

# SCOPE OF WORK

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**Project:** Muja power station  
EP-10256 5H void pump upgrade  
Pontoon pump supply

**Date:** 05 March  
2019

**Business Unit:** Generation

**Prepared by:** Jacobs Engineering and Synergy

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**For approval by:** Dave Lewis, project manager

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This document must not be made available to persons outside Synergy without prior written approval of Synergy

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## 1 INTRODUCTION

Synergy is Western Australia's largest electricity generator and retailer of electricity and gas with more than one million residential, business and industry customers.

Synergy generates electricity using a range of non-renewable and renewable energy sources.

- (a) our major power stations are located in Collie, Kwinana and Pinjar;
- (b) smaller regional power stations are located at Mungarra and West Kalgoorlie; and
- (c) we have wind farms at Albany, Esperance, and Kalbarri, a solar farm near Geraldton, wind-diesel power plants in Bremer Bay, Coral Bay, Denham and Hopetoun, and a solar battery storage facility at Alkimos.

More details relating to Synergy can be found at – [www.synergy.net.au](http://www.synergy.net.au).

## 2 BACKGROUND

5H void is an ex mining pit which holds a volume of water that is accessible to Synergy to use for the purpose of power generation at its Collie and Muja power stations. To maximum the use of mine dewater, Synergy intends to send between 50 – 150 L/s of water to the existing surge ponds and to pump down 5H void to a future target level of 182m RL. The existing pump station arrangement is unable to meet these requirements without an upgrade to the existing system.

This scope of works (**SoW**) covers the procurement of one (1) pontoon mounted pump unit required for the upgrade to the existing pump station.

## 4 DETAILED SCOPE OF WORK

The contractor must:

- (a) design, supply and deliver one (1) pontoon mounted pump unit, including;
  - (i) one (1) Warman® 8/6 AH bare shaft pump in stainless steel materials mounted at 30 degrees (self-priming arrangement);
  - (ii) one (1) WEG 75 kW, 6 Pole, 415 V, 50 Hz foot mounted VSD compatible electric motor, wired to a termination box located at the edge of the pontoon adjacent to the discharge piping;
  - (iii) direct drive arrangement;
  - (iv) pontoon in one of the following two options:
    - (I) **Option 1:** Steel pontoon fabricated in three separate sections, complete with removable pump set frame. Note that the design shall prevent water pooling; or
    - (II) **Option 2:** High density polyethylene (**HDPE**) float pontoon.
  - (v) mooring bollards on the pontoon;
  - (vi) cable tray;
  - (vii) hand rails and a latched gate;
  - (viii) multiple pressure tested floatation cells;
  - (ix) skid runners with wear plates and a dozer push bar;
  - (x) 200 NB stainless steel discharge pipe fitted with a wafer check valve, drain valve, butterfly isolation valve and air release valve. Discharge pipe to terminate with a 200 NB Table 'E' Flange. The contractor must provide detailed information clarifying how the pontoon can be safely disconnected from the discharge floating pipeline for Synergy to review at tender;
  - (xi) two (2) lifesaver rings;
  - (xii) for the steel pontoon option: two pack epoxy marine paint system - the contractor must provide detailed information on their proposed paint system for Synergy review at tender. The design life of the pontoon is 25 years; and
  - (xiii) one (1) complete set of installation, operation, maintenance and spare parts manuals (electronic only).
- (b) design, supply and deliver three (3) mooring ropes (lengths as per the drawing – Attachment B M10-C-0178-001), cable mounts and equipment suitable for installation of the mooring lines onto land anchors (concrete blocks to be provided by Synergy);

- (c) provide installation support on site;
- (d) provide complete set of installation, operation, maintenance and spare parts manuals (electronic only); and
- (e) provide a manufacturer's data report (**MDR**).

All deliverables must meet the design requirements as detailed in this SoW and the data sheet in [Attachment A](#).

The pontoon mounted pump unit will be placed outdoors within the 5H void and be secured in place, using mooring ropes anchored to the shoreline. The pontoon mounted pump unit will feed directly into the existing land-based pump set via a proposed 216 m long DN315 PE100 pipeline. The existing pumpset will then send water approximately 6 km to an existing surge pond using existing infrastructure.

The pontoon mounted pump unit must have a minimum design life of 25 years and be designed to be suitable for the following environmental conditions:

- (a) temperature;
  - (i) maximum recorded (*BOM*): 45 °C
  - (ii) minimum recorded (*BOM*): -6 °C
- (b) water pH – 3; and
- (c) for further water quality information, refer to the datasheet provided as an attachment ([Attachment A](#)).

The pontoon mounted pump unit must be stable enough to allow for regular maintenance activities to occur on the pontoon and solid enough to allow for the pontoon unit to be towed with a small boat and dragged out with heavy mobile equipment for any major maintenance activities.

A summary of the pump design specification is shown in the table below with a detailed datasheet provided as an attachment ([Attachment A](#)) to the SoW.

Component	Specification
<b>Duty point</b>	Max – 150 L/s @ 32m Min – 50 L/s
<b>Motor</b>	75 kW electric motor - VSD compatible Note: power supply cable length to be > 240 m
<b>Control</b>	Variable speed drive – pressure set-point
<b>Duty</b>	Duty only

The following is excluded from the scope of works:

- (a) motor starter, VSD, local control panel, lighting and all electrical wiring from the output terminals of the VSD to pontoon motor termination box;
- (b) all civil works including land bollard concrete foundations.

## **5 SITE LOCATIONS**

- (a) the contractor's installation support work will take place at the 5H Void adjacent to Muja power station, Boys Home Road, Palmer WA; and
- (b) the contractor must provide one technician to travel to the site to provide installation support. The contractor should make allowance for travel to / and accommodation at Collie, WA.

## **6 SPECIFICATIONS AND DRAWINGS**

- (a) Drawings must be supplied in Bentley Systems MicroStation version v8i SELECT series 3 to ensure conformance to Muja power station site requirements.
- (b) Please refer to the Synergy computer aided design and practices standards for all the details relating to drawing formats and requirements. The standards are available to be viewed and downloaded at <https://www.synergy.net.au/suppliers>.

The following documentations are to be provided by the contractor:

- (a) operation and maintenance manuals;
- (b) dimensioned general arrangement drawings (plan and elevation view);
- (c) general arrangement drawings for complete spare parts items list, including part numbers; and
- (d) price list for all spare parts.

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## 7 DELIVERY REQUIREMENTS

- (a) the pontoon mounted pump unit is to be delivered to Synergy's designated site in accordance with the approved contractor's program;
- (b) all Western Australian road transportation regulation must be complied with;
- (c) the contractor must ensure that a suitable robust packaging / transport frame is utilised for the transportation and handling; and
- (d) inspection of the pontoon mounted pump unit will be conducted by Synergy for approval prior to shipping and upon receipt of goods.

## 8 OCCUPATIONAL, HEALTH AND SAFETY MANAGEMENT

All completed works must be compliant with the relevant legislative obligations and statutory requirements:

- (a) OHS act WA 1984;
- (b) OHS regulations 1996;
- (c) all other relevant Western Australian legislation;
- (d) relevant Australian standards including those denoted on supplied drawings; and
- (e) relevant industry codes of practices.

## 9 ATTACHMENTS

- (a) Attachment A Pontoon pump datasheet.
- (b) Attachment B Drawing M10-C-0178-001.

PONTON AND PUMP DATA SHEET				DOC. No.	REV. NO	SHEET No.
				<b>IW182200-EMM-DS-001</b>	<b>A</b>	<b>1 of 5</b>
EQ. NAME				CLIENT DOC. No.	CLIENT REV. NO	
ER4976 - Muja Power Station 5H Void Pump Upgrade				<b>N/A</b>		
PROJECT NAME				TAG No.		
Muja Power Station 5H Void Pump Upgrade						
PROJECT NUMBER				No. REQUIRED	1	
ER4976 / IW182200				No. OPERATING	1	No. STANDBY 0
CLIENT				MANUFACTURER		
Synergy				WEIR		
AREA				MODEL/SIZE		
Generation Business Unit				8/6AH (Pump)		
1.00	<b>GENERAL INFORMATION</b>					
1.01	TYPE			Pontoon Pump Unit (Pontoon & Pump Components)		
1.02	DUTY - CONTINUOUS, OTHER			Duty Only		
1.03	LOCATION - INDOOR/OUTDOOR			Outdoors - Floating on Water (refer water quality characteristics below)		
1.04	CALCULATION REFERENCED, REVISION					
2.00	<b>PUMP PROCESS INFORMATION</b>		<b>UNIT</b>	<b>DATA</b>		
2.01	APPLICATION - SLURRY/LIQUID			Liquid		
2.02	PUMP CONTROL - VSD/FIXED SPEED			VSD (by others)		
2.03	FLUID (SLURRY) DESCRIPTION			Raw Water		
2.04	FLUID COMPOSITION					
2.05	<input type="checkbox"/> TOXIC <input checked="" type="checkbox"/> CORROSIVE <input type="checkbox"/> EROSIV <input type="checkbox"/> FLAMMABL					
2.06	<input type="checkbox"/> EXPLOSIV <input type="checkbox"/> FLAKY <input type="checkbox"/> GRANULAR <input type="checkbox"/> ABRASIV					
2.07	<input type="checkbox"/> CLOGGING <input type="checkbox"/> BUILDS UP & <input type="checkbox"/> OTHE					
2.08	SUCTION TEMPERATURE	MINIMUM	°C	0		
2.09		DESIGN	°C	25		
2.10	FLUID (SLURRY) SG	AT DESIGN		1.01		
2.11	FLUID VISCOSITY	AT DESIGN	mPa.s	N/A		
2.12	VAPOUR PRESSURE OF FLUID	AT DESIGN	kPa	31.18		
2.13	FLUID pH			3		
2.15	SOLIDS CONTENT	DESIGN	% w/w	N/A		
2.14	SOLIDS SG			N/A		
2.16	PARTICLE SIZE	D80	micron	N/A		
2.17		MAXIMUM	micron	N/A		
2.18	FROTH FACTOR			N/A		
2.19	CONDUCTIVITY		uS/cm	1600-1700		
2.20	TURBIDITY		NTU	<1		
2.21	SULPHATE		ppm	400-500		
2.22	CHLORIDE		ppm	200-250		
2.23	SILICA		ppm	16		
2.24	SODIUM		ppm	120-130		
2.25	CALCIUM		ppm	30		
2.26	MAGNESIUM		ppm	40		
2.27	IRON		ppm	6		
2.28	<b>PUMP PERFORMANCE:</b>			MINIMUM FLOW (AT REDUCED SPEED)	NOMINAL FLOW (AT FULL SPEED)	
2.29	FLOW RATE	REQUIRED	L/s	50	150	
2.30		OFFERED	L/s	*	*	
2.31	MINIMUM CONTINUOUS FLOW		L/s	*	*	
2.32	PUMP EFFICIENCY		%	*	*	
2.33	NPSH ACTUAL		m fluid	*	*	
2.34	NPSH REQUIRED		m fluid	*	*	
2.35	PUMP SPEED		RPM	*	1000	
2.36	ABSORBED POWER		kW	*	*	
2.37	INSTALLED POWER		kW	*	<75	
2.38	<b>SUCTION CONDITIONS</b>					
2.39	SUCTION PRESSURE		kPa(g)	*	*	
2.40	ASSUMED IMPELLER CENTRELINE ABOVE GRADE		mm	*	*	
2.41	SUCTION HEAD		m fluid	*	*	
2.42	<b>DISCHARGE CONDITIONS</b>					
2.43	DISCHARGE HEAD		m fluid	*	min 32.17	
2.44	PUMP SHUT OFF HEAD		m fluid	*	*	
REV	DATE	BY	CHKD	APPR	AUTH	REVISION DESCRIPTION
A	10-Sep	JT	AL	GS	GS	Issued for Internal Review
B	10-Sep	JT	AL	GS	GS	Issued for Client Review
0	9-Oct	JT	AL	GS	GS	Issued for Use



PONTON AND PUMP DATA SHEET		DOC. No.	REV. NO	SHEET No.		
		<b>IW182200-EMM-DS-001</b>	<b>A</b>	<b>2 of 5</b>		
EQ. NAME		CLIENT DOC. No.	CLIENT REV. NO			
<b>ER4976 - Muja Power Station 5H Void Pump Upgrade</b>		<b>N/A</b>	<b>0</b>			
		TAG No.	<b>0</b>			
3.00	PUMP MECHANICAL DATA	UNIT	DATA			
3.01	PUMP MANUFACTURER		WEIR			
3.02	PUMP MODEL		8/6AH			
3.03	PUMP TYPE		*			
3.04	PROPOSED CURVE NO:		*			
3.05	NO. STAGES:		1			
3.06	NPSH REQUIRED	m	*			
3.07	PUMP SPEED AT: MINIMUM / NORMAL / DESIGN DUTY	RPM	*			
3.08	IMPELLER DIA. AT: MINIMUM / NORMAL / DESIGN DUTY	mm	*			
3.09	PUMP EFFICIENCY AT: MINIMUM / NORMAL / DESIGN DUTY	%	*			
3.10	MINIMUM REQUIRED MOTOR OUTPUT POWER	kW	*			
3.11	MAX. SHUT-OFF HEAD	m	*			
3.12	IMPELLER TYPE & NO. OF VANES		*			
3.13	PUMP MAX. ALLOWABLE PRESSURE	kPa	*			
3.14	PUMP MAX. ALLOWABLE TEMPERATURE	°C	*			
3.15	MECHANICAL SEAL/ GLAND SEAL		CHESTERTON 170 SC/SC MECHANICAL SEAL			
3.16	GLAND FLUSHING QUANTITY	L/min	*			
3.17	SEAL FLUSH:		*			
3.18	MAX HEAD DESIGN IMPELLER:	m WC	*			
3.19	STUFF BOX PRESS:	kPa (g)	*			
3.20	ROTATION FACING COUPLING:		*			
3.21	MIN. CONTINUOUS FLOW:	m <sup>3</sup> /h	*			
3.22	DESIGN POWER:	kW	*			
3.23	MAX POWER DESIGN IMPELLER:	kW	*			
3.24	CONNECTED POWER	kW	*			
3.25	AUTO BEARING GREASER CAPACITY		18 MONTHS			
3.26						
4.00	PUMP SURFACE TREATMENT	UNIT	DATA			
4.01	CASING		*			
4.02	BASE PLATE		*			
4.03						
5.00	PUMP MATERIALS	UNIT	DATA			
	<b>ALL WETTED PARTS TO BE DUPLEX STAINLESS STEEL (CD4MCuN), OR APPROVED EQUIVALENT</b>					
5.01	CASING		*			
5.02	IMPELLER		*			
5.03	VOLUTE LINER		*			
5.04	CASING LINER		*			
5.05	IMPELLER WEAR RINGS		*			
5.06	CASING WEAR RINGS		*			
5.07	SHAFT		Cast austenitic stainless steel (or approved equivalent)			
5.08	SHAFT SLEEVE		Wrought duplex stainless steel (or approved equivalent)			
5.09	THROAT BUSHING		*			
5.10	STUFFING BOX		*			
5.11	LANTERN RING		*			
5.12	CASING BOLTS		*			
5.13	PACKING		*			
5.14	CASING GASKET		*			
5.15	COUPLING HALVES		*			
5.16	BASE PLATE		*			
5.17	BEARING HOUSING		*			
5.18	SAFETY GUARD		*			
6.00	PUMP NOZZLE SCHEDULE	UNIT	DATA			
6.01	SERVICE		RATING	SIZE DN	FACING	NO.
6.02	SUCTION					
6.03	DISCHARGE					

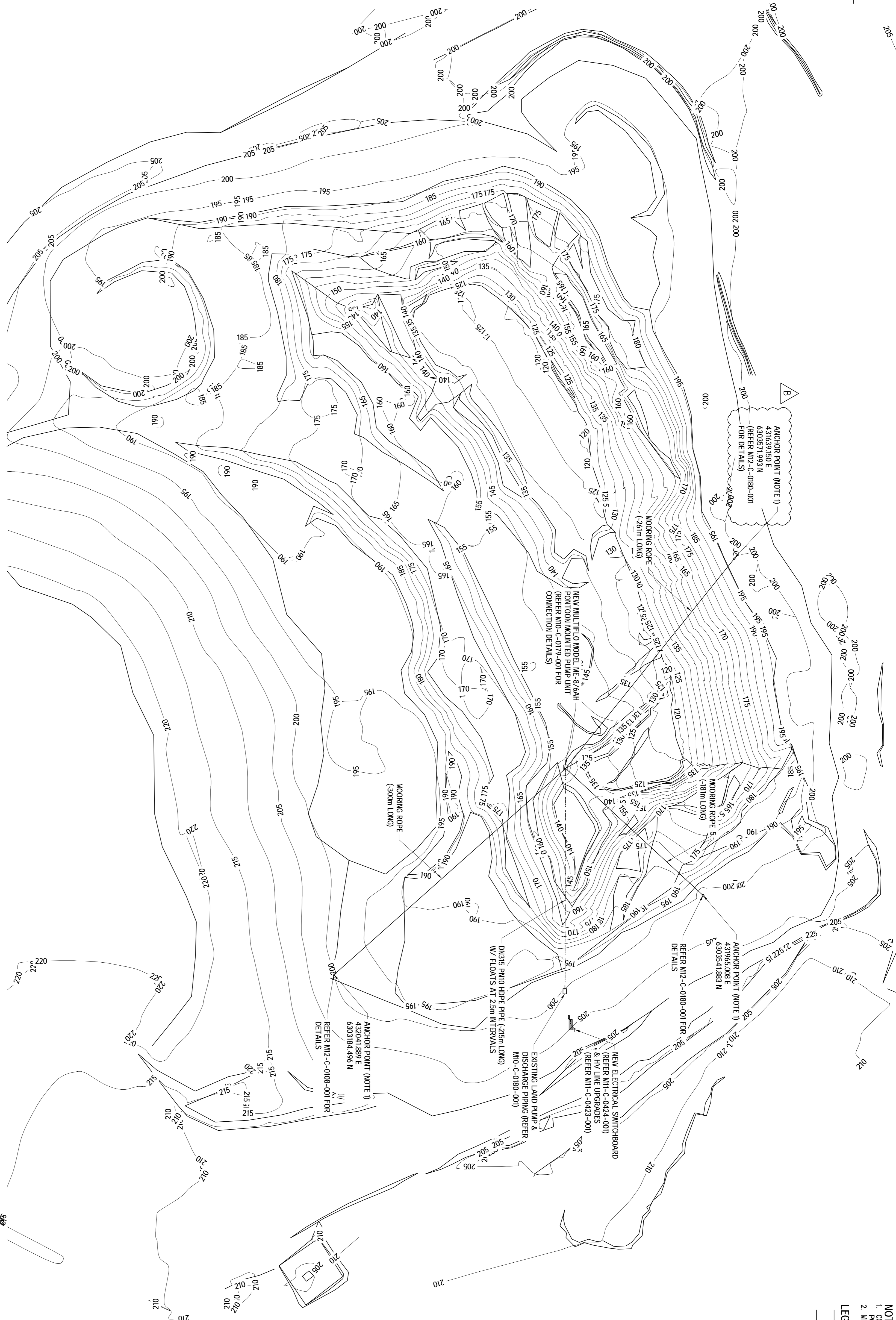
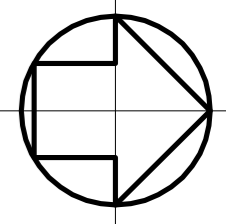
PONTOON AND PUMP DATA SHEET		DOC. No.	REV. NO	SHEET No.
		<b>IW182200-EMM-DS-001</b>	<b>A</b>	<b>3 of 5</b>
EQ. NAME		CLIENT DOC. No.	CLIENT REV. NO	
<b>ER4976 - Muja Power Station 5H Void Pump Upgrade</b>		<b>N/A</b>	<b>0</b>	
		TAG No.	<b>0</b>	
7.00	PONTOON INFORMATION	UNIT	DATA	
7.01			MINIMUM	MAXIMUM
7.02	PONTOON RELATIVE LEVEL	m	182	200
7.03	NUMBER OF MOORING POINTS	Qty	3	
7.04	REQUIRED LENGTH OF MOORING ROPES	m	Refer Drawing M10-C-0178-001	
7.05	WIND SPEED	m/s	37	
7.06	WAVE LOAD	kN/m	2	
7.07	Water pH		3	
7.08				
8.00	PONTOON MATERIALS	UNIT	DATA	
8.01	PONTOON FRAME		OPTION 1: Steel pontoon fabricated in three separate sections, complete with removable pump set frame. Note that the design shall prevent water pooling	
8.02	PUMPSET FRAME		OPTION 2: HDPE float pontoon	
8.03	GUARDRAIL/GATES			
8.04	CABLE TRAY		From edge of pontoon to terminal box	
8.05	FLOATATION CELLS			
8.06	SKID RUNNERS			
8.07	WEAR PLATES			
8.08	DOZER PUSH BAR			
8.09	FLOOR / GRIDMESH			
8.10	MOORING ROPES		Ultra High Molecular Weight Polyethylene	
8.11	CABLE MOUNT			
8.12				
9.00	PROTECTIVE COATINGS	UNIT	DATA	
9.01	PONTOON FRAME		*	
9.02	PUMPSET FRAME		*	
9.03	GUARDRAIL/GATES		*	
9.04	CABLE TRAY		*	
9.05	FLOATATION CELLS		*	
9.06	SKID RUNNERS		*	
9.07	WEAR PLATES		*	
9.08	DOZER PUSH BAR		*	
9.09	FLOOR / GRIDMESH		*	
9.10				
9.11				

PONTON AND PUMP DATA SHEET		DOC. No.	REV. NO	SHEET No.
		<b>IW182200-EMM-DS-001</b>	<b>A</b>	<b>4 of 5</b>
EQ. NAME		CLIENT DOC. No.	CLIENT REV. NO	
<b>ER4976 - Muja Power Station 5H Void Pump Upgrade</b>		<b>N/A</b>	<b>0</b>	
		TAG No.	<b>0</b>	
10.00	PONTON COMPONENTS	UNIT	DATA	
10.01	<b>DISCHARGE PIPEWORK:</b>			
10.02	LENGTH	m		
10.03	SIZE	mm		
10.04	MATERIAL			
10.05	PRESSURE RATING	m head		
10.06	CONNECTION DETAILS		200NB Table 'E' Flange	
10.07	<b>CHECK VALVE:</b>			
10.08	SIZE	mm		
10.09	MATERIAL			
10.10	MODEL			
10.11	TRIM DETAILS			
10.12	PRESSURE RATING	m head		
10.13	<b>DRAIN VALVE</b>			
10.14	SIZE	mm		
10.15	MATERIAL			
10.16	MODEL			
10.17	TRIM DETAILS			
10.18	PRESSURE RATING	m head		
10.19	<b>BUTTERFLY VALVE</b>			
10.20	SIZE	mm		
10.21	MATERIAL			
10.22	MODEL			
10.23	TRIM DETAILS			
10.24	PRESSURE RATING	m head		
10.25	<b>AIR RELEASE VALVE</b>			
10.26	SIZE	mm		
10.27	MATERIAL			
10.28	MODEL			
10.29	TRIM DETAILS			
10.30	PRESSURE RATING	m head		
10.31	<b>GRID MESH</b>			
10.32	REMOVABLE?		Yes / No	
10.33	MATERIAL TYPE			
10.34	<b>LIFE SAVER RINGS</b>			
10.35	QUANTITY		Min 2	
10.36	<b>LATCH GATE</b>			
10.37	SELF-CLOSING?			
10.38	DIMENSIONS	mm x mm x mm		
10.40	<b>ACCESS</b>			
10.41	PONTON ACCESS DETAILS FROM FALL INTO WATER			
10.42	<b>SIGNAGE</b>			
10.43	QUANTITY			
10.44	MATERIAL			
10.45	DIMENSIONS			
10.46	WORDING			
10.47	<b>LIGHTING</b>			
10.48	DETAILS		Lighting is not required	
10.49				
10.50				
10.51				
10.52				
10.53				
10.54				



PONTON AND PUMP DATA SHEET			DOC. No. <b>IW182200-EMM-DS-001</b>	REV. NO <b>A</b>	SHEET No. <b>5 of 5</b>
EQ. NAME <b>ER4976 - Muja Power Station 5H Void Pump Upgrade</b>			CLIENT DOC. No. <b>N/A</b>	CLIENT REV. NO <b>0</b>	
			TAG No. <b>0</b>		
11.00	<b>ELECTRICAL</b>	<b>UNIT</b>	<b>DATA</b>		
11.01	STANDARD		AS 1359		
11.02	SUPPLY POWER	Phas / V / Hz	3 Phase 415V, 50Hz		
11.03	SEPARTE MOTOR DATASHEET PROVIDED? YES/ NO		No		
11.04	DRIVE RATING	kW	75 (To be confirmed by Vendor)		
11.05	MAKE/ NUMBER OF POLE		*		
11.06	VARIABLE SPEED COMPATIBLE	YES/ NO	Yes		
11.07	PREFERRED MANUFACTURER		Toshiba High Efficiency		
11.08	COOLING		TEFC		
11.09	IP RATING		56D		
11.10	TEMPERATURE MONITORING		PT100 3 Wire - One per phase		
11.11	INSULATION		CLASS F		
11.12	ANTI-CONDENSATION HEATER	YES/ NO	YES		
12.00	<b>INSTRUMENTS</b>	<b>UNIT</b>	<b>DATA</b>		
12.01	LIST OUT ANY OTHER INSTRUMENTATION PROVIDED		*		
12.02	VIBRATION MONITORING		4-20mA, 2-wire, loop-powered vibration probe with specified range		
12.03					
12.04					
12.05					
13.00	<b>SHIPPING AND INSTALLATION DATA</b>	<b>UNIT</b>	<b>DATA</b>		
13.01	PUMPSET WEIGHT	kg	*		
13.02	PONTOON WEIGHT	kg	*		
13.03	TOTAL ASSEMBLED WEIGHT	kg	*		
13.04	SHIPPING DIMENSION	m x m x m	*		
13.05					
14.00	<b>REFERENCE SPECIFICATIONS, DESIGN CODES</b>	<b>UNIT</b>	<b>DATA</b>		
14.01					
14.02					
14.03					
14.04					
15.00	<b>REMARKS AND INSTRUCTIONS TO VENDORS</b>				
15.01	ALL INFORMATION IDENTIFIED WITH AN ASTERISK (*) ON THIS FORM SHALL BE PROVIDED BY VENDOR AT TENDER				
15.02	IN THE EVENT OF AN ORDER VENDOR SHALL BE REQUIRED TO COMPLETE AND CONFIRM ALL DATA ON THIS FORM				
15.03	VENDOR WILL SUPPLY ALL NUTS, BOLTS AND GASKETS NECESSARY FOR ASSEMBLY				
15.04					
15.05					
15.06					
15.07					
15.08					
15.09					
15.10					
15.11					
15.12					
15.13					
15.14					
15.15					
15.16					
15.17					
15.18					
15.19					





**NOTES**  
 1. COORDINATES ARE INDICATIVE ONLY. CONTRACTOR TO ENSURE FOUNDATION OF ANCHOR POINTS ARE ABOVE RL 200M.  
 2. MOORING ROPES TO BE SPECIFIED & SUPPLIED BY PONTON PUMP VENDOR.

**LEGEND**  
 ——— MOORING LINES  
 - - - - - DN315 HDPE P110 PIPE

**PLAN**

M10-C-0179-001	PONTON PUMP CONNECTION
M10-C-0180-001	TRANSFER PUMP STATION - MODIFICATIONS
M10-C-0181-001	TRANSFER PUMP STATION - PIPE SPECIALS
M11-C-0142-001	LEGACY SH VOID MAIN SWITCHBOARD SINGLE LINE DIAGRAM
M11-C-0419-001	POWER RETICULATION - GUY ANCHOR DETAILS
M11-C-0420-001	Z24V OHL - POLE P5-7 DETAIL
M11-C-0421-001	Z24V OHL - POLE P5-8 DETAIL
M11-C-0422-001	Z24V OHL - POLE P5-9 DETAIL
M11-C-0423-001	Z24V OHL - PLAN AND PROFILE
M11-C-0424-001	ELECTRICAL SITE LAYOUT
M11-C-0425-001	NEW SH VOID MAIN SWITCHBOARD SINGLE LINE DIAGRAM
M11-C-0426-001	NEW SH VOID I&C CABLE BLOCK DIAGRAM
M12-C-0108-001	ANCHOR POINT FOUNDATION & PIPE SUPPORT DETAILS
M1-S-1067-021	SYSTEM PAID
M1-S-9023-001	Z24V CVBF AREA RETICULATION SINGLE LINE DIAGRAM

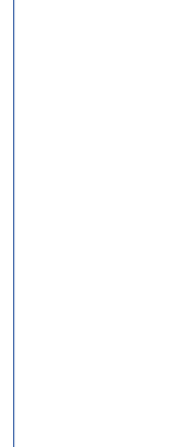
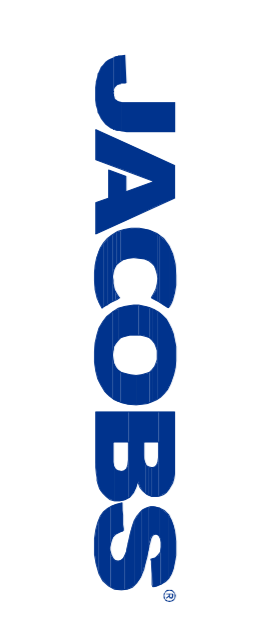
REV	DATE	DRWN	CHK'D	APP'D	DESCRIPTION
B	20.03.19	CL	AL	GS	APPROVED FOR CONSTRUCTION - REVISED COORDINATES
A	15.10.18	CYC	AL	GS	APPROVED FOR CONSTRUCTION

DRAWING REVISIONS	
DESCRIPTION	

DRAWING REFERENCES	
DRAWING NO	TITLE

**MUJA POWER STATION**  
 COMMON PLANT  
 BORE WATER  
 SH VOID  
 GENERAL ARRANGEMENT

DRAWN	C.CARNEVALI	15.10.18	DRAWING NUMBER
CHECKED	A.LEEDMAN	15.10.18	M10-C-0178-001
APPROVED	G.SZCZODA	15.10.18	



SCALE	1	2000 UDN
NEXT SHF		
REVISION		B



# SCOPE OF WORK

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<b>Project:</b>	<b>Muja power station EP-10256 5H void pump upgrade Civil installation</b>	<b>Date:</b> 05 March 2019
<b>Business Unit:</b>	Generation	
<b>Prepared by:</b>	Jacobs Engineering and Synergy	
<b>For approval by:</b>	Dave Lewis, project manager	

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This document must not be made available to persons outside Synergy without prior written approval of Synergy

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## 1 INTRODUCTION

Synergy is Western Australia's largest electricity generator and retailer of electricity and gas with more than one million residential, business and industry customers.

Synergy generates electricity using a range of non-renewable and renewable energy sources.

- (a) our major power stations are located in Collie, Kwinana and Pinjar;
- (b) smaller regional power stations are located at Mungarra and West Kalgoorlie.; and
- (c) we have wind farms at Albany, Esperance, and Kalbarri, a solar farm near Geraldton, wind-diesel power plants in Bremer Bay, Coral Bay, Denham and Hopetoun, and a solar battery storage facility at Alkimos.

More details relating to Synergy can be found at – [www.synergy.net.au](http://www.synergy.net.au).

## 2 BACKGROUND

Synergy's generation business unit (**GBU**) is responsible for our electricity generating assets. GBU's priority is to create and sustain a safe environment for our people.

GBU is made up of three primary operating units:

- (a) thermal generation - the thermal generation team is responsible providing safe, reliable and sustainable energy to the people of WA, through efficient management and operation of our generating assets. The total generating capacity for thermal generation is 1456 MW. The thermal generation fleet consists of our largest station, Muja power station, which consists of eight generating units producing a total of 1128 MW and employing 288 permanent personnel and Collie power station; a single generating unit producing a total of 345 MW owned by Synergy, operated under an operating and maintenance contract.
- (b) gas turbines and distributed generation (**GTDG**) - are specialists in the operation and maintenance of highly automated generating plant. GTDG has 53 employees managing a portfolio of 91 generating units fuelled by gas, wind, steam and diesel with a total generating capacity of 1,300 MW. The portfolio comprises 18 open cycle gas turbines, 45 wind turbines, one combined cycle station and 26 diesel engines.

The gas turbines portfolio is spread over an area from Coral Bay in the north to Kalgoorlie / Esperance in the east and Albany to the south.

- (c) asset optimisation - seeks to maximise sustainable returns from all the GBU power generation assets by analysis plant performance to deliver practical recommendations for business performance improvement and is responsible for developing and maintaining the fleet asset lifecycle missions. Asset Optimisation also maintains project management governance for GBU and executes capital projects in GBU above \$0.5 million.

Asset Optimisation works closely both with the site teams and across business units to achieve the GBU and Synergy objectives.



This scope of work (**SoW**) document is for the civil (concrete) installation associated with a new floating pontoon pump at the 5H void. The purpose of the project is to increase Synergy's capability of drawing water from the void in order to secure future water resource availability.

It is intended to use the new pontoon pump to reach a lower water level in the 5H void, while continuing to utilise the existing land based centrifugal pump and pipelines.

### **3 GENERAL SCOPE OF WORK**

The SoW includes the following:

- (a) supply and installation of a concrete plinth extension at the existing land based centrifugal pump;
- (b) supply and installation of three concrete anchor blocks to support the pontoon mooring lines; and
- (c) supply and installation of concrete foundation for the new switchboard and VSD cubicles.

The SoW does not include electrical works, controls works, mechanical works, or any commissioning. Concrete and civil works associated with the installation of new HV poles is also excluded from the SoW.

Synergy's reserves the right to amend the SoW at a later date, to include additional related input or SoW parameters, should the need arise due to a change in business or technical requirements.

### **4 DETAILED SCOPE OF WORK**

The detailed SoW includes the following:

- (a) removal of the rip rap adjacent to the existing land based centrifugal pump concrete plinth, and stockpiling to allow future reuse;
- (b) stripping and preparation of ground surface adjacent to the existing land based centrifugal pump, and compaction prior to concrete pour;
- (c) supply and installation of a concrete plinth extension at the existing land based centrifugal pump;
- (d) supply and installation of concrete pipe supports for the DN315 and DN400 HDPE pipes (installation of the pipe is by Synergy);
- (e) supply and installation of three concrete anchor blocks (bollards) around the edges of the 5H void, included ground excavation works, and as located on the drawings. The anchor blocks must encase Synergy supplied cable mount poles;
- (f) supply and installation of an electrical switchboard concrete plinth, including penetrations and conduits to the adjacent transformer area;
- (g) as-build the drawings in accordance with Synergy drafting procedures;
- (h) all civil works must be completed by qualified professionals in accordance with relevant Australian Standards;

- (i) outstanding work and defects rectification as (punch) listed;
- (j) site establishment, mobilisation and demobilisation;
- (k) the contractor must complete all preconstruction activities prior to commencement of construction works on site;
- (l) the contractor must develop a construction methodology that complies with the requirements specified in this document, and all relevant Australian Standards and regulatory requirements. The construction methodology must include a detailed construction process description and the document should detail materials, plant, labour and any temporary works required to complete the SoW;
- (m) the contractor must provide their own site accommodation;
- (n) no water or power will be made available from Synergy; and
- (o) no public information signs are required for this project.

## 5 SITE LOCATIONS

The contractor's work will take place at the 5H void adjacent to Muja power station, Boys Home Road, Palmer WA. All contractor's personnel will be required to complete the necessary site inductions.

## 6 DEFINITIONS AND APPLICABLE DOCUMENTS

Concrete works on the following drawings form part of the SoW;

- (a) M10-C-0178-001 General arrangement;
- (b) M10-C-0180-001 Transfer pump station modifications;
- (c) M11-C-0424-001 5H void electrical layout drawing; and
- (d) M12-C-0108-001 Concrete bollards and pipe support details.

The drawings are located in Section 20 Attachments.

The contractor must perform the works in accordance with the following Australian Standards:

- (a) AS 1012 Methods of testing concrete;
- (b) AS 1141 Methods for sampling and testing aggregate;
- (c) AS 1379 The specification and manufacture of concrete;
- (d) AS 1478 Chemical admixtures for concrete;
- (e) AS 2758.1 Aggregates and rock for engineering purposes – Concrete aggregates;
- (f) AS 3600 Concrete structures;
- (g) AS 3610 Formwork for concrete;

- (h) AS 3972 General purpose and blended cements;
- (i) AS 1554.3 Structural steel welding – welding of reinforcing steel; and
- (j) AS 4671 Steel reinforcing materials.

## **7 DELIVERABLES**

The contractor must provide the following deliverables two (2) weeks prior to site mobilisation:

- (a) construction methodology;
- (b) personnel accreditations, qualifications and certifications; and
- (c) OSH management plans.

The contractor must provide the following deliverables prior to practical completion:

- (a) as built drawings to Synergy requirements.

## **8 SPECIFICATIONS AND DRAWINGS**

- (a) Drawings must be supplied in Bentley Systems MicroStation version v8i SELECT series 3 to ensure conformance to Muja power station site requirements.
- (b) Please refer to the Synergy computer aided design and practices standards for all the details relating to drawing formats and requirements. The standards are available to be viewed and downloaded at <https://www.synergy.net.au/suppliers>.

## **9 DELIVERY REQUIREMENTS**

All materials supplied by the contractor must be provided in new condition.

## **10 CONTRACTOR RESOURCE REQUIREMENTS AND QUALIFICATIONS**

- (a) the contractor is to nominate a contractor supervisor/s as follows:
  - (i) the contractor must nominate a qualified works supervisor/s with proven supervisory skills, the supervisor/s must also have thorough understanding of all supervisory responsibilities in regards to safety management;
  - (ii) the contractor supervisor/s must require GBU generation supervisor authorisation prior to supervising any work at any Synergy GBU site;
  - (iii) the nominated supervisor/s must also be contactable at all times during both normal working hours and after hours;
  - (iv) the site supervisor/s must be onsite whenever the contractor and or subcontractors are carrying out the work; and
  - (v) works carried out under the contract will require the following roles:
    - (l) supervisor; and

- (II) qualified trade persons.

The contractor must provide proof of licences, relevant qualifications, training and verification of competencies (**VOC**) of all tradespersons, staff or subcontractors engaged to carry out work under this contract.

Some tasks may involve high risk work, persons employed to undertake high risk work must hold a current high risk work licence specific to the task that they are engaged to undertake.

Any person performing high risk work on the Muja power station site must also hold a current VOC.

## **11 APPROACH AND METHODOLOGY**

The contractor is required to provide their own specific methodology for the completion of the tasks and deliverables.

It is the contractor's obligation to ensure that all work undertaken is in compliance with all applicable legislation, acts and codes.

The contractor must ensure that its resources are adequately trained to fulfil their responsibilities under the contract and must operate at all times in compliance with the law.

## **12 PERFORMANCE STANDARDS AND QUALITY ASSURANCE**

The contractor must ensure all works carried out complies with the technical requirements stated under Section 19 of this SoW.

## **13 TESTING, INSPECTION AND COMMISSIONING**

- (a) all civil works must be completed by qualified professionals in accordance with the relevant Australian Standards; and
- (b) outstanding work and defects must be rectification as (punch) list.

## **14 REPORTING AND COMMUNICATIONS**

- (a) the contractor must provide weekly reporting to keep Synergy informed of progress, status and completion over the course of the work. These reports must be delivered electronically; and
- (b) the contractor must be accessible, responsive, and keep Synergy informed of any issues, as they arise.

## **15 CONTRACTOR RESPONSIBILITIES**

- (a) the contractor is responsible for (a) coordination and management of the work under the contract; and
- (b) the contractor is required to provide its own tools and equipment.

## 16 SYNERGY RESPONSIBILITIES

- (a) Synergy will perform all equipment isolations after a request from the contractor. The request must be made at least three (3) days prior to an isolation occurring; and
- (b) Synergy will free issue the following:
  - (i) three (3) cable mount poles.

## 17 RISKS AND CONSTRAINTS

- (a) the works include working near water, which represents a significant risk to the contractor, which has the potential to result in seriously injury or death. It is the contractor's responsibility to mitigate this risk; and
- (b) 5H void water is acidic with a pH of three (3). The contractor should avoid prolonged contact with the water.

## 18 OCCUPATIONAL, HEALTH AND SAFETY MANAGEMENT

It is the contractor's responsibility to ensure all works performed under the contract comply with all statutory requirements, regulations and legislation, and the most recent edition of the appropriate code of practice and standards relevant to such work in Western Australia.

Contractors must also ensure they have a safety management plan (**SMP**) and comply with statutory requirements and instructions given by the Synergy contract user to perform work for which that are engaged.

In general terms contractors are responsible for:

- (a) ensuring their own safety and the safety of those in their work groups;
- (b) implementing risk management strategies and applying safe systems of work to perform activities;
- (c) ensuring knowledge of and operating in accordance with Synergy's WHSMF, ensuring the requirements of procedures are applied, relevant assessment and monitoring activities are identified, carried out and recorded;
- (d) operating plant in the manner it was designed;
- (e) reporting incidents, injuries, near misses, dangerous events and issues of non-compliance with the WHSMF to their supervisor or Synergy contact; and
- (f) ensuring construction work complies with legislative requirements.

## 18.2 Safety management plan

The contractor's SMP should apply specifically to the SoW outlined in this contract and as a minimum should include the following:

- (a) purpose;
- (b) endorsements;
- (c) health and safety required outcomes;
- (d) health and safety management framework;
- (e) Synergy lifesavers;
- (f) health and safety planning;
- (g) legal and other requirements;
- (h) objectives and targets;
- (i) responsibilities and accountabilities;
- (j) training and competencies;
- (k) consultation and communication;
- (l) employee assistance program;
- (m) health and safety reporting;
- (n) document and data control;
- (o) health and safety risk management;
- (p) safe systems of work;
- (q) emergency response;
- (r) monitoring and measurement;
- (s) incident management; and
- (t) health and safety records management.

## **19 TECHNICAL REQUIREMENTS**

### **19.1 Concrete quality criteria**

#### **19.1.1 Concrete composition and strength requirements**

All concrete must be in accordance with AS1379 except as may otherwise be specified. Concrete materials must be proportioned so that, when transported, placed, compacted and cured in accordance with AS3600, the hardened concrete will comply with the strength grades as defined in AS1379 unless noted otherwise on the drawings.

The concrete must consist of cement, fine and coarse aggregates, water and approved admixtures and must be well mixed and brought to a uniform consistency. The design mix of concrete must also ensure that the resultant concrete will be sound, dense, workable and durable, without segregation, honeycombing or bleeding. Unless otherwise specified, the concrete strength must be minimum 25 MPa after curing for 28 days, the slump of concrete in the plastic state, determined in accordance with AS1379, must be 80 mm at the point of acceptance and the maximum nominal aggregate size must be 20 mm.

#### **19.1.2 Site mixed concrete**

The contractor must only use site mixed concrete for minor applications, where approved by Synergy. The concrete strength must be minimum 25 MPa after curing for 28 days.

#### **19.1.3 Concrete quality monitoring**

- (a) all concrete must be sampled in the plastic state and tested for determination of characteristic strength and for the determination of slump in accordance with AS1379. All labour and equipment required for concrete sampling and testing together with concrete samples and specimens must be provided by the contractor;
- (b) the criteria for concrete quality acceptance must be its compliance with the specified composition, slump and strength grades in accordance with the requirements of AS3600. Testing and assessment for compliance of concrete with specified strength grades must be in accordance with AS1379; and
- (c) concrete which is supplied but which does not conform to the specified acceptance criteria and / or hardened concrete which exhibits any of the defects listed in AS3600, must not be incorporated in the works.

#### **19.1.4 Concrete supply**

The period between commencement of mixing of fresh concrete and completion of its placement must not exceed 90 minutes.

An identification certificate must be forwarded to Synergy in respect of each concrete delivery prior to incorporation in the works. Each certificate must, as a minimum, detail the following:

- (a) name of supplier and place of manufacture;
- (b) serial number of certificate;
- (c) date of supply;
- (d) works name and location;
- (e) delivery vehicle identification;
- (f) quantity of concrete covered by certificate;
- (g) specified class and strength grade or other mix identification;
- (h) cement content and water / cement ratio;
- (i) specified slump;
- (j) maximum nominal size of aggregate;
- (k) method of placement;
- (l) time of commencement of mixing; and
- (m) control of concrete placement period.

