SYDNEY DESALINATION PLANT

Water Quality Plan

25 October 2023

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Document Information

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Authorisation

	Title	**Name**	**Date**
Owner	General Manager Operations	M. Blaikie	25/10/2023
Reviewer	Chief Executive Officer	Philip Narezzi	25/10/2023

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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 A 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.

1. Background

1.1 Metropolitan Water Plan

The NSW Government has developed and released (in August 2022) the Greater Sydney Water Strategy (GSWS) which charts a direction for delivering sustainable and resilient water services to Greater Sydney for the next 20 to 40 years.

The strategy sets out priorities and actions for the delivery of water, wastewater, recycled water and stormwater services into the future to service a growing Greater Sydney population, including the Illawarra and Blue Mountains. It considers that there is a deficit between yield and demand in Greater Sydney requiring better utilisation of existing assets, and furthermore, additional capacity added in the near term

Highlights of the 2022 Plan include:

- building resilience to drought and a changing climate, safeguarding Greater Sydney even in times of prolonged drought and extreme weather events such as floods,
- supporting the economy and jobs, put water at the heart of the community
- implementing water conservation measures such as improved water efficiency, leakage management and reuse programs;
- optimisation and increased utilisation of existing assets
- investment in additional water supply in the next 5-10 years ;
- investment in treated re-use programs for watering trees, sports fields, cooling and greening the city, and industrial use; and
- Smarter use of stormwater with integration into land use planning.

One of the key directions identified in the GSWS is to increase the utilisation of the Sydney Desalination Plant (the Plant) by changing its operation from drought response to flexible full-time operation. This seeks to provide flexibility or optionality for Sydney Water in meeting the objectives in the GSWS and 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 water needs. The Plant's capacity can be doubled to produce approximately 30% of Sydney's water supply, in the future.

1.2 Operating environment

1.2.1 Sydney Desalination Plant Pty Ltd (SDP)

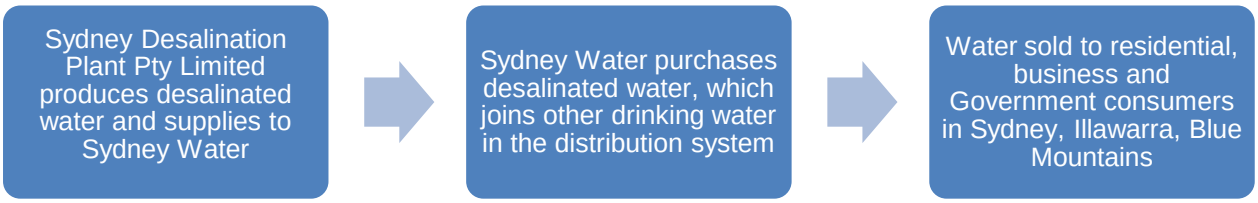
Sydney Desalination Plant Pty Ltd (SDP) holds the long term lease of Sydney Desalination Plant, the Drinking Water Pump Station (DWPS) and the 18km Kurnell to Erskineville pipeline (Pipeline). Drinking water from SDP is added into Sydney Water's distribution system at Erskineville shaft 11.

SDP is jointly owned by the Ontario Teachers' Pension Plan Board (60%) and the Utilities Trust of Australia (40%).

The Plant is primarily regulated via the Water Industry Competition Act 2006 (WICA) and supporting regulations. 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.

Figure 1.1: Current structure of retail arrangements



SDP's Retail Supplier's Licence permits SDP to sell drinking water from the Plant. Currently, its only customer is Sydney Water (see Figure 1.1). Drinking water from the plant mixes in the distribution system with drinking water that originates in Sydney Water's other sources such as dams. Sydney Water sells drinking water to homes and businesses in Sydney, the Illawarra and the Blue Mountains (Figure 1.1).

SDP's Network Operator's Licence conditions include that SDP must comply with Annual Production Requests issued by Sydney Water, and use best endeavours to comply with any other request made by the Sydney Water.

SDP and Sydney Water have entered into a Water Supply Agreement for Sydney Water to purchase drinking water from SDP.

