING. USE ORGANIC TWO-PACK ZINC RICH EPOXY COATING COMPLYING WITH AS/NZS3750.9 APPLIED IN TWO COATS EACH 50 MICRON, MINIMUM TOTAL DRY FILM THICKNESS 100 MICRONS. DO NOT USE SPRAY CANS OF "COLD GALV" OR ZINC ALLOY SOLDER "STICKS". SURFACE PREPARATION OF EXPOSED BARE STEEL TO BE ABRASIVE BLAST CLEANED TO AS1627.4, CLASS 2½ (PREFERRED) OR POWER TOOL CLEANED TO AS1627.2 CLASS ST 3. LIGHTLY SWEEP BLAST GALVANIZED SURFACES.
94. PROVIDE DRILLED VENT / DRAIN HOLES AT TOP AND BOTTOM EXTREMITIES FOR HOLLOW SECTIONS TO BE HOT DIPPED GALVANIZED.
95. PROVIDE DRILLED SUSPENSION HOLES IN END PLATES, ETC FOR ITEMS TO BE HOT DIPPED GALVANIZED.
96. PRIOR TO DIPPING ADVISE SUPERINTENDENT OF ANY DESIGN FEATURES THAT MAY LEAD TO DIFFICULTIES DURING GALVANIZING AND SUBMIT DETAILS FOR IMPROVEMENT.
97. DO NOT PAINT GALVANIZED STEELWORK UNLESS SPECIFIED ON THE ENGINEERING DRAWINGS. ADVISE GALVANIZER OF ITEMS TO BE PAINTED AFTER GALVANIZING AND FINAL ZINC PASSIVATION IS TO BE OMITTED. PREPARE GALVANIZED SURFACES TO BE PAINTED AS PER AS/NZS4680 APPENDIX I AND APPLY PAINT IN THE WORKSHOP. COATING MANUFACTURER TO PROVIDE A 10 YEAR WARRANTY OF COATING SYSTEM.
98. PROTECTIVE COATINGS ARE TO BE SHOP APPLIED AND CURED IN WORKSHOP IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS UNLESS APPROVED OTHERWISE IN WRITING BY SUPERINTENDENT. PROTECTIVE COATINGS ARE TO BE SMOOTH, UNIFORM AND WITHOUT RUNS, BEADS, PINHOLES, SURFACE CRAZING OR OTHER IMPERFECTIONS.
99. PROTECT COATINGS FROM DAMAGE AND DETERIORATION DURING HANDLING, TRANSPORT, STORAGE AND ERECTION. REPAIR DAMAGE TO PROTECTIVE COATINGS TO REINSTATE INTEGRITY OF NOMINATED COATING IN ACCORDANCE WITH MANUFACTURERS' RECOMMENDATIONS AND SPECIFICATION. EDGES OF PATCH REPAIRS TO BE FEATHERED.
100. REFER SPECIFICATION FOR DECORATIVE COATINGS.
101. HOT DIP GALVANIZE FLOOR GRATING AND SUPPLY WITH EDGE TRIMMING BARS ALL ROUND UNO. SECURE GRATINGS TO STEELWORK WITH A PROPRIETARY CLAMPING SYSTEM INSTALLED IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS.

DELIVERABLES

102. SUBMIT NAMES AND CONTACT DETAILS OF PROPOSED FABRICATION AND INSTALLATION SUBCONTRACTORS.
103. SUBMIT SHOP DRAWINGS AND DESIGN CALCULATIONS; REFER GENERAL-DELIVERABLES NOTES. SHOP DRAWINGS AND DESIGN CALCULATIONS TO SHOW: ARRANGEMENT OF MEMBERS, MARKING PLAN, MEMBER SCHEDULE, LOCATION AND ORIENTATION OF MEMBERS IN BUILDING, REQUIRED CAMBER (WHERE APPLICABLE), RELEVANT DETAILS OF EACH ASSEMBLY, COMPONENT AND CONNECTION, DIMENSIONS OF ITEMS, LOADING PARAMETERS AND BRACING LENGTHS ASSUMED IN DESIGN, DESIGN STRESSES, STRENGTH OF MATERIALS, SIZE OF EACH MEMBER, TOLERANCES ON MEMBER SIZES, JOINT DETAILS, TRIMMERS, NOGGINGS etc, LIFTING POINTS, METHOD OF FIXING AND BRACING, DESIGN DEFLECTION, METHOD OF FABRICATION, SIZE AND SPECIFICATION OF CLEATS, BOLTS, SCREWS, WELD SIZES AND TYPES, EXTENTS AND LOCATIONS, WELD CATEGORIES (INCLUDING WHETHER FIELD OR SHOP WELDS) AND BOLTING CATEGORIES, WELD PROCEDURES (INCLUDING POST WELD HEAT TREATMENT), SURFACE PREPARATION METHODS AND PROTECTIVE COATING SYSTEM, VENT / DRAIN HOLES FOR HOT DIP GALVANIZING, PROPOSED JOINTS IN MEMBERS, TEMPORARY MEMBERS, BRACES AND FIXINGS, LOCATION OF FALL ARREST CONNECTIONS, FIXINGS FOR ADJOINING BUILDING ELEMENTS, BASE PLATE DETAILS, FIXINGS FOR PURLINS, GIRTS, LOCATION OF AND PREPARATION FOR SITE WELDS AND BRACING, METHOD OF HANDLING, TEMPORARY WORKS, ASSEMBLY, TRANSPORT AND ERECTION (INCLUDING TEMPORARY BRACING IF REQUIRED), PRECAMBER, etc.
104. PROVIDE DOCUMENTARY EVIDENCE (INCLUDING TEST RESULTS) OF COMPLIANCE WITH RELEVANT AUSTRALIAN STANDARDS ISSUED BY MANUFACTURER FOR ALL STEELWORK AND EACH BATCH OF FASTENERS USED. EVIDENCE MUST PROVIDE CLEAR VERIFICATION THAT PRODUCT MEETS RELEVANT AUSTRALIAN STANDARDS AND BE WRITTEN IN ENGLISH ALPHANUMERIC CHARACTERS. EVIDENCE TO INCLUDE: NAMES AND ADDRESSES OF MANUFACTURER, SUPPLIER AND TESTING AUTHORITY; TEST CERTIFICATE NUMBER AND DATE WITH PAGE NUMBER ON EACH PAGE; PRODUCT TESTING SPECIFICATION AND GRADE OF STEEL; PRODUCT DESIGNATION AND RELEVANT DIMENSIONS; PRODUCT STEEL MAKING PROCESS; LENGTH, BUNDLE, PACK OR UNIQUE IDENTIFIER TO WHICH CERTIFICATE APPLIES; HEAT NUMBER (FROM CASTING); MECHANICAL PROPERTIES FROM TENSILE TEST (ALL VALUES CITED IN AS/NZ STANDARD); WHETHER EACH MEASURED MECHANICAL PROPERTY COMPLIES WITH AS/NZS STANDARD; CHEMICAL ANALYSIS RESULTS AND TYPE OF ANALYSIS UNDERTAKEN; CUSTOMER PURCHASE ORDER TO MATCH BATCH NUMBER; ANY OTHER SYSTEM REFERENCE NUMBERS AND SIGNATURE OF AUTHENTICITY.

CONCRETE

CONCRETE MIX

1. WORKMANSHIP AND MATERIALS TO COMPLY WITH AS3600, AS2870, AS3610, AS1379, AS1478, AS3582, AS3799, AS2758.1, AS1500.5 AND AS3972. FOR LIQUID RETAINING STRUCTURES ALSO COMPLY WITH AS3735.
2. WET CONCRETE TO BE UNIFORM, DENSE, HOMOGENEOUS, COHESIVE AND ABLE TO WORK READILY INTO CORNERS AND AROUND REINFORCEMENT COMPLETELY FILLING FORMWORK WITHOUT SEGREGATION OF AGGREGATES AND / OR FIBRES, EXCESS FREE WATER ON SURFACE, LOSS OF MATERIAL, CONTAMINATION OR OTHER VISIBLE DEFECTS.
3. CONCRETE TO HAVE GOOD DIMENSIONAL STABILITY AND ABLE TO RESIST PLASTIC SETTLEMENT CRACKING, THERMAL CRACKING AND SHRINKAGE CRACKING.
4. FINISHED CONCRETE TO BE A DURABLE, DENSE, HOMOGENEOUS MASS COMPLETELY FILLING FORMWORK, EMBEDDING FIBRES, REINFORCEMENT AND TENDONS, AND FREE OF STONE POCKETS OR HONEYCOMBS, OF UNIFORM COLOUR AND TEXTURE, WITH LOW PERMEABILITY AND ADEQUATE BUT NOT EXCESSIVE STRENGTH FOR GRADE.
5. CONCRETE BLEED TO BE LESS THAN 3% FOR FLOOR AND ROOF SLABS, LESS THAN 2% FOR WALLS.
6. AIR ENTRAINMENT IS NOT PERMITTED UNLESS APPROVED IN WRITING BY SUPERINTENDENT.
7. REVIEW LOCATION OF EMBEDDED ITEMS TO MINIMISE POSSIBLE ZONES OF POOR COMPACTION THAT MAY COMPROMISE STRUCTURAL INTEGRITY.
8. EXTERNALLY EXPOSED CONCRETE TO BE CLASSIFICATION B1 UNO.

9. QUALITY OF CONCRETE ELEMENTS TO BE AS FOLLOWS:

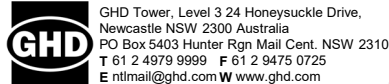
STRUCTURAL ELEMENT	BLINDING	PUMPSTATION	RESERVOIR AND VALVE PIT
EXPOSURE CLASSIFICATION	B1	A1	B1
STRENGTH GRADE (MPa)	N7	N32	S40
TRANSFER STRENGTH (MPa)	-	-	
MINIMUM DENSITY (kg/m ³)	-	2350	2350
MAX AGGREGATE SIZE (mm)	-	20	20
MAXIMUM / PEAK INSITU CONCRETE TEMPERATURE	-	65°C	65°C
CEMENT TYPE	GB	GB	GB
MINIMUM CEMENTITIOUS CONTENT (kg/m ³)	100	-	400
MAXIMUM CEMENTITIOUS CONTENT (kg/m ³)	-	-	460
SUPPLEMENTARY CEMENTITIOUS MATERIAL	-	-	MINIMUM 25% OF FLY ASH OR 50% SLAG
MAXIMUM WATER : CEMENTITIOUS RATIO	-	-	0.45
MAXIMUM 56 DAY DRYING SHRINKAGE (MICROSTRAIN)	-	-	650
REQUIRED SLUMP (mm)		80	80
REQUIRED ADDITIVES		SUPERPLASTICISER	SUPERPLASTICISER
PROJECT ASSESSMENT REQUIRED		YES	YES

10. CONCRETE DENOTED WITH STRENGTH GRADE PREFIX S, SUCH AS S40, IS REQUIRED TO HAVE HIGH DURABILITY. PROVIDE CONCRETE WITH:
 - AN AVERAGE COMPRESSIVE STRENGTH AT COMPLETION OF CURING NOT LESS THAN 75% OF SPECIFIED *f_c*.
 - A TOTAL REACTIVE ALKALI CONTENT NOT GREATER THAN 3.0 kg/m³ Na₂O (EQUIVALENT).
11. CONCRETE DENOTED WITH STRENGTH GRADE PREFIX S, SUCH AS S40, IS REQUIRED TO HAVE HIGH DURABILITY.
 - DO NOT USE METAL INSERTS WITHIN COVER CONCRETE INCLUDING METAL BAR CHAIRS.
 - DO NOT ALLOW CONCRETE TO FALL VERTICALLY WHEN PLACING, OR TO ENTRAP AIR IN ANY OTHER WAY.
 - PREVENT EVAPORATION OF WATER FROM CONCRETE SURFACES IMMEDIATELY AFTER LAYING.
 - MOIST CURE CONCRETE FOR A MINIMUM OF SEVEN DAYS.
12. SUPPLEMENTARY CEMENTITIOUS MATERIALS INCLUDE AMORPHOUS SILICA FUME, FLY ASH, AND GROUND GRANULATED BLAST FURNACE SLAG (GGFBS OR SLAG) COMPLYING WITH AS3582.
13. RHEOLOGY, WORKABILITY AND SLUMP TO BE AS REQUIRED FOR PLACEMENT (eg PUMPING, SPRAYING, CHUTE etc), COMPACTION AND FINISHING. USE SUPERPLASTICISERS AND HIGH RANGE WATER REDUCERS TO AS1478 TO ACHIEVE ADEQUATE WORKABILITY.
14. MAXIMUM ACID SOLUBLE CHLORIDE ION CONTENT OF CONCRETE IS 0.4 kg/m³ UNLESS SUPERINTENDENT GIVES WRITTEN APPROVAL TO USE 0.8 kg/m³ TO AS1379 CLAUSE 2.7.3. DO NOT USE STRONGLY IONISED SALTS, CHLORINE SALTS OR ADMIXTURES CONTAINING MORE THAN 0.1% BY WEIGHT ACID SOLUBLE CHLORIDE. DO NOT ADD SALTS TO CONCRETE UNLESS PROVEN THEY DO NOT ADVERSELY AFFECT DURABILITY.
15. MAXIMUM SULPHATE CONTENT (ACID SOLUBLE SO₃) TO BE LESS THAN 5% BY MASS OF TOTAL CEMENTITIOUS MATERIAL.
16. TOTAL REACTIVE ALKALI CONTENT IN CONCRETE TO BE LESS THAN 2.8 kg/m³ Na₂O_e (EQUIVALENT).

A 80% DETAIL DESIGN				
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CONCRETE (CON.T')

- USE CEMENTITIOUS MATERIALS LESS THAN SIX MONTHS OLD. USE BAGGED CEMENT IN ORDER OF RECEIPT.
- FOR GENERAL BLENDED CEMENT (GB) CONTAINING ORDINARY PORTLAND CEMENT PLUS AT LEAST 5% SUPPLEMENTARY CEMENTITIOUS MATERIALS:
 - SILICA FUME TO BE LESS THAN 10%, OR
 - FLYASH TO BE LESS THAN 25%, OR
 - GROUND GRANULATED BLAST FURNACE SLAG TO BE LESS THAN 40%.
 FOR DOUBLE BLENDED CEMENT TOTAL SUPPLEMENTARY CEMENTITIOUS MATERIAL MUST BE LESS THAN SMALLER OF PERCENTAGES GIVEN ABOVE FOR CONSTITUENTS INCLUDED. FOR TRIPLE BLENDED CEMENT TOTAL SUPPLEMENTARY CEMENTITIOUS MATERIAL MUST BE LESS THAN 40%. CEMENTS MAY BE BLENDED AT CEMENT PLANT OR CONCRETE BATCHING PLANT. OTHER COMBINATIONS OF CEMENTITIOUS CONTENT MAY BE SUBMITTED IN WRITING FOR APPROVAL.
- TEST FINE AND COARSE AGGREGATES FOR POTENTIAL AGGREGATE ALKALI REACTIVITY (AAR) USING CSIRO ACCELERATED MORTAR BAR TEST (REFER SAA HANDBOOK HB-69 APPENDIX B3.2). ALTERNATIVELY USE ASTM C1293 CONCRETE PRISM TEST. PETROGRAPHIC TESTING CAN PROVIDE ADDITIONAL AGGREGATE AAR RISK INFORMATION. TESTS MUST USE SAME CEMENT TYPE AS PROPOSED IN THE WORKS.
- SUPPLEMENTARY CEMENTITIOUS MATERIALS SPECIFIED IN TABLE ABOVE ARE IN ADDITION TO MATERIALS INCORPORATED IN GB CEMENT.
- ADMIXTURES TO COMPLY WITH AS1478. ADMIXTURES MUST NOT REDUCE STRENGTH OF CONCRETE BELOW SPECIFIED VALUE IN SHORT OR LONG TERM. ADMIXTURES MUST NOT CONTAIN CALCIUM CHLORIDE
- USE ADMIXTURES IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS. CONCRETE ADMIXTURES SHALL NOT CAUSE OR ACCELERATE CORROSION OF REINFORCEMENT, NOR BE DETRIMENTAL TO CONCRETE OR STEEL DURING EXPECTED LIFE OF STRUCTURE. DO NOT USE CHEMICAL ADMIXTURES OR OTHER MATERIALS WITHOUT SUPERINTENDENT'S WRITTEN APPROVAL.
- 22.DO NOT ADD WATER TO CONCRETE AFTER TRUCK HAS LEFT BATCHING PLANT.
- MIX CONCRETE TO ENSURE UNIFORM DISTRIBUTION OF CONSTITUENTS.

CONCRETE TESTING

- TEST SLUMP OF EACH BATCH OF CONCRETE DELIVERED BEFORE PLACING CONCRETE FROM THAT DELIVERY. SLUMP MEASURED TO BE NO GREATER THAN TARGET SLUMP WITHIN TOLERANCES GIVEN IN AS1379 CLAUSE 5.2.3. CONCRETE OUTSIDE SLUMP TOLERANCE LIMITS IS LIABLE TO REJECTION. PROVIDE RECORDS OF ALL SLUMP TESTS.
- REGISTER PROJECT FOR DISSEMINATION OF CONCRETE PRODUCTION ASSESSMENT INFORMATION. MANUFACTURER TO CARRY OUT PRODUCTION ASSESSMENT OF CONCRETE FOR COMPLIANCE WITH REQUIREMENTS OF AS1379.
- CARRY OUT PROJECT ASSESSMENT OF CONCRETE TO AS1379 CLAUSE 6.4 AND 6.5. TAKE SAMPLES AT PROJECT SITE AT POINT OF DISCHARGE FROM AGITATOR. SPREAD SAMPLING EVENLY THROUGH POUR. SAMPLE CONCRETE FOR PROJECT ASSESSMENT CONCURRENTLY WITH EACH SAMPLE TAKEN FOR PRODUCTION ASSESSMENT AT PROJECT SITE. FOR EACH CONCRETE DESIGN MIX TAKE ONE SAMPLE FROM EACH 25 m³ OF CONCRETE DELIVERED PER DAY, NOT LESS THAN FIVE SAMPLES TOTAL FOR EACH MIX DESIGN. EACH SAMPLE TO COMPRISE THREE CYLINDERS: TEST ONE AT 7 DAYS AND TWO AT 28 DAYS. TAKE ADDITIONAL SAMPLES OF SPRAYED CONCRETE FOR TESTING AT EARLIER AGE.
- NOTIFY SUPERINTENDENT WITHIN 2 WORKING DAYS IF 7-DAY CONCRETE TEST RESULTS INDICATE 28 DAY STRENGTHS ARE LIKELY TO BE BELOW SPECIFIED STRENGTH.
- FOR TYPE LH CEMENT EACH SAMPLE TO COMPRISE FOUR CYLINDERS: TEST ONE AT 7 DAYS AND TWO AT 28 DAS AND ONE AT 56 DAYS.
- CARRY OUT DRYING SHRINKAGE TESTING TO AS1012.13. FOR EACH CONCRETE DESIGN MIX TAKE ONE SAMPLE EVERY THREE MONTHS, OR FOR EVERY 1000 m³ OF CONCRETE PLACED, MINIMUM OF ONE SAMPLE. EACH SAMPLE TO COMPRISE THREE SPECIMENS. SAMPLE CONCRETE AT PROJECT SITE, DIRECTLY FROM DELIVERY VEHICLE. BASE ASSESSMENT ON AVERAGE OF THREE TEST RESULTS.
- CONCRETE SAMPLING AND TESTING TO BE BY AN APPROVED INDEPENDENT NATA REGISTERED LABORATORY.

FORMWORK

- RESPONSIBILITY FOR DESIGN, CERTIFICATION, CONSTRUCTION AND PERFORMANCE OF FORMWORK AND FALSEWORK LIES WITH CONTRACTOR.
- FORMWORK TO BE DESIGNED BY A SUITABLY QUALIFIED CHARTERED ENGINEER TO AS3600 AND AS3610, AND INDEPENDENTLY CERTIFIED BY A CHARTERED ENGINEER EXPERIENCED IN FORMWORK DESIGN. PROVIDE COPY OF DESIGN CALCULATIONS AND CERTIFICATION TO SUPERINTENDENT. DESIGN FORMWORK TO ACCOMMODATE DIMENSIONAL CHANGES AND MOVEMENTS RESULTING FROM IMPOSED ACTIONS, CONCRETE SHRINKAGE AND CREEP, TEMPERATURE CHANGES, PRESTRESSING FORCES, etc.
- FORMWORK TO BE MORTAR-TIGHT AND HAVE SUFFICIENT RIGIDITY TO PREVENT DISTORTION OR WARPING UNDER PRESSURE OF WET CONCRETE AND OTHER CONSTRUCTION LOADS, PARTICULARLY AT EDGES AND JOINTS.
- FORMWORK TO BE FREE OF DEFECTS THAT MIGHT AFFECT FINISHED CONCRETE SURFACE OR INTEGRITY OF THE STRUCTURE.
- FORMWORK MUST BE ABLE TO BE REMOVED WITHOUT CRACKING, DAMAGING, HAMMERING OR JARRING THE CONCRETE.
- PROVIDE BEAMS WITH AN UPWARDS PRECAMBER AS SHOWN ON DRAWINGS.

- DO NOT SUPPORT OR RESTRAIN FORMWORK ON PERMANENT WORKS OR REINFORCEMENT WITHOUT SUPERINTENDENT'S WRITTEN APPROVAL.
- CONSTRUCT FORMWORK TO COMPLY WITH AS3610 AND CLAUSE 17.6 OF AS3600 WHERE THIS IS MORE STRINGENT SO CONCRETE WILL HAVE LEVELS, DIMENSIONS, CONTOURS, SHAPE, LOCATION AND FINISH SPECIFIED.
- PROVIDE OPENINGS OR REMOVABLE PANELS IN FORMWORK FOR INSPECTION AND CLEANING.
- APPLY RELEASE AGENT COMPATIBLE WITH CONTACT SURFACES TO INTERIOR OF FORMWORK (EXCEPT WHERE CONCRETE IS TO RECEIVE AN APPLIED FINISH OR COATING FOR WHICH THERE IS NO COMPATIBLE RELEASE AGENT). WHERE NECESSARY CLEAN REINFORCEMENT TO REMOVE TRACES OF RELEASE AGENT.
- SEAL JOINTS BETWEEN FORMWORK PANELS, AND TO HARDENED CONCRETE WITH A FLEXIBLE RUBBER STRIP. SET OUT FORMWORK TO GIVE A REGULAR ARRANGEMENT OF PANELS, JOINTS, BOLT HOLES AND SIMILAR VISIBLE ELEMENTS IN FORMED SURFACE.
- DO NOT USE FORMWORK HARDWARE THAT FORMS A COMPLETE HOLE THROUGH CONCRETE ELEMENTS. DO NOT USE REINFORCEMENT TO SUPPORT FORMWORK.
- PROVIDE HOLES IN REBATE FORMERS, etc. AS REQUIRED TO PREVENT AIR ENTRAPMENT.
- CARDBOARD VOID FORMER: USE VOID FORMER THAT WILL NOT DEFLECT DURING CONCRETE PLACING AND COMPACTION OR DURING SETTING PERIOD, BUT WILL COLLAPSE RESULTING IN LOSS OF LOAD CARRYING CAPACITY NOT MORE THAN 48 HOURS AFTER FLOODING WITH WATER. KEEP VOID FORMERS DRY UNTIL CONCRETE IS PLACED.
- DO NOT STRIP FORMWORK PRIOR TO 36 HOURS AFTER PLACEMENT.
- DO NOT STRIP FORMWORK UNTIL CONCRETE HAS HARDENED SUFFICIENTLY TO WITHSTAND MOVEMENT AND FORM REMOVAL WITHOUT DAMAGE AND CONCRETE STRENGTH IS AT LEAST 75% OF SPECIFIED f_c. MINIMUM STRIPPING TIMES TO BE AS PER AS3610 TABLE 5.4.1.
- STRIP FORMWORK TO AS3600 CLAUSE 17.6.
- REMOVE FORM TIE BOLTS WITHOUT DAMAGING CONCRETE. PARTS OF BOLTS LEFT IN CONCRETE MUST NOT INTRUDE INTO COVER CONCRETE. FLUSH FILL HOLES USING APPROVED PROPRIETARY PRE-MIXED NON-SHRINK CEMENTITIOUS REPAIR MORTAR MATCHING CONCRETE SURFACE COLOUR, STRENGTH AND DURABILITY AND ADEQUATE BOND. SUBMIT DETAILS OF PROPOSED REPAIR METHODS TO SUPERINTENDENT FOR APPROVAL.
- CONSTRUCTION TOLERANCES TO BE TO AS3610.

PLACING CONCRETE

- FORMWORK, REINFORCEMENT AND COVER, DOWELS, WATERSTOPS, CAST-IN ITEMS etc TO BE INSPECTED AND APPROVED BY SUITABLY QUALIFIED STRUCTURAL ENGINEER / SUPERINTENDENT / BUILDING SURVEYOR BEFORE CONCRETE IS PLACED.
- REMOVE FREE WATER, DUST AND DEBRIS, STAINS etc FROM FORMS, EXCAVATIONS etc BEFORE PLACING CONCRETE. IN HOT CONDITIONS DAMPEN FORMWORK AND / OR SUB-GRADE BEFORE PLACING CONCRETE.
- INSTALL 0.2 mm HIGH IMPACT RESISTANT VIRGIN POLYETHYLENE FILM DAMP PROOF MEMBRANE TO AS2870 TO BASE TO RETAIN WATER IN FRESH CONCRETE.
- PLACE CONCRETE IN LAYERS LESS THAN 300 mm THICK FOR FIRST LAYER AND 75% OF IMMERSION VIBRATOR LENGTH FOR SUBSEQUENT LAYERS, AND VIBRATE EACH LAYER BEFORE PLACING NEXT.
- ELAPSED TIME BETWEEN WETTING OF MIX AND DISCHARGE OF CONCRETE AT SITE MUST BE AS SHORT AS POSSIBLE, AND MUST NOT EXCEED LIMITS GIVEN WITHOUT SUPERINTENDENT'S PRIOR WRITTEN CONSENT.

CONCRETE TEMPERATURE AT TIME OF DISCHARGE (°C)	MAXIMUM ELAPSED TIME (HOURS)
10-32	1.50
> 32	NOT ACCEPTABLE

- ELAPSED TIME LIMITS MAY BE VARIED IF TRIALS DEMONSTRATE USE OF SET RETARDERS (TYPE Re OR WRRe TO AS1478) PROVIDE ADEQUATE RETENTION OF WORKABILITY FOR LONGER PERIODS AT REQUIRED TEMPERATURE. SLUMP LIMITS STILL APPLY. RE-TEMPERING BEYOND MAXIMUM ALLOWED DISCHARGE TIME USING WATER OR ADMIXTURES IS NOT ALLOWED.
- USE PLACEMENT METHODS THAT WILL MINIMISE PLASTIC SETTLEMENT AND SHRINKAGE CRACKING. LIMIT VERTICAL FREE FALL BY USE OF CHUTES, etc. KEEP CHUTES VERTICAL, FULL AND IMMERSED IN CONCRETE. PLACE CONCRETE IN LAYERS AND BLEND SUCCEEDING LAYERS BY COMPACTION. MAINTAIN CONCRETE EDGE IN A PLASTIC STATE. PROPERLY COMPACT CONCRETE USING MECHANICAL VIBRATORS (AND HAND METHODS IF REQUIRED AND APPROVED BY SUPERINTENDENT) TO REMOVE AIR BUBBLES AND GIVE MAXIMUM COMPACTION WITHOUT SEGREGATION OF CONCRETE. TAKE CARE TO AVOID CONTACT BETWEEN VIBRATORS AND PARTIALLY HARDENED CONCRETE, FORMWORK OR REINFORCEMENT. DO NOT USE VIBRATORS TO MOVE CONCRETE ALONG FORMS.
- PROVIDE AT LEAST ONE WORKING VIBRATOR FOR EVERY 7.5 CUBIC METRES OF CONCRETE PLACED PER HOUR, TWO MINIMUM.
- DO NOT DISTURB CONCRETE ONCE INITIAL SET HAS OCCURRED.
- OBTAIN SUPERINTENDENT'S WRITTEN APPROVAL OF PLACEMENT METHODS FOR CONCRETE ELEMENTS GREATER THAN 1500 mm HEIGHT.
- KEEP ON SITE A LOGBOOK RECORDING EACH PLACEMENT OF CONCRETE INCLUDING DATE, CLIMATIC CONDITIONS, PORTION OF WORK, SPECIFIED GRADE AND SOURCE OF CONCRETE, DELIVERY DOCKET DATA, METHODS OF PLACEMENT AND COMPACTION, PROJECT ASSESSMENT CARRIED OUT, SLUMP MEASUREMENTS, VOLUME AND OTHER NOTABLE MATTERS THAT MAY AFFECT PERFORMANCE OF CONCRETE.

- IN COLD WEATHER MAINTAIN TEMPERATURE OF FRESHLY MIXED CONCRETE WITHIN LIMITS SHOWN BELOW. "OUTDOOR" AIR TEMPERATURE IS AIR TEMPERATURE AT TIME OF MIXING OR PREDICTED OR LIKELY AIR TEMPERATURE DURING NEXT 48 HOURS. BEFORE AND WHILE PLACING CONCRETE MAINTAIN TEMPERATURE OF FORMWORK AND REINFORCEMENT AT > 5°C. DO NOT USE CALCIUM CHLORIDE TO ACCELERATE SETTING TIME. DO NOT USE SALTS, CHEMICALS OR OTHER MATERIAL IN MIX TO LOWER THE FREEZING POINT OF CONCRETE. DO NOT ALLOW FROZEN MATERIALS TO ENTER MIXER. EVALUATE THE NEED FOR INSULATION OF CONCRETE SURFACES. DO NOT USE HIGH ALUMINA CEMENT.
- KEEP FORMS, MATERIALS, EQUIPMENT IN CONTACT WITH CONCRETE FREE OF FROST AND ICE. HEAT CONCRETE MATERIALS (OTHER THAN CEMENT) TO MINIMUM TEMPERATURE NECESSARY TO ENSURE TEMPERATURE OF PLACED CONCRETE IS WITHIN LIMITS SPECIFIED. MAXIMUM WATER TEMPERATURE: 60°C WHEN PLACED IN MIXER.

OUTDOOR AIR TEMPERATURE	TEMPERATURE OF CONCRETE	
	MINIMUM	MAXIMUM
> 5°C	10°C	32°C
< 5°C	18°C	32°C

- IN HOT WEATHER PREVENT PREMATURE STIFFENING OF FRESH CONCRETE; REDUCE WATER ABSORPTION AND EVAPORATION LOSSES. MIX, TRANSPORT, PLACE AND COMPACT CONCRETE AS QUICKLY AS POSSIBLE. DURING PLACEMENT TEMPERATURE OF CONCRETE MUST NOT EXCEED TEMPERATURES BELOW:

CONCRETE ELEMENT	TEMPERATURE LIMIT
UNREINFORCED CONCRETE IN SECTIONS ≥ 1 METRE EACH DIMENSION,	27°C
CONCRETE F _c ≥ 40 MPA IN SECTIONS ≥ 500 MM THICKNESS	27°C
CONCRETE F _c ≥ 40 MPA IN SECTIONS ≥ 500 MM THICKNESS	32°C
ELSEWHERE	32°C

DO NOT MIX CONCRETE WHEN SURROUNDING OUTDOOR SHADE TEMPERATURE ≥ 38°C. MAINTAIN TEMPERATURE OF FORMWORK AND REINFORCEMENT AT ≥ 32°C BEFORE AND DURING PLACING. COOL REINFORCEMENT AND FORMWORK AS REQUIRED. MAINTAIN SPECIFIED TEMPERATURE OF PLACED CONCRETE BY:

- PLACING CONCRETE WHEN AMBIENT TEMPERATURE IS LOW (AT NIGHT)
 - COOL CONCRETE USING LIQUID NITROGEN INJECTION BEFORE PLACING, OR
 - COVER CONTAINER IN WHICH CONCRETE IS TRANSPORTED TO FORMS, OR
 - SHADING AND SPRAYING COARSE AGGREGATE USING COLD WATER, OR
 - USE CHILLED MIXING WATER
- FOR CONCRETE ELEMENTS GREATER THAN 500 mm THICK THAT MAY EXCEED THE MAXIMUM PEAK TEMPERATURE, OR MAXIMUM TEMPERATURE DIFFERENTIAL, OR ARE LIQUID RETAINING OR LIQUID EXCLUDING: UNDERTAKE A CONCRETE EARLY AGE THERMAL / RESTRAINT AND SHRINKAGE CRACK RISK ASSESSMENT (ie WILL CRACKS FORM AND WHAT WIDTH) AND SUBMIT TO SUPERINTENDENT FOR APPROVAL AT LEAST FOUR WEEKS PRIOR TO DELIVERY OF CONCRETE. ASSESSMENT TO ALLOW FOR: CEMENT TYPE AND CONTENT, METHOD OF CONSTRUCTION, ELEMENT TYPE (PILE CAP, PIER, BEAM, FLOOR, ROOF etc), RESTRAINT BY PRIOR CAST CONCRETE, CONCRETE SHRINKAGE AND STRAIN, REINFORCEMENT RATIOS, BAR DIAMETER AND SPACING, CONCRETE THICKNESS, WIDTH AND LENGTH, TEMPERATURE OF ADJACENT CONCRETE, ENVIRONMENTAL CONDITIONS, TIME OF YEAR, TIME OF DAY, CONCRETE CASTING TEMPERATURE, CONCRETE SURFACE INSULATION, FORMWORK STRIPPING TIME, AND ALL OTHER MATTERS INFLUENCING CONCRETE TEMPERATURE AND RESTRAINT.
 - PROTECT FRESH CONCRETE FROM PREMATURE DRYING (PARTICULARLY IN HOT, WINDY OR DRY CONDITIONS), EXCESSIVELY HOT OR COLD TEMPERATURES, SUN, RAIN, FROST, SNOW etc. PROVIDE WIND BREAKS. MAINTAIN CONCRETE AT A REASONABLY CONSTANT TEMPERATURE WITH MINIMUM MOISTURE LOSS FOR CURING PERIOD.
 - FOR CONCRETE WITH WATER:CEMENT RATIO LESS THAN 0.5, IN HOT, WINDY OR DRY (LOW HUMIDITY) CONDITIONS SPRAY EXPOSED SURFACES OF FRESH CONCRETE WITH FOG SPRAY APPLICATION OF ALIPHATIC ALCOHOL RETARDANT IMMEDIATELY AFTER PLACEMENT TO REDUCE RISK OF PLASTIC SHRINKAGE CRACKING. IN SEVERE CLIMATIC CONDITIONS CONSIDER RE-VIBRATING CONCRETE BEFORE IT REACHES INITIAL SET.

- COMMENCE CURING OF CONCRETE TO AS3600 AS SOON AS POSSIBLE AFTER PLACING AND FINISHING OR STRIPPING, AND WITHIN ONE HOUR. ENSURE EXPOSED SURFACES ARE NOT STAINED. ACCEPTABLE METHODS OF CURING INCLUDE:
 - RETENTION OF FORMWORK
 - PONDING OR CONTINUOUS SPRINKLING WITH WATER (MOIST CURING)
 - AN IMPERMEABLE MEMBRANE (USE CLEAR, WHITE OR LIGHT-COLOURED PLASTIC IN HOT CONDITIONS) SEALED AROUND EDGES
 - AN ABSORPTIVE COVER KEPT CONTINUOUSLY WET AND COVERED BY IMPERMEABLE MEMBRANE
 - STEAM CURING
 - AN APPROVED CURING COMPOUND MAINTAINED INTACT (RESPRAY ANY DAMAGED AREAS). PROVIDE:
 - WAX-BASED (CLASS A), RESIN-BASED (CLASS B), OR WATER-BORNE (CLASS Z) CURING COMPOUND TO AS3799
 - EFFICIENCY INDEX MINIMUM 90%
 - CERTIFIED TEST RESULTS FOR WATER RETENTION TO AS3799 APPENDIX B
 - EVIDENCE THAT AN ACCEPTABLE FINAL SURFACE COLOUR WILL BE OBTAINED
 - EVIDENCE OF COMPATIBILITY WITH CONCRETE AND APPLIED FINISHES (IF ANY)
 - METHODS OF OBTAINING REQUIRED ADHESION FOR TOPPING, RENDER etc.
 - UNIFORM CONTINUOUS FLEXIBLE COATING WITHOUT VISIBLE BREAKS OR PINHOLES, WHICH REMAINS UNBROKEN FOR AT LEAST THE CURING PERIOD AFTER APPLICATION.
- DO NOT USE WAX-BASED OR CHLORINATED RUBBER-BASED CURING COMPOUNDS ON CONSTRUCTION JOINTS, SURFACES FORMING SUBSTRATES TO APPLIED FINISHES, CONCRETE TOPPING AND CEMENT BASED RENDER.
- CURE CONTINUOUSLY UNTIL NUMBER OF DAYS DURING WHICH AIR TEMPERATURE IS ABOVE 10°C TOTALS:
 - 3 DAYS FOR EXPOSURES CLASSIFICATION A1 AND A2
 - 7 DAYS FOR EXPOSURE CLASSIFICATION B1, B2 AND C
 - 14 DAYS FOR MIXES CONTAINING GB CEMENT AND SUPPLEMENTARY CEMENTITIOUS MATERIALS.
- PREVENT RAPID DRYING OUT AT END OF CURING PERIOD.
- FINISH CONCRETE SURFACES TO AS3610 AND AS SHOWN BELOW:
 - FORMED SURFACES:
 - EXPOSED SURFACES 2C
 - HIDDEN SURFACES 5
 - FINISHES AS LAID:
 - EXPOSED SURFACES STEEL TROWEL UNO
 - HIDDEN SURFACES WOOD FLOAT
- STEEL TROWEL FINISH: AFTER MACHINE FLOATING, USE POWER TROWELS TO PRODUCE SMOOTH SURFACES FREE OF DEFECTS. WHEN SURFACE HAS HARDENED SUFFICIENTLY, USE STEEL HAND TROWELS TO PRODUCE FINAL CONSOLIDATED FINISH FREE OF TROWEL MARKS, OF UNIFORM IN TEXTURE AND APPEARANCE, MAXIMUM DEVIATION FROM 3 m STRAIGHT EDGE IS LESS THAN 3 mm.
- INSTALL BRITTLE FINISHES (eg TILES etc), JOINT FILLERS AND SEALANTS A MINIMUM OF 3 MONTHS AFTER CASTING CONCRETE. USE A FLEXIBLE TILE GROUT AND WEAK TILE MORTAR.
- BEAM SIZES ARE DESIGNATED DEPTH (INCLUDING SLAB, IF ANY) x WIDTH. PLACE CONCRETE IN SLABS AT SAME TIME AS BEAMS INTEGRAL WITH THEM. SIZES OF CONCRETE ELEMENTS DO NOT INCLUDE THICKNESS OF APPLIED FINISHES OR BLINDING.
- PROVIDE EXPOSED EDGES AND RE-ENTRANT CORNERS WITH 45 DEGREES x 25 mm CHAMFERS OR FILLETS UNO
- PROVIDE AN UPWARDS PRECAMBER AS SHOWN ON DRAWINGS.
- DO NOT MAKE HOLES, PENETRATIONS, RECESSES, CHASES, NOR EMBED PIPES (OTHER THAN THOSE SHOWN ON STRUCTURAL DRAWINGS) WITHOUT APPROVAL OF SUPERINTENDENT. DO NOT PLACE CONDUITS, PIPES etc WITHIN COVER CONCRETE. LOCATE CONDUITS, PIPES etc ONLY IN MIDDLE THIRD OF SLAB OR BEAM DEPTH AND BETWEEN REINFORCEMENT LAYERS, SPACED AT 3 x PIPE / CONDUIT DIAMETER CENTRES MINIMUM. DO NOT CUT REINFORCEMENT AT PENETRATIONS WITHOUT APPROVAL
- PROVIDE DRIP GROOVES IN SOFFIT OF BEAMS AND SLABS AT EXTERNAL PERIMETER OF STRUCTURES. ENSURE COVER TO REINFORCEMENT IS ACHIEVED.
- REMOVE PROPS AND FORMWORK FOR BEAMS AND SLABS AND ENSURE CONCRETE HAS GAINED ADEQUATE STRENGTH BEFORE CONSTRUCTING WALLS OR PLACING OTHER PERMANENT LOADING ON WORK.
- WHERE CONCRETE BEARS ON LOAD BEARING MASONRY AND BRICKWORK, TROWEL SMOOTH AND FLAT A 5 mm THICK LAYER OF MORTAR AND SEPARATE CONCRETE THERE FROM WITH TWO LAYERS OF "SUPER ALCOR".

JOINTS

- FORM CONSTRUCTION JOINTS AND USE ONLY WHERE SHOWN OR WHERE APPROVED BY SUPERINTENDENT. CONSTRUCTION JOINTS IN SLABS TO BE VERTICAL, STRAIGHT AND TRUE. TO ACHIEVE ADEQUATE BOND ENSURE ENTIRE SURFACE IS CLEAN, FREE OF LAITANCE AND BLEMISHES, AND INTENTIONALLY ROUGHENED TO A FULL AMPLITUDE OF NOT LESS THAN 5 mm WITH COARSE AGGREGATE EXPOSED. DAMPEN EXISTING CONCRETE PRIOR TO PLACING ADJACENT FRESH CONCRETE.
- IF CONSTRUCTION JOINTS PROPOSED OTHER THAN WHERE SHOWN, PROVIDE PROPOSED LOCATIONS FOR SUPERINTENDENT'S APPROVAL AT LEAST 7 DAYS PRIOR TO CONSTRUCTION.
- PROVIDE JOINTING MATERIALS COMPATIBLE WHEN USED TOGETHER, AND NON-STAINING TO CONCRETE IN VISIBLE LOCATIONS.
- PROVIDE DETAILS OF CONSTRUCTION JOINTS FOR SUPERINTENDENT'S APPROVAL AT LEAST 7 DAYS PRIOR TO CONSTRUCTION.
- INSTALL WATERSTOPS ONTO SMOOTH CONCRETE SURFACE. DO NOT SCABBLE CONCRETE BENEATH WATERSTOPS.

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CONCRETE (CON.T')

- 86. SUBMIT PROPOSALS FOR CUTTING OR CORING HARDENED CONCRETE OR SAW CUT JOINTS, INCLUDING SPACING, LAYOUT, METHODS, TIMING AND SEQUENCE AT LEAST 7 DAYS BEFORE UNDERTAKING WORKS.
- 87. SAW CUT CRACK CONTROL JOINTS AS SOON AFTER CASTING AS PRACTICABLE TO AVOID SPALLING OR RAVELLING OF JOINT EDGES, AND WITHIN 16 HOURS OF CASTING TO PREVENT THERMAL AND / OR SHRINKAGE CRACKING OF SLAB. IMMEDIATELY AFTER SAW CUTTING FLUSH OUT JOINTS TO REMOVE SAWING RESIDUE AND INSERT A TEMPORARY FOAMED PLASTIC BEAD TO KEEP JOINT CLEAN PRIOR TO FILLING OR SEALING. PROTECT SAW CUTS FROM WHEEL LOADS FOR AT LEAST TWO WEEKS AFTER CUTTING.
- 88. DO NOT INSTALL SEALANTS IF EXPECTED MAXIMUM DAILY TEMPERATURE EXCEEDS 30 DEGREES C. ENSURE RECESSES ARE CLEAN AND DRY PRIOR TO INSTALLING FILLERS OR SEALANTS, AND PREPARE IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS. TOLERANCE ON SEALANT WIDTHS +5, -0 mm.

REINFORCEMENT

- 89. COVER IS CLEAR DISTANCE BETWEEN ANY REINFORCEMENT (INCLUDING LIGATURES, TIE WIRE etc) AND OUTSIDE SURFACE OF STRUCTURAL CONCRETE.
- 90. COVER MUST NOT BE LESS THAN SPECIFIED. PROVIDE MINIMUM CLEAR COVER TO REINFORCEMENT AS SHOWN BELOW, EXCEPT WHERE SPECIFIED OTHERWISE:

LOCATION	COVER (mm)
FOOTINGS, UNDERSIDE SLABS ON GROUND, etc CAST AGAINST MEMBRANE ON GROUND OR BLINDING	40
BEAMS, SLABS - EXTERIOR	30
BEAMS, SLABS - INTERIOR	30
TOP OF SLAB - INTERIOR	30
ELSEWHERE	50
RESERVOIR WALLS - INTERNAL	50
RESERVOIR WALLS - EXTERNAL	40
RESERVOIR FOOTINGS AND SLAB	50

COVER GIVEN IS ONLY FOR CONCRETE CAST AGAINST FORMWORK OR CONCRETE BLINDING UNO. REQUEST REQUIRED COVER DIMENSION FROM SUPERINTENDENT WHERE CONCRETE IS CAST AGAINST GROUND OR A FLEXIBLE MEMBRANE ON GROUND. CONCRETE THICKNESSES MAY BE INCREASED.

- 91. TOLERANCE ON COVER TO BE TO AS5100.5 CLAUSE 4.10.3.1
- 92. PROVIDE 50 mm BLINDING CONCRETE UNDER STRUCTURAL REINFORCED CONCRETE CAST ON GROUND UNO.

DELIVERABLES

- 93. SUBMIT NAMES AND CONTACT DETAILS OF PROPOSED CONCRETE SUBCONTRACTORS, INCLUDING SPRAYED CONCRETE SUB-CONTRACTORS.
- 94. AT LEAST ONE WEEK PRIOR TO CONCRETE PLACEMENT SUBMIT DETAILS OF PROPOSED READY MIXED CONCRETE SUPPLIER, NAME OF CONCRETE DELIVERY SUPERVISOR, LOCATION OF BATCHING PLANT, CONCRETE MIX DESIGNS, METHOD OF CONCRETE TEMPERATURE CONTROL, MIXING, HANDLING, TRANSPORT, PUMPING, PLACEMENT / SPRAYING, COMPACTION, FINISHING, PROTECTION AND CURING, SEQUENCE AND TIMES FOR CONCRETE POURS, CONSTRUCTION JOINT LOCATIONS AT LEAST ONE WEEK PRIOR TO DELIVERY OF CONCRETE FOR SUPERINTENDENT'S APPROVAL. NOMINATE FOR EACH MIX DESIGN THE SOURCE, TYPE AND PROPORTIONS OF CONSTITUENTS, AGGREGATE GRADINGS AND SATURATED SURFACE-DRY DENSITIES, ADDITIVES AND ADMIXTURES, DESIGN WATER CONTENT AND MAXIMUM WATER:CEMENT RATIO, TARGET SLUMP, TARGET CHARACTERISTIC STRENGTH (f_c), BLEED PROPERTIES AND TARGET DRYING SHRINKAGE.
- 95. PROVIDE DOCUMENTARY EVIDENCE OF PREVIOUS PERFORMANCE AND RELEVANT TEST RESULTS OF MIX DESIGN TARGETS, INCLUDING ONE HOUR, THREE HOUR, 1, 3, 7 AND 28 DAY COMPRESSIVE STRENGTHS FOR SPRAYED CONCRETE, AND 3, 7 AND 28 DAY COMPRESSIVE STRENGTHS FOR OTHER CONCRETE MIXES. CHARACTERISTIC STRENGTH, BATCHED MIX CONTENTS VERSUS MIX DESIGN, MEASURED SLUMP, BLEED, AIR CONTENT, PLACEMENT TEMPERATURE AND ADIABATIC TEMPERATURE RISE, DRYING SHRINKAGE, LIMITS OF SOLUBLE SALTS, CHLORIDE AND SULPHATE CONTENTS, AND ALKALI AGGREGATE REACTIVITY OF FINE AND COARSE AGGREGATES etc. BEING CERTIFIED TEST RESULTS MADE ON AT LEAST TWO SEPARATE SAMPLES FROM A NATA REGISTERED LABORATORY EITHER:
 - ON CONCRETE OF SAME MIX DESIGN (IN RESPECT OF ALL DETAILS TO BE NOMINATED ABOVE) OF SAME GRADE MADE UNDER PRODUCTION CONDITIONS IN SAME PLANT WITHIN LAST SIX MONTHS, OR
 - ON TESTS FROM LABORATORY OR PLANT TRIALS OF PROPOSED MIX

- 96. USE READY MIXED CONCRETE MIXED BY BATCH PRODUCTION PROCESS DELIVERED IN AGITATING TRUCKS. FOR EACH BATCH SUPPLY A DOCKET LISTING INFORMATION REQUIRED BY AS1379 CLAUSE 1.7.3 AND FOLLOWING:
 - SERIAL NUMBER OF IDENTIFICATION CERTIFICATES OF EACH BATCH
 - TIME OF BATCHING
 - NAME OF CONCRETE DELIVERY SUPERVISOR
 - ELEMENT FOR WHICH CONCRETE WAS ORDERED AND WHERE IT WAS PLACED
 - METHOD OF PLACEMENT AND CLIMATIC CONDITIONS DURING POUR
 - PROJECT ASSESSMENT CARRIED OUT
 - TOTAL AMOUNT OF WATER REQUIRED BY MIX DESIGN
 - ADMIXTURES TYPE AND QUANTITY
 - ADDITIVES TYPE AND QUANTITY
 - TOTAL AMOUNT OF WATER ADDED AT PLANT
 - TOTAL WATER ADDED AFTER LEAVING BATCHING PLANT
 - TOTAL FREE WATER IN CONCRETE.
 SUPERINTENDENT MAY NOT REQUIRE CONCRETE TRIAL MIX TESTS SUBJECT TO REVIEW OF PRODUCTION TEST RESULTS.
- 97. SUBMIT DETAILS OF ALL PROPOSED CONCRETE COATINGS TO SUPERINTENDENT FOR REVIEW.
- 98. PROVIDE RECORD OF SLUMP TESTING TO SUPERINTENDENT. REFER CONCRETE TESTING NOTES.
- 99. FORWARD CONCRETE PRODUCTION ASSESSMENT INFORMATION TO SUPERINTENDENT AS PER AS1379 CLAUSE 6.4 WHEN PRODUCTION ASSESSMENT IS UNDERTAKEN. REFER CONCRETE TESTING NOTES.
- 100. FORWARD CONCRETE PROJECT ASSESSMENT INFORMATION TO SUPERINTENDENT AS PER AS1379 CLAUSE 6.3 WHEN PROJECT ASSESSMENT IS UNDERTAKEN. REFER CONCRETE TESTING NOTES.
- 101. REPORT DRYING SHRINKAGE TESTING RESULTS TO SUPERINTENDENT. REFER CONCRETE TESTING NOTES.
- 102. PROVIDE CONCRETE TEST RESULTS TO SUPERINTENDENT PROMPTLY, WITHIN SEVEN DAYS OF TESTING.

REINFORCEMENT

- 1. SYMBOLS ON DRAWINGS FOR GRADE AND TYPE OF REINFORCEMENT ARE AS FOLLOWS:
 - R: STRUCTURAL GRADE 250 PLAIN ROUND BAR TO AS/NZS4671
 - N: HOT ROLLED GRADE 500 DEFORMED (RIBBED) BAR DUCTILITY CLASS N TO AS/NZS4671
 - L: HOT ROLLED GRADE 500 DEFORMED BAR DUCTILITY CLASS L TO AS/NZS4671
 - SL: HARD DRAWN WIRE GRADE 500 SQUARE MESH DUCTILITY CLASS L TO AS/NZS4671
 - RL: HARD DRAWN WIRE GRADE 500 RECTANGULAR MESH DUCTILITY CLASS L TO AS/NZS4671
 - TM: HARD DRAWN STEEL GRADE 500 TRENCH MESH DUCTILITY CLASS L TO AS/NZS4671
 - W: GRADE 500 STEEL REINFORCING WIRE TO AS/NZS4671
- 2. MANUFACTURERS AND PROCESSORS OF STEEL REINFORCING AND PRE-STRESSING MATERIALS MUST HOLD A VALID CERTIFICATE OF APPROVAL ISSUED BY ACRS (AUSTRALASIAN CERTIFICATION AUTHORITY FOR REINFORCING AND STRUCTURAL STEELS). PROVIDE ACRS CERTIFICATION OF COMPLIANCE WITH AS/NZS4671, PRODUCT TAGS AND SUPPORTING DOCUMENTATION FOR ALL REINFORCEMENT. PROVIDE CERTIFICATION OF COMPLIANCE WITH AS/NZS4672.1 FOR ALL PRESTRESSING TENDONS.
- 3. PROVIDE DOCUMENTATION TO SHOW THAT REINFORCEMENT SUPPLIER AND MILL COMPLY WITH AS/NZS4671.
- 4. REINFORCEMENT MUST HAVE UNIQUE MARKS TO IDENTIFY SUPPLIER.
- 5. DO NOT USE LOW DUCTILITY REINFORCEMENT (GRADE L) UNO.
- 6. USE MESH SUPPLIED IN FLAT SHEETS UNLESS APPROVED OTHERWISE.
- 7. REINFORCEMENT TO BE CLEAN, FREE OF LOOSE MILL SCALE, RUST, OIL, GREASE, MUD OR OTHER MATERIAL THAT MIGHT REDUCE BOND BETWEEN REINFORCEMENT AND CONCRETE.
- 8. SUBMIT PROPOSAL FOR CUTTING OR DISPLACING REINFORCEMENT. CLEAN AND PROTECT EXPOSED CUT ENDS OF REINFORCEMENT USING 6 mm APPROVED EPOXY. REFER TO CONCRETE REPAIR NOTES FOR TREATMENT OF NEWLY EXPOSED CONCRETE AND REINFORCEMENT SURFACES AT NEW PENETRATIONS OR AREAS OF DEMOLITION.
- 9. DESIGNATION OF REINFORCEMENT BARS IS AS SHOWN:eg 17 N20 - 350 EF
 - 17: DENOTES No OF BARS AND TYPE IN GROUP
 - N: DENOTES BAR GRADE AND DUCTILITY CLASS
 - 20: DENOTES NOMINAL BAR DIAMETER IN mm
 - 350: DENOTES SPACING IN mm
 - EF: DENOTES LOCATION
- 10. TO MINIMISE TRIP HAZARDS CONSIDER MAXIMUM REINFORCEMENT BAR SPACING FOR TRAFFICABLE AREAS PRIOR TO CASTING CONCRETE OF 200 mm. ALTERNATIVELY PROVIDE SL82 ADDITIONAL IF MAIN REINFORCEMENT SPACING IS GREATER THAN 200 mm.
- 11. FOLLOWING ABBREVIATIONS APPLY TO LOCATION OF REINFORCEMENT:
 - EW: EACH WAY FF: FAR FACE BB: BOTTOM BOTTOM (LAID FIRST)
 - EF: EACH FACE B: BOTTOM TT: TOP TOP (LAID LAST)
 - NF: NEAR FACE T: TOP C OR CP: CENTRALLY PLACED
- 12. PROVIDE STANDARD COGS AND HOOKS TO AS3600. TERMINATE ENDS OF COLUMN AND BEAM LIGATURES IN A HOOK OF AT LEAST 135 DEGREES. PROVIDE FIRST LIGATURE WITHIN 50 mm OF FACE OF SUPPORT.
- 13. COG HALF OF SLAB BOTTOM REINFORCEMENT AT EDGES TO ACHIEVE ANCHORAGE.
- 14. COG ENDS OF BEAM TOP AND BOTTOM LONGITUDINAL REINFORCEMENT UNO.
- 15. PROVIDE ONE CONTINUOUS BAR PARALLEL TO (WITHIN 75 mm OF) CONCRETE EDGES, INCLUDING CONSTRUCTION JOINTS UNO.
- 16. PROVIDE N12 DIAGONAL TRIMMER BARS BY 1000 mm LONG AT EACH LAYER OF REINFORCEMENT AT RE-ENTRANT CORNERS, OPENINGS, SERVICE PENETRATIONS etc UNO.
- 17. PROVIDE N12-300 DISTRIBUTION BARS LAPPED 500 WHERE NONE SHOWN ON DRAWINGS.
- 18. REINFORCEMENT IS REPRESENTED DIAGRAMMATICALLY AND IS NOT NECESSARILY IN TRUE PROJECTION. SET REINFORCEMENT OUT AT EQUAL CENTRES IF SPACING IS NOT NOMINATED. PLACE PARALLEL BARS IN THE SAME LAYER UNO.
- 19. CAP STARTER BARS AND OTHER REINFORCEMENT TO REDUCE RISK OF IMPALEMENT AND LACERATIONS.
- 20. ENSURE ALL LAID REINFORCING BARS ARE RESTRAINED BEFORE STOPPING WORK TO PREVENT BARS ROLLING UNDERFOOT.
- 21. REINFORCEMENT TO BE SUPPLIED TO SITE PRE-BENT TO REQUIRED SHAPES. REINFORCEMENT CAGES TO BE PRE-FABRICATED OFF-SITE AS FAR AS PRACTICABLE.
- 22. SECURE REINFORCEMENT IN POSITION AGAINST DISPLACEMENT AND MAINTAIN SPECIFIED CLEAR CONCRETE COVER TO REINFORCEMENT (INCLUDING FITMENTS) BY APPROVED CHAIRS, SPACERS, LIGATURES OR TIES AT 800 mm MAXIMUM CENTRES EACH WAY UNO. PROVIDE ADEQUATE SUPPORT TO PREVENT DISPLACEMENT OF REINFORCEMENT BY WORKERS OR EQUIPMENT DURING CONCRETE PLACEMENT.
- 23. SECURELY TIE REINFORCEMENT WITH WIRE TIES. TURN ENDS OF THE WIRES INTO CONCRETE, CLEAR OF COVER ZONE.
- 24. TIE BUNDLED BARS TOGETHER SO THEY ARE IN CLOSEST POSSIBLE CONTACT WITH 2.5 mm DIAMETER WIRE AT CENTRES LESS THAN 24 TIMES DIAMETER OF SMALLEST BAR IN BUNDLE.
- 25. FOR BEAMS, TIE STIRRUPS TO BARS IN EACH CORNER OF EACH STIRRUP. FIX OTHER LONGITUDINAL BARS TO STIRRUPS AT 1000 MAXIMUM CENTRES.
- 26. FOR EXTERNAL OR CORROSIVE APPLICATIONS USE HOT DIP GALVANIZED TIE WIRES.
- 27. SUPPORT REINFORCEMENT ON PROPRIETARY CONCRETE, METAL OR PLASTIC SUPPORTS ADEQUATE TO WITHSTAND CONSTRUCTION AND TRAFFIC LOADS AND MAINTAIN DURABILITY OF FINISHED CONCRETE STRUCTURE. FOR CONCRETE SURFACES WITH B2 EXPOSURE CLASSIFICATION OR GREATER, ONLY USE PROPRIETARY HIGH STRENGTH FIBRE REINFORCED CEMENT SPACER BLOCKS OR SUPPORTS.
- 28. DO NOT PLACE OR MOVE REINFORCEMENT DURING OR AFTER CONCRETE PLACEMENT.

- 29. ENSURE EMBEDDED ITEMS (INSERTS, THREADED SOCKETS, FERRULES, BOLTS, DISSIMILAR METAL ITEMS, etc) IN COVER CONCRETE OR EXPOSED TO AIR ARE NOT IN CONTACT WITH REINFORCEMENT. PROVIDE ISOLATION BETWEEN DISSIMILAR METALS, AND BETWEEN REINFORCEMENT AND EXPOSED ITEMS.
- 30. OBTAIN SUPERINTENDENT'S APPROVAL OF INSERTS, FIXINGS AND OTHER ITEMS EMBEDDED IN COVER CONCRETE.
- 31. SPLICE REINFORCEMENT ONLY AT LOCATIONS SHOWN ON DRAWINGS OR AS APPROVED BY SUPERINTENDENT. STAGGER LAPS WHERE POSSIBLE. LAPPED SPLICE LENGTHS TO COMPLY WITH AS3600. CLEAR SPACING BETWEEN LAPPED BARS TO BE LESS THAN THREE TIMES BAR DIAMETER. WHERE BAR SIZES VARY USE LAPPED SPLICE LENGTH FOR SMALLER BAR DIAMETER.
- 32. LAPPED SPLICE LENGTHS FOR HORIZONTAL BARS WITH MORE THAN 300 mm CONCRETE CAST BELOW THE BAR AND SPACED AT ≥ 150 mm 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	1740	-	-
≥ 40	≥ 32	510	770	1100	1440	1810	2220
≥ 50	≥ 40	460	630	890	1200	1530	1890

DO NOT INTERPOLATE INTERMEDIATE VALUES OF SPLICE LENGTHS. LAPPED SPLICE LENGTHS FOR BARS IN COLUMNS REFER TO AS3600 OR SUPERINTENDENT. EPOXY COATED BARS, BARS IN LIGHTWEIGHT CONCRETE AND SLIP FORMED CONCRETE WILL REQUIRE LONGER SPLICE LENGTHS. REFER TO AS3600 OR SUPERINTENDENT. LAPPED SPLICE LENGTHS FOR VERTICAL BARS (AND HORIZONTAL BARS WITH LESS THAN 300 mm CONCRETE CAST BELOW THE BAR) SPACED AT ≥ 150 mm CENTRES TO COMPLY WITH THE FOLLOWING UNO: NOT APPLICABLE FOR BARS IN COLUMNS.

COVER	f _c	N12	N16	N20	N24	N28	N32
≥ 25	≥ 20	590	890	1210	-	-	-
≥ 40	≥ 25	490	750	1040	1340	-	-
≥ 40	≥ 32	390	600	840	1110	1400	1710
≥ 50	≥ 40	350	480	690	920	1180	1450

- DO NOT INTERPOLATE INTERMEDIATE VALUES OF SPLICE LENGTHS. LAPPED SPLICE LENGTHS FOR BARS IN COLUMNS REFER TO AS3600 OR SUPERINTENDENT. EPOXY COATED BARS, BARS IN LIGHTWEIGHT CONCRETE AND SLIP FORMED CONCRETE WILL REQUIRE LONGER SPLICE LENGTHS. REFER TO AS3600 OR SUPERINTENDENT.
- 34. REINFORCEMENT SPLICES IN TENSION MEMBERS MUST BE WELDED OR MECHANICAL SPLICES.
- 35. ENSURE REINFORCEMENT COUPLERS PROVIDE FULL TENSION CAPACITY OF REINFORCEMENT.
- 36. LAY MESH REINFORCEMENT SO THAT MINIMUM COVER IS TO MAIN WIRES UNO.
- 37. PROVIDE MINIMUM MESH LAPS TO CROSS WIRES OF REINFORCING MESH. SO TWO OUTERMOST WIRES OF ONE SHEET OVERLAP TWO OUTERMOST WIRES OF ADJACENT SHEET BY AT LEAST 25 mm, THUS:

MESH TYPE	END LAP	SIDE LAP
RECTANGULAR MESH	225	125
SQUARE MESHES SL102 TO SL42	225	225
SL81	125	125
TRENCH MESH	500	N/A

USE LAP LENGTHS BASED ON LARGEST WIRE SPACING. DO NOT LAP MORE THAN THREE SHEETS AT ANY ONE POINT.

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REINFORCEMENT (CON.T)

38. ALTERNATIVELY USE N12 SPLICE BARS TO LAP ADJACENT SHEETS OF MESH, SPACING OF SPLICE BARS TO MATCH SPACING OF BARS IN MESH, SPLICE BARS TO OVERLAP MESH BY 750 mm MINIMUM UNO.
39. SPLICE TRENCH MESH BY A LAP OF 750 mm MINIMUM UNO. AT T- AND L-INTERSECTIONS, CONTINUE TRENCH MESH FULL WIDTH OF INTERSECTION. AT L-INTERSECTIONS PROVIDE AN N12 L BAR TO LAP 750 mm WITH OUTSIDE BARS UNO.
40. DO NOT WELD REINFORCEMENT, CAST-IN ITEMS etc UNLESS SHOWN ON DRAWINGS OR OTHERWISE APPROVED BY SUPERINTENDENT. WHERE ALLOWED, WELDING OF REINFORCEMENT (INCLUDING TACK-WELDING FOR FIXING PURPOSES) TO COMPLY WITH AS3600 AND AS/NZS1554.3. DO NOT WELD REINFORCEMENT WITHIN 75 mm OF A SECTION THAT HAS BEEN BENT (100 mm FOR N28 AND N32 BARS, 125 mm FOR N36 BARS). EXTENT OF WELD INSPECTION / TESTING TO BE:
 - VISUAL SCANNING 100% OF WELDS
 - VISUAL EXAMINATION 100% OF WELDS
 - RADIOGRAPHIC OR ULTRASONIC 100% OF BUTT WELDS
41. USE PREQUALIFIED WELD PROCEDURES AND CONSUMABLES TO AS/NZS1554.1 CLAUSE 4.3.
42. WELDING TO BE UNDERTAKEN BY QUALIFIED AND SUITABLY QUALIFIED EXPERIENCED WELDER UNDER THE ACTIVE SUPERVISION OF QUALIFIED WELDING SUPERVISOR. WELDER AND WELDING SUPERVISOR QUALIFICATIONS TO AS/NZS1554.
43. CARRYOUT WELDING TO AS/NZS1554:
 - WELDS TO BE CATEGORY SP
 - BUTT WELDS TO BE FULL (COMPLETE) PENETRATION UNO
 - ELECTRODES TO BE LOW HYDROGEN WITH TENSILE STRENGTH OF $f_{uw}=490$ MPa, PRE-APPROVED TO AS/NZS1554, eg CLASSIFICATION B - E49XX
44. APPLY WELD PREHEAT IN ACCORDANCE WITH RECOMMENDATIONS OF AS/NZS 1554.1
45. EXTENT OF WELD INSPECTION / TESTING TO BE:
 - VISUAL SCANNING: 100% OF WELDS
 - VISUAL EXAMINATION: 100% OF BUTT WELDS IN TENSION MEMBERS AND 50% OF OTHER WELDS
 - MAGNETIC PARTICLE TESTING: 100% OF BUTT WELDS IN TENSION MEMBERS AND 50% OF OTHER WELDS. MAGNETIC PARTICLE TESTING OT BE REPLACED WITH DYE PENETRANT TESTING FOR STAINLESS STEEL.
 - RADIOGRAPHIC OR ULTRASONIC: 10% OF BUTT WELDS IN TENSION MEMBERS AND 5% OF OTHER WELDS. RADIOGRAPHY TO BE USED FOR THICKNESSES LESS THAN 10 mm, OR ULTRASONIC SHALL BE SUPPLEMENTED BY MAGNETIC PARTICLE TO DETECT SUB SURFACE DEFECTS. DEFECT ACCEPTANCE LEVELS AS SPECIFIED IN AS/NZS 1554.
46. FINISHED SURFACE PROFILE OF WELDS TO BE SMOOTH AND FREE OF SHARP EDGES OR CREVICES. COMPLETELY REMOVE SPLATTER AND SLAG.
47. REPAIR FAULTY WELDS AND DEFECTS REVEALED BY WELD INSPECTION / TESTING AND REPEAT THE EXAMINATION.
48. WELDS TO BE INSPECTED BY INDEPENDENT NATA ACCREDITED QUALIFIED WELDING INSPECTOR TO AS/NZS1554 CLAUSE 7.1. PROVIDE WELDING INSPECTOR'S REPORT TO SUPERINTENDENT.
49. WELDING SYMBOLS ARE TO AS1101.3. "CFW" INDICATES CONTINUOUS FILLET WELD. "FSBW" INDICATES FULL STRENGTH BUTT WELD WHICH IS EQUIVALENT TO CPBW. "CPBW" INDICATES COMPLETE PENETRATION BUTT WELD.
50. DO NOT BEND OR STRAIN REINFORCEMENT IN A WAY THAT MAY CAUSE DAMAGE. BEND DIAMETERS TO BE TO AS3600. BARS TO BE BENT COLD UNO. GRADE 250 BARS MAY BE BENT AT TEMPERATURES UP TO 850°C. DO NOT COOL HEATED BARS BY QUENCHING.
51. USE ONLY N12 QUENCHED AND SELF-TEMPERED REINFORCEMENT FOR PULLOUT BARS OR BARS TO BE BENT ON SITE (eg TEMP CORE BY ONESTEEL). DO NOT USE MICROALLOY REINFORCEMENT FOR PULLOUT BARS AND BARS TO BE BENT ON SITE. CAST IN PULLOUT BARS WITH BEND CLEAR OF CONCRETE. USE PROPRIETARY POWERED BENDING TOOLS WITH PIN DIAMETERS TO AS3600 FOR SITE BENDING OF PULLOUT BARS, USING A SINGLE SMOOTH BENDING ACTION AT AMBIENT TEMPERATURE. DO NOT USE IMPACT BLOWS OR HAMMER BARS, OR BEND BARS USING A PIPE OR USING HEAT. TAKE CARE TO MINIMISE SURFACE DAMAGE, AND INSPECT REBENT BARS FOR CRACKS. REPORT CRACKS TO SUPERINTENDENT.
52. DO NOT CUT, BEND NOR HEAT REINFORCEMENT ON SITE WITHOUT SUPERINTENDENTS PRIOR WRITTEN APPROVAL.
53. ENSURE HOT BENDING OF REINFORCEMENT COMPLIES WITH AS3600 CLAUSE 17.2.3.1. DO NOT HEAT D500N REINFORCEMENT. USE TEMPERATURE INDICATOR PAINTS AND / OR CRAYONS TO ENSURE REINFORCEMENT TEMPERATURE DOES NOT EXCEED MANUFACTURERS RECOMMENDED LIMITS, 450 DEGREES MAXIMUM. REINFORCEMENT THAT CHANGED COLOUR DURING HEATING MUST BE DISCARDED.
54. DO NOT BEND REINFORCEMENT AFTER GALVANIZING OR APPLICATION OF OTHER COATINGS.
55. PERCUSSION ROTARY DRILL HOLES FOR GROUDED BARS AND THREADED RODS (NOTE: CORED HOLES MUST BE ROUGHENED). HOLE DIAMETER AND INSTALLATION TO BE IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS. EMBEDMENT LENGTHS AS PER DRAWINGS.
56. ENSURE HOLES FOR GROUDED BARS AND THREADED RODS ARE DRY AND CLEANED THOROUGHLY BEFORE INSTALLING ANCHORS. WIRE BRUSH HOLES AND BLOW OUT WITH COMPRESSED AIR TO REMOVE DUST. FILL HOLE WITH ADHESIVE USING A CAULKING GUN FROM BOTTOM OF HOLE OUTWARDS. DISCARD ADHESIVE FROM FIRST TRIGGER PULL. PROVIDE BARS / THREADED RODS WITH CHAMFERED (CHISELLED) ENDS. BARS TO BE DEGREASED, AND FLAKY RUST REMOVED. ROTATE WHILE INSERTING TO ENSURE FULLY COATED AND PUSH FULLY INTO HOLE. PROTECT FROM DISTURBANCE DURING CURING. FOLLOW MANUFACTURER'S RECOMMENDATIONS.
57. USE RAMSET CHEMSET RE0502 / EPCON C8 XTREME ADHESIVE IN ACCORDANCE MANUFACTURER'S RECOMMENDATIONS UNO.

MASONRY

- GENERAL*
1. MASONRY WORK TO BE TO AS3700 AND AS/NZS4455.
 2. USE GRADE 15 CONCRETE BLOCKS ie MINIMUM CHARACTERISTIC UNCONFINED COMPRESSIVE STRENGTH (Cu) = 15 MPa TO AS/NZS4455 UNO AND OF DIMENSIONAL CATEGORY DW4 TO AS/NZS4455.
 3. COLOUR AND TEXTURE OF MASONRY UNITS TO BE WITHIN AN AGREED RANGE. MASONRY UNITS TO BE RESISTANT TO SALT ATTACK. MAXIMUM PERMEABILITY OF MASONRY UNITS TO BE 2 mm/minute. EFFLORESCENCE POTENTIAL OF MASONRY UNITS TO BE NIL OR SLIGHT. CHARACTERISTIC LATERAL MODULUS OF RUPTURE OF MASONRY UNITS TO BE 0.8 MPa.
 4. FOR CONCRETE BLOCKWORK USE CLASS M3 MORTAR MADE WITH 1 PART CEMENT: 5 PARTS SAND AND A METHYL CELLULOSE WATER THICKENER (eg: 'DYNEX' AS PRODUCED BY A.V. SYNTEC) TO AS3700. SUBMIT DETAILS OF PROPOSED ADDITIVES FOR SUPERINTENDENT'S WRITTEN APPROVAL. USE WELL GRADED CLEAN SAND WITH LOW CLAY CONTENT (MAXIMUM 10% PASSING THE 75 MICRON SIEVE) AND FREE FROM EFFLORESCING SALTS, ORGANIC MATTER AND OTHER IMPURITIES. USE HYDRATED BUILDING LIME TO AS1672.1 COLOUR AND TEXTURE OF FACE OR POINTING MORTAR TO MATCH APPROVED SAMPLE.
 5. DO NOT CHASE HOLLOW BLOCKWORK. DO NOT CHASE MASONRY WITHOUT PRIOR APPROVAL.
 6. ENSURE THAT PERPENDS AND BEDS ARE COMPLETELY FILLED WITH MORTAR. LAY FROGGED MASONRY UNITS FROG UP, EXCEPT LAY TOP COURSE FROG DOWN.
 7. MORTAR BED JOINTS AND PERPENDS TO BE FULLY BEDDED, 10 mm MAXIMUM WIDE.
 8. BED JOINTS AND PERPENDS IN CONCRETE BLOCKWORK MAY HAVE SHALLOW TOOLING. DO NOT RAKE OUT JOINTS UNLESS REQUIRED BY SPECIFICATION. WORK FACE JOINTS WITH A JOINTING TOOL TO A DENSE SMOOTH SURFACE.
 9. SET OUT MASONRY TO MAINTAIN SPECIFIED ROD AND BOND WITH BED JOINTS AND VERTICAL JOINTS OF UNIFORM WIDTH AND WITH MINIMUM CUTTING OF MASONRY UNITS. USE STRETCHER BOND GENERALLY IN SINGLE LEAF CONSTRUCTION. KEEP PERPENDS IN ALTERNATE COURSES VERTICALLY ALIGNED. DISTRIBUTE APPROVED COLOUR RANGE OF FACE UNITS EVENLY THROUGHOUT FACE WORK TO PREVENT COLOUR CONCENTRATIONS AND BANDING. SELECT MASONRY UNITS FOR UNIFORM WIDTH AND DOUBLE-FACE QUALITIES IN SINGLE LEAF MASONRY WITH FACE WORK BOTH SIDES.
 10. WALLS TO BE BONDED AT INTERSECTIONS UNO.
 11. CLEAN MASONRY PROGRESSIVELY AS WORK PROCEEDS. CLEAN FACE WORK TO REMOVE MORTAR SMears, STAINS, DISCOLOURATION, etc. USE CAVITY BATTEN (AND LIFT PROGRESSIVELY) TO KEEP CAVITIES CLEAR OF MORTAR FINs, DROPPINGS, etc.
 12. CONTROL JOINTS TO BE 20 mm WIDE WITH 25 mm DIAMETER CLOSED CELL POLYETHYLENE FOAM BACKING ROD AND APPROVED POLYSULPHIDE SEALANT AT EXTERNAL FACE UNO. FINISH SEALANT IN LINE WITH MORTAR JOINTS. TOLERANCE ON WIDTH +5, -0 mm. REINFORCEMENT TO BE DISCONTINUOUS AT CONTROL JOINTS. PROVIDE JOINTS IN WALL FINISHES AT CONTROL JOINTS IN MASONRY. PLACE POLYSTYRENE IN VERTICAL JOINTS DURING CONSTRUCTION TO ENSURE THAT MORTAR DROPPINGS AND OTHER HARD MATERIALS DO NOT FALL INTO OR REMAIN IN CONTROL JOINTS. REMOVE POLYSTYRENE AT COMPLETION.
 13. SOLIDLY BED MASONRY SILLS AND THRESHOLDS AND LAY THEM SO THAT TOP SURFACES DRAIN AWAY FROM BUILDING. SET OUT SO THAT NO UNIT IS CUT LESS THAN ¾ OF FULL WIDTH.
 14. WHEN BUILDING IN STEEL DOOR FRAMES etc, FILL BACKS OF JAMBS AND HEADS SOLID WITH MORTAR AS WORK PROCEEDS.
 15. PROTECT FRESHLY LAID MORTAR FROM RAIN, etc.
- REINFORCED MASONRY*
16. FOR REINFORCED MASONRY USE "HEAVILY GALVANIZED" BED JOINT REINFORCEMENT AT 600 mm MAXIMUM CENTRES, COMMENCING 200 mm MAXIMUM ABOVE BASE LEVEL AND LOCATED ABOVE AND BELOW OPENINGS. TERMINATE BED JOINT REINFORCEMENT 200 mm FROM EDGES OF WALL PANELS AND CONTROL JOINTS etc. LAP BED JOINT REINFORCEMENT BY 450 mm. LOCATE WALL TIES IN UNREINFORCED COURSES / BED JOINTS.
 17. USE CONCRETE GROUT FOR FILLING CORES WITH:
 - MINIMUM $f_c = 20$ MPa TO AS3600.
 - MINIMUM CEMENT CONTENT = 300 kg/m³.
 - MAXIMUM AGGREGATE SIZE = 10 mm.
 - SLUMP = 230 ± 30 mm TO AS1012.3.
 WET CORES BEFORE GROUTING.
 18. FOR REINFORCED MASONRY FILL ALL REINFORCED CORES AND BOND BEAMS USING CONCRETE WITH $f_c = 20$ MPa TO AS3600, SLUMP = 80 ± 15 mm TO AS1012.3 UNO.
 19. USE 2N16 CONTINUOUS BARS FOR BOND BEAMS UNO. LAP 600 UNO.
 20. FOR REINFORCED BLOCKWORK PROVIDE N16 BAR ADJACENT TO WALL ENDS, OPENINGS, CONTROL JOINTS AND AT 1200 mm MAX CENTRES UNO. LOCATE REINFORCEMENT CENTRALLY IN CORES UNO.
 21. CARRY OUT PROJECT ASSESSMENT OF CONCRETE AND GROUT TO AS3600.
 22. PROVIDE 15 mm MINIMUM COVER TO REINFORCEMENT TO AS3700 CLAUSE 6.8 FROM INSIDE FACE AND BASE OF BLOCKS, AND 50 mm MINIMUM COVER INCLUDING BLOCK THICKNESS. MAINTAIN COVER BY USE OF "KNOCK-OUT" BLOCKS AND SPACERS AT INTERSECTIONS OF VERTICAL AND HORIZONTAL BARS, eg BLOCK AID BAR CHAIRS BY ONESTEEL OR BY OTHER APPROVED MEANS. SET OUT STARTER BARS USING A TEMPLATE.
 23. REMOVE MORTAR DROPPINGS FROM BOTTOM OF CORES BY USE OF CLEANOUT BLOCKS BEFORE PLACING CONCRETE AND AT HORIZONTAL BREAKS IN CONSTRUCTION. REMOVE MORTAR FINs PROTRUDING FROM JOINTS BEFORE PLACING CONCRETE.
 24. DO NOT PROCEED WITH BLOCKWORK CONSTRUCTION MORE THAN SIX COURSES OR 1500 mm AHEAD OF CONCRETE PLACEMENT. PLACE CONCRETE INFILL IN LIFTS NOT EXCEEDING 400 mm.

25. STOP CONCRETE 50 mm BELOW TOP OF BLOCKS TO PROVIDE KEY FOR FOLLOWING CONCRETE. ENSURE PROPER COMPACTION OF CONCRETE BY "RODDING" OR OTHER APPROVED MEANS.

DELIVERABLES

26. FORWARD CONCRETE AND GROUT PROJECT ASSESSMENT INFORMATION TO SUPERINTENDENT AS PER AS1379 CLAUSE 6.3 WHEN PROJECT ASSESSMENT IS UNDERTAKEN.

PVC WATERSTOPS

GENERAL

1. PVC WATERSTOPS SHALL HAVE A MINIMUM WIDTH OF 230 mm AND A MINIMUM OF FOUR-FLANGE INTERNAL RIBS OR BULBS. ON VERTICAL JOINTS, INTERNAL TYPE WATERSTOPS SHALL EXTEND VERTICALLY TO 50 mm BELOW THE COPING LEVEL.
2. THE MATERIAL SHALL BE FREE FROM SURFACE IMPERFECTIONS, BLISTERS, POROSITY, OR OTHER BLEMISHES. THE WATERSTOP MATERIAL SHALL HAVE PROPERTIES AT LEAST EQUAL TO THOSE LISTED BELOW.
 - a. MINIMUM PROPERTIES AT 25°C:
 - a. TENSILE STRENGTH 13.8 MPA
 - b. ELONGATION AT BREAK 285% MINIMUM
 - c. SOFTNESS (BS 2571) 42-52
 - a. MOVEMENT ACCOMMODATION
 - a. MINIMUM EXTENSION 10 mm
3. MINIMUM TRANSVERSE SHEAR 20 mm
4. WATERSTOPS SHALL BE FABRICATED INTO THE LONGEST PRACTICAL UNITS AT THE SUPPLIER'S WORKS AND SHALL BE CONTINUOUS THROUGHOUT THE STRUCTURE BELOW HIGHEST WATER LEVEL. INTERSECTIONS AND JOINTS SHALL BE FACTORY MADE WHERE POSSIBLE.
5. NO HOLES ARE TO BE MADE THROUGH THE BODY OF THE WATERSTOP. JOINTING OTHER THAN BY WELDING IN ACCORDANCE WITH THE MANUFACTURER'S RECOMMENDED SYSTEM WILL NOT BE PERMITTED.
6. THE INSTALLATION AND JOINTING OF WATERSTOPS SHALL BE STRICTLY IN ACCORDANCE WITH THE MANUFACTURER'S SPECIFICATION. THE JOINTING OF PVC WATERSTOPS AND REPAIRS TO DAMAGED WATERSTOPS SHALL ONLY BE UNDERTAKEN USING HEAT WELDING.
7. THE PVC WATERSTOPS SHALL BE INSTALLED SO THAT THEY ARE SECURELY HELD IN THEIR CORRECT POSITIONS (WITH THE CENTRE OF THE WATERSTOP PLACED IMMEDIATELY UNDER THE LINE OF THE TWO CONCRETE POURS) DURING THE PLACING OF THE CONCRETE, WHICH SHALL BE FULLY COMPACTED AROUND THE WATERSTOP SO THAT NO VOID OR POROUS AREAS ARE LEFT. WHERE REINFORCEMENT IS PRESENT, A MINIMUM CLEARANCE OF 50 MM SHALL BE MAINTAINED BETWEEN THE WATERSTOP AND THE NEAREST FACE OF REINFORCEMENT.

HYDROPHILIC (SWELLABLE) WATERSTOPS

8. SWELLABLE WATER STOP SHALL HAVE A MINIMUM WIDTH OF 20 MM AND A MINIMUM THICKNESS OF 10 MM.
9. THE SWELLABLE WATER STOP MATERIAL SHALL HAVE PROPERTIES AT LEAST EQUAL TO THOSE LISTED BELOW:
 - BE COMPOSED OF POLYOLEFIN – RUBBER COMBINED WITH WATER SOLUBLE RESINS WHICH SWELL IN CONTRACT WITH WATER;
 - TENSILE STRENGTH AT 50% ELONGATION OF 0.6 N/MM²;
 - ELONGATION AT BREAK > 150%; AND
 - A VOLUME INCREASE OF 150% MINIMUM WHEN STORED IN TAP WATER AT 23°C FOR 14 DAYS.
10. THE SWELLABLE WATER STOP SHALL BE INSTALLED STRICTLY IN ACCORDANCE WITH THE MANUFACTURER'S INSTRUCTIONS AND SHALL NOT BE PUNCTURED.
11. WHERE SPECIFIED ON THE DRAWINGS FORMING PART OF THE DRAWINGS, GUN GRADE ABLE SWELLABLE WATER STOP IS TO BE INSTALLED IN ACCORDANCE WITH THE MANUFACTURER'S REQUIREMENTS.

WATERTIGHTNESS TEST

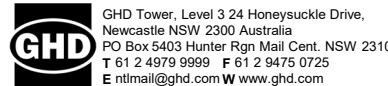
12. ALL LIQUID RETAINING STRUCTURES SHALL BE HYDROSTATICALLY TESTED FOR LEAKAGE.
13. TESTING SHALL BE CARRIED OUT PRIOR TO THE PLACING OF BACKFILL AROUND EACH STRUCTURE AND PRIOR TO PLACING ANY CONCRETE BENCHING, MORTAR TOPPINGS OR TILING.
14. PRIOR TO CARRYING OUT WATERTIGHTNESS TESTS, REMOVE ALL DEBRIS AND CLEAN ALL SURFACES, INSTALL TEMPORARY BLANK FLANGES, PLUGS OR CAPS ON PIPEWORK CAST THROUGH CONCRETE WALLS, SEAL WITH TEMPORARY COVERS ALL OPENINGS IN THE CONCRETE BELOW TOP WATER LEVEL, AND GENERALLY ENSURE THAT EACH STRUCTURE IS WATERTIGHT AND READY FOR TESTING.
15. FILL EACH WATER-RETAINING STRUCTURE WITH WATER TO THE OVERFLOW LEVEL OF THE STRUCTURE AND TEST FOR WATERTIGHTNESS. THE CONTRACTOR SHALL SUPPLY THE WATER FOR THE HYDROSTATIC TESTING. THE CONTRACTOR SHALL BE RESPONSIBLE FOR SUPPLYING AND INSTALLING PUMPS AND PIPES TO TRANSFER THE WATER AND TO EMPTY THE STRUCTURES ON COMPLETION OF THE HYDROSTATIC TESTS.

16. THE STRUCTURE SHALL BE FILLED WITH WATER AT A UNIFORM RATE OF NOT GREATER THAN 2 METRES IN 24 HOURS. NOTE THAT THE FILLING RATE MAY HAVE TO BE RESTRICTED IF THIS RATE CANNOT BE ACHIEVED EITHER THROUGH THE WATER SUPPLY OR THE ABILITY TO SUPPLY RECLAIMED EFFLUENT FOR THE FILLING PURPOSE.
17. COMMENCE THE TEST PERIOD AFTER A 7-DAY STABILISING PERIOD TO ALLOW FOR ABSORPTION AND AUTOGENOUSLY HEALING OF THE CONCRETE. AFTER THE STABILISING PERIOD, RECORD THE LEVEL OF THE LIQUID SURFACE AT 24-HOUR INTERVALS, FOR A TEST PERIOD OF 7 CONSECUTIVE CALENDAR DAYS.
18. THE STRUCTURE SHALL BE DEEMED TO SATISFY THE TEST IF, AT THE END OF THE 7 CALENDAR DAYS, AFTER ALLOWING FOR EVAPORATION AND RAINFALL, NO LEAKAGE IS APPARENT FROM THE STRUCTURE, AND THE WATER LEVEL HAS NOT DROPPED MORE THAN 1/500TH OF THE AVERAGE WATER DEPTH OF THE FULL TANK OR 10 MM, WHICHEVER IS THE LESSER VALUE.
19. THE CONTRACTOR SHALL DETERMINE THE EVAPORATION DURING THE TESTING PERIOD BY DIRECT MEASUREMENT OF EVAPORATION LOSSES VIA AN APPROVED METHODOLOGY.
20. RAINFALL SHALL BE MEASURED AT THE SITE AT A MINIMUM OF 12-HOUR INTERVALS FOR THE DURATION OF THE TEST PERIODS. THE RAINFALL MEASURING DEVICE SHALL BE A PROPRIETARY PRODUCT DESIGNED FOR SUCH USE. LOCATE THE RAIN MEASURING DEVICE TO AVOID RAIN SHADOW EFFECTS FROM STRUCTURES, TREES, AND THE LIKE.
21. ALL LEVELS AND LOSSES SHALL BE RECORDED, AND A LEAKAGE REPORT SHALL BE SUBMITTED FOR EACH STRUCTURE. WHERE WATER LOSS CRITERIA IS NOT MEANT THAN OF LEAKS INCLUDING CRACKS, VISIBLE WET PATCHES ON THE OUTSIDE FACES OF THE STRUCTURES OR INCREASED UNDERDRAIN FLOW SHALL BE RECTIFIED. TO RECTIFY, EMPTY THE STRUCTURE, DETECT AND REPAIR DEFECTS AND RETEST BY REPEAT PROCEDURE AS ABOVE. CONTINUE TO REPAIR AND RETEST UNTIL A SATISFACTORY TEST IS OBTAINED. NO BACKFILLING OF THE STRUCTURE SHALL TAKE PLACE UNTIL ALL THESE REQUIREMENTS ARE MET.
22. MINIMISE THE TOTAL QUANTITY OF TESTED WATER BY RE-USING WATER TO TEST ADJACENT STRUCTURES. THIS IS ESPECIALLY APPLICABLE TO THE TESTING OF LARGER STRUCTURES.
23. ANY PRESSURE RELIEF VALVES WITHIN THE FLOOR OF THE STRUCTURE SHALL BE THOROUGHLY CLEANED AND SEALED PRIOR TO THE COMMENCEMENT OF THE TEST. UPON COMPLETION OF THE TESTS, THE STRUCTURES SHALL BE EMPTIED, OR IF FEASIBLE, THE WATER RETAINED FOR FURTHER TESTING OR COMMISSIONING ACTIVITIES ON OTHER STRUCTURES. DISPOSAL OF WATER SHALL BE AT THE SATISFACTION OF THE CDO.
25. NO MECHANICAL EQUIPMENT SHALL BE INSTALLED IN ANY STRUCTURE BEFORE THE SUCCESSFUL COMPLETION OF THE WATERTIGHTNESS TEST.

A 80% DETAIL DESIGN		Checked	Approved	Date
Rev	Description			
Author	M. PAZ	Drafting Check		
Designer	K. CAPANGPANGAN	Design Check	K. ROWE	

Plot Date: 23-Nov-23 10:27:42 AM

File Name: Autodesk Docs://12589773 - Lachlan Pipeline Duplication Detailed Design/12589773-NEW EUGOWRA ROAD.rvt



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Project No.
12589773

Client	PARKES SHIRES COUNCIL
Project	LACHLINE PIPELINE DUPLICATION DETAIL DESIGN TSS
Status	PRELIMINARY

Drawing Title	STRUCTURAL GENERAL NOTES - SHEET 6
Drawing No.	12589773-S007
Rev	A

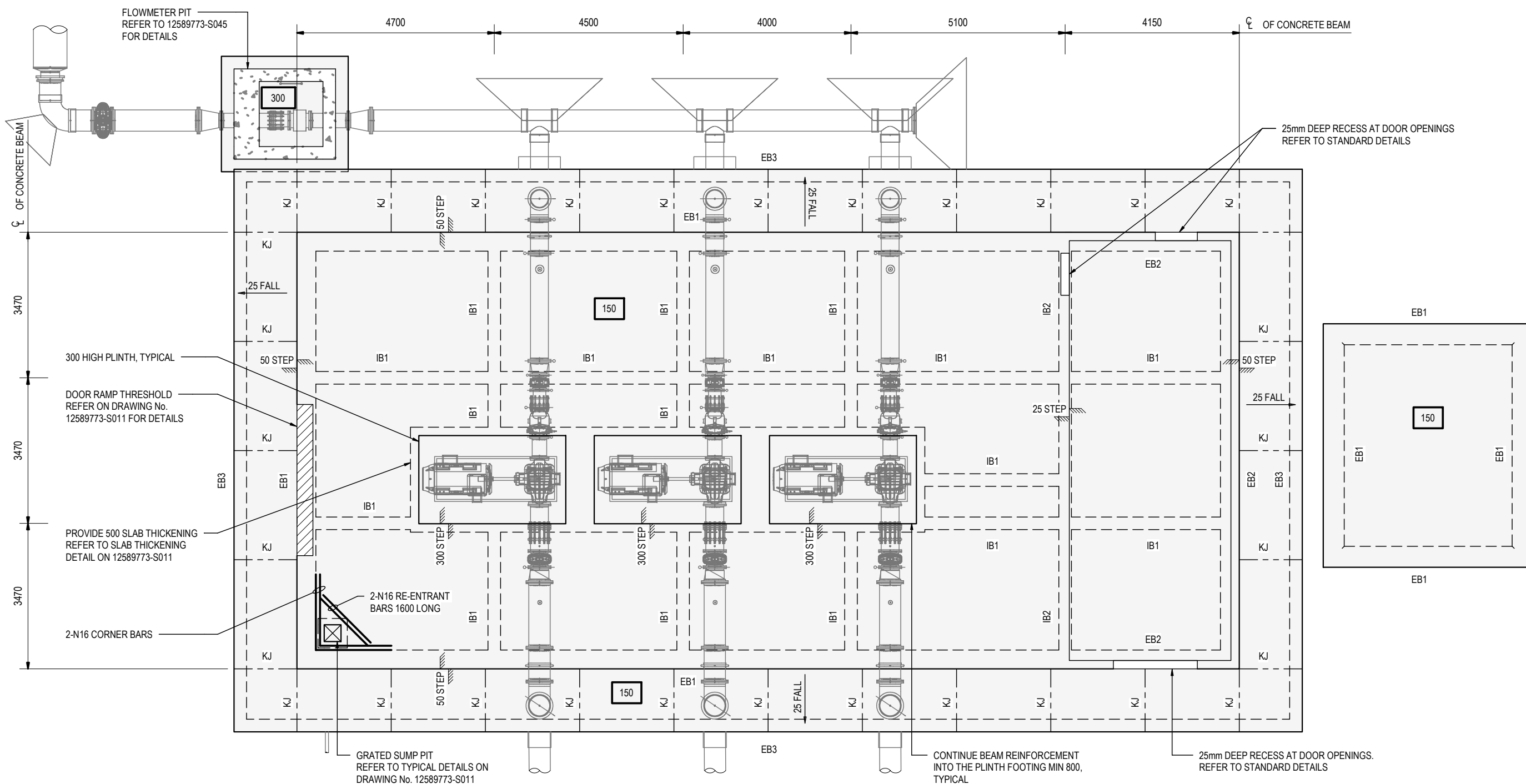
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LEGEND:

- KJ - INDICATES METAL KEY JOINT WITH REMOVABLE CAPPING TO FORM VOID FOR POLYURETHANE SEALANT
- 150 - INDICATES 150 THICK SLAB WITH SL102 MESH TOP AND BOTTOM

STRUCTURAL FOUNDATION SCHEDULE

MARK	DEPTH (mm)	WIDTH (mm)	COMMENTS
EB1	500	450	2-N16 TOP, 3-N16 BOTTOM, N10 TIES AT 250 CTS
EB2	500	450	2-N16 TOP, 3-N16 BOTTOM, N10 TIES AT 250 CTS
EB3	300	300	
IB1	500	300	2-N16 TOP, 3-N16 BOTTOM, N10 TIES AT 250 CTS
IB2	500	300	2-N16 TOP, 3-N16 BOTTOM, N10 TIES AT 250 CTS



TYPICAL SLAB LAYOUT

SCALE 1 : 100

Rev	Description	Checked	Approved	Date
A	80% DETAIL DESIGN			
Author	M. PAZ	Drafting Check		
Designer	K. CAPANGPANGAN	Design Check	K. ROWE	



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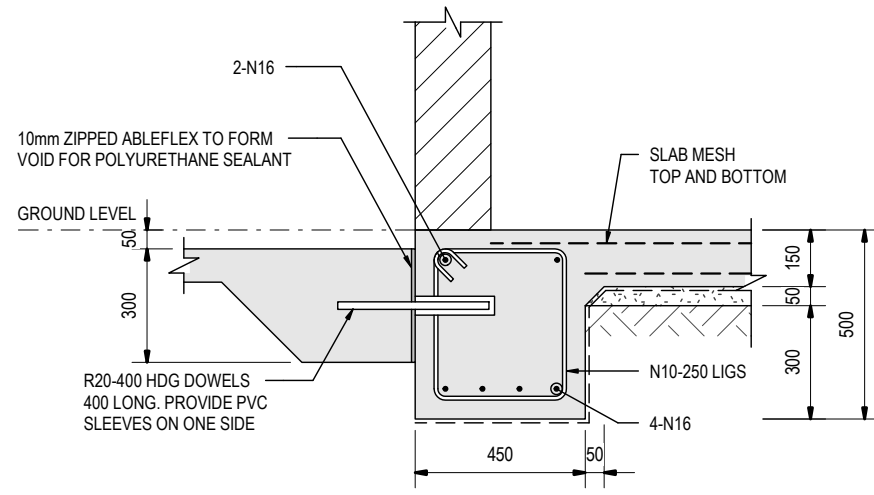


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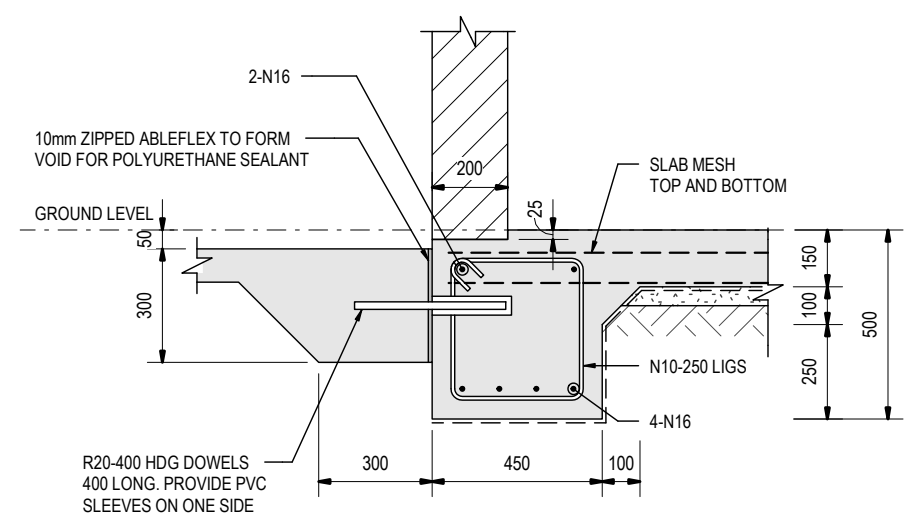
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Project	LACHLINE PIPELINE DUPLICATION DETAIL DESIGN TSS
Status	PRELIMINARY

Drawing Title	STRUCTURAL PUMPSTATION TYPICAL SLAB LAYOUT
Drawing No.	12589773-S010

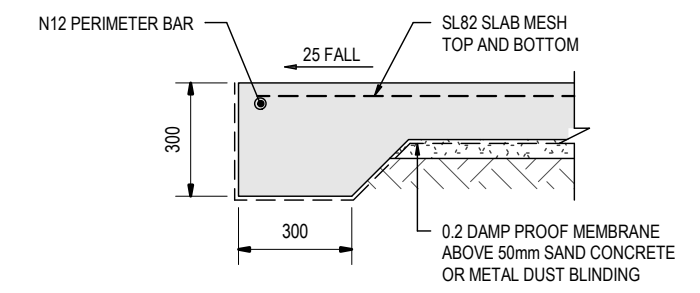
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 Rev **A**



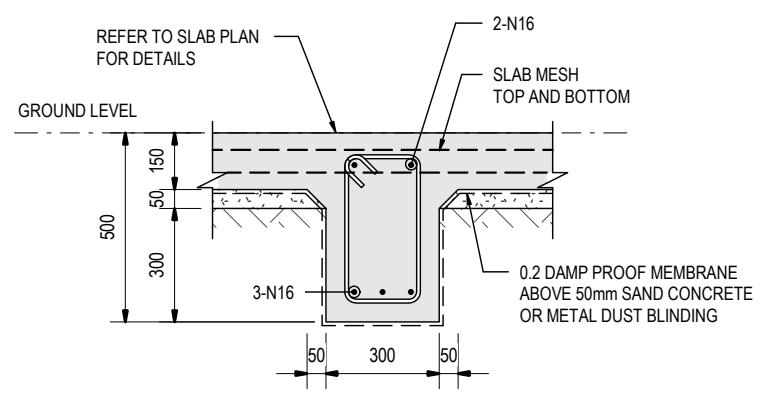
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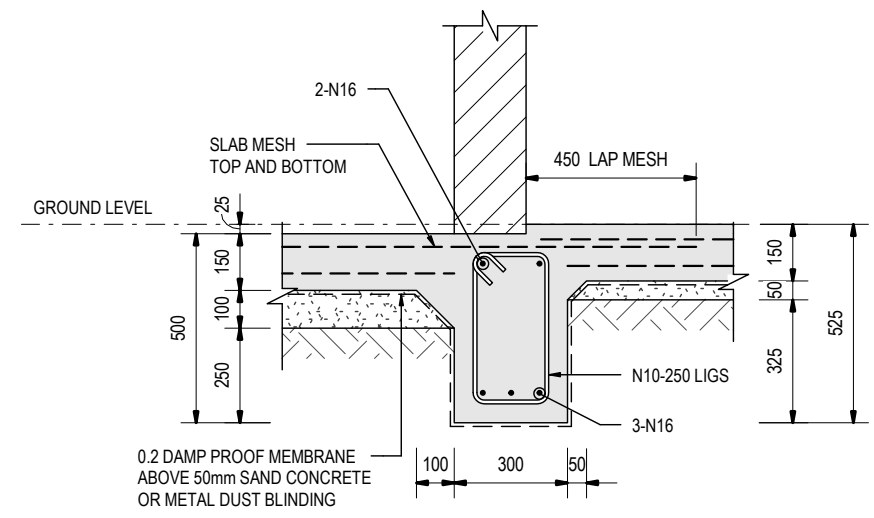
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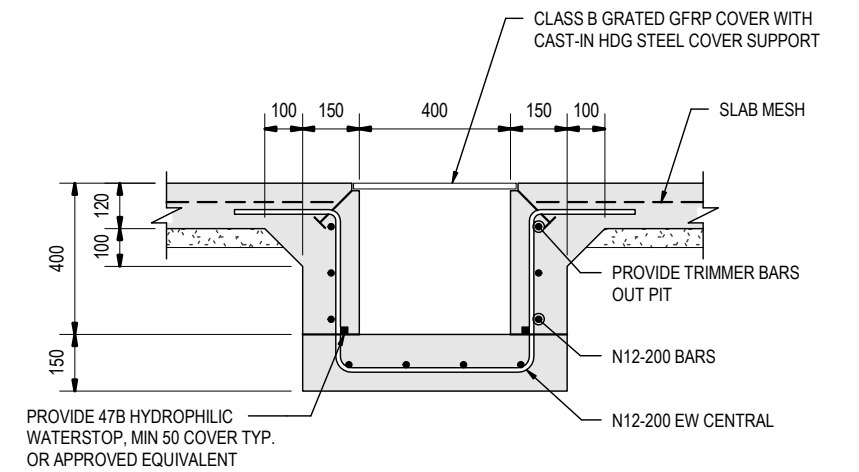
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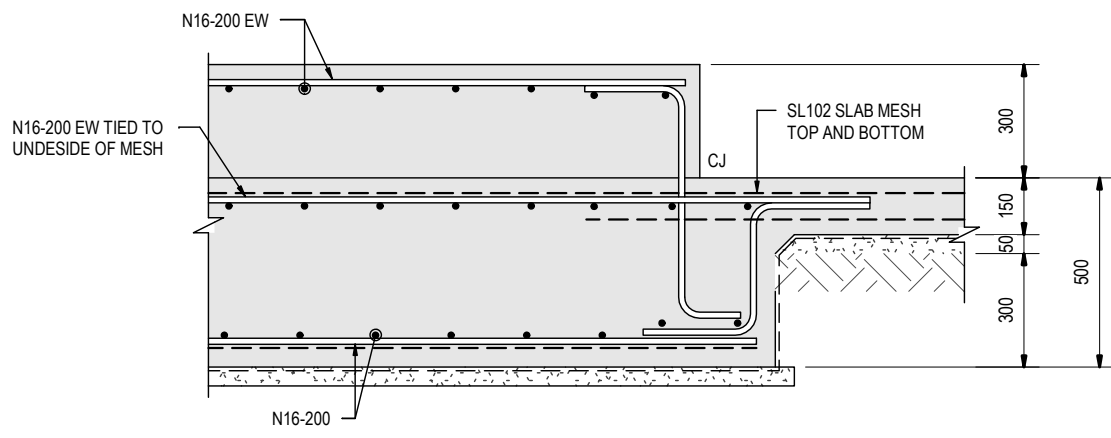
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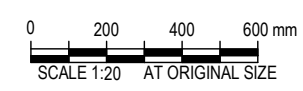
TYPICAL IB2 DETAIL
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TYPICAL SUMP PIT DETAIL
SCALE 1:20



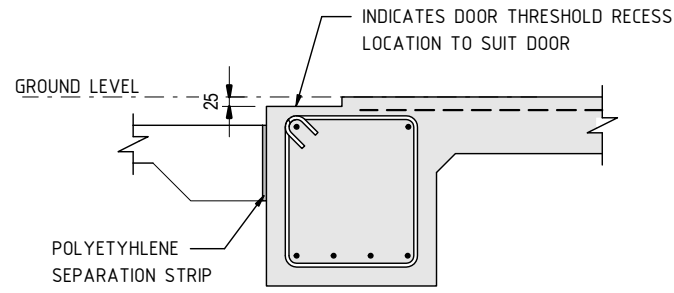
TYPICAL PUMP PLINTH DETAILS
SCALE 1:20



Client	PARKES SHIRES COUNCIL
Project	LACHLINE PIPELINE DUPLICATION DETAIL DESIGN TSS
Status	PRELIMINARY

Drawing Title	STRUCTURAL PUMPSTATION TYPICAL FOOTING DETAILS SHEET 1
Drawing No.	12589773-S011

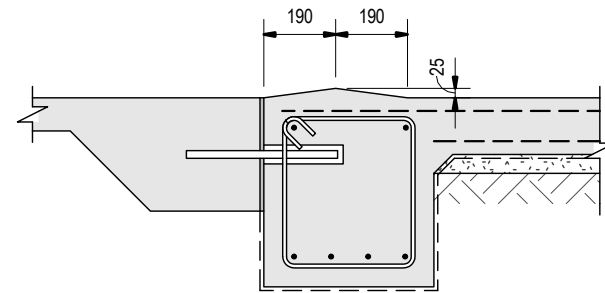
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Author	M. PAZ	Drafting Check		
Designer	K. CAPANGPANGAN	Design Check	K. ROWE	



NOTE: REFER TO EB1 / EB2 FOR REINFORCEMENT DETAILS

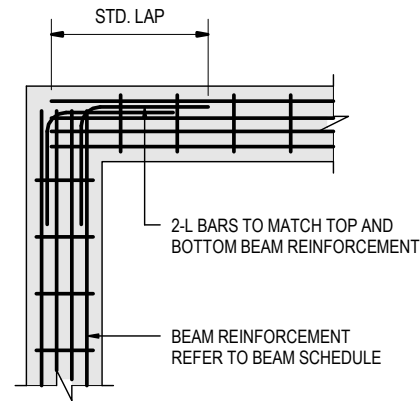
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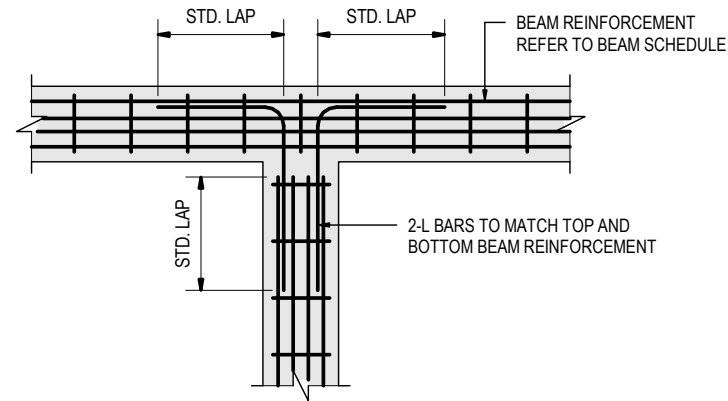
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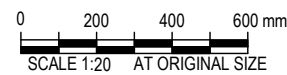
TYPICAL CORNER FOOTING INTERSECTION DETAIL

SCALE 1:20



TYPICAL FOOTING 'T' INTERSECTION DETAIL

SCALE 1:20



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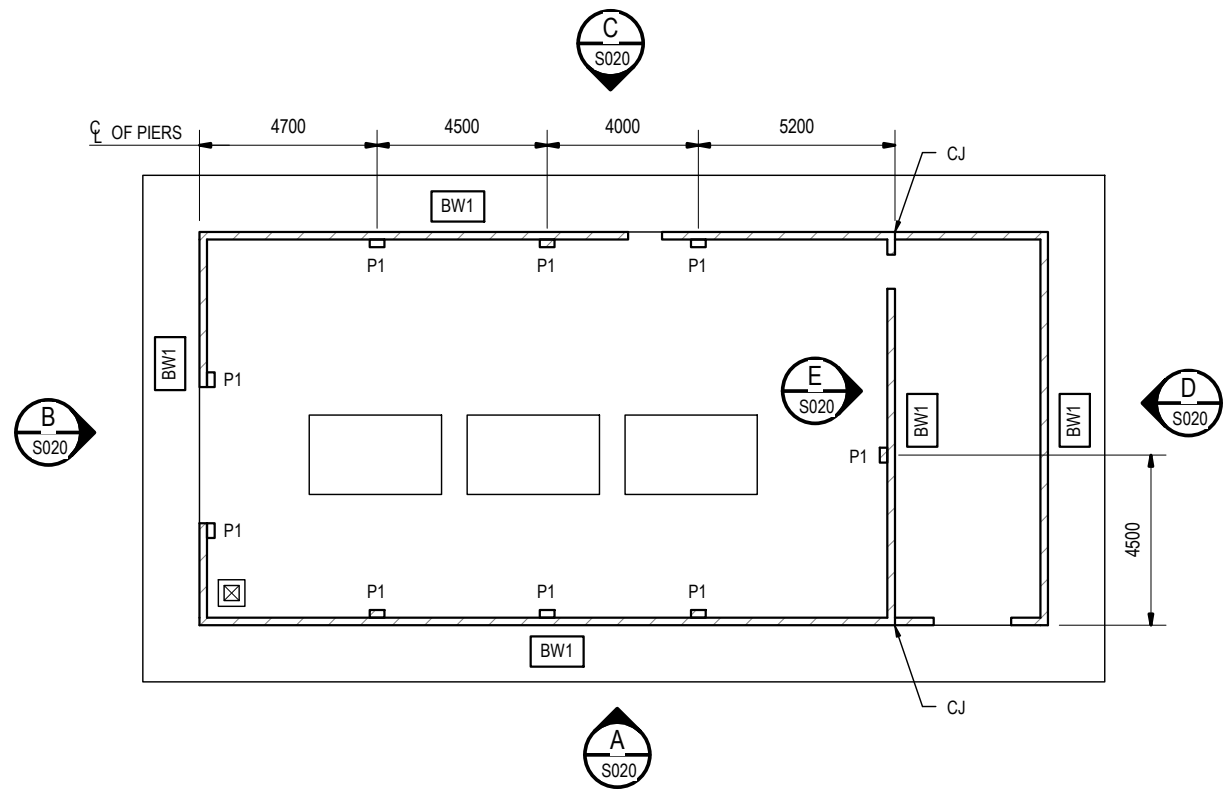


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Client	PARKES SHIRES COUNCIL
Project	LACHLINE PIPELINE DUPLICATION DETAIL DESIGN TSS
Status	PRELIMINARY

Drawing Title	STRUCTURAL PUMPSTATION TYPICAL FOOTING DETAILS SHEET 2
Drawing No.	12589773-S012

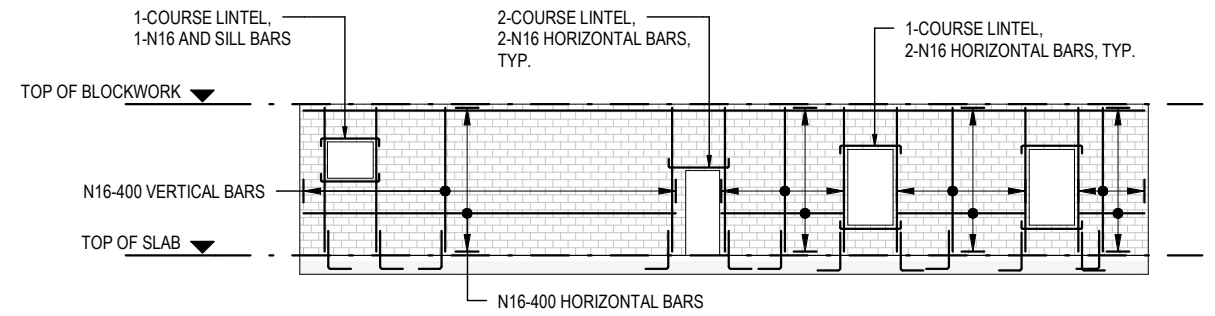
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Author	M. PAZ	Drafting Check		
Designer	K. CAPANGPANGAN	Design Check	K. ROWE	



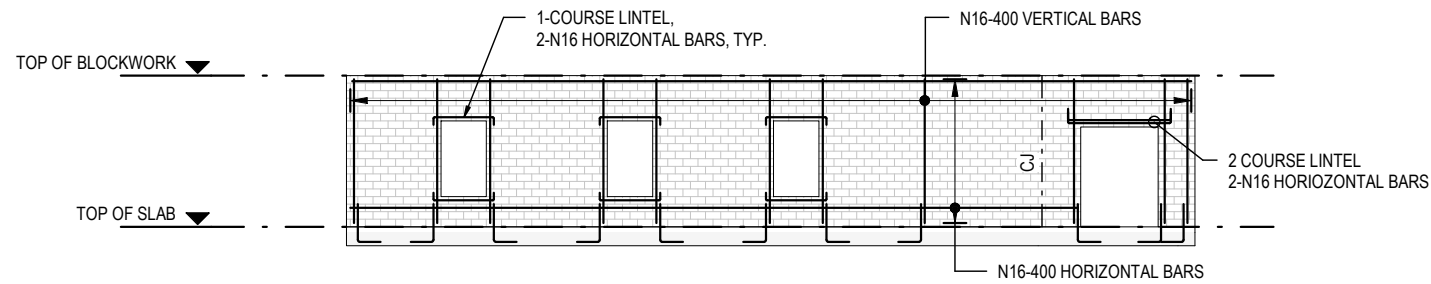
BLOCKWORK ARRANGEMENT PLAN
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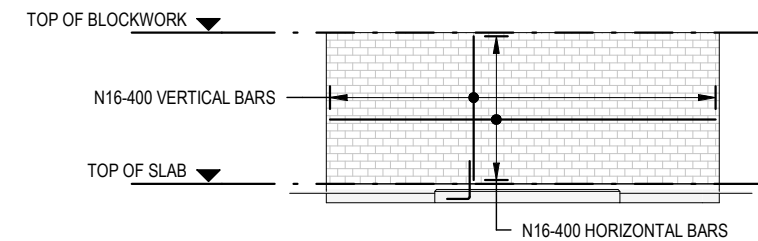
- BW1 - INDICATES 200 SERIES H BLOCKWORK WALL WITH SANDSTONE SPLIT FACE
- P1 - INDICATES ENGAGED PIERS REFER TO SHEET S021 FOR STANDARD DETAILS
- CJ - INDICATES CONTROL JOINTS IN BLOCKWORK REFER TO TYPICAL DETAILS FOR CONSTRUCTION DETAIL



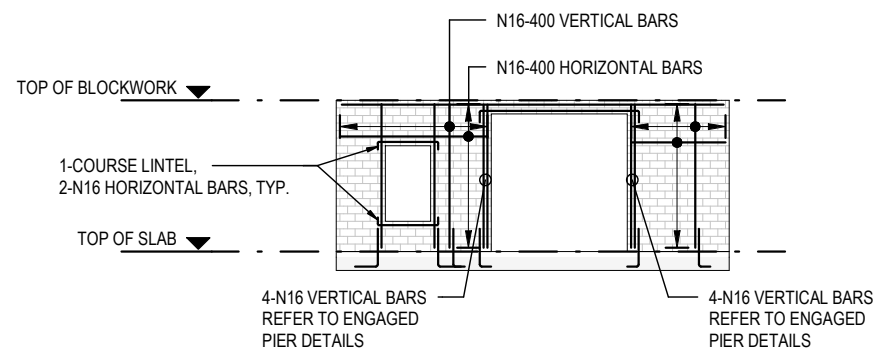
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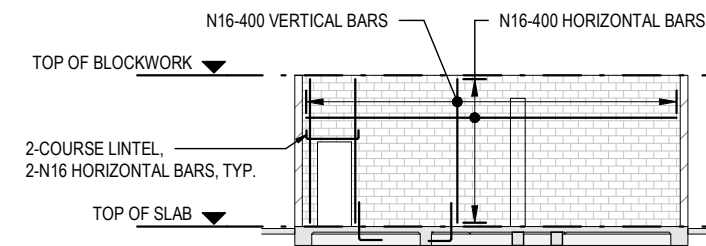
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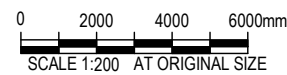
D ELEVATION
SCALE 1:200



B ELEVATION
SCALE 1:200



E ELEVATION
SCALE 1:200



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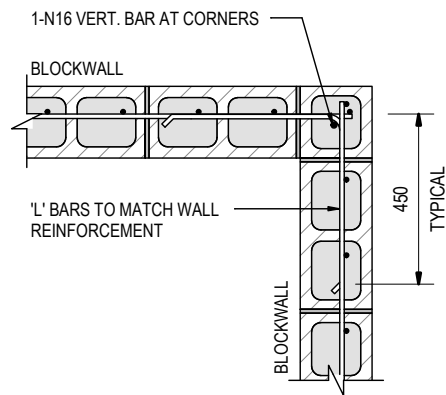
Project No.
12589773

Client	PARKES SHIRES COUNCIL
Project	LACHLINE PIPELINE DUPLICATION DETAIL DESIGN TSS
Status	PRELIMINARY

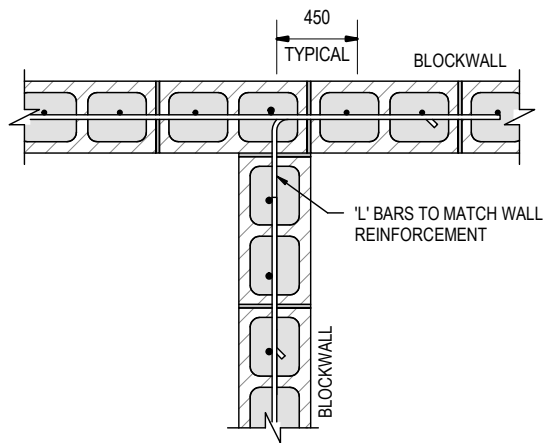
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Drawing No.
12589773-S020

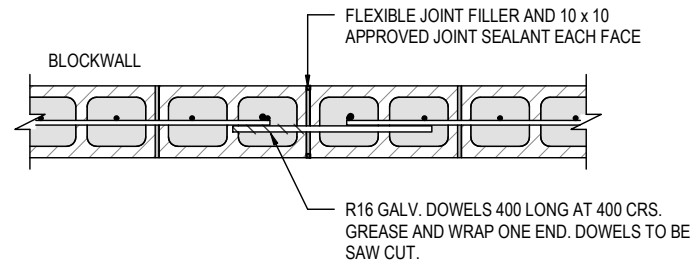
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Author	M. PAZ	Drafting Check		
Designer	K. CAPANGPANGAN	Design Check	K. ROWE	



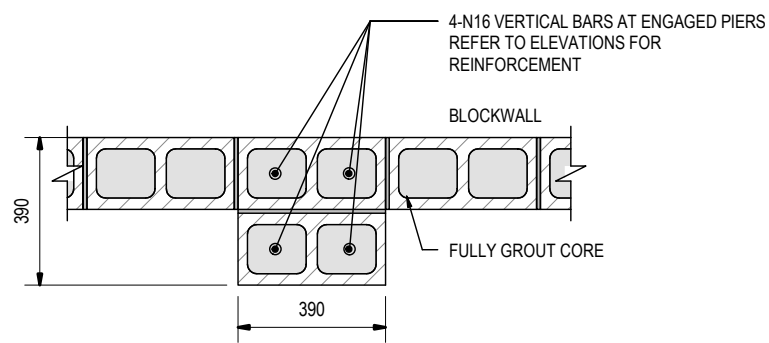
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SCALE 1:20



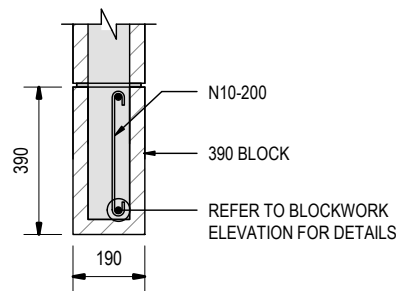
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SCALE 1:20



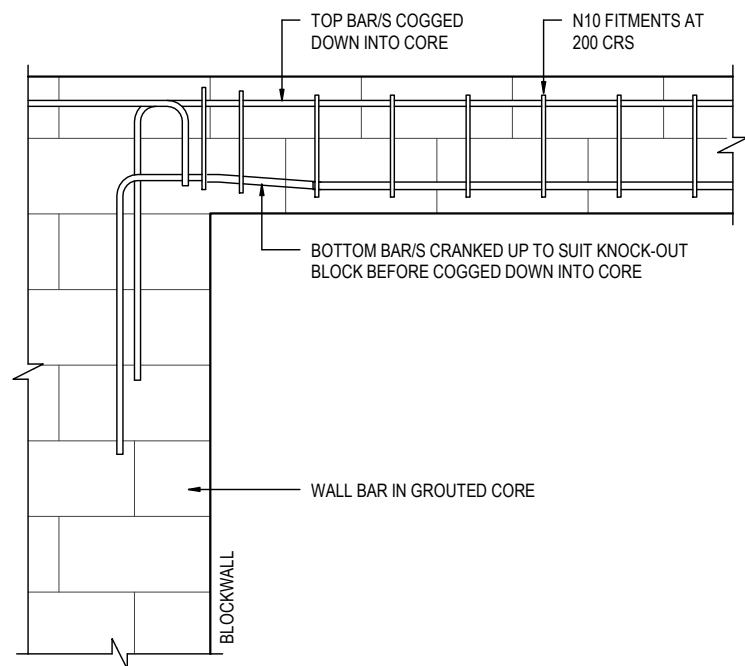
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SCALE 1:20



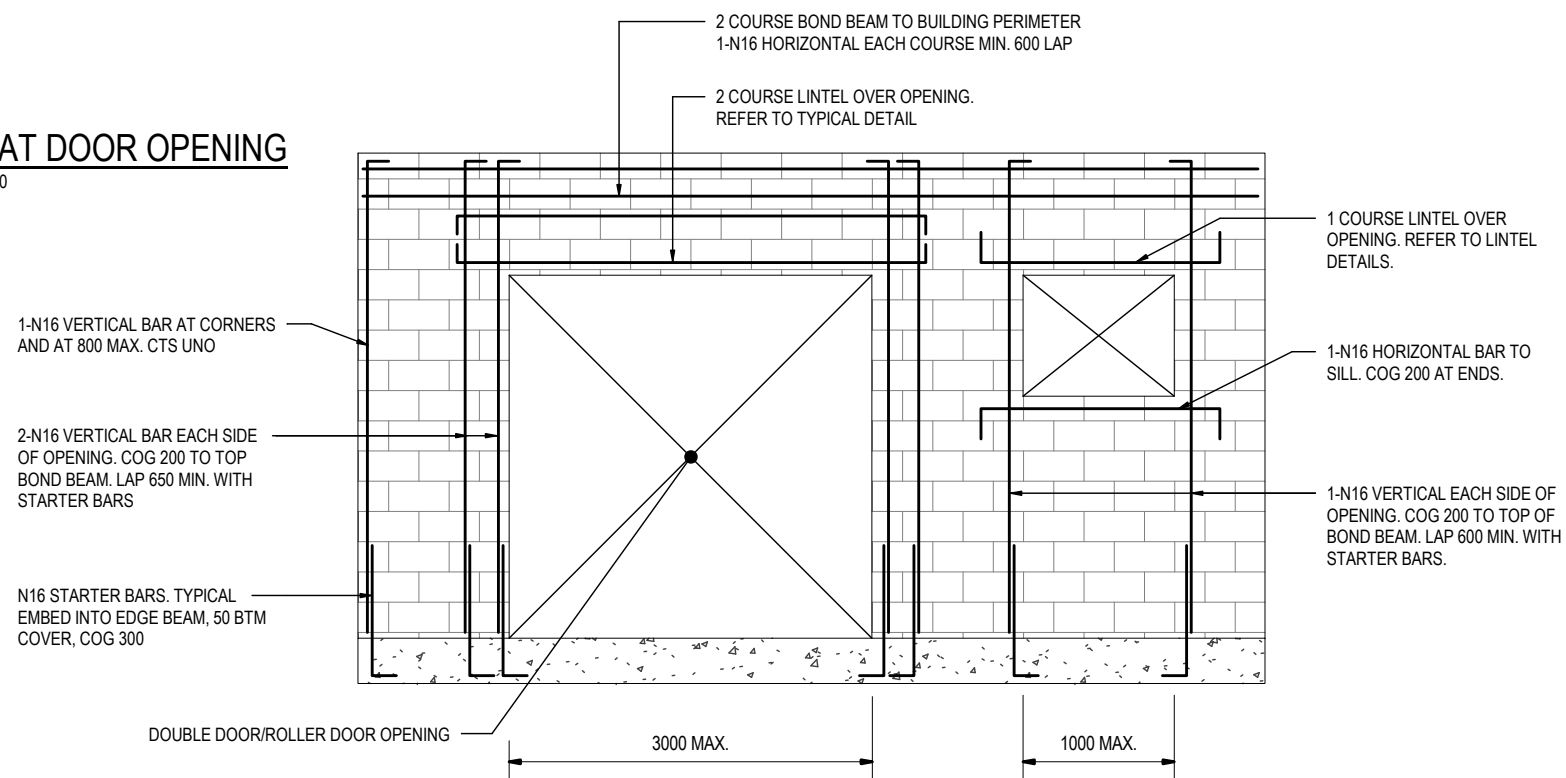
ENGAGED PIER TYPICAL DETAIL
SCALE 1:20



TYPICAL LINTEL DETAIL AT DOOR OPENING
SCALE 1:20



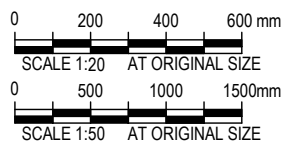
LINTEL SUPPORT DETAIL
SCALE 1:20



TYPICAL BLOCKWORK REINFORCEMENT DETAIL
SCALE 1:50

NOTE: ALL CORES FILLED WITH 20MPa CONCRETE

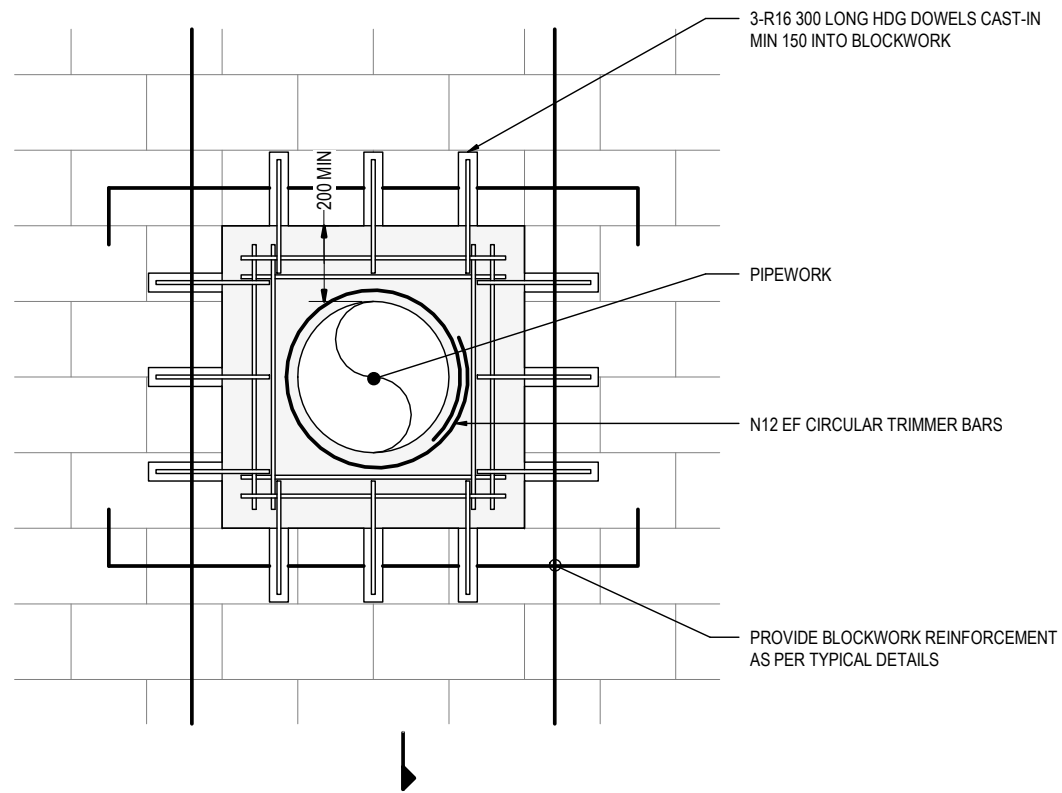
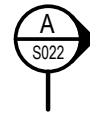
Rev	Description	Checked	Approved	Date
A	80% DETAIL DESIGN			
Author	M. PAZ			
Designer	K. CAPANGPANGAN			
Drafting Check				
Design Check	K. ROWE			



