**[DPXXX]**

**[NAME] WASTEWATER PUMPING STATION**

**LEVEL 1 FUNCTIONAL DESCRIPTION**

**AREA 80 – WASTEWATER PUMPING**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Functional Description Reference: [DPXXX]\_80\_FD\_001** | | | | | |
| **Revision #** | **Date** | **Description** | **By** | **Checked** | **Approved** |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |

\*\*This is the latest available revision and supersedes any previous revisions.

Please discard any previous revisions.



This functional description is intended to be used for up to three pump – pump stations utilised in wastewater networks or new developments.

***Instruction on how to use this document:***

* *Do not change the format of this document.*
* *In the revision information above insert name, surname and company name of the persons creating or reviewing this document. Initials only are not acceptable.*
* *Remember to update the document header and footer with the correct information.*

*The full name of this document is XXYYY\_PP\_FD\_AAAB (Facility Name)*

*Where:*

*XXYYY is the Facility Code*

*PP is the Process Area code*

*FD = Abbreviation for Functional Description*

*AAA = FD level (Level 1)*

*B = FD version (A, B, C etc)*

*Example: WRPPK\_91\_FD\_001A (Papakura Reservoir)*

*Refer to the following standards document for asset and tag naming: Data and Asset Information Standard*

*This standard also contains information about the proper acronym to use for engineering units (Eg. m3. kPa etc.)*

*As a minimum this document needs to be reviewed by the following groups within Watercare before issued for construction.*

* *Operations (Area Operator)*
* *Digital (Control Systems Engineer or Architect)*

This document should be used as a template for a pump station with four pumps if this is required in the future

***This page is intended for the creator of the functional description. Delete this page after final review.***

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# Process Overview and Theory

## Process Overview

This Functional Description (FD) covers the following facilities:

|  |  |
| --- | --- |
| Facility Codes: | [DPXXX] [NAME] Wastewater Pumping Station |
| Area Code: | 80 |
| Alarm Groups: | Choose an item., [DPXXX]\_80 |
| Security Areas: | Choose an item. (Operator), Choose an item.\_SUPR (Supervisor), Choose an item. \_ENGR (Engineer) |
| Region: | [AREA] |
| Zone: | n/a |

### **Plant Location and Access**

The [NAME] WWPS Development is located at [LOCATION].

[INSERT DIRECTION DESCRIPTION]

The site latitude and longitude are (NZTM) [INSERT LATITUDE/LONGITUDE COORDINATES]

[*INSERT FIGURE – Example as shown*]

A picture containing text, map

Description automatically generated

Figure 1: Site location map

[*INSERT FIGURE – Example as shown*]

A sign on the side of a road

Description automatically generated

Figure 2: Site location street view

[*INSERT FIGURE – Example as shown*]

A close up of a map

Description automatically generated

Figure 3: Auckland GIS topographical view showing pump station and wastewater sewers.

### **Drawing and Document References**

|  |  |
| --- | --- |
| Drawing Set [INSERT DRAWING NUMBER RANGE] | [NAME] Wastewater Pumping Station P&ID Drawings |
| Drawing Set [INSERT DRAWING NUMBER RANGE] | [NAME] Wastewater Pumping Station Electrical Drawings |
| Drawing Set [INSERT DRAWING NUMBER RANGE] | [NAME] Wastewater Pumping Station Instrumentation Drawings |
| Drawing Set [INSERT DRAWING NUMBER RANGE] | [NAME] Wastewater Pumping Station Mechanical Drawings |
| Drawing Set [INSERT DRAWING NUMBER RANGE] | [NAME] Wastewater Pumping Station and Rising Main Civil Drawings |
| [DPXXX]\_80\_FD\_002 | Wastewater Pumping Station – Level 2 Functional Description |
| WSL SSS | Watercare Software Standard Specification |

## Process Theory / Process Principles

A SCADA Site View is provided below in Figure 4 that details the site equipment, process flow, and the process information listed in Table 1.

*[INSERT FIGURE]*

Figure 4: SCADA interface for [NAME] WWPS site.

