Annual Environmental Performance Report 2022-23

Incorporating our Special Objectives Statement

Sydney WATER

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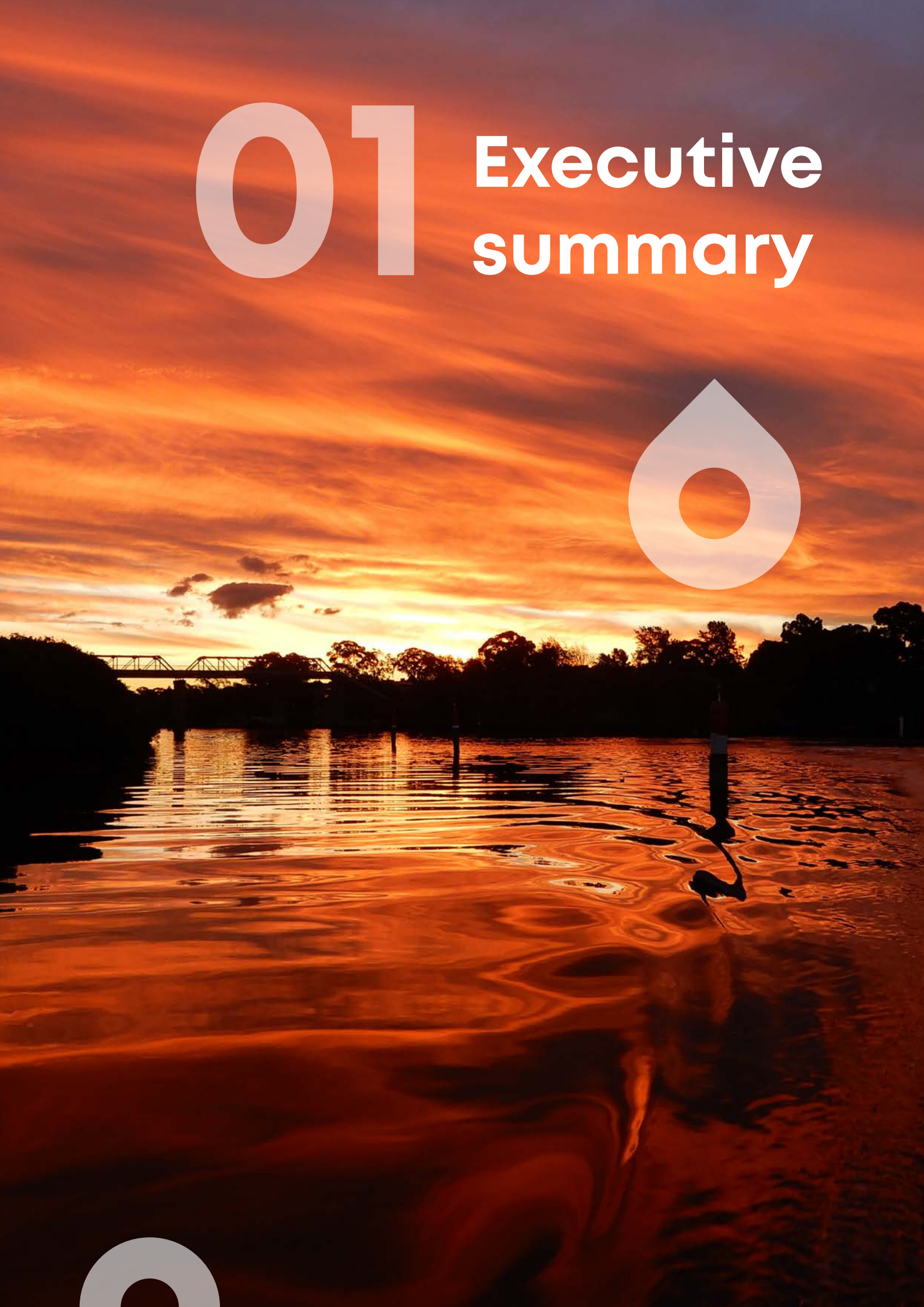


Sydney Water has prepared this Annual Environmental Performance Report 2022-23 which incorporates our statement on the implementation of our special objectives, as required by the Sydney Water Act 1994 (the Act), and our Environmental Indicators Performance Report 2022-23 (Appendix A).

This report summarises how we have addressed the special objectives identified in Section 22 (6) of the Act between 1 July 2022 and 30 June 2023 and provides a holistic statement focused on wastewater discharges and environmental performance. In addition to this report, Sydney Water publishes comprehensive performance reports on our website that demonstrate our implementation of, and performance against, our special objectives.

Sydney Water integrates environmental and public health management into its business decision-making and operational activities. The special objectives are implemented within the business holistically, rather than as separate considerations. This approach ensures social, economic, public health and environmental considerations are balanced and part of Sydney Water's core functions. We have several management systems, plans and frameworks to support and address the special objectives.

Table E-1 highlights key points from the report which demonstrate positive, negative or stable trends/outcomes. Overall, the trend is positive, and we are committed to continually improve our environmental performance through the implementation of our management system frameworks and improvement programs. The report also provides details on key initiatives to improve our performance, most notably the performance of our wastewater systems. These are summarised in Table E-2 against the related environmental issue.

Table E-1: AN OVERVIEW OF ENVIRONMENTAL ISSUES AND TRENDS/ OUTCOMES

SYDNEY WATER ACT 1994 MEANS	Environmental Issue/ Indicator	Key measures from 2022-23 report	Recent performance			
			2019-20	2020-21	2021-22	2022-23
REDUCE IMPACT OF DISCHARGES TO THE ENVIRONMENT	Environmental Performance Indicators	Environmental Impact Index	n/a	●	●	●
		Ecological footprint	n/a	●	●	●
		Net Zero Emissions - Carbon Footprint (Scope1,2 and 3)	n/a	●	●	●
	Wastewater treatment discharges	Maintain waterway flow	●	●	●	●
		Total Nitrogen load (estimated) from inland plants[1]	●	●	●	●
		Total phosphorus load estimated) from inland plants[2]	●	●	●	●
		Oil & grease loads from Deep Ocean Outfall facilities	●	●	●	●
		Total suspended solids loads at Deep Ocean Outfall facilities	●	●	●	●

