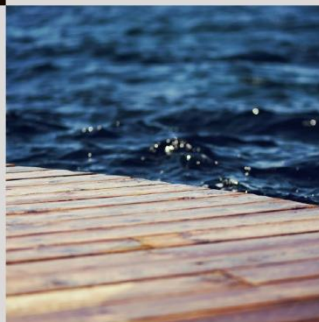




J5908 – Byron Bay STP

ADDITIONAL FLOW PATH – FUNCTIONAL SPECIFICATION

Prepared for Byron Shire Council

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1 Purpose

This Functional Specification provides a plain-English description of equipment and infrastructure at the secondary distribution pit in the Byron Wetlands. This forms part of the Byron Bay Sewage Treatment Plant (STP) Additional Flow Path Project. This Functional Specification shall be read in conjunction with the following:

- Technical Specification
- Drawings; and
- Any other tender documentation.

This document is intended to be used for the following purposes:

- Design, install and operation of the automatic rake system including:
 - o Designing the automatic debris removal rake (Rake) and installation
 - o Designing power supply to Rake
 - o Designing debris removal chute (Chute)
 - o Selecting debris removal hopper (Hopper); and
 - o Designing automatic debris removal system safety and maintenance infrastructure (Safety and Maintenance Infrastructure).
- Install and operation of additional flow path level sensors
- Integration of automatic rake and flow path level sensors and valves into Council's SCADA system.
- Preparations of the control logic for the PLCs by SAFEGroup.
- Configuration of the operator interfaces on the SCADA terminals by SAFEGroup.
- SCADA testing and commissioning by SAFEGroup and Byron Shire Council staff.
- Site Acceptance Testing (SAT) by SAFEGroup and Byron Shire Council staff.
- Training of operations and maintenance personnel by SAFEGroup and Byron Shire Council staff.
- Fault finding by Byron Shire Council operation and maintenance staff.

2 Standard

Standards: The equipment shall comply with the latest revision (including the latest addenda prior to date of submission of the bid) of the relevant Australian Standards, or in their absence with relevant ISO, DIN, US or British Standards, together with the requirements of competent Statutory Authorities having jurisdiction over all or part of the manufacture, installation and operation of the plant.

In particular, AS4024 - Safeguarding of Machinery.

3 Details of the Existing Site

For details of the existing site and location of proposed infrastructure see the layout plans.

4 Design Documentation and Design Review Process

The Contractor shall be responsible for the design computations, drawings and certification and for the submission of design to the Superintendent for acceptance prior to construction for all D&C scope items.

D&C items under this contract are as identified on the drawings, and scope of works.

4.1 Independent Verification

All design computations and drawings are to be checked independently of the designer at the Contractor's expense. The Contractor shall arrange for all designs to be verified and checked by an independent and appropriately qualified professional engineer for the type of services and shall provide the Superintendent with such evidence. An appropriately qualified professional engineer is deemed to be one holding registration as suitably qualified engineer (RPEQ, NER or Equivalent).

The Contractor shall not commence construction until the design calculations, drawings and independent verification has been accepted by the Superintendent. HOLD POINT.

4.2 Design Life

The Contractor shall design all D&C Works for the following service life:

- a. Civil works, structures, pipelines, ductwork supports 50 Years
- b. Mechanical and electrical works 20 Years
- c. Control system and instrumentation 10 years

The Contractor shall state the period of time, following commissioning, before a major refit or replacement is required. Components with a design life less than that specified service life shall be noted and included in the spare parts list.

5 Operation and Maintenance Manuals

The operation and maintenance manual(s) is to include sufficient information to allow successful operation of all mechanical, electrical and control equipment and systems provided, all as provided for this application.

Information is to be included for the following items:

- A table of contents
- A schedule of all equipment supplied including all relevant technical data (such as make, type, model, serial number, options, etc.), and suppliers' name and address
- Full and clear detailed explanations of all aspects of the operation, control and maintenance

6 Safety and Environment

For all components all safety and environmental considerations shall be made as detailed in the technical specification.

7 Materials of Construction

All components covered in this specification shall be constructed of materials which achieve safe and reliable operation and reduce corrosion and wear in the internal and external environments, including liquids, that the system will operate in.

All components must be fitted with corrosion resistant bolts, nuts and washers.