Table 1:[NAME] WWPS process information.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Process Information** | | | | | |
| **Inflow** | Type of Inflow | Wastewater | | | |
| Lots | [VALUE] | | | |
| Total ADWF | [FLOW RATE] L/s | | | |
| Inflow from | Development | | | |
| Total PWWF | [FLOW RATE] L/s | | | |
| **Pumps Installed** | Applicable |  |  | |  |
| Number | 1 | 2 | | 3 |
| Make, Model | [MAKE, MODEL DESCRIPTION] | | | |
| Power Rating | [VALUE] kW | [VALUE] kW | | [VALUE] kW |
| Motor Poles | Fixed [VALUE] Pole | Fixed [VALUE] Pole | | Fixed [VALUE] Pole |
| Motor Starter Type | Choose an item. | Choose an item. | | Choose an item. |
| Rotational Speed | [VALUE] rpm | [VALUE] rpm | | [VALUE] rpm |
| Head (fouled pipe, upper limit) | [VALUE] m | | | |
| Flow | [VALUE] L/sec | | | |
| **Pump Design (Maximum)** | Pumps Programmed to run for Peak Operation | [VALUE] | | | |
| Present Estimated | P1 [VALUE] L/s, | P2 [VALUE] L/s, | | P3 [VALUE] L/s, |
| Duty Pump Minimum | [VALUE] | | | |
| **Station Actual Flow** | Minimum Threshold for High Wet well Alarm Suppression | [VALUE] | | | |
| **Rising Main Details** | Diameter | OD: [VALUE] mm | | ID: [VALUE] mm | |
| Length | [VALUE] m | | | |
| Material | PE [VALUE] SDR [VALUE] PN [VALUE] | | | |
| Isolation | [DESCRIPTION] | | | |
| Storage within the rising main | [VALUE] m3 | | | |
|  |  | | | |
| Discharge Quantity per pump down | [VALUE] m3 | | | |
| **Station Levels (Height above Wetwell floor)** | Sewer Invert | RL [VALUE] m | | | |
| Overflow Level | RL [VALUE] m | | | |
| Approx. RL of Ground at Station | RL [VALUE] m | | | |
| **Flow Measurement** | Meter Type | Choose an item. | | | |
| Location | In concrete chamber adjacent to valve chamber | | | |
| Make, Model | Choose an item. | | | |
| **Wetwell Details** | Diameter | [VALUE] m | | | |
| Depth | [VALUE] m | | | |
| Calculated Wetwell Volume to Overflow | [VALUE] m3 | | | |
| Calculated Wetwell volume to HLA | [VALUE] m3 | | | |
| Calculated Wetwell volume to Duty Pump Start | [VALUE] m3 | | | |
| Calculated Wetwell volume to Duty Pump Stop | [VALUE] m3 | | | |
| Overflow Point | RL [VALUE] m | | | |
| Approximate Dry Weather Storage Times | [VALUE] h | | | |
| **Wetwell Washing System** | Choose an item. | [VALUE] L/s | | | |
| **Odour Filter** | Choose an item. | Up to [VALUE] L/s air flow. | | | |

### **Basic Operation**

The station, including pumps and pipework is designed for a peak wet weather flow of [VALUE] L/s. The station has Choose an item. submersible [PUMP MAKE and MODEL], each with a flow rate of [VALUE] L/s at [VALUE] m head. The pumps are operated as Choose an item.. Pumps may be operated in automatic or manual mode, but normally will be run on auto control and auto duty select. Auto duty select rotates the pump duties so that each pump runs approximately the same number of hours. If manually operated, it is possible to run Choose an item. pumps together. There is a single rising main [VALUE] OD PE [VALUE] SDR [VALUE].

Refer to Section 3 for details on routine automatic operation.

### **Interim Make-up Water Operation**

The Choose an item. a staged approach to the development. This means that make-up water Choose an item. added to ensure that an 8-hour hydraulic retention times is achieve in the rising main as per WSL DP-06.

[ENTER DETAILS OF MAKE-UP WATER FUNCTIONALITY IF APPLICABLE]

### **Level Settings**

Table 2:[NAME] WWPS level settings.

| Approximate operating levels from the bottom of the wet well | | % wet well volume |
| --- | --- | --- |
| Duty Pump Stop | [VALUE] m | 3 % |
| Duty Pump Start | [VALUE] m | 9 % |
| Standby Pump Stop | [VALUE] m | 4 % |
| Standby Pump Start | [VALUE] m | 10 % |
| Wet well low-level alarm | [VALUE] m | 2 % |
| Wet well high-level alarm | [VALUE] m | 12 % |
| Static Overflow Level | [VALUE] m | 80% |

The % values in the table above are approximate values to be used as a guideline. These figures are to be confirmed at the time of commissioning. (This comment is to be removed from the document template when these values are confirmed).

### **Emergency Stop Operation**

All pumps at the site are fitted with emergency stop safety circuits to comply with NZ electrical regulations.

Pump operation is halted following activation of any of its associated emergency stop push buttons. Push buttons are located on the pump’s respective motor starter cell at the MCC.

Typically pumping operation will cease as a consequence of the main power within the starter cell being directly interrupted immediately following activation of the emergency stop. Upon emergency stop activation a critical alarm is generated, and the pump is interlocked out to prevent auto restart when the emergency stop pushbutton(s) are reset.

For recommended operator alarm response refer to standard operating procedures.

Resetting an emergency stop once operated, is undertaken in one of two ways (dependent upon the method employed to interrupt the main power.

**Step 1** – In both cases the emergency stop pushbutton(s) must be released. This is achieved by twisting the latched pushbutton.

**Step 2** – Where interruption of the main power within the starter is affected by “Tripping” the main circuit breaker, the circuit breaker must be reset and then turned back on.

Where interruption of the main power within the starter is affected by opening of a main contactor a “RESET” pushbutton is provided on the front of the motor starter which must be pressed following Step 1.

NOTE: UPON OPERATING THE STARTER CELL RESET PUSHBUTTON OR TURNING ON A CIRCUIT BREAKER AFTER RESETTING IT A PUMP MAY RESUME OPERATION IF IT IS SELECTED FOR REMOTE (AUTOMATIC) OPERATION.

# Process Plant

## Process Equipment

The facility consists of the following primary process equipment.