EFFICIENT AND SUSTAINABLE RESOURCE USE	Wastewater network discharges	Number of Beachwatch sites impacted by wastewater overflows	🔵 🔴 🔴 🔴
		Maintain compliance with dry weather overflow limit condition	🔴 🔴 🔴 🔴
		Total number of wastewater overflow incidents reaching waterways	🔴 🔴 🔴 🔴
		Total number of chokes	● ● ● ●
		Number of chokes / 100 km	🔵 🔵 🔵 🔵
		Frequency of modelled wet weather overflows	🔵 🔴 🔴 🔴
		Wet weather overflow modelled volume	● ● ● ●
	Stormwater network discharges	Silt and rubbish removal volume	● ● ● ●
	Energy use	Grid electricity consumption	🔴 🔵 🔴 🔴
		Renewable energy generation	🔴 🔵 🔴 🔴
		Fuel usage	● ● ● ●
		Gas consumption	● ● ● ●
	Circular Economy and Resource recovery	Biosolids – beneficial reuse	🔵 🔵 🔵 🔵
		Solid waste generation	● ● ● ●
		Solid waste recycled/ reused	● ● ● 🔴
COMMUNITY INVOLVEMENT	Water conservation	Demand on drinking water	● ● ● ●
		Leakage	● ● ● ●
	Community awareness programs	Wastewater campaigns and education programs	● ● ● ●
	Community monitor surveys	Community monitor survey results	● ● ● ●

🔴 Not meeting external or internal targets

🔵 Meeting external or internal target

● No Target established yet

Table E-2: OVERVIEW OF ENVIRONMENTAL ISSUES, TRENDS, OUTCOMES

Environmental issue	Key points from 2022-23 report
Environmental Performance Indicators	We continue to monitor our Environmental Impact Index to track overall progress towards achieving 'thriving, liveable and sustainable cities'. The index score has improved significantly over the last 12 months, reducing to 99.03 in 2022-23 from 148.7 in 2021-22. This improvement was driven by increased preventative maintenance programs and favourable weather conditions. We recognise further improvements are required and we're committed to achieving our target. In 2022-23, our total ecological footprint (EF) from all sources (including direct, indirect, and Scope 1, 2 & 3 sources) was 116,000 ha, representing an approximate 10% increase over the total in 2021-22. The major driver for this increase is the significant increase in capital expenditure between 2021-22 and 2022-23. Other footprint components, such as from bulk water supply from Water NSW has been steady from 2020-21 to 2022-23 but desalinated water supply increased significantly in 2022-23, leading to an increase in the EF (and carbon footprint).
Wastewater treatment discharges	Oil and grease slightly increased in our treated wastewater discharge Malabar WRRF attributed to increasing concentration in the influent. Bondi WRRF and North Head WRRF were stable. Fourteen Beachwatch sites were potentially impacted from wastewater overflows compared to 18 in 2021-22. **Key relevant initiatives:** • In September 2022, Sydney Water commenced a program engaging with numerous food retail businesses within the Bondi catchment to ensure they have a connection agreement with Sydney Water and an approval to discharge commercial trade waste. Trade waste controls will assist in the reduction of oil and grease entering the Bondi wastewater system. • Sydney Water is continuing to conduct programs of work to reduce overflows to Rose Bay Beach and Foreshore Beach. • We are working with the NSW EPA in its review of the regulatory framework for nutrient discharges into the Hawkesbury-Nepean River system, to be implemented from 1 July 2025. With insights from our Hawkesbury-Nepean water quality and hydrodynamic model, as well as community involvement, the new regulatory framework will require smarter integrated water solutions that provide the best balance of social, economic and environmental outcomes for the Hawkesbury-Nepean catchment area. • Sydney Water has commenced planning for the delivery of pollution studies and reduction programs to improve treated water quality and increase reuse from Picton WRRF. Additionally, Sydney Water is also investigating a suitable long term water management strategy for Picton WRRF. • Most of the WRRFs that discharge treated wastewater in the Hawkesbury-Nepean river system are being upgraded or have planned upgrades in the near term.

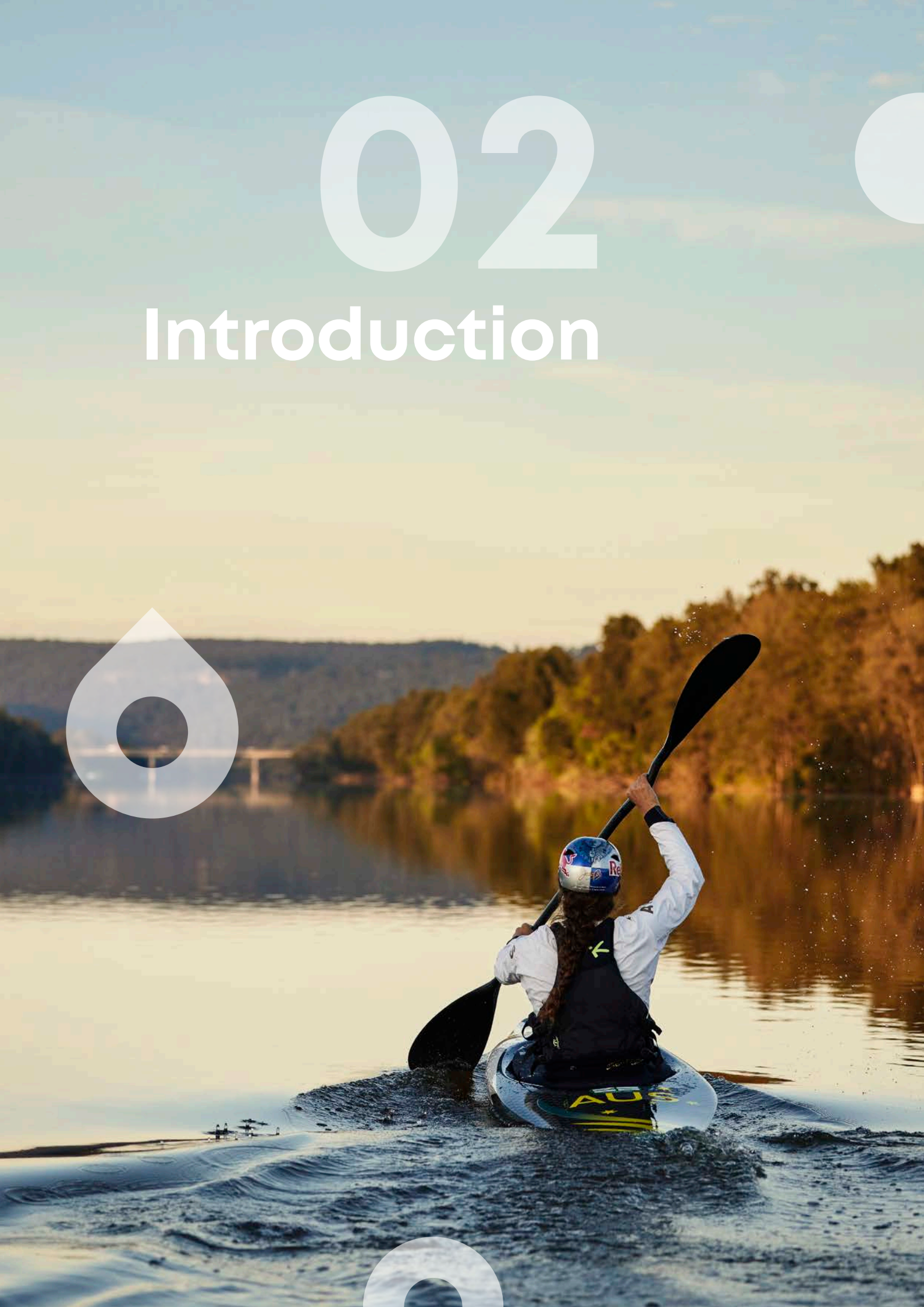
Wastewater network discharges	Wastewater volumes from dry weather overflows decreased in 2022-23, 14.2 ML compared to 15.4 ML in 2021-22. Dry weather overflow volume from ocean system decreased marginally (2%) but from inland system there was a 51% decrease in 2022-23. The total number of dry weather wastewater overflows reaching waterways reduced to 284 in 2022-23 (from 362 in 2021-2022). The number of uncontrolled dry weather overflows reduced to 466 in 2022-23 compared to 582 in 2021-2022. Total number of chokes/network blockages experienced within our wastewater network continued to reduce in 2022-23 (7,644) compared to 2021-2022 (11,070). This low blockage rate marks a significant new record for our wastewater systems (based on available records). The frequency of wet weather overflows from seven wastewater systems exceeded the limits within their Environment Protection Licences (condition L7.2 i.e. maximum number of overflows per 10 years). Trends in modelled wet weather overflow volume decreased for both inland and ocean systems, due to a return to more typical rainfall levels in 2022-23. **Key relevant initiatives:** • Various dry weather overflow abatement investigations and preventative maintenance programs • IoT (Internet of Things) installations for blockage detection and overflow prevention • Lost flow analysis at wastewater pumping stations • Continuous lining of high risk wastewater pipelines • Artificial intelligence to assist the review of pipeline CCTV footage • Wet Weather Overflow Abatement Program which focuses on keeping rainwater out of the wastewater network • Customer Campaigns to reduce the amount of wipes, plastic, oil and grease entering the wastewater system
Stormwater network discharges	We removed silt and rubbish from over 75 stormwater quality improvement devices which prevented 3,841 m3 of debris and 1,159 tonnes of sediment from entering Sydney's waterways in 2022-23 (compared to 1,659 m3 and 1,301 tonnes in 2021-22). **Key relevant initiatives:** • Ongoing works to naturalise and improve stormwater networks, and adoption of water-sensitive urban design principles.

