

**Rosehill Network Pty Ltd**

**ACN 131 213 691**

**RRWS-IMS-DOC-002  
Infrastructure Operating Plan**

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## 1. Introduction

Rosehill Network Pty Ltd (**'Rosehill Network'**) holds Network Operator's Licence number 09\_002 issued under the *Water Industry Competition Act 2006* (NSW) (**'WICA'**) under which it owns water infrastructure that forms part of the Rosehill Recycled Water Scheme (**'Rosehill Scheme'**). This document, Rosehill Network's Infrastructure Operating Plan, has been developed to satisfy the requirements of the *Water Industry Competition (General) Regulation 2008* (NSW).

### 1.1 Rosehill Scheme Overview

The Rosehill Scheme involves:

- extracting secondary treated effluent from Sydney Water's Liverpool to Ashfield Pipeline (**'LAP'**);
- treating the effluent to produce high quality recycled at the Fairfield Advanced Water Treatment Plant (**'Plant'**); and
- transporting recycled water from the Plant, through a distribution network (**'Network'**) to customers in the Fairfield, Cumberland, and Parramatta local government areas (**'Customers'**).

The scope of the Rosehill Scheme is shown in **Annexure A**.

The Rosehill Scheme is underpinned by a 20-year Project Agreement between AquaNet Sydney Pty Ltd (**'AquaNet'**) and Sydney Water and is capable of delivering up to 25 million litres of recycled water per day to Customers.

Under the Project Agreement, AquaNet delivers recycled water to Sydney Water for the sale to its own customers (**'Foundation Customers'**). Sydney Water has retail contracts with the Foundation Customers. Sydney Water supplies up to 32ML/d of treated effluent (according to an effluent specification in the Project Agreement) to the Plant from the LAP. AquaNet may sell any water in excess of that required to supply the Foundation Customers directly to its own customers (**'Non-Foundation Customers'**).

AquaNet owns the Plant and has entered into an Operation and Maintenance Agreement with Veolia Water Australia Pty Ltd (**'Veolia'** or **'VWA'**) who is responsible for maintaining and operating the Plant.

Rosehill Network and its sister company, AquaNet, have entered into a Pipelines Agreement whereby Rosehill Network constructed and owns the Network. Rosehill Network has entered into an Operation and Maintenance Agreement with Veolia who is responsible for maintaining and operating the Network.

Both Rosehill Network and Veolia hold Network Operator Licences under WICA.

The contractual structure of the Rosehill Scheme is depicted in **Annexure B**.

AquaNet and Rosehill Network are both part of the Water Utilities Australia group of companies (**'WUA'**) and through its various subsidiaries, WUA provides the resources, skills and expertise required for AquaNet and Rosehill Network to deliver the Rosehill Scheme.

## 2. Executive Summary

This plan explains how Veolia manage the infrastructure assets to best satisfy the contractual and relevant regulatory requirements for the Rosehill Scheme.

This plan complements Rosehill Network's Water Quality Management Plan as well as the VWA Infrastructure Operating Plan for the Plant and the VWA Water Quality Management Plan for the Plant

by providing details regarding all key asset management activities. The plan is further supported by the Veolia Document, **MAN-3954 Operations Management Plan – Rosehill Recycled Water Scheme**, which provides an overview of the way Veolia addresses the requirements for Quality, Safety, Environment, Asset and Risk Management as required by the Veolia Business Management Manual and relevant standards.

The key features of Veolia’s Asset Management Plan are:

- Establishment of an advanced Asset Management System with the potential to be linked to the SCADA system to ensure accurate and appropriate data capture from day one.
- Early and rigorous attention paid by the Asset Management team to develop a comprehensive maintenance program.
- Integration of condition monitoring, renewal and whole of life cost planning processes to promote high availability and durability of assets.
- A focus on providing a competent, well trained and well supported operations team, with a view to establishing an ‘asset management culture’ on the RRWS.
- Development of effective maintenance and renewal schedules with an emphasis on condition monitoring to minimise risks.
- Implementation of special information systems to manage UF and RO membranes, as well as capital renewal.
- Selective use of RCM through the operations phase to address reliability issues.

### 3. Abbreviations

The following abbreviations are used in this Plan:

<b>AquaNet</b>	AquaNet Sydney Pty Ltd
<b>CIP</b>	Clean in Place
<b>CMMS</b>	Computerised Maintenance Management System
<b>EIS</b>	Environmental Impact Statement
<b>Fairfield AWTP</b>	Fairfield Advance Water Treatment Plant
<b>FARWP</b>	Fairfield Advanced Recycled Water Plant
<b>FMEA</b>	Failure Mode and Effects Analysis
<b>VAMS</b>	Veolia Asset Management System
<b>IBMS</b>	Integrated Business Management System
<b>KPI</b>	Key Performance Indicator
<b>LOS</b>	Level of Service

<b>MTBF</b>	Mean Time Between Failure
<b>O&amp;M</b>	Operations and Maintenance
<b>OH&amp;S</b>	Occupational Health and Safety
<b>PLANT</b>	The Fairfield Recycled Water Plant
<b>PM</b>	Preventative Maintenance
<b>RCA</b>	Root Cause Analysis
<b>RCM</b>	Reliability Centred Maintenance
<b>RO</b>	Reverse Osmosis
<b>Rosehill Network</b>	Rosehill Network Pty Ltd
<b>RRWS</b>	Rosehill Recycled Water Scheme
<b>SCADA</b>	Supervisory Control and Data Acquisition
<b>UF</b>	Ultrafiltration
<b>VWA</b>	Veolia Water Australia

#### 4. Introduction

##### 4.1 Context

This Infrastructure Operating Plan has been prepared as an outline plan in order to assist with the management of assets at Fairfield AWTP.

##### 4.2 Scope

The Infrastructure Operating Plan has been developed to provide the following information:

- An overview of the asset management strategy and how the Infrastructure Operating Plan is developed in accordance with this;
- Descriptions of the staff organisational structure and processes to be put in place to implement the asset management aspects of the Water Quality Plans and monitor compliance with all requirements;
- Explanation of the process for developing, reviewing and updating the maintenance program.
- An outline of the asset management information systems to be used;
- Details of how preventative, corrective and breakdown maintenance is to be conducted on site;
- An overview of the process and value of assessing criticality for all assets;
- An overview of the process for performing condition and risk assessment and how this information is used for future planning;

- An outline of the capital investment strategy and the processes involved in making decisions regarding asset refurbishment and replacement;
- Details of the asset renewal program, which consists of major periodic maintenance items, including overhauls and replacement; and
- A summary of how RO and UF membranes are to be managed.

#### 4.3 Objectives

The Infrastructure Operating Plan is designed to ensure that the Rosehill Scheme assets are managed to the principles of Veolia's Asset Management Strategy. This strategy is an integrated and flexible approach, encompassing whole of life cycle costs.