Table 3:[NAME] WWPS primary process equipment.

| **Equipment Type & Number**  **(Asset)** | | **Equipment Description** | **Capacity/ Range** | **Failsafe State** | **Control Module Type(s)** | **Notes** |
| --- | --- | --- | --- | --- | --- | --- |
| **Mechanical Equipment** | | | | | | |
|  | 80\_PU\_11 | Pump 1 | [VALUE] L/s  0 – [VALUE] A  (0 – [VALUE] kW) | OFF | MTR\_Standard1  AI\_Standard2 | Motor Current |
|  | 80\_PU\_12 | Pump 2 | [VALUE] L/s  0 – [VALUE] A  (0 – [VALUE] kW) | OFF | MTR\_Standard1  AI\_Standard2 | Motor Current |
|  | 80\_PU\_13 | Pump 3 | [VALUE] L/s  0 – [VALUE] A  (0 – [VALUE] kW) | OFF | MTR\_Standard1  AI\_Standard2 | Motor Current |
|  | 08-FA-01 | Dry well ventilation | [VALUE RANGE] L/s | OFF | XXX |  |
| 35\_FA\_01 | | Biofilter fan | [VALUE RANGE] L/s | OFF | XXX |  |
| **Analogue Equipment** | | | | | | |
| 84\_FIT\_011 | | Discharge flow meter | [VALUE RANGE] L/s | n/a | AI\_Standard1 |  |
| 80\_LIT\_021 | | Wet well level transmitter | [VALUE RANGE] m | n/a | AI\_Standard1  DI\_Standard1 |  |
| **Digital Equipment** | | | | | | |
| 80\_LSHH\_025 | | Wet well level switch: High High | n/a | Off=Alarm | DI\_Standard1 |  |
| 80\_LSH\_024 | | Wet well level switch: High | n/a | Off=Alarm | DI\_Standard1 |  |
| 80\_LSL\_023 | | Wet well level switch: Low | n/a | Off=Alarm | DI\_Standard1 |  |
| **Storage** | | | | | | |
|  | 81\_TK\_01 | Storage tank | [VALUE] m3 | n/a |  |  |
|  |  |  |  |  |  |  |

The facility also consists of auxiliary equipment and instrumentations for pump station operation and monitoring.

Table 4:[NAME] WWPS auxiliary instrumentation for monitoring and control.

| **Equipment Type & Number**  **(Asset)** | | **Equipment Description** | **Capacity/ Range** | **Failsafe State** | **Control Module Type(s)** | **Notes** |
| --- | --- | --- | --- | --- | --- | --- |
| **Mechanical Equipment** | | | | | | |
|  |  | Generator | [VALUE] kVA |  |  | Sufficient to sustain two pumps operation |
| **Analogue Equipment** | | | | | | |
| None | | n/a | n/a | n/a | n/a | n/a |
| **Digital Equipment** | | | | | | |
| 01\_RTU\_X01 | | Remote terminal units | n/a |  | RTU\_Standard1 |  |
| 05\_ZSO\_X01 | | Station intruder security | n/a | n/a | SEC\_Standard1 | Three door switches in series: Main, meter and pump doors |
| 05\_FPS\_X01 | | Smoke alarm | n/a | n/a | DI\_Standard1 |  |
| 06\_ZSO\_X02 | | Wet well hatch | n/a | n/a |  |  |
| 06\_ESL\_X01 | | Mains Failure | n/a | Off=Alarm | DI\_Standard1  ALM\_Suppress1 |  |
| 06\_PSU\_X01 | | Power 230 VAC supply/24 VDC charger | n/a | On=Alarm | DI\_Standard1 |  |
| 06\_CB\_X01 | | Incomer circuit breaker | n/a | Off=Alarm | DI\_Standard1 |  |
| 06\_CB\_X02 | | Generator circuit breaker | n/a | Off=Alarm | DI\_Standard1 |  |
| 06\_TVS\_X01 | | Surge diverter | n/a | On=Alarm | DI\_Standard1 |  |
| 80\_SOV\_X01 | | Wet well washer solenoid | N/A | OFF | AI\_Standard1 | Operator Controlled |

# Routine Automatic Operation

## Pump Choose an item. (80\_PU\_Choose an item.)

There are Choose an item. pumps that pump from the wet well to the rising main. The pumps can be operated in remote manual through SCADA.

### **Starting Sequence (SEQ\_001)**

1. A level sensor in the wet well starts and stops the pumps. Refer to Section 1.2.3 for level settings.
2. Pump duties are selected by the Kingfisher RTU which changes the duty pump after each pumping cycle, thus providing even running time on each pump.
3. When the Kingfisher RTU is in automatic control the following sequences occur:

|  |  |
| --- | --- |
| On an increasing wet well level: Sequence 1 | When the level in the wet well reaches the pump start level, then the duty pump will start. Once the level reaches the duty pump stop level, the pump will stop. |
| On a falling wet well level, | The duty pump continues to run until the stop level is reached in the wet well. |

1. If during the sequence, duty pump is unable to maintain the wet well level and the high-level switch is triggered, the sequence of events in Section 3.1.2 will apply.

**Notes:**

A pump start delay of 20 seconds between a pump stop and start exists to prevent the station current limit being exceeded.

### **Standby Operation**

Pump 1 and 2 are hard wired to start and stop based on the high level switch, high level timer relay and low level switch. This is intended as a backup if the wet well level transmitter fails and assumes that the pumps are able to maintain the wet well level under the high-level switch during normal operation. The following occurs in standby operation.

|  |  |
| --- | --- |
| On an increasing wet well level | Wet well level reaches and triggers the high-level switch. Pump 1 is started AND high-level timer will start (2 minutes delay).  Once the timer has been completed, Pump 2 will be started. |
| On an decreasing wet well level | Both pumps will run until the wet well level reaches the low-level switch. Upon triggering the switch, the pumps will stop.  Note that once the circuit is latched by the high-level switch and timer, only the low-level float can stop the pumps. |

The standby operation is further explained in the following paragraph.