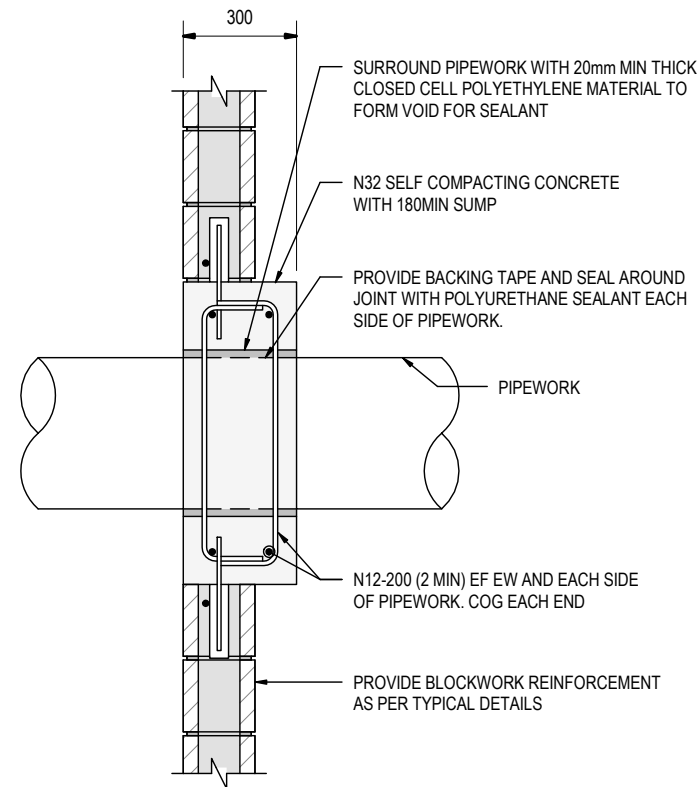
Client	PARKES SHIRES COUNCIL
Project	LACHLINE PIPELINE DUPLICATION DETAIL DESIGN TSS
Status	PRELIMINARY

Drawing Title	STRUCTURAL PUMPSTATION TYPICAL BLOCKWORK DETAILS SHEET 1
Drawing No.	12589773-S021

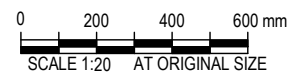
Size **A3**
Rev **A**



**TYPICAL PIPEWORK PENETRATION
ELEVATION**
SCALE 1:20



A SECTION
SCALE 1:20



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12589773

Client	PARKES SHIRES COUNCIL
Project	LACHLINE PIPELINE DUPLICATION DETAIL DESIGN TSS
Status	PRELIMINARY

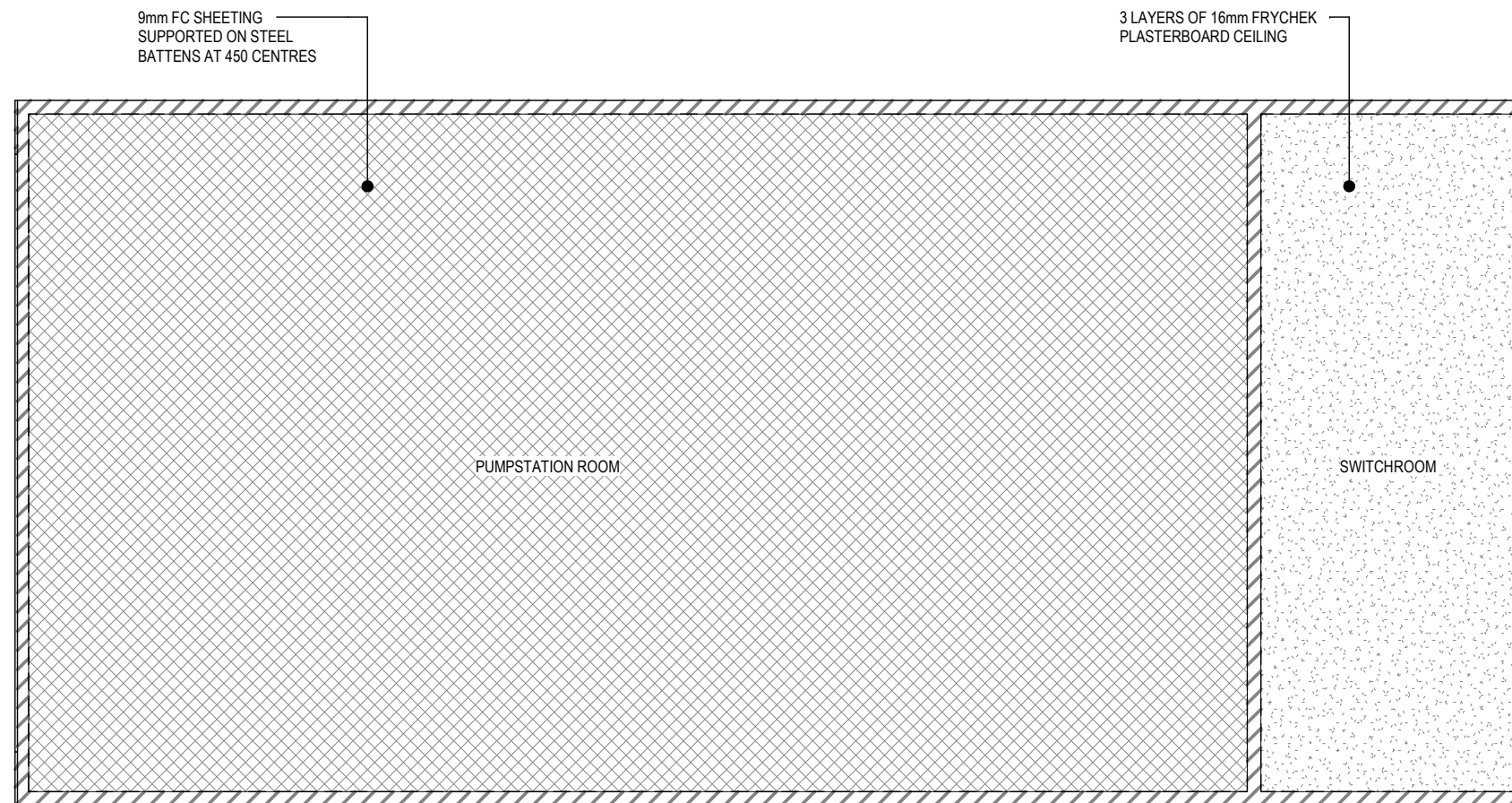
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Drawing No.
12589773-S022

Size
A3

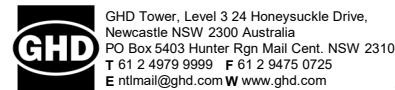
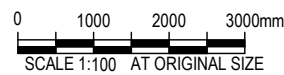
Rev
A

Rev	Description	Checked	Approved	Date
A	80% DETAIL DESIGN			
Author	M. PAZ	Drafting Check		
Designer	K. CAPANGPANGAN	Design Check	K. ROWE	



TYPICAL CEILING PLAN
SCALE 1 : 100

Rev	Description	Checked	Approved	Date
A	80% DETAIL DESIGN			
Author	M. PAZ	Drafting Check		
Designer	K. CAPANGPANGAN	Design Check	K. ROWE	



Client	PARKES SHIRES COUNCIL
Project	LACHLINE PIPELINE DUPLICATION DETAIL DESIGN TSS
Status	PRELIMINARY

Drawing Title	STRUCTURAL PUMPSTATION ROOF AND CEILING PLAN
Drawing No.	12589773-S030


Size
A3
Rev
A

DOOR SCHEDULE

DOOR CODE	LEAF DETAILS		HEIGHT	WIDTH	LEAF DETAILS	FRAME			SEALS	HARDWARE	COMMENTS	QUANTITY
	LEAF TYPE	LEAF FINISH			WIDTH (2ND LEAF)	TYPE	FINISH	FIRE RATING				
D01	SOLID CORE	PAINTED FINISH	2160	820		FILLED STEEL DOOR FRAME	PAINTED		WEATHER SEAL	LOCKWOOD A310 MAGNETIC DOOR STOP	PROVIDE STAINLESS STEEL HINGES TO ALLOW 180 DEGREE OPERATION	2
D02	SOLID CORE	PAINTED FINISH	2600	950	950	FILLED DOOR FRAME	PAINTED	120/120/120	INTUMESCENT FIRE DOOR SEALS	LOCKWOOD A310 MAGNETIC DOOR STOP	PROVIDE STAINLESS STEEL HINGES TO ALLOW 180 DEGREE OPERATION	1
D03	SOLID CORE	PAINTED FINISH	3600	1750	1750	FILLED DOOR FRAME	PAINTED	120/120/120	INTUMESCENT FIRE DOOR SEALS	LOCKWOOD A310 MAGNETIC DOOR STOP	PROVIDE STAINLESS STEEL HINGES TO ALLOW 180 DEGREE OPERATION	1

Rev	Description	Checked	Approved	Date
A	80% DETAIL DESIGN			
Author	M. PAZ	Drafting Check		
Designer	K. CAPANGPANGAN	Design Check	K. ROWE	


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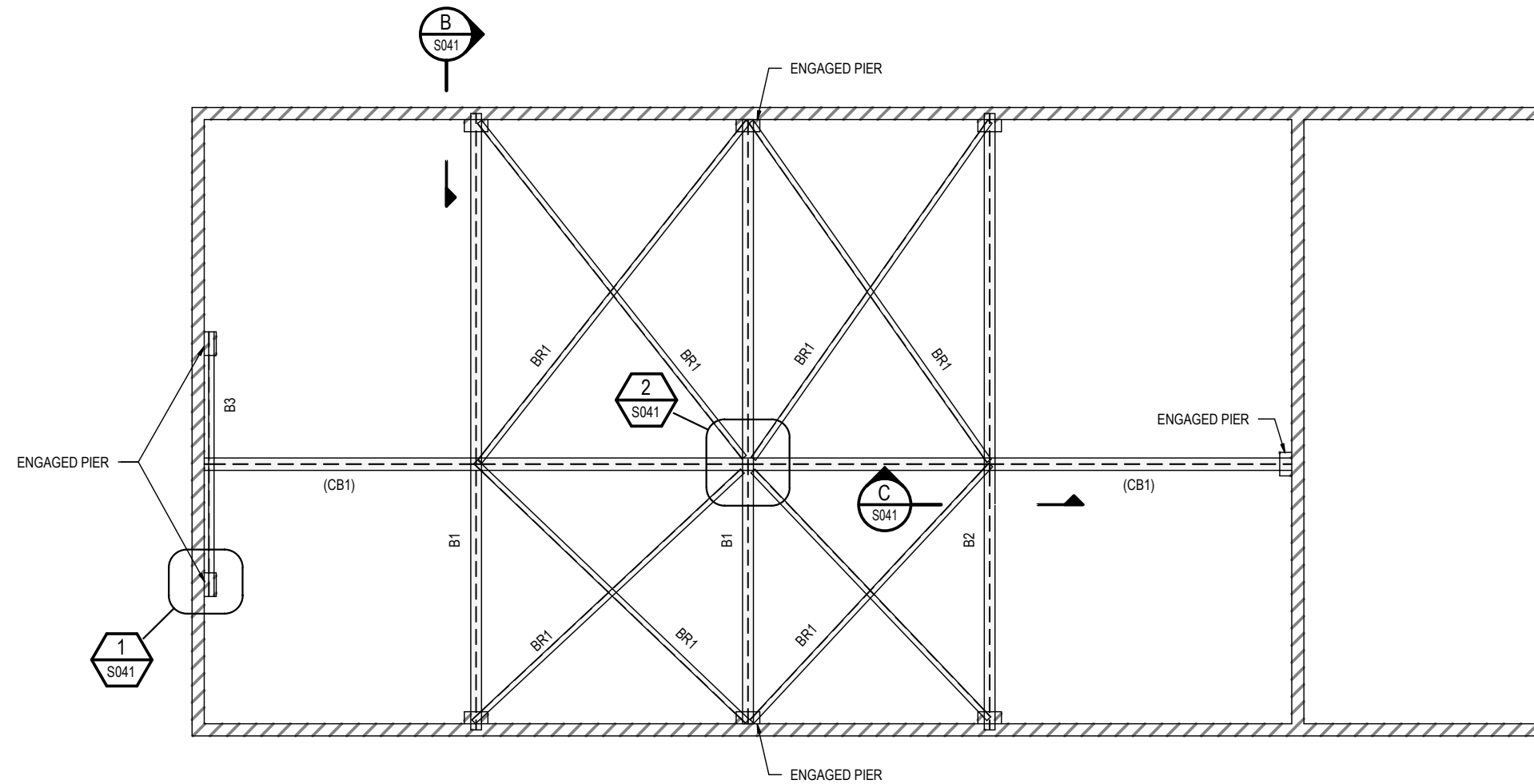
Client	PARKES SHIRES COUNCIL
Project	LACHLINE PIPELINE DUPLICATION DETAIL DESIGN TSS
Status	PRELIMINARY

Drawing Title	STRUCTURAL PUMPSTATION DOOR SCHEDULE
Drawing No.	12589773-S031

Size
A3
 Rev
A

LEGEND:

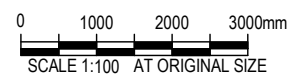
 DENOTES 200 MASONRY BLOCK WALL
REFER TO STANDARD DETAILS



MONORAIL CRANE SUPPORT FRAMING PLAN

SCALE 1 : 100

Rev	Description	Checked	Approved	Date
A	80% DETAIL DESIGN			
Author	M. PAZ	Drafting Check		
Designer	K. CAPANGPANGAN	Design Check	K. ROWE	



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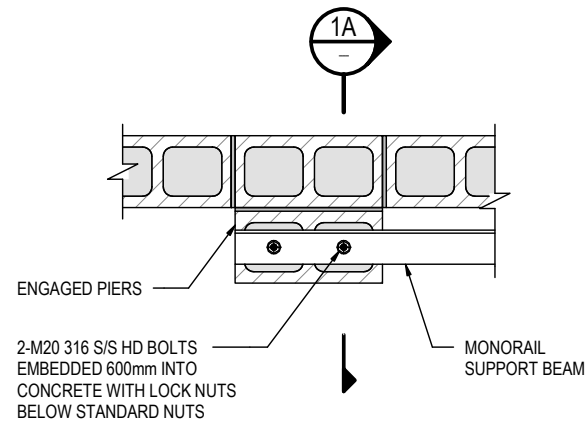
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Project No.
12589773

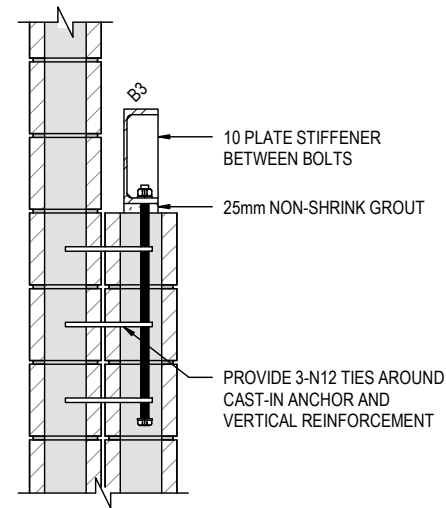
Client	PARKES SHIRES COUNCIL
Project	LACHLINE PIPELINE DUPLICATION DETAIL DESIGN TSS
Status	PRELIMINARY

Drawing Title	STRUCTURAL PUMPSTATION TYPICAL MONORAIL CRANE SUPPORT FRAMING LAYOUT
Drawing No.	12589773-S040

Size
A3
Rev
A

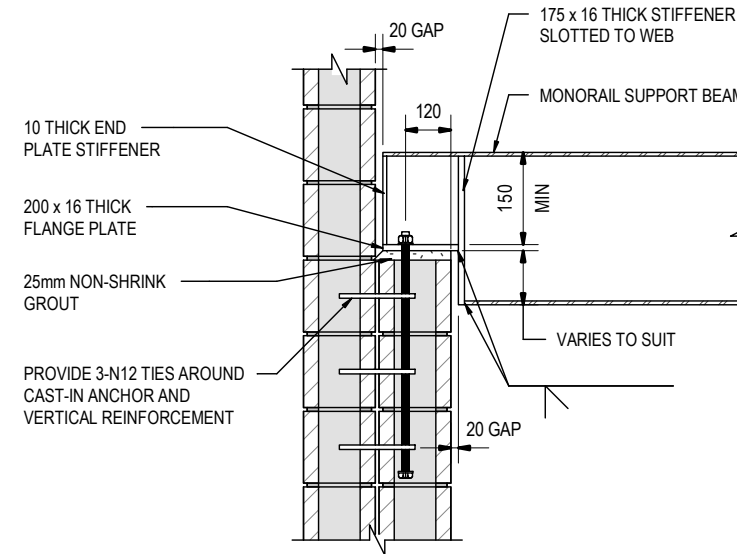


1 DETAIL
S040 SCALE 1:20



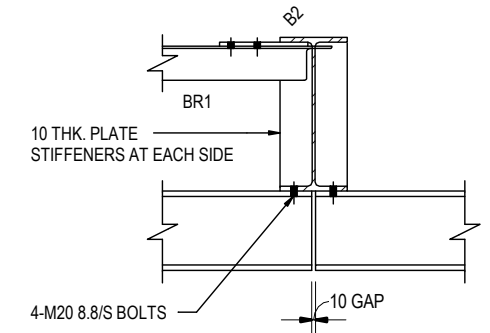
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1A SECTION
SCALE 1:20

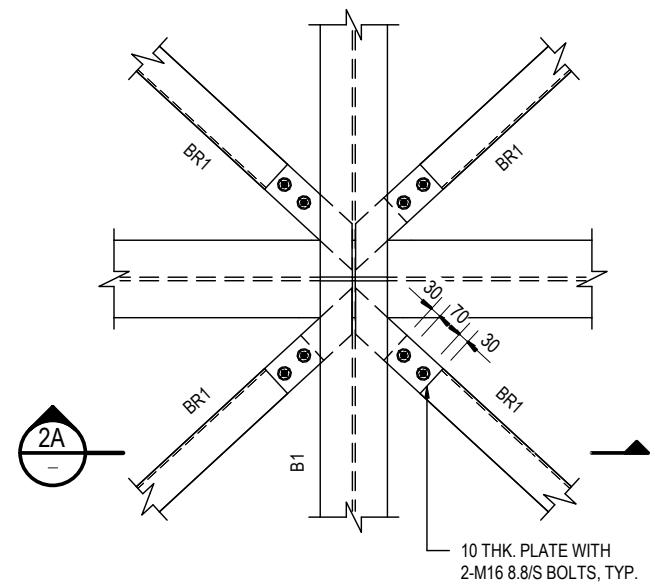


NOTE: REINFORCEMENT NOT SHOWN FOR CLARITY

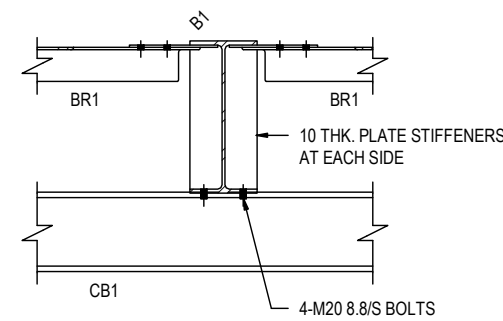
B SECTION
S040 SCALE 1:20



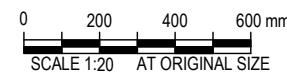
C SECTION
S040 SCALE 1:20



2 DETAIL
S040 SCALE 1:20



2A SECTION
SCALE 1:20

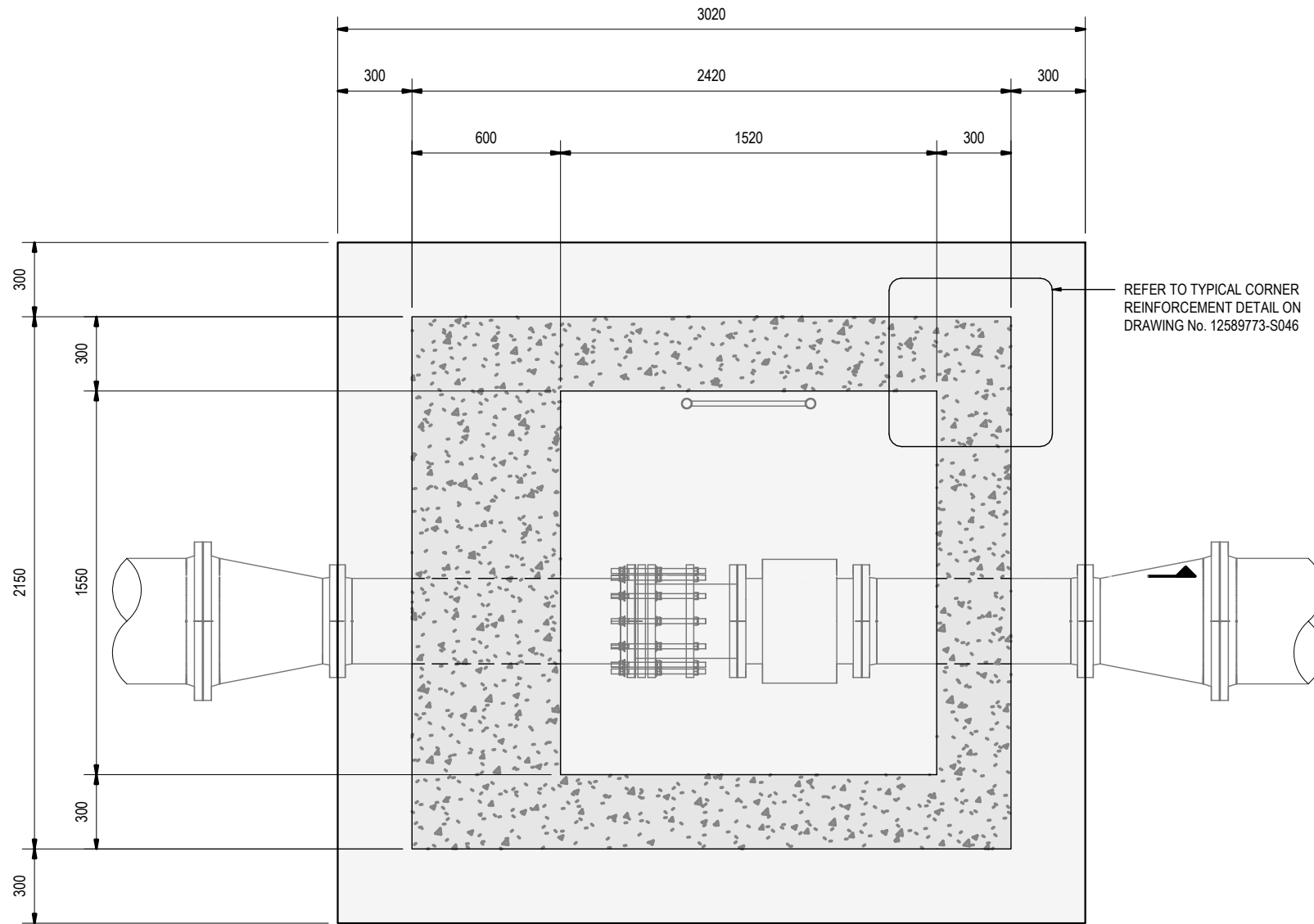
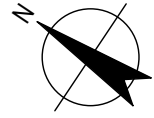


Client	PARKES SHIRES COUNCIL
Project	LACHLINE PIPELINE DUPLICATION DETAIL DESIGN TSS
Status	PRELIMINARY

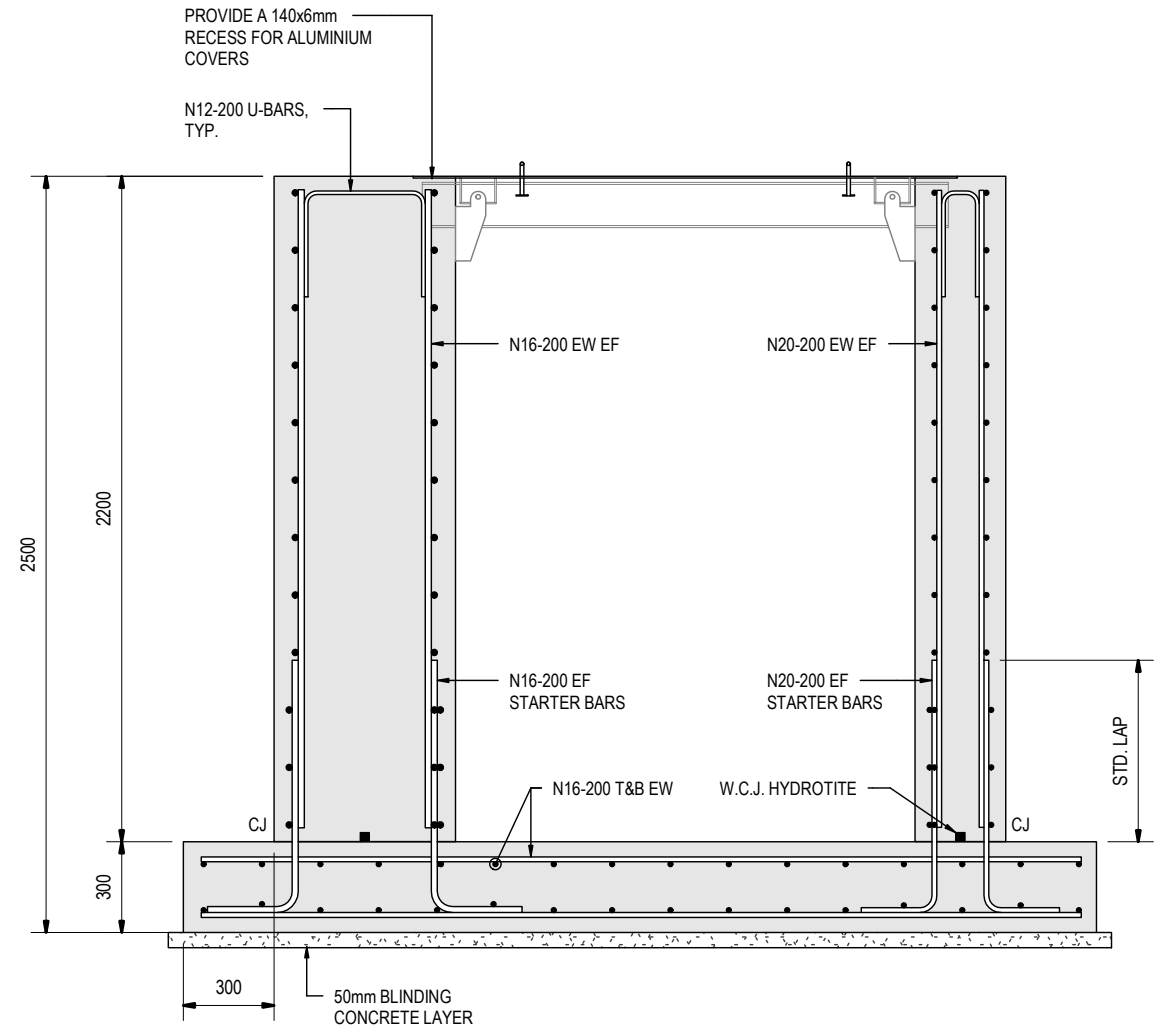
Drawing Title	STRUCTURAL PUMPSTATION TYPICAL MONORAIL BEAM DETAILS
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Drawing No. **12589773-S041**

Rev	Description	Checked	Approved	Date
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Author	M. PAZ	Drafting Check		
Designer	K. CAPANGPANGAN	Design Check	K. ROWE	

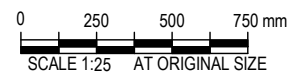


FLOWMETER SLAB LAYOUT
SCALE 1:25



SECTION A-A
SCALE 1:25

Rev	Description	Checked	Approved	Date
A	80% DETAIL DESIGN			
Author	M. PAZ			
Designer	K. CAPANGPANGAN			
Drafting Check				
Design Check	K. ROWE			



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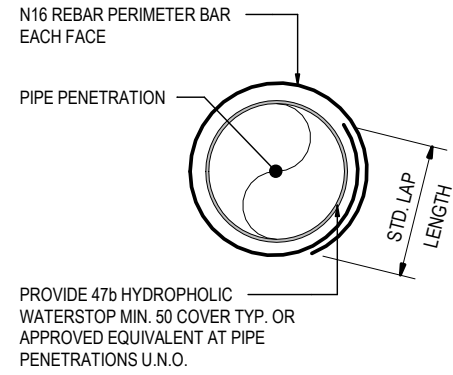
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Project No.
12589773

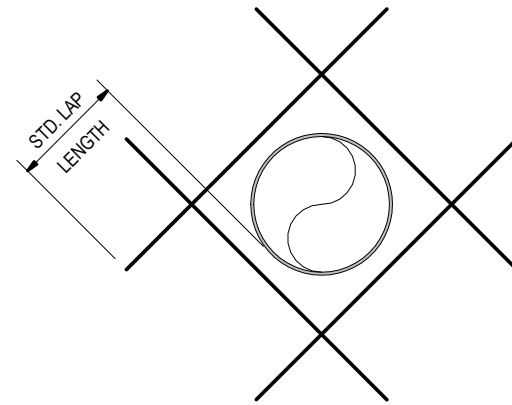
Client	PARKES SHIRES COUNCIL
Project	LACHLINE PIPELINE DUPLICATION DETAIL DESIGN TSS
Status	PRELIMINARY
Status Code	

Drawing Title	STRUCTURAL FLOWMETER PIT TYPICAL LAYOUT PLAN AND DETAILS
Drawing No.	12589773-S045
Rev	A

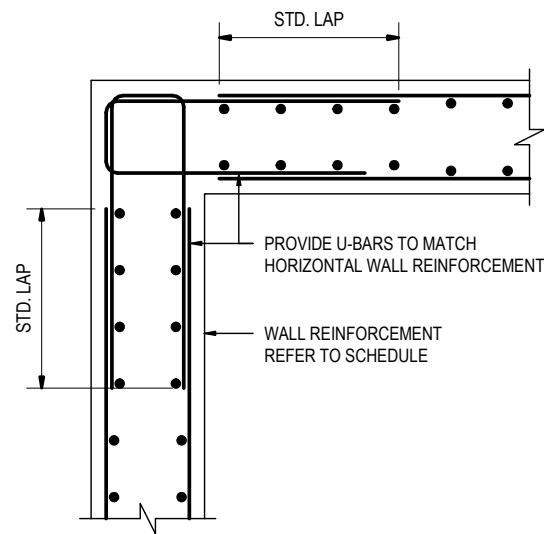
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A3



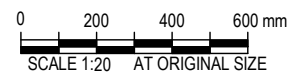
TYPICAL PIPE PENETRATION DETAILS
> 375 DIA PIPE
 SCALE 1:20



TYPICAL PIPE PENETRATION DETAILS
< 375 DIA PIPE
 SCALE 1:20



TYPICAL DOUBLE REINFORCEMENT WALL
CORNER DETAIL
 SCALE 1:20



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Project No.
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Client	PARKES SHIRES COUNCIL
Project	LACHLINE PIPELINE DUPLICATION DETAIL DESIGN TSS
Status	PRELIMINARY

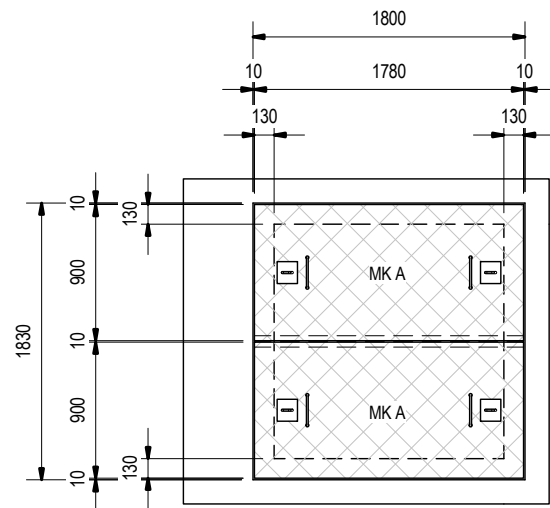
Drawing Title	STRUCTURAL FLOWMETER PIT TYPICAL PIPE PENETRATION DETAILS
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Drawing No.
 12589773-S046

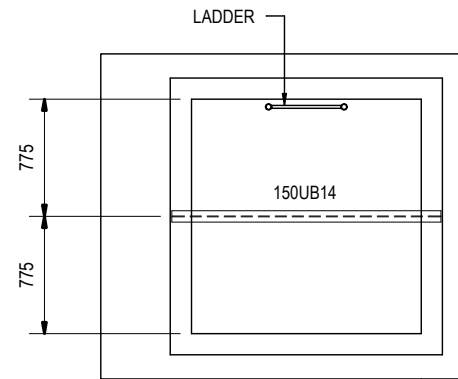
Size
A3

Rev
A

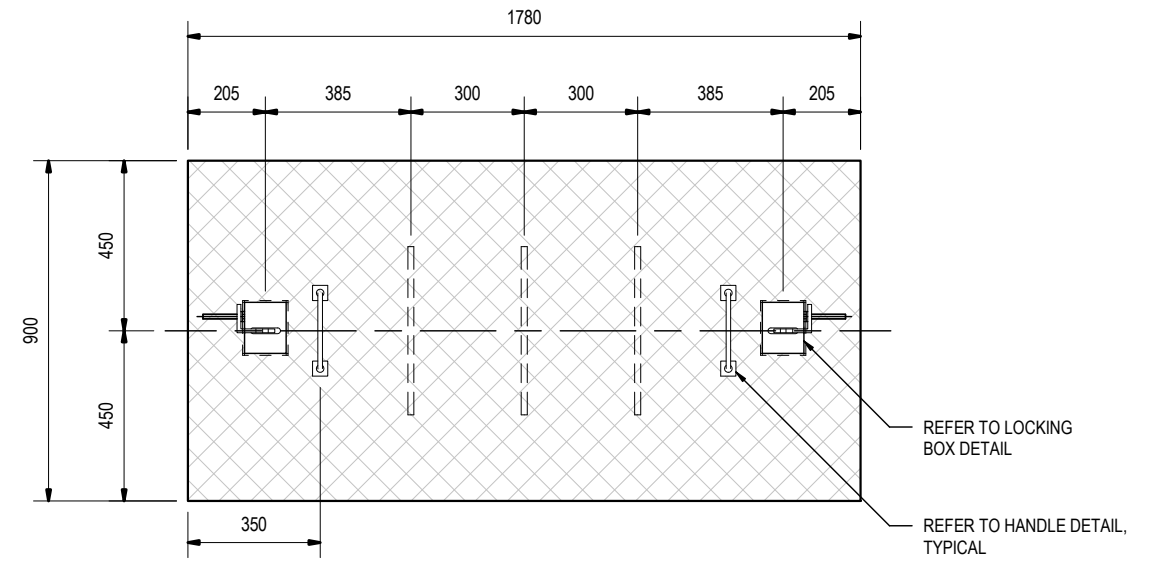
Rev	Description	Checked	Approved	Date
A	80% DETAIL DESIGN			
Author	M. PAZ	Drafting Check		
Designer	K. CAPANGPANGAN	Design Check	K. ROWE	



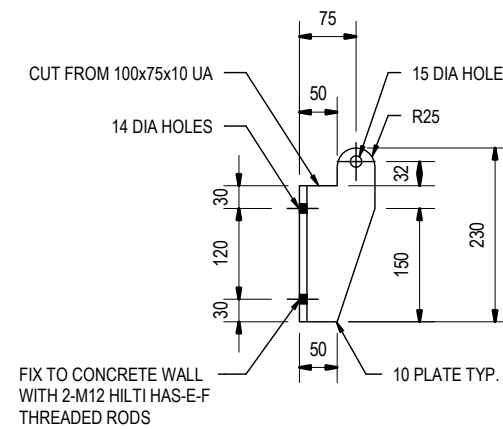
FLOWMETER PIT COVER PLAN
SCALE 1:50



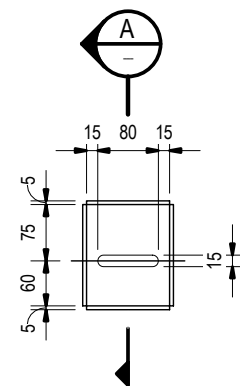
FLOWMETER PIT BEAM PLAN
SCALE 1:50



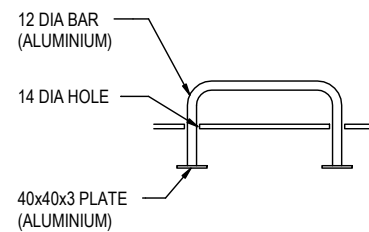
COVER PLATE MK A
SCALE 1:20



LOCKING BRACKET DETAIL
SCALE 1:10



LOCKING BOX DETAILS
SCALE 1:10

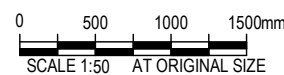
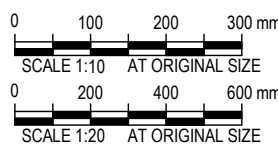


HANDLE DETAIL
SCALE 1:10



SECTION A
SCALE 1:10

Rev	Description	Checked	Approved	Date
A	80% DETAIL DESIGN			
Author	M. PAZ	Drafting Check		
Designer	K. CAPANGPANGAN	Design Check	K. ROWE	



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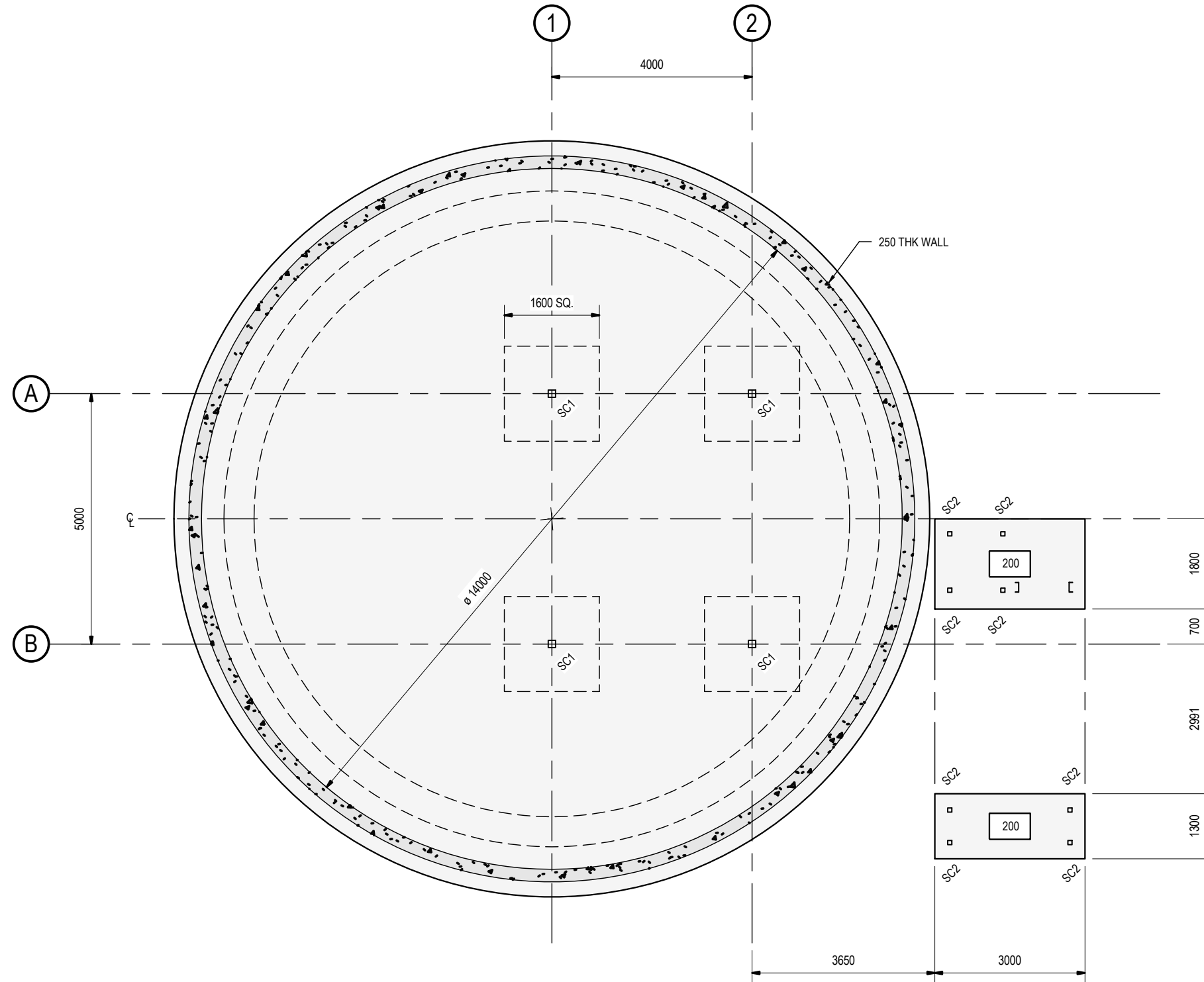
Project No.
12589773

Client	PARKES SHIRES COUNCIL
Project	LACHLINE PIPELINE DUPLICATION DETAIL DESIGN TSS
Status	PRELIMINARY

Drawing Title	STRUCTURAL FLOWMETER PIT PIT COVER PLAN AND DETAILS
Drawing No.	12589773-S048

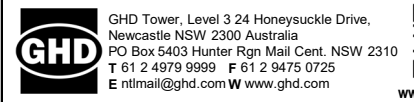
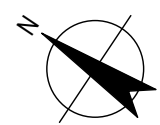
Size
A3
Rev
A

STEEL COLUMN SCHEDULE		
MARK	SIZE	COMMENTS
SC1	150x150x5.0SHS	SS GRADE 316
SC2	89x89x6.0SHS	



TYPICAL FOOTING LAYOUT
SCALE 1 : 100

Rev	Description	Checked	Approved	Date
A	80% DETAIL DESIGN			
Author	M. PAZ	Drafting Check		
Designer	J. O'SULLIVAN	Design Check	K. ROWE	

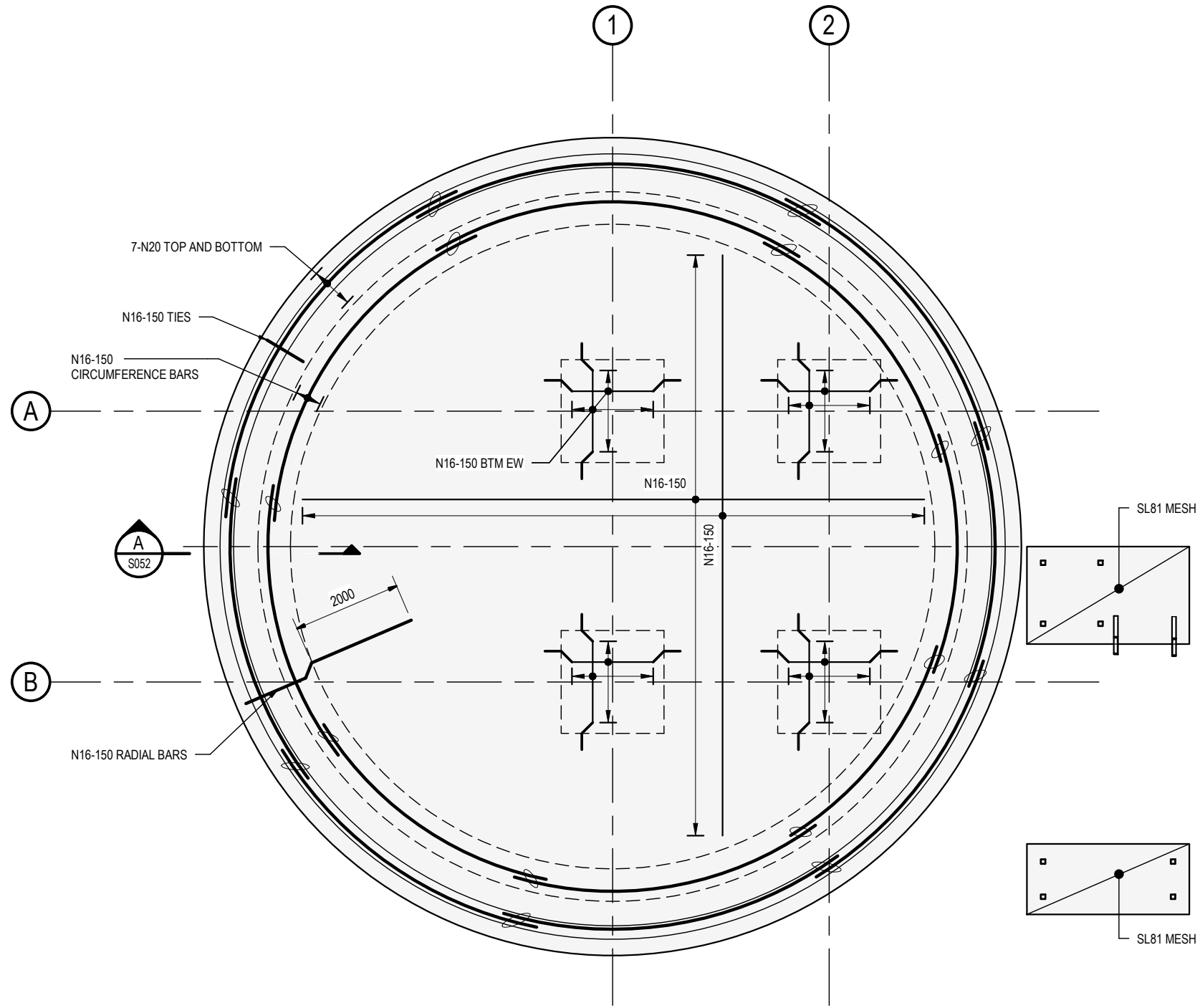


Client	PARKES SHIRES COUNCIL
Project	LACHLINE PIPELINE DUPLICATION DETAIL DESIGN TSS
Status	PRELIMINARY
Status Code	

Drawing Title	STRUCTURAL RESERVOIR TYPICAL FOOTING LAYOUT
Drawing No.	12589773-S050

Size
A3

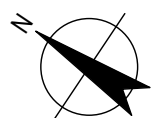
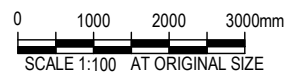
Rev
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TYPICAL FOOTING REINFORCEMENT LAYOUT

SCALE 1 : 100

Rev	Description	Checked	Approved	Date
A	80% DETAIL DESIGN			
Author	M. PAZ	Drafting Check		
Designer	J. O'SULLIVAN	Design Check	K. ROWE	



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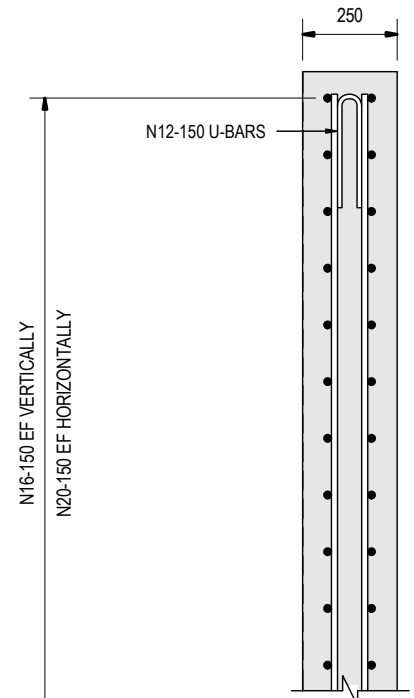
Client	PARKES SHIRES COUNCIL
Project	LACHLINE PIPELINE DUPLICATION DETAIL DESIGN TSS
Status	PRELIMINARY

Drawing Title	STRUCTURAL RESERVOIR TYPICAL FOOTING REINFORCEMENT LAYOUT
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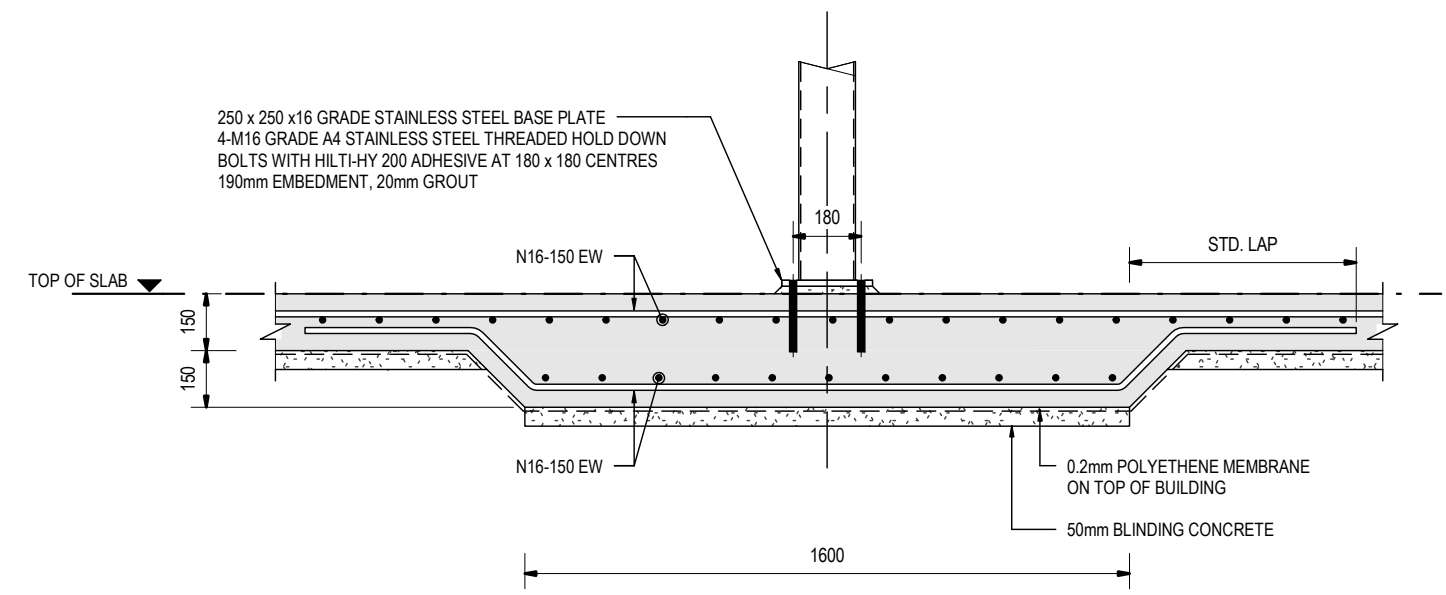
Drawing No.
12589773-S051

Size
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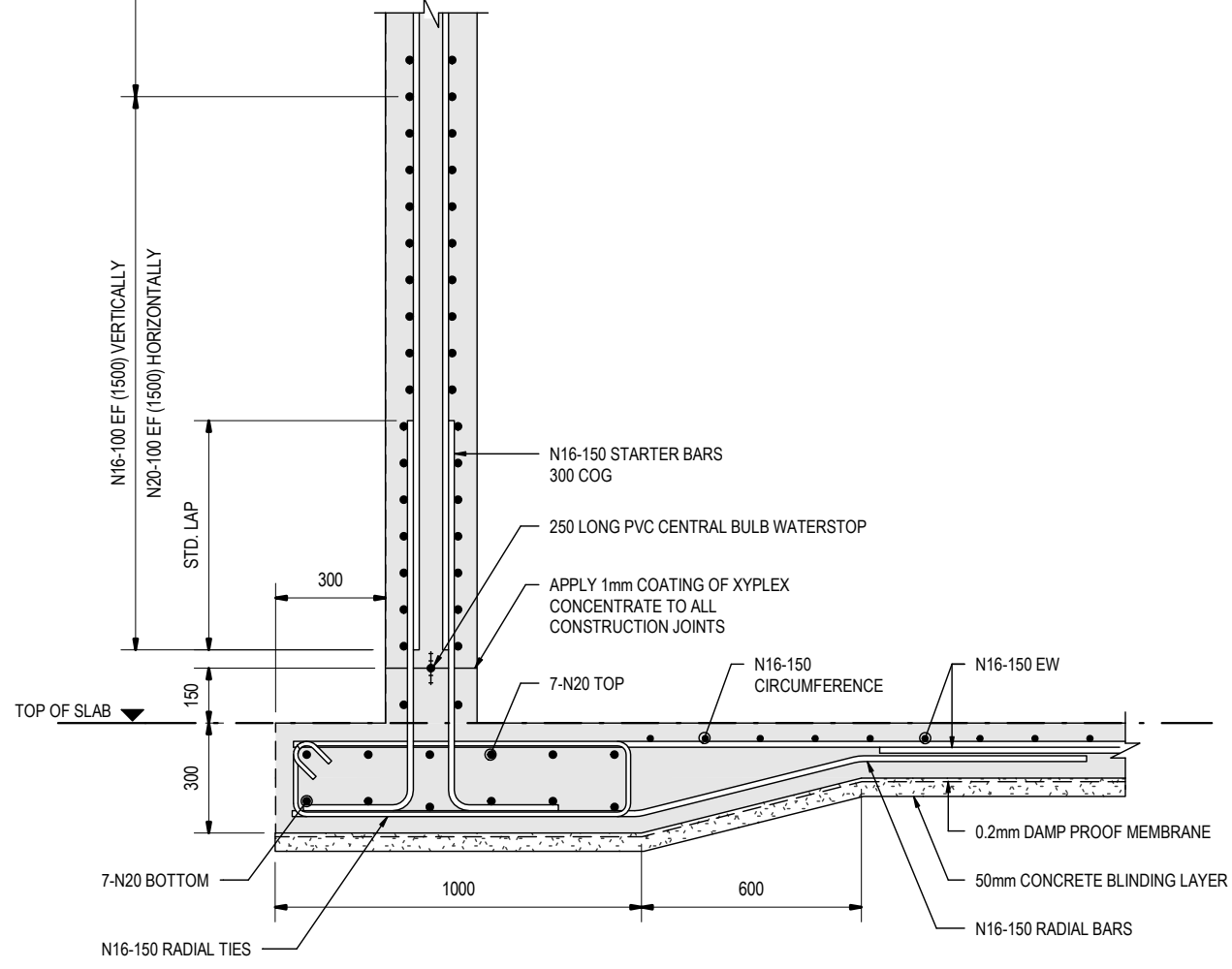
Rev
A



- NOTES:**
1. STAGGER HORIZONTAL REINFORCEMENT BAR LAPPING
 2. PROVIDE HORIZONTAL WATER STOP AT 2.5m SPACING AS PER TYPICAL DETAIL



TYPICAL (SC1) FOOTING DETAIL
SCALE 1 : 20



A SECTION
S051 SCALE 1 : 20



Rev	Description	Checked	Approved	Date
A	80% DETAIL DESIGN			
Author	M. PAZ	Drafting Check		
Designer	J. O'SULLIVAN	Design Check	K. ROWE	

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File Name: Autodesk Docs://12589773 - Lachlan Pipeline Duplication Detailed Design/12589773-NEW EUGOWRA ROAD.rvt

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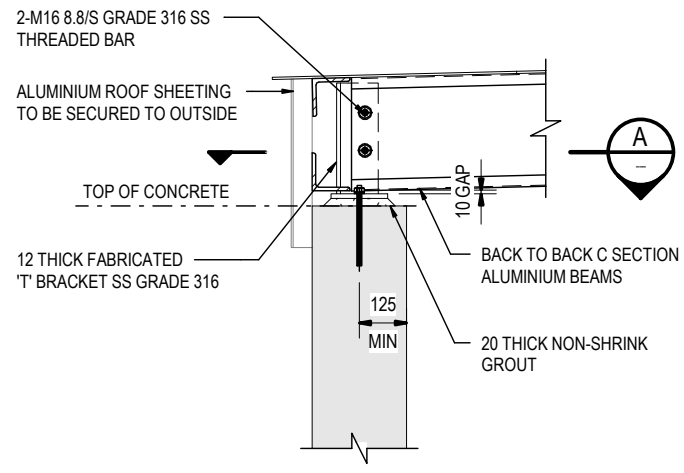


Client	PARKES SHIRES COUNCIL
Project	LACHLINE PIPELINE DUPLICATION DETAIL DESIGN TSS
Status	PRELIMINARY

Drawing Title	STRUCTURAL RESERVOIR TYPICAL REINFORCEMENT DETAILS
Drawing No.	12589773-S052

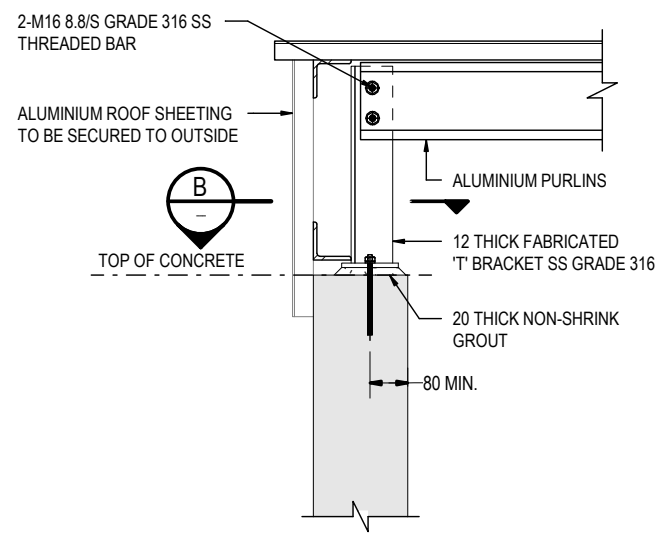
Size **A3**
Rev **A**

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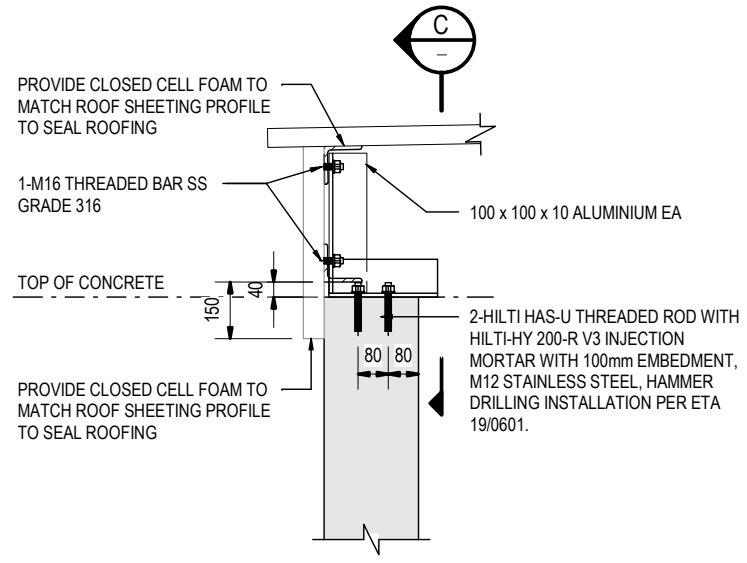
TYPICAL ALUMINUM ROOF BEAM FIXING

SCALE 1:20



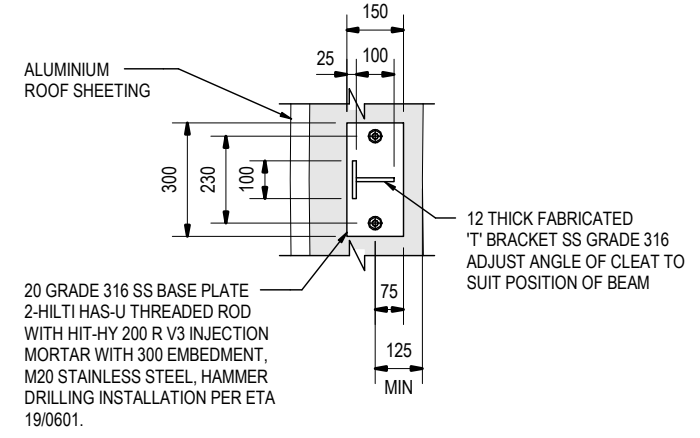
TYPICAL ALUMINUM ROOF PURLIN FIXING

SCALE 1:20

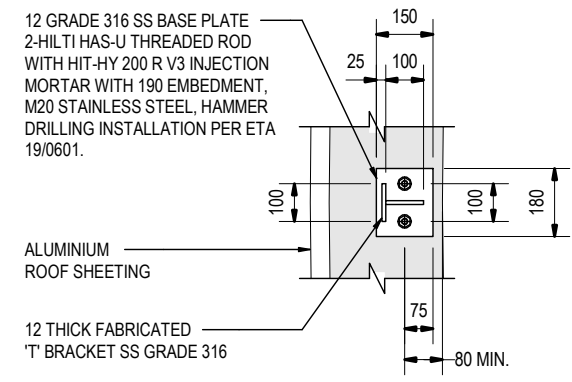


TYPICAL RESERVOIR FASCIA DETAIL

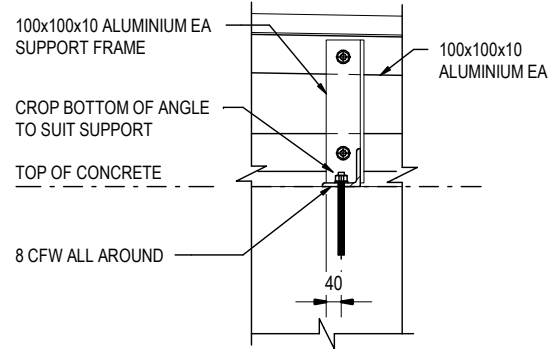
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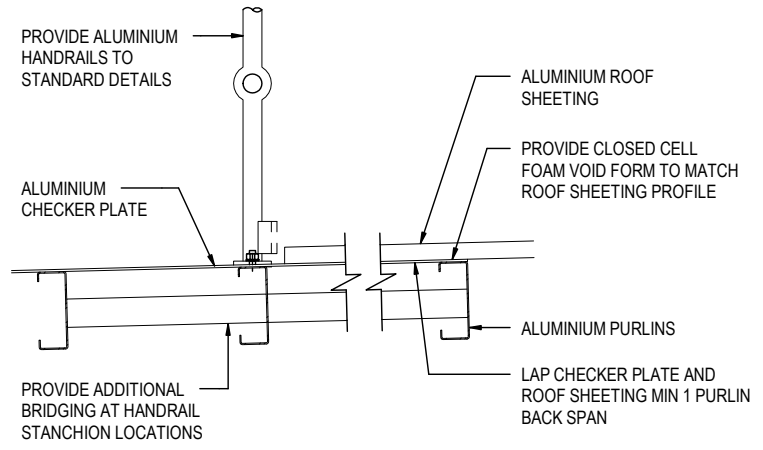
SECTION A
SCALE 1:20



SECTION B
SCALE 1:20

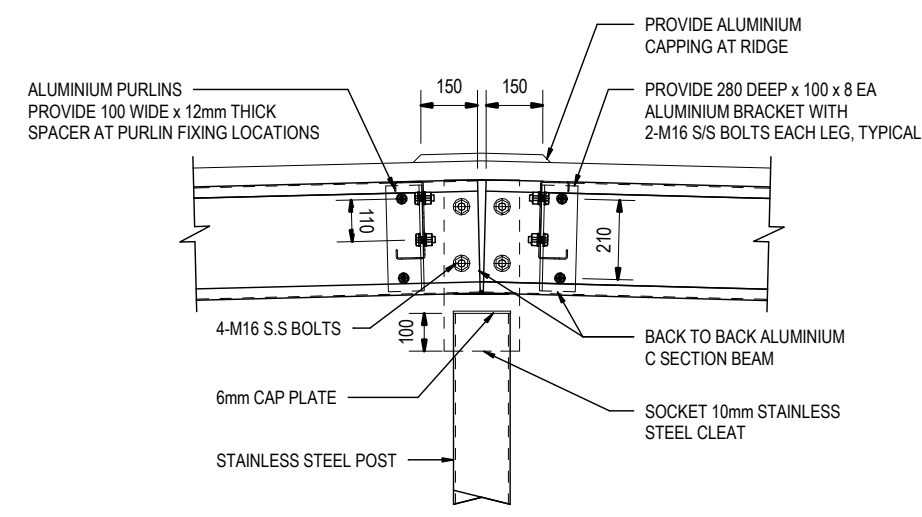


SECTION C
SCALE 1:20



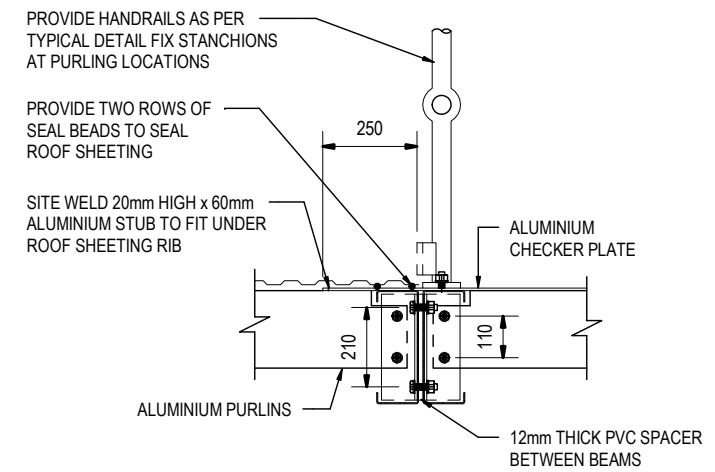
TYPICAL WORKING PLATFORM / ROOF FLASHING DETAIL

SCALE 1:20



TYPICAL STAINLESS STEEL POST FIXING

SCALE 1:20



TYPICAL WORKING PLATFORM / ROOF SIDE FLASHING DETAIL

SCALE 1:20



Rev	Description	Checked	Approved	Date
A	80% DETAIL DESIGN			
Author	M. PAZ			
Designer	J. O'SULLIVAN	Drafting Check		
		Design Check	K. ROWE	

Plot Date: 23-Nov-23 10:28:29 AM

File Name: Autodesk Docs://12589773 - Lachlan Pipeline Duplication Detailed Design/12589773-NEW EUGOWRA ROAD.rvt

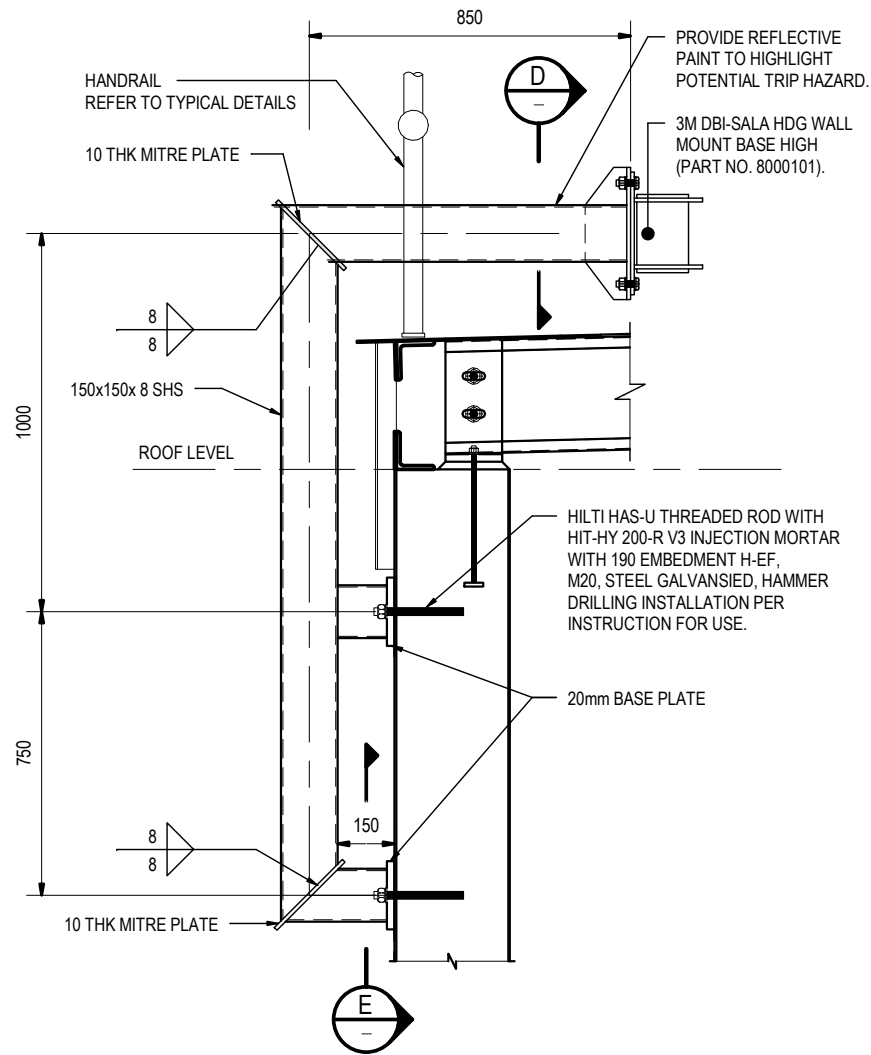


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Project	LACHLINE PIPELINE DUPLICATION DETAIL DESIGN TSS
Status	PRELIMINARY

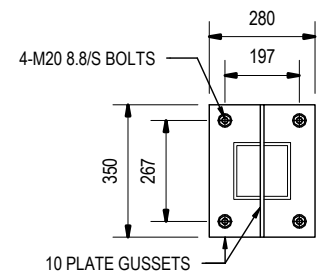
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Drawing No.	12589773-S055

Size **A3**
Rev **A**

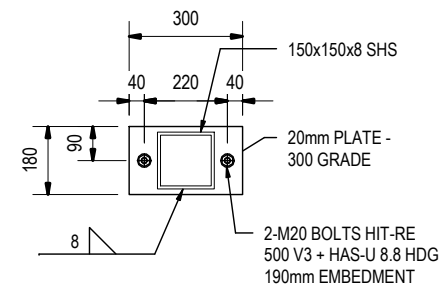
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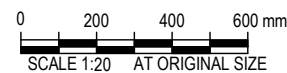
TYPICAL DAVIT ARM MOUNTING CONNECTION
DETAIL
 SCALE 1:20



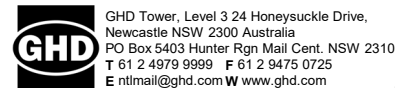
D SECTION
 SCALE 1:20



E SECTION
 SCALE 1:20



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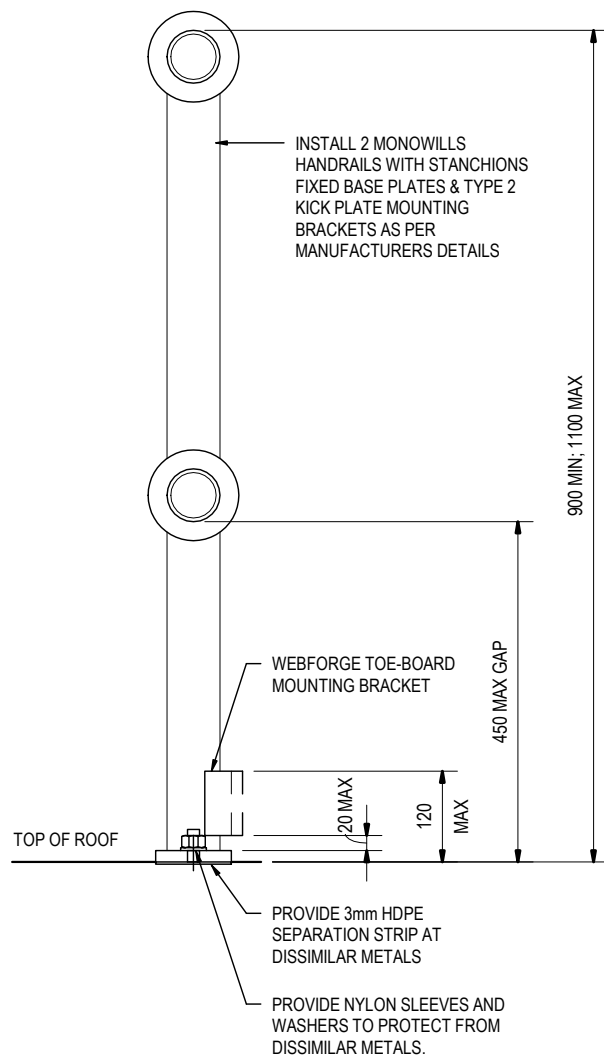
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Client	PARKES SHIRES COUNCIL
Project	LACHLINE PIPELINE DUPLICATION DETAIL DESIGN TSS
Status	PRELIMINARY

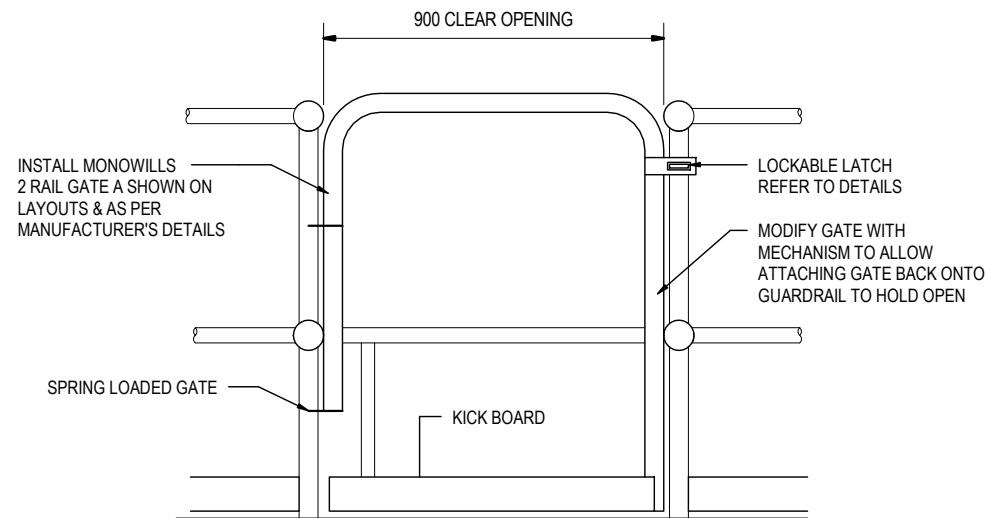
Drawing Title	STRUCTURAL RESERVOIR TYPICAL ROOF STEELWORK DETAILS - SHEET 2
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Drawing No.
12589773-S056

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Author	M. PAZ	Drafting Check		
Designer	J. O'SULLIVAN	Design Check	K. ROWE	



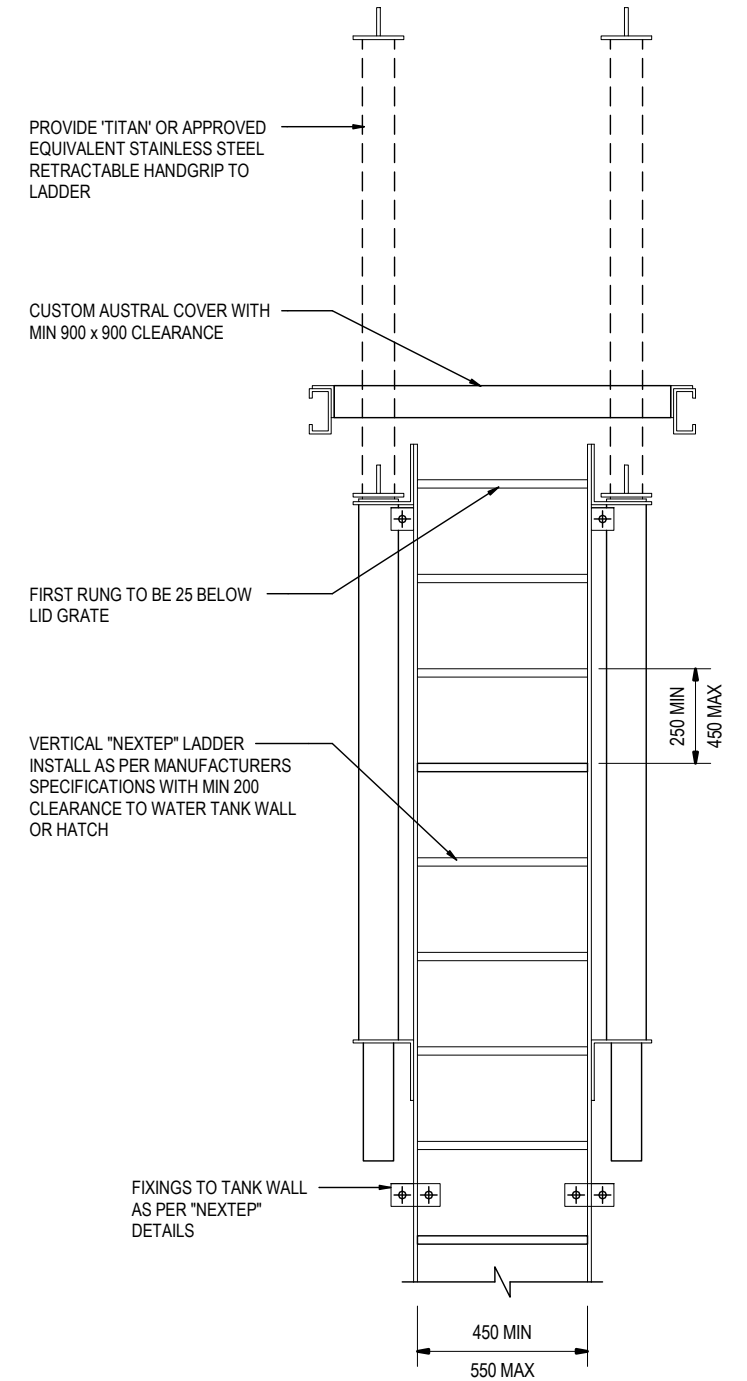
TYPICAL BARRIER DETAIL
SCALE 1 : 10



TYPICAL GATE DETAIL
SCALE 1 : 20

NOTE:

PROVIDE ALUMINUM HANDRAILS AND STAINLESS STEEL FIXINGS (316) WHERE HANDRAILS ARE TO BE ATTACHED TO ALUMINUM ROOF SHEETING. OTHERWISE PROVIDED HDG STEEL HANDRAIL AND FIXINGS.



TYPICAL LADDER DETAIL
SCALE 1 : 20

Rev	Description	Checked	Approved	Date
A	80% DETAIL DESIGN			
Author	M. PAZ	Drafting Check		
Designer	J. O'SULLIVAN	Design Check	K. ROWE	

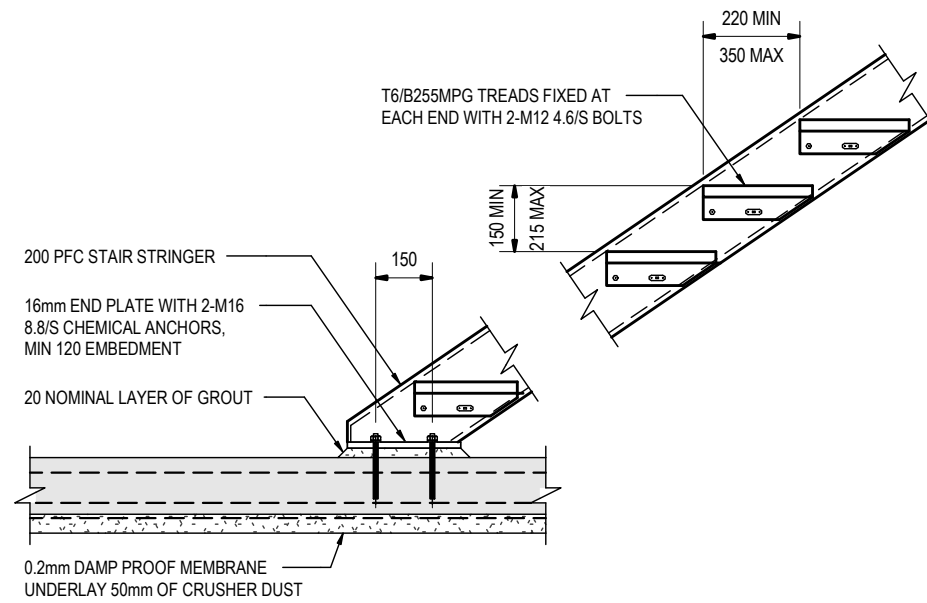
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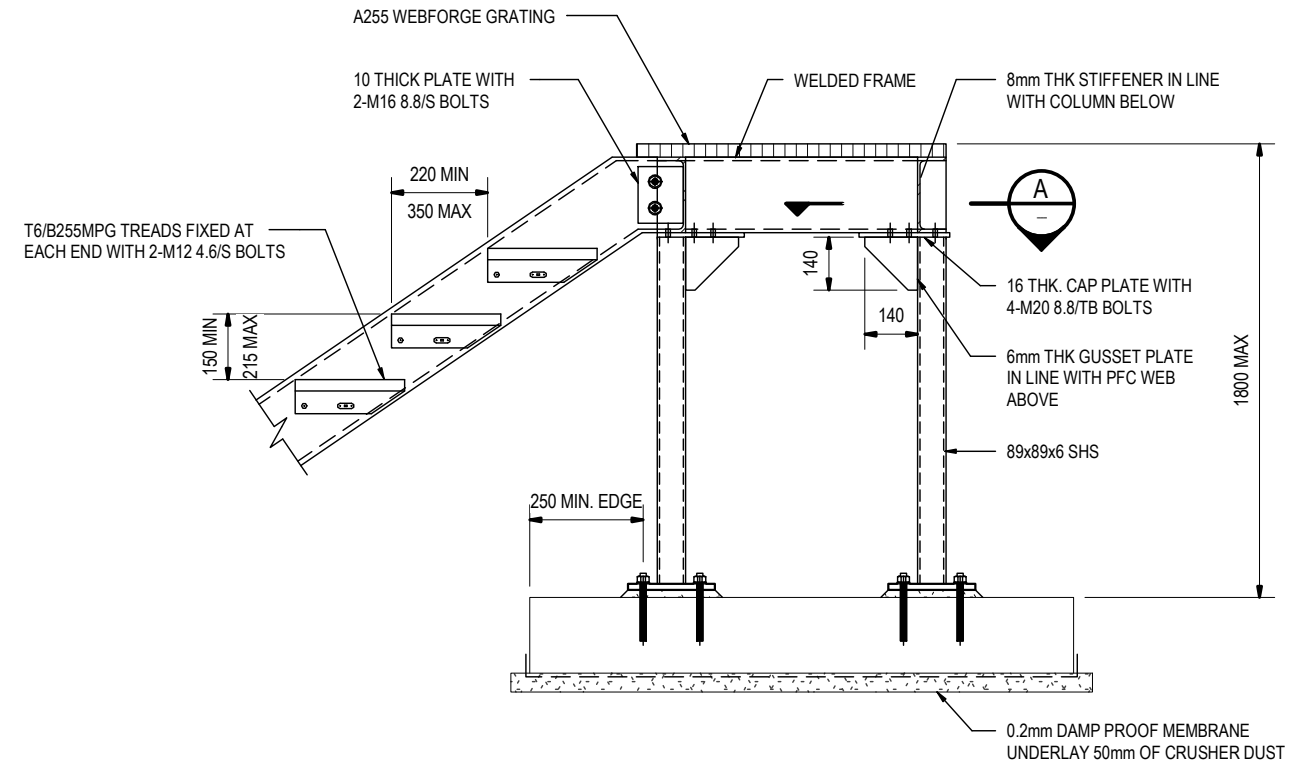
Project No. 12589773

Client **PARKES SHIRES COUNCIL**
Project **LACHLINE PIPELINE DUPLICATION
DETAIL DESIGN TSS**
Status **PRELIMINARY**

Drawing Title **STRUCTURAL
RESERVOIR
TYPICAL ROOF STEELWORK
DETAILS - SHEET 3**
Drawing No. **12589773-S057**
Rev **A**

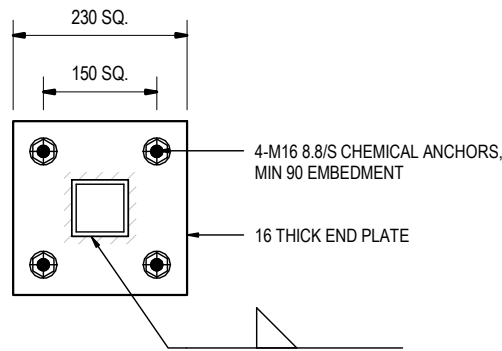


TYPICAL STAIRWAY AND PLATFORM DETAILS
SCALE 1 : 20

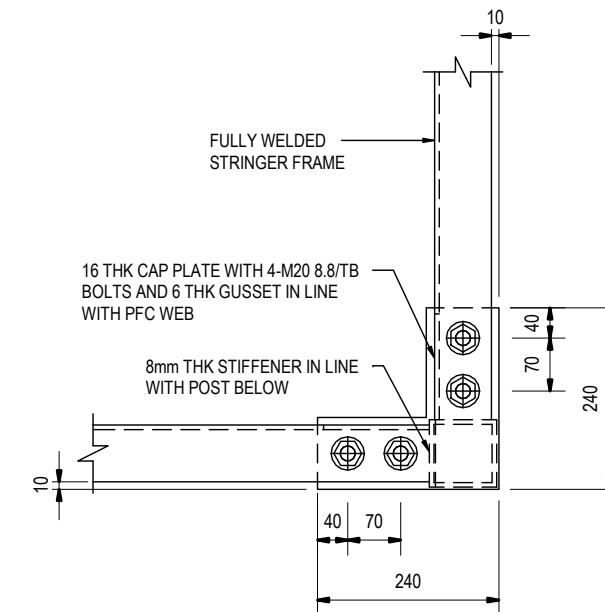


NOTE: HANDRAILS NOT SHOWN FOR CLARITY. PROVIDE HANDRAIL TO CONFORM AS1657

TYPICAL LANDING DETAIL
SCALE 1 : 20

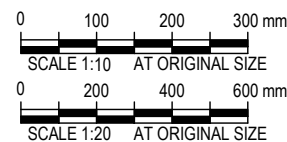


TYPICAL STAIR POST BASE PLATE DETAIL
SCALE 1 : 10



SECTION A
SCALE 1 : 10

Rev	Description	Checked	Approved	Date
A	80% DETAIL DESIGN			
Author	M. PAZ			
Designer	K. CAPANGPANGAN			
Drafting Check				
Design Check	K. ROWE			



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Status	PRELIMINARY

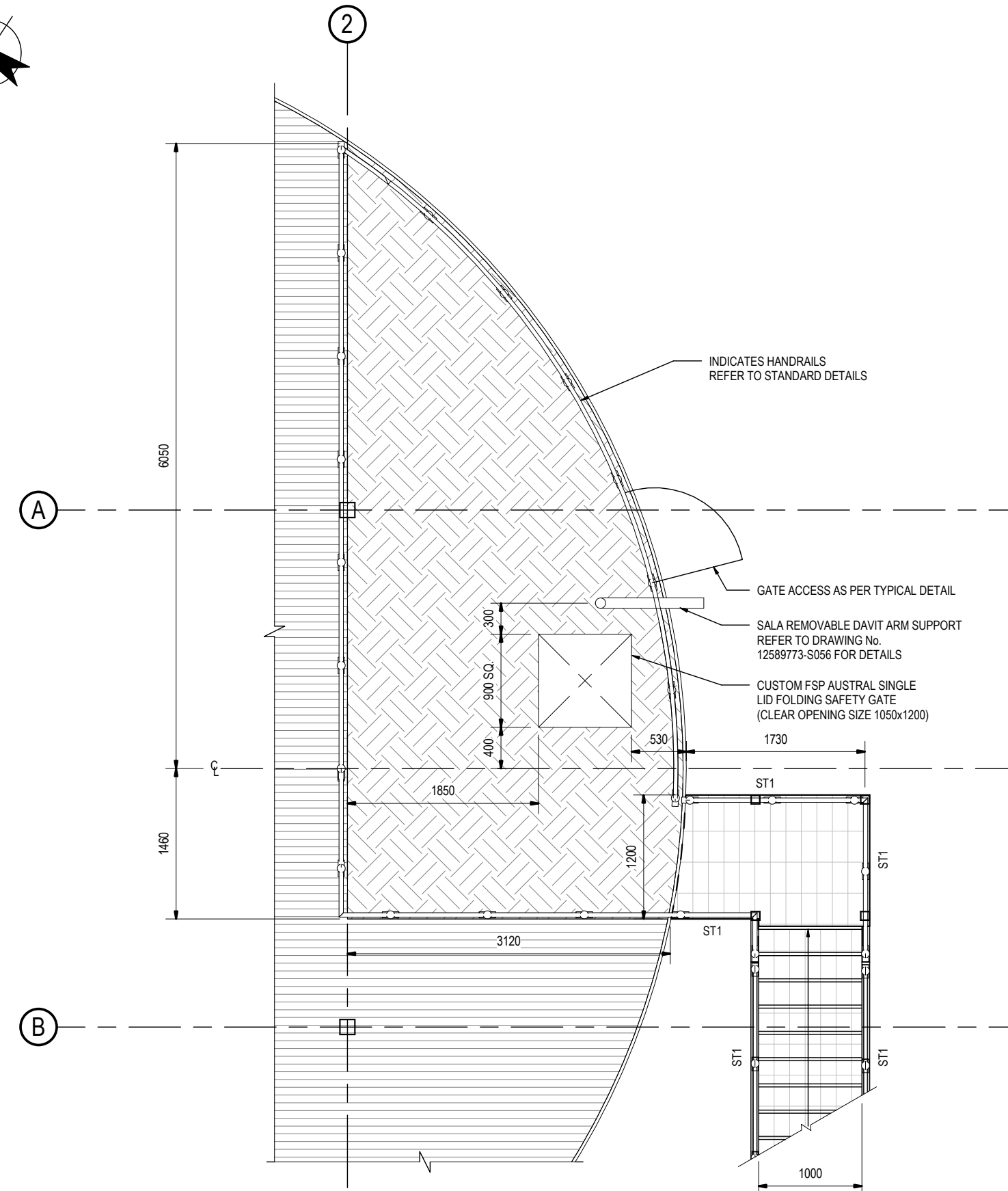
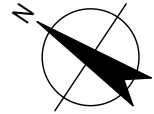
Drawing Title
**STRUCTURAL
TYPICAL STAIR AND PLATFORM
DETAILS**

Status Code

Drawing No.
12589773-S060

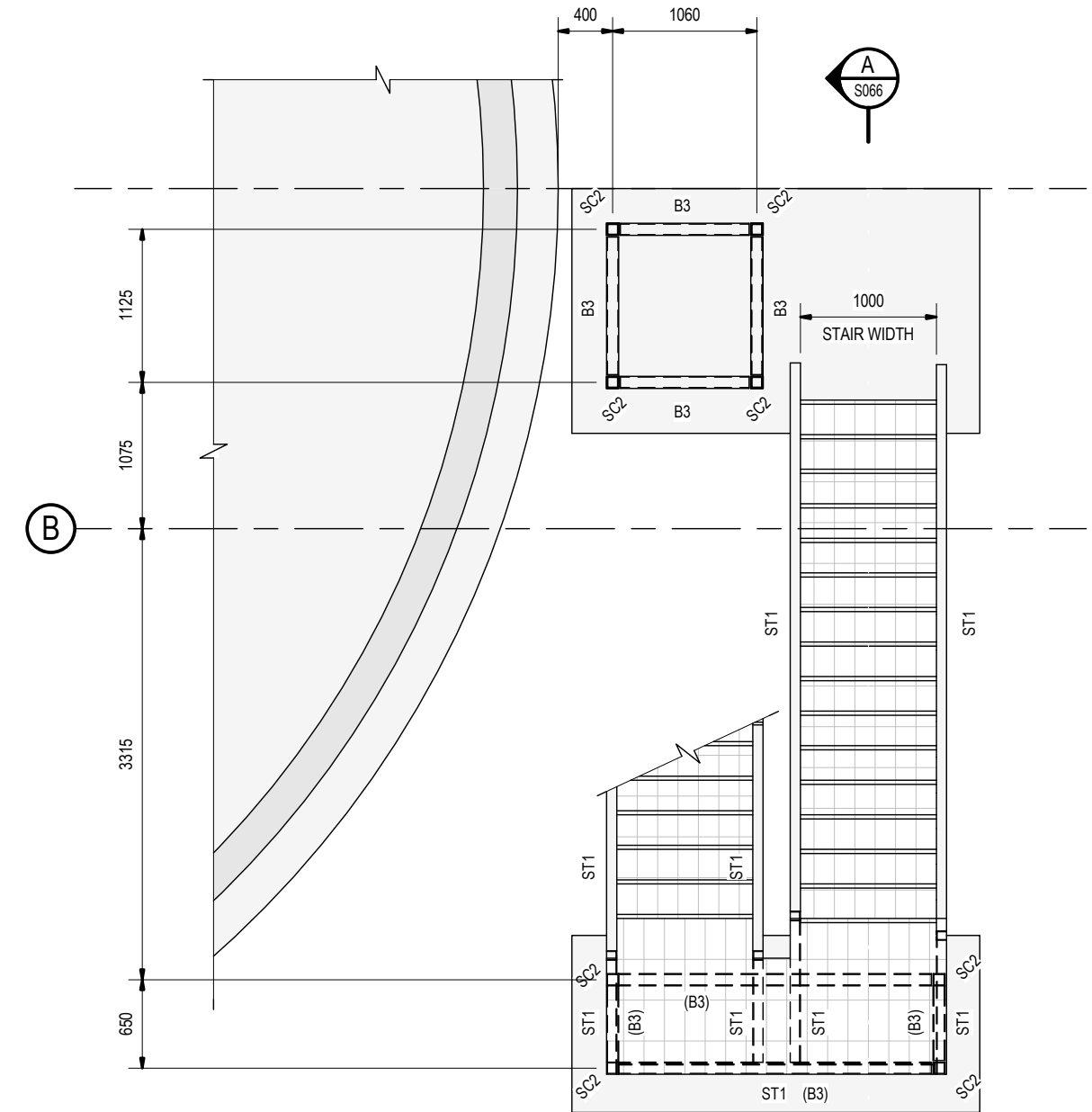
Size
A3

Rev
A



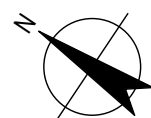
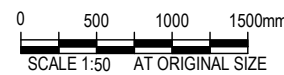
PLATFORM LAYOUT
SCALE 1 : 50

RESERVOIR STAIR FRAMING SCHEDULE		
MARK	SIZE	COMMENTS
B3	89x89x6.0SHS	
SC2	89x89x6.0SHS	
ST1	200PFC	



STAIR PLAN
SCALE 1 : 50

Rev	Description	Checked	Approved	Date
A	80% DETAIL DESIGN			
Author	M. PAZ			
Designer	J. O'SULLIVAN	Drafting Check		
		Design Check	K. ROWE	



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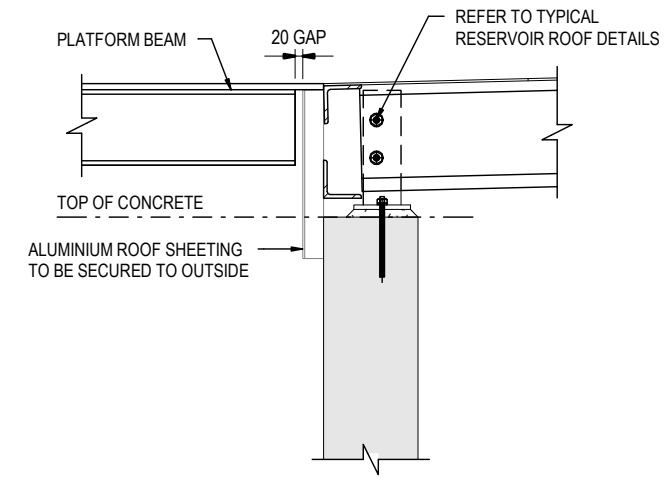
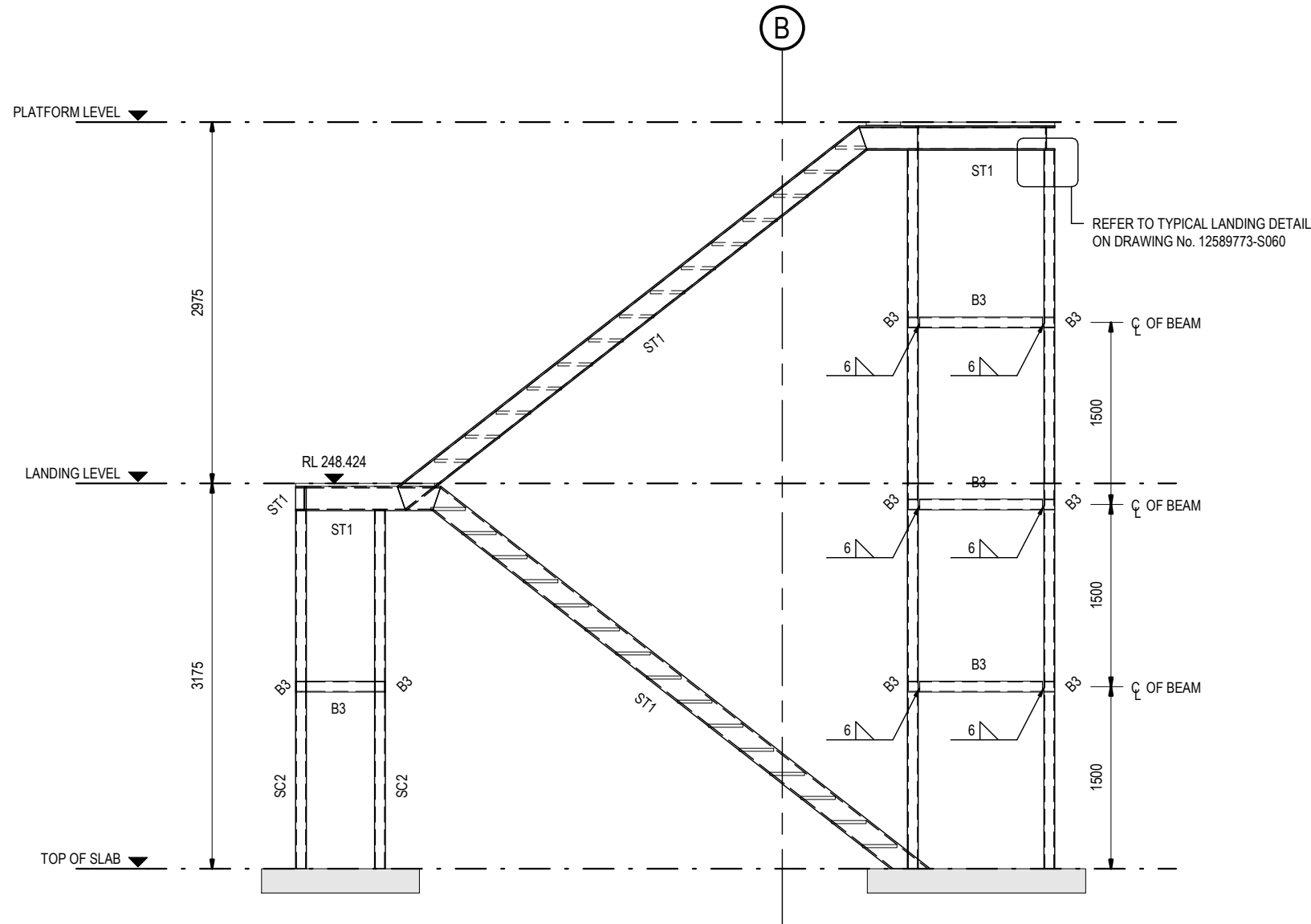
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Project No.
12589773

Client	PARKES SHIRES COUNCIL
Project	LACHLINE PIPELINE DUPLICATION DETAIL DESIGN TSS
Status	PRELIMINARY

Drawing Title	STRUCTURAL RESERVOIR TYPICAL STAIRWAY AND PLATFORM LAYOUT
Drawing No.	12589773-S065

Size
A3
Rev
A

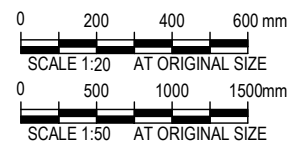


STAIR TO WORKING PLATFORM DETAIL
SCALE 1:20

NOTE: HANDRAILS NOT SHOWN FOR CLARITY

A SECTION
S065 SCALE 1:50

Rev	Description	Checked	Approved	Date
A	80% DETAIL DESIGN			
Author	M. PAZ	Drafting Check		
Designer	J. O'SULLIVAN	Design Check	K. ROWE	



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Client	PARKES SHIRES COUNCIL
Project	LACHLINE PIPELINE DUPLICATION DETAIL DESIGN TSS
Status	PRELIMINARY

Drawing Title	STRUCTURAL RESERVOIR TYPICAL STAIR SECTION AND DETAILS
Drawing No.	12589773-S066

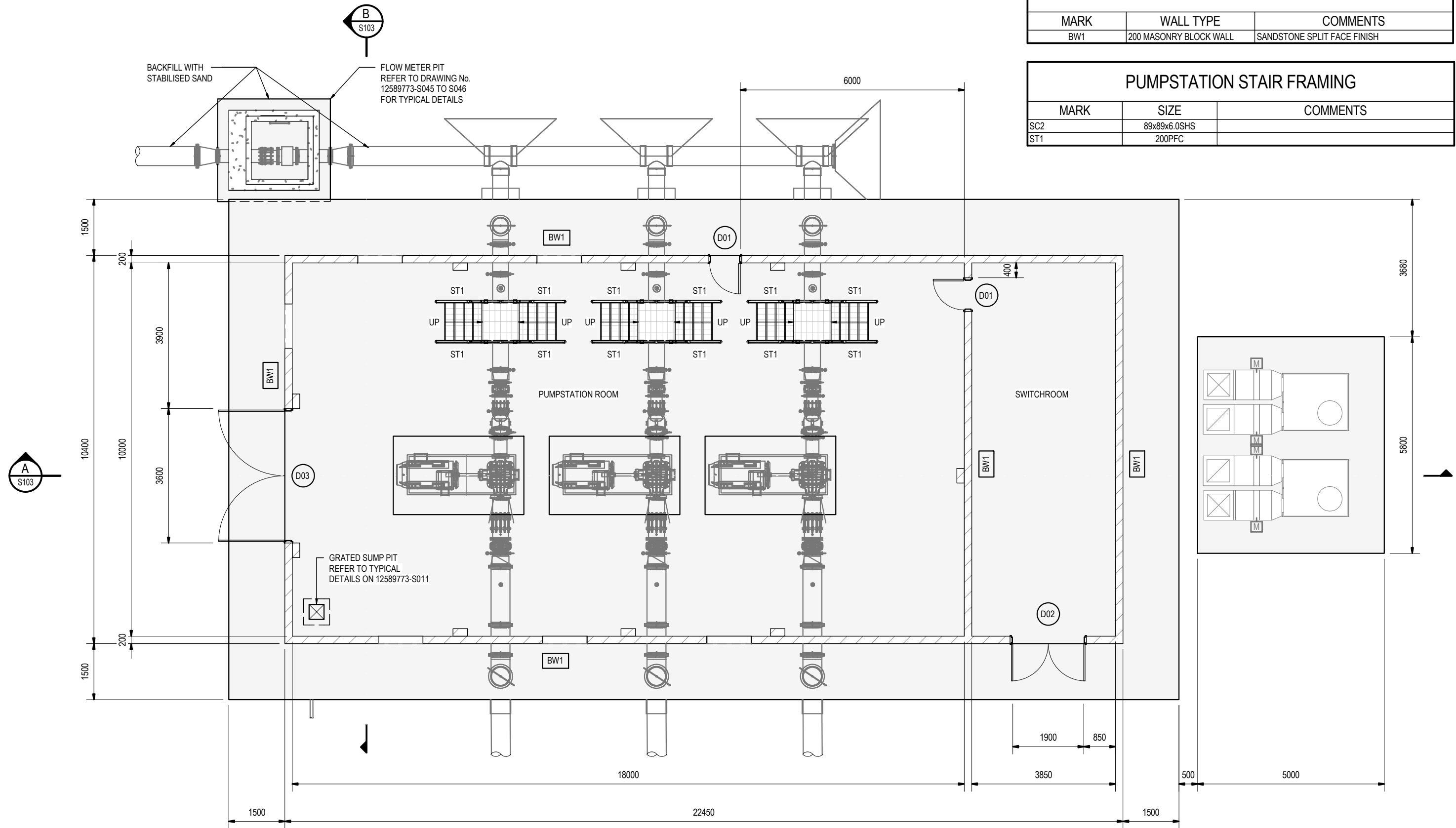
Size
A3
Rev
A

WALL SCHEDULE

MARK	WALL TYPE	COMMENTS
BW1	200 MASONRY BLOCK WALL	SANDSTONE SPLIT FACE FINISH

PUMPSTATION STAIR FRAMING

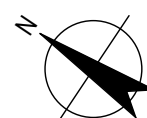
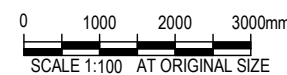
MARK	SIZE	COMMENTS
SC2	89x89x6.0SHS	
ST1	200PFC	



GENERAL ARRANGEMENT PLAN

SCALE 1 : 100

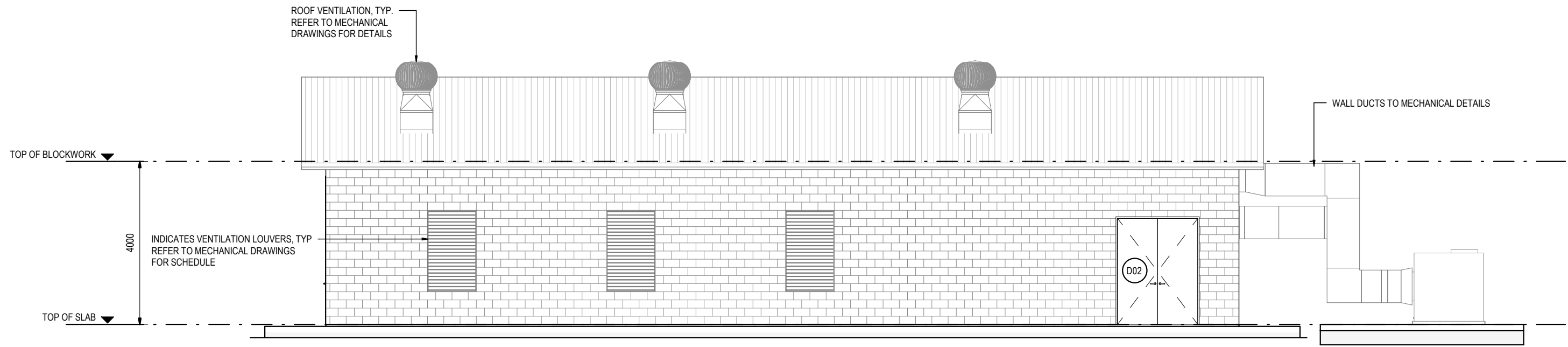
Rev	Description	Checked	Approved	Date
B	80% DETAIL DESIGN			11.10.22
A	30% DETAIL DESIGN			
Author	M. PAZ	Drafting Check		
Designer	K. CAPANGPANGAN	Design Check	K. ROWE	



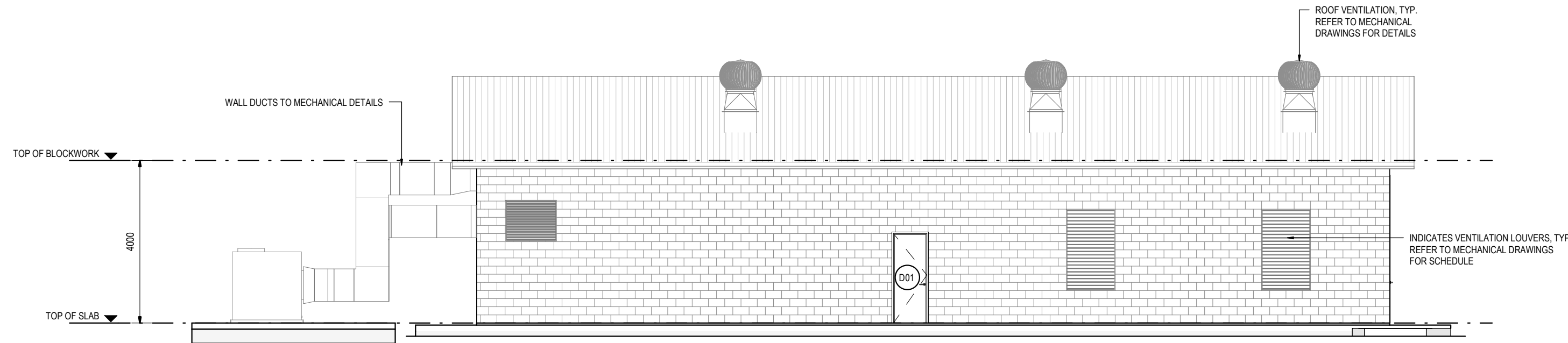
Client	PARKES SHIRES COUNCIL
Project	LACHLINE PIPELINE DUPLICATION DETAIL DESIGN TSS
Status	PRELIMINARY

Drawing Title	STRUCTURAL PUMPSTATION GENERAL ARRANGEMENT PLAN
Drawing No.	12589773-S100

Size **A3**
Rev **B**

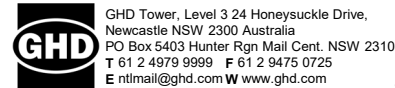
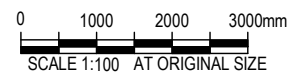


NORTH ELEVATION
SCALE 1 : 100



SOUTH ELEVATION
SCALE 1 : 100

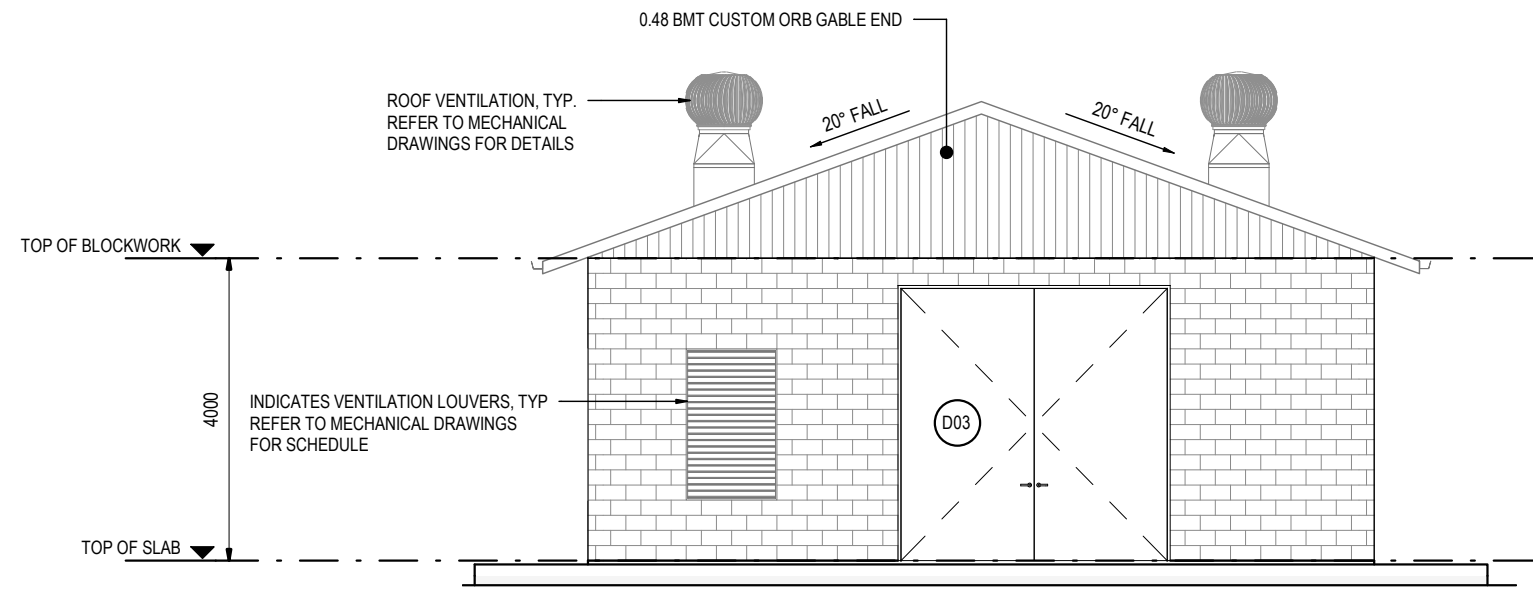
Rev	Description	Checked	Approved	Date
B	80% DETAIL DESIGN			
A	30% DETAIL DESIGN			11.10.22
Rev	Description	Checked	Approved	Date
Author	M. PAZ	Drafting Check		
Designer	K. CAPANGPANGAN	Design Check	K. ROWE	



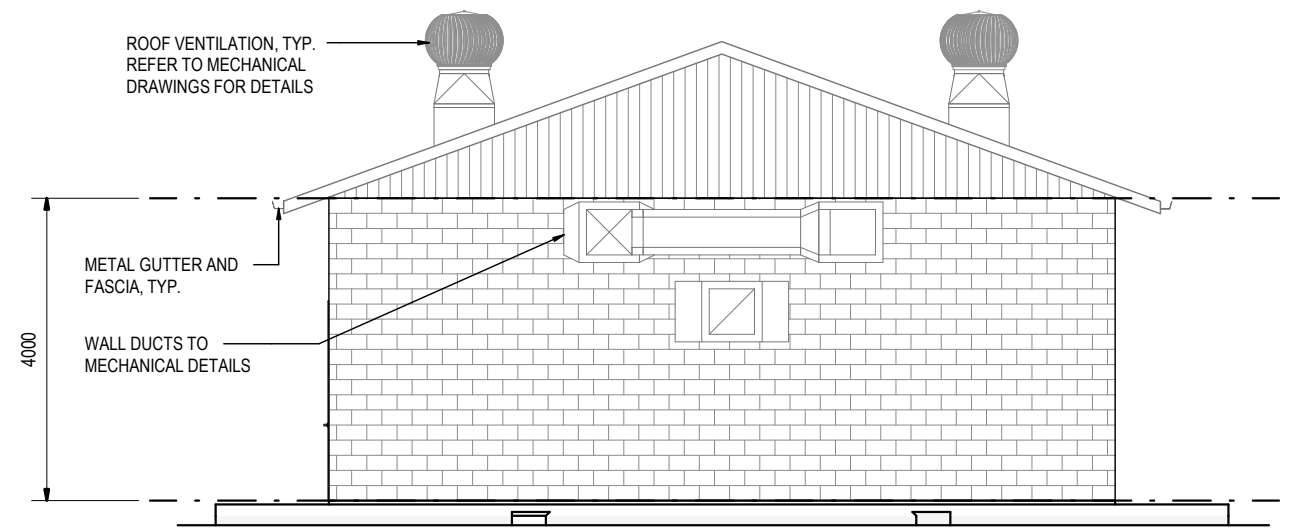
Client	PARKES SHIRES COUNCIL
Project	LACHLINE PIPELINE DUPLICATION DETAIL DESIGN TSS
Status	PRELIMINARY
Project No.	12589773

Drawing Title	STRUCTURAL PUMPSTATION ELEVATIONS - SHEET 1 OF 2
Drawing No.	12589773-S101

Size
A3
Rev
B

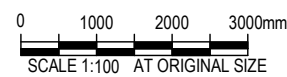


EAST ELEVATION
SCALE 1 : 100



WEST ELEVATION
SCALE 1 : 100

Rev	Description	Checked	Approved	Date
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Author	M. PAZ	Drafting Check		
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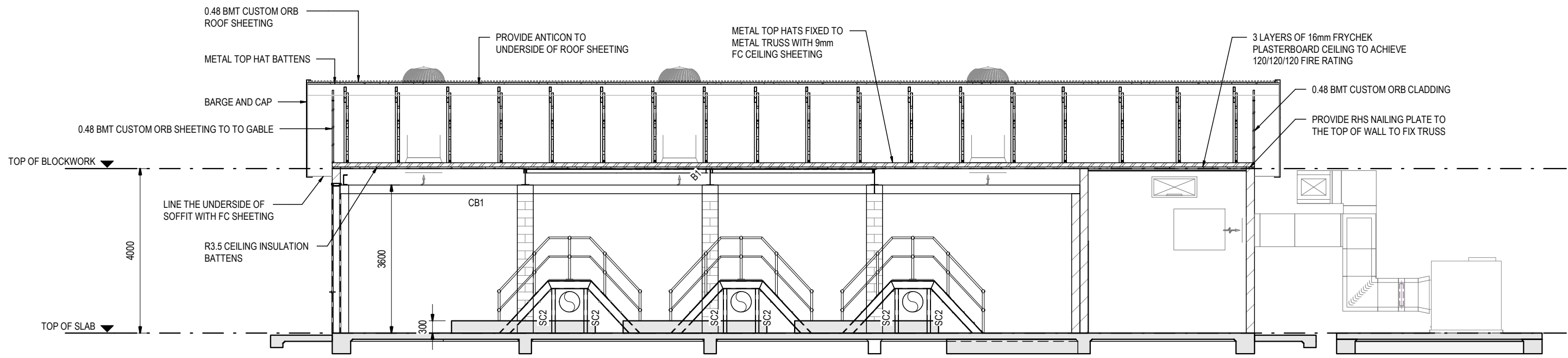
Project No.
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Client	PARKES SHIRES COUNCIL
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Status	PRELIMINARY

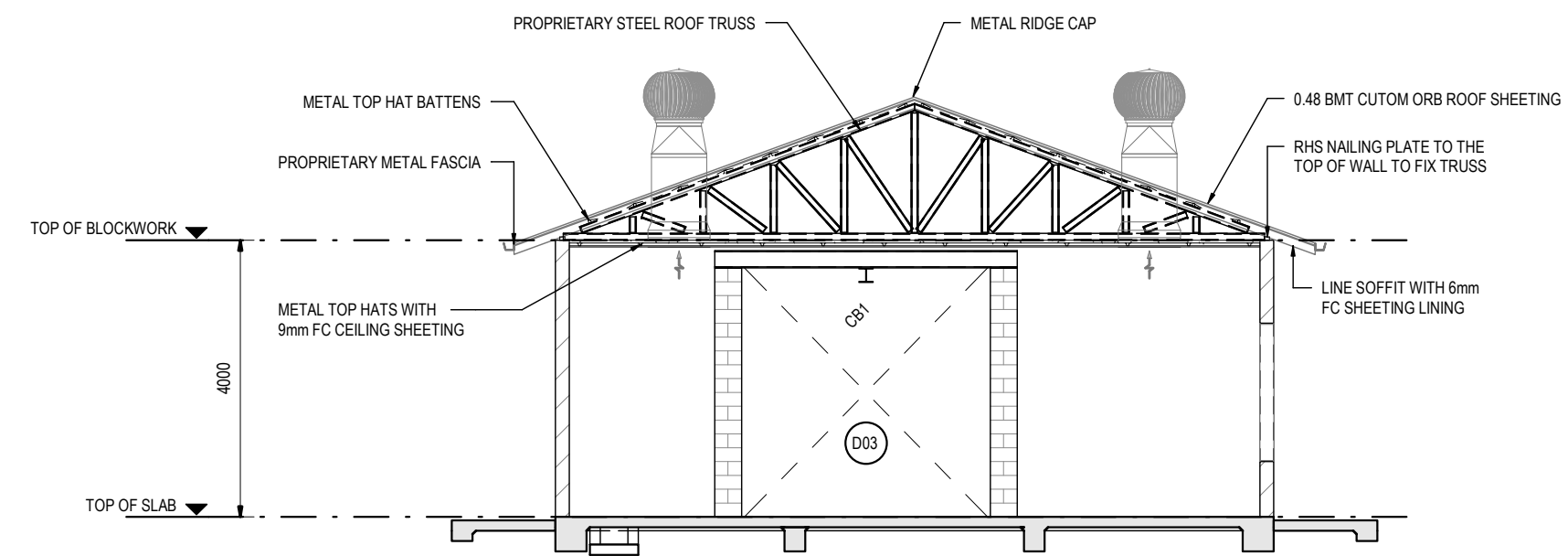
Drawing Title	STRUCTURAL PUMPSTATION ELEVATIONS - SHEET 2 OF 2
Drawing No.	12589773-S102

Size
A3

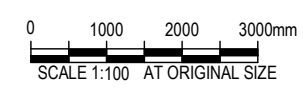
Rev
B



A SECTION
S100 SCALE 1:100



B SECTION
S100 SCALE 1:100



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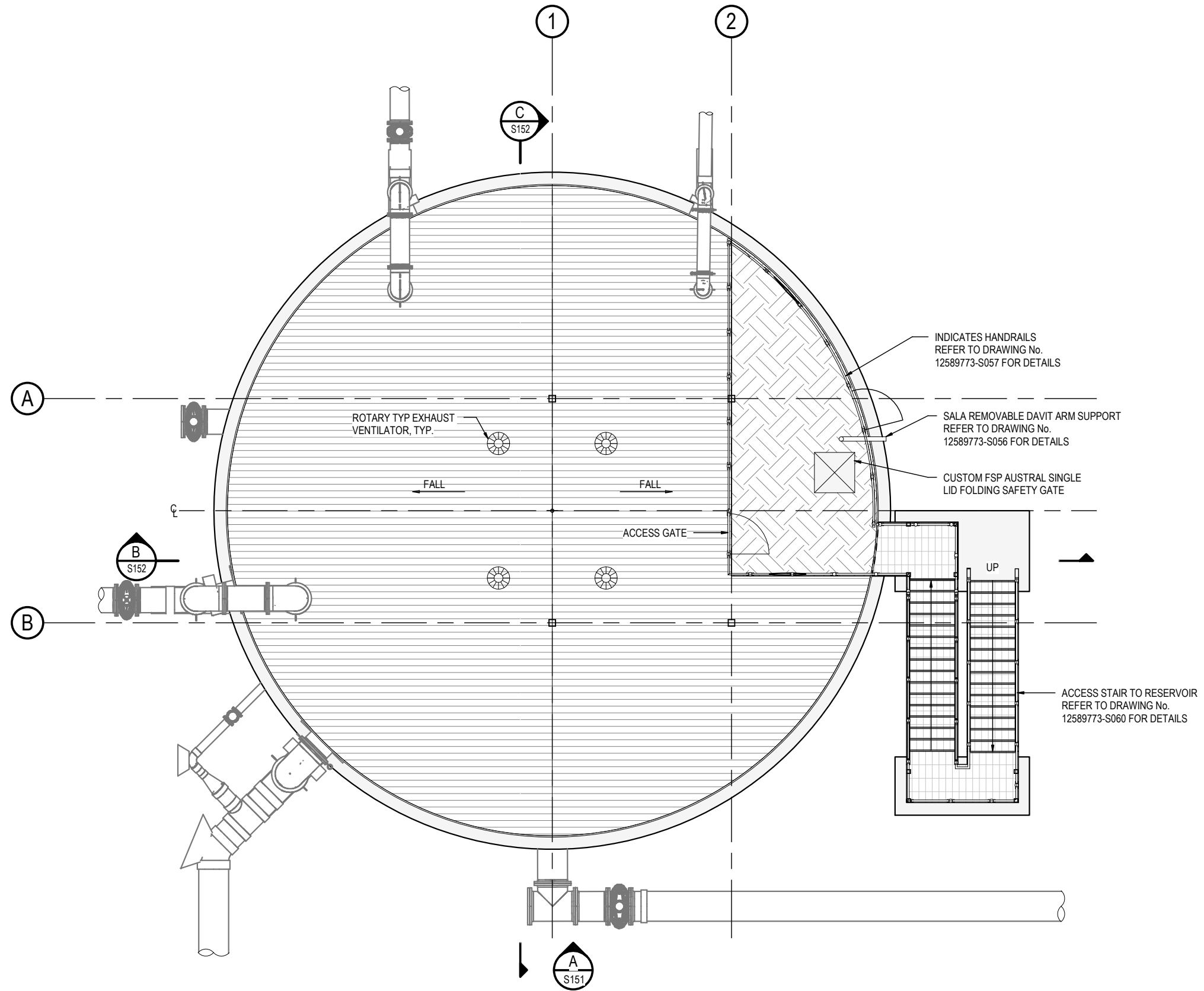
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Client **PARKES SHIRES COUNCIL**
Project **LACHLINE PIPELINE DUPLICATION
DETAIL DESIGN TSS**
Status **PRELIMINARY**

Drawing Title **STRUCTURAL
PUMPSTATION
SECTIONS**

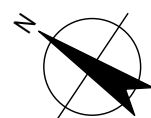
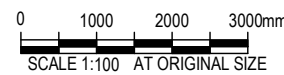
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A	30% DETAIL DESIGN			11.10.22
Author	M. PAZ	Drafting Check		
Designer	K. CAPANGPANGAN	Design Check	K. ROWE	



GENERAL ARRANGEMENT PLAN

SCALE 1 : 100

Rev	Description	Checked	Approved	Date
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A	30% DETAIL DESIGN			11.10.22
Author	M. PAZ	Drafting Check		
Designer	J. O'SULLIVAN	Design Check	K. ROWE	



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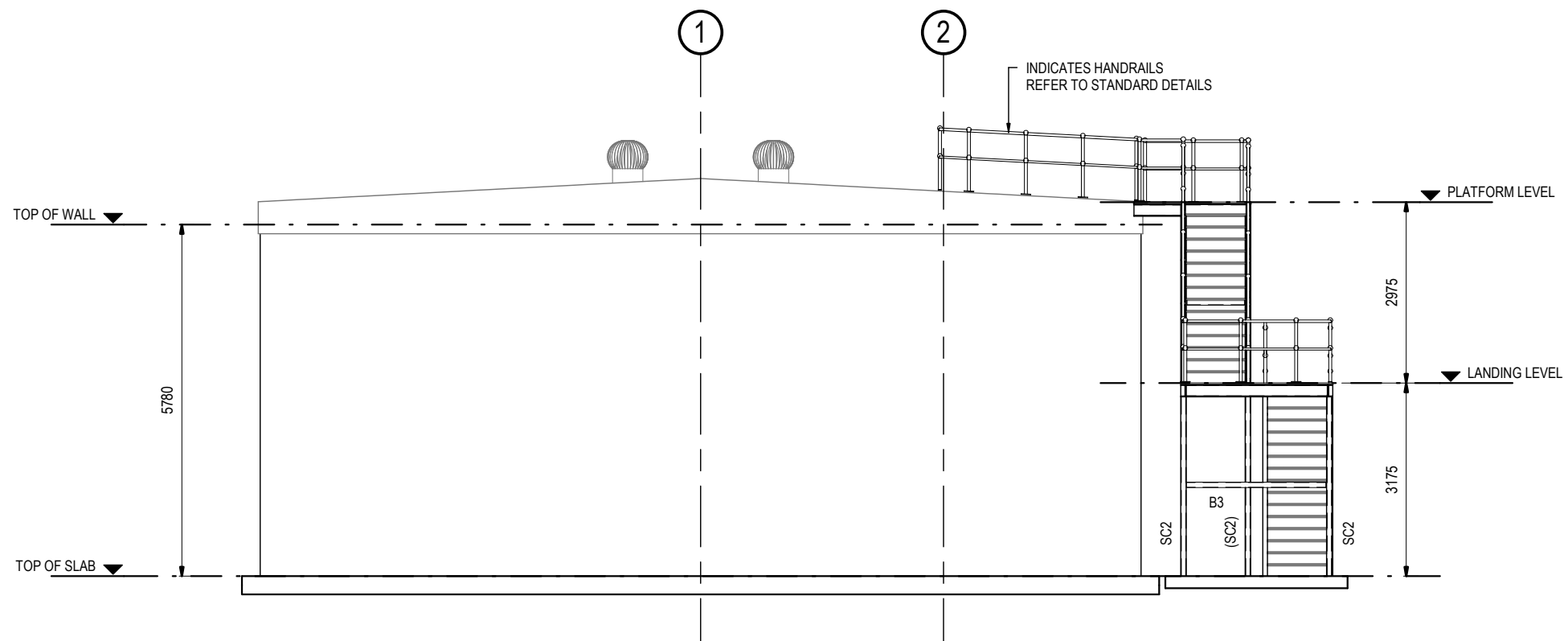
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Project No.
12589773

Client	PARKES SHIRES COUNCIL
Project	LACHLINE PIPELINE DUPLICATION DETAIL DESIGN TSS
Status	PRELIMINARY

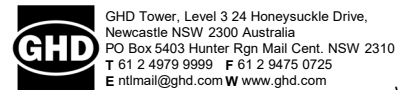
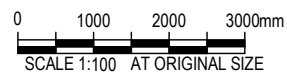
Drawing Title	STRUCTURAL RESERVOIR GENERAL ARRANGEMENT PLAN
Drawing No.	12589773-S150

Size
A3
Rev
B



A ELEVATION
S150 SCALE 1:100

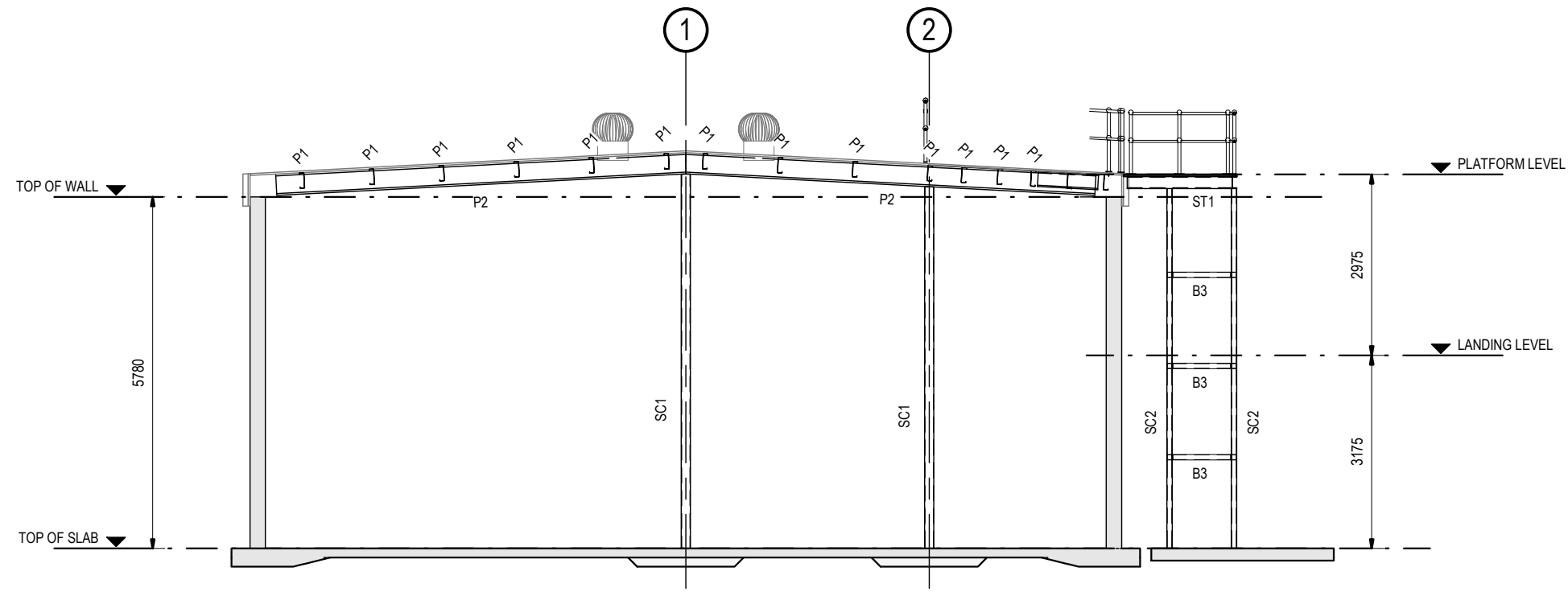
Rev	Description	Checked	Approved	Date
B	80% DETAIL DESIGN			
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Author	M. PAZ	Drafting Check		
Designer	J. O'SULLIVAN	Design Check	K. ROWE	



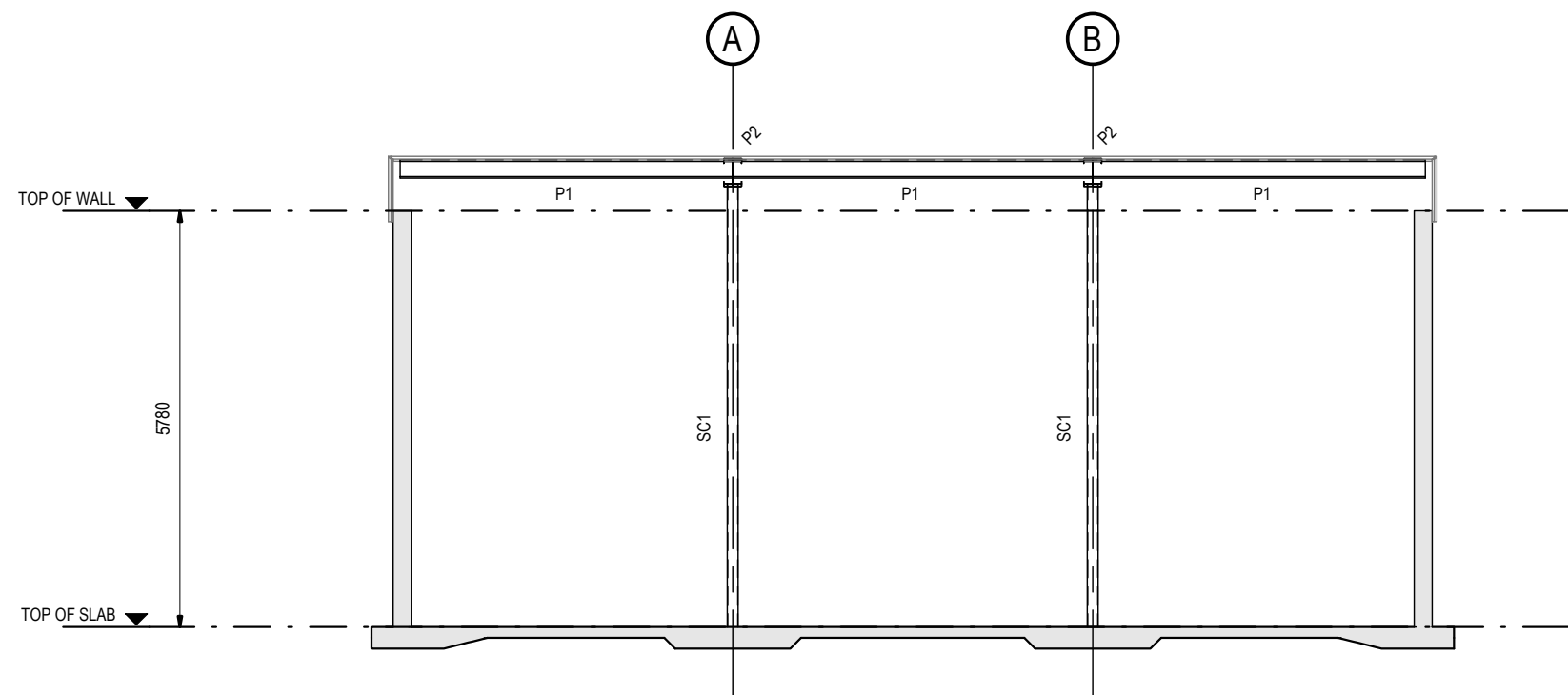
Client	PARKES SHIRES COUNCIL
Project	LACHLINE PIPELINE DUPLICATION DETAIL DESIGN TSS
Status	PRELIMINARY

Drawing Title	STRUCTURAL RESERVOIR ELEVATION
Drawing No.	12589773-S151
Rev	B

Size
A3



B SECTION
S150 SCALE 1:100



C SECTION
S150 SCALE 1:100



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Client **PARKES SHIRES COUNCIL**
Project **LACHLINE PIPELINE DUPLICATION
DETAIL DESIGN TSS**
Status **PRELIMINARY**

Drawing Title **STRUCTURAL
RESERVOIR
SECTIONS**

Rev	Description	Checked	Approved	Date
B	80% DETAIL DESIGN			
A	30% DETAIL DESIGN			11.10.22
Author	M. PAZ	Drafting Check		
Designer	J. O'SULLIVAN	Design Check	K. ROWE	

Project No.
12589773

Status Code

Drawing No.
12589773-S152

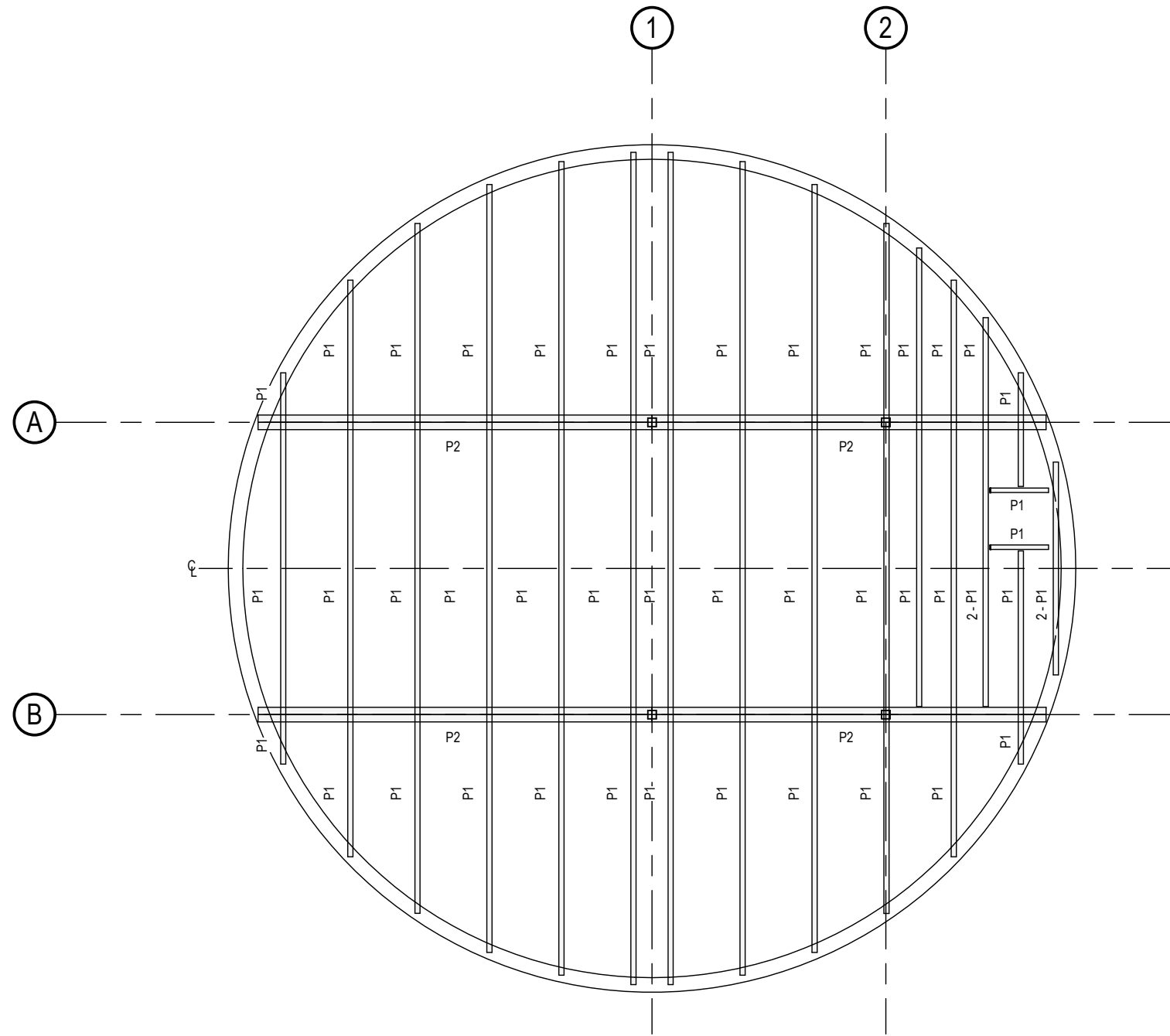
Size
A3
Rev
B

STEEL COLUMN SCHEDULE		
MARK	SIZE	COMMENTS
SC1	150x150x5.0SHS	SS GRADE 316
SC2	89x89x6.0SHS	

ROOF STEEL FRAMING		
MARK	SIZE	COMMENTS
P1	AC25025	
P2	2-AC35030	2 MEMBERS BACK TO BACK

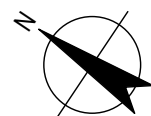
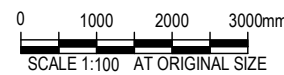
NOTES:

- FALL ARREST SYSTEM TO BE PROVIDED TO ENABLE ACCESS FOR THE ENTIRE ROOF.
- PROVIDE ALSPAN MODIFIED SILICON POLYESTER 0.9 BMT ALUMINIUM ROOF SHEETING.
- ALL PURLINS C AND Z SECTIONS SPECIFIED SHALL BE PERMALITE ALUMINIUM PROFILES



ROOF FRAMING LAYOUT
SCALE 1 : 100

Rev	Description	Checked	Approved	Date
A	80% DETAIL DESIGN			
Author	M. PAZ	Drafting Check		
Designer	J. O'SULLIVAN	Design Check	K. ROWE	



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Project No.
12589773

Client	PARKES SHIRES COUNCIL
Project	LACHLINE PIPELINE DUPLICATION DETAIL DESIGN TSS
Status	PRELIMINARY

Drawing Title	STRUCTURAL RESERVOIR ROOF FRAMING LAYOUT
Drawing No.	12589773-S153
Rev	A

PARKES SHIRE COUNCIL



LACHLAN PIPELINE DUPLICATION DETAILED DESIGN PROJECT 12589773

DRAWING INDEX - MECHANICAL		
PROJECT No.	DRG No.	DRAWING TITLE
	SHEET	
1. MECHANICAL		
12589773	M001	COVER SHEET, LOCALITY PLAN AND DRAWING INDEX
12589773	M002	SPECIFICATION NOTES
12589773	M003	LEGEND AND SCHEDULES
12589773	M100	GROUND FLOOR HVAC LAYOUT
12589773	M102	SECTION DETAILS
12589773	M103	DUCT SECTION DETAILS
12589773	M200	ROOF FLOOR HVAC LAYOUT
12589773	M300	ROOF TANK HVAC LAYOUT
12589773	M400	STANDARD DETAILS

Rev	Description	Checked	Approved	Date
A	30% DETAIL DESIGN	MK	RJ	01/09/23

Author	D.DEGUZMAN	Drafting Check	Checker
Designer	R.PREMRAJKUMAR	Design Check	M.KLUMPP



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Project No.
12589773

Client	PARKES SHIRE COUNCIL
Project	LACHLAN PIPELINE DUPLICATION DETAILED DESIGN PROJECT
Status	PRELIMINARY

Drawing Title	MECHANICAL SERVICES PUMP STATION COVER SHEET, LOCALITY PLAN AND DRAWING INDEX
Drawing No.	12589773-M001

Size
A1
Rev
A

MECHANICAL (HVAC) SPECIFICATION NOTES

GENERAL

THIS SCOPE REPRESENTS THE CLIENTS REQUIREMENTS AND THE TENDERER IS RELIED UPON IN POSSESSING SPECIALIST TRADE EXPERTISE NECESSARY TO COMPLETE THE WORKS IN ACCORDANCE WITH THE DRAWINGS. IN ADDITION, THE TENDERER HAS THE FOLLOWING OBLIGATIONS TO; RAISE IN GOOD TIME, ISSUES REQUIRING DESIGN INPUT OR CLARIFICATION FROM THE CONSULTING ENGINEER, PARTICULARLY IN RESPECT TO OMISSIONS FROM THE TENDER DOCUMENTS & SUGGESTED ALTERNATIVES OR SUBSTITUTIONS.

