



Queensland Urban Utilities

SP302 - Progress Road Pump Station

Operation & Maintenance Manual

Contract Number BW50080-04/05

Manuals Cover Pages

Created 12/09/2006

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¹ VSD = Variable Speed Drive

BRISBANE WATER

Network Control Systems

FUNTIONAL SPECIFICATION

SP302 Progress Rd #2

Sewage Pumping Station

Submersible 2 Pumps With VSD (interlocked)

Version 1.00

Document Signoff

Approval

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Distribution

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Revision Control

Revision Number	Date	Amendment Details	Responsible Officer
Version 0.00	17/10/2005	Original Draft	Alex Witthoft
Version 0.01	21/4/2006	Changed Wet Well Elevation mAHD, Inlet mAHD & Old Dry Well Knife Gate mAHD. Removed reference to emergency storage probe. Removed two pump operation and added one pump only operation. Modified pump kW rating to 122kW. Flowmeter not buried. Generator permanently onsite.	Gerard Anderson
Version 0.02	24/4/2006	Changed station drawing to remove Duty B Start/Stop reference. Removed reference to Standby Generator being temporary in Section 2.2. Removed red-line text. Added picture of Control System graphic.	Gerard Anderson
Version 0.03	3/5/2006	Added info. re. storage chamber type to graphic	Gerard Anderson
Version 1.00	11/8/2006	Created commissioned version. Updated levels.	Gerard Anderson

Document Consultation

Please review the attached document and add your comments where necessary. To ensure that the process is kept within reasonable timeframes, it would be appreciated if you could return this document by the **Requested Return Date** listed below.

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Definitions

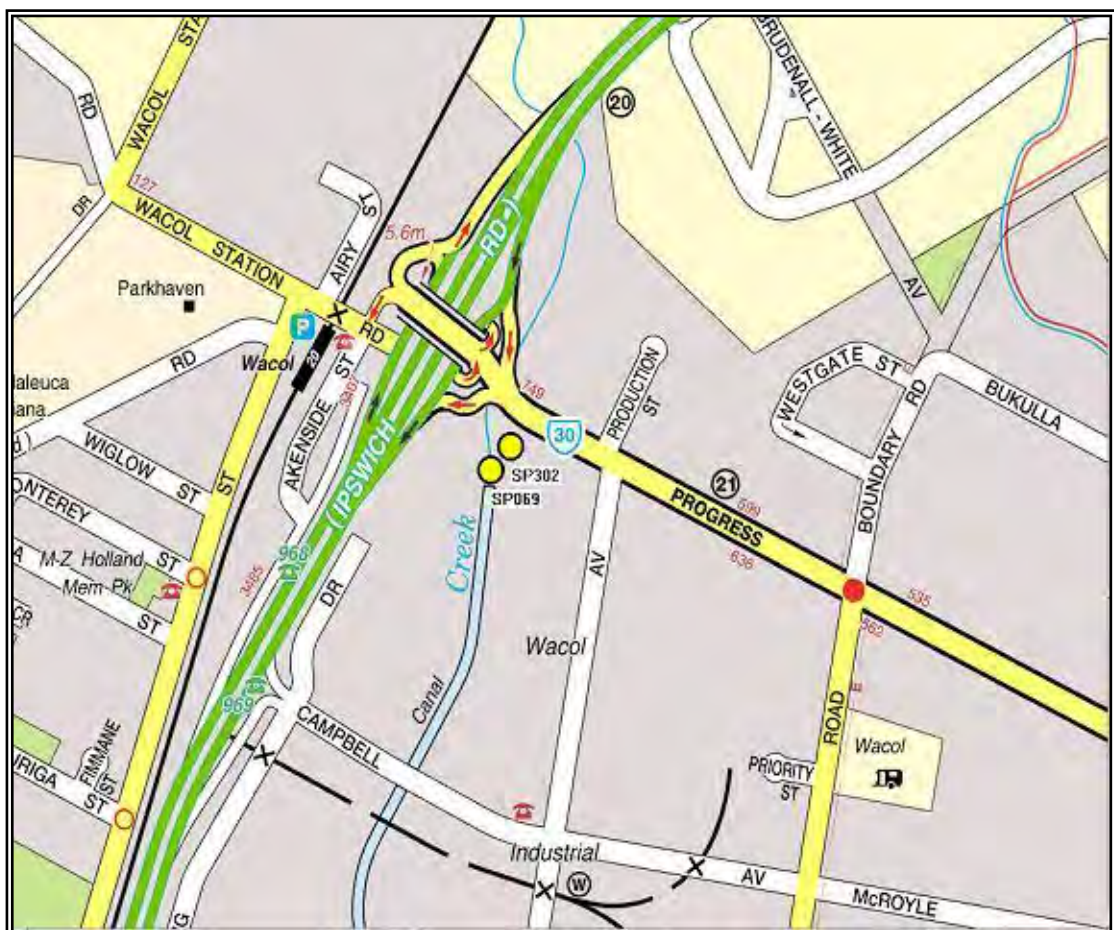
IDTS	Integrated Departmental Telemetry System
RTU	Remote Telemetry Unit
SCADA	Supervisory Control And Data Acquisition
MAHD	Metres above Australia Height Datum