Pump 1 will always be started first followed by Pump 2 for the standby operation scenario. If the pump station is in a situation where the duty pump is unable to maintain wet well level, the following scenarios will occur.

|  |  |
| --- | --- |
| Pump 1 is duty | Upon high level switch being triggered. Pump 1 will still be called to operate AND high-level timer starts.  Once the timer has been completed, Pump 2 will be started.  Both pumps will run until the wet well level reaches the low-level switch. Upon triggering the switch, the pumps will stop. |
| Pump 2 is duty | Upon high level switch being triggered. Pump 1 is started AND high-level timer starts  Once the timer has been completed, Pump 2 still be called to operate.  Both pumps will run until the wet well level reaches the low-level switch. Upon triggering the switch, the pumps will stop. |

### **Duty Control (DTY\_001)**

If the local panel operation selector switch is set to auto, the duty selection will be under the control of the RTU. Pump duties can be overridden by the Central SCADA (see Section 13).

In evaluating duty selection, pump conditions are compared according to the following rank of importance:

Table 5:[NAME] WWPS duty selection priorities.

| **Rank** | **Condition** |
| --- | --- |
| *Most Critical* | Pump Availability (Not in Remote Auto, Isolated, Tripped, Interlocked) |
|  | Pump Control Fail |
|  | Manual Duty Selection (via Local Panel) |
|  | Manual Duty Selection (via SCADA) |
| *Least Critical* | Pump was last one stopped / started (i.e. First On, First Off) |

## Wet Well Washers

The wet well has an automatic washer installed which is automatically operated by a solenoid valve at a certain time of the day which is [VALUE] hours and for a duration of [VALUE] minutes. The time and duration are operator adjustable.

The solenoid valve can be operated in remote manual through SCADA.

## Storage Tank Washers

The following functionality is Choose an item. for this pump station.

The storage tanks are automatically cleaned by spray heads. Water is supplied to the sprayers after the storage tank has been used and emptied through an automated solenoid valve. The valve is triggered to open when wet well high-level alarm is activated (start of filling the storage tank) and subsequently reaching the pump stop level setpoint (storage tank emptied). The washing is operated for an operated adjustable duration of 5 minutes.

The statement above assumed that when the high-level alarm is activated then the storage then starts filling. If the configuration of the site is different from this assumption then the logic should be modified to allow for the storage washers to start when the storage tank is in use.

The solenoid valve can be operated in remote manual through SCADA.

## Odour Control

The odour control system removes foul air from the wet well through a continuously operating extraction fan. There is a running feedback, fault feedback and monitoring of the current draw by the motor. Alarms generated by this system requires site intervention for resetting them.

## Dry Well Ventilation

The following functionality is Choose an item. for this pump station.

[INSERT CONTENT]

## 3.6 Inter-Station Pumping Interlocks

The following functionality is Choose an item. for this pump station.

[INSERT CONTENT]

# Failures

## Station Pumps (80\_PU\_Choose an item.)

On a failure, the duty pump will stop operating, a warning or critical alarm is generated, and duty change occurs.

### **Interlocks**

The pump interlocks are divided into software and hardwired interlocks. Interlock due to hard wired stop will need to be reset in the field.

Software interlocks

* Control fail (based on run feedback signal).
* Pump faulted.

Hardwired interlocks

* Pump not in Auto.
* Emergency stop engaged.
* Pump Isolated.
* VSD status not ready to start.
* Motor over temperature (from Minicas)
* Motor leakage current (from Minicas)

## Mains Power Failure (06\_ESL\_X01)

* On Mains Failure, equipment will go to fail-safe states.
* Warning and critical Mains Failure alarm are generated.
* Control modules alarms on site to be suppressed.
* During power failure alarms and instrument readings are available, no pumps will be available during power failure (battery backup).
* No alarms are applicable for solenoids upon power failure (failures will only be picked up during routine maintenance).
* Upon power resuming Scada will need to be remotely reset.

## Generator Operation

* If the site experiences a Mains Failure (i.e. main circuit breaker open) and temporary generator is connected, a critical alarm is generated.
* If this alarm is on and [*Description*] is healthy then the station is running on a generator.
* No alarms are applicable for solenoids upon main circuit breaker open (failures will only be picked up during routine maintenance).

## 24v DC Power Supply Failure (06\_PSU\_X01)

* Critical alarm is generated.
* The failure can mean the AC power has failed or the power supply has failed.

## 24v PSU Battery Fail

* Critical alarm is generated.
* The power supply has detected the backup battery has failed or is missing.
* The site will continue to operate if the mains power to the pump station is present.
* No alarms are applicable for solenoids upon battery failure (failures will only be pickup during routine maintenance).

## RTU IO Fault (01\_RTU\_X01)

* Critical IO Fault alarm is generated.
* RTU Fault is derived internally via an RTU system flag.