ANY VARIATION TO THE SYSTEMS & OR EQUIPMENT SPECIFIED SHALL BE SUBMITTED FOR APPROVAL BY THE PRINCIPAL PRIOR TO INSTALLATION.

ADEQUATE CLEARANCES ARE TO BE PROVIDED TO ALLOW FOR FUTURE, ONGOING MAINTENANCE & SERVICE OF ALL INSTALLED PLANT & EQUIPMENT.

ALL EQUIPMENT & ASSOCIATED DUCT/PIPES ARE TO BE SUPPORTED AS SPECIFIED & MUST NOT COME IN CONTACT WITH THE CEILING.

ALL PLANT & EQUIPMENT MUST BE INSTALLED/SUPPORTED ON APPROVED MACHINERY MOUNTS AS SPECIFIED.

STANDARDS AND CODES

STANDARDS INCLUDING BUT NOT LIMITED TO:

- NATIONAL CONSTRUCTION CODE (NCC 2022) INCLUDING ALL RELEVANT PARTS OF 'SECTION J'. AS 1668.2.2012 - THE USE OF VENTILATION & AIR CONDITIONING IN BUILDINGS - MECHANICAL VENTILATION FOR ACCEPTABLE INDOOR AIR QUALITY.
- AS 1324.1 - AIR FILTERS FOR USE IN GENERAL VENTILATION & AIR CONDITIONING.
- AS 4254.1 & AS 4254.2 - DUCTWORK FOR AIR-HANDLING SYSTEMS IN BUILDINGS.
- AS 1668.4.2012 - THE USE OF VENTILATION & AIR CONDITIONING IN BUILDINGS - NATURAL VENTILATION.
- AS/NZS 4859.1 - MATERIALS FOR THE THERMAL INSULATION OF BUILDINGS.
- AS/NZS 3000 - WIRING RULES.
- AS/NZS 3008 - ELECTRICAL INSTALLATIONS.
- AS 3500.2 - SANITARY PLUMBING AND DRAINAGE.
- AS 1682.1.2015 - FIRE, SMOKE AND AIR DAMPER SPECIFICATION.

COORDINATION

LAYOUTS OF SERVICE LINES, PLANT & EQUIPMENT SHOWN ON THE DRAWINGS ARE DIAGRAMMATIC ONLY. BEFORE COMMENCING WORK, OBTAIN MEASUREMENTS & OTHER NECESSARY INFORMATION. COORDINATE THE INSTALLATION WITH ADJACENT STRUCTURAL ELEMENTS & ALL SERVICES & TRADES TO ENSURE THE COMPLETE INSTALLATION IS FULLY COORDINATED. ALL WORK ASSOCIATED WITH THE COMPLETION OF THE SCOPE SHALL BE INCLUDED IN THE CONTRACT PRICE & SHALL NOT BE ACCEPTED AS A VARIATION TO THE SCOPE OF WORK.

THROUGHOUT THE PROCESS OF EXECUTION OF THE WORKS THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE COORDINATION OF THEIR DESIGN & INSTALLATION WITH OTHER DESIGNERS & TRADES. UNDER NO CIRCUMSTANCES WILL DEFICIENCY IN THE COORDINATION WITH OTHERS GIVE RISE TO ANY CONTRACT VARIATIONS OR CLAIMS. COORDINATION OF SERVICES SHALL BE PROVIDED IN THE CONTEXT OF SAFE & PRACTICAL OPERATIONAL & MAINTENANCE ACCESS TO ALL ELECTRICAL & MECHANICAL ELEMENTS.

PERFORMANCE

WHILST THE DOCUMENTED DESIGN IS COMPLIANT WITH THE NECESSARY CODES & STANDARDS, THE CONTRACTOR SHALL BE SOLELY RESPONSIBLE FOR THE CERTIFICATION OF THEIR INSTALLATION & ANY ELEMENTS OF THE DOCUMENTED DESIGN THAT THEY MAY MODIFY DURING CONSTRUCTION. THIS CERTIFICATION OF THE INSTALLATION SHALL STATE THAT THE INSTALLATION COMPLIES WITH THE RELEVANT REQUIREMENTS OF THE RELEVANT INSTALLATION CODES, MANUFACTURING CODES & THIS SPECIFICATION.

WORKMANSHIP

ALL MATERIALS & WORKMANSHIP PROVIDED BY THE CONTRACTOR UNDER THIS SCOPE SHALL BE OF GOOD & INDUSTRY STANDARD QUALITY. THE MATERIALS & WORKMANSHIP SHALL BE TO THE APPROVAL OF THE CLIENT & ALL DEFECTIVE MATERIALS & WORK WHEN DIRECTED IN WRITING SHALL BE RECTIFIED AND/OR REMOVED FROM THE WORKS AT THE CONTRACTORS EXPENSE & WITHOUT ANY DELAY TO THE CONSTRUCTION PROGRAM.

DESIGN PARAMETERS

LOCATION: EUGOWRA NSW
SUMMER: 42.4°C DB/24.1°C WB
WINTER: -0.4°C DB, 80% RH
INTERNAL SETPOINTS
SWITCHROOM: 27.0°C SUMMER
HUMIDITY: NOT ACTIVELY UNCONTROLLED

SCOPE OF WORK

- GENERAL NOTES
- ALL WORKS TO BE CARRIED OUT IN ACCORDANCE WITH NCC 2022, MECHANICAL SPECIFICATION, DRAWINGS AND GOOD TRADE PRACTICE.
- DRAWINGS ARE CONCEPTUAL ONLY AND CONTRACTOR IS REQUIRED TO VERIFY ALL CLEARANCES AND SERVICE REQUIREMENTS PRIOR TO ORDERING EQUIPMENT.
- CONTRACTOR TO SUPPLY AND INSTALL ALL SCHEDULED EQUIPMENT. THE WORKS SHALL INCLUDE ALL NECESSARY AND INCIDENTAL WORKS AND FITTINGS THAT WHILE NOT SPECIFICALLY NOTED ARE NECESSARY FOR THE PROPER COMPLETION OF WORKS.
- ALL PLANT AND EQUIPMENT SHALL BE FITTED WITH VIBRATION ISOLATION TO ACHIEVE AN ISOLATION EFFICIENCY OF NOT LESS THAN 90%
- LOCATIONS OF CONTROLS AND SENSORS ARE TO BE CONFIRMED ON SITE. TEMPERATURE SENSORS TO BE LOCATED AWAY FROM DIRECT SUNLIGHT AND DRAUGHTS
- PACKAGED UNITS TO BE INSTALLED AND COMMISSIONED IN ACCORDANCE WITH MANUFACTURERS GUIDELINES.
- A COMMITMENT FOR A FURTHER 12 MONTH PERIOD OF STAGED COMMISSIONING BEYOND HANDOVER DATE SHALL BE ALLOWED FOR. THIS PERIOD IS FOR FINE TUNING THROUGH THE YEAR & WILL CONSIST OF A MINIMUM OF QUARTERLY REVIEW PERIODS.
- SUBMIT OPERATION & MAINTENANCE MANUALS FOR INSTALLATIONS.

ROOF VENTILATORS AND LOUVRES

PROVIDE FAN ASSISTED ROOF VENTILATORS *c/w* MOTORISED DAMPER AND EMBER MESH TO VENTILATE THE PUMP ROOM AS PER THE SCHEDULE. PROVIDE INTAKE LOUVRES *c/w* EMBER MESH AS PER THE SCHEDULE. LOUVRES TO COMPLY WITH NCC 2022.

PACKAGED UNIT

THE SWITCH ROOM IS TO BE SERVED BY ONE (1X) PACKAGED UNITS LOCATED ON THE GROUND EXTERNALLY. SUPPLY AND RETURN AIR IS TO BE VIA DUCTED AIRWAY AS SHOWN ON DRAWINGS. ALL SUPPLY/RETURN AIR DUCTWORK ARE TO BE INTERNALLY INSULATED.

PACKAGED UNIT

THE SWITCH ROOM IS TO BE SERVED BY ONE (1X) PACKAGED UNITS LOCATED ON THE GROUND EXTERNALLY. SUPPLY AND RETURN AIR IS TO BE VIA DUCTED AIRWAY AS SHOWN ON DRAWINGS. ALL SUPPLY/RETURN AIR DUCTWORK ARE TO BE INTERNALLY INSULATED.

FIRE DAMPERS

THE DUCT WORKS PENETRATING TO SWITCH ROOM FROM THE EXTERNAL SIDE ARE TO BE PROVIDED WITH FIRE DAMPERS AS SHOWN ON THE DRAWINGS.

MOTORISED VOLUME CONTROL DAMPERS

THE DUCT WORKS CONNECTED TO THE PACKAGED UNITS, BOTH SUPPLY AND RETURN, ARE TO BE PROVIDED WITH MOTORISED VOLUME CONTROL DAMPERS AS SHOWN ON DRAWINGS.

DUCTWORK

DUCTWORK, CONNECTIONS, AND SUPPORTS TO BE COMPLIANT WITH AS 4254 SERIES, AND SUITABLE FOR EXTERNAL STATIC PRESSURE GENERATED BY PACKAGED AIR CONDITIONING UNIT.

ALL RIGID DUCTWORK TO BE SEALED AGAINST AIRLOSS.

GRILLES

CONTRACTOR TO PROVIDE EXHAUST AIR GRILLE AS PER THE SCHEDULE. SELECTION TO COMPLY WITH NCC 2022.

FIRE SHUTDOWN

PROVIDE SHUTDOWN UPON INITIATION OF FIRE MODE FOR BOTH PAC UNITS. THE EQUIPMENT SHALL SHUT DOWN IN THE CASE OF A FIRE TRIP & BE PREVENTED FROM RESTARTING UNTIL FIRE TRIP RESET. REFER TO ELECTRICAL DRAWINGS FOR MORE DETAILS.

ELECTRICAL SYSTEMS

ELECTRICAL WIRING MUST BE INSTALLED AS REQUIRED FOR COMPLETE & APPROPRIATE OPERATION OF ALL SYSTEMS.

ALL CONTROLS, ACTUATORS, WIRING AND SENSORS ASSOCIATED TO THE ROOF VENTILATORS ARE TO BE SUPPLIED AND INSTALLED BY THE MECHANICAL CONTRACTOR.

EQUIPMENT IS TO BE POWERED FROM THE MCC (SUPPLIED BY ELECTRICAL TRADE), WITH THE MECHANICAL CONTRACTOR PROVIDING WIRING FROM THE MCC TO EQUIPMENT.

MECHANICAL CONTRACTOR TO COORDINATE WITH ELECTRICAL TRADE REGARDING THE REQUIRED SPARE CIRCUITS IN THE BOARD TO POWER THE ROOF VENTILATORS.

CONTROL SYSTEMS

A CONTROL SYSTEM CAPABLE OF MEETING THE FUNCTIONAL DESCRIPTION OF CONTROL REQUIREMENTS IN THIS SPECIFICATION MUST BE PROVIDED.

THE CONTROL SYSTEMS SHALL INCLUDE THE SUPPLY, DESIGN, INSTALLATION & COMMISSIONING OF EQUIPMENT NECESSARY TO MEET THE DOCUMENTED FUNCTIONALITY. THIS IS TO BE COMPLETED BY SPECIALIST TRADES COMPETENT IN THIS TYPE OF WORK WITH LOCAL SUPPORT FOR ONGOING MAINTENANCE & BACK-UP FOR COMPONENTS & SOFTWARE.

CONTROLS FUNCTIONAL DESCRIPTION

GENERAL

THE CONTROL SYSTEMS SHALL INCLUDE THE SUPPLY, DESIGN, INSTALLATION & COMMISSIONING OF EQUIPMENT NECESSARY TO MEET THE DOCUMENTED FUNCTIONALITY. THIS IS TO BE BY SPECIALIST TRADES COMPETENT IN THIS TYPE OF WORK WITH LOCAL SUPPORT FOR ONGOING MAINTENANCE & BACK-UP FOR COMPONENTS & SOFTWARE.

CONTRACTOR TO COORDINATE WITH ELECTRICAL TRADE, PROVIDE THIRD PARTY INNOTECH CONTROLLER (OR SIMILAR) AND REQUIRED SENSORS TO ACHIEVE THE DOCUMENTED FUNCTIONALITY.

PACKAGED UNITS

THE PROVISION IS TO BE CONTROLLED VIA WALL MOUNTED CONTROL PANEL (PROPRIETORY CONTROLLER) THAT ALLOWS STANDARD FAN, MODE & TEMPERATURE SETTINGS.

WHEN PACKAGED UNIT IS IN COOLING MODE & THE OUTDOOR AMBIENT TEMPERATURE IS LESS THAN 27° C (ADJUSTABLE) ECONOMY CYCLE SHOULD BE ENGAGED. THIS MEANS THAT THE PACKAGED UNIT MUST PROVIDE 100% OUTSIDE AIR.

THE RELIEF DAMPERS ARE TO OPEN AND THE RETURN AIR DAMPER TO SHUT IN ORDER TO PROVIDE A RELIEF AIR PATH & AVOID EXCESSIVE PRESSURISATION OF THE SPACE WHEN OUTSIDE AIR VOLUMES ARE HIGH.

ROOF VENTILATORS

ALL WHIRLYBIRDS TO OPERATE ON WIND AND STACK EFFECT WHILST THE INTERNAL ROOM TEMPERATURE REMAINS BELOW 40° CDB.

WHEN THE INTERNAL ROOM TEMPERATURE EXCEEDS 40° CDB:

- MOTORISED DAMPERS OF THE STANDBY ROOF VENTILATORS (RV5 AND RV6) TO SHUT.
- THE BOOSTER FANS OF THE DUTY ROOF VENTILATORS RV1, RV2, RV3 AND RV4 TO START AND RUN AT 2000 L/s.
- BOOSTER FANS TO STOP WHEN INTERNAL ROOM TEMPERATURE DROPS BELOW 38° CDB FOR AT LEAST 30 MINUTES

THE DUTY/STANDY CONFIGURATION TO SWAP ON A WEEKLY BASIS. FAN CONTROL TO BE ACHIEVED USING FACTORY MODIFIED CONTROL PANEL.

FAN RUN CYCLE TIME TO BE ADJUSTABLE. FAN AND DAMPER CONTROL TO BE ACHIEVED USING THIRD PARTY INNOTECH CONTROL PANEL OR SIMILAR.

DUTY/STAND-BY OPERATION OF ROOF VENTILATORS WITHOUT SHUT OFF DAMPERS TO BE AVOIDED DUE TO POTENTIAL SHORT-CIRCUITING OF AIR INTO THE PUMPSTATION THROUGH THE STANDBY-BY UNITS.

WORKS BY OTHER TRADES

THE FOLLOWING WORKS ASSOCIATED WITH THIS SCOPE SHALL BE CARRIED OUT BY OTHER CONTRACTORS AT NO COST TO THE MECHANICAL SERVICES CONTRACTOR, PROVIDED THAT THE MECHANICAL CONTRACTOR SUPPLIES SUFFICIENT DRAWINGS OR DETAILS & PROVIDED THAT SUCH DETAILS ARE SUPPLIED IN AMPLIE TIME FOR THOSE WORKS TO BE CARRIED OUT DURING THE NORMAL PROGRESS OF THE WORK AND/OR IN ACCORDANCE WITH THE PROGRAM FOR THE WORKS. IT IS THE MECHANICAL SERVICES CONTRACTORS RESPONSIBILITY TO COORDINATE & EXECUTE OF THESE WORKS WITH OTHER PARTIES & THE CONSTRUCTION PROGRAMS.

BY THE BUILDER - THE CUTTING OF ALL OPENINGS IN THE BUILDING STRUCTURE FOR THE PENETRATION OF DUCTS, GRILLES, LOUVRES, CONDUITS ETC., & ALL CUTTING, PATCHING, FRAMING UP, FRURING IN & MAKING GOOD ASSOCIATED WITH THE BUILDING STRUCTURE, INCLUDING CHASES, UNDERFLASHING TO BE PROVIDED AS PER MANUFACTURERS SPECIFICATIONS. INSTALLATION OF LOUVRES SUPPLIED BY THE MECHANICAL CONTRACTOR.

BY ELECTRICAL CONTRACTOR -PROVISION OF CAPACITY AT THE MCC TO ENSURE THE MECHANICAL EQUIPMENT CAN BE ADEQUATELY POWERED.

ELECTRICAL TRADE TO PROVIDE THE REQUIRED SPARE CIRCUITS IN THE BOARD TO POWER THE ROOF VENTILATORS.

BY HYDRAULING CONTRACTOR - PROVISION OF DRAIN POINTS FOR THE PACKAGED UNITS.

BY FIRE CONTRACTOR - PROVISION OF AUTO SHUT DOWN OF AC UNITS DURING FIRE TRIP.

WORK FOR OTHER TRADES

THE FOLLOWING WORKS ASSOCIATED WITH THIS SCOPE FOR OTHER TRADES SHALL BE CARRIED OUT BY THE MECHANICAL CONTRACTOR AT NO COST TO THE OTHER CONTRACTORS, PROVIDED THAT THE OTHER SERVICES CONTRACTORS SUPPLIES SUFFICIENT DRAWINGS OR DETAILS. TO ENABLE THESE WORKS TO BE CARRIED OUT, & PROVIDED THAT SUCH DETAILS ARE SUPPLIED IN AMPLIE TIME FOR THOSE WORKS TO BE CARRIED OUT DURING THE NORMAL PROGRESS OF THE WORK AND/OR IN ACCORDANCE WITH THE PROGRAM OF THE WORKS.

FOR THE BUILDER - ALL SIGNAGE REQUIRED TO BE FIXED DIRECTLY TO THE MECHANICAL EQUIPMENT. ALL PAINTING OF MECHANICAL EQUIPMENT, FLASHING & WATERPROOFING OF ALL MECHANICAL WALL PENETRATIONS, MAKING GOOD OF ALL MECHANICAL SERVICES PENETRATIONS.

FOR ELECTRICAL CONTRACTOR - THE MECHANICAL CONTRACTOR SHALL BE RESPONSIBLE FOR COORDINATING WITH THE ELECTRICAL CONTRACTOR TO ENSURE THAT ADEQUATE CAPACITY AND CIRCUIT PROTECTION IS ALLOWED FOR IN THE MCC, CABLING FROM THE MCC TO LOCAL ISOLATORS NEAR EACH ITEM OF EQUIPMENT (AND FINAL WIRING FROM ISOLATORS TO EQUIPMENT) IS THE RESPONSIBILITY OF THE MECHANICAL CONTRACTOR.

MATERIALS, EQUIPMENT AND COMPONENTS

GENERAL

PROVIDED NEW MATERIALS, EQUIPMENT & COMPONENTS SHALL BE NEW, OF GOOD QUALITY & FIT FOR PURPOSE, SELECTED FOR A REASONABLE SERVICE LIFE. DO NOT PROVIDE, WITHOUT APPROVAL, PRODUCTS THAT ARE OBSOLETE, DISCONTINUED OR ABOUT TO BE DISCONTINUED.

MANUFACTURERS

PROVIDED EQUIPMENT & ASSOCIATED ACCESSORIES WHICH ARE THE PRODUCTS OF ESTABLISHED MANUFACTURERS REGULARLY ENGAGED IN THE MANUFACTURE OF SUCH EQUIPMENT, WHO ISSUE COMPREHENSIVE RATING DATA & CERTIFIED TEST DATA ON THEIR PRODUCTS.

CONSISTENCY

FOR THE WHOLE QUANTITY OF EACH MATERIAL OR PRODUCT USE THE SAME MANUFACTURER OR SOURCE & PROVIDE CONSISTENT TYPE, SIZE, QUALITY & APPEARANCE.

SAFETY

PROVIDE ALL NECESSARY SAFETY DEVICES FOR THE PROTECTION OF PERSONNEL AGAINST INJURY & THE PROTECTION OF PLANT & EQUIPMENT AGAINST DAMAGE INCLUDING RELIEF VALVES, BELT GUARDS, SAFETY RAILING, EFFECTIVE EARTHING OF ELECTRICAL COMPONENTS, ELECTRICAL INTERLOCKS, WARNING LIGHTS, & SIGNS, ALARMS & LOCAL LIGHTING. PROVIDE PERMANENT LIFTING EYES FOR EQUIPMENT EXCEEDING 40kg.

PROHIBITED MATERIALS

DO NOT USE ANY OF THE FOLLOWING MATERIALS DURING CONSTRUCTION: ASBESTOS; LEAD WHERE THE METAL OR ITS CORROSION PRODUCTS MAY BE DIRECTLY INGESTED, INHALED OR ABSORBED, OR ANY LEAD-BASED PAINTS OR PRIMERS; CHROMATE PAINT PIGMENT OR CHROMATE WATER TREATMENT; UREA FORMALDEHYDE FOAM OR MATERIALS WHICH MAY RELEASE FORMALDEHYDE IN QUANTITIES WHICH MAY BE HAZARDOUS OR IRRITANT; SYNTHETIC MINERAL FIBRES, MATERIALS IN WHICH CHLOROFLUOROCARBONS, HYDRO CHLOROFLUOROCARBONS OR HEXA-FLUOROACETONES HAVE BEEN USED AS A BLOWING AGENT; CHLOROFLUOROCARBONS; OTHER SUBSTANCES GENERALLY KNOWN TO BE DELETERIOUS TO HEALTH OR SAFETY OR WHICH WOULD ADVERSELY AFFECT THE WORKS.

EXECUTION

GENERAL

INSTALL EQUIPMENT & SERVICES PLUMB, FIX SECURELY & ORGANISE RETICULATED SERVICES NEATLY. PROVIDE FOR MOVEMENT IN BOTH STRUCTURE & SERVICES.

ARRANGEMENT - ARRANGE SERVICES SO THAT SERVICES RUNNING TOGETHER ARE PARALLEL WITH EACH OTHER & WITH ADJACENT BUILDING ELEMENTS.

MOVEMENT & EXPANSION - PROVIDE EXPANSION FACILITIES IN DUCTWORK, PIPING, CABLES, CABLE TRAYS & SUPPORTS TO ACCOMMODATE THERMAL EXPANSION & MOVEMENT AT STRUCTURAL EXPANSION JOINTS.

PROTECTION - PROTECT EQUIPMENT FROM WEATHER & THE INGRESS OF DIRT, MOISTURE, VANDALISM & TAMPERING.

ACCESS - PROVIDE ACCESS TO ALL COMPONENTS REQUIRING ENTRY, INSPECTION OR MAINTENANCE.

PAINTING SERVICES AND EQUIPMENT

IF EXPOSED TO VIEW OR THE ELEMENTS, PAINT NEW SERVICES & EQUIPMENT INCLUDING IN PLANT ROOMS, EXCEPT CHROMIUM, ANODISED ALUMINIUM, GRP, UPVC, STAINLESS STEEL, NON-METALLIC FLEXIBLE MATERIALS & NORMALLY LUBRICATED MACHINED SURFACES. REPAINT PROPRIETARY ITEMS ONLY IF DAMAGED. COMPLY WITH THE REQUIREMENTS OF AS/NZS 2311 SECTIONS 3.6 & 7, OR AS/NZS 2312 SECTIONS 5.8 & 10 AS APPLICABLE. COLOURS: TO AS 2700, COLOUR STANDARDS FOR GENERAL PURPOSES.

IDENTIFICATION

MARK EQUIPMENT, ELECTRICAL WIRING, CONDUITS & DUCTS, TO PROVIDE A READY MEANS OF IDENTIFICATION. PIPING, CONDUITS & DUCTS: TO AS 1345, AS APPLICABLE.

SUBMISSIONS

WORK - AS - EXECUTED

SUBMIT WORK-AS-EXECUTED DRAWINGS. SHOW DIMENSIONS, TYPES & LOCATION OF EQUIPMENT, TRAY CABLES & DUCTWORK IN RELATION TO PERMANENT SITE FEATURES. SHOW THE "AS INSTALLED" LOCATIONS OF BUILDING ELEMENTS, PLANT & EQUIPMENT. SHOW OFF-THE-GRID DIMENSIONS WHERE APPLICABLE. INCLUDE RELATIONSHIP TO BUILDING STRUCTURE & OTHER SERVICES, & CHANGES MADE DURING COMMISSIONING & THE MAINTENANCE PERIOD. INCLUDE SCHEMATIC DRAWINGS OF EACH SYSTEM SHOWING WIRING, & PRINCIPAL ITEMS OF EQUIPMENT. DO NOT PROCEED UNTIL REVIEWED DRAWINGS HAVE BEEN RETURNED, ANY REQUESTED AMENDMENTS HAVE BEEN IMPLEMENTED & FINAL APPROVAL OF A COMPLETED AS-BUILT DRAWING SET IS PROVIDED.

OPERATION AND MAINTENANCE MANUALS

- SUBMIT OPERATION & MAINTENANCE MANUALS FOR INSTALLATIONS (2 COPIES). FORMAT IS TO BE BOTH DIGITAL & AN A4 SIZE LOOSE LEAF, IN COMMERCIAL QUALITY, 4 RING BINDERS WITH HARD COVERS, EACH INDEXED, DIVIDED & TITLED. INCLUDE THE FOLLOWING FEATURES:
- MANUFACTURERS' PRINTED DATA, INCLUDING ASSOCIATED DIAGRAMS.
- SYSTEM DESCRIPTION & MAJOR EQUIPMENT COMPONENTS;
- OPERATION PROCEDURES; MAINTENANCE PROCEDURES;
- OPERATION PROCEDURE FOR THE AC CONTROLLERS;
- COMMISSIONING & TEST FIGURES;
- WARRANTY INFORMATION; &
- DRAWINGS FOLDED TO A4 SIZE & ACCOMMODATE THEM IN THE BINDERS.

TESTING AND COMMISSIONING

CARRY OUT ACCEPTANCE TESTS & FINAL TESTS. COMMISSION ALL PLANT INSTALLED IN THIS CONTRACT & CARRY OUT THE NECESSARY TESTS TO DEMONSTRATE THAT THE SYSTEMS & COMPONENTS MEET ALL PERFORMANCE & AUTHORITY REQUIREMENTS.

PRACTICAL COMPLETION - WILL NOT BE GRANTED WITHOUT THE FOLLOWING: TESTING & COMMISSIONING FINALISED; STABLE OPERATING CONDITIONS OF ALL PLANT; PRELIMINARY INSTRUCTION OF THE BUILDING OWNER OR REPRESENTATIVE IN SAFE OPERATION OF THE PLANT; APPROVED OPERATING INSTRUCTION MANUALS & "AS BUILT" DRAWINGS PROVIDED; & RECTIFICATION & CORRECTION OF ANY DEFECTS & DEFICIENCIES.

COMPLETION

GENERAL REQUIREMENTS

CARRY OUT ACCEPTANCE TESTS & FINAL TESTS. COMMISSION ALL PLANT INSTALLED IN THIS CONTRACT & CARRY OUT THE NECESSARY TESTS TO DEMONSTRATE THAT THE SYSTEMS & COMPONENTS MEET ALL PERFORMANCE & AUTHORITY REQUIREMENTS.

PRACTICAL COMPLETION - WILL NOT BE GRANTED WITHOUT THE FOLLOWING:

- TESTING & COMMISSIONING FINALISED;
- STABLE OPERATING CONDITIONS OF ALL PLANT;
- PRELIMINARY INSTRUCTION OF THE BUILDING OWNER OR REPRESENTATIVE IN SAFE OPERATION OF THE PLANT;
- APPROVED OPERATING INSTRUCTION MANUALS & "AS BUILT" DRAWINGS PROVIDED; &
- RECTIFICATION & CORRECTION OF ANY DEFECTS & DEFICIENCIES.

AIR CONDITIONING CAPACITY TESTS - TEST THE CAPACITIES & PERFORMANCE OF AIR-CONDITIONING SYSTEMS UNDER BOTH SUMMER & WINTER CONDITIONS NO HEATING MODE.

AIR BALANCING - BALANCE THE AIR DISTRIBUTION SYSTEM TO GIVE AIR FLOW RATES WITHIN +10% / -10% OF THE SPECIFIED AIR QUANTITIES, & ENSURE THE AIR IS EVENLY DISTRIBUTED OVER THE FACE OF THE OUTLETS. IT IS NECESSARY FOR THE DAMPER ON THE INDEX RUN FROM THE PACKAGE UNIT TO BE FULLY OPEN. THIS IS TO MINIMISE STATIC PRESSURE ON THE UNIT.

12 MONTHS PERFORMANCE TESTING & BUILDING TUNING PERIOD

A COMMITMENT FOR A FURTHER 12 MONTH PERIOD OF STAGED COMMISSIONING BEYOND HANDOVER DATE SHALL BE ALLOWED FOR. THIS PERIOD IS FOR FINE TUNING THROUGH THE YEAR & WILL CONSIST OF A MINIMUM OF QUARTERLY REVIEW PERIODS.

WORK-AS-EXECUTED DRAWINGS

SUBMIT WORK-AS-EXECUTED DRAWINGS. SHOW DIMENSIONS, TYPES & LOCATION OF EQUIPMENT, TRAY CABLES & DUCTWORK IN RELATION TO PERMANENT SITE FEATURES. SHOW THE "AS INSTALLED" LOCATIONS OF BUILDING ELEMENTS, PLANT & EQUIPMENT. SHOW OFF-THE-GRID DIMENSIONS WHERE APPLICABLE. INCLUDE RELATIONSHIP TO BUILDING STRUCTURE & OTHER SERVICES, & CHANGES MADE DURING COMMISSIONING & THE MAINTENANCE PERIOD. INCLUDE SCHEMATIC DRAWINGS OF EACH SYSTEM SHOWING WIRING, & PRINCIPAL ITEMS OF EQUIPMENT.

OPERATION AND MAINTENANCE MANUALS

SUBMIT OPERATION & MAINTENANCE MANUALS FOR INSTALLATIONS (2 COPIES). FORMAT IS TO BE AN A4 SIZE LOOSE LEAF, IN COMMERCIAL QUALITY, 4 RING BINDERS WITH HARD COVERS, EACH INDEXED, DIVIDED & TITLED. INCLUDE THE FOLLOWING FEATURES: MANUFACTURERS' PRINTED DATA, INCLUDING ASSOCIATED DIAGRAMS, SYSTEM DESCRIPTION & MAJOR EQUIPMENT COMPONENTS, OPERATION PROCEDURES; MAINTENANCE PROCEDURES; COMMISSIONING & TEST FIGURES; DRAWINGS FOLDED TO A4 SIZE & ACCOMMODATE THEM IN THE BINDERS.

ROOF VENTILATORS

ROOF VENTILATOR(S) SHALL BE OF A ROTARY DESIGN INCORPORATING A SEALED BEARING AXLE SYSTEM. DESIGN SHALL INCLUDE ALL APPLICABLE DAMPERS, ACCESSORIES, FIXINGS AND FLASHINGS. INSTALL TO MANUFACTURERS RECOMMENDATIONS.

ROOF VENTILATORS MUST BE FITTED WITH A TRANSITION BASE, BIRD MESH, EMBER MESH AND INCORPORATE A BOOSTER FAN THAT DOES NOT IMPACT THROAT AREA.

VENTILATORS MUST ACHIEVE A Cd OF 0.7 OR GREATER, AND BE TESTED ACCORDING TO AS 2428.1 (RAIN), AS 2428.2 (WIND), AS 2428.4 (FIRE) AND AS 2428.5 (COEFFICIENT OF DISCHARGE).

ROOF VENTILATORS TO BE INSTALLED AND FLASHED AS PER MANUFACTURERS DETAIL. COLOUR TO MATCH ROOF SHEETING.

LOUVRES

LOUVRES

HORIZONTAL OUTDOOR LOUVRES SHALL BE OF EXTRUDED ALUMINIUM CONSTRUCTION WITH 45mm CURVED HORIZONTAL BLADES FIXED AT THEIR ENDS WITH STAINLESS STEEL SCREWS INTO A WELDED ALUMINIUM FRAME. THE STRUCTURE SHALL BE DESIGNED TO WITHSTAND A WIND LOAD OF 95kg/m².

SAFETY IN DESIGN

SAFE WORK AUSTRALIA HAS LEGISLATED THE 'SAFE DESIGN OF STRUCTURES' IN OCTOBER 2018. THIS REQUIRES THE CLIENT, DESIGNERS, BUILDERS & CONTRACTORS TO CONSIDER & PROVIDE ALL NECESSARY SAFETY DEVICES FOR THE PROTECTION OF PERSONNEL AGAINST INJURY & THE PROTECTION OF PLANT & EQUIPMENT AGAINST DAMAGE.

THE CONTRACTOR SHALL BE AWARE OF THE CODE OF PRACTICE REQUIREMENTS FOR 'SAFE DESIGN OF STRUCTURES'. REFER TO www.safeworkaustralia.gov.au FOR FURTHER INFORMATION.

THIS INCLUDES CONSIDERING ACTUAL STRUCTURES, PLANT, ACCESS, GUARDS, SAFETY RAILING, EARTHING OF ELECTRICAL COMPONENTS, ELECTRICAL INTERLOCKS, WARNING LIGHTS, & SIGNS, ALARMS & LOCAL LIGHTING. PROVIDE PERMANENT LIFTING EYES FOR EQUIPMENT EXCEEDING 40kg, ETC. POSITION & LOCATION OF PLANT & EQUIPMENT MUST BE SUCH THAT REGULAR MAINTENANCE & SERVICING ACCESS CAN BE CARRIED OUT SAFELY & SECURELY.

THE SAFETY RISK MITIGATION ITEMS BELOW ARE BASED ON GHD'S DESIGN EXPERIENCE & DO NOT NECESSARILY ACCOUNT FOR ALL CONSTRUCTION, OPERATION, MAINTENANCE & DEMOLITION SAFETY RISKS.

BASED ON INFORMATION AVAILABLE AT THE TIME OF THIS DOCUMENTATION, IN ITS CAPACITY AS DESIGNER ONLY GHD HAS TRIED TO IDENTIFY SAFETY RISKS PERTAINING TO CONSTRUCTION, OPERATION, MAINTENANCE, INCLUSION (OR NOT) OF ANY ITEM DOES NOT REDUCE OR LIMIT OBLIGATIONS OF CONSTRUCTOR, USER, MAINTAINER TO UNDERTAKE APPROPRIATE RISK MANAGEMENT ACTIVITIES TO REDUCE RISK.

- PROVIDE PROTECTION TO PERSONNEL FROM PLANT & EQUIPMENT.
- REVIEW ADEQUACY OF WORKING SPACE AVAILABLE FOR CONSTRUCTION ACTIVITIES. ENSURE SEPARATION OF PLANT & PERSONNEL ON SITE, INCLUDING MOVEMENTS OF BOTH.
- ENSURE ISOLATION SAFE SYSTEMS OF WORK OR PROTECTIVE MEASURES ARE INSTALLED BEFORE WORKING NEAR LIVE ELECTRICAL INFRASTRUCTURE. PROVIDE PROTECTION OF ELECTRICAL OVERHEAD WIRING SYSTEMS DURING CONSTRUCTION.
- WRITTEN RISK ASSESSMENTS ARE ADVISED FOR ACCESS TO OPEN EXCAVATIONS OR CONFINED SPACES.
- INSTRUCT SERVICES CONTRACTORS UNDER NO CIRCUMSTANCES CAN STRUCTURAL MEMBERS BE CUT, NOTCHED OR DRILLED TO ACCOMMODATE NEW SERVICES.
- MINIMISE SITE BASED TREATMENTS (eg. WELDING, CUTTING, SPRAY PAINTING, GRIT BLASTING ETC.) PROVIDE ADEQUATE PROTECTION SCREENING & VENTILATION TO MINIMISE HAZARDS TO PERSONNEL IF SITE BASED TREATMENT IS UNAVOIDABLE.
- TRY TO AVOID WORKING IN CONFINED SPACES. IF CONFINED SPACES WORK CAN'T BE AVOIDED, PROVIDE SAFE WORK METHOD STATEMENT ADDRESSING MITIGATION OF RISKS, PROVIDE ADEQUATE SIGNAGE TO TEMPORARY & PERMANENT CONFINED SPACES TO AS 2865.

DIFFUSERS AND GRILLES

GENERAL

ALL SUPPLY AND RETURN AIR REGISTERS ARE TO BE AS SCHEDULED, OR AN EQUIVALENT APPROVED BY THE SUPERINTENDENT.

FILTERS

PERFORMANCE & CONSTRUCTION: TO AS 1324.1. FILTER CLASS TO AS 1324.1. FILTER TYPE TO AS 1324.1.

FILTER MEDIA SHALL BE SYNTHETIC FIBRES BOUNDED TOGETHER & SHALL BE MOISTURE, FIRE & FUNGUS RESISTANT.

DRY MEDIA FILTERS SHALL NOT BE CONSTRUCTED OF GLASS FIBRES OR SIMILAR MATERIALS THAT MAY SHED FIBRES INTO THE AIR STREAM.

ALL FILTER FRAMES & INSTALLATIONS SHALL BE SUCH THAT A POSITIVE SEAL IS MAINTAINED TO PREVENT LEAKAGE PAST THE FILTER MEDIA. DUE TO THEIR LOCATION OUTDOORS, FILTER HOUSING ACCESS PANELS MUST BE SEALED WITH A REUSABLE NEOPRENE SEAL TO PREVENT RAIN INGRESS INTO THE FILTERS.

ENSURE THAT THERE ARE NO LEAKS BETWEEN THE FILTER HOLDING FRAME & THE CASING. SEAL INDIVIDUAL FILTER UNITS TO EACH OTHER. SEAL FILTER CONNECTIONS TO ADJOINING EQUIPMENT, PANELING OR SUPPORTING FRAMING. DO NOT USE ADHESIVE TAPES FOR SEALING.

PACKAGED UNIT

PACKAGE UNIT IS TO BE OF THE MAKE & MODEL AS SPECIFIED, INCLUDING OPTIONAL EXTRAS. ANY PROPOSED ALTERNATIVE MUST MEET THE SAME PERFORMANCE & BE COORDINATED SPATIALLY BY THE MECHANICAL CONTRACTOR.

DUCTWORK AND FITTINGS

DUCTWORK STANDARD: TO AS 4254.2.

INSULATION MATERIALS STANDARD: TO AS/NZS 4859.1.

DUCT INSULATION TO BE IN ACCORDANCE WITH NCC 2022 SECTION J.

SUPPLY & INSTALL DUCTWORK SYSTEMS COMPLETE WITH TRANSITIONS, BENDS, TEES, SUPPORTS, HANGERS, DAMPERS, OFFSETS, TURNING VANES, FLEXIBLE CONNECTIONS, TAKE OFFS, AIR OUTLETS, GRILLES & FITTINGS NECESSARY FOR THE SATISFACTORY OPERATION OF THE AIR SYSTEMS. THIS INCLUDES THE SAFE, RELIABLE & EFFICIENT TESTING, COMMISSIONING, OPERATION & MAINTENANCE.

DRAWINGS SHOW ROUTES & SIZES OF DUCTS BUT DO NOT DETAIL ALL OFFSETS & BENDS REQUIRED FOR CO-ORDINATION BETWEEN TRADES & FOR INTEGRATION WITH BUILDING STRUCTURE & FINISHES.

SIZES ARE DUCT DIMENSIONS OF THE AIR PASSAGE &, IN THE CASE OF RECTANGULAR DUCTWORK, THE FIRST DIMENSION QUOTED IS THE DIMENSION OF THE SIDE IN VIEW ON THE PARTICULAR PLAN OR ELEVATION.

ALL DUCTS WHICH MAY PASS THROUGH FIRE RATED WALLS, FLO

PACKAGED UNIT SCHEDULE

EQUIPMENT	SPACE SERVED	TOTAL SUPPLY AIR QUANTITY (L/s)	TOTAL OUTSIDE AIR QUANTITY (L/s)	EXTERNAL STATIC PRESSURE AT MACHINE NOMINAL AIRFLOW (Pa)	SOUND PRESSURE LEVEL @ 3M (SWL dBA)	TOTAL COOLING CAPACITY (kW)	SENSIBLE COOLING CAPACITY (kW)	TOTAL HEATING CAPACITY (kW)	ENTERING AIR CONDITIONS SUMMER (°CDB / °CWB)	ENTERING AIR CONDITIONS WINTER (°CDB)	DESIGN AMBIENT TEMPERATURES (°CDB SUMMER / °CDB WINTER)	COIL ENTERING TEMPERATURES (°CDB / °CWB)	ELECTRICAL INPUT (V / PHASE / MAX RUNNING AMPS PER PHASE)	POWERED FROM	BASE SELECTION	COMMENTS
PAC.1	SWITCH ROOM	2,200	50	300	62	25.9	-	37	25.4/17.9	5.2	42.4 / -0.4	27.3/19.5	400/3/35	MCC	OPA 350RLTFPQ-S1	MANUFACTURER OPTIONS REQUIRED ARE: OPPOSITE HAND SPIGOTS AS PER DRAWING, ECONOMY CYCLE, WEATHER HOOD, EC PLUG FANS. MACHINE REQUIRED TO SHUT DOWN UPON ACTIVATION OF FIRE MODE. SEE SPECIFICATION NOTES SHEET FOR INFORMATION ON CONTROLS.
PAC.1	SWITCH ROOM	2,200	50	300	62	25.9	-	37	25.4/17.9	5.2	42.4 / -0.4	27.3/19.5	400/3/35	MCC	OPA 350RLTFPQ-S1	MANUFACTURER OPTIONS REQUIRED ARE: OPPOSITE HAND SPIGOTS AS PER DRAWING, ECONOMY CYCLE, WEATHER HOOD, EC PLUG FANS. MACHINE REQUIRED TO SHUT DOWN UPON ACTIVATION OF FIRE MODE. SEE SPECIFICATION NOTES SHEET FOR INFORMATION ON CONTROLS.

NOTE: UNIT SELECTIONS ARE FOR TENDER PURPOSES ONLY. CONTRACTOR TO PERFORM FINAL DESIGN CALCULATIONS TO VERIFY CAPACITY AND THE REQUIRED EXTERNAL STATIC PRESSURE.

ROOF VENTILATOR SCHEDULE

EQUIPMENT	TYPE	NATURAL VENTILATION AIRFLOW (L/s) (@ 3.05m STACK, 6.4km/hr WIND FACTOR, 6°C dT)	AIRFLOW USING BOOSTER FAN (L/s @ 50 PA)	BASE SELECTION	POWER SUPPLY (V / ph / A)	CONTROL METHODOLOGY	COMMENTS
RV.1	SLOPE MOUNTED ROTARY VENTILATOR c/w TRANSITION BASE, DAMPER AND BOOSTER FAN	609	2000	AIROCLE 5AV.0600/050-4	240 / 1 / 3	PLEASE REFER TO CONTROLS SECTIONS	TO BE FITTED WITH EMBER MESH TO COMPLY WITH BAL12.5 RATING
RV.2		609	2000	AIROCLE 5AV.0600/050-4	240 / 1 / 3		
RV.3		609	2000	AIROCLE 5AV.0600/050-4	240 / 1 / 3		
RV.4		609	2000	AIROCLE 5AV.0600/050-4	240 / 1 / 3		
RV.5		609	2000	AIROCLE 5AV.0600/050-4	240 / 1 / 3		
RV.6		609	2000	AIROCLE 5AV.0600/050-4	240 / 1 / 3		
RV-WT-01	SLOPE MOUNTED ROTARY VENTILATOR	271	N/A	AIROCLE 5AV.0400/030-4	240 / 1 / 0.43	TO BE FITTED WITH VERMIN PROOF MESH	
RV-WT-02		271	N/A	AIROCLE 5AV.0400/030-4	240 / 1 / 0.43		

AIR TERMINAL SCHEDULE

EQUIPMENT	APPLICATION	AIR TERMINAL STYLE	PLENUM	MIN NECK SIZE (W x H) (mm)	BASE EQUIPMENT SELECTION	COMMENT
S1	SUPPLY AIR	SWIRL	-	595X595	HOLYOAKE CFP	-
E1	RETURN AIR	EGG CRATE	-	600X600	HOLYOAKE EC-125 SERIES	-
E2	EXHAUST AIR	EGG CRATE	-	1000X1000	HOLYOAKE EC-125 SERIES	-

FILTER SCHEDULE

FILTER	LOCATION	TYPE	MEDIA TYPE & CLASS TO AS 1324.1.2.1	MAXIMUM FILTER FACE VELOCITY (m/s)	FILTER RATING	DIMENSIONS (H X W X D)	QTY.	BASE SELECTION
AF.1	PAC.1 AND PAC.2	PLEATED PANEL (50mm)	TYPE 1, CLASS A	2.3	G4	600X300X50	2	AeroPleat Eco 287x592x48-0
AF.2	PAC.1 AND PAC.2	PLEATED PANEL (50mm)	TYPE 1, CLASS A	2.3	G4	600X500X50	4	AeroPleat Eco 287x592x48-0

ROOF COWL SCHEDULE

EQUIPMENT TAG	AREA SERVED	NOMINAL AIR FLOW (L/S)	BASE SELECTION	COMMENTS
RC-WT-01	WATER TANK ROOM	280	FANTECH RV1	TO BE FITTED WITH VERMIN PROOF MESH
RC-WT-02		280	FANTECH RV1	

WEATHERPROOF LOUVRE SCHEDULE

EQUIPMENT	LOUVER FACE SIZE W x H (mm)	MINIMUM FREE AREA OF LOUVRE (%)	MAKE/MODEL	COLOR	COMMENTS
LV.1	1200X2000	51.00%	OHL-124	TBC	TO BE FITTED WITH EMBER MESH TO COMPLY WITH BAL 12.5 RATING.

MECHANICAL LEGEND

	ROOF COWL
	LOUVRE
	SWIRL SUPPLY AIR DIFFUSER
	MOTORISED VOLUME CONTROL DAMPER
	MOTORISED FIRE DAMPER
	FIRE DAMPER
	AIR FLOW DIRECTION
	TEMPERATURE SENSOR
	A/C UNIT CONTROLLER WITH IN-BUILT TEMPERATURE SENSOR
	SQUARE BEND COMPLETE WITH TURNING VANES
	SUPPLY AIR DUCT RISER/DROPPER
	EXHAUST OR RETURN AIR DUCT RISER/DROPPER
	INSULATED SUPPLY AIR DUCT
	INSULATED RETURN AIR DUCT
	INSULATED EXHAUST AIR DUCT

Rev	Description	Checked	Approved	Date
A	30% DETAIL DESIGN	MK	RJ	01/09/23

Author: D.DEGUZMAN, Drafting Check: M.KLUMPP, Designer: R.PREMRAJKUMAR, Design Check: M.KLUMPP



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Client: **PARKES SHIRE COUNCIL**
 Project: **LACHLAN PIPELINE DUPLICATION DETAILED DESIGN PROJECT**
 Status: **PRELIMINARY**

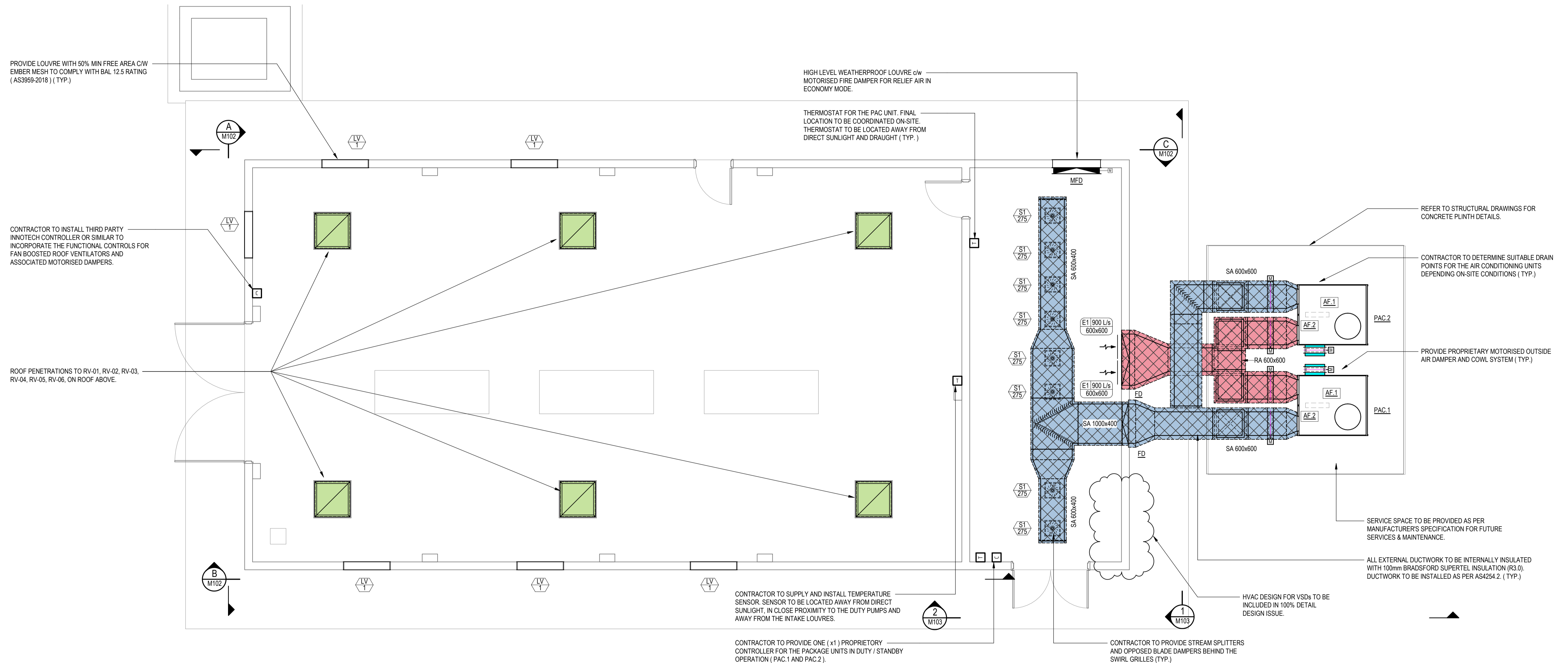
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Status Code: **S0**
 Drawing No.: **12589773-M003**

Size: **A1**
 Rev: **A**

NOTES

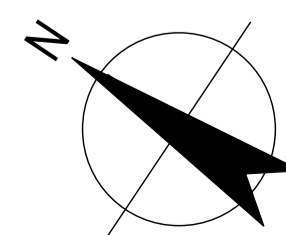
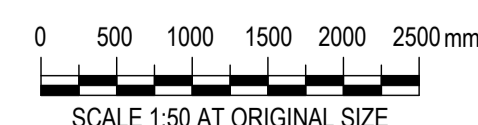
1. ALL PIPEWORK AND DUCTWORK TO BE INSULATED AS PER NCC 2022.
2. CONDENSATE PIPEWORK TO BE SIZED AND RUN AS REQUIRED BY CONTRACTOR TO ENSURE SUITABLE FLOW TO DRAIN POINTS AND PREVENT OVERFLOW.
3. ALL DUCT SIZES SHOWN ARE INTERNAL AIRWAY SIZES ONLY.
4. ALL AIR CONDITIONING SYSTEMS SHALL AUTOMATICALLY SHUT DOWN ON THE INITIATION OF FIRE MODE.
5. FINAL LOCATION OF CONTROL PANEL TO BE APPROVED BY CLIENT.



GROUND LAYOUT
SCALE 1:50

Rev	Description	Checked	Approved	Date
A	30% DETAIL DESIGN	MK	RJ	01/09/23

Author: D.DEGUZMAN, Drafting Check: M.KLUMPP, Designer: R.PREMRAJKUMAR, Design Check: M.KLUMPP



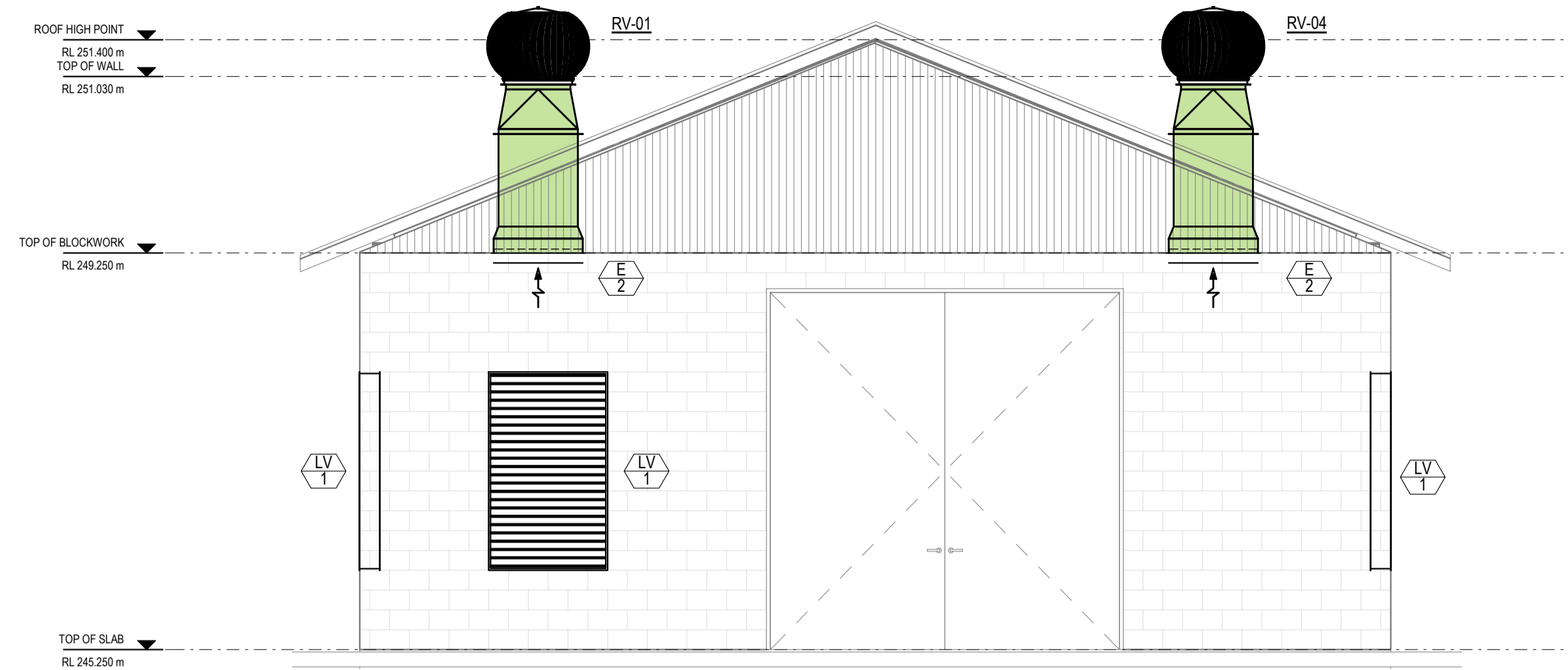
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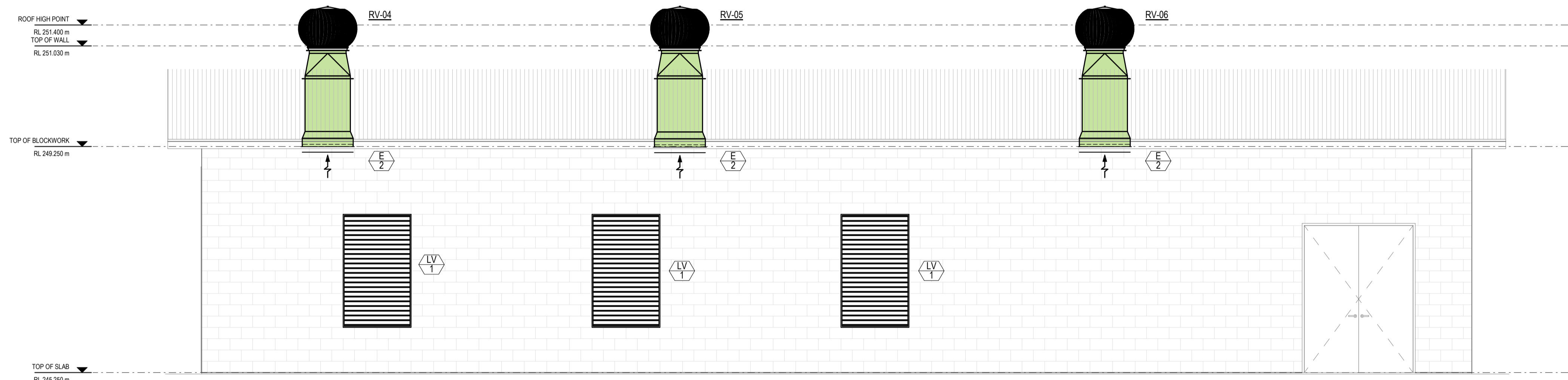
www.ghd.com
Project No. 12589773

Client **PARKES SHIRE COUNCIL**
Project **LACHLAN PIPELINE DUPLICATION DETAILED DESIGN PROJECT**
Status **PRELIMINARY**

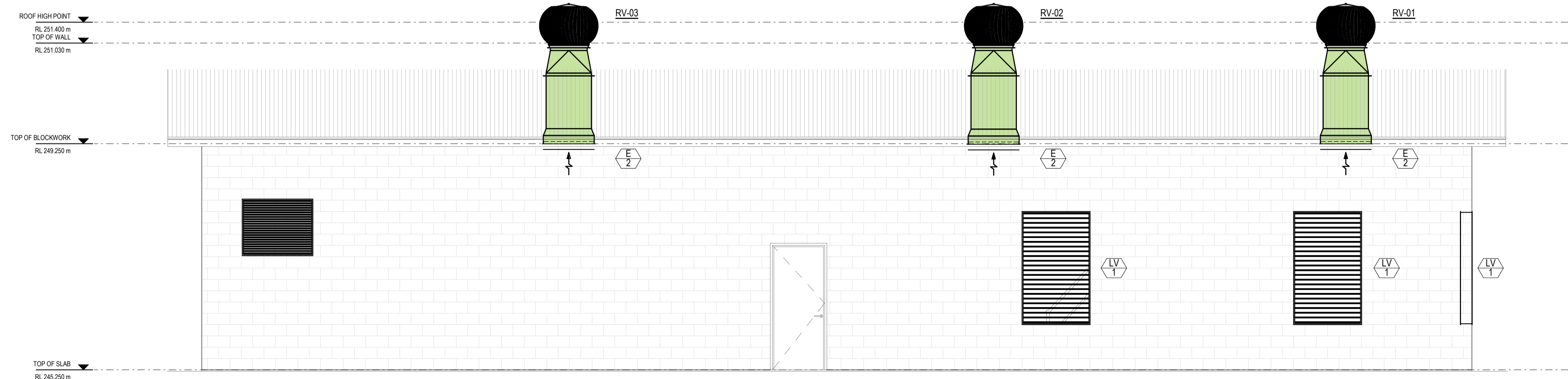
Drawing Title **MECHANICAL SERVICES NEW EUGOWRA ROAD PUMP STATION GROUND FLOOR HVAC LAYOUT**
Drawing No. **12589773-M100**
Status Code **S0**
Rev **A**



SECTION - A
SCALE 1 : 50



SECTION - B
SCALE 1 : 50



SECTION - C
SCALE 1 : 50

Rev	Description	Checked	Approved	Date
A	30% DETAIL DESIGN	MK	RJ	01/09/23
Author	D.DEGUZMAN	Drafting Check	Checker	
Designer	R.PREMRAJKUMAR	Design Check	M.KLUMPP	



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Project No.
12589773

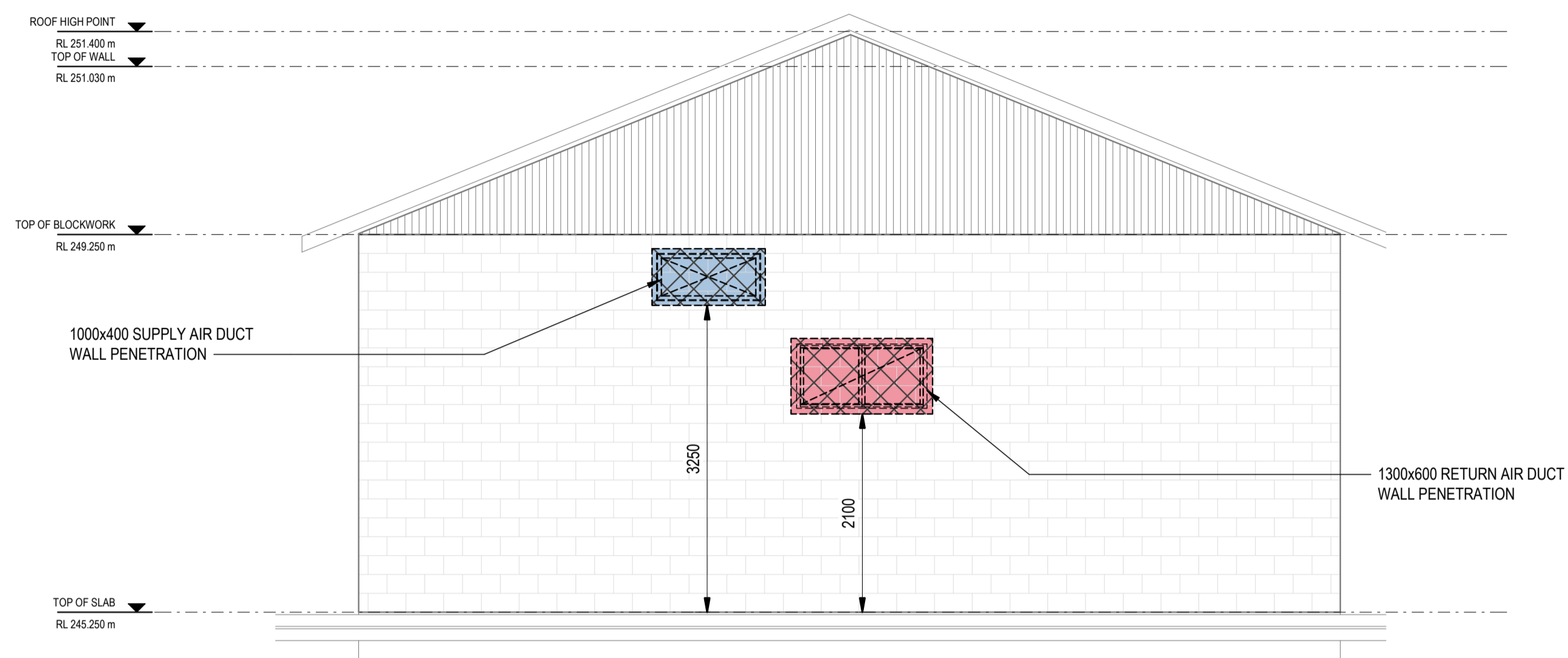
Client **PARKES SHIRE COUNCIL**
 Project **LACHLAN PIPELINE DUPLICATION
 DETAILED DESIGN PROJECT**
 Status **PRELIMINARY**

Drawing Title
**MECHANICAL SERVICES
 NEW EUGOWRA ROAD
 PUMP STATION
 SECTION DETAILS**

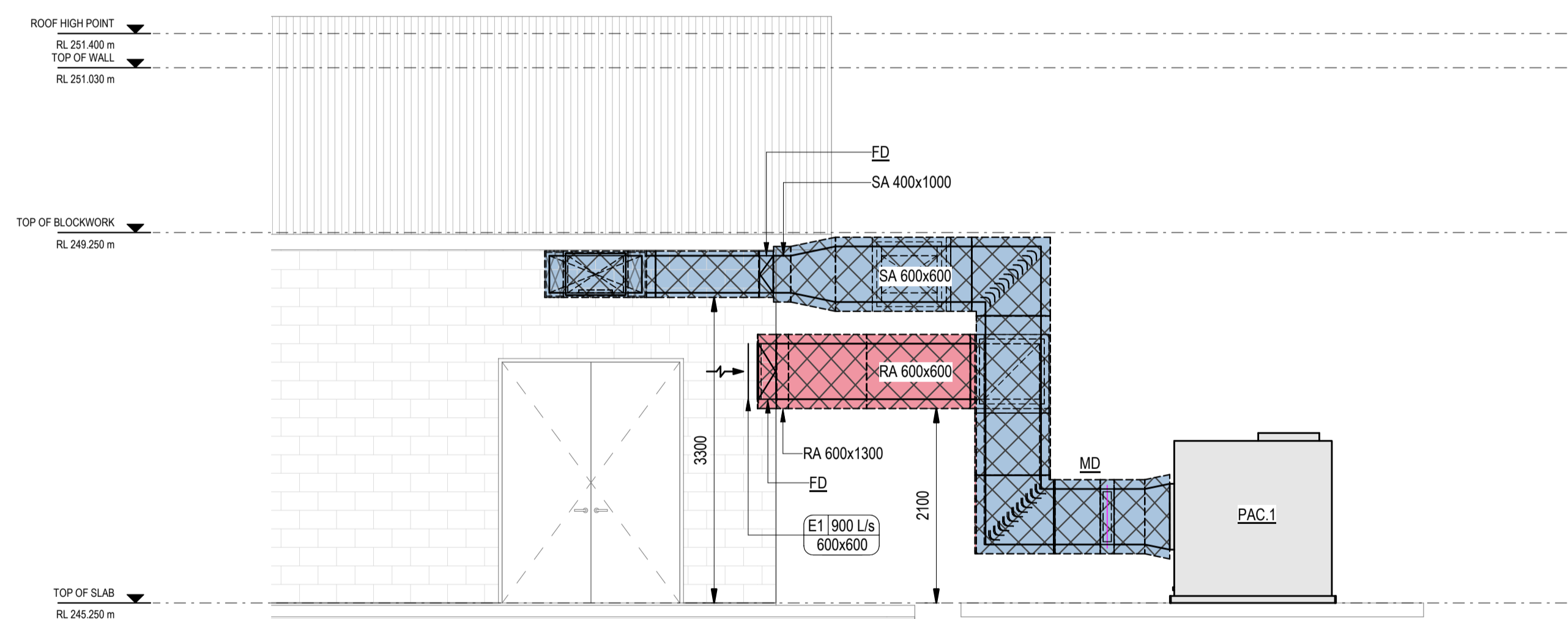
Status Code **S0**

Drawing No.
12589773-M102

Size
A1
Rev
A



SECTION - D
SCALE 1 : 50



SECTION - E
SCALE 1 : 50

Rev	Description	Checked	Approved	Date
A	30% DETAIL DESIGN	MK	RJ	01/09/23
Author	D.DEGUZMAN	Drafting Check		
Designer	R.PREMAJKUMAR	Design Check	M.KLUMPP	



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Project No.
12589773

Client	PARKES SHIRE COUNCIL
Project	LACHLAN PIPELINE DUPLICATION DETAILED DESIGN PROJECT
Status	

Drawing Title
**MECHANICAL SERVICES
NEW EUGOWRA ROAD
SWITCH ROOM
DUCT SECTION DETAILS**

Drawing No.
12589773-M103

Size
A1
Rev
A

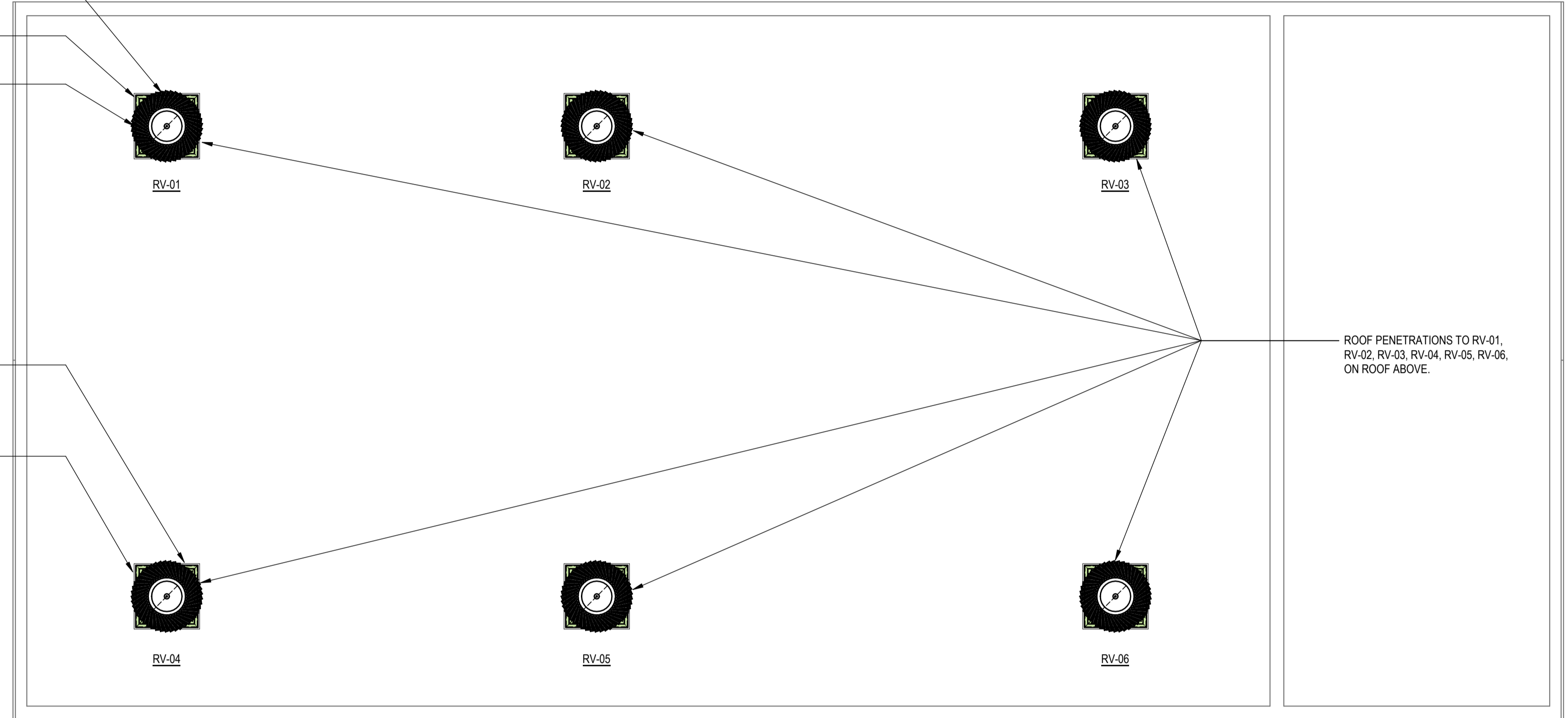
SUPPLY AND INSTALL AIROCCLE SAV 0600 / 050 - 4
ROOF VENTILATORS C/W MOTORISED DAMPERS
(TYP.)

800x800 TRANSITIONING OPENING
FOR ROOF VENTILATORS (TYP.)

CONTRACTOR TO COORDINATE THE LAYOUT OF THE
ROOF VENTILATORS WITH THE ROOF STRUCTURE.
BUILDER TO PROVIDE THE REQUIRED BOX OUTS TO
FACILITATE THE INSTALLATION OF THE ROOF
VENTILATOR (TYP.)

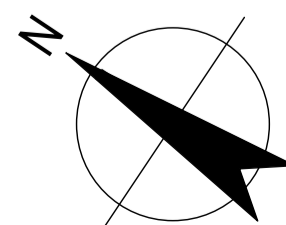
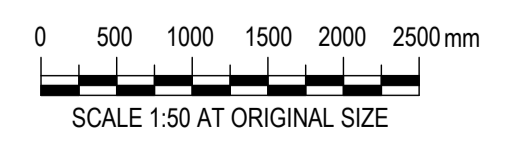
CONTRACTOR TO ENSURE THE SHORTEST DISTANCE
BETWEEN ANY TWO ROOF VENTILATORS TO BE
GREATER THAN 5 METERS.

CONTRACTOR TO PROVIDE FLASHING
TO SUIT ROOF PROFILE (TYP.)



ROOF LAYOUT
SCALE 1:50

Rev	Description	Checked	Approved	Date
A	30% DETAIL DESIGN	MK	RJ	01/09/23
Author	D.DEGUZMAN	Drafting Check	Checker	
Designer	R.PREMRAJKUMAR	Design Check	M.KLUMPP	



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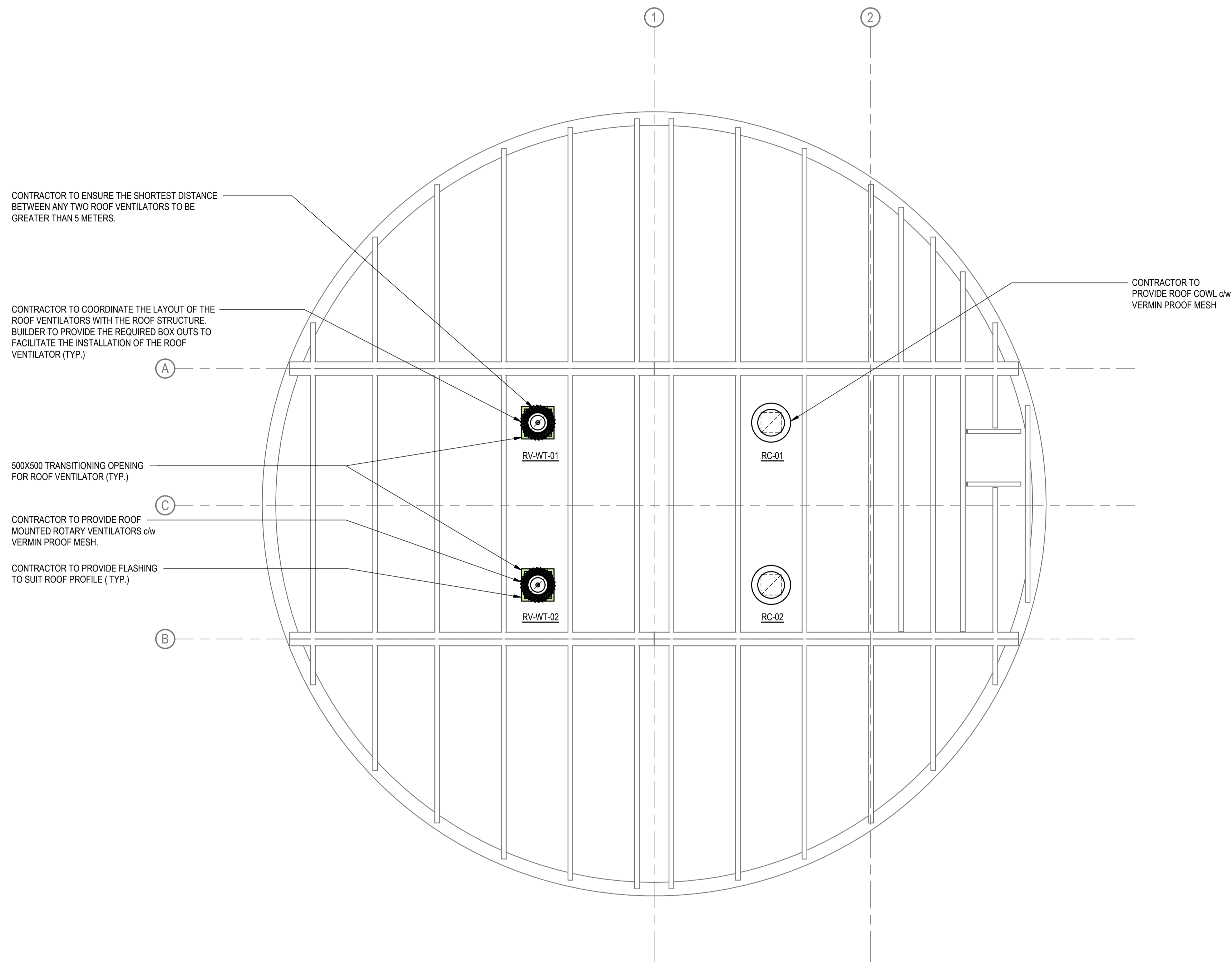


Project No.
12589773

Client **PARKES SHIRE COUNCIL**
Project **LACHLAN PIPELINE DUPLICATION
DETAILED DESIGN PROJECT**
Status **PRELIMINARY**

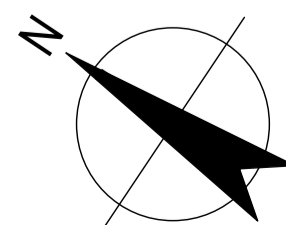
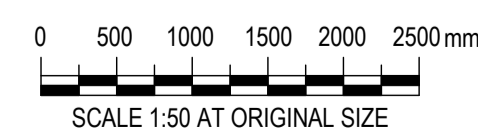
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NEW EUGOWRA ROAD
PUMP STATION
ROOF FLOOR HVAC LAYOUT**
Drawing No. **12589773-M200**
Status Code **S0**

Size **A1**
Rev **A**



ROOF TANK HVAC LAYOUT
SCALE 1:50

Rev	Description	Checked	Approved	Date
A	30% DETAIL DESIGN	MK	RJ	01/09/23
Author	D.DEGUZMAN	Drafting Check		
Designer	R.PREMAJKUMAR	Design Check	M.KLUMPP	



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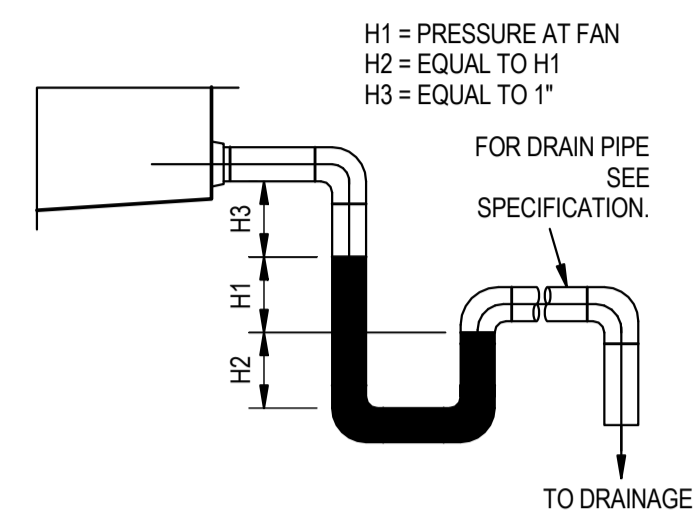
Project No.
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Client	PARKES SHIRE COUNCIL
Project	LACHLAN PIPELINE DUPLICATION DETAILED DESIGN PROJECT
Status	PRELIMINARY

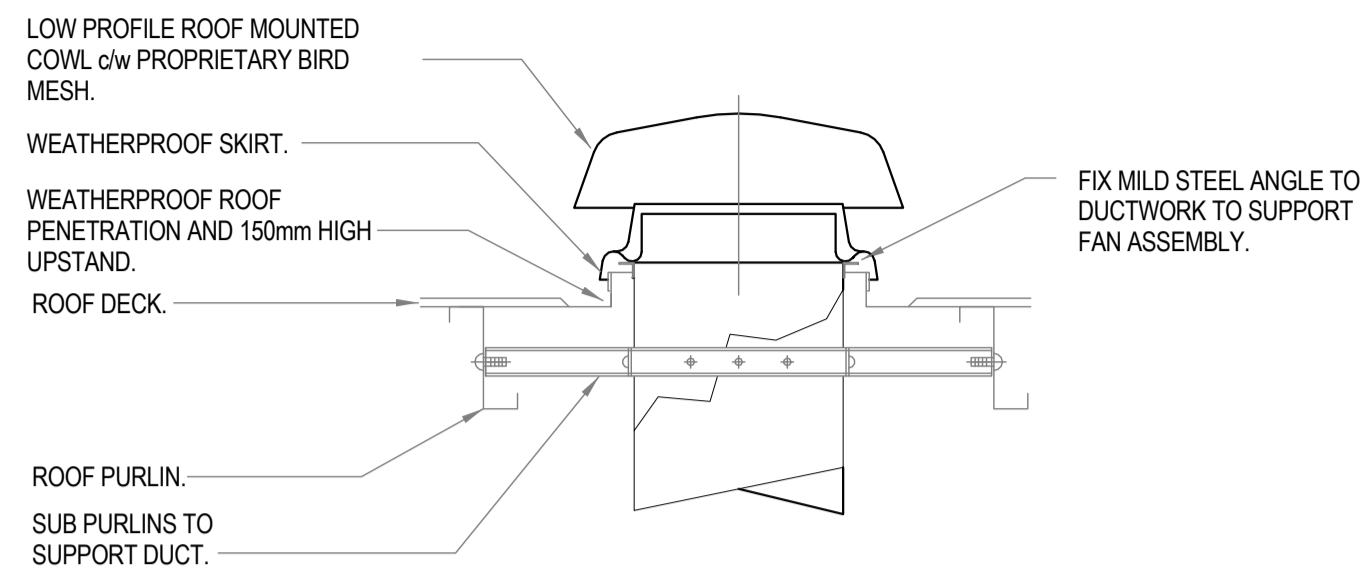
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Drawing No.	12589773-M300

Size
A1

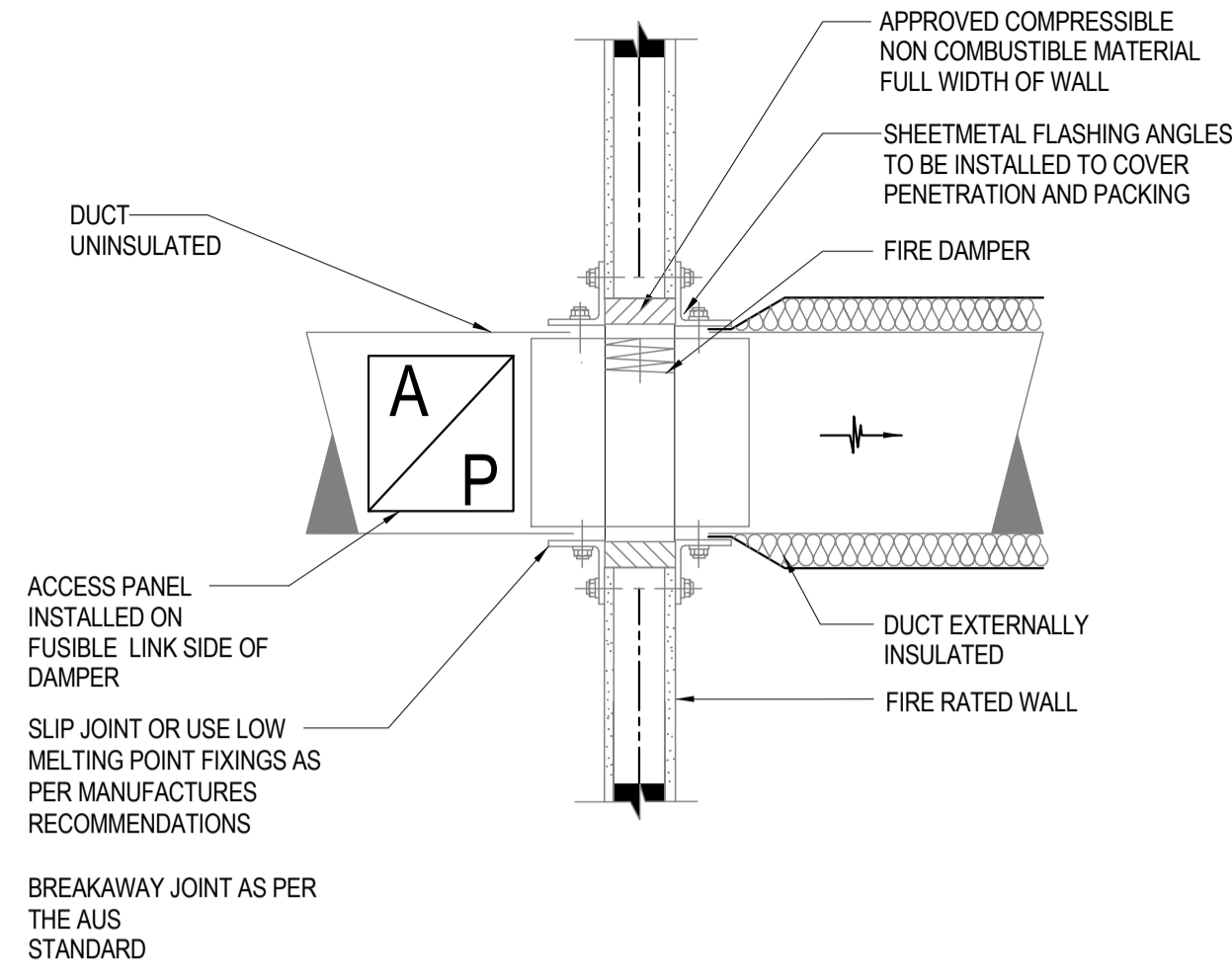
Rev
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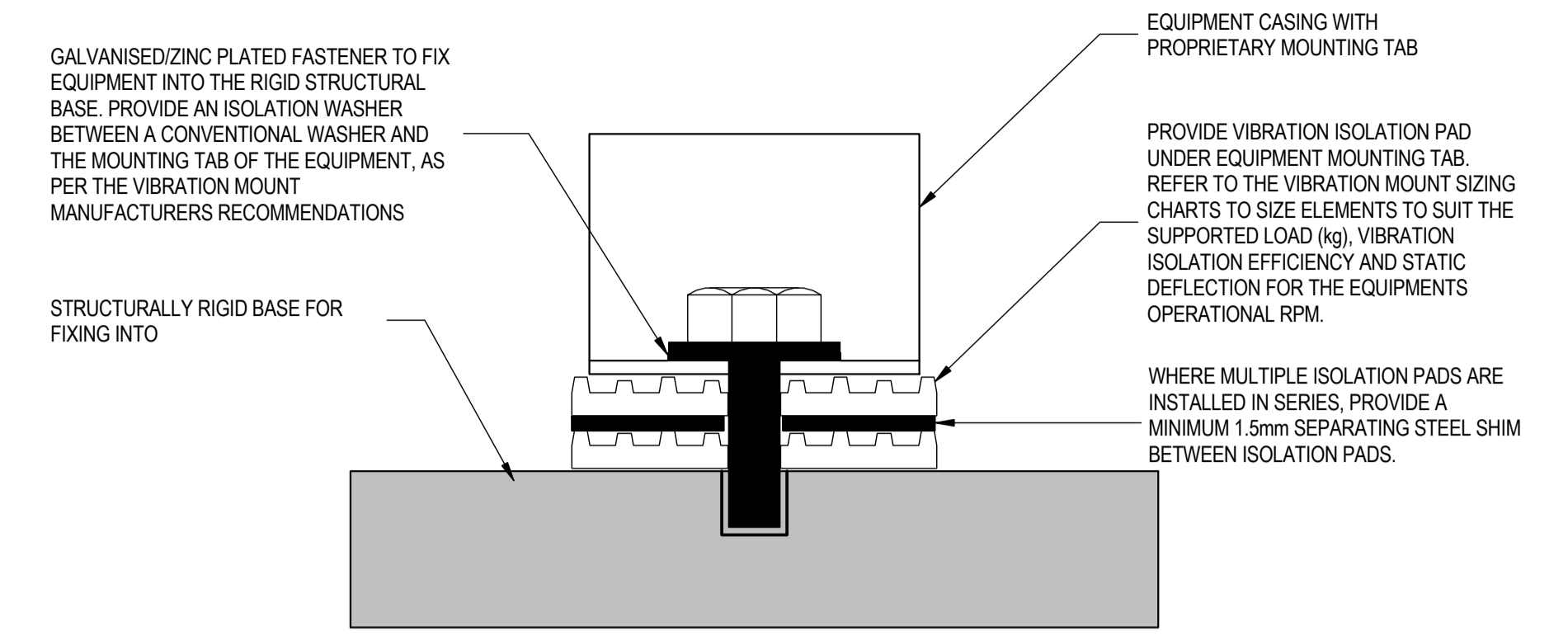
DETAIL OF CONDENSATE DRAINS
NOT TO SCALE



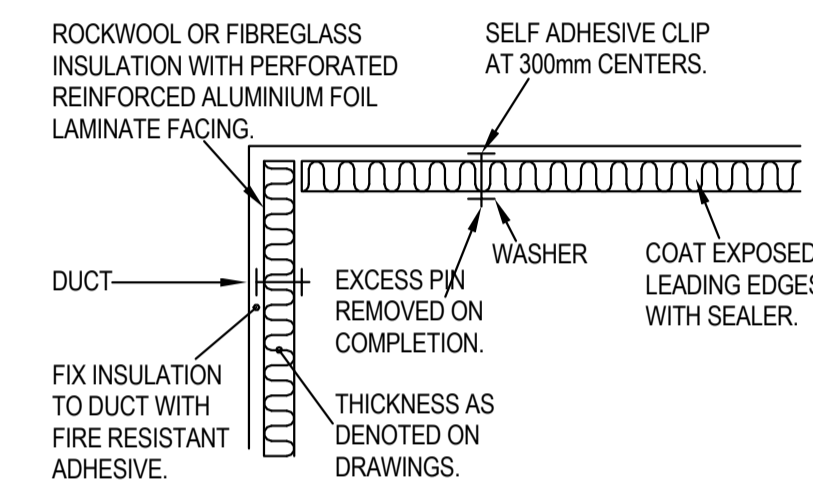
ROOF MOUNTED COWL DETAIL - FLAT DECK
NOT TO SCALE



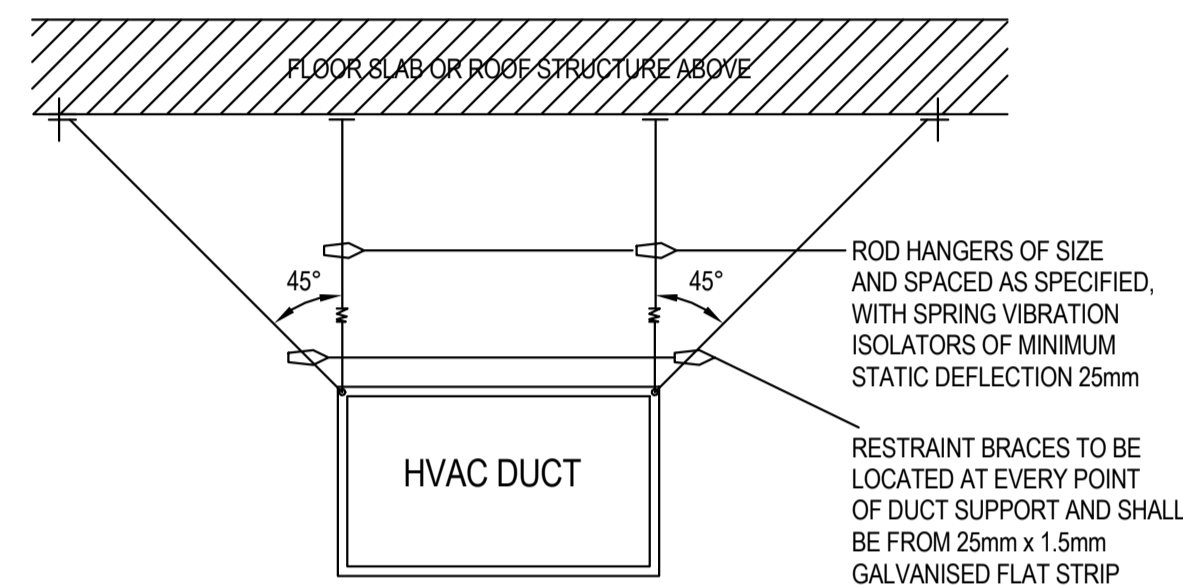
TYPICAL FIRE RATED DUCTWORK WALL PENETRATION DETAIL
NOT TO SCALE



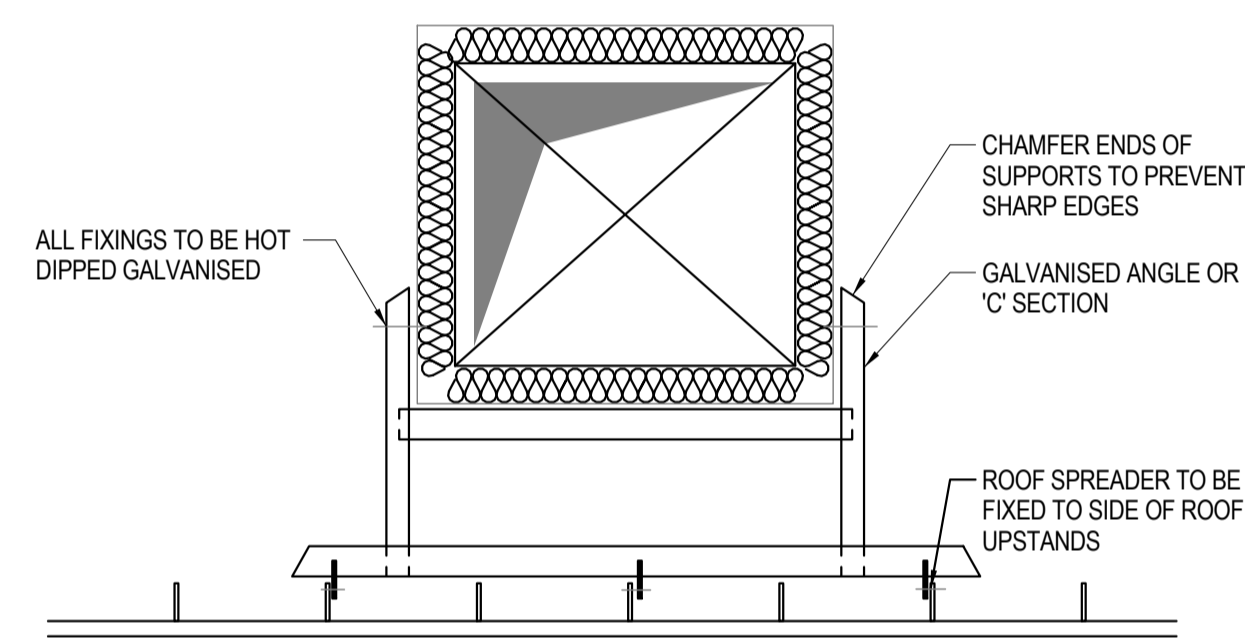
WAFFLE PAD VIBRATION ISOLATION INTO RIGID BASE ON GRADE
NOT TO SCALE



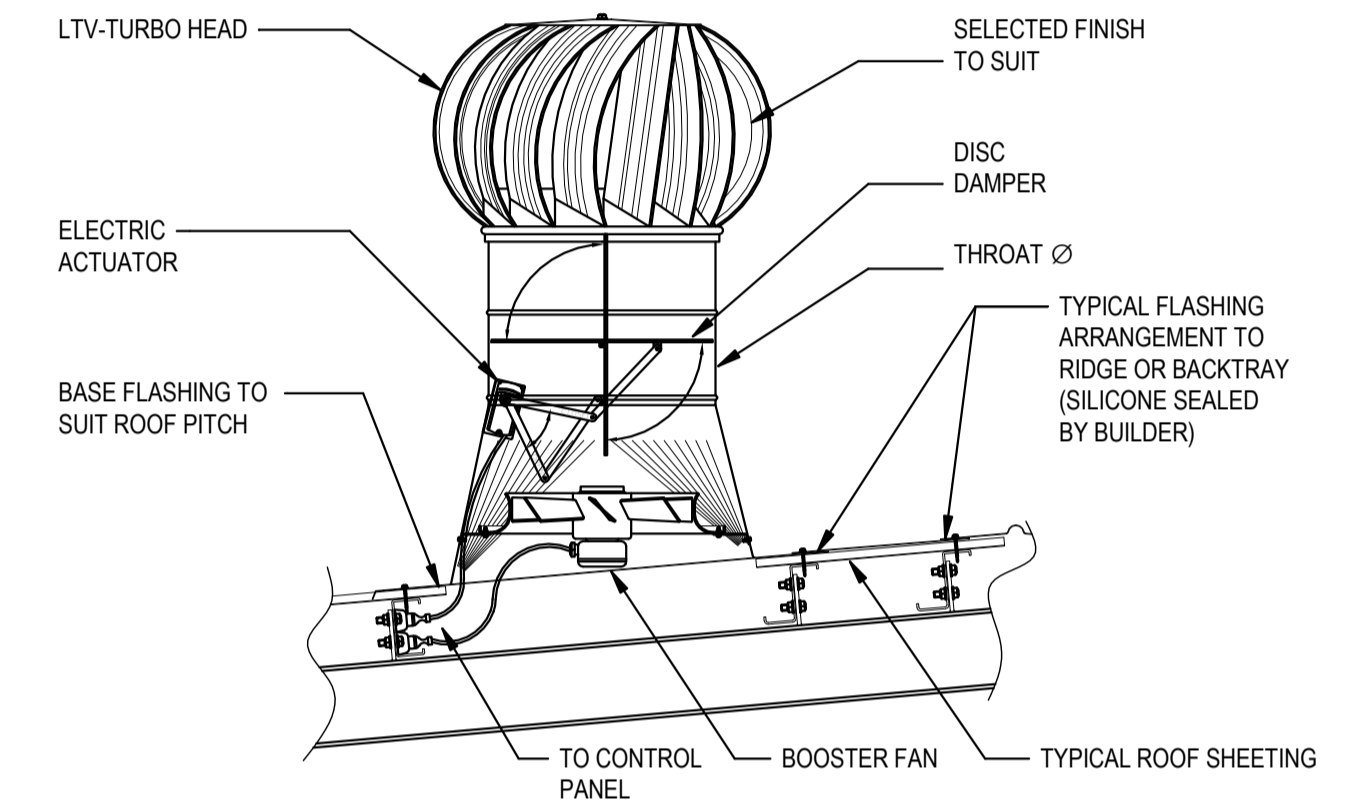
INTERNAL DUCT INSULATION
NOT TO SCALE



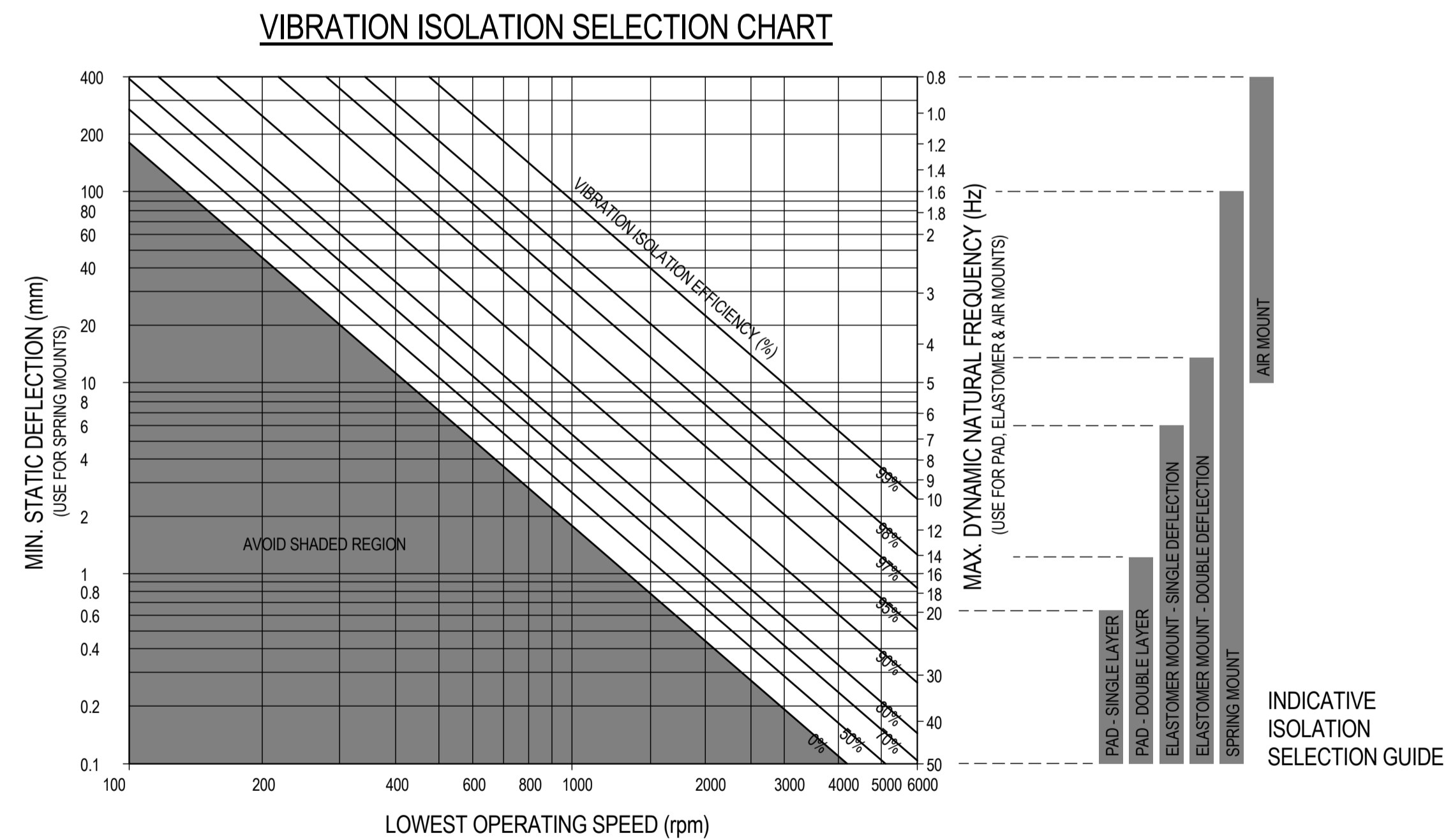
TYPICAL ADDITIONAL DUCT & FCU RESTRAINTS
NOT TO SCALE



TYPICAL ROOF MOUNTED DUCTWORK SUPPORT DETAIL
NOT TO SCALE

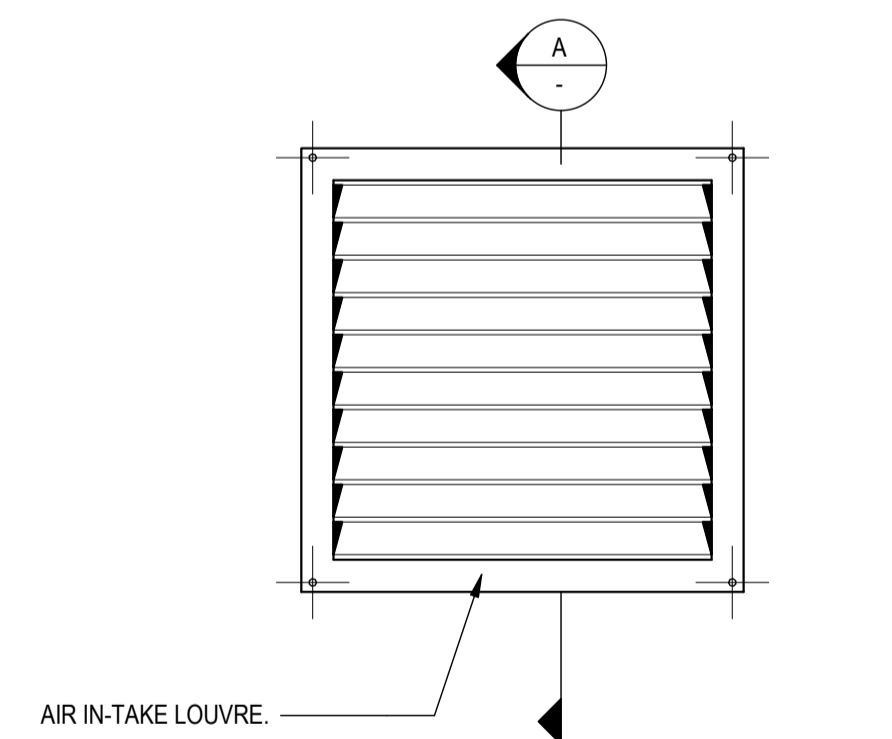


ROOF VENTILATOR DETAILS
NOT TO SCALE

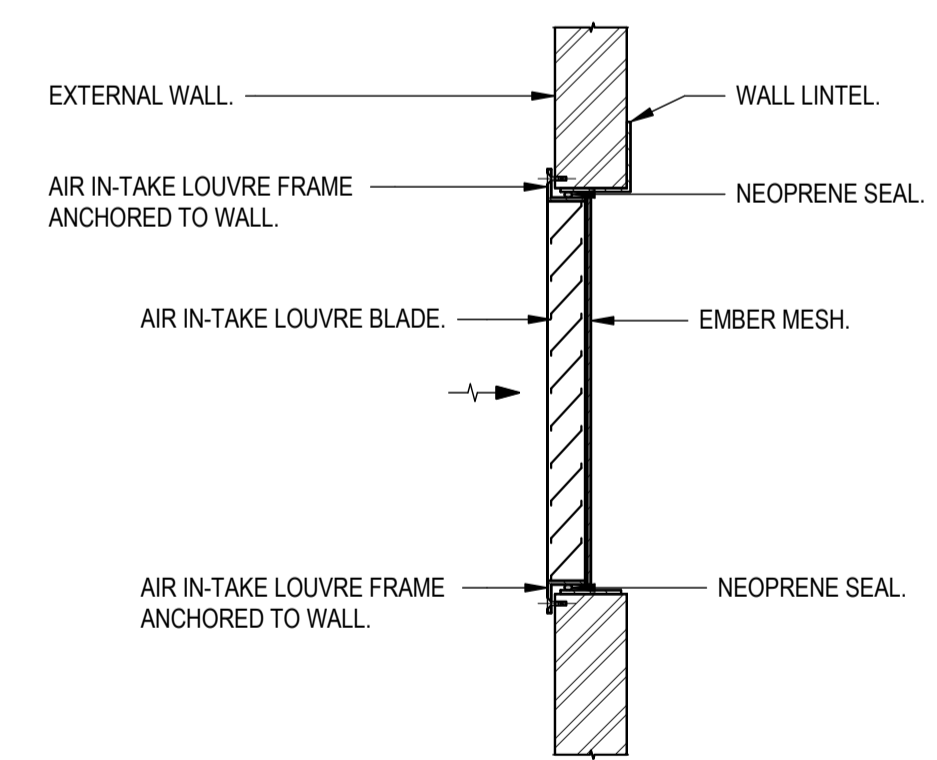


VIBRATION ISOLATION MOUNT SELECTION CHART - NOTES FOR USAGE:

1. THE VIBRATION ISOLATION CHART IS PROVIDED FOR INFORMATION AND IS INTENDED AS A GUIDE ONLY. FINAL SELECTION AND DESIGN OF VIBRATION ISOLATION MOUNTS IS THE RESPONSIBILITY OF THE CONTRACTOR, TO SUIT LOCAL INSTALLATION CONSTRAINTS AND THE REQUIREMENTS OUTLINED IN THE PROJECT DOCUMENTATION.
2. THE VIBRATION ISOLATION CHART SHOULD BE USED FOR SINGLE MASS SYSTEMS ONLY, WITH A DIRECT CONNECTION TO STRUCTURE. IT SHOULD NEVER BE USED FOR INSTALLATIONS WITH INERTIA BASES, OR FOR DOUBLE MASS SYSTEMS.
3. LOOK UP THE EQUIPMENT'S LOWEST OPERATIONAL SPEED (rpm) ON THE X-AXIS. READ VERTICALLY UP THE SELECTION CHART UNTIL THE OPERATIONAL SPEED LINE INTERSECTS THE REQUIRED VIBRATION ISOLATION EFFICIENCY (%) LINE.
4. READ ACROSS TO THE LEFT OF THE CHART TO DETERMINE THE REQUIRED MINIMUM STATIC DEFLECTION AND READ ACROSS TO THE RIGHT AXIS OF THE CHART TO DETERMINE THE MAXIMUM NATURAL FREQUENCY (Hz).
5. SELECTION OF ISOLATORS TO ACHIEVE THE REQUIRED MINIMUM STATIC DEFLECTION (FOR SPRINGS) OR MAX. NATURAL FREQUENCY (FOR PAD, ELASTOMER & AIR MOUNTS) WHILE SUPPORTING THE MASS PER ISOLATOR (kg OR kPa). AN INDICATIVE SELECTION GUIDE FOR TYPE OF ISOLATOR IS PROVIDED TO THE RIGHT OF THE CHART, ALTHOUGH NOTE THIS IS FOR GUIDANCE PURPOSES ONLY & SHALL NOT BE USED IN LEUI OF MANUFACTURER'S TECHNICAL DATA.