### **19.2 CONCRETE MATERIALS**

#### **19.2.1 Cement**

Cement for concrete and mortar to be incorporated in the works must be type GP Portland Cement to AS3972 and used in accordance with the requirements of AS1379.

#### **19.2.2 Water**

Water used in concrete and mortar must be of a general potable quality, free from amounts of matter which are harmful to concrete, reinforcement, tendons or other embedded items.



### 19.2.3 Concrete aggregates

Fine and coarse aggregates for use in concrete must conform to the requirements of AS 2758.1 testing of aggregates for concrete must be carried out in accordance with AS 1141 and other appropriate methods as directed by this specification.

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

Fine and coarse aggregates must be separately tested for potential alkali aggregate reactivity (**AAR**) using the same cement type as nominated for the works. Current laboratory test data may be accepted at the discretion of the Synergy.

Fine aggregate for concrete and mortar must be well graded natural silica sands. It must consist of hard, durable grains and must be free from injurious amounts of dust, soft particles, alkali, organic matter, loam or other deleterious substances. Chert (flint like form of quartz) must not be used as fine aggregate. Fine aggregate must not produce a colour darker than the standard in the colorimetric test for organic impurities described in AS1141. The fine aggregate must be well graded in accordance with AS2758.1.

Coarse aggregate must consist of crushed unweathered granite, diorite, basalt, other approved hard durable rock or approved screened river shingle which does not contain minerals known to react deleteriously with cement alkalis. Chert must not be used as coarse aggregate. The maximum aggregate size must be 20 mm.

In order to obtain an acceptable grading, the coarse aggregate must be batched in at least two size designations. Coarse aggregate must be graded in accordance with AS2758.1.

### 19.2.4 Concrete admixtures

Admixtures proposed for use in concrete work must be subject to the prior approval of Synergy.

## 19.3 Steel reinforcement work

The contractor must supply and install all steel reinforcement as shown on the drawings. Steel reinforcing bars, wire and fabric must comply with AS4671. Reinforcing bars must be bent cold in a manner that will not damage them and must be dimensioned and shaped in accordance with AS3600.

Reinforcement must be placed as shown on the drawings. Unless otherwise directed or shown on the drawings, measurement must be to the centre lines of the reinforcing bars. Reinforcement must be fixed in position by means of 1.6 mm diameter black tie wire so as to avoid displacement by concreting work. Protruding of the black tie wire into the cover zone is not permitted.

Reinforcement materials must not be disturbed after incorporation in concrete. Chairs, hangers, spacers or other acceptable reinforcement supports must be made of concrete, however where approved by Synergy, plastic materials may be used for dry environments only. Tack welding of intersecting reinforcement bars must not be permitted.

Splicing of reinforcement must be by welding or lapping. Splices must be staggered so that splices in adjacent bars are not within the same lap length. Splices must be lapped as shown on the drawings.

Welding of reinforcement must comply with AS/NZS 1554.3.

#### **19.4 Concrete formwork and falsework**

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

Formwork and falsework must be structurally adequate to support formwork, concrete, and reinforcement loads as well as all impact loads transmitted by concreting operations and equipment. Formwork and falsework must be designed, constructed and maintained so as to achieve finished surface tolerances as specified. Form linings may be steel, select grade tongued and grooved hardwood, or plywood. Formwork for successive lifts must not be supported by previously placed concrete until that concrete has achieved a minimum characteristic strength of 15 MPa.

Use of tie wire passing from one face of a concrete form to another face must not be permitted. Bolts that fix or support formwork must be greased and so arranged that they may easily be removed from the concrete without damage to the concrete.

Blockouts, inserts and embedded items must be located and fixed so that the construction tolerances are complied with. Unless otherwise noted, embedded metallic items must be electrically isolated from reinforcement materials.

#### **19.5 Placing of concrete**

##### **19.5.1 Preparation for concreting**

Formwork must be inspected prior to concreting. All formwork joints must be stopped and all debris must be removed from the space to be occupied by the concrete. All formwork joints must be sealed to prevent slurry loss. Formwork and all surfaces against which concrete is to be placed must be clean and must be thoroughly wetted with water. Concrete delivery chutes and tubes must also be clean and must be flushed with water before and after each concreting operation. All pipes, covers, frames, tubes, ducts and bolts which are to be embedded in the concrete together with formwork for structural openings, must be cleaned of loose rust, scale, paint, dirt and oil and must be secure in their specified positions prior to the placing of concrete.

Embedment must not be secured to the reinforcement by electrically conductive fixings. Where small embedment or openings obstruct the placement of reinforcement and special details are not shown on the drawings, the reinforcement must be displaced or bent in gradual curves around the embedment. Surfaces of forms, reinforcement and embedded materials that have become encrusted with dried mortar or grout from concrete previously placed must be cleaned of all such mortar or grout before the surrounding or adjacent concrete is placed.

##### **19.5.2 Gravity placing of concrete**

All concrete must be placed in position as soon as possible after the addition of mixing water. Concrete that has begun to set before its final compaction has been completed must be removed from the works.

### **19.5.3 Pumping of concrete**

If concrete placement by pumping is proposed, the concrete specification and pumping must be subject to approval by Synergy. Prior to pumping, the concrete discharge pipeline must be lubricated with mortar having the same proportions of cement to fine aggregate as the approved concrete mix to be discharged through it. The concrete must be pumped in a continuous uninterrupted process and a pump feed-hopper equipped with an agitator must be used to minimise segregation of concrete mix components. The delivery point of the pipeline must be continually relocated so as to avoid deposition of large quantities of concrete in any single location.

### **19.5.4 Maximum concrete lifts in structures**

The concrete must be placed in lifts not exceeding 2.5 metres in depth and these lifts must comprise layers not exceeding 500 mm in depth, except that the first layer of the first lift must not exceed 300 mm in depth. The placing procedures must be arranged so as to avoid cold joints between adjoining layers of a lift.

### **19.5.5 Prevention of segregation**

The methods and equipment used for transporting concrete and the duration of transportation operations must be such as will prevent segregation of coarse aggregate. In so far as practicable, concrete must be deposited directly in its final position in a manner which will avoid segregation.

### **19.5.6 Non-acceptance of retempered concrete**

The use of retempered concrete must not be permitted. Concrete that has begun to set prior to its placement and compaction in place must be removed and replaced at no additional cost to Synergy.

### **19.5.7 Control of concreting in rain**

Concrete (or mortar) must not be placed during rain unless adequately protected. Materials that have been subjected to rain must be removed and replaced.

### **19.5.8 Compaction of concrete**

Compaction of concrete in structures must be by immersion-type vibrators. Concrete vibrators must be operated at speeds of at least 10,000 vibrations per minute when immersed in the concrete. At least two such vibrators in working condition must be on the site at the commencement of each concrete placing. In consolidating each layer of concrete, the vibrator must be operated in a near vertical position and the vibrating head must be allowed to penetrate and revibrate the concrete in the upper portion of the underlying layer. Layers of concrete must not be placed until layers previously placed have been vibrated thoroughly. Contact of the vibrating head with surfaces of the forms must be minimised.

## 19.7 Surface finish of concrete

### 19.7.1 Formed surfaces

Location	Type of Finish
All exposed vertical faces	Class 2 to AS3610
All totally concealed formed faces	Class 5 to AS3610

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

### 19.7.2 Unformed concrete surfaces

Unformed surfaces which are permanently concealed must be screeded finish, consisting of levelling and screeding the concrete to produce an even uniform surface to a tolerance of 10 mm in 3 m.

### 19.7.3 Form oils and releasing agents

Form oils or releasing agents, if approved for use, must be of the stable and non-toxic type.

### 19.7.4 Removal of formwork

Formwork must be removed only in accordance with the minimum formwork stripping times set out in AS3610.

### 19.7.5 Curing preliminaries

All formwork which may be exposed to direct sunlight and which will support concrete during the curing operations must be wrapped with an approved absorbent cover fabric which will be maintained in a damp condition until completion of curing operations.

## 19.8 Curing of concrete

### 19.8.1 General

The contractor must submit for approval their proposed curing regime for all concrete work on this project a minimum of seven (7) days prior to any concrete construction.

Curing must be undertaken to satisfy short term requirements to prevent plastic cracking and long term requirements of ensuring continued cement hydration.

### 19.8.2 Initial concrete curing

The concrete must be kept moist from time of placement until surface finishing is completed by use of spraying a 'white coloured' evaporation retardant to prevent plastic shrinkage cracking and / or crusting.

### 19.8.3 Surfaces requiring bond

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

#### 19.8.4 Hardened concrete curing

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

- (a) prevent moisture evaporation from the concrete surface by covering completely with polythene sheeting or equivalent covering material securely held in position. The covering must be in full contact with the concrete surface. The edges of the sheeting must be taped or must be overlapped by at least 200 mm and the whole must be securely held in position. Any damage to or displacement of the sheeting during construction operations must immediately be made good. An additional measure for consideration is the top concrete surface must be kept continuously moist by the use of an absorbent cover being saturated with water and then immediately being covered by the polythene sheet;
- (b) pond or continuously sprinkle the surface with water. Intermittent curing, such as spraying with water once a day, is not acceptable;
- (c) apply an approved liquid curing compound to exposed concrete surfaces where approved by Synergy; and
- (d) do not allow any traffic to pass over or materials to be deposited on any concrete during its curing period without taking precautions to prevent damage to the concrete.

#### 19.8.5 Liquid curing compounds

General and specific characteristics of curing compounds and testing thereof must comply with the requirements of AS 3799. For each curing compound proposed for use a current certificate of compliance from the supplier must be provided. For each batch delivered, the contractor must provide a certificate of uniformity from the supplier.

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

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

The curing compound must be applied to unformed surfaces immediately after completion of all finishing operations, and to formed surfaces within 30 minutes of the removal of formwork from the section.

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

Any curing compound must be compatible with both the concrete mix and the applied finishes and must take account of all possible finishes (for example protective coatings) to be applied to the concrete, and consider concrete surface preparation for such finishes. If the curing membrane has an impact on the concrete surface preparation (for

example requiring blast cleaning removal) alternative curing methods must be considered.

## **19.9 STRUCTURAL CONCRETE JOINTWORK**

### **19.9.1 General**

Construction joints must include joints over which monolithic action of the concrete is required. Construction joints include those, which require grooving and sealing as shown in the drawings.

Construction joints must be located where shown on the drawings and must be vertical or horizontal, unless otherwise specified or approved by Synergy.

In the event of an unscheduled delay in a concreting operation, any proposal by the contractor to introduce an unplanned construction joint must be approved by Synergy. Synergy may direct removal of the concrete and replacement with fresh concrete at his discretion.

### **19.9.2 Concrete jointwork surface preparation**

As soon as placed concrete has set to the degree that its coarse aggregates cannot be dislodged by the specified cleaning processes, construction joint surfaces must be cleaned by sand blasting or wet scabbling which must remove all laitance, loose or defective concrete and other foreign materials. Joint surfaces must then be washed with water and excess water must be blown off by air-jetting or equivalent procedure.

The resulting joint surfaces must be flat, with clean and protruding coarse aggregate. After cleaning, construction joints must be kept continuously moist until the placement of the adjoining concrete.

## **19.10 WEATHER AND CONCRETE TEMPERATURE**

### **19.10.1 General**

The temperature of all concrete when it is being placed must not exceed 32 °C. Concrete must not be placed if the ambient temperature immediately prior to propose placing exceeds 38 °C or is less than 5 °C.

### **19.10.2 Moisture retention in concrete**

The contractor must provide a 0.25 mm plastic sheeting duly lapped over all natural surfaces and blinding layers on which structural concrete is to be placed so as to retain water in the fresh concrete.

### **19.10.3 Control of concrete placement period**

Whenever the ambient temperature is 32 °C or higher, concrete must be mixed, transported and compacted in place as rapidly as practicable. The period from commencement of mixing to final screeding or finishing of concrete must not exceed one (1) hour.

### **19.10.4 Exposed concrete surface protection**

Whenever the ambient temperature is 32 °C or higher, exposed surfaces of each structural concrete element must be shaded from the direct rays of the sun in an approved manner for at least ten (10) days after concreting of that element.

## **20 ATTACHMENTS**

Detailed design drawings:

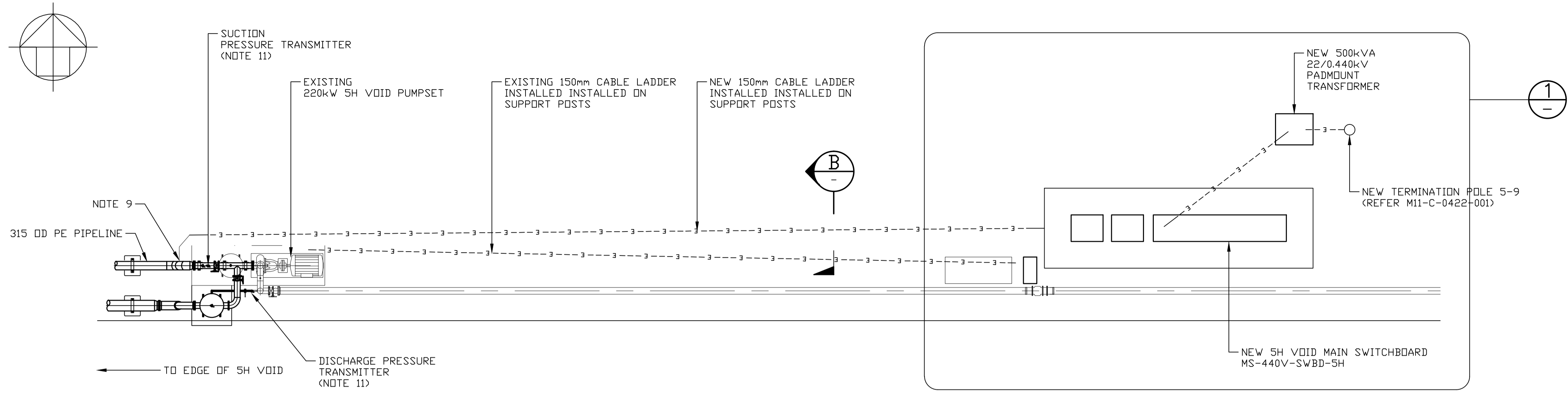
- (a) M10-C-0178-001 General arrangement;
- (b) M10-C-0180-001 Transfer pump station modifications;
- (c) M11-C-0424-001 Electrical site layout; and
- (d) M12-C-0108-001 Concrete bollards and pipe support details.











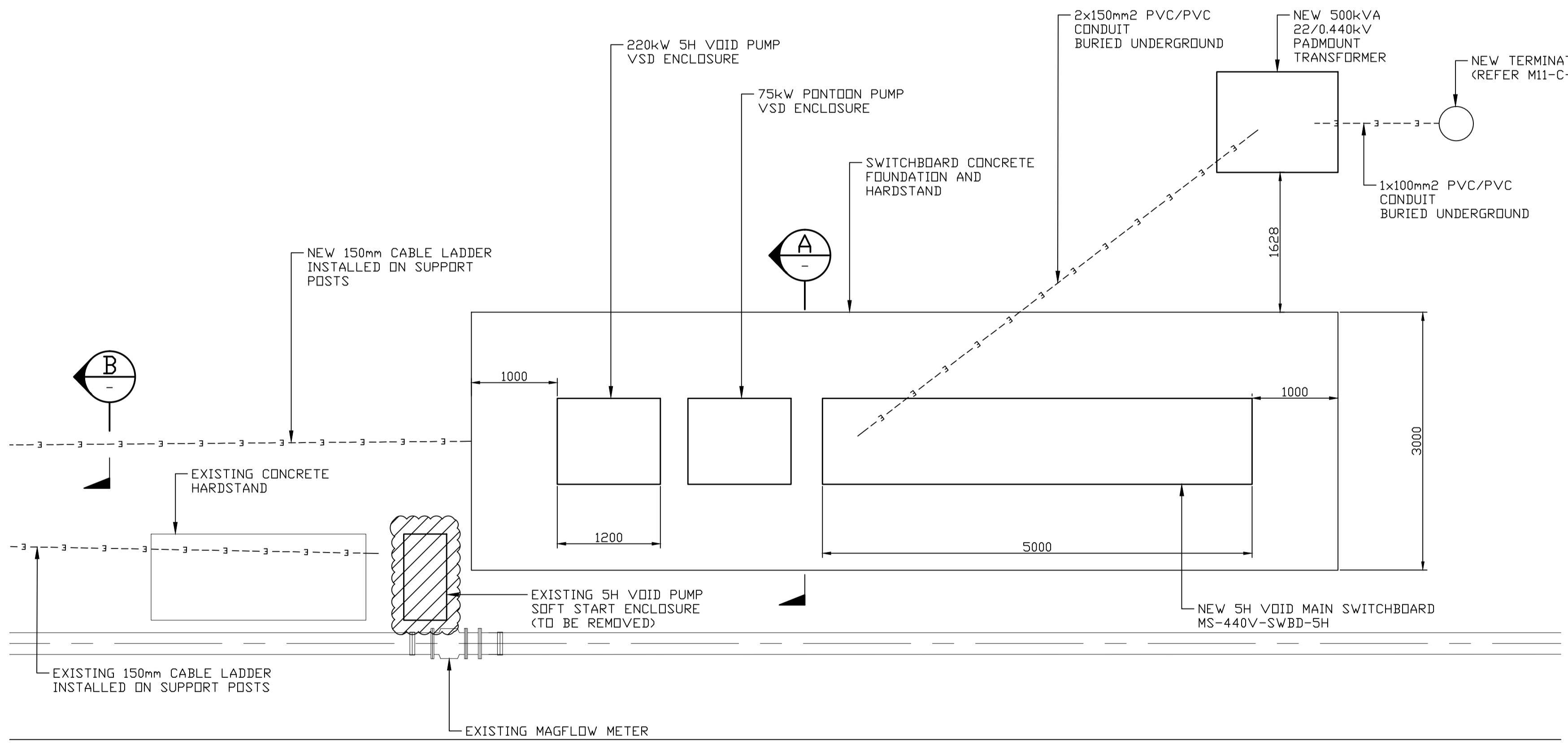
SITE LAYOUT

GENERAL NOTES

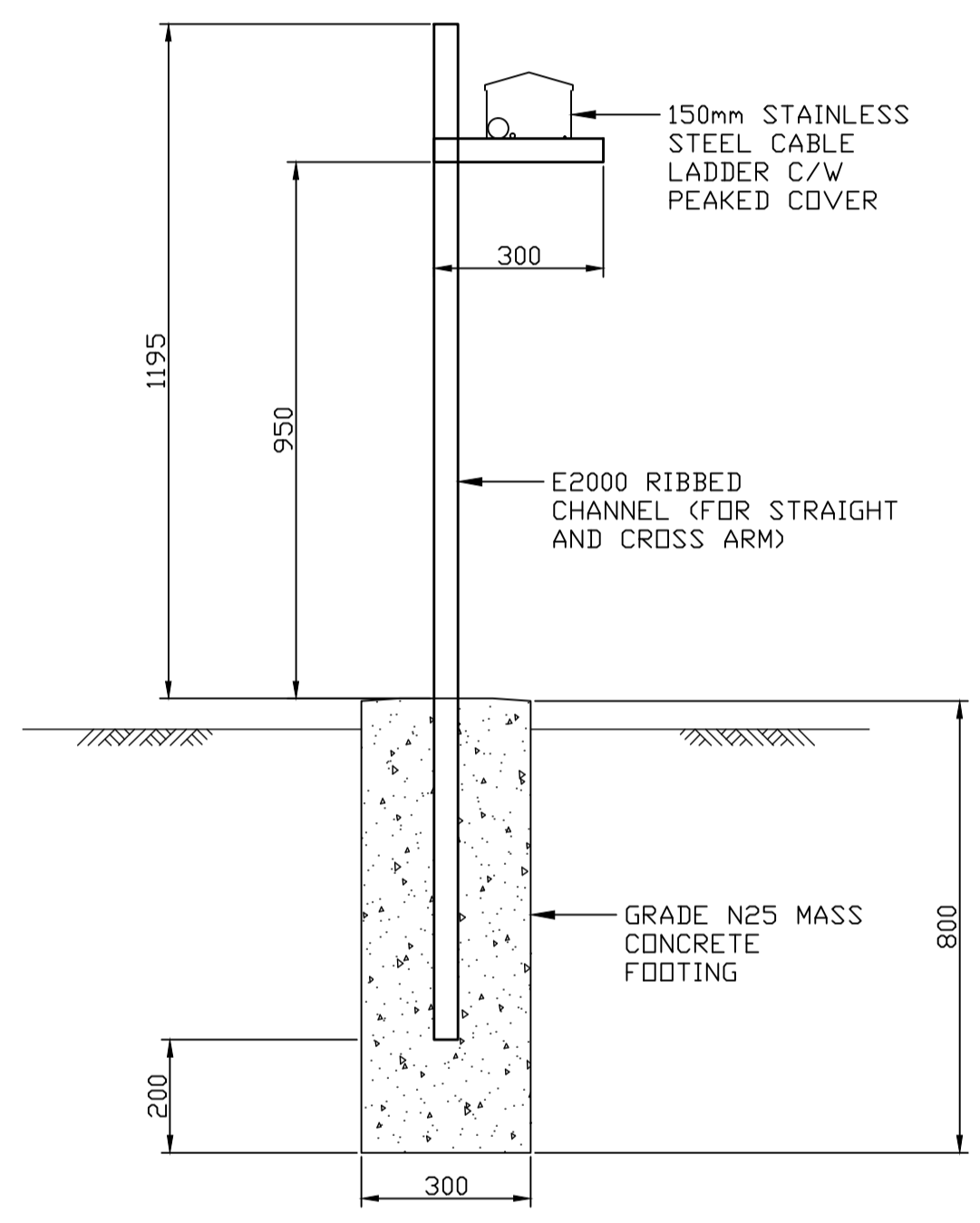
1. SITE LAYOUT IS BASED ON VISUAL SURVEY. POSITIONS AND DIMENSIONS OF EXISTING AND NEW EQUIPMENT TO BE CONFIRMED BASED ON FACTUAL LAND SURVEY DATA AND EQUIPMENT VENDOR DATA.
2. ALL DIMENSIONS GIVEN IN MM.
3. NEW 500kVA PADMOUNT TRANSFORMER TO INCLUDE CONCRETE FOUNDATION.
4. AREA AROUND NEW SWITCHBOARD, TRANSFORMER AND TERMINATION POLE TO BE CLEARED AND LEVELLED PRIOR TO POURING OF FOUNDATION AND INSTALLATION OF EQUIPMENT.
5. NEW SWITCHBOARD AND VSD CUBICLES TO BE MOUNTED ON 500mm HIGH STAINLESS STEEL SUPPORT STANDS TO FACILITATE INSTALLATION OF CABLES BETWEEN SWITCHBOARD, CUBICLES AND FIELD EQUIPMENT.
6. EXISTING 150mm CABLE LADDER TO BE USED TO INSTALL CABLE BETWEEN VSD CUBICLE AND 220kW PUMPSET.
7. SWITCHBOARD AND VSD CONCRETE FOUNDATION DETAILS TO BE FINALISED FOLLOWING WEIGHT AND DIMENSION DATA FROM EQUIPMENT VENDOR.
8. INSTALLATION DEPTH OF CABLE SUPPORTS TO BE CONFIRMED BASED ON SOIL INFORMATION ON SITE.
9. AT THE END OF THE NEW CABLE SUPPORT RUN FOR THE PONTON PUMP, CABLES TO BE STRAPPED ON TO THE 315 OD PIPE RUN TO THE PONTON PUMP.
10. FOR CONCRETE DETAILS, REFER NOTE C3 ON M12-C-0108-001 & THE CONCRETE SCOPE OF WORKS.
11. CONTRACTOR TO SITE RUN CONDUIT FROM CABLE ABOVE GROUND CABLE LADDER TO PRESSURE TRANSMITTERS.

HOLDS

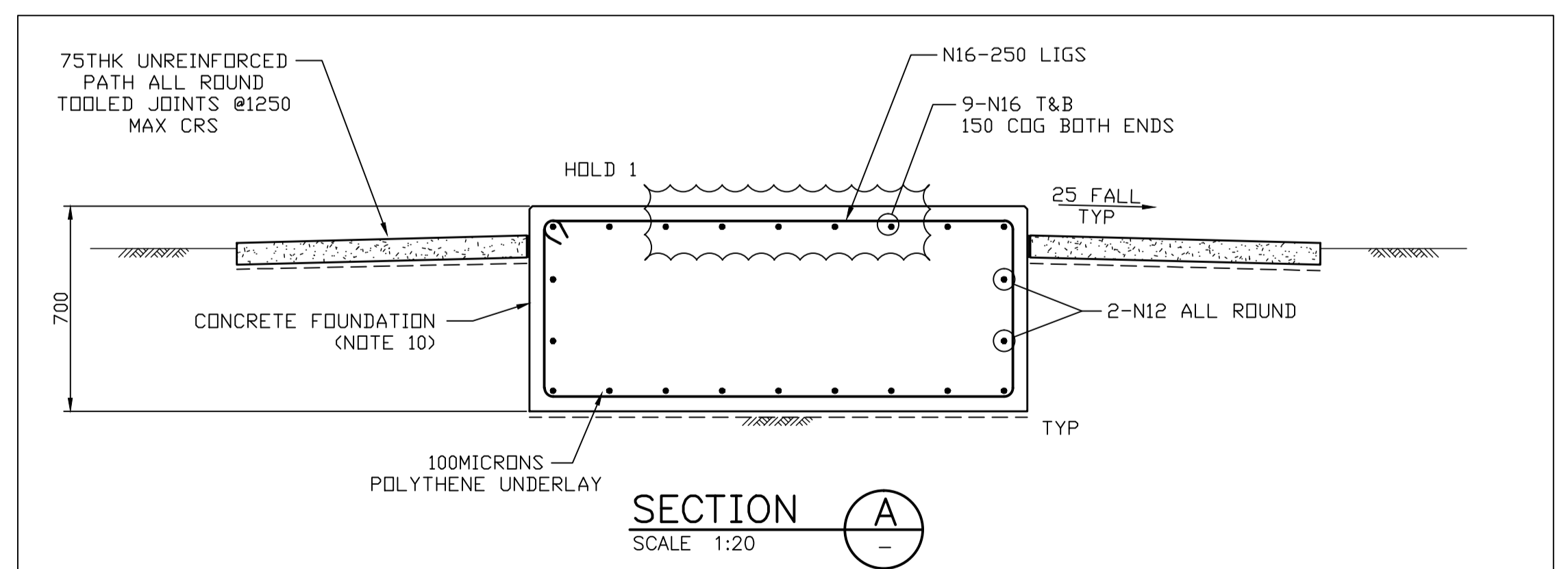
1. ANCHOR BOLTS AND CONDUIT PENETRATIONS TO BE CONFIRMED FOLLOWING CONFIRMATION FROM SWITCHBOARD VENDOR.



DETAIL 1 SCALE 1:40



SECTION B SCALE 1:12.5



SECTION A SCALE 1:20

DRAWING No	TITLE
M-S-9023-001	22kV CWRP AREA RETICULATION SINGLE LINE DIAGRAM
M11-C-0142-001	LEGACY 5H VOID MAIN SWITCHBOARD SINGLE LINE DIAGRAM
M11-C-0419-001	POWER RETICULATION - GUY ANCHOR DETAILS
M11-C-0420-001	22kV OHTL - POLE P5-7 DETAIL
M11-C-0421-001	22kV OHTL - POLE P5-8 DETAIL
M11-C-0422-001	22kV OHTL - POLE P5-9 DETAIL
M11-C-0423-001	22kV LINE EXTENSION - PLAN AND PROFILE
M11-C-0425-001	MS-440V-SWBD-5H SINGLE LINE DIAGRAM

MUJA POWER STATION  
COMMON PLANT  
BORE WATER  
5H VOID  
ELECTRICAL SITE LAYOUT

DRAWN	D. OLADJO	05.09.18	DRAWING NUMBER	M11-C-0424-001
CHECKED	E. BAHRAM	15.10.18		
APPROVED	G. SZOZDA	15.10.18		
<p>SCALE 1: 100 U.O.N.</p>				
NEXT SHT		REVISION A		

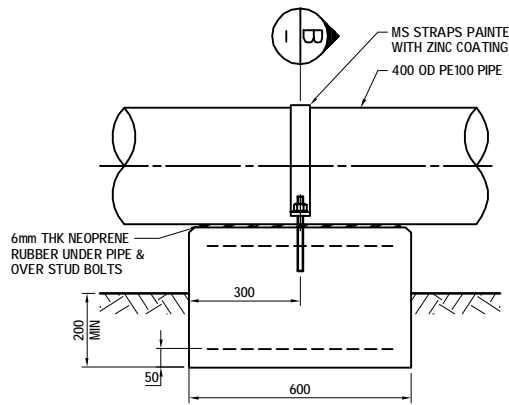
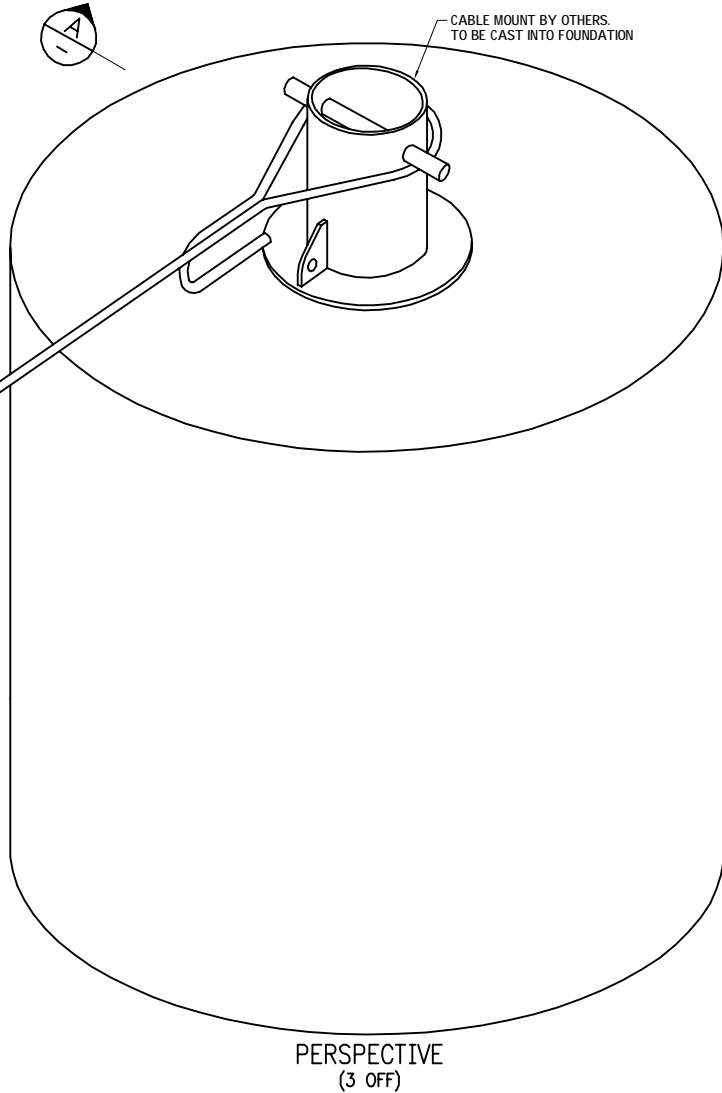


REV	DATE	DRWN	CHK'D	APP'D	DESCRIPTION
A	15.10.18	DO	EB	GS	APPROVED FOR CONSTRUCTION

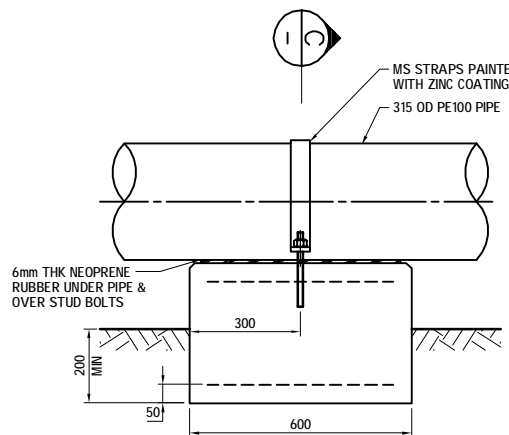
DRAWING REVISIONS

DRAWING REFERENCES

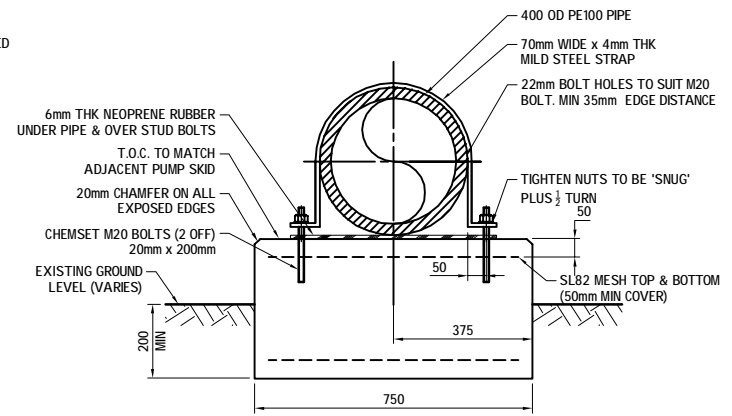
(d) M12-C-0108-001 Concrete bollards and pip support details



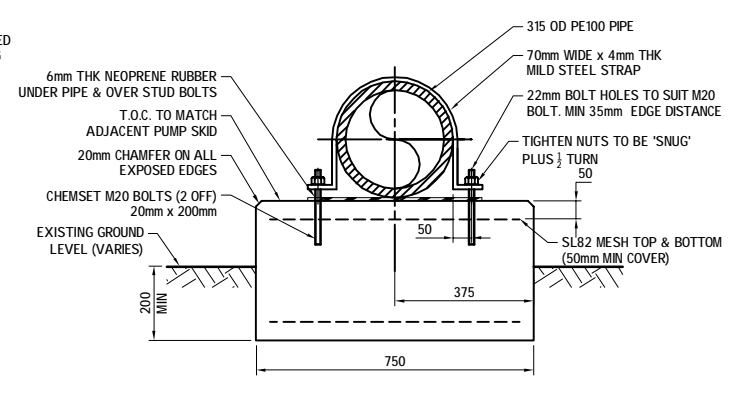
400 OD PIPE SUPPORT BLOCK



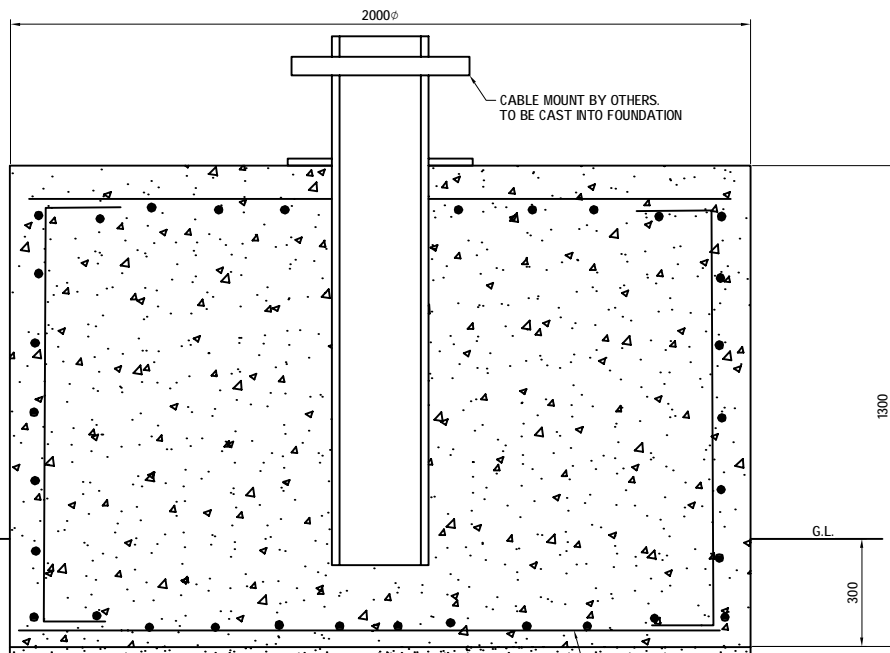
315 OD PIPE SUPPORT BLOCK



SECTION B



SECTION C



SECTION A

- GENERAL NOTES**
- THESE DRAWINGS SHALL BE READ IN CONJUNCTION WITH ALL OTHER DRAWINGS AND SPECIFICATIONS AND WITH SUCH OTHER WRITTEN INSTRUCTIONS AS MAY BE ISSUED DURING THE COURSE OF THE CONTRACT. ALL DISCREPANCIES SHALL BE REFERRED TO THE ENGINEER FOR DECISION BEFORE PROCEEDING WITH WORK.
  - ALL MATERIALS AND WORKMANSHIP SHALL BE IN ACCORDANCE WITH THE RELEVANT AND CURRENT AUSTRALIAN STANDARD AND WITH THE BY-LAWS AND ORDINANCES OF THE RELEVANT AUTHORITY EXCEPT WHERE VARYED BY THE PROJECT SPECIFICATION.
  - UNLESS NOTED OTHERWISE, ALL LEVELS ARE IN METRES AND ALL DIMENSIONS ARE IN MILLIMETRES.
  - THESE ENGINEERING DRAWINGS HAVE BEEN PREPARED FROM INFORMATION AVAILABLE AT THE TIME OF ISSUE. AS THIS INFORMATION MAY BE SUBJECT TO CHANGE PRIOR TO OR DURING CONSTRUCTION THE CONTRACTOR IS TO ADVISE THE ENGINEER WHERE DISCREPANCIES OCCUR.
  - THE CONTRACTOR SHALL BE RESPONSIBLE FOR ENSURING THAT SUFFICIENT TOLERANCES ARE PROVIDED AND INTEGRATED THROUGHOUT ALL ELEMENTS OF THE WORKS.
  - THE CONTRACTOR SHALL BE RESPONSIBLE FOR ENSURING THAT SUFFICIENT TOLERANCES ARE PROVIDED AND INTEGRATED THROUGHOUT ALL ELEMENTS OF THE WORKS.
- CONCRETE NOTES**
- ALL WORKMANSHIP AND MATERIALS SHALL BE IN ACCORDANCE WITH AS 3600 AND THE CONCRETE SPECIFICATION.
  - CONCRETE SHALL BE FROM AN APPROVED SOURCE AND SHALL COMPLY WITH THE REQUIREMENTS OF THE FOLLOWING STANDARDS, UNLESS NOTED OTHERWISE :-
    - AS 3600 - CONCRETE STRUCTURES
    - AS 4671 - STEEL REINFORCING BARS FOR CONCRETE
    - AS 3972 - PORTLAND CEMENT
    - AS 1379 - READY-MIXED CONCRETE
    - AS 2758.1 - CONCRETE AGGREGATES
  - CONCRETE SHALL BE SUPPLIED ON A PERFORMANCE BASIS AND HAVE THE FOLLOWING CHARACTERISTICS :-
 

ELEMENT	STRENGTH f <sub>c</sub> (MPa) CLASS GP	MAXIMUM AGGREGATE SIZE (mm)	SLUMP (mm)
SAND BLINDING	25	-	80
PAD FOOTINGS	32	20	80
- CONCRETE MIX DESIGN, INCLUDING PROPORTIONS OF ADDITIVES AND CEMENTITIOUS REPLACEMENT MATERIALS, SHALL BE SUBMITTED FOR APPROVAL PRIOR TO THE PLACEMENT OF ANY CONCRETE. CALCIUM CHLORIDE SHALL NOT BE USED IN ANY MIX. FLYASH IS NOT TO BE USED AS A CEMENT REPLACEMENT BUT MAY BE ADDED FOR WORKABILITY TO A MAXIMUM 25% OF CEMENT CONTENT.
- CONCRETE COVER TO REINFORCEMENT SHALL BE AS FOLLOWS UNLESS NOTED ON DRAWING.
  - THE FINISHED CONCRETE SHALL BE A DENSE HOMOGENEOUS MASS, COMPLETELY FILLING THE FORMWORK THOROUGHLY EMBEDDING THE REINFORCEMENT AND FREE OF STONE POCKETS.
  - ALL FORMED EXPOSED EDGES AND RE-ENTRANT CORNERS SHALL BE CHAMFERED OR FILLETED 15MM UNLESS NOTED.
  - NO PENETRATIONS, CHASES OR TEMPORARY FIXTURES OTHER THAN THOSE SHOWN ON THE STRUCTURAL DRAWINGS, ARE PERMITTED IN THE CONCRETE MEMBERS WITHOUT PRIOR APPROVAL OF THE ENGINEER.
  - ALL CONCRETE SHALL BE COMPACTED USING VIBRATION EQUIPMENT AS FOLLOWS :-
    - USE IMMERSION TYPE VIBRATORS VERTICALLY, NOT HORIZONTALLY, IN OVERLAPPING SPOT PATTERN AND/OR VIBRATING SCREED. VIBRATION IN EACH LOCATION SHOULD CONTINUE UNTIL AIR BUBBLES CEASE TO APPEAR (GENERALLY AFTER 20-30 SECONDS).
  - THE CONCRETE SHALL BE TESTED FOR COMPLIANCE BY PROJECT CONTROL TESTING. SUBMIT COPIES OF TEST RESULTS TO ENGINEER FOR REVIEW.
  - INITIAL CURING OF CONCRETE SHALL COMMENCE NO LATER THAN 2 HOURS AFTER FINISHING OPERATIONS HAVE BEEN COMPLETED. THE CONCRETE SHALL BE KEPT CONTINUOUSLY MOIST AT LEAST OVERNIGHT BY :-
    - i) PONDING OR CONTINUOUS SPRINKLING WITH WATER
    - ii) USE OF AN ABSORPTIVE COVER KEPT CONTINUOUSLY WET
    - iii) COATING WITH AN APPROVED SPRAYED MEMBRANE CURING COMPOUND COMPLYING WITH AS 3799
  - FINAL CURING SHALL IMMEDIATELY FOLLOW INITIAL CURING AND SHALL BE CONTINUED FOR 7 DAYS. ONE OF THE FOLLOWING CURING METHODS SHALL BE ADOPTED FOR FINAL CURING :-
    - i) PONDING OR CONTINUOUS SPRINKLING WITH WATER USE OF AN APPROVED MOISTURE RETAINING COVERING SUCH AS HEAVY GAUGE CLEAR
    - ii) POLYETHYLENE SHEETING OR BUILDING PAPER, FIRMLY HELD AGAINST THE CONCRETE SURFACES TO PREVENT AIR CIRCULATION AT THE CONCRETE SURFACES. SUCH COVERS SHALL BE MAINTAINED UNDAMAGED DURING THE CURING PERIOD.
    - iii) COATING WITH AN APPROVED SPRAYED MEMBRANE CURING COMPOUND COMPLYING WITH AS 3799.
  - MINIMUM FORMWORK STRIPPING TIMES TO BE IN ACCORDANCE WITH AS 3610-1995. FORMWORK CLASS 3. STRIPPING TIMES - FORMWORK MAY BE STRIPPED AFTER THE FOLLOWING:-
    - VERTICAL ELEMENTS = 2 DAYS

- REINFORCEMENT**
- REINFORCEMENT SHOWN ON THE DRAWINGS IS REPRESENTED DIAGRAMMATICALLY AND NOT NECESSARILY SHOWN IN TRUE PROJECTION.
  - SPLICING IN REINFORCEMENT SHALL BE MADE ONLY IN THE POSITION SHOWN ON THE DRAWINGS OR AS OTHERWISE APPROVED BY THE ENGINEER. WHERE THE LAP LENGTH IS NOT SHOWN IT SHALL BE SUFFICIENT TO DEVELOP THE FULL STRENGTH OF THE REINFORCEMENT. BAR LAPS IN MILLIMETRES ARE TO BE AS SHOWN BELOW UNLESS SHOWN OTHERWISE :-
    - N12 .....500
    - N16 .....650
  - REINFORCEMENT SYMBOLS :-
    - N - DENOTES GRADE 500N HIGH YIELD DEFORMED BARS TO AS 4671
  - REINFORCEMENT ABBREVIATIONS :-
    - EF .....EACH FACE
    - EW .....EACH WAY
  - WELDING OF REINFORCEMENT IS NOT PERMITTED UNLESS SHOWN ON THE DRAWINGS OR APPROVED BY THE ENGINEER.
  - ALL REINFORCEMENT SHALL BE FIRMLY SUPPORTED ON PLASTIC CHAIRS OR CONCRETE CHAIRS AT NOT GREATER THAN 1 METRE CENTRES BOTH WAYS. ALL REINFORCEMENT SHALL BE SECURELY TIED WITH GALVANISED WIRE TIES AND ALL THE ENDS SHALL BE TURNED INTO THE MEMBER CLEAR OF THE COVER ZONE. MESH SHALL BE SUPPORTED ON PLASTIC OR CONCRETE CHAIRS AT 800 MAXIMUM CENTRES. REINFORCEMENT DEVELOPMENT LENGTHS SHALL EQUAL LAP LENGTHS. THE ENGINEER SHALL BE GIVEN A MINIMUM OF 24 HOURS NOTICE FOR REINFORCEMENT INSPECTION AND CONCRETE SHALL NOT BE DELIVERED UNTIL FINAL APPROVAL IS OBTAINED.