Energy use	Sydney Water's goal is to achieve grid electricity consumption equivalent to our 1998 usage (366 GWh). In 2022-23, consumption was 388 GWh, above the internal benchmark by 21 GWh (compared to 386 GWh in 2021-22). Sydney Water's on-site renewable energy generation (51,239,023 kWh) was equivalent to 11.8% of our total energy consumption in 2022-23. Renewable generation was lower than the previous two years. Fuel usage from Sydney Water increased due a significant increase in major projects and capital works. Natural gas consumption increased in 2022-23 due to higher-than average use at multiple sites throughout Sydney Water's operations. These sites include Potts Hill Depot, West Hornsby WRRF, Warriewood WRRF, and West Ryde laboratories. **Key relevant initiatives**: • Continued implementation of the Net Zero Carbon Plan from 2021-22 onwards.
Water Conservation	In 2022-23 we produced around 40,000 ML of recycled water which resulted in a reduction of drinking water demand of around 12,000 ML. Water leakage in 2022-23 was estimated at 129 ML/d, an increase compared to 2021-22 (121.5 ML/d) despite a continued focus on our leakage program. This is outside the range of the Economic Level of Leakage (ELL) due to a significant step change in the three quarters, Q4 2021-22 to Q2 2022-23. Water leakage then returned to normal levels over the first half of 2023 (Q3 and Q4 of the reporting period). Overall, water conservation efforts led to 1,473 ML of water savings. **Key relevant initiatives:** • Ongoing implementation of water efficiency programs • Minimising the loss of water through leakage reduction programs • Maximising recycled water production
Circular Economy and Resource Recovery	Sydney Water has been consistently achieving 100% beneficial use of biosolids captured from our WRRFs. Sydney Water generated 345,748 tonnes of solid waste, which was similar compared to 2021-22. Of this waste, 79% per cent was reused onsite, offsite, or sent offsite for recycling. The overall recycling rate for 2022-23 was similar to 2021-22 (80%). Of the waste generated from our construction and demolition activities, 84% (242,924 tonnes) was recycled or reused.

Circular Economy and Resource Recovery	**Key relevant initiatives :** • Finalised our Circular Economy and Resource Recovery strategic blueprint. • Designing a Circular Economy Precinct at the Upper South Creek AWRC site is Sydney Water's flagship opportunity to bring our Circular Economy and Resource Recovery strategic blueprint to life. • Commissioned the Malabar WRRF Biomethane Project in July 2023. Co-funded by Jemena and ARENA. It is a first in Australia to blend biomethane directly into the natural gas grid. • Established a macroalgae trial at Picton WRRF, a NSW-first circular economy pilot project using macroalgae to set a new standard in global wastewater management.
Community awareness	• During 2022-23, our Community Education Team engaged with nearly 50,000 children and adults through the Wonders of Water Discovery Van to increase water literacy. • The Our Water, Our Voice customer engagement program was launched in July 2022 and is due to be completed in December 2023. It is the largest customer engagement program in the history of Sydney Water with over 6,000 participants to date. • Sydney Water was involved in several key events during 2022-23 including the SCG 'Pink Test' (through Cricket NSW sponsorship), Ramadan Nights at Lakemba, the Royal Easter Show and World Pride events to share key messaging around water conservation, encourage people to drink tap water and visit the Waterwise Website. • Water efficiency campaigns were run including: -'Turn it off Bob' campaign, to increase awareness of day-to-day water usage in and around people's homes -'Save it With Me' campaign featuring Olympic gold medallist, Jess Fox to influence and track public discourse on water. • There has not been significant investment in wastewater campaigns during 2022-23 as due to a deliberate focus on water conservation messages as a dry El Niño climate phase was forecasted. Wastewater campaigns that provide renewed messaging on the impacts of wipes, plastics and oil/grease in the wastewater system are planned for the 2023-24 financial year. • Our Brand Tracker and Community Sentiment Monitor tools help us understand feedback from the community. - The Brand Tracker showed 69% of the 3,259 people surveyed plan to reduce water usage in and outside the home, 46% intend to use less water in the bathroom and 41% said they would use less water in the kitchen. The Brand Tracker Customer Promises related to the environment have remained stable during 2022-23. - Our Community Sentiment Monitor provides a snapshot of what is working well and the challenges and opportunities. One of the key challenges that Sydney Water faces is that more than half of our customers (55%) believe that it is okay to flush items other than human waste and toilet paper, down the toilet (Table 5-2), Social media and digital campaigns have attempted to address this behaviour and these programs will recommence in 2024.