The primary objectives of the Infrastructure Operating Plan are to enable the physical assets of the scheme to be maintained, repaired, rehabilitated and replaced in such a way as to ensure the following outcomes:

- No drop in level of service delivered over the duration of the contract.
- Optimum equipment performance, reliability and availability.
- Minimum total cost of ownership of each asset over its life cycle.
- Minimum business risks to all stakeholders.
- Compliance with all statutory and contractual requirements.

### 5. Asset Management Strategy

#### 5.1 Strategy overview

Veolia's strategy for asset management uses an integrated approach which considers all aspects of the asset's life cycle including safety, operational performance, levels of service, contractual requirements, maintenance requirements and the asset's whole of life costs.

A flexible approach accommodates the continuing change in external factors associated with economic influences, customer expectations and business needs. Veolia's strategy enables ready reassessment and reiteration of inputs and outputs via periodic reviews and appraisals of all areas contained in an asset's life cycle.

Veolia's asset management strategy and is designed to:

- Reflect industry best practice.
- Produce an integrated structure that supports all the activities of the business.
- Ensure that the owner, operator and customers are not exposed to undue risk.
- Ensure sustainability of the environment.
- Create an objective, transparent management tool for monitoring asset performance against the relevant statutory obligations, policies, standards, levels of service and operational targets, and for reporting to authorities, customers and community.

- Minimise the cost of the managed assets over their useful life by balancing investment needs within economic and operational guidelines to ensure maximum efficiency in terms of capital investment and operational costs.
- Ensure that the Plant maintains the minimum flows for which it was designed.
- To manage and operate the Plant as an efficient business enterprise, it is essential to maintain the quality and performance of the assets at their optimum level. Detailed in this Infrastructure Operating Plan is the processes, which provide:
  - An effective mechanism for compiling a comprehensive asset register of all plant assets linked with quality, physical parameters, condition, criticality and performance of the assets.
  - Procedures for determining and recording asset condition and criticality;
  - Evaluating whole of life options;
  - Techniques for determining asset short- and long-term investment priorities and balance against the availability of funds; and
  - A program for asset management, maintenance, upgrading and replacement of assets that can cater for dynamic conditions.

## 5.2 Planning Framework

Veolia utilises an integrated approach to asset management planning which considers the impact of all internal and external influences on the systems assets – technical, financial, social, political and economic.

Veolia establishes maintenance regimes, maintenance standards, operating procedures and investment and replacement strategies that are linked to ensure ongoing service delivery in the most cost effective manner.

The asset management planning process consists of an annual review and refinement to allow for changing internal and external factors such as:

- The asset management principles, strategy and objectives of the asset owner;
- Industry-wide guidelines and standards for assessment management (including the International Infrastructure Management Manual)
- Environmental legislation;
- Funding and investment priority philosophies;
- Occupational health and safety regulations;
- Changing technology;
- Industrial relations legislation; and
- Community expectations.

The asset management framework that is to be used for developing and revising the integrated Asset Management Plan is shown in the following table:

Step		Details
Step 1	Define Performance Criteria and Service Levels	These are defined using contract requirements and KPIs, EIS requirements, Licence Requirements, Environmental Plan and statutory obligations and performance standards.
Step 2	Establish Policies and Procedures	The policies and procedures required to deliver Veolia’s asset management strategy reside in the Operations Management Plan (On Tap).
Step 3	Define Asset Register and Data Standard	The Plant’s assets are defined and categorised into specific areas and asset types using an asset register and data standard. The asset register is created and maintained in Veolia’s Computerised Maintenance Management System (CMMS) software.
Step 4	Define Maintenance Requirements	Maintenance requirements for assets are determined and managed in Veolia’s CMMS. Preventative maintenance implemented based on manufacturers recommendations and asset condition and risk assessment.
Step 5	Asset Condition Grading and Assessment	Assets have regular condition assessments conducted with defined standards and policies. An overall asset assessment is performed to identify any areas of potential concern.
Step 6	Analysis and Review of Asset Assessment	From the information collected in Step 5, an asset assessment identifies any shortfalls in asset condition and performance. A decision is then made either to continue to maintain or renew assets. Assets may be operated to failure based on whole of life costing evaluation options.
Step 7	Review Maintenance Requirements	Based on decisions made in Step 6, the options to increase or decrease maintenance expenditure is determined, reviewed and evaluated.
Step 8	Asset Replacement Program	Based on the assessments made in Step 6, the options available for asset replacement or refurbishment can be determined, reviewed and evaluated.
Step 9	Review / Revise Investment Needs	To assess the implications of changing inputs, business parameters, outputs, standards and targets, the results of outputs and total expenditure needs will be reviewed.

**6. Asset Management Organisation**

**6.1 Veolia Staffing Structure and Responsibilities**

An organisational structure showing key Veolia positions relevant to asset management is shown in **Annexure C**.

The asset management responsibilities of the key site-based staff are as follows:

- Operations Manager – Jointly review and approve the O&M Plan.

- Level 6 Operator – Key site point of contact for all maintenance issues. Organise material resources and supervise operator-maintainers, electrical and mechanical tradesmen and subcontractors engaged in corrective maintenance and technical or vendor specific preventative maintenance activities. Manage the supply and transfer of spare parts and other and other inventory to and from the onsite store.  
Responsible for maintenance program planning. Develop and coordinate major preventative maintenance activities, including condition monitoring. Maintain the asset register. Develop the maintenance strategy and asset replacement program. Manage client reports and communications.

The asset management responsibilities of the key members of Veolia’s asset management team, based in the Veolia Water Australia head office, are as follows:

- Corporate Asset Manager – Manage the provision of IT systems and engineering services support to enable assets to be managed in accordance with the asset management requirements of the O&M Plan, the asset renewal program, and the reporting requirements of The Client.
- Asset Performance Engineer– Assist in data collection and CMMS establishment activities and perform systems administration for VAMS. Facilitate workshops and provide technical and systems support for RCM.
- Jointly review and implement the asset management component of the O&M Plan. Oversee development of the maintenance plan to align with best practice for Plant operations and maintenance. Review all aspects of the asset management framework, including the maintenance strategy and asset replacement program.
- Assist in the development of the asset renewal program, as well as ongoing monitoring and reporting. Track performance of asset renewals and provide IT support for the capital planning system.
- Asset Project Engineer– Conduct serviceability and reliability investigations. Provide engineering and project management assistance for major asset renewal and improvement projects.  
Provide engineering support to plant staff. Perform analysis of CMMS and carry out root-cause-analysis (RCA) and reliability investigations as required. Ensure that information is appropriately captured and stored in the Computerised Maintenance Management System (CMMS) VAMS, and monitor and report on Plant asset management performance.
- Electrical / Controls Engineer – Administer, develop and arrange for training for the site SCADA system. Provide project management and engineering assistance for key electrical and controls projects.

## 6.2 Labour Resourcing

To achieve the maintenance objectives of the Plant, the following staff are allocated:

- Veolia operator-maintainers – in addition to operating the Scheme, Five (5) operators carry out routine asset maintenance. The following tradespeople are available on dayshift to carry out preventive and breakdown maintenance tasks:
  - instrument technicians, electrical and mechanical fitters.
- Network Coordinator - available to coordinate and carry out operations and works on the Network.