8 Wiring Requirements

8.1 Standards

The power cable and its installation shall comply with the requirements of the following standards:

- AS/NZS 1660 Test Methods for Electric Cables, Cords and Conductors
- AS/NZS 3000 Electrical Installations (known as the Australian / New Zealand Wiring Rules)
- AS/NZS 3008.1 Electrical Installations – Selection of Cables
- AS/NZS 3191 Electric Flexible Cords; and
- AS/NZS 5000 Electric Cables – Polymeric insulated.

8.2 Cable

- The cable shall be suitable for permanent water submersion
- The cable shall be UV and weather resistant; and
- The cable shall be flexible.

8.3 Installation

- The cable shall be installed to the manufacturer's specification
- No cable joins shall be used in the installation; and
- Cable glands are to be used at both ends of the cable.

9 Technical Requirements - Automatic Debris Removal Raking System

The Contractor shall design, supply and install the automatic debris removal raking system including:

- one (1) automatic debris removal rake
- one (1) debris removal chute
- one (1) debris removal hopper; and
- the associated safety and maintenance infrastructure

9.1 Automatic Debris Removal Rake (Rake)

9.2 Operation of the Rake

The Rake shall be capable of removing channel debris, including leaves, branches and other organic matter from the full width (1200 mm) and full height (780 mm) of the secondary distribution pit inlet.

The exclusion grate shall be a width of 15 mm.

In the circumstance when the Rake becomes jammed, the Rake shall be capable of automatically switching to reverse operation for an adjustable period of time and then commence normal (forward) operation. This mode of operation shall allow for the clearance of minor blockages.

The Rake shall be capable of alarm output to the Council PLC in the case that the automatic rake mechanism becomes jammed and unable to operate in forward or reverse modes; fails to clear the blockage after three reverse mode cycles or in any way fails to operate as required.

The Rake must allow for a minimum flow of 100L/s.

All dimensions shall be confirmed by the Contractor as part of the survey.

9.2.1 Rake Configuration

The Rake shall be located within the inlet of the secondary distribution pit.

The Contractor shall provide structural engineering and fixtures to assure secure install, which allows for safe and reliable operation, of the Rake at its proposed location.

The Contractor can propose any type of automatic rake which complies with the specification.

The automatic rake motor shall be fitted with a lifting eye to be removed safely for maintenance.

9.2.2 Rake Control

The Rake shall have adjustable speed settings.

The Rake shall be capable of operation on timer control.

The Rake shall be capable of receiving digital signal, such as that from a level sensor, for control.

The Rake shall be capable of operation manually in forward and reverse modes.

9.2.3 Rake Construction

The mechanical and electrical components offered shall be suitable for use in outdoor areas.

Bearings shall be of the roller ball type, self-aligning and equipped with greased labyrinth seals. Grease nipples shall be provided in locations that afford adequate access. The bearing housing shall be equipped with a protected grease relief port.

Damage to parts during delivery or install shall be repaired in accordance with AS1627.

9.2.4 Rake Wiring Requirements

Standards

The power cable and its installation shall comply with the requirements of the following standards:

- AS/NZS 1660 Test methods for electric cables, cords and conductors;
- AS/NZS 3000 Electrical installations (known as the Australian / New Zealand Wiring Rules);
- AS/NZS 3008.1 Electrical installations – selection of cables;
- AS/NZS 3191 Electric flexible cords; and
- AS/NZS 5000 Electric Cables – Polymeric insulated.

Cables

- All cables shall be suitable for permanent water submersion;
- All cables shall be UV and weather resistant; and
- All cables shall be flexible.

Installation

- The cable shall be installed to the manufacturer's specification;
- No cable joins shall be used in the installation; and
- Cable glands are to be used at both ends of the cable.

9.3 Debris Removal Chute (Chute)

9.3.1 Chute Operation

The Chute shall be capable of transferring debris from the outlet of the Rake to the inlet of the Hopper without blockage or impeded flow.

The Chute may use gravity or mechanical force as the mechanism of transferring debris; however, if gravity is used the height differential between the inlet and outlet of the Chute must be such as to allow for transfer without blockage.

If mechanical mechanism is used for the transfer of debris, then no moving parts shall be accessible from any areas outside the safety cage.

The Chute shall have suitable access to allow for easy clearance of blocked material in the case that blockage does occur.