APPROVED FOR CONSTRUCTION

REV	DATE	DRWN	CHK'D	APP'D	DESCRIPTION
A	15.10.18	CYC	AL	GS	ISSUED FOR CONSTRUCTION

DRAWING No	TITLE
M10-C-0180-001	TRANSFER PUMP STATION - MODIFICATIONS
M10-C-0178-001	GENERAL ARRANGEMENT

**MUJA POWER STATION**

COMMON PLANT  
BORE WATER  
5H VOID  
PONTON PUMP BOLLARD & PIPE SUPPORT  
DETAILS

DRAWN	C.CARNEVALI	15.10.18
CHECKED	A.LEEDMAN	15.10.18
APPROVED	G.SZOZDA	15.10.18

**JACOBS**

JOB No. IW182200  
Durack Centre, 263 Adelaide Terrace, Perth, W.A. 6000

DRAWING NUMBER  
**M12-C-0108-001**

SCALE 1: 10 U.O.N.

synergy

NEXT SHT  
REVISION  
A



# SCOPE OF WORK



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**Project:** Muja power station  
EP-10256 5H void pump upgrade  
Electrical instrumentation control

**Date:** 05 March  
2019

**Business Unit:** Generation

**Prepared by:** Jacobs Engineering and Synergy

**For approval by:** Dave Lewis, project manager

---



This document must not be made available to persons outside Synergy without prior written approval of Synergy

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**7 ATTACHMENTS ..... 7**

## 1 INTRODUCTION

Synergy is Western Australia's largest electricity generator and retailer of electricity and gas with more than one million residential, business and industry customers.

Synergy generates electricity using a range of non-renewable and renewable energy sources.

- (a) our major power stations are located in Collie, Kwinana and Pinjar;
- (b) smaller regional power stations are located at Mungarra and West Kalgoorlie; and
- (c) we have wind farms at Albany, Esperance, and Kalbarri, a solar farm near Geraldton, wind-diesel power plants in Bremer Bay, Coral Bay, Denham and Hopetoun, and a solar battery storage facility at Alkimos.

More details relating to Synergy can be found at – [www.synergy.net.au](http://www.synergy.net.au).

## 2 BACKGROUND

5H void is an ex mining pit which holds a volume of water that is accessible to Synergy to use for the purpose of power generation at its Collie and Muja power stations. To maximise the use of mine dewater, Synergy intends to transfer between 50 and 150 L/s of water to the existing Muja power station surge ponds and to pump down 5H void to a future target level of 182 m RL. The onshore pump station arrangement is unable to meet these requirements without an upgrade. The purpose of the project is to increase Synergy's capability of drawing water from the void in order to secure future water resource availability.

To achieve flowrate of 50 – 150 L/s to the existing surge ponds and to pump down 5H void to a future target level of 182 m RL, a new floating pontoon pump must be installed in the 5H void, to maintain a minimum of 10 m pressure at the inlet of existing onshore based centrifugal pump. Both the pumps will be coupled with VSDs. New pressure transmitters must also be installed for control and protection of the equipment, while continuing to utilise existing flowmeter (FT-111, as per the PID: [M-S-1067/21](#)) for flow control of the future system.

This scope of works (**SoW**) covers the electrical, instrumentation and control works required for the upgrade to the onshore pump station.

### 3 DETAILED SCOPE OF WORK

The detailed SoW shall include, but not be limited to:

#### 3.1 New 5H void main switchboard and VSD cubicles

- (a) supply, install, test and commission the new main switchboard and VSD cubicles in accordance with the design drawings, specifications and datasheets;
- (b) undertake required earthworks at the proposed location of the switchboard to facilitate installation;
- (c) supply, install, test, terminate and commission the upstream and downstream circuits fed from the new main switchboard. Specifically, the contractor must complete the connection for the following:
  - (i) power and control cables connection from the 500 kVA transformer to the new main switchboard;
  - (ii) power and control cables to and from the new 225 kW onshore pump VSD cubicle;
  - (iii) power and control cables and from the new 75 kW pontoon pump VSD cubicle;
  - (iv) power and control cables to the existing magnetic flow meter;
  - (v) power cables to the 75 kW pontoon pump and 220 kW onshore pump anti condensation heaters; and
  - (vi) power cable to new RTU cubicle adjacent to legacy premier coal switchboard. Existing 185 mm<sup>2</sup> cable to be reused and extended / jointed with 2.5 mm<sup>2</sup> cable to complete circuit between the new switchboard and the new RTU cubicle.
- (d) supply, install, test and commission underground and above ground cable conveyance to facilitate the installation to and from new switchboard, transformer, VSD cubicles, and final loads and in accordance with the design drawings; and
- (e) undertake earth resistivity testing (where required) to determine size and installation depth for earth electrode. The contractor is then required to supply, install, test and commission the electrode and overall protective earth system.

#### 3.2 New 5H void 500 kVA 22 / 0.433 kV transformer

- (a) supply, install, test and commission the new 500 kVA 22 / 0.440 kV padmount transformer in accordance with the design drawings, specifications and datasheets; and
- (b) undertake required earthworks at the proposed location of the transformer to facilitate installation.

**3.3 Modifications to legacy 5H void switchboard (Premier Coal switchboard)**

- (a) disconnect and remove existing power meter from switchboard. Power meter to be provided to Synergy following removal. All exposed penetrations and cut-outs resulting from removal must be appropriately covered and sealed; and
- (b) disconnect and remove 185 mm<sup>2</sup> 3C+E cable from switchboard. Cable penetrations to be appropriately covered and sealed following removal.

**3.4 New 22 kV distribution line**

- (a) supply, install, test and commission the new 22 kV distribution line from existing pole 5-7 to the proposed location of the 5H void in accordance with the design drawings and specifications.

**3.5 Existing soft starter cubicle**

- (a) disconnect all cables upstream and downstream of soft starter cubicle, followed by removal of cubicle from the 5H void. The cubicle must be provided to Synergy following removal.

**3.6 22 kV overhead distribution line survey and geotech**

- (a) the contractor must undertake a survey along the proposed route of the 22 kV distribution line extension to confirm the proposed alignment of the new distribution line. The information collected from the survey must be used to finalise the design of the distribution line; and
- (b) the contractor must undertake a geotechnical investigation along the route of the 22 kV distribution line extension to confirm. The results of the investigation must be used to confirm and finalize the design of the 22 kV distribution line.

**3.7 New pressure transmitter PT-113 (onshore pump suction)**

- (a) supply, install, test and calibrate onshore pump suction pressure transmitter PT-113 as per equipment datasheet and standard installation manual attached herewith;
- (b) supply and install, crimp lugs and terminate 1 pair 1.5 mm<sup>2</sup>, screened, 7 / 0.50, (1.5 mm<sup>2</sup>) Dekron cable from onshore pump suction pressure transmitter PT-113 to pontoon pump P-112 VSD2 inside new 5H void switchboard enclosure; and
- (c) supply and install all cable and wiring labels from pump suction pressure transmitter 00GAF00CP001 to VSD2, as per attached cable block diagram.



**3.8 New pressure transmitter PT-114 (onshore pump discharge):**

- (a) supply, install, test and calibrate onshore pump discharge pressure transmitter PT-114 as per equipment datasheet and standard installation manual attached herewith;
- (b) supply and install, crimp lugs and terminate one pair 1.5 mm<sup>2</sup>, screened, 7 / 0.50, (1.5 mm<sup>2</sup>) Dekron cable from onshore pump discharge pressure transmitter PT-114 to onshore pump P-111 VSD1 inside new 5H void switchboard enclosure; and
- (c) supply and install all cable and wiring labels from onshore pump discharge pressure transmitter PT-114 to VSD1, as per attached cable block diagram.

**3.9 Replacement of existing magnetic flow transmitter FT-111:**

- (a) supply, install, test and calibrate 5H void flow magnetic transmitter FT-111 as per equipment datasheet and standard installation manual attached herewith;
- (b) supply and install, crimp lugs and terminate one pair 1.5 mm<sup>2</sup>, screened, 7 / 0.50, (1.5 mm<sup>2</sup>) Dekron cable from 5H void flow transmitter FT-111 to onshore pump P-111 VSD1 inside new 5H void switchboard enclosure;
- (c) supply and install, crimp lugs and terminate C2.5-2E power supply cable 5H void switchboard to 5H void flow transmitter FT-111 as per M11-C-0425-001 SLD; and
- (d) supply and install all cable and wiring labels from 5H void flow transmitter FT-111 to VSD1, as per as per attached SLD and cable block diagram.

**3.10 VSD 1 onshore pump P-111**

- (a) supply and install, crimp lugs and terminate C1.5+4E, 1.5 mm<sup>2</sup>, white numbered cores, non SWA cable from VSD1 to RTU1 inside new 5H void switchboard enclosure;
- (b) supply and install, crimp lugs and terminate one pair 1.5 mm<sup>2</sup>, screened, 7 / 0.50, (1.5 mm<sup>2</sup>) Dekron cable from VSD1 to RTU1 inside new 5H void switchboard enclosure;
- (c) supply and install, crimp lugs and terminate two pair Belden 82842 RS-485 cable from new 5H void switchboard to VSD1;
- (d) supply and install, crimp lugs and terminate two pair Belden 82842 RS-485 cable from VSD1 to VSD2; and
- (e) supply and install all cable and wiring labels, as per as per attached cable block diagram.

### 3.12 VSD2 new pontoon pump P-112

- (a) supply and install, crimp lugs and terminate C1.5+4E, 1.5 mm<sup>2</sup>, white numbered cores, non SWA cable from VSD2 to RTU1 inside new 5H void switchboard enclosure;
- (b) supply and install, crimp lugs and terminate two pair Belden 82842 RS-485 cable from VSD2 to RTU1; and
- (c) supply and install all cable and wiring labels from VSD2 to RTU1, as per as per attached cable block diagram.

### 3.13 Remote terminal units 1 and 2 (RTU1 and RTU2)

- (a) conduct a radio survey and provide a detailed report for validating viable line of sight radio paths between RTU1 $\leftrightarrow$ RTU2 $\leftrightarrow$ CWRF. Additionally, investigate option for eliminating need of RTU2 (direct link from RTU1 to CWRF) if radio survey results prove it feasible. Cost impact of modification to be provided (e.g. additional cost associated with higher RTU antenna vs. elimination of RTU2);
- (b) supply and install, configure, test and commission main RTU1, located in the new 5H void main switchboard, based on the drawings, functional description document and I/O list;
- (c) supply and install, configure, test and commission transceiver RTU2 including IP-67 enclosure mounted on the legacy 5H void switchboard, based on the design drawings, functional description document and I/O list;
- (d) interface RTU1 to switchboard circuit breakers as per I/O list and cable block diagram;
- (e) modify CWRF SCADA HMI and logic to accommodate interface to the new RTU2 (refer [IW182200-EMM-LST-001](#) for communication I/O list);
- (f) establish radio communication link between the RTU1, RTU2 and the CWRF. test and prove functionality;
- (g) implement operator's interface at the CWRF HMI to allow system start / stop and "line filling" commands and flow setpoint adjustment; and
- (h) all equipment must be installed in accordance to the OEM manuals and recommendations.

### **3.15 Acceptance testing and documentation**

- (a) all work performed and all materials furnished under this SoW must comply with applicable statutory requirements of Federal, State and Local authorities, and must conform to the requirements of this SoW and Synergy standard specifications;
- (b) all equipment installed must be inspected and tested for electrical safety by the licensed electrician performing the work;
- (c) the contractor must provide full set of ITP's at the completion of the works, prior to any equipment energisation;
- (d) the contractor must provide complete set of installation, operation, maintenance and spare parts manuals (electronic only) for all equipment supplied, and the documentation must be referenced to the equipment schedule;
- (e) all deliverables must meet the design requirements as discussed in this section and the data sheet, functional description, cable block diagram for example in appendices;
- (f) the contractor must provide temperature rise calculations for the VSD enclosures, main switchboard and padmount transformer as part of their tender submission. The effects of forced cooling, air-conditioning, enclosure design / IP rating, solar heating and heat exchanges must also be included in the calculations;
- (g) for VSD's the contractor must include calculations detailing and confirming the life expectancy of the capacitors; and
- (h) the contractor must complete their design of to the requirements of AS/NZS 3000 and AS/NZS 2067 and must provide documentation, calculations and test certificates to support and validate the design. Detailed schematics, general arrangements, materials lists, and a list of settings must be provided for applicable equipment.

### **3.16 Work excluded**

The following is excluded from this SoW:

- (a) pontoon pump installation;
- (b) civil and concrete works associated with the switchboard slab; and
- (c) all mechanical works.

## **4 SITE LOCATIONS**

The contractor's installation support work will take place at the 5H void adjacent to Muja power station, Boys Home Road, Palmer WA. All contractor's personnel will be required to complete the necessary site inductions.

## 5 SPECIFICATIONS AND DRAWINGS

- (a) Drawings must be supplied in Bentley Systems MicroStation version v8i SELECT series 3 to ensure conformance to Muja power station site requirements.
- (b) Please refer to the Synergy computer aided design and practices standards for all the details relating to drawing formats and requirements. The standards are available to be viewed and downloaded at <https://www.synergy.net.au/suppliers>.

The following documentations are to be provided by the contractor:

- (a) on-site radio survey report;
- (b) function design specification;
- (c) dimensioned general arrangement drawings (plan and elevation view);
- (d) loop drawings;
- (e) schematics drawings;
- (f) single line diagram;
- (g) electrical site layout drawing;
- (h) electrical equipment list;
- (i) termination diagrams;
- (j) fat and sat procedure;
- (k) commissioning plan; and
- (l) operation and maintenance manuals.

## 6 OCCUPATIONAL, HEALTH AND SAFETY MANAGEMENT

All completed works must be compliant with the relevant legislative obligations and statutory requirements:

- (a) OHS act WA 1984;
- (b) OHS regulations 1996;
- (c) all other relevant Western Australian legislation;
- (d) relevant Australian standards including those denoted on supplied drawings; and
- (e) relevant industry codes of practices.

## 7 ATTACHMENTS

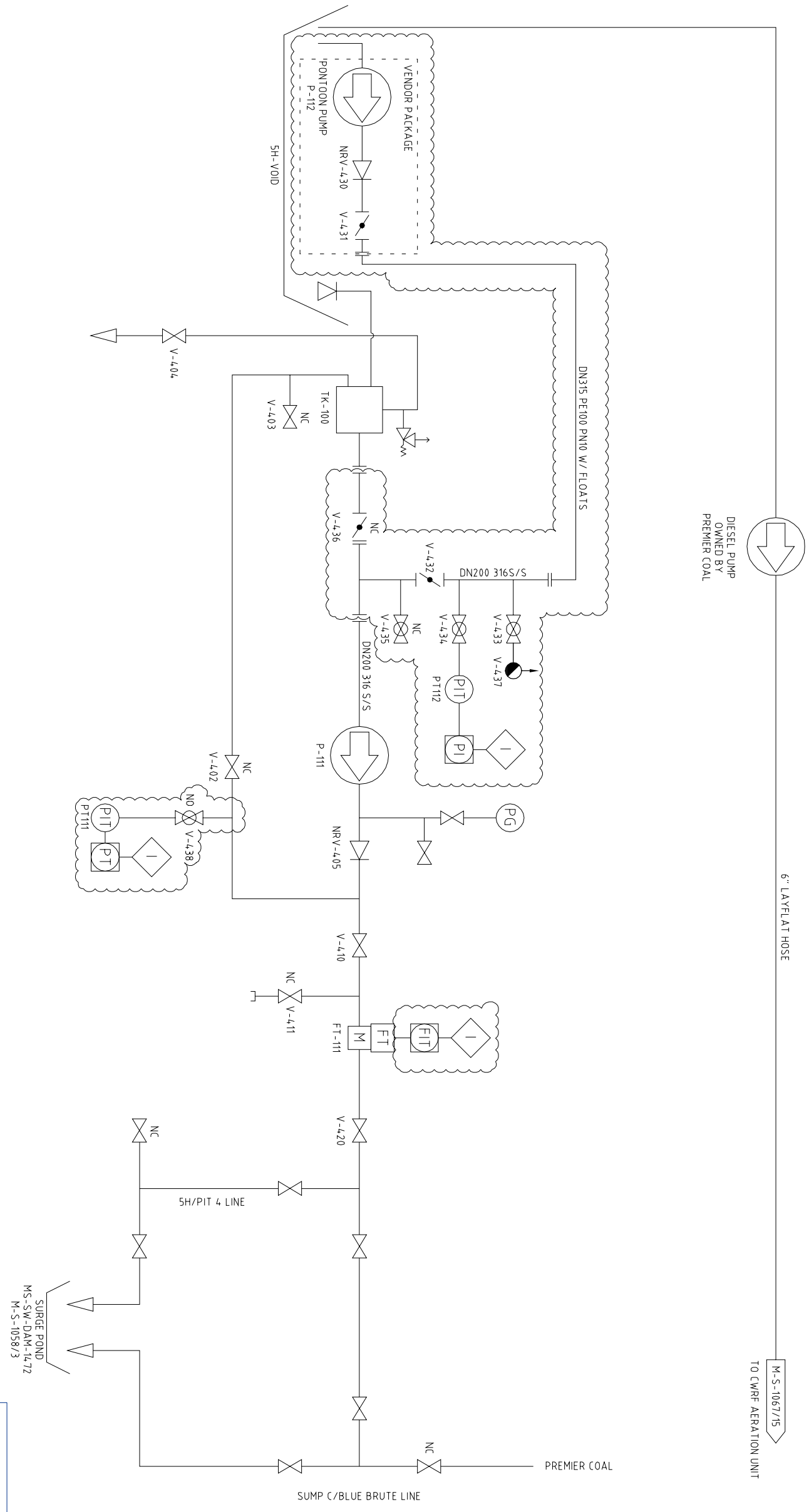
- (a) Attachment A EI&C Drawings;
  - (i) [M-S-1067-021](#) 5H void P&ID;

- (ii) [M11-C-0419-001](#) Power reticulation guy anchor details;
  - (iii) [M11-C-0420-001](#) 22kV OHTL pole 5-7 arrangement;
  - (iv) [M11-C-0421-001](#) 22kV OHTL pole 5-8 arrangement;
  - (v) [M11-C-0422-001](#) 22kV OHTL pole 5-9 arrangement;
  - (vi) [M11-C-0423-001](#) 22kV OHTL plan and profile;
  - (vii) [M11-C-0424-001](#) 5H void electrical site layout drawing;
  - (viii) [M11-C-0425-001](#) New 5H void main switchboard single line diagram;
  - (ix) [M11-C-0426-001](#) I&C Cable Block Diagram; and
  - (x) [M-S-9023-001](#) CWRP 22kV Area Single Line Diagram.
- (b) [Attachment B](#) IW182200-EJ-FD-0001: Functional description;
  - (c) Attachment C Not Used;
  - (d) [Attachment D](#) IW182200-EMM-LST-001: I/O list;
  - (e) [Attachment E](#) IW182200-EMM-LST-002: Cable list;
  - (f) [Attachment F](#) IW182200-EMM-LST-003: Alarm list;
  - (g) [Attachment G](#) IW182200-EMM-LST-004: Equipment list;
  - (h) [Attachment H](#) Electrical and instrumentation equipment datasheets;
  - (i) [Attachment I](#) IW182200-EE-DST-0001 – New 5H void main switchboard datasheet;
  - (j) [Attachment J](#) IW182200-EE-DST-0002: New 220kW VSD cubicle datasheet;
  - (k) [Attachment K](#) IW182200-EE-DST-0003: New 75kW VSD cubicle datasheet;
  - (l) [Attachment L](#) IW182200-EE-DST-0004: New 500kVA transformer datasheet;
  - (m) [Attachment M](#) IW182200-EE-LST-0002: Power cable schedule; and
  - (n) [Attachment N](#) IW182200-EE-LST-0001: Electrical equipment list.

**P-111**  
 END-SUCTION CENTRIFUGAL  
 DUTY FLOW: 50/150 L/s  
 DUTY PRESSURE: 50/73m  
 MOTOR: 220kw VSD

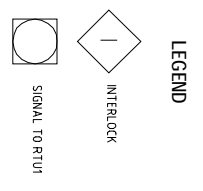
**P-112**  
 PONTON PUMP  
 DUTY FLOW: 50/150 L/s  
 DUTY PRESSURE: 28/29m  
 MOTOR: 75kw VSD

**DIESEL PUMP**  
 OWNED BY  
 PREMIER COAL



**NOTES**  
 1. ALL EQUIPMENT IDS TO BE PREFIXED BY MS-BW UNLESS OTHERWISE STATED

Attachment A EI&dc Drawings



REV	DATE	DRWN	CHK'D	APP'D	DESCRIPTION
A	29.07.15	AK	MP	MP	ADDED REF TO M-S-1058/3 WD 09371431
B	AUG 16	AK	MP	MP	ADDED V-4.11
C	15.10.18	CYC	AL	GS	PONTON PUMP PACKAGE PROPOSED WORKS AS CLOURED

NO	DATE	BY	DESCRIPTION
0			

DRAWING REVISIONS		DRAWING REFERENCES	
DESCRIPTION		DRAWING NO	
M-S-1067-021		GENERAL ARRANGEMENT	
M-S-1067-021		SYSTEM P&ID	
M10-C-0178-001		DRAWING NO	

DRAWING REFERENCES		DRAWING REFERENCES	
M-S-1067-021		SYSTEM P&ID	
M10-C-0178-001		DRAWING NO	
M-S-1058/3		DRAWING NO	
M-S-1067/15		DRAWING NO	

**MUJA POWER STATION**  
 COMMON PLANT  
 BORE WATER  
 SH VOID  
 PIPING & INSTRUMENTATION DIAGRAM (P&ID)



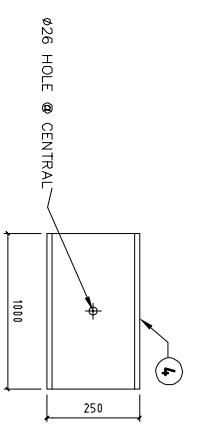
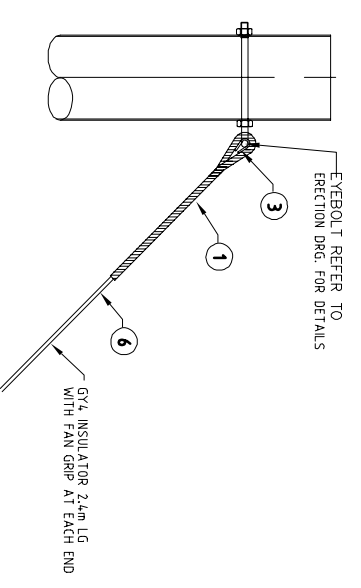
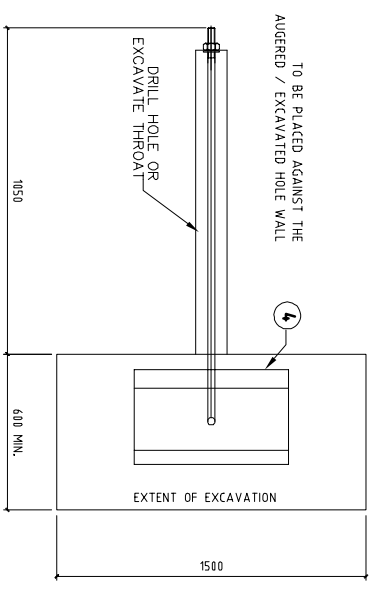
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APPROVED	M PHARO	29.06.2015		
SCALE	1	UON	NEXT SHIT	
			REVISION	C

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MATERIAL LIST			
STAY ASSEMBLY 19/3.25 (MAX TENSION = 137kN)			
ITEM	QTY.	DESCRIPTION	DWG No.
1	4	PREFORM TERMINATION	N/A
2	1	M24 x 2400 GR. 8.8 ANCHOR BOLT	N/A
3	2	20mm OPEN THIMBLE	N/A
4	1	STAY ANCHOR PFC 300 - 500 LG 'SA1'	-
5	1	WHITE PVC MARKER	N/A
6	1	19/3.25 GALV. GUY WIRE GR1320	N/A
7	1	M24 BOW	N/A

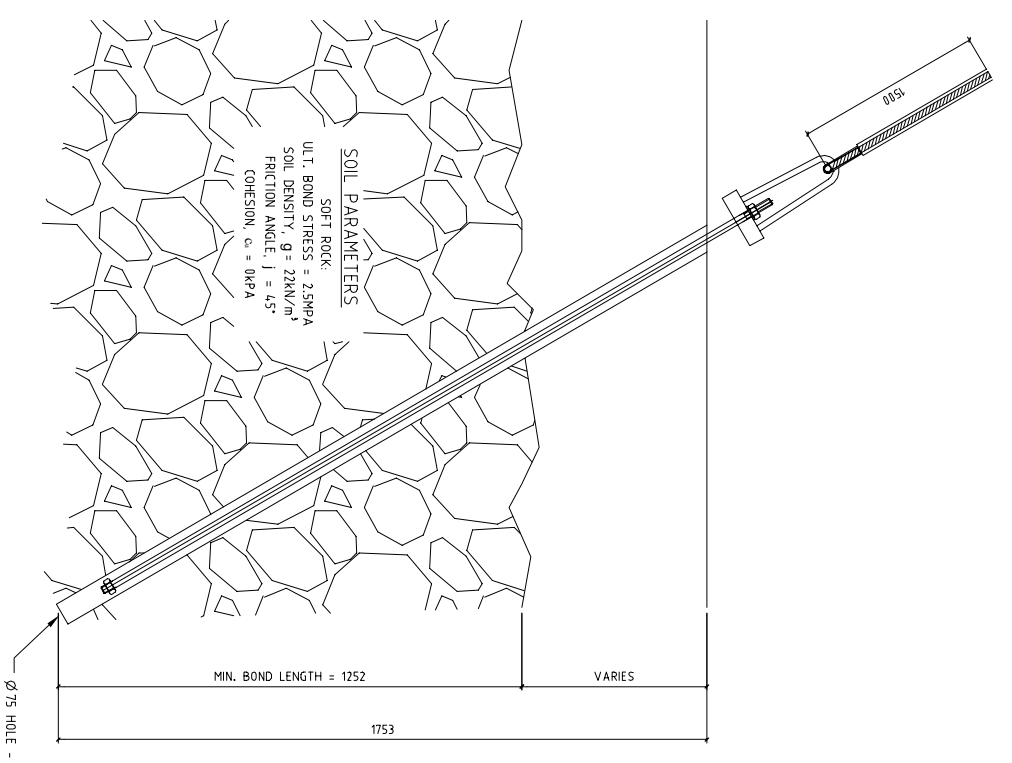
**NOTES**

- CONTRACTOR TO CONFIRM GROUND CONDITIONS

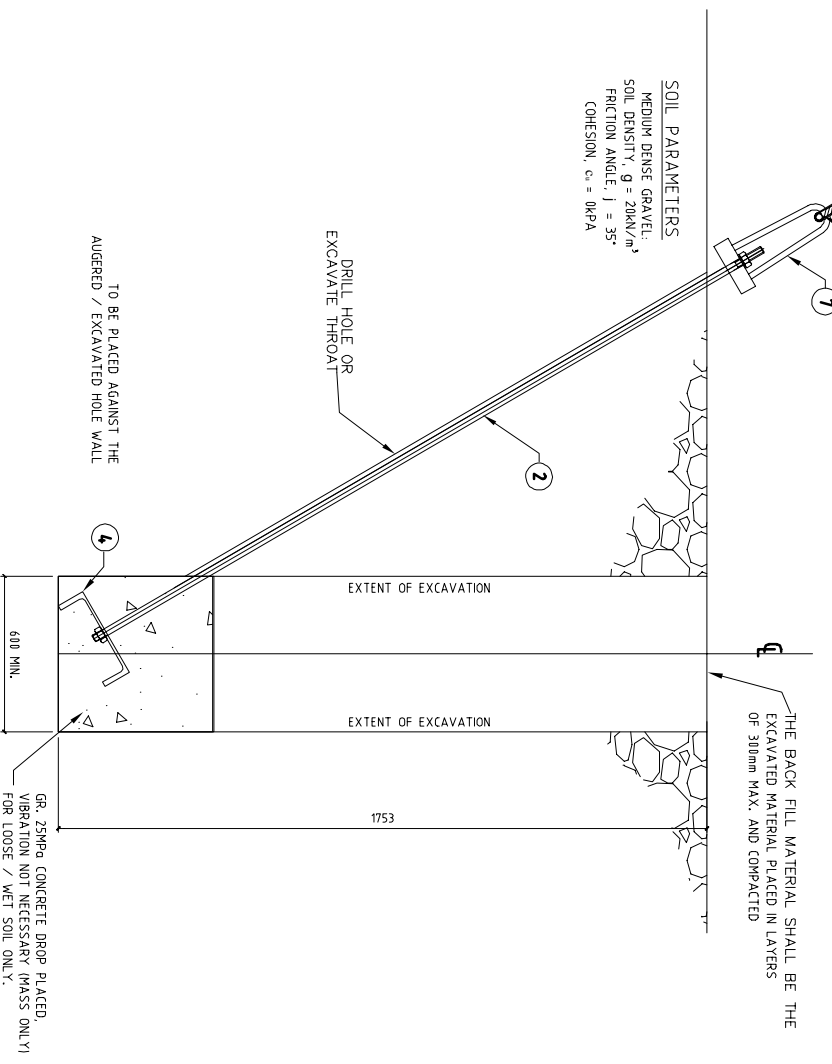


STAY ANCHOR DETAIL 'SA1'

**ISSUED FOR TENDERING ONLY**



STAY ANCHOR IN ROCK



STAY ANCHOR IN WEATHERED ROCK

REV	DATE	DRWN	CHKD	APP'D	DESCRIPTION
0	17.08.18	MG	ST	AG	ISSUED FOR INTERNAL REVIEW
1	07.09.18	MG	AO	AO	FOR REVIEW AND COMMENT
2	12.10.18	MG	AO	AO	ISSUED FOR TENDERING ONLY

MHT-C-0420-001	22kV OHL TRANSFORMER HORIZONTAL DEVIATION POLE P5-7
MHT-C-0421-001 <th>22kV OHL INTERMEDIATE POLE P5-8</th>	22kV OHL INTERMEDIATE POLE P5-8
MHT-C-0422-001 <th>22kV OHL TERMINATION CABLE POLE P5-9</th>	22kV OHL TERMINATION CABLE POLE P5-9
MHT-C-0423-001 <th>22kV OHL PLAN AND PROFILE</th>	22kV OHL PLAN AND PROFILE
MHT-C-0424-001 <th>ELECTRICAL SITE LAYOUT</th>	ELECTRICAL SITE LAYOUT
MHT-C-0178-001 <th>5H VIVID GENERAL ARRANGEMENT</th>	5H VIVID GENERAL ARRANGEMENT

**MUJA POWER STATION**  
POWER RETICULATION  
GUY ANCHOR DETAILS

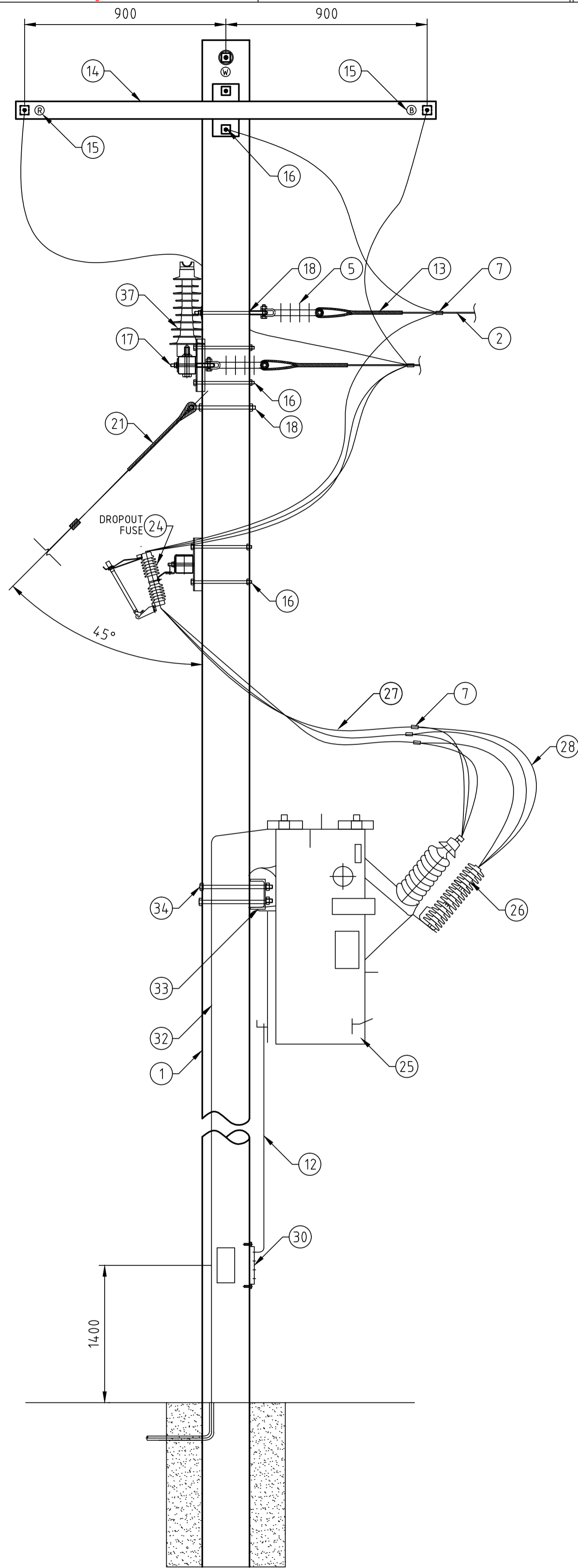
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Checked: A OTHMANN  
Approved: A OTHMANN

Drawn: MHT-C-0419-001

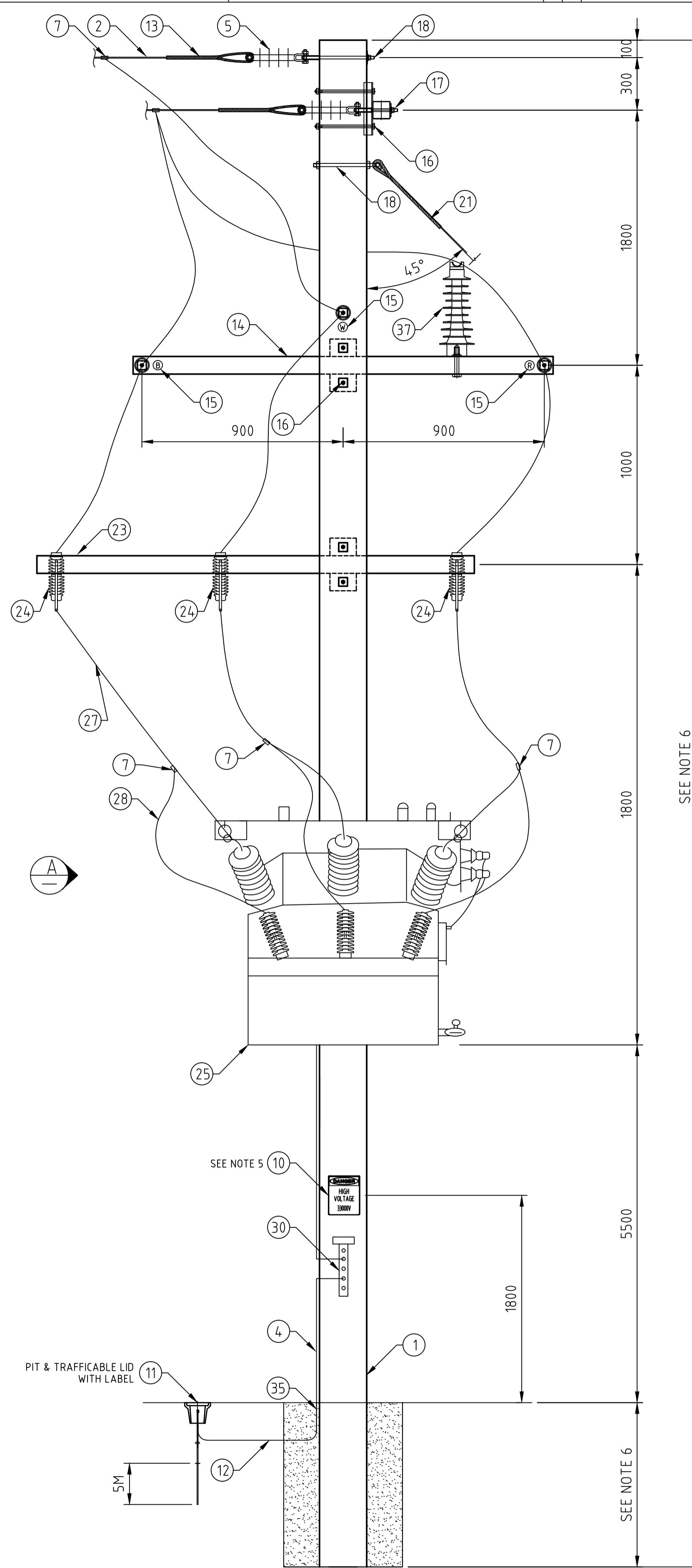
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Next Sht: REVISION 2

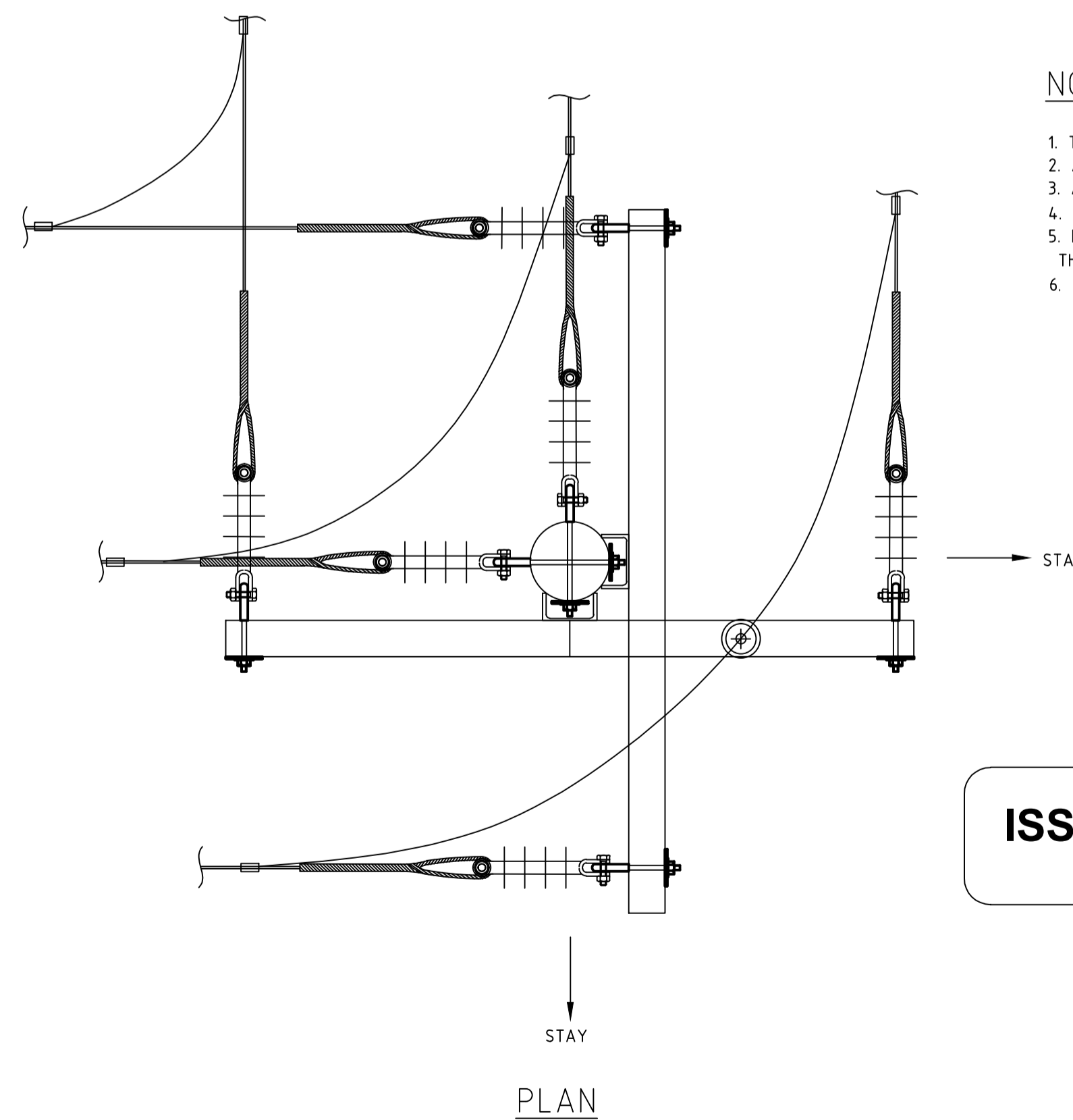




VIEW A



ELEVATION



PLAN

MATERIALS LIST

ITEM	QTY.	DESCRIPTION	LENGTH	STRENGTH	MAT'L	REMARKS
1	1	POLE	NOTE 6	-	-	SEE NOTE 6
2	AS REQ.	PHASE CONDUCTOR - REFER TO TABLE FOR DETAILS	AS REQ.	-	-	-
3	-	-	-	-	-	-
4	1	EARTH BOND - 95mm <sup>2</sup> EARTH WIRE TO EARTH BAR	-	-	-	-
5	6	STRAIN INSULATOR ASSEMBLY	-	-	-	-
6	-	-	-	-	-	-
7	AS REQ.	PARALLEL GROOVE CLAMP TO SUIT PHASE CONDUCTOR	-	-	-	TO SUIT ITEM 2
8	-	-	-	-	-	-
9	AS REQ.	BOLT, HEX HEAD c/w NUT & WASHER - M12	TO SUIT	GR 8.8	GALV.	-
10	1	POLE No. DANGER SIGN c/w FIXTURES	-	-	-	-
11	2	EARTH ROD c/w CLAMP	5M	-	-	-
12	2	EARTH WIRE PVC - 120mm <sup>2</sup> Cu	AS REQ.	-	Cu	GREEN/YELLOW
13	6	DEAD END FITTING TO SUIT CONDUCTOR	AS REQ.	-	-	-
14	2	TERMINATION CROSSARM - SHS 125x9.0	2000mm	-	GALV.	-
15	6	PHASE IDENTIFICATION TAGS	-	-	-	1 SET 'R' - 'W' - 'B'
16	6	BOLT HEX HEAD c/w NUT & WASHER - M20	360mm	GR 8.8	GALV.	-
17	4	EYEBOLT c/w NUT & WASHER - M20	150mm	-	GALV.	-
18	4	EYEBOLT c/w NUT & WASHER - M20	360mm	-	GALV.	-
19	-	-	-	-	Cu	-
20	-	-	-	-	-	-
21	2	STAY ASSEMBLY	-	-	-	HD4-2850-VE-00201
22	-	-	-	-	-	-
23	1	-	-	-	GALV.	-
24	3	22kV DROP-OUT FUSE	-	-	-	-
25	1	EXISTING TRANSFORMER	-	-	-	EXISTING TRANSFORMER TO BE RETAINED
26	3	22kV SURGE ARRESTORS	-	-	-	-
27	6	LEAD TO SUIT CONDUCTOR c/w 120mm <sup>2</sup> LUG	-	-	GALV.	-
28	3	APPLE LEAD / LUG	AS REQ.	-	-	-
29	-	-	-	-	-	-
30	1	EARTH BAR c/w STAND OFF INSULATORS - 50x6 FL	-	-	Cu	-
31	-	-	-	-	-	-
32	1	LV CABLE	-	-	-	-
33	1	TRANSFORMER MOUNTING BRACKET - 150 PFC	1000mm	-	-	-
34	2	BOLT HEX HEAD c/w NUT & WASHER - M20	450mm	-	GALV.	-
35	1	CONDUIT 25mm DIA. c/w MOUNTING STRAPS	1500mm	-	GALV.	-
36	-	-	-	-	-	-
37	1	POST INSULATOR ASSEMBLY	AS REQ.	-	GALV.	-

NOTES

1. THE MATERIAL LIST IS SPECIFIC TO THIS DRG. ONLY.
2. ALL STEEL WORK TO BE GALVANISED.
3. ALL DIMENSIONS ARE IN MILLIMETRES.
4. ALL BOLTS THROUGH POLE ARE TO BE FITTED WITH GALV. SPRING WASHERS.
5. DANGER SIGN AND POLE ID TAGS TO BE POSITIONED ON THE POLE FACING THE ACCESS TRACK APPROX 1.8m ABOVE GROUND.
6. TO BE CONFIRMED UPON GEOTECHNICAL INVESTIGATION AND GROUND PROFILE SURVEY.

