SYDNEY DESALINATION PLANT

# WATER QUALITY PLAN

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# Document history and status

| Rev. | Date | Reviewed by | Approved by | Revision details |
|---|---|---|---|---|
| 1 | April 2013 | V Wypych<br>G Ovens | Keith Davies | 1st Revision following ownership change |
| 2 | April 2015 | L Welsh<br>G Ovens<br>P Birkby<br>J Camenzuli | Keith Davies | 2nd Revision |
| 3 | May 2015 | L Welsh | Keith Davies | Addition of CCP 1A |

*Signed for and on behalf of Sydney Desalination Plant Pty Limited:*

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*Chief Executive Officer*

*Date:* 27 May 2015

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**Commercial-in-Confidence Appendices**

# 1 Executive Summary

## 1.1 Meeting licence requirements

The *Water Industry Competition Act 2006* licences require a water quality plan that specifies how the twelve elements of the framework for the management of drinking water quality, as detailed in the Australian Drinking Water Guidelines, have been addressed and will be implemented.

The current Australian Drinking Water Guidelines provide a framework for good management of drinking water supplies and are concerned with the safety of drinking water supplies from both a health and aesthetic perspective. The Australian Drinking Water Guidelines are part of the National Water Quality Management Strategy and have been developed by the National Health and Medical Research Council and the Natural Resource Management Ministerial Council in consultation with the water industry.

One of the key focuses in the Australian Drinking Water Guidelines is the Framework for Management of Drinking Water Quality (the Framework). The Framework sets out a structured and systematic approach for the management of drinking water quality from catchment to consumer, to assure water quality safety and reliability.

The Framework addresses the following four general areas:

- Commitment to drinking water quality management
- System analysis and management
- Supporting requirements
- Review

Appendix 1 of this plan provides a detailed analysis of compliance with *Water Industry Competition Act* licence requirements. It provides an in-depth summary of SDP's and Veolia Water's (the plant operator) strategies in relation to how SDP meets each of the components of the Australian Drinking Water Guidelines.

# 2 Background

## 2.1 Metropolitan Water Plan

The NSW Government's Metropolitan Water Plan (the Plan) outlines the measures that ensure Sydney, the Illawarra and the Blue Mountains have enough water now and in the future.

In the 2010 Plan, there are four main parts that make up the NSW Government's 'Water 4 Life' plan: dams, recycling, desalination and water efficiency.

The desalination plant is the main initiative in the Plan to provide a non-rainfall dependent source of water to secure Sydney's water supply against the effects of climate change, population growth and drought.

The plant can supply up to 250 million litres of water a day, which is up to 15% of Sydney's current water needs. The plant is capable of being scaled up to double its capacity if required in the future. The Plan prescribes the operating rules for the plant.

## 2.2 Operating Environment

### 2.2.1 Sydney Desalination Plant Pty Ltd (SDP)

Sydney Desalination Plant Pty Ltd (SDP), which holds the long term lease of Sydney Desalination Plant, the Drinking Water Pump Station and the Kurnell to Erskineville pipeline is jointly owned by the Ontario Teachers' Pension Plan Board (50%) and two funds managed by Hastings Funds Management Limited: Utilities Trust of Australia and The Infrastructure Fund (together 50%).

Drinking Water from SDP is added into Sydney Water's distribution system at Erskineville via an 18 kilometre long pipeline.

SDP has been granted two licences under the *Water Industry Competition Act 2006*:

1. Retail Supplier's Licence No. 10_011R, to supply water by means of the water industry infrastructure under the Network Operator Licence no 10_010.

2. Network Operator's Licence No. 10_010 to construct, operate and maintain water industry infrastructure.

The Retail Supplier's Licence permits SDP to sell drinking water from the plant. Currently, its only customer is Sydney Water (see Figure 1). Drinking water from the plant mixes with drinking water that originates in Sydney Water's other sources such as dams, in the distribution system. Sydney Water sells drinking water to homes and businesses in Sydney, the Illawarra and the Blue Mountains.