- General subcontractors – resourcing requirements vary depending on the work scheduled, but subcontractor tradesmen are engaged on an ad-hoc basis to carry out basic maintenance routines (as required).
- Specialist subcontractors – separate commercial agreements are established for the carrying out of specialist maintenance activities such as servicing of chemical instrumentation, large pump systems, lifting equipment etc.

Key service suppliers, including subcontractors, were identified during the procurement phase of the project. A continuing review process is to take place to ensure that service and supply is optimised.

### 6.3 **Equipment Resourcing**

The following facilities are available including, mobile plant and equipment to ensure maintenance at the plant is properly carried out:

- Maintenance workshop
- Electrical workshop
- Spares storeroom
- Workshop gantry
- Workshop storage for consumables and tools
- Workshop bench tools (bench grinder, drill etc.)
- Workshop welding bay and equipment
- Operator vehicles (utilities etc.)
- Operator laptops
- Tools (mechanical fitting, electrical etc.)
- Instrument calibration equipment
- Condition monitoring equipment (Non-contact thermometer etc.)
- Lifting equipment (block and tackle etc.)
- Access equipment (ladders, davits etc.)
- PPE and safety equipment (gas detectors, chemical suits, masks etc.)

Equipment required for major overhauls/repairs or specialised maintenance is generally provided by service contractors.

### 6.4 **Culture and Training**

In line with the Veolia Document, ***POL-7-3 Learning and Development Policy***, Veolia fosters an ‘asset management culture’ through communication, leadership and training. Culture is a key element that ensures that the objectives of the O&M Plan are realised. Veolia facilitates this by first appointing highly motivated, skilled and experienced staff to key positions. In addition, the following support is provided:

- General systems training of all staff to enable them to:
  - use the CMMS system to manage assets, maintenance activities, condition assessment and spare parts.

- understand the specific CMMS data collection and reporting needs of asset management, and how this is used by the business to reduce risk, generate efficiencies and savings, and improve performance.
- Specialised asset management staff are available to assist key staff to enable them to:
  - perform criticality analysis of assets and condition grading and use this information to manage risk and prioritise renewals
  - perform ‘whole of life’ analysis to understand and justify capital projects involving renewal or modifications
  - use and analyse the results of condition monitoring technologies and analysis techniques (such as vibration, oil analysis and thermography) to promote ‘predictive’ maintenance.
  - perform root-cause-analysis to fault-find complex or repeated failures.
- Communication and involvement of key staff in asset management developments within the company through:
  - regular site-based meetings with the asset management staff;
  - attendance at periodic maintenance and CMMS user-group conferences;
  - participation in workshops to plan specific asset management improvements;
  - dissemination of maintenance systems updates via electronic means

In accordance with the Veolia Document, **PRO-15-1 Contractor Management Procedure**, Veolia use its Contractor Management System to ensure that all subcontractors who carry out maintenance activities are suitably qualified and trained and have appropriate insurances.

Similarly, Veolia staff who carry out maintenance are to have a suitable trade and/or other qualifications and must be aware of all appropriate legislation and standards. In this way, the Plant Operator will ensure that all activities are performed in a safe and competent manner.

## 6.5 Policies and Procedures

The policies and procedures required to implement the asset management strategy form part of Veolia’s Integrated Business Management System. The system’s documentation is stored within the BMS system and is controlled and maintained in accordance with the Veolia Document, **PRO-129 Documented Information Procedure**.

The integrated management system is used to manage all aspects of the operation and maintenance of the Rosehill Recycled Water Scheme. This includes the following Veolia Documents:

- **STA-311-2 Asset Management Strategy**
- **PRO-3825-2 CMMS Operations and Maintenance Procedure**
- **PRO-3826-2 Conducting Preventative Maintenance Procedure**
- **PRO-3827-2 Conducting Breakdown Maintenance Procedure**
- **PRO-3821-2 Membrane Maintenance and Replacement Procedure**
- **PRO-327-1 Criticality and Condition Grading Procedure**
- **PRO-3822-2 Asset Condition and Risk Assessment Procedure**
- **PRO-326-1 Developing and Maintaining an Asset Replacement Plan Procedure**
- **PRO-3828-2 Spares Parts Management Procedure**
- **POL-12-2 Asset Management Policy**

- ***PRO-3829-2 Asset Reporting and Analysis of Maintenance Procedure***
- ***TEM-38-1 VAMS Static Data Recording Procedure***
- ***PRO-331-2 Asset Location Numbering and Data Procedure***

A complete list of Veolia documents pertaining to the Rosehill Recycled Water Scheme (RRWS) can be generated at any time from the BMS. Reports can show complete listings of recently updated documents.

## 6.6 Establishment of Systems

Veolia manage data in multiple information systems to make asset management effective for the RRWS. The most important of these systems is the computerised maintenance management system (CMMS). The process of setting up these systems prior to commissioning has been critical to asset management, as shown below.

## 6.7 Documentation and Records

Veolia capture and store, within its CMMS historical information relating to maintenance, repair and replacement activities conducted on infrastructure assets. Overall, the CMMS records the following:

- Comprehensive asset register reflecting an up-to-date configuration of the RRWS equipment
- History of all preventative, corrective and breakdown asset maintenance conducted on all assets
- Instrument calibration history
- Meter information and condition monitoring results
- Inventory of spare parts holdings

In addition, the CMMS records the financial details of all purchases of materials and labour carried out in the course of conducting maintenance.

## 6.8 Compliance and Management Review

As part of the Integrated Business Management System, this Infrastructure Operating Plan is subject to internal audits and review to ensure that activities on site comply with the requirements of the plan.

Revision of this information takes place for the life of the operating contract to allow for changing internal and external factors such as changing technology, funding and investment priority philosophies, Environmental, WHS and IR regulations and other factors.

## 7. Performance Management

### 7.1 Levels of Service Targets

The mandatory performance criteria for the RRWS are defined in the Contract Requirements.

These operational performance requirements define the minimum level of service (LOS) in terms of water quality, water volume and general performance that is to be delivered by the Plant Operator.

The LOS is defined in the reference specification in Veolia Document, ***TEM-3898-1 Recycled Water Specification***.

The successful commissioning of the Plant was a milestone for demonstrating that the initial as-constructed equipment configuration is able to deliver the required LOS.

LOS is a key driver of asset management, particularly in setting targets for (a) plant and equipment availability; (b) maintenance productivity and effectiveness; and (c) equipment operational efficiency.

### 7.2 Performance monitoring and review

Veolia monitor performance and reports to the client on a monthly basis, performance against the agreed standards in accordance with the Contract Requirements.

The supervisory control and data acquisition (SCADA) system is the key source of online equipment performance monitoring for the RRWS. This SCADA performance data is used in three ways:

- Key flow, process and quality information will be stored in a data historian for trending analysis, monitoring and fault finding.
- Those items that contribute to a General Failure or Water Quality Failure is captured in the Performance Management System, which can be used for client reporting.
- Performance indicators based on meters that fall below, or rise above, a predefined level (such as motor currents and log reduction values for UF cells) have the potential to trigger corrective maintenance activities in the CMMS.