ISSUED FOR TENDERING ONLY

**JACOBS**

JOB No. 1W182200  
Durack Centre, 263 Adelaide Terrace, Perth, W.A. 6000

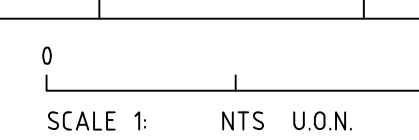
MUJA POWER STATION

POWER RETICULATION  
22kV OHL TRANSFORMER HORIZONTAL DEVIATION  
POLE P5-7

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CHECKED	A OTHMAN	20.08.18
APPROVED	A SIDDIQUE	20.08.18

DRAWING NUMBER  
M11-C-0420-001

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	REVISION	2



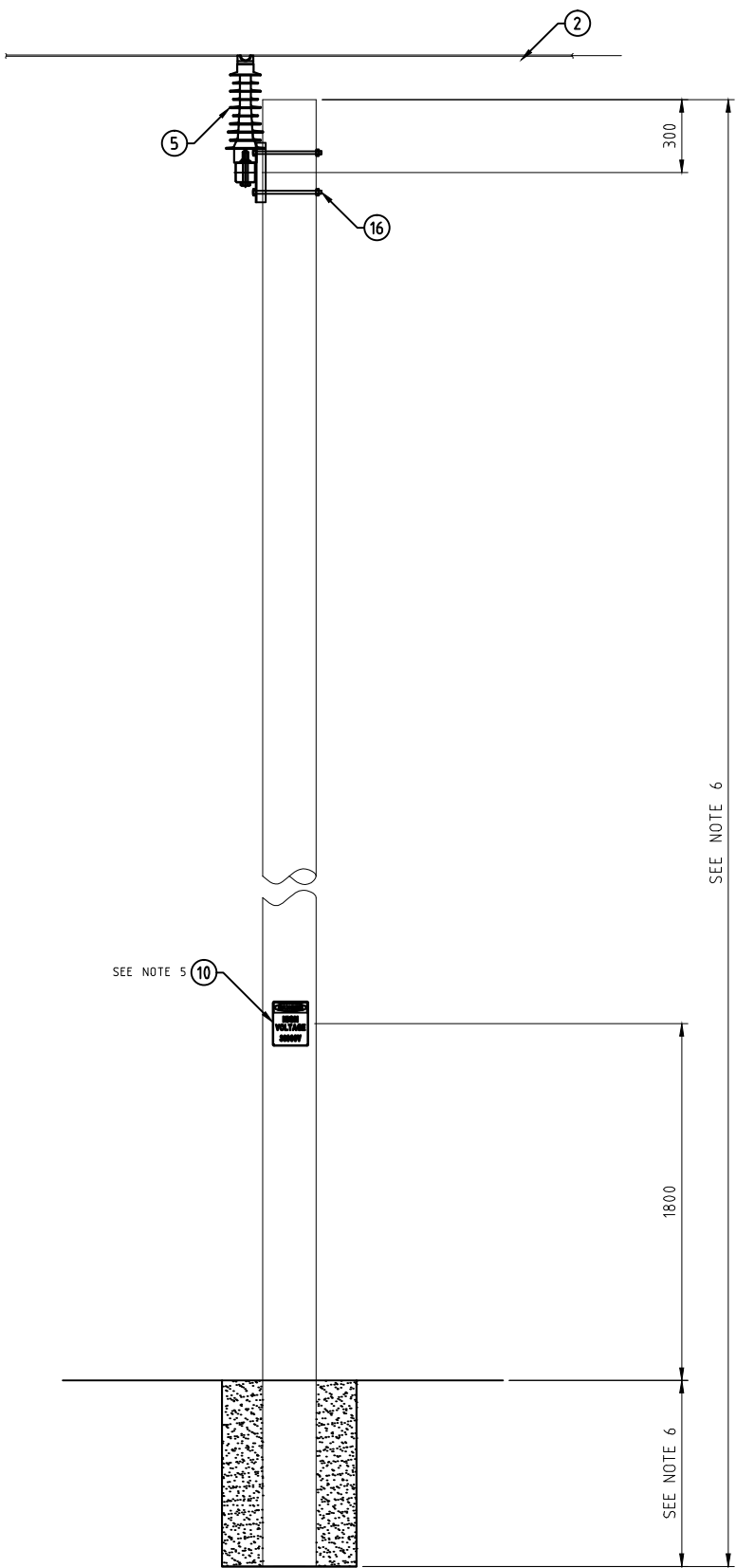
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1	07.09.18	MG	AO	AO	FOR REVIEW AND COMMENT
0	17.08.18	MG	AO	AO	ISSUED FOR INTERNAL REVIEW

DRAWING No	TITLE
M11-C-0419-001	GUY ANCHOR DETAILS
M11-C-0421-001	22kV OHL INTERMEDIATE POLE P5-8
M11-C-0422-001	22kV OHL TERMINATION CABLE POLE P5-9
M11-C-0423-001	22kV OHL PLAN AND PROFILE
M11-C-00424-001	ELECTRICAL SITE LAYOUT
M10-C-0178-001	5H VOID GENERAL ARRANGEMENT

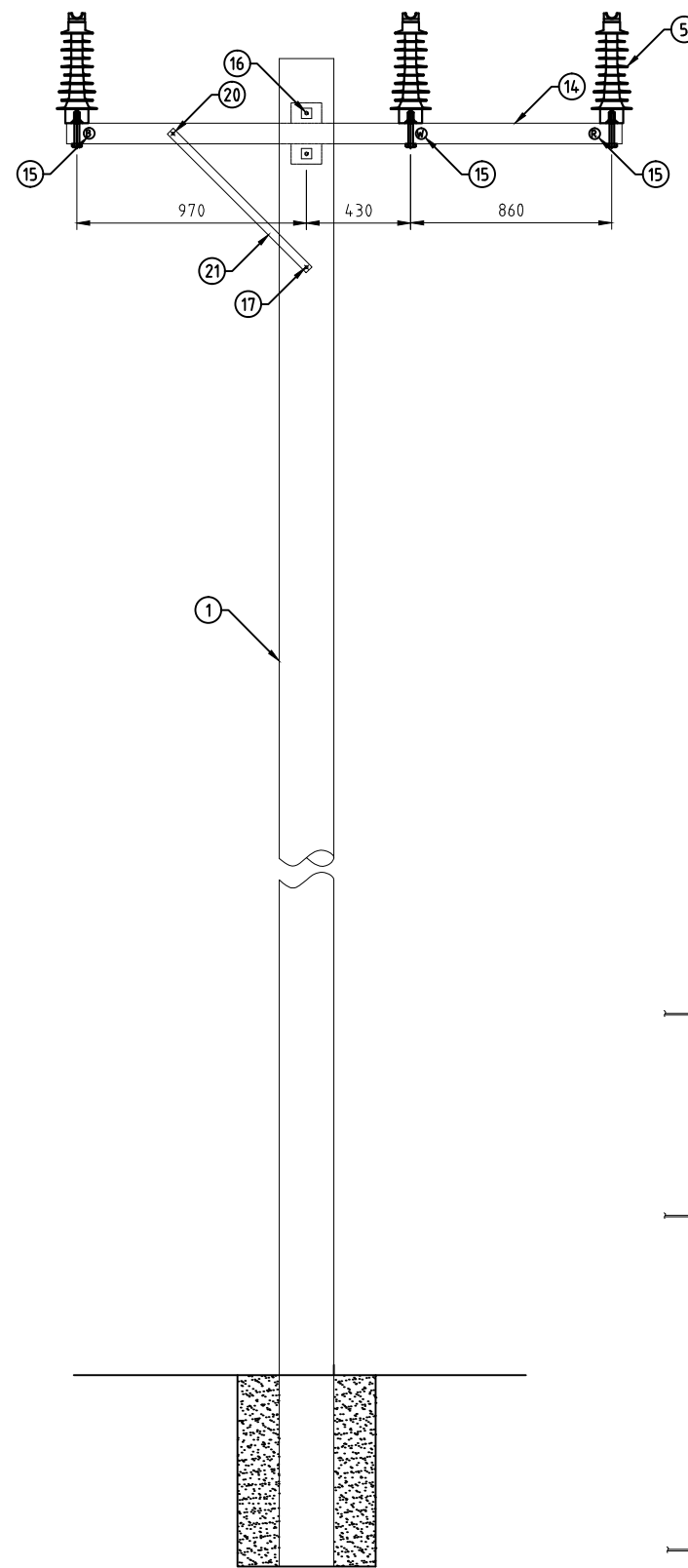


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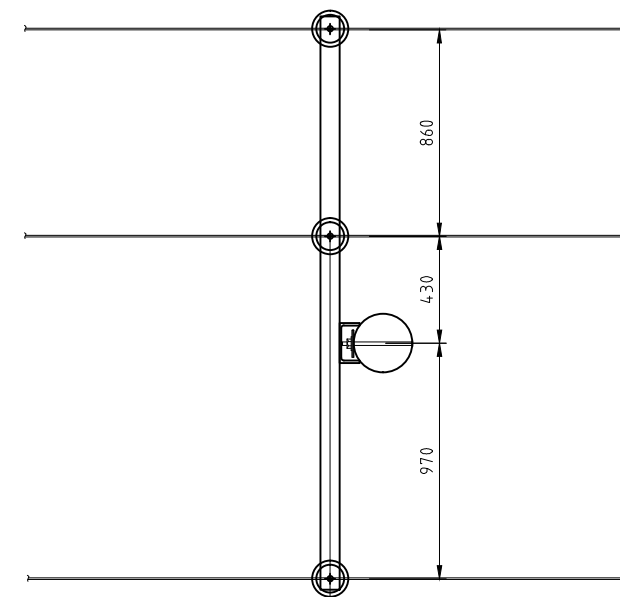
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1	1	POLE	-	-	WOOD	SEE NOTE 6
2	AS REQ.	PHASE CONDUCTOR - 'MOON'	AS REQ.	-	-	-
3	-	-	-	-	-	-
4	-	-	-	-	-	-
5	3	POST INSULATOR ASSEMBLY	-	-	-	R11ET145N OR EQUIVALENT
6	-	-	-	-	-	-
7	-	-	-	-	-	-
8	-	-	-	-	-	-
9	-	-	-	-	-	-
10	1	POLE No. DANGER SIGN c/w FIXTURES	-	-	-	-
11	-	-	-	-	-	-
12	-	-	-	-	-	-
13	-	-	-	-	-	-
14	1	OFFSET CROSSARM 125X4.0 SHS	-	-	GALV.	REFER TO CROSSARM TABLE
15	3	PHASE IDENTIFICATION TAGS	-	-	-	1 SET 'R' - 'W' - 'B'
16	2	BOLT HEX HEAD c/w NUT & WASHER - M20	360mm	GR 8.8	GALV.	-
17	1	BOLT HEX HEAD c/w NUT & WASHER - M16	360mm	GR 8.8	GALV.	-
18	-	-	-	-	-	-
19	-	-	-	-	-	-
20	1	BOLT, HEX HEAD c/w 2 NUTS & WASHER - M16	170mm	GR 8.8	GALV.	-
21	1	BRACING STRAP - FL 50x5	1000mm	GR 300	GALV.	-



ELEVATION



VIEW A



PLAN

NOTES

1. THE MATERIAL LIST IS SPECIFIC TO THIS DRG. ONLY.
2. ALL STEELWORK TO BE GALVANISED.
3. ALL DIMENSIONS ARE IN MILLIMETRES.
4. ALL BOLTS THROUGH POLE ARE TO BE FITTED WITH GALV. SPRING WASHERS.
5. DANGER SIGN AND POLE ID TAGS TO BE POSITIONED ON THE POLE FACING THE ACCESS TRACK APPROX 1.8m ABOVE GROUND.
6. TO BE CONFIRMED UPON GEOTECHNICAL INVESTIGATION AND GROUND PROFILE SURVEY.

**ISSUED FOR TENDERING ONLY**

REV	DATE	DRWN	CHK'D	APP'D	DESCRIPTION
2	12.10.18	MG	AO	AO	ISSUED FOR TENDERING ONLY
1	07.09.18	MG	AO	AO	FOR REVIEW AND COMMENT
0	17.08.18	MG	AD	AD	ISSUED FOR INTERNAL REVIEW

DESCRIPTION	DRAWING REVISIONS

DRAWING No	TITLE
M11-C-0419-001	GUY ANCHOR DETAILS
M11-C-0420-001	22kV OHL TRANSFORMER HORIZONTAL DEVIATION POLE P5-7
M11-C-0422-001	22kV OHL TERMINATION CABLE POLE P5-9
M11-C-0423-001	22kV OHL PLAN AND PROFILE
M11-C-0424-001	ELECTRICAL SITE LAYOUT
M10-C-0178-001	5H VOID GENERAL ARRANGEMENT

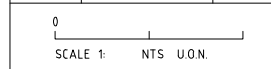
**MUJA POWER STATION**  
POWER RETICULATION  
22kV OHL - INTERMEDIATE POLE ASSEMBLY  
POLE P5-8

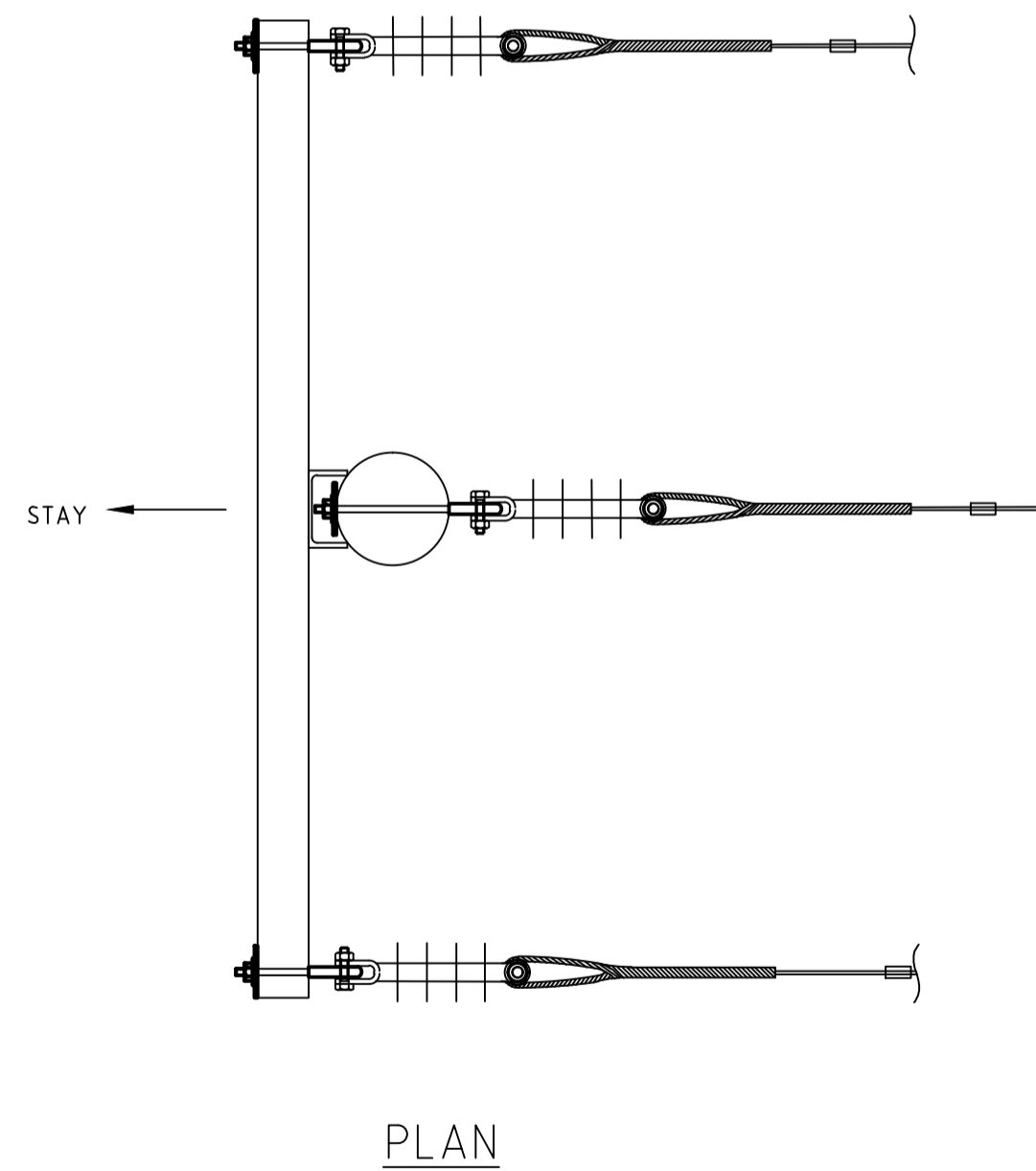
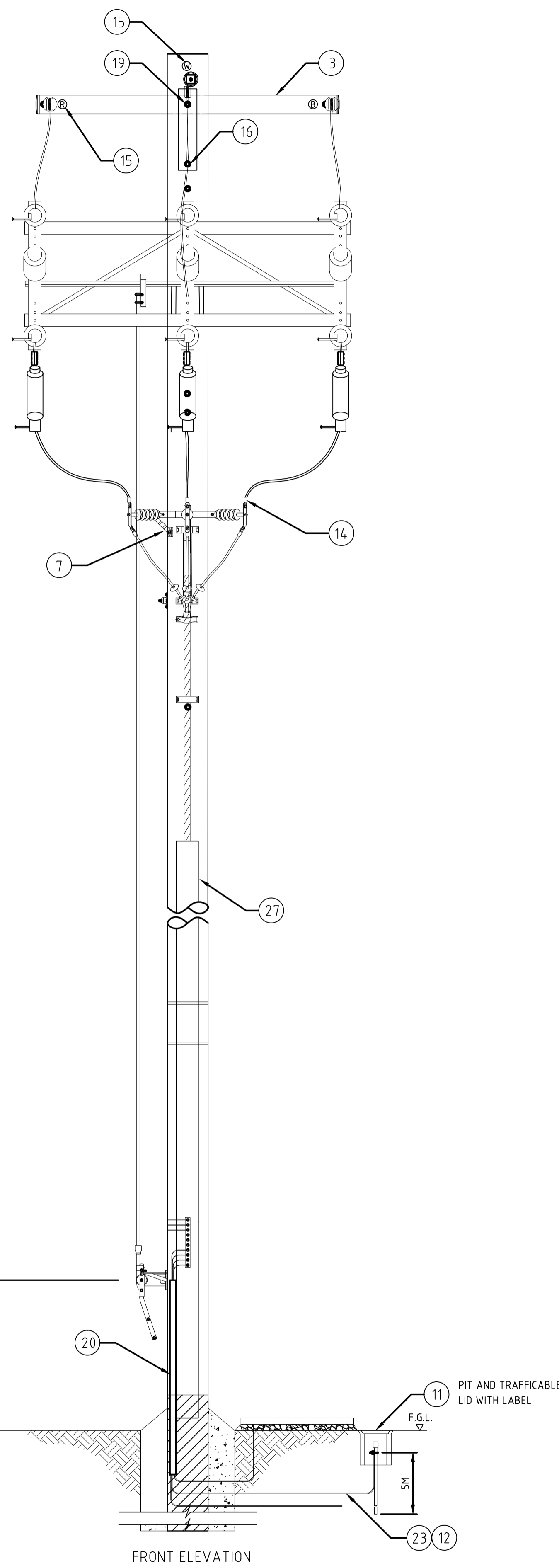
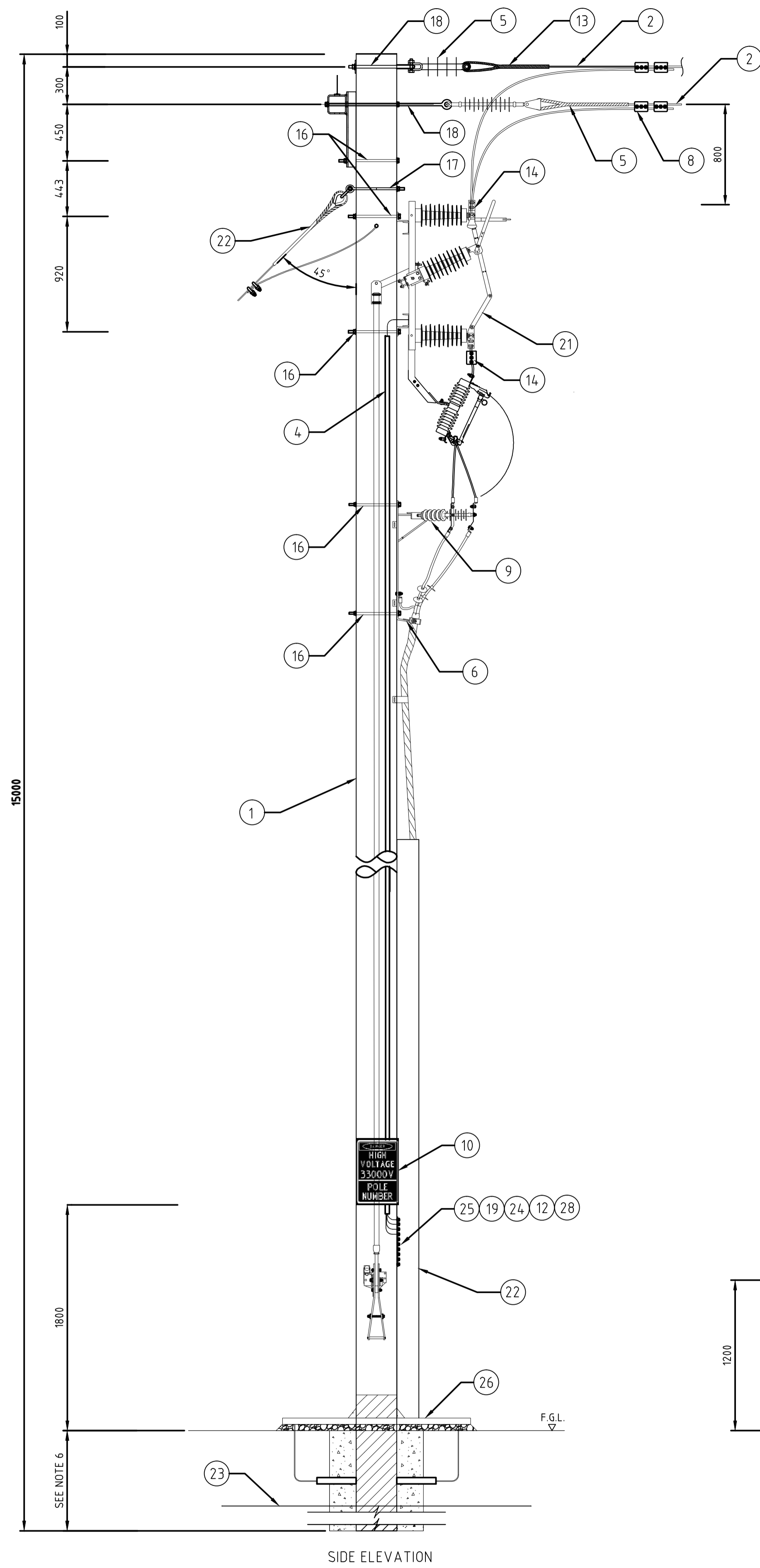
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CHECKED	A OTHMANN	20.08.18
APPROVED	A OTHMANN	20.08.18

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DRAWING NUMBER  
**M11-C-0421-001**

**synergy** NEXT SHT  
REVISION 2





**ISSUED FOR TENDERING ONLY**

**NOTES**

1. THE MATERIAL LIST IS SPECIFIC TO THIS DRAWING ONLY.
2. ALL STEELWORK TO BE GALVANISED.
3. ALL DIMENSIONS ARE IN MILLIMETRES.
4. ALL BOLTS THROUGH POLE ARE TO BE FITTED WITH GALVANISED SPRING WASHERS.
5. DANGER SIGN AND POLE ID TAGS TO BE POSITIONED ON THE POLE FACING THE ACCESS TRACK APPROX 1.8m ABOVE GROUND.
6. TO BE CONFIRMED UPON GEOTECHNICAL INVESTIGATION AND GROUND PROFILE SURVEY.

MATERIALS LIST						
ITEM	QTY.	DESCRIPTION	LENGTH	STRENGTH	MAT'L	REMARKS
1	1	POLE	NOTE 6	-	WOOD	SEE NOTE 6
2	AS REQ.	PHASE CONDUCTOR - 'MOON'	AS REQ.	-	-	-
3	1	SECTION/TERMINATION CROSSARM C/W MOUNTING BRACKET-SHS150x9x2400mm	-	-	-	-
4	1	EARTH BOND - 95mm Cu EARTH WIRE TO EARTH BAR	-	-	-	-
5	3	STRAIN INSULATOR ASSEMBLY	-	-	-	-
6	1	CABLE TERMINATION MOUNTING BRACKET TO SUIT 300Cu(1x3C)22kV XLPE CABLE	-	-	-	-
7	1	CABLE TERMINATION KIT TO SUIT 300Cu (1x3C) 22kV XLPE CABLE	-	-	-	RAYCHEM
8	AS REQ.	PG CLAMP TO SUIT PHASE/TAP-DOWN CONDUCTOR	-	-	-	-
9	3	SURGE ARRESTORS - 33kV	-	-	-	-
10	1	POLE No. DANGER SIGN c/w FIXTURES	-	-	-	EQUIPMENT TAGS: MS-22K-CFS-5H MS-22K-ISOL-5H
11	1	EARTH PIT AND REEL ASSEMBLY	5M	-	-	-
12	1	EARTH WIRE PVC - 120mm SQUARED CU	AS REQ.	-	Cu	GREEN/YELLOW
13	3	DEAD END FITTING TO SUIT CONDUCTOR	AS REQ.	-	-	-
14	9	CRIMPLUG TO SUIT PHASE/TAP-OVER CONDUCTOR	-	-	GALV.	-
15	1	PHASE IDENTIFICATION TAGS	-	-	-	1 SET 'R' - 'W' - 'B'
16	5	BOLT HEX HEAD c/w NUT & WASHER - M20	TO SUIT	GR 8.8	GALV.	-
17	1	EYEBOLT c/w NUT & WASHER - M24	TO SUIT	-	GALV.	-
18	3	EYEBOLT c/w NUT & WASHER - M20	TO SUIT	-	GALV.	-
19	1	BOLT HEX HEAD c/w NUT & WASHER - M24	-	-	-	-
20	AS REQ.	CONDUIT Ø25mm c/w MOUNTING STRAPS	AS REQD.	-	GALV.	-
21	1	36KV VERTICAL MOUNTED, 630A FUSED DISCONNECTOR C/W FLICKER ARCING HORNS & HANDLE	-	-	-	-
22	1	STAY ASSEMBLY TYPE 1. (19/3.25)	-	-	-	-
23	1	120Cu BARE GRADING RING EARTH WIRE	-	-	-	-
24	1	95mm <sup>2</sup> Cu EARTH TAIL	-	-	Cu	-
25	1	EARTH BAR c/w STAND OFF INSULATORS - 50x6 FL	-	-	Cu	-
26	1	ISOLATOR EARTH MAT	-	-	-	-
27	1	150mm CABLE LADDER c/w SUN COVER	AS REQ.	-	-	-
28	AS REQ.	PG CLAMP TO SUIT EARTH WIRE	-	-	-	-

DRAWING No	TITLE
M11-C-0419-001	GUY ANCHOR DETAILS
M11-C-0420-001	22kV OHL TRANSFORMER HORIZONTAL DEVIATION POLE P5-7
M11-C-0421-001	22kV OHL INTERMEDIATE POLE P5-8
M11-C-0423-001	22kV OHL PLAN AND PROFILE
M11-C-0424-001	ELECTRICAL SITE LAYOUT
M10-C-0178-001	5H VOID GENERAL ARRANGEMENT

MUJA POWER STATION  
POWER RETICULATION  
22kV OHL - TERMINATION CABLE POLE  
POLE P5-9

REV	DATE	DRWN	CHK'D	APP'D	DESCRIPTION
2	12.10.18	MG	AO	AO	ISSUED FOR TENDERING ONLY
1	07.09.18	MG	AO	AO	FOR REVIEW AND COMMENT
0	07.08.18	MG	ST	AG	ISSUED FOR INTERNAL REVIEW

**JACOBS**  
JOB No. 1W182200  
Durack Centre, 263 Adelaide Terrace, Perth, W.A.

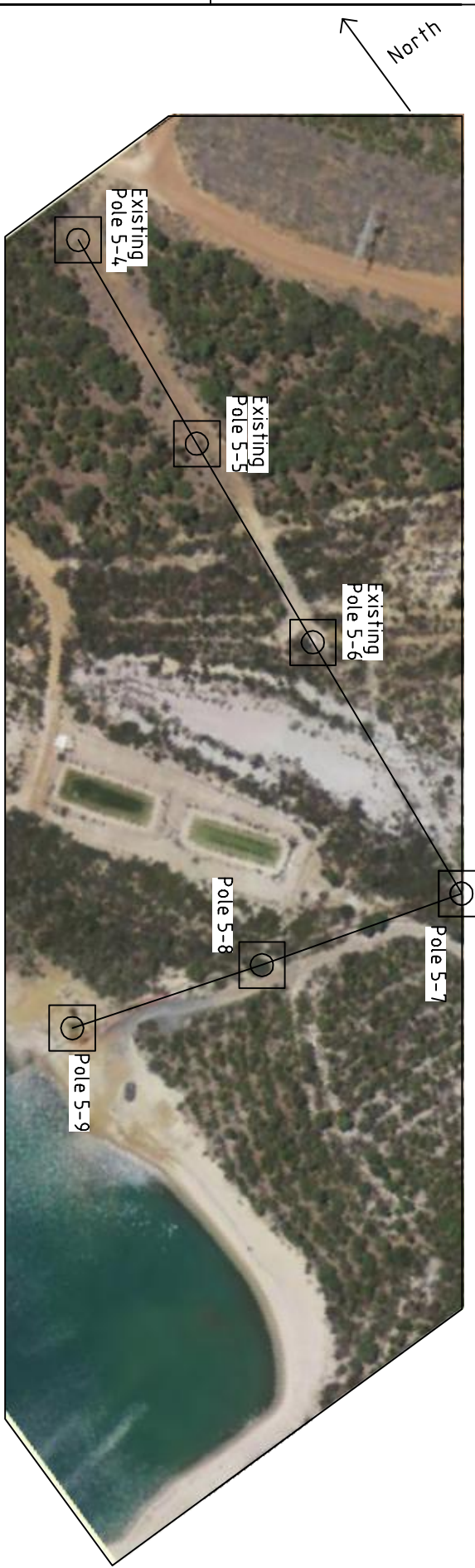
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synergy

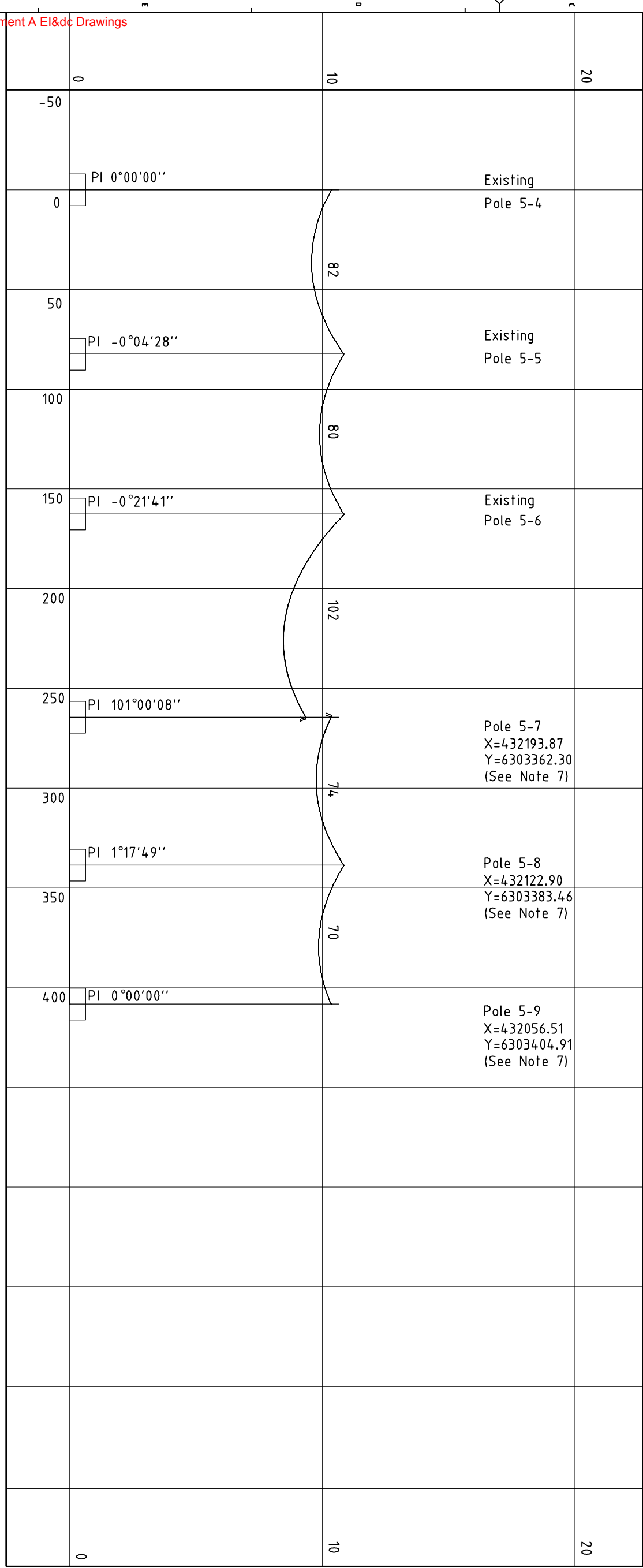
DRAWN	M GLANZ	17.08.18
CHECKED	A OTHMANN	20.08.18
APPROVED	A OTHMANN	20.08.18

NEXT SHT	
REVISION	2



North

19.0 m Horiz. Scale  
1.5 m Vert. Scale



NOTES

- GROUND PROFILE SURVEY TO BE CARRIED OUT BY A LICENSED SURVEYOR TO FINALIZE THE HEIGHT OF THE POLES.
- GEOTECHNICAL INVESTIGATION TO BE CARRIED OUT TO FINALIZE POLE FOUNDATION DESIGN.
- THE CONTRACTOR SHALL CARRY OUT THE SURVEY OF THE EXISTING LINE SO THAT THE EXISTING LINE CAN BE ANALYSED TO FINALIZE THE DESIGN OF POLE P5-7.
- NEW POLE P5-7 SHALL BE 5M AWAY BEFORE THE EXISTING POLE TO ENSURE SUFFICIENT CONDUCTOR LENGTH FROM THE EXISTING P5-7 POLE LOCATION. RELOCATE THE EXISTING TRANSFORMER AND SWITCHBOARD ONTO THE NEW POLE P5-7.
- PROPOSED CONDUCTOR IS MOON STRUNG AT 15% OF CBL @ EDT.
- ALL UNITS ARE IN METERS.
- COORDINATES TO BE APPROVED BY SYNERGY PRIOR TO CONSTRUCTION.

ISSUED FOR TENDERING ONLY

REV	DATE	DRAWN	CHECKD	APP'D	DESCRIPTION
0	07/08/18	MG	ST	AG	ISSUED FOR INTERNAL REVIEW
1	07/09/18	MG	AO	AO	FOR REVIEW AND COMMENT
2	12/01/18	MG	AO	AO	ISSUED FOR TENDERING ONLY

DRAWING NO	TITLE
M11-C-0419-001	GRID ANCHOR DETAILS
M11-C-0420-001	22kV OHL TRANSFORMER HORIZONTAL DEVIATION POLE P5-7
M11-C-0421-001	22kV OHL INTERMEDIATE POLE P5-8
M11-C-0422-001	22kV OHL TERMINATION CABLE POLE P5-9
M11-C-0424-001	ELECTRICAL SITE LAYOUT
M11-C-0378-001	5M YARD GENERAL ARRANGEMENT

DRAWING NO	TITLE
M11-C-0423-001	MUJA POWER STATION POWER RETICULATION 22kV OHL - PLAN AND PROFILE

**JACOBS**  
208 No. 1W/182208  
DRAFT Centre, 233 Adelaide Terrace, Perth, W.A. 6000

**synergy**  
DRAWN: H GLANZ 07/08/18  
CHECKED: A OTTMANN 20/08/18  
APPROVED: A OTTMANN 20/08/18

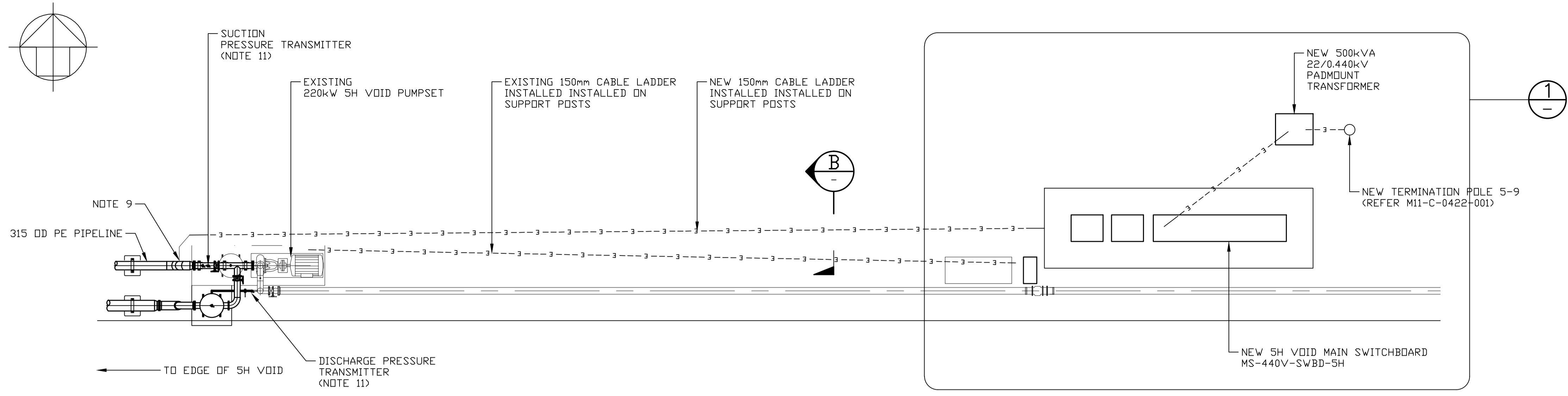
DRAWING NUMBER: M11-C-0423-001

SCALE: 1: NTS UON

NEXT SHIT: REVISION: 2

02177 Electricity Generation and Grid Corporation / The Energy Company of Australia / The Federal Centre, 175 St Georges Terrace Perth WA 6000 AUSTRALIA





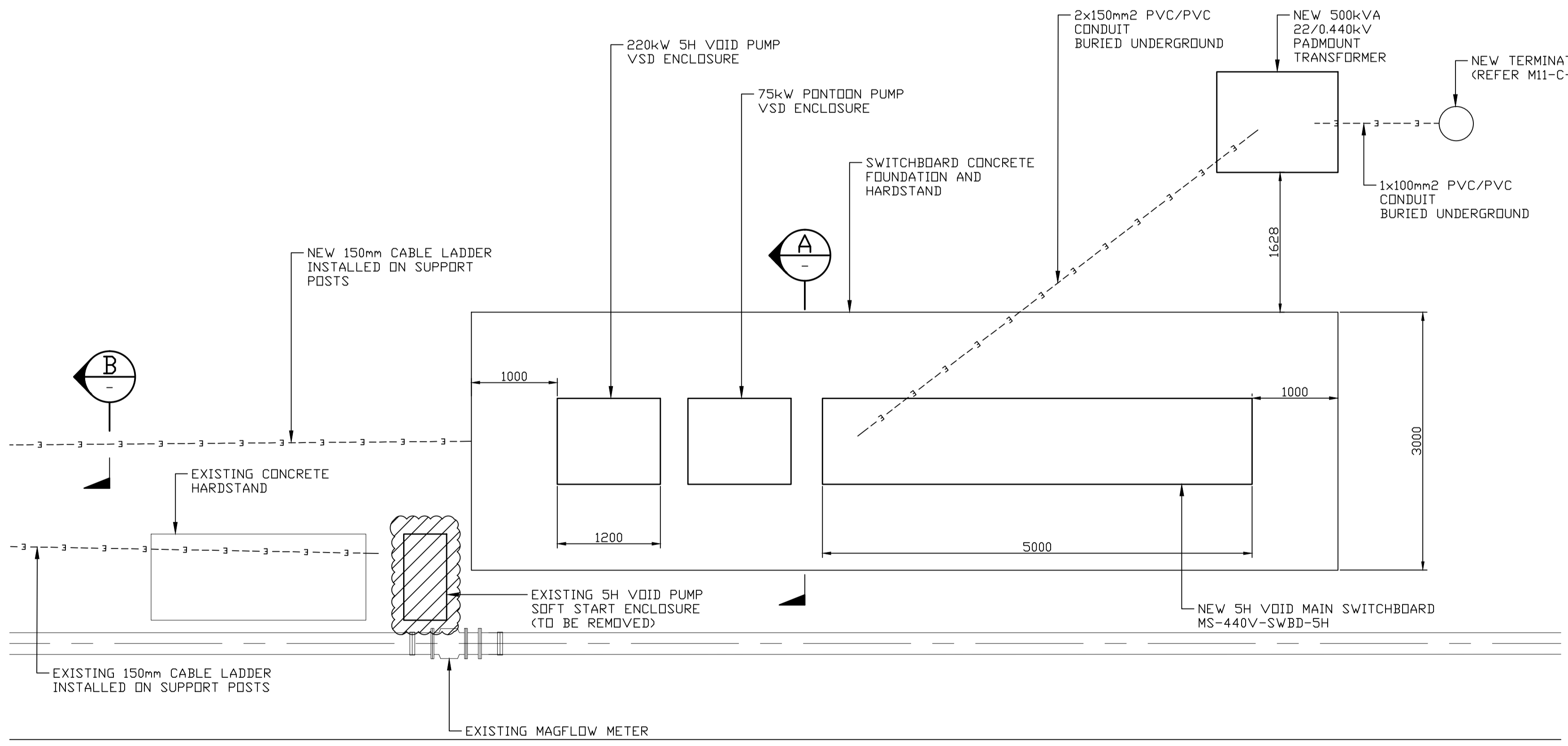
SITE LAYOUT

GENERAL NOTES

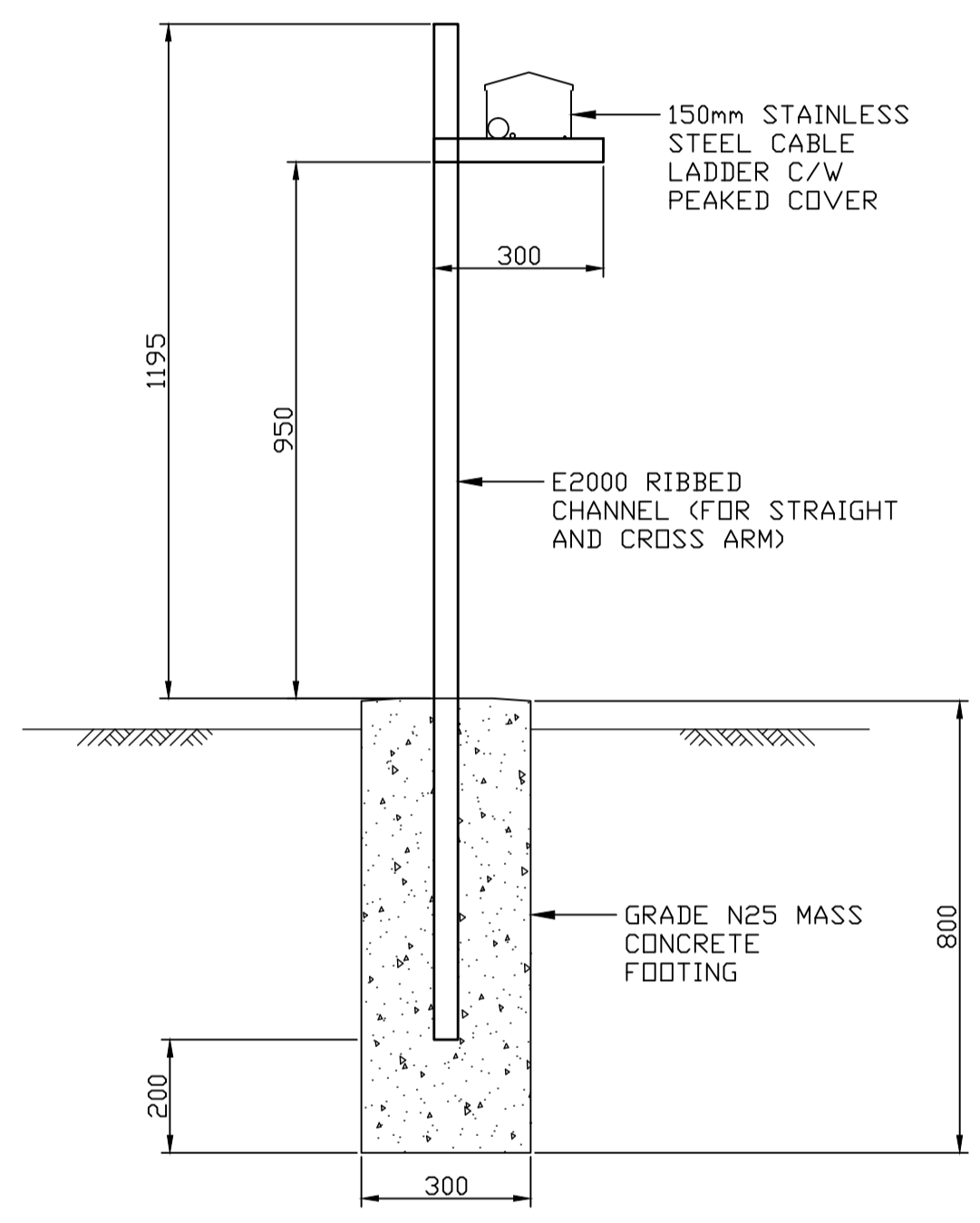
1. SITE LAYOUT IS BASED ON VISUAL SURVEY. POSITIONS AND DIMENSIONS OF EXISTING AND NEW EQUIPMENT TO BE CONFIRMED BASED ON FACTUAL LAND SURVEY DATA AND EQUIPMENT VENDOR DATA.
2. ALL DIMENSIONS GIVEN IN MM.
3. NEW 500kVA PADMOUNT TRANSFORMER TO INCLUDE CONCRETE FOUNDATION.
4. AREA AROUND NEW SWITCHBOARD, TRANSFORMER AND TERMINATION POLE TO BE CLEARED AND LEVELLED PRIOR TO POURING OF FOUNDATION AND INSTALLATION OF EQUIPMENT.
5. NEW SWITCHBOARD AND VSD CUBICLES TO BE MOUNTED ON 500mm HIGH STAINLESS STEEL SUPPORT STANDS TO FACILITATE INSTALLATION OF CABLES BETWEEN SWITCHBOARD, CUBICLES AND FIELD EQUIPMENT.
6. EXISTING 150mm CABLE LADDER TO BE USED TO INSTALL CABLE BETWEEN VSD CUBICLE AND 220kW PUMPSET.
7. SWITCHBOARD AND VSD CONCRETE FOUNDATION DETAILS TO BE FINALISED FOLLOWING WEIGHT AND DIMENSION DATA FROM EQUIPMENT VENDOR.
8. INSTALLATION DEPTH OF CABLE SUPPORTS TO BE CONFIRMED BASED ON SOIL INFORMATION ON SITE.
9. AT THE END OF THE NEW CABLE SUPPORT RUN FOR THE PONTON PUMP, CABLES TO BE STRAPPED ON TO THE 315 OD PIPE RUN TO THE PONTON PUMP.
10. FOR CONCRETE DETAILS, REFER NOTE C3 ON M12-C-0108-001 & THE CONCRETE SCOPE OF WORKS.
11. CONTRACTOR TO SITE RUN CONDUIT FROM CABLE ABOVE GROUND CABLE LADDER TO PRESSURE TRANSMITTERS.