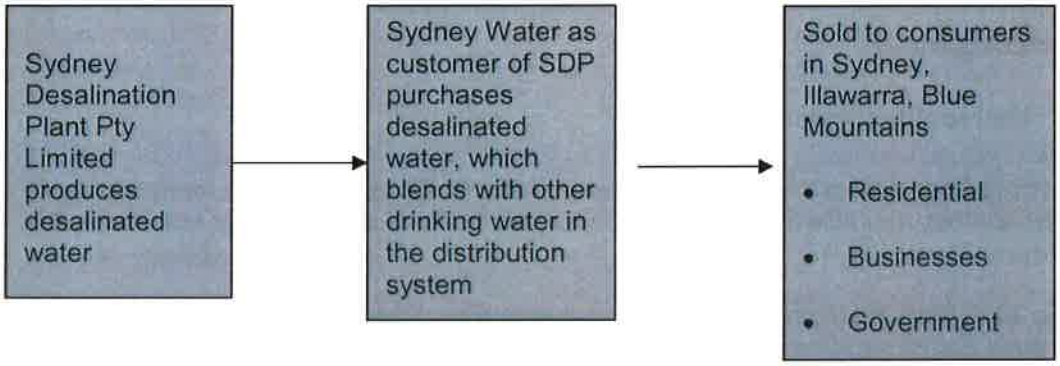


**Figure 1: Current structure of retail arrangements**

SDP and Sydney Water have entered into a long term Water Supply Agreement for Sydney Water to purchase drinking water from SDP in accordance with operating rules set out in the Metropolitan Water Plans applicable and updated periodically.

### 2.2.2 Veolia Water Australia (VWA)

SDP has entered into three long-term contracts with Veolia Water Australia (VWA) for the operation and maintenance of the desalination plant, drinking water pump station as well as the Kurnell to Erskineville pipeline.

VWA is a world leader in managing, operating and providing water and wastewater infrastructure services. It operates treatment plants and networks to provide drinking water, treat wastewater and produce recycled water for reuse.

### 2.2.3 Institutional arrangements

Institutional arrangements for the desalination plant are shown in Figure 2.