1 INTRODUCTION

This document contains the site specific details and describes the non standard functional requirements for control, monitoring and telemetry at sewage pump station SP302 at Progress Rd #2, Wacol. The functional requirements described in the document are in addition to the standard functionality detailed in “SPSV3 SEWAGE PUMPING STATION SUBMERSIBLE 3 PUMPS WITH VFD”¹. This standard specification was written for a 3 pump station, of which only 2 pumps are allowed to run at any given time.

The functionality for SP302 Progress Rd #2 is identical to the above standard (SPSV3) with the following exceptions, the third pump is removed and only 1 pump is allowed to run at any given time. There is a risk of overflows due to the heading up in the Discharge MH with both pumps working, therefore it is recommended that the pumps be interlocked. NB The pumps are physically interlocked within the switchboard wiring and logically interlocked within the PLC software.

All site specific values are detailed in this document. The site specific details and the non standard functional requirements in this document were derived from the “Project Delivery Document” written by Ross Anderson and



Associates Pty Ltd (2). Some site specific values were provided by the Commissioning Manager, Reg McGirr.

Figure 1: SP302 Location Map

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1.1 Site Background

The Progress Road conventional pump station (SP069) and 200/300mm diameter CI rising main were constructed in 1964 to service the Wacol Industrial Estate. It is located off Progress Road adjacent to Sandy Creek in Wacol, with the rising main to the old Wacol Wastewater Treatment Plant located alongside the Ipswich - Brisbane Highway.

In 1980, the sewerage system was upgraded with the abandonment of the old Wacol WWTP and construction of a new 375mm diameter AC rising main, located alongside the existing 200/300 mm diameter CI rising main to a discharge Maintenance Hole delivering into the 375 mm diameter gravity sewer to Sanananda St Pump Station. Sanananda St PS pumps to the Darra and Oxley Creek Branch Sewer and the Oxley WWTP, with partial flow diversion currently under construction to the Wacol Treatment Plant.

The current Progress Road Pump Station (SP069) receives trade waste, is nearing design capacity and presents a high risk to the environment from dry weather overflows. The proposed pump station SP302 (which will replace the existing pump station), rising main and associated works will provide:

- for the pumping of ultimate sewage flows from the catchment (160L/s at approximately 35metres head).
- operational improvements to allow pump well isolation and grit removal.
- additional storage for dry weather overflows by using the existing wet and dry well structures.
- reduced risk of sewage overflows to the environment.

1.2 General Process Description

The Progress Road Pump Station currently delivers approximately 110L/s from each pump. This will be upgraded with new pumps capable of pumping a flow of 160L/s against an estimated system head of 35 metres.