1.2.2 Veolia Water Australia (VWA)

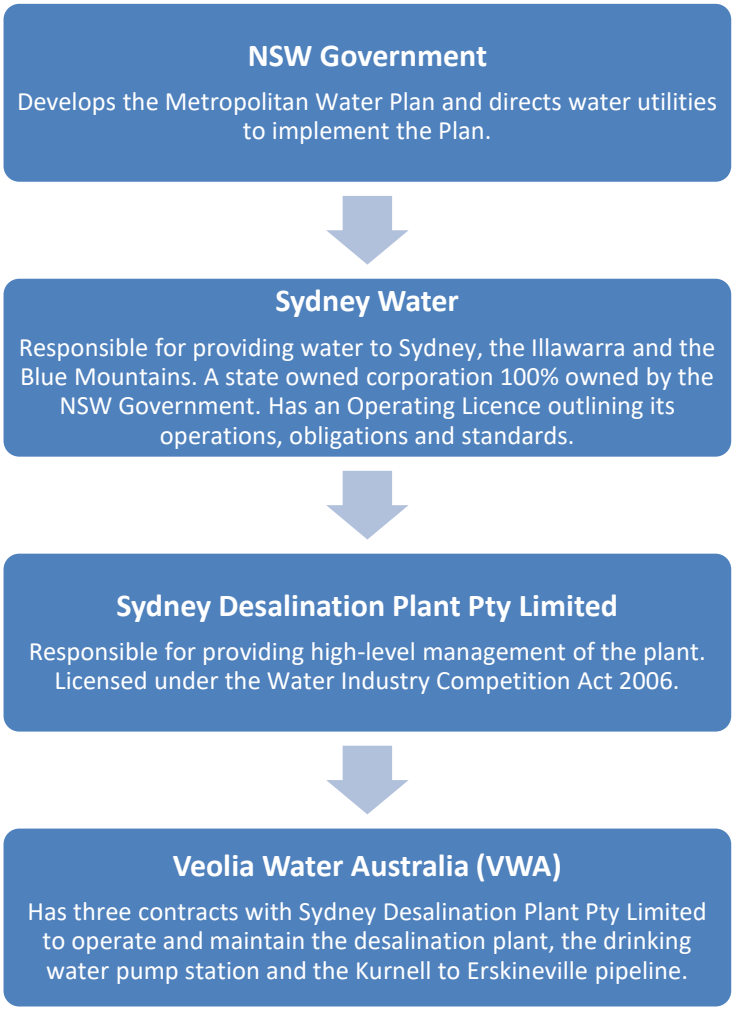
SDP has entered into three long-term contracts with Veolia Water Australia (VWA) for the operation and maintenance of the Plant, DWPS as well as the Kurnell to Erskineville Pipeline.

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.

1.2.3 Institutional arrangements

Institutional arrangements for SDP are shown in Figure 1.2.

Figure 1.2: Institutional arrangements for the Sydney Desalination Plant Pty Limited



1.2.4 Operational Arrangements

Figure 1.3 shows the process and business structure map for SDP and the Plant operational arrangements. It indicates the company boundaries, physical responsibilities, drivers, management systems and interfaces.