## SCADA RTU Comms Failure (01\_RTU\_X01)

* Central SCADA polls the RTU on a regular basis
* If no response is received from the RTU after 3 poll retries, a communication failure flag is activated in the Central SCADA I/O driver.
* Every 10 minutes a communications watchdog implemented in the RTU is updated with the seconds since midnight and the value is sent by the RTU to the central SCADA as an unsolicited message.
* If the I/O driver failure flag is activated or the SCADA watchdog value has not changed, an RTU Comms Fail alarm is raised on the SCADA indicating no updates are being received by the SCADA from the RTU.

Communications Failure alarms can be generated by the following sources:

* **Watchdog**

A communications module in the RTU software produces a seconds of the day value every 10mins and is read by the SCADA system. If the value does not change within 10mins a countdown of 15mins will begin, after which, a comms fail alarm (critical) will trigger.

* **Software Communications Driver**

A system tag within the software IO driver will trigger a 15min countdown if communications between the IO driver and RTU ceases or fails, after which, a comms fail (critical) alarm will trigger.

*Refer section 2.5.3 DNP3 Driver Configuration in the NCU Software Standard*

*Specification.*

## Interstation Communications (XXX)

* If Inter-site communication is required between two sites, Site A RTU will read the Watchdog variable from Site B RTU, a high priority alarm is flagged on the Central SCADA when the Watchdog value has not changed after at a set time (determined at the of commissioning).
* Inter-site alarm is only generated on Site A RTU and not Site B RTU.
* It is assumed that Site A's operation is dependent on Site B's status, if it's vice versa then the Watchdog alarm is generated on Site B's RTU.

*Include a description of the interstation communications logic in this section. (Remove this section and comment if this is not applicable. Remove this comment when description is entered)*

## Mechanical Failure

* There is no feedback from the solenoid valves, failures will only be picked up during routine maintenance checks.

# Alarms

All alarm trigger description will begin with [NAME] Wastewater Pump Station.

## Station Alarms

Table 6: [NAME] WWPS station alarms.

| **Alarm Trigger Description** | **Control System Tag** | | **Units** | **Default Setting** | **Alarm On Delay (sec)** | **Priority** | **Control Action/ Note** | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Station Overflow | 80\_LAHH\_025\_A | | n/a | n/a | 30 | Critical | | *Note 1* | |
| Wetwell High Level | 80\_LAH\_024\_A | | n/a | n/a | 30 | Critical | | *Note 1* | |
| Wetwell Low Level | 80\_LAL\_023\_A | | n/a | n/a | 30 | Critical | | *Note 1* | |
| Level High Alarm | 80\_LI\_011\_Hi | | m | [VALUE] | 30 | Warning | | *Note 1* | |
| Level Low Alarm | 80\_LI\_011\_Lo | | m | [VALUE] | 30 | Warning | | *Note 1* | |
| Level Fault Alarm | 80\_LI\_011\_Fault | | n/a | n/a | 60 | Warning | | *Note 1* | |
| Level Calibrate Mode Alarm | 80\_LI\_011\_Calib | | n/a | n/a | 30 | Warning | |  | |
| Level Out of service | 80\_LI\_011\_OOSMode | | n/a | n/a | 30 | Warning | |  | |
| Pump 1 Control Fail | | 80\_PU\_11\_CtrlFail | n/a | n/a | 60 | Warning | | *Change pump duty* |
| Pump 1 Emergency Stop | | 80\_PU\_11\_Estop | n/a | n/a | 0 | Critical | | *Change pump duty* |
| Pump 1 Isolated | 80\_PU\_11\_Isolated | | n/a | n/a | 0 | Warning | | *Change pump duty* | |
| Pump 1 Tripped | 80\_PU\_11\_Tripped | | n/a | n/a | 60 | Critical | | *Change pump duty* | |
| Pump 1 Starts Per Hour | 80\_PU\_11\_StPHr | | n/a | [VALUE] | 0 | Warning | |  | |
| Pump 1 Temperature | 80\_PU\_11\_Temp | | n/a | n/a | 15 | Warning | |  | |
| Pump 1 Leakage | 80\_PU\_11\_Leak | | n/a | n/a | 15 | Warning | |  | |
| Pump 2 Control Fail | 80\_PU\_12\_CtrlFail | | n/a | n/a | 60 | Warning | | *Change pump duty* | |
| Pump 2 Emergency Stop | 80\_PU\_12\_Estop | | n/a | n/a | 0 | Critical | | *Change pump duty* | |
| Pump 2 Isolated | 80\_PU\_12\_Isolated | | n/a | n/a | 0 | Warning | | *Change pump duty* | |
| Pump 2 Tripped | 80\_PU\_12\_Tripped | | n/a | n/a | 60 | Critical | | *Change pump duty* | |
| Pump 2 Starts Per Hour | 80\_PU\_12\_StPHr | | n/a | [VALUE] | 0 | Warning |  | | |
| Pump 2 Temperature | 80\_PU\_12\_Temp | | n/a | n/a | 15 | Warning |  | | |
| Pu2p 2 Leakage | 80\_PU\_12\_Leak | | n/a | n/a | 15 | Warning |  | | |
| [PUMP 3] | Same as above | |  |  |  |  |  | | |
| [Flowmeter] |  | |  |  |  |  |  | | |
| Valve Chamber Flooded | 80\_LAH\_024 | | n/a | n/a | 30 | Critical |  | | |
| Site Unavailable  (All pumps are not available) | 80\_SITE\_X01\_NotAvail | | m | n/a | 60 | Critical |  | | |
| Site Inactive | 80\_SITE\_X01\_InActive | | n/a | n/a | 5400 | Warning | *Note 2* | | |
| Site Suppressed | 80\_SITE\_X01\_XXX | | n/a | n/a | 0 | Warning |  | | |
| [INTERSITE COMMS FAIL] |  | |  |  |  |  |  | | |

Note 1: For recommended operator alarm response refer to standard operating procedures.