9.3.2 Debris Removal Hopper (Hopper)

The Hopper shall be located on the flat hardstand area as indicated on the layout plans, allowing for access of vehicle to Hopper.

The Hopper shall allow for drainage of liquid.

The Hopper shall have an inlet which is compatible with the Chute outlet as to not impede flow of debris to the Hopper.

The Hopper shall have lockable wheels.

The Hopper shall have side lifting pockets and lifting lugs.

The Hopper shall have a volume of 1.5 – 2.5 m³.

9.4 Automatic Debris Removal System Safety and Maintenance Infrastructure (Safety and Maintenance Infrastructure)

The Safety and Maintenance Infrastructure shall include at a minimum:

- Lockable safety cage; and
- Operation and maintenance platform(s).

The Safety and Maintenance Infrastructure shall:

- Include a lockable safety cage
- Prevent access to all moving parts of the Rake by non-authorised personnel and the public
- Allow enough room for reasonable and safe access for operation and maintenance of the Rake and Chute including clearing of blockages
- Allow for standing room above overflow level (300 mm above hardstand area of distribution pit)
- Allow for access from walkway to Rake and all areas of the Distribution Pit hardstand; and
- Be fitted with a power isolation for the Rake, which allows for manual operation only, on entry of safety cage. This power isolation shall be interlocked with the safety cage access.

10 Technical Requirements – Additional Flow Path Level Sensors (Sensors)

10.1 Sensors

Two Sensors shall be required for supply and install within the additional flow path.

The Sensors shall be installed in positions on the additional flow path as indicated in the layout plans.

The Sensors shall be RX2104-WL Data Logger MicroRX Water Level Station unless otherwise specified by the Superintendent.

The Sensors shall be installed and fixed at the locations specified in the layout plans and as per the manufacturer's specifications.

The Sensors shall be housed in a lockable cabinet. Locks shall be compatible with Council key sets.

Power supply to the Sensors shall be via the integrated 1.7-Watt solar panel and NiMH rechargeable battery.

Digital output shall be via wireless transmission as per manufacturers specification.

The Sensor shall be fitted with all components to measure and transmit level reading to the PLC system.

The Sensor shall be calibrated prior to operation in line with the manufacturer's recommendations.

10.2 Sensor operation

The main function of the Sensors is to transmit a high-level setpoint signal to the Council PLC.

A high-level signal from the Sensors shall be affect the operational modes of pump station pumps dependent on the status of the DN150 control valve, as per the below.

Sensor 1 Signal	Sensor 2 Signal	DN150 Status	Pump Status
High level (off)	High level (off)	Open or closed	On
High level (on)	High level (off)	Open	On
		Closed	Off
High level (off)	High level (on)	Open	On
		Closed	Off
High level (on)	High level (on)	Open	On
		Closed	Off

11 General

General information details PLC control and display for the:

- Rake
- Automated valves (DN150 and DN375); and
- Sensors.

The Contractor shall be responsible for subcontracting SAFEGroup for the PLC integration and display of all relevant components of this project.

11.1 Modes of Operation

Byron Shire Council staff may select the following modes of operation for standard devices. These modes are selected via the selector mechanisms in SCADA. For each device, a mode of operation determines how it is monitored and controlled.

Mode	LCP Selector Switch	SCADA	Applicable Devices
Off	OFF	N/A	Valves and Rake

SCADA Automatic	REMOTE	Automatic	Valves and Rake
SCADA Manual	REMOTE	Manual	Valves and Rake
Manual (Field)	LOCAL	N/A	Valves and Rake
Out of Service	REMOTE	Out of Service	Valves and Rake

Devices (drives, valves) can only be operated in SCADA Automatic and SCADA Manual modes when they are In Service (i.e., not in Out of Service mode) and are not prevented from operating by trips or interlocks.

SCADA AUTO mode shall allow control of the Rake via adjustable parameters, timers and operator pre-sets / setpoints. The process shall operate without operator intervention for varying lengths of time.

SCADA MANUAL mode shall allow an operator to manually control each device via screens from the SCADA terminals. Interlocks shall be required preventing operation of a particular device if certain conditions are present e.g. high level.

Signals from Instruments (level / flow transmitters, contact inputs etc.,) are displayed on the SCADA and used by the PLC.