02

Introduction



2.1 Background

2.1.1 As required by the Sydney Water Act 1994 (the Act), this Annual Environmental Performance Report incorporates our statement on the implementation of our special objectives, and our Environmental Indicators Performance Report 2022-23. The Act requires us to publish our statement on the implementation of our special objectives as part of our annual report on environmental indicators.

This report summarises our environmental performance and demonstrates how we addressed the special objectives identified in the Act between 1 July 2022 and 30 June 2023.

Our business is underpinned by the three principal objectives outlined in the Act:

1. To be a successful business.

2. To protect the environment by conducting its operations in compliance with the principles of ecologically sustainable development.

3. To protect public health by supplying safe drinking water to its customers and other members of the public in compliance with the requirements of our Operating Licence.

These objectives enable us to achieve a sustainable future by balancing social, economic and environmental considerations.

In addition to this, Section 22 of the Act states that in implementing the principal objectives, we have the following special objectives:

1. To reduce risks to human health.

2. To prevent the degradation of the environment.

These objectives are to be interpreted and implemented as specified in Section 22 of the Act and Section 6 of the Protection of the Environment Administrations Act 1991, so far as they are relevant to our business.

2.2 Implementing the special objectives

Sydney Water integrates environmental and public health management into our business-as-usual operations. The special objectives are addressed holistically so that we can carefully balance our social, economic, public health and environmental considerations. The management systems, plans and frameworks we've established to support our business operations include the:

- Environmental Management System, certified to the International Organisation for Standardisation (ISO)14001, provides a systematic, planned approach to managing environmental risks.
- Drinking Water Management System, aligned to the Australian Drinking Water Guidelines 2011, which describes the methods we use to ensure the quality and quantity of drinking water we supply to our customers.
- Recycled Water Management System, aligned to the Australian Guidelines for Water Recycling 2006, which describes the methods we use to ensure we supply high-quality recycled water to our customers and minimise risks to human health.
- Quality Management System, certified to the ISO9001 standard, enables us to continually monitor and measure how we are performing so we can improve and be more effective.
- Asset Management System, certified to the ISO55001 standard, provides a framework that supports our asset management activities to deliver customer service outcomes and continual improvement.
- General requirements for the competence of testing and calibration laboratories, ISO/IEC 17025 is the main ISO standard used by testing and calibration laboratories. Accreditation to ISO/ IEC 17025 plays an important role in supporting the validity, impartiality and reliability of results from testing and calibration laboratories.

2.3 Reporting against our special objectives

2.3.1 One Strategy to deliver our vision

Sydney Water's vision – creating a better life with world class water services – is at the core of Our strategy for the 2020-2030 period. This strategy has four strategic outcomes that inform our activities and respond to the current challenges facing our customers, our business and the environment.

The four strategic outcomes are:

- **We are the first choice of customers and partners** to deliver a world-class customer experience and we collaborate with our current and future customers, communities, stakeholders and partners to deliver better outcomes
- **We have a high-performance culture** to deliver results with a focus on safety, inclusion, innovation and accountability
- **We deliver thriving, liveable and sustainable cities** with world-class, digitally enabled products and services and champion for the environment, public health and a safe and resilient water supply.
- **We are a successful and innovative business** that is socially responsible and sustains a positive return for our shareholders and the community.