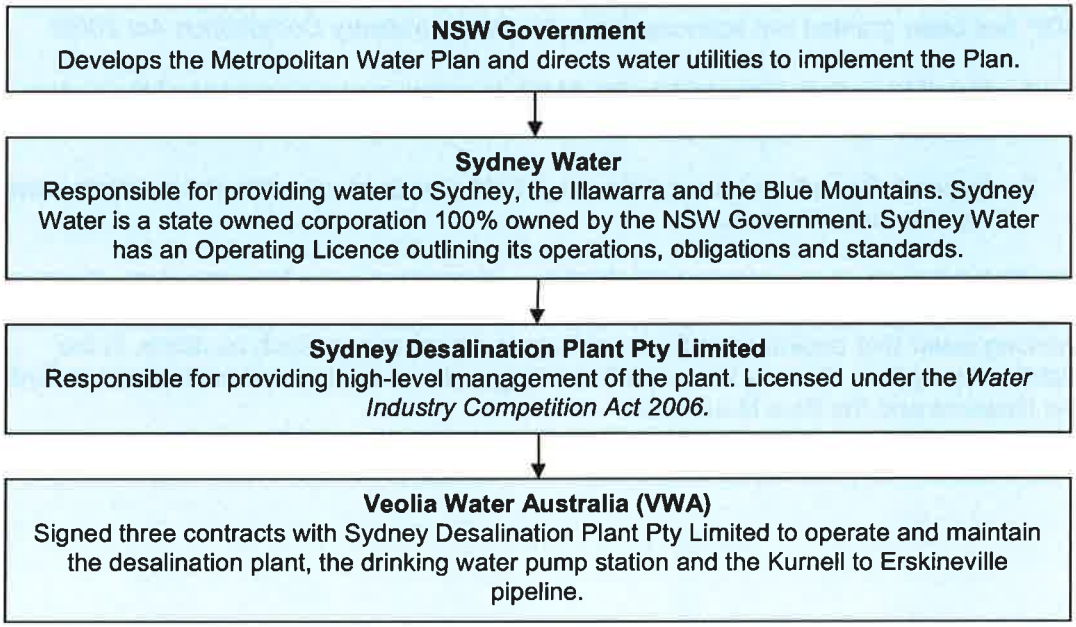


**Figure 2 : Institutional arrangements for the Sydney Desalination Plant**

### 2.2.4 Operational Arrangements

Figure 3 outlines the process and business structure map for the desalination plant operational arrangements indicating the company boundaries, physical responsibilities, drivers, management systems and interfaces.

The operational boundary between SDP and the customer (Sydney Water Corporation) is at the last valve before shaft 11 where the pipeline enters the city tunnel (asset # SNSV1/VLV01).

This *Water Quality Plan* sets out SDP's strategies to ensure that the quality of drinking water supplied by the Sydney desalination plant continues to meet regulatory requirements under the *Water Industry Competition Act 2006,* and that systems and processes are in place to address any water quality issues that may arise.

VWA maintains integrated business management system (IBMS) which incorporates quality, safety; food safety and environment (refer to Section 4 below). This *Water Quality Plan* utilises the IBMS to ensure compliance. The plan needs to be read in conjunction with any relevant VWA documentation as referred to in Appendix 1.