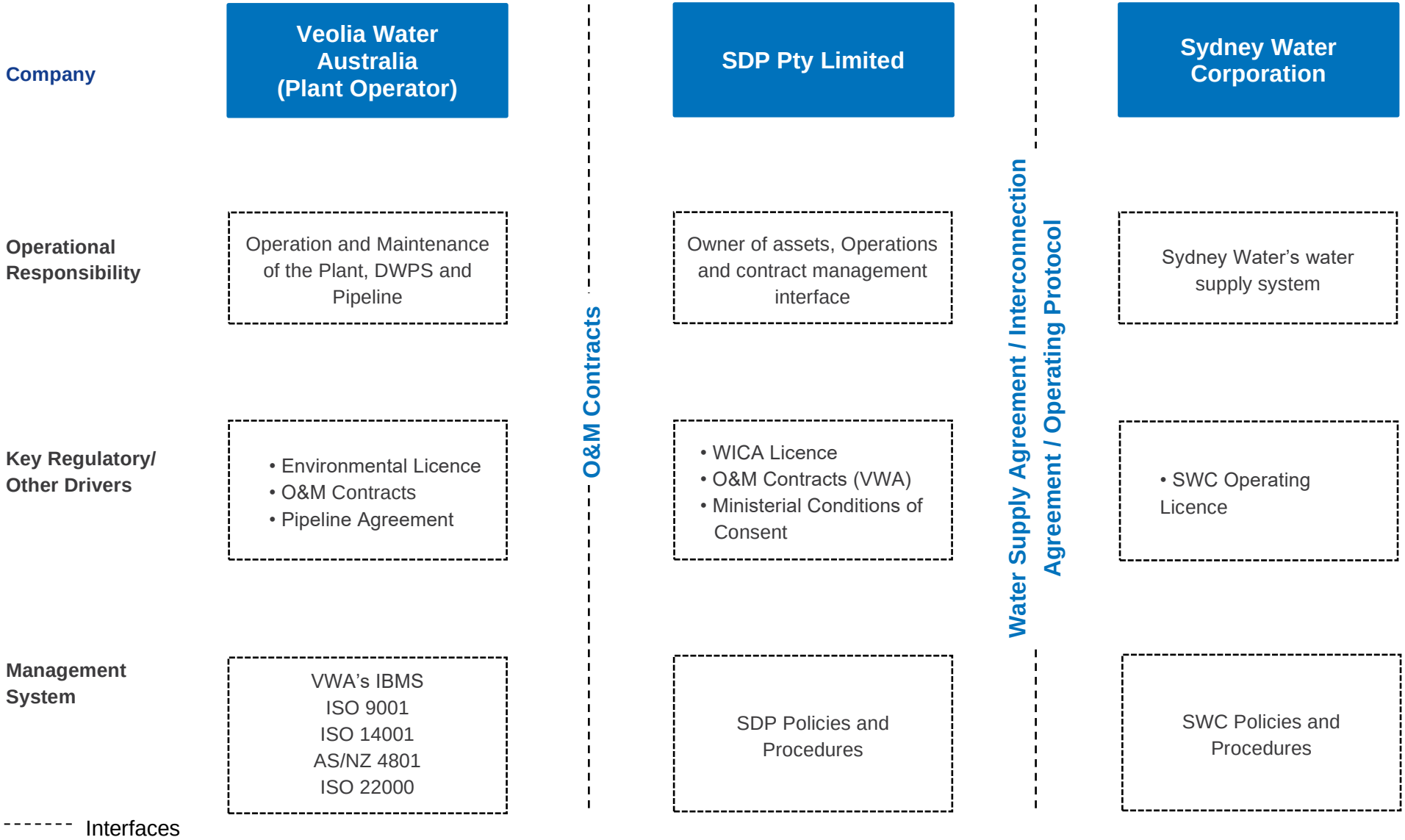
The operational boundary between SDP and the customer (Sydney Water Corporation) is at the last valve before shaft 11 where the pipeline enters the city tunnel (asset # SNSV1/VLV01).

This Infrastructure Operating Plan sets out SDP's strategies to ensure that WICA and regulation requirements are met, including:

- The operation and maintenance of the infrastructure, including particulars as to the life span of the infrastructure and the arrangements for the renewal of the infrastructure, and
- The continued safe and reliable performance of the infrastructure, and
- The continuity of water supply, and
- The maintenance, monitoring and reporting of standards of service under the three contracts with VWA for the Plant, the Pipeline and the DWPS.

This plan shall be reviewed on a regular basis according to the requirements of the Water Industry Competition Licence No. 10_010.

Figure 1.3: Desalination business structure and management processes



2. Overview of the Desalination plant and scheme

2.1 Scheme description

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

The Plant site is comprised of Lot 2 in DP 1077972, Lot 1 in DP 1088703, Kurnell, the offshore discharge and inlet structures located in the Tasman Sea, associated inlet and outlet tunnels, and the area of the Pipeline. Figure 2.1 shows the location of the Plant and Pipeline. There are no off-takes from the Pipeline until its connection to the City Tunnel at Erskineville and distribution into the Potts Hill system.

The Plant can 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 powered by 100% renewable energy. Water is delivered from the Plant into Sydney Water's system in compliance with the guideline values in the Australian Drinking Water Guidelines. SDP supplies water to Sydney Water under a 50-year Water Supply Agreement, the term of which concludes in 2062.

The Plant was placed into water security mode (mothball) in June 2012 and this continued until January 2019.