Figure 1: OUR VISION, STRATEGIC OUTCOMES AND VALUES FOR THE 2020-2030 PERIOD

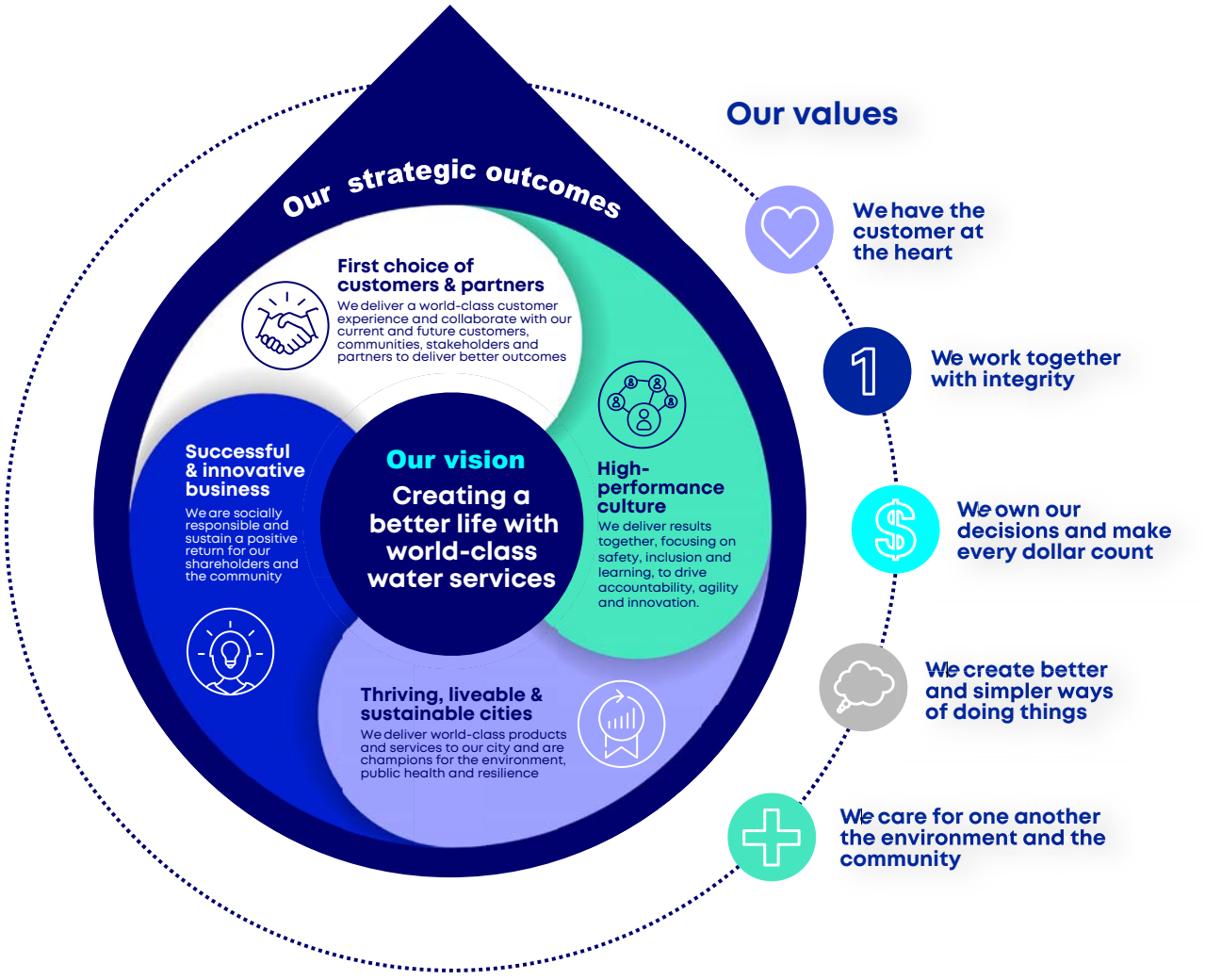


Table 2-1: REPORTING AGAINST SPECIAL OBJECTIVES REQUIREMENTS

Sydney Water Act 1994 means	Protection of the Environment Administration (POEA) Act 1991 means	Link to relevant Strategy goals and enterprise areas of work	Where addressed in this report
Reducing the environmental impact of discharges into or onto the air, water or land of substances likely to cause harm to the environment	Adopting the principle of reducing to harmless levels the discharge into the air, water or land of substances likely to cause harm to the environment. Setting mandatory targets for environmental improvement. Promoting pollution prevention.	Healthy Waterways & Environment Embed circular economy practices as part of our core business Net Zero Carbon Program	Section 3 – Reduce impact of discharges to the environment Section 4 – Efficient and sustainable resource reuse Section 2 – Preparing for a changing climate
Re-using and recovering energy, water and other materials and substances, used or discharged by Sydney Water, by the use of appropriate technology, practices and procedures. Reducing use of energy, water and other materials and substances.	Encouraging the reduction of the use of materials, encouraging the re-use and recycling of materials; and encouraging material recovery.	Embed circular economy practices as part of our core business. Circular Economy and Resource Recovery practices. Net Zero Carbon Program	Section 4 – Efficient and sustainable resource reuse • Develop and implement water conservation program • Maintain our grid-sourced electricity demand • Bioresources • Waste
Minimising Sydney Water's creation of waste by the use of appropriate technology, practices and procedures.	Minimising the creation of waste by the use of appropriate technology. Regulating the transportation, collection, treatment, storage, and disposal of waste.	Embed circular economy practices as part of our core business. Resource recovery & circular economy.	Section 4 – Efficient and sustainable resource reuse • Bioresources • Waste

Sydney Water Act 1994 means	Protection of the Environment Administration (POEA) Act 1991 means3	Link to relevant Strategy goals and enterprise areas of work	Where addressed in this report
	Promoting community involvement in decisions about environmental matters. Conducting public education and awareness programs about matters. Ensuring the community has access to relevant information about hazardous substances arising from, or stored, used or sold by, any industry or public authority.	Drive Innovation and make a positive social impact on our communities.	Section 5 – Community involvement • Customer satisfaction, awareness and behaviour

This report provides a holistic statement with a focus on wastewater discharges and provides trending data. In addition to this report, we publish several comprehensive performance reports on our website that demonstrate our implementation of, and performance against, the special objectives. Please refer to the following reports available at sydneywater.com.au for more information:

- **Sydney Water Annual Report** – covers our achievements and challenges over the previous year, our performance against our statutory requirements and the progress we've made towards meeting our corporate strategic goals.
- **Water Conservation Report** – outlines how we are meeting our water conservation requirements and contributing to water efficiency, leakage management and water-recycling initiatives.
- **EPA pollution monitoring data reports** – we test water quality at our water resource recovery facilities (WRRFs), water filtration plants every month. We publish the results of our tests within 14 days of the last test result becoming available.

2.5 Sewage Treatment System Impact Monitoring Program (STSIMP) Report

Some information in this report refers closely to the outcomes of our 2022-23 Sewage Treatment System Impact Monitoring Program (STSIMP) Data Report (Sydney Water 2023). The STSIMP was in place for 15 years between July 2008 to June 2023 to satisfy condition M5.1 of our EPLs. In April 2023, the EPA approved a new monitoring program entitled 'Sydney Water Aquatic Monitoring (SWAM) program' to replace the STSIMP.

The STSIMP was aimed to monitor the environment in Sydney Water's area of operations to determine general trends in water quality over time. It monitors Sydney Water's performance and determines where Sydney Water's contribution to water quality may pose a risk to environmental ecosystems and human health. It contains a summary of wastewater discharge quality, quantity and load data for key pollutants relating to regulatory limits.

This report also contains inland and ocean receiving water quality, wastewater overflows and recycled water data. The 2022-23 STSIMP Data Report was provided to the EPA on 15 December 2023 and will be published on Sydney Water's web site in early 2024. This report only extracts relevant highlights from the 2022-23 STSIMP Data report. For further details please refer to the 2022-23 STSIMP Data report.

2.6 Weather and climate change

Climate change is leading to more extreme, frequent, and compounding weather events.

Sydney Water's services and potential environmental impacts are interlinked with the prevailing climate.

In 2022-23, our environmental performance was affected by the return of average to dry conditions after a wet 2021-2022. The year started with an east coast low, with an unusually wet spring (Above average rainfall in Sydney of 140%, Camden 200%, Campbeltown 200%).

The summer season had below average rainfall in the west of Sydney (Penrith Lakes 62%) and above average rainfall closer to the coast (Canterbury 166%). This was followed by a dry autumn and an extremely dry winter.

In mid-2022 Sydney Water formally adopted a position statement: that we will plan and invest prudently to ensure we can maintain service levels by managing our climate risk.

In addition to the influence of natural drivers, anthropogenic climate change continues to influence climate and the likelihood of more extreme events as we plan for an uncertain future.

Sydney Water has also adopted and will continue to adopt new methodologies to adapt to climate change, enabling us to be prepared in the face of a variable climate. New tools will be embedded into our planning and asset management practices to ensure we are planning for a future climate, not a past climate.

Sydney Water has developed a climate change adaptation guideline ("Guidebook") to provide specific advice to our teams. This Guidebook outlines our position on climate change adaptation, Sydney specific hazard and impact information as well guidance on how to embed the position. It also provides tools to improve our existing risk management processes and implement the position in all key business processes.

We continue to use the Cross-Dependency Initiative (XDI) geo-spatial climate risk application to provide forecast risk to parts of our asset base. We are also collaborating with external organisations and stakeholders to improve our understanding of compounding climate risks such as storms and sea-level rise.