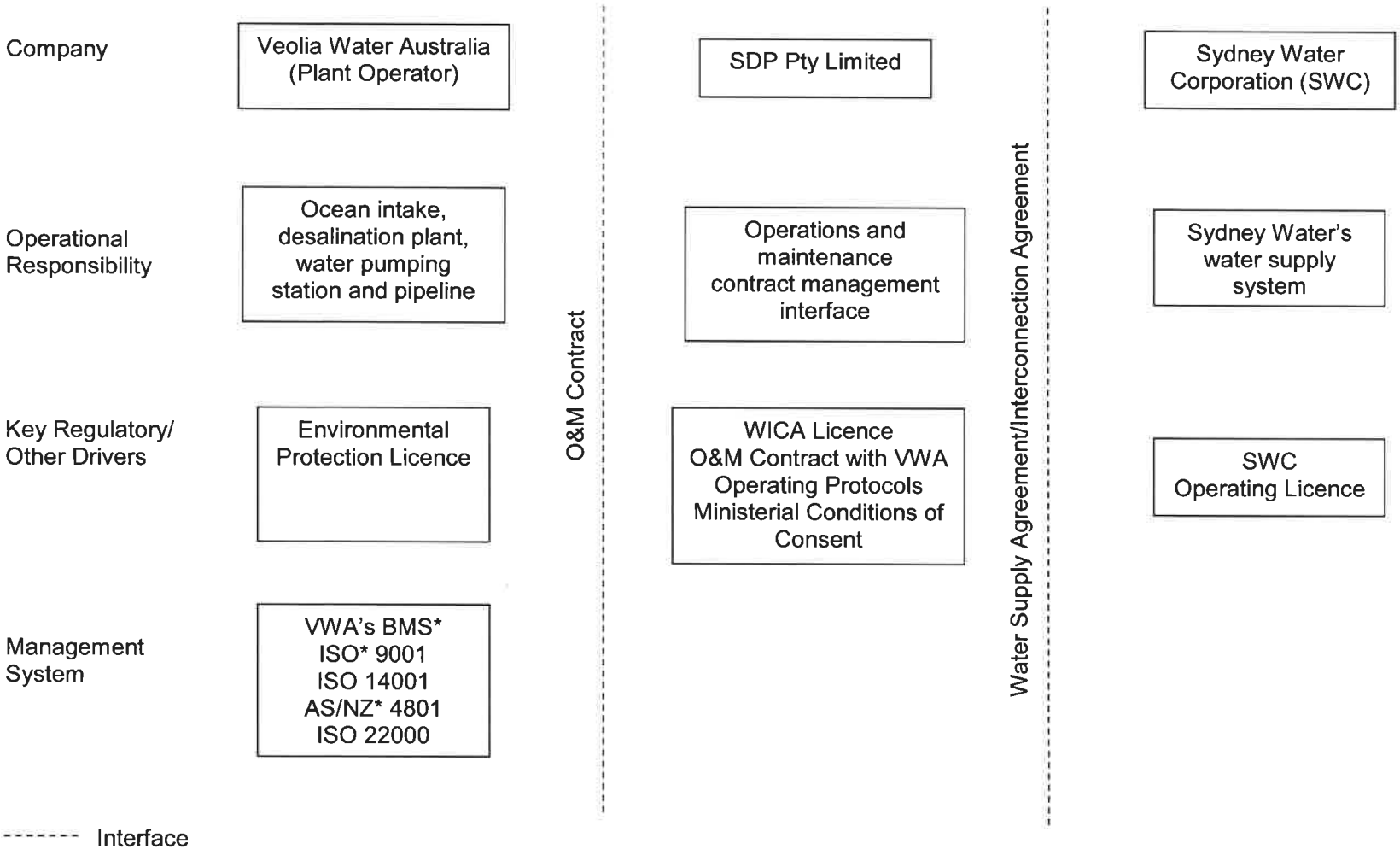


**Figure 3: Desalination processes and business structure**

# 3 Overview of the desalination plant and scheme

## 3.1 Scheme description

SDP is responsible for the production of drinking water from the desalination plant, and pumping of this water into Sydney Water's distribution system via the pipeline.

Figure 4 below shows the location of the desalination plant and pipeline. There are no off takes from the pipeline until its connection to the City Tunnel at Erskineville for distribution into the Potts Hill system.

The desalination plant will supply an average of 250 million litres per day of drinking water, which represents about 15% of the total supply for Sydney.

The plant commenced operation in 2010 and is powered100% by renewable energy. Water is delivered into Sydney Water's system in compliance with the guideline values in the Australian Drinking Water Guidelines.

The plant was shut down on 1 July 2012 to accord with SDP's regulatory and licensing regime. The plant will not be restarted as long as available water storage:

- is equal to or greater than 70%, and has not been less than 70% since it was last equal to or greater than 80%; or
- is equal to or greater than 80%.


**Figure 4: Schematic of desalination plant delivery pipeline to Erskineville**

### 3.2 Energy use

The plant's energy use is 100% offset by renewable energy, through the use of energy and LGCs supplied under long term contracts with Infigen Pty Ltd and one of their subsidiaries, Renewable Power Ventures.

### 3.3 Key processes

The key processes at the desalination plant include:

- Intake screening – drum screens to remove debris, seaweed and other large size marine organisms. The filtered seawater is then pumped to the next step in the filtration process. Pre-treatment to remove fine particles, which could affect the reverse osmosis membranes.
- Cartridge filters to protect the reverse osmosis membranes.
- Reverse osmosis membranes – to produce ultra pure desalinated water
- Remineralisation to chemically balance the water to match conventional water sourced from dams.
- Chlorine disinfection.
- Chloramination to maintain an effective disinfection residual to protect against accidental recontamination and to control bacterial regrowth in the distribution system.
- Fluoridation as legislated, for improved dental health.
- Pumping to deliver the water into the City Tunnel at Erskineville and then into the wider Sydney Water supply system.

An overview of key processes and critical control points are illustrated in Figure 5. Detailed process flow diagrams and critical control points are obtained from VWA's Integrated Business Management System (IBMS).