FRESH AIR IN-TAKE LOUVRE DETAIL
NOT TO SCALE



SECTION A
NOT TO SCALE

Rev	Description	Checked	Approved	Date
A	30% DETAIL DESIGN	MK	RJ	01/09/23
Author	D.DEGUZMAN Drafting Check			
Designer	R.PREMAKUMAR Design Check M.KLUMPP			



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Project No.
12589773

Client **PARKES SHIRE COUNCIL**
Project **LACHLAN PIPELINE DUPLICATION DETAILED DESIGN PROJECT**
Status **PRELIMINARY**

Drawing Title **MECHANICAL SERVICES NEW EUGOWRA ROAD STANDARD DETAILS**

Status Code **S0**

Drawing No. **12589773-M400**

Size **A1**
Rev **A**

PARKES SHIRE COUNCIL



LACHLAN PIPELINE DUPLICATION DETAIL DESIGN TSS ELECTRICAL SERVICES

12589773



LOCALITY PLAN
NOT TO SCALE

DRAWING LIST

DRG No. DRAWING TITLE

GENERAL

12589773-E001 COVER SHEET, LOCALITY PLAN & DRAWING INDEX
12589773-E002 ELECTRICAL SERVICES LEGEND

NEW EUGOWRA ROAD PUMP STATION

12589773-E006 NEW EUGOWRA ROAD PUMP STATION - MSB - SINGLE LINE DIAGRAM
12589773-E007 NEW EUGOWRA ROAD PUMP STATION - MSB INCOMER - SCHEMATIC DIAGRAM

12589773-E009 NEW EUGOWRA ROAD PUMP STATION - 24VDC CONTROL POWER SUPPLY - SINGLE LINE DIAGRAM
12589773-E010 NEW EUGOWRA ROAD PUMP STATION - DISTRIBUTION BOARD (DB-01) - SINGLE LINE DIAGRAM
12589773-E011 NEW EUGOWRA ROAD PUMP STATION - MSB - GENERAL ARRANGEMENT

12589773-E012 NEW EUGOWRA ROAD PUMP STATION - ELECTRICAL SITE PLAN
12589773-E013 NEW EUGOWRA ROAD PUMP STATION - POWER & COMMUNICATIONS LAYOUT
12589773-E014 NEW EUGOWRA ROAD PUMP STATION - LIGHTING LAYOUT
12589773-E015 NEW EUGOWRA ROAD PUMP STATION - FIRE & SECURITY LAYOUT

12589773-E016 NEW EUGOWRA ROAD PUMP STATION - PUMP 1 - SCHEMATIC DIAGRAM
12589773-E017 NEW EUGOWRA ROAD PUMP STATION - PUMP 2 - SCHEMATIC DIAGRAM
12589773-E018 NEW EUGOWRA ROAD PUMP STATION - PUMP 3 - SCHEMATIC DIAGRAM

12589773-E020 NEW EUGOWRA ROAD PUMP STATION - PUMP 1 - TERMINATION DIAGRAM
12589773-E021 NEW EUGOWRA ROAD PUMP STATION - PUMP 2 - TERMINATION DIAGRAM
12589773-E022 NEW EUGOWRA ROAD PUMP STATION - PUMP 3 - TERMINATION DIAGRAM

12589773-E023 NEW EUGOWRA ROAD PUMP STATION - FLOW TRANSMITTER (FT1) - INSTRUMENT LOOP DIAGRAM
12589773-E024 NEW EUGOWRA ROAD PUMP STATION - HIGH LEVEL SWITCH - INSTRUMENT LOOP DIAGRAM
12589773-E025 NEW EUGOWRA ROAD PUMP STATION - LOW LEVEL SWITCH - INSTRUMENT LOOP DIAGRAM
12589773-E026 NEW EUGOWRA ROAD PUMP STATION - LOW LOW LEVEL SWITCH - INSTRUMENT LOOP DIAGRAM
12589773-E027 NEW EUGOWRA ROAD PUMP STATION - SECURITY & FIRE - INSTRUMENT LOOP DIAGRAM

12589773-E028 NEW EUGOWRA ROAD PUMP STATION - TELEMETRY COMMUNICATIONS DIAGRAM

12589773-E029 NEW EUGOWRA ROAD PUMP STATION - DIGITAL INPUT SLOT 1 - SHEET 1
12589773-E030 NEW EUGOWRA ROAD PUMP STATION - DIGITAL INPUT SLOT 1 - SHEET 2
12589773-E031 NEW EUGOWRA ROAD PUMP STATION - DIGITAL OUTPUT SLOT 2 - SHEET 1
12589773-E032 NEW EUGOWRA ROAD PUMP STATION - DIGITAL OUTPUT SLOT 2 - SHEET 2
12589773-E033 NEW EUGOWRA ROAD PUMP STATION - ANALOG INPUT SLOT 3

DRAWING LIST

DRG No. DRAWING TITLE

NEW BOOSTER (AKUNA) PUMP STATION

12589773-E106 NEW BOOSTER (AKUNA) PUMP STATION - MSB - SINGLE LINE DIAGRAM
12589773-E107 NEW BOOSTER (AKUNA) PUMP STATION - MSB INCOMER - SCHEMATIC DIAGRAM

12589773-E109 NEW BOOSTER (AKUNA) PUMP STATION - 24VDC CONTROL POWER SUPPLY - SINGLE LINE DIAGRAM
12589773-E110 NEW BOOSTER (AKUNA) PUMP STATION - DISTRIBUTION BOARD (DB-01) - SINGLE LINE DIAGRAM
12589773-E111 NEW BOOSTER (AKUNA) PUMP STATION - MSB - GENERAL ARRANGEMENT

12589773-E112 NEW BOOSTER (AKUNA) PUMP STATION - ELECTRICAL SITE PLAN
12589773-E113 NEW BOOSTER (AKUNA) PUMP STATION - POWER & COMMUNICATIONS LAYOUT
12589773-E114 NEW BOOSTER (AKUNA) PUMP STATION - LIGHTING LAYOUT
12589773-E115 NEW BOOSTER (AKUNA) PUMP STATION - FIRE & SECURITY LAYOUT

12589773-E116 NEW BOOSTER (AKUNA) PUMP STATION - PUMP 1 - SCHEMATIC DIAGRAM
12589773-E117 NEW BOOSTER (AKUNA) PUMP STATION - PUMP 2 - SCHEMATIC DIAGRAM
12589773-E118 NEW BOOSTER (AKUNA) PUMP STATION - PUMP 3 - SCHEMATIC DIAGRAM

12589773-E120 NEW BOOSTER (AKUNA) PUMP STATION - PUMP 1 - TERMINATION DIAGRAM
12589773-E121 NEW BOOSTER (AKUNA) PUMP STATION - PUMP 2 - TERMINATION DIAGRAM
12589773-E122 NEW BOOSTER (AKUNA) PUMP STATION - PUMP 3 - TERMINATION DIAGRAM

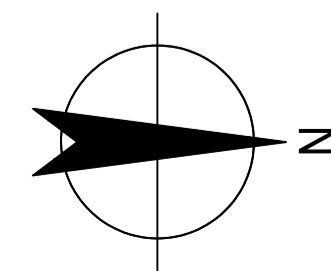
12589773-E123 NEW BOOSTER (AKUNA) PUMP STATION - FLOW TRANSMITTER (FT1) - INSTRUMENT LOOP DIAGRAM
12589773-E124 NEW BOOSTER (AKUNA) PUMP STATION - HIGH LEVEL SWITCH - INSTRUMENT LOOP DIAGRAM
12589773-E125 NEW BOOSTER (AKUNA) PUMP STATION - LOW LEVEL SWITCH - INSTRUMENT LOOP DIAGRAM
12589773-E126 NEW BOOSTER (AKUNA) PUMP STATION - LOW LOW LEVEL SWITCH - INSTRUMENT LOOP DIAGRAM
12589773-E127 NEW BOOSTER (AKUNA) PUMP STATION - SECURITY & FIRE - INSTRUMENT LOOP DIAGRAM

12589773-E128 NEW BOOSTER (AKUNA) PUMP STATION - TELEMETRY COMMUNICATIONS DIAGRAM

12589773-E129 NEW BOOSTER (AKUNA) PUMP STATION - DIGITAL INPUT SLOT 1 - SHEET 1
12589773-E130 NEW BOOSTER (AKUNA) PUMP STATION - DIGITAL INPUT SLOT 1 - SHEET 2
12589773-E131 NEW BOOSTER (AKUNA) PUMP STATION - DIGITAL OUTPUT SLOT 2 - SHEET 1
12589773-E132 NEW BOOSTER (AKUNA) PUMP STATION - DIGITAL OUTPUT SLOT 2 - SHEET 2
12589773-E133 NEW BOOSTER (AKUNA) PUMP STATION - ANALOG INPUT SLOT 3

Rev	Description	Checked	Approved	Date
A	80% DETAILED DESIGN	RJ	NM	16.10.23

Author B.SNEESBY Drafting Check A.COOMBER*
Designer D.EDSER Design Check G.BIERNAT*



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Project No.
12589773

Client PARKES SHIRE COUNCIL
Project LACHLAN PIPELINE DUPLICATION
DETAIL DESIGN TSS
Status PRELIMINARY

Drawing Title
ELECTRICAL SERVICES
COVER SHEET, LOCALITY PLAN &
DRAWING INDEX

Size
A1
Rev
A

Drawing No.
12589773-E001

SITE RETICULATION

	MAIN SWITCHBOARD
	VSD
	DISTRIBUTION BOARD
	CABLE TRAY
	UG ELECTRICAL CONDUIT
	ELECTRICAL CABLE PIT
EP1	DENOTES (1000 x 1000 x 882mm DEEP POLYCRETE PIT WITH CLASS C LID. ACO POLYCRETE TYPE 99 OR APPROVED EQUIVALENT)
EP2	DENOTES (511 x 511 x 600mm DEEP POLYCRETE PIT WITH CLASS C LID. ACO POLYCRETE TYPE 45 OR APPROVED EQUIVALENT)
	POWER OUTLET (CLIPSAL IP56 SERIES OR EQUIVALENT) 1N DENOTES SINGLE PHASE 3N DENOTES 3 PHASE (RATING AS INDICATED)
	ISOLATOR (LOCATE TO SUIT CONNECTED EQUIPMENT) (CLIPSAL IP56 SERIES OR EQUIVALENT) 1N DENOTES SINGLE PHASE 3N DENOTES 3 PHASE (RATING AS INDICATED)
	3 PHASE DIRECT CONNECTION
	GENERATOR LINK BOX
	LOCAL CONTROL STATION
	VISUAL ALARM DEVICE
	POWER CIRCUIT
	POWER CIRCUIT DESIGNATION

FIRE DETECTION

SMOKE DETECTOR

SECURITY

REED SWITCH (RECESSED)

LIGHTING

	35W LED BATTEN LUMINAIRE
	35W LED BATTEN LUMINAIRE WITH EMERGENCY PACK
	35W LED BATTEN LUMINAIRE (WALL MOUNTED)

EMERGENCY EXIT LIGHT

LIGHTING CONTROL

	10A LIGHT SWITCH - 1 WAY
	10A LIGHT SWITCH - 2 WAY
	MOTION DETECTOR
	PE CELL
	SWITCH WIRE
	LIGHTING CIRCUIT DESIGNATION

SINGLE LINE DIAGRAM

	FIBRE PATCH LEADS
	CAT6 CABLING / PATCH LEADS
	SC CONNECTOR
	LC CONNECTOR
	ST CONNECTOR
	ETHERNET RJ45 CONNECTOR
	DISTRIBUTION BOARD
	OPEN SWITCH
	CLOSED SWITCH
	ISOLATOR
	OPEN CONTACTOR
	CLOSED CONTACTOR
	CIRCUIT BREAKER
	CIRCUIT BREAKER WITH RCD
	OPEN PUSH BUTTON
	CLOSED PUSH BUTTON
	EMERGENCY STOP PUSH BUTTON
	TIMER SWITCH
	KEYSWITCH
	FUSE
	RESISTOR
	SURGE DIVERTER
	JUNCTION
	SINGLE PHASE
	DOUBLE PHASE
	TRIPLE PHASE
	CURRENT TRANSFORMER
	METER
	DOL MOTOR STARTER (NON-REVERSING)
	VARIABLE SPEED DRIVE
	UPS
	AC/DC POWER SUPPLY
	DC/DC POWER SUPPLY
	TRANSFORMER
	TRANSFORMER WITH EARTH
	TIMER RELAY
	COIL
	RELAY
	THERMISTOR
	INDICATOR
	3 PHASE MOTOR
	3 PHASE MOTOR
	SINGLE PHASE MOTOR
	CHARGING MOTOR
	SELECTOR SWITCH
	CABLE NUMBER IDENTIFIER
	PLC DIGITAL INPUT
	PLC DIGITAL OUTPUT
	PLC ANALOG INPUT
	PLC ANALOG OUTPUT
	PLC REMOTE INPUT
	PLC REMOTE OUTPUT
	PLC TERMINAL
	MSB TERMINAL
	FIELD TERMINAL
	EQUIPMENT TERMINAL
	SOUNDER BEACON

NOTES:

1. STANDARD SYMBOLOGY SHOWN. NOT ALL SYMBOLS USED IN THIS SET.

Rev	Description	Checked	Approved	Date
A	80% DETAILED DESIGN	RJ	NM	16.10.23
Author	B.SNEESBY	Drafting Check	A.COOMBER*	
Designer	D.EDSER	Design Check	G.BIERNAT*	

File Name: C:\Users\bsneesby\ACCDocs\GHD Services Pty Ltd\12589773 - Lachlan Pipeline Duplication Detailed Design\01 WIP\01 WIP - Electrical\04 Drawings\12589773-E002.dwg



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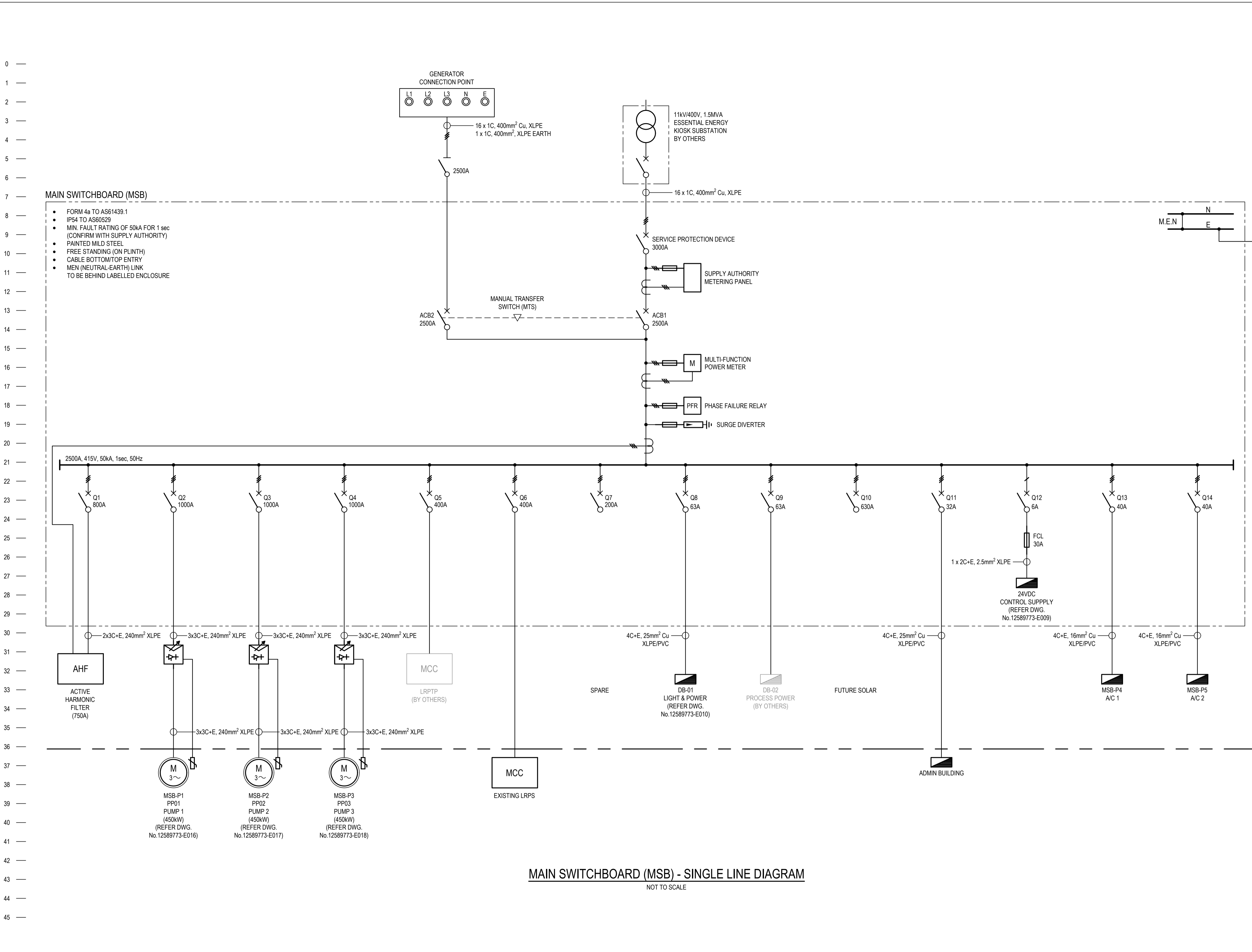
Project No.
12589773

Client **PARKES SHIRE COUNCIL**
 Project **LACHLAN PIPELINE DUPLICATION
DETAIL DESIGN TSS**
 Status **PRELIMINARY**

Drawing Title
**ELECTRICAL SERVICES
ELECTRICAL SERVICES LEGEND**

Drawing No.
12589773-E002

Size
A1
 Rev
A



- NOTES:**
- SUBSTATION (KIOSK TYPE) DETAIL TO BE PROVIDED.
 - GENERATOR CONNECTION SIZE TO BE DETERMINED.
 - CABLES FROM KIOSK SUBSTATION TO INCOMER, ASSUMED TO BE INSTALLED IN U/G CONDUITS.
 - CABLES FROM VSD TO MOTOR, ASSUMED TO BE INSTALLED IN U/G CONDUITS.
 - CABLE LENGTHS TO BE CONFIRMED BY CONTRACTOR PRIOR TO INSTALLATION.
 - CONTRACTOR TO CONFIRM CIRCUIT BREAKER SETTINGS GRADE WITH UPSTREAM PROTECTION DEVICE.
 - CONTRACTOR TO PROVIDE ARC FLASH CALCULATION AND ITS LABEL, THAT INCLUDES INCIDENT ENERGY LEVEL, BOUNDARY, PPE RATING AND SAFE WORKING DISTANCE.
 - CONTRACTOR TO PROVIDE ABB ACS580-01/07 or ACQ580-01/07 SERIES VARIABLE SPEED DRIVES. THESE MODELS HAVE HEAT VENTS AT THE TOP. THE HEAT WILL BE DUCTED OUT OF THE SWITCHROOM.
 - ACTIVE HARMONIC FILTER BASED ON FUSECO TOP VENT SERIES. THIS ALLOWS FOR THE HEAT FROM THE AHF UNIT TO BE DUCTED OUT OF SWITCHROOM.

- MAIN SWITCHBOARD (MSB)**
- FORM 4a TO AS61439.1
 - IP54 TO AS60529
 - MIN. FAULT RATING OF 50kA FOR 1 sec (CONFIRM WITH SUPPLY AUTHORITY)
 - PAINTED MILD STEEL
 - FREE STANDING (ON PLINTH)
 - CABLE BOTTOM/TOP ENTRY
 - MEN (NEUTRAL-EARTH) LINK TO BE BEHIND LABELLED ENCLOSURE

MAIN SWITCHBOARD (MSB) - SINGLE LINE DIAGRAM
NOT TO SCALE

Rev	Description	Checked	Approved	Date
A	80% DETAILED DESIGN	RJ	NM	16.10.23
Author	B.SNEESBY	Drafting Check	A.COOMBER*	
Designer	D.EDSER	Design Check	G.BIERNAT*	

File Name: C:\Users\bsneesby\ACCDocs\GHD Services Pty Ltd\12589773 - Lachlan Pipeline Duplication Detailed Design\01 WIP\01 WIP - Electrical\04 Drawings\12589773-E006.dwg

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Project No. 12589773

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Client **PARKES SHIRE COUNCIL**

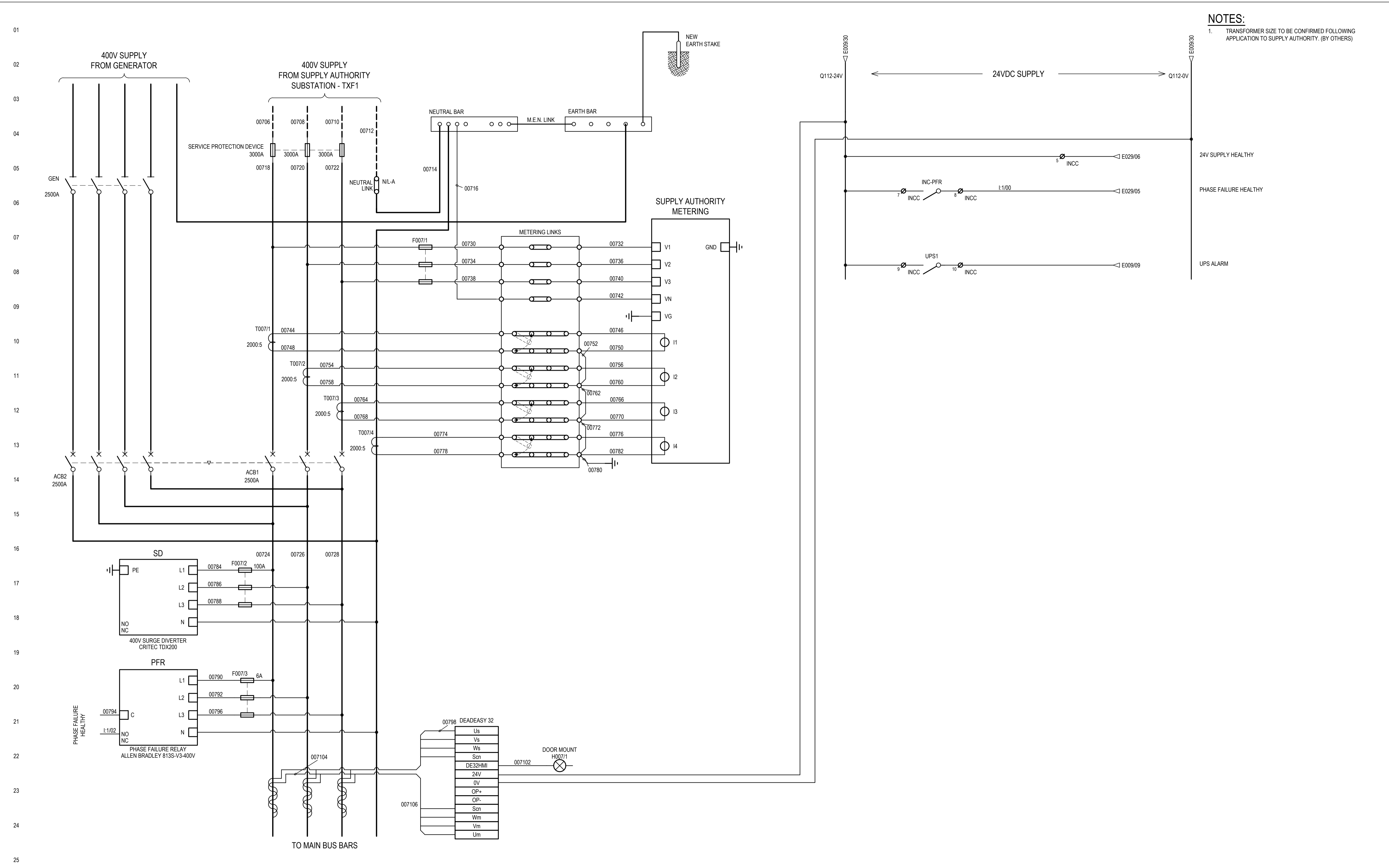
Project **LACHLAN PIPELINE DUPLICATION
DETAIL DESIGN TSS**

Status **PRELIMINARY**

Drawing Title **ELECTRICAL SERVICES
NEW EUGOWRA ROAD PUMP STATION
MSB - SINGLE LINE DIAGRAM**

Drawing No. **12589773-E006**

Rev **A**



NOTES:
 1. TRANSFORMER SIZE TO BE CONFIRMED FOLLOWING APPLICATION TO SUPPLY AUTHORITY. (BY OTHERS)

Rev	Description	Checked	Approved	Date
A	80% DETAILED DESIGN	RJ	NM	16.10.23

Author: B.SNEESBY Drafting Check: A.COOMBER*
 Designer: D.EDSER Design Check: G.BIERNAT*

File Name: C:\Users\bsneesby\ACCDocs\GHD Services Pty Ltd\12589773 - Lachlan Pipeline Duplication Detailed Design\01 WIP\01 WIP - Electrical\04 Drawings\12589773-E007.dwg

Plot Date: 17 October 2023 - 11:39 AM Plotted by: Brock Sneesby

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PARKES SHIRE COUNCIL

Project No. 12589773

Client: **PARKES SHIRE COUNCIL**

Project: **LACHLAN PIPELINE DUPLICATION
 DETAIL DESIGN TSS**

Status: **PRELIMINARY**

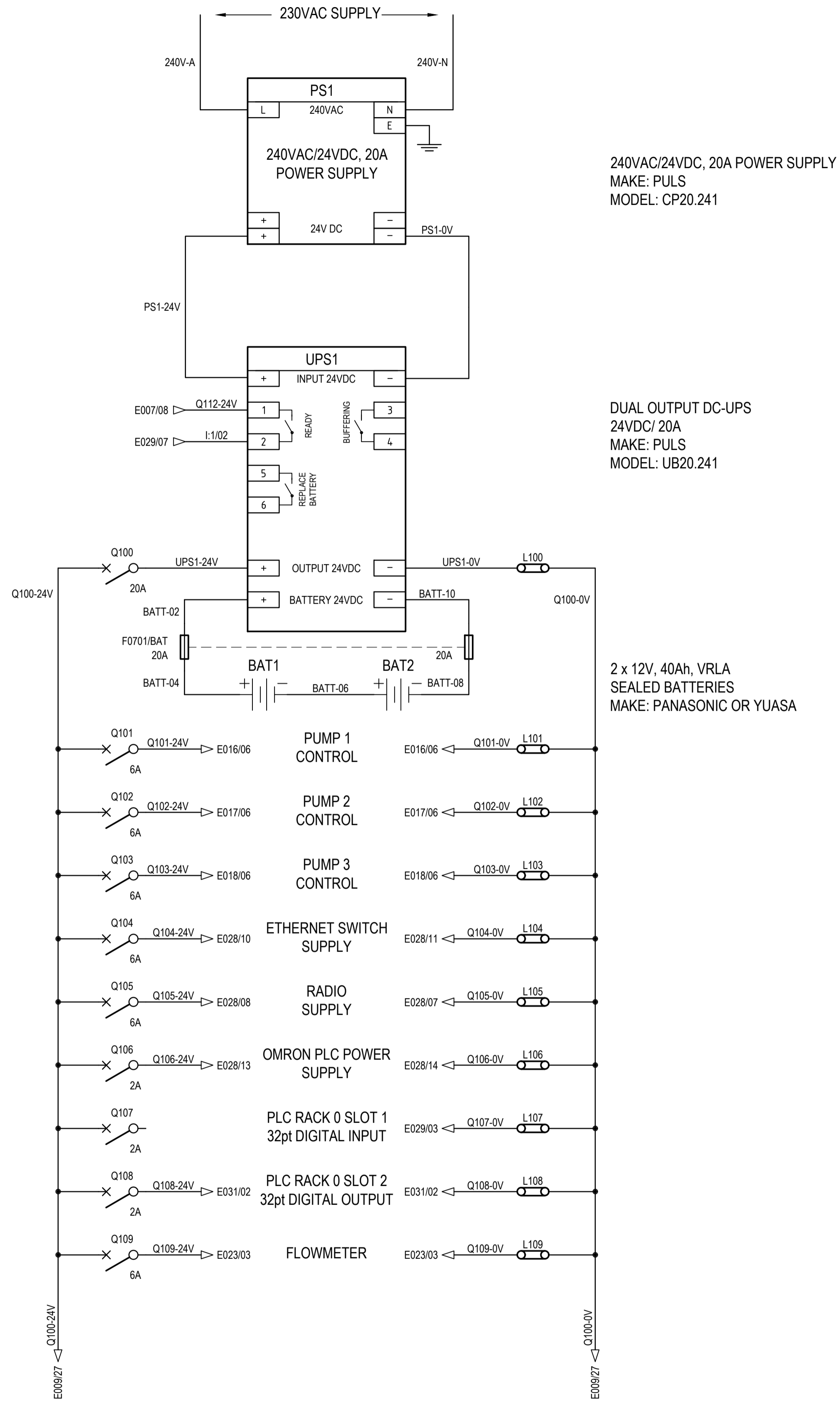
Drawing Title: **ELECTRICAL SERVICES
 NEW EUGOWRA ROAD PUMP STATION
 MSB INCOMER
 SCHEMATIC DIAGRAM**

Drawing No. 12589773-E007

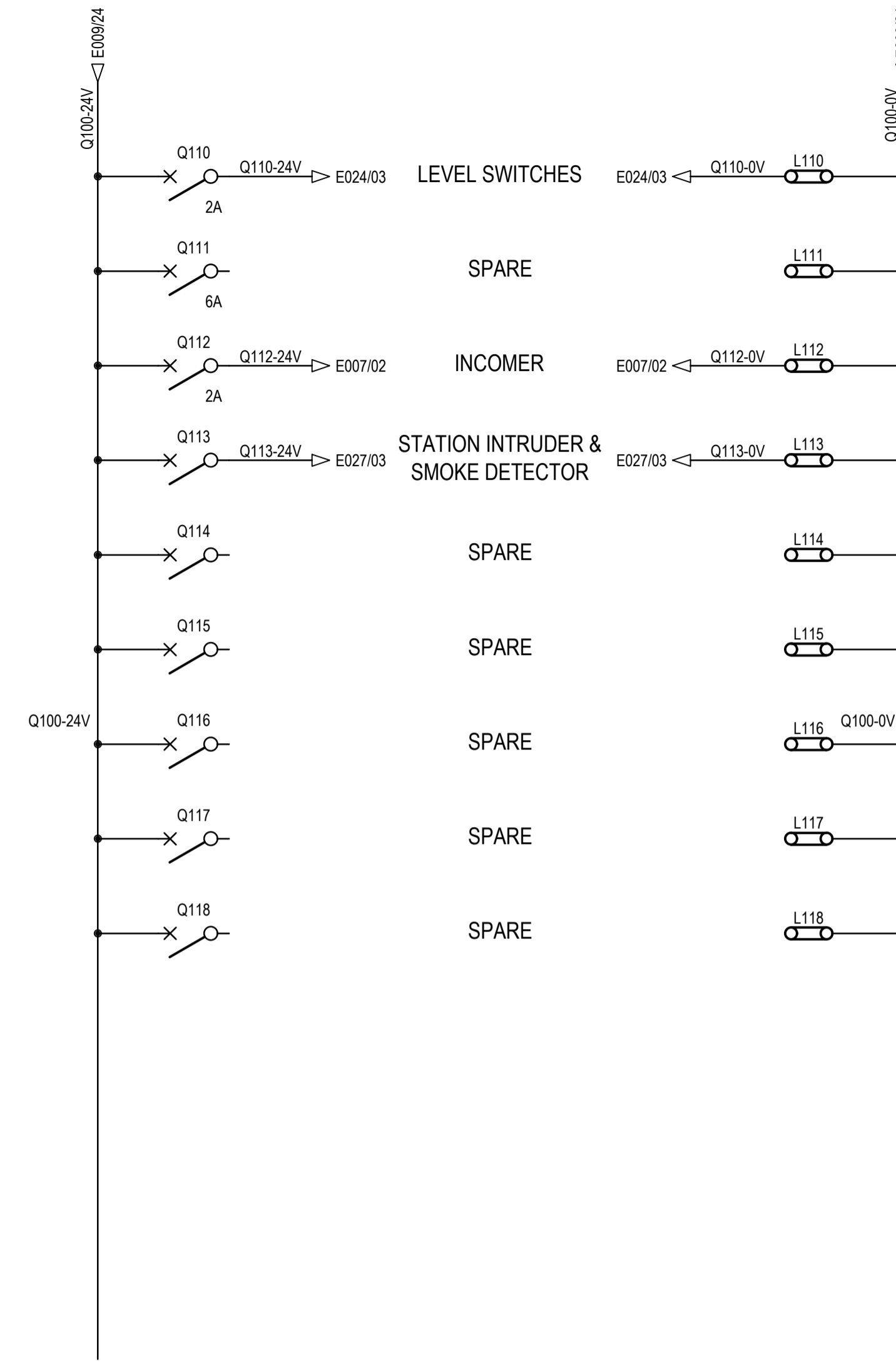
Rev A

Size **A1**

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NOTES:
1. UPS ALARM OUTPUT TO BE CONFIGURED FOR ALARM CONDITIONS 'BATTERY LOW - STATE OF CHARGE' AND 'BATTERY LOW - BATTERY VOLTAGE'. RELAY CONTACT TO BE SET ACTIVE LOW TO INDICATE BATTERY LOW.

Rev	Description	Checked	Approved	Date
A	80% DETAILED DESIGN	RJ	NM	16.10.23

Author: B.SNEESBY Drafting Check: A.COOMBER*
Designer: D.EDSER Design Check: G.BIERNAT*

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Plotted by: Brock Sneesby

Plot Date: 17 October 2023 - 11:39 AM

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PARKES SHIRE COUNCIL

Project No. 12589773

Client: PARKES SHIRE COUNCIL

Project: LACHLAN PIPELINE DUPLICATION
DETAIL DESIGN TSS

Status: PRELIMINARY

Drawing Title: ELECTRICAL SERVICES
NEW EUGOWRA ROAD PUMP STATION
24VDC CONTROL POWER SUPPLY
SINGLE LINE DIAGRAM

Size: A1

Drawing No. 12589773-E009

Rev: A

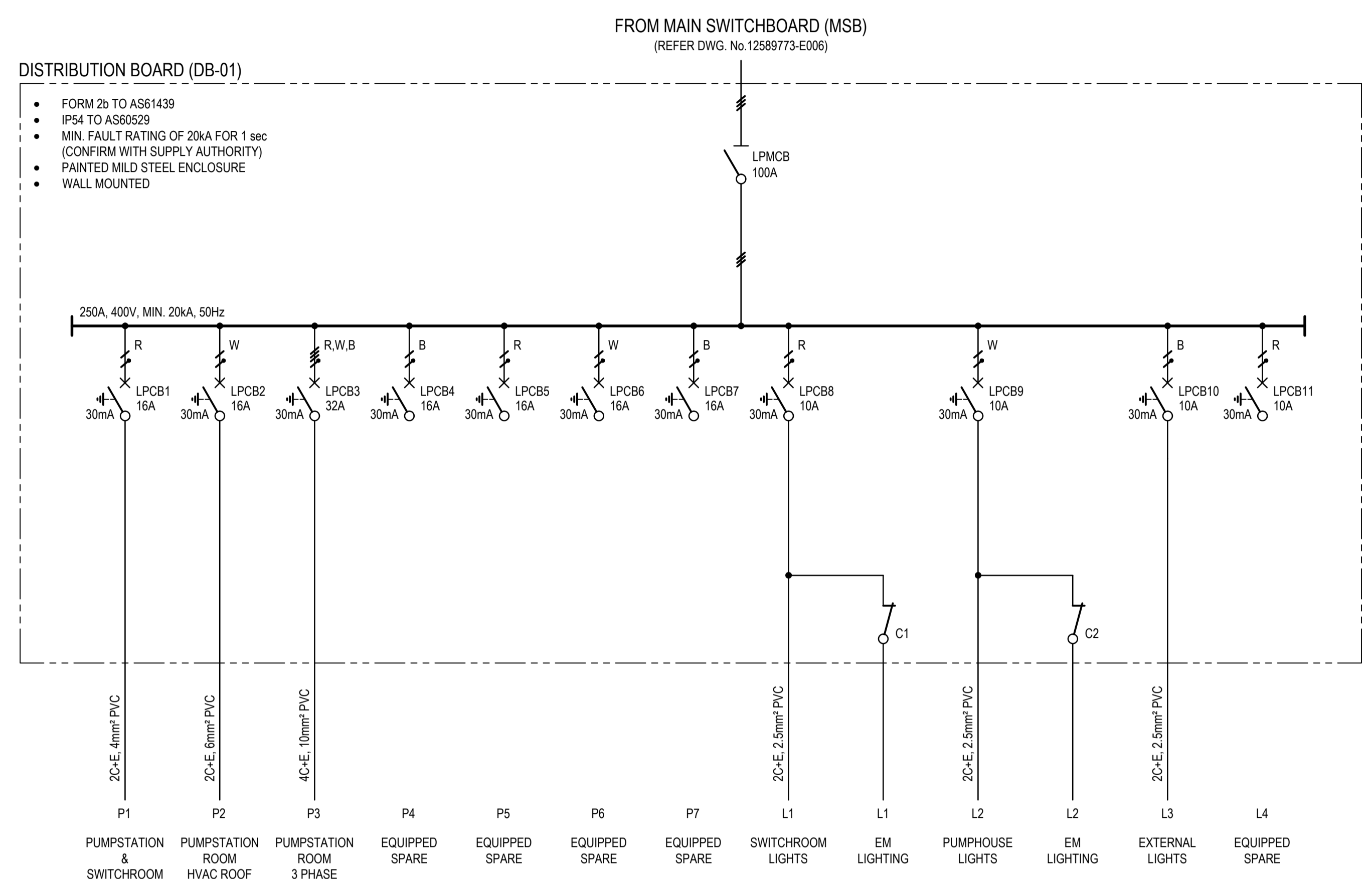
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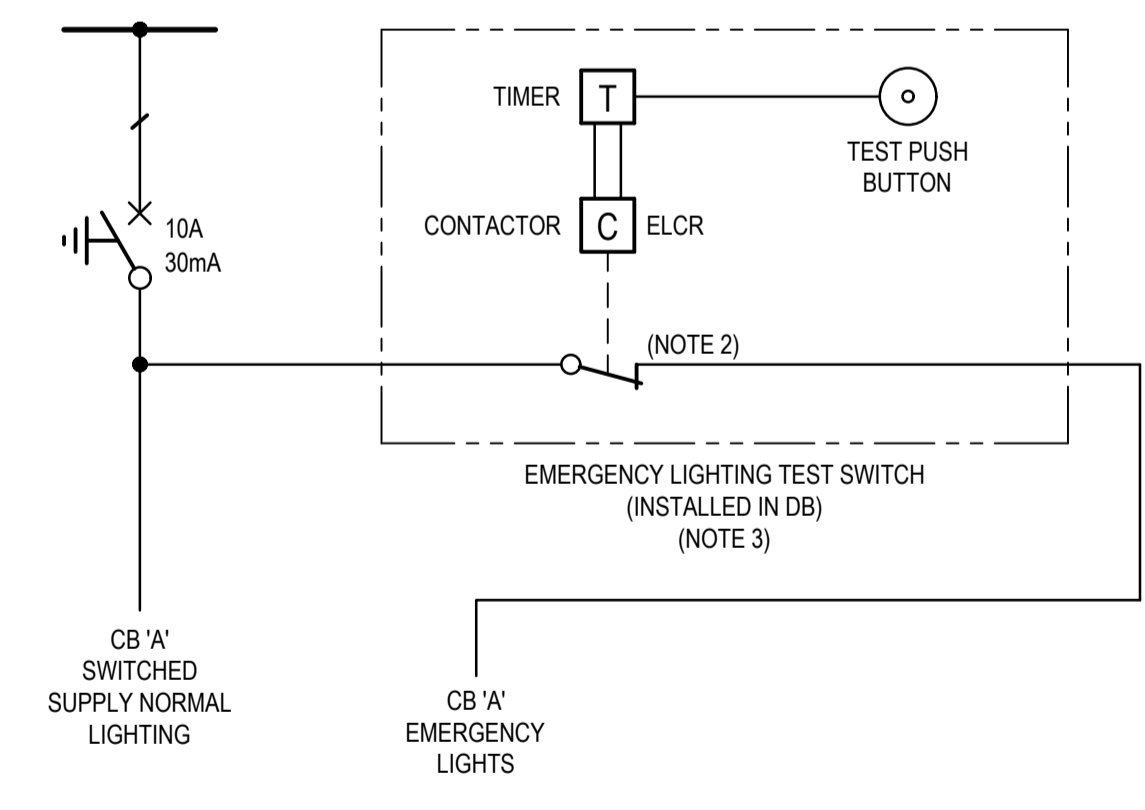
NOTES:

- ENSURE LOADS ARE BALANCED ACROSS ALL PHASES.
- No. OF POLES TO SUIT No. OF SWITCHED CIRCUITS.
- ALL EMERGENCY & EXIT LIGHTING SHALL BE POWERED FROM THE NEAREST RESPECTIVE LIGHT CIRCUIT VIA EMERGENCY TEST CIRCUIT LOCATED WITHIN THE RESPECTIVE DISTRIBUTION BOARD & INSTALLED IN COMPLIANCE WITH AS/NZS2293.1.
- PROVIDE A PROPRIETARY EMERGENCY LIGHTING TEST SWITCH WITH KEYED ACTIVATION AND AUTOMATIC TIMER, AS PER AS/NZS 2293.1:2018.
- ALL SINGLE PHASE RCD'S TO BE SINGLE POLE.



DISTRIBUTION BOARD (DB-01) - SINGLE LINE DIAGRAM

NOT TO SCALE

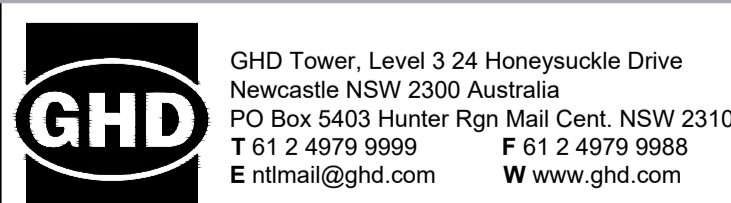


TYPICAL EMERGENCY LIGHTING & TEST CIRCUIT

NOT TO SCALE

Rev	Description	Checked	Approved	Date
A	80% DETAILED DESIGN	RJ	NM	16.10.23
Author	B.SNEESBY	Drafting Check	A.COOMBER*	
Designer	D.EDSER	Design Check	G.BIERNAT*	

File Name: C:\Users\bsneesby\ACCDocs\GHD Services Pty Ltd\12589773 - Lachlan Pipeline Duplication Detailed Design\01 WIP\01 WIP - Electrical\04 Drawings\12589773-E010.dwg



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Project No. 12589773

Client: PARKES SHIRE COUNCIL
 Project: LACHLAN PIPELINE DUPLICATION
 DETAIL DESIGN TSS
 Status: PRELIMINARY

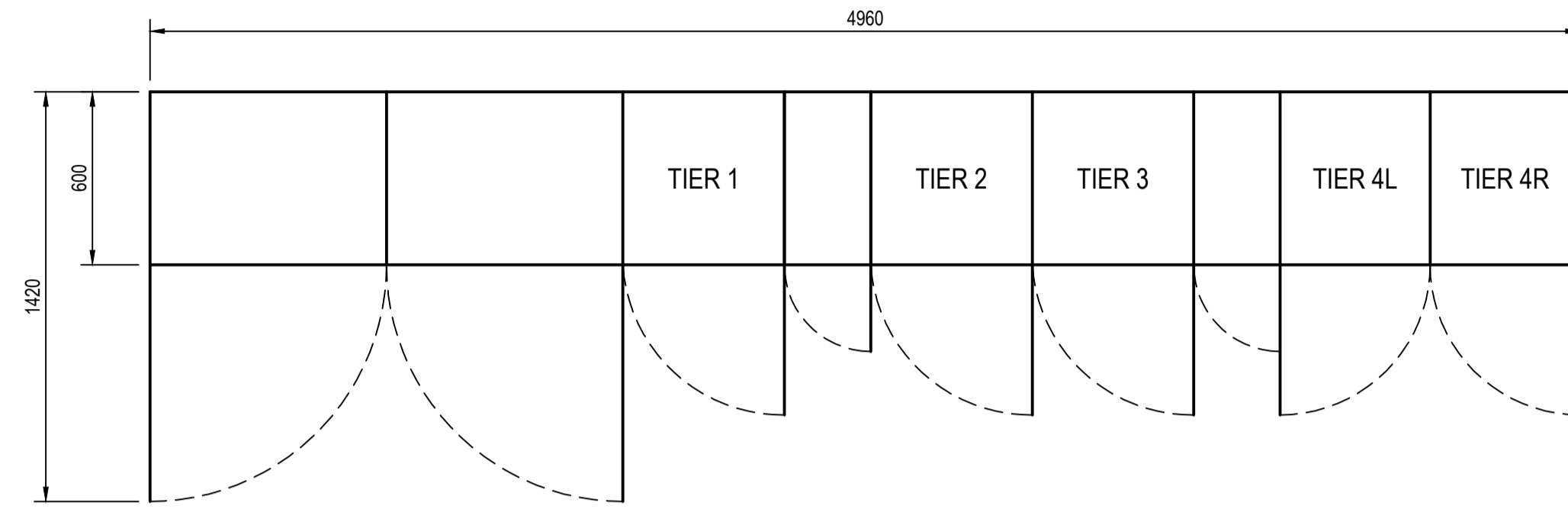
Drawing Title: ELECTRICAL SERVICES
 NEW EUGOWRA ROAD PUMP STATION
 DISTRIBUTION BOARD (DB-01)
 SINGLE LINE DIAGRAM

Drawing No. 12589773-E010
 Rev A

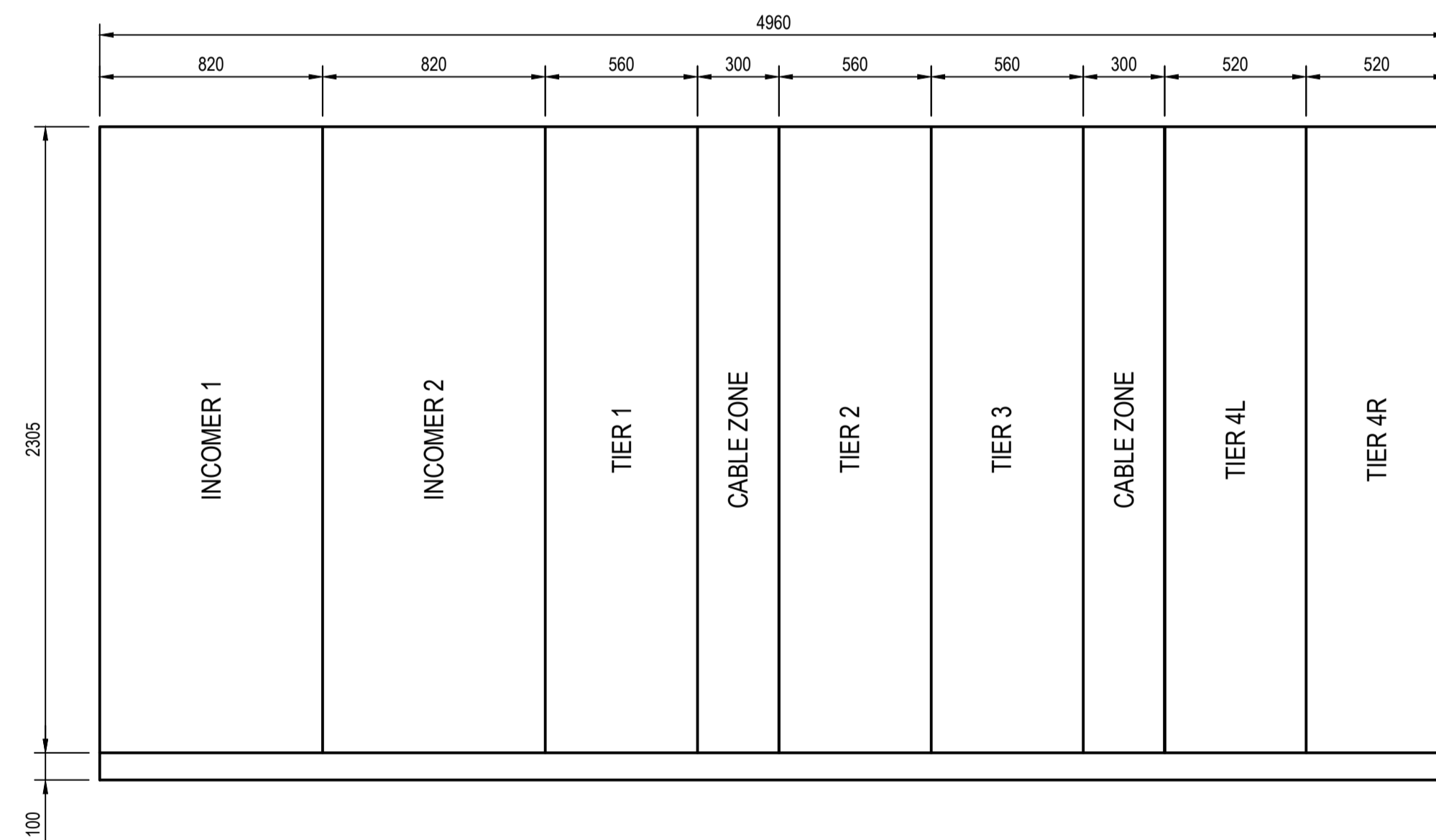
Size: A1

NOTES:

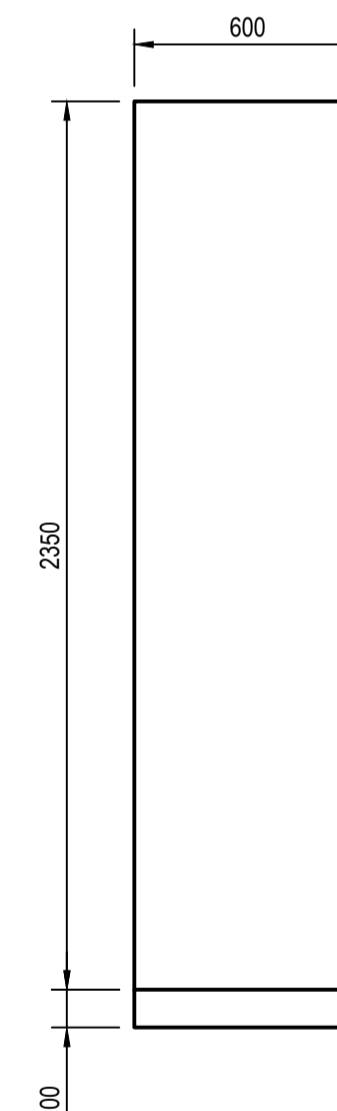
1. CABLE ENTRY IS AT BOTTOM OF MSB.
2. BUSBAR IS AT TOP OF MSB.
3. AN INDICATIVE MSB LAYOUT IS SHOWN BASED ON THE SINGLE LINE DIAGRAM.
4. ARC FLASH DISCHARGE DUCTS TO BE PROVIDED ON TOP OF THE SWITCHGEAR PANELS DIRECTING OUTSIDE THE BUILDING.
5. PANELS TO BE LOCKABLE WITH A PADLOCK & BY INTERLOCKING ARRANGEMENT - DOORS HINGED WITH LIFT OFF FACILITY.
6. NAMING AND NUMBERING OF EQUIPMENT, PANELS AND LOCATIONS TO MEET ENERGY AUTHORITY AND OWNER'S REQUIREMENTS.
7. ALL DIMENSIONS ARE IN MILLIMETRES (mm) AND INDICATIVE ONLY. FINAL DIMENSIONS TO BE CONFIRMED DURING THE DETAILED DESIGN.



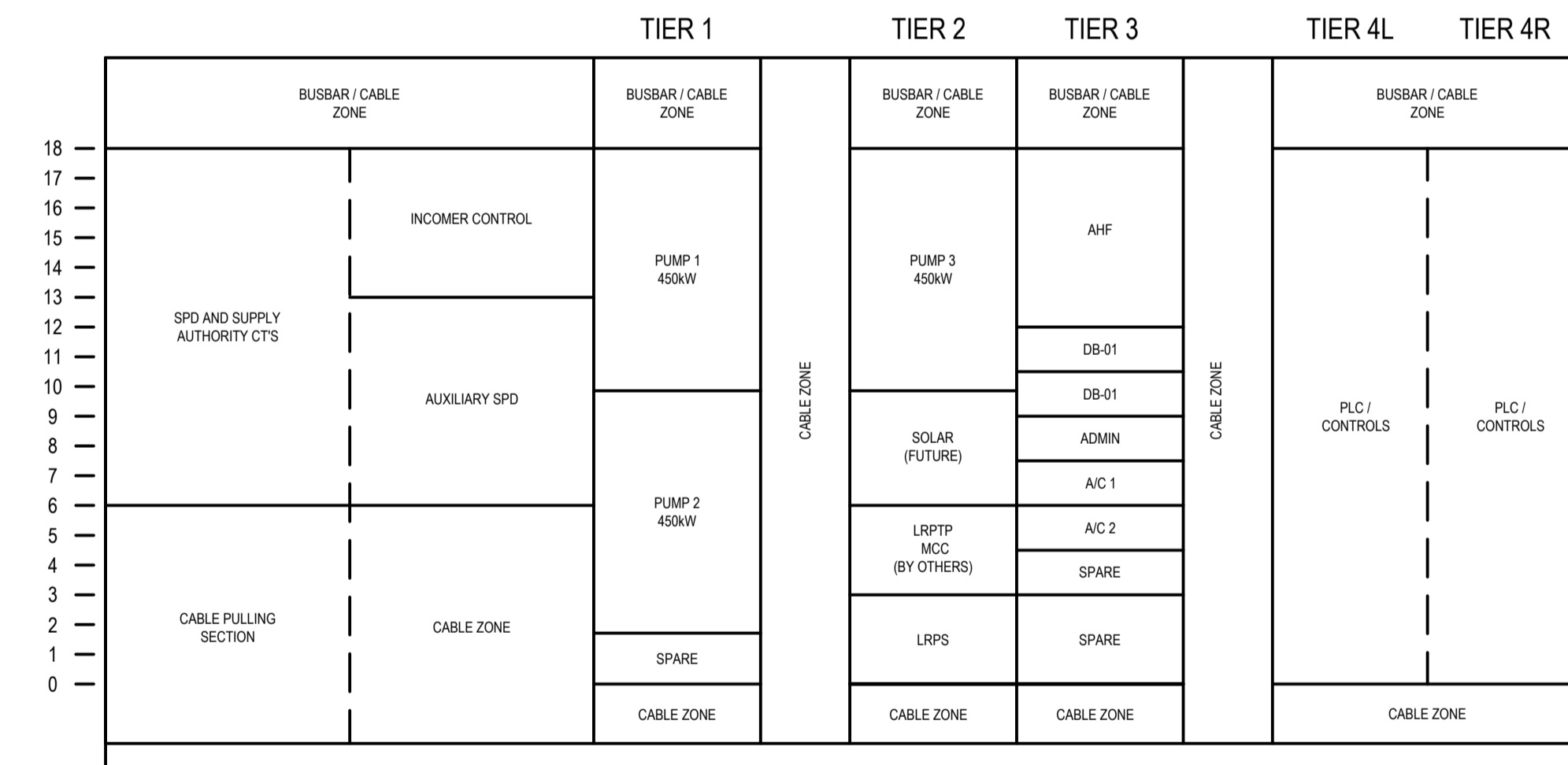
TOP VIEW (MSB)
SCALE 1 : 20



FRONT VIEW (MSB SECTIONS)
SCALE 1 : 20

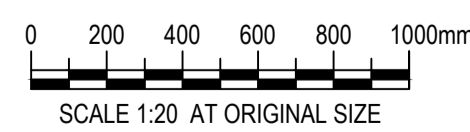


RIGHT SIDE VIEW
SCALE 1 : 20



FRONT VIEW (MSB CELL LAYOUT)
SCALE 1 : 20

Rev	Description	Checked	Approved	Date
A	80% DETAILED DESIGN	RJ	NM	16.10.23
Author	B.SNEESBY	Drafting Check	A.COOMBER*	
Designer	D.EDSER	Design Check	G.BIERNAT*	



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Project No.
12589773

Client PARKES SHIRE COUNCIL

Project LACHLAN PIPELINE DUPLICATION
DETAIL DESIGN TSS

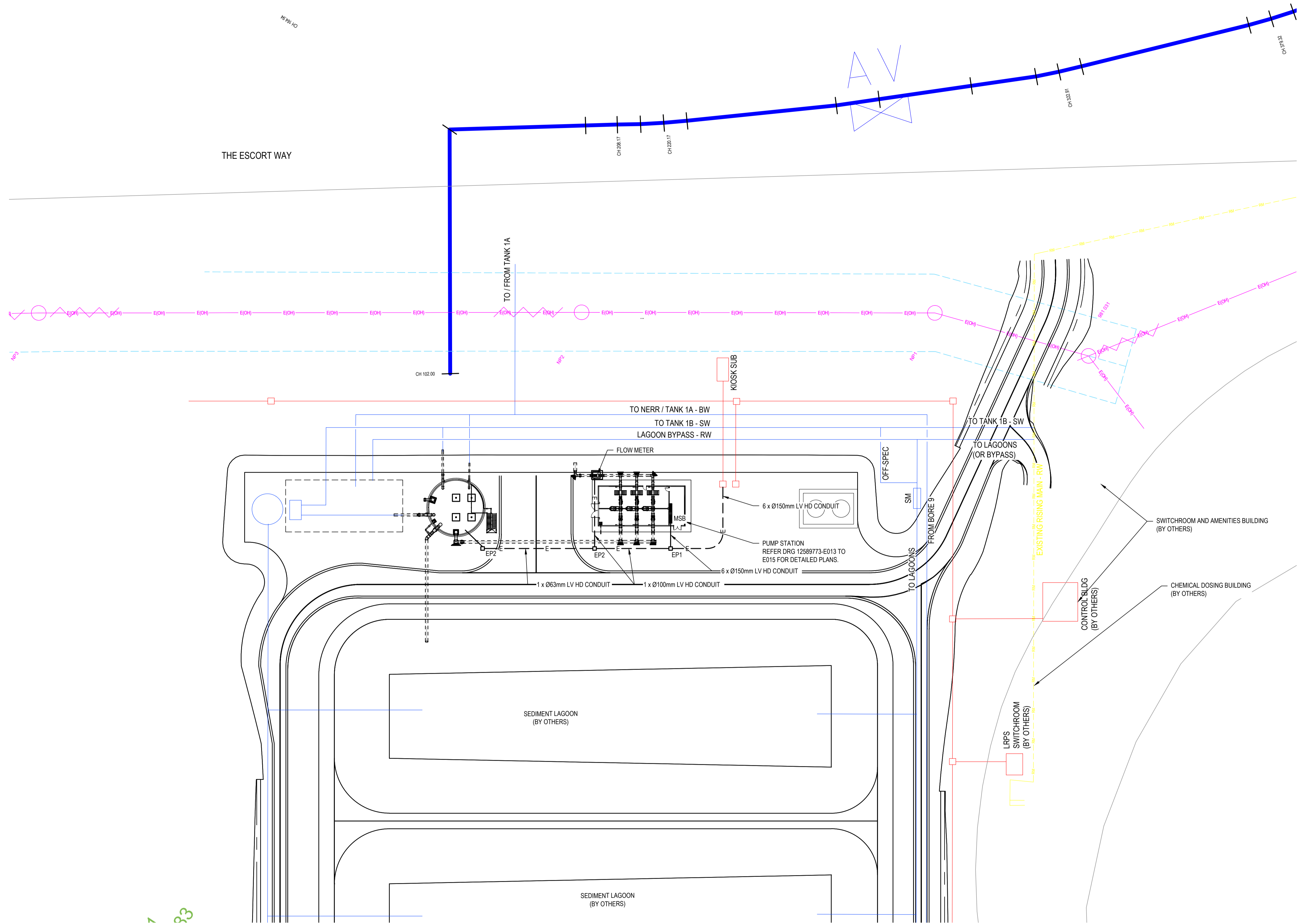
Status PRELIMINARY

Drawing Title
ELECTRICAL SERVICES
NEW EUGOWRA ROAD PUMP STATION
MSB
GENERAL ARRANGEMENT

Size
A1

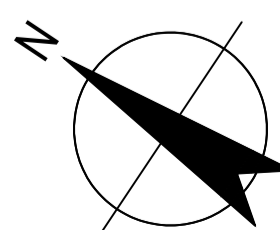
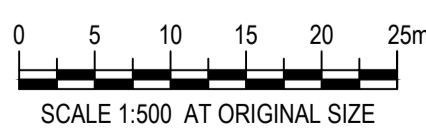
Rev
A

Drawing No.
12589773-E011



ELECTRICAL SITE PLAN
SCALE 1 : 500

Rev	Description	Checked	Approved	Date
A	80% DETAILED DESIGN	RJ	NM	16.10.23
Author	B.SNEESBY	Drafting Check	A.COOMBER*	
Designer	D.EDSER	Design Check	G.BIERNAT*	



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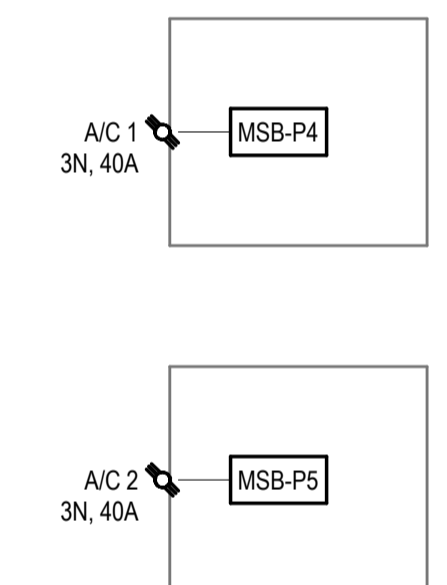
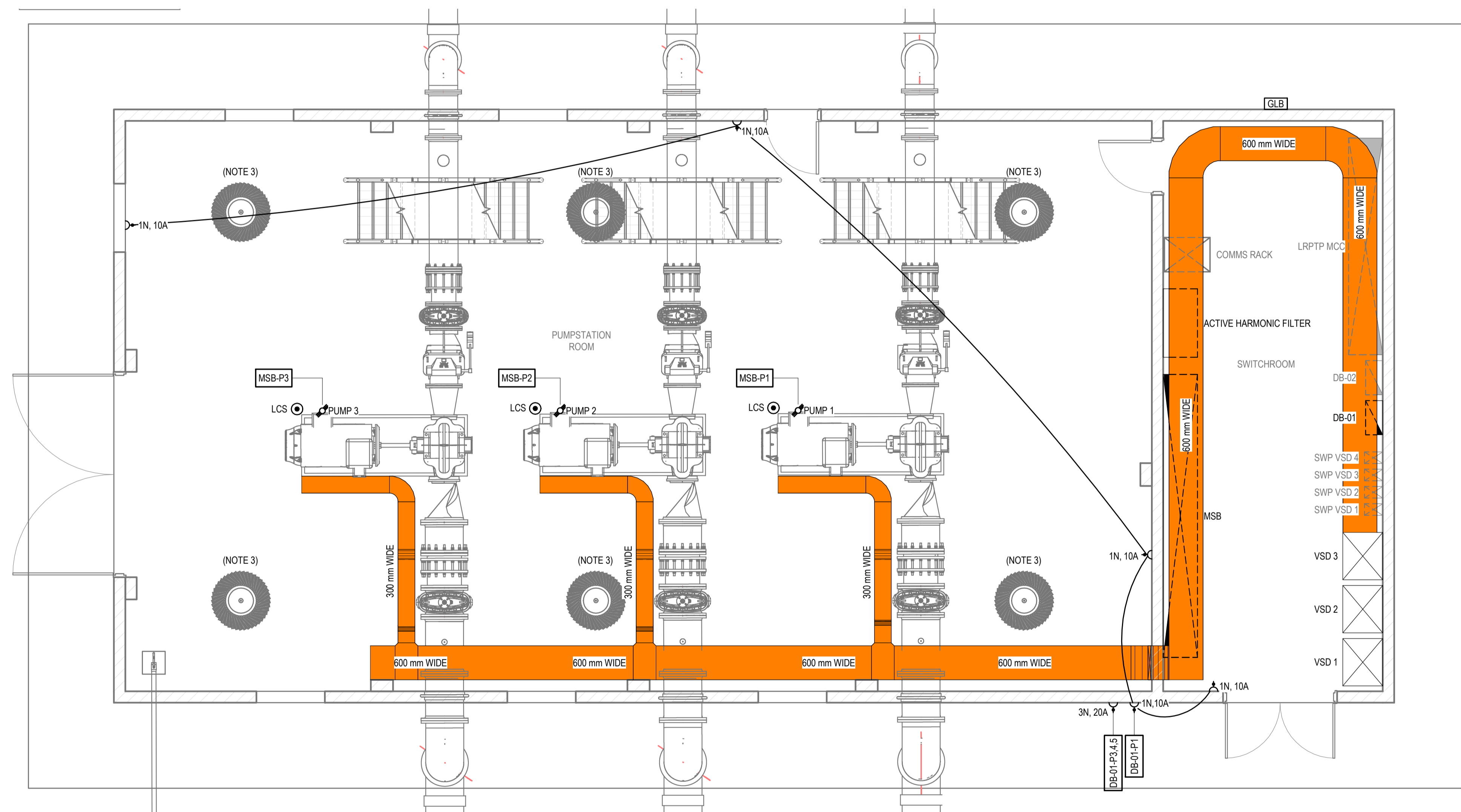
Client	PARKES SHIRE COUNCIL
Project	LACHLAN PIPELINE DUPLICATION DETAIL DESIGN TSS
Status	PRELIMINARY

Drawing Title	ELECTRICAL SERVICES NEW EUGOWRA ROAD PUMP STATION ELECTRICAL SITE PLAN
Drawing No.	12589773-E012

Size
A1
Rev
A

NOTES:

1. ELECTRICAL INSTALLATION SHALL COMPLY WITH AS/NZS 3000, AS 3008, AS/NZS 61439 AND NSW SERVICE AND INSTALLATION RULES.
2. ALL POWER OUTLETS SHALL BE FED FROM DEDICATED CIRCUITS. REFER TO SINGLE LINE DIAGRAMS.
3. COORDINATE LOCATION OF POWER FOR HVAC UNITS WITH DETAILED HVAC DESIGN DRAWINGS. POWER TO BE FED FROM DB-01-P2.
4. FINAL LOCATIONS OF ELECTRICAL EQUIPMENT, POWER SUPPLIES AND ISOLATORS SHALL BE ADJUSTED DURING CONSTRUCTION TO AVOID CONFLICTS.
5. FINAL LOCATIONS OF ELECTRICAL EQUIPMENT, POWER SUPPLIES AND ISOLATORS SHALL BE COORDINATED DURING CONSTRUCTION.

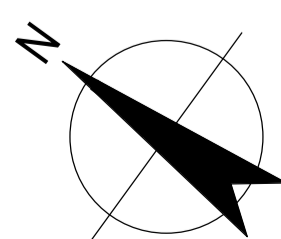
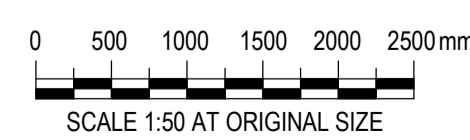


POWER & COMMUNICATIONS LAYOUT

SCALE 1:50

Rev	Description	Checked	Approved	Date
A	80% DETAILED DESIGN	RJ	NM	16.10.23

Author	A.COOMBER	Drafting Check	A.COOMBER*
Designer	D.EDSER	Design Check	G.BIERNAT*



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Project **LACHLAN PIPELINE DUPLICATION
DETAIL DESIGN TSS**

Status **PRELIMINARY**

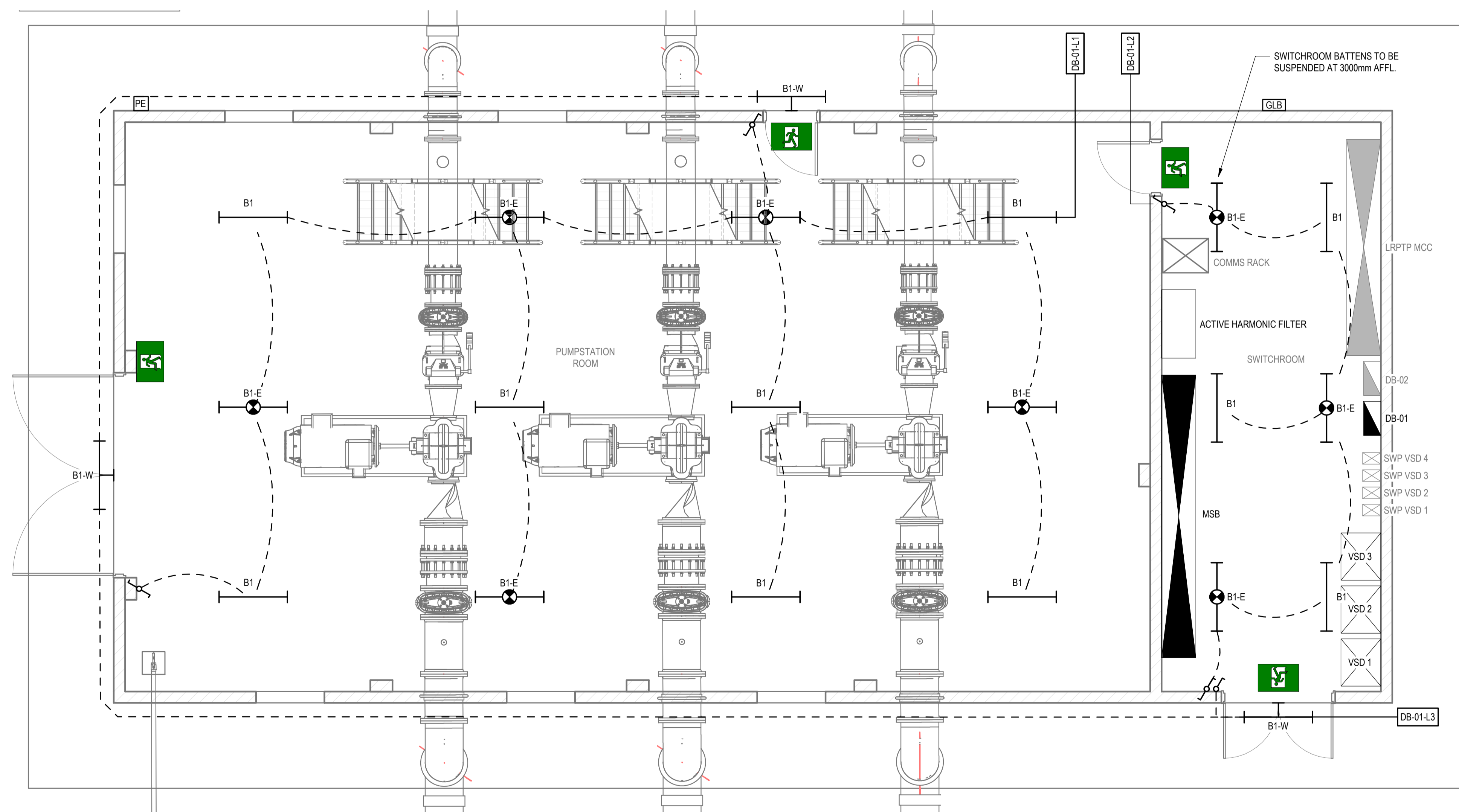
Drawing Title **ELECTRICAL SERVICES
EUGOWRA ROAD PUMP STATION
POWER AND COMMUNICATIONS
LAYOUT**

Drawing No.
12589773-E013

Size **A1**
Rev **A**

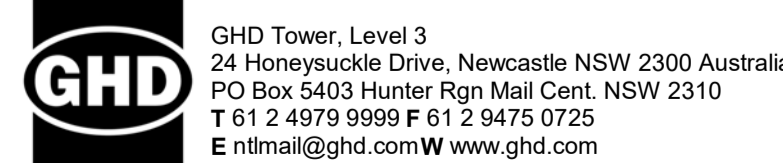
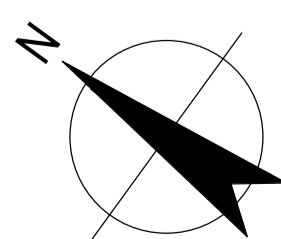
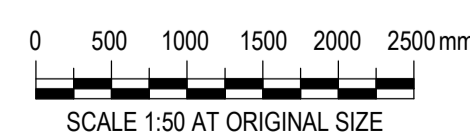
NOTES:

1. LIGHTING DESIGN SHALL BE IN ACCORDANCE WITH THE CURRENT REQUIREMENTS OF AS/NZS 1680.2.1 AND AS/NZS 1680.2.4.
2. EMERGENCY EGRESS LIGHTING AND EXIT SIGNS SHALL BE IN ACCORDANCE WITH AS/NZS 2293 AND POWERED FROM THE INDICATED LIGHTING CIRCUIT.
3. LAMPS OF SIMILAR TYPES SHALL BE OF THE SAME COLOUR TEMPERATURE AND BATCH UNLESS OTHERWISE INDICATED.
4. CONFIRM THE FINAL LOCATIONS OF THE LIGHT FITTINGS DURING CONSTRUCTION.
5. EXTERNAL AREA LIGHTING TO BE CONTROLLED BY A SEPARATE SWITCH AS SHOWN.
6. PROVIDE EMERGENCY LIGHTING TEST CIRCUIT AS PER AS/NZS 2293:2018, REFER TO SINGLE LINE DIAGRAMS FOR DETAILS.



LIGHTING LAYOUT
SCALE 1:50

Rev	Description	Checked	Approved	Date
A	80% DETAILED DESIGN	RJ	NM	16.10.23
Author	A.COOMBER	Drafting Check	A.COOMBER*	
Designer	D.EDSER	Design Check	G.BIERNAT*	



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Project No.
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Project **LACHLAN PIPELINE DUPLICATION
DETAIL DESIGN TSS**
Status **PRELIMINARY**

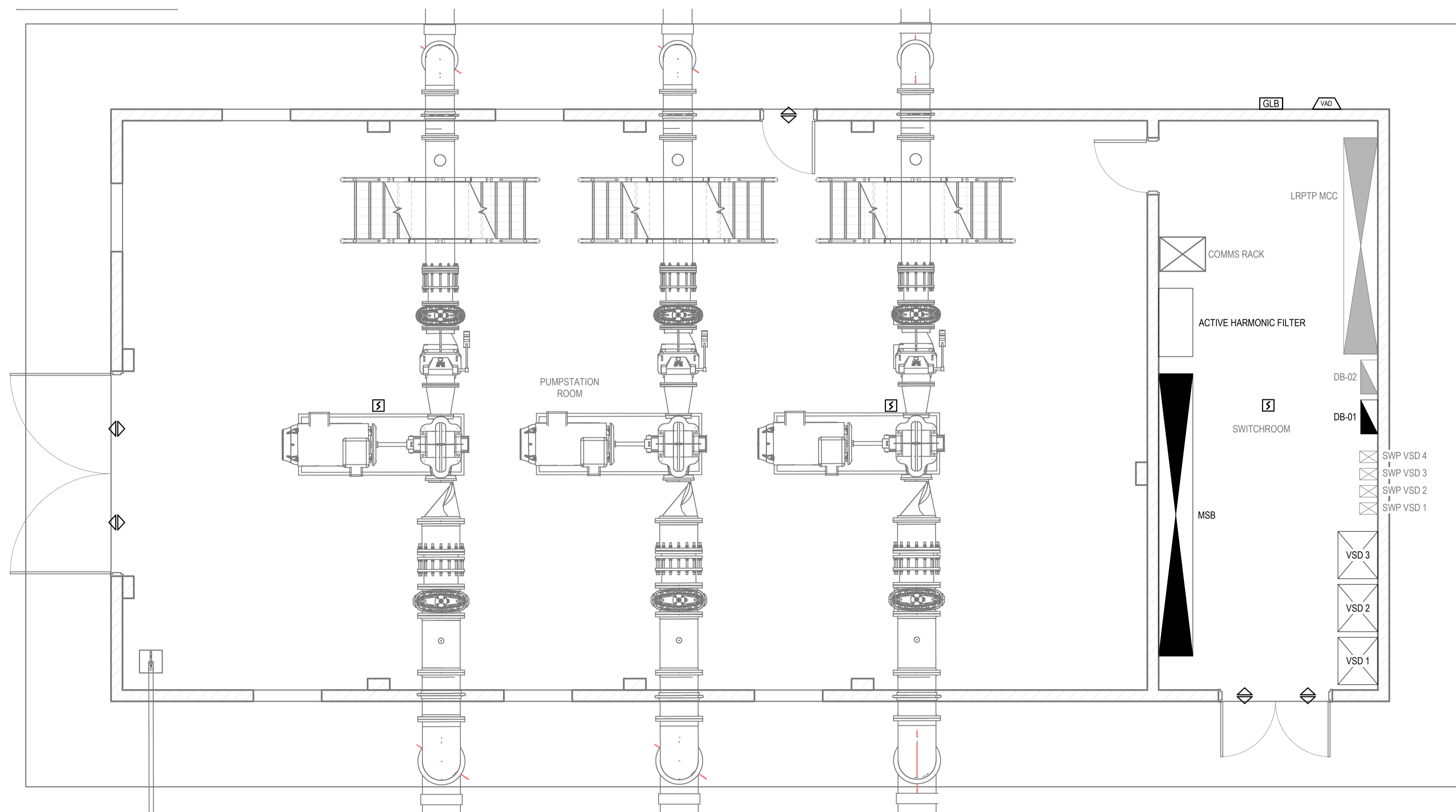
Drawing Title **ELECTRICAL SERVICES
EUGOWRA ROAD PUMP STATION
LIGHTING LAYOUT**

Drawing No.
12589773-E014

Size **A1**
Rev **A**

NOTES:

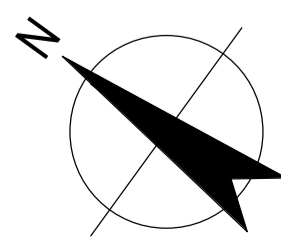
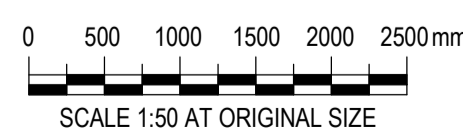
1. ALL FIRE SERVICES SHALL BE IN ACCORDANCE WITH THE CURRENT REQUIREMENTS OF THE BUILDING CODE OF AUSTRALIA AND AS1670 SERIES.
2. CONTRACTOR SHALL SUPPLY AND INSTALL ALARM SOUNDERS COMPLIANT TO AS1670.1.
3. FIRE SYSTEM DESIGNER SHALL COORDINATE WITH MECHANICAL SERVICES DESIGNER TO COMPLETE HVAC & SMOKE CONTROL SYSTEM.
4. ALL CABLING TO AND FROM THE FIRE SYSTEM EQUIPMENT SHALL BE FIRE RATED AND BE COLOURED IN ACCORDANCE WITH APPLICABLE AUSTRALIAN STANDARDS.
5. FIRE SYSTEM DESIGNER TO CONFIRM ON SITE THE FINAL LOCATION OF FIRE SERVICES DEVICES.
6. FIRE SERVICES WIRING SHALL BE INSTALLED IN 20mm HD UPVC WHITE CONDUITS AND FITTINGS.
7. PROVIDE FIRE BRIGADE CALL POINT & BACK TO BASE OWNERS MAIN COMMUNICATION FACILITY. THE LOCATION OF THE FLASHING LIGHT IS NOT SHOWN AND TO BE DETERMINED IN CONSULTATION WITH FIRE BRIGADE & OWNER.
8. PROVIDE DIGITAL INPUT FROM DOOR SWITCHES TO PLC FOR SECURITY MONITORING.
9. DOOR SWITCHES TO BE SCHNEIDER XCKD2145P16.



FIRE DETECTION & SECURITY LAYOUT
SCALE 1:50

Rev	Description	Checked	Approved	Date
A	80% DETAILED DESIGN	RJ	NM	16.10.23

Author	A.COOMBER	Drafting Check	A.COOMBER*
Designer	D.EDSER	Design Check	G.BIERNAT*



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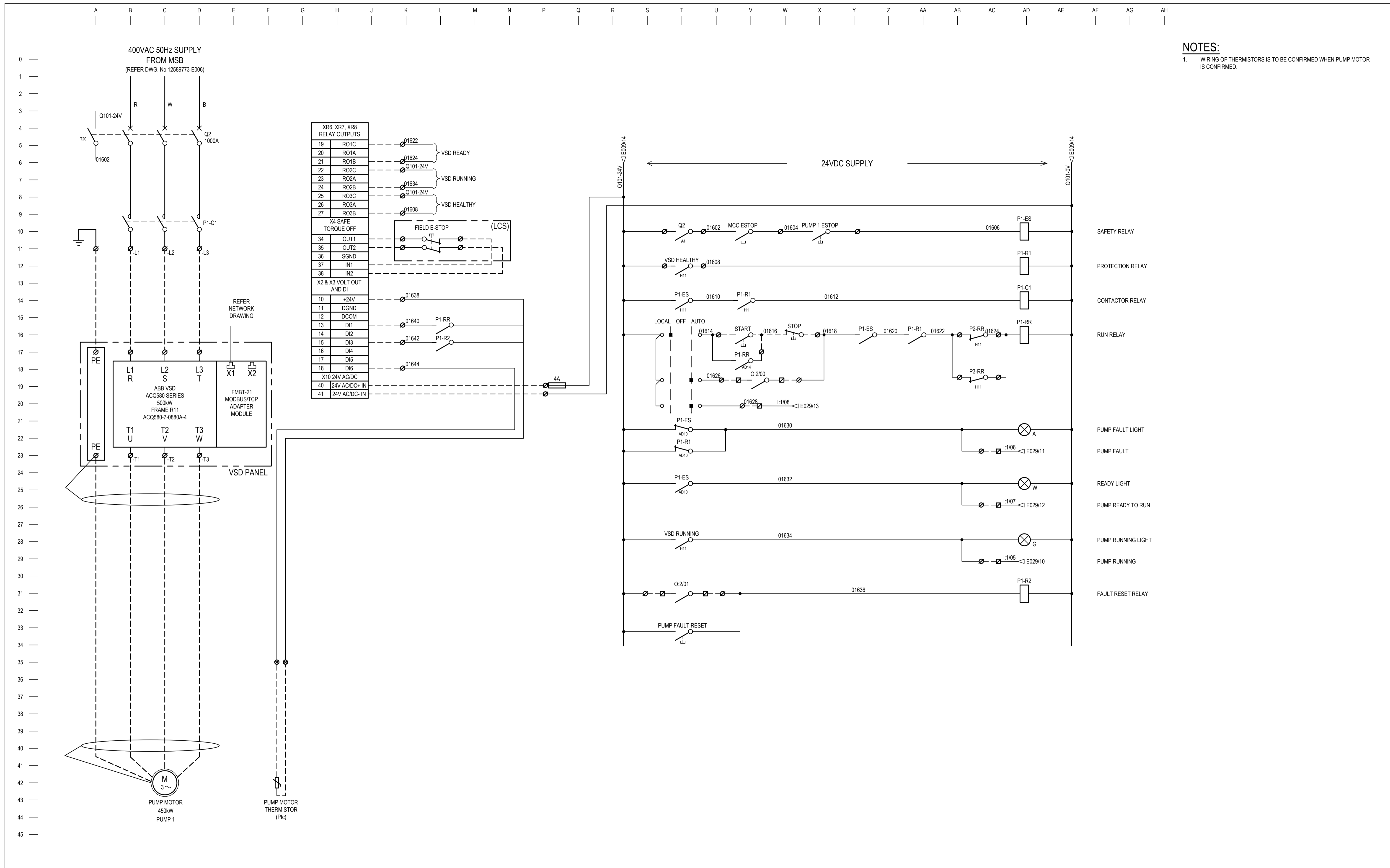
Project No.
12589773

Client **PARKES SHIRES COUNCIL**
 Project **LACHLAN PIPELINE DUPLICATION
DETAIL DESIGN TSS**
 Status **PRELIMINARY**

Drawing Title **ELECTRICAL SERVICES
EUGOWRA ROAD PUMP STATION
FIRE AND SECURITY LAYOUT**

Drawing No. **12589773-E015**

Size **A1**
Rev **A**



Rev	Description	Checked	Approved	Date
A	80% DETAILED DESIGN	RJ	NM	16.10.23

Author: B.SNEESBY Drafting Check: A.COOMBER*
 Designer: D.EDSER Design Check: G.BIERNAT*

File Name: C:\Users\bsneesby\ACCDocs\GHD Services Pty Ltd\12589773 - Lachlan Pipeline Duplication Detailed Design\01 WIP\01 WIP - Electrical\04 Drawings\12589773-E016.dwg

Plot Date: 17 October 2023 - 11:42 AM Plotted by: Brock Sneesby

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PARKES SHIRE COUNCIL

Project No. 12589773

Client: PARKES SHIRE COUNCIL

Project: LACHLAN PIPELINE DUPLICATION
DETAIL DESIGN TSS

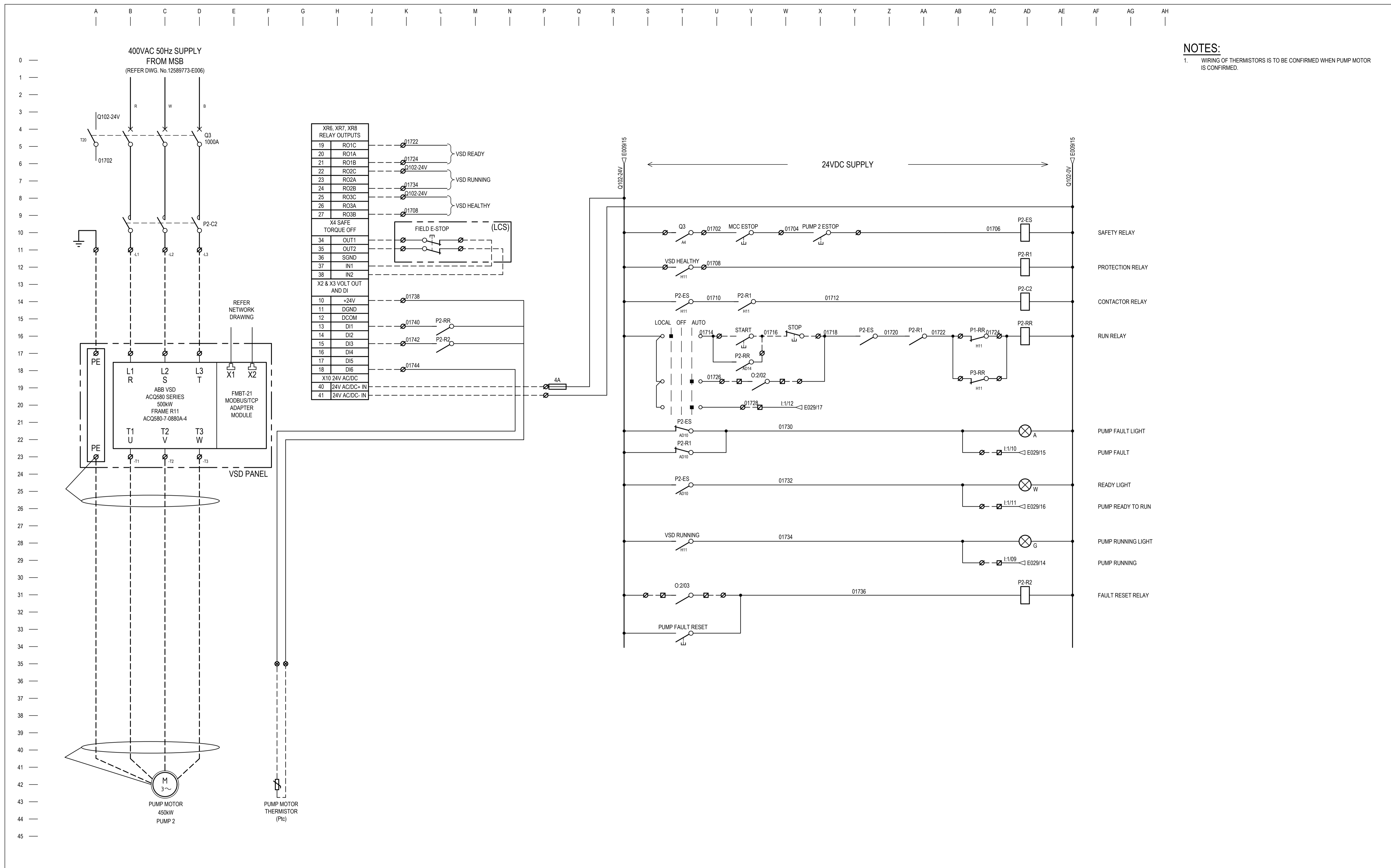
Status: PRELIMINARY

Drawing Title: ELECTRICAL SERVICES
NEW EUGOWRA ROAD PUMP STATION
PUMP 1 - SCHEMATIC DIAGRAM

Drawing No. 12589773-E016

Rev A

Size: A1



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A	80% DETAILED DESIGN	RJ	NM	16.10.23

Author: B.SNEESBY Drafting Check: A.COOMBER*
 Designer: D.EDSER Design Check: G.BIERNAT*

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Project No. 12589773

Client: **PARKES SHIRE COUNCIL**

Project: **LACHLAN PIPELINE DUPLICATION
DETAIL DESIGN TSS**

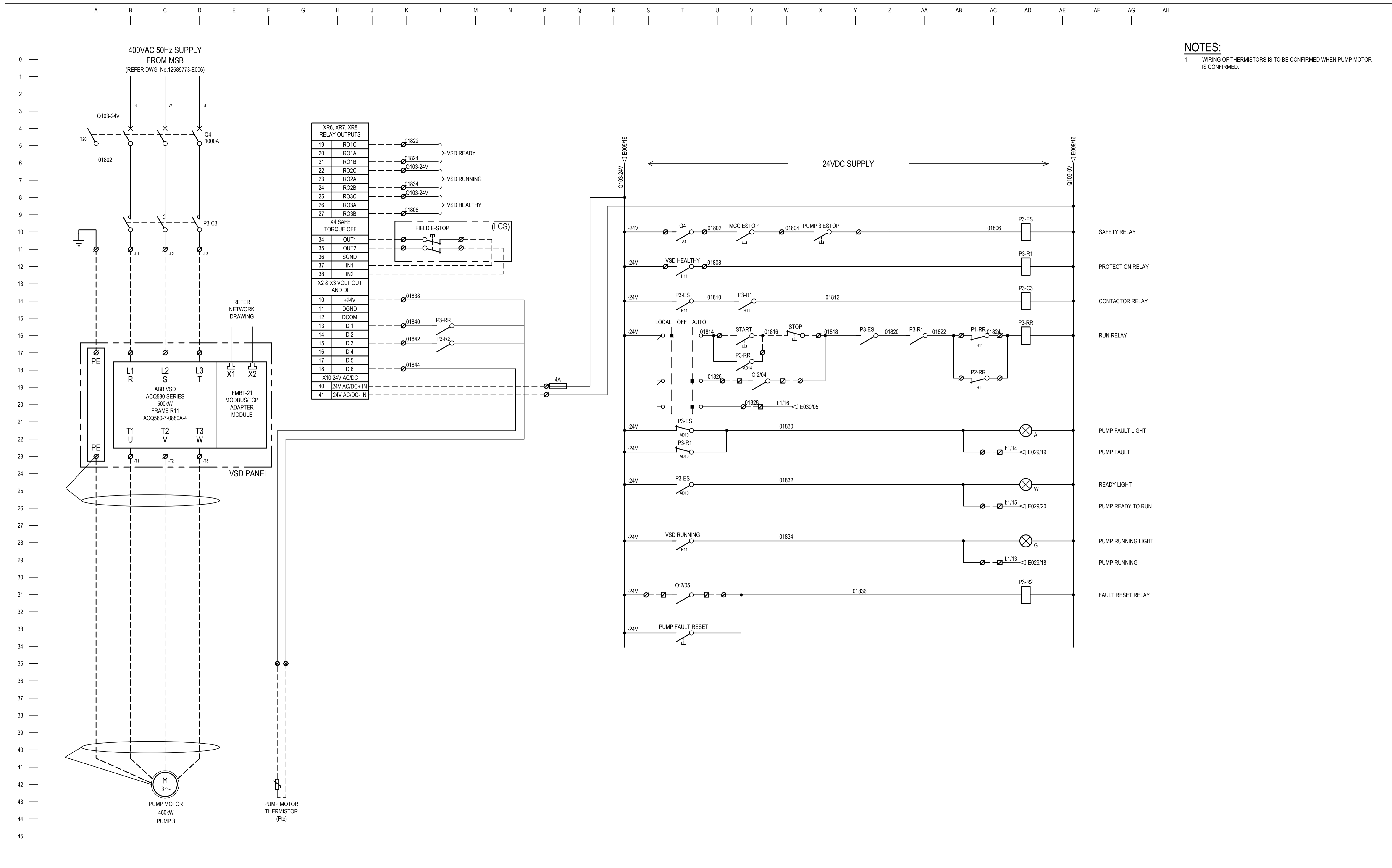
Status: **PRELIMINARY**

Drawing Title: **ELECTRICAL SERVICES
NEW EUGOWRA ROAD PUMP STATION
PUMP 2 - SCHEMATIC DIAGRAM**

Size: **A1**

Rev: **A**

Drawing No.: **12589773-E017**



NOTES:
 1. WIRING OF THERMISTORS IS TO BE CONFIRMED WHEN PUMP MOTOR IS CONFIRMED.

Rev	Description	Checked	Approved	Date
A	80% DETAILED DESIGN	RJ	NM	16.10.23

Author: B.SNEESBY Drafting Check: A.COOMBER*
 Designer: D.EDSER Design Check: G.BIERNAT*

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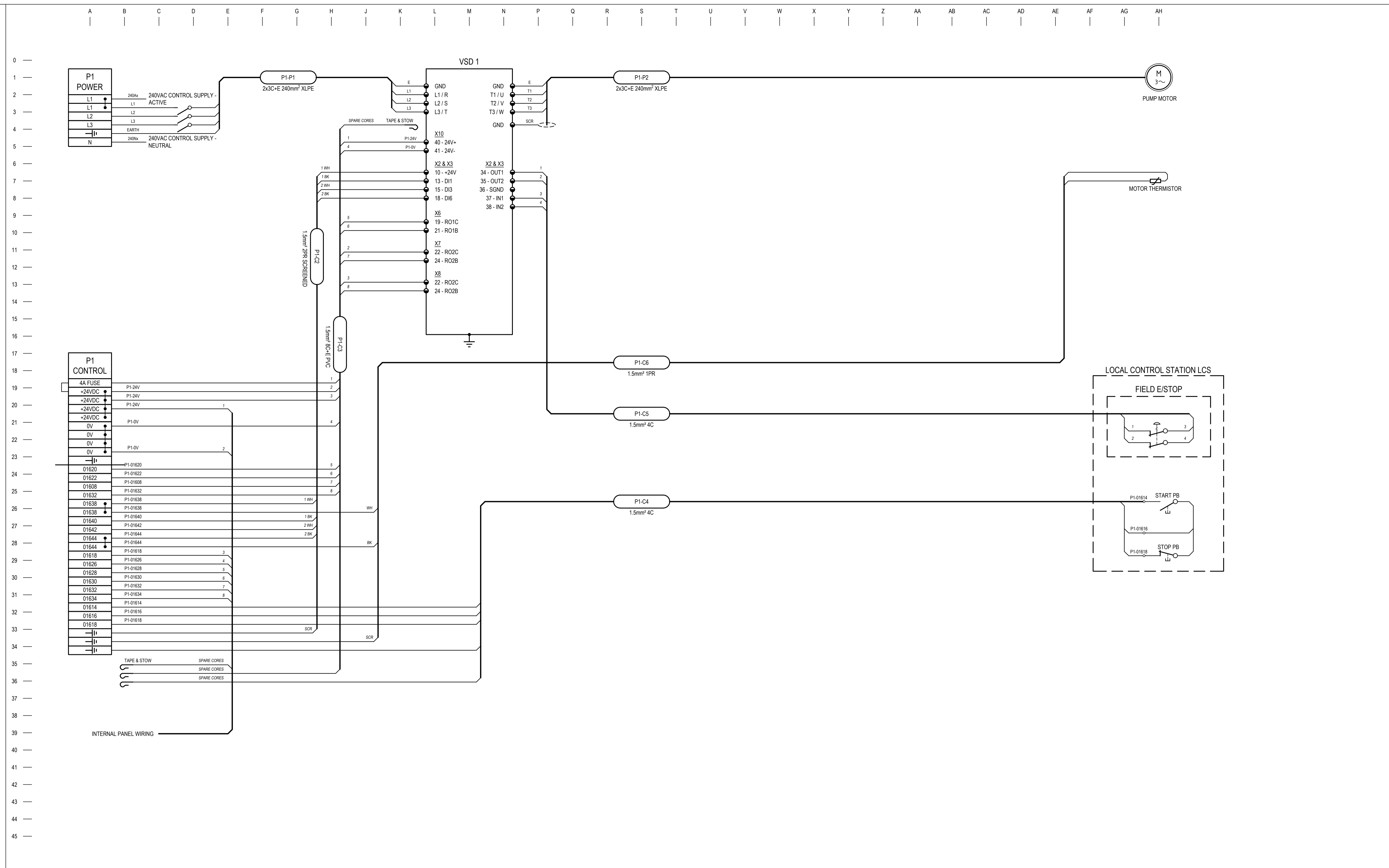
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Project No.
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Client: PARKES SHIRE COUNCIL
 Project: LACHLAN PIPELINE DUPLICATION
 DETAIL DESIGN TSS
 Status: PRELIMINARY

Drawing Title: ELECTRICAL SERVICES
 NEW EUGOWRA ROAD PUMP STATION
 PUMP 3 - SCHEMATIC DIAGRAM

Drawing No.: 12589773-E018
 Rev: A



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A	80% DETAILED DESIGN	RJ	NM	16.10.23

Author: B.SNEESBY Drafting Check: A.COOMBER*
 Designer: D.EDSER Design Check: G.BIERNAT*

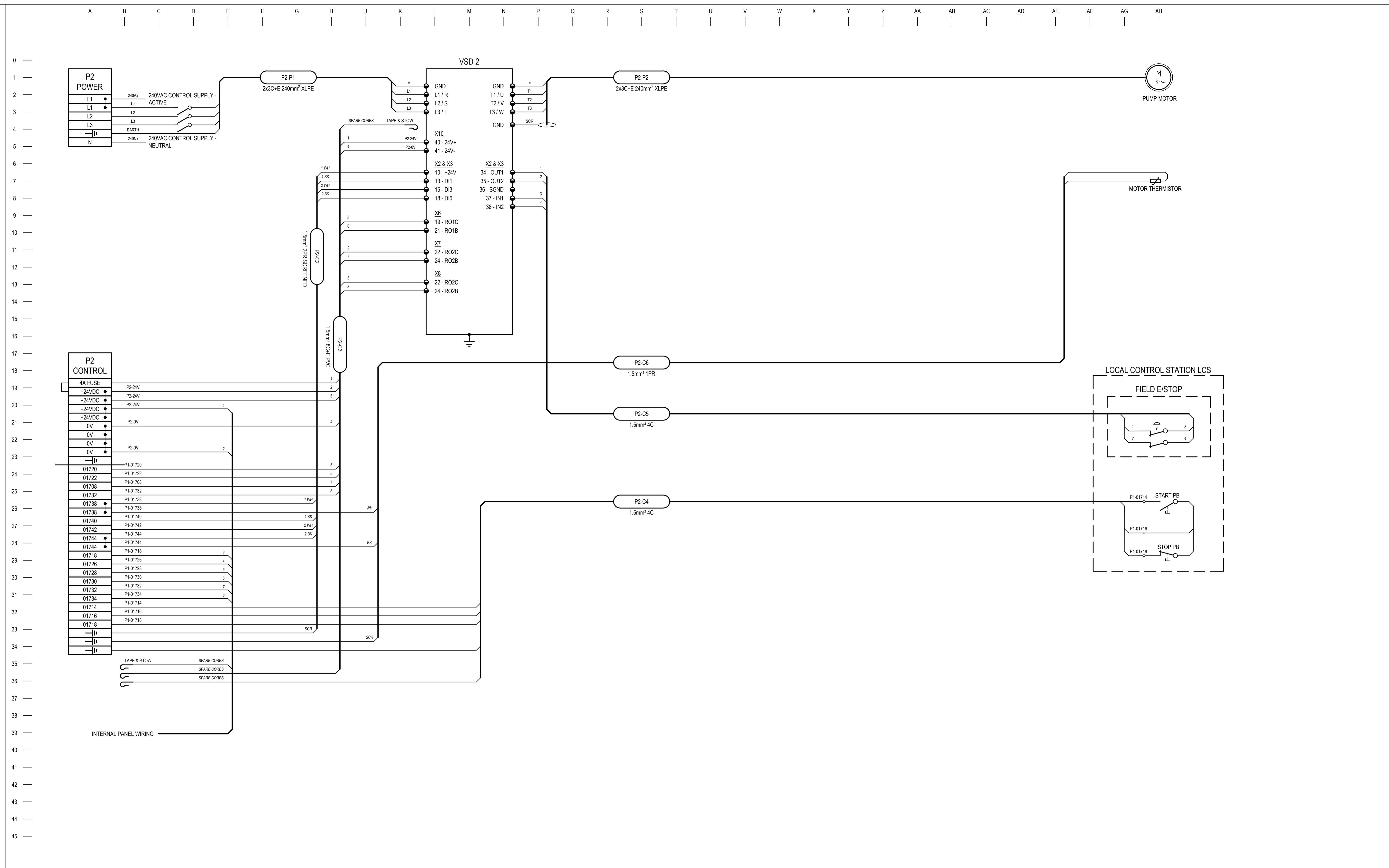
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Project No. 12589773
 Project: LACHLAN PIPELINE DUPLICATION
 DETAIL DESIGN TSS
 Status: PRELIMINARY

Client: PARKES SHIRE COUNCIL
 Drawing Title: ELECTRICAL SERVICES
 NEW EUGOWRA ROAD PUMP STATION
 PUMP 1 - TERMINATION DIAGRAM

Drawing No. 12589773-E020
 Size: A1
 Rev: A



Rev	Description	Checked	Approved	Date
A	80% DETAILED DESIGN	RJ	NM	16.10.23

Author: B.SNEESBY Drafting Check: A.COOMBER*
 Designer: D.EDSER Design Check: G.BIERNAT*

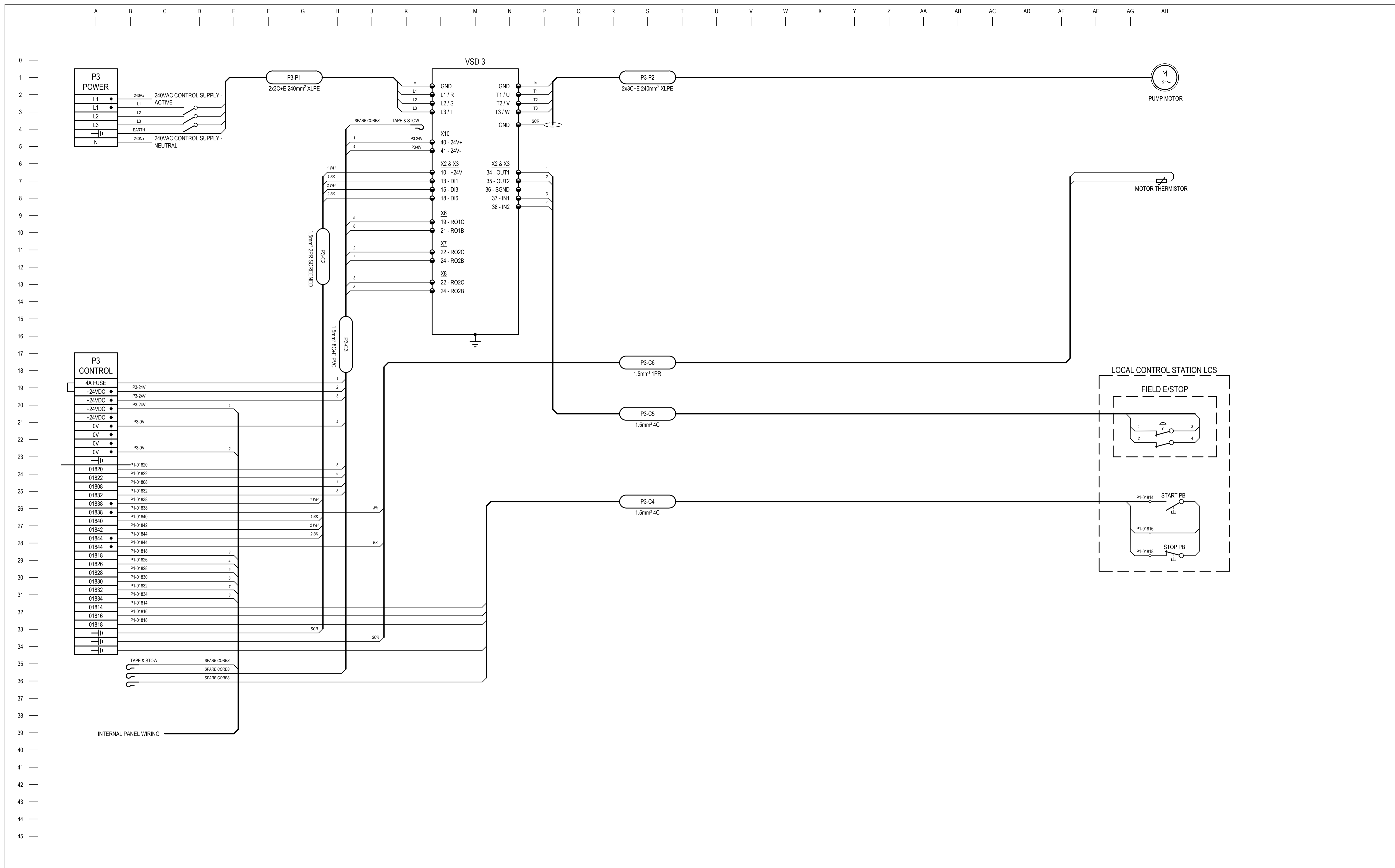
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Project No. 12589773

Client: PARKES SHIRE COUNCIL
 Project: LACHLAN PIPELINE DUPLICATION
 DETAIL DESIGN TSS
 Status: PRELIMINARY

Drawing Title: ELECTRICAL SERVICES
 NEW EUGOWRA ROAD PUMP STATION
 PUMP 2 - TERMINATION DIAGRAM
 Drawing No. 12589773-E021
 Rev A



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A	80% DETAILED DESIGN	RJ	NM	16.10.23

Author: B.SNEESBY Drafting Check: A.COOMBER*
 Designer: D.EDSER Design Check: G.BIERNAT*

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Project: LACHLAN PIPELINE DUPLICATION
DETAIL DESIGN TSS

Status: PRELIMINARY

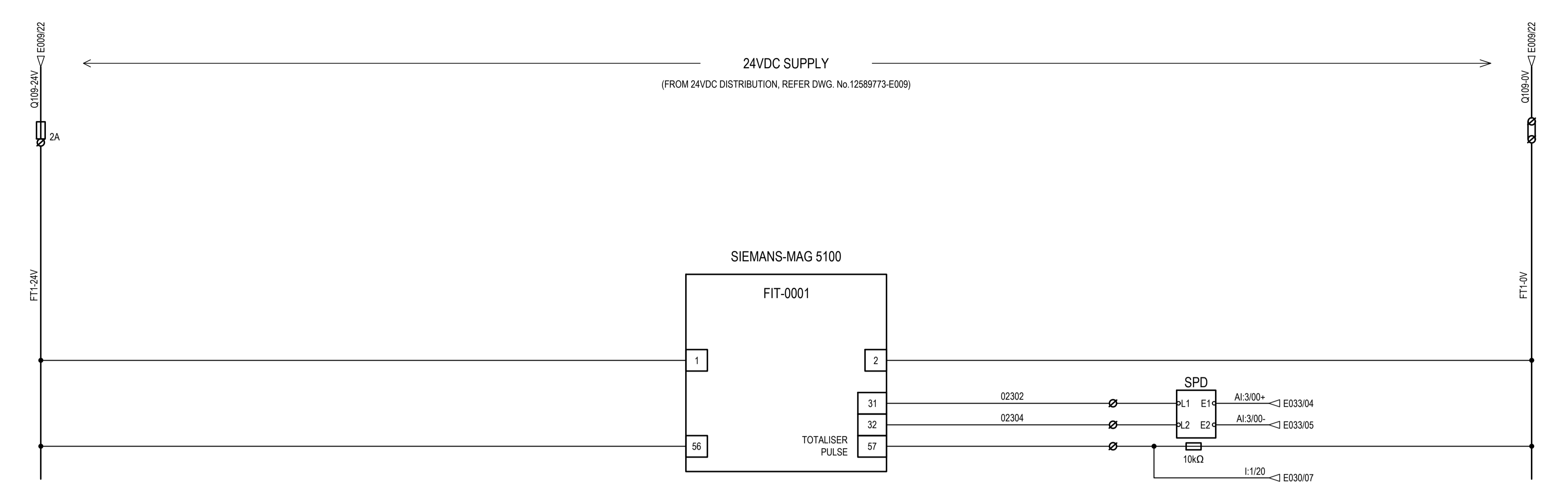
Drawing Title: ELECTRICAL SERVICES
NEW EUGOWRA ROAD PUMP STATION
PUMP 3 - TERMINATION DIAGRAM

Drawing No.: 12589773-E022

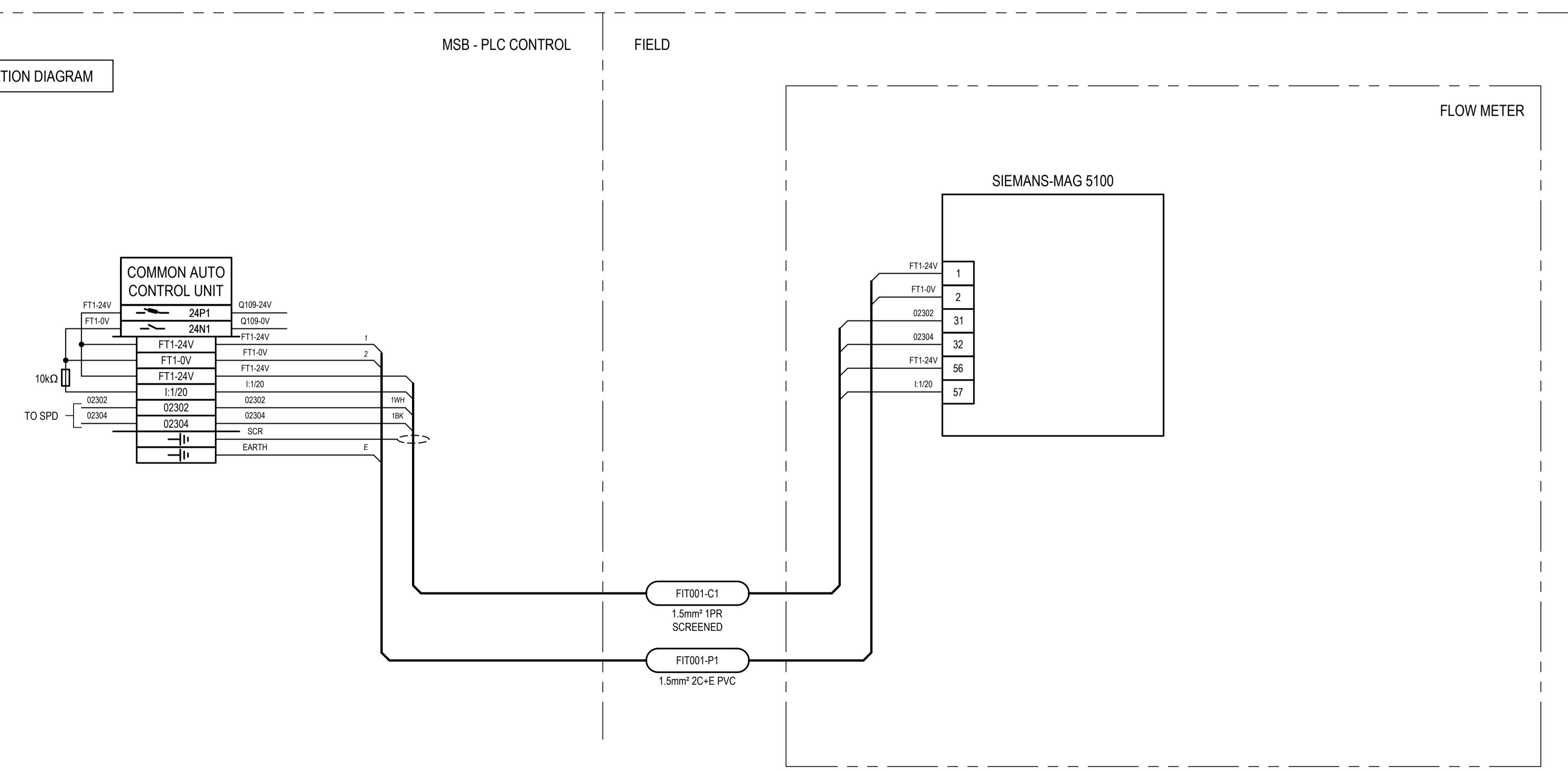
Rev: A

A B C D E F G H J K L M N P Q R S T U V W X Y Z AA AB AC AD AE AF AG AH

SCHEMATIC DIAGRAM



TERMINATION DIAGRAM



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Author: B.SNEESBY Drafting Check: A.COOMBER*
 Designer: D.EDSER Design Check: G.BIERNAT*

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Client: PARKES SHIRE COUNCIL

Project: LACHLAN PIPELINE DUPLICATION
 DETAIL DESIGN TSS

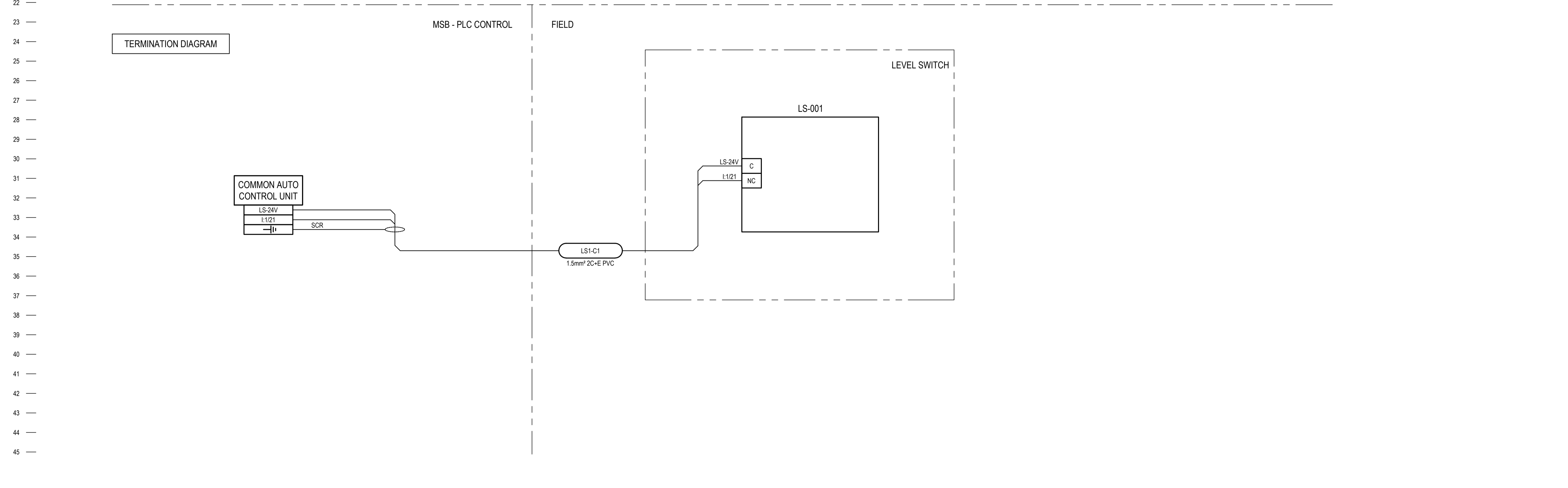
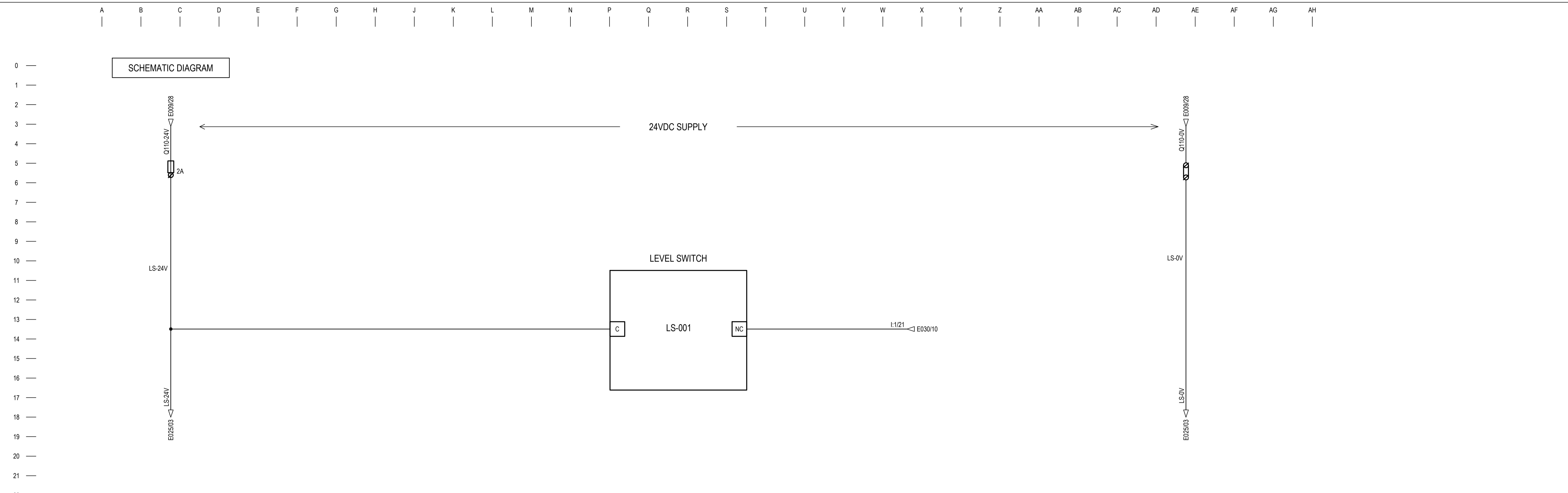
Status: PRELIMINARY

Drawing Title: ELECTRICAL SERVICES
 NEW EUGOWRA ROAD PUMP STATION
 FLOW TRANSMITTER (FT1)
 INSTRUMENT LOOP DIAGRAM

Drawing No. 12589773-E023

Size: A1

Rev: A



Rev	Description	Checked	Approved	Date
A	80% DETAILED DESIGN	RJ	NM	16.10.23

Author: B.SNEESBY Drafting Check: A.COOMBER*
 Designer: D.EDSER Design Check: G.BIERNAT*

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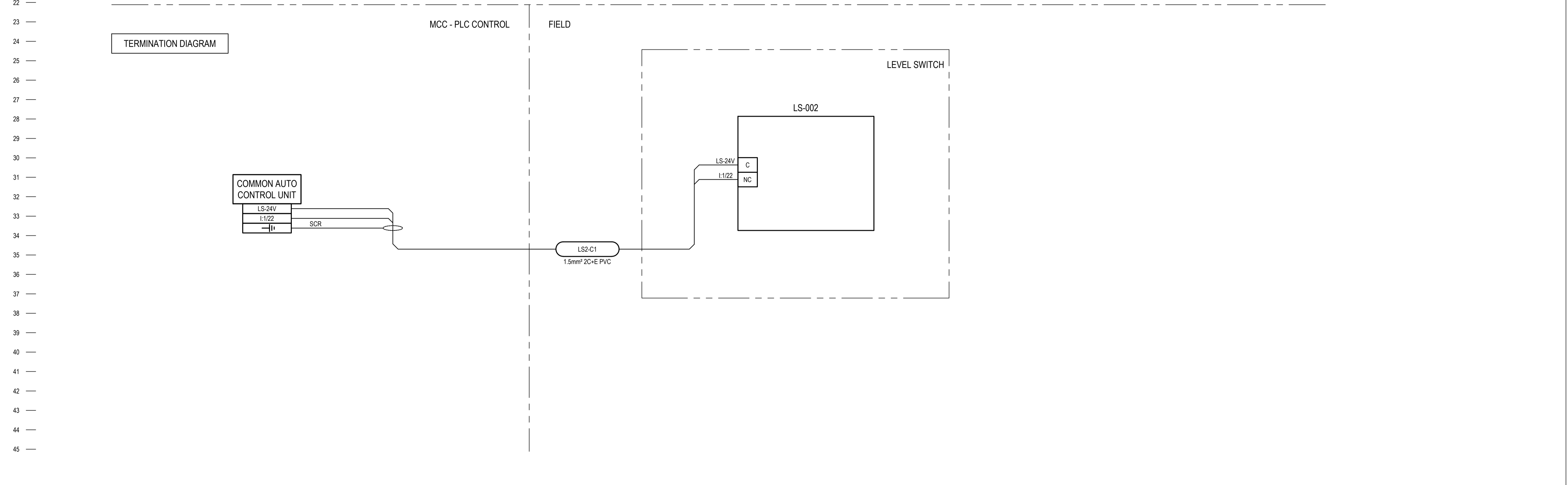
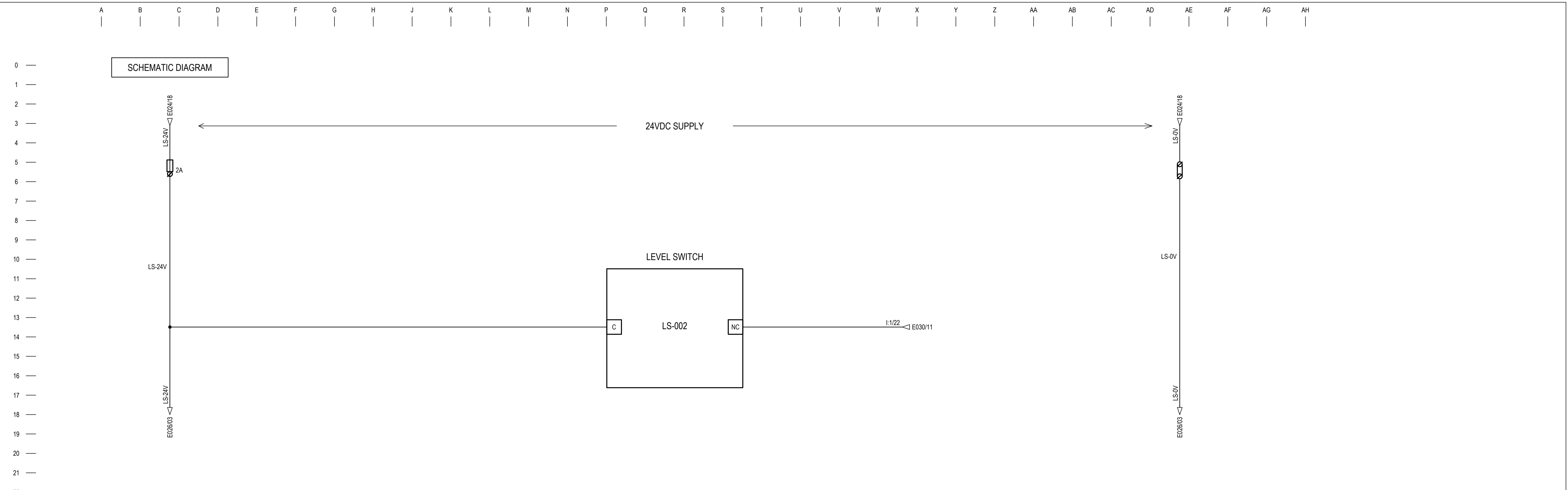
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Project No.
 12589773

Client	PARKES SHIRE COUNCIL
Project	LACHLAN PIPELINE DUPLICATION DETAIL DESIGN TSS
Status	PRELIMINARY

Drawing Title ELECTRICAL SERVICES NEW EUGOWRA ROAD PUMP STATION HIGH LEVEL SWITCH INSTRUMENT LOOP DIAGRAM	Drawing No. 12589773-E024
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Size
A1
 Rev
A



Rev	Description	Checked	Approved	Date
A	80% DETAILED DESIGN	RJ	NM	16.10.23

Author: B.SNEESBY Drafting Check: A.COOMBER*
 Designer: D.EDSER Design Check: G.BIERNAT*

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Project No. 12589773

Client: PARKES SHIRE COUNCIL

Project: LACHLAN PIPELINE DUPLICATION
 DETAIL DESIGN TSS

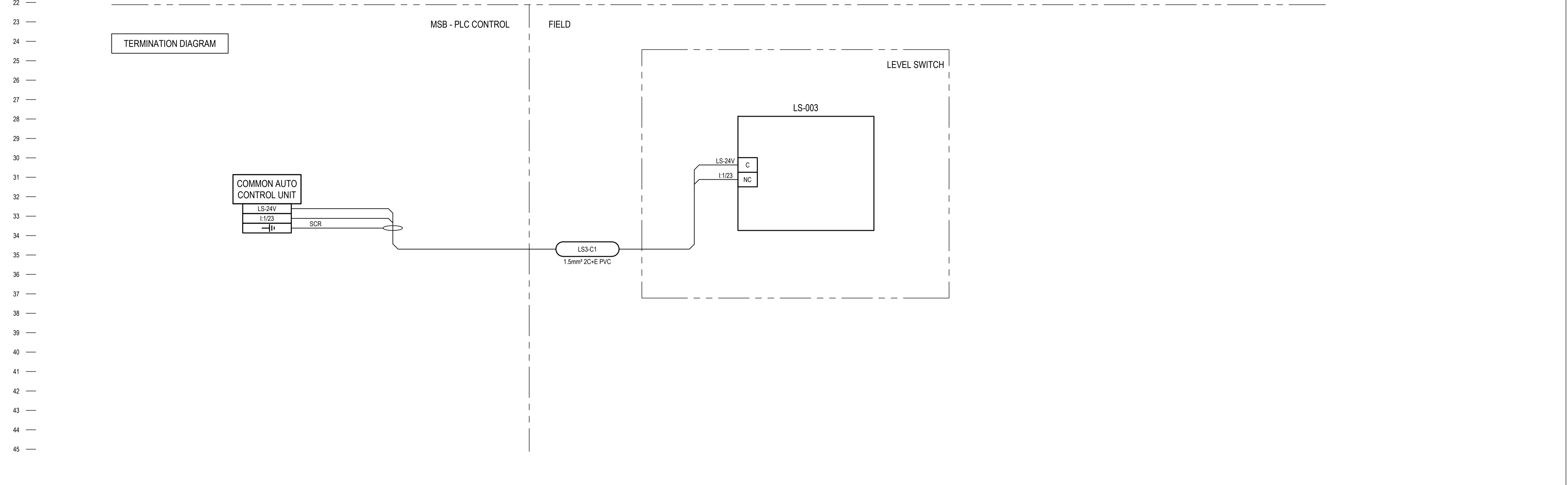
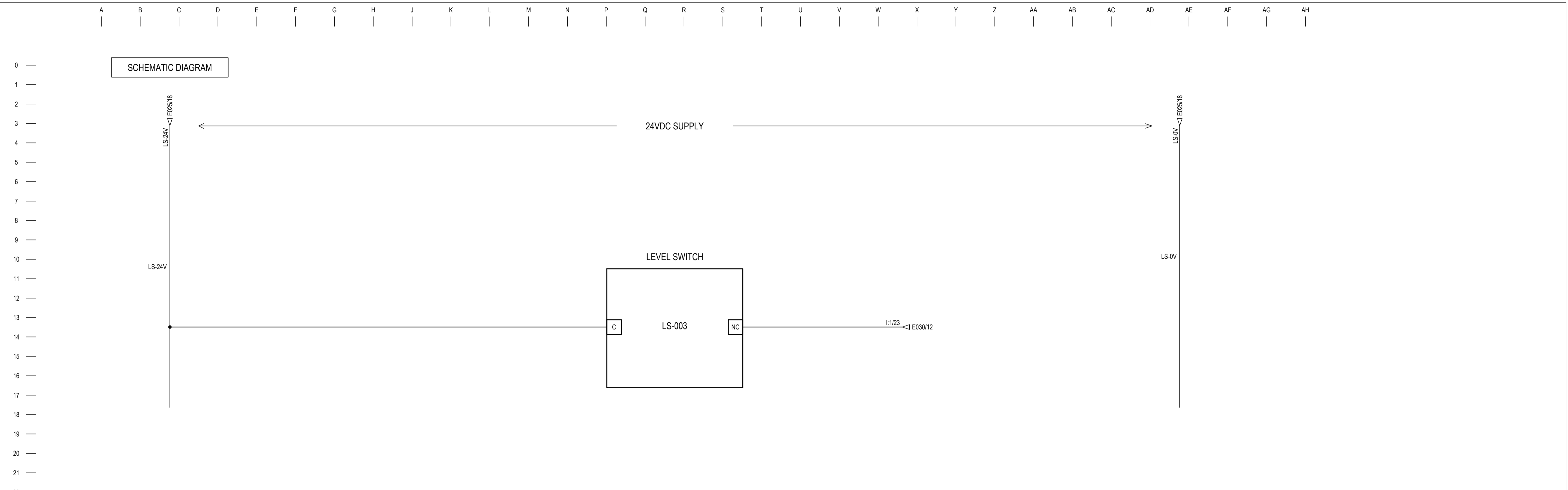
Status: PRELIMINARY

Drawing Title: ELECTRICAL SERVICES
 NEW EUGOWRA ROAD PUMP STATION
 LOW LEVEL SWITCH
 INSTRUMENT LOOP DIAGRAM

Drawing No. 12589773-E025

Size: A1

Rev: A



Rev	Description	Checked	Approved	Date
A	80% DETAILED DESIGN	RJ	NM	16.10.23
Author	B.SNEESBY	Drafting Check	A.COOMBER*	
Designer	D.EDSER	Design Check	G.BIERNAT*	

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Project No. 12589773

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Client	PARKES SHIRE COUNCIL
Project	LACHLAN PIPELINE DUPLICATION DETAIL DESIGN TSS
Status	PRELIMINARY

Drawing Title	ELECTRICAL SERVICES NEW EUGOWRA ROAD PUMP STATION LOW LOW LEVEL SWITCH INSTRUMENT LOOP DIAGRAM
Drawing No.	12589773-E026

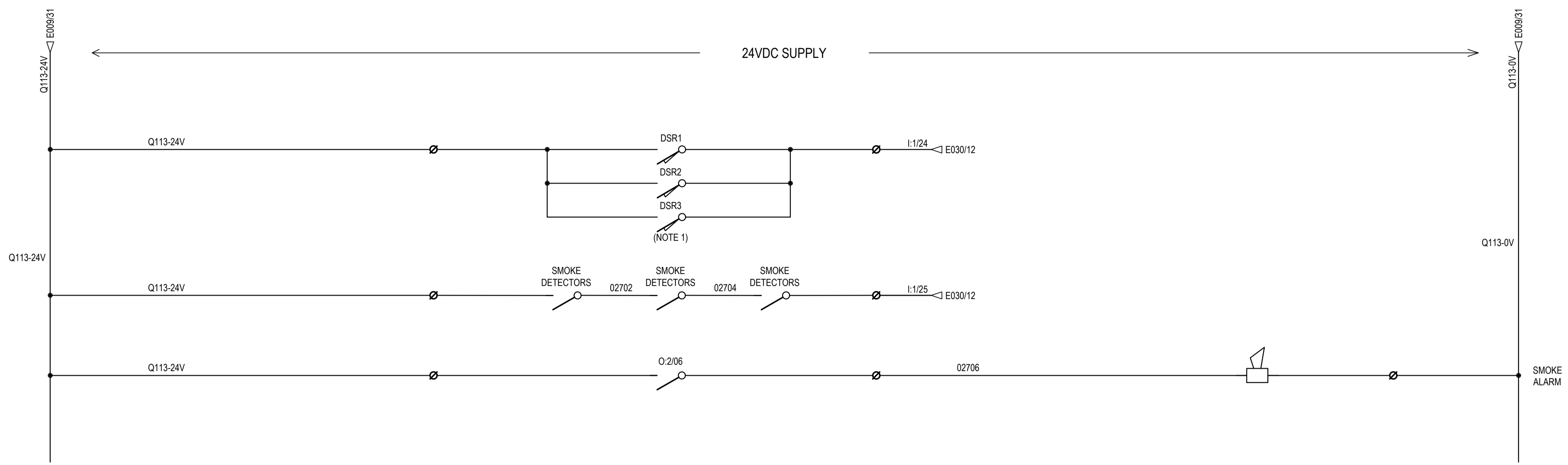
Size **A1**

Rev **A**

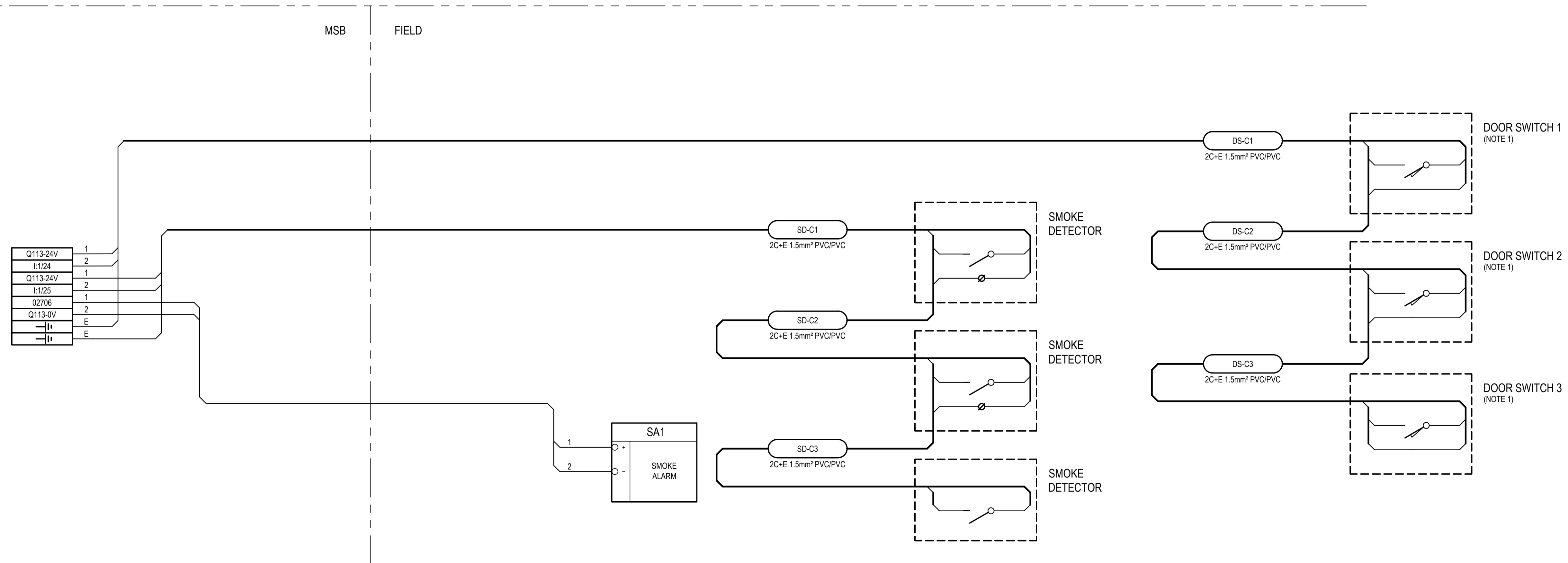
A B C D E F G H J K L M N P Q R S T U V W X Y Z AA AB AC AD AE AF AG AH

NOTES:
 1. NUMBER OF DOOR SWITCHES TO SUIT NUMBER OF DOORS. SWITCHES TO BE CONNECTED IN PARALLEL.