Reduce impact of discharges to the environment

03

3. Reduce impact of discharges to the environment

Collecting and treating the community's wastewater plays an enormous role in protecting the environment from pollution and improving the health of our waterways. Our wastewater system has 30 Water Resource Recovery Facilities (WRRFs) and 14 of these facilities produce recycled water. All of our wastewater systems are licensed by the NSW EPA. Our WRRFs receive wastewater from residential, commercial, and industrial customers and discharge treated wastewater to inland waterways and the ocean. In 2022-23 Sydney Water collected 601,195 ML of wastewater, servicing an estimated population of 5,213,000 people. We produced 41,198 ML of recycled water that we supplied to a population of around 102,000 people, including environmental flows transferred from our Advanced Water Treatment Plant at St Marys to the Nepean River at Penrith.

3.1 Benefits of wastewater treatment

Healthy waterways are critical to the plants and animals that live there. Our rivers are full of life, and maintaining flow is essential for their survival. Treating our wastewater not only protects public health; it protects habitats for terrestrial and aquatic life. Water also has scenic and recreational values and contributes to the quality of life that communities can enjoy, including water activities such as swimming, fishing, boating and picnicking.

"Finding platypus living in The Hills, especially the urban parts, is truly amazing," Dr Peter Gangemi, The Mayor of The Hills Shire. "These findings mean our waterways and the local environment are attractive places for these incredible animals to live and thrive.

"It is important that we all do our part to protect platypuses and ensure they remain in the waterways of The Hills for generations to come," Dr Michelle Ryan.

3.1.1 Healthy waterways and our environment strategic blueprint

Sydney Water launched its Healthy Waterways and Environment Strategic Blueprint in June 2022. It sets out our pathway to world-class environmental performance and identifies how to deliver our corporate strategy outcomes to create and maintain waterways that are clean, thriving and safe for swimming. It addresses the way Sydney Water's core services interact and impact waterways:

- rivers downstream of dams that provide our city with drinking water
- urban waterways that take the stormwater that drains from streets and buildings, as well as some wastewater discharges
- our coasts that receive the majority of treated wastewater
- the land that we use to operate our assets and provide our services.

Our directions for environmental protection and waterway health have been extensively tested and shaped by customers and key stakeholders. Our commitments include:

- Preventing pollution
- Water efficiency and diversity
- Recovery of resources
- Climate resilient systems
- Net zero carbon emissions
- Cool, green, natural places
- Safe recreation and swimming
- Amplify first nations voices

3.1.2 Impacts on swimming locations

The water quality of beaches and other swimming locations is monitored under the NSW Government's Beachwatch programs. Beachwatch suitability grades provide an assessment of the suitability over time of a swimming location for recreation. There are five grades ranging from Very Good to Very Poor. In 2022-23, the Beachwatch program (DPE and Sydney Water) monitored 115 sites within the Sydney Water area of operations. There were 775 observations where Enterococci (measured in colony forming units per 100 mL(cfu/100mL)) levels were above the primary contact guideline (>35 cfu/100 mL) at Beach and Harbour sites. Austinmer Beach from Wollongong was the only site where the primary contact guideline was maintained throughout 2022-23 under all weather conditions. Out of the 775 observations, 168 dry weather exceedances were assessed based on high conductivity (>30,000 µS/cm) and no rainfall (72 hours rainfall <2mm). These 168 dry weather exceedances were from 68 beaches and investigated further. The investigation focused on assessing data collected under Sydney Water's Environmental Response (ER) and Dry Weather Leakage Program (DWLP) projects. All data was extracted and then filtered by sites that exceeded the primary contact guideline. The site list was rationalised to include only wastewater inflow points – the point at which a surcharge reaches any waterway – or any site sampled that is deemed to be a primary or secondary contact waterway. The sampling information was then mapped against the 168 Beachwatch exceedances. Any site sampled under the ER or DWLP projects that met the above criteria and occurred within seven days before and seven days after the Beachwatch exceedance was deemed to have a potential impact.

Table 3-1: SUMMARY OF BEACHWATCH PROGRAM CHANGES IN SUITABILITY GRADE FOR SITES IMPACTED BY SYDNEY WATER'S OPERATIONS IN 2021-22 and 2022-23 BASED ON KNOWN DRY WEATHER OVERFLOWS

Site and site name	Potential impact from wastewater overflows	Beach Suitability grade 2019-20	Beach Suitability grade 2020-21	Beach Suitability grade 2021-22	Beach Suitability grade 2022-23
Sydney Beaches					
Bronte Beach	2021-22	🟢	🟢	🟢	🟢
Coogee Beach	2021-22	🟢	🔴	🔴	🔴
Sydney harbours and estuaries					
Bayview Baths	2022-23	🟢	🔴	🔴	🔴
Cabarita Beach	2021-22	🟢	🟢	🟢	🟢
Chinamans Beach	2021-22	🟢	🟢	🟢	🟢
Clontarf Pool	2021-22	🟢	🟢	🟢	🟢
Carss Point baths	2022-23	🟢	🔴	🔴	🔴
Dolls Point Baths	2022-23	🟢	🔴	🔴	🔴
Dawn Fraser Pool	2022-23	🟢	🟢	🟢	🟢
Foreshore Beach	2022-23	🔴	🔴	🔴	🔴
Frenchmans Bay	2021-22	🔴	🔴	🔴	🔴

Gunnamatta Bay	2021-22	🟢	🟢	🔴	🔴
Gymea Bay Baths	2021-22	🔴	🔴	🔴	🔴
Hayes Street Beach	2022-23	🟢	🟢	🟢	🟢
Horderns Beach	2022-23	🟢	🟢	🟢	🟢
Jew Fish bay Baths	2022-23	🟢	🔴	🔴	🔴
Kyeemagh Baths	2021-22	🟢	🔴	🔴	🔴
Little Manly Cove	2021-22	🟢	🟢	🟢	🟢
Lilli Pilli Baths	2021-22	🟢	🟢	🟢	🟢
Monterey Baths	2022-23	🟢	🟢	🟢	🟢
Murray Rose Pool	2021-22	🟢	🟢	🟢	🟢
Parsley Bay	2021-22	🟢	🟢	🟢	🟢
Rose Bay Beach	2021-22	🟢	🔴	🔴	🔴
Sandringham Baths	2022-23	🟢	🟢	🟢	🟢
Tambourine Bay	2022-23	🔴	🔴	🔴	🔴
Woodford Bay	2022-23	🟢	🟢	🟢	🟢
Woolwich Baths	2022-23	🟢	🟢	🔴	🔴
Illawarra beaches					
Lake Illawarra Entrance Lagoon	2021-22	🟢	🟢	🔴	🔴
Total number of sites impacted in 2022-23 sites	14				

🔴 Needs Improvement (Poor, Very Poor Grade)

🟢 Good/Very Good Grade

Using the above methodology for 2022-23 data, wastewater overflows from Sydney Water's networks may have contributed to elevated Enterococci at 14 of the 115 Beachwatch sites (12% of all sites) on 19 occasions. Eleven of these sites had only one dry weather overflow incident. There were two incidents at Dolls Point Baths and three incidents both at Carss Point Baths and Foreshore Beach during 2022-23 when Sydney Water's wastewater network may have contributed to these exceedances.