HOLDS

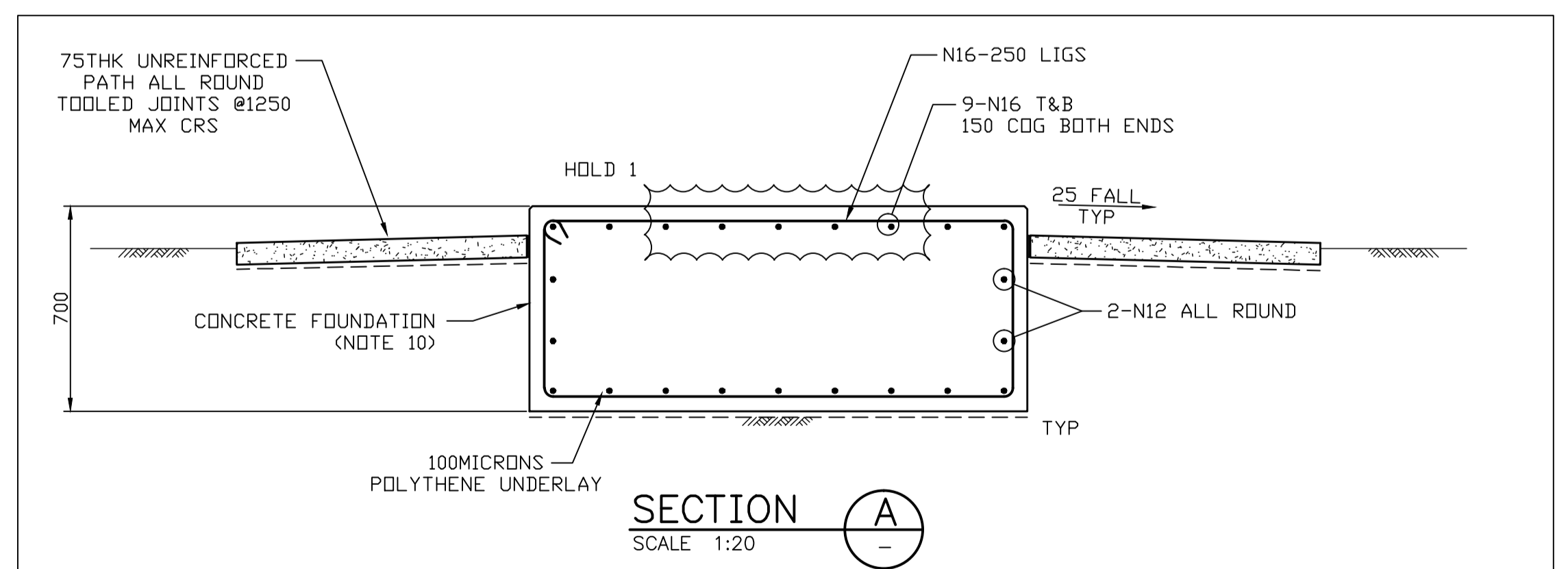
1. ANCHOR BOLTS AND CONDUIT PENETRATIONS TO BE CONFIRMED FOLLOWING CONFIRMATION FROM SWITCHBOARD VENDOR.



DETAIL 1 SCALE 1:40



SECTION B SCALE 1:12.5



SECTION A SCALE 1:20

DRAWING No	TITLE
M-S-9023-001	22kV CWRP AREA RETICULATION SINGLE LINE DIAGRAM
M11-C-0142-001	LEGACY 5H VOID MAIN SWITCHBOARD SINGLE LINE DIAGRAM
M11-C-0419-001	POWER RETICULATION - GUY ANCHOR DETAILS
M11-C-0420-001	22kV OHTL - POLE P5-7 DETAIL
M11-C-0421-001	22kV OHTL - POLE P5-8 DETAIL
M11-C-0422-001	22kV OHTL - POLE P5-9 DETAIL
M11-C-0423-001	22kV LINE EXTENSION - PLAN AND PROFILE
M11-C-0425-001	MS-440V-SWBD-5H SINGLE LINE DIAGRAM

MUJA POWER STATION  
COMMON PLANT  
BORE WATER  
5H VOID  
ELECTRICAL SITE LAYOUT

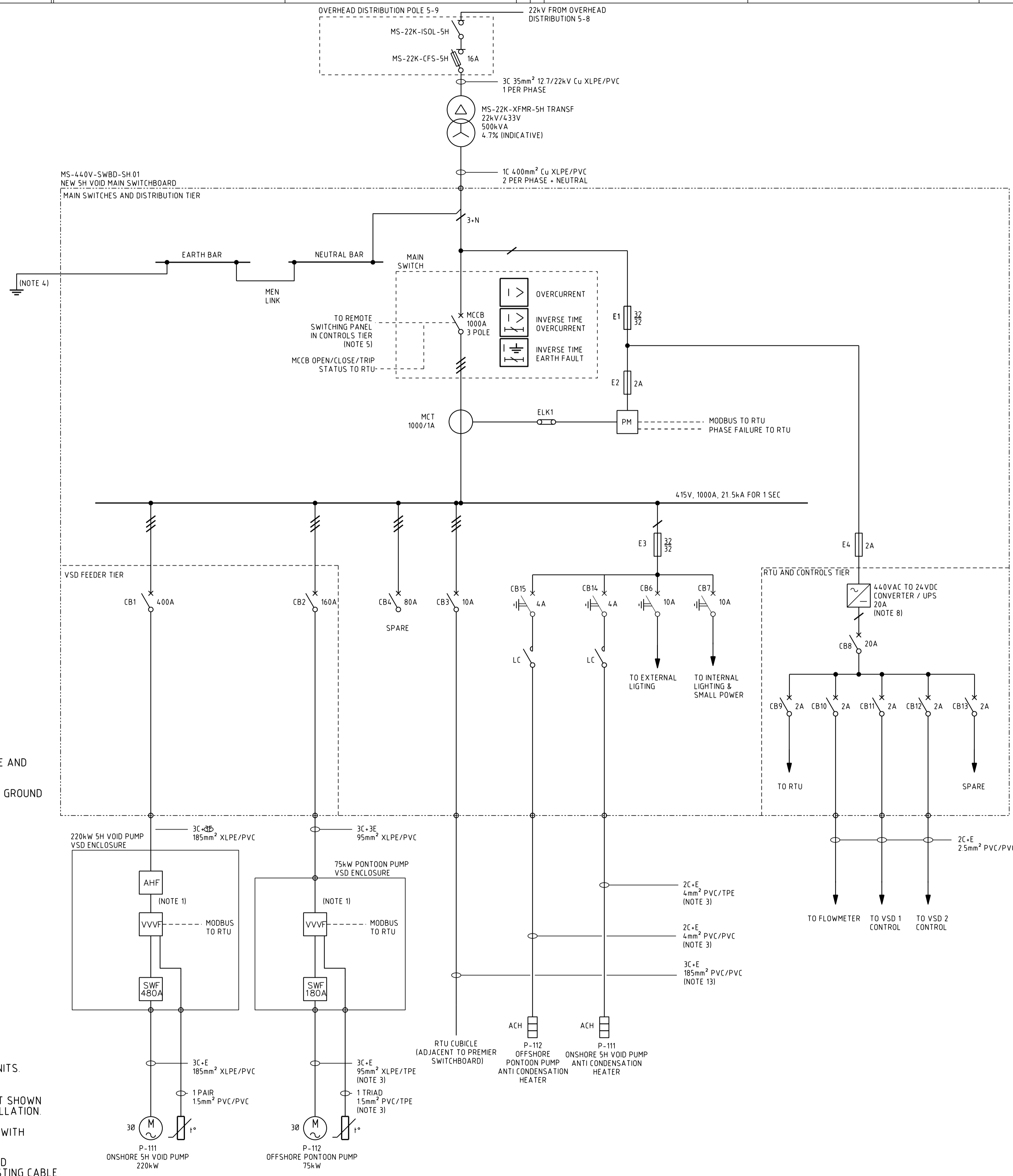
DRAWN	D. OLADJO	05.09.18	DRAWING NUMBER	M11-C-0424-001
CHECKED	E. BAHRAM	15.10.18		
APPROVED	G. SZOZDA	15.10.18		
<p>SCALE 1: 100 U.O.N.</p>				
			NEXT SHT	
			REVISION	A



REV	DATE	DRWN	CHK'D	APP'D	DESCRIPTION
A	15.10.18	DO	EB	GS	APPROVED FOR CONSTRUCTION

DRAWING REVISIONS

DRAWING REFERENCES



- NOTES:**
- VSD'S TO INCLUDE CONTROL KEYPAD TO FACILITATE MANUAL CONTROL KEYPAD TO BE MOUNTED ON SWITCHBOARD ESCUTHEON
  - NEW SWITCHBOARDS AND VSD CUBICLES TO BE IP56 RATED FOR OUTDOOR USE AND SHALL INCLUDE SLOPED HOOD TO REDUCE THE EFFECTS OF SOLAR RADIATION
  - POWER AND AUXILIARIES FOR THE 5H VOID PONTOON PUMP TO BE RUN ABOVE GROUND ON CABLE LADDER ATTACHED TO WATER MAIN
  - EARTH ROD TO BE INSTALLED ADJACENT TO NEW MAIN SWITCHBOARD. EARTH ROD SIZE AND INSTALLATION DEPTH TO BE CONFIRMED FOLLOWING TESTING BY D&C CONTRACTOR
  - SWITCHBOARD TO INCLUDE REMOTE SWITCHING TIER LOCATED AT THE OPPOSITE END OF THE SWITCHBOARD INCOMER. REMOTE SWITCHING PANEL TO INCLUDE DISCREPANCY SWITCHES FOR CB OPEN, CB CLOSE AND INDICATING LIGHTS FOR CB OPENED, CB CLOSED AND CB TRIPPED
  - POWER METER TO INCLUDE kWh MEASUREMENT IN ADDITION TO VOLTS, AMPS, kVA, kVAR MEASUREMENTS
  - VSD'S, SINE WAVE FILTERS AND HARMONIC FILTERS TO BE INSTALLED INSIDE IP56 RATED ENCLOSURE. SWITCHBOARD MANUFACTURER TO DESIGN ENCLOSURE'S TO MEET TEMPERATURE RISE REQUIREMENTS OF EQUIPMENT AND OVERALL ASSEMBLY
  - 240V AC / 24V DC CONVERTER TO INCLUDE INTEGRAL UPS CAPABLE OF PROVIDING 4 HOURS OF BACKUP TO 24V DISTRIBUTION
  - EMERGENCY STOP PUSHBUTTONS TO BE INSTALLED ON THE FRONT OF VSD CUBICLES
  - PRESSURE AND FLOW TRANSMITTERS TO BE WIRED DIRECTLY TO THE VSD UNITS. WIRING NOT SHOWN ON THIS DRAWING
  - CONTROL CABLES BETWEEN MAIN SWITCHBOARD, VSD'S AND FLOWMETER NOT SHOWN REFER TO CABLE SCHEDULE FOR FULL DETAILS OF CABLES REQUIRED FOR INSTALLATION
  - ALL ELECTRICAL AND CONTROL EQUIPMENT TO BE PROVIDED IN ACCORDANCE WITH SYNERGY'S G CLAUSE SECTION 03
  - EXISTING 185mm<sup>2</sup> CABLE BETWEEN LEGACY PREMIER COAL SWITCHBOARD AND REDUNDANT SOFT STARTER TO BE REUSED TO FEED THE NEW RTU CUBICLE. EXISTING CABLE TO BE JOINTED AND EXTENDED AT EACH END WITH 2.5mm<sup>2</sup> PVC/PVC CABLE TO COMPLETE THE CIRCUIT.

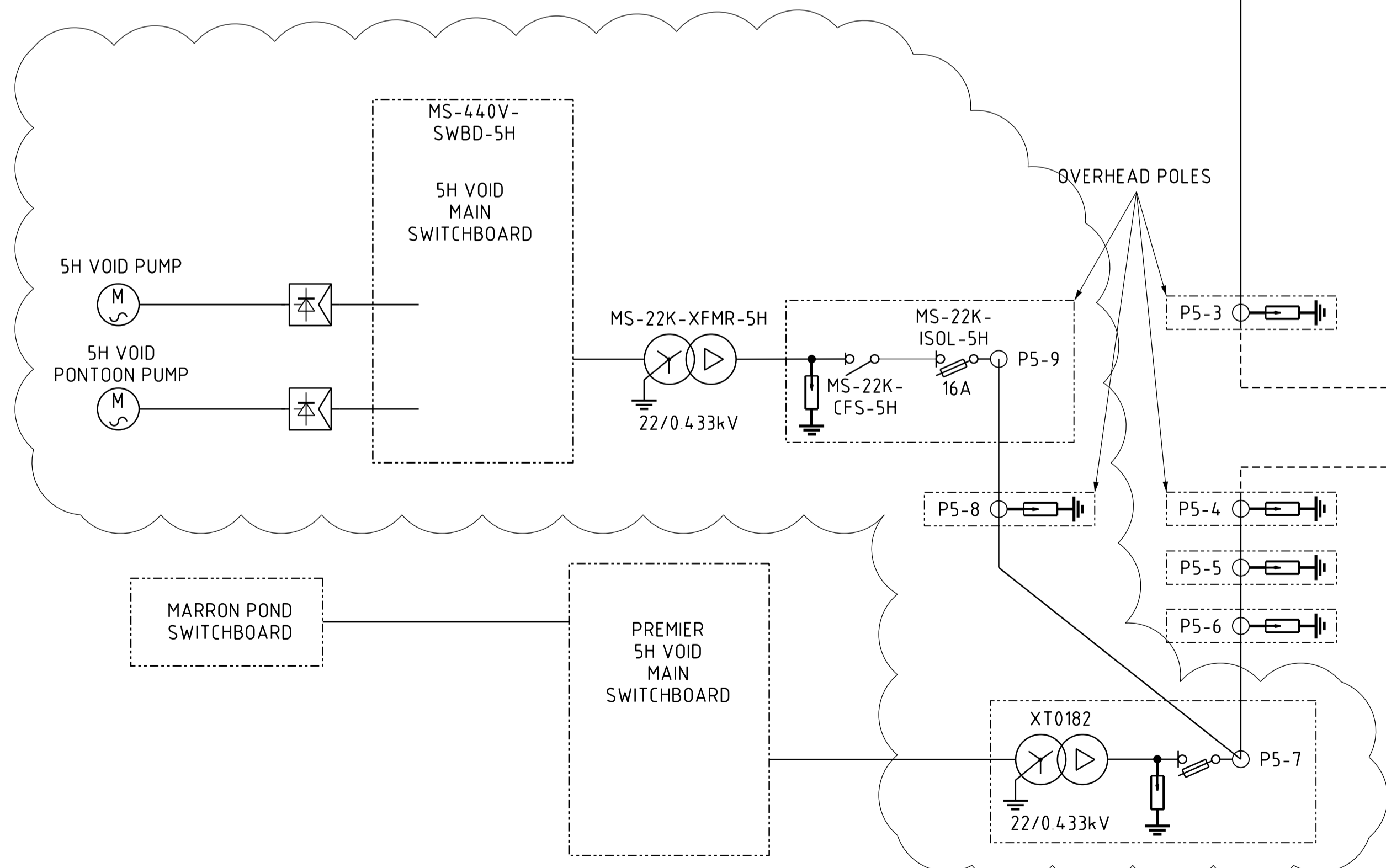
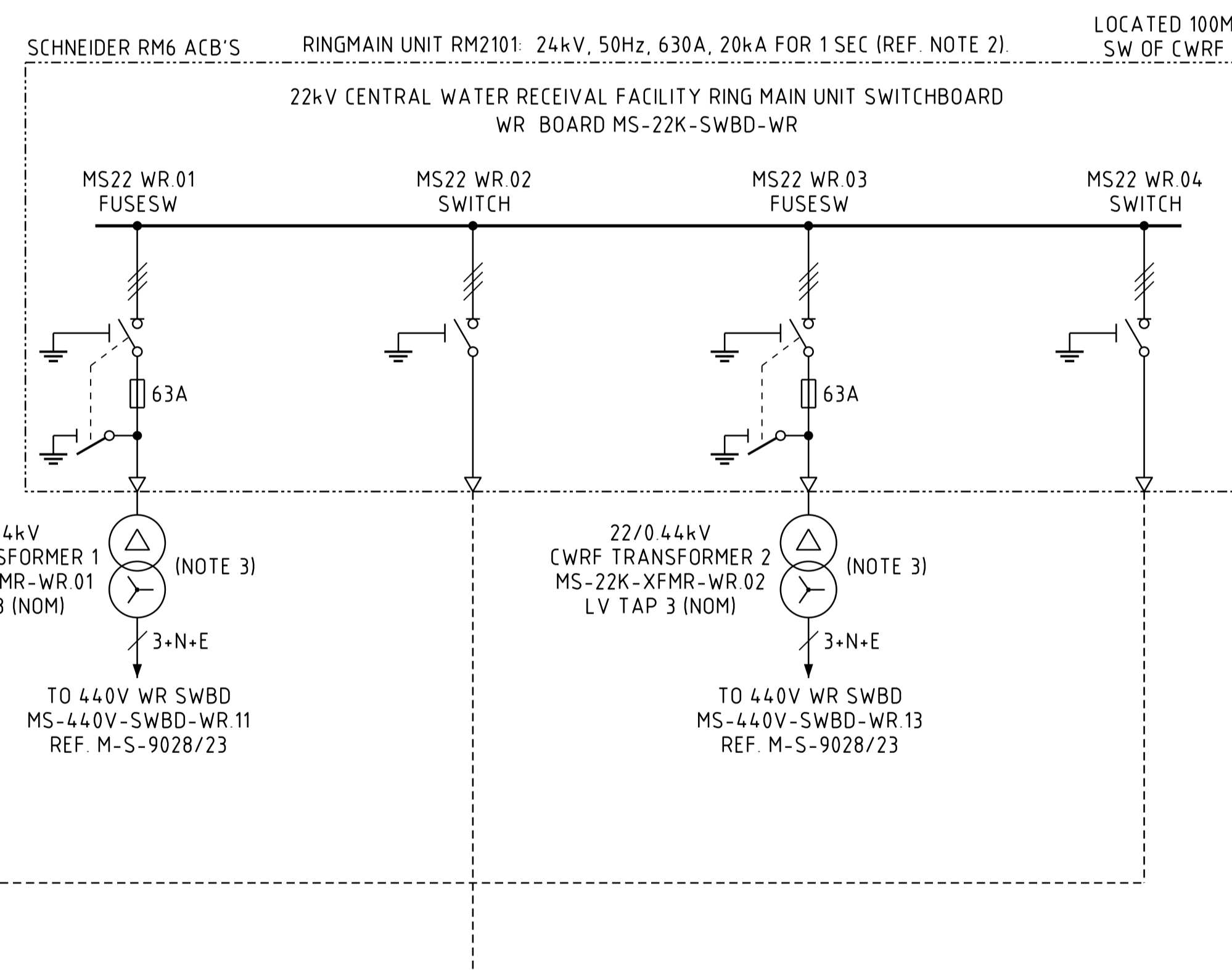
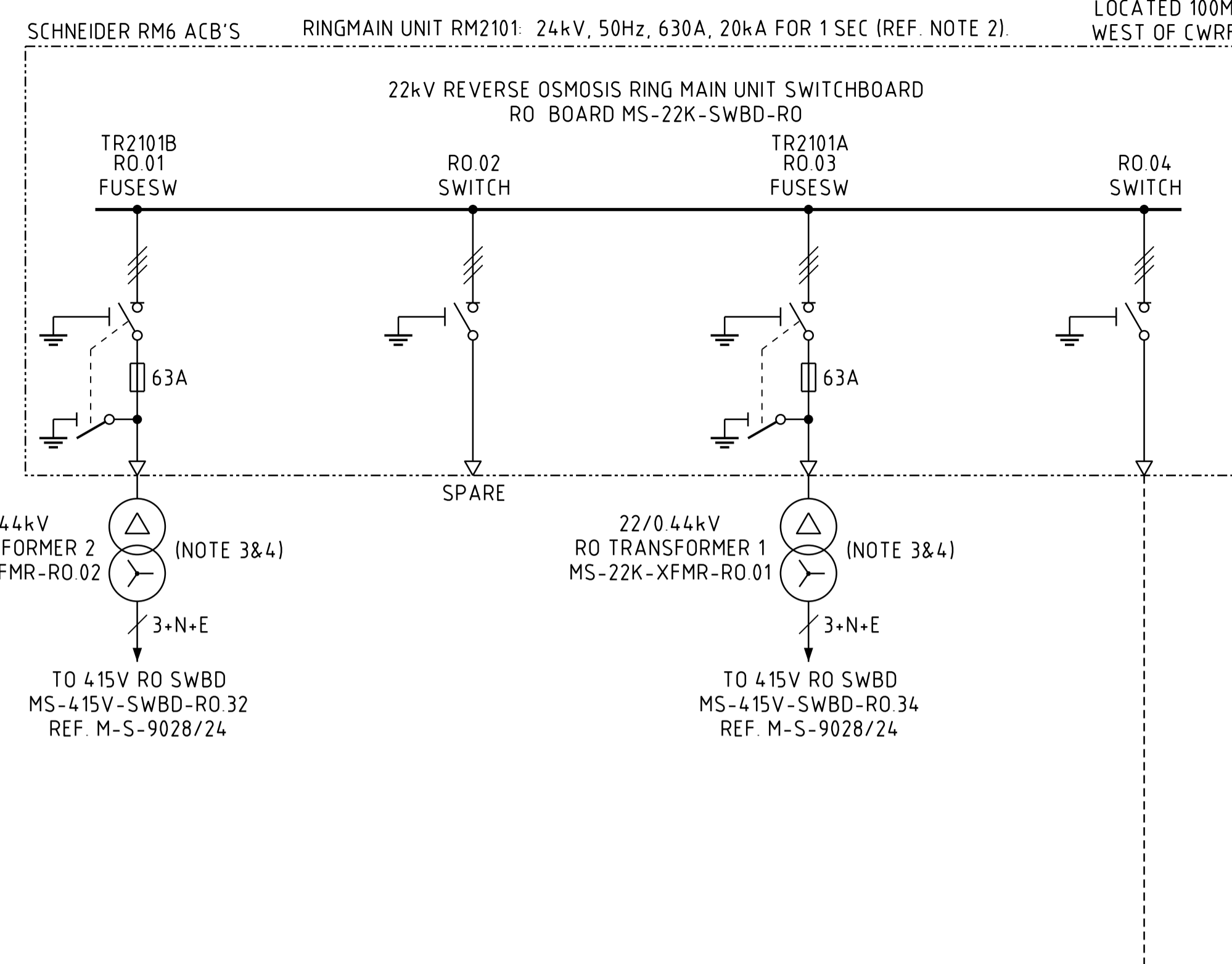
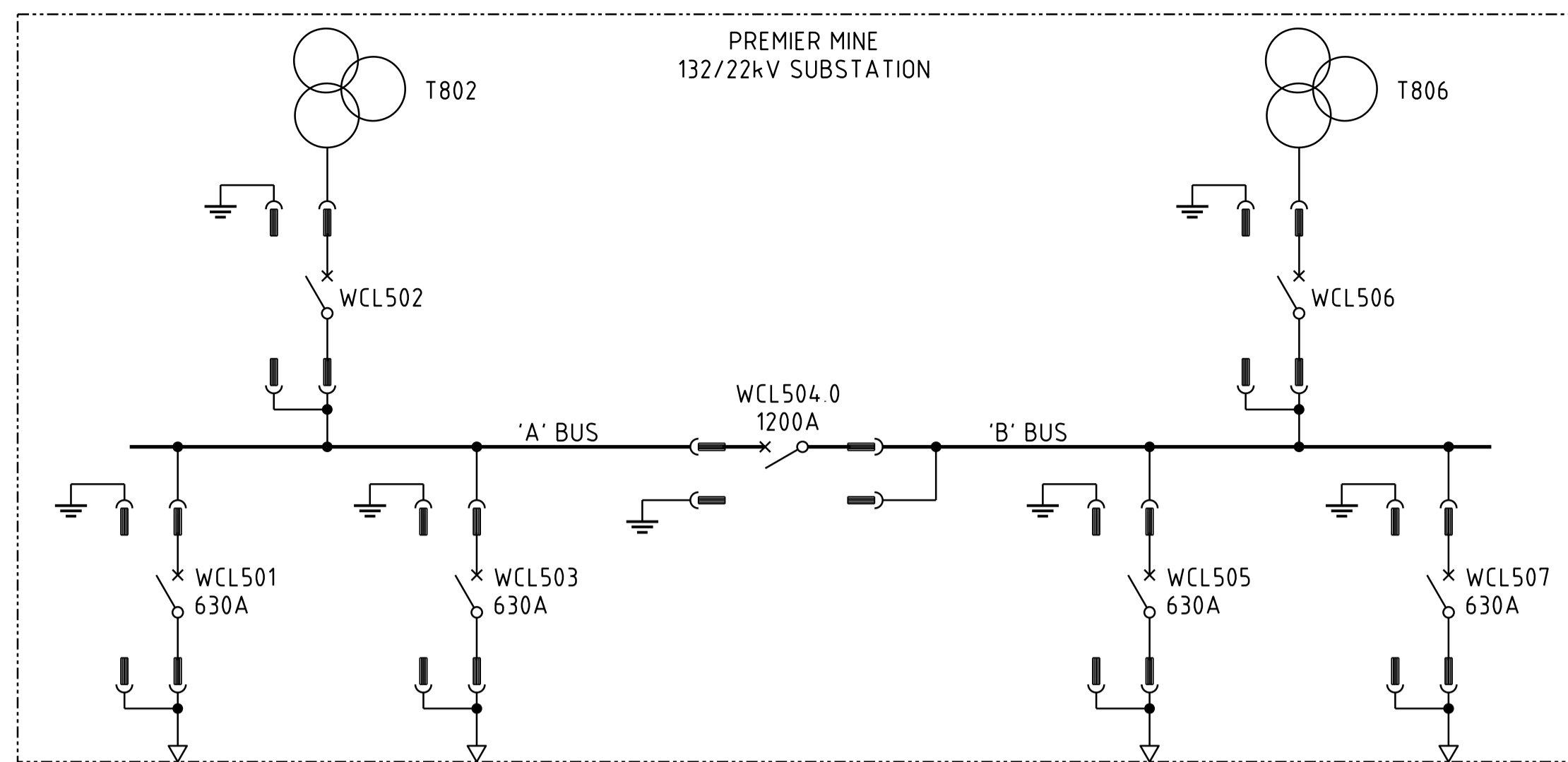
**ISSUED FOR TENDERING ONLY**

EQUIPMENT SCHEDULE			
SYMBOL	DESCRIPTION	TYPE	
ACH	ANTI CONDENSATION HEATER	VENDOR TO ADVISE	
AHF	ADVANCED HARMONIC FILTER	VENDOR TO ADVISE	
MCCB	MAIN SWITCH	VENDOR TO ADVISE	
VVVF	VARIABLE SPEED DRIVE	VENDOR TO ADVISE	
ELK1	METERING TEST LINK	VENDOR TO ADVISE	
E1	2A FUSE	VENDOR TO ADVISE	
FCL	FAULT CURRENT LIMITER	VENDOR TO ADVISE	
MCT	METERING CURRENT TRANSFORMER	VENDOR TO ADVISE	
SWF	SINE WAVE FILTER	VENDOR TO ADVISE	

<b>MUJA POWER STATION</b>				DRAWN: D. O'REILLY 10/9/2018	DRAWING NUMBER <b>M11/C/0425/001</b>																		
<b>5H VOID SWITCHBOARD SINGLE LINE DIAGRAM</b>				CHECKED: E. BAHRAM 10/9/2018																			
SCALE 1: U.O.N.				APPROVED: D. OLADEJO 10/9/2018																			
DRAWING REVISIONS		DRAWING REFERENCES		<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%;">REV</td> <td style="width: 15%;">DATE</td> <td style="width: 15%;">DRWN</td> <td style="width: 10%;">CHK'D</td> <td style="width: 10%;">APP'D</td> <td style="width: 15%;">DESCRIPTION</td> </tr> <tr> <td>2</td> <td>16/10/18</td> <td>DSO</td> <td>EB</td> <td>DD</td> <td>ISSUED FOR TENDERING ONLY</td> </tr> <tr> <td>1</td> <td>19/7/18</td> <td>DSO</td> <td>EB</td> <td>DD</td> <td>FOR REVIEW AND COMMENT</td> </tr> </table>		REV	DATE	DRWN	CHK'D	APP'D	DESCRIPTION	2	16/10/18	DSO	EB	DD	ISSUED FOR TENDERING ONLY	1	19/7/18	DSO	EB	DD	FOR REVIEW AND COMMENT
REV	DATE	DRWN	CHK'D	APP'D	DESCRIPTION																		
2	16/10/18	DSO	EB	DD	ISSUED FOR TENDERING ONLY																		
1	19/7/18	DSO	EB	DD	FOR REVIEW AND COMMENT																		







- NOTES:**
- ALL PLANT No's ON THIS DRAWING TO BE PREFIXED BY MS-22K-SWBD- UNLESS SHOWN OTHERWISE
  - RING MAIN UNITS TO BE SUPPLIED WITH SUITABLE OUTDOOR WEATHERPROOF ENCLOSURE MINIMUM RATING OF IP55
  - STAR POINT OF 22/0.44kV TX'S ARE EARTHED AT MCC
  - TRANSFORMER LV TAP CHANGED TO 1 TO REDUCE OUTPUT TO 415V

							<b>MUJA POWER STATION</b>		DRAWN: M HEAD, APR 2016		DRAWING NUMBER: M-S-9023/1																																			
							22kV CENTRAL WATER RECEIVING FACILITY SUPPLY 22kV RO SWITCHBOARD - MS-22K-SWBD-RO 22kV CWRP SWITCHBOARD - MS-22K-SWBD-WR 5H VOID SWITCHBOARD - MS-440V-SWBD-5H SINGLE LINE DIAGRAM		CHECKED: S.ROBINSON, AUG 2016																																					
									APPROVED: S.ROBINSON, AUG 2016		NEXT SHT: B																																			
									SCALE 1: U.O.N.		REVISION: B																																			
<table border="1"> <tr> <th>REV</th> <th>DATE</th> <th>DRWN</th> <th>CHK'D</th> <th>APP'D</th> <th>DESCRIPTION</th> </tr> <tr> <td>B</td> <td>OCT 18</td> <td>DO</td> <td>EB</td> <td>DO</td> <td>UPDATED AS PER 5H VOID PUMP UPGRADE DESIGN</td> </tr> <tr> <td>A</td> <td>AUG 16</td> <td>AK</td> <td>S.R</td> <td>S.R</td> <td>ADDED NOTE 4 DETAILS UPDATED AS PER MARKUPS S.ROBINSON</td> </tr> </table>					REV	DATE	DRWN	CHK'D	APP'D	DESCRIPTION	B	OCT 18	DO	EB	DO	UPDATED AS PER 5H VOID PUMP UPGRADE DESIGN	A	AUG 16	AK	S.R	S.R	ADDED NOTE 4 DETAILS UPDATED AS PER MARKUPS S.ROBINSON	<table border="1"> <tr> <th>DRAWING No</th> <th>TITLE</th> </tr> <tr> <td>M-S-9028/24</td> <td>CENTRAL WATER RECEIVING FACILITY REVERSE OSMOSIS SWITCHBOARD</td> </tr> <tr> <td>M-S-9028/23</td> <td>CENTRAL WATER RECEIVING FACILITY 440V MCC</td> </tr> </table>		DRAWING No	TITLE	M-S-9028/24	CENTRAL WATER RECEIVING FACILITY REVERSE OSMOSIS SWITCHBOARD	M-S-9028/23	CENTRAL WATER RECEIVING FACILITY 440V MCC	<table border="1"> <tr> <th>DRAWING No</th> <th>TITLE</th> </tr> <tr> <td>M-S-9028/24</td> <td>CENTRAL WATER RECEIVING FACILITY REVERSE OSMOSIS SWITCHBOARD</td> </tr> <tr> <td>M-S-9028/23</td> <td>CENTRAL WATER RECEIVING FACILITY 440V MCC</td> </tr> </table>		DRAWING No	TITLE	M-S-9028/24	CENTRAL WATER RECEIVING FACILITY REVERSE OSMOSIS SWITCHBOARD	M-S-9028/23	CENTRAL WATER RECEIVING FACILITY 440V MCC	<table border="1"> <tr> <th>DRAWING No</th> <th>TITLE</th> </tr> <tr> <td>M-S-9028/24</td> <td>CENTRAL WATER RECEIVING FACILITY REVERSE OSMOSIS SWITCHBOARD</td> </tr> <tr> <td>M-S-9028/23</td> <td>CENTRAL WATER RECEIVING FACILITY 440V MCC</td> </tr> </table>		DRAWING No	TITLE	M-S-9028/24	CENTRAL WATER RECEIVING FACILITY REVERSE OSMOSIS SWITCHBOARD	M-S-9028/23	CENTRAL WATER RECEIVING FACILITY 440V MCC
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M-S-9028/23	CENTRAL WATER RECEIVING FACILITY 440V MCC																																													

## FUNCTIONAL DESCRIPTION

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**Project:** ER4976 Muja Power Station 5H Void Pump Upgrade **Date:** 1/11/2018

**Business Unit:** Generation Business Unit

**Prepared by:** Sundeepica Thusu

**Reviewed by:** Greg Szozda

**For approval by:** David Lewis, Project Manager

---



This document must not be made available to persons outside Synergy without prior written approval of Synergy

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## 1. PURPOSE

The purpose of this document is to specify the control functionality of the new Pump Station for the Muja 5H Mine Void Dewatering System. The sequencing and the drive control logic for the pumps described in this document are implemented in the dedicated RTU located in a separate enclosure in the Main 5H Void Switchboard.

## 2. INTRODUCTION

In order to sustain its mining operation and deliver coal fuel to Synergy's thermal power stations in the Collie Basin, Premier Coal (PCL) need to maintain suitable water table levels. They achieve this by dewatering mine pits via bores and transferring excess water to available artificial reservoirs. 5H void is one such ex-mining pit which holds a volume of water that is accessible to Synergy for use. Synergy has a long standing arrangement with PCL whereby a Synergy owned and operated pumping system is used to extract water from the 5H void thus controlling water level and allowing PCL to dispose of the water from the mining operations.

Currently Synergy can acquire approx. 13ML/day from 5H void with existing equipment.

The new Pump Station for the Muja 5H Mine Void Dewatering System increases the pumping capability and allows maintaining of the water table in the 5H void at lower levels.

Synergy intends to transfer between 50-150l/s of water to the existing Muja Power Station surge ponds and maintain 5H void level at a target level of 182m RL.

## 3. DEFINITIONS & ABBREVIATIONS

REFERENCE	MEANING
<b>CWRF</b>	Central Waste Receive Facility
<b>l/s</b>	Litre per second
<b>m</b>	Metre-Head (10m = 1bar = 100kPa)
<b>MCC</b>	Motor Control Centre
<b>ML/day</b>	Mega-Litre per day
<b>P&amp;ID</b>	Piping & Instrumentation Diagrams
<b>PCL</b>	Premier Coal Limited
<b>PI controller</b>	Proportional-Integral Controller
<b>RL</b>	Reference Level

REFERENCE	MEANING
RTU	Remote Telemetry Unit
VSD	Variable Speed Drive

#### 4. CODES & STANDARDS

##### 4.1 GOVERNMENT STATUTORY REQUIREMENTS AND SUPPLY

All aspects of Works shall comply with relevant Government Acts and Regulations having jurisdiction over them.

##### 4.2 AUSTRALIAN AND INTERNATIONAL STANDARDS

All aspects of works shall comply with the latest editions of the relevant Australian or International Standards & codes of Practice relevant to such work in Australia.

##### 4.3 SYNERGY STANDARDS & SPECIFICATIONS

- Contractors are required to comply with Synergy's General Conditions of Contract Goods & Services available for viewing at <https://www.synergy.net.au/suppliers>.
- All drawings must comply with Synergy's computer aided design technical requirements and engineering drafting standards and practices. **Please refer to Annexure (DM# 4342122)**

##### 4.4 DOCUMENTS AND DRAWINGS

This document should be read in conjunction with the following related Drawings and Documents.

DOCUMENT NUMBER	TITLE
M-S-1067/21	Common Plant Bore Water 5H Void P&ID
M11-C-0426-001	Common Plant Bore Water 5H Void I&C Cable Block Diagram
IW182200-EMM-LST-001	Signal List
IW182200-EMM-LST-003	Alarm List
IW182200-EMM-LST-004	Equipment List

#### **4.5 CONFLICTS BETWEEN CODES, STANDARDS OR SPECIFICATIONS**

Where a conflict exists between codes, standards or specifications, the contractor shall notify the Company in writing and obtain clarification from the Company prior to proceeding with any works.

### **5. DESCRIPTION OF FACILITIES**

#### **5.1 LOCATION**

The 5H Mine void is located adjacent to Muja Power Station, Boys Home Road, Palmer WA. Muja Power station is situated 22kms east of Collie, Western Australia.

#### **5.2 CURRENT DEWATERING SYSTEM**

The system consists of one (1) skid mounted duty end-suction electric centrifugal pump (220kW, Aquaplug AQUESH200-560-S60 model, serial number 08235002, designation P-111), designed for approximately 10 ML/day (115L/s) @ 100m head. The skid includes a suction priming tank to allow the system to be primed prior to start-up.

This pump is installed on the shore of the 5H void and will not be capable of operation at the future target level in 5H Void of 182m RL (this level is equivalent to a 20m suction static lift, which is unachievable at ambient pressures).

#### **5.3 UPGRADED PUMP STATION**

To achieve target flowrate of 50-150L/s at the future level 182m RL in the 5H Void, the upgrade to the pumping arrangement is required. In the upgraded arrangement, a pontoon pump set (Pump No. P-112) will be installed within the void, connecting with the suction of the existing onshore pump that will be used as an in-line booster for achieving the target flowrate.

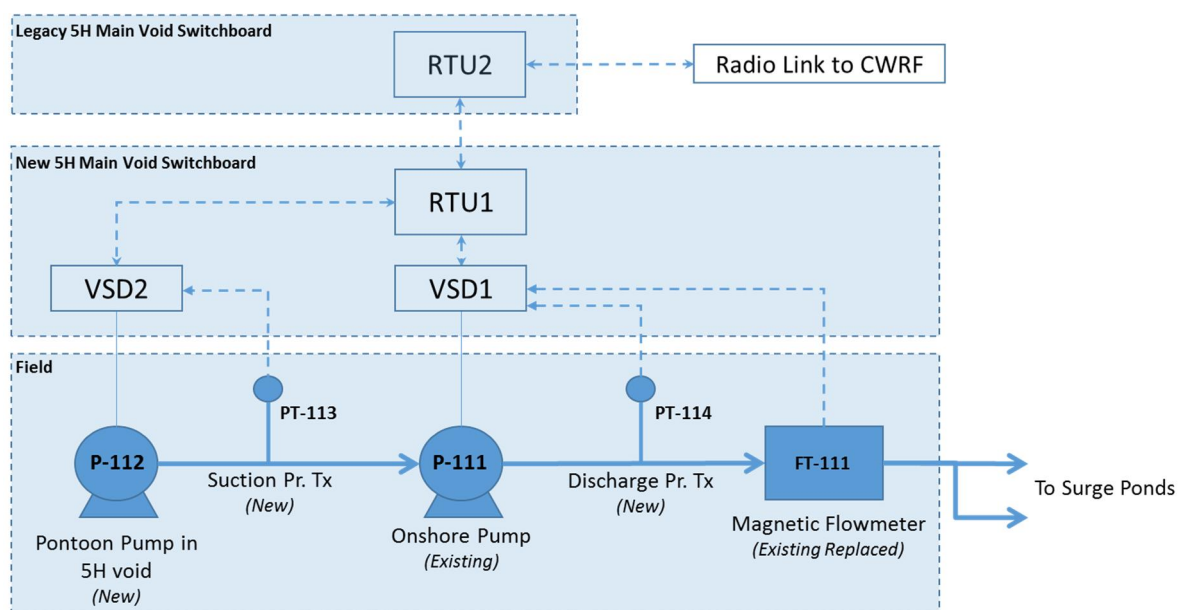
The following sections describe operation philosophy of the upgraded system.