SCHEMATIC DIAGRAM



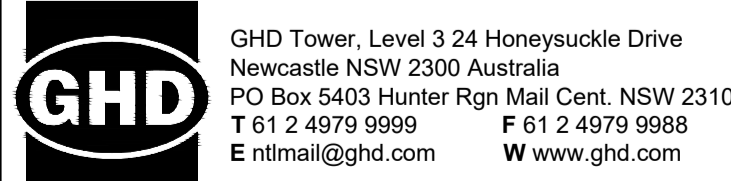
TERMINATION DIAGRAM



Rev	Description	Checked	Approved	Date
A	80% DETAILED DESIGN	RJ	NM	16.10.23

Author: B.SNEESBY Drafting Check: A.COOMBER*
 Designer: D.EDSER Design Check: G.BIERNAT*

File Name: C:\Users\bsneesby\ACCDocs\GHD Services Pty Ltd\12589773 - Lachlan Pipeline Duplication Detailed Design\01 WIP\01 WIP - Electrical\04 Drawings\12589773-E027.dwg



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Project No. 12589773

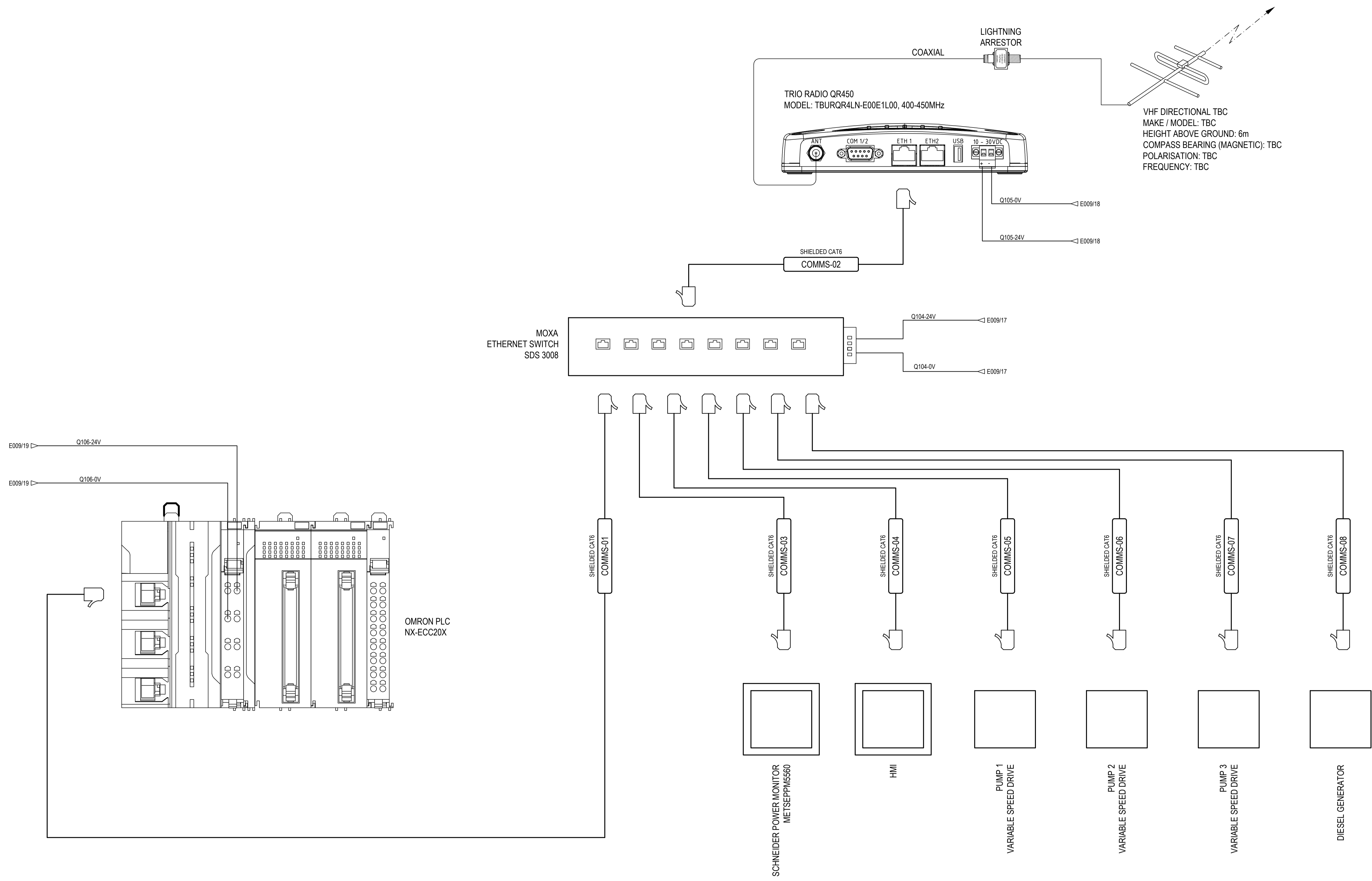
Client: PARKES SHIRE COUNCIL
 Project: LACHLAN PIPELINE DUPLICATION
 DETAIL DESIGN TSS
 Status: PRELIMINARY

Drawing Title: ELECTRICAL SERVICES
 NEW EUGOWRA ROAD PUMP STATION
 SECURITY & FIRE
 INSTRUMENT LOOP DIAGRAM

Drawing No. 12589773-E027

Size: A1
 Rev: A

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Rev	Description	Checked	Approved	Date
A	80% DETAILED DESIGN	RJ	NM	16.10.23

Author: B.SNEESBY Drafting Check: A.COOMBER*
 Designer: D.EDSER Design Check: G.BIERNAT*

File Name: C:\Users\bsneesby\ACCDocs\GHD Services Pty Ltd\12589773 - Lachlan Pipeline Duplication Detailed Design\01 WIP\01 WIP - Electrical\04 Drawings\12589773-E028.dwg

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Project No. 12589773

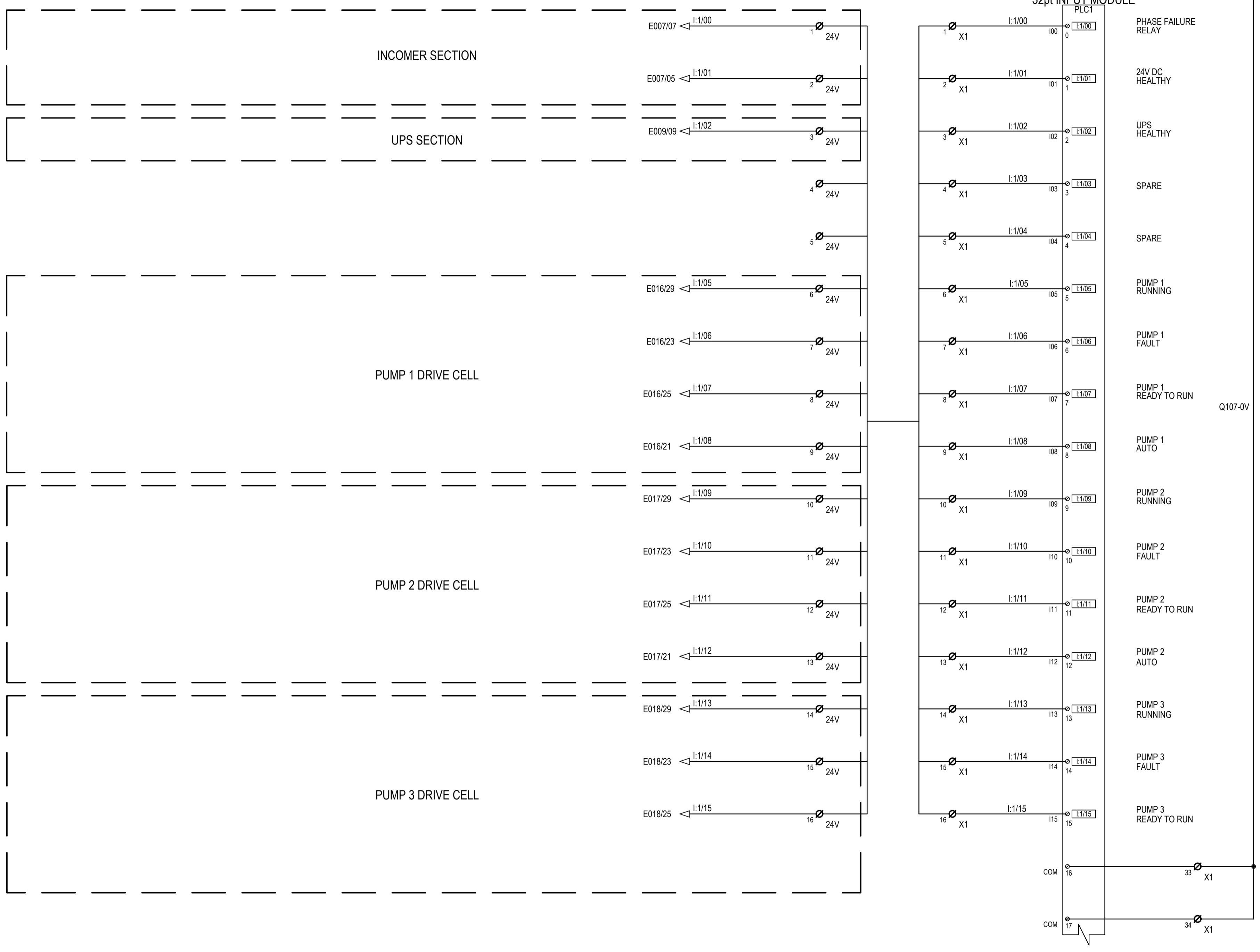
Client: PARKES SHIRE COUNCIL
 Project: LACHLAN PIPELINE DUPLICATION
 DETAIL DESIGN TSS
 Status: PRELIMINARY

Drawing Title: ELECTRICAL SERVICES
 NEW EUGOWRA ROAD PUMP STATION
 TELEMETRY
 COMMUNICATIONS DIAGRAM

Drawing No. 12589773-E028

Size: A1
 Rev: A

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(CONTINUED ON DWG No. 12589773-E030)

Rev	Description	Checked	Approved	Date
A	80% DETAILED DESIGN	RJ	NM	16.10.23

Author B.SNEESBY Drafting Check A.COOMBER*
Designer D.EDSER Design Check G.BIERNAT*

File Name: C:\Users\bsneesby\ACCDocs\GHD Services Pty Ltd\12589773 - Lachlan Pipeline Duplication Detailed Design\01 WIP\01 WIP - Electrical\04 Drawings\12589773-E029.dwg

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Project No. 12589773

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Client PARKES SHIRE COUNCIL

Project LACHLAN PIPELINE DUPLICATION
DETAIL DESIGN TSS

Status PRELIMINARY

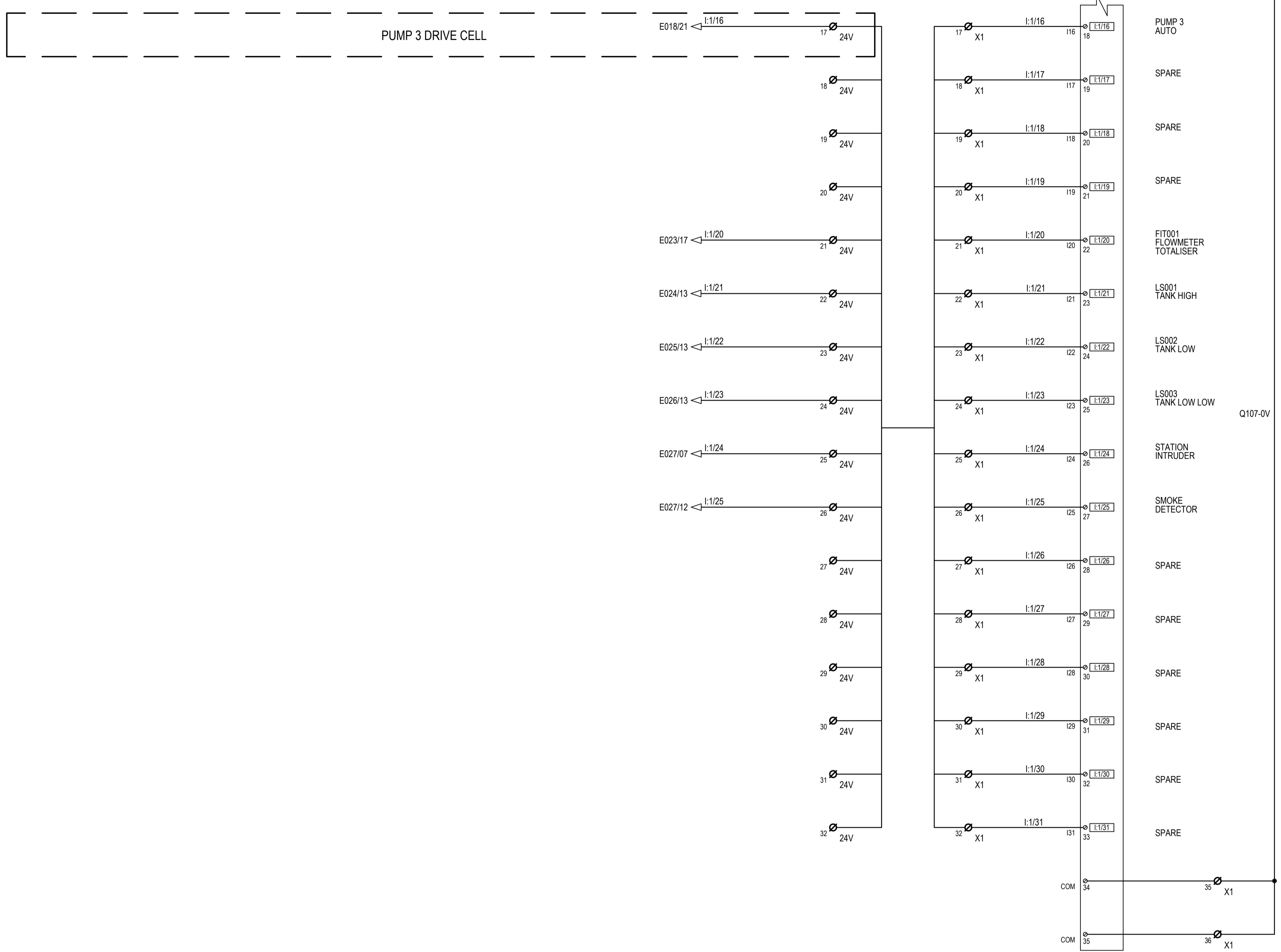
Drawing Title ELECTRICAL SERVICES
NEW EUGOWRA ROAD PUMP STATION
DIGITAL INPUT
SLOT 1 - SHEET 1

Drawing No. 12589773-E029

Size A1



Rev A

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Rev	Description	Checked	Approved	Date
A	80% DETAILED DESIGN	RJ	NM	16.10.23

Author: B.SNEESBY Drafting Check: A.COOMBER*
 Designer: D.EDSER Design Check: G.BIERNAT*

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Client	PARKES SHIRE COUNCIL
Project	LACHLAN PIPELINE DUPLICATION DETAIL DESIGN TSS
Status	PRELIMINARY

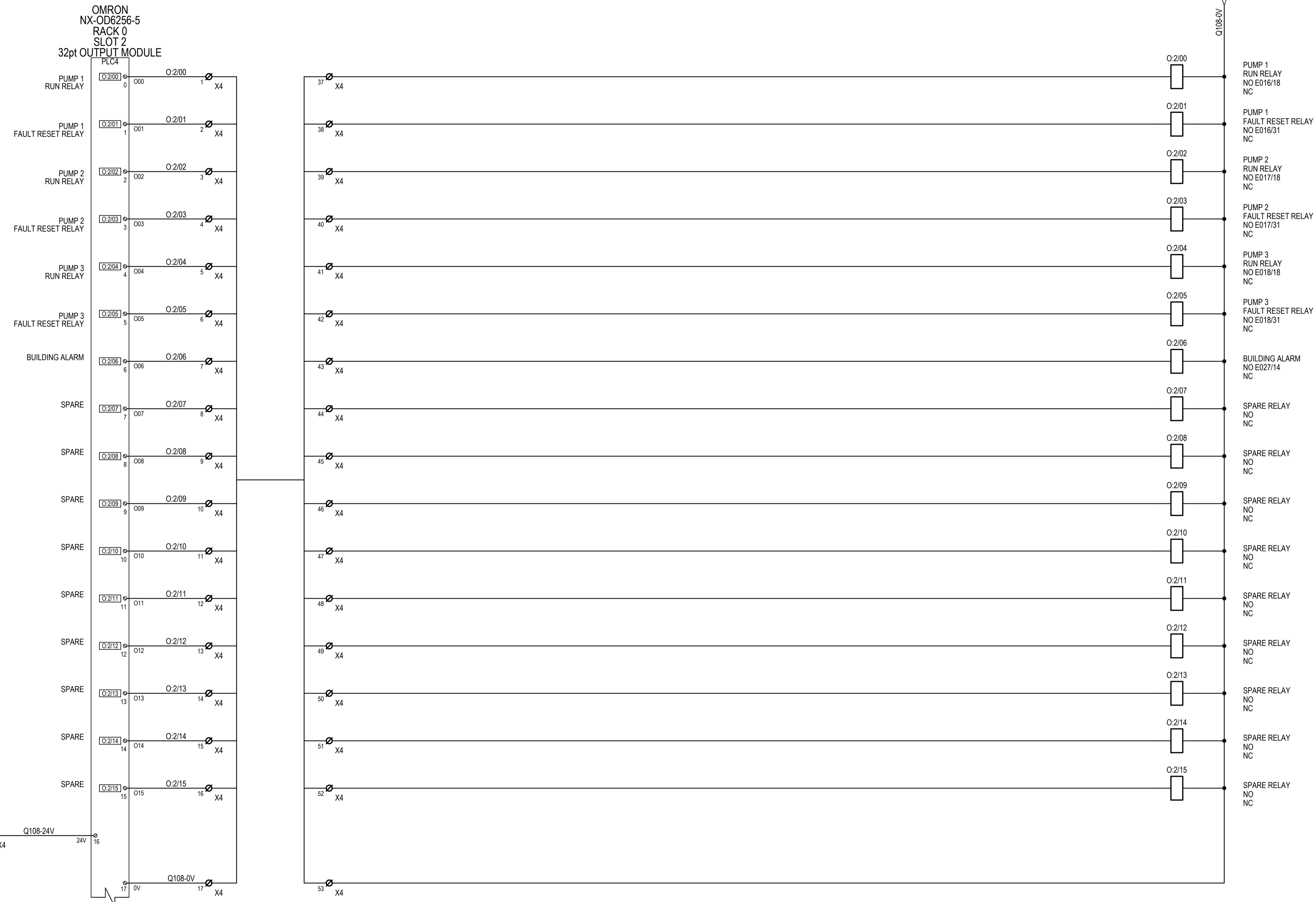
Drawing Title ELECTRICAL SERVICES NEW EUGOWRA ROAD PUMP STATION DIGITAL INPUT SLOT 1 - SHEET 2	Drawing No. 12589773-E030
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Size **A1**
 Rev **A**

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Q108-24V
E00921

Q108-0V
E00921





(CONTINUED ON DWG No. 12589773-E032)

Rev	Description	Checked	Approved	Date
A	80% DETAILED DESIGN	RJ	NM	16.10.23

Author: B.SNEESBY Drafting Check: A.COOMBER*
Designer: D.EDSER Design Check: G.BIERNAT*

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Project No. 12589773

Client: PARKES SHIRE COUNCIL

Project: LACHLAN PIPELINE DUPLICATION
DETAIL DESIGN TSS

Status: PRELIMINARY

Drawing Title: ELECTRICAL SERVICES
NEW EUGOWRA ROAD PUMP STATION
DIGITAL OUTPUT
SLOT 2 - SHEET 1

Drawing No. 12589773-E031

Size: A1
Rev: A

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Q108-24V E00921

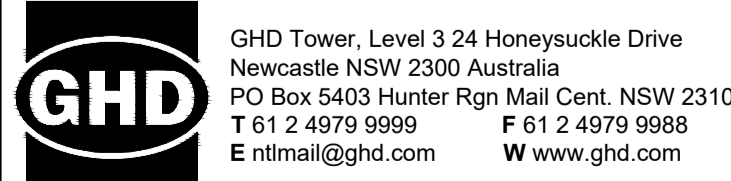
(CONTINUED ON DWG No. 12589773-E031)

Q108-0V E00921



Rev	Description	Checked	Approved	Date
A	80% DETAILED DESIGN	RJ	NM	16.10.23
Author	B.SNEESBY	Drafting Check	A.COOMBER*	
Designer	D.EDSER	Design Check	G.BIERNAT*	

File Name: C:\Users\bsneesby\ACCDocs\GHD Services Pty Ltd\12589773 - Lachlan Pipeline Duplication Detailed Design\01 WIP\01 WIP - Electrical\04 Drawings\12589773-E032.dwg



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Project No.
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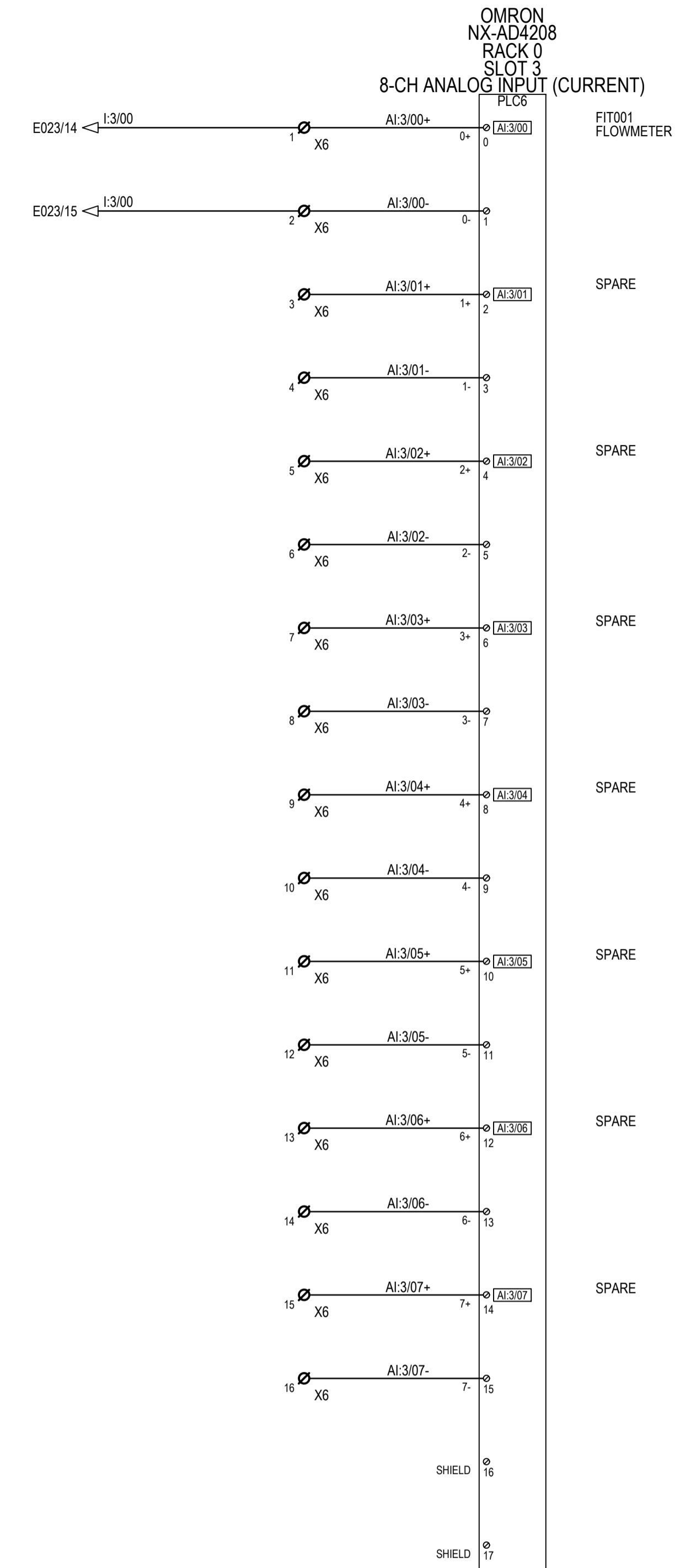
Client	PARKES SHIRE COUNCIL
Project	LACHLAN PIPELINE DUPLICATION DETAIL DESIGN TSS
Status	PRELIMINARY

Drawing Title
ELECTRICAL SERVICES
NEW EUGOWRA ROAD PUMP STATION
DIGITAL OUTPUT
SLOT 2 - SHEET 2

Drawing No.
12589773-E032

Size
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Rev
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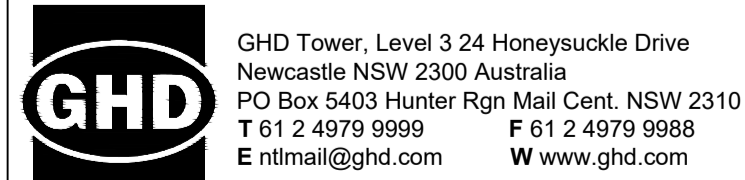
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Rev	Description	Checked	Approved	Date
A	80% DETAILED DESIGN	RJ	NM	16.10.23

Author	B.SNEESBY	Drafting Check	A.COOMBER*
Designer	D.EDSER	Design Check	G.BIERNAT*

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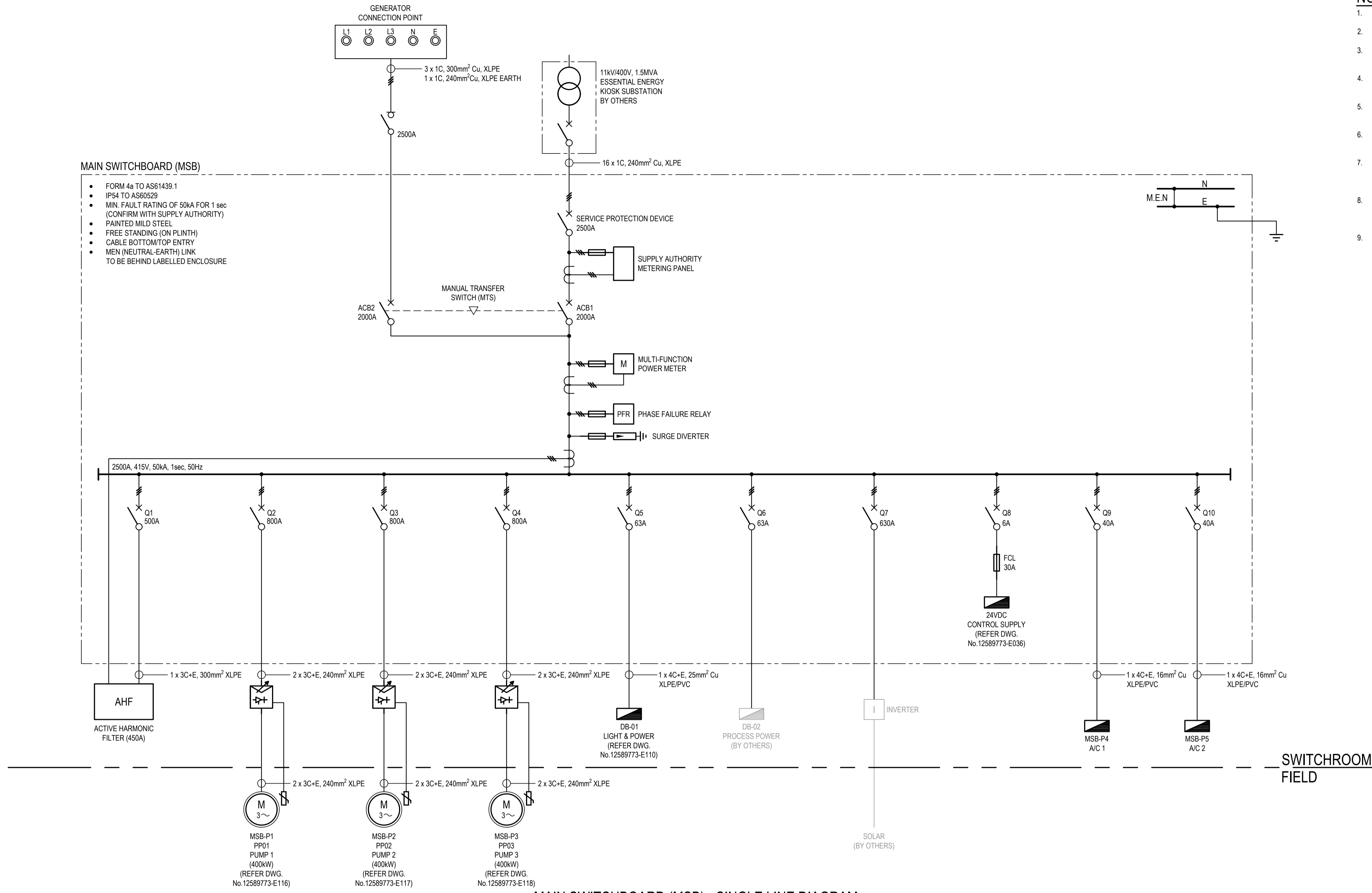
Client	PARKES SHIRE COUNCIL
Project	LACHLAN PIPELINE DUPLICATION DETAIL DESIGN TSS
Status	PRELIMINARY

Drawing Title	ELECTRICAL SERVICES NEW EUGOWRA ROAD PUMP STATION ANALOG INPUT SLOT 3
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Size
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Rev
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Drawing No.
12589773-E033

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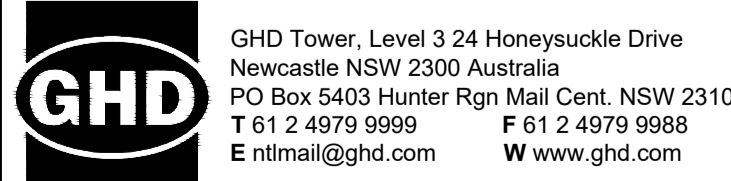


- NOTES:**
1. SUBSTATION (KIOSK TYPE) DETAIL TO BE PROVIDED.
 2. GENERATOR CONNECTION SIZE TO BE DETERMINED.
 3. CABLES FROM KIOSK SUBSTATION TO INCOMER, ASSUMED TO BE INSTALLED IN U/G CONDUITS.
 4. CABLES FROM VSD TO MOTOR, ASSUMED TO BE INSTALLED IN U/G CONDUITS.
 5. CABLE LENGTHS TO BE CONFIRMED BY CONTRACTOR PRIOR TO INSTALLATION.
 6. CONTRACTOR TO CONFIRM CIRCUIT BREAKER SETTINGS GRADE WITH UPSTREAM PROTECTION DEVICE.
 7. CONTRACTOR TO PROVIDE ARC FLASH CALCULATION AND ITS LABEL, THAT INCLUDES INCIDENT ENERGY LEVEL, BOUNDARY, PPE RATING AND SAFE WORKING DISTANCE.
 8. CONTRACTOR TO PROVIDE ABB ACS580-01/07 or ACO580-01/07 SERIES VARIABLE SPEED DRIVES. THESE MODELS HAVE HEAT VENTS AT THE TOP. THE HEAT WILL BE DUCTED OUT OF THE SWITCHROOM.
 9. ACTIVE HARMONIC FILTER BASED ON FUSECO TOP VENT SERIES. THIS ALLOWS FOR THE HEAT FROM THE AHF UNIT TO BE DUCTED OUT OF SWITCHROOM.

MAIN SWITCHBOARD (MSB) - SINGLE LINE DIAGRAM
NOT TO SCALE

Rev	Description	Checked	Approved	Date
A	80% DETAILED DESIGN	RJ	NM	16.10.23
Author	B.SNEESBY	Drafting Check	A.COOMBER*	
Designer	D.EDSER	Design Check	G.BIERNAT*	

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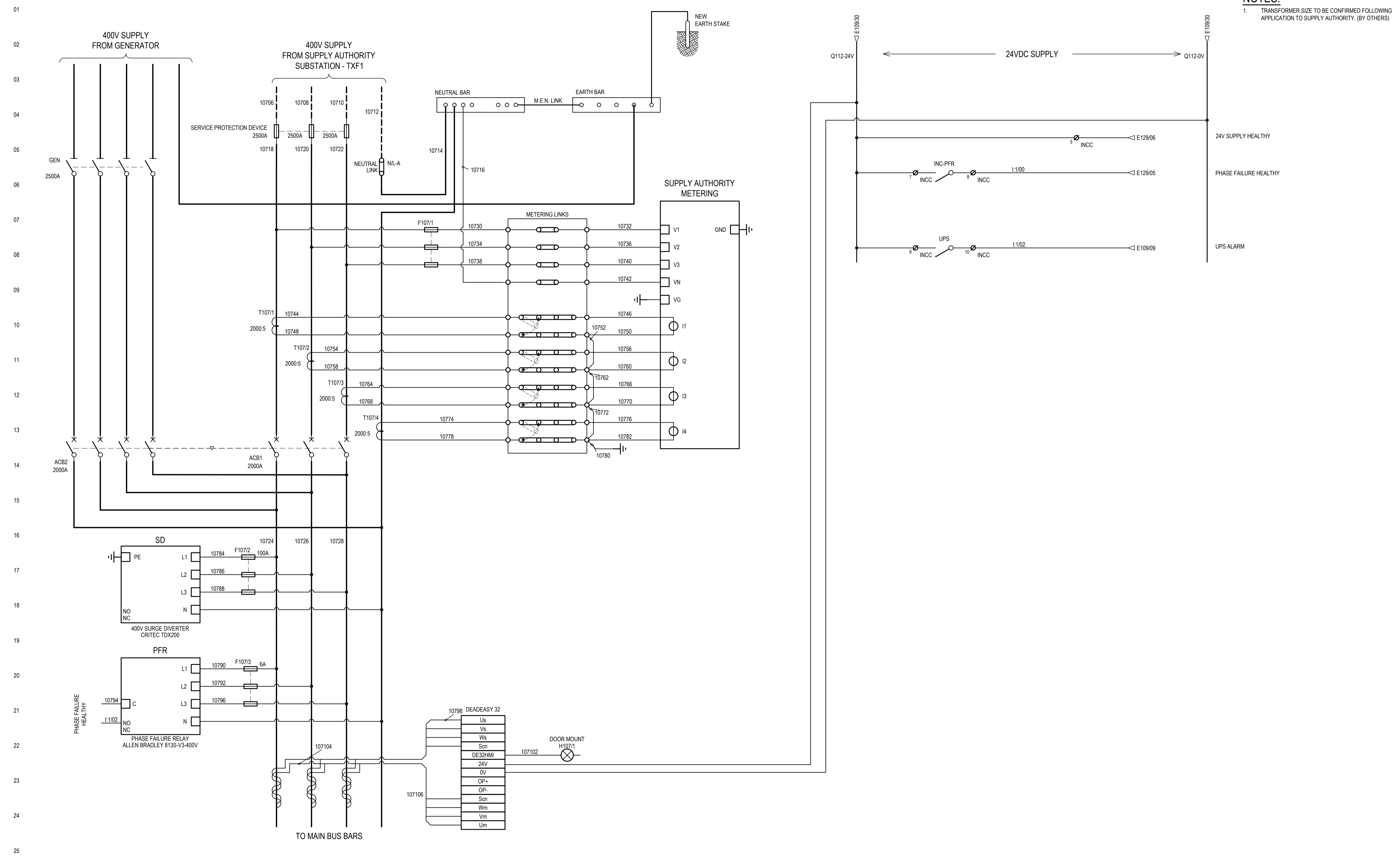
Project No. 12589773

Client **PARKES SHIRE COUNCIL**
Project **LACHLAN PIPELINE DUPLICATION
DETAIL DESIGN TSS**
Status **PRELIMINARY**

Drawing Title **ELECTRICAL SERVICES
NEW BOOSTER (AKUNA) PUMP STATION
MSB - SINGLE LINE DIAGRAM**
Drawing No. **12589773-E106**
Rev **A**

Size **A1**

NOTES:
 1. TRANSFORMER SIZE TO BE CONFIRMED FOLLOWING APPLICATION TO SUPPLY AUTHORITY. (BY OTHERS)



Rev	Description	Checked	Approved	Date
A	80% DETAILED DESIGN	RJ	NM	16.10.23

Author: B.SNEESBY Drafting Check: A.COOMBER*
 Designer: D.EDSER Design Check: G.BIERNAT*

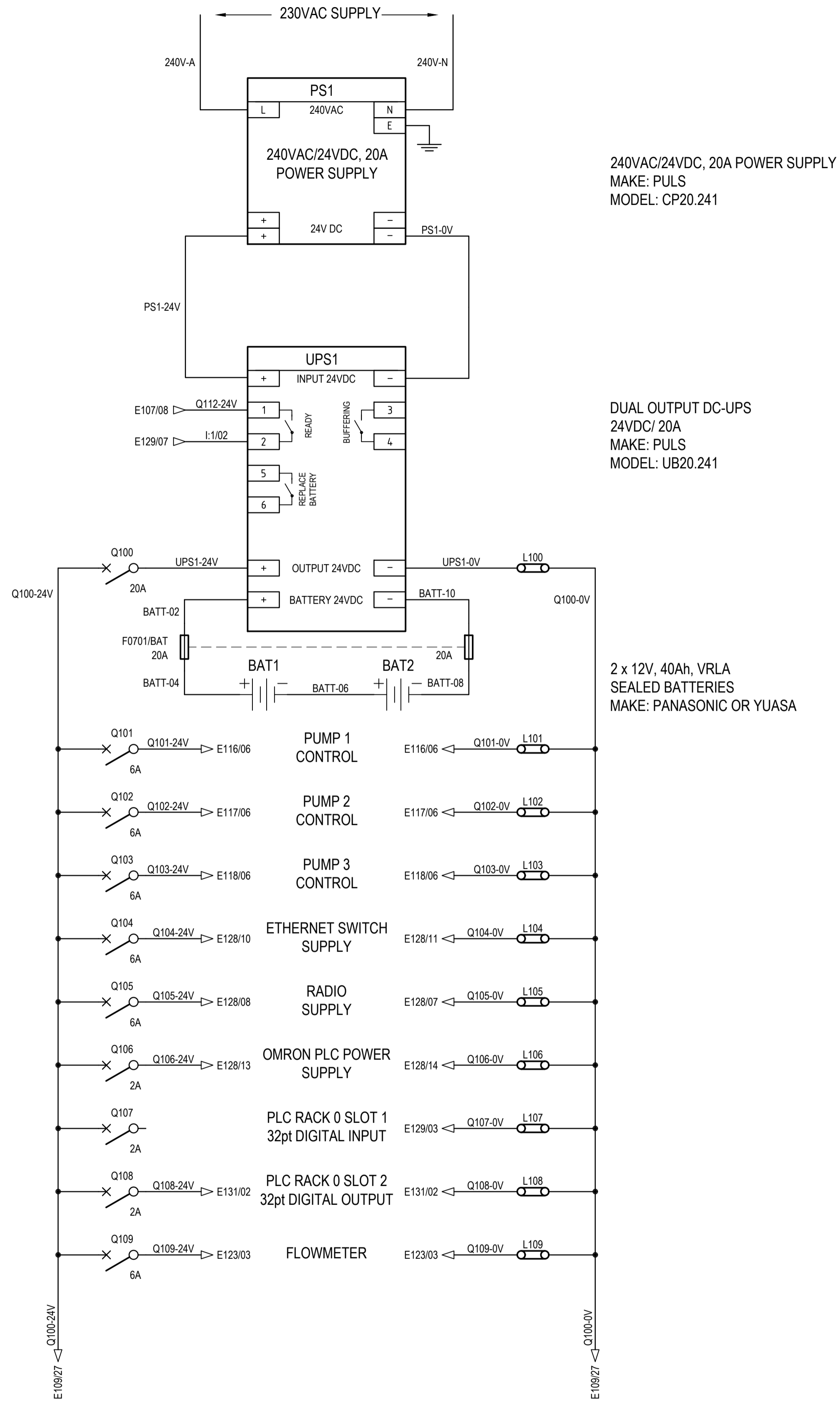
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Project No. 12589773
 Status: PRELIMINARY

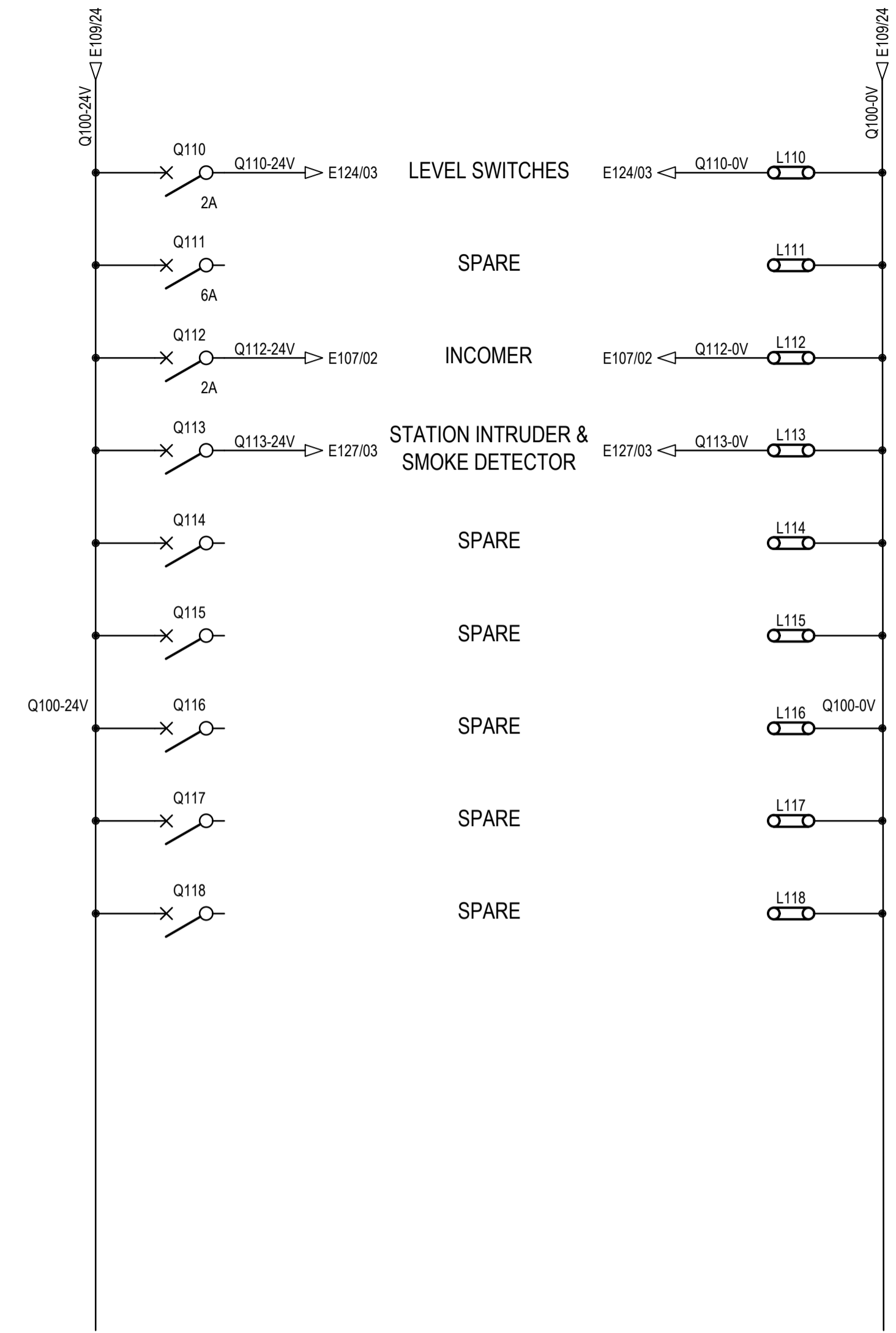
Client: PARKES SHIRE COUNCIL
 Project: LACHLAN PIPELINE DUPLICATION
 DETAIL DESIGN TSS
 Status: PRELIMINARY

Drawing Title: ELECTRICAL SERVICES
 NEW BOOSTER (AKUNA) PUMP STATION
 MSB INCOMER
 SCHEMATIC DIAGRAM
 Drawing No. 12589773-E107
 Rev A

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NOTES:

- UPS ALARM OUTPUT TO BE CONFIGURED FOR ALARM CONDITIONS 'BATTERY LOW - STATE OF CHARGE' AND 'BATTERY LOW - BATTERY VOLTAGE'. RELAY CONTACT TO BE SET ACTIVE LOW TO INDICATE BATTERY LOW.

Rev	Description	Checked	Approved	Date
A	80% DETAILED DESIGN	RJ	NM	16.10.23

Author: B.SNEESBY Drafting Check: A.COOMBER*
Designer: D.EDSER Design Check: G.BIERNAT*

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Project No. 12589773

Client: **PARKES SHIRE COUNCIL**

Project: **LACHLAN PIPELINE DUPLICATION
DETAIL DESIGN TSS**

Status: **PRELIMINARY**

Drawing Title: **ELECTRICAL SERVICES
NEW BOOSTER (AKUNA) PUMP STATION
24VDC CONTROL POWER SUPPLY
SINGLE LINE DIAGRAM**

Drawing No. 12589773-E109

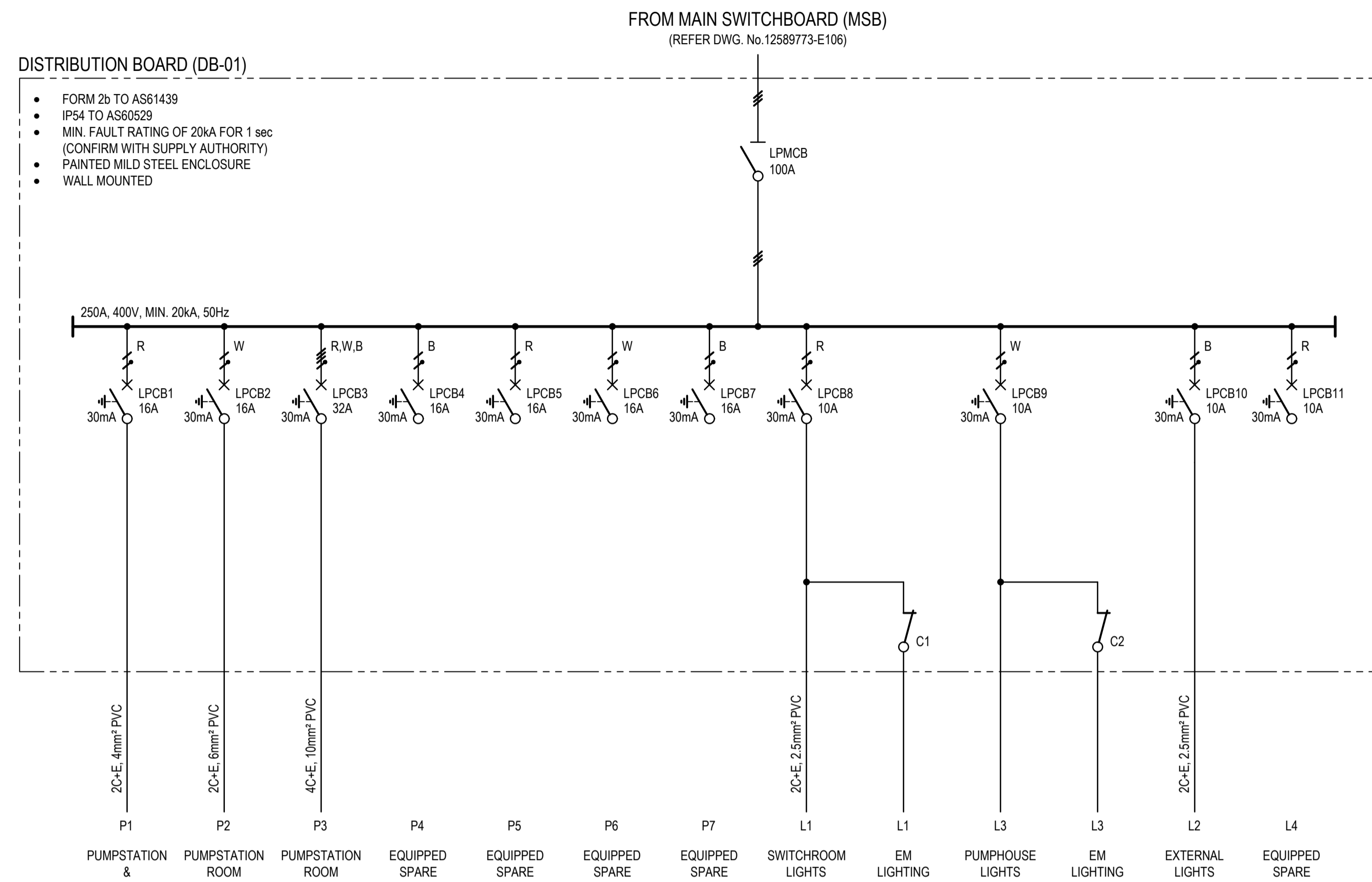
Size: **A1**

Rev: **A**

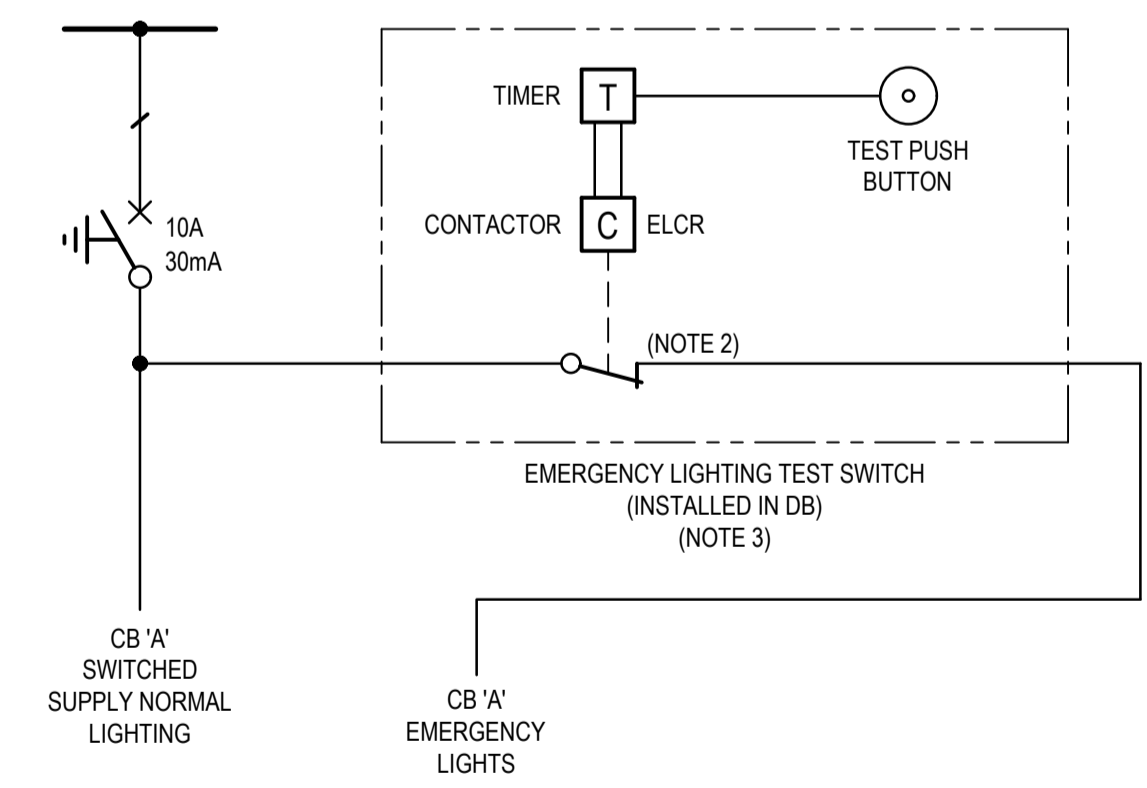
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NOTES:

1. ENSURE LOADS ARE BALANCED ACROSS ALL PHASES.
2. No. OF POLES TO SUIT No. OF SWITCHED CIRCUITS.
3. ALL EMERGENCY & EXIT LIGHTING SHALL BE POWERED FROM THE NEAREST RESPECTIVE LIGHT CIRCUIT VIA EMERGENCY TEST CIRCUIT LOCATED WITHIN THE RESPECTIVE DISTRIBUTION BOARD & INSTALLED IN COMPLIANCE WITH AS/NZS2293.1.
4. PROVIDE A PROPRIETY EMERGENCY LIGHTING TEST SWITCH WITH KEYED ACTIVATION AND AUTOMATIC TIMER, AS PER AS/NZS 2293.1:2018.
5. ALL SINGLE PHASE RCD'S TO BE SINGLE POLE.

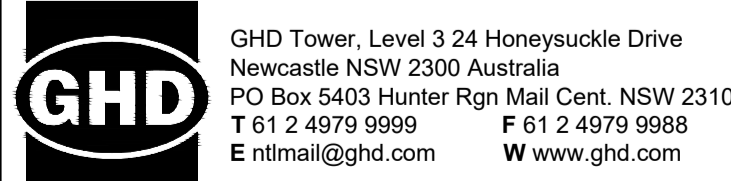


DISTRIBUTION BOARD (DB-01) - SINGLE LINE DIAGRAM
NOT TO SCALE



TYPICAL EMERGENCY LIGHTING & TEST CIRCUIT
NOT TO SCALE

Rev	Description	Checked	Approved	Date
A	80% DETAILED DESIGN	RJ	NM	16.10.23
Author	B.SNEESBY	Drafting Check	A.COOMBER*	
Designer	D.EDSER	Design Check	G.BIERNAT*	



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Project No. 12589773

Client **PARKES SHIRE COUNCIL**

Project **LACHLAN PIPELINE DUPLICATION
DETAIL DESIGN TSS**

Status **PRELIMINARY**

Drawing Title **ELECTRICAL SERVICES
NEW BOOSTER (AKUNA) PUMP STATION
DISTRIBUTION BOARD (DB-01)
SINGLE LINE DIAGRAM**

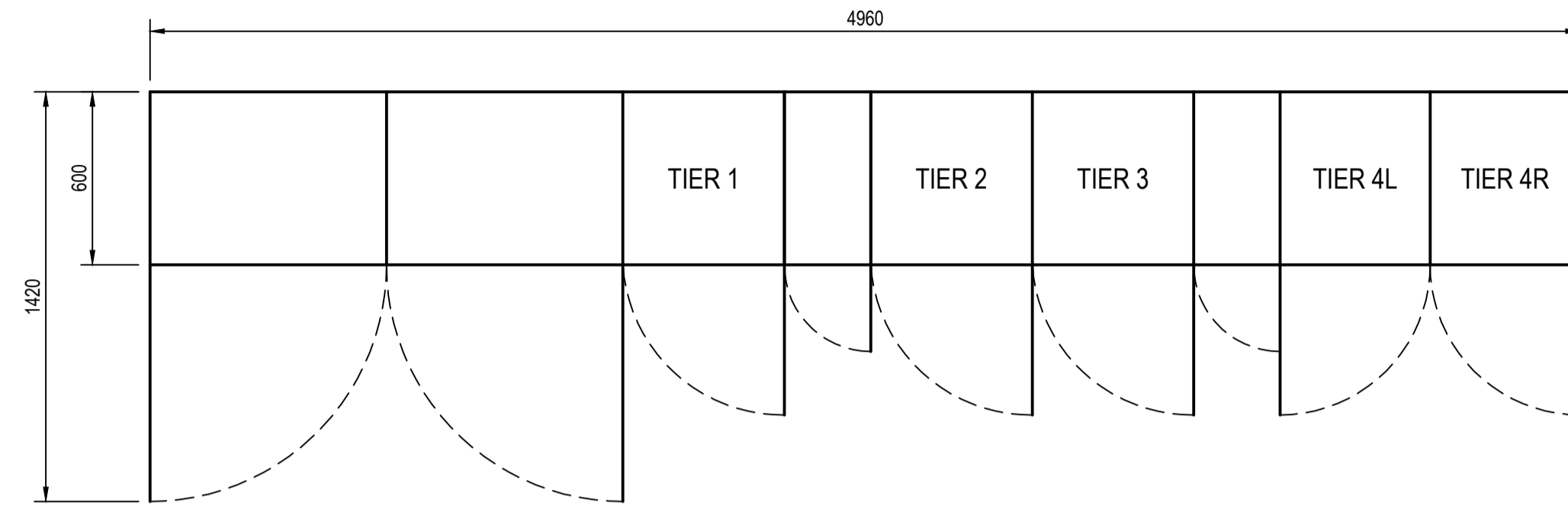
Size **A1**

Rev **A**

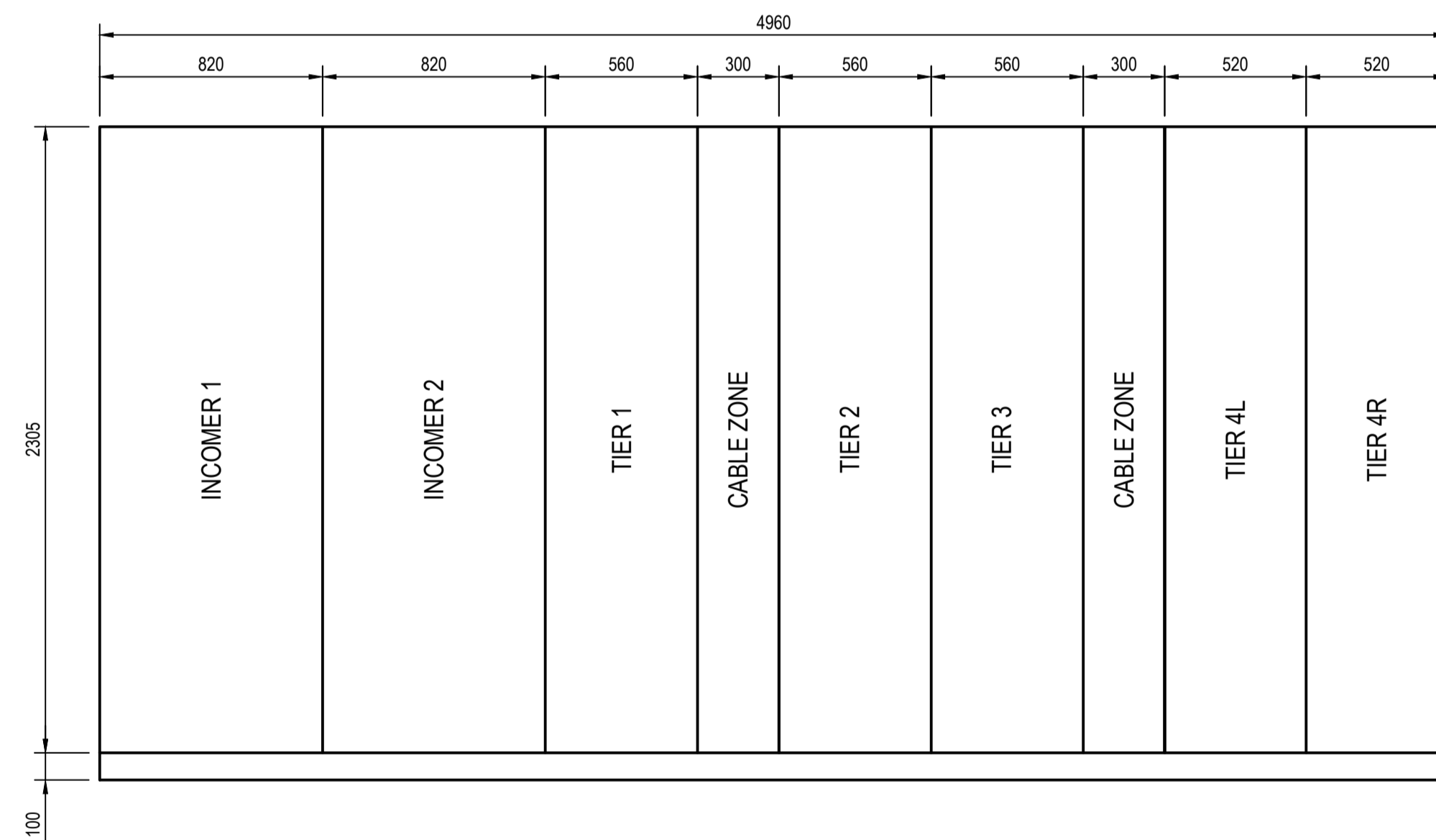
Drawing No. 12589773-E110

NOTES:

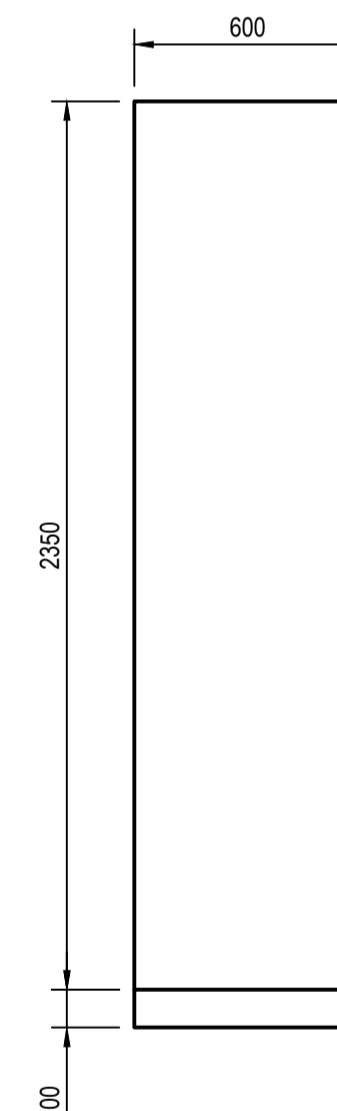
- CABLE ENTRY IS AT BOTTOM OF MSB.
- BUSBAR IS AT TOP OF MSB.
- AN INDICATIVE MSB LAYOUT IS SHOWN BASED ON THE SINGLE LINE DIAGRAM.
- ARC FLASH DISCHARGE DUCTS TO BE PROVIDED ON TOP OF THE SWITCHGEAR PANELS DIRECTING OUTSIDE THE BUILDING.
- PANELS TO BE LOCKABLE WITH A PADLOCK & BY INTERLOCKING ARRANGEMENT - DOORS HINGED WITH LIFT OFF FACILITY.
- NAMING AND NUMBERING OF EQUIPMENT, PANELS AND LOCATIONS TO MEET ENERGY AUTHORITY AND OWNER'S REQUIREMENTS.
- ALL DIMENSIONS ARE IN MILLIMETRES (mm) AND INDICATIVE ONLY. FINAL DIMENSIONS TO BE CONFIRMED DURING THE DETAILED DESIGN.



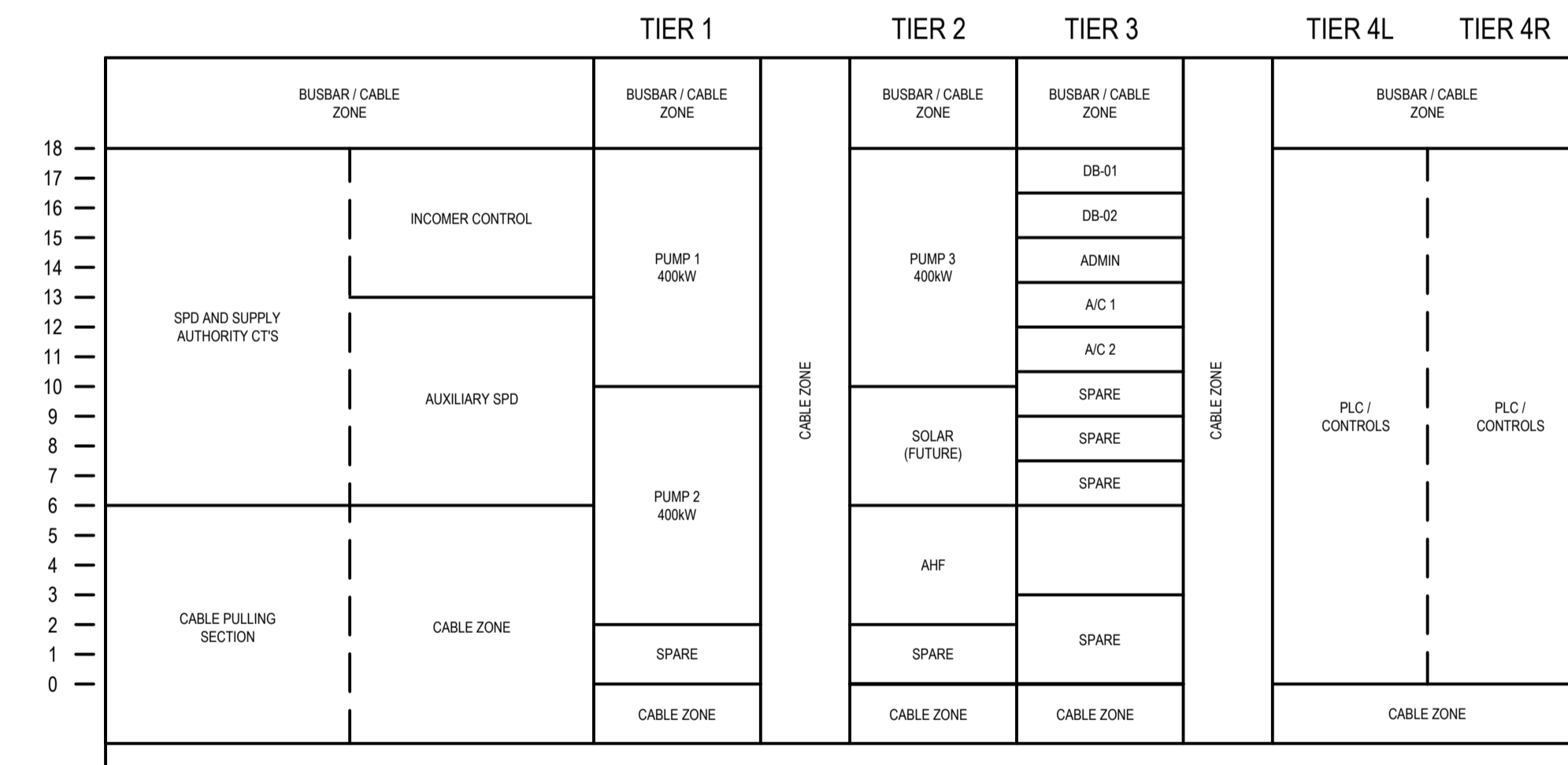
TOP VIEW (MSB)
SCALE 1 : 20



FRONT VIEW (MSB SECTIONS)
SCALE 1 : 20



RIGHT SIDE VIEW
SCALE 1 : 20



FRONT VIEW (MSB CELL LAYOUT)
SCALE 1 : 20

Rev	Description	Checked	Approved	Date
A	80% DETAILED DESIGN	RJ	NM	16.10.23
Author	B.SNEESBY	Drafting Check	A.COOMBER*	
Designer	D.EDSER	Design Check	G.BIERNAT*	



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Project No.
12589773

Client PARKES SHIRE COUNCIL

Project LACHLAN PIPELINE DUPLICATION
DETAIL DESIGN TSS

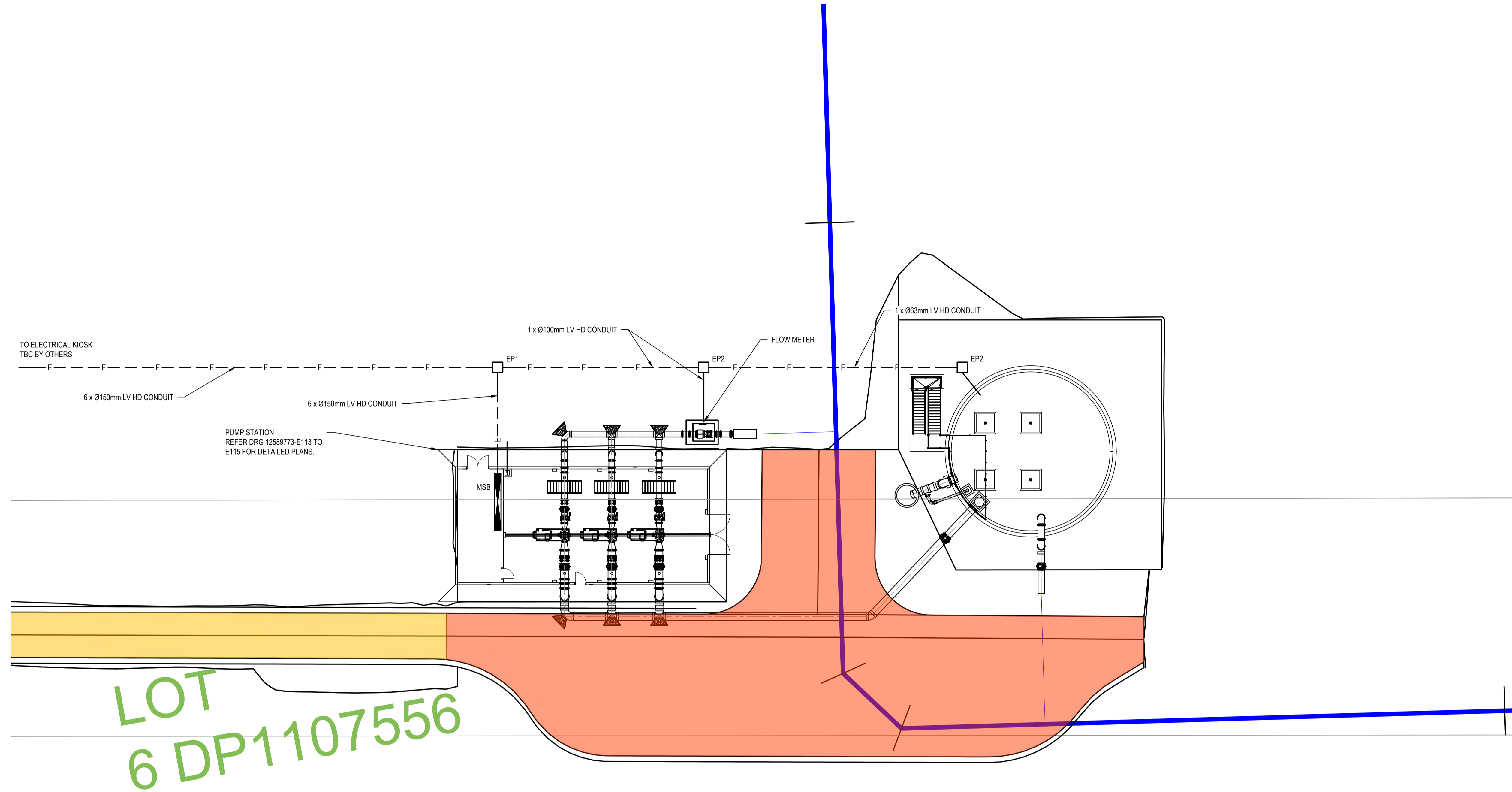
Status PRELIMINARY

Drawing Title
ELECTRICAL SERVICES
NEW BOOSTER (AKUNA) PUMP STATION
MSB
GENERAL ARRANGEMENT

Size
A1

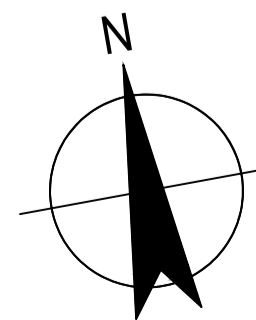
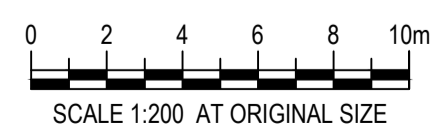
Rev
A

Drawing No.
12589773-E111



ELECTRICAL SITE PLAN
SCALE 1 : 200

Rev	Description	Checked	Approved	Date
A	80% DETAILED DESIGN	RJ	NM	16.10.23
Author	B.SNEESBY	Drafting Check	A.COOMBER*	
Designer	D.EDSER	Design Check	G.BIERNAT*	



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Project No.
12589773

Client	PARKES SHIRE COUNCIL
Project	LACHLAN PIPELINE DUPLICATION DETAIL DESIGN TSS
Status	PRELIMINARY

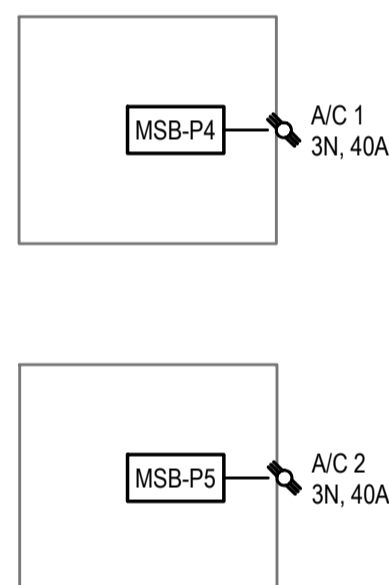
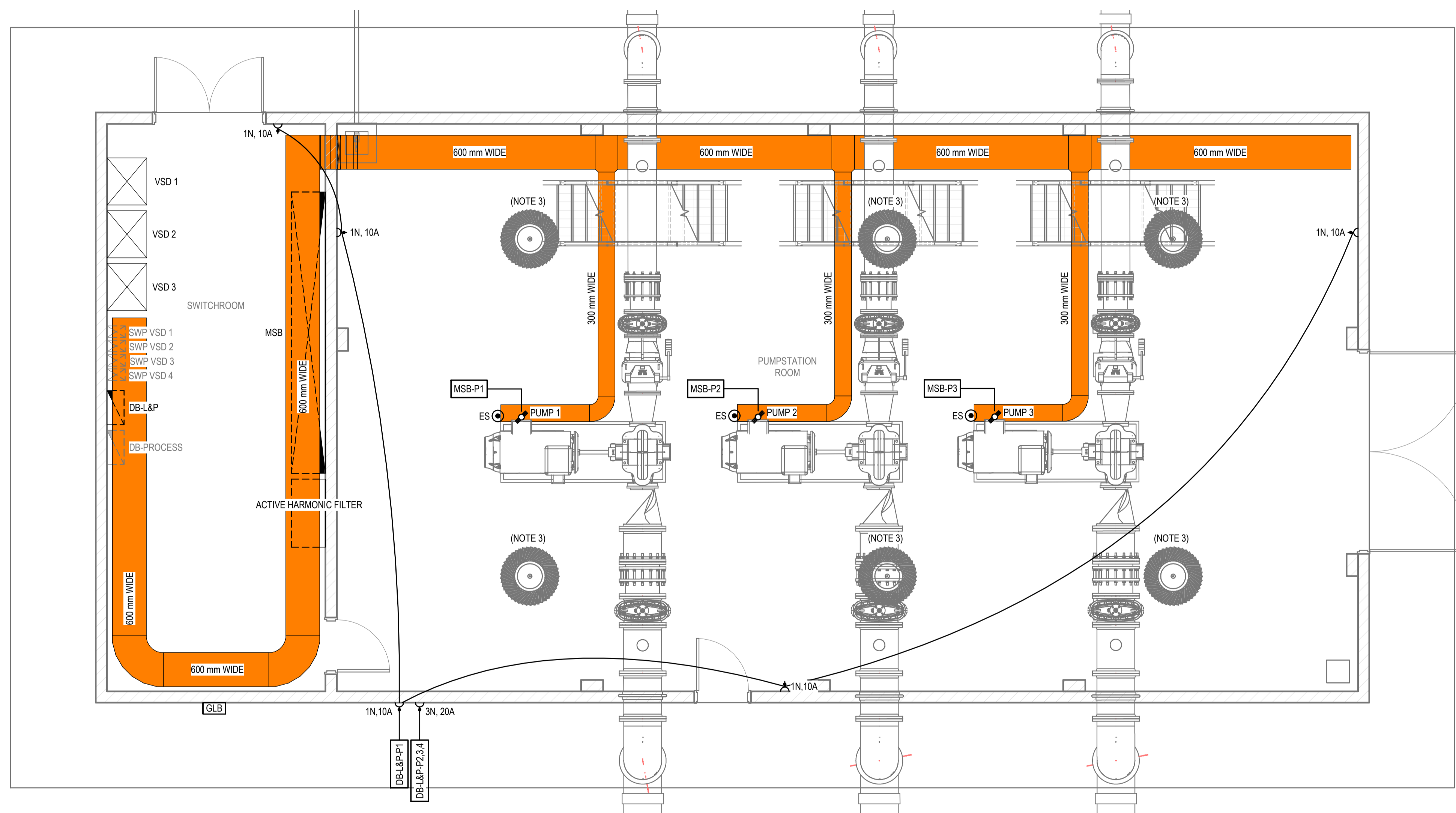
Drawing Title
ELECTRICAL SERVICES
NEW BOOSTER (AKUNA) PUMP STATION
ELECTRICAL SITE PLAN

Drawing No.
12589773-E112

Size
A1
Rev
A

NOTES:

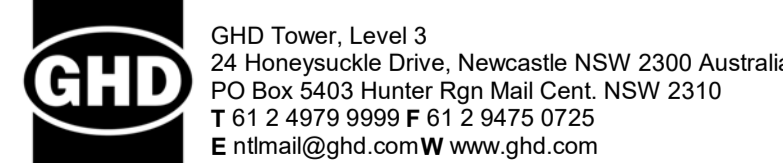
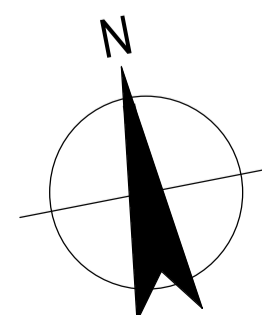
1. ELECTRICAL INSTALLATION SHALL COMPLY WITH AS/NZS 3000, AS 3008, AS/NZS 61439 AND NSW SERVICE AND INSTALLATION RULES.
2. ALL POWER OUTLETS SHALL BE FED FROM DEDICATED CIRCUITS. REFER TO SINGLE LINE DIAGRAMS.
3. COORDINATE LOCATION OF POWER FOR HVAC UNITS WITH DETAILED HVAC DESIGN DRAWINGS. POWER TO BE FED FROM DB-01-P2.
4. FINAL LOCATIONS OF ELECTRICAL EQUIPMENT, POWER SUPPLIES AND ISOLATORS SHALL BE ADJUSTED DURING CONSTRUCTION TO AVOID CONFLICTS.
5. FINAL LOCATIONS OF ELECTRICAL EQUIPMENT, POWER SUPPLIES AND ISOLATORS SHALL BE COORDINATED DURING CONSTRUCTION.



POWER & COMMUNICATIONS LAYOUT

SCALE 1:50

Rev	Description	Checked	Approved	Date
A	80% DETAILED DESIGN	RJ	NM	16.10.23
Author	A.COOMBER	Drafting Check	A.COOMBER*	
Designer	D.EDSER	Design Check	G.BIERNAT*	



Project No.
12589773

Client	PARKES SHIRES COUNCIL
Project	LACHLAN PIPELINE DUPLICATION DETAIL DESIGN TSS
Status	PRELIMINARY

Drawing Title
**ELECTRICAL SERVICES
NEW BOOSTER (AKUNA)
POWER AND COMMUNICATIONS
LAYOUT**

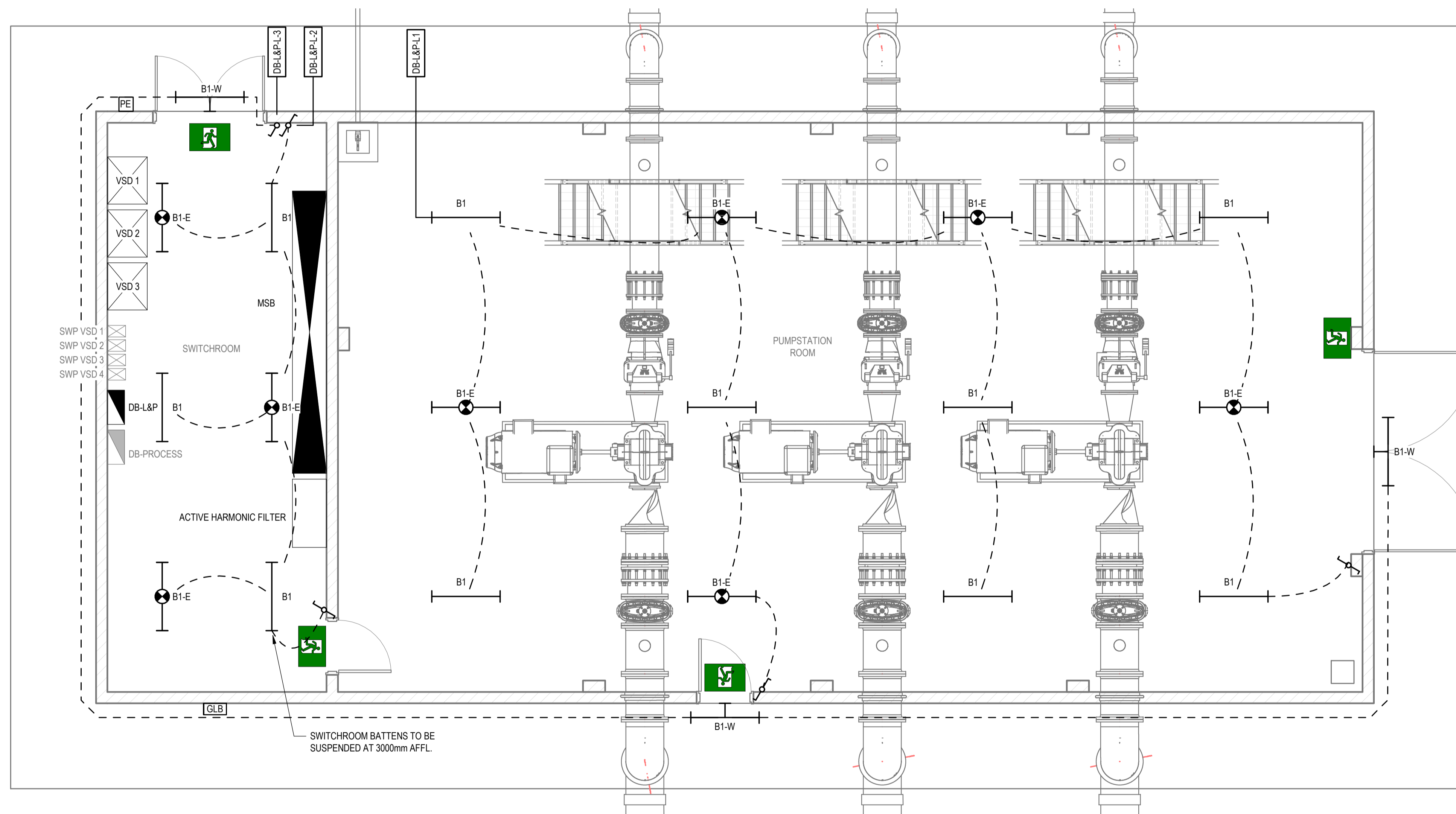
Drawing No.
12589773-E113

Size
A1

Rev
A

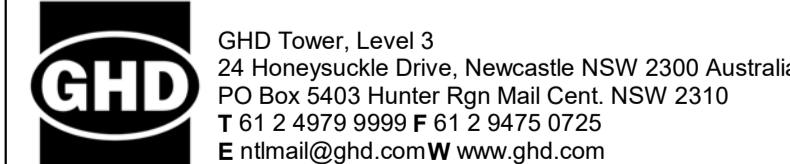
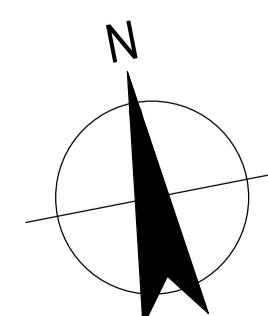
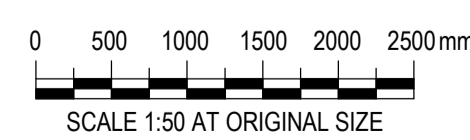
NOTES:

1. LIGHTING DESIGN SHALL BE IN ACCORDANCE WITH THE CURRENT REQUIREMENTS OF AS/NZS 1680.2.1 AND AS/NZS 1680.2.4.
2. EMERGENCY EGRESS LIGHTING AND EXIT SIGNS SHALL BE IN ACCORDANCE WITH AS/NZS2293 AND POWERED FROM THE INDICATED LIGHTING CIRCUIT.
3. LAMPS OF SIMILAR TYPES SHALL BE OF THE SAME COLOUR TEMPERATURE AND BATCH UNLESS OTHERWISE INDICATED.
4. CONFIRM THE FINAL LOCATIONS OF THE LIGHT FITTINGS DURING CONSTRUCTION.
5. EXTERNAL AREA LIGHTING TO BE CONTROLLED BY A SEPARATE SWITCH AS SHOWN.
6. PROVIDE EMERGENCY LIGHTING TEST CIRCUIT AS PER AS/NZS 2293.2018. REFER TO SINGLE LINE DIAGRAMS FOR DETAILS.



LIGHTING LAYOUT
SCALE 1:50

Rev	Description	Checked	Approved	Date
A	80% DETAILED DESIGN	RJ	NM	16.10.23
Author	A.COOMBER	Drafting Check	A.COOMBER*	
Designer	D.EDSER	Design Check	G.BIERNAT*	



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Project No.
12589773

Client	PARKES SHIRES COUNCIL
Project	LACHLAN PIPELINE DUPLICATION DETAIL DESIGN TSS
Status	PRELIMINARY

Drawing Title
**ELECTRICAL SERVICES
NEW BOOSTER (AKUNA)
LIGHTING LAYOUT**

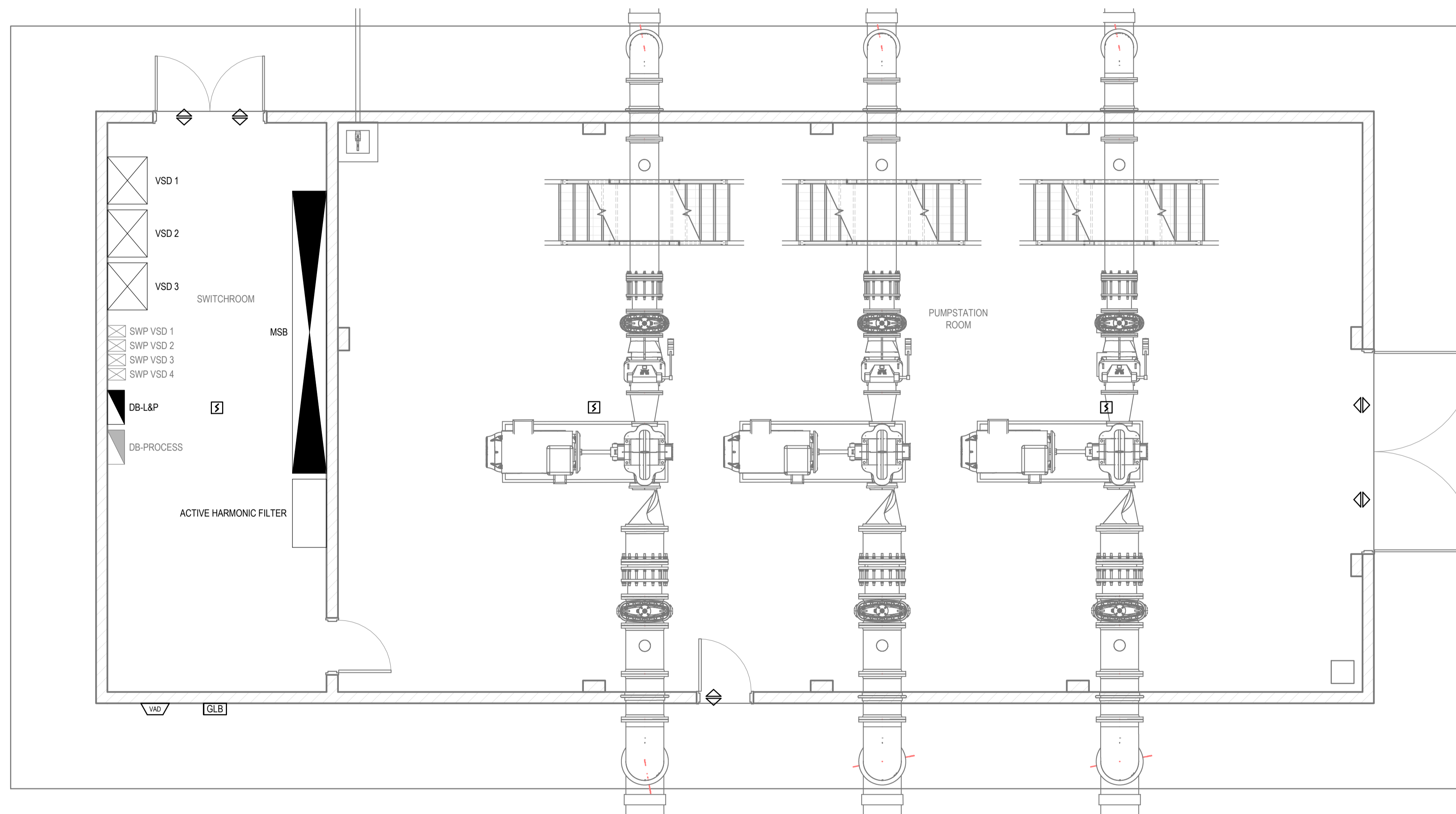
Status Code
12589773-E114

Size
A1

Rev
A

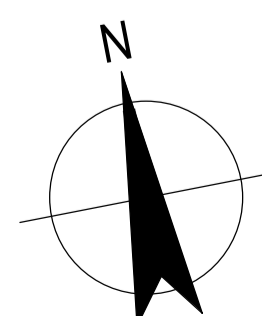
NOTES:

1. ALL FIRE SERVICES SHALL BE IN ACCORDANCE WITH THE CURRENT REQUIREMENTS OF THE BUILDING CODE OF AUSTRALIA AND AS1670 SERIES.
2. CONTRACTOR SHALL SUPPLY AND INSTALL ALARM SOUNDERS COMPLIANT TO AS1670.1.
3. FIRE SYSTEM DESIGNER SHALL COORDINATE WITH MECHANICAL SERVICES DESIGNER TO COMPLETE HVAC & SMOKE CONTROL SYSTEM.
4. ALL CABLING TO AND FROM THE FIRE SYSTEM EQUIPMENT SHALL BE FIRE RATED AND BE COLOURED IN ACCORDANCE WITH APPLICABLE AUSTRALIAN STANDARDS.
5. FIRE SYSTEM DESIGNER TO CONFIRM ON SITE THE FINAL LOCATION OF FIRE SERVICES DEVICES.
6. FIRE SERVICES WIRING SHALL BE INSTALLED IN 20mm HD UPVC WHITE CONDUITS AND FITTINGS.
7. PROVIDE FIRE BRIGADE CALL POINT & BACK TO BASE OWNERS MAIN COMMUNICATION FACILITY. THE LOCATION OF THE FLASHING LIGHT IS NOT SHOWN AND TO BE DETERMINED IN CONSULTATION WITH FIRE BRIGADE & OWNER.
8. PROVIDE DIGITAL INPUT FROM DOOR SWITCHES TO PLC FOR SECURITY MONITORING.
9. DOOR SWITCHES TO BE SCHNEIDER XCKD214SP16.



FIRE DETECTION & SECURITY LAYOUT
SCALE 1:50

Rev	Description	Checked	Approved	Date
A	80% DETAILED DESIGN	RJ	NM	16.10.23
Author	A.COOMBER	Drafting Check	A.COOMBER*	
Designer	D.EDSER	Design Check	G.BIERNAT*	



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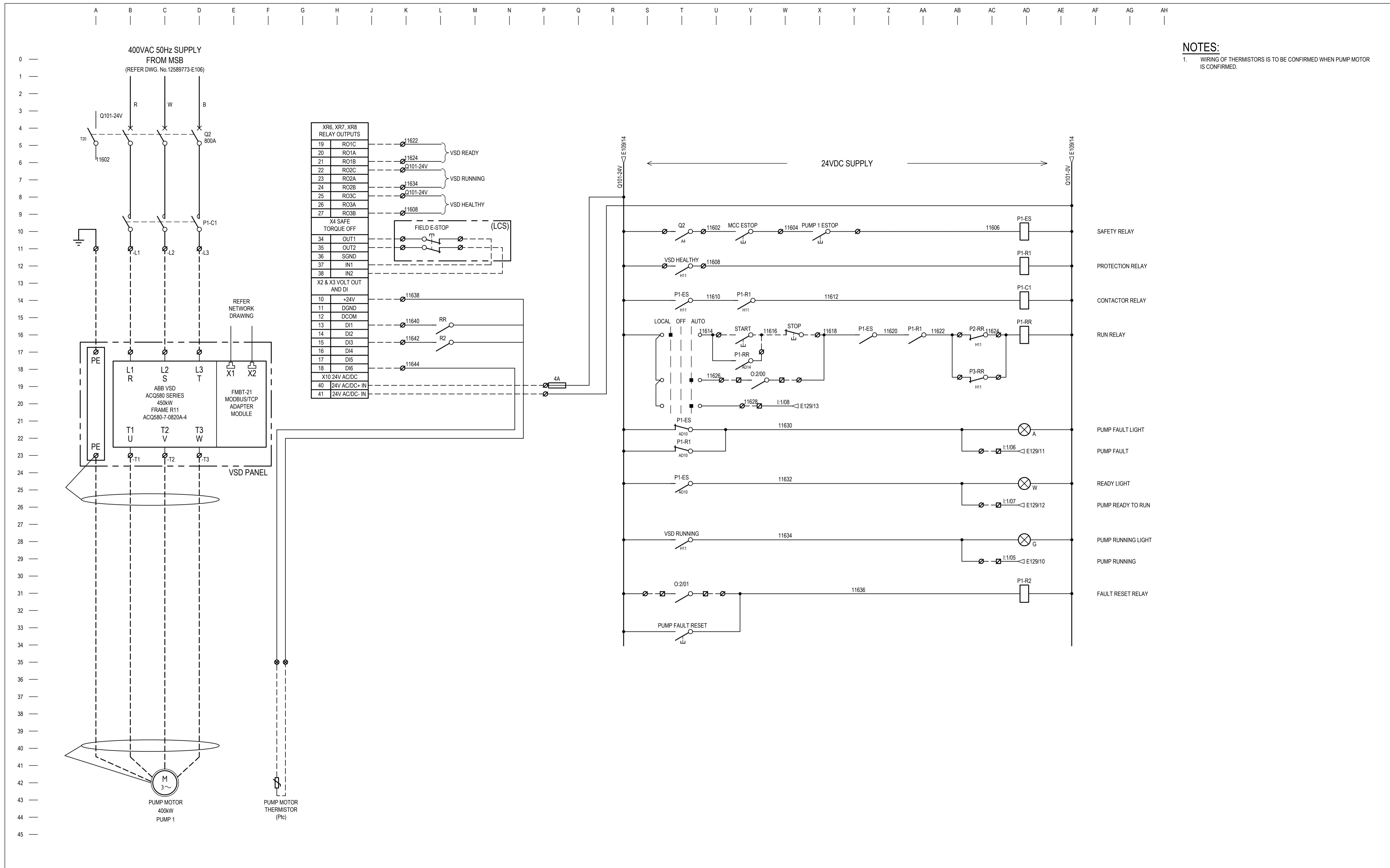
Project No.
12589773

Client **PARKES SHIRES COUNCIL**
Project **LACHLAN PIPELINE DUPLICATION
DETAIL DESIGN TSS**
Status **PRELIMINARY**

Drawing Title
**ELECTRICAL SERVICES
NEW BOOSTER (AKUNA)
FIRE AND SECURITY LAYOUT**

Drawing No.
12589773-E115

Size
A1
Rev
A



NOTES:
1. WIRING OF THERMISTORS IS TO BE CONFIRMED WHEN PUMP MOTOR IS CONFIRMED.

Rev	Description	Checked	Approved	Date
A	80% DETAILED DESIGN	RJ	NM	16.10.23

Author: B.SNEESBY Drafting Check: A.COOMBER*
Designer: D.EDSER Design Check: G.BIERNAT*

Plot Date: 17 October 2023 - 11:54 AM Plotted by: Brock Sneesby

File Name: C:\Users\bsneesby\ACCDocs\GHD Services Pty Ltd\12589773 - Lachlan Pipeline Duplication Detailed Design\01 WIP\01 WIP - Electrical\04 Drawings\12589773-E116.dwg

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Project No. 12589773

Client: **PARKES SHIRE COUNCIL**

Project: **LACHLAN PIPELINE DUPLICATION
DETAIL DESIGN TSS**

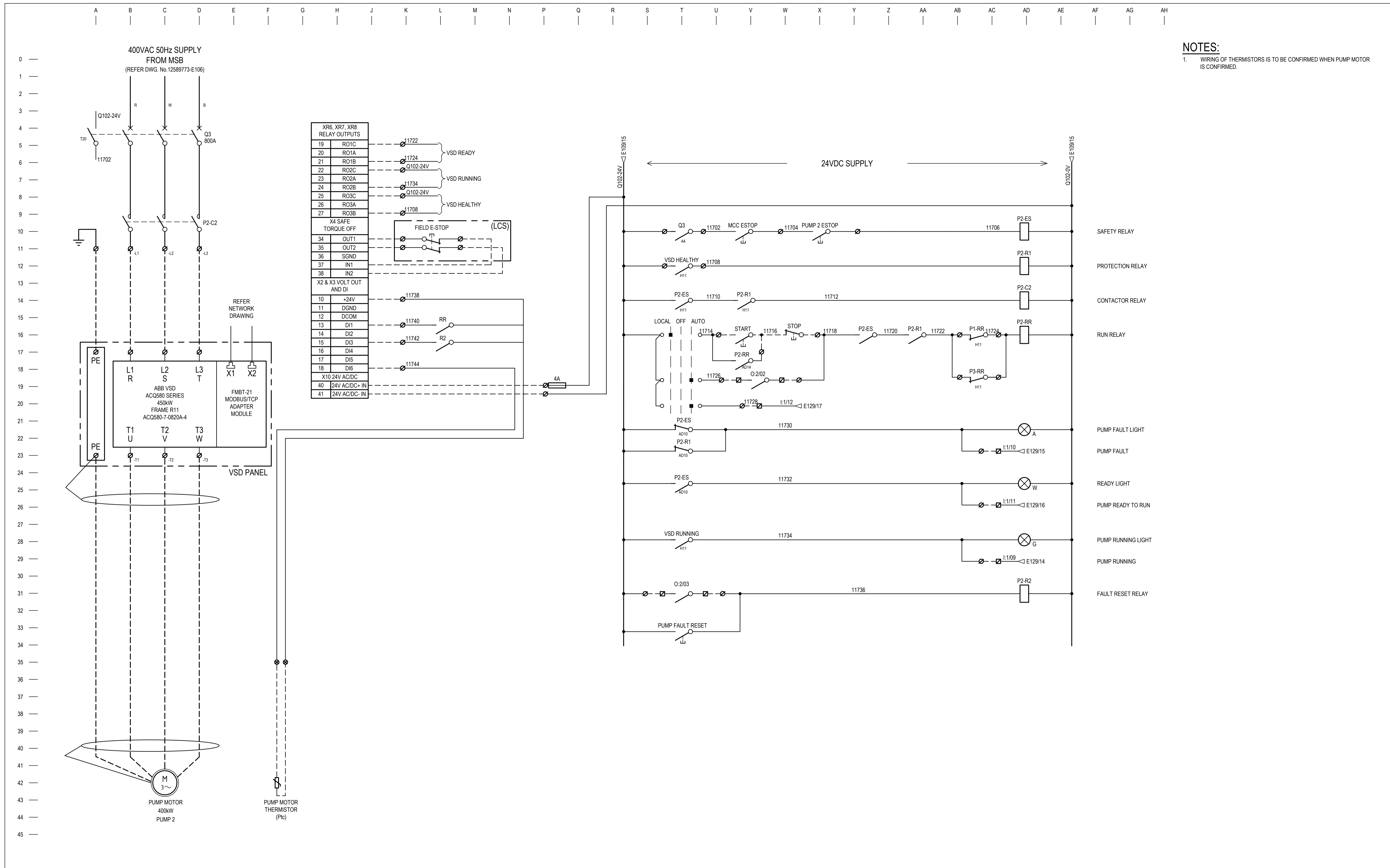
Status: **PRELIMINARY**

Drawing Title: **ELECTRICAL SERVICES
NEW BOOSTER (AKUNA) PUMP STATION
PUMP 1 - SCHEMATIC DIAGRAM**

Drawing No. 12589773-E116

Size: **A1**

Rev: **A**



NOTES:
1. WIRING OF THERMISTORS IS TO BE CONFIRMED WHEN PUMP MOTOR IS CONFIRMED.

Rev	Description	Checked	Approved	Date
A	80% DETAILED DESIGN	RJ	NM	16.10.23

Author: B.SNEESBY Drafting Check: A.COOMBER*
Designer: D.EDSER Design Check: G.BIERNAT*

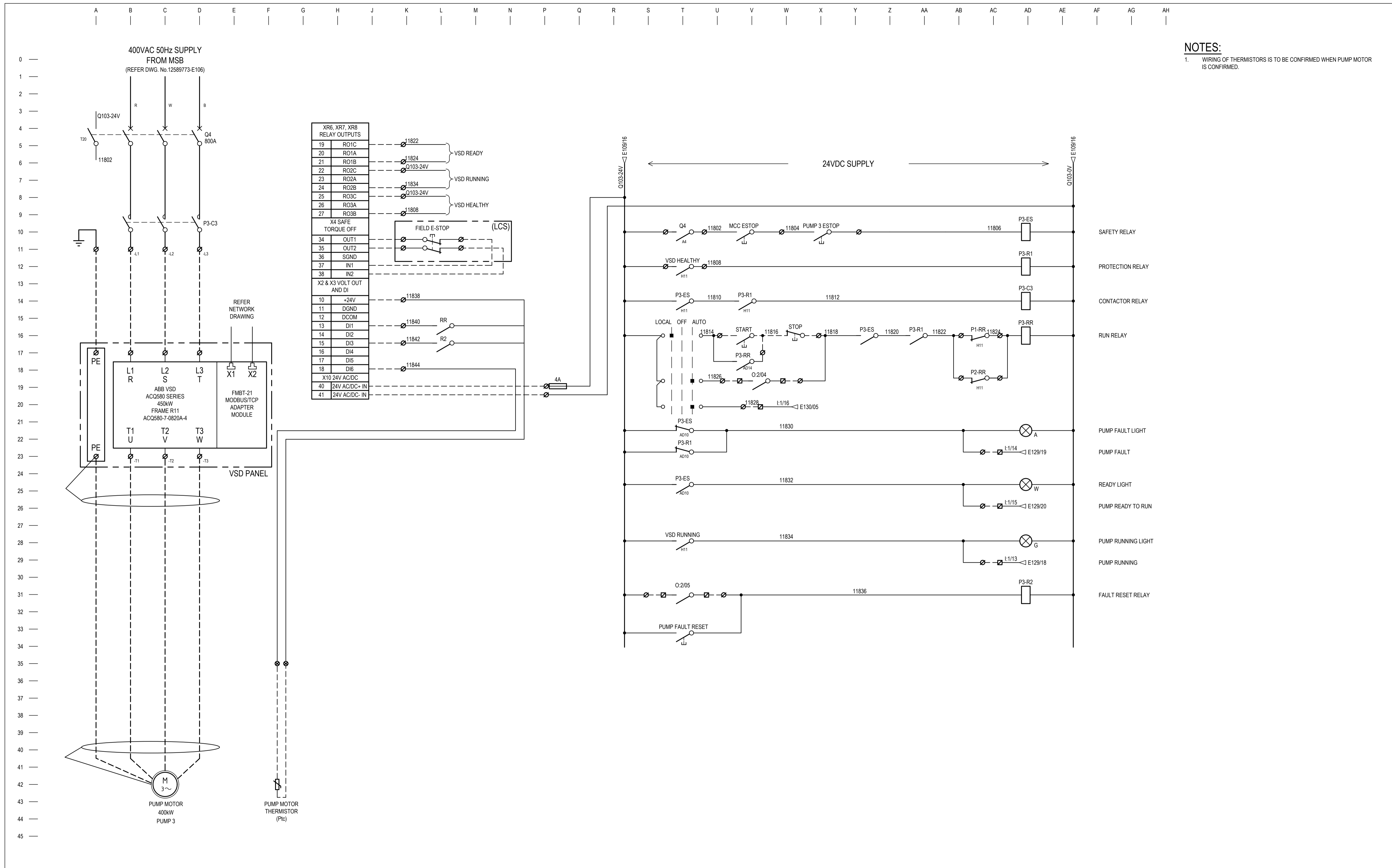
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Client: PARKES SHIRE COUNCIL
Project: LACHLAN PIPELINE DUPLICATION
DETAIL DESIGN TSS
Status: PRELIMINARY

Drawing Title: ELECTRICAL SERVICES
NEW BOOSTER (AKUNA) PUMP STATION
PUMP 2 - SCHEMATIC DIAGRAM
Drawing No.: 12589773-E117
Rev: A

Size: A1
Rev: A



NOTES:
 1. WIRING OF THERMISTORS IS TO BE CONFIRMED WHEN PUMP MOTOR IS CONFIRMED.