The lack of dry weather overflow storage in the existing wet well is a current risk which will be reduced with the construction of the new wet well. The new wet well will be connected to the old facilities so that overflows may readily enter the storage and be drained back to the new wet well. The operating philosophy of the overflow storage shall be determined in consultation with operations staff.

The duty pump will be requested to start at minimum speed (40 Hz) when the wet well level exceeds the start Duty level (10.100 mAHD). The station speed has been restricted to 40Hz (max & min speeds). Effectively this means PID control has been eliminated and the station is a start/stop station. The minimum speed has been set to 40Hz due to concerns over the noise coming from the pump motor during startup at 35Hz. The maximum speed has been set at 40Hz also, to prevent any damage to the rising main (which is suspected of being near failure). If PID mode was available, the pump would operate under PID control to maintain level at 10.200 mAHD. In PID mode the pump speed should be capable of varying from minimum speed of 35 Hz to deliver approximately 50 l/sec to maximum speed of 50Hz to deliver approximately 160 l/sec. The modulating PID control would otherwise continue until the Stop Duty level (9.100 mAHD) is reached. At time of writing this station is a stop/start station.

For a full description of control algorithm of the station refer to the standard function specification “SPSV3 SEWAGE PUMPING STATION SUBMERSIBLE 3 PUMPS WITH VFD” ⁽¹⁾. Note that the SP302 Progress Rd #2 site only contains 2 VSD pumps and only one VSD pump is allowed to operate at any given time. There is a risk of overflows due to the heading up in the Discharge MH with both pumps working, therefore it is recommended that the pumps be interlocked. NB The pumps are physically interlocked within the switchboard wiring and logically interlocked within the PLC software.

Ref: Drg No: 486/5/7-JB 004 New 200 DN DICL Overflow Return Pipe. The above Overflow Return Pipe has a 200 DN Kinifegate valve fitted to pipework in the existing Pump Station this valve is normally closed.

2 EQUIPMENT INSTALLED

2.1 Standard Equipment

SP302 Progress Rd #2 pump station has the following standard equipment installed. The functionality for the control, monitoring and alarming for these items is fully described in the standard functional specification.

Pumps	Two Grundfoss submersible pumps with 122 kW four pole electric motors are installed in the wet well. Each pump is fitted with moisture probes in the oil chamber and thermistors in the stator windings.
Pump Starters	Two Danfoss Variable Frequency Drives (VLT8200) are installed in the pump station switchboard.
Flow meters	One ABB Magmaster electromagnetic flow meters is installed in the discharge mains. The flowmeter will be used in the flow control algorithm (PID Loop) to control the speed of the pumps. This flowmeter is not buried.
Level Sensors	One Vega hydrostatic level transmitter installed in the wet well. One Multitrode level probe (Surcharge imminent) installed in the wet well.
Pressure Transmitters	One Vega D84 pressure transmitters are installed on the discharge side of the pumps.

2.2 Non Standard Equipment

SP302 Progress Rd #2 pump station has the following non standard equipment installed. The functionality for the control, monitoring and telemetry for is described in the following sections as these items are NOT described in the standard specification.

Emergency Generator	The switchboard will have a generator permanently connected.
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2.2.1 Emergency Generator

The emergency generator is designed to the standard functionality as described by “DIESEL STANDBY GENERATOR LOCAL CONTROL PANEL FUNCTIONAL DESCRIPTION”.³ The generator is supplied with the PLC fully configured and loaded with the standard program. The RTU (Logica MD3311) will programmed with the standard interface program that will provide the monitoring, control and telemetry to the IDTS master station.