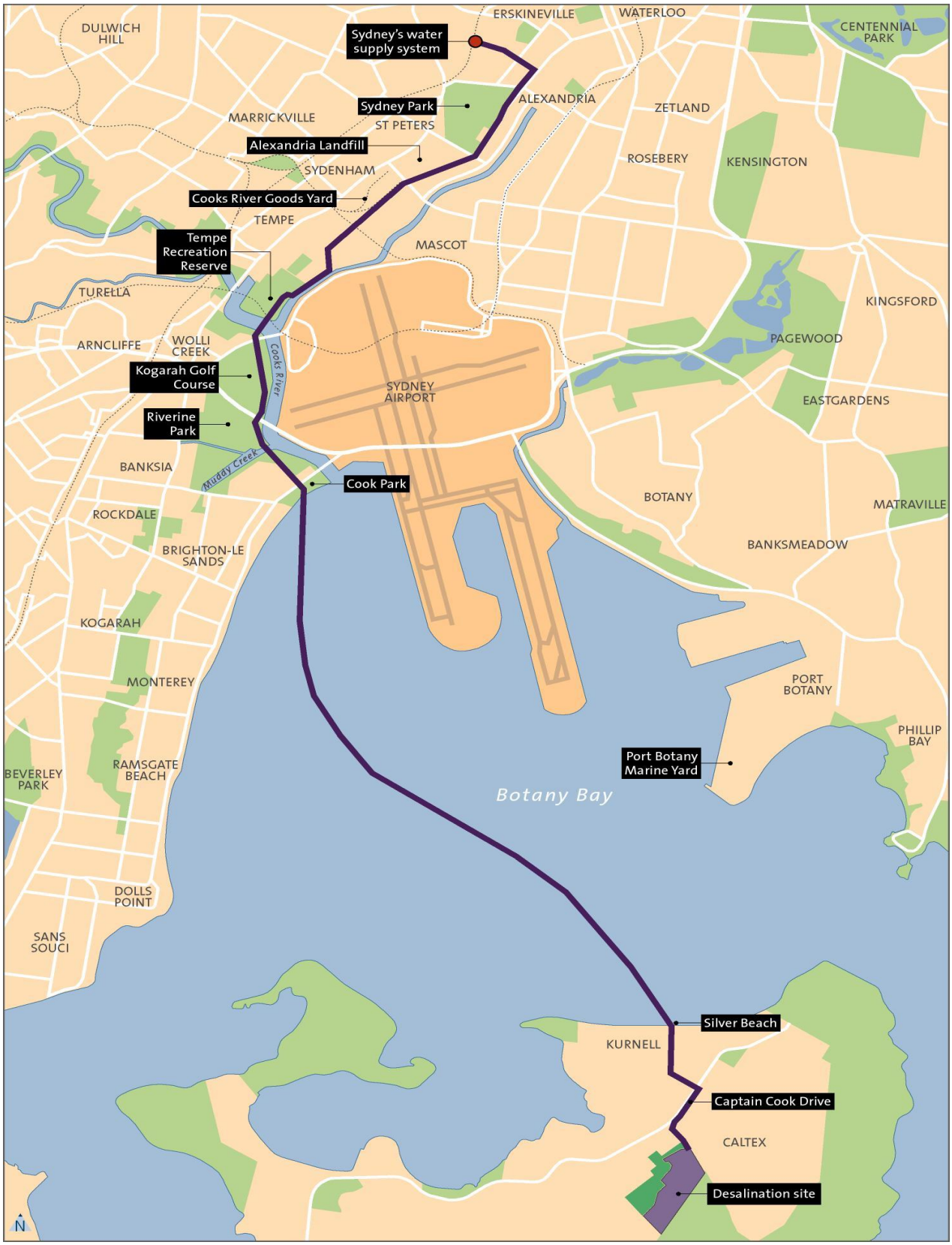
On 27 January 2019 Water NSW notified SDP that the Available Storages fell below 60% and consequently Sydney Water confirmed with SDP that, under the Operating Licence conditions at the time, a Restart Trigger had been met and the period to restart the Plant had commenced. SDP was ready and committed to respond, and achieved successful restart of its water infrastructure and supply at or above an annual average of 250 Mega-litres of water per day (ML/day).

Following a period of heavy rainfall in February 2020, the Available Storages of Sydney rose from approximately 41% to above 75% within a short period. On 27 March 2020 Sydney Water and SDP entered an agreement whereby SDP remained operational to mitigate the effects of bushfires, flooding, and damaging storms on water quality, as well as to support major system maintenance. This arrangement continued until 30 June 2023, to ensure Public Health was maintained.

From 1 July 2023, the Plant has formally shifted to flexible full-time operation with production requests issued by Sydney Water depending on network needs. Under SDP's revised Network Operator's licence, SDP must meet flow requests as specified by Sydney Water in accordance with the operational protocol that seek to achieve the following:

1. To maximise yield contribution of the Sydney Desalination Plant to Sydney's water supply and slow the depletion rate during drought
2. Operate SDP and other water filtration plants to reduce the risk of dam spill where practical
3. Allow Sydney Water and SDP flexibility to respond to system shocks, outages and maintenance in accordance with good operating practice

Figure 2.1: Schematic of the Plant and delivery Pipeline to Erskineville



2.2 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.