Under normal operation, all devices will be in Automatic and Available and all instruments will be In Service (Available). In this situation, the entire operation is monitored and controlled automatically by the PLC. The operator (or engineer) can select alternative modes of operation for individual pieces of equipment through the SCADA and the LCP selector switches when equipment failure or other conditions prevent the PLC from adequately controlling the processes.

The mode of operation of the device / instrument affects:

- Personnel, Device and Plant Protection – Trips and Interlocks
- Availability of the device for automatic and manual control
- Availability of the device for duty operation

Mode	Functionality
SCADA (Manual) (Auto Selected on LCS)	SCADA control: Enabled LCP selector switch: "Remote" SCADA setting: Manual Has alarms enabled Is Unavailable and Not Ready Does not affect the running of any other related device being operated by the sequence. The LCS must be switched to "Auto", and "Manual" mode selected at the SCADA Terminal. Running the unit in SCADA Manual mode shall disable all automatic operating actions. Stop/start functions of the inlet valve and Rake shall be possible via the SCADA. All set points, such as Rake speeds and valve position shall be manually adjustable via the SCADA during operation. All personnel safety and equipment interlocks shall be enabled. Indication and alarms shall be

	visible from the SCADA. Does not apply operator adjustable ramp rates for changes in VSD speeds. If the Rake is running in SCADA Auto Mode and SCADA Manual Mode is selected, the Rake shall continue operating, however it shall be removed from any automatic sequences or control loops currently in operation. The valve shall remain at its current position, which shall be recorded for when the system is re-set to SCADA Auto mode.
SCADA (Auto) (Auto Selected on LCS)	SCADA control: Enabled LCS selector switch: "Remote" SCADA setting: Auto The LCS must be selected to "Auto", and "Auto" mode selected at the SCADA Terminal. Running the unit in SCADA Auto mode shall operate the system automatically as dictated by the PLC. All set points shall be automatically determined or applied from the PLC during operation. All safety equipment shall be enabled (both hardwired and software). Indication and alarms shall be visible at the SCADA Terminal. If the unit is operating in SCADA Manual Mode and SCADA Auto Mode is selected at the SCADA Terminal, the PLC shall determine its operating status (whether duty 1 or duty 2) and adjust the motor speed or valve position (as applicable) to meet the required set points.
Out of Service Mode	SCADA control: Disabled LCS selector switch: "Auto" SCADA setting: Auto Out Of Service (OOS) Mode applies to devices and instruments and is typically used when the device or instrument has failed and is awaiting maintenance. Out of Service mode is not available when the device is in Manual Mode. Switching the LCS Selector Switch to Manual mode, automatically cancels Out Of Service. Out of Service has a slightly different meaning for devices (Rakes, valves etc.) and instruments (transmitters, contact inputs etc.). For devices in Out of Service Mode the device:

	- Is Unavailable and Not Ready and therefore cannot be automatically controlled by the sequence logic programmed in the PLC or by the operator from SCADA. - Has alarms disabled. For Instruments in Out of Service Mode the instrument: - Has alarms disabled. - Transmitter's reports minimum engineering value (zero for level for example). - Contact Inputs reports inactive. Note: Out of Service mode does not disable hardwired interlocks.
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11.2 Mode Changes and Resulting Actions

The tables in this section describe all possible mode changes and the resulting action for different types of standard devices.

Mode change while in Off mode (LCS)

The following Table describes the behaviour of each device when switching between the SCADA adjustable modes while a device is placed in the Off Mode.

SCADA Mode Change	Device
Auto → Manual	Drive Does Not Start
Manual → Auto	Drive Does Not Start
In Service → Out of Service	Drive Does Not Start Disable Alarm
Out of Service → In Service (When in Auto Or Manual)	Reset Trips Enable Alarms Drive Does Not Start

Mode change while in Remote mode (AUTO on LCS)

The following Table describes the behaviour of each device when switching between the SCADA adjustable modes while a device is placed in the Automatic Mode on LCS.

SCADA Mode Change	Device
Auto → Manual	Keep Current Condition
Manual → Auto	Operate as Determined By PLC Sequence
In Service →	Immediate Stop

Out of Service	Disable Alarms
In Service → Out of Service (When in Auto)	Reset Trips Enable Alarms Operate as Determined By Sequence
Out of Service → In Service (When in Manual)	Reset Trips Enable Alarms Drive Does Not Start

Mode change while in Manual mode (on LCS)

The following Table describes the behaviour of each device when switching between the SCADA adjustable modes while a device is placed in the Manual Mode on LCS.