## 6. EQUIPMENT CONTROL

### 6.1 OVERVIEW

The configuration of the new 5H Void Pump Station is shown on below **Figure 1**: Control System Diagram for Pump Station Upgrade (refer P&ID M-S-1067/21 & IO List IW182200-EMM-LST-001 for more details).



**Figure 1: Control System Diagram for Pump Station Upgrade**

The system consists of two pumps:

1. New Pontoon Pump set (P-112) with duty flow of 50-150L/s connected in series with the Onshore Pump set,
2. Existing Onshore Pump set (P111) serving as a line booster.

Both pumps are equipped with, 50Hz Electric Motors driven by the Variable Speed Drives (VSD2 and VSD1 respectively).

There are two Gauge Pressure Transmitters (PT-113 & PT-114) installed on the suction and discharge of the onshore pump respectively.

The suction pressure transmitter PT-113 provides feedback for the pressure control loop of the Pontoon Pump. The transmitter is connected directly to Pontoon Pump P-112

VSD with signal being re-retransmitted to the plant SCADA. Closed loop control is implemented at the VSD with the setpoint of 10m gauge pressure (100kPaG).

Discharge pressure transmitter PT-113 protects downstream piping from the overpressure via flow controller pressure limiter and overpressure protection functionality in the pumps control logic. The transmitter is connected directly to Onshore Pump P-111 VSD signal being re-retransmitted to the plant SCADA.

Magnetic Flowmeter FT-111 located downstream of the P-111 provides feedback for the flow control loop. The transmitter is connected directly to Onshore Pump P-111 VSD signal being re-retransmitted to the plant SCADA.

Both pumps VSD's are configured with "Dry Pump" and "End of Curve" protection features. Downstream piping overpressure and Onshore Pump low suction pressure protection functions are implemented on the associated RTU1.

A Miri AD2000 Remote Telemetry Unit (RTU1), located in a separate enclosure in the New 5H Void Main Switchboard, performs system start-up and shutdown functionality in remote-automatic mode and also interfaces control & monitoring signals to the CWRP SCADA System via radio interface to RTU2 and further to CWRP and Synergy control network. RTU1 is interfaced to the pumps VSD's with hardwired Start/Stop & Protection OFF commands. Additionally, the flow setpoint signal is hardwired from RTU1 to the Onshore Pump P-111 VSD1.

All motor/VSD diagnostic signals and process measurements (FT-111, PT-113, PT-114) are interfaced to RTU1 from both VSD's via RS-485 serial link interface using Modbus protocol. The following is the Modbus configuration table:

<b>Equipment</b>	<b>Node</b>	<b>Interface (RS-485, half-duplex mode)</b>
RTU1	Master	Baud rate: 115200
VSD1	Slave 1	Data bits: 8
VSD2	Slave 2	Stop bits: 1
MCC Power Meter	Slave 3	Parity: None
		Flow control: None

RTU2 is located in Legacy 5H Void Switchboard in a dedicated IP-67 Enclosure. RTU2 serves as the communication gateway between the RTU1 and CWRP telemetry.

Refer P&ID (M-S-1067/21), Equipment List (IW182200-EMM-LST-004) and I/O List (IW182200-EMM-LST-001) for further information.

## 6.2 OPERATIONAL MODES

Each Pump can operate in one of the two modes of operation:

- Automatic (Auto-Remote system start/stop from RTU through command from CWRP SCADA),
- Manual (Local).

The Start & Stop interlocks for the individual pumps are as detailed in section 0.

### 6.2.1 Auto Mode Operation

In Auto Mode of Operation, the system is governed by commands from the CWRP HMI (system start command pulse and reclaim water flow setpoint). The system Auto mode is enabled when both pumps VSD's are selected to Remote mode (via control pad on the VSD front plate).

Upon receiving the start command from CWRP, the RTU latches the start command and executes the following system start-up sequence:

1. Pontoon Pump VSD Starts and automatically ramps up/down to achieve set pressure of 10m at PT-113, as detailed in control narrative in section 6.5.
2. Once 7m pressure is achieved at PT-113, and drive interlocks are satisfied, the Onshore Pump (P-111) starts and the VSD1 ramps up/down to achieve and maintain the target flowrate at Flow Transmitter FT-111, as set by the Operator at CWRP SCADA.
3. Sequence completed.

The system automatically stops upon receiving stop command from CWRP (pulse), via unlatching the start command. When requested to stop, the RTU1 will drive the flow setpoint for Onshore Pump (P-111) to normal minimum of 50l/s (10s rump-down timer) before switching both pumps off simultaneously.

The system activates alarms at low Onshore Pump suction PT-113 pressure 30s after system start, at high Onshore Pump discharge PT-114 pressure at any time and at flow FT-111 below 50% of expected value 30s after system start or step setpoint change. Please refer document, IW182200-EMM-LST-003 for the detailed Alarm List to be programmed into RTU's. Refer Section 0 for detailed description of alarms and interlocks.

### **Pipeline Filling Operation**

Under some circumstances (e.g. maintenance works or long periods of out of service) the pipelines downstream of the 5H Void pumping station may be drained. The system will require filling up prior to being placed in normal operation.

The filling up is achieved via selecting "Pipeline Filling" mode at the SCADA interface and issuing system start command. Upon selecting this option, the flow setpoint will be automatically set to minimum design value of 20l/s until the "Pipeline Filling" mode is deselected. Operating at this low flow setpoint will provide controlled pipe filling with minimum pressure excursions or disturbances.

The system will issue alarm if operating in this mode for longer than 4 hours to prevent prolonged run of the pump motors at low speeds.

### **6.2.2 Local Mode**

Local Mode can be selected from the control pad on each pump VSD front plate. Once in Local mode, individual pump operation can be controlled from the VSD local pushbuttons (start, stop, speed setpoint adjustment). Safety & Equipment Protection Interlocks will remain active. Flow setpoint on RTU1 and SCADA will change into tracking mode of the current flow when pump selected to Local.

Local stop command is always enabled on the VSD, thus pump can be stopped with single pushbutton, without changing modes, in case if necessary. If the pump has been stopped from the VSD while running in the remote mode, an "Unexpected Change of State" alarm will be raised by the system to indicate local operation without mode change. The system will be locked out until the alarm is acknowledged by the operator.

## **6.3 PUMP OPERATION & INTERLOCKS**

### **6.3.1 PONTOON PUMP (P-112) ALARMS & INTERLOCKS**

#### **A. Pontoon Pump Alarms**

The following Pontoon Pump alarms are activated at CWRF HMI:

- VSD2 FAULT
- Motor Winding temperature >HIGH (any of three motor winding RTD's)
- Pump bearing vibration VT-115 >HIGH
- Motor Overcurrent (past start-up period)
- P-113 pressure <7m, 30s after pump start (Pump Deficient alarm)
- Pump stopped locally while running in remote mode

#### **B. Pontoon Pump Start Permissions**

The Pontoon Pump is prohibited from Auto starting until following conditions are met:

- Pump in AUTO mode
- VSD2 status is HEALTHY
- No VSD2 FAULT present
- Motor Winding temperatures and bearing vibration are not HIGH
- VSD2 Feeder CB is CLOSED
- No Current Overload present
- Onshore Pump suction pressure transmitter PT-113 HEALTHY

#### **C. Pontoon Pump Interlocks**

Pontoon Pump is automatically tripped under the following conditions:

- Winding temperatures HIGH HIGH (any of three motor winding RTD's)
- Pump bearing vibration VT-115 HIGH HIGH
- VSD2 FAULT
- VSD2 Feeder CB OPEN
- Motor Current Overload
- Pump running for 30s and Onshore Pump P-111 NOT RUNNING

Trip command is independently hardwired from RTU1 to the VSD2 terminals and operates in both; Auto and Manual modes.

## 6.3.2 ONSHORE PUMP (P-111) ALARMS & INTERLOCKS

### A. Onshore Pump Alarms

The following Onshore Pump alarms are activated at CWRP HMI:

- VSD1 FAULT
- Motor Winding temperature >HIGH
- Motor Overcurrent (past start-up period)
- FT-111 flow vs. setpoint deviation >20% 30s after pump start or step setpoint change (Pump Deficient alarm)
- Pump operating at “filling” setpoint of 20l/s for 4hours
- Pump stopped locally while running in remote mode

### B. Onshore Pump Start Permissions

The Onshore Pump is prohibited from Auto starting until the following conditions are met:

- Pump in AUTO Mode
- Pontoon Pump is RUNNING
- Pump Inlet Pressure (PT-113) is greater than 7m
- VSD1 status is HEALTHY
- No VSD1 FAULT present
- Motor Winding temperatures are not HIGH
- VSD1 Feeder CB is CLOSED
- No Current Overload present
- Onshore Pump discharge pressure transmitter PT-114 HEALTHY
- Flow transmitter FT-111 HEALTHY

### C. Onshore Pump Interlocks

Onshore Pump is automatically tripped under the following conditions:

- Pump Suction Pressure (PT-113) less than 5m after 30s from pump start
- Pump Discharge Pressure (PT-114) greater than 100m
- Pontoon Pump NOT RUNNING
- Pump Motor Winding temperature HIGH HIGH
- VSD1 FAULT
- VSD1 Feeder CB OPEN
- Motor Current Overload



A trip command is independently hardwired from RTU to the VSD1 terminals and operates in both; Auto and Manual modes.

In case of either pump trip, the latched automatic start command is cancelled until activated again by the CWRP Operator.

## **6.4 GENERAL SYSTEM ALARMS**

In addition to individual alarms and interlocks associated with particular drive, there is a number of system alarms flagging abnormal state of the system:

- RTU1 to RTU2 communication fault (alarm generated by RTU2 based on the loss of heartbeat signal from RTU1) – system will continue running if in operation, however system start command will be locked until fault is rectified
- RTU2 to CWRP communication fault (alarm generated at CWRP based on the loss of heartbeat signal from RTU2) – system will continue running if in operation, however system start command will be locked until fault is rectified
- Radio link strength LOW alarm – initiated when strength of the radio link between RTU1 and RTU2 or RTU2 and CWRP drops below 30%
- Panel door open – indicates maintenance activities on the RTU panels – no action is taken by the system
- Mains or battery LOW power alarm – indicated respective power source malfunction. No direct action is taken by the system, the pumps however will stop on loss of control power due to fail safe design of the emergency stop circuit

## **6.5 ANALOGUE CONTROL**

### **6.5.1 Onshore Pump Suction Pressure PI Controller**

The objective of the controller is to achieve stable pressure of 10m head at the suction of the Onshore Pump.

The pressure is controlled by adjusting speed of the Pontoon Pump P-112 motor via VSD2. The Onshore Pump suction pressure transmitter PT-113 is hardwired to the VSD2 and provides closed loop feedback to the controller implemented directly at the VSD.

The VSD additionally provides “Dry Pump” and “End of Curve” protection as per standard Danfoss configuration.

### **6.5.2 Onshore Pump Flow Rate PI Controller**

The objective of the controller is to achieve a target system flowrate at as set by the Operator via SCADA.

The flowrate is controlled by adjusting speed of the Onshore Pump P-111 motor via VSD1. The flow transmitter FT-111 is hardwired directly to VSD1 and provides closed loop feedback to the controller implemented directly at the VSD. The RTU1 provides hardwired flow setpoint set by the Operator via SCADA.

In order to protect the downstream piping, the flow controller limits VSD1 speed if Onshore Pump discharge pressure exceeds 95m, indicated by transmitter PT-114 hardwired to the VSD. The RTU1 flow setpoint changes to actual flow tracking mode when VSD1 is selected to Local, or NOT RUNNING, thus providing bump-less transition. The controller is automatically enabled when pump VSD is in Auto mode and RUNNING for 10s (pump start delay).

The VSD additionally provides “Dry Pump” and “End of Curve” protection as per standard Danfoss configuration.



ER4976 - Muja Power Station SH Void Pump Upgrade										DOC. NO.	REV. NO.		
IO LIST										IW182200-EMM-LST-001	0		
										CLIENT DOC. NO.	CLIENT REV. NO.		
PROJECT NAME ER4976 / IW182200 CLIENT Synergy Generation Business Unit										NA			
Item	Instrument Tag	Signal Name	Signal Description	DI	DO	AI	AO	Engineered Status/Range	Unit	Source	Source Modbus/MIRI Address	Destination	Destination MIRI Address
1	MS-BW-PT-113 INSTRU	MS-BW-PT-113 X001	Onshore Pump Suction Pressure					0-600	kPaG	VSD2 (Modbus RS485 - Slave 2)		RTU1	
2	MS-BW-PT-114 INSTRU	MS-BW-PT-114 X001	Onshore Pump Discharge Pressure					0-1800	kPaG	VSD1 (Modbus RS485 - Slave 1)		RTU1	
3	MS-BW-FT-111 INSTRU	MS-BW-FT-111 X001	SH Void Water Flow					0-200	l/s	VSD2 (Modbus RS485 - Slave 2)		RTU1	
4	MS-BW-VT-115 INSTRU	MS-BW-VT-115 X001	Pontoon Pump Bearing Vibration					0-35	mm/s	VSD2 (Modbus RS485 - Slave 2)		RTU1	
5	MS-BW-P-111 STARTR	MS-BW-P-111 YB01	VSD 1 CMD ON					ACTIVE		RTU1		VSD1 (Hardwired)	
6	MS-BW-P-111 STARTR	MS-BW-P-111 YB02	VSD 1 PROTECTION OFF					NOT ACTIVE		RTU1			
7	MS-BW-P-111 STARTR	MS-BW-P-111 XB01	VSD 1 RUNNING					RUN FB				RTU1	
8	MS-BW-P-111 STARTR	MS-BW-P-111 XB15	VSD 1 HEALTHY					HEALTHY				RTU1	
9	MS-BW-P-111 PUMP	MS-BW-P-111 XB17	Onshore Pump AUTO					AUTO				RTU1	
10	MS-BW-P-111 PUMP	MS-BW-P-111 XB14	Onshore Pump FAULT					FAULT				RTU1	
11	MS-BW-P-111 MOTOR	MS-BW-P-111 XB20	Onshore Pump Motor Current Overload					ACTIVE		VSD1 (Modbus RS485 - Slave 1)		RTU1	
12	MS-BW-P-111 PUMP	MS-BW-P-111 X001	Onshore Pump SPEED					0-50	Hz			RTU1	
13	MS-BW-P-111 MOTOR	MS-BW-P-111 X002	Onshore Pump Motor CURRENT					400	A			RTU1	
14	MS-BW-P-111 MOTOR	MS-BW-P-111 X004	Onshore Pump Motor Winding Temperature					0-200	°C			RTU1	
15	MS-BW-P-111 MOTOR	MS-BW-P-111 X003	Onshore Pump Motor Power					0-220	kW			RTU1	
16	MS-BW-P-112 STARTR	MS-BW-P-112 YB01	VSD 2 CMD ON					ACTIVE		RTU1		VSD2 (Hardwired)	
17	MS-BW-P-112 STARTR	MS-BW-P-112 YB02	VSD 2 PROTECTION OFF					NOT ACTIVE		RTU1			
18	MS-BW-P-112 STARTR	MS-BW-P-112 XB01	VSD 2 RUNNING					RUN FB				RTU1	
19	MS-BW-P-112 STARTR	MS-BW-P-112 XB15	VSD 2 HEALTHY					HEALTHY				RTU1	
20	MS-BW-P-112 PUMP	MS-BW-P-112 XB17	Pontoon Pump AUTO					AUTO				RTU1	
21	MS-BW-P-112 PUMP	MS-BW-P-112 XB14	Pontoon Pump FAULT					FAULT				RTU1	
22	MS-BW-P-112 MOTOR	MS-BW-P-112 XB20	Pontoon Pump Current Overload					ACTIVE		VSD2 (Modbus RS485 - Slave 2)		RTU1	
23	MS-BW-P-112 PUMP	MS-BW-P-112 X001	Pontoon Pump SPEED					0-50Hz	rpm			RTU1	
24	MS-BW-P-112 MOTOR	MS-BW-P-112 X002	Pontoon Pump Motor CURRENT					150	A			RTU1	
25	MS-BW-P-112 MOTOR	MS-BW-P-112 X004	Pontoon Pump Motor Winding Temperature Blue Phase					0-150	°C			RTU1	
26	MS-BW-P-112 MOTOR	MS-BW-P-112 X005	Pontoon Pump Motor Winding Temperature Red Phase					0-150	°C			RTU1	
27	MS-BW-P-112 MOTOR	MS-BW-P-112 X006	Pontoon Pump Motor Winding Temperature White Phase					0-150	°C			RTU1	
28	MS-BW-P-112 MOTOR	MS-BW-P-112 X003	Pontoon Pump Motor Power					0-75	kW			RTU1	
29	MS-440V-SWBD-SH METER	MS-440V-SWBD-SH X001	Metering Voltage					TBA	V			RTU1	
30	MS-440V-SWBD-SH METER	MS-440V-SWBD-SH X002	Metering Current					TBA	A			RTU1	
31	MS-440V-SWBD-SH METER	MS-440V-SWBD-SH X003	Metering Power Factor					TBA				RTU1	
32	MS-440V-SWBD-SH METER	MS-440V-SWBD-SH X004	Metering Apparent Power					TBA	MVA			RTU1	
33	MS-440V-SWBD-SH METER	MS-440V-SWBD-SH X005	Metering Reactive Power					TBA	MVAR			RTU1	
34	MS-440V-XFMR-SH TRANSF	MS-440V-XFMR-SH XG01	Transformer Temperature HIGH					HIGH				RTU1	Electrical (Hardwired)
35	MS-440V-XFMR-SH TRANSF	MS-440V-XFMR-SH XG02	Transformer Pressure HIGH					HIGH				RTU1	Electrical (Hardwired)
36	MS-440V-SWBD-SH.01 FUSE SW	MS-440V-SWBD-SH.01 XB01	VSD 1 Feeder CB OPEN					OPEN				RTU1	Electrical (Hardwired)
37	MS-440V-SWBD-SH.02 FUSE SW	MS-440V-SWBD-SH.02 XB01	VSD 2 Feeder CB OPEN					OPEN				RTU1	Electrical (Hardwired)
38	MS-440V-SWBD-SH INSTRU	MS-440V-SWBD-SH XG01	Incomer Phase Failure					FAILURE				RTU1	Electrical (Hardwired)
39	MS-440V-SWBD-SH INSTRU	MS-440V-SWBD-SH XB01	Main Incomer OPEN					OPEN				RTU1	Electrical (Hardwired)
40	MS-440V-SWBD-SH INSTRU	MS-440V-SWBD-SH XB02	Main Incomer CLOSED					CLOSED				RTU1	Electrical (Hardwired)
41	MS-440V-SWBD-SH INSTRU	MS-440V-SWBD-SH XB20	Main Incomer TRIP					TRIPPED				RTU1	Electrical (Hardwired)
42	MS-BW-TM-SH.01 TELMTY	MS-BW-TM-SH.01 XG01	RTU1 Mains Power Loss					OPEN				RTU1	(Hardwired)
43	MS-BW-TM-SH.01 TELMTY	MS-BW-TM-SH.01 XG02	RTU1 Battery Power Low					LOW				RTU1	(Hardwired)
44	MS-BW-TM-SH.01 TELMTY	MS-BW-TM-SH.01 XG03	RTU1 Panel Door Open					OPEN				RTU1	(Hardwired)
45	MS-BW-TM-SH.01 TELMTY	MS-BW-TM-SH.01 YB01	SH Void Pumping System Command ON					CMD ON		RTU2 (Radio Link)		RTU1	
46	MS-BW-TM-SH.01 TELMTY	MS-BW-TM-SH.01 YB02	SH Void Pumping System Command OFF					CMD OFF		RTU2 (Radio Link)		RTU1	
47	MS-BW-TM-SH.01 TELMTY	MS-BW-TM-SH.01 YQ41	SH Void Pumping System Flow Setpoint					0-200	l/s	RTU2 (Radio Link)		RTU1	
48	MS-BW-TM-SH.01 TELMTY	MS-BW-TM-SH.01 YQ41	SH Void Pumping System Flow Setpoint					0-200	l/s	RTU1 (Hardwired)		VSD1 (Hardwired)	
49	MS-BW-TM-SH.01 TELMTY	MS-BW-TM-SH.01 ZV01	SH Void Pumping System Comms Heartbeat					ACTIVE		RTU2 (Radio Link)		RTU1	
50	MS-BW-TM-SH.01 TELMTY	MS-BW-TM-SH.01 ZV02	SH Void Pumping System Comms Heartbeat Feedback					ACTIVE		RTU1 (Radio Link)		RTU2	



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IO LIST												CLIENT DOC. No. N/A	CLIENT REV. NO
PROJECT NAME	Muja Power Station 5H Void Pump Upgrade												
PROJECT NUMBER	ER4976 / IW182200												
CLIENT AREA	Synergy Generation Business Unit												
Item	Instrument Tag	Signal Name	Signal Description	DI	DO	AI	AO	Energised Status Range	Unit	Source	Source MIRI Address	Destination	Destination MIRI Address
1	MS-BW-PT-113 INSTRU	MS-BW-PT-113 XQ01	Onshore Pump Suction Pressure			1		0-600	kPaG	RTU1 (Radio Link)		CWRF (Radio Link)	
2	MS-BW-PT-114 INSTRU	MS-BW-PT-114 XQ01	Onshore Pump Discharge Pressure			1		0-1800	kPaG	RTU1 (Radio Link)		CWRF (Radio Link)	
3	MS-BW-PT-111 INSTRU	MS-BW-PT-111 XQ01	SH Void Water Flow			1		0-200	l/s	RTU1 (Radio Link)		CWRF (Radio Link)	
4	MS-BW-VT-115 INSTRU	MS-BW-VT-115 XQ01	Pontoon Pump Bearing Vibration			1		0-35	mm/s	RTU1 (Radio Link)		CWRF (Radio Link)	
5	MS-BW-P-111 STARTR	MS-BW-P-111 YB01	VSD 1 CMD ON	1				ACTIVE		RTU1 (Radio Link)		CWRF (Radio Link)	
6	MS-BW-P-111 STARTR	MS-BW-P-111 YB02	VSD 1 PROTECTION OFF	1				NOT ACTIVE		RTU1 (Radio Link)		CWRF (Radio Link)	
7	MS-BW-P-111 STARTR	MS-BW-P-111 XB01	VSD 1 RUNNING	1				RUN FB		RTU1 (Radio Link)		CWRF (Radio Link)	
8	MS-BW-P-111 STARTR	MS-BW-P-111 XB15	VSD 1 HEALTHY	1				HEALTHY		RTU1 (Radio Link)		CWRF (Radio Link)	
9	MS-BW-P-111 PUMP	MS-BW-P-111 XB17	Onshore Pump AUTO	1				AUTO		RTU1 (Radio Link)		CWRF (Radio Link)	
10	MS-BW-P-111 PUMP	MS-BW-P-111 XB14	Onshore Pump FAULT	1				FAULT		RTU1 (Radio Link)		CWRF (Radio Link)	
11	MS-BW-P-111 MOTOR	MS-BW-P-111 XB20	Onshore Pump Motor Current Overload	1				ACTIVE		RTU1 (Radio Link)		CWRF (Radio Link)	
12	MS-BW-P-111 PUMP	MS-BW-P-111 XQ01	Onshore Pump SPEED			1		0-50	Hz	RTU1 (Radio Link)		CWRF (Radio Link)	
13	MS-BW-P-111 MOTOR	MS-BW-P-111 XQ02	Onshore Pump Motor CURRENT			1		400	A	RTU1 (Radio Link)		CWRF (Radio Link)	
14	MS-BW-P-111 MOTOR	MS-BW-P-111 XQ04	Onshore Pump Motor Winding Temperature			1		0-200	°C	RTU1 (Radio Link)		CWRF (Radio Link)	
15	MS-BW-P-111 MOTOR	MS-BW-P-111 XQ03	Onshore Pump Motor Power			1		0-220	kW	RTU1 (Radio Link)		CWRF (Radio Link)	
16	MS-BW-P-112 STARTR	MS-BW-P-112 YB01	VSD 2 CMD ON	1				ACTIVE		RTU1 (Radio Link)		CWRF (Radio Link)	
17	MS-BW-P-112 STARTR	MS-BW-P-112 YB02	VSD 2 PROTECTION OFF	1				NOT ACTIVE		RTU1 (Radio Link)		CWRF (Radio Link)	
18	MS-BW-P-112 STARTR	MS-BW-P-112 XB01	VSD 2 RUNNING	1				RUN FB		RTU1 (Radio Link)		CWRF (Radio Link)	
19	MS-BW-P-112 STARTR	MS-BW-P-112 XB15	VSD 2 HEALTHY	1				HEALTHY		RTU1 (Radio Link)		CWRF (Radio Link)	
20	MS-BW-P-112 PUMP	MS-BW-P-112 XB17	Pontoon Pump AUTO	1				AUTO		RTU1 (Radio Link)		CWRF (Radio Link)	
21	MS-BW-P-112 PUMP	MS-BW-P-112 XB14	Pontoon Pump FAULT	1				FAULT		RTU1 (Radio Link)		CWRF (Radio Link)	
22	MS-BW-P-112 MOTOR	MS-BW-P-112 XB20	Pontoon Pump Current Overload	1				ACTIVE		RTU1 (Radio Link)		CWRF (Radio Link)	
23	MS-BW-P-112 PUMP	MS-BW-P-112 XQ01	Pontoon Pump SPEED			1		0-50	Hz	RTU1 (Radio Link)		CWRF (Radio Link)	
24	MS-BW-P-112 MOTOR	MS-BW-P-112 XQ02	Pontoon Pump Motor CURRENT			1		150	A	RTU1 (Radio Link)		CWRF (Radio Link)	
25	MS-BW-P-112 MOTOR	MS-BW-P-112 XQ04	Pontoon Pump Motor Winding Temperature Blue Phase			1		0-200	°C	RTU1 (Radio Link)		CWRF (Radio Link)	
26	MS-BW-P-112 MOTOR	MS-BW-P-112 XQ05	Pontoon Pump Motor Winding Temperature Red Phase			1		0-200	°C	RTU1 (Radio Link)		CWRF (Radio Link)	
27	MS-BW-P-112 MOTOR	MS-BW-P-112 XQ06	Pontoon Pump Motor Winding Temperature White Phase			1		0-200	°C	RTU1 (Radio Link)		CWRF (Radio Link)	
28	MS-BW-P-112 MOTOR	MS-BW-P-112 XQ03	Pontoon Pump Motor Power			1		0-75	kW	RTU1 (Radio Link)		CWRF (Radio Link)	
29	MS-440V-SWBD-SH METER	MS-440V-SWBD-SH XQ01	Metering Current			1		TBA	V	RTU1 (Radio Link)		CWRF (Radio Link)	
30	MS-440V-SWBD-SH METER	MS-440V-SWBD-SH XQ02	Metering Voltage			1		TBA	A	RTU1 (Radio Link)		CWRF (Radio Link)	
31	MS-440V-SWBD-SH METER	MS-440V-SWBD-SH XQ03	Metering Power Factor			1		TBA		RTU1 (Radio Link)		CWRF (Radio Link)	
32	MS-440V-SWBD-SH METER	MS-440V-SWBD-SH XQ04	Metering Apparent Power			1		TBA	MVA	RTU1 (Radio Link)		CWRF (Radio Link)	
33	MS-440V-SWBD-SH METER	MS-440V-SWBD-SH XQ05	Metering Reactive Power			1		TBA	MVAR	RTU1 (Radio Link)		CWRF (Radio Link)	
34	MS-440V-XFMR-SH TRANSF	MS-440V-XFMR-SH XG01	Transformer Temperature HIGH	1				HIGH		RTU1 (Radio Link)		CWRF (Radio Link)	
35	MS-440V-XFMR-SH TRANSF	MS-440V-XFMR-SH XG02	Transformer Pressure HIGH	1				HIGH		RTU1 (Radio Link)		CWRF (Radio Link)	
36	MS-440V-SWBD-SH 01 FUSESW	MS-440V-SWBD-SH 01 XB01	VSD 1 Feeder CB OPEN	1				OPEN		RTU1 (Radio Link)		CWRF (Radio Link)	
37	MS-440V-SWBD-SH 02 FUSESW	MS-440V-SWBD-SH 02 XB01	VSD 2 Feeder CB OPEN	1				OPEN		RTU1 (Radio Link)		CWRF (Radio Link)	
38	MS-440V-SWBD-SH INSTRU	MS-440V-SWBD-SH XG01	Incomer Phase Failure	1				FAILURE		RTU1 (Radio Link)		CWRF (Radio Link)	
39	MS-440V-SWBD-SH INSTRU	MS-440V-SWBD-SH XB01	Main Incomer OPEN	1				OPEN		RTU1 (Radio Link)		CWRF (Radio Link)	
40	MS-440V-SWBD-SH INSTRU	MS-440V-SWBD-SH XB02	Main Incomer CLOSED	1				CLOSED		RTU1 (Radio Link)		CWRF (Radio Link)	
41	MS-440V-SWBD-SH INSTRU	MS-440V-SWBD-SH XB20	Main Incomer TRIP	1				TRIPPED		RTU1 (Radio Link)		CWRF (Radio Link)	
42	MS-BW-TM-SH-01 TELMTY	MS-BW-TM-SH-01 XG01	RTU1 Mains Power Loss	1				OPEN		RTU1 (Radio Link)		CWRF (Radio Link)	
43	MS-BW-TM-SH-01 TELMTY	MS-BW-TM-SH-01 XG02	RTU1 Battery Power Low	1				LOW		RTU1 (Radio Link)		CWRF (Radio Link)	
44	MS-BW-TM-SH-01 TELMTY	MS-BW-TM-SH-01 XG03	RTU1 Panel Door Open	1				OPEN		RTU1 (Radio Link)		CWRF (Radio Link)	
45	MS-BW-TM-SH-02 TELMTY	MS-BW-TM-SH-02 XG01	RTU2 Mains Power Loss	1				OPEN		RTU2 (hardwired)		CWRF (Radio Link)	
46	MS-BW-TM-SH-02 TELMTY	MS-BW-TM-SH-02 XG02	RTU2 Battery Power Low	1				LOW		RTU2 (hardwired)		CWRF (Radio Link)	
47	MS-BW-TM-SH-02 TELMTY	MS-BW-TM-SH-02 XG03	RTU2 Panel Door Open	1				OPEN		RTU2 (hardwired)		CWRF (Radio Link)	
48	MS-BW-TM-SH-01 TELMTY	MS-BW-TM-SH-01 YB01	SH Void Pumping System Command ON	1	1			CMD ON		CWRF (Radio Link)		RTU1	
49	MS-BW-TM-SH-01 TELMTY	MS-BW-TM-SH-01 YB02	SH Void Pumping System Command OFF	1	1			CMD OFF		CWRF (Radio Link)		RTU1	
50	MS-BW-TM-SH-01 TELMTY	MS-BW-TM-SH-01 YQ41	SH Void Pumping System Flow Setpoint	1	1	1		0-200	l/s	CWRF (Radio Link)		RTU1	
51	MS-BW-TM-SH-01 TELMTY	MS-BW-TM-SH-01 ZV01	SH Void Pumping System Comms Heartbeat	1				ACTIVE		CWRF (Radio Link)		RTU1	
52	MS-BW-TM-SH-01 TELMTY	MS-BW-TM-SH-01 ZV02	SH Void Pumping System Comms Heartbeat Feedback	1				ACTIVE		RTU1 (Radio Link)		CWRF (Radio Link)	
53	MS-BW-TM-SH-01 TELMTY	MS-BW-TM-SH-01 XQ01	SH Void Pumping System Comms Strength RTU1 to RTU2			1		0-100	%	RTU2 (Radio Link)		CWRF (Radio Link)	



ER4976 - Muja Power Station 5H Void Pump Upgrade													
IO LIST													
PROJECT NAME PROJECT NUMBER CLIENT AREA										Muja Power Station 5H Void Pump Upgrade ER4976 / IW182200 Synergy Generation Business Unit			
										DOC. No. IW182200-EMM-LST-001	REV. NO 0	CLIENT DOC. No. N/A	CLIENT REV. NO
Item	Instrument Tag	Signal Name	Signal Description	DI	DO	AI	AO	Energised Status/ Range	Unit	Source	Source MIRI Address	Destination	Destination MIRI Address
1	MS-BW-PT-113 INSTRU	MS-BW-PT-113 XQ01	Onshore Pump Suction Pressure				1	0-600	kPaG	RTU2 (Radio Link)		CWRF	
2	MS-BW-PT-114 INSTRU	MS-BW-PT-114 XQ01	Onshore Pump Discharge Pressure				1	0-1800	kPaG	RTU2 (Radio Link)		CWRF	
3	MS-BW-FT-111 INSTRU	MS-BW-FT-111 XQ01	5H Void Water Flow				1	0-200	l/s	RTU2 (Radio Link)		CWRF	
4	MS-BW-VT-115 INSTRU	MS-BW-VT-115 XQ01	Pontoon Pump Bearing Vibration				1	0-35	mm/s	RTU2 (Radio Link)		CWRF	
5	MS-BW-P-111 STARTR	MS-BW-P-111 YB01	VSD 1 CMD ON		1			ACTIVE		RTU2 (Radio Link)		CWRF	
6	MS-BW-P-111 STARTR	MS-BW-P-111 YB02	VSD 1 PROTECTION OFF		1			NOT ACTIVE		RTU2 (Radio Link)		CWRF	
7	MS-BW-P-111 STARTR	MS-BW-P-111 XB01	VSD 1 RUNNING		1			RUN FB		RTU2 (Radio Link)		CWRF	
8	MS-BW-P-111 STARTR	MS-BW-P-111 XB15	VSD 1 HEALTHY		1			HEALTHY		RTU2 (Radio Link)		CWRF	
9	MS-BW-P-111 PUMP	MS-BW-P-111 XB17	Onshore Pump AUTO		1			AUTO		RTU2 (Radio Link)		CWRF	
10	MS-BW-P-111 PUMP	MS-BW-P-111 XB14	Onshore Pump FAULT		1			FAULT		RTU2 (Radio Link)		CWRF	
11	MS-BW-P-111 MOTOR	MS-BW-P-111 XB20	Onshore Pump Motor Current Overload		1			ACTIVE		RTU2 (Radio Link)		CWRF	
12	MS-BW-P-111 PUMP	MS-BW-P-111 XQ01	Onshore Pump SPEED			1		0-50	Hz	RTU2 (Radio Link)		CWRF	
13	MS-BW-P-111 MOTOR	MS-BW-P-111 XQ02	Onshore Pump Motor CURRENT			1		400	A	RTU2 (Radio Link)		CWRF	
14	MS-BW-P-111 MOTOR	MS-BW-P-111 XQ04	Onshore Pump Motor Winding Temperature			1		0-200	°C	RTU2 (Radio Link)		CWRF	
15	MS-BW-P-111 MOTOR	MS-BW-P-111 XQ03	Onshore Pump Motor Power			1		0-220	kW	RTU2 (Radio Link)		CWRF	
16	MS-BW-P-112 STARTR	MS-BW-P-112 YB01	VSD 2 CMD ON		1			ACTIVE		RTU2 (Radio Link)		CWRF	
17	MS-BW-P-112 STARTR	MS-BW-P-112 YB02	VSD 2 PROTECTION OFF		1			NOT ACTIVE		RTU2 (Radio Link)		CWRF	
18	MS-BW-P-112 STARTR	MS-BW-P-112 XB01	VSD 2 RUNNING		1			RUN FB		RTU2 (Radio Link)		CWRF	
19	MS-BW-P-112 STARTR	MS-BW-P-112 XB15	VSD 2 HEALTHY		1			HEALTHY		RTU2 (Radio Link)		CWRF	
20	MS-BW-P-112 PUMP	MS-BW-P-112 XB17	Pontoon Pump AUTO		1			AUTO		RTU2 (Radio Link)		CWRF	
21	MS-BW-P-112 PUMP	MS-BW-P-112 XB14	Pontoon Pump FAULT		1			FAULT		RTU2 (Radio Link)		CWRF	
22	MS-BW-P-112 MOTOR	MS-BW-P-112 XB20	Pontoon Pump Current Overload		1			ACTIVE		RTU2 (Radio Link)		CWRF	
23	MS-BW-P-112 PUMP	MS-BW-P-112 XQ01	Pontoon Pump SPEED			1		0-50Hz	rpm	RTU2 (Radio Link)		CWRF	
24	MS-BW-P-112 MOTOR	MS-BW-P-112 XQ02	Pontoon Pump Motor CURRENT			1		150	A	RTU2 (Radio Link)		CWRF	
25	MS-BW-P-112 MOTOR	MS-BW-P-112 XQ04	Pontoon Pump Motor Winding Temperature Blue Phase			1		0-200	°C	RTU2 (Radio Link)		CWRF	
26	MS-BW-P-112 MOTOR	MS-BW-P-112 XQ05	Pontoon Pump Motor Winding Temperature Red Phase			1		0-200	°C	RTU2 (Radio Link)		CWRF	
27	MS-BW-P-112 MOTOR	MS-BW-P-112 XQ06	Pontoon Pump Motor Winding Temperature White Phase			1		0-200	°C	RTU2 (Radio Link)		CWRF	
28	MS-BW-P-112 MOTOR	MS-BW-P-112 XQ03	Pontoon Pump Motor Power			1		0-75	kW	RTU2 (Radio Link)		CWRF	
29	MS-440V-SWBD-SH METER	MS-440V-SWBD-SH XQ01	Metering Voltage			1		TBA	V	RTU2 (Radio Link)		CWRF	
30	MS-440V-SWBD-SH METER	MS-440V-SWBD-SH XQ02	Metering Current			1		TBA	A	RTU2 (Radio Link)		CWRF	
31	MS-440V-SWBD-SH METER	MS-440V-SWBD-SH XQ03	Metering Power Factor			1		TBA		RTU2 (Radio Link)		CWRF	
32	MS-440V-SWBD-SH METER	MS-440V-SWBD-SH XQ04	Metering Apparent Power			1		TBA	MVA	RTU2 (Radio Link)		CWRF	
33	MS-440V-SWBD-SH METER	MS-440V-SWBD-SH XQ05	Metering Reactive Power			1		TBA	MVAR	RTU2 (Radio Link)		CWRF	
34	MS-440V-XFMR-SH TRANSF	MS-440V-XFMR-SH XG01	Transformer Temperature HIGH		1			HIGH		RTU2 (Radio Link)		CWRF	
35	MS-440V-XFMR-SH TRANSF	MS-440V-XFMR-SH XG02	Transformer Pressure HIGH		1			HIGH		RTU2 (Radio Link)		CWRF	
36	MS-440V-SWBD-SH.01 FUSESW	MS-440V-SWBD-SH.01 XB01	VSD 1 Feeder CB OPEN		1			OPEN		RTU2 (Radio Link)		CWRF	
37	MS-440V-SWBD-SH.02 FUSESW	MS-440V-SWBD-SH.02 XB01	VSD 2 Feeder CB OPEN		1			OPEN		RTU2 (Radio Link)		CWRF	
38	MS-440V-SWBD-SH INSTRU	MS-440V-SWBD-SH XG01	Incomer Phase Failure		1			FAILURE		RTU2 (Radio Link)		CWRF	
39	MS-440V-SWBD-SH INSTRU	MS-440V-SWBD-SH XB01	Main Incomer OPEN		1			OPEN		RTU2 (Radio Link)		CWRF	
40	MS-440V-SWBD-SH INSTRU	MS-440V-SWBD-SH XB02	Main Incomer CLOSED		1			CLOSED		RTU2 (Radio Link)		CWRF	
41	MS-440V-SWBD-SH INSTRU	MS-440V-SWBD-SH XB20	Main Incomer TRIP		1			TRIPPED		RTU2 (Radio Link)		CWRF	
42	MS-BW-TM-SH.01 TELMTY	MS-BW-TM-SH.01 XG01	RTU1 Mains Power Loss		1			OPEN		RTU2 (Radio Link)		CWRF	
43	MS-BW-TM-SH.01 TELMTY	MS-BW-TM-SH.01 XG02	RTU1 Battery Power Low		1			LOW		RTU2 (Radio Link)		CWRF	
44	MS-BW-TM-SH.01 TELMTY	MS-BW-TM-SH.01 XG03	RTU1 Panel Door Open		1			OPEN		RTU2 (Radio Link)		CWRF	
45	MS-BW-TM-SH.02 TELMTY	MS-BW-TM-SH.02 XG01	RTU2 Mains Power Loss		1			OPEN		RTU2 (Radio Link)		CWRF	
46	MS-BW-TM-SH.02 TELMTY	MS-BW-TM-SH.02 XG02	RTU2 Battery Power Low		1			LOW		RTU2 (Radio Link)		CWRF	
47	MS-BW-TM-SH.02 TELMTY	MS-BW-TM-SH.02 XG03	RTU2 Panel Door Open		1			OPEN		RTU2 (Radio Link)		CWRF	
48	MS-BW-TM-SH.01 TELMTY	MS-BW-TM-SH.01 YB01	5H Void Pumping System Command ON		1			CMD ON		CWRF (Radio Link)		RTU2	
49	MS-BW-TM-SH.01 TELMTY	MS-BW-TM-SH.01 YB02	5H Void Pumping System Command OFF		1			CMD OFF		CWRF (Radio Link)		RTU2	
50	MS-BW-TM-SH.01 TELMTY	MS-BW-TM-SH.01 YQ41	5H Void Pumping System Flow Setpoint			1		0-200	l/s	CWRF (Radio Link)		RTU2	
51	MS-BW-TM-SH.01 TELMTY	MS-BW-TM-SH.01 ZV01	5H Void Pumping System Comms Heartbeat		1			ACTIVE		CWRF (Radio Link)		RTU2	
52	MS-BW-TM-SH.01 TELMTY	MS-BW-TM-SH.01 ZV02	5H Void Pumping System Comms Heartbeat Feedback		1			ACTIVE		RTU2 (Radio Link)		CWRF	
53	MS-BW-TM-SH.01 TELMTY	MS-BW-TM-SH.01 XQ01	5H Void Pumping System Comms Strength RTU1 to RTU2		1			0-100	%	RTU2 (Radio Link)		CWRF	
54	MS-BW-TM-SH.02 TELMTY	MS-BW-TM-SH.02 XQ01	5H Void Pumping System Comms Strength RTU2 to CWRF		1			0-100	%	RTU2 (Radio Link)		CWRF	

**JACOBS®**

ER4976 - Muja Power Station 5H Void Pump Upgrade		DOC. No. <b>IW182200-EMM-LST-002</b>		REV. NO	0	
I&C CABLE LIST		CLIENT DOC. No. <b>N/A</b>		CLIENT REV. NO		
PROJECT NAME	Muja Power Station 5H Void Pump Upgrade					
PROJECT NUMBER	ER4976 / IW182200					
CLIENT	Synergy					
AREA	Generation Business Unit					
Item	Cable No.	Cable From	Cable To	Cable Type	Length	Device
1	906002	MS-BW-PT-113 INSTRU	VSD1: MS-BW-P-111 STARTR	I1.5-1S Decron	20m	Pressure Transmitter
2	906003	MS-BW-PT-114 INSTRU	VSD2: MS-BW-P-112 STARTR	I1.5-1S Decron	20m	Pressure Transmitter
3	906004	MS-BW-FT-111 INSTRU	VSD2: MS-BW-P-112 STARTR	I1.5-1S Decron	20m	Flowmeter (replaced)
4	906005	VSD2: MS-BW-P-112 STARTR	MS-BW-TM-5H.01 TELMTY	C1.5-4E	5m	VSD1
5	906006	VSD1: MS-BW-P-111 STARTR	MS-BW-TM-5H.01 TELMTY	C1.5-4E	5m	VSD2
6	906007	VSD1: MS-BW-P-111 STARTR	VSD2: MS-BW-P-112 STARTR	Belden 82842 RS-485*	5m	VSD1 - Modbus
7	906008	VSD2: MS-BW-P-112 STARTR	MS-BW-TM-5H.01 TELMTY	Belden 82842 RS-485*	5m	VSD2 - Modbus
8	906009	MCC Power Meter: MS-440V-SWBD-5H METER	VSD1: MS-BW-P-111 STARTR	Belden 82842 RS-485*	5m	Power Meter - Modbus
9	906010	Transformer: MS-440V-XFMR-5H TRANSF	MS-BW-TM-5H.01 TELMTY	C1.5-4E	5m	Transformer
10	906017	MS-BW-TM-5H.01 TELMTY	VSD2: MS-BW-P-112 STARTR	I1.5-1S Decron	5m	Flow setpoint

Note: Lengths indicative only.