3 CONTROL PHILOSOPHY

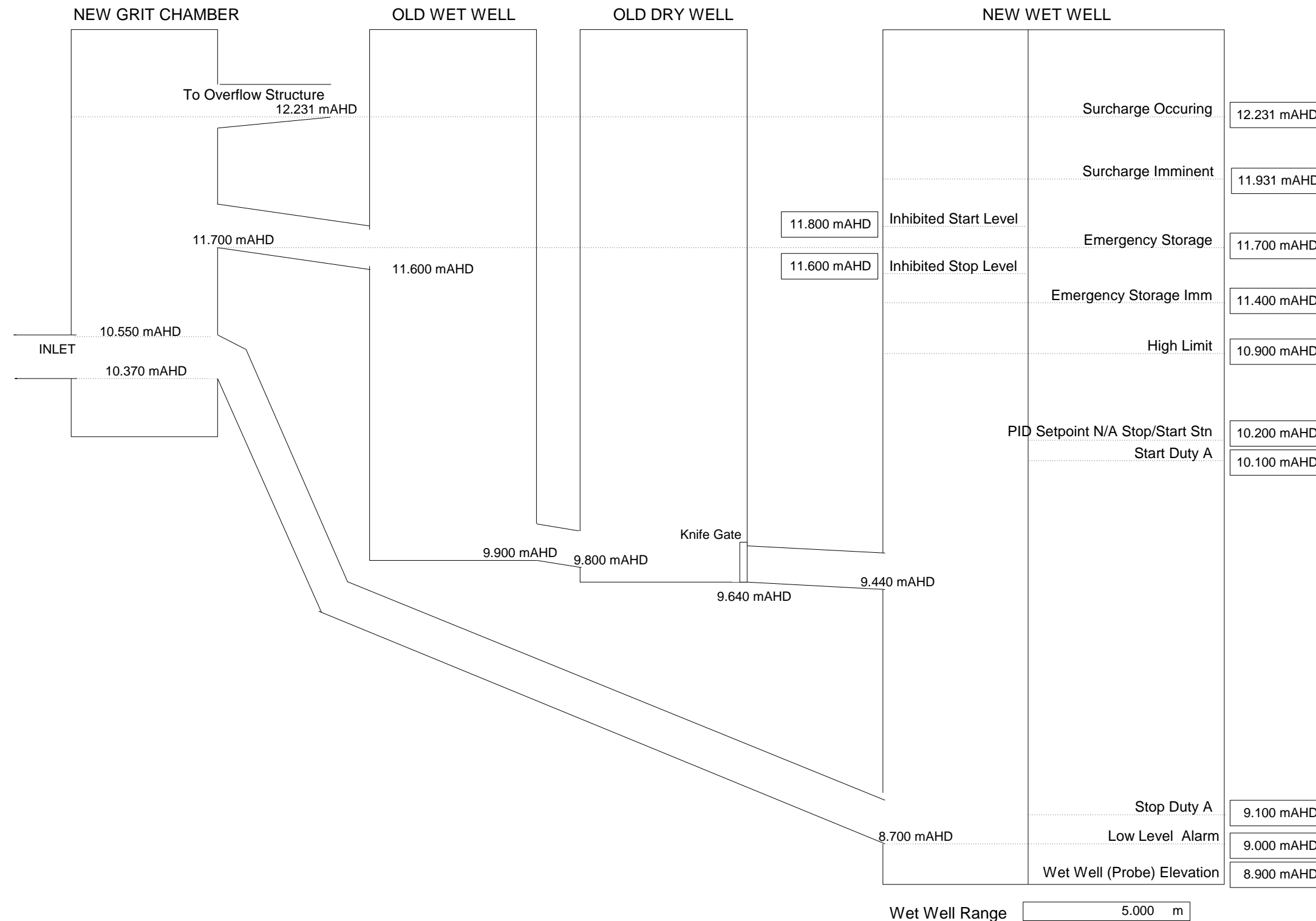


Figure 2: SP302 Station Level Set Points

SOME LEVELS MAY CHANGE ACCORDING TO COMMISSIONING FIGURES

3.1 Site Specific Values

Table 1: Site Specific Constants defined in the PLC

Tag Name	Description	Type	Value	Units
Sewerage Pumping Station				
Stn01grSurchPumpingTime	Surcharge pumping duration ³	Integer	TBA	Sec
Delivery flow				
Flw0[x]txRange	Delivery flow – Range	Real	300	l/s
Stn01grMinFlow1Pmp	Delivery flow – Minimum flow – 1 Pump	Real	50	l/s
Stn01grMaxFlow1Pmp	Delivery flow – Maximum flow – 1 Pump	Real	160	l/s
Stn01grMinFlow2Pmp	Delivery flow – Minimum flow – 2 Pump	Real	N/A	
Stn01grMaxFlow2Pmp	Delivery flow – Maximum flow – 2 Pump	Real	N/A	
Delivery pressure				
Pre01txRange	Delivery pressure – Range (NB 0 - 70M)	Real	7000	mmAHD/10
Pre01txZero	Delivery pressure – Elevation of the transducer	Real	T.B.A	mmAHD/10
Pump Blockage				
Stn01grPmpBlockFlowKneeSP	Flow blocked limit for flow/level PID control (knee)	Integer	500	l/s x 10
Stn01grPmpBlockSpeedKneeSP	VFD speed blocked limit for flow/level PID control (knee)	Integer	800	Hz x 100
Stn01grPmpBlockSpeedMinSP	VFD speed blocked limit for minimum flow PID control	Integer	1000	Hz x 100
Wet well level				
Wwl01txRange	Wet well level range	Integer	5000	mm
Wwl01txSurchImmLevelSP	Wet well surcharge imminent level	Integer	11.931	mmAHD
Wwl01grInhStartLevelSP	Wet well inhibit mode start level	Integer	11.800	mmAHD
Wwl01grInhStopLevelSP	Wet well inhibit mode stop level	Integer	11.600	mmAHD
Wwl01grRunatMaxLvISP	Wet well run at maximum speed level	Integer	10.900	mmAHD
Wwl01txDtyBStartLevelSP	Wet well duty B pump start level	Integer	N/A	mmAHD
Wwl01txPIDLevelSP	Wet well PID set point	Integer	10.200	mmAHD
Wwl01txDtyAStartLevelSP	Wet well duty A pump start level	Integer	10.100	mmAHD