Treatment processes incorporate 24 hour online monitoring and automatic shutdowns that would prevent the supply of drinking water to customers in the event that the water produced did not meet the specifications. The water quality specifications in the contract with VWA meet (or exceed) the requirements of the Australian Drinking Water Guidelines. Further details are described in the Water Supply Agreement with Sydney Water and the operating protocol between SDP, Sydney Water and VWA.

Rigorous safety barriers (see section 3.6 critical control points) are in place to ensure a high quality of water, from the Tasman Sea 'catchment' to the plant, and the delivery point via pipeline.

Sydney Water, SDP and VWA Supervisory Control and Data Acquisition (SCADA) systems continuously monitor system operation. Key control points at the desalination plant are linked via SCADA with Sydney Water's control system to ensure continuous online 24 hour monitoring from catchment to tap.

Comprehensive monitoring plans are in place as part of the Operations and Maintenance Contract and VWA's IBMS. An operating protocol between Sydney Water, SDP and VWA is in place to manage any operational events and incidents, including appropriate stakeholder notifications. In addition, SDP has an Incident Management Plan under the Water Supply Agreement. Operational procedures and process control are further described in Appendix 1 element 4.

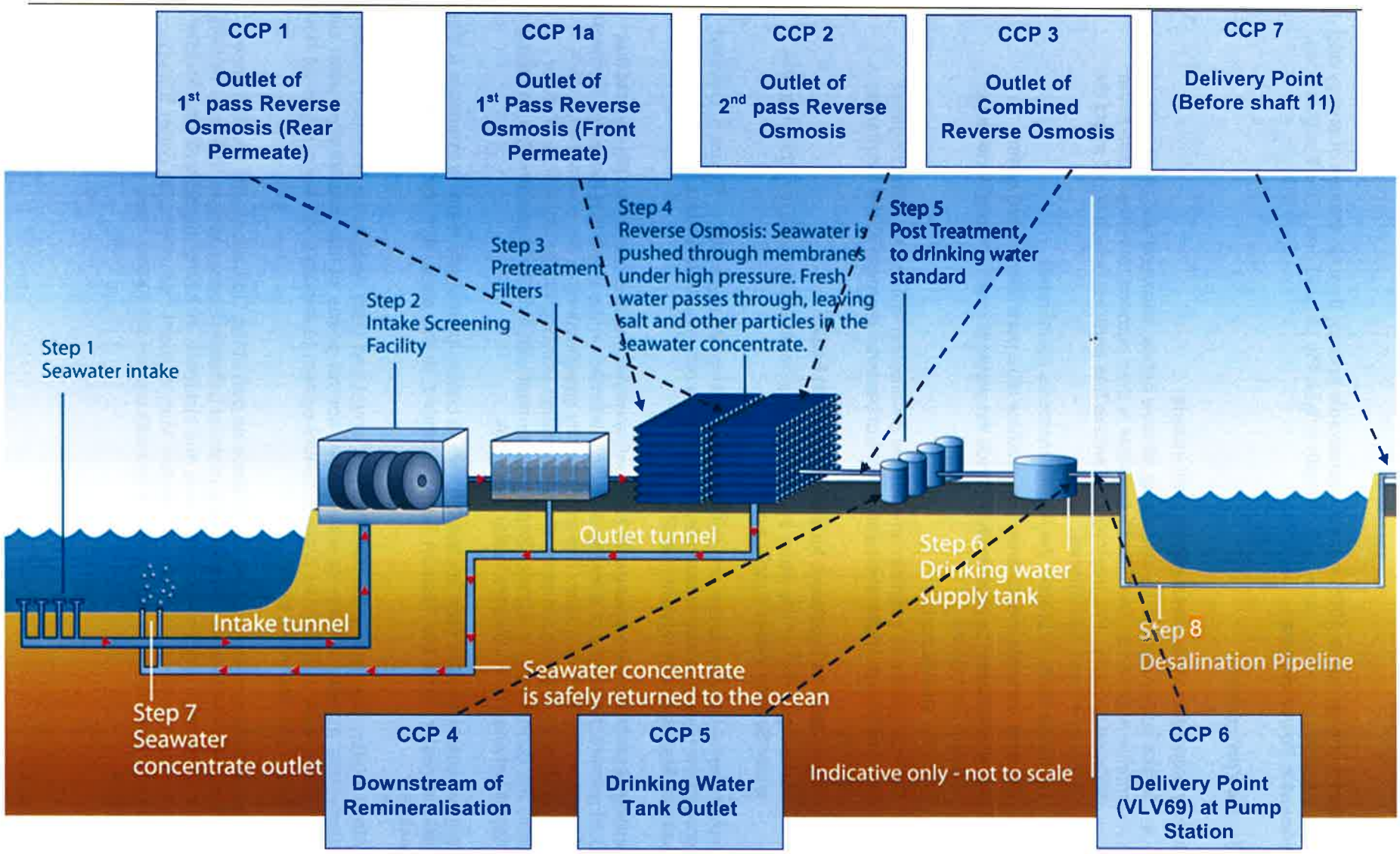


**Figure 5: Key steps of the desalination plant process including critical control points (CCP)**

### 3.4 Operating Protocols

SDP, Sydney Water and VWA have developed an operating protocol, attached to the Water Supply Agreement. The operating protocol describes the operational interface arrangement and key procedures, including:

- Water supply system.
- Storage and distribution.
- Water quality
- Operational responsibility.
- Management of emergency situations.
- Communication including primary point of contact and communication contact levels.
- Planned maintenance / shutdown protocols.
- Operational change request.

The protocol clearly defines the roles and responsibilities that each party and staff member undertakes regarding the operation of the Sydney desalination plant.

VWA has incident and emergency management plans in place and these are incorporated into the company's integrated business management system (IBMS).

### 3.5 Risk assessment

SDP has a risk register and reports risk status into a committee of its Board. VWA has a corporate risk management framework and risk register as part of the IBMS. Operational risk management is delegated to VWA as operator and this is reflected in the respective risk registers for each business.