\* - 2pair cable with single pair used in half-duplex mode, equivalent cable type can be used upon approval by Synergy.





PROJECT NAME		Muja Power Station 5H Void Pump Upgrade		DOC. No.		REV. NO			
PROJECT NUMBER		ER4976 / IW182200		IW182200-EMM-LST-003		0			
CLIENT		Synergy		CLIENT DOC. No.		N/A		CLIENT REV. NO	
AREA		Generation Business Unit		ALARM LIST					
Item	Instrument tag	Signal Name	Signal Description	Setpoint	Action	Type	Alarm Priority	Alarm Suppression	Comments
1	MS-BW-PT-113 INSTRU	MS-BW-PT-113 XH51	Onshore Pump Suction Pressure LOW	5m	Trip VSD1	Trip	HIGH	Pontoon Pump OFF	
2	MS-BW-PT-113 INSTRU	MS-BW-PT-113 XH01	Onshore Pump Suction Pressure HIGH	100m	Trip VSD2	Trip	HIGH	None	
3	MS-BW-PT-114 INSTRU	MS-BW-PT-114 XH01	Onshore Pump Discharge Pressure HIGH	100m	Trip VSD1	Trip	HIGH	None	
4	MS-BW-PT-114 INSTRU	MS-BW-PT-114 XH51	Onshore Pump Discharge Pressure LOW	5m	Trip VSD1	Trip	HIGH	Onshore Pump OFF	
5	MS-BW-VT-111 INSTRU	MS-BW-VT-111 XH61	Water Flow LOW	< 50% of Set value	Trip VSD1	Trip	HIGH	Onshore Pump OFF	
6	MS-BW-VT-115 INSTRU	MS-BW-VT-115 XH01	Pontoon Pump Bearing Vibration HIGH	>5mm/s	ALARM	ALARM	MEDIUM	None	
7	MS-BW-VT-115 INSTRU	MS-BW-VT-115 XH03	Pontoon Pump Bearing Vibration HIGH HIGH	>10mm/s	Trip VSD2	Trip	HIGH	None	
8	MS-BW-P-111 PUMP	MS-BW-P-111 XB14	Onshore Pump FAULT	ACTIVE	Trip VSD1	Trip	HIGH	None	
9	MS-BW-P-111 MOTOR	MS-BW-P-111 XB20	Onshore Pump Motor Current Overload	ACTIVE	Trip VSD1	Trip	HIGH	None	
10	MS-BW-P-111 MOTOR	MS-BW-P-111 XH03	Onshore Pump Motor Winding Temperature HIGH	>150°C	ALARM	ALARM	LOW	None	
11	MS-BW-P-111 MOTOR	MS-BW-P-111 XH06	Onshore Pump Motor Winding Temperature HIGH HIGH	>180°C	Trip VSD1	Trip	HIGH	None	
12	MS-BW-P-112 PUMP	MS-BW-P-112 MOTOR XB14	Pontoon Pump Motor FAULT	ACTIVE	Trip VSD2	Trip	HIGH	None	
13	MS-BW-P-112 MOTOR	MS-BW-P-112 MOTOR XB20	Pontoon Pump Motor Current Overload	ACTIVE	Trip VSD2	Trip	HIGH	None	
14	MS-BW-P-112 MOTOR	MS-BW-P-112 MOTOR XH03	Pontoon Pump Motor Winding Temperature Blue Phase HIGH	>130°C	ALARM	ALARM	LOW	None	
15	MS-BW-P-112 MOTOR	MS-BW-P-112 MOTOR XH06	Pontoon Pump Motor Winding Temperature Blue Phase HIGH HIGH	>160°C	Trip VSD2	Trip	HIGH	None	
16	MS-BW-P-112 MOTOR	MS-BW-P-112 MOTOR XH04	Pontoon Pump Motor Winding Temperature Red Phase HIGH	>130°C	ALARM	ALARM	LOW	None	
17	MS-BW-P-112 MOTOR	MS-BW-P-112 MOTOR XH07	Pontoon Pump Motor Winding Temperature Red Phase HIGH HIGH	>160°C	Trip VSD2	Trip	HIGH	None	
18	MS-BW-P-112 MOTOR	MS-BW-P-112 MOTOR XH05	Pontoon Pump Motor Winding Temperature White Phase HIGH	>130°C	ALARM	ALARM	LOW	None	
19	MS-BW-P-112 MOTOR	MS-BW-P-112 MOTOR XH08	Pontoon Pump Motor Winding Temperature White Phase HIGH HIGH	>160°C	Trip VSD2	Trip	HIGH	None	
20	MS-440V-XFMR-5H TRANSF	MS-440V-XFMR-5H XG01	Transformer Temperature HIGH	ACTIVE	ALARM	Alarm	LOW	None	
21	MS-440V-XFMR-5H TRANSF	MS-440V-XFMR-5H XG02	Transformer Pressure HIGH	ACTIVE	ALARM	Alarm	LOW	None	
22	MS-440V-SWBD-5H.01 FUSE	MS-440V-SWBD-5H.01 XB01	VSD 1 Feeder CB OPEN	OPEN	Trip VSD1	Trip	HIGH	None	
23	MS-440V-SWBD-5H.02 FUSE	MS-440V-SWBD-5H.02 XB01	VSD 2 Feeder CB OPEN	OPEN	Trip VSD2	Trip	HIGH	None	
24	MS-440V-SWBD-5H INSTRU	MS-440V-SWBD-5H XG01	Incomer Phase Failure	ACTIVE	ALARM	Alarm	LOW	None	
25	MS-BW-TM-5H.01 TELMTY	MS-BW-TM-5H.01 XG01	RTU1 Mains Power Low	ACTIVE	ALARM	Alarm	LOW	None	
26	MS-BW-TM-5H.01 TELMTY	MS-BW-TM-5H.01 XG02	RTU1 Battery Power Low	ACTIVE	ALARM	Alarm	LOW	None	
27	MS-BW-TM-5H.01 TELMTY	MS-BW-TM-5H.01 XG03	RTU1 Panel Door Open	ACTIVE	ALARM	Alarm	LOW	None	
28	MS-BW-TM-5H.02 TELMTY	MS-BW-TM-5H.02 XG01	RTU2 Mains Power Low	ACTIVE	ALARM	Alarm	LOW	None	
29	MS-BW-TM-5H.02 TELMTY	MS-BW-TM-5H.02 XG02	RTU2 Battery Power Low	ACTIVE	ALARM	Alarm	LOW	None	
30	MS-BW-TM-5H.02 TELMTY	MS-BW-TM-5H.02 XG03	RTU2 Panel Door Open	ACTIVE	ALARM	Alarm	LOW	None	
31	MS-BW-TM-5H.01 TELMTY	MS-BW-TM-5H.01 ZV03	RTU1 to RTU2 Comms Failure	ACTIVE	ALARM	Alarm	HIGH	None	
32	MS-BW-TM-5H.02 TELMTY	MS-BW-TM-5H.02 ZV03	RTU2 to CWRP Comms Failure	ACTIVE	ALARM	Alarm	HIGH	None	
33	MS-BW-TM-5H.01 TELMTY	MS-BW-TM-5H.01 ZV04	Pipeline Filling Sequence Running >4hrs	ACTIVE	ALARM	Alarm	MEDIUM	None	
34	MS-BW-TM-5H.01 TELMTY	MS-BW-P-111 MOTOR ZV01	Onshore Pump Stopped Unexpectedly	ACTIVE	ALARM	Alarm	HIGH	None	
35	MS-BW-TM-5H.01 TELMTY	MS-BW-P-112 MOTOR ZV01	Pontoon Pump Stopped Unexpectedly	ACTIVE	ALARM	Alarm	HIGH	None	
36	MS-BW-TM-5H.01 TELMTY	MS-BW-TM-5H.01 XH01	SH Void Pumping System Comms Strenght RTU1 to RTU2 <LOW	<30%	ALARM	Alarm	MEDIUM	None	
37	MS-BW-TM-5H.02 TELMTY	MS-BW-TM-5H.02 XH01	SH Void Pumping System Comms Strenght RTU2 to CWRP <LOW	<30%	ALARM	Alarm	MEDIUM	None	



<b>ER4976 - Muja Power Station 5H Void Pump Upgrade</b>						DOC. No. <b>IW182200-EMM-LST-004</b>			REV. NO <b>0</b>		
<b>I&amp;C EQUIPMENT LIST</b>						CLIENT DOC. No. <b>N/A</b>			CLIENT REV. NO		
<b>PROJECT NAME</b>	Muja Power Station 5H Void Pump Upgrade										
<b>PROJECT NUMBER</b>	ER4976 / IW182200										
<b>CLIENT</b>	Synergy										
<b>AREA</b>	Generation Business Unit										
Item	Qty	Instrument Tag	P&ID No.	Pipeline No.	Description	Range LO	Range HI	Unit	Data Sheet	Manufacturer	Model
1	1	MS-BW-PT-113 INSTRU	M-S-1067/21	TBA	Onshore Pump Suction Pressure	0	600	kPa	IW18222-EMM-DS-PT-113	Emerson Rosemount	3051TG
2	1	MS-BW-PT-114 INSTRU	M-S-1067/21	TBA	Onshore Pump Discharge Pressure	0	1500	kPa	IW18222-EMM-DS-PT-114	Emerson Rosemount	3051TG
3	1	MS-BW-VT-115 INSTRU	N/A	TBA	Pontoon Pump Bearing Vibration	0	35	mm/s	IW18222-EMM-DS-VT-115	TBA	TBA
4	1	MS-BW-FT-111 INSTRU	M-S-1067/22	TBA	Onshore Pump Discharge Flow	0	200	l/s	IW18222-EMM-DS-FT-111	ABB MagFlow	F251Z4110A005ER341
5	1	MS-BW-TM-5H.01 TELMTY	NA	NA	Remote Telemetry Unit 1	xx	xx	xx	xx	Miri Technologies	TBA
6	1	MS-BW-TM-5H.02 TELMTY	NA	NA	Remote Telemetry Unit 2	xx	xx	xx	xx	Miri Technologies	TBA

<b>JACOBS</b> <b>INSTRUMENT TECHNICAL DATA SHEET</b> <b>FLOWMETER - MAGNETIC</b>				DOCUMENT No.	Rev
				EDS-MS-BW-FT-111	A
<b>ENGINEERING INFORMATION (Synergy to complete)</b>					1
TAG NUMBER	MS-BW-FT-111 INSTRU	PR NUMBER	IW182200		2
TANK/VESSEL NUMBER	N/A	MATERIAL	HDPE		3
PIPELINE NUMBER	TBA	LOOP DRAWING	TBA		4
P&I DRAWING	M-S-1067/21	SAMA DRAWING	TBA		5
HOOK-UP DRAWING	TBA	CONTRACT No.	TBA		6
DUTY DESCRIPTION	5H Void Flow				7
<b>SERVICE CONDITIONS (BWAPL to complete)</b>					8
MEDIUM					9
PRESSURE	kPag	MIN. 0	NORM. 800	MAX. 1800	10
TEMPERATURE	°C	MIN. 10	NORM. 20	MAX. 25	11
FLOW	l/s	MIN. 20	NORM. 150	MAX. 160	12
CONDUCTIVITY	µS/cm	TBA			13
NORMAL VISCOSITY	cP	1 @20°C			14
NORMAL SPEC. GRAVITY @ TEMP.		998.25kg/m <sup>3</sup> @20°C			15
					16
AREA CLASSIFICATION	Non Hazardous				17
REQUIRED ACCURACY	0.5%				18
<b>EQUIPMENT DATA (Vendor to complete)</b>					19
VENDOR					20
<b>PRIMARY ELEMENT:</b>					21
MANUFACTURER	ABB MagFlow	MODEL No.	MF/F251Z4110A005ER341	SERIAL No.	22
TYPE		LINE SIZE			23
PROCESS CONNECTION	TYPE	SIZE		RATING	24
BODY MATERIAL		MOUNTING			25
LINER MATERIAL					26
ELECTRODE TYPE		ELECTRODE MATERIAL			27
GROUNDING RING MATERIAL					28
TERMINAL HOUSING	MATERIAL	MOUNTING		IP RATING	29
ELECTRICAL ENTRY					30
OPERATING TEMP. RANGE	MIN.		MAX.		31
ZERO STABILITY					32
METER FACTOR		LINEARITY			33
ACCURACY		REPEATABILITY			34
<b>CONVERTER / TRANSMITTER:</b>					35
MANUFACTURER		MODEL No.		SERIAL No.	36
ELECTRONIC HOUSING	MATERIAL	MOUNTING		IP RATING	37
OPERATING TEMP RANGE	MIN.		MAX.		38
POWER SUPPLY		POWER SUPPLY SOURCE			39
SIGNAL INPUT		SIGNAL OUTPUT			40
DIRECT OR REMOTE ELECTRONICS					41
ELECTRICAL ENTRY					42
INDICATOR	TYPE		UNITS		43
UNIT OF MEASUREMENT					44
COMMUNICATION PROTOCOL					45
MEASURED RANGE	MIN.		MAX.		46
CALIBRATED RANGE	MIN.		MAX.		47
ACCURACY		EMPTY PIPE DETECTION			48
PAINT SPECIFICATION					49
CALIBRATION CERTIFICATE					50
<b>REMARKS</b>					51
1. Transmitter range to be set as 0-200l/s					52
2. Instrument assembly to include sun shade					53
					54
					55
					56
					57
					58
					59
					60
Revision No.	A	0	1		
Prepared by & Date	ST 21/08/2018				
Reviewed by & Date	GPS 16/10/2018				
Approval by & Date					
Status	Review	Purchase	As Built		

Title		New 5H Void Main Switchboard Datasheet					
Location	Muja Power Station	Area	5H Void	Date	16/10/2018	Rev	B
ASSET No.	VTA	Specification No.	G Clause Section 03	Quantity	1		
<i>Latest Revision Project &amp; Consultant Details (If Applicable)</i>		Project Name	Muja Power Station 5H Void Pump Upgrade				
Synergy Project Number	ER4976	Consultant Name	JACOBS Australia Pty Ltd				
Consultant Proj' Num'	IW182200	Consultant Doc' Num'	IW182200-EE-DST-0001				
System Description	New 5H Void Main Switchboard						
Manufacturer	VTA	Type	VTA	Serial Number	VTA		
<b>GENERAL REQUIREMENTS</b>							
Equipment life expectancy	25	Years					
Degree of protection	IP53						
Rated frequency	50	Hz					
Rated nominal voltage (Ue)	440	V					
Rated insulation voltage (Ui)	1000	V					
Rated impulse withstand voltage (Uimp)	4000	V					
Rated short-time fault withstand current (1 sec)	21.5	kA RMS					
Main busbar rated current	1000A	Amps					
Power cable entry	Bottom						
Control cable entry	Bottom						
Incoming cable size	400	mm2					
No. Active conductors / phase	2						
No. Neutral conductors	2						
Insulation type	Air						
Control Voltage	24VDC		Integral battery backup required for 4 hours autonomy				
Protection Relay	YES						
Metering CT	Required		1000/1A Class 0.5 10VA Current Transformer				
Power Metering	Required		Simeas P610 or equivalent				
<b>REMARKS</b>							
Remarks							
1) Main Switchboard Located Outdoors near large body of water							
2) Refer to single line diagram M11-C-0425 for switchboard arrangement details							
3) Switchboard to include 500mm high support frame to facilitate cable conveyance							
4) RTU to be installed inside switchboard							
5) VSD/Enclosure located in high corrosion (PH3 environment). Enclosure to material to be suitable for installation in environment. Vendor to provide calculations detailing the temperature rise of the switchboard confirming the life expectancy of its subcomponents							
<b>SHIPPING (Supplier to complete)</b>							
Total shipping weight		kg					
Revision No.	<b>A</b>	<b>Date</b>		<b>B</b>	<b>Date</b>		
Prepared by / Date	D. Oladejo	16/07/2018		D. Oladejo	16/10/2018		
Reviewed / Checked by / Date	E. Bahram	26/08/2018		E. Bahram	16/10/2018		
Consultant Approved by / Date	D. Oladejo	10/09/2018		D. Oladejo	16/10/2018		
Client Approved by / Date							
Status	IFR			IFT			
<b>NOTES:</b>							
1. Data Sheet based on Singleline Drawing No		M11-C-0425-001	Revision:		A		
2. One data sheet required for each Switchboard							
3. Where an item doesn't apply show n/a.							

Title	Existing 220kW Onshore Pump - VSD Datasheet						
Location	Muja Power Station	Area	5H Void	Date	16/10/2018	Rev	B
ASSET No.	VTA	Specification No.	G Clause Section 03	Quantity	1		
<b>Latest Revision Project &amp; Consultant Details (If Applicable)</b>		Project Name	Muja Power Station 5H Void Pump Upgrade				
Synergy Project Number	ER4976	Consultant Name	JACOBS Australia Pty Ltd				
Consultant Proj' Num'	IW182200	Consultant Doc' Num'	IW182200-EE-DST-0002				
System Description	220kW Onshore Pump - VSD Datasheet						
Manufacturer	VTA	Type	VTA	Serial Number	VTA		
<b>GENERAL REQUIREMENTS</b>							
Equipment life expectancy	25	Years	<b>Motor data</b>				
Rated nominal voltage	415	V	Make	Toshiba			
Rated system frequency	50	Hz	Type	Squirrel cage motor			
VVVF auxiliary power	24VDC External		Enclosure	TEFC			
VVVF control power	24VDC		Nameplate rating	220	kW		
VVVF field interface power	24VDC		Nameplate voltage	415	V		
Prospective 3ph fault downstream of feeder fuse at LV Switchboard	21.5kA		Nameplate current	371	Amps		
Maximum Air Temperature	45 degC		Nameplate frequency	50	Hz		
Minimum Air Temperature	-4 degC		Power Factor	0.87			
<b>Enclosure requirements</b>			Insulation class/rise	F/155	Deg C		
Enclosure protection	IP54		Temperature detectors	1 x TP 1 Thermistor			
Colour	Manufacturer's standard						
Cable entry	Bottom						
Supply cable	Internal switchboard cabling						
Motor cable	1X3C+E 185mm <sup>2</sup> Cu, 0.6/1kV XLPE/PVC						
Motor cable length	20	meters	<b>Load data</b>				
Access restrictions	Front only		Load application	Centrifugal Pump			
Cooling system (redundancy)	Air cooler (none)		Load profile	Variable torque			
Exhaust ducting	Yes		Speed range	0Hz to 50 Hz			
Other			Starting torque requirements	100% for 10 seconds			
<b>Equipment options</b>			Short-term overload duty	110% for 1 minute in 5			
Input protection	VTA		torque mode	motoring			
Safe Torque Off	Yes		Speed regulation	0.5	%		
Contactors	Not Required.						
Output earth/ground switch (lockable)	Not Required.		<b>Communication options</b>				
Harmonic mitigation	Required	10% THDi	Speed control	Modbus TCP with backup Analog (4-20mA)			
RFI filter	Required	VTA	Status	Modbus TCP			
Output filter (du/dt. Sine wave)	Required	Sine Wave Filter	Configurable digital I/O	Yes			
Arc Flash detection/features	VTA		Minimum I/O Requirement	8DI, 8DO, 8AI, 8AO			
<b>Control/Monitor options</b>			<b>Services</b>				
Local control/display	Yes - keypad		FAT witnessed	No			
Local control/display language	English		On-site commissioning	Yes			
Additional local controls	Not Required.		On-site training	No			
Power quality monitor (input)	Yes						
Motor temperature monitor (winding and bearing)	1 x TP 1 Thermistor input		Notes	VTA: Vendor to advise			
Digital/analogue meters	No		1) Refer to Single Line Diagram M11-C-0419-001				
Pump thermal cutout switch input	No		2) VSD to be provided inside IP54 rated enclosure together with sine wave filter.				
Other	Front mounted USB diagnostic port		3) Emergency Stop Pushbutton to be mounted on the front of VSD Enclosure				
<b>SHIPPING (Supplier to complete)</b>			4) VSD/Enclosure located in high corrosion (PH3 environment). Enclosure material to be suitable for installation in environment.				
Total shipping weight			5) Vendor to provide calculations detailing the temperature rise of the VSD enclosure and confirming the life expectancy of the VSD and its subcomponents				
Revision No.	A	Date	B	Date			
Prepared by / Date	D. Oladejo	24/08/2018	D. Oladejo	16/10/2018			
Reviewed / Checked by / Date	E. Bahram	24/08/2018	E. Bahram	16/10/2018			
Consultant Approved by / Date	D. Oladejo	10/09/2018	D. Oladejo	16/10/2018			
Client Approved by / Date							
Status	IFR		IFT				
<b>NOTES:</b>							
1. One data sheet required for each VVVF							
2. Where an item doesn't apply show n/a.							

Title	75kW Pontoon Pump - VSD Datasheet						
Location	Muja Power Station	Area	5H Void	Date	16/10/2018	Rev	B
ASSET No.	VTA	Specification No.	G Clause Section 03		Quantity	1	
<b>Latest Revision Project &amp; Consultant Details (If Applicable)</b>		Project Name	Muja Power Station 5H Void Pump Upgrade				
Synergy Project Number	ER4976	Consultant Name	JACOBS Australia Pty Ltd				
Consultant Proj' Num'	IW182200	Consultant Doc' Num'	IW182200-EE-DST-0003				
System Description	75kW Pontoon Pump - VSD Datasheet						
Manufacturer	VTA	Type	VTA	Serial Number	VTA		
<b>GENERAL REQUIREMENTS</b>							
Equipment life expectancy	25	Years	<b>Motor data</b>				
Rated nominal voltage	415	V	Make	Unknown			
Rated system frequency	50	Hz	Type	Squirrel cage motor			
VFD auxiliary power	24VDC External		Enclosure	TEFC			
VFD control power	24VDC		Nameplate rating	75	kW		
VFD field interface power	24VDC		Nameplate voltage	415	V		
Prospective 3ph fault downstream of feeder fuse at LV Switchboard	21.5kA		Nameplate current	131	Amps		
Maximum Air Temperature	45 degC		Nameplate frequency	50	Hz		
Minimum Air Temperature	-4 degC		Nameplate speed	1480	rpm		
<b>Enclosure requirements</b>			Insulation class/rise	F/155	Deg C		
Enclosure protection	IP54		Temperature detectors	1 x PT100 Wdg RTDs per phase			
Colour	Manufacturer's standard		Motor cooling fan size	NA	kW		
Cable entry	Bottom		Motor cooling fan supply	NA			
Supply cable	Internal switchboard cabling		Anti-Condensation heater supply	1ph, 240V, 50Hz			
Motor cable	1X3C+E 185mm <sup>2</sup> Cu, 0.6/1kV XLPE/TPE		<b>Load data</b>				
Motor cable length	220	meters	Load application	Centrifugal Pump			
Access restrictions	Front only		Load profile	Variable torque			
Cooling system (redundancy)	Air cooler (none)		Speed range	0Hz to 50 Hz			
Exhaust ducting	Yes		Starting torque requirements	100% for 10 seconds			
Other			Short-term overload duty	110% for 1 minute in 5			
<b>Equipment options</b>			torque mode	Motoring			
Input protection	VTA		Speed regulation	0.5	%		
Safe Torque Off	Yes		Other				
Contactors	Not Required.		<b>Communication options</b>				
Output earth/ground switch (lockable)	Not Required		Speed control	Modbus TCP with backup Analog (4-20mA)			
Harmonic mitigation	Not Required		Status	Modbus TCP			
RFI filter	Required	VTA	Configurable digital I/O	Yes			
Output filter (du/dt. Sine wave)	Required	Sine Wave Filter	Minimum I/O Requirement	8DI, 8DO, 8AI, 8AO			
Arc Flash detection/features	VTA		<b>Services</b>				
<b>Control/Monitor options</b>			FAT witnessed	No			
Local control/display	Yes - keypad		On-site commissioning	Yes			
Local control/display language	English		On-site training	No			
Additional local controls	Not Required.						
Power quality monitor (input)	Yes						
Motor temperature monitor (winding and bearing)	Required - 1 x PT100 RTD per winding		Notes	VTA: Vendor to advise			
Digital/analogue meters	No		1) Refer to Single Line Diagram M11-C-0419-001				
Pump thermal cutout switch input	No		2) VSD to be provided inside IP54 rated enclosure together with sine wave filter.				
Other	Front mounted USB diagnostic port		3) Emergency Stop Pushbutton to be mounted on the front of VSD Enclosure				
<b>SHIPPING (Supplier to complete)</b>			4) VSD/Enclosure located in high corrosion (PH3 environment). Enclosure material to be suitable for installation in environment.				
Total shipping weight			5) Vendor to provide calculations detailing the temperature rise of the VSD enclosure and confirming the life expectancy of the VSD and its subcomponents				
Revision No.	<b>A</b>	<b>Date</b>	<b>B</b>	<b>Date</b>			
Prepared by / Date	D. Oladejo	24/08/2018	D. Oladejo	16/10/2018			
Reviewed / Checked by / Date	E. Bahram	24/08/2018	E. Bahram	16/10/2018			
Consultant Approved by / Date			D. oladejo	16/10/2018			
Client Approved by / Date							
Status	IFR			IFT			
<b>NOTES:</b>							
1. One data sheet required for each VVVF							
2. Where an item doesn't apply show n/a.							

Title <b>Attachment 1 IW182200-EE-DST-004 - New 5H Void 500kVA Transformer RevB</b>							
Location	Muja Power Station	Area	5H Void	Date	16/10/2018	Rev	B
ASSET No.	VTA	Specification No.	G Clause Section 03	Quantity			1
<b>Latest Revision Project &amp; Consultant Details (If Applicable)</b>		Project Name	Muja Power Station 5H Void Pump Upgrade				
Synergy Project Number	ER4976	Consultant Name	JACOBS Australia Pty Ltd				
Consultant Proj' Num'	IW182200	Consultant Doc' Num'	IW182200-EE-DST-0004				
<b>System Description</b>		New 5H Void 500kVA Transformer					
Manufacturer	VTA	Type	VTA	Serial Number	VTA		
<b>GENERAL REQUIREMENTS</b>							
Continuous Rating	500	kVA	Dimensions				
Number of windings	2		Length	VTA	mm		
Primary Voltage	22000	V	Width	VTA	mm		
Secondary Voltage	433	V	Height	VTA	mm		
Operating Frequency	50	Hz	Installation Location	Outdoors			
Lightning Withstand Voltage / BIL	150	kV	Maximum Ambient Temperature	43.5	deg C		
Power Frequency Withstand (rms)	50	kV	Minimum Ambient Temperature	-4	deg C		
Vector Group	Dyn1	V	Equipment Life Expectancy	25	Years		
Type of enclosure	Kiosk						
<b>Voltage Tappings</b>							
Range	+-5%						
Size	2.50%	Steps					
Tapped Winding	Primary						
Tap changer type	Off-load						
Impedance	VTA	%					
Type of Cooling	ONAN						
Type of Winding	VTA						
<b>Losses</b>							
No Load	VTA	kW					
Full Load	VTA	kW					
Maximum Audible Sound Power	VTA	dBA					
Weight	VTA	kg					
IP Rating	VTA						
Integral concrete pad	Required						
Integral bund	Required						
Over-temperature alarm / contacts	Required						
Over-pressure alarm / contacts	Required						
Oil Capacity	VTA						
			Remarks	Transformer to be manufactured to AS/NZS 60076			
			1) Transformer to be located outdoors near large body of corrosive water (PH level of 3). Enclosure materials to be suitable for environment and shall prevent/resist corrosion.				
			2) Refer to single line diagram M11-C-0425 for load arrangement and M11-C-0426 for site layout				
			3) Off-load tap changer to be lockable type				
			4) Transformer enclosure to have sloped roof or otherwise be constructed to prevent pooling of water on surface				
<b>SHIPPING (Supplier to complete)</b>							
Total shipping weight			kg				
Revision No.	<b>A</b>	<b>Date</b>		<b>B</b>	<b>Date</b>		
Prepared by / Date	D. Oladejo	16/07/2018		D. Oladejo	16/10/2018		
Reviewed / Checked by / Date	E. Bahram	26/08/2018		E. Bahram	16/10/2018		
Consultant Approved by / Date	D. Oladejo	10/09/2018		D. Oladejo	16/10/2018		
Client Approved by / Date							
Status	IFR			IFT			
<b>NOTES:</b>							
1. Data Sheet based on Singleline Drawing No		M11-C-0425-001	Revision:	A			
2. One data sheet required for each Transformer							
3. Where an item doesn't apply show n/a.							





<b>ER4976 - Muja Power Station 5H Void Pump Upgrade</b>		<b>DOC. No.</b>		<b>REV. NO</b>	<b>0</b>
		IW182200-EE-LS-002			
		<b>CLIENT DOC. No.</b>		<b>CLIENT REV. NO</b>	
<b>ELECTRICAL CABLE SCHEDULE</b>		N/A			
<b>PROJECT NAME</b>	Muja Power Station 5H Void Pump Upgrade				
<b>PROJECT NUMBER</b>	ER4976 / IW182200				
<b>CLIENT</b>	Synergy				
<b>AREA</b>	Generation Business Unit				

Revision	Ref DWG No.	Cable No	Plant Area	From Drive/Service	To Drive/Service	Core Size (mm <sup>2</sup> )	Conductor Material	Number of Cores	Insulation / Sheath	Cable Length (m)	Cable Type	Max Current	Comments
<b>Muja 5H Void Cables</b>													
0	M11-C-0425-001	Note 2	Muja 5H Void	Distribution Pole 5-9 Terminals	500kVA Padmount Transformer	35	Cu	3C	XLPE/CWS/PVC	15	35mm2 Cu 3C XLPE/CWS/PVC	150A	
0	M11-C-0425-001	905995-R1	Muja 5H Void	500kVA Padmount Transformer	New 5H Void Main Switchboard Red Phase 1	400	Cu	1C	XLPE/PVC	15	400mm2 Cu 1C XLPE/PVC	500A	
0	M11-C-0425-001	905995-R2	Muja 5H Void	500kVA Padmount Transformer	New 5H Void Main Switchboard Red Phase 2	400	Cu	1C	XLPE/PVC	15	400mm2 Cu 1C XLPE/PVC	500A	
0	M11-C-0425-001	905995-W1	Muja 5H Void	500kVA Padmount Transformer	New 5H Void Main Switchboard White Phase 1	400	Cu	1C	XLPE/PVC	15	400mm2 Cu 1C XLPE/PVC	500A	
0	M11-C-0425-001	905995-W2	Muja 5H Void	500kVA Padmount Transformer	New 5H Void Main Switchboard White Phase 2	400	Cu	1C	XLPE/PVC	15	400mm2 Cu 1C XLPE/PVC	500A	
0	M11-C-0425-001	905995-B1	Muja 5H Void	500kVA Padmount Transformer	New 5H Void Main Switchboard Blue Phase 1	400	Cu	1C	XLPE/PVC	15	400mm2 Cu 1C XLPE/PVC	500A	
0	M11-C-0425-001	905995-B2	Muja 5H Void	500kVA Padmount Transformer	New 5H Void Main Switchboard Blue Phase 2	400	Cu	1C	XLPE/PVC	15	400mm2 Cu 1C XLPE/PVC	500A	
0	M11-C-0425-001	905995-N1	Muja 5H Void	500kVA Padmount Transformer	New 5H Void Main Switchboard Neutral 1	400	Cu	1C	XLPE/PVC	15	400mm2 Cu 1C XLPE/PVC	500A	
0	M11-C-0425-001	905995-N2	Muja 5H Void	500kVA Padmount Transformer	New 5H Void Main Switchboard Neutral 2	400	Cu	1C	XLPE/PVC	15	400mm2 Cu 1C XLPE/PVC	500A	
0	M11-C-0425-001	905996	Muja 5H Void	New 5H Void Main Switchboard	Earthing Electrode / Pit	120	Cu	1C	PVC/PVC	15	120mm2 Cu 1C PVC/PVC	NA	
0	M11-C-0425-001	905997	Muja 5H Void	New 5H Void Main Switchboard	5H Void 220kW VSD Cubicle	185	Cu	3C+3E	XLPE/PVC	5	185mm2 Cu 3C+3E XLPE/PVC	347A	Symetrically Screened VSD Cable
0	M11-C-0425-001	905998	Muja 5H Void	5H Void 220kW VSD Cubicle	Existing 5H Void 225kW Pump	185	Cu	3C+E	XLPE/PVC	20	185mm2 Cu 3C+E XLPE/PVC	347A	
0	M11-C-0425-001	905999	Muja 5H Void	New 5H Void Main Switchboard	Existing 5H Void 225kW Pump Anti Condensation Heater	2.5	Cu	2C+E	PVC/PVC	20	2.5mm2 Cu 2C+E PVC/PVC	1.5A	
0	M11-C-0425-001	906000	Muja 5H Void	5H Void 220kW VSD Cubicle	Existing 5H Void 225kW Pump Thermistor	1.5	Cu	1PR	PVC/PVC	20	1.5mm2 Cu 1PR PVC/PVC	1A	
0	M11-C-0425-001	906001	Muja 5H Void	New 5H Void Main Switchboard	5H Void 75kW Pontoon Pump VSD Cubicle	95	Cu	3C+3E	XLPE/PVC	5	95mm2 Cu 3C+3E XLPE/PVC	131A	Symetrically Screened VSD Cable
0	M11-C-0425-001	906011	Muja 5H Void	5H Void 75kW Pontoon Pump VSD Cubicle	5H Void Pontoon Pump	95	Cu	3C+E	XLPE/TPR	220	95mm2 Cu 3C+E XLPE/TPR	131A	
0	M11-C-0425-001	906012	Muja 5H Void	New 5H Void Main Switchboard	5H Void Pontoon Pump Anti Condensation Heater	2.5	Cu	2C+E	PVC/TPR	220	2.5mm2 Cu 2C+E PVC/TPR	1.5A	
0	M11-C-0425-001	906013	Muja 5H Void	5H Void 75kW Pontoon Pump VSD Cubicle	5H Void Pontoon Pump RTD's and Vibration Sensors	1.5	Cu	4 TRI	PVC/TPR	220	1.5mm2 Cu 4 TRI PVC/TPR	1A	RTD and Vibration sensors cabling back to VSD
0	M11-C-0425-001	906014	Muja 5H Void	New 5H Void Main Switchboard	5H Void Magnetic Flowmeter	2.5	Cu	2C+E	PVC/PVC	10	2.5mm2 Cu 2C+E PVC/PVC	1A	New supply for replacement flowmeter
0	M11-C-0425-001	906015	Muja 5H Void	New 5H Void Main Switchboard	5H Void 220kW VSD Cubicle	2.5	Cu	2C+E	PVC/PVC	5	2.5mm2 Cu 2C+E PVC/PVC	1A	VSD Auxiliary Power Cable
0	M11-C-0425-001	906016	Muja 5H Void	New 5H Void Main Switchboard	5H Void 220kW VSD Cubicle	2.5	Cu	12PR	PVC/SCR/PVC	5	2.5mm2 Cu 12PR PVC/SCR/PVC	1A	Signal Control Cable
0	M11-C-0425-001	906017	Muja 5H Void	New 5H Void Main Switchboard	5H Void 75kW Pontoon Pump VSD Cubicle	2.5	Cu	12PR	PVC/SCR/PVC	5	2.5mm2 Cu 12PR PVC/SCR/PVC	1A	Signal Control Cable
0	M11-C-0425-001	906018	Muja 5H Void	New 5H Void Main Switchboard	5H Void 75kW Pontoon Pump VSD Cubicle	2.5	Cu	2C+E	PVC/PVC	5	2.5mm2 Cu 2C+E PVC/PVC	1A	VSD Auxiliary Power Cable
0	M11-C-0425-001	906019	Legacy 5H Switchboard	New 5H Void Main Switchboard	RTU Cubicle	2.5	Cu	2C+E	PVC/PVC	5	2.5mm2 Cu 2C+E PVC/PVC	1A	New cable to be jointed at each end of the existing 185mm2 3C and E cable between the Legacy Switchboard and the redundant soft starter

Notes

- The length of cables is indicative only. Contractor to verify all lengths at tender
- Transformer HV Cable number to be assigned by Premier Coal

<b>JACOBS</b>							
<b>ER4976 - Muja Power Station 5H Void Pump Upgrade</b>				DOC. No. <b>IW182200-EE-LST-001</b>			
<b>ELECTRICAL EQUIPMENT LIST</b>				CLIENT DOC. No. <b>N/A</b>			
				REV. NO <b>A</b>			
				CLIENT REV. NO			
<b>PROJECT NAME</b>	Muja Power Station 5H Void Pump Upgrade						
<b>PROJECT NUMBER</b>	ER4976 / IW182200						
<b>CLIENT</b>	Synergy						
<b>AREA</b>	Generation Business Unit						
<b>Item</b>	<b>Qty</b>	<b>Equipment Tag</b>	<b>Drawing No.</b>	<b>Description</b>	<b>Data Sheet</b>	<b>Manufacturer</b>	<b>Model</b>
1	1	MS-440V-SWBD-5H	M11-C-0425-001	New 5H Void Main Switchboard	IW18220-EE-DST-001	VTA	VTA
2	1	TBA	M11-C-0425-001	220kW 5H Void Pump VSD	IW18220-EE-DST-002	Danfoss	VTA
3	1	TBA	M11-C-0425-001	75kW Pontoon Pump VSD	IW18220-EE-DST-003	Danfoss	VTA
4	1	TBA	M11-C-0425-001	500kVA 22/0.433kV Padmount Transformer	IW18220-EE-DST-004	VTA	VTA

# SCOPE OF WORK



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**Project:** Muja power station  
EP-10256 5H void pump upgrade  
Mechanical installation

**Date:** 06 March  
2019

**Business Unit:** Generation

**Prepared by:** Jacobs Engineering and Synergy

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**For approval by:** Dave Lewis, project manager

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This document must not be made available to persons outside Synergy without prior written approval of Synergy

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## 1 INTRODUCTION

Synergy is Western Australia's largest electricity generator and retailer of electricity and gas with more than one million residential, business and industry customers.

Synergy generates electricity using a range of non-renewable and renewable energy sources.

- (a) our major power stations are located in Collie, Kwinana and Pinjar;
- (b) smaller regional power stations are located at Mungarra and West Kalgoorlie.; and
- (c) we have wind farms at Albany, Esperance, and Kalbarri, a solar farm near Geraldton, wind-diesel power plants in Bremer Bay, Coral Bay, Denham and Hopetoun, and a solar battery storage facility at Alkimos.

More details relating to Synergy can be found at – [www.synergy.net.au](http://www.synergy.net.au).

## 2 BACKGROUND

Synergy's generation business unit (**GBU**) is responsible for our electricity generating assets. GBU's priority is to create and sustain a safe environment for our people.

GBU is made up of three primary operating units:

- (a) thermal generation - the thermal generation team is responsible providing safe, reliable and sustainable energy to the people of WA, through efficient management and operation of our generating assets. The total generating capacity for thermal generation is 1456 MW. The thermal generation fleet consists of our largest station, Muja power station, which consists of eight generating units producing a total of 1128 MW and employing 288 permanent personnel and Collie power station; a single generating unit producing a total of 345 MW owned by Synergy, operated under an operating and maintenance contract.
- (b) gas turbines and distributed generation (**GTDG**) - are specialists in the operation and maintenance of highly automated generating plant. GTDG has 53 employees managing a portfolio of 91 generating units fuelled by gas, wind, steam and diesel with a total generating capacity of 1,300 MW. The portfolio comprises 18 open cycle gas turbines, 45 wind turbines, one combined cycle station and 26 diesel engines.

The gas turbines portfolio is spread over an area from Coral Bay in the north to Kalgoorlie / Esperance in the east and Albany to the south.

- (c) asset optimisation - seeks to maximise sustainable returns from all the GBU power generation assets by analysis plant performance to deliver practical recommendations for business performance improvement and is responsible for developing and maintaining the fleet asset lifecycle missions. Asset Optimisation also maintains project management governance for GBU and executes capital projects in GBU above \$0.5 million.

Asset Optimisation works closely both with the site teams and across business units to achieve the GBU and Synergy objectives.

This scope of work (**SoW**) document is for the mechanical installation of a new floating pontoon pump at the 5H void. The purpose of the project is to increase Synergy's capability of drawing water from the void in order to secure future water resource availability.

It is intended to use the new pontoon pump to reach a lower water level in the 5H void, while continuing to utilise the existing land based centrifugal pump and pipelines.

### **3 GENERAL SCOPE OF WORK**

The SoW includes the following:

- (a) installation of the contractor supplied pontoon pump and mooring lines;
- (b) supply and installation of a 216 m long, DN315 HDPE PN10 floating pipeline and pipe floats;
- (c) supply and installation of piping tie-in works to the existing land based centrifugal pump; and
- (d) supply and installation of flanges, pipe fittings, bolts, nuts, washers and all other ancillaries as required to mechanically install the works as per the drawings.

The SoW does not include electrical works, controls works, civil / concrete works, or any commissioning.

Synergy's reserves the right to amend the SoW at a later date, to include additional related input or SoW parameters, should the need arise due to a change in business or technical requirements.

### **4 DETAILED SCOPE OF WORK**

The detailed SoW includes the following:

- (a) installation of contractor supplied pontoon pump skid, including unloading of the pontoon pump skid at the Muja power station and further transport of the skid;
- (b) installation of the contractor supplied mooring lines and tensioning equipment to mooring posts located at concrete anchor blocks (mooring posts and anchor blocks will be installed by others);
- (c) supply and installation of 216m of DN315 HDPE PN10 pipeline and pipe floats. The contractor must allow for at least 10 percent additional pipe length;
- (d) strap and cable tie the power and thermistor cables to the floating pipeline;
- (e) fabrication and delivery to site of 316 S/S pipework (spools '1', '2', '3' and '4'), valves and fittings as per the drawings;
- (f) disconnect the suction tank from existing land based pump and install new pipework (spools '1', '2', '3' and '4'), valves and fittings as per the drawings;
- (g) reinstall the suction tank on the extended concrete plinth (plinth extension by others), and the suction pipe supports using chemical anchors;



- (h) site run a new DN50 316S/S pipe from the pump discharge to the suction tank, reusing and installing the existing valves and pressure gauge;
- (i) pressure test the floating HDPE pipeline in accordance with AS2033: Installation of polyethylene pipe systems;
- (j) as-build the drawings in accordance with Synergy drafting procedures;
- (k) all mechanical works must be completed by qualified pipe fitters and welders in accordance with relevant Australian Standards, including AS2033: Installation of polyethylene pipe systems;
- (l) outstanding work and defects rectification as punch listed;
- (m) site establishment, mobilisation and demobilisation;
- (n) the contractor must complete all preconstruction activities prior to commencement of construction works on site;
- (o) the contractor must ensure that the construction risk assessment workshop (**CRAW**) is completed prior to the submission of an OSH management plan;
- (p) the contractor must develop a construction methodology that complies with the requirements specified in this document, and all relevant Australian Standards and regulatory requirements. The construction methodology must include a detailed construction process description and the document should detail materials, plant, labour and any temporary works required to complete the SoW;
- (q) the contractor must provide their own site accommodation if required;
- (r) no water or power will be made available from the principal; and
- (s) no public information signs are required for this project.

## 5 SITE LOCATIONS

The contractor's work will take place at the 5H void adjacent to Muja power station. All contractor's personnel will be required to complete the necessary site inductions.

## 6 DEFINITIONS AND APPLICABLE DOCUMENTS

The following drawings form part of the SoW;

- (a) M10-C-0178-001 General arrangement;
- (b) M10-C-0179-001 Pontoon pump connection detail;
- (c) M10-C-0180-001 Transfer pump station modifications;
- (d) M10-C-0181-001 Transfer pump station spools; and
- (e) M-S-1067/21 Process and instrumentation diagram.