In addition to process monitoring and optimisation of energy consumption Veolia perform condition monitoring and periodic efficiency reviews of major machinery. This review entails analysing the operating efficiency of high-energy-consuming equipment, specifically the RO pumps.

The purpose of performing this analysis is two-fold. The first is to promote energy savings—inefficient pumps require more energy to meet the same output. Where a significant drop in efficiency is detected, a maintenance activity is to be raised in the CMMS to investigate and identify the root cause of the problem. The second is to identify early indications of deterioration in condition.

### 7.3 Changes to Service Levels

If future changes in demand or other requirements (such as recycled water quality) necessitate modifications to the LOS, then it will be necessary for Veolia to carefully consider how the delivery of the new LOS will impact the performance and management of its assets.

## 8. Asset Inventory

### 8.1 General

Veolia maintains an up-to-date inventory of infrastructure assets, known as the ‘asset register’, reflecting the as-built configuration of the plant.

The asset register database is carefully structured with an appropriate resolution to ensure that:

- site staff, managers and engineers are able to find items easily and unambiguously;
- data capture is properly matched to analysis and reporting requirements; and
- maintenance history and cost information are captured at the right level (identified in a risk assessment process).

## 8.2 Asset Register

The scope of the asset register is to identify all infrastructure assets associated with the Plant, including machinery, structures, and electrical installations.

The asset register has been created, using data from numerous sources including

- Asset list
  - Grouped in major system and equipment areas
- As-built equipment lists (mechanical, electrical, valve and instrumentation)
  - Potential for make, model, serial number, size, capacity, warranty, asset type
- As-built drawings
  - primarily the process and instrumentation drawings (P&IDs) as a checklist for asset that have been included
- Financial
  - purchase date and price where know.

Once collected, asset data is collated into an asset register using the agreed structure for the asset hierarchy as defined in Veolia guidelines. Veolia then developed a full asset inventory in the CMMS and integrates this information, along with the O&M manuals and spare parts lists as part of the Business Management Plan.

## 8.3 Asset interface points (boundaries)

The limits of the agreement for the Asset Management and the Operations of the RRWS are defined in the Veolia Document, ***TEM-3942-1 Definition of Interface Points***.

## 9. Asset Management System

### 9.1 CMMS

#### 9.1.1 General

- A Computerised Maintenance Management System (CMMS) forms the basis of Veolia's asset management and maintenance plans and will be used for scheduling, recording and analysing all maintenance activities.
- Veolia uses a new generation computerised maintenance management system (CMMS), called VAMS. The system utilises a web interface and is an important tool for the day-to-day management of asset maintenance and repairs, as well as spares inventory.
- Based on the leading asset management software platform Infor EAM, VAMS has been specially developed by Veolia Water to suit the needs of managing water and wastewater treatment infrastructure assets. It includes many features, including: modules for managing asset details and configuration, preventative maintenance planning and scheduling, purchasing, management of spares, workflow and analysis.

#### 9.1.2 Establishment and Use of Asset Management System

- Veolia has developed an asset register and preventative maintenance work order data in the computerised maintenance management system (CMMS).
- The CMMS comprise an inventory of all managed assets. It includes criticality and condition grading of all asset components, and other relevant data such as capacity, size

and age. Information is archived to allow trending of asset condition over the operating period.

- Most importantly, the system is to be used to capture data relating to all inspection and maintenance activities conducted at the Plant.
- All required preventative, corrective and breakdown maintenance information is entered into the VAMS database, properly linked to the assets that work is to be carried out on. Upon completion of tasks, maintenance personnel record the task as completed in VAMS with the following information:
  - date completed
  - personnel undertaking the work
  - labour hours for task
  - materials used
  - asset condition and performance data as observed during maintenance activities, including a brief description of work and important notes
- A high quality preventive maintenance program is critical to prevent inadequate equipment performance that can result in environmental or process incidents. Adherence to the preventive maintenance program must be assessed on a frequent basis, using maintenance performance indicators.
- VAMS is used to monitor preventive and corrective maintenance ratios with the objective of minimising breakdowns and failures.
- Regular reviews of maintenance performance will lead to progressive refinement and optimisation of the overall maintenance program. Equally important is the issue of breakdown maintenance, which must be undertaken in a timely, reliable manner.
- A KPI dashboard can be individually configured to monitor performance against certain contractual measures, compliance with statutory requirements as well as benchmarking and monitoring of internal KPI's.

## 10. Maintenance Planning and Execution

### 10.1 Work Instructions

Work orders and associated task instructions are planned for and generated prior to their required start date. They are issued by the Level 6 Operator to a trade group who are responsible for:

- Preparation – review of work to be undertaken and ensuring that all materials, spares and tools are available for the timing of the work.
- Safety and Environmental constraints – permits to work, entry permits etc. to be completed as required in high risk areas such as confined spaces.
- Operational constraints – avoid incidents leading to water quality or quantity problems.
- Completion of all maintenance tasks.
- Closing of work instructions in the Computerised Maintenance Management. System with all required data completed – hours worked, spares used, external resources etc.

If something unexpected is noted while undertaking the work, the person responsible for the maintenance is required to raise a breakdown maintenance order. Work instructions for each asset are regularly reviewed by all maintenance staff.

For efficiency, work instructions are not raised for minor housekeeping items, such as keeping plant clean and tidy, and operational running checks that must be done on a daily basis. These items are managed using Veolia Documents, **TEM-3778-2 Daily SCADA Checks** and **TEM-3777-2 Operator Rounds**.

## 10.2 Maintenance program optimisation

Initially, the preventative maintenance program has been developed on the basis of vendor recommendations and Veolia Maintenance Standards. This program is reviewed regularly and in the event of reliability issues occurring. To this end, Veolia will apply an initial maintenance review and optimisation process, as well as ongoing selective application of analysis in accordance with the principles of reliability centred maintenance (RCM). For more detail refer to the Veolia Document, **PRO-327-2 Criticality and Condition Grading Procedure**.

RCM provides a rigorous analysis framework for ensuring that the most cost-effective maintenance activities are employed to manage an asset's failure modes. There are a number of different versions of RCM, but the key elements of any RCM process are defined in SAE Standard JA1011 Evaluation Criteria for Reliability Centered Maintenance. Consistent with this standard is the 'RCM-2' framework, which Veolia Water has successfully used in a number of applications, particularly in North America.

When properly applied, RCM typically results in a reduced amount of routine maintenance work, while introducing more inspections and diagnostic activities to identify hidden failures and enable a greater degree of maintenance that is condition-based.

Application of RCM is most effective when a 'review group' approach is employed. To achieve this, a well-trained facilitator will conduct workshops with relevant plant-based technical experts. Software is used to document the steps taken and the resulting actions.

Although it can be time-consuming to perform, the outcome of RCM will usually be not only improved reliability and cost, but also an audit trail for maintenance changes, and a much deeper understanding of the assets by all participants. This last point contributes very positively to developing a proactive asset management culture within the operations team.