SCADA Mode Change	Device
Auto → Manual	Drive Operation Unaffected
Manual → Auto	Drive Operation Unaffected
In Service → Out of Service	Cannot Be Selected – Field Mode Cancels Out of Service
In Service → Out of Service (When in Automatically Occurs When Field Selected)	Reset Trips Enable Alarms Drive Does Not Start

Note: The inlet valve will stop at its current position when its mode is changed to SCADA Manual. The inlet valve will close when its mode is changed to Out of Service, Field or Off.

11.3 Status Indication

The status of all valves or Rake shall be indicated at the SCADA Terminal as defined:

- PLC Availability / Unavailable
- Control Supply Healthy / Not Healthy
- Motor Isolated / Not Isolated
- Motor Running / Not Running
- Motor Fault / No Fault
- Emergency Stop Operated / Not Operated
- Communication Fault / No Fault

Additional status indication shall be provided in line with specific “non-standard” drive features.

11.4 Interlocks

Interlocks shall prevent the Rake from running under a range of specified conditions.

Personal Safety interlocks shall cause the Rake to trip, and an alarm shall be generated.

When running the system in Manual Mode, the Rake is controlled locally by Hard Wired Control. No signal sent to VSD. No Interlocks or Permissives are enabled / latched.

While in SCADA Manual Mode safety interlocks shall be enabled. All interlocks shall be enabled while in SCADA Auto Mode.

11.5 Alarms

When scheduling the required alarms, the alarm priority must be nominated. All devices and instrumentation shall be assigned alarms and alarm priorities. The alarm priorities will range Low, Medium and High.

NB: Before an alarm is activated the condition causing the alarm must be continuously present for a pre-set time (time to be set based on circumstance and consequence).

The following alarm statuses will be available in the control system:

- Active unacknowledged
- Active acknowledged
- Inactive unacknowledged
- Inactive acknowledged – alarm log

Alarm Actions

When an alarm is generated, it shall be displayed on the Alarm Status Bar, which must be visible to the SCADA user at all times, at the SCADA Terminal. Sound and colour indication for each alarm priority must be provided. Colour indication shall also be provided for acknowledged and unacknowledged alarms. Existing colour standards will be applied to active / inactive / acknowledged / disabled alarms.

Alarms shall be logged on the Alarm Page and shall indicate transitions between Active, Inactive and Operator-Acknowledge transitions.

The following information must be made available at the SCADA Terminal when an alarm is generated (where relevant):

- Time and date when alarm became active, inactive, acknowledged (in an alarm history log)
- Alarm tag name
- Alarm description
- Alarm status – active, inactive, acknowledged, unacknowledged
- Alarm Priority (indicated by text colour)

12 Installation and Commissioning

Prior to performance testing the Contractor must complete a thorough commissioning program, to prove the automatic debris removal rake system is ready for service, in line with a commissioning plan accepted by the Superintendent.

13 Performance Testing

The performance testings shall be undertaken to ensure that the specific performance objectives have been met. This testing shall proceed only after the following pre-requisites have been met:

- All operation and maintenance manuals have been submitted
- Operator training has been completed
- Commissioning has been completed along with acceptance of commissioning report by the Superintendent
- Works-as-Executed Drawings are submitted
- Submission and acceptance by the Superintendent of testing protocol; and
- Seven (7) days' notice to the Superintendent.

The tests shall be determined to be successful if all pre-requisites are met to the Superintendent's satisfaction. Failure of any test shall require the Contractor to submit a report detailing the cause of the failure. The Contractor shall be responsible for work to rectify the failure, at its own cost, and the test shall then be repeated in full.

14 Maintenance and Warranty

The first fill of oil shall be supplied by the Contractor with all equipment. The Contractor shall also be responsible for returning to site upon completion of the initial run in period when the Contractor shall refill oil free of charge.

The Contractor shall allow for, in the tender sum, two (2) visits to site, by competent Contractors, to inspect the operation of plant and to make any adjustment which are required for optimum operation. Each of these visits shall include a meeting with Principal staff to discuss operational issues. The Superintendent shall receive seven (7) days' notice of each visit.