Rev	Description	Checked	Approved	Date
A	80% DETAILED DESIGN	RJ	NM	16.10.23

Author: B.SNEESBY Drafting Check: A.COOMBER*
 Designer: D.EDSER Design Check: G.BIERNAT*

File Name: C:\Users\bsneesby\ACCDocs\GHD Services Pty Ltd\12589773 - Lachlan Pipeline Duplication Detailed Design\01 WIP\01 WIP - Electrical\04 Drawings\12589773-E118.dwg

Plot Date: 17 October 2023 - 11:55 AM Plotted by: Brock Sneesby

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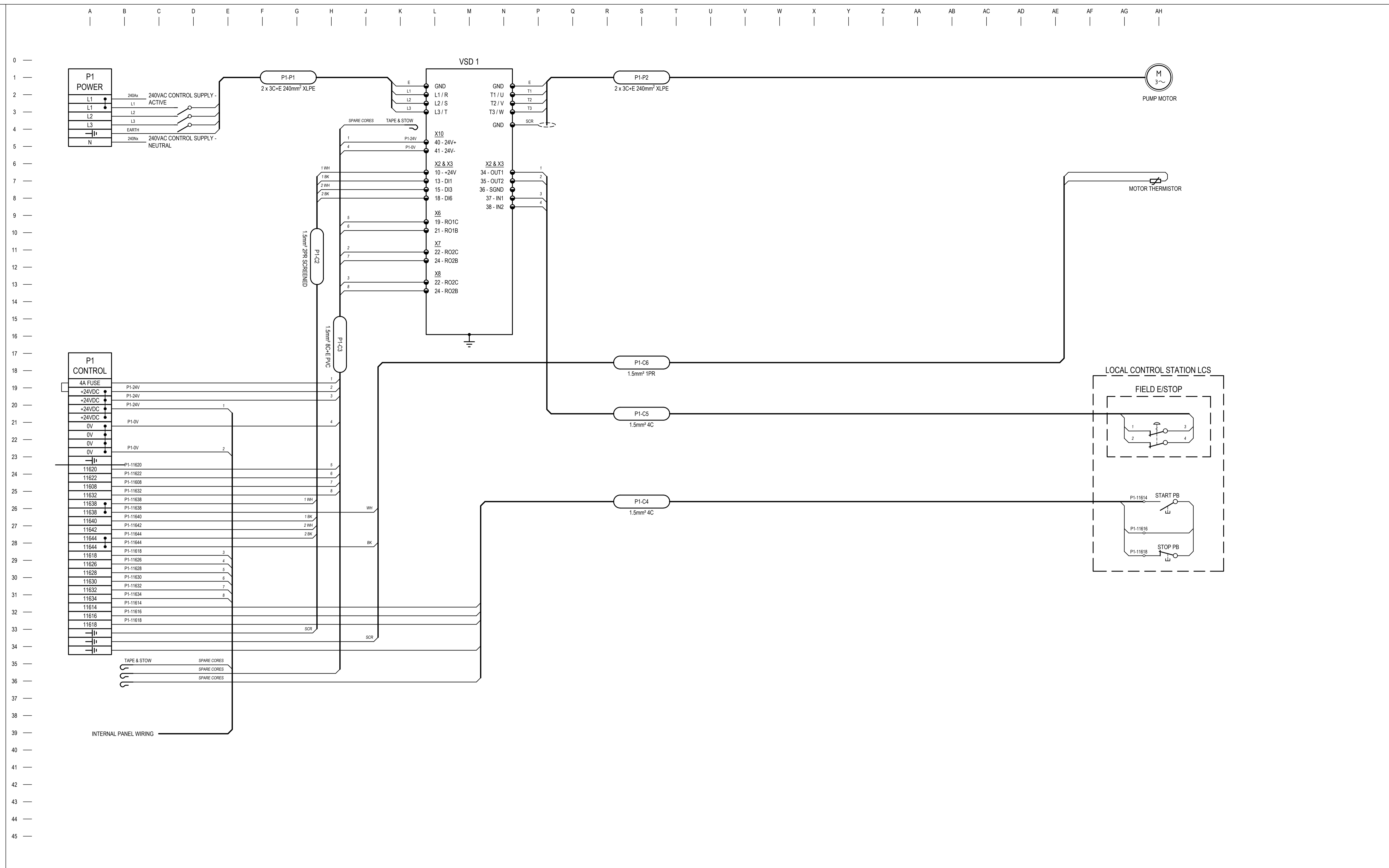
Project No. 12589773

Client: PARKES SHIRE COUNCIL
 Project: LACHLAN PIPELINE DUPLICATION
 DETAIL DESIGN TSS
 Status: PRELIMINARY

Drawing Title: ELECTRICAL SERVICES
 NEW BOOSTER (AKUNA) PUMP STATION
 PUMP 3 - SCHEMATIC DIAGRAM

Project No. 12589773-E118

Size: A1
 Rev: A



Rev	Description	Checked	Approved	Date
A	80% DETAILED DESIGN	RJ	NM	16.10.23

Author: B.SNEESBY Drafting Check: A.COOMBER*
 Designer: D.EDSER Design Check: G.BIERNAT*

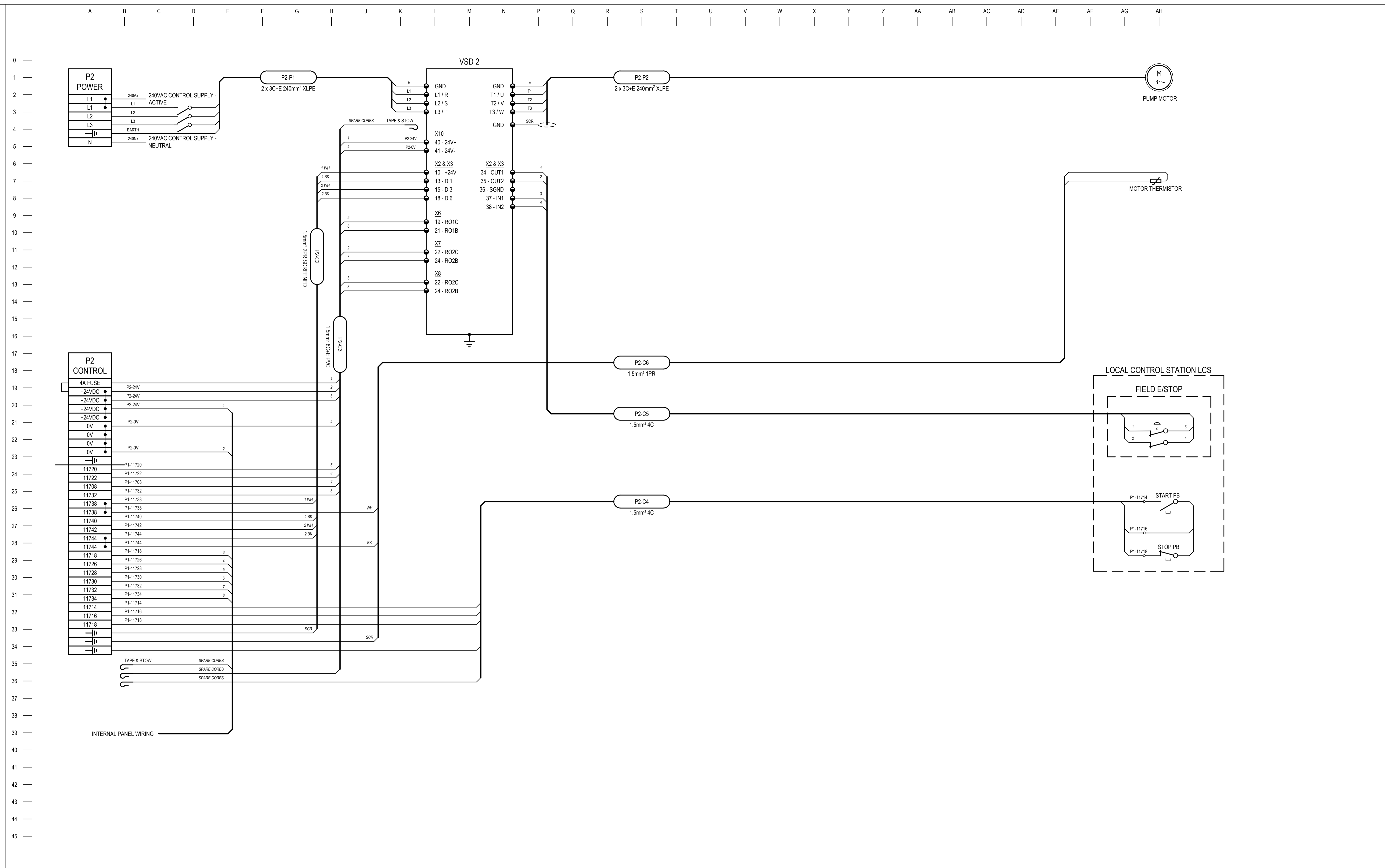
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Project No. 12589773

Client: PARKES SHIRE COUNCIL
 Project: LACHLAN PIPELINE DUPLICATION
 DETAIL DESIGN TSS
 Status: PRELIMINARY

Drawing Title: ELECTRICAL SERVICES
 NEW BOOSTER (AKUNA) PUMP STATION
 PUMP 1 - TERMINATION DIAGRAM
 Drawing No. 12589773-E120
 Rev A



Rev	Description	Checked	Approved	Date
A	80% DETAILED DESIGN	RJ	NM	16.10.23

Author: B.SNEESBY Drafting Check: A.COOMBER*
 Designer: D.EDSER Design Check: G.BIERNAT*

File Name: C:\Users\bsneesby\ACCDocs\GHD Services Pty Ltd\12589773 - Lachlan Pipeline Duplication Detailed Design\01 WIP\01 WIP - Electrical\04 Drawings\12589773-E121.dwg

Plot Date: 17 October 2023 - 11:56 AM Plotted by: Brock Sneesby

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Project No. 12589773

Client: PARKES SHIRE COUNCIL

Project: LACHLAN PIPELINE DUPLICATION
 DETAIL DESIGN TSS

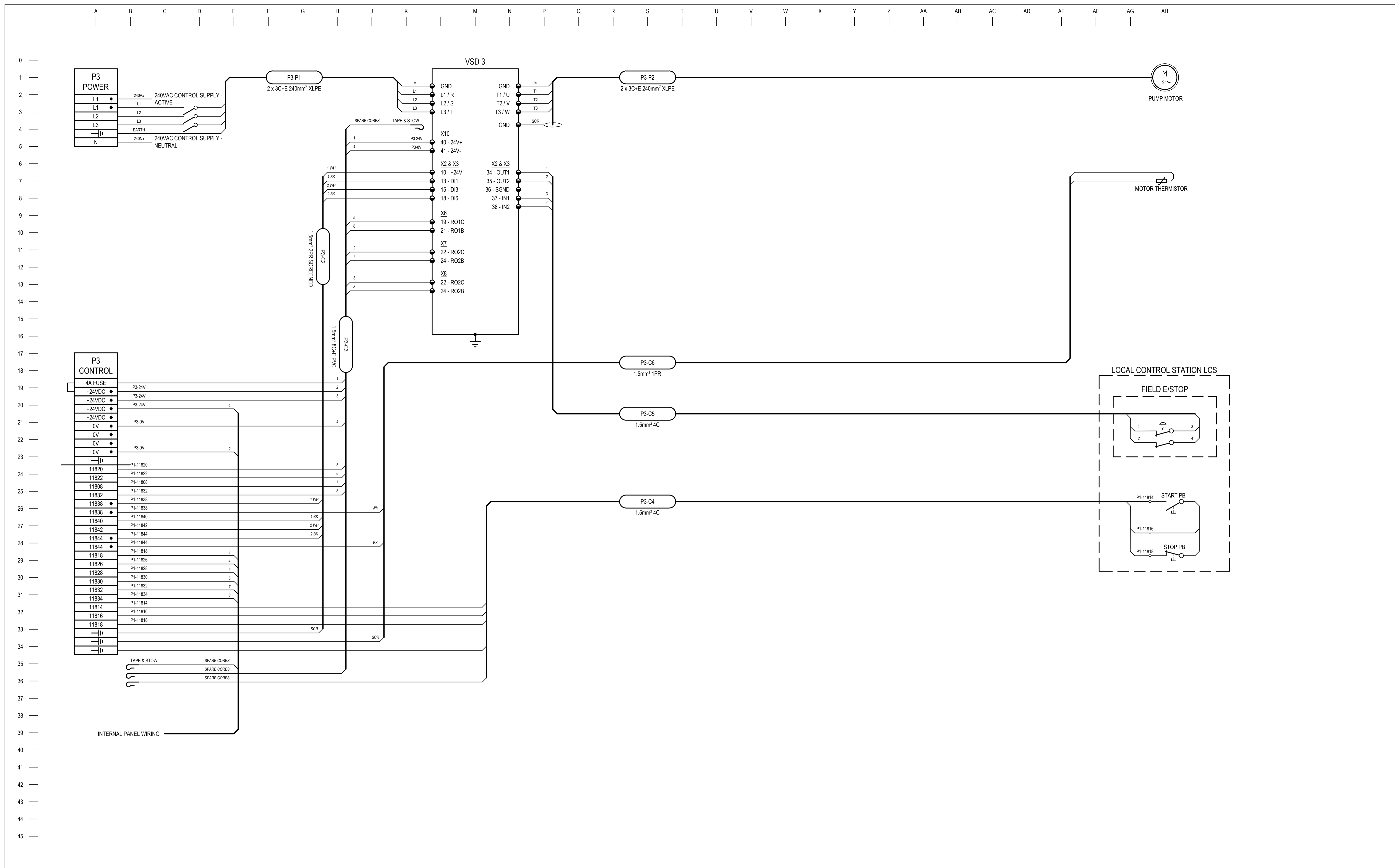
Status: PRELIMINARY

Drawing Title: ELECTRICAL SERVICES
 NEW BOOSTER (AKUNA) PUMP STATION
 PUMP 2 - TERMINATION DIAGRAM

Drawing No. 12589773-E121

Size: A1

Rev: A



Rev	Description	Checked	Approved	Date
A	80% DETAILED DESIGN	RJ	NM	16.10.23

Author: B.SNEESBY Drafting Check: A.COOMBER*
 Designer: D.EDSER Design Check: G.BIERNAT*

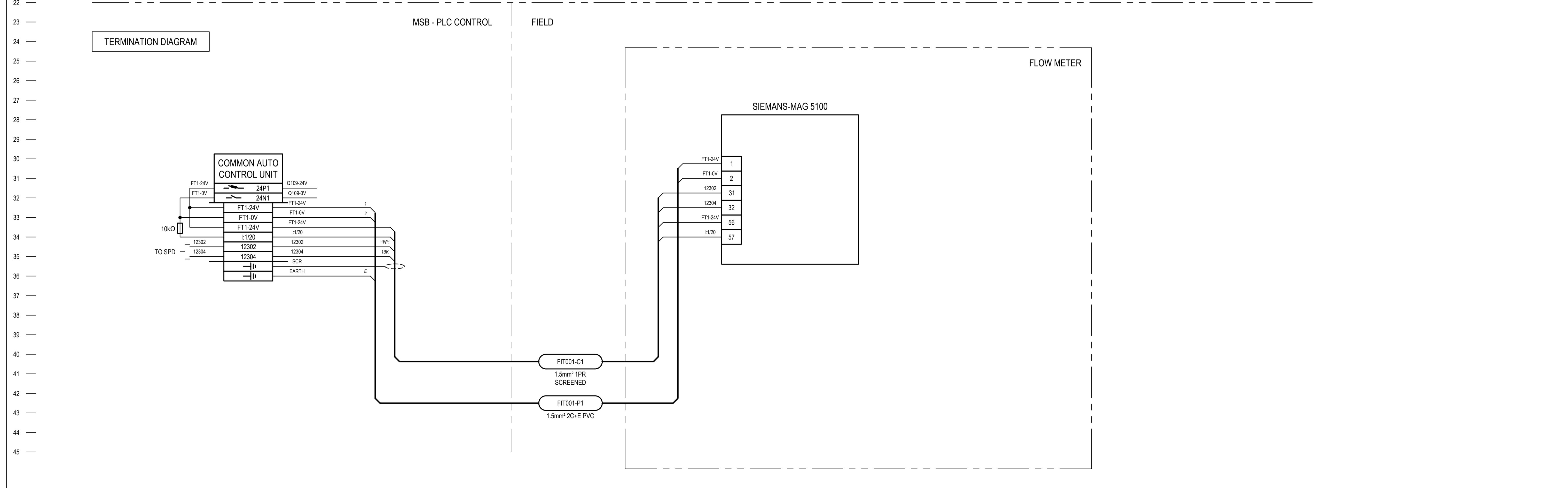
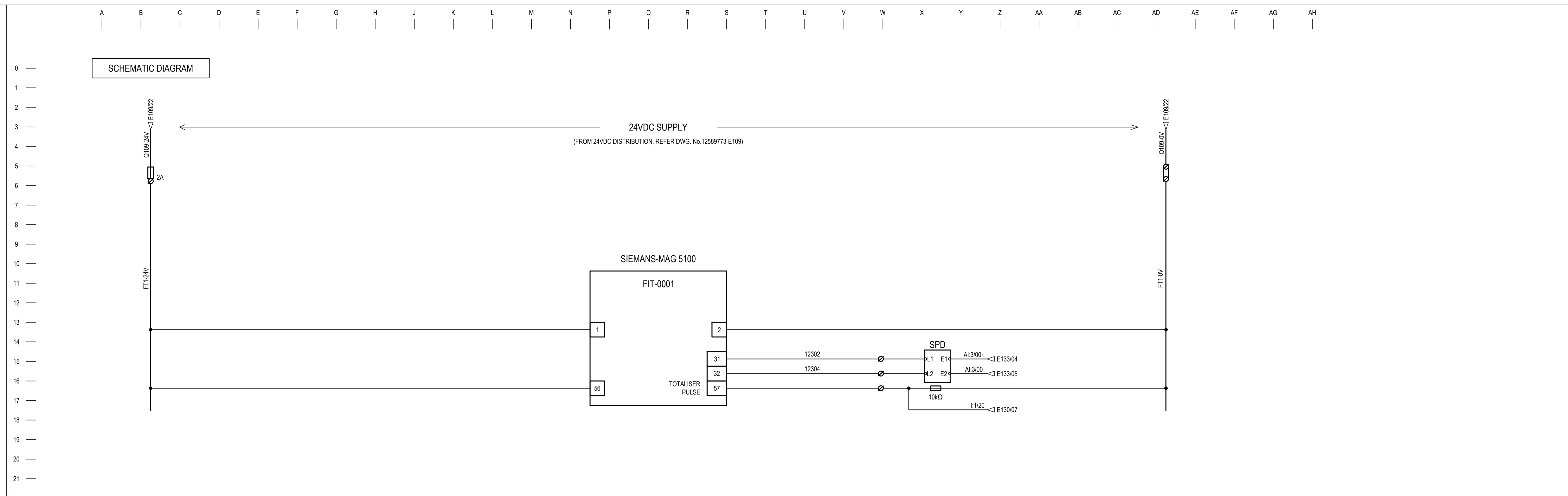
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Project No. 12589773

Client: PARKES SHIRE COUNCIL
 Project: LACHLAN PIPELINE DUPLICATION
 DETAIL DESIGN TSS
 Status: PRELIMINARY

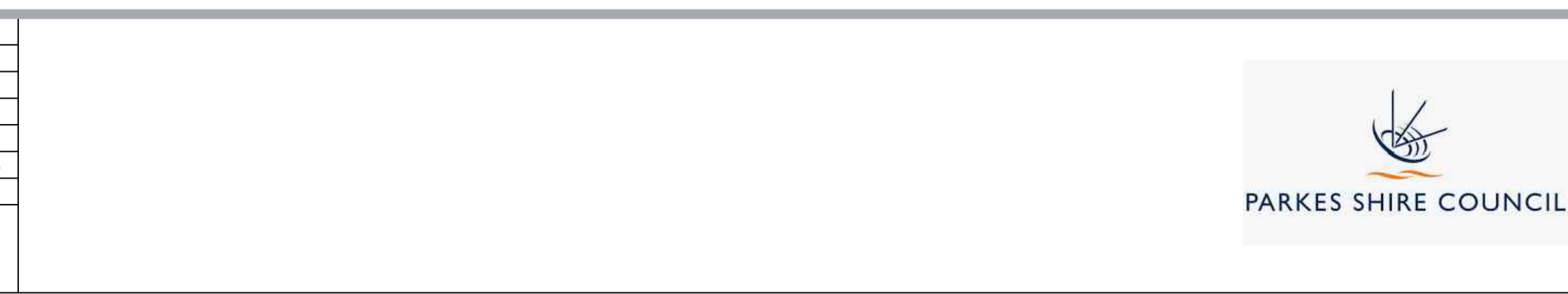
Drawing Title: ELECTRICAL SERVICES
 NEW BOOSTER (AKUNA) PUMP STATION
 PUMP 3 - TERMINATION DIAGRAM

Drawing No. 12589773-E122
 Rev A



Rev	Description	Checked	Approved	Date
A	80% DETAILED DESIGN	RJ	NM	16.10.23

Author: B.SNEESBY Drafting Check: A.COOMBER*
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Project No. 12589773

Client: PARKES SHIRE COUNCIL
 Project: LACHLAN PIPELINE DUPLICATION
 DETAIL DESIGN TSS
 Status: PRELIMINARY

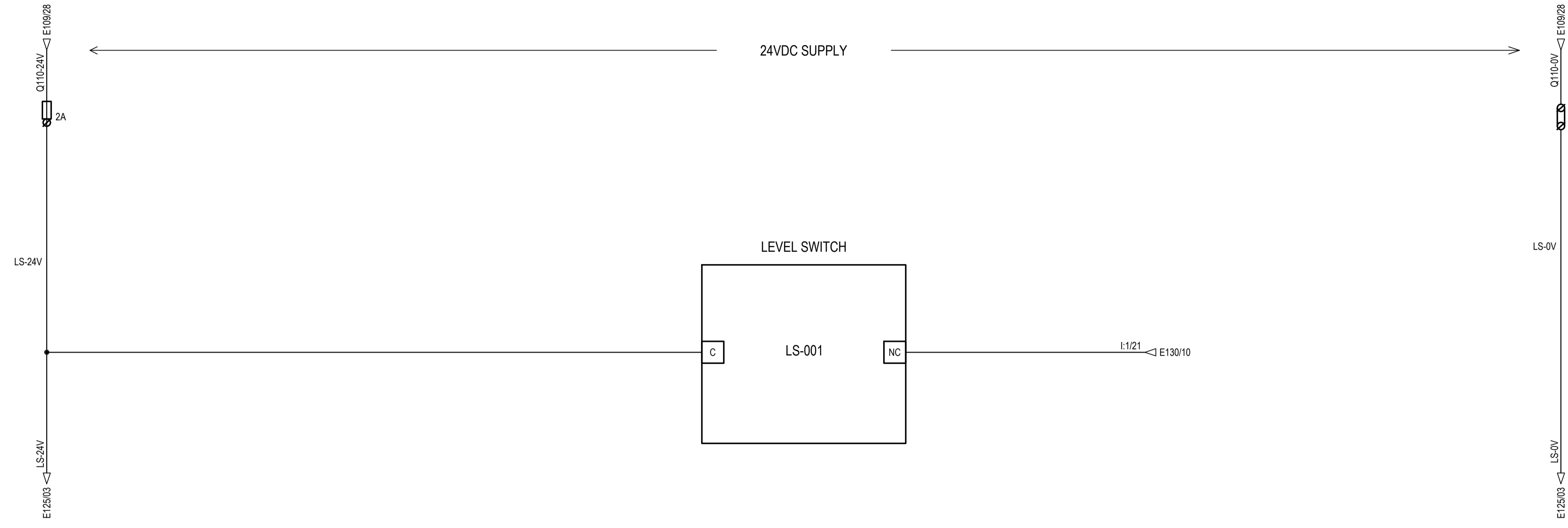
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 NEW BOOSTER (AKUNA) PUMP STATION
 FLOW TRANSMITTER (FT1)
 INSTRUMENT LOOP DIAGRAM

Drawing No. 12589773-E123
 Rev A

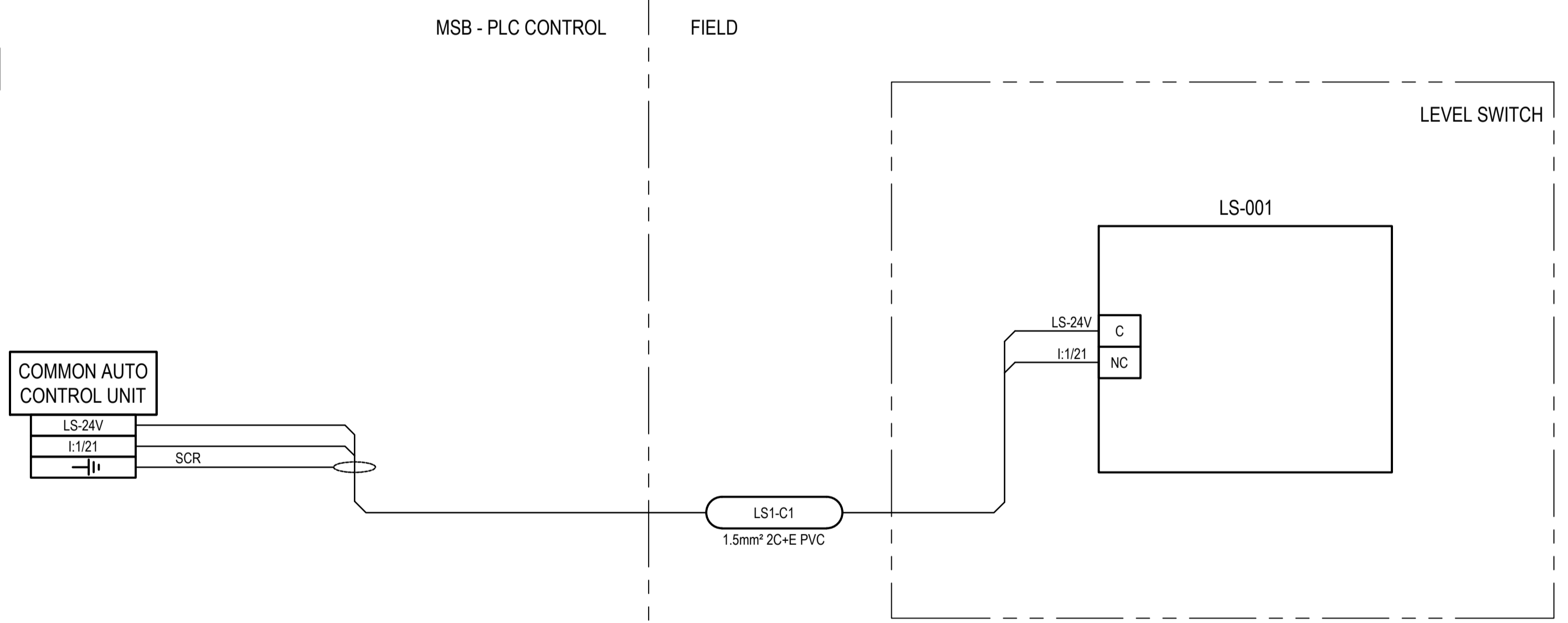
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SCHEMATIC DIAGRAM

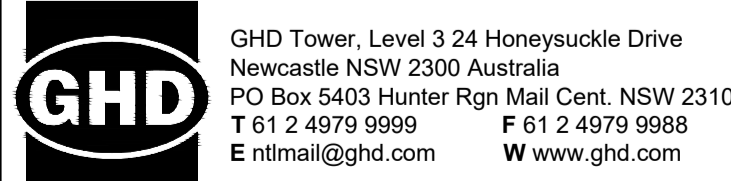


TERMINATION DIAGRAM



Rev	Description	Checked	Approved	Date
A	80% DETAILED DESIGN	RJ	NM	16.10.23
Author	B.SNEESBY	Drafting Check	A.COOMBER*	
Designer	D.EDSER	Design Check	G.BIERNAT*	

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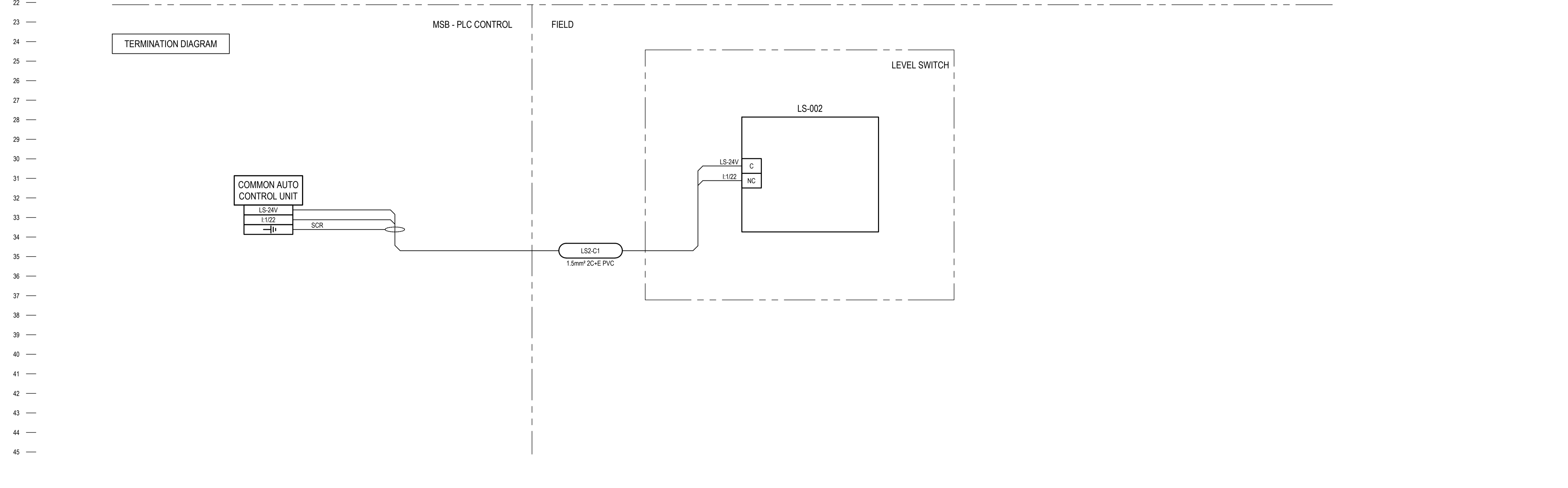
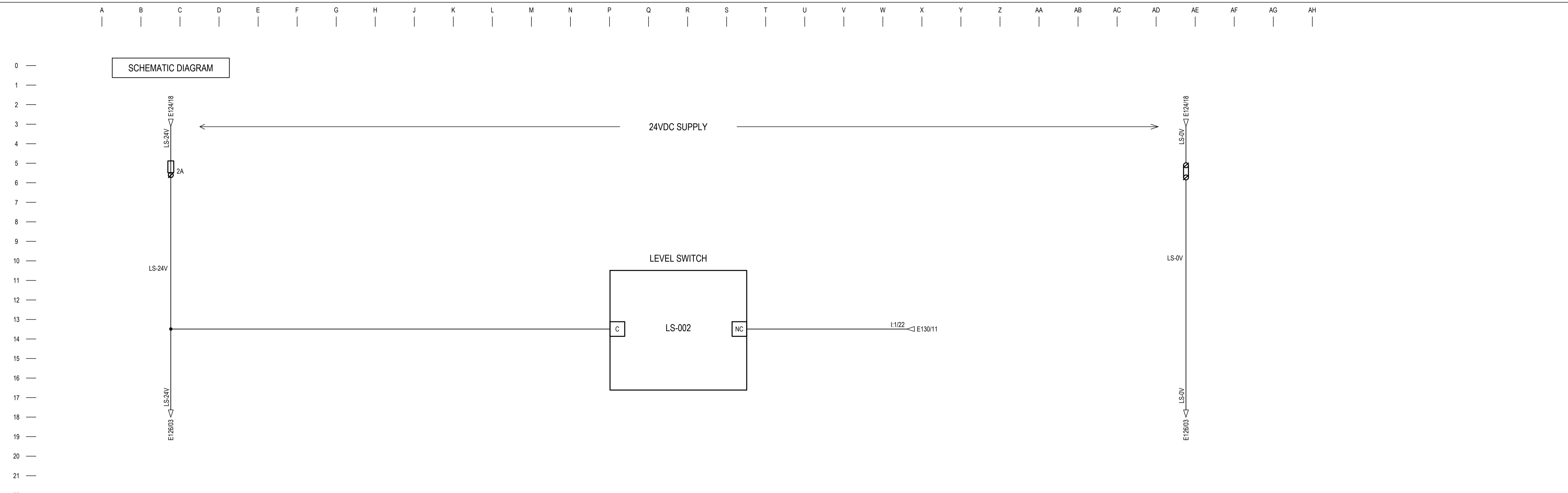
Project No. 12589773

Client	PARKES SHIRE COUNCIL
Project	LACHLAN PIPELINE DUPLICATION DETAIL DESIGN TSS
Status	PRELIMINARY

Drawing Title
ELECTRICAL SERVICES
NEW EUGOWRA ROAD PUMP STATION
FLOAT SWITCH
TERMINATION DIAGRAM

Drawing No. 12589773-E124

Size A1
Rev A



Rev	Description	Checked	Approved	Date
A	80% DETAILED DESIGN	RJ	NM	16.10.23

Author: B.SNEESBY Drafting Check: A.COOMBER*
 Designer: D.EDSER Design Check: G.BIERNAT*

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Client: **PARKES SHIRE COUNCIL**

Project: **LACHLAN PIPELINE DUPLICATION
 DETAIL DESIGN TSS**

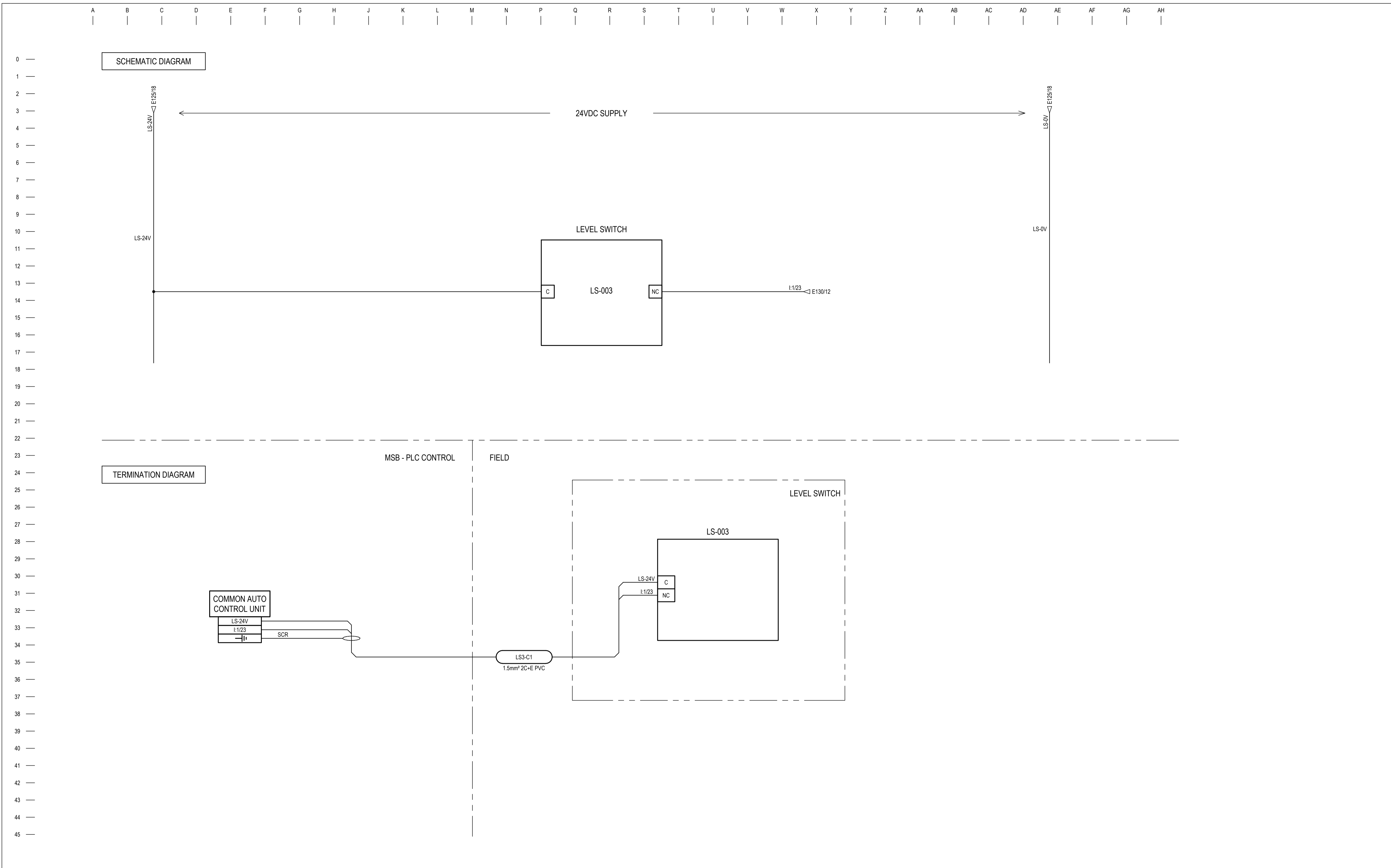
Status: **PRELIMINARY**

Drawing Title: **ELECTRICAL SERVICES
 NEW EUGOWRA ROAD PUMP STATION
 LOW LEVEL SWITCH
 INSTRUMENT LOOP DIAGRAM**

Drawing No. 12589773-E125

Size: **A1**

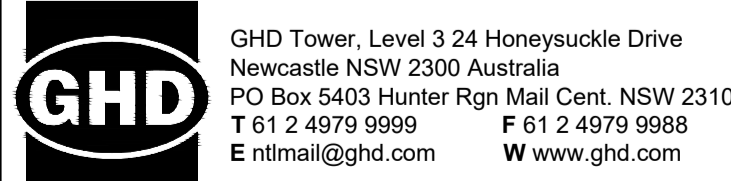
Rev: **A**



Rev	Description	Checked	Approved	Date
A	80% DETAILED DESIGN	RJ	NM	16.10.23
Author	B.SNEESBY	Drafting Check	A.COOMBER*	
Designer	D.EDSER	Design Check	G.BIERNAT*	

Plot Date: 17 October 2023 - 11:59 AM Plotted by: Brock Sneesby

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Project No.
12589773

Client	PARKES SHIRE COUNCIL
Project	LACHLAN PIPELINE DUPLICATION DETAIL DESIGN TSS
Status	PRELIMINARY

Drawing Title	ELECTRICAL SERVICES NEW EUGOWRA ROAD PUMP STATION LOW LOW LEVEL SWITCH INSTRUMENT LOOP DIAGRAM
Drawing No.	12589773-E126

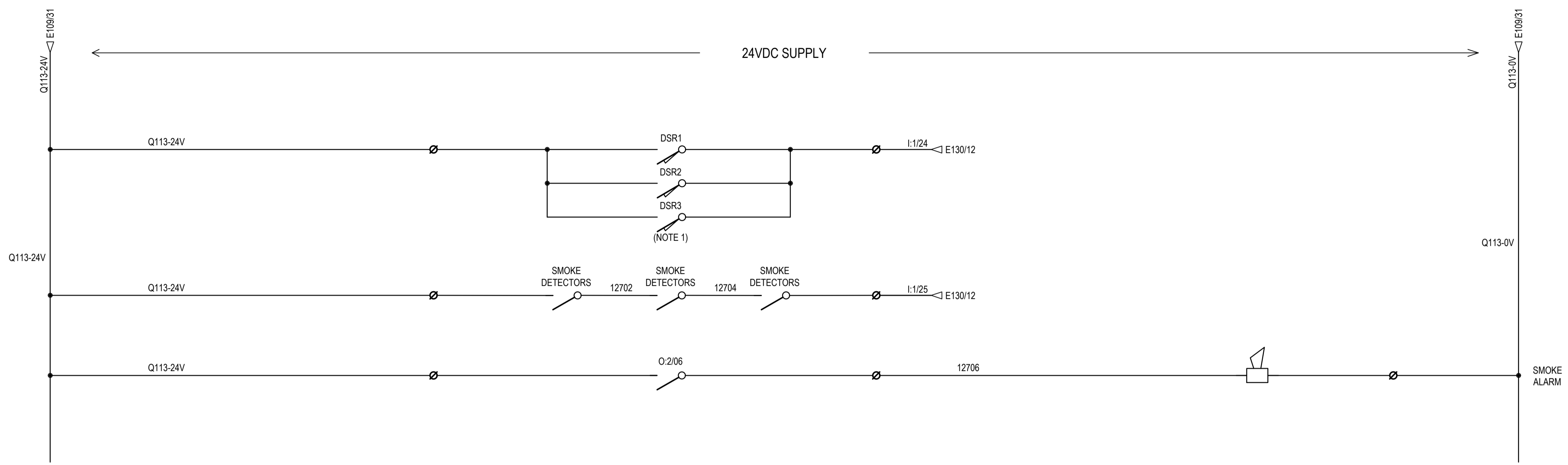
Size
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Rev
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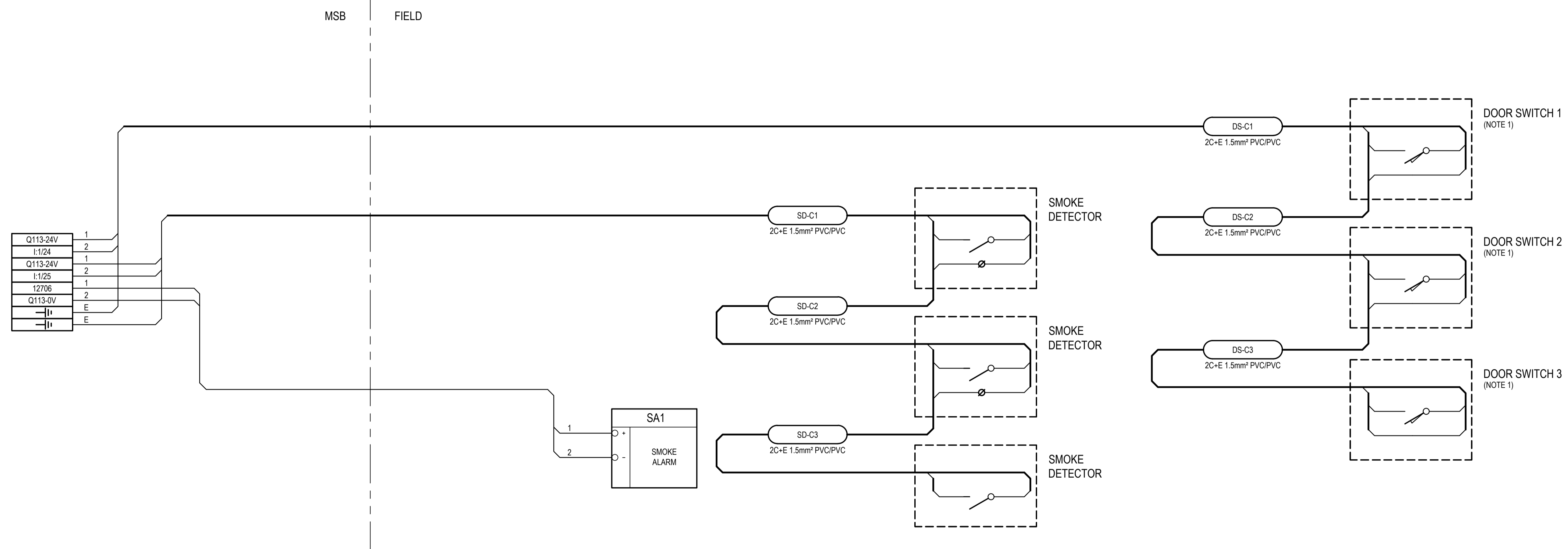
A B C D E F G H J K L M N P Q R S T U V W X Y Z AA AB AC AD AE AF AG AH

NOTES:
 1. NUMBER OF DOOR SWITCHES TO SUIT NUMBER OF DOORS. SWITCHES TO BE CONNECTED IN PARALLEL.

SCHEMATIC DIAGRAM



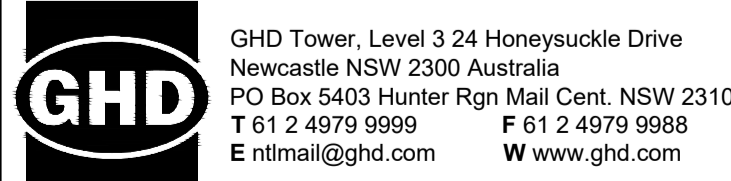
TERMINATION DIAGRAM



Rev	Description	Checked	Approved	Date
A	80% DETAILED DESIGN	RJ	NM	16.10.23

Author: B.SNEESBY Drafting Check: A.COOMBER*
 Designer: D.EDSER Design Check: G.BIERNAT*

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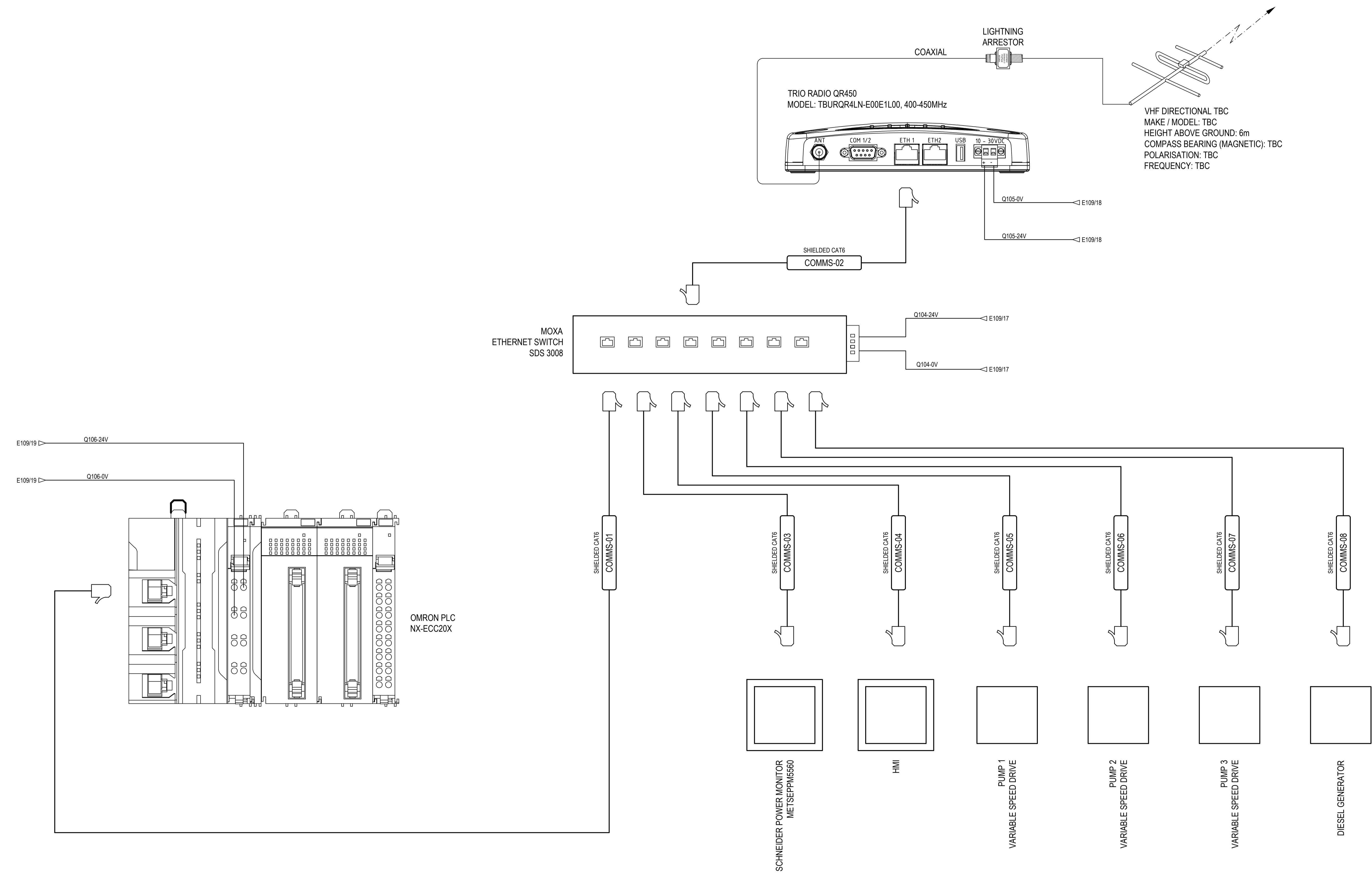
Client: PARKES SHIRE COUNCIL
 Project: LACHLAN PIPELINE DUPLICATION
 DETAIL DESIGN TSS
 Status: PRELIMINARY

Drawing Title: ELECTRICAL SERVICES
 NEW EUGOWRA ROAD PUMP STATION
 SECURITY & FIRE
 INSTRUMENT LOOP DIAGRAM

Drawing No. 12589773-E127

Size: A1
 Rev: A

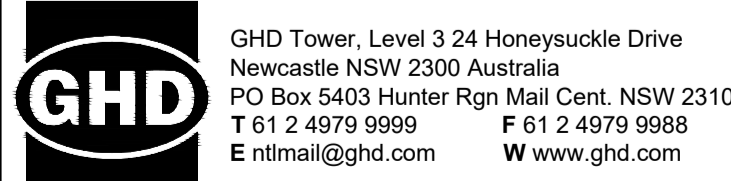
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Rev	Description	Checked	Approved	Date
A	80% DETAILED DESIGN	RJ	NM	16.10.23

Author: B.SNEESBY Drafting Check: A.COOMBER*
 Designer: D.EDSER Design Check: G.BIERNAT*

File Name: C:\Users\bsneesby\ACCDocs\GHD Services Pty Ltd\12589773 - Lachlan Pipeline Duplication Detailed Design\01 WIP\01 WIP - Electrical\04 Drawings\12589773-E128.dwg



Client: PARKES SHIRE COUNCIL
 Project: LACHLAN PIPELINE DUPLICATION
 DETAIL DESIGN TSS
 Status: PRELIMINARY

Drawing Title: ELECTRICAL SERVICES
 NEW BOOSTER (AKUNA) PUMP STATION
 TELEMETRY
 COMMUNICATIONS DIAGRAM

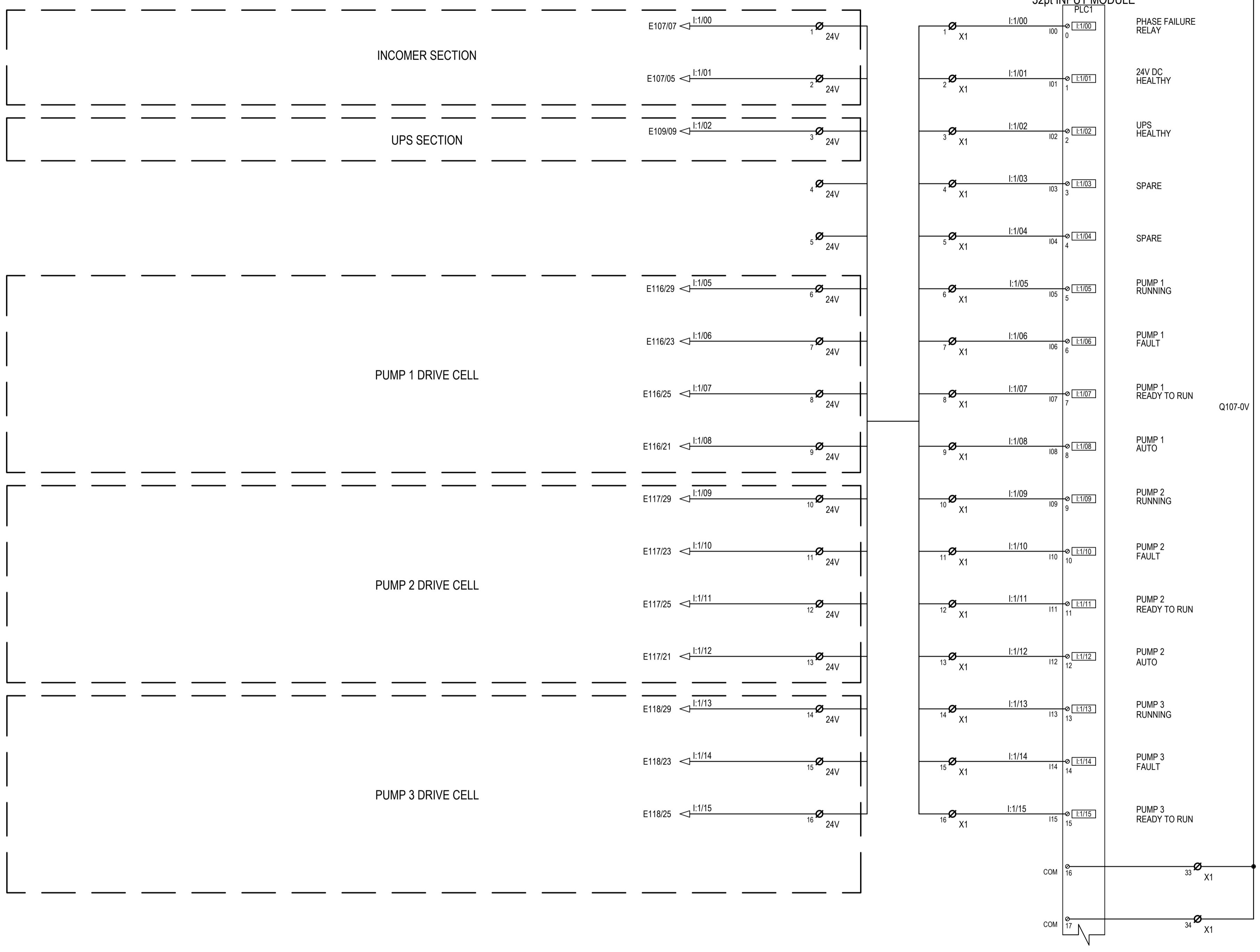
Size: A1
 Rev: A

Project No. 12589773

Status Code: -

Drawing No. 12589773-E128

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A	80% DETAILED DESIGN	RJ	NM	16.10.23

Author B.SNEESBY Drafting Check A.COOMBER*
Designer D.EDSER Design Check G.BIERNAT*

File Name: C:\Users\bsneesby\ACCDocs\GHD Services Pty Ltd\12589773 - Lachlan Pipeline Duplication Detailed Design\01 WIP\01 WIP - Electrical\04 Drawings\12589773-E129.dwg

Plot Date: 17 October 2023 - 12:01 PM Plotted by: Brock Sneesby

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Project No. 12589773

Client **PARKES SHIRE COUNCIL**

Project **LACHLAN PIPELINE DUPLICATION
DETAIL DESIGN TSS**

Status **PRELIMINARY**

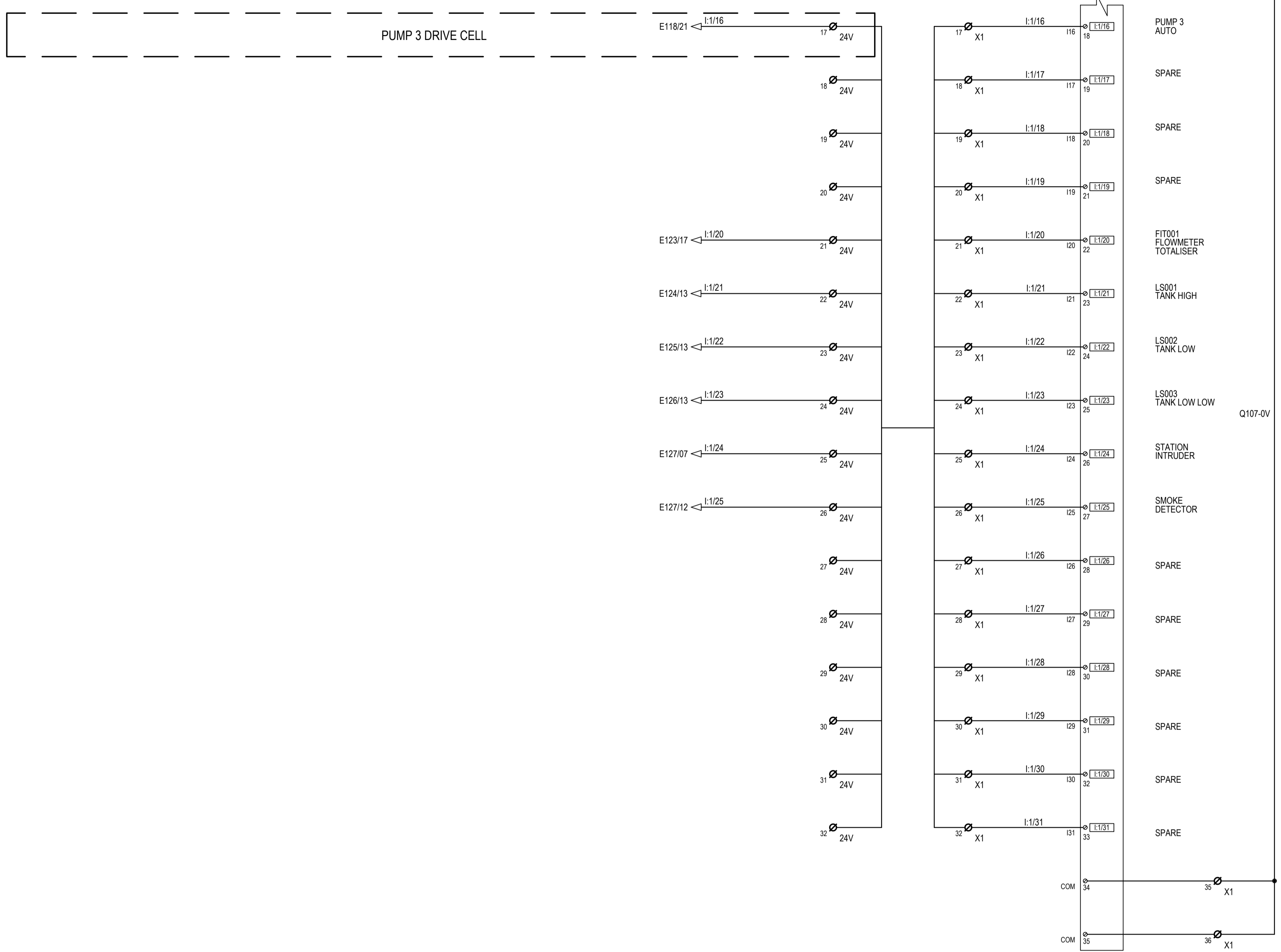
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NEW EUGOWRA ROAD PUMP STATION
DIGITAL INPUT
SLOT 1 - SHEET 1**

Drawing No. **12589773-E129**

Size **A1**

Rev **A**

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Rev	Description	Checked	Approved	Date
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Author B.SNEESBY Drafting Check A.COOMBER*
 Designer D.EDSER Design Check G.BIERNAT*




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Project No.
12589773

Client	PARKES SHIRE COUNCIL
Project	LACHLAN PIPELINE DUPLICATION DETAIL DESIGN TSS
Status	PRELIMINARY

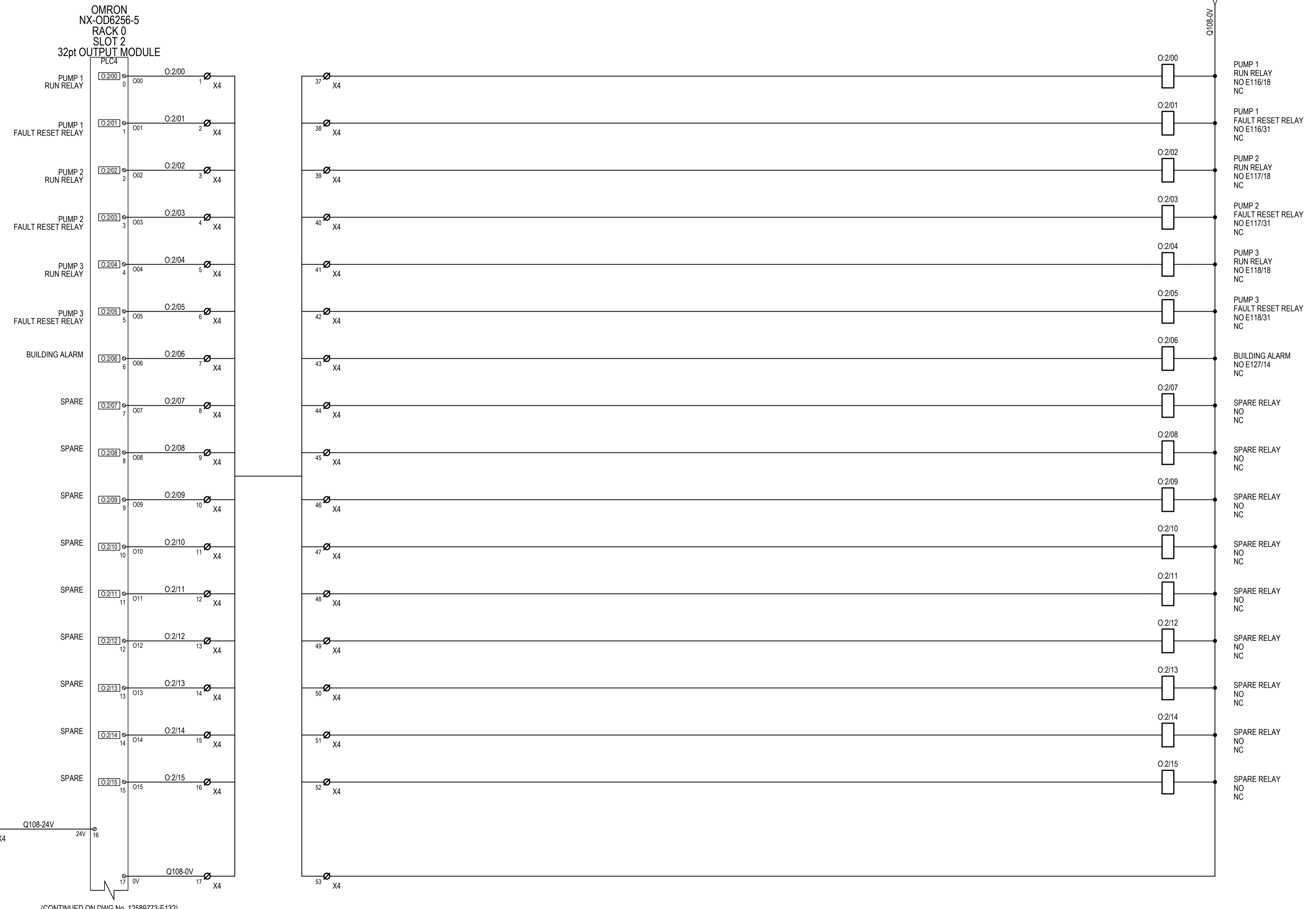
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Drawing No.	12589773-E130

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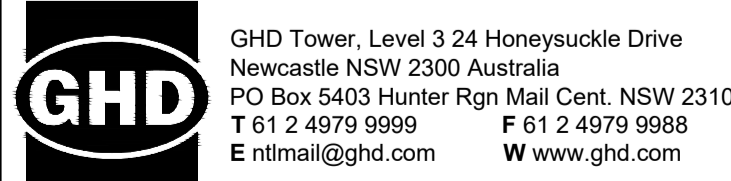
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(CONTINUED ON DWG No. 12589773-E132)

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A	80% DETAILED DESIGN	RJ	NM	16.10.23
Author	B.SNEESBY	Drafting Check	A.COOMBER*	
Designer	D.EDSER	Design Check	G.BIERNAT*	

File Name: C:\Users\bsneesby\ACCDocs\GHD Services Pty Ltd\12589773 - Lachlan Pipeline Duplication Detailed Design\01 WIP\01 WIP - Electrical\04 Drawings\12589773-E131.dwg



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Project No.
12589773

Client PARKES SHIRE COUNCIL
Project LACHLAN PIPELINE DUPLICATION
DETAIL DESIGN TSS
Status PRELIMINARY

Drawing Title
ELECTRICAL SERVICES
NEW BOOSTER (AKUNA) PUMP STATION
DIGITAL OUTPUT
SLOT 2 - SHEET 1

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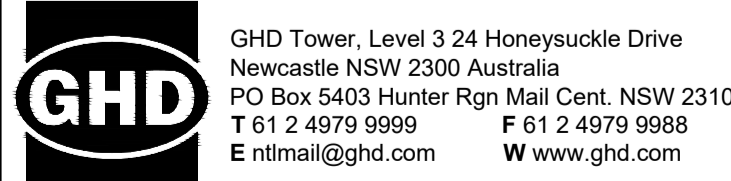
(CONTINUED ON DWG No. 12589773-E131)

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Rev	Description	Checked	Approved	Date
A	80% DETAILED DESIGN	RJ	NM	16.10.23
Author	B.SNEESBY	Drafting Check	A.COOMBER*	
Designer	D.EDSER	Design Check	G.BIERNAT*	

File Name: C:\Users\bsneesby\ACCDocs\GHD Services Pty Ltd\12589773 - Lachlan Pipeline Duplication Detailed Design\01 WIP\01 WIP - Electrical\04 Drawings\12589773-E132.dwg



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Project No.
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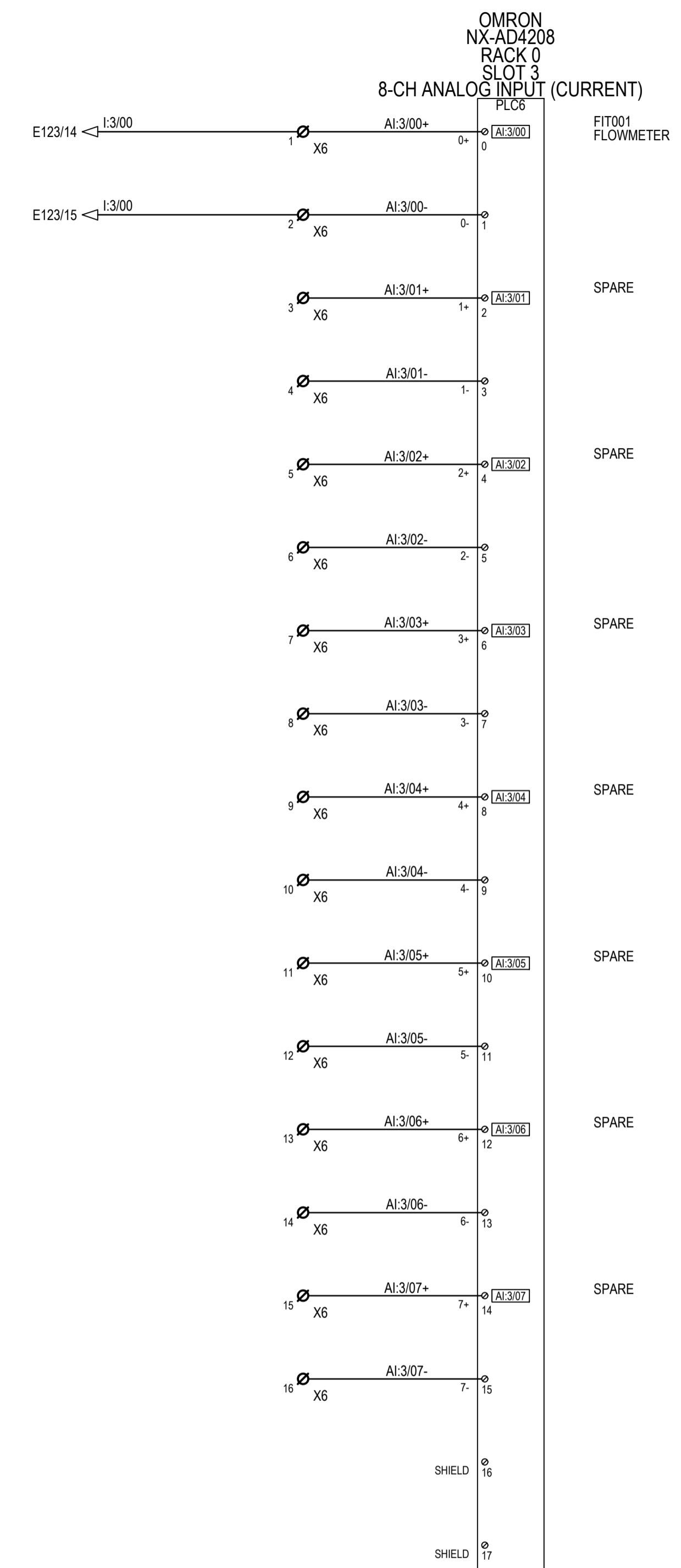
Client	PARKES SHIRE COUNCIL
Project	LACHLAN PIPELINE DUPLICATION DETAIL DESIGN TSS
Status	PRELIMINARY

Drawing Title
ELECTRICAL SERVICES
NEW BOOSTER (AKUNA) PUMP STATION
DIGITAL OUTPUT
SLOT 2 - SHEET 2

Drawing No.
12589773-E132



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Rev	Description	Checked	Approved	Date
A	80% DETAILED DESIGN	RJ	NM	16.10.23

Author	B.SNEESBY	Drafting Check	A.COOMBER*
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Project No.
12589773

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Client	PARKES SHIRE COUNCIL
Project	LACHLAN PIPELINE DUPLICATION DETAIL DESIGN TSS
Status	PRELIMINARY

Drawing Title	ELECTRICAL SERVICES NEW BOOSTER (AKUNA) PUMP STATION ANALOG INPUT SLOT 3
Drawing No.	12589773-E133

Size
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Rev
A

PARKES SHIRE COUNCIUL



LACHLAN PIPELINE DUPLICATION DETAILED DESIGN PROJECT 12589773

DRAWING INDEX - MECHANICAL		
PROJECT No.	DRG No.	
	SHEET	DRAWING TITLE
1. MECHANICAL		
12589773	M001	COVER SHEET, LOCALITY PLAN AND DRAWING INDEX
12589773	M002	SPECIFICATION NOTES
12589773	M003	LEGEND AND SCHEDULE
12589773	M100	GROUND FLOOR HVAC LAYOUT
12589773	M102	SECTION DETAILS
12589773	M103	DUCT SECTION DETAILS
12589773	M200	ROOF FLOOR HVAC LAYOUT
12589773	M300	ROOF TANK HVAC LAYOUT
12589773	M400	STANDARD DETAILS

Rev	Description	Checked	Approved	Date
A	30% DETAIL DESIGN	MK	RJ	01/09/23

Author: D.DEGUZMAN, Drafting Check
 Designer: P.PREMRAJKUMAR, Design Check, M.KLUMPP



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Project No.
12589773

Client **PARKES SHIRE COUNCIUL**
 Project **LACHLAN PIPELINE DUPLICATION
DETAILED DESIGN PROJECT**
 Status **PRELIMINARY**

Drawing Title **MECHANICAL SERVICES
COVER SHEET, LOCALITY PLAN AND
DRAWING INDEX**

Drawing No.
12589773-M001

Size **A1**
Rev **A**

MECHANICAL (HVAC) SPECIFICATION NOTES

GENERAL

THIS SCOPE REPRESENTS THE CLIENTS REQUIREMENTS AND THE TENDERER IS RELIED UPON IN POSSESSING SPECIALIST TRADE EXPERTISE NECESSARY TO COMPLETE THE WORKS IN ACCORDANCE WITH THE DRAWINGS. IN ADDITION, THE TENDERER HAS THE FOLLOWING OBLIGATIONS TO; RAISE IN GOOD TIME, ISSUES REQUIRING DESIGN INPUT OR CLARIFICATION FROM THE CONSULTING ENGINEER, PARTICULARLY IN RESPECT TO OMISSIONS FROM THE TENDER DOCUMENTS & SUGGESTED ALTERNATIVES OR SUBSTITUTIONS.

ANY VARIATION TO THE SYSTEMS & OR EQUIPMENT SPECIFIED SHALL BE SUBMITTED FOR APPROVAL BY THE PRINCIPAL PRIOR TO INSTALLATION.

ADEQUATE CLEARANCES ARE TO BE PROVIDED TO ALLOW FOR FUTURE, ONGOING MAINTENANCE & SERVICE OF ALL INSTALLED PLANT & EQUIPMENT.

ALL EQUIPMENT & ASSOCIATED DUCT/PIPES ARE TO BE SUPPORTED AS SPECIFIED & MUST NOT COME IN CONTACT WITH THE CEILING.

ALL PLANT & EQUIPMENT MUST BE INSTALLED/SUPPORTED ON APPROVED MACHINERY MOUNTS AS SPECIFIED.

STANDARDS AND CODES

STANDARDS INCLUDING BUT NOT LIMITED TO:

NATIONAL CONSTRUCTION CODE (NCC 2022) INCLUDING ALL RELEVANT PARTS OF 'SECTION J'. AS 1668.2:2012 - THE USE OF VENTILATION & AIR CONDITIONING IN BUILDINGS - MECHANICAL VENTILATION FOR ACCEPTABLE INDOOR-AIR QUALITY.

AS 1324.1 - AIR FILTERS FOR USE IN GENERAL VENTILATION & AIR CONDITIONING.

AS 4254.1 & AS 4254.2 - DUCTWORK FOR AIR-HANDLING SYSTEMS IN BUILDINGS.

AS 1668.4:2012 - THE USE OF VENTILATION & AIR CONDITIONING IN BUILDINGS - NATURAL VENTILATION.

AS/NZS 4859.1 - MATERIALS FOR THE THERMAL INSULATION OF BUILDINGS.

AS/NZS 3000 - WIRING RULES.

AS/NZS 3008 - ELECTRICAL INSTALLATIONS.

AS 3500.2 - SANITARY PLUMBING AND DRAINAGE.

AS 1682.1:2015 - FIRE, SMOKE AND AIR DAMPER SPECIFICATION.

COORDINATION

LAYOUTS OF SERVICE LINES, PLANT & EQUIPMENT SHOWN ON THE DRAWINGS ARE DIAGRAMMATIC ONLY. BEFORE COMMENCING WORK, OBTAIN MEASUREMENTS & OTHER NECESSARY INFORMATION. COORDINATE THE INSTALLATION WITH ADJACENT STRUCTURAL ELEMENTS & ALL SERVICES & TRADES TO ENSURE THE COMPLETE INSTALLATION IS FULLY COORDINATED. ALL WORK ASSOCIATED WITH THE COMPLETION OF THE SCOPE SHALL BE INCLUDED IN THE CONTRACT PRICE & SHALL NOT BE ACCEPTED AS A VARIATION TO THE SCOPE OF WORK.

THROUGHOUT THE PROCESS OF EXECUTION OF THE WORKS THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE COORDINATION OF THEIR DESIGN & INSTALLATION WITH OTHER DESIGNERS & TRADES. UNDER NO CIRCUMSTANCES WILL DEFICIENCY IN THE COORDINATION WITH OTHERS GIVE RISE TO ANY CONTRACT VARIATIONS OR CLAIMS. COORDINATION OF SERVICES SHALL BE PROVIDED IN THE CONTEXT OF SAFE & PRACTICAL OPERATIONAL & MAINTENANCE ACCESS TO ALL ELECTRICAL & MECHANICAL ELEMENTS.

PERFORMANCE

WHILST THE DOCUMENTED DESIGN IS COMPLIANT WITH THE NECESSARY CODES & STANDARDS, THE CONTRACTOR SHALL BE SOLELY RESPONSIBLE FOR THE CERTIFICATION OF THEIR INSTALLATION & ANY ELEMENTS OF THE DOCUMENTED DESIGN THAT THEY MAY MODIFY DURING CONSTRUCTION. THIS CERTIFICATION OF THE INSTALLATION SHALL STATE THAT THE INSTALLATION COMPLIES WITH THE RELEVANT REQUIREMENTS OF THE RELEVANT INSTALLATION CODES, MANUFACTURING CODES & THIS SPECIFICATION.

WORKMANSHIP

ALL MATERIALS & WORKMANSHIP PROVIDED BY THE CONTRACTOR UNDER THIS SCOPE SHALL BE OF GOOD & INDUSTRY STANDARD QUALITY. THE MATERIALS & WORKMANSHIP SHALL BE TO THE APPROVAL OF THE CLIENT & ALL DEFECTIVE MATERIALS & WORK WHEN DIRECTED IN WRITING SHALL BE RECTIFIED AND/OR REMOVED FROM THE WORKS AT THE CONTRACTORS EXPENSE & WITHOUT ANY DELAY TO THE CONSTRUCTION PROGRAM.

DESIGN PARAMETERS

LOCATION: AKUNA NSW

SUMMER: 42.4°CDB/24.1°CWB

WINTER: -0.4°CDB, 80%RH

INTERNAL SETPOINTS

SWITCHROOM: 27.0°C SUMMER

HUMIDITY: NOT ACTIVELY UNCONTROLLED

SCOPE OF WORK

GENERAL NOTES

-ALL WORKS TO BE CARRIED OUT IN ACCORDANCE WITH NCC 2022, MECHANICAL SPECIFICATION, DRAWINGS AND GOOD TRADE PRACTICE.

-DRAWINGS ARE CONCEPTUAL ONLY AND CONTRACTOR IS REQUIRED TO VERIFY ALL CLEARANCES AND SERVICE REQUIREMENTS PRIOR TO ORDERING EQUIPMENT.

-CONTRACTOR TO SUPPLY AND INSTALL ALL SCHEDULED EQUIPMENT. THE WORKS SHALL INCLUDE ALL NECESSARY AND INCIDENTAL WORKS AND FITTINGS THAT WHILE NOT SPECIFICALLY NOTED ARE NECESSARY FOR THE PROPER COMPLETION OF WORKS.

-ALL PLANT AND EQUIPMENT SHALL BE FITTED WITH VIBRATION ISOLATION TO ACHIEVE AN ISOLATION EFFICIENCY OF NOT LESS THAN 90%

-LOCATIONS OF CONTROLS AND SENSORS ARE TO BE CONFIRMED ON SITE. TEMPERATURE SENSORS TO BE LOCATED AWAY FROM DIRECT SUNLIGHT AND DRAUGHTS.

-PACKAGED UNITS TO BE INSTALLED AND COMMISSIONED IN ACCORDANCE WITH MANUFACTURERS GUIDELINES.

-A COMMITMENT FOR A FURTHER 12 MONTH PERIOD OF STAGED COMMISSIONING BEYOND HANDOVER DATE SHALL BE ALLOWED FOR. THIS PERIOD IS FOR FINE TUNING THROUGH THE YEAR & WILL CONSIST OF A MINIMUM OF QUARTERLY REVIEW PERIODS.

-SUBMIT OPERATION & MAINTENANCE MANUALS FOR INSTALLATIONS.

ROOF VENTILATORS AND LOUVRES

PROVIDE FAN ASSISTED ROOF VENTILATORS **o/w** MOTORISED DAMPER AND EMBER MESH TO VENTILATE THE PUMP ROOM AS PER THE SCHEDULE. PROVIDE INTAKE LOUVRES **o/w** EMBER MESH AS PER THE SCHEDULE. LOUVRES TO COMPLY WITH NCC 2022.

PACKAGED UNIT

THE SWITCH ROOM IS TO BE SERVED BY ONE (1X) PACKAGED UNITS LOCATED ON THE GROUND EXTERNALLY. SUPPLY AND RETURN AIR IS TO BE VIA DUCTED AIRWAY AS SHOWN ON DRAWINGS. ALL SUPPLY/RETURN AIR DUCTWORK ARE TO BE INTERNALLY INSULATED.

FIRE DAMPERS

THE DUCT WORKS PENETRATING TO SWITCH ROOM FROM THE EXTERNAL SIDE ARE TO BE PROVIDED WITH FIRE DAMPERS AS SHOWN ON THE DRAWINGS.

MOTORISED VOLUME CONTROL DAMPERS

THE DUCT WORKS CONNECTED TO THE PACKAGED UNITS, BOTH SUPPLY AND RETURN, ARE TO BE PROVIDED WITH MOTORISED VOLUME CONTROL DAMPERS AS SHOWN ON DRAWINGS.

DUCTWORK

DUCTWORK, CONNECTIONS, AND SUPPORTS TO BE COMPLIANT WITH AS 4254 SERIES, AND SUITABLE FOR EXTERNAL STATIC PRESSURE GENERATED BY PACKAGED AIR CONDITIONING UNIT.

ALL RIGID DUCTWORK TO BE SEALED AGAINST AIRLOSS.

GRILLES

CONTRACTOR TO PROVIDE EXHAUST AIR GRILLE AS PER THE SCHEDULE. SELECTION TO COMPLY WITH NCC 2022.

FIRE SHUTDOWN

PROVIDE SHUTDOWN UPON INITIATION OF FIRE MODE FOR BOTH PAC UNITS. THE EQUIPMENT SHALL SHUT DOWN IN THE CASE OF A FIRE TRIP & BE PREVENTED FROM RESTARTING UNTIL FIRE TRIP RESET. REFER TO ELECTRICAL DRAWINGS FOR MORE DETAILS.

ELECTRICAL SYSTEMS

ELECTRICAL WIRING MUST BE INSTALLED AS REQUIRED FOR COMPLETE & APPROPRIATE OPERATION OF ALL SYSTEMS.

ALL CONTROLS, ACTUATORS, WIRING AND SENSORS ASSOCIATED TO THE ROOF VENTILATORS ARE TO BE SUPPLIED AND INSTALLED BY THE MECHANICAL CONTRACTOR.

EQUIPMENT IS TO BE POWERED FROM THE MCC (SUPPLIED BY ELECTRICAL TRADE), WITH THE MECHANICAL CONTRACTOR PROVIDING WIRING FROM THE MCC TO EQUIPMENT.

MECHANICAL CONTRACTOR TO COORDINATE WITH ELECTRICAL TRADE REGARDING THE REQUIRED SPARE CIRCUITS IN THE BOARD TO POWER THE ROOF VENTILATORS.

CONTROL SYSTEMS

A CONTROL SYSTEM CAPABLE OF MEETING THE FUNCTIONAL DESCRIPTION OF CONTROL REQUIREMENTS IN THIS SPECIFICATION MUST BE PROVIDED.

THE CONTROL SYSTEMS SHALL INCLUDE THE SUPPLY, DESIGN, INSTALLATION & COMMISSIONING OF EQUIPMENT NECESSARY TO MEET THE DOCUMENTED FUNCTIONALITY. THIS IS TO BE COMPLETED BY SPECIALIST TRADES COMPETENT IN THIS TYPE OF WORK WITH LOCAL SUPPORT FOR ONGOING MAINTENANCE & BACK-UP FOR COMPONENTS & SOFTWARE.

CONTROLS FUNCTIONAL DESCRIPTION

GENERAL

THE CONTROL SYSTEMS SHALL INCLUDE THE SUPPLY, DESIGN, INSTALLATION & COMMISSIONING OF EQUIPMENT NECESSARY TO MEET THE DOCUMENTED FUNCTIONALITY. THIS IS TO BE BY SPECIALIST TRADES COMPETENT IN THIS TYPE OF WORK WITH LOCAL SUPPORT FOR ONGOING MAINTENANCE & BACK-UP FOR COMPONENTS & SOFTWARE.

CONTRACTOR TO COORDINATE WITH ELECTRICAL TRADE, PROVIDE THIRD PARTY INNOTECH CONTROLLER (OR SIMILAR) AND REQUIRED SENSORS TO ACHIEVE THE DOCUMENTED FUNCTIONALITY.

PACKAGED UNITS

THE PROVISION IS TO BE CONTROLLED VIA WALL MOUNTED CONTROL PANEL (PROPRIETARY CONTROLLER) THAT ALLOWS STANDARD FAN, MODE & TEMPERATURE SETTINGS.

WHEN PACKAGED UNIT IS IN COOLING MODE & THE OUTDOOR AMBIENT TEMPERATURE IS LESS THAN 27° C (ADJUSTABLE) ECONOMY CYCLE SHOULD BE ENGAGED. THIS MEANS THAT THE PACKAGED UNIT MUST PROVIDE 100% OUTSIDE AIR.

THE RELIEF DAMPERS ARE TO OPEN AND THE RETURN AIR DAMPER TO SHUT IN ORDER TO PROVIDE A RELIEF AIR PATH & AVOID EXCESSIVE PRESSURISATION OF THE SPACE WHEN OUTSIDE AIR VOLUMES ARE HIGH.

ROOF VENTILATORS

ALL WHIRLYBIRDS TO OPERATE ON WIND AND STACK EFFECT WHILST THE INTERNAL ROOM TEMPERATURE REMAINS BELOW 40° CDB.

WHEN THE INTERNAL ROOM TEMPERATURE EXCEEDS 40° CDB: - MOTORISED DAMPERS OF THE STANDBY ROOF VENTILATORS (RV5 AND RV6) TO SHUT. - THE BOOSTER FANS OF THE DUTY ROOF VENTILATORS RV1, RV2, RV3 AND RV4 TO START AND RUN AT 2000 L/s.

- BOOSTER FANS TO STOP WHEN INTERNAL ROOM TEMPERATURE DROPS BELOW 38° CDB FOR AT LEAST 30 MINUTES

THE DUTY/STANDY CONFIGURATION TO SWAP ON A WEEKLY BASIS. FAN CONTROL TO BE ACHIEVED USING FACTORY MODIFIED CONTROL PANEL.

FAN RUN CYCLE TIME TO BE ADJUSTABLE. FAN AND DAMPER CONTROL TO BE ACHIEVED USING THIRD PARTY INNOTECH CONTROL PANEL OR SIMILAR.

DUTY/STAND-BY OPERATION OF ROOF VENTILATORS WITHOUT SHUT OFF DAMPERS TO BE AVOIDED DUE TO POTENTIAL SHORT-CIRCUITING OF AIR INTO THE PUMPSTATION THROUGH THE STANDBY UNITS.

WORKS BY OTHER TRADES

THE FOLLOWING WORKS ASSOCIATED WITH THIS SCOPE SHALL BE CARRIED OUT BY OTHER CONTRACTORS AT NO COST TO THE MECHANICAL SERVICES CONTRACTOR, PROVIDED THAT THE MECHANICAL CONTRACTOR SUPPLIES SUFFICIENT DRAWINGS OR DETAILS & PROVIDED THAT SUCH DETAILS ARE SUPPLIED IN AMPLE TIME FOR THOSE WORKS TO BE CARRIED OUT DURING THE NORMAL PROGRESS OF THE WORK AND/OR IN ACCORDANCE WITH THE PROGRAM FOR THE WORKS. IT IS THE MECHANICAL SERVICES CONTRACTORS RESPONSIBILITY TO COORDINATE & EXECUTE OF THESE WORKS WITH OTHER PARTIES & THE CONSTRUCTION PROGRAMS.

BY THE BUILDER - THE CUTTING OF ALL OPENINGS IN THE BUILDING STRUCTURE FOR THE PENETRATION OF DUCTS, GRILLES, LOUVRES, CONDUITS ETC. & ALL CUTTING, PATCHING, FRAMING UP, FURRING IN & MAKING GOOD ASSOCIATED WITH THE BUILDING STRUCTURE, INCLUDING CHASES, UNDERFLASHING TO BE PROVIDED AS PER MANUFACTURERS SPECIFICATIONS. INSTALLATION OF LOUVRES SUPPLIED BY THE MECHANICAL CONTRACTOR.

BY ELECTRICAL CONTRACTOR -PROVISION OF CAPACITY AT THE MCC TO ENSURE THE MECHANICAL EQUIPMENT CAN BE ADEQUATELY POWERED.

ELECTRICAL TRADE TO PROVIDE THE REQUIRED SPARE CIRCUITS IN THE BOARD TO POWER THE ROOF VENTILATORS.

BY HYDRAULING CONTRACTOR - PROVISION OF DRAIN POINTS FOR THE PACKAGED UNITS.

BY FIRE CONTRACTOR - PROVISION OF AUTO SHUT DOWN OF AC UNITS DURING FIRE TRIP.

WORK FOR OTHER TRADES

THE FOLLOWING WORKS ASSOCIATED WITH THIS SCOPE FOR OTHER TRADES SHALL BE CARRIED OUT BY THE MECHANICAL CONTRACTOR AT NO COST TO THE OTHER CONTRACTORS, PROVIDED THAT THE OTHER SERVICES CONTRACTORS SUPPLIES SUFFICIENT DRAWINGS OR DETAILS, TO ENABLE THESE WORKS TO BE CARRIED OUT, & PROVIDED THAT SUCH DETAILS ARE SUPPLIED IN AMPLE TIME FOR THOSE WORKS TO BE CARRIED OUT DURING THE NORMAL PROGRESS OF THE WORK AND/OR IN ACCORDANCE WITH THE PROGRAM OF THE WORKS.

FOR THE BUILDER - ALL SIGNAGE REQUIRED TO BE FIXED DIRECTLY TO THE MECHANICAL EQUIPMENT. ALL PAINTING OF MECHANICAL EQUIPMENT, FLASHING & WATERPROOFING OF ALL MECHANICAL WALL PENETRATIONS, MAKING GOOD OF ALL MECHANICAL SERVICES PENETRATIONS.

FOR ELECTRICAL CONTRACTOR - THE MECHANICAL CONTRACTOR SHALL BE RESPONSIBLE FOR COORDINATING WITH THE ELECTRICAL CONTRACTOR TO ENSURE THAT ADEQUATE CAPACITY AND CIRCUIT PROTECTION IS ALLOWED FOR IN THE MCC. CABLING FROM THE MCC TO LOCAL ISOLATORS NEAR EACH ITEM OF EQUIPMENT (AND FINAL WIRING FROM ISOLATORS TO EQUIPMENT) IS THE RESPONSIBILITY OF THE MECHANICAL CONTRACTOR.

MATERIALS, EQUIPMENT AND COMPONENTS

GENERAL

PROVIDED NEW MATERIALS, EQUIPMENT & COMPONENTS SHALL BE NEW, OF GOOD QUALITY & FIT FOR PURPOSE, SELECTED FOR A REASONABLE SERVICE LIFE. DO NOT PROVIDE, WITHOUT APPROVAL, PRODUCTS THAT ARE OBSOLETE, DISCONTINUED OR ABOUT TO BE DISCONTINUED.

MANUFACTURERS

PROVIDED EQUIPMENT & ASSOCIATED ACCESSORIES WHICH ARE THE PRODUCTS OF ESTABLISHED MANUFACTURERS REGULARLY ENGAGED IN THE MANUFACTURE OF SUCH EQUIPMENT, WHO ISSUE COMPREHENSIVE RATING DATA & CERTIFIED TEST DATA ON THEIR PRODUCTS.

CONSISTENCY

FOR THE WHOLE QUANTITY OF EACH MATERIAL OR PRODUCT USE THE SAME MANUFACTURER OR SOURCE & PROVIDE CONSISTENT TYPE, SIZE, QUALITY & APPEARANCE.

SAFETY

PROVIDE ALL NECESSARY SAFETY DEVICES FOR THE PROTECTION OF PERSONNEL AGAINST INJURY & THE PROTECTION OF PLANT & EQUIPMENT AGAINST DAMAGE INCLUDING RELIEF VALVES, BELT GUARDS, SAFETY RAILING, EFFECTIVE EARTHING OF ELECTRICAL COMPONENTS, ELECTRICAL INTERLOCKS, WARNING LIGHTS, & SIGNS, ALARMS & LOCAL LIGHTING. PROVIDE PERMANENT LIFTING EYES FOR EQUIPMENT EXCEEDING 40kg.

PROHIBITED MATERIALS

DO NOT USE ANY OF THE FOLLOWING MATERIALS DURING CONSTRUCTION, ASBESTOS, LEAD WHERE THE METAL OR ITS CORROSION PRODUCTS MAY BE DIRECTLY INGESTED, INHALED OR ABSORBED, OR ANY LEAD-BASED PAINTS OR PRIMERS, CHROMATE PAINT PIGMENT OR CHROMATE WATER TREATMENT; UREA FORMALDEHYDE FOAM OR MATERIALS WHICH MAY RELEASE FORMALDEHYDE IN QUANTITIES WHICH MAY BE HAZARDOUS OR IRRITANT; SYNTHETIC MINERAL FIBRES, MATERIALS IN WHICH CHLOROFLUOROCARBONS, HYDRO CHLOROFLUOROCARBONS OR HEXA-FLUOROACETONES HAVE BEEN USED AS A BLOWING AGENT; CHLOROFLUOROCARBONS; OTHER SUBSTANCES GENERALLY KNOWN TO BE DELETERIOUS TO HEALTH OR SAFETY OR WHICH WOULD ADVERSELY AFFECT THE WORKS.

EXECUTION

GENERAL

INSTALL EQUIPMENT & SERVICES PLUMB, FIX SECURELY & ORGANISE RETICULATED SERVICES NEATLY. PROVIDE FOR MOVEMENT IN BOTH STRUCTURE & SERVICES.

ARRANGEMENT - ARRANGE SERVICES SO THAT SERVICES RUNNING TOGETHER ARE PARALLEL WITH EACH OTHER & WITH ADJACENT BUILDING ELEMENTS.

MOVEMENT & EXPANSION - PROVIDE EXPANSION FACILITIES IN DUCTWORK, PIPING, CABLES, CABLE TRAYS & SUPPORTS TO ACCOMMODATE THERMAL EXPANSION & MOVEMENT AT STRUCTURAL EXPANSION JOINTS.

PROTECTION - PROTECT EQUIPMENT FROM WEATHER & THE INGRESS OF DIRT, MOISTURE, VANDALISM & TAMPERING.

ACCESS - PROVIDE ACCESS TO ALL COMPONENTS REQUIRING ENTRY, INSPECTION OR MAINTENANCE.

PAINTING SERVICES AND EQUIPMENT

IF EXPOSED TO VIEW OR THE ELEMENTS, PAINT NEW SERVICES & EQUIPMENT INCLUDING IN PLANT ROOMS, EXCEPT CHROMIUM, ANODISED ALUMINIUM, GRP, UPVC, STAINLESS STEEL, NON-METALLIC FLEXIBLE MATERIALS & NORMALLY LUBRICATED MACHINED SURFACES. REPAINT PROPRIETARY ITEMS ONLY IF DAMAGED. COMPLY WITH THE REQUIREMENTS OF AS/NZS 2311 SECTIONS 3.6 & 7, OR AS/NZS 2312 SECTIONS 5.8 & 10 AS APPLICABLE. COLOURS: TO AS 2700, COLOUR STANDARDS FOR GENERAL PURPOSES.

IDENTIFICATION

MARK EQUIPMENT, ELECTRICAL WIRING, CONDUITS & DUCTS, TO PROVIDE A READY MEANS OF IDENTIFICATION. PIPING, CONDUITS & DUCTS: TO AS 1345, AS APPLICABLE.

SUBMISSIONS

WORK - AS - EXECUTED

SUBMIT WORK-AS-EXECUTED DRAWINGS. SHOW DIMENSIONS, TYPES & LOCATION OF EQUIPMENT, TRAY CABLES & DUCTWORK IN RELATION TO PERMANENT SITE FEATURES. SHOW THE 'AS INSTALLED' LOCATIONS OF BUILDING ELEMENTS, PLANT & EQUIPMENT. SHOW OFF-THE-GRID DIMENSIONS WHERE APPLICABLE. INCLUDE RELATIONSHIP TO BUILDING STRUCTURE & OTHER SERVICES, & CHANGES MADE DURING COMMISSIONING & THE MAINTENANCE PERIOD. INCLUDE SCHEMATIC DRAWINGS OF EACH SYSTEM SHOWING WIRING, & PRINCIPAL ITEMS OF EQUIPMENT. DO NOT PROCEED UNTIL REVIEWED DRAWINGS HAVE BEEN RETURNED, ANY REQUESTED AMENDMENTS HAVE BEEN IMPLEMENTED & FINAL APPROVAL OF A COMPLETED AS-BUILT DRAWING SET IS PROVIDED.

OPERATION AND MAINTENANCE MANUALS

SUBMIT OPERATION & MAINTENANCE MANUALS FOR INSTALLATIONS (2 COPIES). FORMAT IS TO BE BOTH DIGITAL & AN A4 SIZE LOOSE LEAF, IN COMMERCIAL QUALITY, 4 RING BINDERS WITH HARD COVERS, EACH INDEXED, DIVIDED & TITLED. INCLUDE THE FOLLOWING FEATURES:

- MANUFACTURERS' PRINTED DATA, INCLUDING ASSOCIATED DIAGRAMS;

- SYSTEM DESCRIPTIONS; MAJOR EQUIPMENT COMPONENTS;

- OPERATION PROCEDURES; MAINTENANCE PROCEDURES;

- OPERATION PROCEDURE FOR THE AC CONTROLLERS;

- COMMISSIONING & TEST FIGURES;

- WARRANTY INFORMATION; &

- DRAWINGS FOLDED TO A4 SIZE & ACCOMMODATE THEM IN THE BINDERS.

TESTING AND COMMISSIONING

CARRY OUT ACCEPTANCE TESTS & FINAL TESTS. COMMISSION ALL PLANT INSTALLED IN THIS CONTRACT & CARRY OUT THE NECESSARY TESTS TO DEMONSTRATE THAT THE SYSTEMS & COMPONENTS MEET ALL PERFORMANCE & AUTHORITY REQUIREMENTS.

PRACTICAL COMPLETION - WILL NOT BE GRANTED WITHOUT THE FOLLOWING: TESTING & COMMISSIONING FINALISED, STABLE OPERATING CONDITIONS OF ALL PLANT; PRELIMINARY INSTRUCTION OF THE BUILDING OWNER OR REPRESENTATIVE IN SAFE OPERATION OF THE PLANT; APPROVED OPERATING INSTRUCTION MANUALS & 'AS BUILT' DRAWINGS PROVIDED; & RECTIFICATION & CORRECTION OF ANY DEFECTS & DEFICIENCIES.

COMPLETION

GENERAL REQUIREMENTS

CARRY OUT ACCEPTANCE TESTS & FINAL TESTS. COMMISSION ALL PLANT INSTALLED IN THIS CONTRACT & CARRY OUT THE NECESSARY TESTS TO DEMONSTRATE THAT THE SYSTEMS & COMPONENTS MEET ALL PERFORMANCE & AUTHORITY REQUIREMENTS.

PRACTICAL COMPLETION - WILL NOT BE GRANTED WITHOUT THE FOLLOWING:

- TESTING & COMMISSIONING FINALISED;

- STABLE OPERATING CONDITIONS OF ALL PLANT;

- PRELIMINARY INSTRUCTION OF THE BUILDING OWNER OR REPRESENTATIVE IN SAFE OPERATION OF THE PLANT;

- APPROVED OPERATING INSTRUCTION MANUALS & 'AS BUILT' DRAWINGS PROVIDED; &

- RECTIFICATION & CORRECTION OF ANY DEFECTS & DEFICIENCIES.

AIR CONDITIONING CAPACITY TESTS - TEST THE CAPACITIES & PERFORMANCE OF AIR-CONDITIONING SYSTEMS UNDER BOTH SUMMER & WINTER CONDITIONS NO HEATING MODE.

AIR BALANCING - BALANCE THE AIR DISTRIBUTION SYSTEM TO GIVE AIR FLOW RATES WITHIN +10% / -10% OF THE SPECIFIED AIR QUANTITIES, & ENSURE THE AIR IS EVENLY DISTRIBUTED OVER THE FACE OF THE OUTLETS. IT IS NECESSARY FOR THE DAMPER ON THE INDEX RUN FROM THE PACKAGE UNIT TO BE FULLY OPEN. THIS IS TO MINIMISE STATIC PRESSURE ON THE UNIT.

12 MONTHS PERFORMANCE TESTING & BUILDING TUNING PERIOD

A COMMITMENT FOR A FURTHER 12 MONTH PERIOD OF STAGED COMMISSIONING BEYOND HANDOVER DATE SHALL BE ALLOWED FOR. THIS PERIOD IS FOR FINE TUNING THROUGH THE YEAR & WILL CONSIST OF A MINIMUM OF QUARTERLY REVIEW PERIODS.

WORK-AS-EXECUTED DRAWINGS

SUBMIT WORK-AS-EXECUTED DRAWINGS. SHOW DIMENSIONS, TYPES & LOCATION OF EQUIPMENT, TRAY CABLES & DUCTWORK IN RELATION TO PERMANENT SITE FEATURES. SHOW THE 'AS INSTALLED' LOCATIONS OF BUILDING ELEMENTS, PLANT & EQUIPMENT. SHOW OFF-THE-GRID DIMENSIONS WHERE APPLICABLE. INCLUDE RELATIONSHIP TO BUILDING STRUCTURE & OTHER SERVICES, & CHANGES MADE DURING COMMISSIONING & THE MAINTENANCE PERIOD. INCLUDE SCHEMATIC DRAWINGS OF EACH SYSTEM SHOWING WIRING, & PRINCIPAL ITEMS OF EQUIPMENT.

OPERATION AND MAINTENANCE MANUALS

SUBMIT OPERATION & MAINTENANCE MANUALS FOR INSTALLATIONS (2 COPIES). FORMAT IS TO BE AN A4 SIZE LOOSE LEAF, IN COMMERCIAL QUALITY, 4 RING BINDERS WITH HARD COVERS, EACH INDEXED, DIVIDED & TITLED. INCLUDE THE FOLLOWING FEATURES: MANUFACTURERS' PRINTED DATA, INCLUDING ASSOCIATED DIAGRAMS, SYSTEM DESCRIPTION & MAJOR EQUIPMENT COMPONENTS, OPERATION PROCEDURES; MAINTENANCE PROCEDURES; COMMISSIONING & TEST FIGURES; DRAWINGS FOLDED TO A4 SIZE & ACCOMMODATE THEM IN THE BINDERS.

ROOF VENTILATORS

ROOF VENTILATOR(S) SHALL BE OF A ROTARY DESIGN INCORPORATING A SEALED BEARING AXLE SYSTEM. DESIGN SHALL INCLUDE ALL APPLICABLE DAMPERS, ACCESSORIES, FIXINGS AND FLASHINGS. INSTALL TO MANUFACTURERS RECOMMENDATIONS.

ROOF VENTILATORS MUST BE FITTED WITH A TRANSITION BASE, BIRD MESH, EMBER MESH AND INCORPORATE A BOOSTER FAN THAT DOES NOT IMPACT THROAT AREA.

VENTILATORS MUST ACHIEVE A Cd OF 0.7 OR GREATER, AND BE TESTED ACCORDING TO AS 2428.1 (RAIN), AS 2428.2 (WIND), AS 2428.4 (FIRE) AND AS 2428.5 (COEFFICIENT OF DISCHARGE).

ROOF VENTILATORS TO BE INSTALLED AND FLASHED AS PER MANUFACTURERS DETAIL. COLOUR TO MATCH ROOF SHEETING.

LOUVRES

LOUVRES

HORIZONTAL OUTDOOR LOUVRES SHALL BE OF EXTRUDED ALUMINIUM CONSTRUCTION WITH 45mm CURVED HORIZONTAL BLADES FIXED AT THEIR ENDS WITH STAINLESS STEEL SCREWS INTO A WELDED ALUMINIUM FRAME. THE STRUCTURE SHALL BE DESIGNED TO WITHSTAND A WIND LOAD OF 95kg/m².

SAFETY IN DESIGN

SAFE WORK AUSTRALIA HAS LEGISLATED THE 'SAFE DESIGN OF STRUCTURES' IN OCTOBER 2018. THIS REQUIRES THE CLIENT, DESIGNERS, BUILDERS & CONTRACTORS TO CONSIDER & PROVIDE ALL NECESSARY SAFETY DEVICES FOR THE PROTECTION OF PERSONNEL AGAINST INJURY & THE PROTECTION OF PLANT & EQUIPMENT AGAINST DAMAGE.

THE CONTRACTOR SHALL BE AWARE OF THE CODE OF PRACTICE REQUIREMENTS FOR 'SAFE DESIGN OF STRUCTURES'. REFER TO www.safeworkaustralia.gov.au FOR FURTHER INFORMATION.

THIS INCLUDES CONSIDERING ACTUAL STRUCTURES, PLANT, ACCESS, GUARDS, SAFETY RAILING, EARTHING OF ELECTRICAL COMPONENTS, ELECTRICAL INTERLOCKS, WARNING LIGHTS, & SIGNS, ALARMS & LOCAL LIGHTING, PROVIDE PERMANENT LIFTING EYES FOR EQUIPMENT EXCEEDING 40kg, ETC. POSITION & LOCATION OF PLANT & EQUIPMENT MUST BE SUCH THAT REGULAR MAINTENANCE & SERVICING ACCESS CAN BE CARRIED OUT SAFELY & SECURELY.

THE SAFETY RISK MITIGATION ITEMS BELOW ARE BASED ON GHD'S DESIGN EXPERIENCE & DO NOT NECESSARILY ACCOUNT FOR ALL CONSTRUCTION, OPERATION, MAINTENANCE & DEMOLITION SAFETY RISKS.

BASED ON INFORMATION AVAILABLE AT THE TIME OF THIS DOCUMENTATION, IN ITS CAPACITY AS DESIGNER ONLY GHD HAS TRIED TO IDENTIFY SAFETY RISKS PERTAINING TO CONSTRUCTION, OPERATION, MAINTENANCE, INCLUSION (OR NOT) OF ANY ITEM DOES NOT REDUCE OR LIMIT OBLIGATIONS OF CONSTRUCTOR, USER, MAINTAINER TO UNDERTAKE APPROPRIATE RISK MANAGEMENT ACTIVITIES TO REDUCE RISK.

PROVIDE PROTECTION TO PERSONNEL FROM PLANT & EQUIPMENT.

REVIEW ADEQUACY OF WORKING SPACE AVAILABLE FOR CONSTRUCTION ACTIVITIES. ENSURE SEPARATION OF PLANT & PERSONNEL ON SITE, INCLUDING MOVEMENTS OF BOTH.

ENSURE ISOLATION SAFE SYSTEMS OF WORK OR PROTECTIVE MEASURES ARE INSTALLED BEFORE WORKING NEAR LIVE ELECTRICAL INFRASTRUCTURE. PROVIDE PROTECTION OF ELECTRICAL OVERHEAD WIRING SYSTEMS DURING CONSTRUCTION.

WRITTEN RISK ASSESSMENTS ARE ADVISED FOR ACCESS TO OPEN EXCAVATIONS OR CONFINED SPACES.

INSTRUCT SERVICES CONTRACTORS UNDER NO CIRCUMSTANCES CAN STRUCTURAL MEMBERS BE CUT, NOTCHED OR DRILLED TO ACCOMMODATE NEW SERVICES.

MINIMISE SITE BASED TREATMENTS (eg. WELDING, CUTTING, SPRAY PAINTING, GRIT BLASTING ETC.) PROVIDE ADEQUATE PROTECTION SCREENING & VENTILATION TO MINIMISE HAZARDS TO PERSONNEL IF SITE BASED TREATMENT IS UNAVOIDABLE.

TRY TO AVOID WORKING IN CONFINED SPACES. IF CONFINED SPACES WORK CANT BE AVOIDED, PROVIDE SAFE WORK METHOD STATEMENT ADDRESSING MITIGATION OF RISKS. PROVIDE ADEQUATE SIGNAGE TO TEMPORARY & PERMANENT CONFINED SPACES TO AS 2865.

Rev	Description	Checked	Approved	Date
A	30% DETAIL DESIGN	MK	RJ	01/09/23
Author	D.DEGUZMAN	Drafting Check		
Designer	P.PREMRAJKUMAR	Design Check	M.KLUMPP	

Plot Date: 26/10/2023 12:56:36 PM

File Name: Autodesk Docs://12589773 - Lachlan Pipeline Duplication Detailed Design/12589773-AKUNA ROAD PS-HVAC-R22.vt



PACKAGED UNIT SCHEDULE

EQUIPMENT	SPACE SERVED	TOTAL SUPPLY AIR QUANTITY (L/s)	TOTAL OUTSIDE AIR QUANTITY (L/s)	EXTERNAL STATIC PRESSURE AT MACHINE NOMINAL AIRFLOW (Pa)	SOUND PRESSURE LEVEL @ 3M (SWL dBA)	TOTAL COOLING CAPACITY (kW)	SENSIBLE COOLING CAPACITY (kW)	TOTAL HEATING CAPACITY (kW)	ENTERING AIR CONDITIONS SUMMER (°CDB / °CWB)	ENTERING AIR CONDITIONS WINTER (°CDB)	DESIGN AMBIENT TEMPERATURES (°CDB SUMMER / °CDB WINTER)	COIL ENTERING TEMPERATURES (°CDB / °CWB)	ELECTRICAL INPUT (V / PHASE / MAX RUNNING AMPS PER PHASE)	POWERED FROM	BASE SELECTION	COMMENTS
PAC.1	SWITCH ROOM	2,200	50	300	62	25.9	-	37	25.4/17.9	5.2	42.4 / -0.4	27.3/19.5	400/3/35	MCC	OPA 350RLTFPQ-S1	MANUFACTURER OPTIONS REQUIRED ARE: OPPOSITE HAND SPIGOTS AS PER DRAWING, ECONOMY CYCLE, WEATHER HOOD, EC PLUG FANS. MACHINE REQUIRED TO SHUT DOWN UPON ACTIVATION OF FIRE MODE. SEE SPECIFICATION NOTES SHEET FOR INFORMATION ON CONTROLS.
PAC.1	SWITCH ROOM	2,200	50	300	62	25.9	-	37	25.4/17.9	5.2	42.4 / -0.4	27.3/19.5	400/3/35	MCC	OPA 350RLTFPQ-S1	MANUFACTURER OPTIONS REQUIRED ARE: OPPOSITE HAND SPIGOTS AS PER DRAWING, ECONOMY CYCLE, WEATHER HOOD, EC PLUG FANS. MACHINE REQUIRED TO SHUT DOWN UPON ACTIVATION OF FIRE MODE. SEE SPECIFICATION NOTES SHEET FOR INFORMATION ON CONTROLS.

NOTE: UNIT SELECTIONS ARE FOR TENDER PURPOSES ONLY. CONTRACTOR TO PERFORM FINAL DESIGN CALCULATIONS TO VERIFY CAPACITY AND THE REQUIRED EXTERNAL STATIC PRESSURE.

ROOF VENTILATOR SCHEDULE

EQUIPMENT	TYPE	NATURAL VENTILATION AIRFLOW (L/s) (@ 3.05m STACK, 6.4km/hr WIND FACTOR, 6°C dT)	AIRFLOW USING BOOSTER FAN (L/s @ 50 PA)	BASE SELECTION	POWER SUPPLY (V / ph / A)	CONTROL METHODOLOGY	COMMENTS
RV.1	SLOPE MOUNTED ROTARY VENTILATOR c/w TRANSITION BASE, DAMPER AND BOOSTER FAN	609	2000	AIROCLE 5AV.0600/050-4	240 / 1 / 3	PLEASE REFER TO CONTROLS SECTIONS	TO BE FITTED WITH EMBER MESH TO COMPLY WITH BAL12.5 RATING
RV.2		609	2000	AIROCLE 5AV.0600/050-4	240 / 1 / 3		
RV.3		609	2000	AIROCLE 5AV.0600/050-4	240 / 1 / 3		
RV.4		609	2000	AIROCLE 5AV.0600/050-4	240 / 1 / 3		
RV.5		609	2000	AIROCLE 5AV.0600/050-4	240 / 1 / 3		
RV.6		609	2000	AIROCLE 5AV.0600/050-4	240 / 1 / 3		
RV-WT-01	SLOPE MOUNTED ROTARY VENTILATOR	271	N/A	AIROCLE 5AV.0400/030-4	240 / 1 / 0.43		TO BE FITTED WITH VERMIN PROOF MESH
RV-WT-02		271	N/A	AIROCLE 5AV.0400/030-4	240 / 1 / 0.43		

AIR TERMINAL SCHEDULE

EQUIPMENT	APPLICATION	AIR TERMINAL STYLE	PLENUM	MIN NECK SIZE (W x H) (mm)	BASE EQUIPMENT SELECTION	COMMENT
S1	SUPPLY AIR	SWIRL	-	595X595	HOLYOAKE CFP	-
E1	RETURN AIR	EGG CRATE	-	600X600	HOLYOAKE EC-125 SERIES	-
E2	EXHAUST AIR	EGG CRATE	-	1000X1000	HOLYOAKE EC-125 SERIES	-

FILTER SCHEDULE

FILTER	LOCATION	TYPE	MEDIA TYPE & CLASS TO AS 1324.1.2.1	MAXIMUM FILTER FACE VELOCITY (m/s)	FILTER RATING	DIMENSIONS (H X W X D)	QTY.	BASE SELECTION
AF.1	PAC.1 AND PAC.2	PLEATED PANEL (50mm)	TYPE 1, CLASS A	2.3	G4	600X300X50	2	AeroPleat Eco 287x592x48-0
AF.2	PAC.1 AND PAC.2	PLEATED PANEL (50mm)	TYPE 1, CLASS A	2.3	G4	600X500X50	4	AeroPleat Eco 287x592x48-0



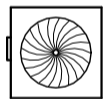
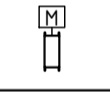

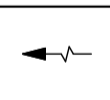
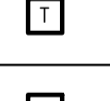
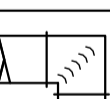
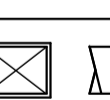
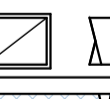
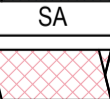
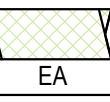


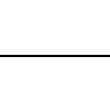
ROOF COWL SCHEDULE

EQUIPMENT TAG	AREA SERVED	NOMINAL AIR FLOW (L/S)	BASE SELECTION	COMMENTS
RC-WT-01	WATER TANK ROOM	280	FANTECH RV1	TO BE FITTED WITH VERMIN PROOF MESH
RC-WT-02		280	FANTECH RV1	

WEATHERPROOF LOUVRE SCHEDULE

EQUIPMENT	LOUVER FACE SIZE W x H (mm)	MINIMUM FREE AREA OF LOUVRE (%)	MAKE/MODEL	COLOR	COMMENTS
LV.1	1200X2000	51.00%	OHL-124	TBC	TO BE FITTED WITH EMBER MESH TO COMPLY WITH BAL 12.5 RATING.

MECHANICAL LEGEND

	ROOF COWL
	LOUVRE
	SWIRL SUPPLY AIR DIFFUSER
	MOTORISED VOLUME CONTROL DAMPER
	MOTORISED FIRE DAMPER
	FIRE DAMPER
	AIR FLOW DIRECTION
	TEMPERATURE SENSOR
	A/C UNIT CONTROLLER WITH IN-BUILT TEMPERATURE SENSOR
	SQUARE BEND COMPLETE WITH TURNING VANES
	SUPPLY AIR DUCT RISER/DROPPER
	EXHAUST OR RETURN AIR DUCT RISER/DROPPER
	INSULATED SUPPLY AIR DUCT
	INSULATED RETURN AIR DUCT
	INSULATED EXHAUST AIR DUCT

Rev	Description	Checked	Approved	Date
A	30% DETAIL DESIGN	MK	RJ	01/09/23

Author: D.DEGUZMAN Drafting Check
 Designer: P.PREMAKUMAR Design Check M.KLUMPP



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Client: **PARKES SHIRE COUNCIL**
 Project: **LACHLAN PIPELINE DUPLICATION DETAILED DESIGN PROJECT**
 Status: **PRELIMINARY**

Drawing Title: **MECHANICAL SERVICES AKUNA ROAD LEGEND AND SCHEDULE**

Size **A1**

Rev **A**

NOTES

1. ALL PIPEWORK AND DUCTWORK TO BE INSULATED AS PER NCC 2022.
2. CONDENSATE PIPEWORK TO BE SIZED AND RUN AS REQUIRED BY CONTRACTOR TO ENSURE SUITABLE FLOW TO DRAIN POINTS AND PREVENT OVERFLOW.
3. ALL DUCT SIZES SHOWN ARE INTERNAL AIRWAY SIZES ONLY.
4. ALL AIR CONDITIONING SYSTEMS SHALL AUTOMATICALLY SHUT DOWN ON THE INITIATION OF FIRE MODE.
5. FINAL LOCATION OF CONTROL PANEL TO BE APPROVED BY CLIENT.

PROVIDE LOU/RE WITH 50% MIN FREE AREA C/W EMBER MESH TO COMPLY WITH BAL 12.5 RATING (AS3959-2018) (TYP.)

CONTRACTOR TO INSTALL THIRD PARTY INNOTECH CONTROLLER OR SIMILAR TO INCORPORATE THE FUNCTIONAL CONTROLS FOR FAN BOOSTED ROOF VENTILATORS AND ASSOCIATED MOTORISED DAMPERS.

ROOF PENETRATIONS TO RV-01, RV-02, RV-03, RV-04, RV-05, RV-06, ON ROOF ABOVE.

HIGH LEVEL WEATHERPROOF LOU/RE c/w MOTORISED FIRE DAMPER FOR RELIEF AIR IN ECONOMY MODE.

THERMOSTAT FOR THE PAC UNIT. FINAL LOCATION TO BE COORDINATED ON-SITE. THERMOSTAT TO BE LOCATED AWAY FROM DIRECT SUNLIGHT AND DRAUGHT (TYP.)

CONTRACTOR TO SUPPLY AND INSTALL TEMPERATURE SENSOR. SENSOR TO BE LOCATED AWAY FROM DIRECT SUNLIGHT, IN CLOSE PROXIMITY TO THE DUTY PUMPS AND AWAY FROM THE INTAKE LOUVRES.

CONTRACTOR TO PROVIDE ONE (x1) PROPRIETARY CONTROLLER FOR THE PACKAGE UNITS IN DUTY / STANDBY OPERATION (PAC.1 AND PAC.2).

CONTRACTOR TO PROVIDE STREAM SPLITTERS AND OPPOSED BLADE DAMPERS BEHIND THE SWIRL GRILLES (TYP.)

HVAC DESIGN FOR VSDs TO BE INCLUDED IN 100% DETAIL DESIGN ISSUE.

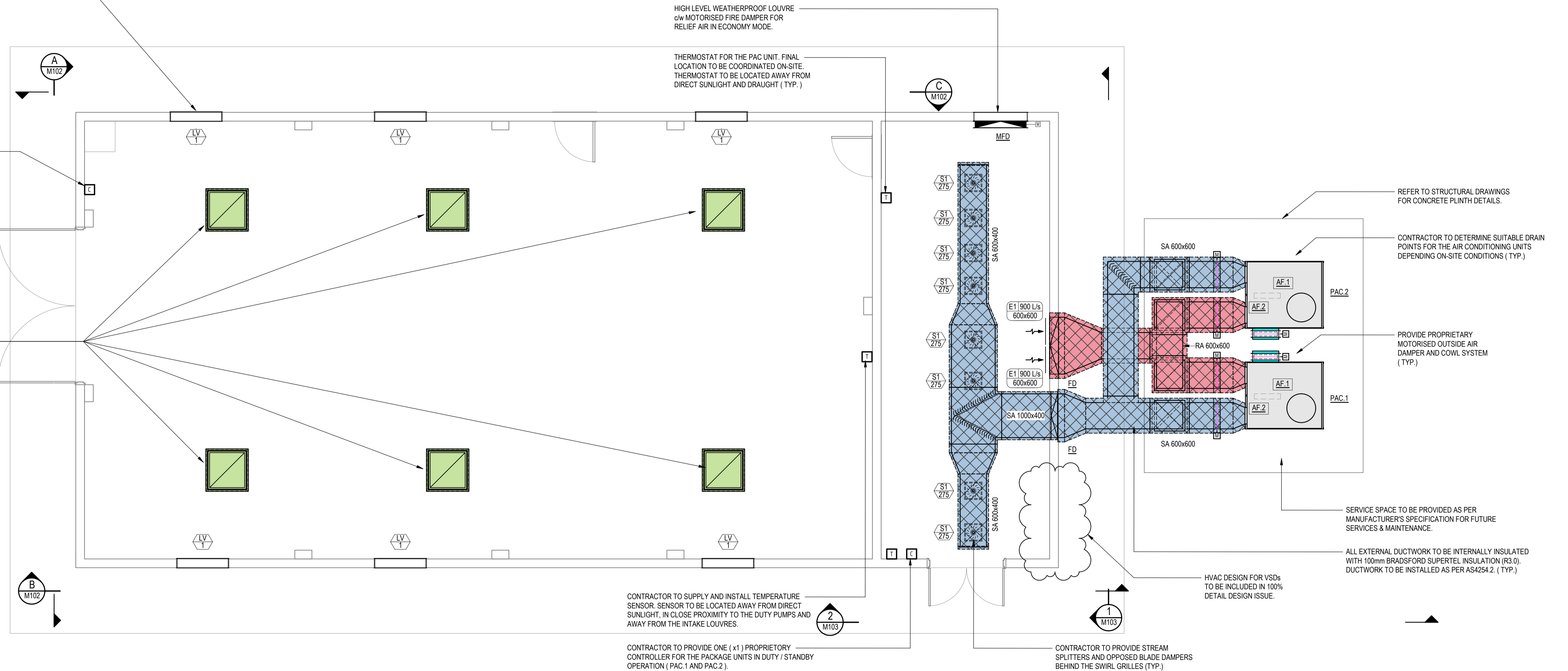
SERVICE SPACE TO BE PROVIDED AS PER MANUFACTURER'S SPECIFICATION FOR FUTURE SERVICES & MAINTENANCE.

ALL EXTERNAL DUCTWORK TO BE INTERNALLY INSULATED WITH 100mm BRADFORD SUPERTEL INSULATION (R3.0). DUCTWORK TO BE INSTALLED AS PER AS4254.2 (TYP.)

PROVIDE PROPRIETARY MOTORISED OUTSIDE AIR DAMPER AND COWL SYSTEM (TYP.)

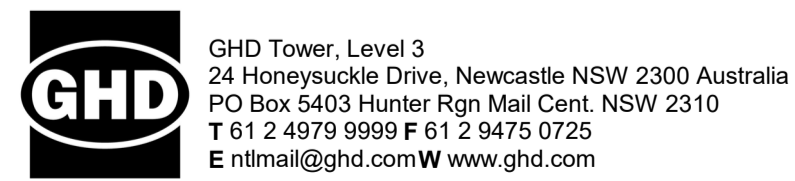
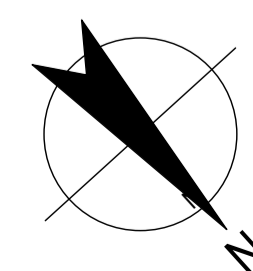
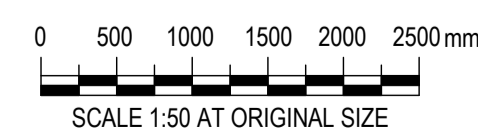
CONTRACTOR TO DETERMINE SUITABLE DRAIN POINTS FOR THE AIR CONDITIONING UNITS DEPENDING ON-SITE CONDITIONS (TYP.)

REFER TO STRUCTURAL DRAWINGS FOR CONCRETE PLINTH DETAILS.



GROUND FLOOR HVAC LAYOUT
SCALE 1 : 50

Rev	Description	Checked	Approved	Date
B	30% DETAIL DESIGN	MK	RJ	01/09/23
A				
Author	D.DEGUZMAN Drafting Check			
Designer	P.PREMRAJKUMAR Design Check M.KLUMPP			



Client **PARKES SHIRE COUNCIL**

Project **LACHLAN PIPELINE DUPLICATION DETAILED DESIGN PROJECT**

Status **PRELIMINARY**

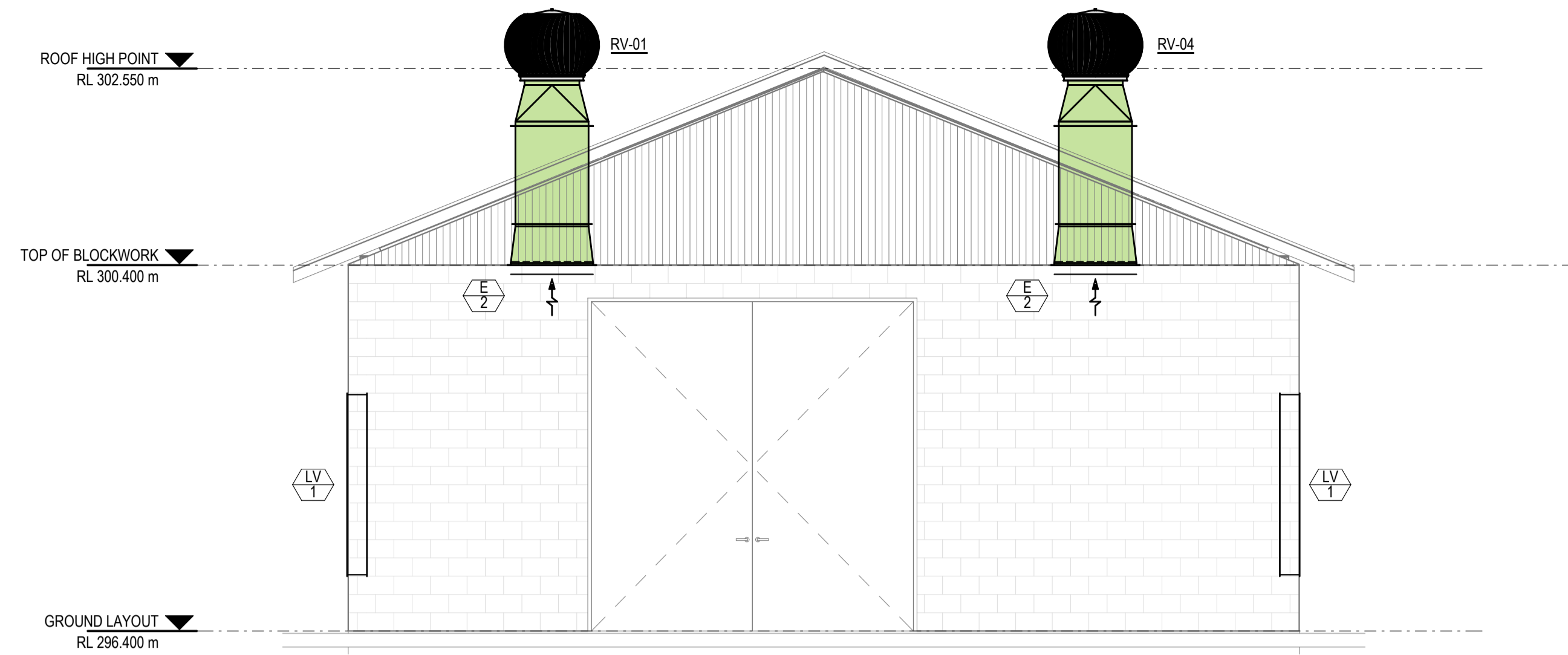
Project No. **12589773**

Drawing Title **MECHANICAL SERVICES AKUNA ROAD PUMP STATION GROUND FLOOR HVAC LAYOUT**

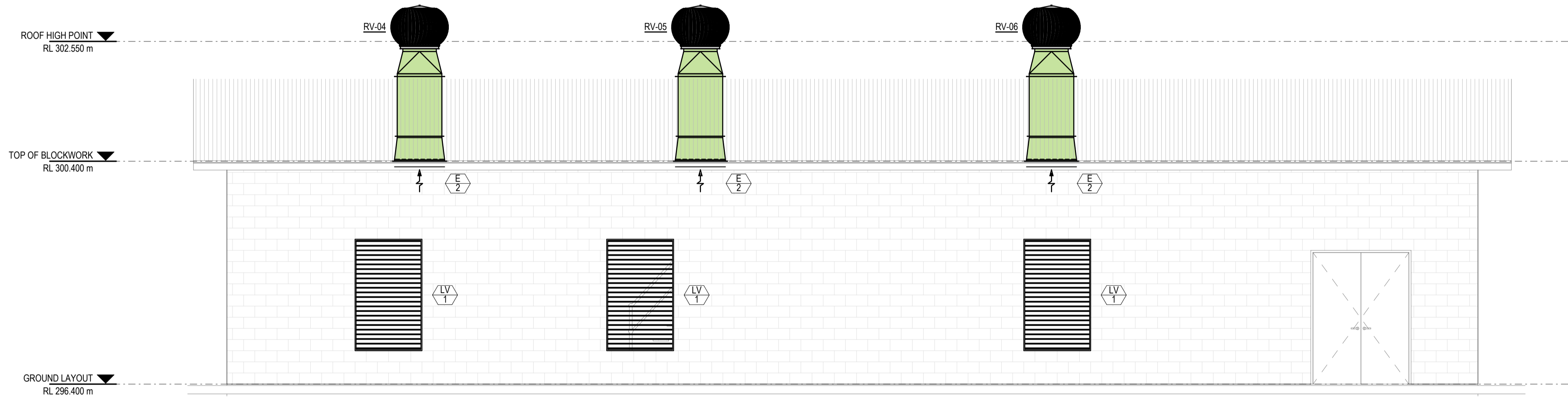
Drawing No. **12589773-M100**

Size **A1**

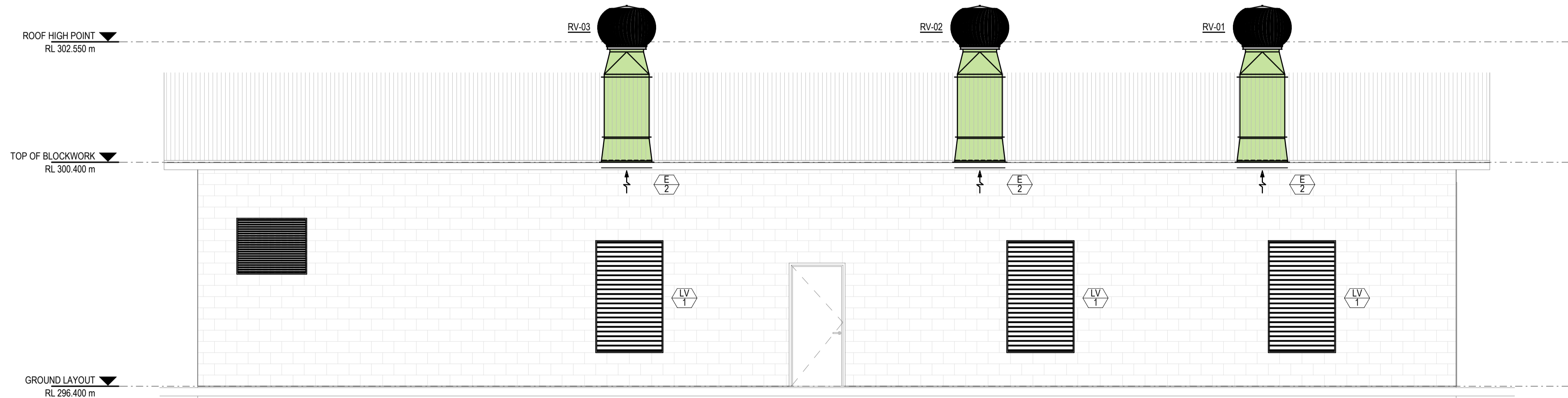
Rev **B**



SECTION - A
SCALE 1:50

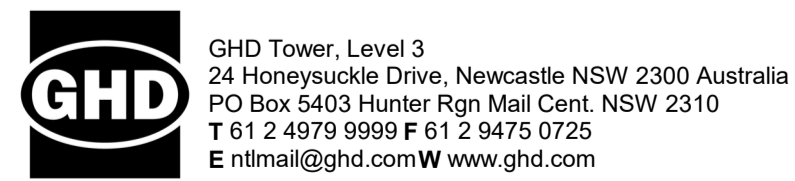
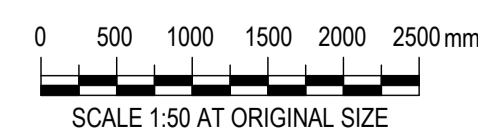


SECTION - B
SCALE 1:50



SECTION - C
SCALE 1:50

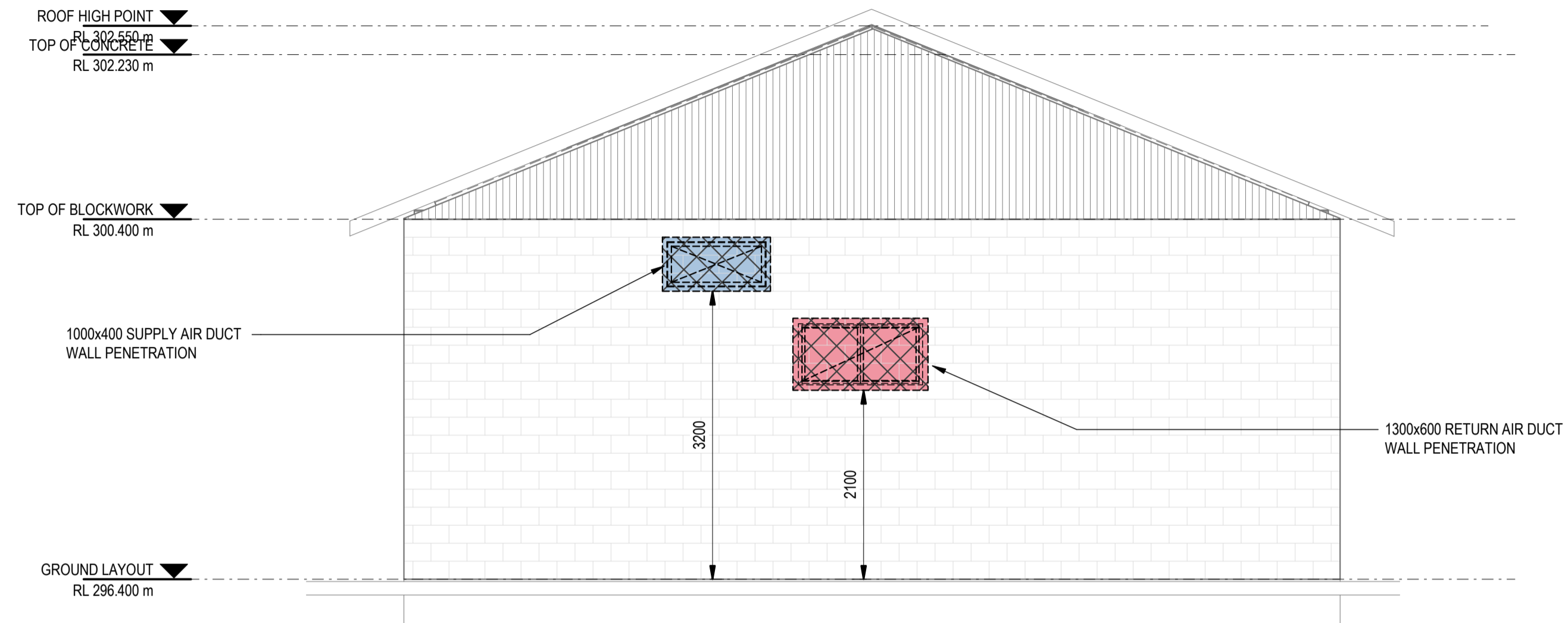
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A	30% DETAIL DESIGN	MK	RJ	01/09/23
Author	D.DEGUZMAN Drafting Check			
Designer	P.PREMRAJKUMAR Design Check M.KLUMPP			



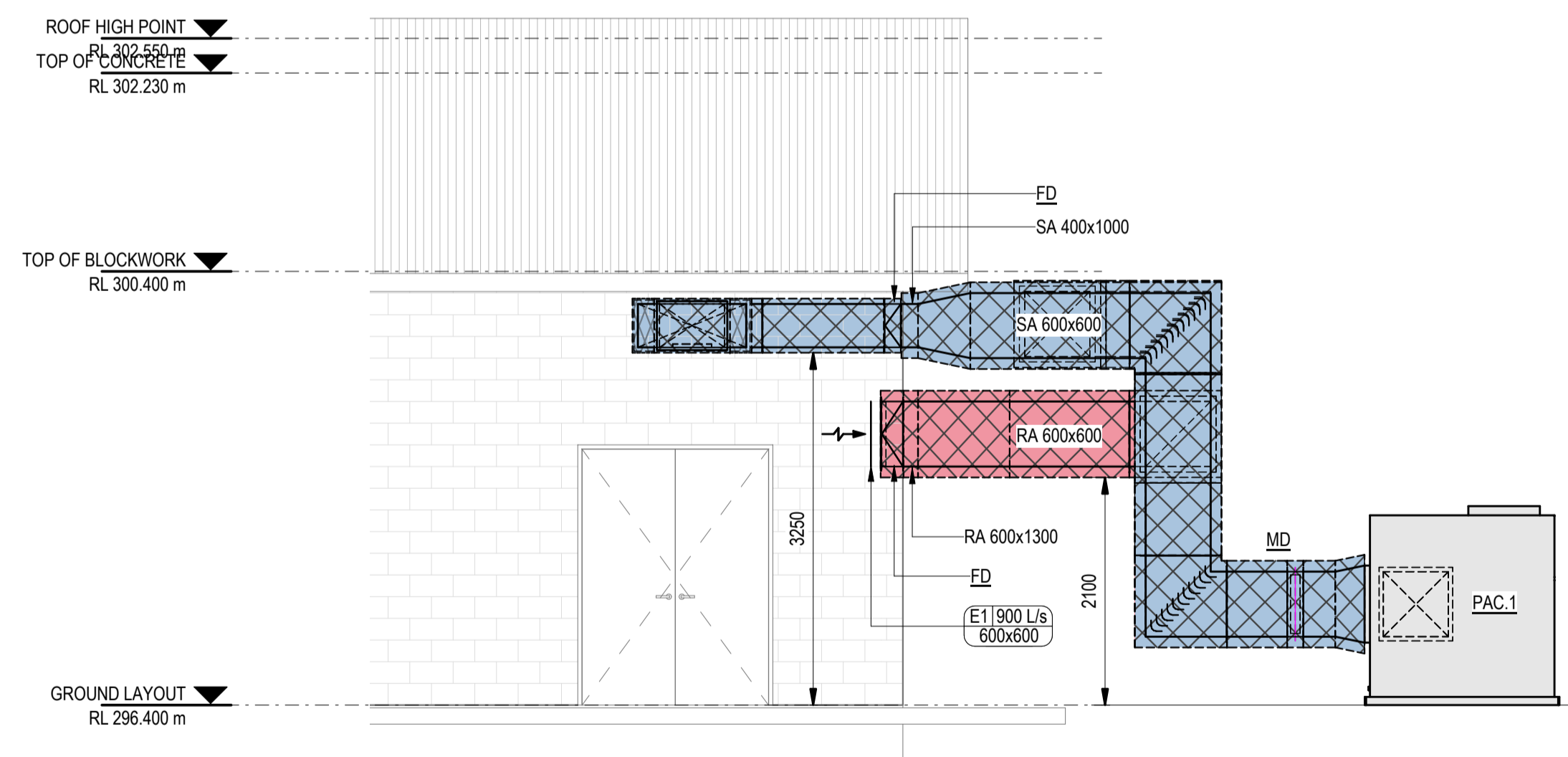
Project No.
12589773

Client **PARKES SHIRE COUNCIL**
Project **LACHLAN PIPELINE DUPLICATION
DETAILED DESIGN PROJECT**
Status

Drawing Title **MECHANICAL SERVICES
AKUNA ROAD
PUMP STATION
SECTION DETAILS**
Drawing No. **12589773-M102**
Rev **A**



SECTION - D
SCALE 1:50



SECTION - E
SCALE 1:50

Rev	Description	Checked	Approved	Date
A	30% DETAIL DESIGN	MK	RJ	01/09/23
Author	D.DEGUZMAN	Drafting Check		
Designer	P.PREMRAJKUMAR	Design Check	M.KLUMPP	



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Project No.
12589773

Client **PARKES SHIRE COUNCIL**
Project **LACHLAN PIPELINE DUPLICATION
DETAILED DESIGN PROJECT**
Status **PRELIMINARY**

Drawing Title
**MECHANICAL SERVICES
AKUNA ROAD
SWITCH ROOM
DUCT SECTION DETAILS**

Drawing No.
12589773-M103

Size
A1
Rev
A

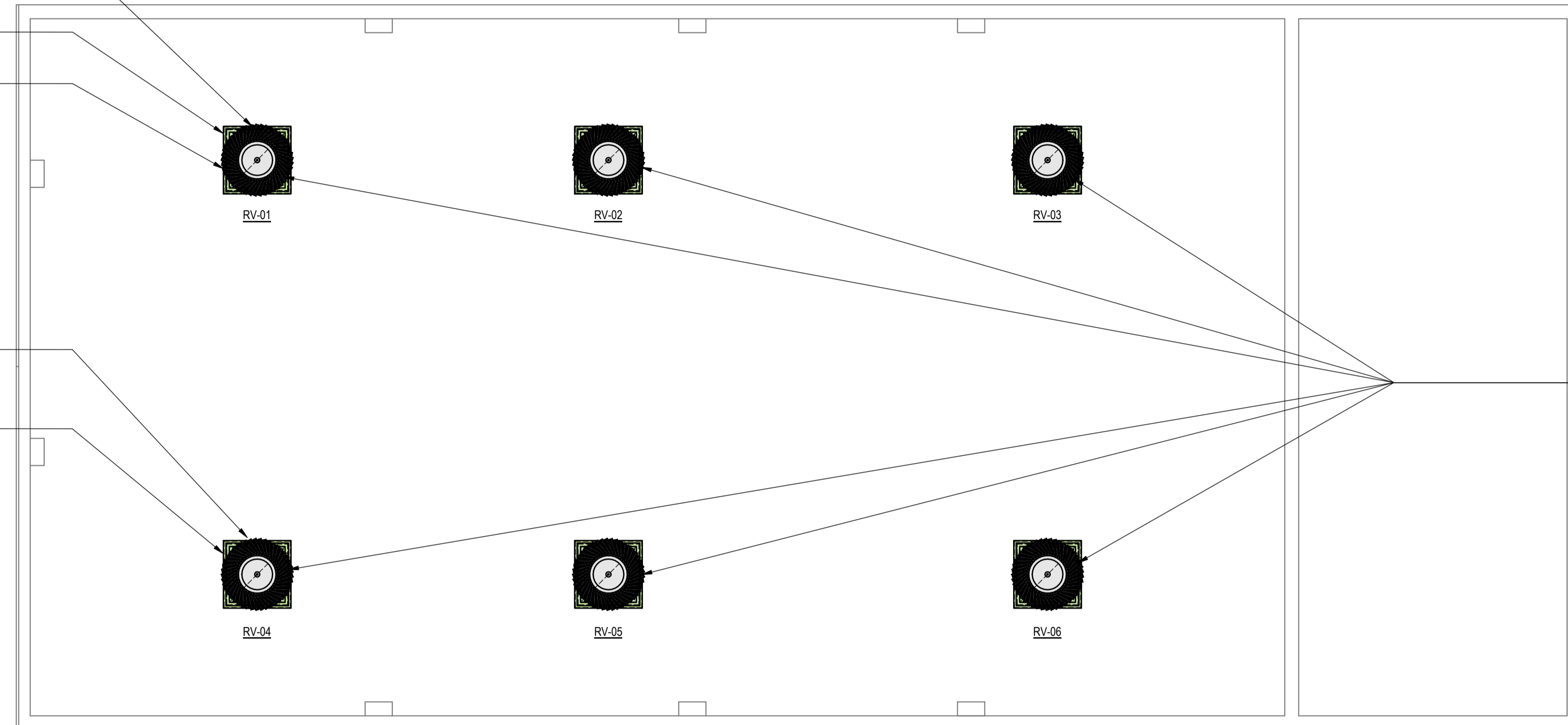
SUPPLY AND INSTALL AIROCLE
SAV.0600 / 050 - 4 ROOF VENTILATORS
CW MOTORISED DAMPERS (TYP.)

800x800 TRANSITIONING OPENING
FOR ROOF VENTILATORS (TYP.)

CONTRACTOR TO COORDINATE THE LAYOUT OF THE
ROOF VENTILATORS WITH THE ROOF STRUCTURE.
BUILDER TO PROVIDE THE REQUIRED BOX OUTS TO
FACILITATE THE INSTALLATION OF THE ROOF
VENTILATOR (TYP.)

CONTRACTOR TO ENSURE THE SHORTEST DISTANCE
BETWEEN ANY TWO ROOF VENTILATORS TO BE
GREATER THAN 5 METERS.

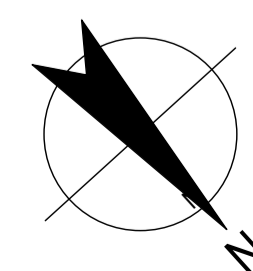
CONTRACTOR TO PROVIDE FLASHING
TO SUIT ROOF PROFILE (TYP.)



ROOF PENETRATIONS TO RV-01,
RV-02, RV-03, RV-04, RV-05, RV-06, ON
ROOF ABOVE.