On the RRWS, Veolia will apply selective use of the comprehensive RCM framework for critical assets where there are major reliability issues or excessive maintenance costs.

## 10.3 Preventative Maintenance

### 10.3.1 General preventative maintenance

Maintenance of the RRWS is predominantly a planned activity, with the emphasis on regular inspection, routine servicing and timely replacement or repair of asset components. Excessive maintenance is to be avoided, but each asset and asset component should be capable of reaching its economic life.

The preventative maintenance requirements of the RRWS are initially dictated by vendor recommendations and Veolia Maintenance standards. These in turn will be designed to ensure maximum reliability of plant items and developed on the basis of information provided from a variety of sources, including manufacturer's recommendations, equipment operation and maintenance manuals and operational experience from other plants. In general they fall into two groups:

1. Time-based preventative maintenance – this is applied where the operation of equipment is fairly consistent over time and is scheduled in the Computerised Maintenance Management

System on the basis of fixed intervals of time (such as monthly, quarterly or annually). This includes regular inspections and checks of all process equipment

2. Running hours-based preventative maintenance – this is applied where operation of equipment is highly variable, for which maintenance investigations and/or actions are triggered by running hours

For more detail refer to the Veolia Document, **PRO-3826-2 Conducting Preventive Maintenance Procedure**.

#### 10.4 Corrective maintenance

In addition to planned preventative maintenance, there is a need to perform on-condition, or 'corrective', maintenance. This is essentially maintenance conducted on the basis of sub-optimal condition, with the aim of preventing further loss of performance or running to failure.

Corrective maintenance may come about as a result of a discovery from a condition inspection or test, or during the conduct of a preventative maintenance routine. Alternatively it may be triggered by online condition or performance monitoring parameters, which give early indication of deterioration.

#### 10.5 Condition Monitoring

While many corrective maintenance activities cannot themselves be easily planned, the inspections, diagnostic checks and condition monitoring activities that trigger them can be. In this way, Veolia employ a number of 'predictive' maintenance activities as part of the preventative maintenance plan for the Rosehill Recycled Water Scheme.

Condition monitoring and inspections are planned to be an integral part of the maintenance strategy for the RRWS. These include:

- Online monitoring of efficiency, performance and condition indicators.
- Vibration analysis.
- Oil analysis.
- Thermographic imaging, (where possible).
- Corrosion monitoring.
- Visual inspection and condition grading.

#### 10.6 Breakdown Maintenance

In contrast to the more organised structure of preventative maintenance, emergency and breakdown maintenance is unpredictable and requires operations and maintenance personnel to be reactive.

Since one of the primary objectives of maintenance is to ensure that equipment is able to meet the required performance standard at all times, then all breakdowns must be attended to.

Breakdowns that constitute an 'incident' are to be addressed as outlined in the Veolia Document, **MAN-3935-4 Incident and Emergency Management Manual**.

When a breakdown is discovered, operator-maintainer personnel identify the item and a decision is made as to how the item is addressed. This decision takes into account a number of different factors, including: the risks and consequences of not rectifying the problem; the costs and complexity of

rectifying the problem; the criticality of the item that failed and its impact on operations; and the overall priorities of the client and operations team.

Information about the breakdown maintenance activity is then entered into the CMMS at the earliest opportunity, and this includes the type/mode of failure, as well as details about the suspected cause, the results of follow-up investigations and the impact on operations, personnel and equipment safety and/or the environment. In the process, the item will be automatically added to the outstanding work list with an appropriate response time along with any tools or spares required.

If the breakdown maintenance item is an emergency, maintenance staff may repair the selected asset on the spot, ensuring all WH&S procedures are undertaken and input into the CMMS at the completion of the works.

In addition to providing historical information, capture of the failure information also provides input into planning activities. Where, for example, equipment is identified with unusually low mean time between failures (MTBF) and/or is incurring unexpectedly high maintenance costs, the whole of life costs of the asset will be reviewed with a view to revising the preventative maintenance and routine checks associated with that item.

For more detail refer to the Veolia Document, ***PRO-3827-2 Conducting Breakdown Maintenance Procedure***.

## 10.7 Outage Planning

Veolia plan carefully for maintenance that requires taking plant out of service. At all times, the operations and maintenance team act to ensure a balance between servicing equipment without compromising availability of plant.

As much as possible outages are scheduled to ensure minimum impact or risk to operations. An understanding of the criticality of the assets is essential to ensure that if maintenance is performed on equipment that is normally in standby, then there is still sufficient system redundancy to mitigate against the key risks.

For this reason, it is expected that outages for major preventative items and repairs as much as practical are planned to coincide with periods of reduced output.

## 10.8 Spare Parts

### 10.8.1 Management of Spare Inventory

Initially spare parts have been purchased in accordance with Veolia's process for identification of critical spares as well as suppliers' recommendations. The spare parts inventory is established in the CMMS.

Spare parts are linked to assets and maintenance activities and be identified as used when they are removed from the store. This in turn automatically adjusts stock levels left in the CMMS.

Minimum stock levels are be allocated for each spare part. Once reached reorder reports can be produced for maintenance personnel. The minimum stock level are be based on lead time of replacement, frequency of used, price and criticality of the spare part. Each spare is linked to a preferred supplier to assist in purchasing of new stock.

The CMMS is capable of producing the following reports:

- Monthly reports with average spare part values to determine:
  - Volume and value of spare parts on shelf

- Volume and value of spare parts used during the month
- Volume and value of spare parts purchased during the month
- Stocktake audits are conducted yearly to determine the accuracy of the system.

#### 10.8.2 11.7.2 Critical spares identification

The criticality of the spare parts is an indication on how important it is to have a spare part on site. Having the right spare parts at the right time can save the plant from a long-term loss of production. However, having expensive and poorly chosen spare parts on site can be considered as unutilised capital and a waste of space in the plant's storeroom.

The criticality assessment for spares is a decision making tool to help decide, according to the suppliers' recommendations and the team's experience, whether a spare should be purchased or not.

The spare parts criticality is assessed on a figure calculated from asset criticality and lead time. The result of the assessment is the spare criticality and can be used to assist with the decision to hold an item.

For more detail refer to the Veolia Document, ***PRO-3828-2 Spare Parts Management Procedure***.

## 11. Criticality Assessment

### 11.1 Priorities

Evaluating asset criticality is one of the most important asset management activities that Veolia conduct on the Rosehill Recycled Water Scheme.

As an indicator of the 'consequence' of asset failure, criticality grading enables assets and associated management activities to be prioritised based on risk. At the Fairfield Recycled Water Plant, Veolia use criticality for the following:

- Monitoring asset risk levels. Performing asset assessment, based on combining the results of criticality with the latest condition grade (see condition assessment below). Asset risk levels are then used to set priorities for renewals.
- Listing critical spares. Identifying critical spares required to be held on site, based on asset criticality and lead time.
- Prioritising reliability analysis. Setting priorities for analysing assets to improve maintenance costs or reliability, including analysis for reliability centred maintenance (RCM).