VWA's corporate risk management framework conforms to AS/NZS ISO 31000. The framework is based on a systematic approach to risk management which ensures comprehensive analysis of all aspects of the operation. VWA has a site-specific risk assessment for the Sydney Desalination Plant, pump station and the pipeline which is reviewed annually.

The site-specific risk assessment covers key characteristics of the water supply system from seawater intake to the delivery point. Hazards were identified and assessed in this process. Controls have been implemented where appropriate. Critical control points are described in section 3.6.

VWA use a multiple barrier approach to maintain and improve drinking water quality.

Other references to risk assessment can be found in Appendix 1 element 2.

### 3.6 Critical control points

A critical control point is defined as an activity, procedure or process at which a control can be applied, which is essential to prevent a hazard or reduce it to an acceptable level.

Critical control points have been identified for those potential hazards that represent a significant risk and require elimination or reduction to assure supply of safe drinking water. The critical control points are shown in Figure 5.

A critical control point has several operational requirements, including:

- operational parameters that can be measured and for which critical limits can be set to define the operational effectiveness of the activity
- operational parameters that can be monitored frequently enough to reveal any exceptions in a timely manner
- procedures for corrective action that can be implemented in response to deviation from critical limits.

Critical limits are performance criteria that separate acceptability from unacceptability in relation to hazard control and water safety. Deviation from critical limits indicates loss of control of the process or activity and should be regarded as representing a potentially unacceptable health risk. Such events result in immediate notification to IPART and NSW Health where appropriate. Incident response plans and operational protocols are in place to manage water quality events. These are contained in VWA's Incident and Emergency Manual and SDP's Incident Management Plan under the Water Supply Agreement.

A summary table of critical control points for the desalination plant is shown in Appendix 2. Documentation and procedures for critical control points are further described in Appendix 1 element 3.