Wwl01txDtyBStopLevelSP	Wet well duty B pump stop level	Integer	N/A	mmAHD
Wwl01txDtyAStopLevelSP	Wet well duty A pump stop level	Integer	9.100	mmAHD
Wwl01txZero	Wet well empty level (4mA of Probe)	Integer	8.900	mmAHD
Variable Frequency Drive				
Stn01grMinSpeed	Variable Frequency Drive – Minimum Speed	Integer	4000	Hz x 100
Stn01grMaxSpeed	Variable Frequency Drive – Maximum Speed	Integer	5000	Hz x 100

Table 2: Site Specific Constants defined in the RTU

Tag Name	Description	Type	Value	Units
flw1almInhibitTm	Delivery flow - Alarm inhibit timer	Integer	15	sec
pre1almInhibitTm	Delivery pressure - Alarm inhibit timer	Integer	15	sec
wwl1surchLvIVol	Wet well volume at surcharge level	Real	T.B.A	kl
wwl1lvISurcharge	Wet well surcharge occurring level	Real	12.231	mAHD
Pumps 1 & 2				
Pmp[x]almInhPwrTm	Pump [x] - Motor power alarm inhibit timer.	Integer	15	sec
pmp[x]almInhCrntTm	Pump [x] - Motor current alarm inhibit timer.	Integer	15	sec
pmp[x]currRange	Pump [x] - Motor current range	Real	210	Amps

Table 3: Site Specific Variable defined in the RTU

Wet well level				
wwl1highLimit	Wet well level - High alarm set point	Integer	10900	mmAHD
wwl1lowLimit	Wet well level - Low alarm set point	Integer	9000	mmAHD
Delivery flow				
flw1highLimit	Delivery flow - High alarm set point	Integer	300	ml/s x 10
flw1lowLimit	Delivery flow - Low alarm set point	Integer	35	ml/s x 10
Delivery pressure				
pre1highLimit	Delivery pressure DN1370 – High alarm set point	Integer	35	MAHD
pre1lowLimit	Delivery pressure DN1370 – Low alarm set point	Integer	10	MAHD
Pumps 1 & 2				
pmp[x]currHiLimit	Pump [x] - Motor current high alarm set point ⁴	Integer	140	Amps
pmp[x]currLoLimit	Pump [x] - Motor current low alarm set point ⁵	Integer	0	Amps
pmp[x]powHiLimit	Pump [x] - Motor power high alarm set point	Integer	85	Watts
pmp[x]powLoLimit	Pump [x] - Motor power low alarm set point	Integer	0	Watts