Twenty-eight wastewater overflows impacted sites and respective beach suitability grades as determined by DPE (previously DPIE) (DPE 2022 and DPE 2023) over the last two years. The beach suitability grades deteriorated at three of these sites and were stable at the remaining sites compared to the 2021-22 results.

- Four of the sites were consistently impacted by wastewater overflows for the last two consecutive years (2021-22 and 2022-23). These were Foreshore Beach, Hayes Street Beach, Jew Fish Bay Baths and Parsley Bay.

- None of the three sites where beach suitability grades deteriorated were impacted by wastewater overflows in 2022-23 (Gunnamatta Bay Baths, Woolwich Baths and Lake Illawarra Entrance Lagoon). However, all three sites were impacted in 2021-22.

Sydney Water is currently conducting programs of work to reduce overflows to Rose Bay Beach and Foreshore Beach. Please also refer to section 3.8 for further details on improvements in our wastewater network performance.

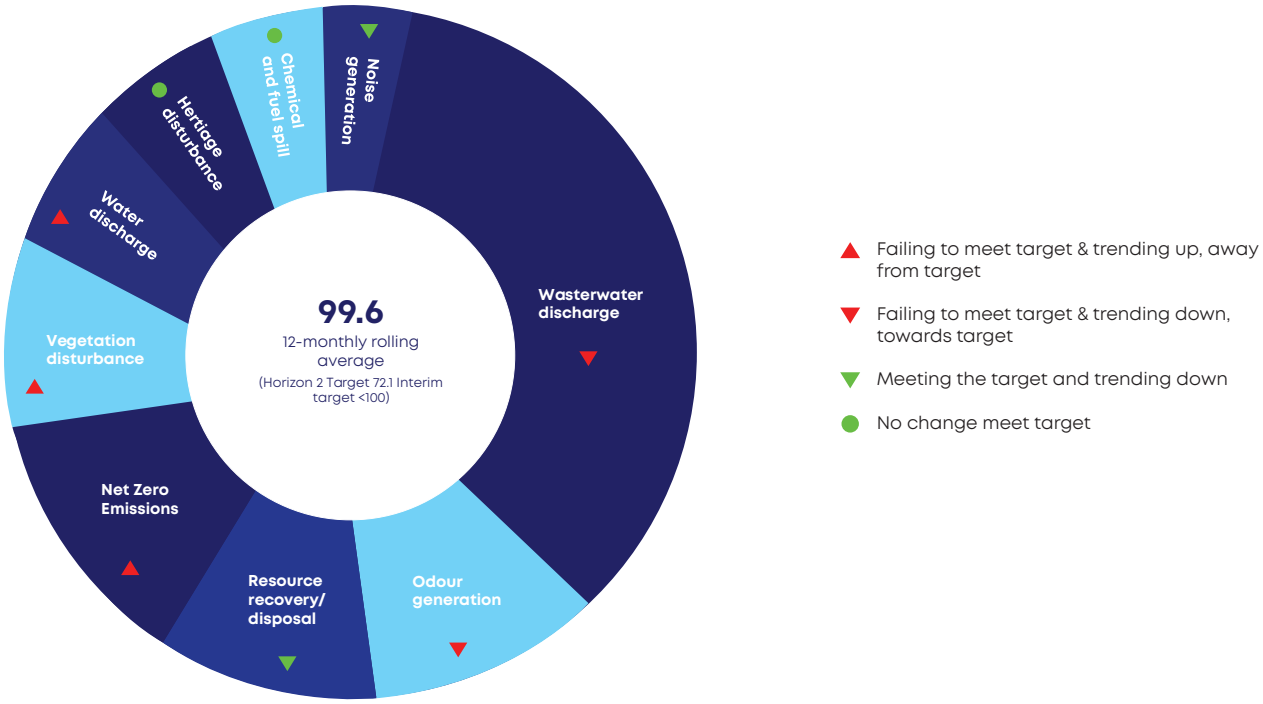
3.2 Environmental Impact Index (overall measure)

Caring for and protecting the environment is a core value in everything we do at Sydney Water. We have developed an Environmental Impact Index (EII) to track our overall progress towards achieving 'thriving, liveable and sustainable cities' (one of our four strategic outcomes).

The EII considers and appropriately weights all of Sydney Water's significant environmental aspects in its calculation. An environmental aspect is an element of our organisation's activities, products or services that interacts or can interact with the environment. The following aspects were identified as significant for Sydney Water, and are ordered from highest to lowest weighting within the EII:

Caring for and protecting the environment is a core value in everything we do at Sydney Water

Figure 3-1: QUARTERLY ENVIRONMENTAL IMPACT INDEX (Q4) 2022-23

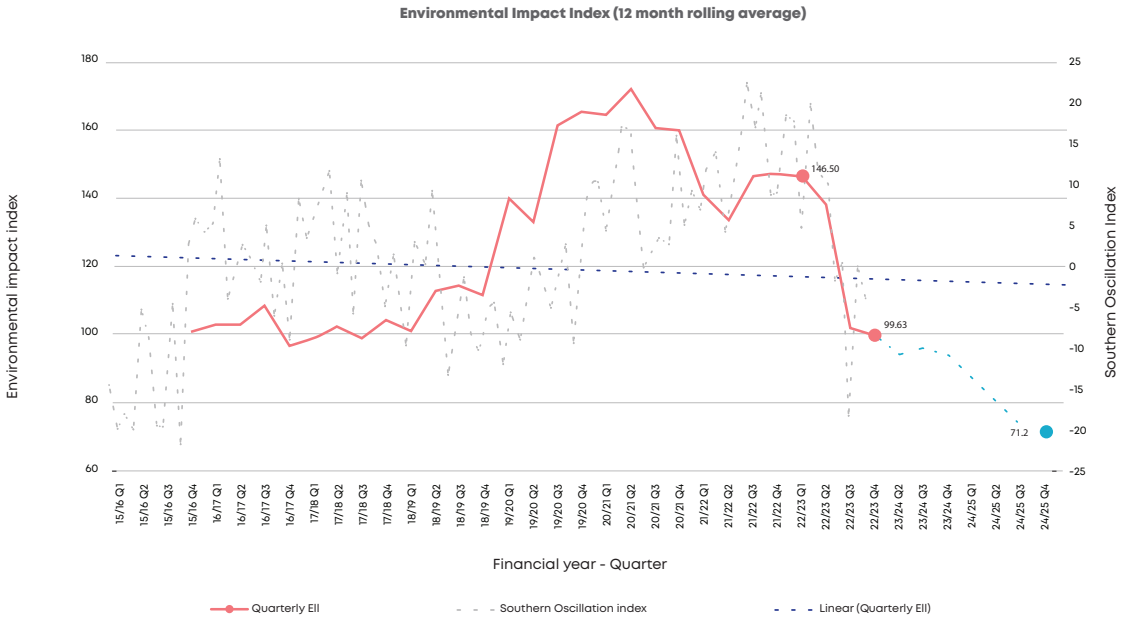


- Wastewater discharge
- Emissions
- Resource recovery/disposal
- Odour generation
- Water discharge
- Vegetation disturbance
- Chemical and fuel spill
- Heritage disturbance
- Noise generation