Note 2: The time the station is inactive (no pumps are running) is measured. If the current inactivity period exceeds the inactivity time set point, a station inactive alarm is raised.

## 5.2 System Alarms

Table 7: [NAME] WWPS system alarms.

| **Alarm Trigger Description** | **Equipment No.** | **Units** | **Default Setting** | **Alarm On Delay (sec)** | **Priority** | **Action / Notes** | |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Phase Fail – Mains Fail Alarm | 06\_EAL\_X01 | n/a | n/a | 5 | Warning | Supress Alarms | |
| Phase Fail – Mains Fail Extended Alarm | 06\_EAL\_X01 | n/a | n/a | 14400 | Critical | Supress Alarms | |
| 24VDC PSU – Mains Fail Alarm | 06\_EAL\_X02 | n/a | n/a | 5 | Critical | None | |
| 24VDC PSU – Battery Low Alarm | 06\_EAL\_X03 | n/a | n/a | 120 | Critical | | None |
| Surge Diverter Tripped | 06\_TVS\_X01 | n/a | n/a | 5 | Warning | | None |
| Mains Breaker Open | 06\_CB\_X01 | n/a | n/a | 5 | Critical | None | |
| Cabinet Door | 05\_ZAO\_X01 | n/a | n/a | 5 | Critical | None | |
| Wetwell Hatch Open | 05\_ZAO\_X02 | n/a | n/a | 5 | Critical | None | |
| RTU Status IO Fault | 01\_RTU\_X01\_XX | n/a | n/a | 0 | Critical | None | |
| RTU Status Comms Fail | 01\_RTU\_X01\_Comms | n/a | n/a | 0 | Critical | Set in MTU | |
| RTU Status Poll Disabled | 01\_RTU\_X01\_XX | n/a | n/a | 0 | Warning |  | |
| RTU Status Time Deviation | 01\_RTU\_X01\_XX | n/a | n/a | 1800 | Warning |  | |

# Off-Normal Functions

## Pumps (80\_PU\_Choose an item. and 80\_SITE\_X01)

In Remote Manual, each pump can be controlled from its SCADA faceplate. From the SCADA system it will only be possible to control pumps, starting a pump will initiate the start sequence within the RTU (Sequence 1) as detailed above.

The pump mode selection is common for both pumps and is selected from the Station Mode faceplate (SITE\_X01). Station Mode and Remote Manual operation is restricted by SCADA security.

In Local, each pump can be controlled from the local control panel.

## Analogue Instruments

All analogue instruments have a Calibrate and OOS mode. Refer to the standard documentation for details.

Upon entering the calibrate mode, the instrument will hold its last value until it exits the mode. The instrument will automatically exit this mode after 3600 seconds.

In OSS mode, the measured value will be set to an operator adjustable setpoint.

# Process Diversions / Overflows

The overflow point from the pump station discharges from the wet well as per the elevation and plan views. This discharges to the overflow outlet.

The overflow point is at RL [VALUE] which is [VALUE] m from Wet well base level and [VALUE] m from lid level.

# Shutdown Sequence

There Choose an item. shutdown sequences for this pump stationChoose an item.

[INSERT DETAILS OF AUTOMATIC SHUTDOWN SEQUENCES IF APPLICABLE]

# External Inputs and Outputs

There Choose an item. external inputs and outputs for this pump stationChoose an item.

[INSERT DETAILS OF EXTERNAL IO IF APPLICABLE]

# Derived Variables

## Pump Station

Table 8: [NAME] WWPS Derived variables with associated details.

| **Description** | **Equipment No(s).** | **Units** | **Capacity / Range** | **Control Module Type(s) / Calculation** | **Name of HMI Display(s)** |
| --- | --- | --- | --- | --- | --- |
| Flowmeter Pumped  Volume Running 24h  period (m3) | 84\_FQI\_011\_Total24h | m3 | XX | FQI\_Standard1 | Site Mimic, AI  Faceplate |
| Wet well Wier Lip Level | 80\_LI\_121\_Lip | m | [VALUE] | constant set in RTU | Site Mimic |
| Wet well Overflow | 80\_LI\_121\_OFlow Lvl2 | m | [VALUE] | LI\_011\_PV  - LI\_011\_Lip | Site Mimic |
| Wet well Volume | 80\_TK\_02 | m3 | [VALUE] | CALC\_DPVol1 | Site Information Popup |
| Site Total Current | 80\_IQ\_X01\_PV | A | XX | All pumps current as applicable  PU\_01\_AMPS  + PU\_02\_AMPS  + PU\_02\_AMPS | Site Information Popup |
| Main Pump 1 Run  Time per Hour | 80\_PU\_11\_RTPHr | min | 0 - 60 | MTR\_Statistics1 | Motor Faceplate |
| Main Pump 1 Starts  per Hour | 80\_PU\_11\_StPHr | Count | 0 - 20 | MTR\_Statistics1 | Motor Faceplate |
| Main Pump 1 Running  Hours | 80\_PU\_11\_RunHours | h | 0 - 32000 | MTR\_Statistics1 | Motor Faceplate |
| MTR\_Stats1Main  Pump 2 Run Time per  Hour | 80\_PU\_12\_RTPHr | min | 0 - 60 | MTR\_Statistics1 | Motor Faceplate |
| Main Pump 2 Starts  per Hour | 80\_PU\_12\_StPHr | Count | 0 - 20 | MTR\_Statistics1 | Motor Faceplate |
| Main Pump 2 Running  Hours | 80\_PU\_12\_RunHours | h | 0 - 32000 | MTR\_Statistics1 | Motor Faceplate |
| [PUMP 3] |  |  |  |  |  |