Table 4: Wet Well Level vs Volume Data (not including Emergency Storage Volume)

	Height (mAHD)	Volume m ³	Remaining Storage m ³	% Level	% Volume
1	8.500	0.000		0.0	0.0
2	8.700				
3	8.900				
4	9.200				
5	9.400				
6	9.800				
7	9.900				
8	10.000				
9	10.200				
10	10.400				
11	10.600				
12	10.800				
13	11.000				
14	11.200				
15	11.400				
16	11.600				
17	11.700				
18	11.800				
19	12.000				
20	12.231		0.000	100.0	100.0

Table 5: Emergency Storage Level vs Volume Data

	Height (mAHD)	Volume m ³	Remaining Storage m ³	% Level	% Volume
1	9.400	0.000		0.0	0.0
2	9.800				
3	9.900				
4	10.000				
5	10.200				
6	10.400				
7	10.600				
8	10.800				
9	11.000				
10	11.200				
11	11.400				
12	11.600				
13	11.700				
14	11.800				
15	12.000				
16	12.231		0.000	100.0	100.0
17	-	-	-	-	-
18	-	-	-	-	-
19	-	-	-	-	-
20	-	-	-	-	-

3.2 Non Standard Monitoring and Alarms

3.2.1 Emergency Storage Level

As the Vega probe takes a few seconds to initialise, all the wet well alarms except for invalid, are suppressed for 10 seconds upon RTU start up

Invalid

The signal is deemed invalid if it is

Less than (4mA – dead band) or greater than (20mA + dead band) for 1 second.

Once the invalid alarm has been activated it can only be reset when the signal is both greater than 4mA and less than 20mA for 20 seconds. The time delays ensure that a signal is truly invalid before an alarm is set and that it is stable before it is reset. The dead band is calculated using the site invalid hysteresis value multiplied by the range.

If the gravity sewer level becomes invalid, the gravity sewer low and high alarm alarms are suppressed.

NOTE: As the level is backed up by the battery – the site power does **not** suppress the invalid alarm.

Wet Well Level mAHD

After the standard conversion from RTU raw counts (800-4000) to engineering units (meters) this signal is converted to mAHD to be able to do a meaningful comparison between different sites. The following formulas are used to calculate these values.

$$\text{ES (mAHD)} = \text{ES (meters)} + \text{ES Zero Level (mAHD)}$$

IDTS Database Record Name		
Plant	Quantity	Description
Wet_well	Level	Wet Well Level

3.3 Non Standard IDTS Picture

The details picture for the new SP302 Progress Rd #2 will be based upon the standard picture for a 2 pump submersible and have the following additional features:

- Emergency Storage Chamber visual indication (Self Drain with Manual Knife Gate Valve).
- Mobile Generator icon