### 11.2 Criticality Grading

Veolia defines an asset as critical if a significant adverse impact is expected in the event of total failure. When determining the criticality grade, the assessor must understand how the asset fits into the larger process, and how its failure will impact overall operational performance, operator and customer safety, and the environment.

The grading is conducted in accordance with the Veolia Document, ***PRO-327-2 Criticality and Condition Assessment Procedure***.

Criticality grading of assets in the Plant has been conducted following commissioning of the Plant. Since criticality is determined by plant configuration, future criticality assessment will be performed as

required by the asset team and involve site staff or when modifications are undertaken or if high risk events occur.

## 12. Condition Grading and Asset Assessment

### 12.1 Purpose

The purpose of the condition grading and asset assessments is to provide a structured and consistent approach to review the condition and expected life of the asset, maintenance and renewal requirements, and the management of risk which feeds into the asset renewal plan.

A risk-based approach represents best practice in determining the method of assessment, and the frequency of monitoring activities. Asset condition rating and criticality factor are determined to produce an asset risk level assessment.

### 12.2 Condition Grading

The condition grade for an asset is an indicator of the likelihood of total asset failure within 12 months of the assessment.

Operational staff is required to perform the assessment in groups of two as a minimum to reduce the level of error from subjectivity. The assessment is based on factoring in multiple criteria, taking into account the dominant failure modes of each asset and the signs of deterioration in condition that best predict where the asset lies in its life-cycle as per the Veolia Document, ***PRO-327-2 Criticality and Condition Grading Procedure***.

### 12.3 Inspection frequency and records

Asset condition inspections are programmed on an annual basis as a minimum and opportunistically carried out with repairs and scheduled works.

### 12.4 Asset Assessment

The asset assessment is conducted using the condition and criticality gradings in accordance with Veolia Document, ***PRO-327-2 Criticality and Condition Grading Procedure***.

#### 12.4.1 Low Asset Risk Level

For assets with a 'low' score (1-4) the assessment has determined that given the criticality and the condition, they are of minimum current risk to the treatment plant operation.

If it turns out that renewals are planned for a given period, then a low score suggests that the renewal is not required if the main justification is on the basis of condition. Therefore, such activities, in the right circumstances can be delayed.

#### 12.4.2 Moderate Asset Risk Level

For assets with a 'moderate' score (5-6), the criticality and condition are such that there is not high enough risk to clearly justify a renewal (although it could be considered), but sufficient risk to warrant closer monitoring of the asset's performance and condition. If the condition deteriorates further, then it is incumbent of Veolia to then address the 'high' risk level.

#### 12.4.3 High Asset Risk Level

For assets with a 'high' score (8-10), the asset risk must be immediately and actively managed. The Operator must investigate the asset more thoroughly then determine whether to plan a renewal for the earliest opportunity or put in place a failure contingency strategy. The latter may involve purchasing a spare part or arrange for a work-around in the event of asset failure.

#### 12.4.4 Extreme Asset Risk Level

Only critical assets can have an 'extreme' score (12-15), which is designed to set the priority of action above assets with a 'high' level. In reality having an extreme score means that failure of the asset will result in adverse consequences and the likelihood is possible or expected. Immediate intervention or a failure management plan is required to be in place.

#### 12.5 Asset Assessment Reporting

Gradings for criticality and condition will be recorded in time-series data in the CMMS to enable trending and review of historical indicators.

### 13. Asset Renewal and Durability

#### 13.1 Forecasting challenges

The main asset management system at the Plant will be the CMMS. However, it should be noted that a CMMS is primarily designed as a maintenance transaction system, to schedule and record details of maintenance as it is carried out.

Such systems are not suitable for long term forecasting of capital renewal requirements, since these items will depend heavily on individual failure patterns and deterioration curves that apply for different assets. At any plant, the number of different failure patterns is as varied as the number of assets themselves, and to deal with this complexity, it is necessary to use a separate planning system.

#### 13.2 Planning and Managing Renewals

To manage the expenditure on asset replacement and refurbishment and ensure that they are planned in such a way as to minimise operational risks while remaining cost-effective, Veolia will implement its Contract Asset Renewal Management System (Sinapse).

Employed at a number of sites, Sinapse is a decision support system (DSS) that combines a structured process with a simple user interface for developing and managing the asset renewal program.

At its heart is a methodology for combining the results of the asset risk level assessment, as well as a historical renewal summary and a future renewal strategy, consisting each of a renewal 'profile' based on the following parameters:

- renewal intervention frequency;
- number of refurbishments per life-cycle of the asset;
- replacement cost; and
- refurbishment cost.

Key information is presented in a structured format to enable the maintenance team to make decisions about how to best manage risk and renewal. This information includes:

- Risk level. The results of the last criticality, condition and asset assessments. If the risk level is high or extreme, the manager is required to make comments about what is being done to address this, including a failure contingency strategy if applicable.
- Historical summary. A list of historical renewals carried out on the asset, as well as a summary of the actual past renewal profile, determined by averaging the data in the list. The more renewals that are carried out the more accurate this data becomes.
- Renewal strategy. A strategy for managing renewals moving forward is based on Veolia's projection of the above four renewal profile parameters. This strategy may be

altered at any time based on review of the historical summary as well as the current asset risk level.

- Future renewals. The planned renewal strategy will automatically produce a list of all upcoming renewals based on the renewal strategy and the date and type of the last renewal carried out.

Veolia use the Sinapse system not only to determine whether renewals for low risk-level assets should be delayed and for high risk-levels brought forward, but also to track and report past expenditure, as well as prepare future budgets and long term models.

### 13.3 Handover and Residual Life

The SINAPSE system has been designed in such a way as to accommodate plants in which the assets are handed over at the end of the contract term.

Where assets have a stipulated handover life requirement. Where the system identifies that the normal program could lead to the asset not meeting this requirement, it will automatically program an extra intervention at the end of the contract to ensure this requirement is met. The Operations Manager may then bring this extra intervention to the second last or third last years of the contract to ensure that the workload is manageable.

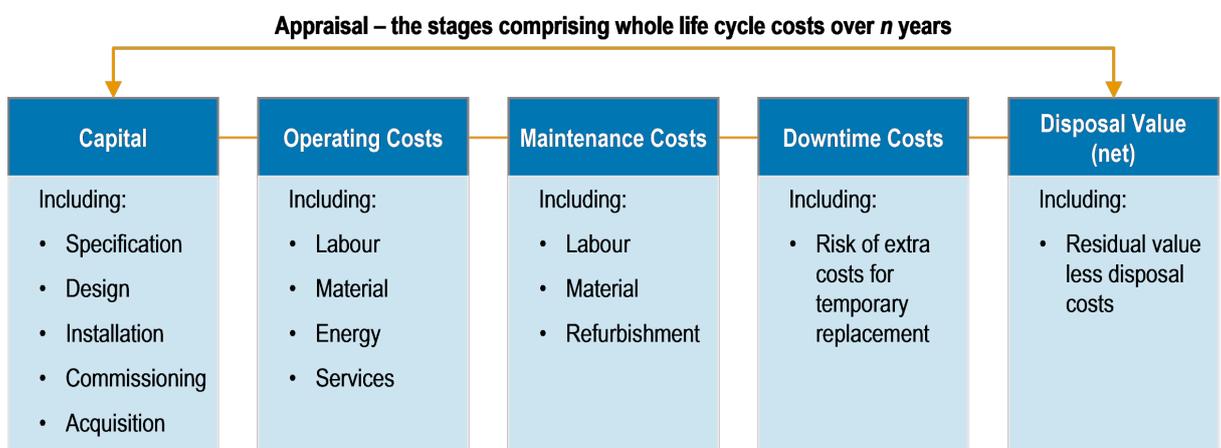
This value will be used in the SINAPSE to assist the Operations Manager in determining whether planned replacement of the asset needs to be brought forward to avoid unplanned failure.