2.3 Key processes

The key processes at the Plant include:

- Intake screening – drum screens to remove debris, seaweed and other marine organisms greater than 3mm. The filtered seawater is then pumped to the next step in the filtration process.
- Pre-treatment media filtration to remove fine particles, which could affect the reverse osmosis membranes.
- Cartridge filters to protect the reverse osmosis membranes.
- Reverse osmosis membrane treatment to remove dissolved salts and produce ultra-pure desalinated water.
- Remineralisation to chemically balance the water, protect the distribution system assets and provide comparable water quality to conventional filtered surface water sources.
- Chlorine disinfection as a barrier against bacterial contamination.
- 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 2.2. Detailed process flow diagrams and critical control points are obtained from VWA's Integrated Business Management System (IBMS). A generalised flow diagram of the Plant is presented in Appendix C.

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 are in place to ensure a high quality of water, from the Tasman Sea 'catchment' to the plant, and the delivery point via pipeline such as the setting of critical control points (see Section 2.6).

SDP and VWA's Supervisory Control and Data Acquisition (SCADA) systems continuously monitor system operation. Key control points at the desalination plant, DWPS and delivery point at Shaft 11 are linked via SCADA and 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 A element 4.

2.4 Operating Protocols

SDP and Sydney Water 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 requests and the water order process including agreement of Annual Production Requests and other production requests between Sydney Water and SDP.

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

SDP, Sydney Water and VWA have incident and emergency management procedures and plans in place which include integration of each other party into emergency response..

2.5 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, with the oversight of SDP, and this is reflected in the respective risk registers for each business. SDP also included key strategic operational risks in its risk register.

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.

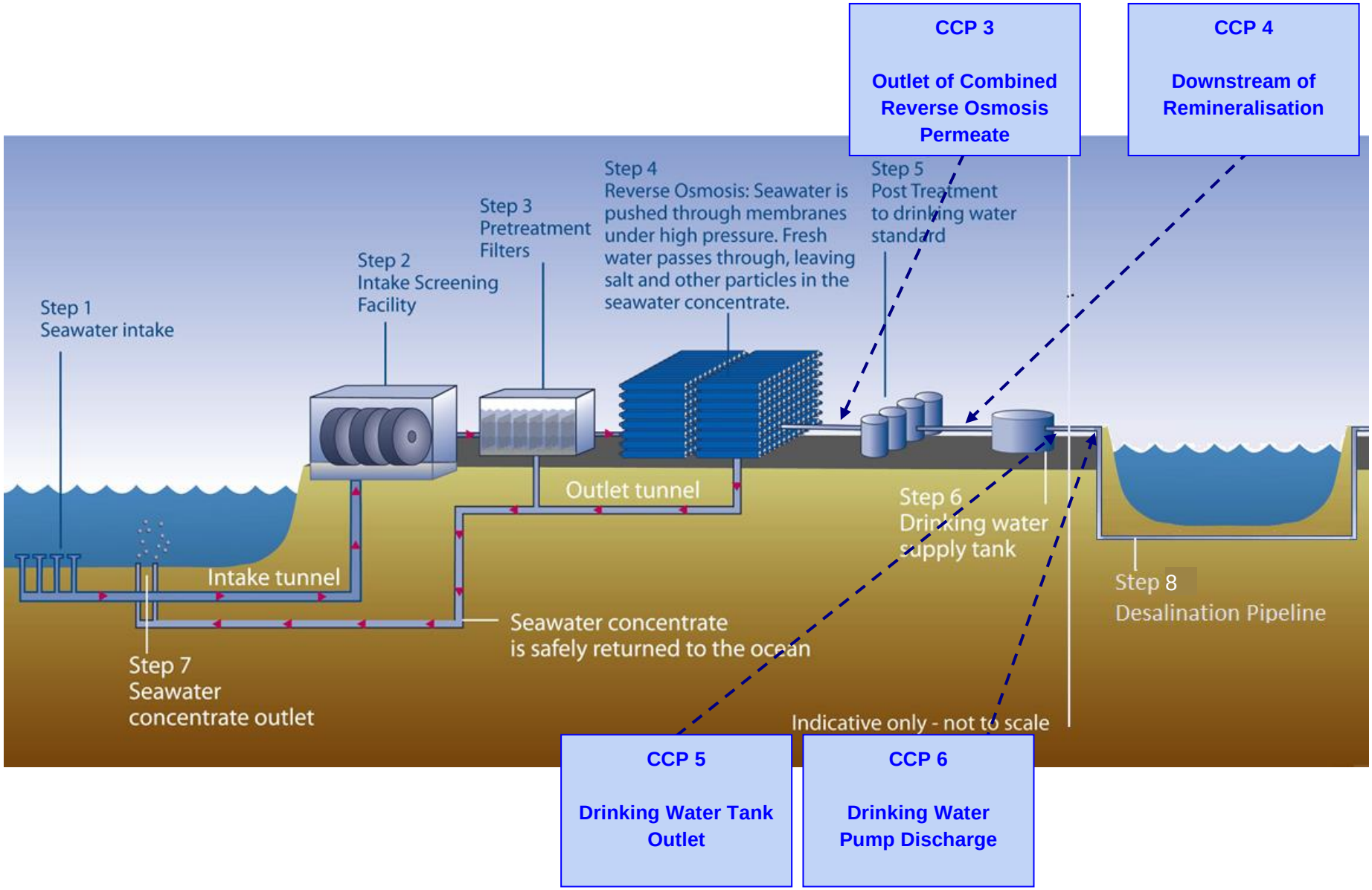
The site-specific risk assessment covers key characteristics of the water supply system from seawater intake to the delivery point. Hazards were identified and assessed in this process. Controls have been implemented where appropriate. Critical control points are described in Section 2.6.