ROOF FLOOR HVAC LAYOUT
SCALE 1 : 50

Rev	Description	Checked	Approved	Date
A	30% DETAIL DESIGN	MK	RJ	01/09/23
Author	D.DEGUZMAN Drafting Check			
Designer	P.PREMRAJKUMAR Design Check M.KLUMPP			



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Project No.
12589773

Client **PARKES SHIRE COUNCIL**

Project **LACHLAN PIPELINE DUPLICATION
DETAILED DESIGN PROJECT**

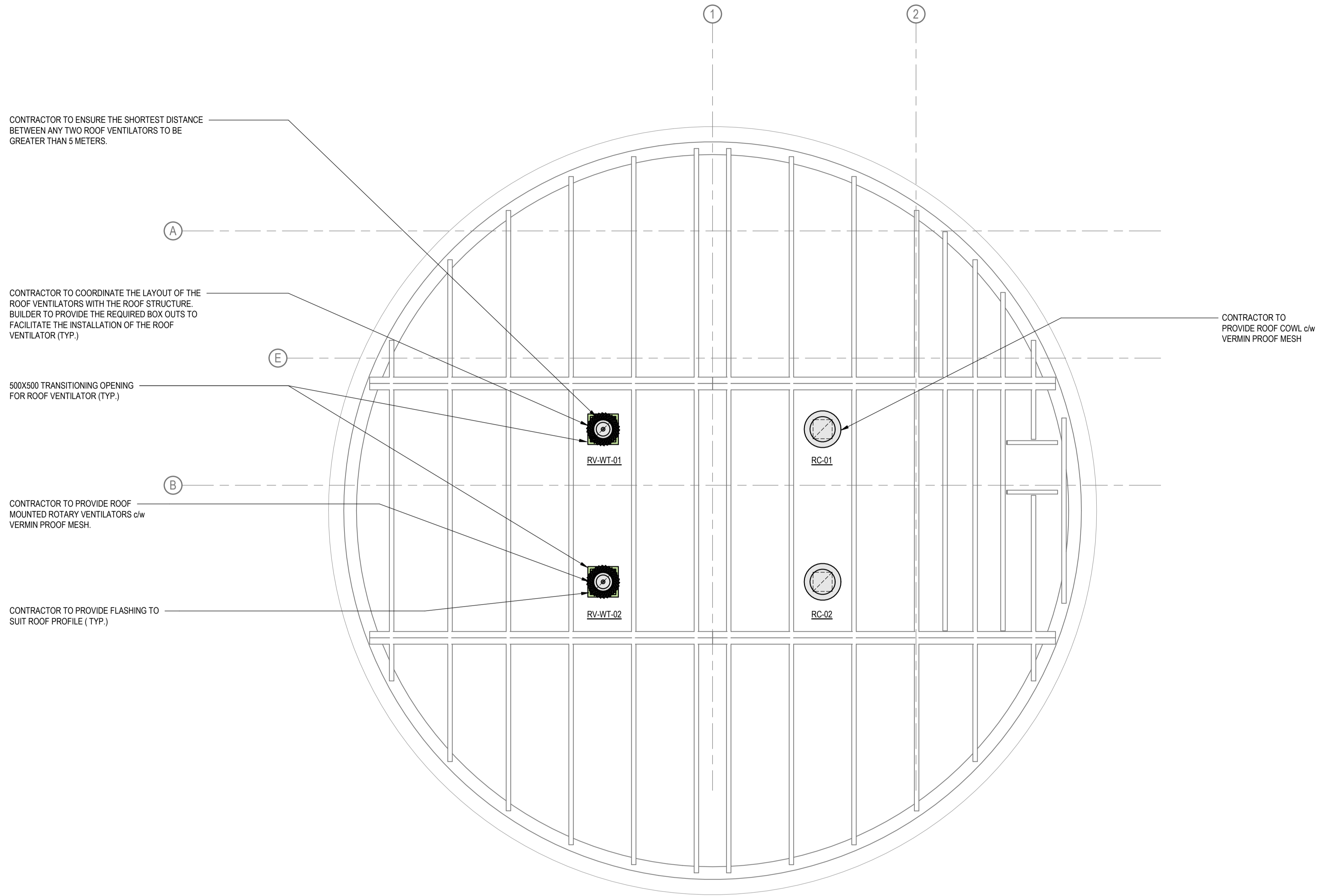
Status **PRELIMINARY**

Drawing Title
**MECHANICAL SERVICES
AKUNA ROAD
PUMP STATION
ROOF FLOOR HVAC LAYOUT**

Drawing No.
12589773-M200

Size
A1

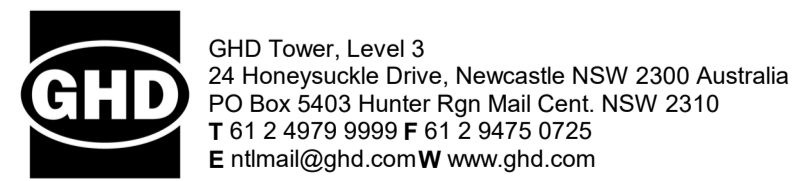
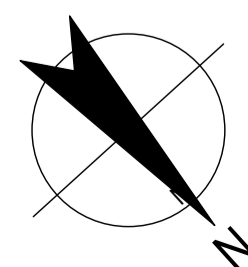
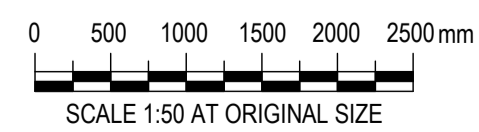
Rev
A



ROOF TANK HVAC LAYOUT
SCALE 1 : 50

Rev	Description	Checked	Approved	Date
A	30% DETAIL DESIGN	MK	RJ	01/09/23

Author D.DEGUZMAN Drafting Check
Designer P.PREMRAJKUMAR Design Check M.KLUMPP



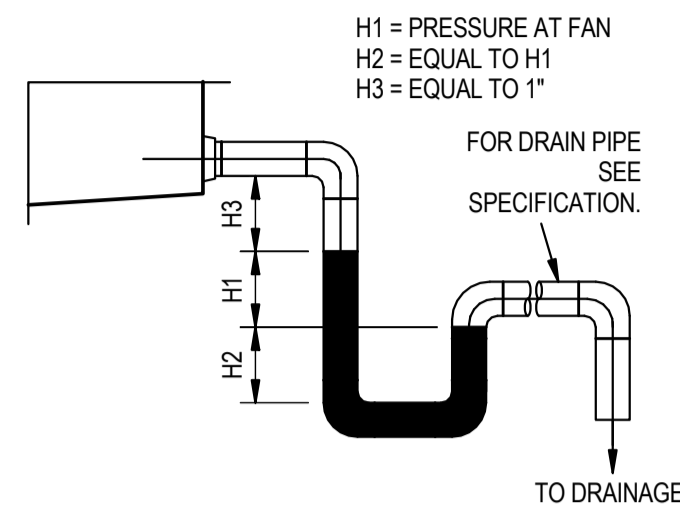
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12589773

Client **PARKES SHIRE COUNCIL**
Project **LACHLAN PIPELINE DUPLICATION
DETAILED DESIGN PROJECT**
Status **PRELIMINARY**

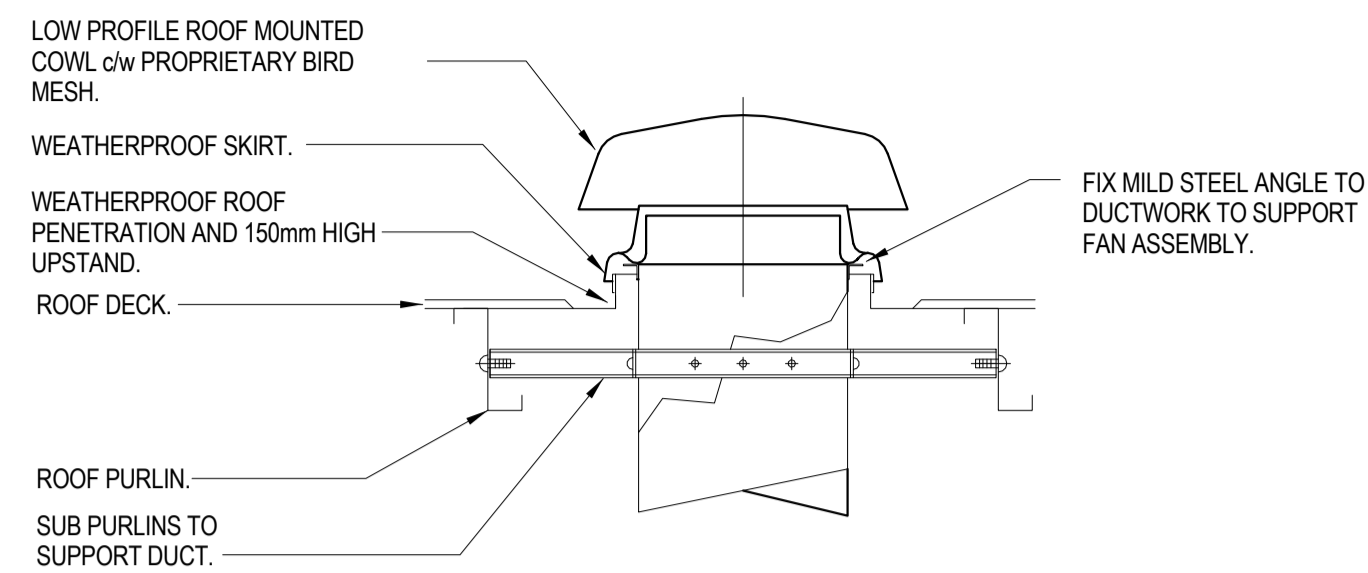
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AKUNA ROAD
RESERVOIR
ROOF TANK HVAC LAYOUT**

Drawing No.
12589773-M300

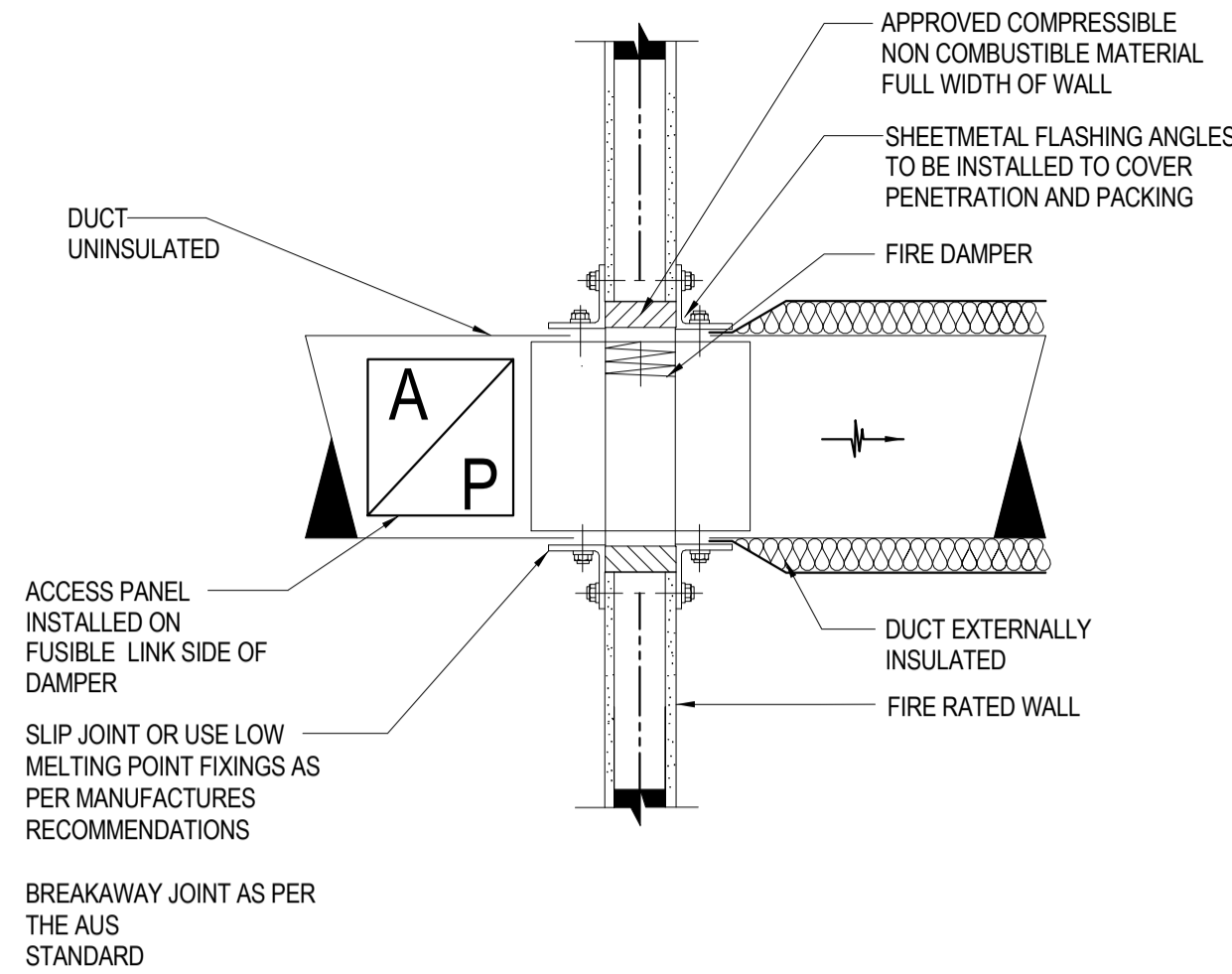
Size
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Rev
A



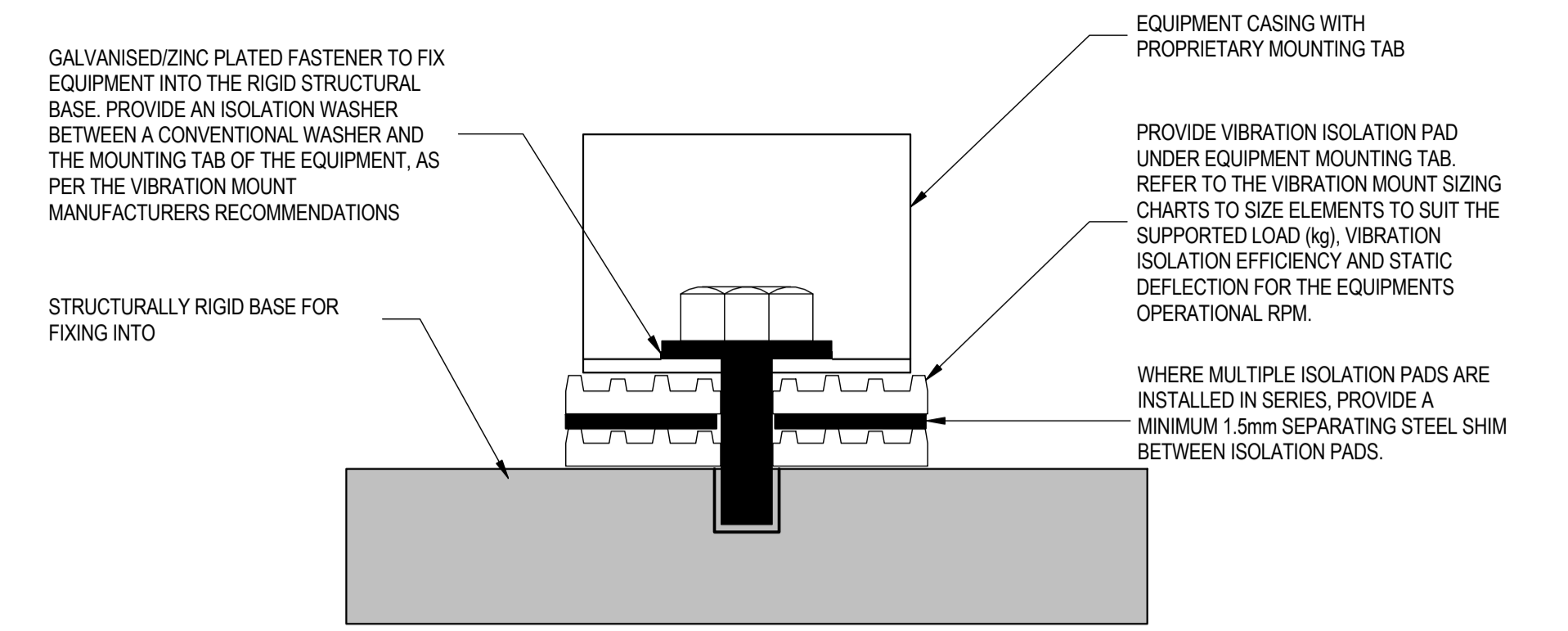
DETAIL OF CONDENSATE DRAINS
NOT TO SCALE



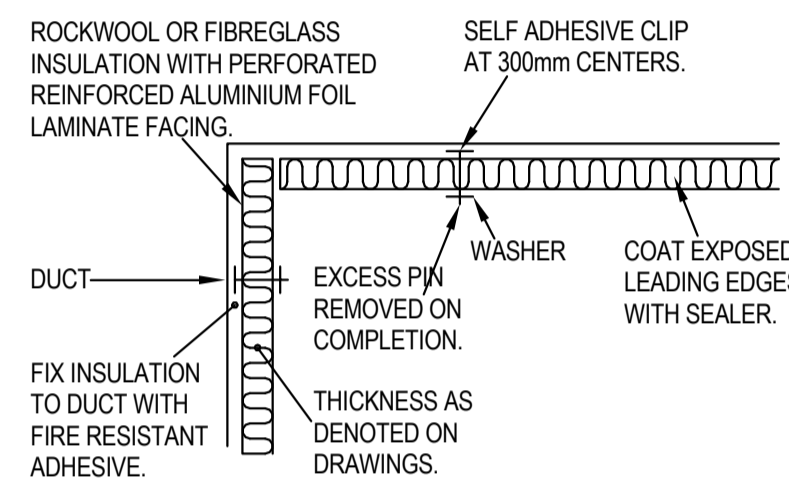
ROOF MOUNTED COWL DETAIL - FLAT DECK
NOT TO SCALE



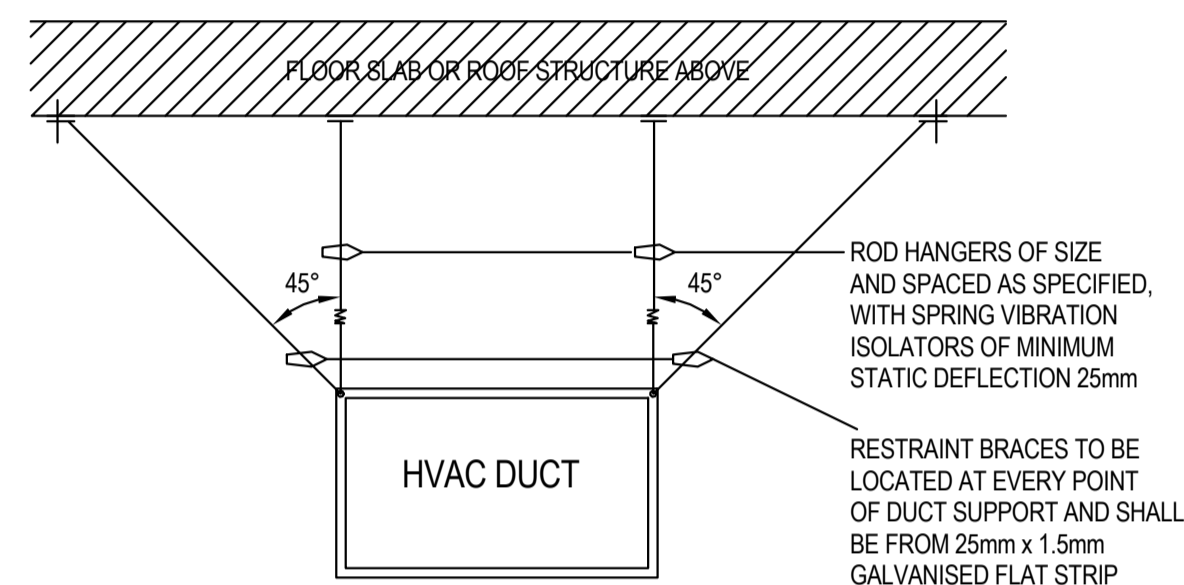
TYPICAL FIRE RATED DUCTWORK WALL PENETRATION DETAIL
NOT TO SCALE



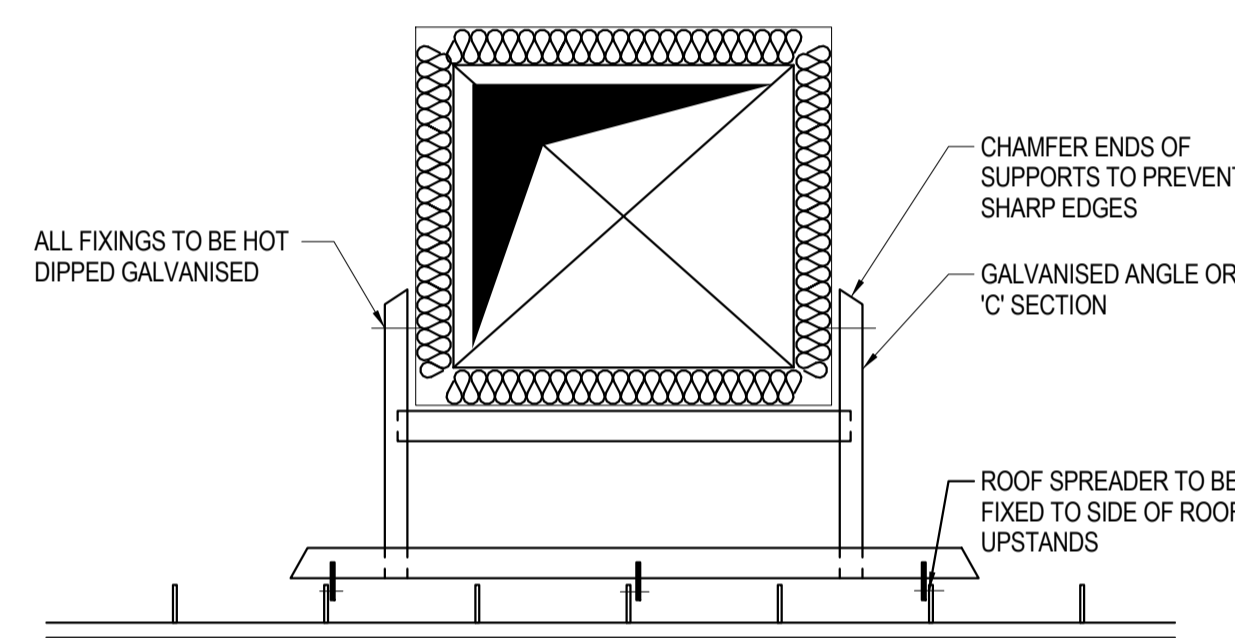
WAFFLE PAD VIBRATION ISOLATION INTO RIGID BASE ON GRADE
NOT TO SCALE



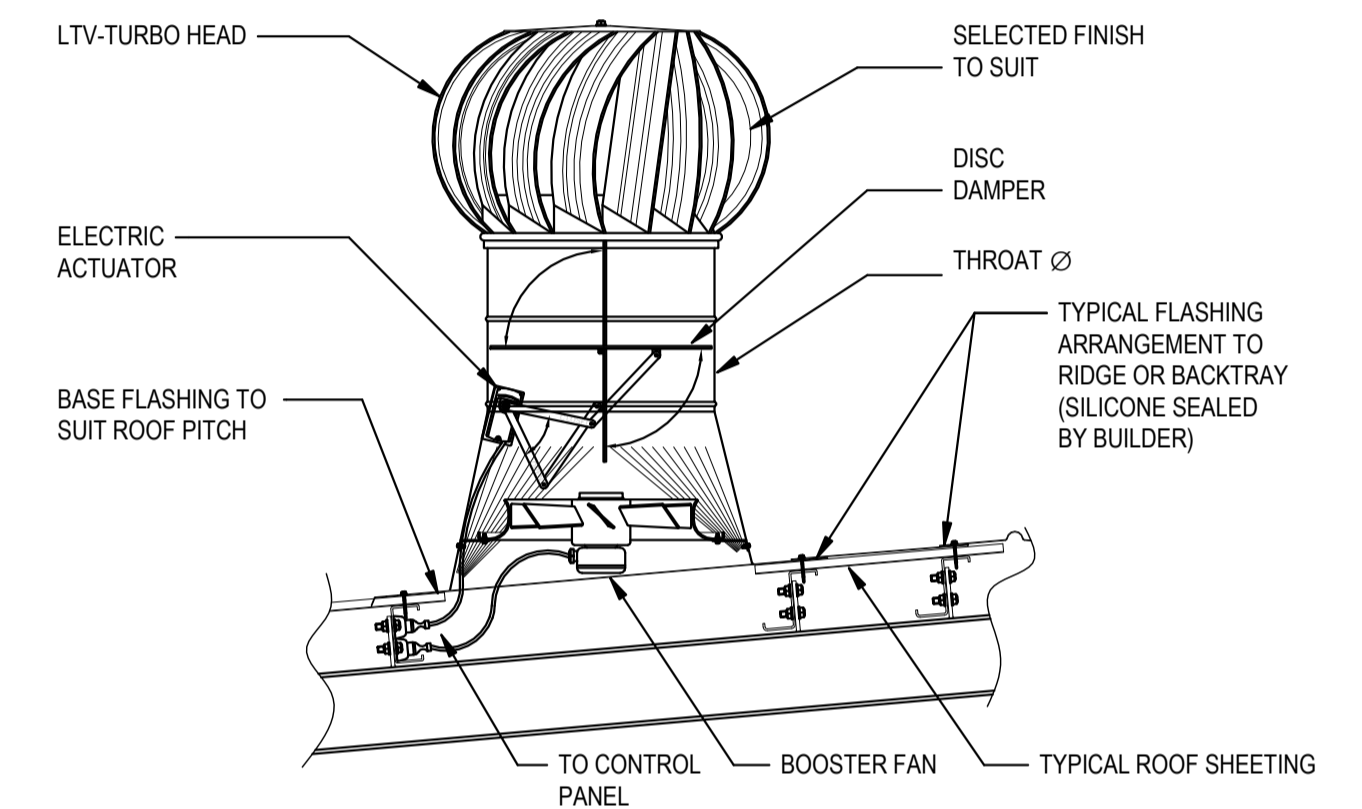
INTERNAL DUCT INSULATION
NOT TO SCALE



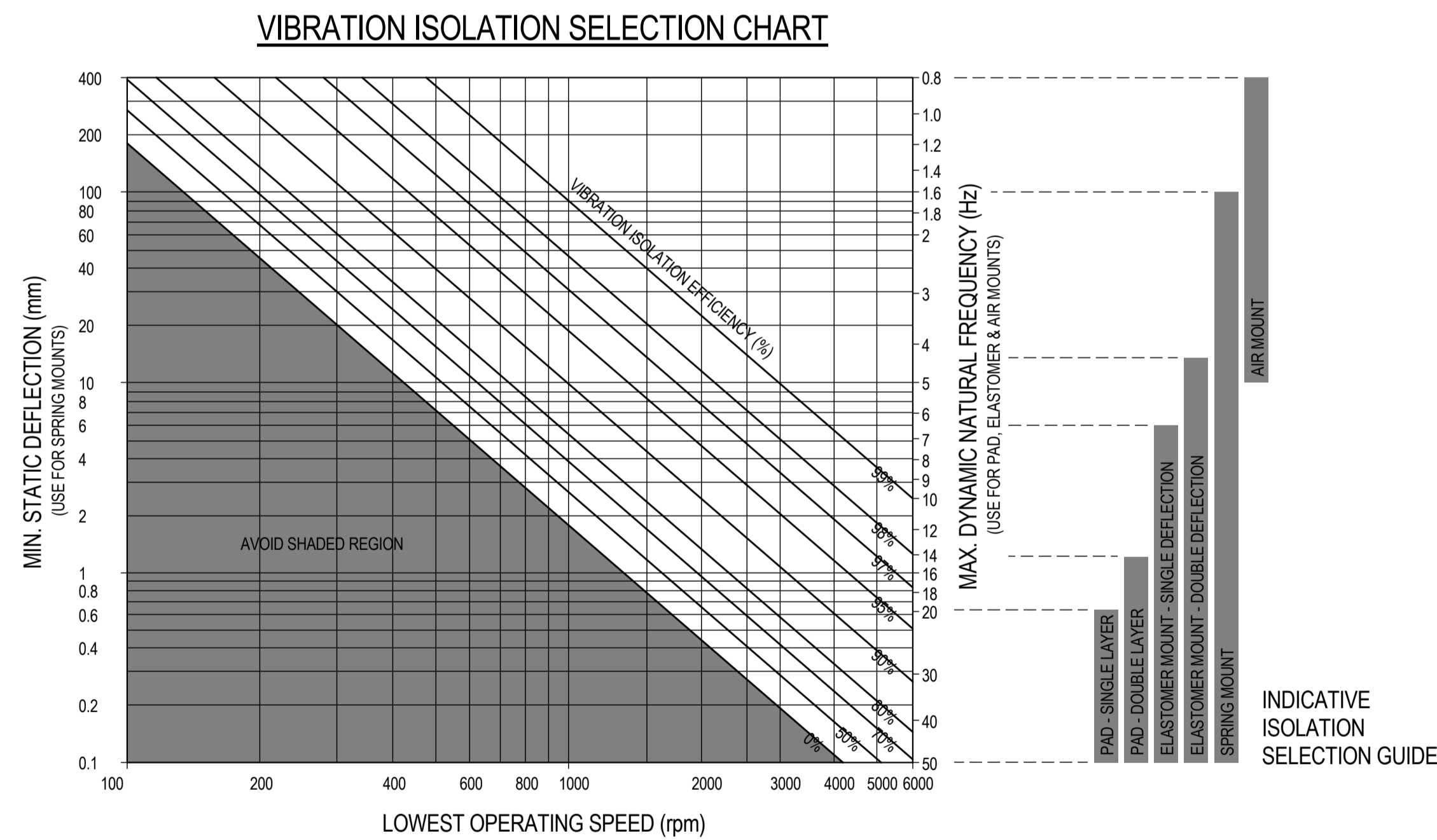
TYPICAL ADDITIONAL DUCT & FCU RESTRAINTS
NOT TO SCALE



TYPICAL ROOF MOUNTED DUCTWORK SUPPORT DETAIL
NOT TO SCALE

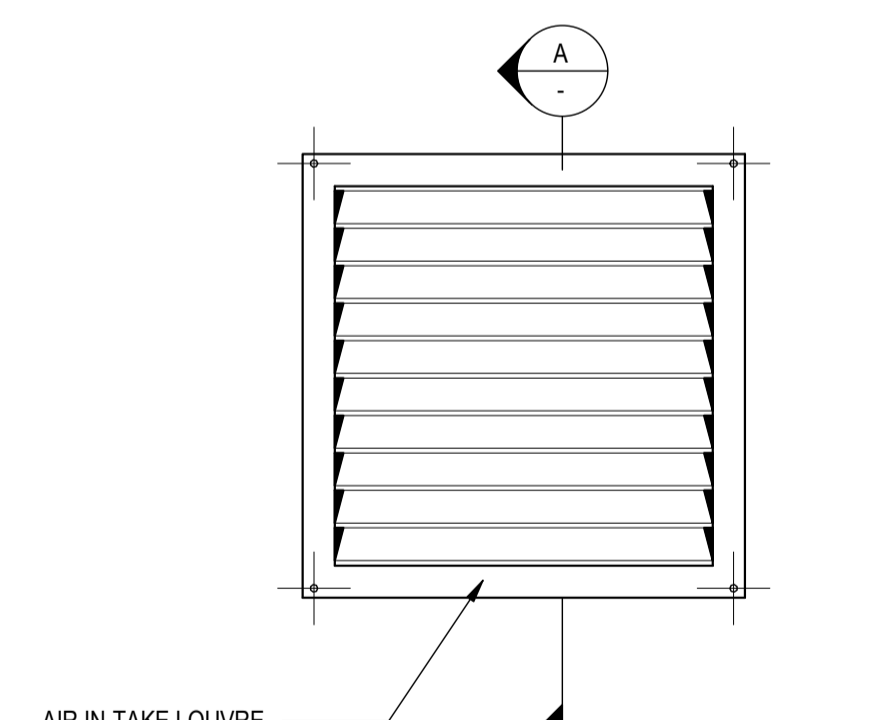


ROOF VENTILATOR DETAILS
NOT TO SCALE

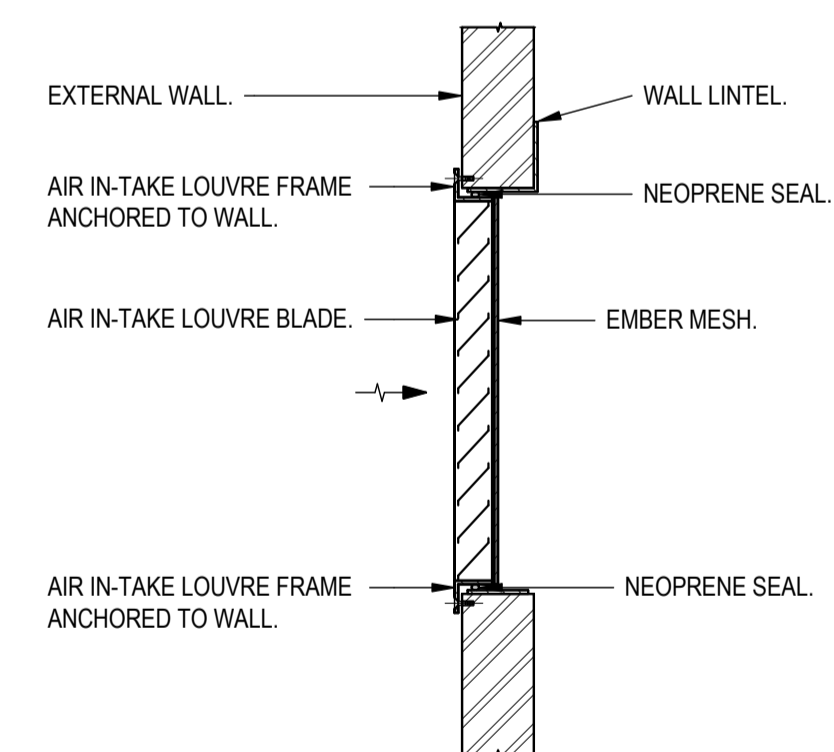


VIBRATION ISOLATION MOUNT SELECTION CHART - NOTES FOR USAGE:

1. THE VIBRATION ISOLATION CHART IS PROVIDED FOR INFORMATION AND IS INTENDED AS A GUIDE ONLY. FINAL SELECTION AND DESIGN OF VIBRATION ISOLATION MOUNTS IS THE RESPONSIBILITY OF THE CONTRACTOR, TO SUIT LOCAL INSTALLATION CONSTRAINTS AND THE REQUIREMENTS OUTLINED IN THE PROJECT DOCUMENTATION.
2. THE VIBRATION ISOLATION CHART SHOULD BE USED FOR SINGLE MASS SYSTEMS ONLY, WITH A DIRECT CONNECTION TO STRUCTURE. IT SHOULD NEVER BE USED FOR INSTALLATIONS WITH INERTIA BASES, OR FOR DOUBLE MASS SYSTEMS.
3. LOOK UP THE EQUIPMENT'S LOWEST OPERATIONAL SPEED (rpm) ON THE X-AXIS. READ VERTICALLY UP THE SELECTION CHART UNTIL THE OPERATIONAL SPEED LINE INTERSECTS THE REQUIRED VIBRATION ISOLATION EFFICIENCY (%) LINE.
4. READ ACROSS TO THE LEFT OF THE CHART TO DETERMINE THE REQUIRED MINIMUM STATIC DEFLECTION AND READ ACROSS TO THE RIGHT AXIS OF THE CHART TO DETERMINE THE MAXIMUM NATURAL FREQUENCY (Hz).
5. SELECTION OF ISOLATORS TO ACHIEVE THE REQUIRED MINIMUM STATIC DEFLECTION (FOR SPRINGS) OR MAX. NATURAL FREQUENCY (FOR PAD, ELASTOMER & AIR MOUNTS) WHILE SUPPORTING THE MASS PER ISOLATOR (kg OR kPa). AN INDICATIVE SELECTION GUIDE FOR TYPE OF ISOLATOR IS PROVIDED TO THE RIGHT OF THE CHART, ALTHOUGH NOTE THIS IS FOR GUIDANCE PURPOSES ONLY & SHALL NOT BE USED IN LEU OF MANUFACTURER'S TECHNICAL DATA.



FRESH AIR IN-TAKE LOUVRE DETAIL
NOT TO SCALE



SECTION A
NOT TO SCALE

Rev	Description	Checked	Approved	Date
A	30% DETAIL DESIGN	MK	RJ	01/09/23
Author	D.DEGUZMAN Drafting Check			
Designer	P.PREMAKUMAR Design Check M.KLUMPP			



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Client **PARKES SHIRE COUNCIL**
Project **LACHLAN PIPELINE DUPLICATION DETAILED DESIGN PROJECT**
Status **PRELIMINARY**

Drawing Title **MECHANICAL SERVICES AKUNA ROAD STANDARD DETAILS**

Size **A1**
Drawing No. **12589773-M400**
Rev **A**

**GHD**

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**Transmittal
Record**

Transmittal No:
22-12589773-T001

Date: **23/10/2023**

To: **Parks Shire Council**

Attention: -

Address: -

Copy To:

From: **R.Johnson**

Project: **Lachlan Pipeline Duplication Detail Design TSS**

Project No: **12589773**

Reason: **Revision**

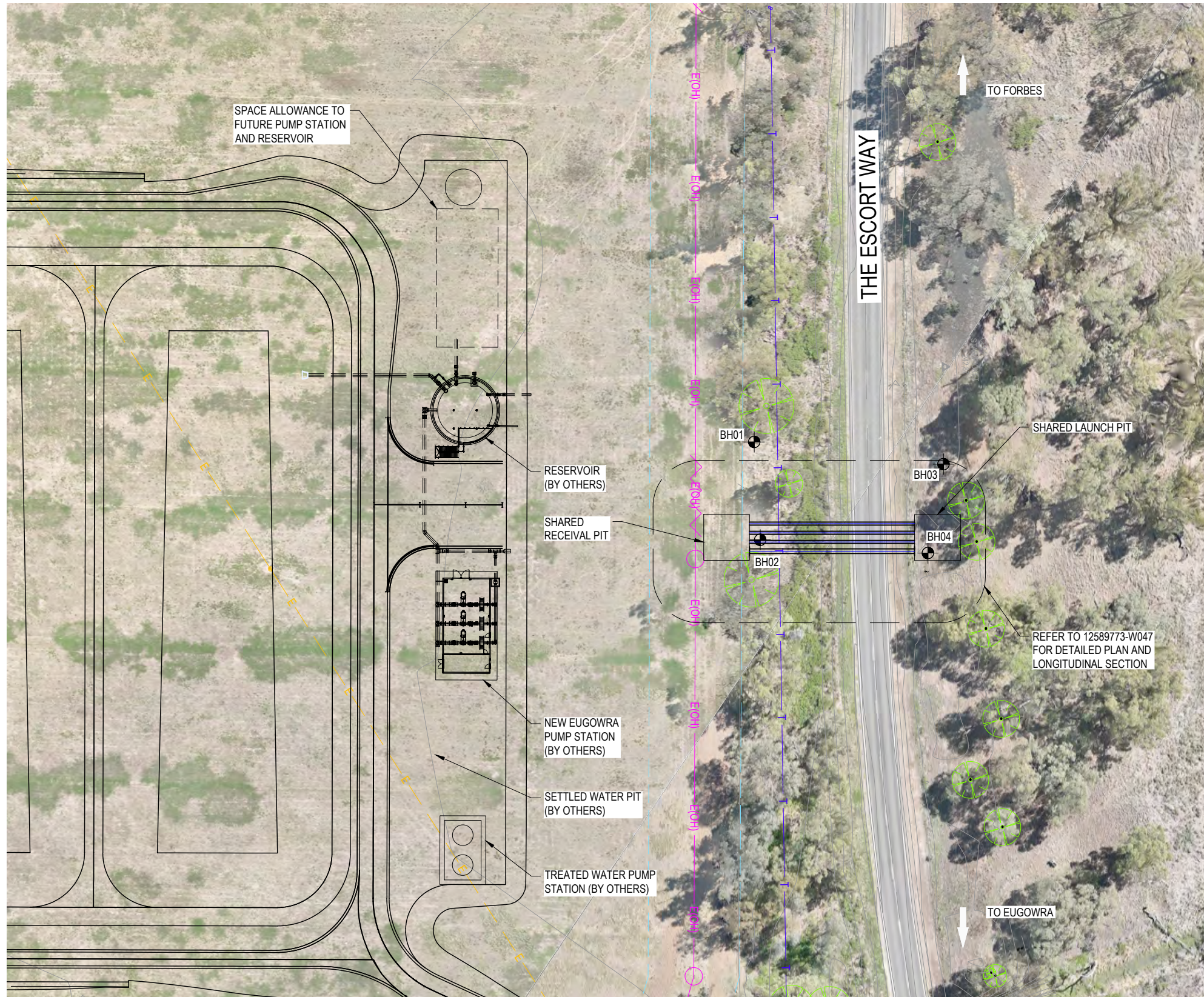
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E002	A	ELECTRICAL SERVICES LEGEND	1
E006	A	NEW EUGOWRA ROAD PUMP STATION - MSB - SINGLE LINE DIAGRAM	1
E007	A	NEW EUGOWRA ROAD PUMP STATION - MSB INCOMER - SCHEMATIC DIAGRAM	1
E009	A	NEW EUGOWRA ROAD PUMP STATION - 24VDC CONTROL POWER SUPPLY - SINGLE LINE DIAGRAM	1
E010	A	NEW EUGOWRA ROAD PUMP STATION - DISTRIBUTION BOARD (DB-01) - SINGLE LINE DIAGRAM	1
E011	A	NEW EUGOWRA ROAD PUMP STATION - MSB - GENERAL ARRANGEMENT	1
E012	A	NEW EUGOWRA ROAD PUMP STATION - ELECTRICAL SITE PLAN	1
E013	A	NEW EUGOWRA ROAD PUMP STATION - POWER & COMMUNICATIONS LAYOUT	1
E014	A	NEW EUGOWRA ROAD PUMP STATION - LIGHTING LAYOUT	1
E015	A	NEW EUGOWRA ROAD PUMP STATION - FIRE & SECURITY LAYOUT	1
E016	A	NEW EUGOWRA ROAD PUMP STATION - PUMP 1 - SCHEMATIC DIAGRAM	1
E017	A	NEW EUGOWRA ROAD PUMP STATION - PUMP 2 - SCHEMATIC DIAGRAM	1
E018	A	NEW EUGOWRA ROAD PUMP STATION - PUMP 3 - SCHEMATIC DIAGRAM	1
E020	A	NEW EUGOWRA ROAD PUMP STATION - PUMP 1 - TERMINATION DIAGRAM	1
E021	A	NEW EUGOWRA ROAD PUMP STATION - PUMP 2 - TERMINATION DIAGRAM	1
E022	A	NEW EUGOWRA ROAD PUMP STATION - PUMP 3 - TERMINATION DIAGRAM	1
E023	A	NEW EUGOWRA ROAD PUMP STATION - FLOW TRANSMITTER (FT1) - INSTRUMENT LOOP DIAGRAM	1
E024	A	NEW EUGOWRA ROAD PUMP STATION - HIGH LEVEL SWITCH - INSTRUMENT LOOP DIAGRAM	1
E025	A	NEW EUGOWRA ROAD PUMP STATION - LOW LEVEL SWITCH - INSTRUMENT LOOP DIAGRAM	1
E026	A	NEW EUGOWRA ROAD PUMP STATION - LOW LOW LEVEL SWITCH - INSTRUMENT LOOP DIAGRAM	1
E027	A	NEW EUGOWRA ROAD PUMP STATION - SECURITY & FIRE - INSTRUMENT LOOP DIAGRAM	1
E028	A	NEW EUGOWRA ROAD PUMP STATION - TELEMETRY COMMUNICATIONS DIAGRAM	1
E029	A	NEW EUGOWRA ROAD PUMP STATION - DIGITAL INPUT SLOT 1 - SHEET 1	1
E030	A	NEW EUGOWRA ROAD PUMP STATION - DIGITAL INPUT SLOT 1 - SHEET 2	1
E031	A	NEW EUGOWRA ROAD PUMP STATION - DIGITAL OUTPUT SLOT 2 - SHEET 1	1
E032	A	NEW EUGOWRA ROAD PUMP STATION - DIGITAL OUTPUT SLOT 2 - SHEET 2	1
E033	A	NEW EUGOWRA ROAD PUMP STATION - ANALOG INPUT SLOT 3	1
E106	A	NEW BOOSTER (AKUNA) PUMP STATION - MSB - SINGLE LINE DIAGRAM	1
E107	A	NEW BOOSTER (AKUNA) PUMP STATION - MSB INCOMER - SCHEMATIC DIAGRAM	1
E109	A	NEW BOOSTER (AKUNA) PUMP STATION - 24VDC CONTROL POWER SUPPLY - SINGLE LINE DIAGRAM	1

Drawing No	Rev	Drawing Title	Copies
E110	A	NEW BOOSTER (AKUNA) PUMP STATION - DISTRIBUTION BOARD (DB-01) - SINGLE LINE DIAGRAM	1
E111	A	NEW BOOSTER (AKUNA) PUMP STATION - MSB - GENERAL ARRANGEMENT	1
E112	A	NEW BOOSTER (AKUNA) PUMP STATION - ELECTRICAL SITE PLAN	1
E113	A	NEW BOOSTER (AKUNA) PUMP STATION - POWER & COMMUNICATIONS LAYOUT	1
E114	A	NEW BOOSTER (AKUNA) PUMP STATION - LIGHTING LAYOUT	1
E115	A	NEW BOOSTER (AKUNA) PUMP STATION - FIRE & SECURITY LAYOUT	1
E116	A	NEW BOOSTER (AKUNA) PUMP STATION - PUMP 1 - SCHEMATIC DIAGRAM	1
E117	A	NEW BOOSTER (AKUNA) PUMP STATION - PUMP 2 - SCHEMATIC DIAGRAM	1
E118	A	NEW BOOSTER (AKUNA) PUMP STATION - PUMP 3 - SCHEMATIC DIAGRAM	1
E120	A	NEW BOOSTER (AKUNA) PUMP STATION - PUMP 1 - TERMINATION DIAGRAM	1
E121	A	NEW BOOSTER (AKUNA) PUMP STATION - PUMP 2 - TERMINATION DIAGRAM	1
E122	A	NEW BOOSTER (AKUNA) PUMP STATION - PUMP 3 - TERMINATION DIAGRAM	1
E123	A	NEW BOOSTER (AKUNA) PUMP STATION - FLOW TRANSMITTER (FT1) - INSTRUMENT LOOP DIAGRAM	1
E124	A	NEW BOOSTER (AKUNA) PUMP STATION - HIGH LEVEL SWITCH - INSTRUMENT LOOP DIAGRAM	1
E125	A	NEW BOOSTER (AKUNA) PUMP STATION - LOW LEVEL SWITCH - INSTRUMENT LOOP DIAGRAM	1
E126	A	NEW BOOSTER (AKUNA) PUMP STATION - LOW LOW LEVEL SWITCH - INSTRUMENT LOOP DIAGRAM	1
E127	A	NEW BOOSTER (AKUNA) PUMP STATION - SECURITY & FIRE - INSTRUMENT LOOP DIAGRAM	1
E128	A	NEW BOOSTER (AKUNA) PUMP STATION - TELEMETRY COMMUNICATIONS DIAGRAM	1
E129	A	NEW BOOSTER (AKUNA) PUMP STATION - DIGITAL INPUT SLOT 1 - SHEET 1	1
E130	A	NEW BOOSTER (AKUNA) PUMP STATION - DIGITAL INPUT SLOT 1 - SHEET 2	1
E131	A	NEW BOOSTER (AKUNA) PUMP STATION - DIGITAL OUTPUT SLOT 2 - SHEET 1	1
E132	A	NEW BOOSTER (AKUNA) PUMP STATION - DIGITAL OUTPUT SLOT 2 - SHEET 2	1
E133	A	NEW BOOSTER (AKUNA) PUMP STATION - ANALOG INPUT SLOT 3	1

Remarks: -

Sent by: Email

Per:



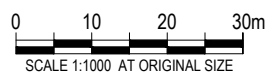
- LEGEND:**
- WATER MAIN
 - EXISTING FENCE
 - E(OH) EXISTING OVERHEAD POWER LINE
 - E EXISTING ELECTRICAL
 - W EXISTING WATER
 - T EXISTING TELSTRA
 - EXISTING CONTOUR
 - EXISTING TREE
 - BHXX BOREHOLE
 - EASEMENT

PLAN
SCALE 1:1000



Rev	Description	Checked	Approved	Date
0	ISSUE FOR TENDER	RJ	NM	16.08.23

Author J.LONDON Drafting Check J. LONDON
 Designer F. DOMINGUEZ Design Check R. JOHNSON



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Client **PARKES SHIRE COUNCIL**

Project **LACHLAN PIPELINE DUPLICATION
DETAIL DESIGN TSS**

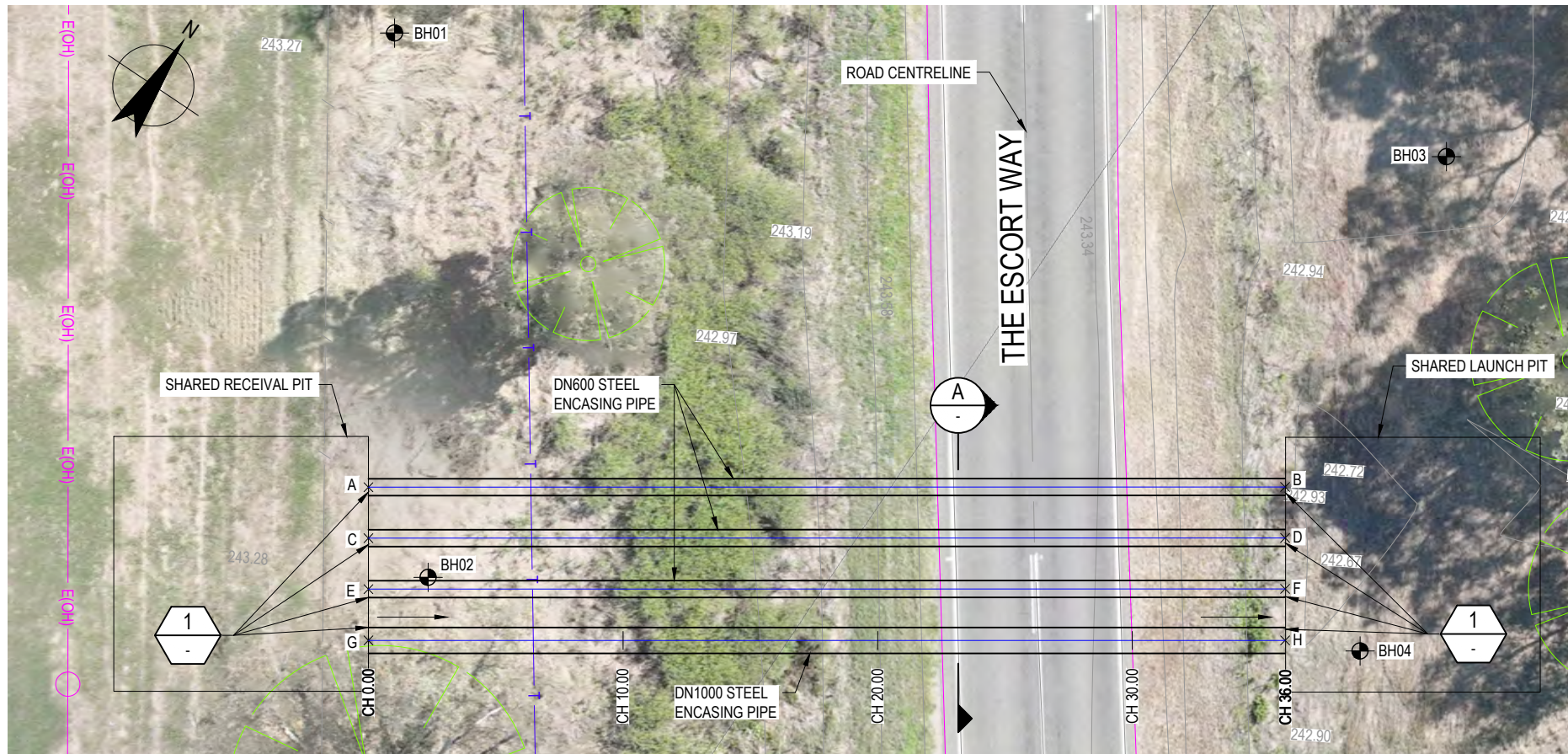
Status **PRELIMINARY**

Drawing Title **EUGOWRA PUMP STATION TO
THE ESCORT WAY ROAD CROSSING
GENERAL ARRANGEMENT**

Size **A3**

Status Code **12589773-W046**

Rev **0**

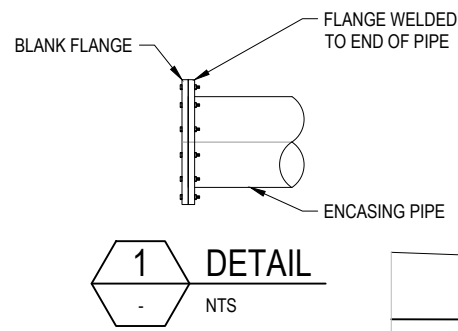
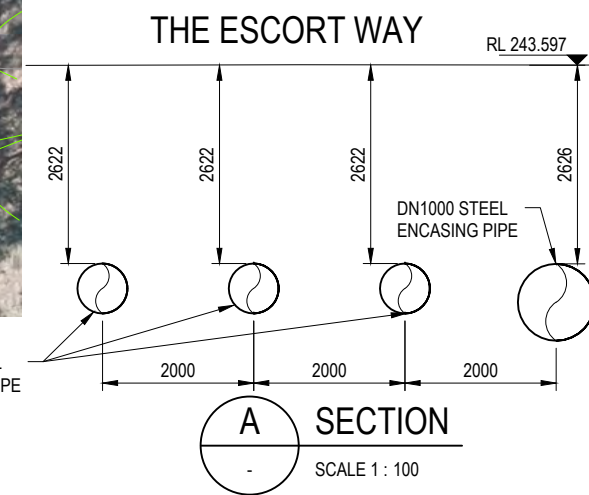


PIPELINE SETOUT TABLE		
MARK	EASTING	NORTHING
A	605868.082	6304916.631
B	605897.966	6304936.704
C	605869.197	6304914.970
D	605899.081	6304935.044
E	605870.311	6304913.310
F	605900.195	6304933.383
G	605871.434	6304911.638
H	605901.323	6304931.704

BOREHOLE SETOUT TABLE		
MARK	EASTING	NORTHING
BH01	605859.0	6304932.0
BH02	605872.0	6304915.0
BH03	605896.0	6304951.0
BH04	605904.0	6304933.0

- LEGEND:**
- WATER MAIN
 - EXISTING FENCE
 - E(OH) EXISTING OVERHEAD POWER LINE
 - T EXISTING TELSTRA
 - EXISTING EDGE OF BITUMEN
 - EXISTING CONTOUR
 - EXISTING TREE
 - BHXX BOREHOLE

- NOTES:**
- ALL DIMENSIONS IN MILLIMETRES.
 - METHODS OF INSTALLATION TO BE AS DIRECTED BY THE WATER AGENCY OR ROAD OWNER.
 - PIPE JACKING ENCASING PIPE - STEEL
WATER MAIN/PRODUCT PIPE (BY OTHERS)
- MAX. OD450 MATERIALS TO BE EITHER HDPE, MSCL FUSION BONDED PE COATING, DICL, PVC
- DN800 PE100 PN16
 - STEEL PIPE JOINTS TO BE EITHER PLAIN ENDS WITH WELDED COLLAR, BUTT WELDED OR SLIP-IN TYPE WELDED JOINTS.
 - BORES ARE TO HAVE MINIMUM OF 2m SPACING CENTRE TO CENTRE.
 - AUGER PITS ON EITHER SIDE OF THE ROAD WILL HOUSE ALL FOUR BORES. DETAILED PIT DESIGN IS INCLUDED IN CONTRACTOR SCOPE.
 - WATER MAIN/PRODUCT PIPE INSTALLATION AND GROUTING ARE OUT OF SCOPE.
 - SIMULTANEOUS BORING OPERATIONS ARE NOT PERMITTED.
 - WATER LEVEL EXPECTED APPROXIMATELY 7m BELOW SURFACE LEVEL.
 - MARKER POST SHOULD BE INSTALLED ON EITHER SIDE OF STATE ROAD CROSSINGS.
 - BOREHOLE SETOUTS ARE BASED ON PSWP-LACHLAN PIPELINE DUPLICATION GEOTECHNICAL INVESTIGATION REPORT ON AUGUST 4, 2023.
 - CONTRACTOR TO SUPPORT THE POWER POLE DURING CONSTRUCTION AS NECESSARY.
 - CONTRACTOR TO CONFIRM IF 6mm PIPE WALL THICKNESS IS SUFFICIENT FOR THE PROPOSED CASING INSTALLATION METHODOLOGY.



PLAN
SCALE 1:250

SECTION A
SCALE 1:100

	0.00	10.00	20.00	23.16	29.58	30.00	36.00
DEPTH TO INVERT	3.233	3.010	3.516	3.642	3.425	3.428	3.028
PIPE INVERT LEVEL	240.001	239.981	239.961	239.955	239.942	239.941	239.929
EXISTING SURFACE	243.234	242.991	243.477	243.597	243.367	243.369	242.957
CHAINAGE	0.00	10.00	20.00	23.16	29.58	30.00	36.00

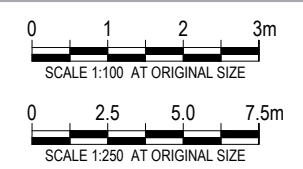
	0.00	10.00	20.00	23.11	29.53	30.00	36.00
DEPTH TO INVERT	2.879	2.682	3.079	3.282	3.058	3.043	2.584
PIPE INVERT LEVEL	240.357	240.337	240.317	240.311	240.298	240.297	240.285
EXISTING SURFACE	243.236	243.019	243.396	243.593	243.356	243.340	242.869
CHAINAGE	0.00	10.00	20.00	23.11	29.53	30.00	36.00

LONGITUDINAL SECTION
SCALE HORI. 1:250; VERT. 1:250



Rev	Description	Checked	Approved	Date
0	ISSUE FOR TENDER	RJ	NM	16.08.23

Author: J.LONDON Drafting Check: J.LONDON
Designer: F.DOMINGUEZ Design Check: R.JOHNSON



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Client: **PARKES SHIRE COUNCIL**
Project: **LACHLAN PIPELINE DUPLICATION
DETAIL DESIGN TSS**
Status: **PRELIMINARY**

Drawing Title: **ESCORT WAY ROAD CROSSING
DETAILED PLAN AND
LONGITUDINAL SECTION**
Drawing No: **12589773-W047**
Rev: **0**

Appendix B

Safety in Design register



HSE040 Safety in Design Risk Assessment



Notes: *Designs with significant quantities of dangerous goods may require detailed risk assessments under Dangerous Goods or Major Hazard legislation
 * Most industrial processes will require an industry specific assessment, e.g. HAZOP and/or Quantitative Risk Assessment for facilities that have chemical or high-pressure processes under Dangerous Goods or Major Hazard legislation.

Design Life Cycle:	Investigation and Design	Setup, Construction and Commissioning	Operation	Maintenance	Disposal	Date:	30/11/2023	Revision No:	A
Job Name:	Lachlan Pipeline Duplication Detail Design TSS		Job No:	12589773	Client	Design:	GHD		

People involved in Risk Assessment:

Design Ref	Type	Design Life Cycle Stage <small>(Select from Drop Down Box)</small>	Hazards <small>What could cause injury or ill health, damage to property or damage to the environment</small>	Risk <small>What could go wrong and what might happen as a result</small>	Existing Control Measures	Initial Risk Rating			Potential Control Measures <small>(Consider Hierarchy of Control - Elimination, Substitution, Isolation, Engineering Controls, Administrative Controls, PPE)</small>	Responsibility	By When	Decision / Status	Residual Risk Rating			Comments
						C	L	RR					C	L	RR	
Investigation and design																
1	General	Investigation and Design	Design and construction issues due to unidentified services	Damage to existing utilities during construction. Disruption to existing communications or water supply services during construction. Injury to construction workers as a result of unexpectedly coming into contact with existing infrastructure or services.	Typical offset increase from road to provide additional space. DBYD survey informing concept design.	C- Severe	4 - Likely	Moderate	GHD to allow for detailed survey should the need for further survey data be identified during a site visit.	Contractor/GHD	Detailed design	Open	C- Severe	2 - Unlikely	Low	Construction contractor to manage residual risk.
2	General	Investigation and Design	Unexpected ground conditions	Excavation collapses a risk to workers and equipment, particularly in deep excavations.	Geotechnical Assessment to be completed	E- Catastrophic	1 - Very Unlikely	Moderate	Contractor to ensure geotechnical supervisions throughout the construction, designed secant piles or trench shoring, dewatering to be completed throughout the project, no worker within trench during rain events	Contractor	During construction	Appropriate Geotechnical supervision throughout installation	E- Catastrophic	1 - Very Unlikely	Moderate	
3	General	Investigation and Design	Acid sulphate soil	Potential off site leaching event of uncontained acid sulphate soils	Geotechnical Assessment to be completed	E- Catastrophic	1 - Very Unlikely	Moderate	Contractor to ensure geotechnical supervisions throughout the construction, industry standard approach to on-site testing, treatment and off-site disposal.	Contractor	During construction	Appropriate Geotechnical supervision throughout excavation	D - Critical	1 - Very Unlikely	Moderate	
4	General	Investigation and Design	Design clashes with non-PSC controlled services	Designing works that clash with existing telecom services	Geotechnical Assessment to be completed	C- Severe	3 - Possible	Moderate	Design to avoid 'typical' telecoms footpath/road reserve allocation and add note to drawings for contractor to locate	GHD/Contractor	Before Construction	Open	C- Severe	1 - Very Unlikely	Low	
5	General	Investigation and Design	Noise Pollution	Complaints from residents living near to pipeline trenching.	Nil	C- Severe	3 - Possible	Moderate	Noise sensitivity analysis to be conducted prior to commencement of works. Night-time works are to be restricted to minimise noise pollution.	Contractor	During Design		C- Severe	3 - Possible	Moderate	
6	General	Investigation and Design	Authorised access	injury to personnel	Signage to Australian standard noted in specification and drawings	C- Severe	3 - Possible	Moderate	signage, PSC lock access to authorised locations	PSC/GHD	Before Construction		C- Severe	1 - Very Unlikely	Low	
7	General	Investigation and Design	High pressure	When maintaining system, Operator may be exposed to high pressure.	Nil	C- Severe	3 - Possible	Moderate	Risk to be reviewed with as part of the Detail Design phase. Review also to identify need for lockable valves.	GHD	Detailed design	Open	C- Severe	2 - Unlikely	Low	
8	Watermain	Investigation and Design	Trenchless construction	Potential for injury / difficult construction conditions / community disruption and tree impacts	Minimise footprint and tree impacts	C- Severe	3 - Possible	Moderate	Contractor to reassess the location of the works during detailed design and prior to construction.	GHD/Contractor	Prior to construction	Open	C- Severe	2 - Unlikely	Low	
9	Watermain	Investigation and Design	Access/egress to trenchless construction	Slip, trip fall over water body from steep slope		D - Critical	3 - Possible	Significant	Outline safe operating procedures in the construction safety management plan. Contractor to install physical barriers around trenchless construction.	Contractor	Prior to construction	Open	D - Critical	2 - Unlikely	Moderate	
10																
11																
12																
Setup, Construction and Commissioning																
13	General	Setup, Construction and Commissioning	Proximity to overhead power lines	Contact with overhead power lines during construction	Services located as part of a Dial Before You Dig request	E- Catastrophic	3 - Possible	Extreme	Contractor to implement safe work methods for working in close proximity to existing power lines, including limiters on excavators, etc. Contractors to liaise with power supplier	Contractor/GHD	Prior to Construction	Contractor to ensure overhead power lines are visible with warning signs	E- Catastrophic	2 - Unlikely	Significant	
14	General	Setup, Construction and Commissioning	Noise Pollution	Complaints from neighbours during construction and plant operation	Nil	B - Major	3 - Possible	Low	PSC to engage neighbours. Works to be performed during normal work hours	Contractor/PSC	Prior to Construction	PSC to letter drop, Contractor to perform works within normal work hours	B - Major	2 - Unlikely	Negligible	

Initial Risk Rating														Residual Risk Rating		
Design Ref	Type	Design Life Cycle Stage <small>(Select from Drop Down Box)</small>	Hazards <small>What could cause injury or ill health, damage to property or damage to the environment</small>	Risk <small>What could go wrong and what might happen as a result</small>	Existing Control Measures	C	L	RR	Potential Control Measures <small>(Consider Hierarchy of Control - Elimination, Substitution, Isolation, Engineering Controls, Administrative Controls, PPE)</small>	Responsibility	By When	Decision / Status	C	L	RR	Comments
15	General	Setup, Construction and Commissioning	Construction works in close proximity to residential property and existing infrastructure	Injury to general public and/or construction workers.	Contractor to set up fencing around job site	B - Major	3 - Possible	Low	Notifying residents in advance of works commencing. Clear inspection of property prior to commencing works. Traffic Management Plan and Construction Safety Management Plan implemented. Clear signage and physical barricading of construction area. Where possible, install a 1.8 m tall steel mesh fence to separate public from the construction works and stage works around non-peak periods.	Contractor	Prior and during construction	Open	B - Major	2 - Unlikely	Negligible	
16	General	Setup, Construction and Commissioning	People Access (work platforms, restricted workspaces, ladders/platforms)	Risk of workers being injured due to being in a restricted area	Contractor to set up barricade around deep excavations	C- Severe	2 - Unlikely	Low	Ensure workers trained in the correct areas are in locations. Signed work site areas, toolbox talk every morning, Site induction and strict sign in policies.	Contractor	Prior and during construction	Contractor to set up appropriate barricades around excavations.	C- Severe	1 - Very Unlikely	Low	
17	General	Setup, Construction and Commissioning	People Access (work platforms, restricted workspaces, deep excavations)	Risk of workers being injured due to being in a restricted area	Contractor to set up barricade around deep excavations	C- Severe	2 - Unlikely	Low	Ensure workers trained in the correct areas are in locations. Tool box talks. Allow for ramps in and out of excavations to Australian standards	Contractor	Prior and during construction		C- Severe	1 - Very Unlikely	Low	
18	General	Setup, Construction and Commissioning	Waste disposal	Health issues associated with disposal of waste material from construction.	Nil	C- Severe	4 - Likely	Moderate	Assessment undertaken in REF. Some spoil to be used as fill material for battering of site. Ensure no runoff or leaching from waste storage sites.	Contractor	Prior to construction and during construction	Open	D - Critical	2 - Unlikely	Moderate	
19	General	Setup, Construction and Commissioning	Temperature and Humidity	Heat related illness		B - Major	2 - Unlikely	Negligible	Contractor to implement own requirements in regards to hazards related to heat	Contractor	Prior to construction	To be implemented by Contractor	B - Major	1 - Very Unlikely	Negligible	
20	General	Setup, Construction and Commissioning	Dust, Fumes & Smoke	Construction emissions		B - Major	3 - Possible	Low	Contractor to develop site EMP and construction management plan	Contractor	Prior to Construction	To be implemented by Contractor	B - Major	3 - Possible	Low	
21	General	Setup, Construction and Commissioning	Debris on road	Vehicle Accidents, risk to works and public		B - Major	4 - Likely	Low	Contractor to develop site EMP and construction management plan, contractor to implement routine road sweeping and cleaning. Monitor road condition throughout project	Contractor	During Construction	Weekly road cleaning to be implemented. Contractor to satisfy PSC superintendent in regards to road cleanliness	B - Major	2 - Unlikely	Negligible	
22	General	Setup, Construction and Commissioning	Aboriginal artefacts potentially impacted or damaged	Potential impacts to subsurface Aboriginal artefacts during construction works	Due diligence assessment	C- Severe	3 - Possible	Moderate	Undertake Aboriginal Cultural Heritage assessment so there is a more thorough initial assessment that would provide greater protection should anything be uncovered during construction.	GHD / PSC	Prior to Construction	Open	B - Major	3 - Possible	Low	
23	General	Setup, Construction and Commissioning	Contamination during works	Contact with biological waste	Health and Safety Plans and Vaccinations for staff	C- Severe	4 - Likely	Moderate	All staff to be vaccinated and clear hygiene plans established for site, liaise with PSC during cut in periods. Scour/clean line before any cut ins.	Contractor	During construction	Plans to be submitted to DPE	C- Severe	2 - Unlikely	Low	
24	Site	Setup, Construction and Commissioning	Accessibility for backfilling	Insufficient access for backfilling		C- Severe	3 - Possible	Moderate	Use long armed excavator to reach over backfill areas, flowable fill i.e. stabilised sand	GHD/Contractor	During construction	During construction	C- Severe	3 - Possible	Moderate	
25	Site	Setup, Construction and Commissioning	Wet weather during construction	Rain water collected in pits overflows into waterways	Standard trenchless methodology - includes banded pit, pumps, etc	C- Severe	2 - Unlikely	Low	Flood management plan	Contractor	Prior to construction and during construction	Open	B - Major	2 - Unlikely	Negligible	
26	General	Setup, Construction and Commissioning	Covid-19	Timeframe/limit the number of drilling workers on site / resourcing issues	Nil	C- Severe	3 - Possible	Moderate	Detailed design to state in the specifications the tenderer should include a resourcing plan to consider covid-19 restrictions	GHD / PSC	Prior to Construction	Open	B - Major	2 - Unlikely	Negligible	
27	General	Setup, Construction and Commissioning	Excavations	Excavation collapses a risk to workers and equipment, particularly in deep excavations.	Nil	D - Critical	3 - Possible	Significant	Use benching back or temporary support works to support excavations where required due to excavations depth or stability of ground material. Contractor to monitor adjacent sites for any effects that may result from caisson construction.	Contractor	During construction	Contractor to review all excavations and provide certified temporary support works where required.	D - Critical	2 - Unlikely	Moderate	
28	General	Setup, Construction and Commissioning	Excavations	Worker may fall into excavation	Nil	C- Severe	3 - Possible	Moderate	Contractor to use appropriate fencing and barricading around excavations where required	Contractor	During Construction	Contractor to review all excavations and provide certified temporary support works where required. Monitor adjacent sites for effects of excavations.	D - Critical	2 - Unlikely	Moderate	
29	General	Setup, Construction and Commissioning	Dewatering	environmental release	allowed in quantities	C- Severe	1 - Very Unlikely	Low	Contractor to design and allow management of water on site. EMP to be submitted.	Contractor	During construction	Open	C- Severe	1 - Very Unlikely	Low	
30	General	Setup, Construction and Commissioning	Construction timeframe	Impact to community activities	Nil	B - Major	3 - Possible	Low	Detailed design to include restricted timeframe within the technical specifications, no construction works in the middle of summer or school holidays	GHD / Contractor	Prior to construction and during construction	Open	B - Major	2 - Unlikely	Negligible	

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						C	L	RR					C	L	RR	
						B - Major	3 - Possible	Low					B - Major	3 - Possible	Low	
31	General	Setup, Construction and Commissioning	Use of machinery in limited work space near main road	Coming into contact with traffic	Traffic control	B - Major	3 - Possible	Low	Implement Traffic Control Measures	Contractor	During construction	Contractor to Implement	B - Major	3 - Possible	Low	
32	General	Setup, Construction and Commissioning	Use of tools and working with heavy materials	Injury occurring from use of tools and heavy materials hitting/injuring workers and/or existing structures	Machinery used to manoeuvre heavy materials and safety work method statements used for each task undertaken that presents any risks. PPE	C- Severe	2 - Unlikely	Low	Having skilled operators using machinery and supervision at all times during these tasks, the use of spotters as required by law	Contractor	During construction	To be implemented	C- Severe	1 - Very Unlikely	Low	
33	General	Setup, Construction and Commissioning	Frequency of vehicle/machinery accessing the site - daily/3 times a week for a month during construction	Vehicles may impact existing assets / accessibility	Nil	C- Severe	2 - Unlikely	Low	Contractor to provide traffic management plan to PSC for review / approval	Contractor	During construction	Open	C- Severe	1 - Very Unlikely	Low	
34	General	Setup, Construction and Commissioning	Use of machinery	Hitting underground services	Skilled operators using machinery and supervision of surrounds is carried out at all times	C- Severe	2 - Unlikely	Low	Use a spotter during works with machinery, DBYD information made readily available to all personnel. Use of vacuum excavation methods in proximity of known or suspected existing services.	Contractor	During Construction	To be implemented	C- Severe	1 - Very Unlikely	Low	
35	General	Setup, Construction and Commissioning	No coordination between design documents	Delayed to project	Designed in accordance with PSC standards	C- Severe	3 - Possible	Moderate	All concrete works to meet Structural specification, Contractor to confirm footing design, coordinate onsite	Contractor	During Construction	Contractor to Implement	E- Catastrophic	1 - Very Unlikely	Moderate	
36	General	Setup, Construction and Commissioning	Confined spaces and restricted access areas	Access by non competent person(s)	WH&S Queensland Confined Space Code of Practice 2011, AS 2865-2009: Confined spaces	C- Severe	3 - Possible	Moderate	Site to be fenced off during construction. Contractor to ensure legislative requirements regarding confined spaces etc. are met. All staff working in confined spaces are to have the appropriate training and certification. Gas meters are to be in operation while work is being undertaken in confined spaces	Contractor	Prior to Construction	To be implemented by Contractor	C- Severe	2 - Unlikely	Low	
37	General	Setup, Construction and Commissioning	Unknown Services	Damage to services during construction	Site survey and inspection completed	C- Severe	2 - Unlikely	Low	Potholing to be conducted during setup	Contractor	Prior to Construction	Potholing to be conducted during setup	C- Severe	1 - Very Unlikely	Low	
34	General	Setup, Construction and Commissioning	Setting out excavation zone	May hit unknown buried services	Site survey undertaken.	C- Severe	2 - Unlikely	Low	Site survey and geotechnical investigations, DBYD completed	Contractor	Prior to Construction	Contractor to verify service locations. If there is a need to redirect services contractor is to consult with regulatory authority to avoid loss of service.	C- Severe	1 - Very Unlikely	Low	
35	General	Setup, Construction and Commissioning	Disturbance or damage of services during construction	Loss of services (water, sanitation, gas, comms, electricity)	A survey has identified services where possible	D - Critical	3 - Possible	Significant	Contractor is to undertake any additional investigations necessary to protect services and undertake additional potholing and or survey if deemed required. If there is a need to redirect services, contractor is to consult with regulatory authority for that service.	Contractor	Prior to construction	Contractor to verify service locations. If there is a need to redirect services contractor is to consult with regulatory authority to avoid loss of service.	D - Critical	2 - Unlikely	Moderate	
36	General	Setup, Construction and Commissioning	Concrete works, formwork and steel work	Injury to workers around formwork, steel work and placement of concrete	Appropriate PPE to be worn. Qualified workers to be used where required (i.e. grinding)	B - Major	4 - Likely	Low	SWMS completed and Construction methodology plan put in place	Contractor	Prior to construction		B - Major	3 - Possible	Low	
37	Water Main	Setup, Construction and Commissioning	Excavation and laying of pipe across services	Hitting underground services during excavation and installation of pipe	A survey has identified services where possible	D - Critical	2 - Unlikely	Moderate	Services to be isolated prior to excavation around then. New services to be laid if existing damaged	Contractor	During construction		D - Critical	2 - Unlikely	Moderate	
38	General	Setup, Construction and Commissioning	Existing private property assets.	Damage to private property assets (i.e. fencing)	Nil	C- Severe	4 - Likely	Moderate	Where works are to be conducted in proximity to existing private assets, fencing off of the asset ought to be conducted. If the asset must be removed to enable works to continue, the contractor is to ensure the property owner consents and agrees to a remediation method for any damages caused / changes to their asset made during the process of construction.	Contractor	During construction	Open	C- Severe	2 - Unlikely	Low	
39	Water Main	Setup, Construction and Commissioning	Excavation of launch / receival pit	Damage to utility services causing disruptions/electricution/fire	Nil	D - Critical	3 - Possible	Significant	DBYD plans; Excavation permit; Non destructive excavation to locate services and Utility technician at site as required	Contractor	During construction	Open	D - Critical	2 - Unlikely	Moderate	
40	Water Main	Setup, Construction and Commissioning	Unloading boring machine and steel casings	Dropped loads resulting in injuries	Nil	B - Major	4 - Likely	Low	Contractor to secure the following: Lifting of machines from designated points; Warning signs/alarms/lights to be in place; Correct PPE and Never lift over personnel	Contractor	During construction	Open	B - Major	3 - Possible	Low	
41	Water Main	Setup, Construction and Commissioning	Installation of boring machine/frame/rais into launch pit	Dropped loads resulting in injuries Working in overhead cables	Nil	B - Major	3 - Possible	Low	1. Qualified operators only to use equipment 2. Inspection of lifting chains prior to use 3. Warning signs/alarms/lights to be in place 4. Correct PPE 5. Never enter under a suspended load	Contractor	During construction	Open	B - Major	3 - Possible	Low	
42	General	Setup, Construction and Commissioning	Plant / equipment refuelling	Ignition sources causing fire or explosion Accidental fuel spills resulting in environmental damage	Nil	B - Major	4 - Likely	Low	Contractor to develop safe work statement.	Contractor	During construction	Open	B - Major	3 - Possible	Low	

Initial Risk Rating														Residual Risk Rating		
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43	General	Setup, Construction and Commissioning	Construction adjacent to trees.	Risk of injury when pruning or removing trees or damage to property.	Nil	C- Severe	3 - Possible	Moderate	Contractor to develop safe work statement. Contractor to use appropriate work methods and tools/machinery to safely remove/trim trees.	Contractor	Detailed design/Construction	Open	C- Severe	2 - Unlikely	Low	
44	Water Main	Setup, Construction and Commissioning	Pipe thrust blocks	Thrust block is fully loaded before concrete reaches adequate strength.	Nil	D - Critical	3 - Possible	Significant	Thrust blocks to be allowed to set for minimum 7 days after being constructed before pressure testing /commissioning occurs.	Contractor	During construction	Open	D - Critical	2 - Unlikely	Moderate	
45	General	Setup, Construction and Commissioning	Open trench construction (particularly for deeper trench depths (>1.5 m) and launch/receival pits of trenchless crossings)	Injury to construction workers from trip or fall near/into the trench. Excavation faces are unlikely to be self-supporting above the water table for any reliable duration and collapsing/flowing sand soils are likely beneath the water table	Nil	D - Critical	3 - Possible	Significant	Outline safe operating procedures in the construction safety management plan. Contractor to install physical barriers around trench. Cover temporary excavations.	Contractor	Prior to construction	Open	D - Critical	2 - Unlikely	Moderate	
46	General	Setup, Construction and Commissioning	Security on site being open space	Damage of construction machinery by public	Nil	C- Severe	2 - Unlikely	Low	Contractor to secure the construction area	Contractor	During construction	Open	C- Severe	1 - Very Unlikely	Low	
47	Watermain	Setup, Construction and Commissioning	Inadequate ground conditions for trenchless	Time delays, HDD cost increase, cost variations to PSC	Geotech investigations conducted during concept design	C- Severe	4 - Likely	Moderate	Provide all relevant geotechnical investigations available to Contractor D&C contract may reduce risk D&C to undertake own geotechnical investigations PSC supervision on site	GHD/Contractor/PSC	Prior to and during construction	Open	C- Severe	3 - Possible	Moderate	
48	HVAC	Setup, Construction and Commissioning	Trips and Fall	Injuries while working from heights. E.g: working on an uneven surface, unstable ladder, no safe harness points, no provision of an elevated platform.	Provide elevated platform, adequate harness or functional ladder.	A - Minor	2 - Unlikely	Negligible	Engineering control	Contractor/Worker	During construction	Open	A - Minor	1 - Very Unlikely	Negligible	
49	HVAC	Setup, Construction and Commissioning	Temperature and Humidity	Internal Discomfort	Provide adequate plant capacity. Provide temporary AC when internal temperatures cause major discomfort to workers.	B - Major	5 - Almost Certain	Moderate	Engineering control	GHD/Contractor	During construction	Open	B - Major	3 - Possible	Low	
50	HVAC	Setup, Construction and Commissioning	Accessibility	Fall from height during routine maintenance	Provide elevated platform or adequate harness to worker.	D - Critical	3 - Possible	Significant	Engineering control	GHD/Contractor	During construction	Open	B - Major	2 - Unlikely	Negligible	
51	HVAC	Setup, Construction and Commissioning	Excessive noise from mechanical equipment installation	Loud noise levels that could potentially cause hearing impairment for workers.	Workers to be provided with adequate ear protection PPE.	D - Critical	3 - Possible	Significant	Contractor to provide adequate ear protection PPE and enforce strict rules on worker to wear them when working with excessive noise from mechanical equipment.	GHD/Contractor	During construction	Open	B - Major	2 - Unlikely	Negligible	
52	HVAC	Setup, Construction and Commissioning	Heavy Lifting	Equipment lift - crane hazard, falling hazard	Allocate adequate people to assist in lifting or moving to heavy equipment, provide enough access for crane or lift equipment should they are required.	D - Critical	3 - Possible	Significant	Engineering control	GHD/Contractor	During construction	Open	B - Major	2 - Unlikely	Negligible	
Operation																
50	Community	Operation	Public access to pits/valves/elevated reservoir	Injury or death (plus associated public liability, legal and reputational impacts) to members of the public from inappropriate use of pits, pump station or elevated reservoir access	Nil	E- Catastrophic	3 - Possible	Extreme	Isolation controls: - Install pumps in lockable block building within locked fenced area - Install elevated reservoir within locked fenced area - Install signs warning of danger - Ensure guard rails on reservoir installed	GHD/PSC	Detailed Design	Open	E- Catastrophic	3 - Possible	Extreme	Risk to be handed over to PSC
51	Environment	Operation	Scouring of main when not in use	Discharge of chlorinated water to the environment when pipeline is scoured.	Nil	C- Severe	4 - Likely	Moderate	Engineering controls - Scour pump out chambers. Admin controls - PSC to develop scour pump out plan	PSC	During operation	Open	C- Severe	3 - Possible	Moderate	Risk to be handed over to PSC
52	Detail Design	Operation	Driving over flow meter pit cover	Failure of the pit cover and damaging the pipework	Top level of the pit is 100mm above ground level to discourage vehicular traffic over the pit cover.	E- Catastrophic	4 - Likely	Extreme	Engineering controls: - Install traffic bollards around the pit to restrict vehicular traffic	Contractor/PSC	Construction and maintenance	Open	E- Catastrophic	1 - Very Unlikely	Moderate	
53	Pump Station	Operation	Communications, e.g. normal, emergency	Controls/SCADA does not interface with float detection	Specifications requires communication with controls	C- Severe	2 - Unlikely	Low	Specify in design how to incorporate proposed controls into existing system	Contractor	Detailed design	Open	C- Severe	2 - Unlikely	Low	

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						C	L	RR					C	L	RR	
54	Pump Station	Operation	Electrical equipment fails and high temperatures observed in pump station building	WPS unable to get water supply and workers unable to work due to heat in building.	Nil	D - Critical	3 - Possible	Significant	Install ventilation controls	GHD	Detailed design	Open	D - Critical	2 - Unlikely	Moderate	
55	Water Main	Operation	Differential settlement.	Differential settlement of the pipework could shear joints and promote pipe leaks and/or bursts.		C- Severe	4 - Likely	Moderate	Use flexible jointing where possible to allow pipework to 'adapt' to differential settlement. Use appropriate bedding material.	GHD	Detailed design	Open	C- Severe	2 - Unlikely	Low	
56	Water Main	Operation	Driving over air valves in vehicles/mowers	Failures of the air valve and pipeline broken	Nil	B - Major	3 - Possible	Low	Engineering controls: - Ensure pipe to have air valves installed are shown to be 1 m depth on design to ensure pit lids are flush with ground.	Contractor/PSC	Construction and maintenance	Open	B - Major	2 - Unlikely	Negligible	
57	HVAC	Operation	Electrical Isolation	Power supplies inadequately isolated	Provide training and written procedures	D - Critical	2 - Unlikely	Moderate	Provide Training and written procedures refresher and administrative control.	GHD/Contractor	Construction and maintenance	Open	D - Critical	1 - Very Unlikely	Moderate	
58	HVAC	Operation	Operations, work practice	Equipment operated incorrectly	Provide Training and written procedures	A - Minor	1 - Very Unlikely	Negligible	Provide Training and written procedures refresher and administrative controls.	GHD/Contractor	Construction and maintenance	Open	A - Minor	1 - Very Unlikely	Negligible	
59	HVAC	Operation	Temperature and Humidity	High temperature and high humidity can create an inhabitable space for people to work in.	Maintain equipment to manufacturers requirements. Provide Training and written procedures.	D - Critical	3 - Possible	Significant	Maintain equipment to manufacturers requirements. Provide Training and written procedures refresher and administration controls.	GHD/Contractor	Construction and maintenance	Open	D - Critical	1 - Very Unlikely	Moderate	
60																
61																
62																
Maintenance																
63	Vehicle Access	Maintenance	Vehicular access for maintenance vehicles.	Injury to general public or maintenance personnel from maintenance vehicles due to minimal locations for safe roadside parking.	Concept design to consider placement of valves for safety possible access within construction of vertical alignment and existing infrastructure. Detailed design reviewed this.	C- Severe	3 - Possible	Moderate	PSC operations and maintenance teams to confirm appropriate locations for vehicle parking when inspecting each valve.	PSC	Maintenance	Open	C- Severe	2 - Unlikely	Low	
64	Environment	Maintenance	Environmental	Damage to the pumps may lead to potential environmental contamination of the local soils of oils and other material.	Nil	C- Severe	3 - Possible	Moderate	Engineering controls: - install sumps and chlorine dosing facility within buildings to capture any spills. - regular inspection of pumps and dosing equipment	GHD/PSC	Detailed design and during operation	Open	C- Severe	2 - Unlikely	Low	Risk to be handed over to PSC
65	Plant and Equipment	Maintenance	Maintenance work on elevated reservoir	Injuries to person conducting maintenance at elevated reservoir location	Nil	E- Catastrophic	3 - Possible	Extreme	Engineering controls: - Staircases with landings used in preference of laddys and designed in accordance with AS1657. Staircases to have railings to access top of tank stand and enclosed ladder with railing to access top of tanks. Lockable access to gate at ground level with anti-climb preventative measures to be installed on tank stand.	GHD/PSC	Detailed design and during operation	Open	E- Catastrophic	2 - Unlikely	Significant	Risk to be handed over to PSC
66	Plant and Equipment	Maintenance	Maintenance work on pumps	Injuries to person conducting maintenance in transfer pump station	Nil	D - Critical	3 - Possible	Significant	Engineering controls: - Ease of access to pumps by allowable light truck to reverse into building and use swivel base hydraulic hoist with winch Administrative controls - warning signs PPE - steel cap boots, gloves, for all workers	GHD/PSC	Detailed design and during operation	Open	C- Severe	2 - Unlikely	Low	Risk to be handed over to PSC
67	HVAC	Maintenance	Stored Energy	Stored energy can lead to electricution of workers	Provide Training and written procedures on isolation / discharge	D - Critical	3 - Possible	Significant	Provide Training and written procedures on isolation / discharge refresher and admistration controls	GHD/Contractor	Detailed design and during operation	Open	D - Critical	1 - Very Unlikely	Moderate	
68	HVAC	Maintenance	Inspections	Equipment inaccessible	Ensure all equipment are accessible	C- Severe	4 - Likely	Moderate	Engineering Control	GHD/Contractor	Detailed design and during operation	Open	C- Severe	1 - Very Unlikely	Low	



HSE040 Safety in Design Risk Assessment



Notes: *Designs with significant quantities of dangerous goods may require detailed risk assessments under Dangerous Goods or Major Hazard legislation
 * Most industrial processes will require an industry specific assessment, e.g. HAZOP and/or Quantitative Risk Assessment for facilities that have chemical or high-pressure processes under Dangerous Goods or Major Hazard legislation.

Design Life Cycle:	Investigation and Design	Setup, Construction and Commissioning	Operation	Maintenance	Disposal	Date:	30/11/2023	Revision No:	A		
Job Name:	LPDP - "Underbores" concept design			Job No:	12589773	Client:	Parkes Shire Council			Design:	GHD

People involved in Risk Assessment:

Initial Risk Rating													Residual Risk Rating			
Design Ref	Type	Design Life Cycle Stage <small>(Select from Drop Down Box)</small>	Hazards <small>What could cause injury or ill health, damage to property or damage to the environment</small>	Risk <small>What could go wrong and what might happen as a result</small>	Existing Control Measures	Initial Risk Rating			Potential Control Measures <small>(Consider Hierarchy of Control - Elimination, Substitution, Isolation, Engineering Controls, Administrative Controls, PPE)</small>	Responsibility	By When	Decision / Status	Residual Risk Rating			Comments
						C	L	RR					C	L	RR	
Investigation and design																
1	General	Investigation and Design	Design and construction issues due to unidentified services	Damage to existing utilities during construction. Disruption to existing communications or water supply services during construction. Injury to construction workers as a result of unexpectedly coming into contact with existing infrastructure or services.	Typical offset increase from road to provide additional space. BYDA survey informing concept design.	C- Severe	4 - Likely	Moderate	GHD to allow for detailed survey should the need for further survey data be identified during a site visit.	Contractor/GHD	Detailed design	Open	C- Severe	2 - Unlikely	Low	Construction contractor to manage residual risk.
2	General	Investigation and Design	Unexpected ground conditions	Excavation collapses a risk to workers and equipment, particularly in deep excavations.	Geotechnical Assessment to be completed	E- Catastrophic	1 - Very Unlikely	Moderate	Contractor to ensure geotechnical supervisions throughout the construction, designed secant piles or trench shoring, dewatering to be completed throughout the project, no worker within trench during rain events	Contractor	During construction	Appropriate Geotechnical supervision throughout installation	E- Catastrophic	1 - Very Unlikely	Moderate	
3	General	Investigation and Design	Acid sulphate soil	Potential off site leaching event of uncontained acid sulphate soils	Geotechnical Assessment to be completed	E- Catastrophic	1 - Very Unlikely	Moderate	Contractor to ensure geotechnical supervisions throughout the construction, industry standard approach to on-site testing, treatment and off-site disposal.	Contractor	During construction	Appropriate Geotechnical supervision throughout excavation	D - Critical	1 - Very Unlikely	Moderate	
4	General	Investigation and Design	Design clashes with non-PSC controlled services	Designing works that clash with existing telecom services	Geotechnical Assessment to be completed	C- Severe	3 - Possible	Moderate	Design to avoid 'typical' telecoms footpath/road reserve allocation and add note to drawings for contractor to locate	GHD/Contractor	Before Construction	Open	C- Severe	1 - Very Unlikely	Low	
5	General	Investigation and Design	Noise Pollution	Complaints from residents living near to pipeline trenching.	Nil	C- Severe	3 - Possible	Moderate	Noise sensitivity analysis to be conducted prior to commencement of works. Night-time works are to be restricted to minimise noise pollution.	Contractor	During Design		C- Severe	3 - Possible	Moderate	
6	General	Investigation and Design	Authorised access	injury to personnel	Signage to Australian standard noted in specification and drawings	C- Severe	3 - Possible	Moderate	signage, PSC lock access to authorised locations	PSC/GHD	Before Construction		C- Severe	1 - Very Unlikely	Low	
7	General	Investigation and Design	High pressure	When maintaining system, Operator may be exposed to high pressure.	Nil	C- Severe	3 - Possible	Moderate	Risk to be reviewed with as part of the Detail Design phase. Review also to identify need for lockable valves.	GHD	Detailed design	Open	C- Severe	2 - Unlikely	Low	
8	Watermain	Investigation and Design	Trenchless construction	Potential for injury / difficult construction conditions / community disruption and tree impacts	Minimise footprint and tree impacts	C- Severe	3 - Possible	Moderate	Contractor to reassess the location of the works during detailed design and prior to construction.	GHD/Contractor	Prior to construction	Open	C- Severe	2 - Unlikely	Low	
9	Watermain	Investigation and Design	Access/egress to trenchless construction	Slip, trip fall over water body from steep slope		D - Critical	3 - Possible	Significant	Outline safe operating procedures in the construction safety management plan. Contractor to install physical barriers around trenchless construction.	Contractor	Prior to construction	Open	D - Critical	2 - Unlikely	Moderate	
Setup, Construction and Commissioning																
13	General	Setup, Construction and Commissioning	Proximity to overhead power lines	Contact with overhead power lines during construction	Services located as part of a Before You Dig Australia request	E- Catastrophic	3 - Possible	Extreme	Contractor to implement safe work methods for working in close proximity to existing power lines, including limiters on excavators, etc. Contractors to liaise with power supplier	Contractor/GHD	Prior to Construction	Contractor to ensure overhead power lines are visible with warning signs	E- Catastrophic	2 - Unlikely	Significant	
14	General	Setup, Construction and Commissioning	Noise Pollution	Complaints from neighbours during construction and plant operation	Nil	B - Major	3 - Possible	Low	PSC to engage neighbours. Works to be performed during normal work hours	Contractor/PSC	Prior to Construction	PSC to letter drop, Contractor to perform works within normal work hours	B - Major	2 - Unlikely	Negligible	

Initial Risk Rating														Residual Risk Rating		
Design Ref	Type	Design Life Cycle Stage <small>(Select from Drop Down Box)</small>	Hazards <small>What could cause injury or ill health, damage to property or damage to the environment</small>	Risk <small>What could go wrong and what might happen as a result</small>	Existing Control Measures	C	L	RR	Potential Control Measures <small>(Consider Hierarchy of Control - Elimination, Substitution, Isolation, Engineering Controls, Administrative Controls, PPE)</small>	Responsibility	By When	Decision / Status	C	L	RR	Comments
15	General	Setup, Construction and Commissioning	Construction works in close proximity to residential property and existing infrastructure	Injury to general public and/or construction workers.	Contractor to set up fencing around job site	B - Major	3 - Possible	Low	Notifying residents in advance of works commencing. Clear inspection of property prior to commencing works. Traffic Management Plan and Construction Safety Management Plan implemented. Clear signage and physical barricading of construction area. Where possible, install a 1.8 m tall steel mesh fence to separate public from the construction works and stage works around non-peak periods.	Contractor	Prior and during construction	Open	B - Major	2 - Unlikely	Negligible	
16	General	Setup, Construction and Commissioning	People Access (work platforms, restricted workspaces, ladders/platforms)	Risk of workers being injured due to being in a restricted area	Contractor to set up barricade around deep excavations	C- Severe	2 - Unlikely	Low	Ensure workers trained in the correct areas are in locations. Signed work site areas, toolbox talk every morning, Site induction and strict sign in policies.	Contractor	Prior and during construction	Contractor to set up appropriate barricades around excavations.	C- Severe	1 - Very Unlikely	Low	
17	General	Setup, Construction and Commissioning	People Access (work platforms, restricted workspaces, deep excavations)	Risk of workers being injured due to being in a restricted area	Contractor to set up barricade around deep excavations	C- Severe	2 - Unlikely	Low	Ensure workers trained in the correct areas are in locations. Tool box talks. Allow for ramps in and out of excavations to Australian standards	Contractor	Prior and during construction		C- Severe	1 - Very Unlikely	Low	
18	General	Setup, Construction and Commissioning	Waste disposal	Health issues associated with disposal of waste material from construction.	Nil	C- Severe	4 - Likely	Moderate	Assessment undertaken in REF. Some spoil to be used as fill material for battering of site. Ensure no runoff or leaching from waste storage sites.	Contractor	Prior to construction and during construction	Open	D - Critical	2 - Unlikely	Moderate	
19	General	Setup, Construction and Commissioning	Temperature and Humidity	Heat related illness		B - Major	2 - Unlikely	Negligible	Contractor to implement own requirements in regards to hazards related to heat	Contractor	Prior to construction	To be implemented by Contractor	B - Major	1 - Very Unlikely	Negligible	
20	General	Setup, Construction and Commissioning	Dust, Fumes & Smoke	Construction emissions		B - Major	3 - Possible	Low	Contractor to develop site EMP and construction management plan	Contractor	Prior to Construction	To be implemented by Contractor	B - Major	3 - Possible	Low	
21	General	Setup, Construction and Commissioning	Debris on road	Vehicle Accidents, risk to works and public		B - Major	4 - Likely	Low	Contractor to develop site EMP and construction management plan, contractor to implement routine road sweeping and cleaning. Monitor road condition throughout project	Contractor	During Construction	Weekly road cleaning to be implemented. Contractor to satisfy PSC superintendent in regards to road cleanliness	B - Major	2 - Unlikely	Negligible	
22	General	Setup, Construction and Commissioning	Aboriginal artefacts potentially impacted or damaged	Potential impacts to subsurface Aboriginal artefacts during construction works	Due diligence assessment	C- Severe	3 - Possible	Moderate	Undertake Aboriginal Cultural Heritage assessment so there is a more thorough initial assessment that would provide greater protection should anything be uncovered during construction.	GHD / PSC	Prior to Construction	Open	B - Major	3 - Possible	Low	
23	General	Setup, Construction and Commissioning	Contamination during works	Contact with biological waste	Health and Safety Plans and Vaccinations for staff	C- Severe	4 - Likely	Moderate	All staff to be vaccinated and clear hygiene plans established for site, liaise with PSC during cut in periods. Scour/clean line before any cut ins.	Contractor	During construction	Plans to be submitted to DPE	C- Severe	2 - Unlikely	Low	
24	Site	Setup, Construction and Commissioning	Accessibility for backfilling	Insufficient access for backfilling		C- Severe	3 - Possible	Moderate	Use long armed excavator to reach over backfill areas, flowable fill i.e. stabilised sand	GHD/Contractor	During construction	During construction	C- Severe	3 - Possible	Moderate	
25	Site	Setup, Construction and Commissioning	Wet weather during construction	Rain water collected in pits overflows into waterways	Standard trenchless methodology - includes banded pit, pumps, etc	C- Severe	2 - Unlikely	Low	Flood management plan	Contractor	Prior to construction and during construction	Open	B - Major	2 - Unlikely	Negligible	
26	General	Setup, Construction and Commissioning	Covid-19	Timeframe/limit the number of drilling workers on site / resourcing issues	Nil	C- Severe	3 - Possible	Moderate	Detailed design to state in the specifications the tenderer should include a resourcing plan to consider covid-19 restrictions	GHD / PSC	Prior to Construction	Open	B - Major	2 - Unlikely	Negligible	
27	General	Setup, Construction and Commissioning	Excavations	Excavation collapses a risk to workers and equipment, particularly in deep excavations.	Nil	D - Critical	3 - Possible	Significant	Use benching back or temporary support works to support excavations where required due to excavations depth or stability of ground material. Contractor to monitor adjacent sites for any effects that may result from caisson construction.	Contractor	During construction	Contractor to review all excavations and provide certified temporary support works where required.	D - Critical	2 - Unlikely	Moderate	
28	General	Setup, Construction and Commissioning	Excavations	Worker may fall into excavation	Nil	C- Severe	3 - Possible	Moderate	Contractor to use appropriate fencing and barricading around excavations where required	Contractor	During Construction	Contractor to review all excavations and provide certified temporary support works where required. Monitor adjacent sites for effects of excavations.	D - Critical	2 - Unlikely	Moderate	
29	General	Setup, Construction and Commissioning	Dewatering	environmental release	allowed in quantities	C- Severe	1 - Very Unlikely	Low	Contractor to design and allow management of water on site. EMP to be submitted.	Contractor	During construction	Open	C- Severe	1 - Very Unlikely	Low	
30	General	Setup, Construction and Commissioning	Construction timeframe	Impact to community activities	Nil	B - Major	3 - Possible	Low	Detailed design to include restricted timeframe within the technical specifications, no construction works in the middle of summer or school holidays	GHD / Contractor	Prior to construction and during construction	Open	B - Major	2 - Unlikely	Negligible	

Design Ref	Type	Design Life Cycle Stage (Select from Drop Down Box)	Hazards <small>What could cause injury or ill health, damage to property or damage to the environment</small>	Risk <small>What could go wrong and what might happen as a result</small>	Existing Control Measures	Initial Risk Rating			Potential Control Measures <small>(Consider Hierarchy of Control - Elimination, Substitution, Isolation, Engineering Controls, Administrative Controls, PPE)</small>	Responsibility	By When	Decision / Status	Residual Risk Rating			Comments
						C	L	RR					C	L	RR	
31	General	Setup, Construction and Commissioning	Use of machinery in limited work space near The Escort Way	Coming into contact with traffic	Traffic control	B - Major	3 - Possible	Low	Implement Traffic Control Measures	Contractor	During construction	Contractor to Implement	B - Major	3 - Possible	Low	
32	General	Setup, Construction and Commissioning	Use of tools and working with heavy materials	Injury occurring from use of tools and heavy materials hitting/injuring workers and/or existing structures	Machinery used to manoeuvre heavy materials and safety work method statements used for each task undertaken that presents any risks. PPE	C- Severe	2 - Unlikely	Low	Having skilled operators using machinery and supervision at all times during these tasks, the use of spotters as required by law	Contractor	During construction	To be implemented	C- Severe	1 - Very Unlikely	Low	
33	General	Setup, Construction and Commissioning	Frequency of vehicle/machinery accessing the site - daily/3 times a week for a month during construction	Vehicles may impact existing assets / accessibility	Nil	C- Severe	2 - Unlikely	Low	Contractor to provide traffic management plan to PSC for review / approval	Contractor	During construction	Open	C- Severe	1 - Very Unlikely	Low	
34	General	Setup, Construction and Commissioning	Use of machinery	Hitting underground services	Skilled operators using machinery and supervision of surrounds is carried out at all times	C- Severe	2 - Unlikely	Low	Use a spotter during works with machinery, DBYD information made readily available to all personnel. Use of vacuum excavation methods in proximity of known or suspected existing services.	Contractor	During Construction	To be implemented	C- Severe	1 - Very Unlikely	Low	
35	General	Setup, Construction and Commissioning	No coordination between design documents	Delayed to project	Designed in accordance with PSC standards	C- Severe	3 - Possible	Moderate	All concrete works to meet Structural specification, Contractor to confirm footing design, coordinate onsite	Contractor	During Construction	Contractor to Implement	E- Catastrophic	1 - Very Unlikely	Moderate	
36	General	Setup, Construction and Commissioning	Confined spaces and restricted access areas	Access by non competent person(s)	WH&S Queensland Confined Space Code of Practice 2011, AS 2865-2009: Confined spaces	C- Severe	3 - Possible	Moderate	Site to be fenced off during construction. Contractor to ensure legislative requirements regarding confined spaces etc. are met. All staff working in confined spaces are to have the appropriate training and certification. Gas meters are to be in operation while work is being undertaken in confined spaces	Contractor	Prior to Construction	To be implemented by Contractor	C- Severe	2 - Unlikely	Low	
37	General	Setup, Construction and Commissioning	Unknown Services	Damage to services during construction	Site survey and inspection completed	C- Severe	2 - Unlikely	Low	Potholing to be conducted during setup	Contractor	Prior to Construction	Potholing to be conducted during setup	C- Severe	1 - Very Unlikely	Low	
34	General	Setup, Construction and Commissioning	Setting out excavation zone	May hit unknown buried services	Site survey undertaken.	C- Severe	2 - Unlikely	Low	Site survey and geotechnical investigations, DBYD completed	Contractor	Prior to Construction	Contractor to verify service locations. If there is a need to redirect services contractor is to consult with regulatory authority to avoid loss of service.	C- Severe	1 - Very Unlikely	Low	
35	General	Setup, Construction and Commissioning	Disturbance or damage of services during construction	Loss of services (water, sanitation, gas, comms, electricity)	A survey has identified services where possible	D - Critical	3 - Possible	Significant	Contractor is to undertake any additional investigations necessary to protect services and undertake additional potholing and or survey if deemed required. If there is a need to redirect services, contractor is to consult with regulatory authority for that service.	Contractor	Prior to construction	Contractor to verify service locations. If there is a need to redirect services contractor is to consult with regulatory authority to avoid loss of service.	D - Critical	2 - Unlikely	Moderate	
36	General	Setup, Construction and Commissioning	Concrete works, formwork and steel work	Injury to workers around formwork, steel work and placement of concrete	Appropriate PPE to be worn. Qualified workers to be used where required (i.e. grinding)	B - Major	4 - Likely	Low	SWMS completed and Construction methodology plan put in place	Contractor	Prior to construction		B - Major	3 - Possible	Low	
37	Water Main	Setup, Construction and Commissioning	Excavation and laying of pipe across services	Hitting underground services during excavation and installation of pipe	A survey has identified services where possible	D - Critical	2 - Unlikely	Moderate	Services to be isolated prior to excavation around then. New services to be laid if existing damaged	Contractor	During construction		D - Critical	2 - Unlikely	Moderate	
38	General	Setup, Construction and Commissioning	Existing private property assets.	Damage to private property assets (i.e. fencing)	Nil	C- Severe	4 - Likely	Moderate	Where works are to be conducted in proximity to existing private assets, fencing off of the asset ought to be conducted. If the asset must be removed to enable works to continue, the contractor is to ensure the property owner consents and agrees to a remediation method for any damages caused / changes to their asset made during the process of construction.	Contractor	During construction	Open	C- Severe	2 - Unlikely	Low	
39	Water Main	Setup, Construction and Commissioning	Excavation of launch / receival pit	Damage to utility services causing disruptions/electrification/fire	Nil	D - Critical	3 - Possible	Significant	DBYD plans; Excavation permit; Non destructive excavation to locate services and Utility technician at site as required	Contractor	During construction	Open	D - Critical	2 - Unlikely	Moderate	
40	Water Main	Setup, Construction and Commissioning	Unloading boring machine and steel casings	Dropped loads resulting in injuries	Nil	B - Major	4 - Likely	Low	Contractor to secure the following: Lifting of machines from designated points; Warning signs/alarms/lights to be in place; Correct PPE and Never lift over personnel	Contractor	During construction	Open	B - Major	3 - Possible	Low	
41	Water Main	Setup, Construction and Commissioning	Installation of boring machine/frame/rails into launch pit	Dropped loads resulting in injuries Working in overhead cables	Nil	B - Major	3 - Possible	Low	1. Qualified operators only to use equipment 2. Inspection of lifting chains prior to use 3. Warning signs/alarms/lights to be in place 4. Correct PPE 5. Never enter under a suspended load	Contractor	During construction	Open	B - Major	3 - Possible	Low	
42	General	Setup, Construction and Commissioning	Plant / equipment refuelling	Ignition sources causing fire or explosion Accidental fuel spills resulting in environmental damage	Nil	B - Major	4 - Likely	Low	Contractor to develop safe work statement.	Contractor	During construction	Open	B - Major	3 - Possible	Low	

Initial Risk Rating														Residual Risk Rating		
Design Ref	Type	Design Life Cycle Stage <small>(Select from Drop Down Box)</small>	Hazards <small>What could cause injury or ill health, damage to property or damage to the environment</small>	Risk <small>What could go wrong and what might happen as a result</small>	Existing Control Measures	Initial Risk Rating			Potential Control Measures <small>(Consider Hierarchy of Control - Elimination, Substitution, Isolation, Engineering Controls, Administrative Controls, PPE)</small>	Responsibility	By When	Decision / Status	Residual Risk Rating			Comments
						C	L	RR					C	L	RR	
43	General	Setup, Construction and Commissioning	Construction adjacent to trees.	Risk of injury when pruning or removing trees or damage to property.	Nil	C - Severe	3 - Possible	Moderate	Contractor to develop safe work statement. Contractor to use appropriate work methods and tools/machinery to safely remove/trim trees.	Contractor	Detailed design/Construction	Open	C - Severe	2 - Unlikely	Low	
44	Water Main	Setup, Construction and Commissioning	Pipe thrust blocks	Thrust block is fully loaded before concrete reaches adequate strength.	Nil	D - Critical	3 - Possible	Significant	Thrust blocks to be allowed to set for minimum 7 days after being constructed before pressure testing/commissioning occurs.	Contractor	During construction	Open	D - Critical	2 - Unlikely	Moderate	
45	General	Setup, Construction and Commissioning	Open trench construction (launch/receival pits of trenchless crossings)	Injury to construction workers from trip or fall near/into the trench. Excavation faces are unlikely to be self-supporting above the water table for any reliable duration and collapsing/flowing sand soils are likely beneath the water table	Nil	D - Critical	3 - Possible	Significant	Outline safe operating procedures in the construction safety management plan. Contractor to install physical barriers around trench. Cover temporary excavations.	Contractor	Prior to construction	Open	D - Critical	2 - Unlikely	Moderate	
46	General	Setup, Construction and Commissioning	Security on site being open space	Damage of construction machinery by public	Nil	C - Severe	2 - Unlikely	Low	Contractor to secure the construction area	Contractor	During construction	Open	C - Severe	1 - Very Unlikely	Low	
47	Watermain	Setup, Construction and Commissioning	Inadequate ground conditions for trenchless	Time delays, HDD cost increase, cost variations to PSC	Geotech investigations conducted during concept design	C - Severe	4 - Likely	Moderate	Provide all relevant geotechnical investigations available to Contractor D&C contract may reduce risk D&C to undertake own geotechnical investigations PSC supervision on site	GHD/Contractor/PSC	Prior to and during construction	Open	C - Severe	3 - Possible	Moderate	
Operation																
48	General	Operation	Greater than anticipated loads due to public or vehicle access after construction	Damage to pipework	alignment minimises trafficable areas	B - Major	3 - Possible	Low	Detailed design to include pipe protection/trafficable cover types in critical areas.	GHD/PSC	Detailed Design	Open	B - Major	2 - Unlikely	Negligible	Risk to be handed over to PSC
49	Environment	Operation	Scouring of main when not in use	Discharge of chlorinated water to the environment when pipeline is scoured.	Nil	C - Severe	4 - Likely	Moderate	Engineering controls - Scour pump out chambers. Admin controls - PSC to develop scour pump out plan	PSC	During operation	Open	C - Severe	3 - Possible	Moderate	Risk to be handed over to PSC
50	Water main	Operation	Forces from water velocities around bends	Pipe disconnecting and water bursting out.	Fully restraint welded pipe	C - Severe	2 - Unlikely	Low	Design to current Australian standards, Contractor to provide appropriate QA to ensure project is constructed as per design drawings and standards.	Contractor/PSC	Prior to construction and during construction	Open	C - Severe	1 - Very Unlikely	Low	
51	Water Main	Operation	Differential settlement.	Differential settlement of the pipework could shear joints and promote pipe leaks and/or bursts.		C - Severe	4 - Likely	Moderate	Use flexible jointing where possible to allow pipework to 'adapt' to differential settlement. Use appropriate bedding material.	GHD	Detailed design	Open	C - Severe	2 - Unlikely	Low	
52	Water Main	Operation	Driving over air valves in vehicles/mowers	Failures of the air valve and pipeline broken	Nil	B - Major	3 - Possible	Low	Engineering controls: - Ensure pipe to have air valves installed are shown to be 1 m depth on design to ensure pit lids are flush with ground.	Contractor/PSC	Construction and maintenance	Open	B - Major	2 - Unlikely	Negligible	
Maintenance																
53	Vehicle Access	Maintenance	Vehicle access for maintenance vehicles.	Injury to general public or maintenance personnel from maintenance vehicles due to minimal locations for safe roadside parking.	Concept design to consider placement of valves for safety possible access within construction of vertical alignment and existing infrastructure. Detailed design reviewed this.	C - Severe	3 - Possible	Moderate	PSC operations and maintenance teams to confirm appropriate locations for vehicle parking when inspecting each valve.	PSC	Maintenance	Open	C - Severe	2 - Unlikely	Low	

Appendix C

Pump comparison letter

Your ref:
Our ref: 12589773

09 March 2023

Jason Myers
Parkes Shire Council
NSW

Lachlan Pipeline Duplication Detail Design TSS: Pump selection

Dear Jason

As part of the Lachlan Pipeline Duplication Project (LPDP) GHD has prepared a comparison between pump models from two pump suppliers (Xylem and Flowserve) for Parkes Shire Council (PSC) to consider and endorse for the detail design of the New Eugowra Road pumping station (NERPS) and the Akuna Road pumping station (ARPS). This work has been prepared based on discussions with PSC and is to be used to assist Council in determining a preferred pump supplier.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

1. Pipeline configuration

Due to the evolution of the LPDP and discussions with PSC a final pipe size combination of DN800 and DN710 HDPE has been confirmed. The current iteration of the pipeline design includes these pipe sizes and assumes the Flowserve pumps drive the flow. Relatively minor changes to the pipe section are anticipated if PSC view the Xylem pumps as the favourable pump supplier.

Below are the hydraulic grade lines (HGL) for the NERPS to ARPS and ARPS the Parkes WTP pipe sections when operating at the Flowserve dual parallel pump duties outlined in Table 1. Additionally, the sections of pipe size and pressure rating are visualised.

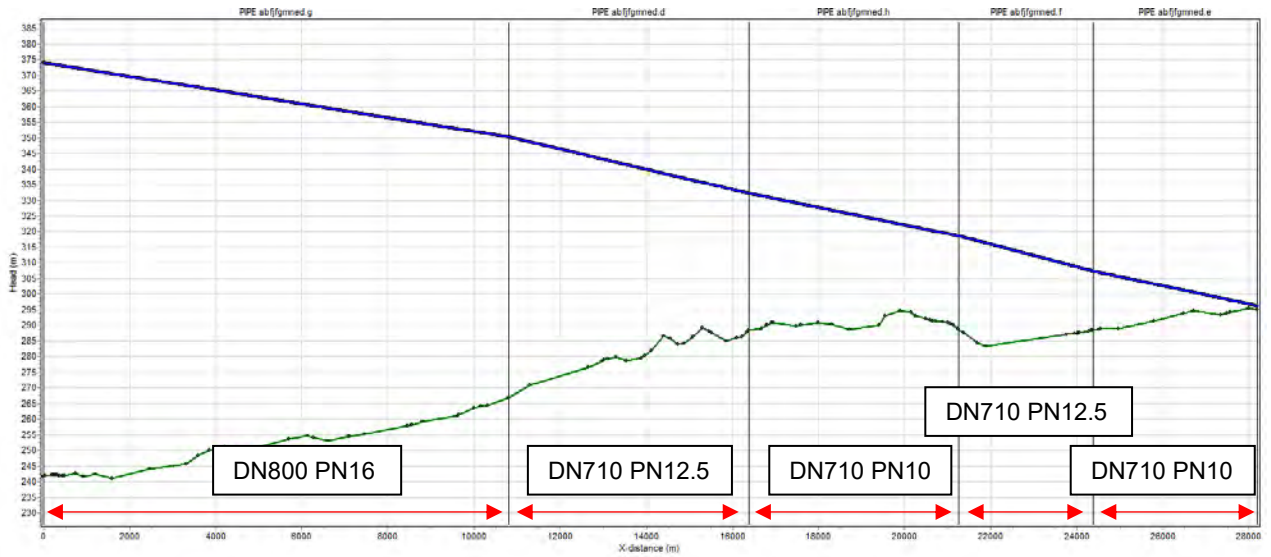


Figure 1 ERPS to ARPS pipe profile

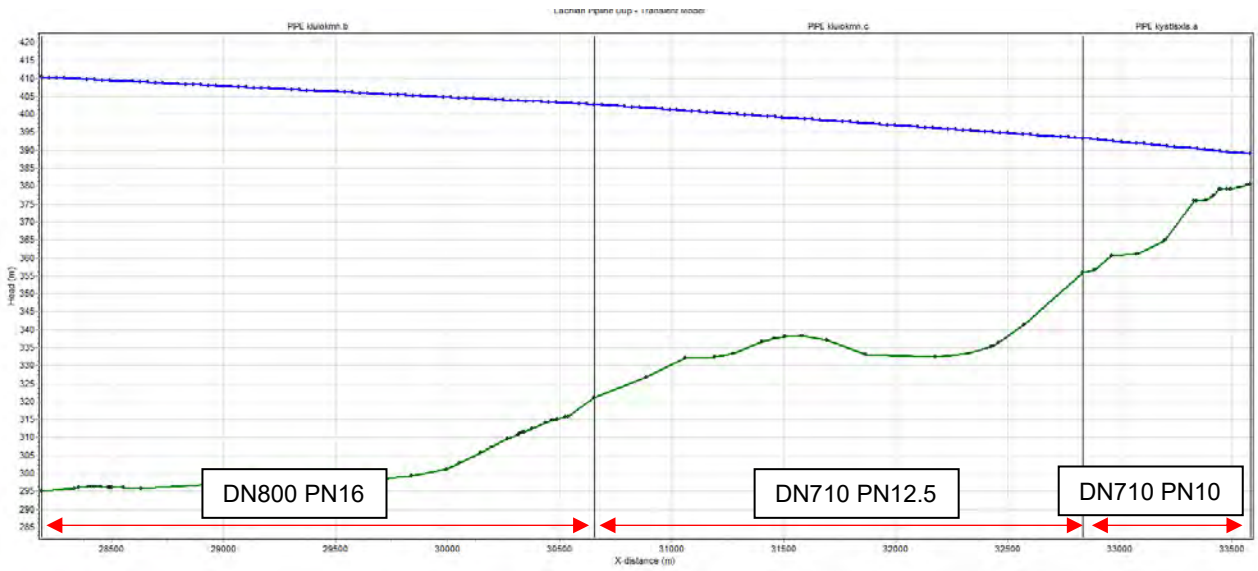


Figure 2 ARPS to Parkes WTP pipe profile

2. Pump comparison

A number of pump aspects are being considered throughout the detailed design of the LPDP. Whilst all design aspects are considered a few have comparatively greater impacts to the system than others. These aspects and consideration are thought of as critical. The aspects GHD sees as critical include pump operation, power required, cost and lead time. These factors can affect the performance of the system as well and the price and timeline of the project. The differences regarding the critical factors between the pump suppliers are highlight below and their impacts are discussed in Section 3.

The critical differences between the nominated pumps include:

- Better flow matching between NERPS and ARPS with the Flowserve pumps (20 L/s disparity). Compared to Xylem pumps with a flow disparity of 40 L/s.
- An approximate 3-5% better maximum efficiency for the Flowserve pumps.
- A larger motor power requirement of 3 x 450 kW for the Flowserve NERPS as compared to the 3 x 400 kW requirement for equivalent Xylem pump.
- A \$53K cheaper per pump unit cost for the Flowserve pumps which accumulates to a \$318K saving.
- A 14-week better lead time for the Xylem pumps.

See below a tabulated comparison of the of the Xylem and Flowserve pumps for both the NERPS and ARPS pumps.

Table 1 Xylem and Flowserve pump comparison

	Xylem		Flowserve	
	Eugowra	Akuna	Eugowra	Akuna
Pump model	e-XC200-625	e-XC200-655	250-LNN-600	250-LNN-600
Maximum flow (L/s)	304	315	364	350
Maximum head (m)	143	142	138	128
Impeller diameter (mm)	600	600	606	606
Single pump duty	NA	300 L/s @ 99 m	NA	305 L/s @ 100 m
Dual parallel pump duty	445 L/s @ 125 m	485 L/s @ 115	455 L/s @ 127 m	475 L/s 113 m
Power requirement (kW)	400		450	400
Pump speed (rpm)	1492		1490	
Pump weight (kg)	3,763		2,940 (baseplate weight not included)	
Pump size: LxBxH (mm)	3024 x 1030 x 1602		2981 x 1100 x 1135	
Best efficiency point	81.9%	81.8%	85.1%	87.2%
Cost (per pump)	\$178K		\$125K	
Total cost (all six pumps)	\$1,068K		\$750K	
Lead time	20-22 weeks		36 weeks	

3. Discussion and recommendations

From an operational perspective the suppliers are very similar however the Flowserve pumps are a slightly more optimal solution. The better efficiencies will allow for a more economical pump operation, though for NERPS however this better efficiency is counteracted by a higher power requirement. Additionally, the better flow disparity between the Flowserve pumps results in prolonged uninterrupted pumping time as the ARPS will not need to be shut off as frequently.

In addition to the above, the largest differences between the options which GHD view as most relevant to PSC decision are the cost and lead time of the pump units. The Flowserve pumps are notably better priced and save PSC an upfront cost of \$318K. The lead time for the pumps is however 14 weeks longer than the Xylem option at 36 weeks. As the pumping stations are approximately 12 months off being built, this lead time is likely to be a lesser factor in PSC decision.

Therefore, due to the factors discussed GHD recommends the Flowserve pumps be adopted for the design at both the NERPS and ARPS. PSC are requested to endorse this recommendation to allow the designs to be further progressed.

Regards



Renee Johnson
Technical Director - Water

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Appendix A

Eugowra PS - Xylem pump datasheet

e-XC200-625/4000W/W45BDS4AG

Technical data

Company name
Contact
Phone number
e-mail address

Operating data			
1	Pumpe type	Single head pump	Fluid Water, pure
2	No. of pumps	1	Operating temperature at A °C 4
3	Nominal flow	l/s 0	Max / Min Operating Temperature °C /
4	Nominal head	m 0	pH-value at t A 7
5	Static head	m 0	Density at t A kg/m ³ 1000
6	Inlet pressure	kPa 0	Kin. viscosity at t A mm ² /s 1.569
7	Environmental temperature	°C 20	Vapor pressure at t A kPa 100
8	Available system NPSH	m 0	Altitude 0

Pump data			
9	Lubrication	Grease Lubricated [STD]	
10	Execution	Clockwise Rotation - viewed from motor end [STD]	
11	Design	Double Suction Split Case Pumps	
12	Operating speed	1492 rpm	
13	Suction nozzle	DN 250 / PN16 / EN 1092-2	Impeller Ø
14	Discharge nozzle	DN 200 / PN16 / EN 1092-2	
15	Max. casing pressure	kPa 3100	Flow
16	Max. working pressure	kPa 1402.8	
17	Impeller type	Radial impeller	Head
18	Head H(Q=0)	m 140	
19	Max. shaft power	kW 403.3	Shaft power kW
20	Pump weight	kg	
21	Total weight	kg 3,762.6	Efficiency %
			NPSH 3% m

Materials			
22		Pump	Shaft Seal
23	Casings	[D] - EN-GJS-500-7 / QT500-7 / ASTM A536, 80-55-06	Rubber below seal [STD]
24	Impeller + Impeller Wear Ring	[S] - 304 SS - 1.4308 / ZG0Cr18Ni9 / ASTM - CF8	MR2 - Seal on sleeve 4
25	Shaft Construction	Dry (sleeves) [STD]	Mechanical seal diameter 100 mm
26	Shaft	1.7035 / 40Cr / AISI - 5140	Seal faces Carbon [STD]
27	Shaft Sleeve	304 SS - 1.4301 / 0Cr18Ni9 / AISI - 304	Stationary ring Silicon Carbide
28	Shaft Sleeve Nuts	304 SS - 1.4301 / 0Cr18Ni9 / AISI - 304	Elastomers EPDM [STD]
29	Casing Wear Ring	Bronze - CuSn8Zn4 / ASTM - C90300	Springs 316 SS - 1.4401 / 0Cr17Ni12Mo2 / AISI - 316
30	Lantern Ring	Cast Iron	Other metal parts 316 SS - 1.4401 / 0Cr17Ni12Mo2 / AISI - 316
31	Seal flush lines	304 SS - 1.4301 / 0Cr18Ni9 / AISI - 304	Material code Carbon-SiC-EPDM [STD]
32			
33			
34			
35			
36			
37			
38			
39			
40			
41			

Motor data				Coupling			
42	Manufacturer	WEG		Manufacturer	Flender		
43	Specific design	IE3 3ph Surface Motor - W22 - Premium Efficiency		Series	N-EUPEX - Type A		
44	Type	W22 355 A/B B3 400 kW		Spacer length	4 mm	Suitable for EEx-design NO	
45	Rated power	400 kW	Rated current 714 A	Shaft diameter	Motor	100 mm	Frame size 250
46	Nominal speed	1492 rpm	Rated voltage 400 V		Pump	75 mm	Weight 70.5 kg
47	Frame size	355 A/B	Service factor 1	CG-05			
48	Weight kg	2,089.0	Degree of protection IP55	Coupling protection Material 1.0038 RAL 2000 painted			
49	Length shaft end	210 mm	Design acc. standard IEC	Weight 26 kg			

Base plate		Remarks
50	Name	FRAME XC24-847-354
51	Weight kg	335.0
52		

e-XC200-625/4000WW45BDS4AG

Performance curve

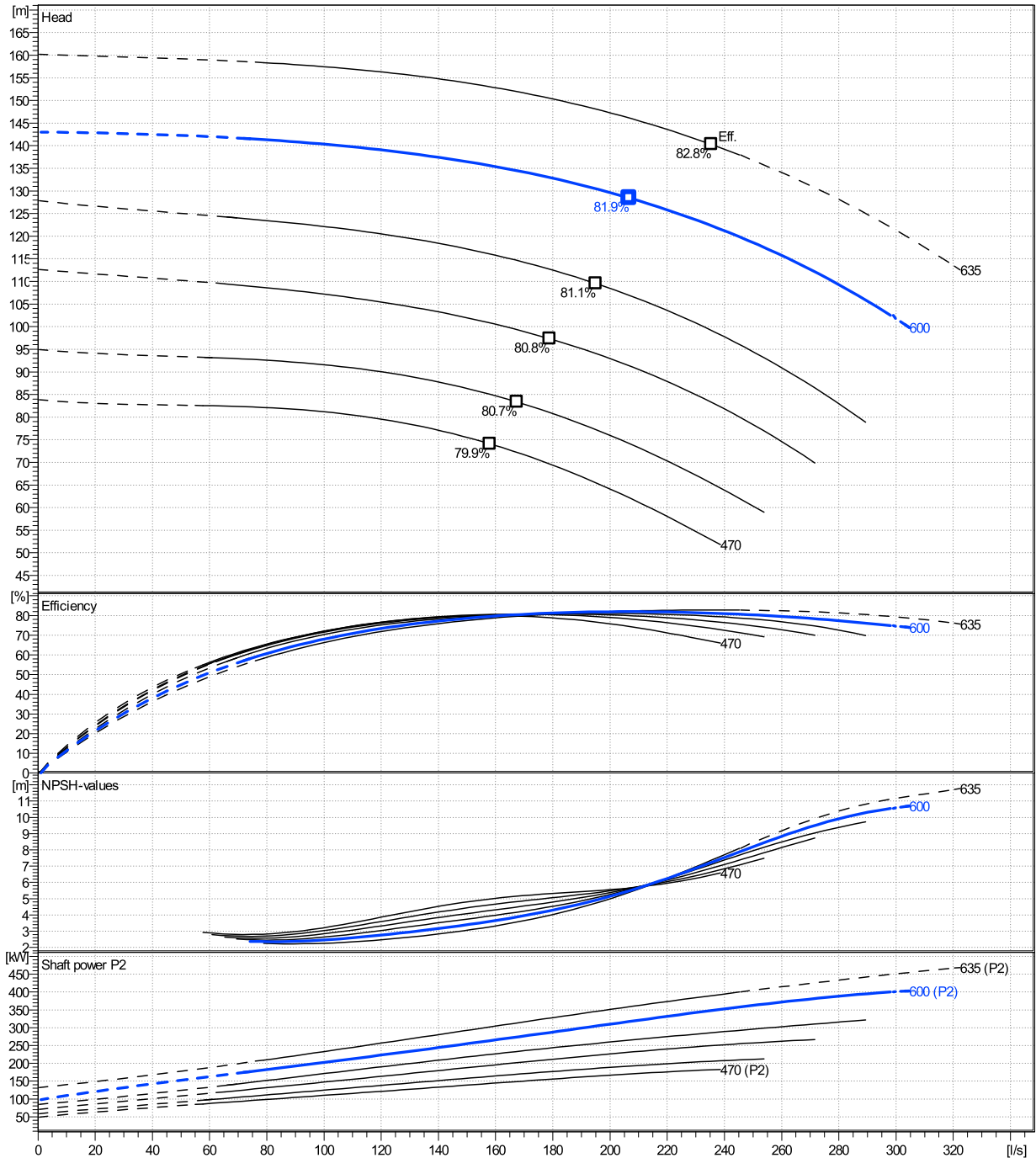
Company name
Contact
Phone number
e-mail address

	Ø inch	Pump capacity			Pump head		Shaft power P2			Frequency	Hz	
		Min. l/s	Max. l/s	η Max. l/s	H(Q=0) m	η Max. m	P2(Q=0) kW	Max. kW	η Max. kW	Operating speed	rpm	
actual	23.622	74.1	298	207	143	128				50	1492	
Min.	18.504	/	/	158	83.9	74.1		403	317	Nominal flow	l/s	0
Max.	25.000	/	/	235	160	140		/	143	Nominal head	m	0
									390	Inlet pressure	kPa	0
										Static head	m	0

Power datas referred to:

hydr. Performance acceptance acc. To EN ISO 9906 Class Grade 2B

Water, pure [100%] ; 4°C; 1000kg/m³; 1.57mm²/s

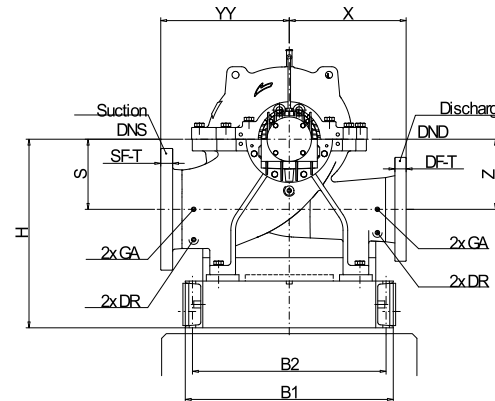
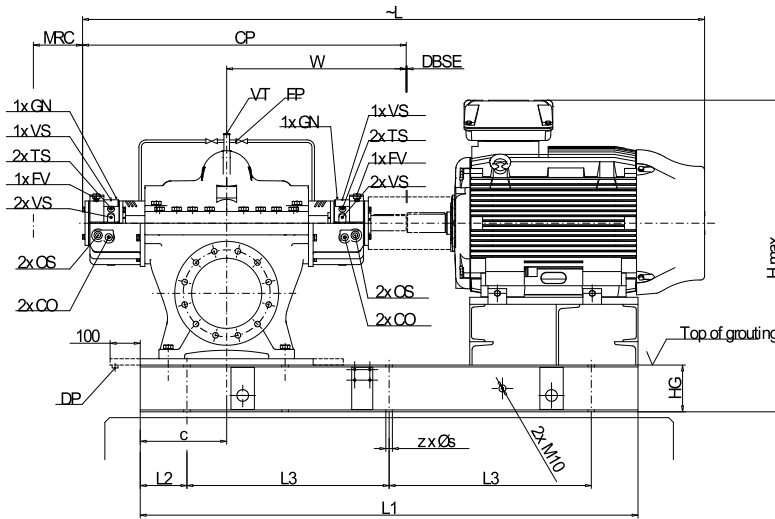


e-XC200-625/4000W/W45BDS4AG

Dimensions

Company name
Contact
Phone number
e-mail address

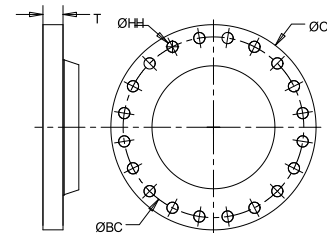
Complete Unit with Baseplate
Clockwise Rotation - viewed from motor end [STD]
IE3 3ph Surface Motor - W22 - Premium Efficiency
W22 355 A/B B3 400 kW



DR ... Drain Rp1/2
FP ... Flush Rp3/8
FV ... Fill/Vent Cup Rp3/8 standard
GA ... Gauge Connection Rp1/2
GN ... Grease Nipple M10x1 standard
TS ... Temperature Sensor M10x1
VT ... Vent Rp1/2
VS ...