### 13.4 Analysis of Whole Life Costs

The SINAPSE is a planning system based on combining simplified predictive modelling of failure with assessment of the asset risk level. It can be used to generate both short-term budgets and long-term forecasts. However, when it comes time to perform major interventions, more investigation is required.

The methodology to be adopted by the Operations Team in the decision to create, renew or dispose of an asset will be based on the 'whole of the life' costs associated with the asset, using discounted cash flows and economic evaluation.

Whole of life costing analysis brings together all the costs of ownership and operation over the whole life of an asset. An example of the type of costs involved with whole life cycle costing is shown in the following table:



When planning to renew assets, Veolia will consult as required all relevant contract and technical documents, in particular as-built drawings, manufacturer-supplied information and the durability plan.

This will ensure that material selection, and other factors that influence asset durability, are properly addressed during the Operations phase.

The outcomes of the condition grading and asset assessment are to identify critical and non-critical areas of operation and review the type of future asset maintenance or replacement that is required.

The analysis of the assessment score is linked to a whole life cycle cost analysis. Each asset is evaluated for risk and whole of life cost for its specific future maintenance needs.

Part of the analysis and review is to determine the actions required to be undertaken. The options available include:

- Current preventative maintenance activities are reviewed and increased or decreased;
- Pre-emptive asset replacement or refurbishment is employed;
- Increased condition monitoring;
- Purchasing of critical spares to mitigate this risk;
- Run to failure (for assets that are not critical)

A continuing emphasis is to be placed on utilising information collected and analysed to review the breakdown maintenance expenditure, preventative maintenance expenditure and asset renewal program.

Properly organised maintenance takes into account economic aspects and operating constraints. Increasingly, non-repairable components are used for basic equipment. The cost of repairing these components is often very high, and therefore a cost-benefit analysis must be undertaken to justify whether such a repair is economically viable compared with replacement of the component.

As a general rule, replacement of small items of equipment is preferred with the faulty item being removed and repaired in specialised workshops. Certain repairs are more economically performed by specialists who have advanced training and specialised tools at their disposal and are able to complete the work faster and cheaper. This brings about the need to subcontract selected maintenance work. This practice takes account of experience acquired in other applications and increases operational security.

### 13.5 Asset Disposal

In instances where a decision is made to dispose of an asset, then the disposal activity will be conducted in accordance with the Veolia Document, ***PRO-3823-2 Asset Creation and Renewal Procedure***.

For the infrastructure assets within the RRWS, the owner will be AquaNet. Disposal will necessitate that the Operations Manager takes responsibility, obtains the appropriate approvals and conducts, as required, a risk assessment to ensure that the means of disposal is not only cost-effective, but also safe and environmentally friendly.

If the asset includes any data stored within it, then it will be the Operations Manager's responsibility to ensure that the information is properly erased prior to, or in conjunction with the disposal.

## 14. Asset Review and Planning

### 14.1 General

Following a review of preventative maintenance tasks or an asset assessment, maintenance may be increased to reduce risk and prolong asset lives and ultimately reduce expenditure. The decrease in maintenance on a specific asset is only undertaken if there is no increase in risk to plant operation.

Maintenance may also be decreased or ceased and the asset may be run to failure if it does not affect plant operation.

Any decisions made on changes to maintenance requirements on a specific asset initiate a review of maintenance requirements of assets of similar type across the plant. All assets of similar types will be re-evaluated with specific emphasis on the effect of the changes on risk to operations.

#### 14.2 Asset Review and Reporting Program

A tapered review process is utilised to minimise plant resources and to implement a process that accurately reflects the rate of change in condition of the asset and associated risk of failure.

Where practical ongoing condition based monitoring and review will be undertaken. The Veolia Document, **PRO-3829-2 Asset Reporting and Analysis of Maintenance Procedure**, details the reporting and asset review process that will be undertaken.

Over time, the review period for individual assets, or groups of assets, is optimised based on asset history data, and appropriate techniques for decay and risk analysis.

### 15. Capital Investment Strategy

#### 15.1 Asset Renewal

Veolia has developed schedules for asset renewal. In the process it has identified the estimated costs associated with all asset overhaul and replacement activities through the life of the Contract.

#### 15.2 Initial Planning

Planning for future capital investment needs and options aim to focus on the objectives and investment categories shown in the following table:

Objective	Capital Investment Category
Estimate the investment needed over time to maintain the serviceability of existing assets	Renewal: Capital - Maintenance investment for assets
Meet higher water quality and environmental standards	Water Quality: Capital - Water quality investment Environment: Capital - Environmental investment
Meet higher service levels and performance standards	Improvements: Capital - Service levels investment
Meet growth in demand	Growth and New Demand: Capital - growth and demand investment

Adopting an integrated approach to asset management planning establishes the appropriate links between investment needs and outputs to:

- Identify the current level of service, performance, condition and serviceability of the assets
- Establish appropriate targets, standards and forecasts of service levels
- Establish planned and justified investments by priorities
- Balance investment, operational and maintenance needs with outputs

The outcome of the iteration process is to identify the preferred investment needs and options.

### 15.3 Project Appraisal and Investment Studies

When needs have been identified, the resulting capital investment needs are evaluated, justified and prioritised as part of the project appraisal process.

Investment studies should be undertaken to deal with strategic options, while project appraisals focus on individual schemes and projects. Investment studies will cover:

- Investment strategy
- Investment justification
- Unit costs
- Investment compilation by asset type/investment category
- Assessment of outputs
- Assessment of total investment

Project study and appraisal reports will cover:

- Justification of need
- Statement of facts (including current situation and forecasts)
- Design criteria (including planning horizon)
- Options consideration
- Investment costs
- Operating costs/ operating method
- Whole of life cycle cost/net present value options - summary of all options and costs
- Investment type, allocation and priority ranking
- Investment program and profiling

### 15.4 Capital Program – Compilation and Priority Ranking

The capital investment proposals and options derived from the asset management planning studies have to be expressed in varied formats to assist the priority ranking of projects. Using an integrated format to collate the Asset Renewal Plan allows sensitivity analyses to be undertaken to determine the effects of varying and re profiling investment needs with outputs.

The effect of sensitivity tests on the various investment categories could include the following.