Note 1: The wet well lip level is the level where an overflow will occur.

## Wet well and Storage Tank Volume Calculation

Time to overflow and remaining tank volume is calculated using the standard block OverflowTime\_From\_Volume1\_1.

If the site has no storage chamber include this comment:

The time to overflow alert is calculated, and an alarm triggered, on a calculation based on the wetwell level and wetwell lip level.

If the site has a storage chamber include this comment:

The remaining storage tank volume and is calculated every 15 minutes using the wetwell level and a lookup table.

Remove comment above that does not apply.

Refer to *WSL Software Standard Specification* for further information.

The wet well is a [WET WELL MATERIAL] vertical cylindrical tank with dimensions approximately [VALUE] m deep and [VALUE] m diameter.

Volume is given in the table below, which includes Choose an item. volume.

Table 9: [NAME] WWPS estimated combined volume at average daily flow.

| **Data point** | **depth from bottom of wet well [m]** | **Cone base height [m]** | **Cone base volume per depth [m3]** | **Wet well straight shell volume per depth [m3]** | **Storage tank volume per depth [m3]** | **Combined volume [m3]** |
| --- | --- | --- | --- | --- | --- | --- |
| 1 |  |  |  |  |  |  |
| 2 |  |  |  |  |  |  |
| 3 |  |  |  |  |  |  |
| 4 |  |  |  |  |  |  |
| 5 |  |  |  |  |  |  |
| 6 |  |  |  |  |  |  |
| 7 |  |  |  |  |  |  |
| 8 |  |  |  |  |  |  |
| 9 |  |  |  |  |  |  |
| 10 |  |  |  |  |  |  |
| 11 |  |  |  |  |  |  |
| 12 |  |  |  |  |  |  |
| 13 |  |  |  |  |  |  |
| 14 |  |  |  |  |  |  |
| 15 |  |  |  |  |  |  |
| 16 |  |  |  |  |  |  |
| 17 |  |  |  |  |  |  |
| 18 |  |  |  |  |  |  |
| 19 |  |  |  |  |  |  |
| 20 |  |  |  |  |  |  |
| 21 |  |  |  |  |  |  |
| 22 |  |  |  |  |  |  |
| 23 |  |  |  |  |  |  |
| 24 |  |  |  |  |  |  |
| 25 |  |  |  |  |  |  |
| 26 |  |  |  |  |  |  |
| 27 |  |  |  |  |  |  |
| 28 |  |  |  |  |  |  |
| 29 |  |  |  |  |  |  |
| 30 |  |  |  |  |  |  |
| 31 |  |  |  |  |  |  |
| 32 |  |  |  |  |  |  |
| 33 |  |  |  |  |  |  |
| 34 |  |  |  |  |  |  |
| 35 |  |  |  |  |  |  |
| 36 |  |  |  |  |  |  |
| 37 |  |  |  |  |  |  |
| 38 |  |  |  |  |  |  |
| 39 |  |  |  |  |  |  |
| 40 |  |  |  |  |  |  |

# System Redundancy

## Process Equipment

The following are the main process equipment with redundancy:

* Pumps operated as Choose an item.
* Wet well level transmitter (high and low level switches to initiate pump operation)

## Control System

The following are the main control system equipment with redundancy:

* RTU Power supply – battery backed.

# Isolation Schemes

There Choose an item. specific isolation schemes for this pump stationChoose an item.

[INSERT DETAILS OF ISOLATION SCHEMES]

# Operator Interface

### **Central SCADA**

The primary control for the plant is via the central SCADA system via the following graphics:

| **Name** | **Description** | **Relevant P&IDs** |
| --- | --- | --- |
| [DPXXX]\_80.gfxSiteScreen | [NAME] Wastewater Pump Station | [VALUE] |

The central SCADA polls each of the site RTUs on a radio channel on a regular basis to receive RTU timestamped status updates and alarm events using DNP3 over UHF radio ethernet.

The RTU records alarm events and changes to instrument readings greater than a threshold in its onboard logs. During communication all new RTU logs are retrieved to populate the central SCADA trends and alarm and events history. Backfilling occurs if there has been a disruption in SCADA to RTU communication. In between SCADA update polls, critical alarms at any RTU are sent as unsolicited messages from the RTU to the SCADA to display as soon as possible on the alarm banner.

### **Duty Selection**

Pump duties are selected from the Central SCADA. Selecting a duty other than Auto Select has the effect of inhibiting the standby pump from running. Pump duties are alternated automatically each pump run.