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

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

A conceptual flow diagram of the system has been produced in consultation with VWA and is attached at Appendix C

Figure 2.2: Key steps of the desalination plant process including critical control points (CCPs)



2.6 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 2.2.

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 B. Documentation and procedures for critical control points are further described in Appendix A element 3.

2.7 Drinking water quality

VWA monitors the water quality at the seawater intake, throughout the plant, at the DWPS discharge and at the delivery point into the network at Shaft 11and reports on the results to SDP monthly and as required. SDP also has access to the monitoring systems for additional oversight and verification. Sydney Water monitors water quality at the Plant and 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 A element 5. During routine operations, VWA will provide monthly reports to SDP and SDP in turn provides reports to SWC. The drinking water quality requirements of the contract for the desalination plant are shown in Table 2.1.

Table 2.1: Drinking water specifications summary table

Drinking Water Quality	Unit	Target Values (95 %ile)	Warranted Values (100 %ile)	ADWG Guidelines (Health ‡)
Turbidity	NTU	<0.3	<0.5	5
True colour	TCU	<5	<10	15
pH	-	±0.3 of set-point	7.3 - 8.3	6.5 - 8.5
TDS	mg/L	<115	Max. 140	600
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	mg/L	±0.25 of set-point (initial value 0.7)	±0.25 of set-point (0.25 - 1.5)	3#
Fluoride	mg/L	0.9 – 1.1	0.8-1.2	1.5‡
Iron	mg/L	<0.2	≤0.2	0.3
Chlorine : Ammonia		±0.3 of set-point of (2:1 - 8:1)	±0.3 of set-point (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	mg/L as CaCO3	>40	Min. 35 Max. 50	No requirement
Calcium carbonate precipitation potential (CCPP)	mg/L as CaCO3	-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:

* Performance can be regarded as satisfactory if over the preceding 12 months at least the minimum number of routine samples has been tested for E.coli and at least 98% of scheduled samples (as distinct from repeat or special purpose samples) contain no E.coli.

\# Chloraminated supply (monochloramine)

^ 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'.

‡ Health related guidelines

3. 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.

4. Stakeholder Engagement

The key stakeholders for the Plant and SDP include:

- SDP
- VWA
- Sydney Water
- NSW Health
- Office of Environment and Heritage (OEH)
- NSW Environment Protection Authority (EPA)
- IPART
- NSW Treasury
- The NSW Department of Planning and Environment
- Water NSW
- Consumers
- Local Community
- Ausgrid
- Iberdrola Australia (formerly Infigen Energy)
- The NSW Department of Home Affairs

SDP liaises regularly with IPART, Sydney Water, NSW Treasury and VWA 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 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, however contact information is available on the SDP website.

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

5. 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.
- Regular operational and contractual meetings between SDP and Sydney Water.
- 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.

6. 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/.

7. Definitions

Term Definition

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

Appendix A

Summary of Compliance with Australia Drinking Water Guidelines

Commercial in Confidence

Appendix B

Critical Control Points Table

Appendix C

Generalised Flow Diagram