- Maintenance of assets: changes in asset maintenance and replacement policies could be assessed and linked to service levels, standards and asset lives. Performance criteria could be reviewed
- Growth development: forecast rates of growth and new development could be reassessed

Compilation of projects into a Capital Investment Program would begin at the project appraisal stage, where project need, justification and benefits (both technical and financial) would all be subject to scrutiny. Within each investment category (i.e., Renewal, Water Quality, Environment, Improvement, Growth and New Demand, and Other), projects would be graded by priority. This would involve various techniques including whole of life cycle analysis and timed targets.

Investment category is prioritised by analysing investment levels by category and asset type to a capital investment expenditure ceiling. Scenarios examined would include least cost options, economic appraisal, maintenance options and establishing hurdle grades to supplement the serviceability and actual performance criteria.

The final preferred Capital Investment Program derived from the investment review and iteration process leads into the Asset Renewal Plan.

The systematic structured approach to asset management planning integrates key aspects into an overall strategy to operate the system effectively and economically.

By introducing an integrated process to justify the investment needs, economic optimisation comes from ensuring that resources are effectively directed at assets to achieve their maintenance, operation and service outputs.

The Asset Renewal Plan is an integral part of the asset management system and ensures that the performance of assets provide the service level objectives in the longer term.

By establishing the condition and performance of existing assets, a benchmark can be established to justify asset investment needs in conjunction with funding threshold and priorities.

Asset management planning is an important part of Veolia's management strategy to support the efficient and effective operation and maintenance of the Plant.

## 16. **Membrane Management**

### 16.1 **General**

Having effective management and maintenance of the membrane system will ensure that the water quality objectives are met and the most cost effective operation of system from an energy, chemical consumption and membrane replacement perspective is achieved.

A clearly defined membrane maintenance programme involves a number of clearly defined processes. These include performance monitoring and process testing.

Another key component of monitoring fouling rates is the ability to autopsy the membrane modules. In addition to using the resources of the membrane supplier, or a third party provider, the membrane modules can be sent to Veolia Water's Research centre in Paris, Centre de Recherche Maison Laffitte (CRML).

Autopsy diagnostics allow identification of the cause of potential membrane degradation and fouling problems as well as optimisation of the CIP solutions depending on the fouling characteristics.

### 16.2 **Membrane Types**

Two types of membranes are used in the FRWP's process:

- Ultrafiltration - UF Membranes, Memcor/Evoqua S10N
- Reverse Osmosis - RO Membranes, Hydranautics ESPA 2LD

### 16.3 Membrane Management

A key aspect of optimising the asset lives is the effective management of the Plant's membrane inventory.

In Australia, Veolia manages successfully ultrafiltration (UF) and reverse osmosis (RO) membranes in several plants the largest being:

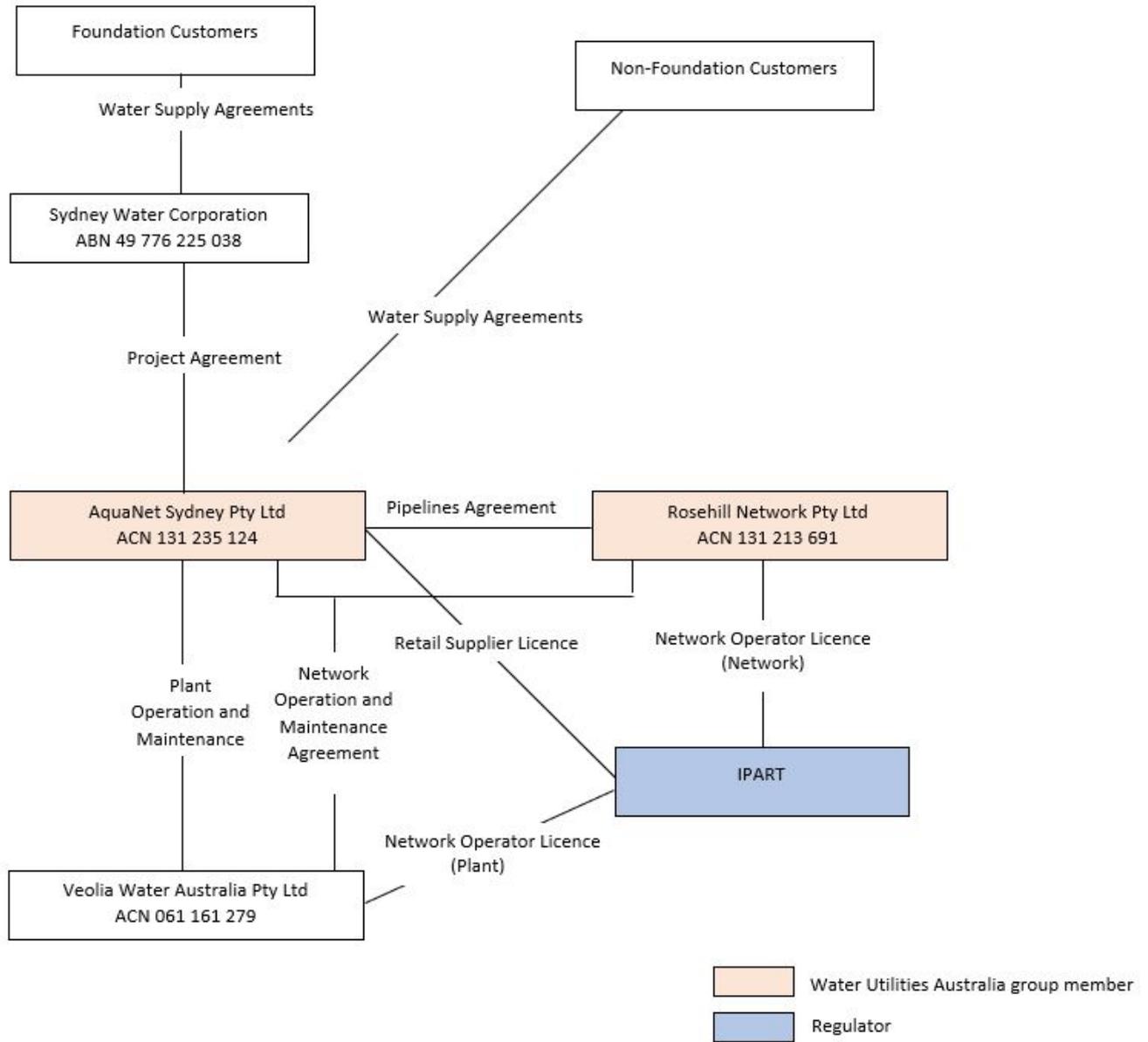
- For UF membranes - Bendigo plant with average output capacity 126 ML/day
- For RO membranes - Sydney Desalination Plant with average output capacity 250 ML/day.

For detailed information regarding membrane management refer to the Veolia Document, ***PRO-3821-2 Membrane Maintenance and Replacement Procedure***.

**Annexure A – Overview of the Rosehill Scheme**



**Annexure B – Rosehill Scheme Contractual Framework**



**Annexure C – Key Veolia Personnel**