Rotation: CW View from Motor to Pump

MRC Minimum removal clearance for bearing and seal maintenance
DBSE ... Distance between shaft ends



Dimensions [mm]			
B1	1030	SF-ND	250
B2	960	SF-OD	405
c	320	W	748
CP	1343	X	600
DBSE	4	YY	650
DF-BC	295	Z	350
DF-HH	23	z	6x
DF-HQ	12x		
DF-ND	200		
DF-OD	340		
H Max.	1602		
H	847		
H1	620		
HD1	620		
HG	200		
L	3024		
L1	2500		
L2	250		
L3	1000		
MRC	4		
s	29		
S	350		
SF-BC	355		
SF-HH	28		
SF-HQ	12x		

Connections	
Suction nozzle	Discharge nozzle
DN 250	DN 200
PN16	PN16
EN 1092-2	EN 1092-2
Weight (+/- 5%)	
Pump	1,242 kg
Coupling	71 kg
Coupling guard	26 kg
Base plate	335 kg
Motor	2,089 kg
Total weight	3,763 kg

Dimensions and weight without obligation

Project	Project ID	Created by	Created on 01-25-23	Last update 01-25-23
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Appendix B

Akuna PS - Xylem pump datasheet

e-XC200-655/4000WW45BDS4AG

Technical data

Company name
Contact
Phone number
e-mail address

Operating data				
1	Pumpe type	Single head pump	Fluid	Water, pure
2	No. of pumps	1	Operating temperature at A	°C 4
3	Nominal flow	l/s 0	Max / Min Operating Temperature	°C /
4	Nominal head	m 0	pH-value at t A	7
5	Static head	m 0	Density at t A	kg/m ³ 1000
6	Inlet pressure	kPa 0	Kin. viscosity at t A	mm ² /s 1.569
7	Environmental temperature	°C 20	Vapor pressure at t A	kPa 100
8	Available system NPSH	m 0	Altitude	0

Pump data				
9	Lubrication	Grease Lubricated [STD]		
10	Execution	Clockwise Rotation - viewed from motor end [STD]		
11	Design	Double Suction Split Case Pumps		
12	Operating speed	1492 rpm		
13	Suction nozzle	DN 250 / PN16 / EN 1092-2	Impeller Ø	
14	Discharge nozzle	DN 200 / PN16 / EN 1092-2		
15	Max. casing pressure	kPa 3100	Flow	
16	Max. working pressure	kPa 1395.9		
17	Impeller type	Radial impeller	Head	
18	Head H(Q=0)	m 140		
19	Max. shaft power	kW 397.4	Shaft power	kW
20	Pump weight	kg	Efficiency	%
21	Total weight	kg 3,762.6	NPSH 3%	m

Materials				
22		Pump	Shaft Seal	
23	Casings	[D] - EN-GJS-500-7 / QT500-7 / ASTM A536, 80-55-06	Rubber below seal [STD]	
24	Impeller + Impeller Wear Ring	[S] - 304 SS - 1.4308 / ZG0Cr18Ni9 / ASTM - CF8	MR2 - Seal on sleeve	4
25	Shaft Construction	Dry (sleeves) [STD]	Mechanical seal diameter	100 mm
26	Shaft	1.7035 / 40Cr / AISI - 5140	Seal faces	Carbon [STD]
27	Shaft Sleeve	304 SS - 1.4301 / 0Cr18Ni9 / AISI - 304	Stationary ring	Silicon Carbide
28	Shaft Sleeve Nuts	304 SS - 1.4301 / 0Cr18Ni9 / AISI - 304	Elastomers	EPDM [STD]
29	Casing Wear Ring	Bronze - CuSn8Zn4 / ASTM - C90300	Springs	316 SS - 1.4401 / 0Cr17Ni12Mo2 / AISI - 316
30	Lantern Ring	Cast Iron	Other metal parts	316 SS - 1.4401 / 0Cr17Ni12Mo2 / AISI - 316
31	Seal flush lines	304 SS - 1.4301 / 0Cr18Ni9 / AISI - 304	Material code	Carbon-SiC-EPDM [STD]
32				
33				
34				
35				
36				
37				
38				
39				
40				
41				

Motor data				Coupling					
42	Manufacturer	WEG		Manufacturer	Flender				
43	Specific design	IE3 3ph Surface Motor - W22 - Premium Efficiency		Series	N-EUPEX - Type A				
44	Type	W22 355 A/B B3 400 kW		Spacer length	4 mm	Suitable for EEx-design	NO		
45	Rated power	400 kW	Rated current	714 A	Shaft diameter	Motor	100 mm	Frame size	250
46	Nominal speed	1492 rpm	Rated voltage	400 V		Pump	75 mm	Weight	70.5 kg
47	Frame size	355 A/B	Service factor	1	CG-05				
48	Weight	kg 2,089.0	Degree of protection	IP55	Coupling protection	Material	1.0038 RAL 2000 painted		
49	Length shaft end	210 mm	Design acc. standard	IEC		Weight	26 kg		

Base plate		Remarks
50	Name	FRAME XC24-847-354
51	Weight	kg 335.0
52		

e-XC200-655/4000WW45BDS4AG

Performance curve

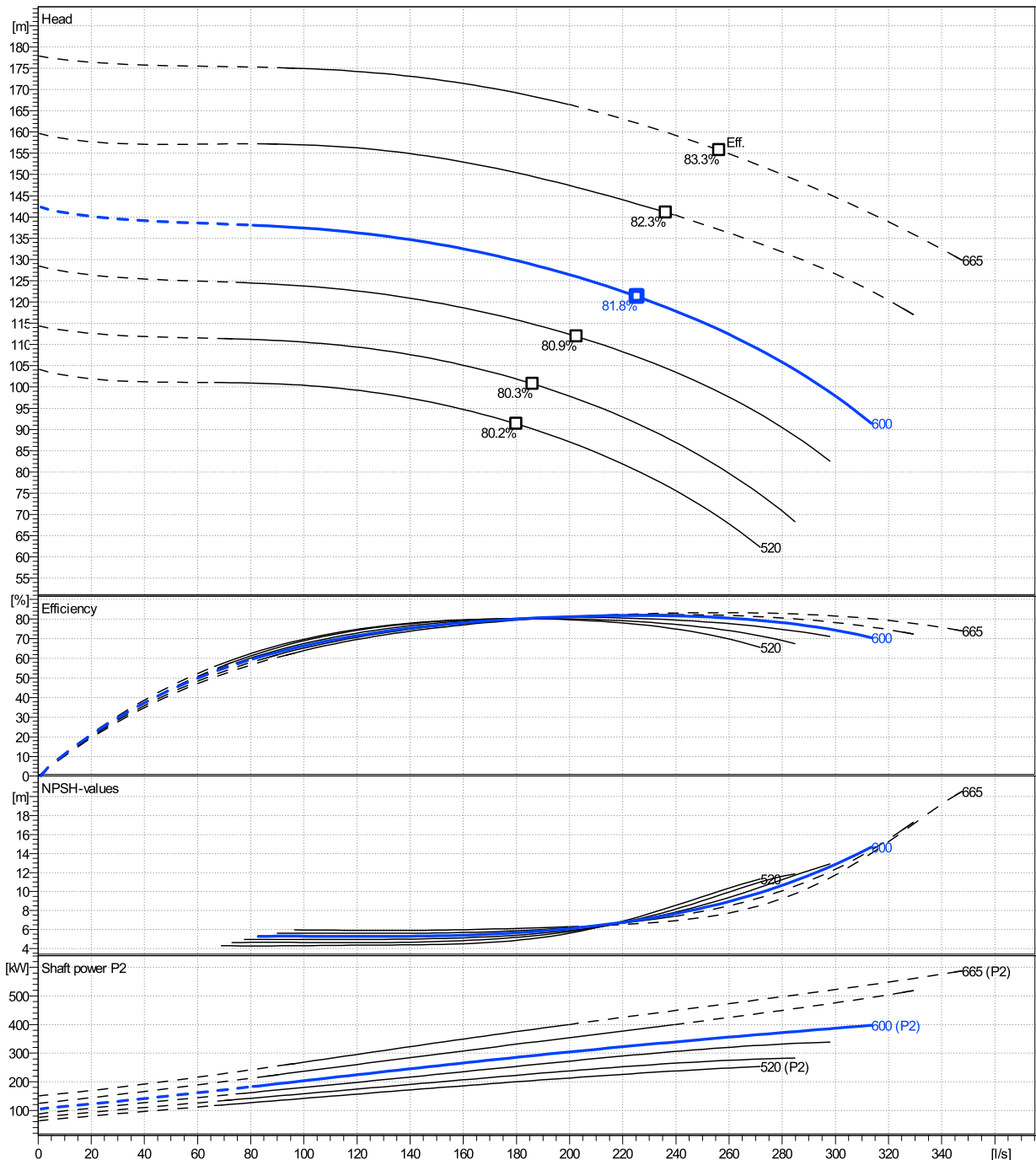
Company name
Contact
Phone number
e-mail address

	Ø inch	Pump capacity			Pump head		Shaft power P2			Frequency	Hz	
		Operating range Min. l/s	Max. l/s	η Max. l/s	H(Q=0) m	η Max. m	P2(Q=0) kW	Max. kW	η Max. kW	Operating speed	rpm	
actual	23.622	82.8	314	225	142	121		397	327	Nominal flow	l/s	0
Min.	20.472	/	/	180	104	91.3		/	200	Nominal head	m	0
Max.	26.181	/	/	256	178	156		/	469	Inlet pressure	kPa	0
										Static head	m	0

Power datas referred to:

hydr. Performance acceptance acc. To EN ISO 9906 Class Grade 2B

Water, pure [100%] ; 4°C; 1000kg/m³; 1.57mm²/s

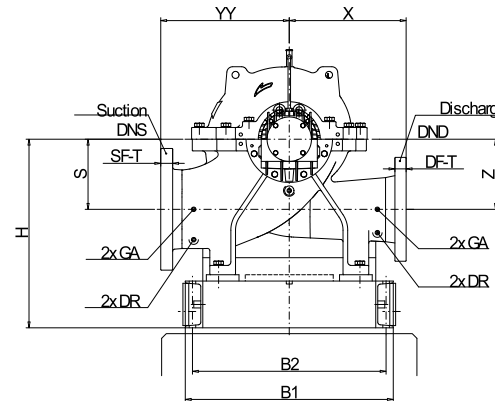
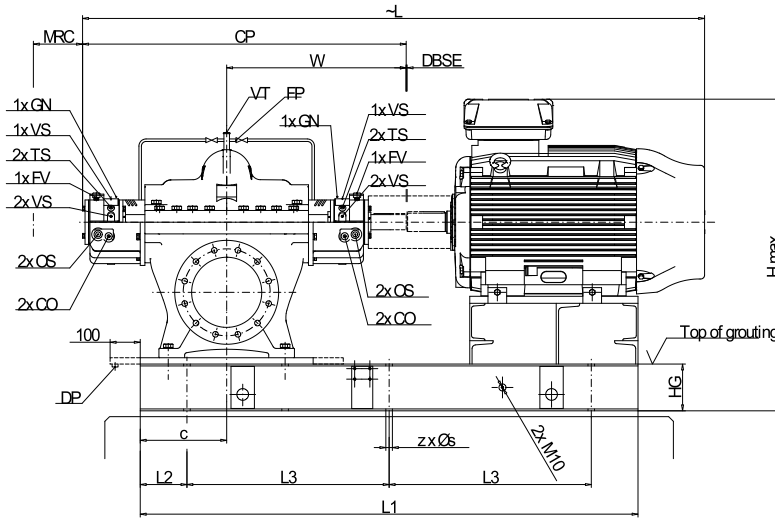


e-XC200-655/4000W/W45BDS4AG

Dimensions

Company name
Contact
Phone number
e-mail address

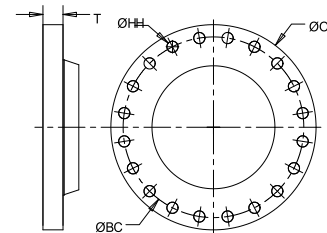
Complete Unit with Baseplate
Clockwise Rotation - viewed from motor end [STD]
IE3 3ph Surface Motor - W22 - Premium Efficiency
W22 355 A/B B3 400 kW



- DR ... Drain Rp1/2
- FP ... Flush Rp3/8
- FV ... Fill/Vent Cup Rp3/8 standard
- GA ... Gauge Connection Rp1/2
- GN ... Grease Nipple M10x1 standard
- TS ... Temperature Sensor M10x1
- VT ... Vent Rp1/2
- VS ...

Rotation: CW View from Motor to Pump

MRC Minimum removal clearance for bearing and seal maintenance
DBSE ... Distance between shaft ends



Dimensions [mm]			
B1	1030	SF-ND	250
B2	960	SF-OD	405
c	320	W	748
CP	1343	X	600
DBSE	4	YY	650
DF-BC	295	Z	350
DF-HH	23	z	6x
DF-HQ	12x		
DF-ND	200		
DF-OD	340		
H Max.	1602		
H	847		
H1	620		
HD1	620		
HG	200		
L	3024		
L1	2500		
L2	250		
L3	1000		
MRC	4		
s	29		
S	350		
SF-BC	355		
SF-HH	28		
SF-HQ	12x		

Connections	
Suction nozzle	Discharge nozzle
DN 250	DN 200
PN16	PN16
EN 1092-2	EN 1092-2
Weight (+/- 5%)	
Pump	1,242 kg
Coupling	71 kg
Coupling guard	26 kg
Base plate	335 kg
Motor	2,089 kg
Total weight	3,763 kg

Dimensions and weight without obligation

Project	Project ID	Created by	Created on 02-01-23	Last update 02-01-23
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Appendix C

**Eugowra PS - Flowserve pump
datasheet**

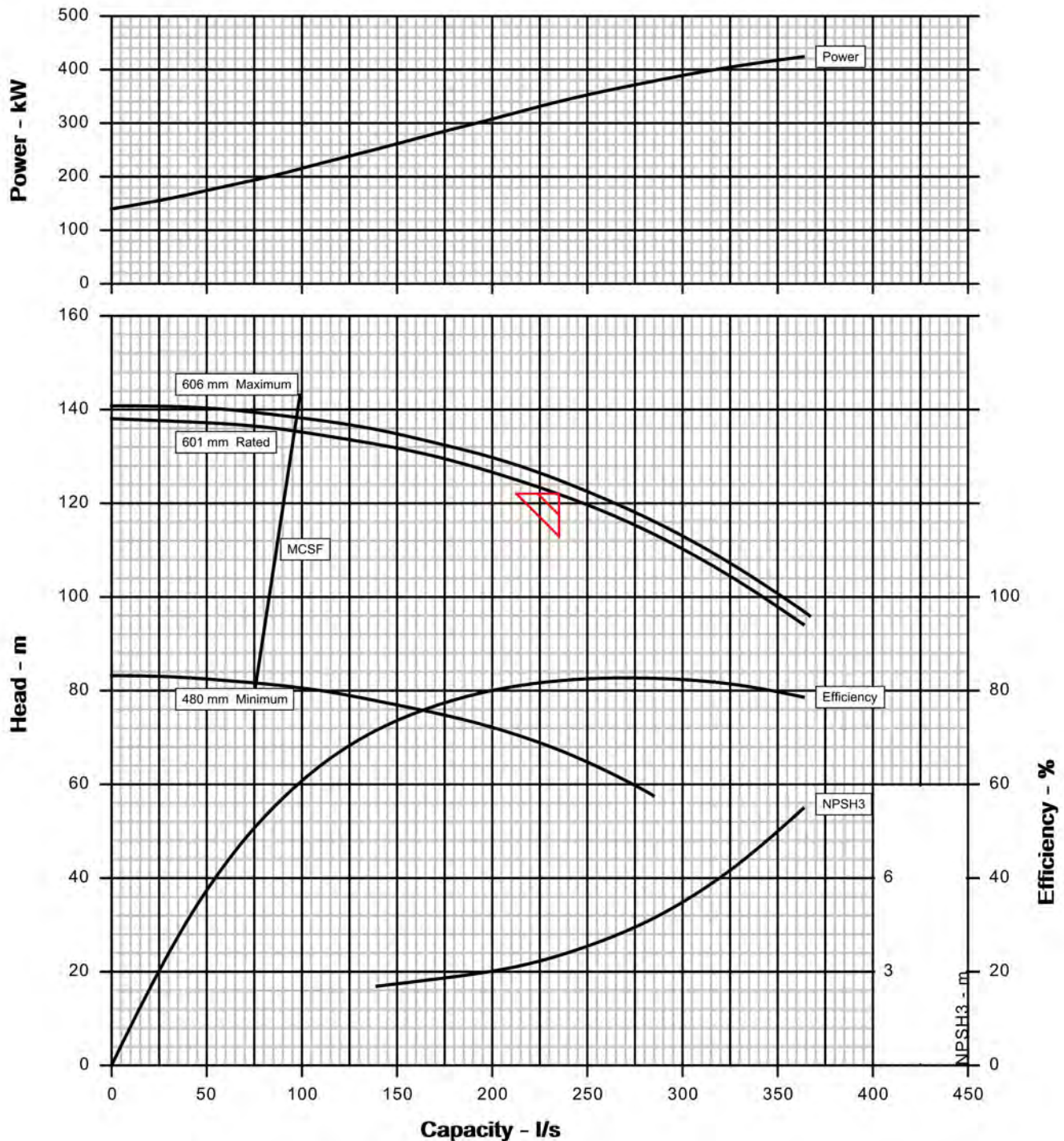


Pump size & type / Stages : 250-LNN-600 / 1
 Based on curve no. : 925R1/1-AA
 Impeller diameter : 601 mm

Customer : GHD
 Item number : P1-3
 Service : -
 Flowserve reference : 3777874784
 Date : February 13, 2023

Capacity : 235.0 l/s
 Head : 122.00 m
 Density / Specific gravity : - / 0.996
 Pump speed : 1,490 rpm
 Ns / Nss (per eye) : 1,135 / 9,410 (US)
 Test tolerance : ISO 9906 Grade 1B

CURVES ARE APPROXIMATE, PUMP IS GUARANTEED FOR ONE SET OF CONDITIONS; CAPACITY, HEAD, AND EFFICIENCY.

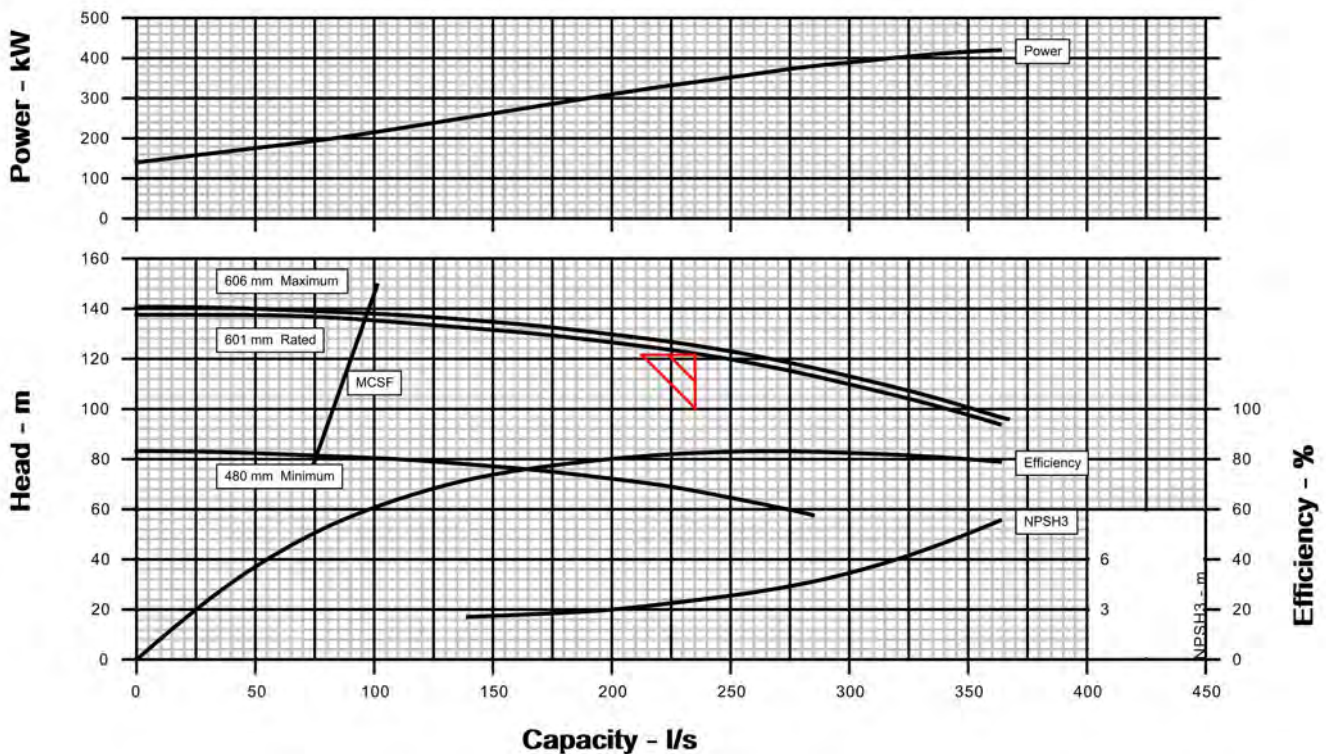


Customer	: GHD	Pump / Stages	: 250-LNN-600 / 1
Customer reference	: New pumps Parkes	Based on curve no.	: 925R1/1-AA
Item number	: P1-3	Flowserve reference	: 3777874784
Service	: -	Date	: February 13, 2023

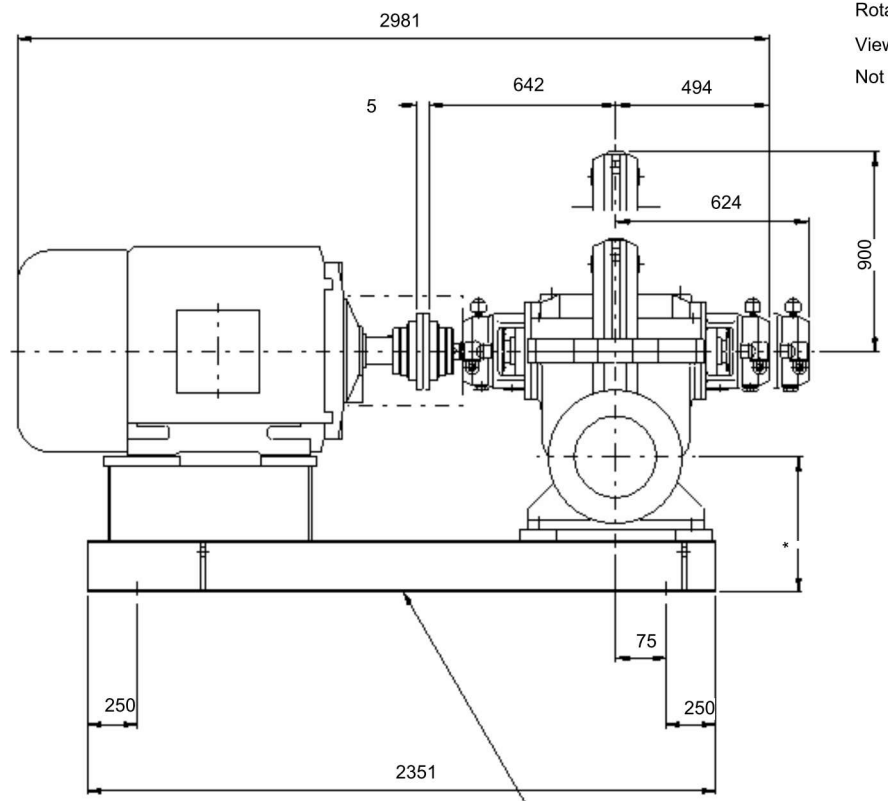
Operating Conditions		Materials / Specification	
Capacity (rated/normal)	: 235.0 l/s / -	Material column code	: B1
Water capacity (CQ=1.00)	: -	Pump specification	: -
Total developed head	: 122.00 m	Other Requirements	
Water head (CH=1.00)	: -	Hydraulic selection : No specification	
NPSHa/NPSHa less margin	: 10.0 m / -	Construction : No specification	
Maximum suction pressure	: 0.0 kPa.g	Test tolerance : ISO 9906 Grade 1B	
Liquid		Driver Sizing : Max Power(MCSF to EOC) using SF	
Liquid type	: Fresh water		
Liquid description	: -		
Temperature	: 30 °C		
Density / Specific gravity	: - / 0.996		
Solid Size - Actual / Limit	: - / -		
Viscosity / Vapor pressure	: 1.00 cP / 4.23 kPa.a		

Performance			
Hydraulic power	: 280 kW	Impeller diameter	
Pump speed	: 1,490 rpm	Rated	: 601 mm
Pump overall efficiency (CE=1.00)	: 82.1 %	Maximum	: 606 mm
NPSH required (NPSH3)	: 3.5 m	Minimum	: 480 mm
Rated brake power	: 340 kW	Ns / Nss (per eye)	: 1,135 / 9,410 (US)
Maximum brake power	: 423 kW	Minimum continuous flow	: 96.3 l/s
Driver power rating	: 450 kW / 603 hp	Maximum head at rated diameter	: 137.97 m
Casing working pressure	: 1,345.4 kPa.g	Flow at BEP	: 276.0 l/s
(based on shut off @ cut dia/rated SG)		Flow as % of BEP	: 85.1 %
Maximum allowable	: 1,600.0 kPa.g	Efficiency at normal flow	: -
Hydrostatic test pressure	: 2,400.0 kPa.g	Impeller diameter ratio (rated/max)	: 99.2 %
Estimated rated seal chamber pressure	: -	Head rise to shut off	: 13.1 %
		Total head ratio (rated / max) / (max / rated)	: 97.6 % / 102.5 %

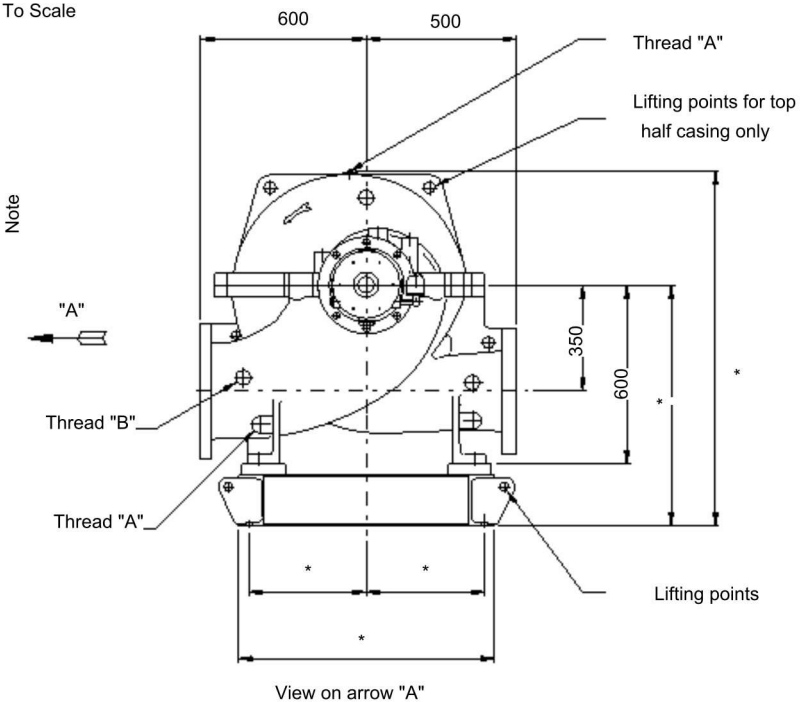
CURVES ARE APPROXIMATE, PUMP IS GUARANTEED FOR ONE SET OF CONDITIONS; CAPACITY, HEAD, AND EFFICIENCY.



Customer	: GHD	Pump / Stages	: 250-LNN-600	/ 1
Customer reference	: New pumps Parkes	Based on curve no.	: 925R1/1-AA	
Item number	: P1-3	Flowserve reference	: 3777874784	
Service	: -	Date	: February 13, 2023	
Construction				
Nozzles	Size	Rating	Face	Position
Suction	300 mm	PN16	FF	Side
Discharge	250 mm	PN16	FF	Side
Casing mounting	: Foot			
Casing split	: Axial			
Impeller type	: Double Suction 5 Vanes			
Bearing type (radial)	: Single Row Ball			
Bearing number (radial)	: 6214			
Bearing type (thrust)	: Single Row Ball			
Bearing number (thrust)	: 6214			
Bearing lubrication	: Grease			
Rotation (view from coupling)	: CW per Hyd. Institute			
Materials				
Casing	: EN-GJS-400-15			
Impeller	: 10% Tin Bronze			
Case wear ring	: Bronze			
Impeller wear ring	: Not Fitted			
Inducer	: N/A			
Shaft	: 13% Cr Steel			
Sleeve	: Not Fitted			
Baseplate, Coupling and Guard				
Baseplate type	: Common Pump & Motor			
Baseplate material	: Fabricated Steel			
Coupling manufacturer	: FPD Choice			
Coupling size	: FPD-2100			
Coupling / Shaft guard	: Non Spacer Steel			
Weights (Approx.)				
Bareshaft pump (net)	: 840.0 kg			
Baseplate (net)	: ***			
Driver (net)	: 2,100.0 kg			
Shipping gross weight/volume	: *** / ***			
Testing				
Hydrostatic test	: Non witnessed			
Performance test	: None			
NPSH test	: None			
Paint and Package				
Pump paint	: FPD Paint Syst. 1			
Base grout surface prep	: -			
Shipment type	: Domestic			
Driver Information				
Manufacturer	: ABB M3BP B3 E3			
Power	: 450 kW / 603 hp			
Service factor (requested / actual)	: 1.0 / 1.0			
Synchronous speed	: 1,500 rpm			
Orientation / Mounting	: Horizontal / Foot			
Driver type	: IEC			
Frame-size / material	: 355L / Cast Iron			
Enclosure	: TEFC IP55			
Hazardous area class	: -			
Explosion 'T' rating	: -			
Volts / Phase / Hz	: 415 / 3 / 50 Hz			
Amps-full load/locked rotor	: 784.00 A / 5,410.00 A			
Motor starting	: Direct on line (DOL)			
Insulation	: Cl. F			
Temperature rise	: 80 °C			
Bearings	: Ball			
Lubrication	: -			
Motor mounted by	: -			
Sound Pressure (dBA @ 1.0 m)				
Driver, expected	: 80.0 dBA			
Pump & driver, estimated	: -			
Seal Information				
Arrangement	: Sing.Bal Cartridge			
Size	: 80 mm			
Manufacturer / Type	: Flowserve / ISC2 in 316ss			
Material code (Man'f/API)	: SiC/Car/Vit / 5Z4T			
Internal neck bushing	: None			
Gland				
Gland material	: 316 St St			
Flush	: 1/2" NPT			
Vent	: 1/2" NPT			
Drain	: 1/2" NPT			
Auxiliary seal device	: Carbon Bush			
Piping				
Seal flush plan	: Plan 11			
Seal flush construction	: -			
Seal flush material	: Carbon steel			
Aux seal flush plan	: None			
Aux seal flush construction	: -			
Aux seal flush material	: -			
Notes				
Sound Pressure Levels:				
-Subject to 3 dBA tolerance				
-Refer for Contractual Values				
Refer for Values not shown				
-				
ver. 19-6-15				



Rotation: Clockwise
Viewed on pump coupling
Not To Scale



"A" NPT 1/2 in.
"B" NPT 1/2 in.

Note
Height to remove Top Half casing
Clearance required for lifting equipment
Top Half Casing weight approx 215 Kg

* 2.85 Bolt holes each side
Dia. Equi spaced

Flanges Drilled PN 16

	Bore	P.C.D.	No of Holes	Size of Holes
Suction	300 mm	410 mm	12	26 mm
Discharge	250 mm	355 mm	12	26 mm

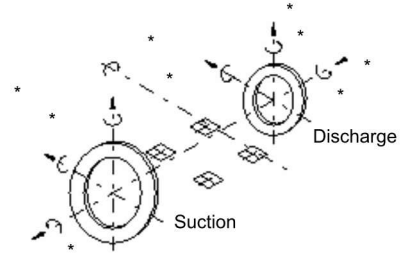
Holes drilled off centre equi spaced

Typical Drawing, not certified

Certified Drawir: C772/001/P01 order

Maximum Moments(kNm) and Forces(kN)

	Mx	My	Mz	Fx	Fy	Fz
Suction	6.10	2.98	4.61	6.68	8.01	5.34
Discharge	5.02	2.44	3.80	5.34	6.68	4.45



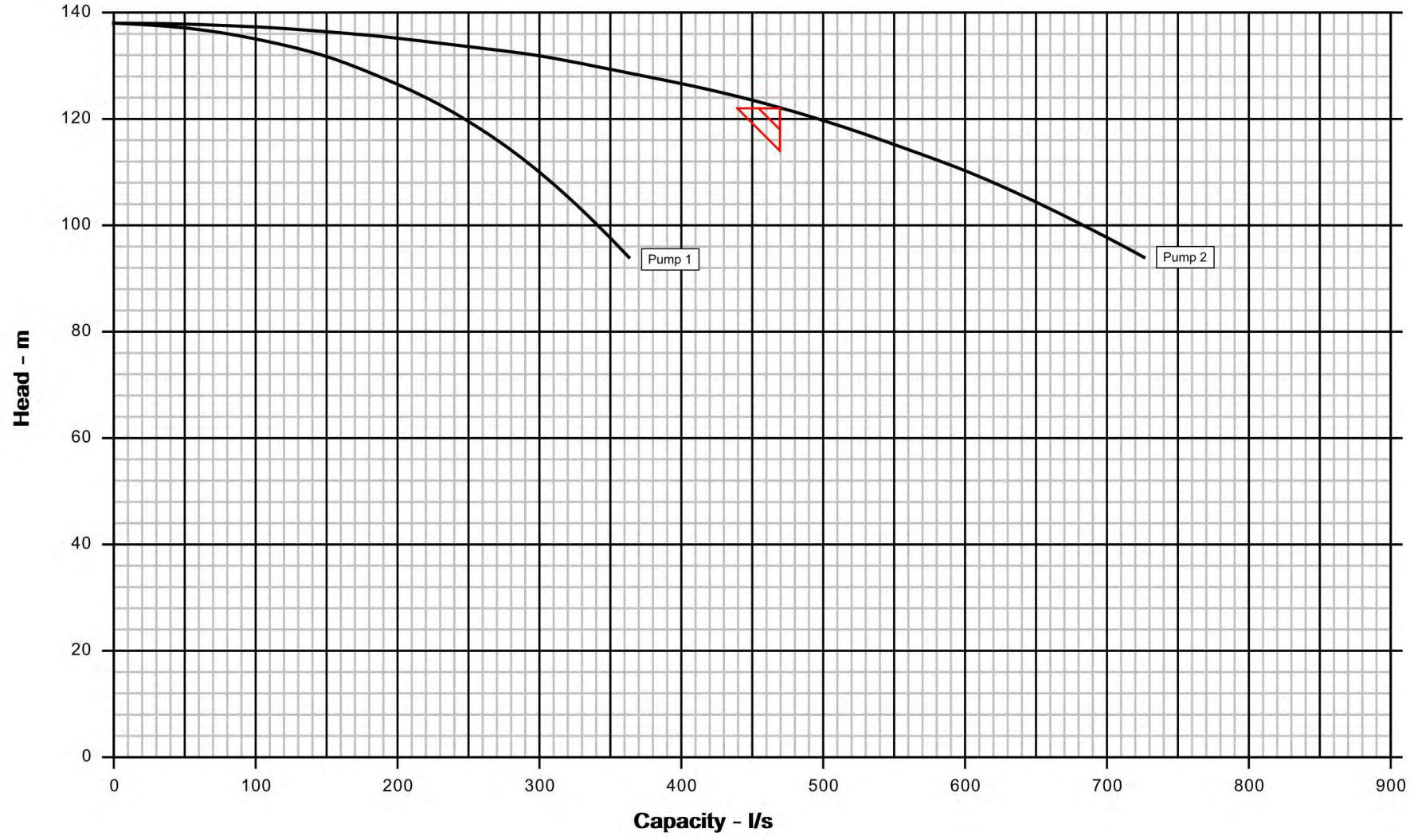
Customer	: GHD	Pump size & type	: 250-LNN-600	Drawing number	: -
Item number	: P1-3	Pump speed / Stages	: 1,490 rpm / 1	Date	: February 13, 2023
Service	: -	Flow / Head	: 235.0 l/s / 122.00 m	Certified by / Date	: -
Customer PO #	: -	Driver power / Frame	: 450 kW / 603 hp / 355L	Seal type	: ISC2 in 316ss
Flowserve reference	: 3777874784	Volts / Phase / Hz	: 415 / 3 / 50 Hz	Seal flush plan	: Plan 11

Customer : GHD
Item number : P1-3
Service : -
Flowsolve reference : 3777874784
Pump size & type / Stages : 250-LNN-600 / 1
Based on curve no. : 925R1/1-AA
Impeller diameter : 601 mm



Capacity : 235.0 l/s
Head : 122.00 m
Density / Specific gravity : - / 0.996
Pump speed : 1,490 rpm
Ns / Nss (per eye) : 1,135 / 9,410 (US)
Date : February 13, 2023

CURVES ARE APPROXIMATE, PUMP IS GUARANTEED FOR ONE SET OF CONDITIONS; CAPACITY, HEAD, AND EFFICIENCY.

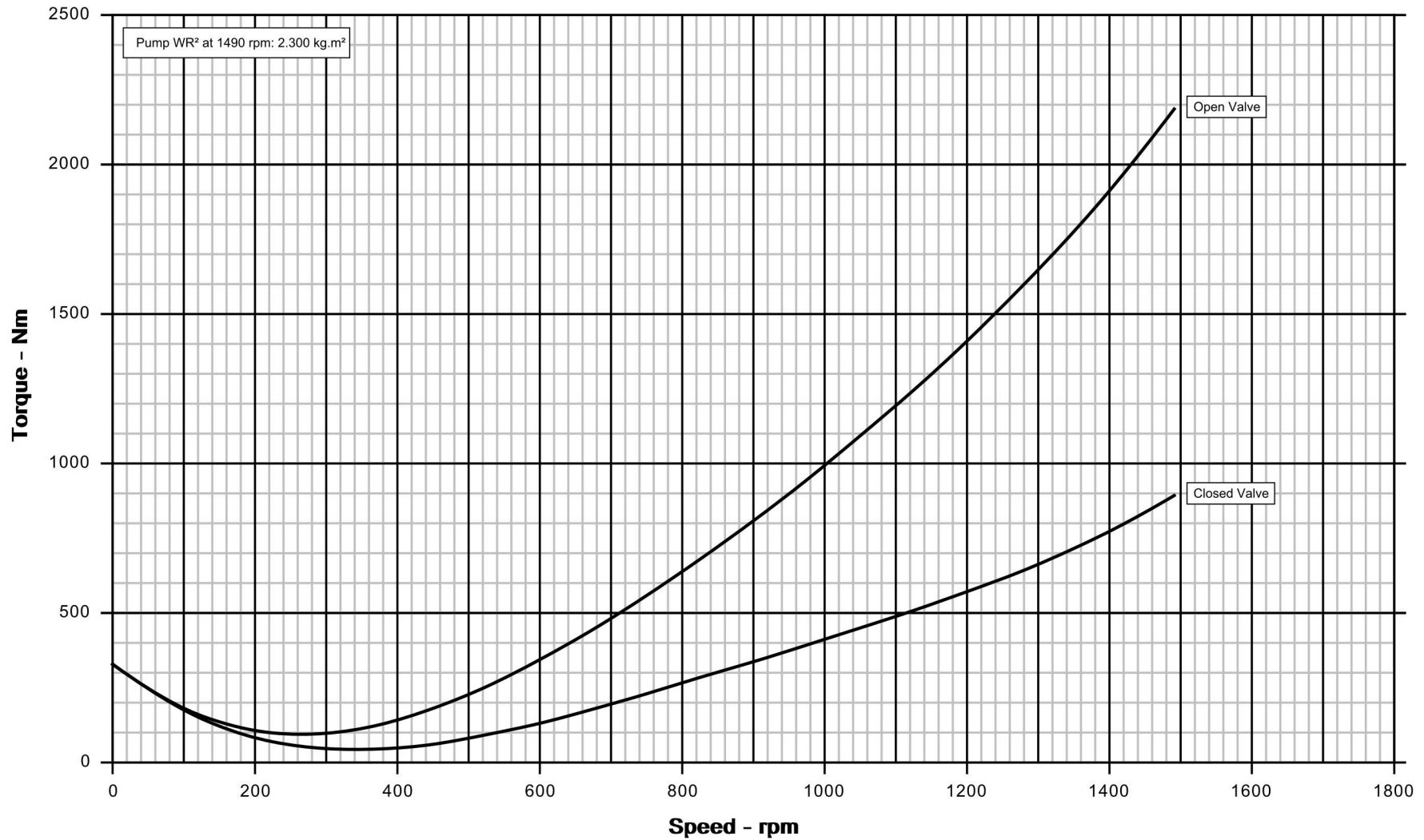


Customer : GHD
Item number : P1-3
Service : -
Flowserve reference : 3777874784
Pump size & type / Stages : 250-LNN-600 / 1
Based on curve no. : 925R1/1-AA
Impeller diameter : 601 mm



Capacity : 235.0 l/s
Head : 122.00 m
Density / Specific gravity : - / 0.996
Pump speed : 1,490 rpm
Ns / Nss (per eye) : 1,135 / 9,410 (US)
Pump WR² at 1,490 rpm : 2.300 kg.m²
Date : February 13, 2023

CURVES ARE APPROXIMATE, PUMP IS GUARANTEED FOR ONE SET OF CONDITIONS; CAPACITY, HEAD, AND EFFICIENCY.



Appendix D

Akuna PS - Flowserve pump datasheet

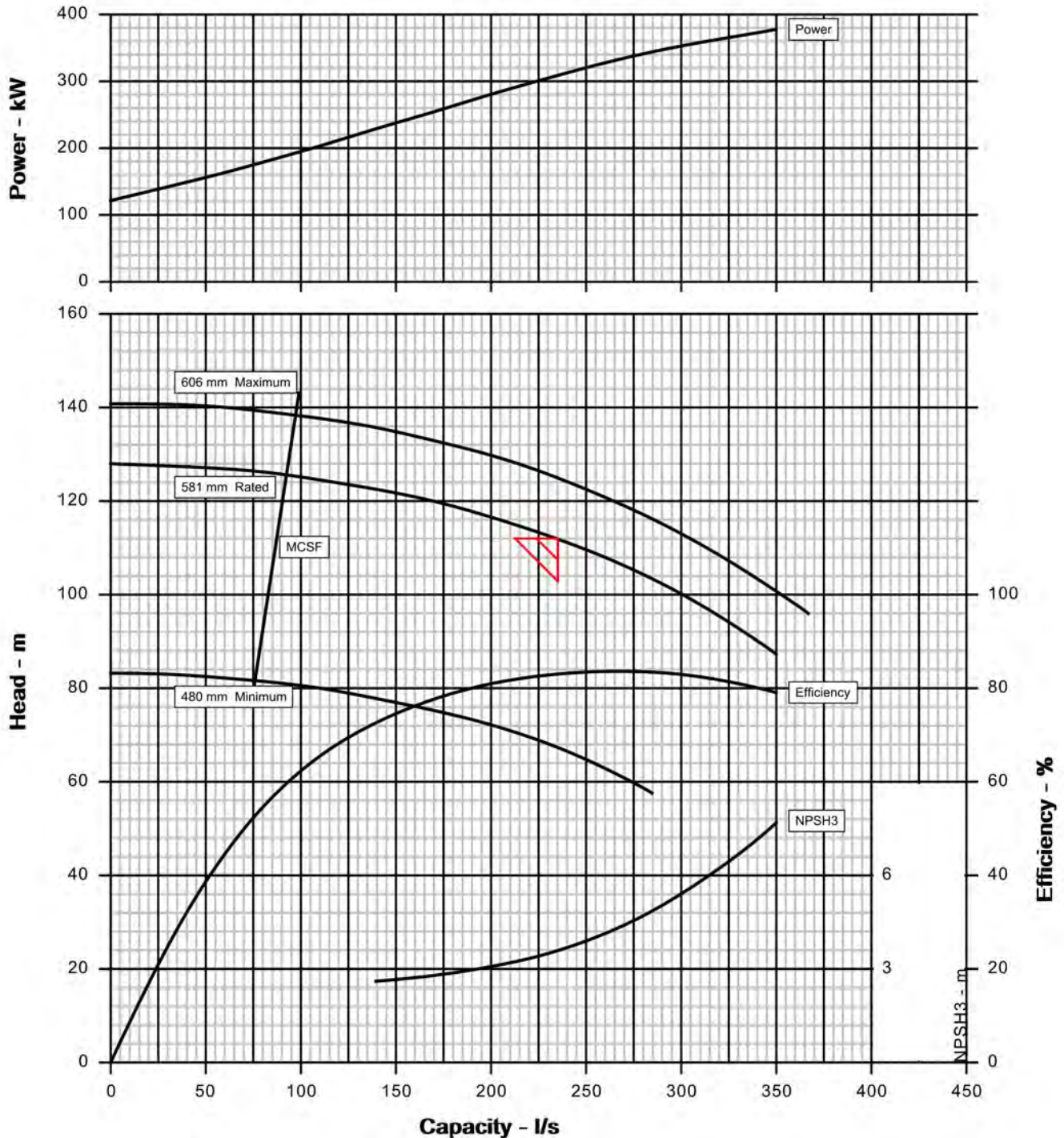


Pump size & type / Stages : 250-LNN-600 / 1
 Based on curve no. : 925R1/1-AA
 Impeller diameter : 581 mm

Customer : GHD
 Item number : P4-6
 Service : -
 Flowserve reference : 3777874784
 Date : February 13, 2023

Capacity : 235.0 l/s
 Head : 112.00 m
 Density / Specific gravity : - / 0.996
 Pump speed : 1,490 rpm
 Ns / Nss (per eye) : 1,135 / 9,410 (US)
 Test tolerance : ISO 9906 Grade 1B

CURVES ARE APPROXIMATE, PUMP IS GUARANTEED FOR ONE SET OF CONDITIONS; CAPACITY, HEAD, AND EFFICIENCY.

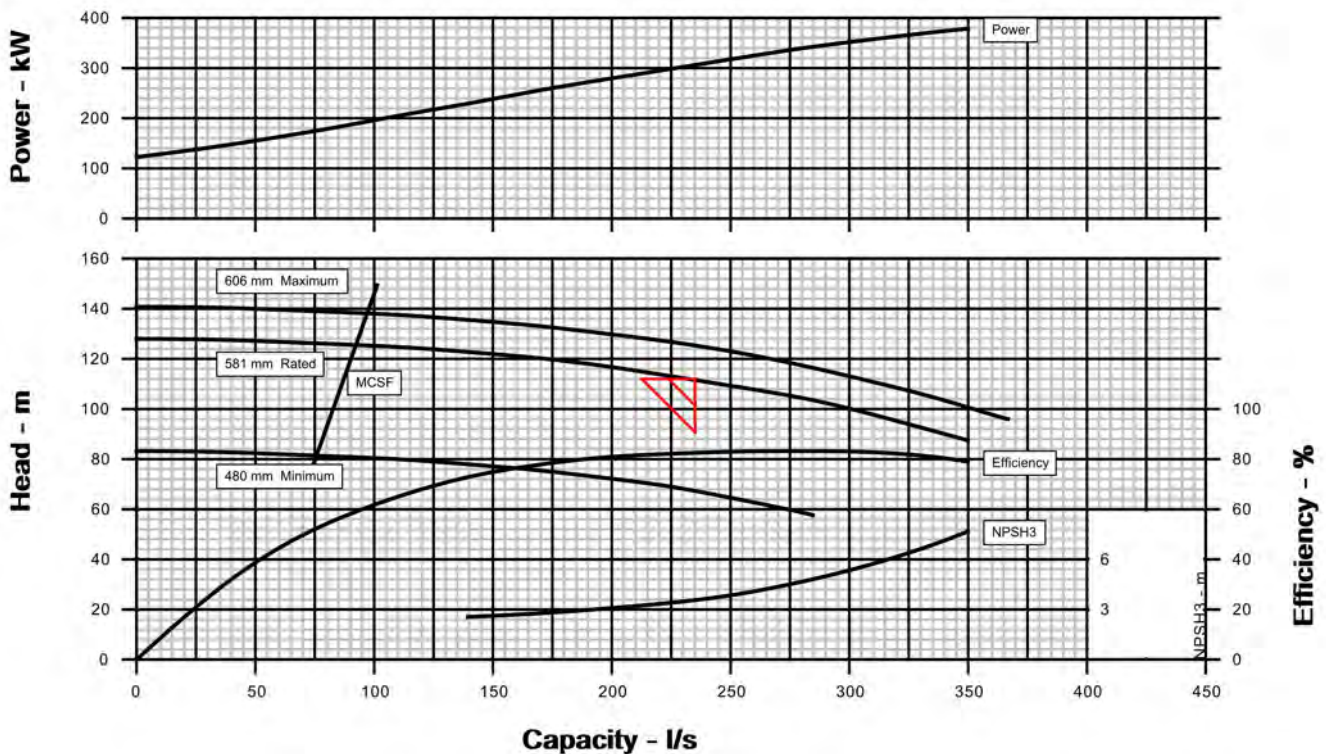


Customer	: GHD	Pump / Stages	: 250-LNN-600 / 1
Customer reference	: New pumps Parkes	Based on curve no.	: 925R1/1-AA
Item number	: P4-6	Flowserve reference	: 3777874784
Service	: -	Date	: February 13, 2023

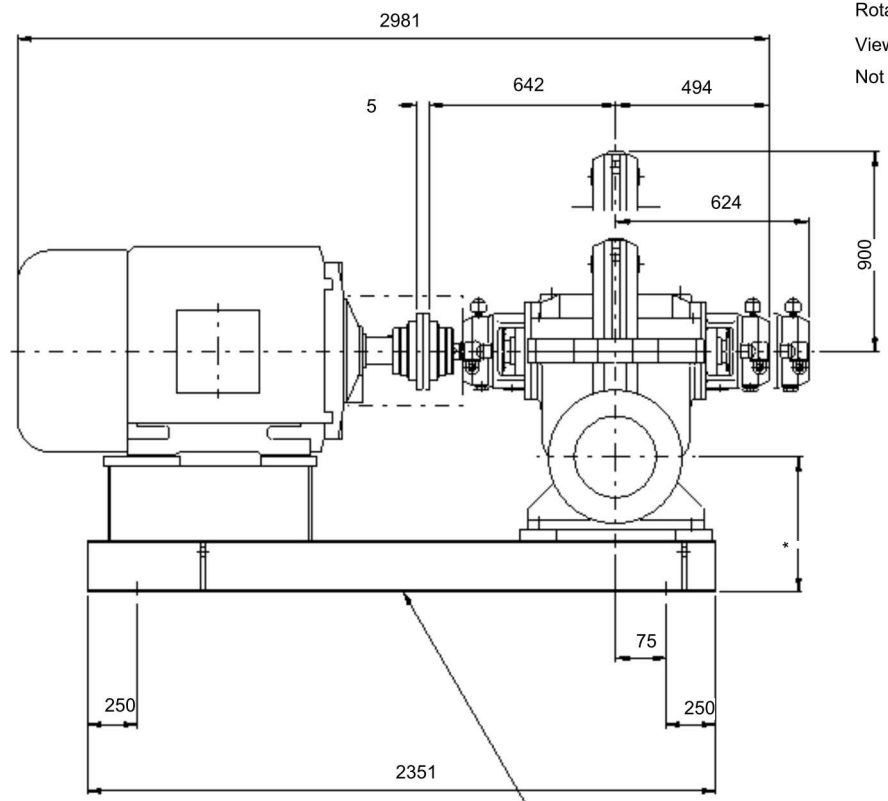
Operating Conditions		Materials / Specification	
Capacity (rated/normal)	: 235.0 l/s / -	Material column code	: B1
Water capacity (CQ=1.00)	: -	Pump specification	: -
Total developed head	: 112.00 m	Other Requirements	
Water head (CH=1.00)	: -	Hydraulic selection : No specification	
NPSHa/NPSHa less margin	: 10.0 m / -	Construction : No specification	
Maximum suction pressure	: 0.0 kPa.g	Test tolerance : ISO 9906 Grade 1B	
Liquid		Driver Sizing : Max Power(MCSF to EOC) using SF	
Liquid type	: Fresh water		
Liquid description	: -		
Temperature	: 30 °C		
Density / Specific gravity	: - / 0.996		
Solid Size - Actual / Limit	: - / -		
Viscosity / Vapor pressure	: 1.00 cP / 4.23 kPa.a		

Performance			
Hydraulic power	: 257 kW	Impeller diameter	
Pump speed	: 1,490 rpm	Rated	: 581 mm
Pump overall efficiency (CE=1.00)	: 83.0 %	Maximum	: 606 mm
NPSH required (NPSH3)	: 3.6 m	Minimum	: 480 mm
Rated brake power	: 309 kW	Ns / Nss (per eye)	: 1,135 / 9,410 (US)
Maximum brake power	: 377 kW	Minimum continuous flow	: 93.2 l/s
Driver power rating	: 400 kW / 536 hp	Maximum head at rated diameter	: 127.88 m
Casing working pressure	: 1,247.0 kPa.g	Flow at BEP	: 269.6 l/s
(based on shut off @ cut dia/rated SG)		Flow as % of BEP	: 87.2 %
Maximum allowable	: 1,600.0 kPa.g	Efficiency at normal flow	: -
Hydrostatic test pressure	: 2,400.0 kPa.g	Impeller diameter ratio (rated/max)	: 95.9 %
Estimated rated seal chamber pressure	: -	Head rise to shut off	: 14.2 %
		Total head ratio (rated / max) / (max / rated)	: 89.6 % / 111.6 %

CURVES ARE APPROXIMATE, PUMP IS GUARANTEED FOR ONE SET OF CONDITIONS; CAPACITY, HEAD, AND EFFICIENCY.

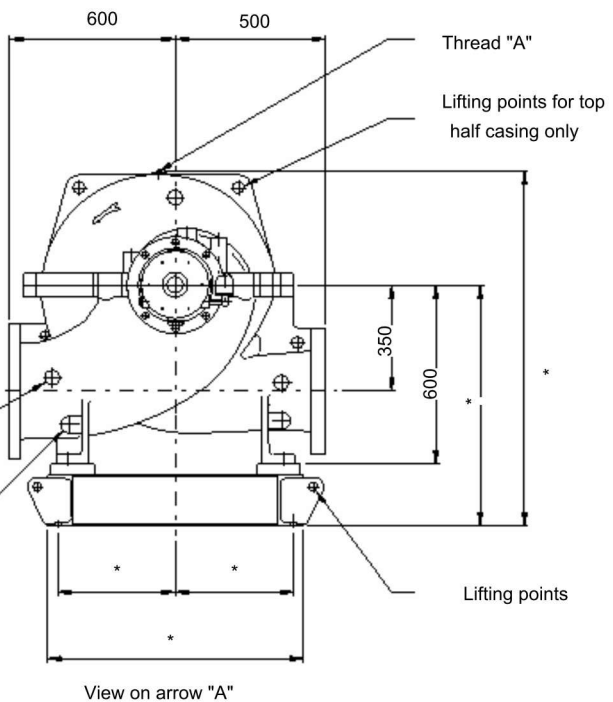


Customer	: GHD	Pump / Stages	: 250-LNN-600	/ 1
Customer reference	: New pumps Parkes	Based on curve no.	: 925R1/1-AA	
Item number	: P4-6	Flowserve reference	: 3777874784	
Service	: -	Date	: February 13, 2023	
Construction				
Nozzles	Size	Rating	Face	Position
Suction	300 mm	PN16	FF	Side
Discharge	250 mm	PN16	FF	Side
Casing mounting	: Foot			
Casing split	: Axial			
Impeller type	: Double Suction 5 Vanes			
Bearing type (radial)	: Single Row Ball			
Bearing number (radial)	: 6214			
Bearing type (thrust)	: Single Row Ball			
Bearing number (thrust)	: 6214			
Bearing lubrication	: Grease			
Rotation (view from coupling)	: CW per Hyd. Institute			
Materials				
Casing	: EN-GJS-400-15			
Impeller	: 10% Tin Bronze			
Case wear ring	: Bronze			
Impeller wear ring	: Not Fitted			
Inducer	: N/A			
Shaft	: 13% Cr Steel			
Sleeve	: Not Fitted			
Baseplate, Coupling and Guard				
Baseplate type	: Common Pump & Motor			
Baseplate material	: Fabricated Steel			
Coupling manufacturer	: FPD Choice			
Coupling size	: FPD-2100			
Coupling / Shaft guard	: Non Spacer Steel			
Weights (Approx.)				
Bareshaft pump (net)	: 840.0 kg			
Baseplate (net)	: ***			
Driver (net)	: 2,100.0 kg			
Shipping gross weight/volume	: *** / ***			
Testing				
Hydrostatic test	: Non witnessed			
Performance test	: None			
NPSH test	: None			
Paint and Package				
Pump paint	: FPD Paint Syst. 1			
Base grout surface prep	: -			
Shipment type	: Domestic			
Driver Information				
Manufacturer	: ABB M3BP B3 E3			
Power	: 400 kW / 536 hp			
Service factor (requested / actual)	: 1.0 / 1.0			
Synchronous speed	: 1,500 rpm			
Orientation / Mounting	: Horizontal / Foot			
Driver type	: IEC			
Frame-size / material	: 355L / Cast Iron			
Enclosure	: TEFC IP55			
Hazardous area class	: -			
Explosion 'T' rating	: -			
Volts / Phase / Hz	: 415 / 3 / 50 Hz			
Amps-full load/locked rotor	: 700.00 A / 4,760.00 A			
Motor starting	: Direct on line (DOL)			
Insulation	: Cl. F			
Temperature rise	: 80 °C			
Bearings	: Ball			
Lubrication	: -			
Motor mounted by	: -			
Sound Pressure (dBA @ 1.0 m)				
Driver, expected	: 80.0 dBA			
Pump & driver, estimated	: -			
Seal Information				
Arrangement	: Sing.Bal Cartridge			
Size	: 80 mm			
Manufacturer / Type	: Flowserve / ISC2 in 316ss			
Material code (Man'f/API)	: SiC/Car/Vit / 5Z4T			
Internal neck bushing	: None			
Gland				
Gland material	: 316 St St			
Flush	: 1/2" NPT			
Vent	: 1/2" NPT			
Drain	: 1/2" NPT			
Auxiliary seal device	: Carbon Bush			
Piping				
Seal flush plan	: Plan 11			
Seal flush construction	: -			
Seal flush material	: Carbon steel			
Aux seal flush plan	: None			
Aux seal flush construction	: -			
Aux seal flush material	: -			
Notes				
Sound Pressure Levels:				
-Subject to 3 dBA tolerance				
-Refer for Contractual Values				
Refer for Values not shown				
-				
ver. 19-6-15				



Rotation: Clockwise
Viewed on pump coupling
Not To Scale

Note



"A" NPT 1/2 in.
"B" NPT 1/2 in.

Note

Height to remove Top Half casing
Clearance required for lifting equipment
Top Half Casing weight approx 215 Kg

* 2.85 Bolt holes each side
Dia. Equi spaced

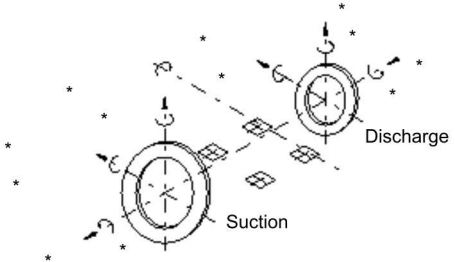
Flanges Drilled PN 16

	Bore	P.C.D.	No of Holes	Size of Holes
Suction	300 mm	410 mm	12	26 mm
Discharge	250 mm	355 mm	12	26 mm

Holes drilled off centre equi spaced

Typical Drawing, not certified

Certified Drawir: C772/001/P01 order



	Maximum Moments(kNm) and Forces(kN)					
	Mx	My	Mz	Fx	Fy	Fz
Suction	6.10	2.98	4.61	6.68	8.01	5.34
Discharge	5.02	2.44	3.80	5.34	6.68	4.45

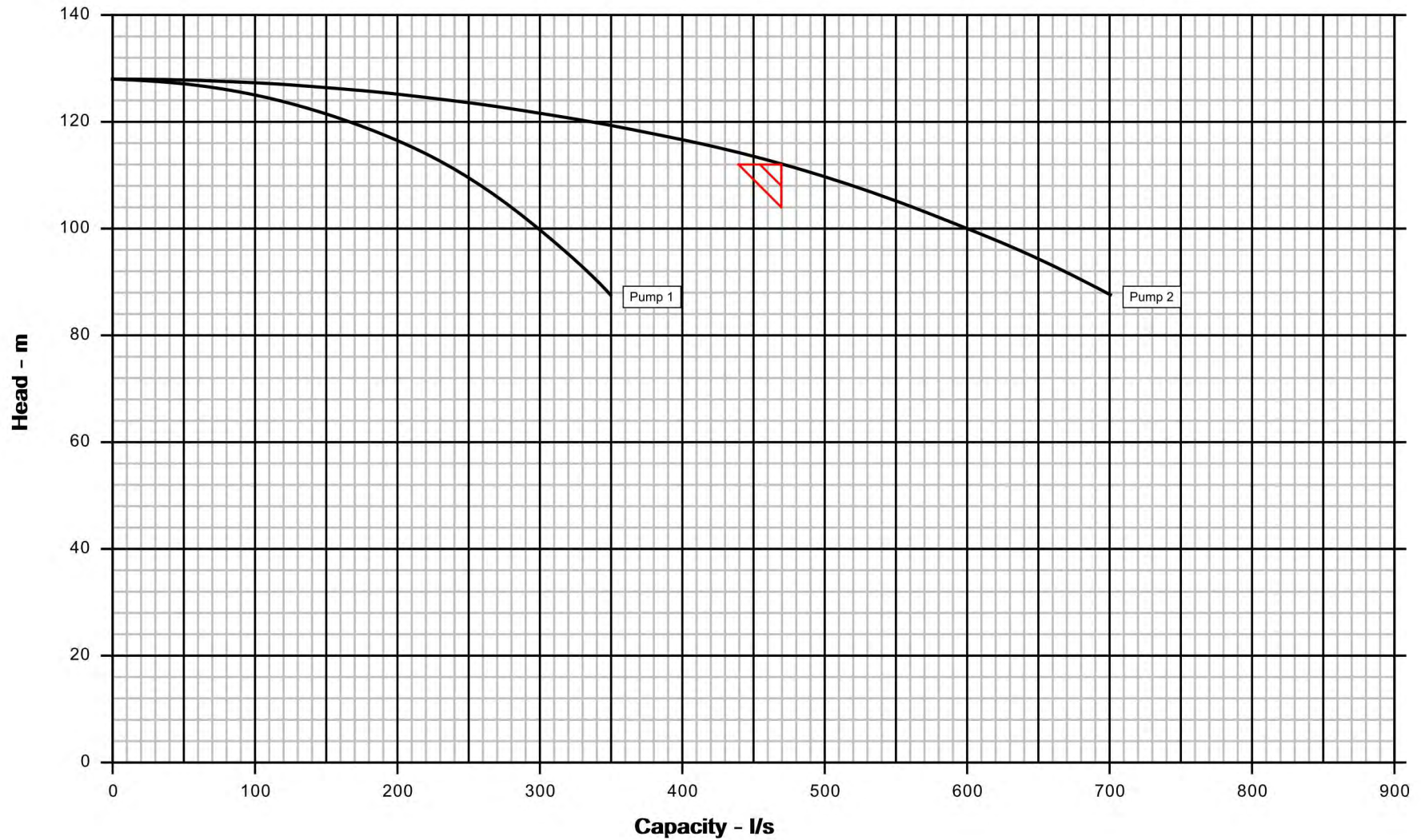
Customer	: GHD	Pump size & type	: 250-LNN-600	Drawing number	: -
Item number	: P4-6	Pump speed / Stages	: 1,490 rpm / 1	Date	: February 13, 2023
Service	: -	Flow / Head	: 235.0 l/s / 112.00 m	Certified by / Date	: -
Customer PO #	: -	Driver power / Frame	: 400 kW / 536 hp / 355L	Seal type	: ISC2 in 316ss
Flowserve reference	: 3777874784	Volts / Phase / Hz	: 415 / 3 / 50 Hz	Seal flush plan	: Plan 11

Customer : GHD
Item number : P4-6
Service : -
Flowsolve reference : 3777874784
Pump size & type / Stages : 250-LNN-600 / 1
Based on curve no. : 925R1/1-AA
Impeller diameter : 581 mm



Capacity : 235.0 l/s
Head : 112.00 m
Density / Specific gravity : - / 0.996
Pump speed : 1,490 rpm
Ns / Nss (per eye) : 1,135 / 9,410 (US)
Date : February 13, 2023

CURVES ARE APPROXIMATE, PUMP IS GUARANTEED FOR ONE SET OF CONDITIONS; CAPACITY, HEAD, AND EFFICIENCY.

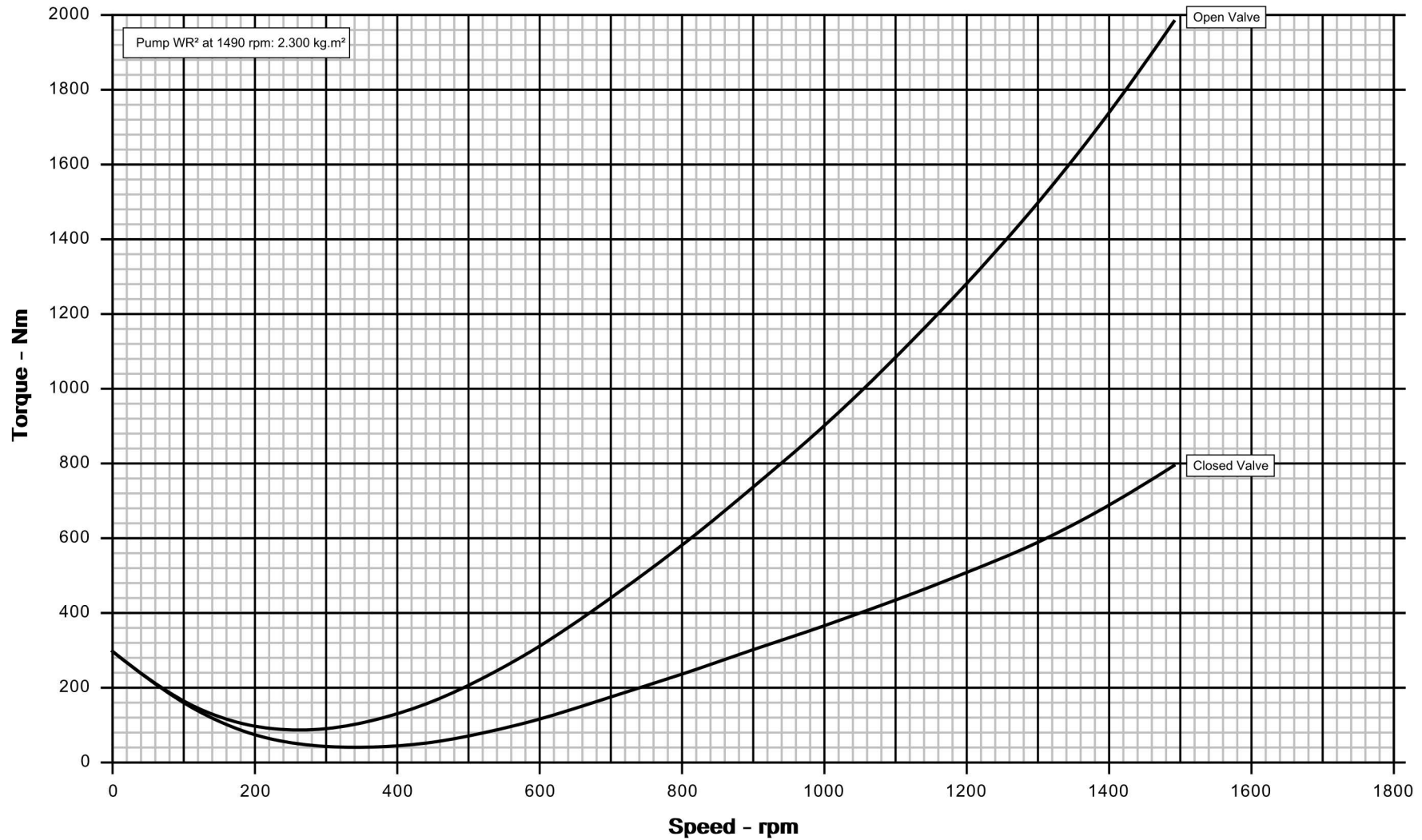


Customer : GHD
 Item number : P4-6
 Service : -
 Flowsolve reference : 3777874784
 Pump size & type / Stages : 250-LNN-600 / 1
 Based on curve no. : 925R1/1-AA
 Impeller diameter : 581 mm



Capacity : 235.0 l/s
 Head : 112.00 m
 Density / Specific gravity : - / 0.996
 Pump speed : 1,490 rpm
 Ns / Nss (per eye) : 1,135 / 9,410 (US)
 Pump WR² at 1,490 rpm : 2.300 kg.m²
 Date : February 13, 2023

CURVES ARE APPROXIMATE, PUMP IS GUARANTEED FOR ONE SET OF CONDITIONS; CAPACITY, HEAD, AND EFFICIENCY.



Appendix D

Flowsolve pump data sheets

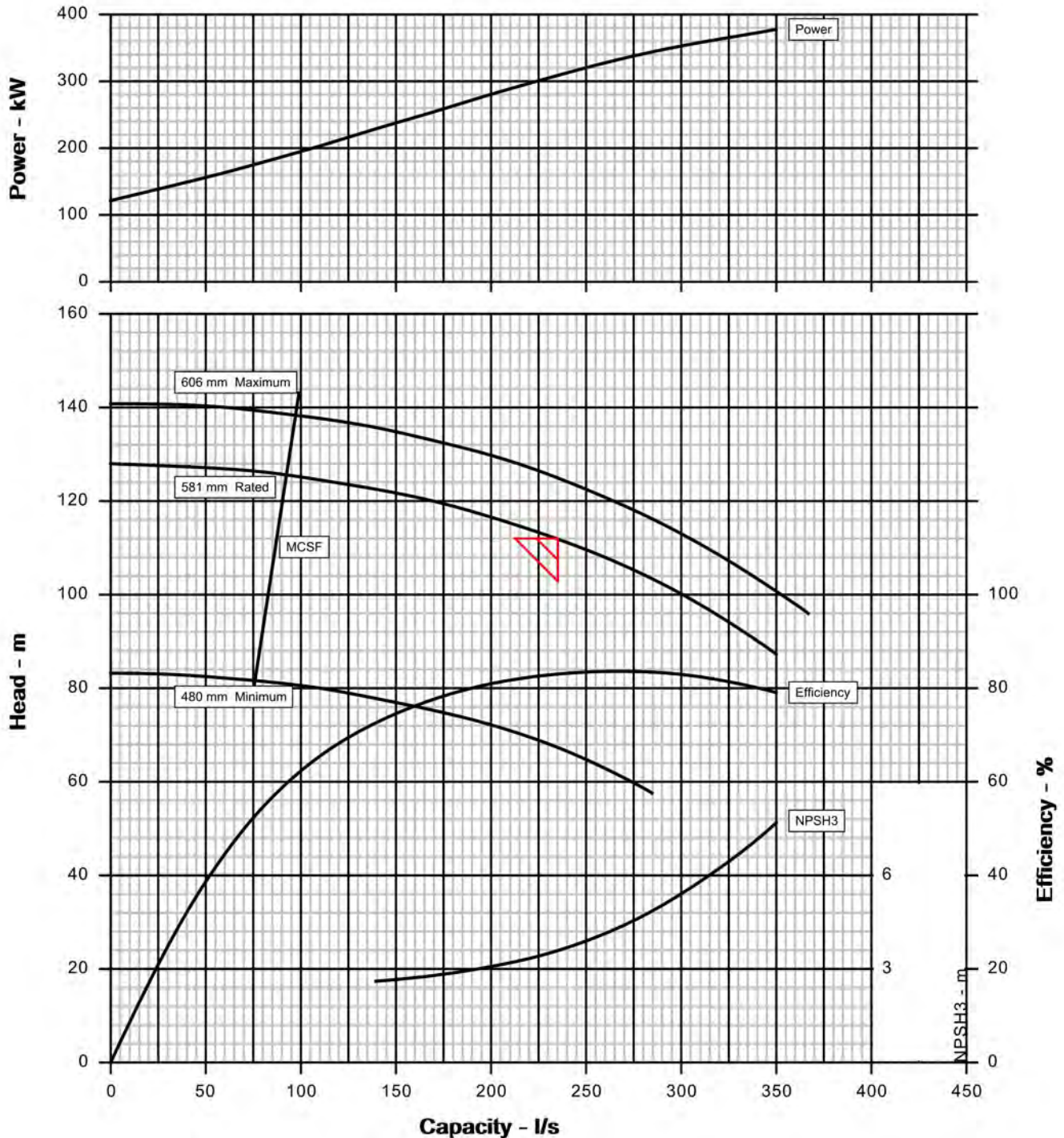


Pump size & type / Stages : 250-LNN-600 / 1
 Based on curve no. : 925R1/1-AA
 Impeller diameter : 581 mm

Customer : GHD
 Item number : P4-6
 Service : -
 Flowserve reference : 3777874784
 Date : February 13, 2023

Capacity : 235.0 l/s
 Head : 112.00 m
 Density / Specific gravity : - / 0.996
 Pump speed : 1,490 rpm
 Ns / Nss (per eye) : 1,135 / 9,410 (US)
 Test tolerance : ISO 9906 Grade 1B

CURVES ARE APPROXIMATE, PUMP IS GUARANTEED FOR ONE SET OF CONDITIONS; CAPACITY, HEAD, AND EFFICIENCY.

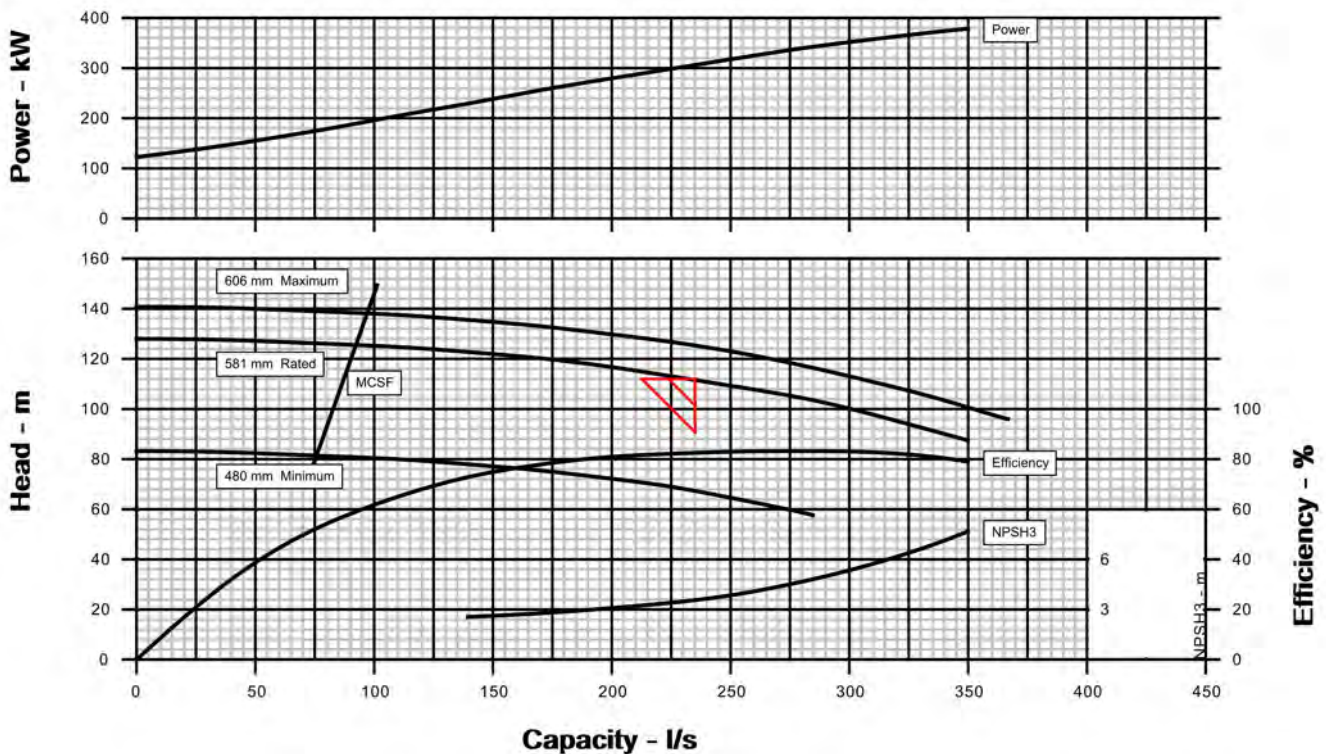


Customer	: GHD	Pump / Stages	: 250-LNN-600 / 1
Customer reference	: New pumps Parkes	Based on curve no.	: 925R1/1-AA
Item number	: P4-6	Flowserve reference	: 3777874784
Service	: -	Date	: February 13, 2023

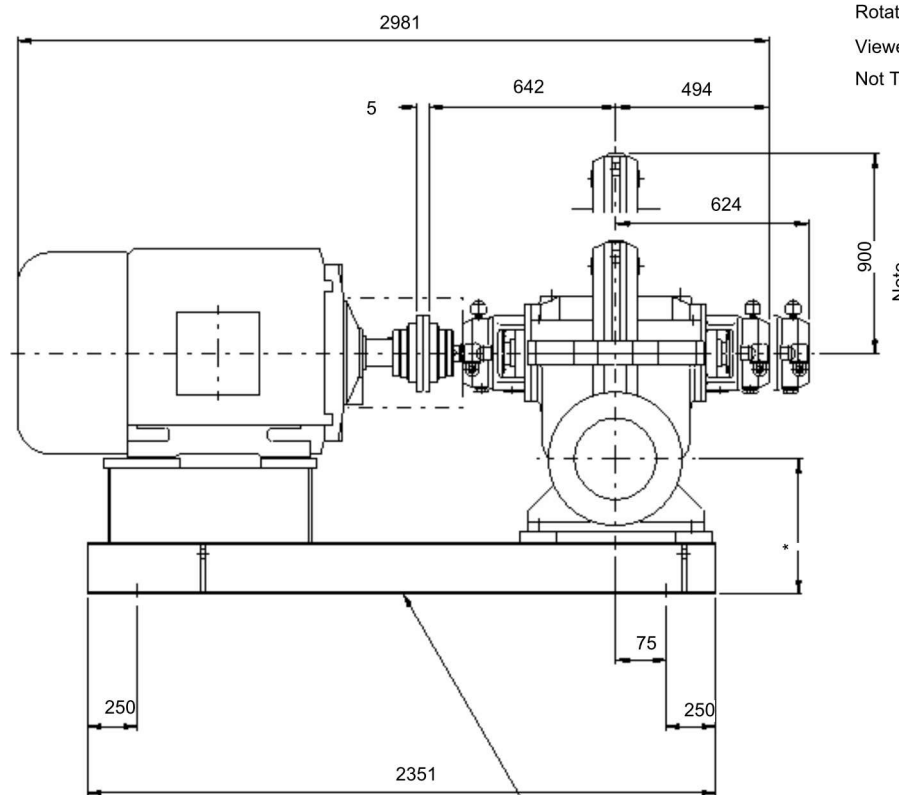
Operating Conditions		Materials / Specification	
Capacity (rated/normal)	: 235.0 l/s / -	Material column code	: B1
Water capacity (CQ=1.00)	: -	Pump specification	: -
Total developed head	: 112.00 m	Other Requirements	
Water head (CH=1.00)	: -	Hydraulic selection : No specification	
NPSHa/NPSHa less margin	: 10.0 m / -	Construction : No specification	
Maximum suction pressure	: 0.0 kPa.g	Test tolerance : ISO 9906 Grade 1B	
Liquid		Driver Sizing : Max Power(MCSF to EOC) using SF	
Liquid type	: Fresh water		
Liquid description	: -		
Temperature	: 30 °C		
Density / Specific gravity	: - / 0.996		
Solid Size - Actual / Limit	: - / -		
Viscosity / Vapor pressure	: 1.00 cP / 4.23 kPa.a		

Performance			
Hydraulic power	: 257 kW	Impeller diameter	
Pump speed	: 1,490 rpm	Rated	: 581 mm
Pump overall efficiency (CE=1.00)	: 83.0 %	Maximum	: 606 mm
NPSH required (NPSH3)	: 3.6 m	Minimum	: 480 mm
Rated brake power	: 309 kW	Ns / Nss (per eye)	: 1,135 / 9,410 (US)
Maximum brake power	: 377 kW	Minimum continuous flow	: 93.2 l/s
Driver power rating	: 400 kW / 536 hp	Maximum head at rated diameter	: 127.88 m
Casing working pressure	: 1,247.0 kPa.g	Flow at BEP	: 269.6 l/s
(based on shut off @ cut dia/rated SG)		Flow as % of BEP	: 87.2 %
Maximum allowable	: 1,600.0 kPa.g	Efficiency at normal flow	: -
Hydrostatic test pressure	: 2,400.0 kPa.g	Impeller diameter ratio (rated/max)	: 95.9 %
Estimated rated seal chamber pressure	: -	Head rise to shut off	: 14.2 %
		Total head ratio (rated / max) / (max / rated)	: 89.6 % / 111.6 %

CURVES ARE APPROXIMATE, PUMP IS GUARANTEED FOR ONE SET OF CONDITIONS; CAPACITY, HEAD, AND EFFICIENCY.

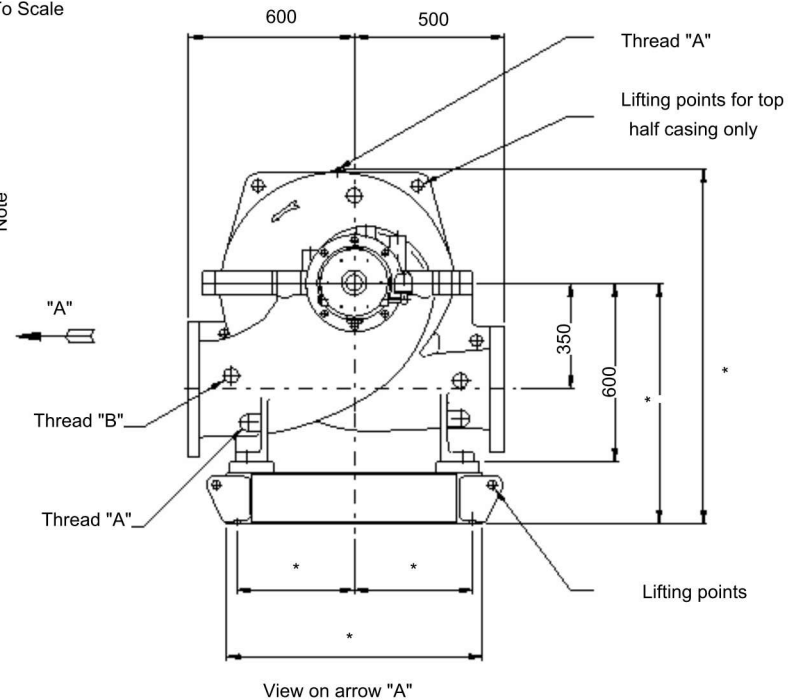


Customer	: GHD	Pump / Stages	: 250-LNN-600	/ 1
Customer reference	: New pumps Parkes	Based on curve no.	: 925R1/1-AA	
Item number	: P4-6	Flowserve reference	: 3777874784	
Service	: -	Date	: February 13, 2023	
Construction				
Nozzles	Size	Rating	Face	Position
Suction	300 mm	PN16	FF	Side
Discharge	250 mm	PN16	FF	Side
Casing mounting	: Foot			
Casing split	: Axial			
Impeller type	: Double Suction 5 Vanes			
Bearing type (radial)	: Single Row Ball			
Bearing number (radial)	: 6214			
Bearing type (thrust)	: Single Row Ball			
Bearing number (thrust)	: 6214			
Bearing lubrication	: Grease			
Rotation (view from coupling)	: CW per Hyd. Institute			
Materials				
Casing	: EN-GJS-400-15			
Impeller	: 10% Tin Bronze			
Case wear ring	: Bronze			
Impeller wear ring	: Not Fitted			
Inducer	: N/A			
Shaft	: 13% Cr Steel			
Sleeve	: Not Fitted			
Baseplate, Coupling and Guard				
Baseplate type	: Common Pump & Motor			
Baseplate material	: Fabricated Steel			
Coupling manufacturer	: FPD Choice			
Coupling size	: FPD-2100			
Coupling / Shaft guard	: Non Spacer Steel			
Weights (Approx.)				
Bareshaft pump (net)	: 840.0 kg			
Baseplate (net)	: ***			
Driver (net)	: 2,100.0 kg			
Shipping gross weight/volume	: *** / ***			
Testing				
Hydrostatic test	: Non witnessed			
Performance test	: None			
NPSH test	: None			
Paint and Package				
Pump paint	: FPD Paint Syst. 1			
Base grout surface prep	: -			
Shipment type	: Domestic			
Driver Information				
Manufacturer	: ABB M3BP B3 E3			
Power	: 400 kW / 536 hp			
Service factor (requested / actual)	: 1.0 / 1.0			
Synchronous speed	: 1,500 rpm			
Orientation / Mounting	: Horizontal / Foot			
Driver type	: IEC			
Frame-size / material	: 355L / Cast Iron			
Enclosure	: TEFC IP55			
Hazardous area class	: -			
Explosion 'T' rating	: -			
Volts / Phase / Hz	: 415 / 3 / 50 Hz			
Amps-full load/locked rotor	: 700.00 A / 4,760.00 A			
Motor starting	: Direct on line (DOL)			
Insulation	: Cl. F			
Temperature rise	: 80 °C			
Bearings	: Ball			
Lubrication	: -			
Motor mounted by	: -			
Sound Pressure (dBA @ 1.0 m)				
Driver, expected	: 80.0 dBA			
Pump & driver, estimated	: -			
Seal Information				
Arrangement	: Sing.Bal Cartridge			
Size	: 80 mm			
Manufacturer / Type	: Flowserve / ISC2 in 316ss			
Material code (Man'f/API)	: SiC/Car/Vit / 5Z4T			
Internal neck bushing	: None			
Gland				
Gland material	: 316 St St			
Flush	: 1/2" NPT			
Vent	: 1/2" NPT			
Drain	: 1/2" NPT			
Auxiliary seal device	: Carbon Bush			
Piping				
Seal flush plan	: Plan 11			
Seal flush construction	: -			
Seal flush material	: Carbon steel			
Aux seal flush plan	: None			
Aux seal flush construction	: -			
Aux seal flush material	: -			
Notes				
Sound Pressure Levels:				
-Subject to 3 dBA tolerance				
-Refer for Contractual Values				
Refer for Values not shown				
-				
ver. 19-6-15				



Rotation: Clockwise
Viewed on pump coupling
Not To Scale

Note



"A" NPT 1/2 in.
"B" NPT 1/2 in.

Note
Height to remove Top Half casing
Clearance required for lifting equipment
Top Half Casing weight approx 215 Kg

* 2.85 Bolt holes each side
Dia. Equi spaced

Flanges Drilled PN 16

	Bore	P.C.D.	No of Holes	Size of Holes
Suction	300 mm	410 mm	12	26 mm
Discharge	250 mm	355 mm	12	26 mm

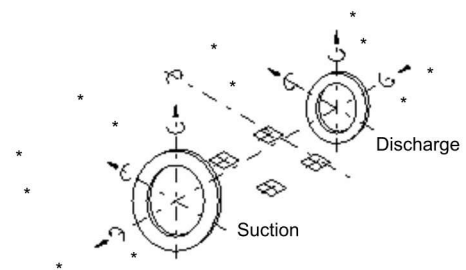
Holes drilled off centre equi spaced

Typical Drawing, not certified

Certified Drawir: C772/001/P01 order

Maximum Moments(kNm) and Forces(kN)

	Mx	My	Mz	Fx	Fy	Fz
Suction	6.10	2.98	4.61	6.68	8.01	5.34
Discharge	5.02	2.44	3.80	5.34	6.68	4.45



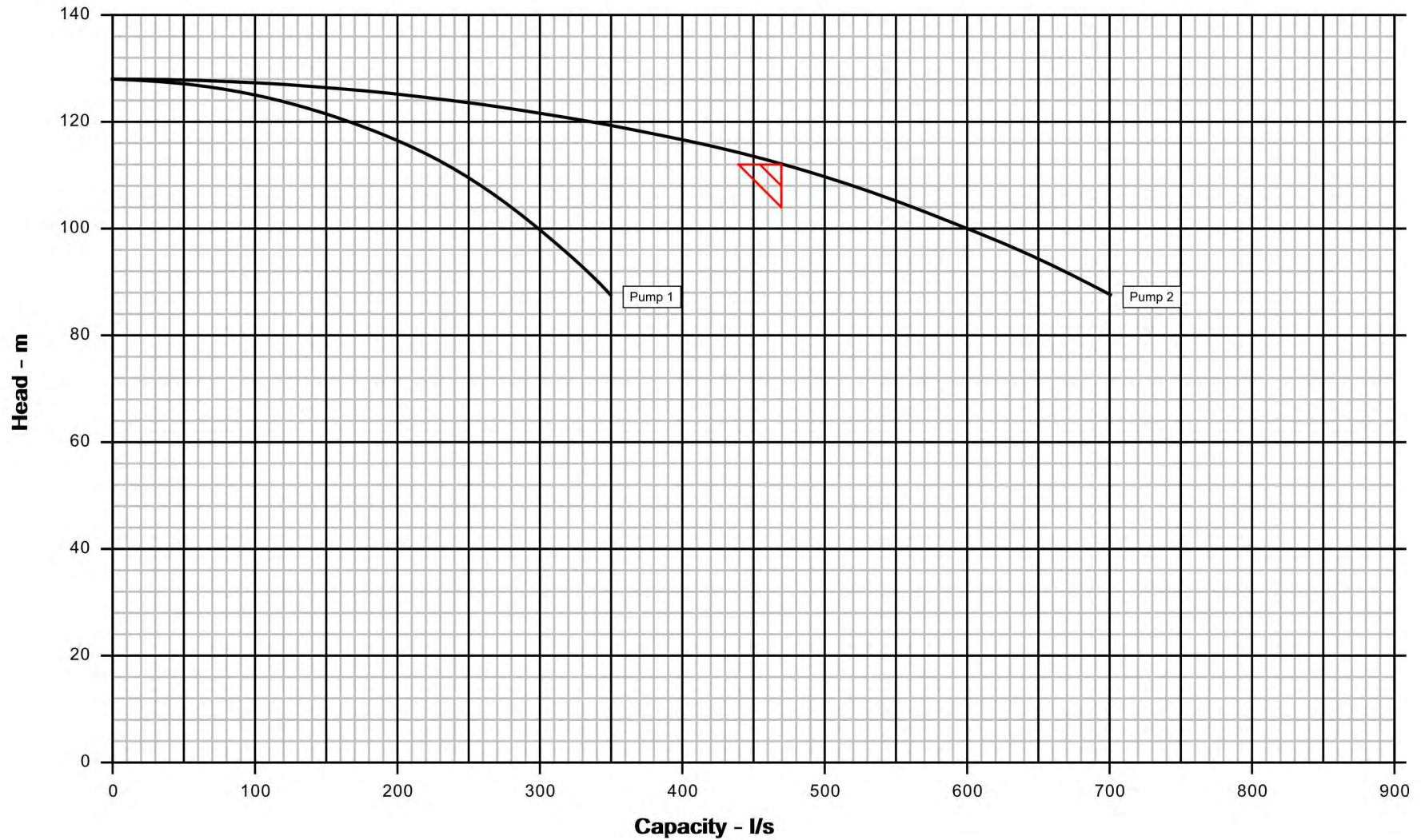
Customer	: GHD	Pump size & type	: 250-LNN-600	Drawing number	: -
Item number	: P4-6	Pump speed / Stages	: 1,490 rpm / 1	Date	: February 13, 2023
Service	: -	Flow / Head	: 235.0 l/s / 112.00 m	Certified by / Date	: -
Customer PO #	: -	Driver power / Frame	: 400 kW / 536 hp / 355L	Seal type	: ISC2 in 316ss
Flowserve reference	: 3777874784	Volts / Phase / Hz	: 415 / 3 / 50 Hz	Seal flush plan	: Plan 11

Customer : GHD
Item number : P4-6
Service : -
Flowsolve reference : 3777874784
Pump size & type / Stages : 250-LNN-600 / 1
Based on curve no. : 925R1/1-AA
Impeller diameter : 581 mm



Capacity : 235.0 l/s
Head : 112.00 m
Density / Specific gravity : - / 0.996
Pump speed : 1,490 rpm
Ns / Nss (per eye) : 1,135 / 9,410 (US)
Date : February 13, 2023

CURVES ARE APPROXIMATE, PUMP IS GUARANTEED FOR ONE SET OF CONDITIONS; CAPACITY, HEAD, AND EFFICIENCY.

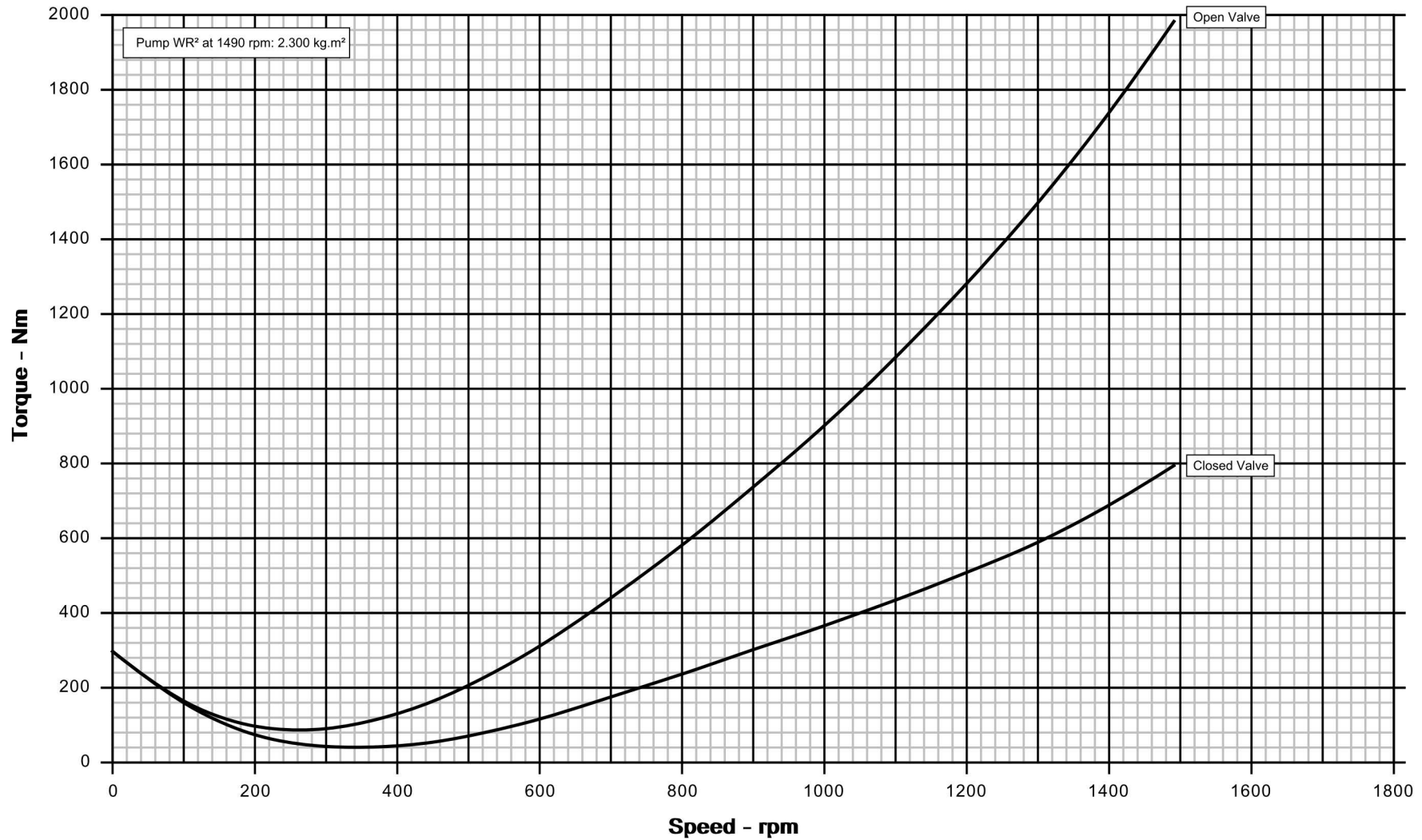


Customer : GHD
 Item number : P4-6
 Service : -
 Flowsolve reference : 3777874784
 Pump size & type / Stages : 250-LNN-600 / 1
 Based on curve no. : 925R1/1-AA
 Impeller diameter : 581 mm



Capacity : 235.0 l/s
 Head : 112.00 m
 Density / Specific gravity : - / 0.996
 Pump speed : 1,490 rpm
 Ns / Nss (per eye) : 1,135 / 9,410 (US)
 Pump WR² at 1,490 rpm : 2.300 kg.m²
 Date : February 13, 2023

CURVES ARE APPROXIMATE, PUMP IS GUARANTEED FOR ONE SET OF CONDITIONS; CAPACITY, HEAD, AND EFFICIENCY.



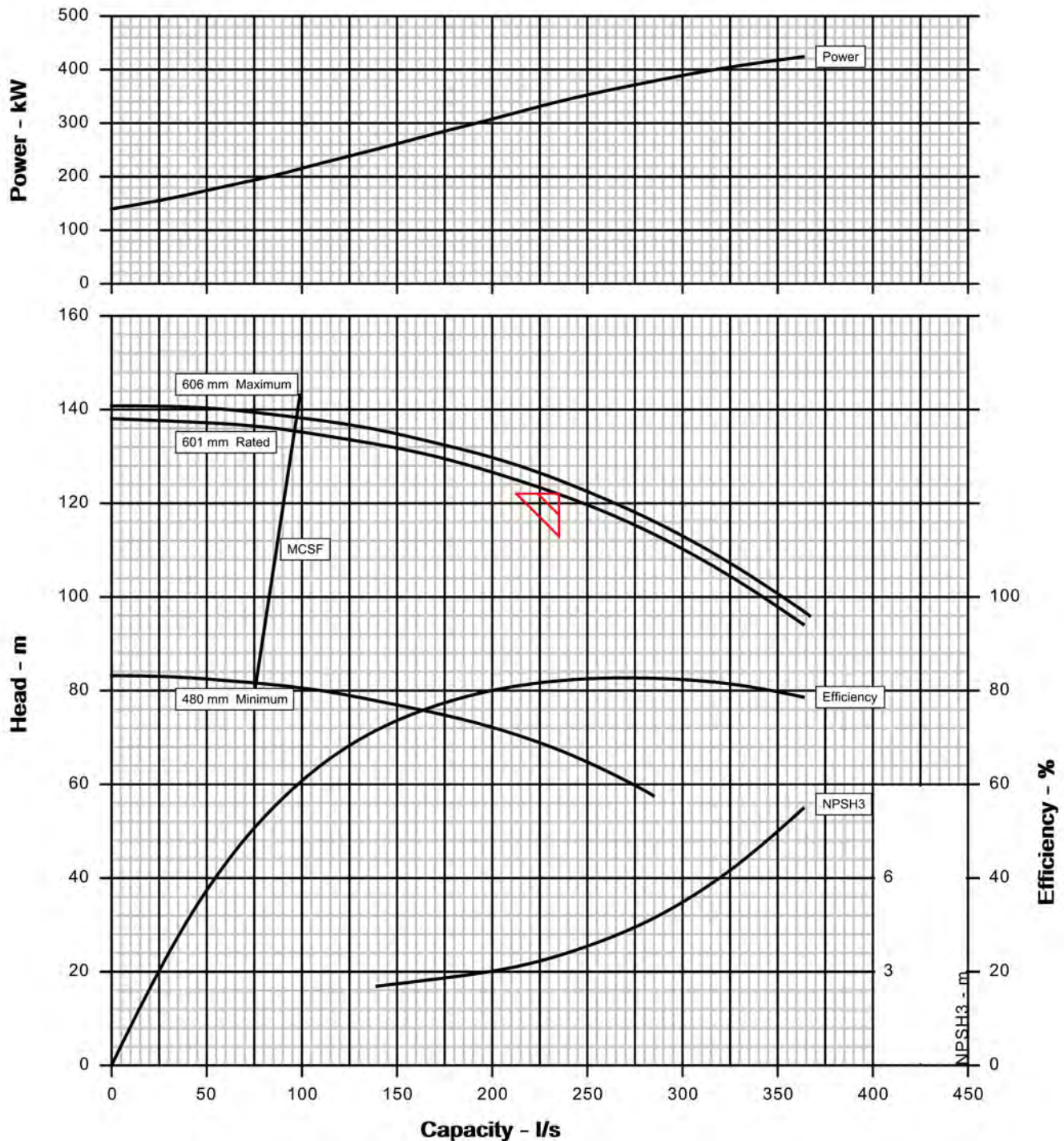


Pump size & type / Stages : 250-LNN-600 / 1
Based on curve no. : 925R1/1-AA
Impeller diameter : 601 mm

Customer : GHD
Item number : P1-3
Service : -
Flowserve reference : 3777874784
Date : February 13, 2023

Capacity : 235.0 l/s
Head : 122.00 m
Density / Specific gravity : - / 0.996
Pump speed : 1,490 rpm
Ns / Nss (per eye) : 1,135 / 9,410 (US)
Test tolerance : ISO 9906 Grade 1B

CURVES ARE APPROXIMATE, PUMP IS GUARANTEED FOR ONE SET OF CONDITIONS; CAPACITY, HEAD, AND EFFICIENCY.

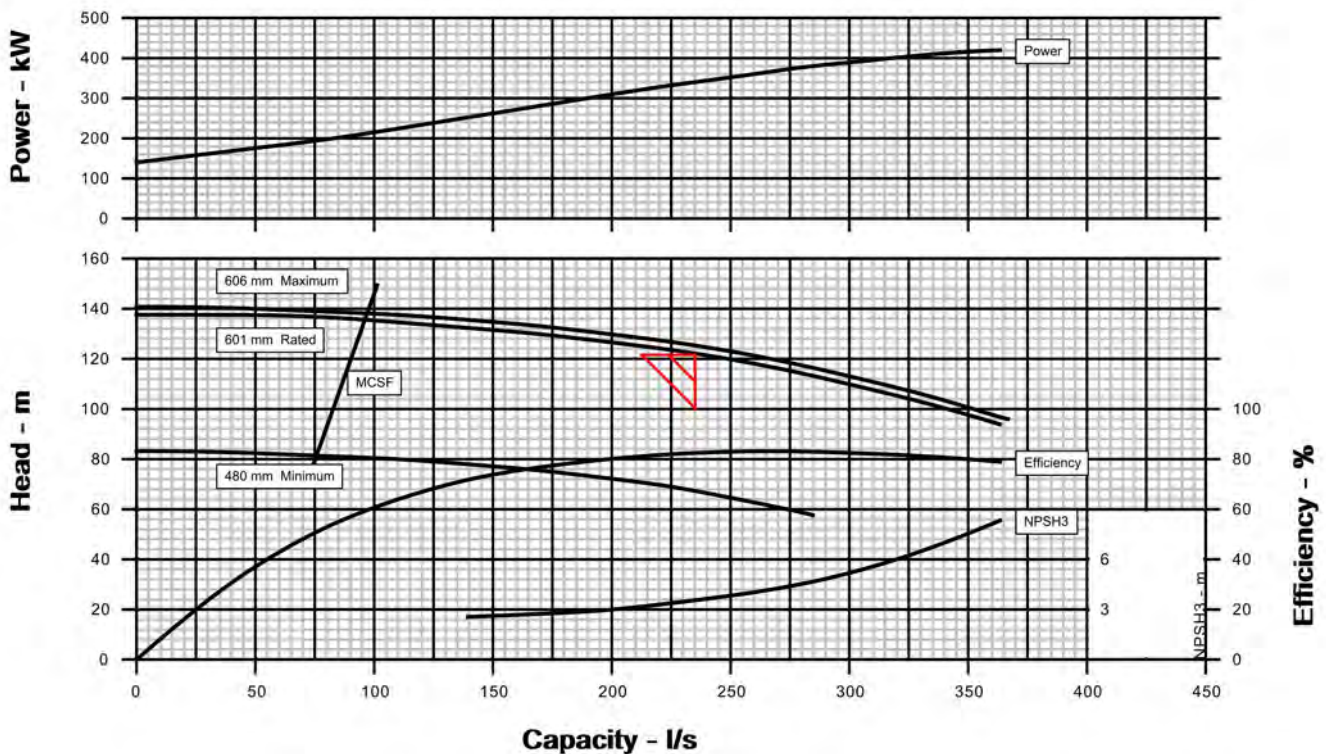


Customer	: GHD	Pump / Stages	: 250-LNN-600 / 1
Customer reference	: New pumps Parkes	Based on curve no.	: 925R1/1-AA
Item number	: P1-3	Flowserve reference	: 3777874784
Service	: -	Date	: February 13, 2023

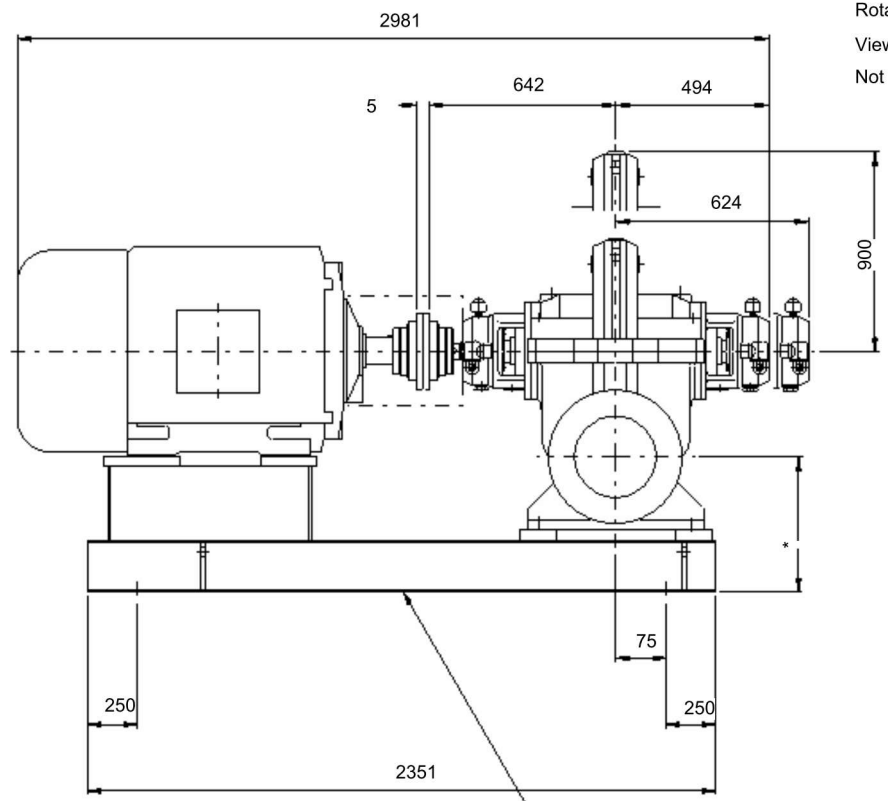
Operating Conditions		Materials / Specification	
Capacity (rated/normal)	: 235.0 l/s / -	Material column code	: B1
Water capacity (CQ=1.00)	: -	Pump specification	: -
Total developed head	: 122.00 m	Other Requirements	
Water head (CH=1.00)	: -	Hydraulic selection	: No specification
NPSHa/NPSHa less margin	: 10.0 m / -	Construction	: No specification
Maximum suction pressure	: 0.0 kPa.g	Test tolerance	: ISO 9906 Grade 1B
Liquid		Driver Sizing	: Max Power(MCSF to EOC) using SF
Liquid type	: Fresh water		
Liquid description	: -		
Temperature	: 30 °C		
Density / Specific gravity	: - / 0.996		
Solid Size - Actual / Limit	: - / -		
Viscosity / Vapor pressure	: 1.00 cP / 4.23 kPa.a		

Performance			
Hydraulic power	: 280 kW	Impeller diameter	
Pump speed	: 1,490 rpm	Rated	: 601 mm
Pump overall efficiency (CE=1.00)	: 82.1 %	Maximum	: 606 mm
NPSH required (NPSH3)	: 3.5 m	Minimum	: 480 mm
Rated brake power	: 340 kW	Ns / Nss (per eye)	: 1,135 / 9,410 (US)
Maximum brake power	: 423 kW	Minimum continuous flow	: 96.3 l/s
Driver power rating	: 450 kW / 603 hp	Maximum head at rated diameter	: 137.97 m
Casing working pressure	: 1,345.4 kPa.g	Flow at BEP	: 276.0 l/s
(based on shut off @ cut dia/rated SG)		Flow as % of BEP	: 85.1 %
Maximum allowable	: 1,600.0 kPa.g	Efficiency at normal flow	: -
Hydrostatic test pressure	: 2,400.0 kPa.g	Impeller diameter ratio (rated/max)	: 99.2 %
Estimated rated seal chamber pressure	: -	Head rise to shut off	: 13.1 %
		Total head ratio (rated / max) / (max / rated)	: 97.6 % / 102.5 %

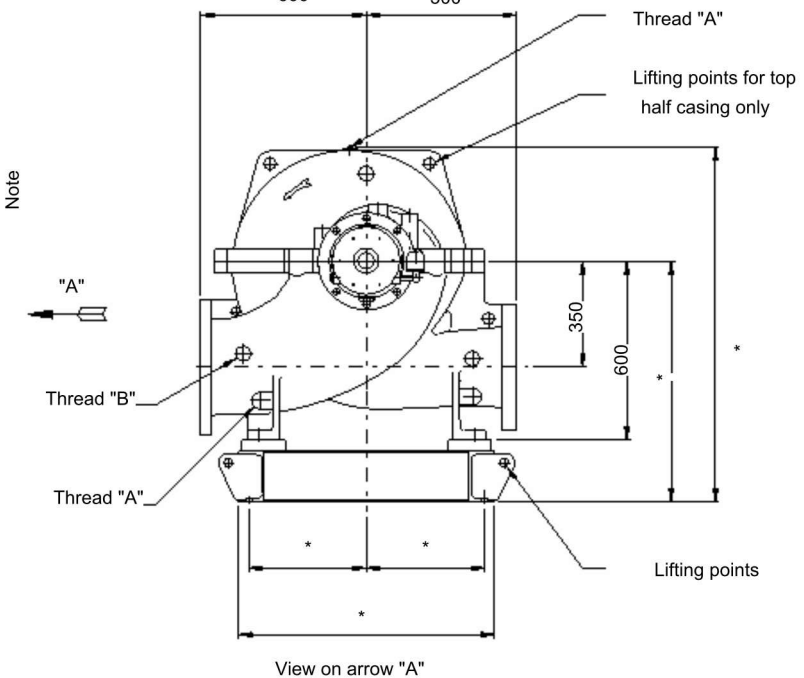
CURVES ARE APPROXIMATE, PUMP IS GUARANTEED FOR ONE SET OF CONDITIONS; CAPACITY, HEAD, AND EFFICIENCY.



Customer	: GHD	Pump / Stages	: 250-LNN-600	/ 1
Customer reference	: New pumps Parkes	Based on curve no.	: 925R1/1-AA	
Item number	: P1-3	Flowserve reference	: 3777874784	
Service	: -	Date	: February 13, 2023	
Construction				
Nozzles	Size	Rating	Face	Position
Suction	300 mm	PN16	FF	Side
Discharge	250 mm	PN16	FF	Side
Casing mounting	: Foot			
Casing split	: Axial			
Impeller type	: Double Suction 5 Vanes			
Bearing type (radial)	: Single Row Ball			
Bearing number (radial)	: 6214			
Bearing type (thrust)	: Single Row Ball			
Bearing number (thrust)	: 6214			
Bearing lubrication	: Grease			
Rotation (view from coupling)	: CW per Hyd. Institute			
Materials				
Casing	: EN-GJS-400-15			
Impeller	: 10% Tin Bronze			
Case wear ring	: Bronze			
Impeller wear ring	: Not Fitted			
Inducer	: N/A			
Shaft	: 13% Cr Steel			
Sleeve	: Not Fitted			
Baseplate, Coupling and Guard				
Baseplate type	: Common Pump & Motor			
Baseplate material	: Fabricated Steel			
Coupling manufacturer	: FPD Choice			
Coupling size	: FPD-2100			
Coupling / Shaft guard	: Non Spacer Steel			
Weights (Approx.)				
Bareshaft pump (net)	: 840.0 kg			
Baseplate (net)	: ***			
Driver (net)	: 2,100.0 kg			
Shipping gross weight/volume	: *** / ***			
Testing				
Hydrostatic test	: Non witnessed			
Performance test	: None			
NPSH test	: None			
Paint and Package				
Pump paint	: FPD Paint Syst. 1			
Base grout surface prep	: -			
Shipment type	: Domestic			
Driver Information				
Manufacturer	: ABB M3BP B3 E3			
Power	: 450 kW / 603 hp			
Service factor (requested / actual)	: 1.0 / 1.0			
Synchronous speed	: 1,500 rpm			
Orientation / Mounting	: Horizontal / Foot			
Driver type	: IEC			
Frame-size / material	: 355L / Cast Iron			
Enclosure	: TEFC IP55			
Hazardous area class	: -			
Explosion 'T' rating	: -			
Volts / Phase / Hz	: 415 / 3 / 50 Hz			
Amps-full load/locked rotor	: 784.00 A / 5,410.00 A			
Motor starting	: Direct on line (DOL)			
Insulation	: Cl. F			
Temperature rise	: 80 °C			
Bearings	: Ball			
Lubrication	: -			
Motor mounted by	: -			
Sound Pressure (dBA @ 1.0 m)				
Driver, expected	: 80.0 dBA			
Pump & driver, estimated	: -			
Seal Information				
Arrangement	: Sing.Bal Cartridge			
Size	: 80 mm			
Manufacturer / Type	: Flowserve / ISC2 in 316ss			
Material code (Man'f/API)	: SiC/Car/Vit / 5Z4T			
Internal neck bushing	: None			
Gland				
Gland material	: 316 St St			
Flush	: 1/2" NPT			
Vent	: 1/2" NPT			
Drain	: 1/2" NPT			
Auxiliary seal device	: Carbon Bush			
Piping				
Seal flush plan	: Plan 11			
Seal flush construction	: -			
Seal flush material	: Carbon steel			
Aux seal flush plan	: None			
Aux seal flush construction	: -			
Aux seal flush material	: -			
Notes				
Sound Pressure Levels:				
-Subject to 3 dBA tolerance				
-Refer for Contractual Values				
Refer for Values not shown				
-				
ver. 19-6-15				



Rotation: Clockwise
Viewed on pump coupling
Not To Scale



"A" NPT 1/2 in.
"B" NPT 1/2 in.

Note
Height to remove Top Half casing
Clearance required for lifting equipment
Top Half Casing weight approx 215 Kg

* 2.85 Bolt holes each side
Dia. Equi spaced

Flanges Drilled PN 16

	Bore	P.C.D.	No of Holes	Size of Holes
Suction	300 mm	410 mm	12	26 mm
Discharge	250 mm	355 mm	12	26 mm

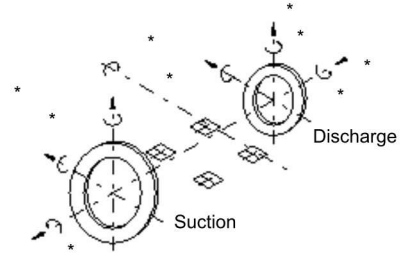
Holes drilled off centre equi spaced

Typical Drawing, not certified

Certified Drawir: C772/001/P01 order

Maximum Moments(kNm) and Forces(kN)

	Mx	My	Mz	Fx	Fy	Fz
Suction	6.10	2.98	4.61	6.68	8.01	5.34
Discharge	5.02	2.44	3.80	5.34	6.68	4.45



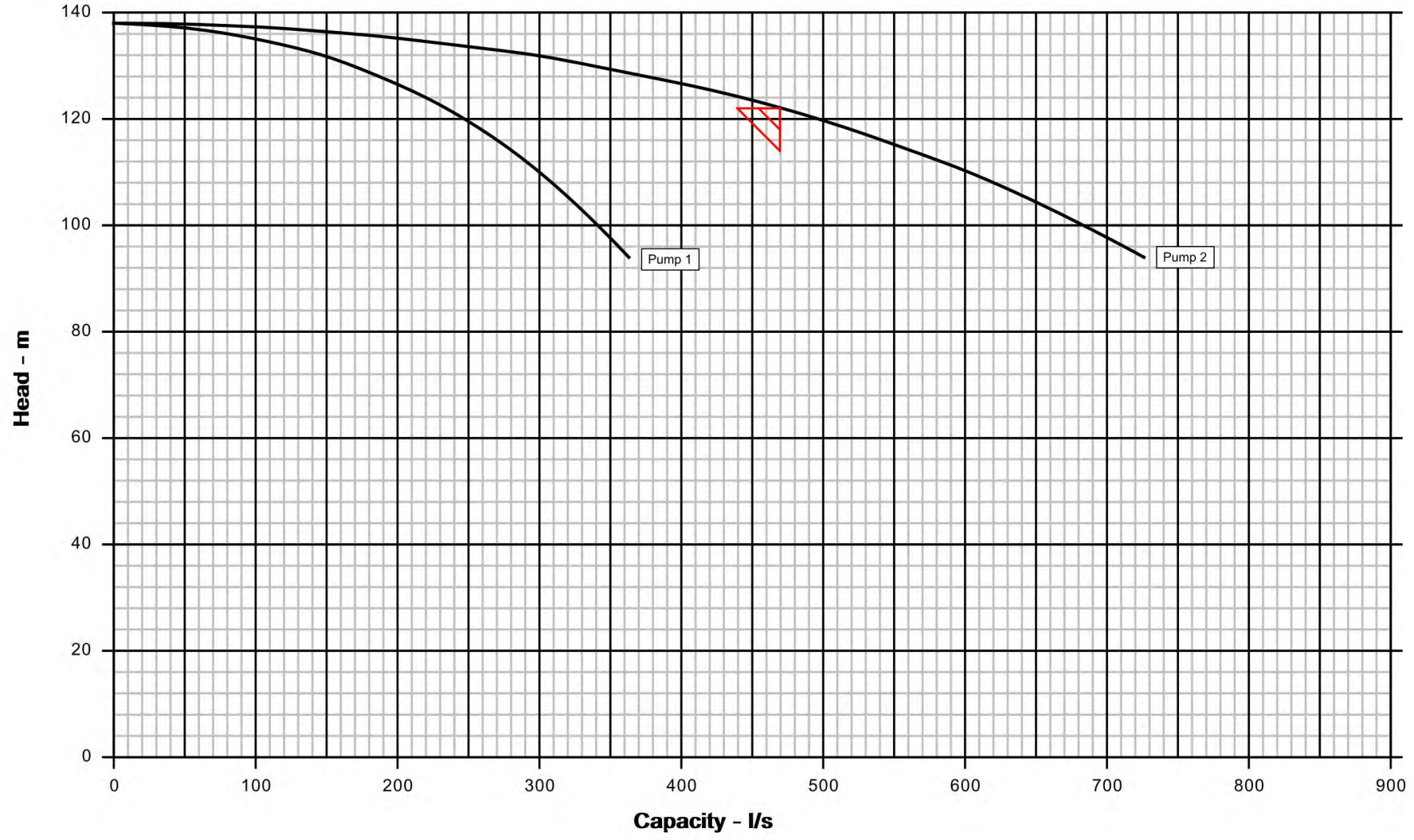
Customer	: GHD	Pump size & type	: 250-LNN-600	Drawing number	: -
Item number	: P1-3	Pump speed / Stages	: 1,490 rpm / 1	Date	: February 13, 2023
Service	: -	Flow / Head	: 235.0 l/s / 122.00 m	Certified by / Date	: -
Customer PO #	: -	Driver power / Frame	: 450 kW / 603 hp / 355L	Seal type	: ISC2 in 316ss
Flowserve reference	: 3777874784	Volts / Phase / Hz	: 415 / 3 / 50 Hz	Seal flush plan	: Plan 11

Customer : GHD
Item number : P1-3
Service : -
Flowsolve reference : 3777874784
Pump size & type / Stages : 250-LNN-600 / 1
Based on curve no. : 925R1/1-AA
Impeller diameter : 601 mm



Capacity : 235.0 l/s
Head : 122.00 m
Density / Specific gravity : - / 0.996
Pump speed : 1,490 rpm
Ns / Nss (per eye) : 1,135 / 9,410 (US)
Date : February 13, 2023

CURVES ARE APPROXIMATE, PUMP IS GUARANTEED FOR ONE SET OF CONDITIONS; CAPACITY, HEAD, AND EFFICIENCY.

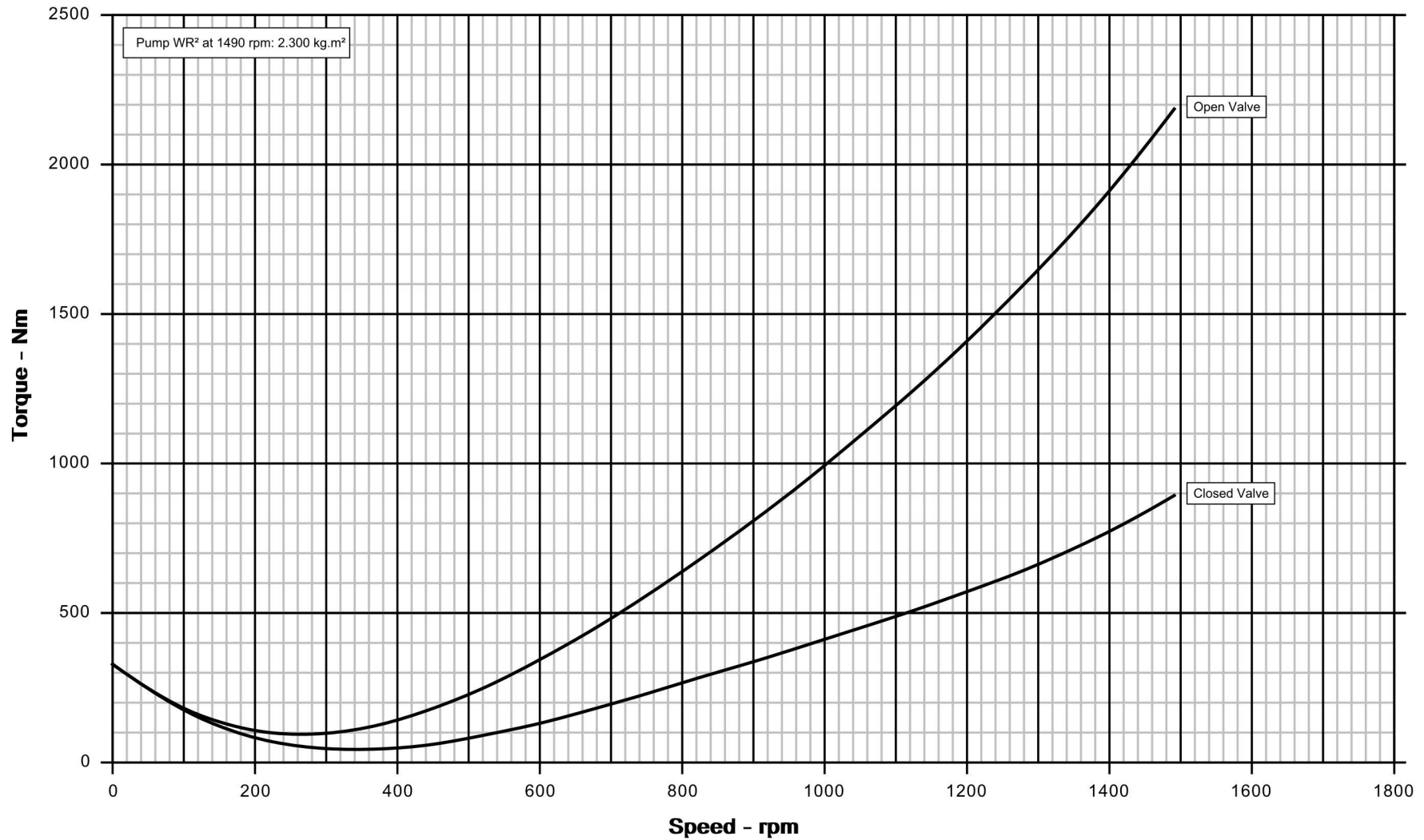


Customer : GHD
Item number : P1-3
Service : -
Flowserve reference : 3777874784
Pump size & type / Stages : 250-LNN-600 / 1
Based on curve no. : 925R1/1-AA
Impeller diameter : 601 mm



Capacity : 235.0 l/s
Head : 122.00 m
Density / Specific gravity : - / 0.996
Pump speed : 1,490 rpm
Ns / Nss (per eye) : 1,135 / 9,410 (US)
Pump WR² at 1,490 rpm : 2.300 kg.m²
Date : February 13, 2023

CURVES ARE APPROXIMATE, PUMP IS GUARANTEED FOR ONE SET OF CONDITIONS; CAPACITY, HEAD, AND EFFICIENCY.



Appendix E

**PWSP - Lachlan Pipeline Duplication
Geotechnical Investigation Report, Parkes
Shire Council, D & N Geotechnical, 4
August 2023**



ghd.com

→ **The Power of Commitment**