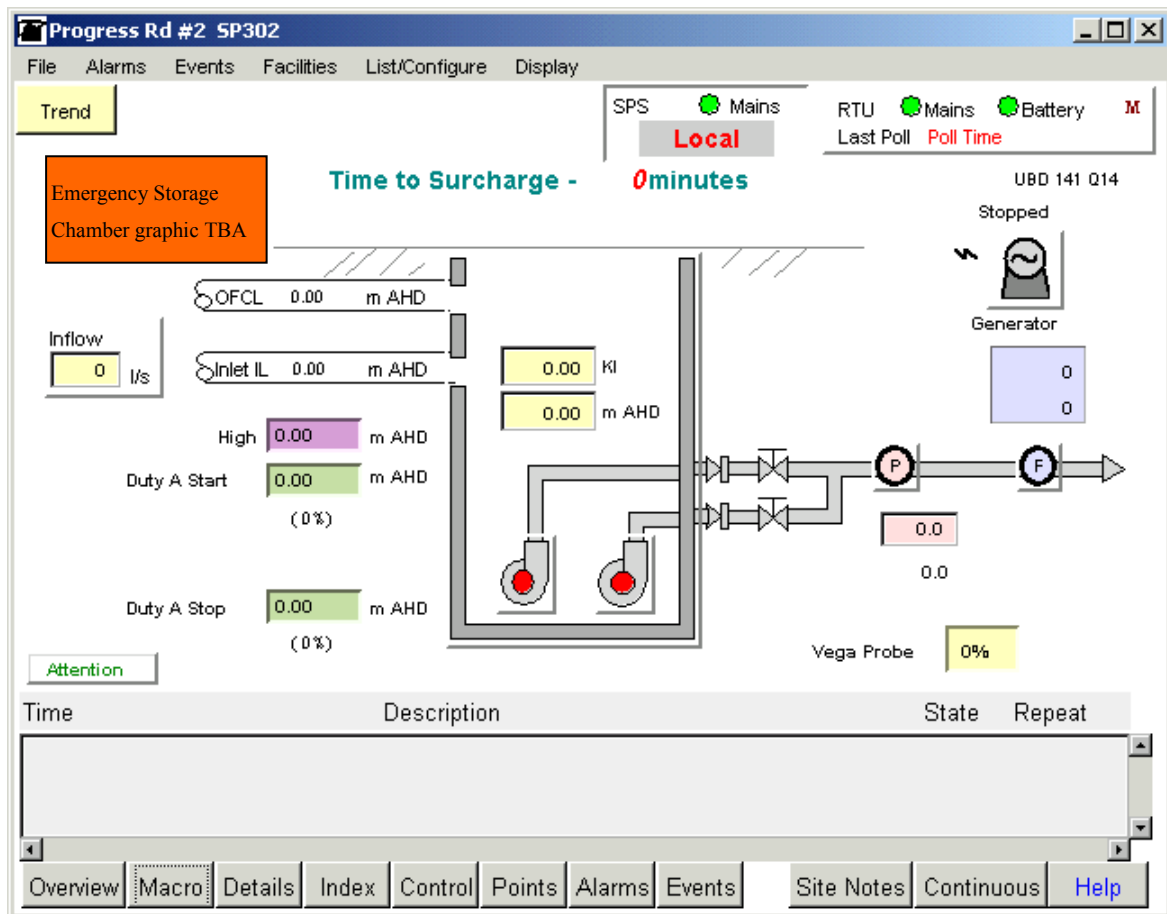


Figure 3: SP302 Progress Rd #2 Operator Schematic

3.4 Sewer Network Overview

The sewer network overview page will be updated to replace the existing SP069 Progress Rd in the S2 Oxley Sewer network with the new SP302 Progress Rd #2.

4 REFERENCES

1

TITLE	SPSV3 Sewage Pumping Station Submersible 3 Pumps With VFD – Functional Specification
DOCUMENT ID	003589
VERSION	0.30
AUTHOR	Alex Witthoft , Brisbane Water – Network Control Systems
DOCUMENT OWNER	Peter Sherriff, Brisbane Water – Network Control Systems

2

TITLE	MAJOR PROJECTS : PROJECT DELIVERY DOCUMENT FOR PROGRESS ROAD PUMP STATION UPGRADE
DOCUMENT ID	ProgressPDDv4.doc
VERSION	FEBRUARY 2002
AUTHOR	Ross Anderson and Associates Pty Ltd
DOCUMENT OWNER	LUCKIE ALUWIHARE

3

TITLE	Diesel Standby Generator - Local Control Panel - Functional Description
DOCUMENT ID	N/A
VERSION	02
AUTHOR	SOUTH EAST POWER GENERATION
DOCUMENT OWNER	