# Control System Functionality

### **Standard Control Module**

Refer to WSL Software Standard Specification for software standards applied for this plant.

### **Time Synchronisation**

The RTU time is synchronised with the DNP3 master on power up and once per day.

### **Control System Hardware**

The facility is controlled by a Kingfisher CP-35 RTU connected to the central SCADA system via Trio Q-series radios. Refer to the electrical drawings for RTU input/output modules and configuration.

Table 10:[NAME] WWPS control system equipment.

| **SCADA** | **Device** | **Item** | **Description** | |
| --- | --- | --- | --- | --- |
| System | AVEVA System Platform | NA | Wastewater | |
| **RTU** | **Device** | **Device ID(s)** | **RTU / DNP Address** | **DNP Offset** |
| RTU | KF+ CP-35 | [DESCRIPTION] | [VALUE] | [VALUE] |
| **Radio** | **Device** | **Device ID(s)** |  |  |
| Site Radio | Q-Series Radio | [VALUE] |  |  |
| Channel | [DESCRIPTION] | [VALUE] |  |  |
| Repeater | [DESCRIPTION] | [VALUE] |  |  |

### **Communications**

Table 11:[NAME] WWPS control system communications to downstream devices.

| **Device** | **Equipment No** | **Port** | **Protocol** | **Address** | **Notes** |
| --- | --- | --- | --- | --- | --- |
| [DESCRIPTION] | [DESCRIPTION] | [VALUE] | [VALUE] | [VALUE] |  |
|  |  |  |  |  |  |

# Historical Process Data

Refer to *WSL Software Standard Specification* for historical data collection standards applied for this plant.

The following data are historised in AVEVA PI system.

Table 12:[NAME] WWPS PI data.

Analog Data:

| **PI tags** | **Description** | **Unit** |
| --- | --- | --- |
| [DPXXX]\_01\_RTU\_X01.WATCHDOG | RTU Status Watchdog | Seconds |
| [DPXXX]\_80\_IQ\_X01.PV | Current PV | Amps |
| [DPXXX]\_80\_IQ\_X01.PVAVG | Current PV (15min Average) | Amps |
| [DPXXX]\_80\_LI\_011.LIPLVL | Wetwell Level OF Weir Lip Level | Meters |
| [DPXXX]\_80\_LI\_011.OFLOWLVL | Wetwell Level OF Level above Lip | Meters |
| [DPXXX]\_80\_LI\_011.PV | Wetwell Level PV | Meters |
| [DPXXX]\_80\_LI\_011.PVAVG | Wetwell Level PV (15min Average) | Meters |
| [DPXXX]\_80\_PU\_01.RTPHR | Pump 01 Run Time Per Hour | Minutes |
| [DPXXX]\_80\_PU\_01.STPHR | Pump 01 Starts Per Hour Alarm | None |
| [DPXXX]\_80\_PU\_01\_AMPS.PV | Pump 01 Current PV | Amps |
| [DPXXX]\_80\_PU\_01\_AMPS.PVAVG | Pump 01 Current PV (15min Average) | Amps |
| [DPXXX]\_80\_PU\_02.RTPHR | Pump 02 Run Time Per Hour | Minutes |
| [DPXXX]\_80\_PU\_02.STPHR | Pump 02 Starts Per Hour Alarm | None |
| [DPXXX]\_80\_PU\_02\_AMPS.PV | Pump 02 Current PV | Amps |
| [DPXXX]\_80\_PU\_02\_AMPS.PVAVG | Pump 02 Current PV (15min Average) | Amps |
| [DPXXX]\_80\_SITE\_X02.TIMEOF | Time to Overflow | Minutes |
| [DPXXX]\_80\_SITE\_X02.VOLUME | Current Network Storage Volume | Meters3 |
| [DPXXX]\_84\_FIT\_011\_PV | Station Discharge Flow | Litres/sec |
| [DPXXX]\_84\_FQI\_011\_TOTAL | Station Discharge Flow Totaliser | Meters3 |
| [DPXXX]\_84\_FQI\_011\_TOTAL15M | Station Discharge Flow 15 Min Volume | Meters3 |

Digital Data:

| **PI tags** | **Description** | **Unit** |
| --- | --- | --- |
| [DPXXX]\_01\_RTU\_X01.COMMSFAILA | RTU Status Comms Failure | Alarm |
| [DPXXX]\_80\_LAHH\_015.A | Overflow Alarm | Alarm |
| [DPXXX]\_80\_LAHH\_015.PV | Overflow Alarm | Alarm |
| [DPXXX]\_80\_LI\_011\_OFLOW.A | Overflow Alarm | Alarm |
| [DPXXX]\_06\_EAL\_X01\_A | Mains Fail Alarm | Alarm |
| [DPXXX]\_80\_LAH\_014\_A | Wetwell Level High Alarm | Alarm |
| [DPXXX]\_80\_LAL\_013\_A | Wetwell Level Low Alarm | Alarm |
| [DPXXX]\_80\_PU\_11\_RUNNING | Pump 1 Running Status | Event |
| [DPXXX]\_80\_PU\_11\_TRIPPED | Pump 1 Starter Tripped | Alarm |
| [DPXXX]\_80\_PU\_12\_RUNNING | Pump 2 Running Status | Event |
| [DPXXX]\_80\_PU\_12\_TRIPPED | Pump 2 Starter Tripped | Alarm |