The drawings are located in [Section 19](#) Attachments.



## 7 DELIVERABLES

The contractor must provide the following deliverables two (2) weeks prior to site mobilisation:

- (a) minutes of the CRAW;
- (b) construction methodology;
- (c) personnel accreditations, qualifications and certifications; and
- (d) OSH management plans.

The contractor must provide the following deliverables prior to practical completion:

- (a) as-built drawings to Synergy requirements; and
- (b) pressure test report, including instrument calibration certificates.

## 8 SPECIFICATIONS AND DRAWINGS

- (a) Drawings must be supplied in Bentley Systems MicroStation version v8i SELECT series 3 to ensure conformance to Muja power station site requirements.
- (b) Please refer to the Synergy computer aided design and practices standards for all the details relating to drawing formats and requirements. The standards are available to be viewed and downloaded at <https://www.synergy.net.au/suppliers>.

## 9 DELIVERY REQUIREMENTS

The HDPE pipeline, pipe floats, pipe fittings and valves must be provided in new condition.

## 10 CONTRACTOR RESOURCE REQUIREMENTS AND QUALIFICATIONS

- (a) the contractor is to nominate a contractor supervisor/s as follows:
  - (i) the contractor must nominate a qualified works supervisor/s with proven supervisory skills, the supervisor/s must also have thorough understanding of all supervisory responsibilities in regards to safety management;
  - (ii) the contractor supervisor/s must require GBU generation supervisor authorisation prior to supervising any work at any Synergy GBU site;
  - (iii) the nominated supervisor/s must also be contactable at all times during both normal working hours and after hours;
  - (iv) the site supervisor/s must be onsite whenever the contractor and or subcontractors are carrying out the work; and
  - (v) works carried out under the contract will require the following roles:
    - (I) supervisor; and
    - (II) qualified trade persons.

The contractor must provide proof of licences, relevant qualifications, training and verification of competencies (**VOC**) of all tradespersons, staff or subcontractors engaged to carry out work under this contract.

Some tasks may involve high risk work, persons employed to undertake high risk work must hold a current high risk work licence specific to the task that they are engaged to undertake.

Any person performing high risk work on the Muja power station site must also hold a current VOC.

## **11 APPROACH AND METHODOLOGY**

The contractor is required to provide their own specific methodology for the completion of the tasks and deliverables. The following methodology shall be considered by the contractor:

- (a) installation of contractor supplied pontoon pump skid. The contractor must unload the pontoon pump skid at the Muja power station and transport the skid to the edge of the void at the existing pit entry ramp (west side of the 5H void). The contractor must use heavy vehicles and guide ropes to drag or lift the pontoon into the water. Once floating, the pontoon must be transported to the eastern edge of the 5H void using a towing boat to be provided by the contractor;
- (b) supply and installation of 216m of DN315 HDPE PN10 pipeline and pipe floats. The contractor must make the flanged connection to the pontoon at the eastern edge of the 5H void, including all electrical cable terminations. The contractor must weld the pipe on land adjacent to the 5H void. While using pipe rollers, the contractor must install the pipe floats and tie the power and control cables to the pipeline, as the pipeline is simultaneously pushed into the 5H void;
- (c) installation of the contractor supplied mooring lines. The contractor must use a small towing boat to transport the mooring lines from the floating pontoon to the edge of the pond (or vice versa) and secure the pontoon in position using the contractor supplied tensioning equipment. The contractor must install the tensioning equipment to concrete anchor blocks, the contractor must confirm using GPS that the pontoon is located as per the drawings; and
- (d) disconnect the suction tank from existing land based pump and install new pipework, valves and fittings as per the drawings. Install the floating pipeline end to the new pipework. Reinstall the suction tank at the new location on the concrete plinth, and the suction tank supports using chemical anchors.

It is the contractor's obligation to ensure that all work undertaken is in compliance with all applicable legislation, acts and codes.

The contractor must ensure that its resources are adequately trained to fulfil their responsibilities under the contract and must operate at all times in compliance with the law.

## **12 PERFORMANCE STANDARDS AND QUALITY ASSURANCE**

- (a) all mechanical works must be completed by qualified pipe fitters and welders in accordance with the relevant Australian Standards, including AS2033:2008 Installation of polyethylene pipe systems;

- (b) the contractor will submit a weld pack included “weld procedure specification” (**WPS**) and “welding procedure qualification record” (**WPQR**) and ITP for any workshop or on-site pipe work and welding work. This will require sign off and acceptance by the Synergy welding officer, prior to any work being carried out; and
- (c) particular attention must be given to the welding of the stainless steel pipes and the passivation after welding to mitigate the potential for corrosion around the welds.

### **13 TESTING, INSPECTION AND COMMISSIONING**

- (a) the contractor must pressure test the floating HDPE pipeline in accordance with AS2033: Installation of polyethylene pipe systems; and
- (b) outstanding work and defects must be rectification as (punch) listed.

### **14 REPORTING AND COMMUNICATIONS**

- (a) the contractor must provide weekly reporting to keep Synergy informed of progress, status and completion over the course of the work. These reports must be delivered electronically; and
- (b) the contractor must be accessible, responsive, and keep Synergy informed of any issues, as they arise.

### **15 CONTRACTOR RESPONSIBILITIES**

- (a) the contractor is responsible for coordination and management of the work under the contract; and
- (b) the contractor is required to provide its own tools and equipment.

### **16 SYNERGY RESPONSIBILITIES**

- (a) Synergy will perform all equipment isolations after a request from the contractor. The request must be made at least three (3) days prior to an isolation occurring; and

## 17 RISKS AND CONSTRAINTS

- (a) the works include working over water, which represents a significant risk to the contractor, which has the potential to result in seriously injury or death. It is the contractors responsibility to mitigate this risk in the CRAW; and
- (b) 5H void water is acidic with a pH of three. The contractor should avoid prolonged contact with the water.

## 18 OCCUPATIONAL, HEALTH AND SAFETY MANAGEMENT

All completed works must be compliant with the relevant legislative obligations and Statutory requirements.

- (a) OHS act WA 1984;
- (b) OHS regulations 1996;
- (c) all other relevant Western Australian legislation;
- (d) relevant Australian standards including those denoted on supplied drawings; and
- (e) relevant industry codes of practices.

Contractors must also ensure they have a safety management plan (**SMP**) and comply with statutory requirements and instructions given by the Synergy contract user to perform work for which that are engaged.

In general terms contractors are responsible for:

- (a) ensuring their own safety and the safety of those in their work groups;
- (b) implementing risk management strategies and applying safe systems of work to perform activities;
- (c) ensuring knowledge of and operating in accordance with Synergy's WHSMF, ensuring the requirements of procedures are applied, relevant assessment and monitoring activities are identified, carried out and recorded;
- (d) operating plant in the manner it was designed;
- (e) reporting incidents, injuries, near misses, dangerous events and issues of non-compliance with the WHSMF to their supervisor or Synergy contact; and
- (f) ensuring construction work complies with legislative requirements.

## 18.2 Safety management plan

The contractor's SMP should apply specifically to the SoW outlined in this contract and as a minimum should include the following:

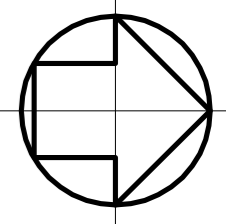
- (a) purpose;
- (b) endorsements;
- (c) health and safety required outcomes;
- (d) health and safety management framework;
- (e) Synergy lifesavers;
- (f) health and safety planning;
- (g) legal and other requirements;
- (h) objectives and targets;
- (i) responsibilities and accountabilities;
- (i) training and competencies;
- (j) consultation and communication;
- (k) employee assistance program;
- (l) health and safety reporting;
- (m) document and data control;
- (n) health and safety risk management;
- (o) safe systems of work;
- (p) emergency response;
- (q) monitoring and measurement;
- (r) incident management; and
- (s) health and safety records management.

**19 ATTACHMENTS**

Detailed design drawings:

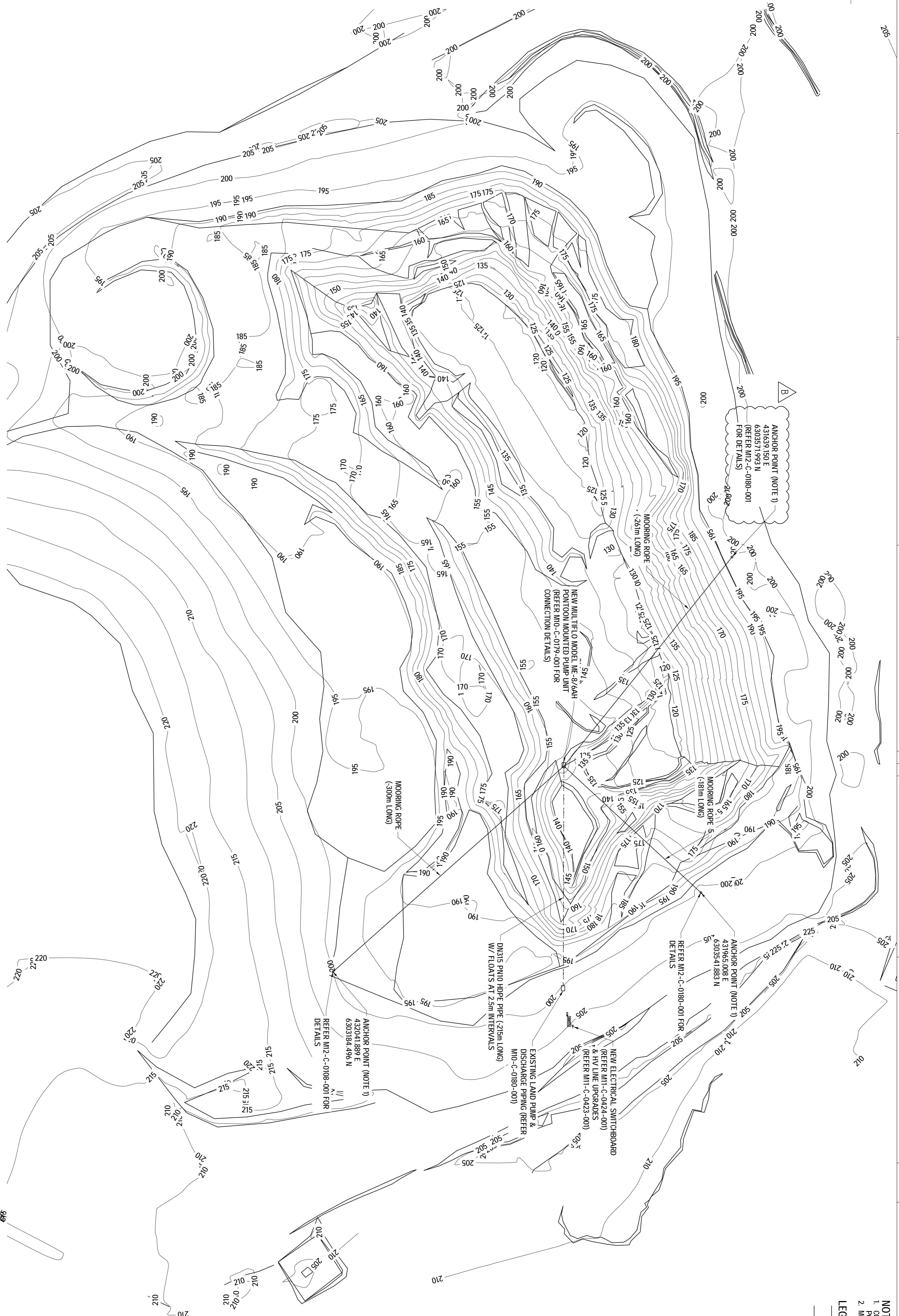
- (a) [M10-C-0178-001](#) General arrangement;
- (b) [M10-C-0179-001](#) Pontoon pump connection detail;
- (c) [M10-C-0180-001](#) Transfer pump station modifications;
- (d) [M10-C-0181-001](#) Transfer pump station spools; and
- (e) [M-S-1067/21](#) Process and instrumentation diagram.





**NOTES**  
 1. COORDINATES ARE INDICATIVE ONLY. CONTRACTOR TO ENSURE FOUNDATION OF ANCHOR POINTS ARE ABOVE RL 200M.  
 2. MOORING ROPE TO BE SPECIFIED & SUPPLIED BY PONTON PUMP VENDOR.

**LEGEND**  
 ——— MOORING LIMES  
 - - - - - DN315 HDPE PIPE



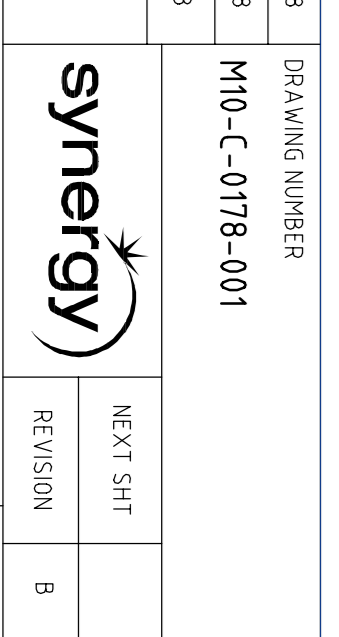
**PLAN**

M10-C-0179-001	PONTON PUMP CONNECTION
M10-C-0180-001	TRANSFER PUMP STATION - MODIFICATIONS
M10-C-0181-001	TRANSFER PUMP STATION - PIPE SPECIALS
M11-C-0142-001	LEGACY SH VOID MAIN SWITCHBOARD SINGLE LINE DIAGRAM
M11-C-0419-001	POWER RETICULATION - GUY ANCHOR DETAILS
M11-C-0420-001	22kV OHL - POLE P5-7 DETAIL
M11-C-0421-001	22kV OHL - POLE P5-8 DETAIL
M11-C-0422-001	22kV OHL - POLE P5-9 DETAIL
M11-C-0423-001	22kV OHL - PLAN AND PROFILE
M11-C-0424-001	ELECTRICAL SITE LAYOUT
M11-C-0425-001	NEW SH VOID MAIN SWITCHBOARD SINGLE LINE DIAGRAM
M11-C-0426-001	NEW SH VOID I&C CABLE BLOCK DIAGRAM
M12-C-0108-001	ANCHOR POINT FOUNDATION & PIPE SUPPORT DETAILS
M1-S-1067-021	SYSTEM PAID
M1-S-9023-001	22kV CVBF AREA RETICULATION SINGLE LINE DIAGRAM
M1-S-9023-001	DRAWING NO

DRAWING REFERENCES	
M10-C-0179-001	PONTON PUMP CONNECTION
M10-C-0180-001	TRANSFER PUMP STATION - MODIFICATIONS
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M1-S-9023-001	DRAWING NO

**MUJA POWER STATION**  
 COMMON PLANT  
 BORE WATER  
 SH VOID  
 GENERAL ARRANGEMENT

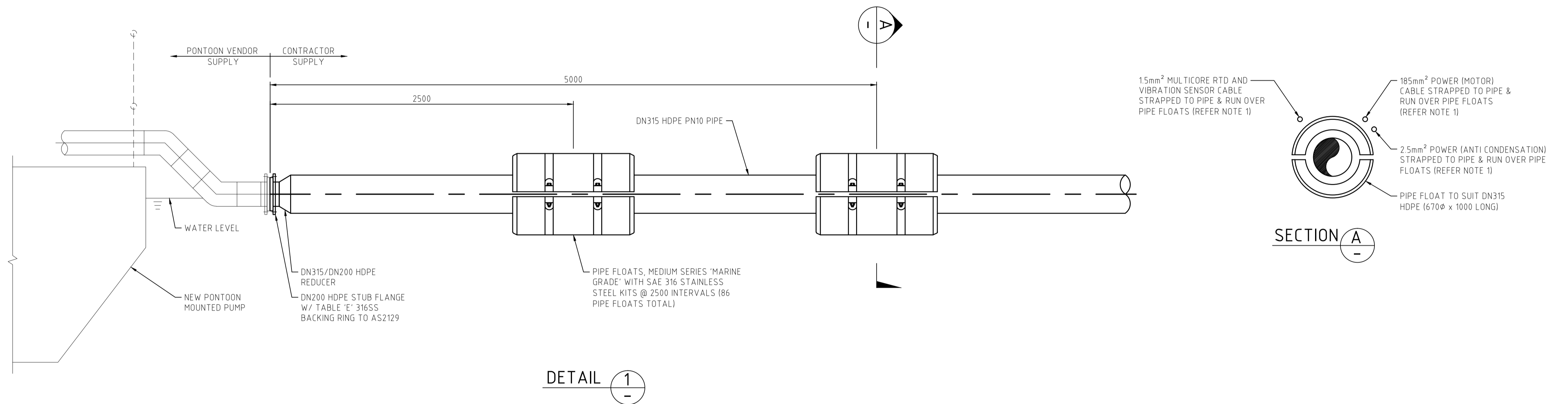
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APPROVED	G.SZOZDA	15.10.18	
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- NOTES**
1. CABLES TO BE TAPED TO THE PIPE USING "ADVANCE" AT 10 PVC HEAVY DUTY PIPEWRAP TAPE OR APPROVED EQUIVALENT. CABLES ARE TO BE FURTHER SECURED WITH BLACK CABLE TIES.
  2. PIPEFLOATS TO BE INSTALLED IN ACCORDANCE WITH THE VENDORS INSTRUCTIONS.
  3. ALL BOLTS, NUTS & WASHERS TO 316 SS.
  4. ALL GASKETS TO BE 3MM EPDM.



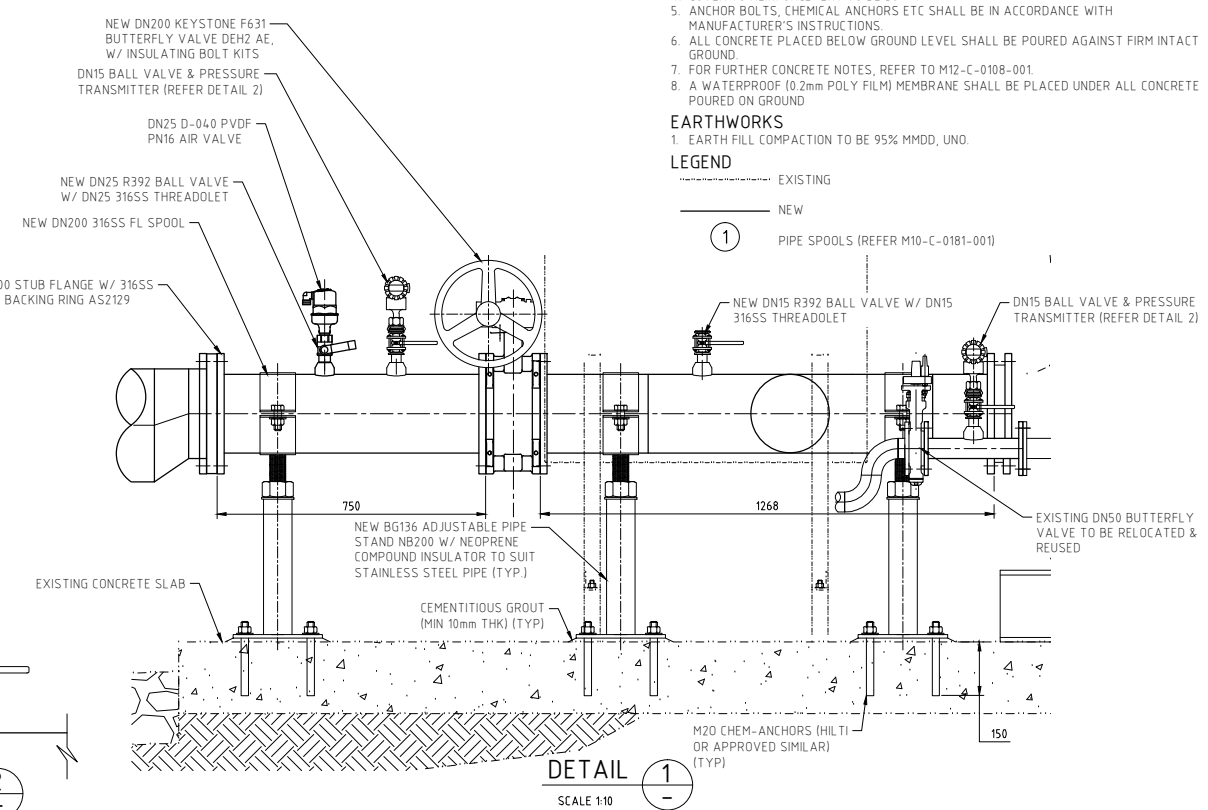
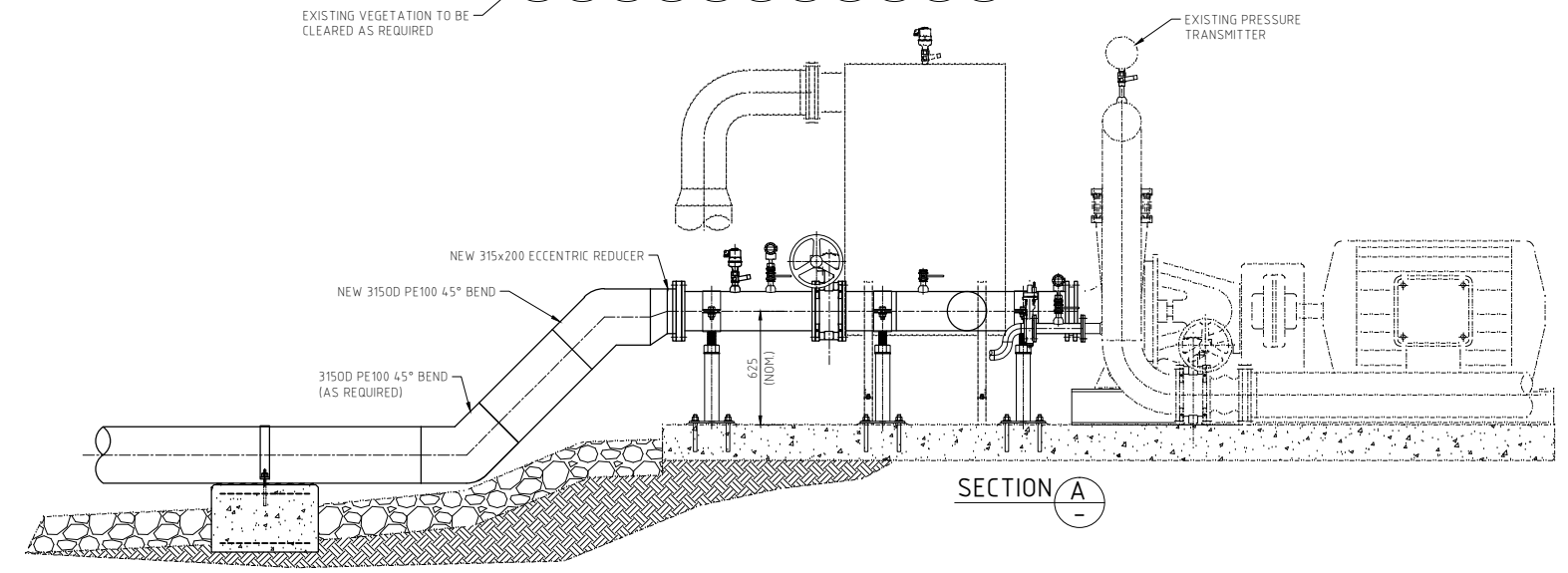
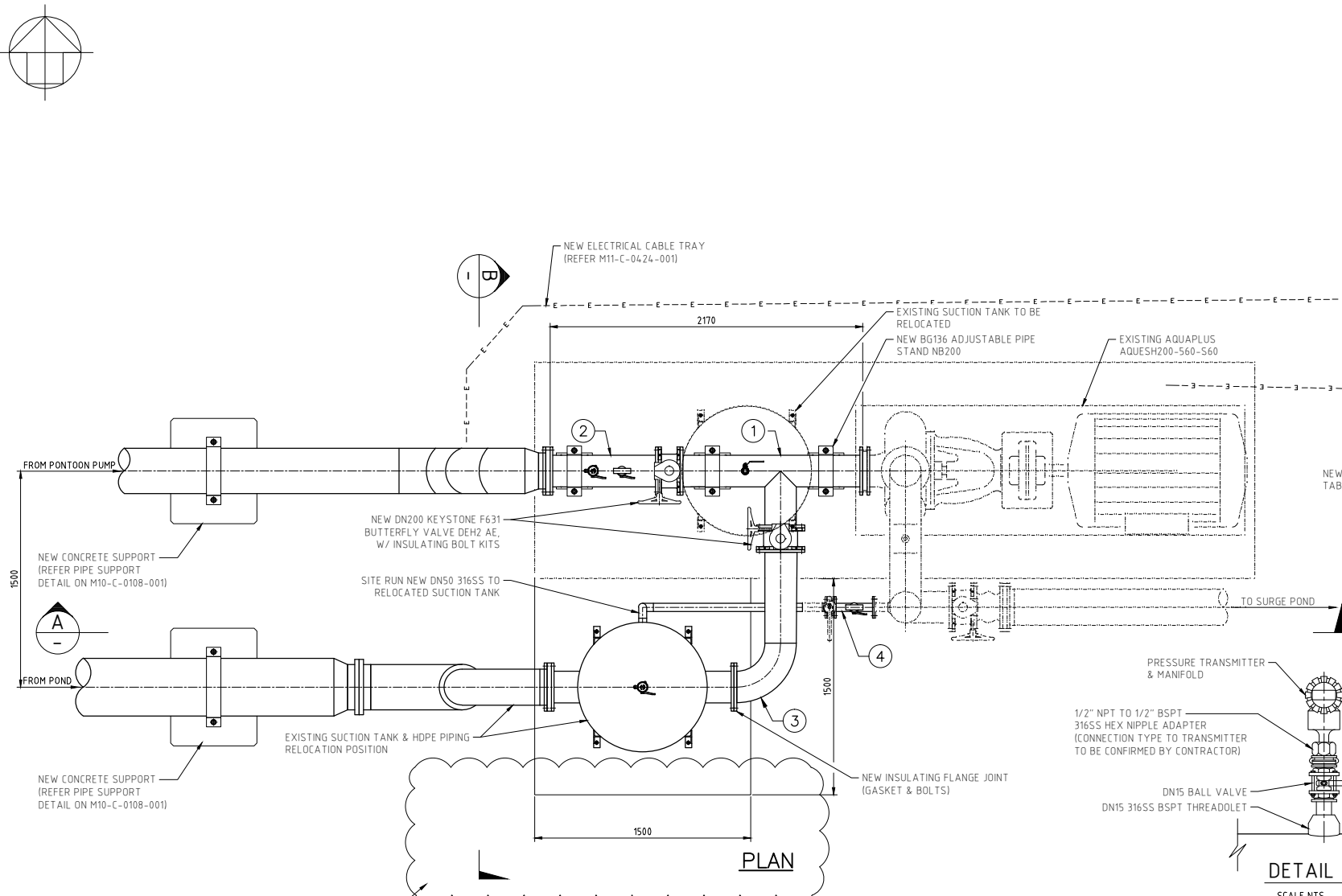
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**JACOBS**

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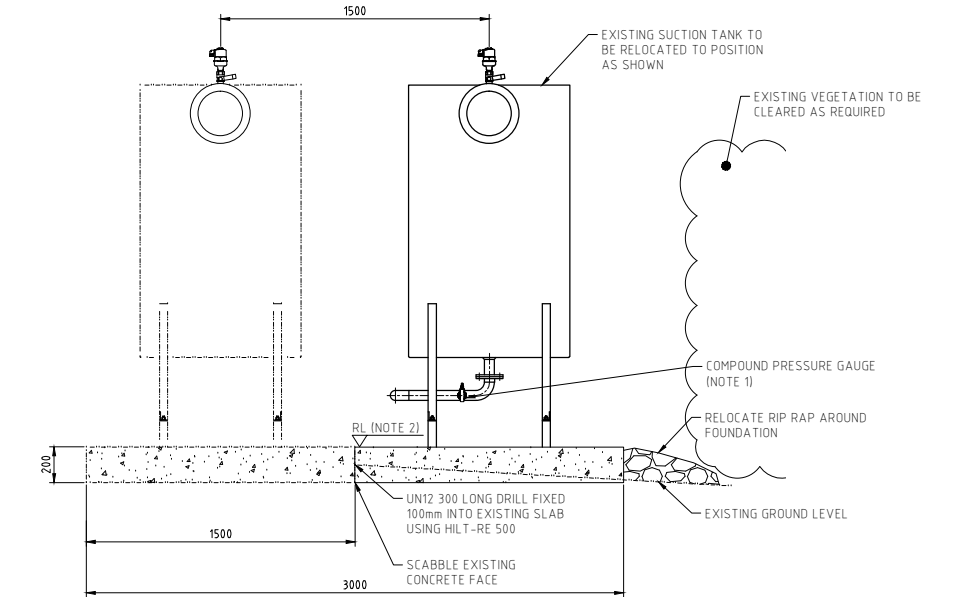
MUJA POWER STATION  
COMMON PLANT  
BORE WATER  
SH VOID  
PONTON PUMP CONNECTION DETAILS

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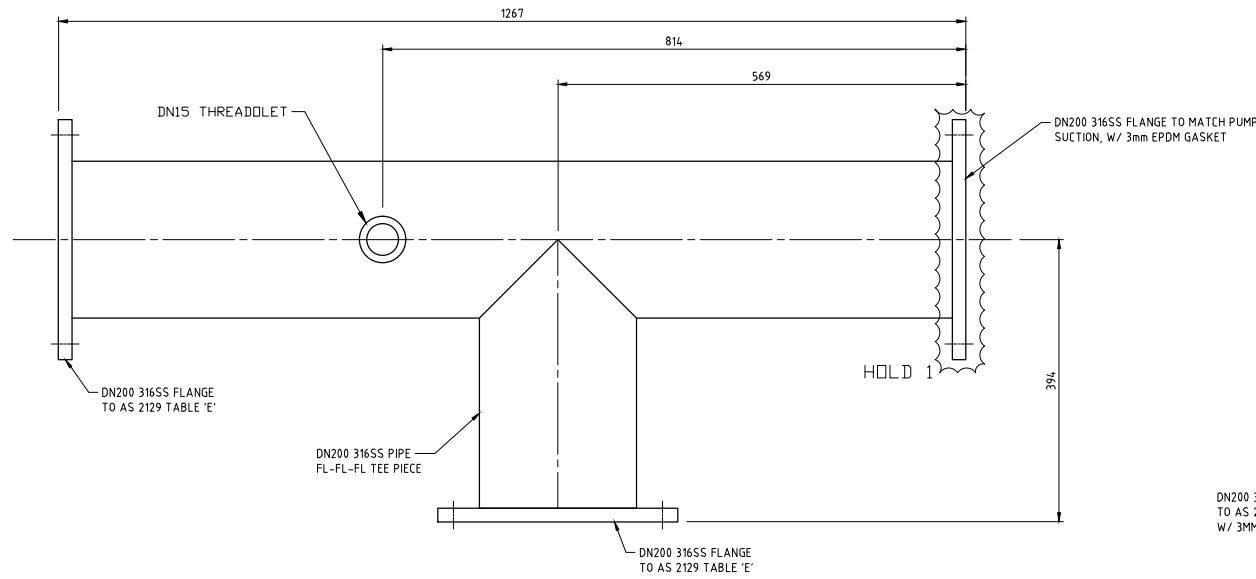


SECTION B

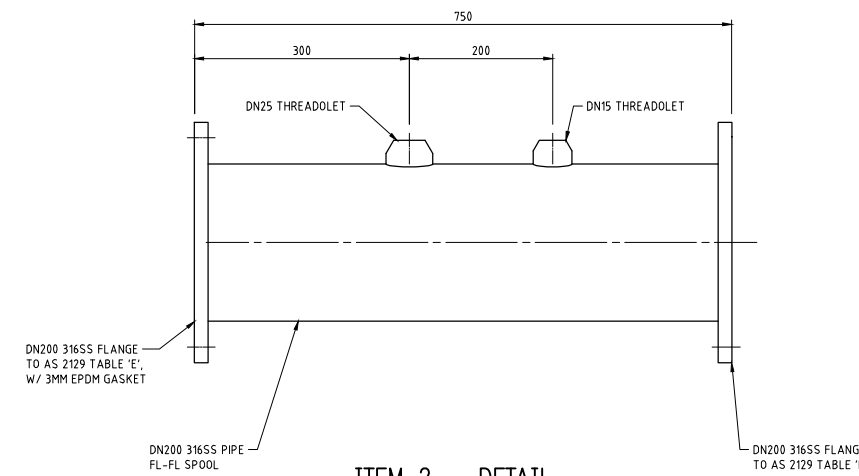
- GENERAL NOTES**
- REUSE EXISTING COMPOUND PRESSURE GAUGE UNDER SUCTION TANK.
  - NEW SLAB TOC TO MATCH EXISTING SLAB RL.
- PIPEWORK AND VALVING**
- ALL ABOVE GROUND POLYETHYLENE PIPE TO BE PE100 BLACK PE STUB FLANGE PRESSURE RATING TO MATCH PRESSURE RATING OF PE PIPE TO WHICH IT IS WELDED UND.
  - ALL VALVES SHALL BE LOCKABLE TO ALLOW POSITIVE LOCAL MECHANICAL ISOLATION OF SYSTEM.
  - RUBBER INSERTS TO BE USED BETWEEN PIPE AND EACH SUPPORT.
- CONCRETE**
- ALL CONCRETE WORKS AND CONCRETE REINFORCEMENT SHALL BE IN ACCORDANCE WITH SCOPE OF WORKS.
  - ALL CONCRETE EDGES TO BE CHAMFERED.
  - ALL CONCRETE TO BE GRADE 32 / 20 / 80.  
F'c = 32MPa @ 28 DAYS.  
MAX AGGREGATE SIZE = 20MM.  
SLUMP = 80MM.
  - COVER TO REINFORCEMENT TO BE 50MM.
  - ANCHOR BOLTS, CHEMICAL ANCHORS ETC SHALL BE IN ACCORDANCE WITH MANUFACTURER'S INSTRUCTIONS.
  - ALL CONCRETE PLACED BELOW GROUND LEVEL SHALL BE POURED AGAINST FIRM INTACT GROUND.
  - FOR FURTHER CONCRETE NOTES, REFER TO M12-C-0108-001.
  - A WATERPROOF 10.2mm POLY FILM MEMBRANE SHALL BE PLACED UNDER ALL CONCRETE POURED ON GROUND.
- EARTHWORKS**
- EARTH FILL COMPACTION TO BE 95% MMD, UND.
- LEGEND**
- EXISTING
  - NEW
  - PIPE SPOOLS (REFER M10-C-0181-001)



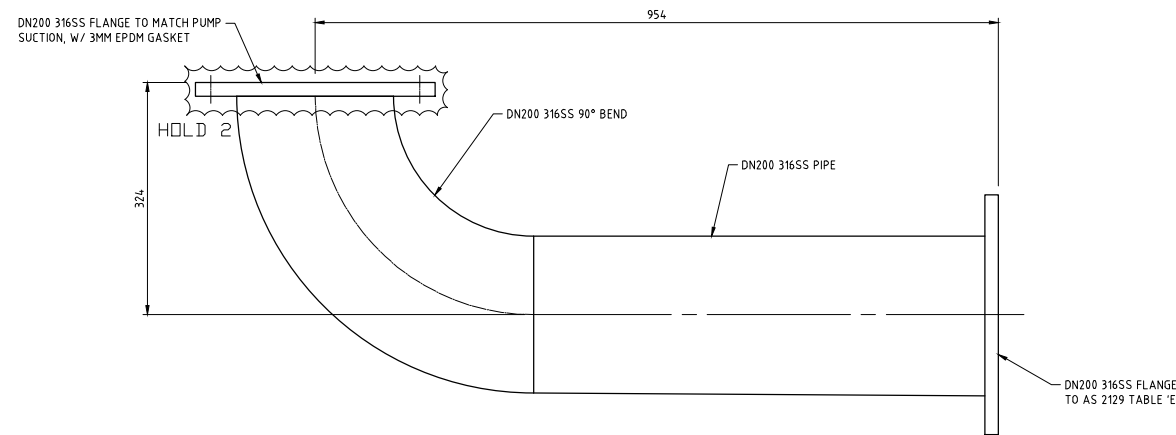
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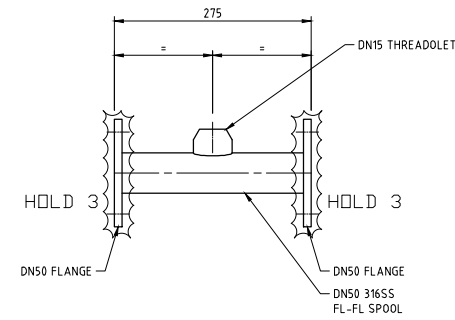
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ITEM 4 - DETAIL  
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GENERAL NOTES

- UNLESS NOTED OTHERWISE ALL DIMENSIONS ARE IN MILLIMETRES.
- ALL DIMENSIONS TO BE CHECKED ON SITE AND CONFIRMED PRIOR TO FABRICATION AND COMMENCEMENT OF ANY WORKS.
- ALL DRAWINGS SHALL BE READ IN CONJUNCTION WITH THE SCOPE OF WORKS.

STAINLESS STEEL NOTES

- ALL STAINLESS STEEL PIPE SHALL BE GRADE 316L, SCHEDULE 40S TO ASTM A312M AND ALL STAINLESS STEEL BUTT-WELD FITTINGS SHALL BE GRADE 316L TO ASTM A403M.
- STAINLESS STEEL PIPE WELDING SHALL BE IN ACCORDANCE WITH AS 4041 CLASS 2P PIPING WITH BUTT WELDED JOINTS. REMOVE WELD SPATTER, OXIDE AND CHEMICALLY PASSIVATE THE WELD.
- WHERE A STAINLESS STEEL SITE WELD IS USED, PIPE SPECIAL TO BE RETURNED OFFSITE FOR PICKLING AND PASSIVATING PRIOR TO INSTALLATION.
- FLANGE BOLT HOLES TO BE POSITIONED OFF CENTRE UNLESS OTHERWISE SHOWN.
- ALL FLANGES SHALL BE AS 2129 TABLE 'E' UND.
- CONTRACTOR TO DETERMINE BOLT LENGTHS.
- ALL THREADOLETS TO BE FITTED WITH 316SS BARREL NIPPLES, USING THREAD SEALANT & TAPE.

HOLDS

- CONTRACTOR TO CONFIRM EXISTING PUMP SUCTION FLANGE STANDARD PRIOR TO FABRICATION OF THIS SPOOL.
- CONTRACTOR TO CONFIRM EXISTING TANK DISCHARGE FLANGE STANDARD PRIOR TO FABRICATION OF THIS SPOOL.
- CONTRACTOR TO CONFIRM EXISTING FLANGE STANDARD PRIOR TO FABRICATION OF THIS SPOOL.



REV	DATE	DRWN	CHK'D	APP'D	DESCRIPTION	DRAWING No	TITLE
A	15.10.18	CYC	AL	GS	APPROVED FOR CONSTRUCTION	M10-C-0180-001	TRANSFER PUMP STATION - MODIFICATIONS
						M10-C-0178-001	GENERAL ARRANGEMENT
DRAWING REVISIONS						DRAWING REFERENCES	

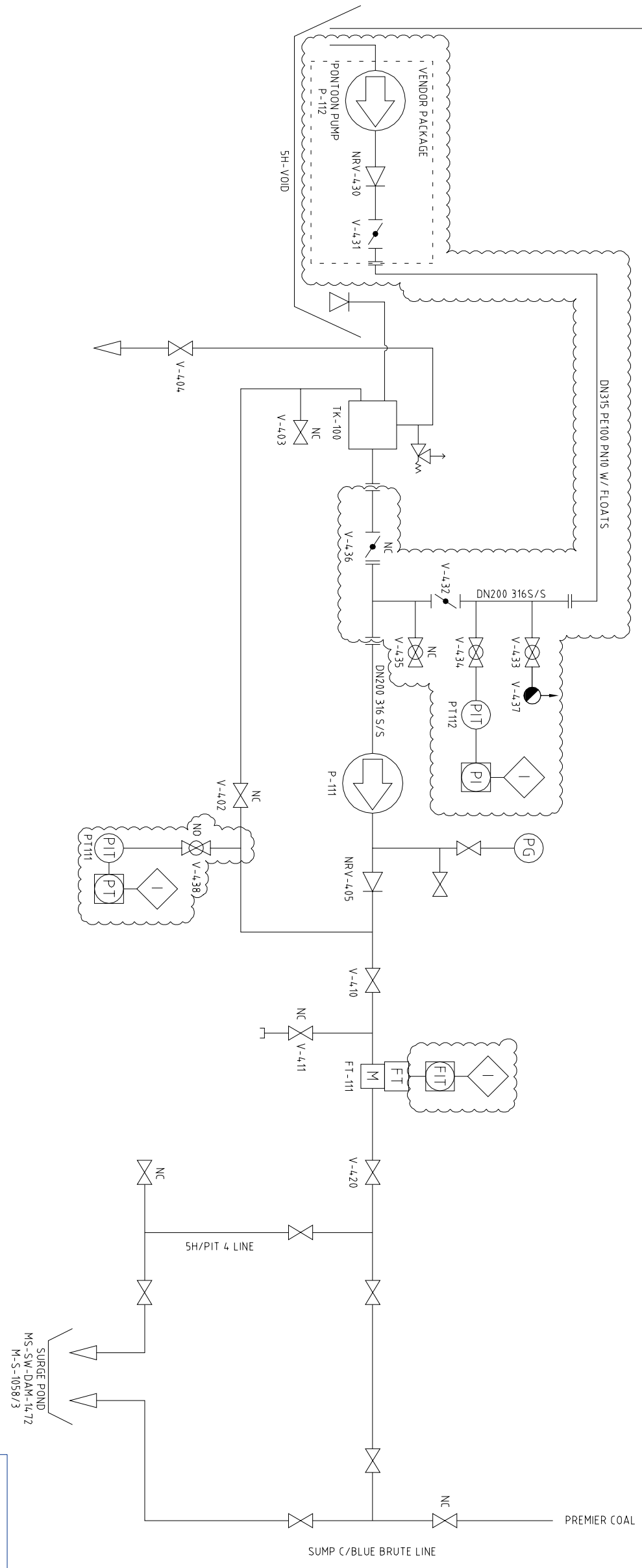
MUJA POWER STATION  
COMMON PLANT  
BORE WATER  
SH VOID  
TRANSFER PUMP STATION - PIPE SPECIALS

DRAWN	C.CARNEVALI	15.10.18	DRAWING NUMBER	M10-C-0181-001
CHECKED	A.LEEDMAN	15.10.18		
APPROVED	G.SZOZDA	15.10.18		
<p>SCALE 1: 10 U.O.N.</p>				NEXT SHT REVISION A

**P-111**  
 END-SUCTION CENTRIFUGAL  
 DUTY FLOW: 50/150 L/S  
 DUTY PRESSURE: 50/73m  
 MOTOR: 220kw VSD

**P-112**  
 PONTON PUMP  
 DUTY FLOW: 50/150 L/S  
 DUTY PRESSURE: 28/29m  
 MOTOR: 75kw VSD

6" LAYFLAT HOSE  
 DIESEL PUMP  
 OWNED BY  
 PREMIER COAL  
 TO CWRF AERATION UNIT  
 M-S-1067/15



**LEGEND**  
 INTERLOCK  
 SIGNAL TO RTUI

**NOTES**  
 1. ALL EQUIPMENT IDS TO BE PREFIXED BY MS-BW UNLESS OTHERWISE STATED

(e) M-S-1067/21 Process and instrumentation design

REV	DATE	DRWN	CHK'D	APP'D	DESCRIPTION
A	29.07.15	AK	MP	MP	ADDED REF TO M-S-1058/3 WD 09371431
B	AUG 16	AK	MP	MP	ADDED V-411
C	15.10.18	CYC	AL	GS	PONTON PUMP PACKAGE PROPOSED WORKS AS CLOURED

**MUJA POWER STATION**  
 COMMON PLANT  
 BORE WATER  
 SH VOID  
 PIPING & INSTRUMENTATION DIAGRAM (P&ID)

SCALE	1	UON
0		



DRAWN	A KRUGER	23.06.2015	DRAWING NUMBER
CHECKED	M PHARO	29.06.2015	M-S-1067-021
APPROVED	M PHARO	29.06.2015	



NEXT SHIT	
REVISION	C