### 3.7 Drinking water quality

VWA monitors the water quality at the seawater intake, throughout the plant and at the plant delivery point and reports on the results to SDP monthly and as required. Sydney Water monitors water quality at shaft 11 delivery point online via its Systems Operating Centre. Systems and protocols are in place to ensure that the Australian Drinking Water Guidelines are met at all times. This includes communication between Sydney Water, SDP, VWA and NSW Health.

SDP and VWA conduct a wide range of monitoring for this scheme. This is further described in Appendix 1 element 5. In routine operations, VWA will provide monthly reports to SDP. The drinking water quality requirements of the contract for the desalination plant are shown in Table 2.

**Table 2: Drinking water specifications summary table**

| Sydney Desalination Plant | | | | |
|---|---|---|---|---|
| **Drinking Water Quality (ex Drinking Water Storage Tank)** | **Unit** | **Target Values (95 %ile)** | **Warranted Values (100 %ile)** | **ADWG Guidelines** |
| Turbidity | NTU | <0.3 | <0.5 | 5 |
| True colour | TCU | <5 | <10 | 15 |
| pH (Maximum deviation from setpoint) | - | ±0.3 of setpoint | Min. 7.3 Max. 8.3 | Min 6.5 Max 8.5 |
| TDS | mg/L | <115 | Max. 140 | 500 |
| Chloride | mg/L | <35 | Max. 45 | 250 |
| Boron | mg/L | <1.0 | Max. 2.0 | 4 |
| Bromide | mg/L | <0.30 | Max. 0.40 | No requirement |
| Chlorine (maximum deviation from setpoint) | mg/L | ±0.25 of Setpoint initial value 0.7 | ±0.25 of Setpoint (between 0.25 | 3# |

| Sydney Desalination Plant | | | | |
|---|---|---|---|---|
| **Drinking Water Quality (ex Drinking Water Storage Tank)** | **Unit** | **Target Values (95 %ile)** | **Warranted Values (100 %ile)** | **ADWG Guidelines** |
| | | | and 1.5mg/L) | |
| Fluoride | mg/L | 0.9 – 1.1 | 0.8-1.2 | 1.5 |
| Iron | mg/L | <0.2 | ≤0.2 | 0.3 |
| Chlorine : Ammonia (maximum deviation from target) | | ±0.3 of setpoint of between 2:1 and 8:1 | ±0.3 of setpoint initial value 3:1 | No requirement |
| Taste and odour | | Not objectionable to Taste & Odour panel | Not objectionable | Acceptable to most people |
| Total coliforms | /100mL | 0 | 0 | 0^ |
| E. Coli | /100mL | 0 | 0 | 0* |
| $(Cl + 2\ SO_4)/HCO_3$( Larson's index) | mmol/ mmol | <1 | <1.5 | No requirement |
| Alkalinity (as $CaCO_3$) | mg/L | >40 | Min. 35 Max. 50 | No requirement |
| Calcium carbonate precipitation potential (CCPP) (as $CaCO_3$) | mg/L | -3 to -6 | Min. -8 Max. -1 | No requirement |
| All other parameters must comply with the health values of the Australian Drinking Water Guidelines. | | | | |

**Notes:**

* For samples representative of the quality supplied to consumers, performance can be regarded as satisfactory if over the preceding 12 months:
1. At least the minimum number of routine samples has been tested for E.coli (or thermotolerant);
2. At least 98% of scheduled samples (as distinct from repeat or special purpose samples) contain no E.coli (or thermotolerant coliforms).

\# Chloraminated supply

^ 'The relative abundance of coliforms makes them useful in monitoring the efficiency of water treatment and disinfection processes. They should generally not be detected in water sampled immediately after disinfection'.

## 4 Management Systems

The Operations and Maintenance contractor, VWA has developed and maintains the Integrated Business Management System (IBMS) which is certified to ISO 9001 (Quality), ISO 14001 (Environment), ISO22000 (Food Safety), OHSAS18001(OHS) and AS/NZ 4801 (OHS).

The IBMS is a combination of business processes, objectives, culture, products and services / outputs, documents, actions, requirements / inputs, risk and controls, knowledge and responsibilities.

By following this system and processes, both companies can facilitate:

- proper accountability, probity and transparency
- compliance with contractual and other performance requirements
- compliance with relevant legislation and regulations
- identification, assessment and management of risks

- employee understanding of expectations and standards as relevant to their role, site or contract
- identification and implementation of best practice in key aspects of its business
- planning, documentation and monitoring of business performance
- setting of goals, objectives and targets to continually improve business performance
- capturing, recording and communicating business knowledge.

Key elements such as management review, document control, training and auditing are also combined into a holistic approach to business management.

VWA's management systems adhere to the principles of ISO 9001 which include the requirements of:

- Management Support – through management commitment to the quality systems; authorisation of the quality policies; business planning commitment; responsibility, authority and communication; and management review
- Document Control – including requirements of registering documents; documentation protocols; regular document review and use of document templates; and records management.
- Resource Management – including provision of resources; appropriate management of human resources (including training and assessment); provision of appropriate infrastructure and work environment.
- Product Realisation – management of customers and customer enquiries; purchasing processes; control of monitoring and measurement devices.
- Measurement, Analysis and Improvement – through management of non-conforming products; analysis of data, management review and improvement processes.

VWA's IBMS, and associated documents, incorporates the business management of the plant from the ocean intake, through production and delivery to the operational boundary.

The IBMS is regularly reviewed and audited. Internal, collaborative and external audits are carried out on the plant. The results and findings from these audits are reported by VWA to SDP.

## 5 Stakeholder Engagement

The key stakeholders for the desalination plant include:

- SDP
- VWA
- Sydney Water
- NSW Health
- Office of Environment and Heritage (OEH)
- IPART
- The NSW Department of Planning and Environment
- Consumers
- Local Community

SDP liaises regularly with IPART, Sydney Water and Veolia on a range of operational and regulatory matters. SDP liaises with NSW Health as required, in relation to the quality of water supplied from the desalination plant.

SDP and VWA liaise with the Department of Planning and Environment in regards to any remaining requirements of the Planning Minister's Conditions of Approval as required.

When the plant is not operational, liaison with consumers and the local community is limited.

The plant operator, VWA, liaises with the OEH regarding compliance with the Environment Protection Licence.

## 6 Continuous improvement and review

Continuous improvement and review of overall processes and this document is currently facilitated through:

- Regular meetings between SDP management and relevant regulatory agencies.
- Regular operational and contractual meetings between SDP and VWA.
- Management review of business systems.
- Quality system, O&M Contract and regulatory audits.
- Incident and issue management systems

This Water Quality Plan will be reviewed regularly.

## 7 Public reporting

SDP provides operational details about the plant including information on operating hours, volume of desalinated water produced and equivalent emissions of carbon dioxide associated with the operation on its website http://sydneydesal.com.au/.

## 8 Definitions

| Term | Definition |
|---|---|
| **AS/NZ** | Australian and New Zealand Standard. |
| **IBMS** | Veolia Water's Integrated Business Management System. |
| **Customer** | Defined as 'Sydney Water' – being SDPs only current 'customer. |
| **Consumer** | Defined as the public receiving the water at the 'tap' from Sydney Water (consistent with the SWC Operating Licence). |
| **DWPS** | Drinking Water Pumping Station |
| **EPL** | Environment Protection Licence at the Plant. |
| **ISO** | International Standards Organisation. |
| **Operational Monitoring** | Sampling and analysis that occurs for the purpose of producing the desalinised water that is sold to the customer (monitoring of the plant output) |
| **SDP** | Sydney Desalination Plant Pty Limited. |
| **Verification Monitoring** | The sampling and analysis that occurs in the distribution system |

| Term | Definition |
|---|---|
| | for the purpose of ensuring quality water is received by consumers at the tap. |
| **VWA** | Veolia Water Australia |
| **WSA** | Water Supply Agreement. |