Our EII was calculated to be 99.6 at the end of 2022-23 (Figure 3-2). The EII is lower compared to Q4 2021-22 (148.7) and Q4 2020-21 (154.7). We are committed to continually improving our environmental performance. The key input metrics affecting performance of the EII for the end of 2022-23 included:

- An improvement in many wastewater discharge performance metrics including:
  - A lower number of dry weather overflow incidents from our wastewater networks due to an increase in preventative maintenance, installation of IoT sensors to proactively detect blockages and favourable weather conditions.
  - A reduced suspended solids discharged from our deep ocean outfall WRRFs
  - A decreasing trend in oil and grease discharges from our ocean WRRFs since the COVID-19 pandemic
  - Fewer Beachwatch exceedances,
- Overall reduction in nutrient load discharges from our inland WRRFs largely due to drier weather
- An increase in the percent waste sent to landfill was mainly due to an increase in construction works for our major projects.
- A lower number of odour complaints compared to 2021-22, mainly attributable to a lower number of dry weather overflows from our wastewater networks.
- A greater area of native vegetation cleared compared to the previous year. This again is mainly due to an increase in construction works for our major projects.

Figure 3-2: HISTORICAL ENVIRONMENTAL IMPACT INDEX



These aspects may have adverse or beneficial impacts on the environment, which can result in risks and opportunities for Sydney Water.

The EII is a metric that indicates the overall environmental impact of our organisation. We track the EII quarterly, which provides the organisation with information to proactively address areas of concern and move towards achieving our environmental aspirations defined within our Sydney Water Strategy 2020-30. Key aspirations include reducing our environmental impact and carbon footprint and contributing to world-class environmental performance.

Figure 3-2 shows how our quarterly EII results have changed over recent years. The Southern Oscillation Index (SOI) is also displayed alongside the EII. The SOI gives an indication of the development and intensity of El Niño or La Niña events in the Pacific Ocean, which have an influence on our environmental performance. Sustained negative values of the SOI below –7 often indicate El Niño episodes. Sustained positive values of the SOI above +7 are typical of a La Niña episode.

3.3 Ecological footprint

We continued to calculate our ecological footprint4 (Figure 3-3) and carbon footprint (Figure 3-4). The ecological footprint methodology combines detailed direct organisation impacts (Sydney Water land use data, scope 1 and scope 2 emissions) with full supply-chain carbon emissions (scope 3 sources) and all supplier land disturbance impacts, to yield a comprehensive ecological (and carbon) footprint measurement.

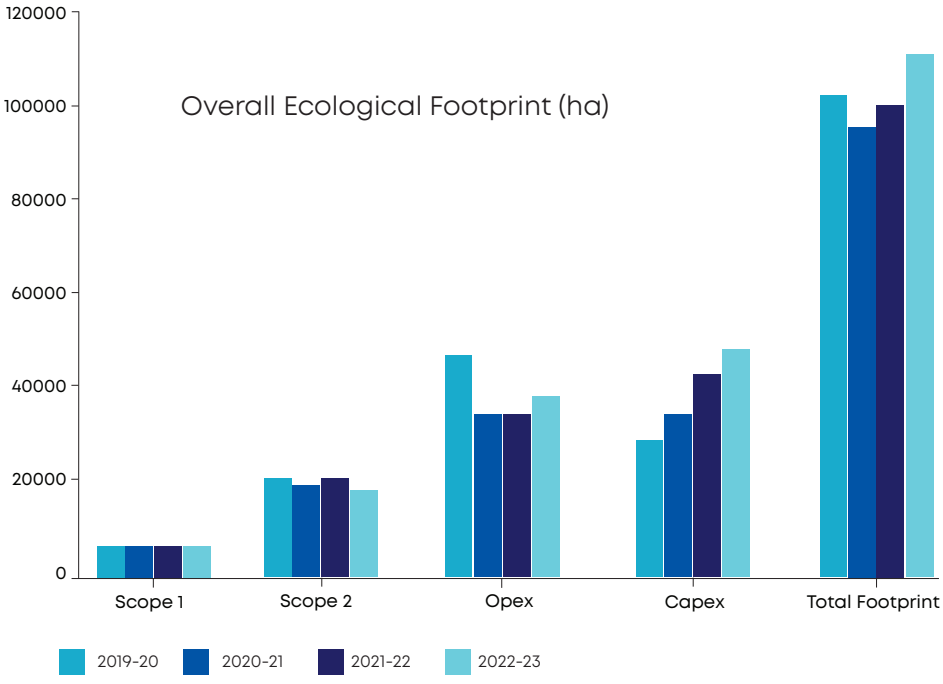
In 2022-23, our total ecological footprint (EF) from all sources (including direct, indirect, and Scope 1, 2 & 3 emissions) was 116,000 ha, representing an approximate 10% increase over the total in 2021-22. The direct emissions equivalent EF (Scope 1) and the electricity-related EF (Scope 2) both fluctuate by around 10% over the four-year period, due to largely to typical operational variations.

The operational expenditure (Opex) component of the EF, as shown in the graph below, comprises the footprints associated with the delivery of desalinated water, the Sydney Water-related footprint of WaterNSW, and the footprints of the other SW operational expenditures/ activities. Of this Opex EF, the two most important contributions are electricity emissions associated with the desalination plant and those with water pumping by WaterNSW, the latter of which was particularly high during the relatively lower rainfall year of 2019-20. Although it is not discernible in the Opex bars in the graph below, desalinated water volumes approximately tripled between 2021-22 & 2022-23, with the most recent year's total desalinated impacts being comparable with 2019-20, with lower impacts in the intervening years.

In addition to the high WaterNSW electricity contribution to the 2019-20 Opex EF, the other major driver for the overall increase in the total ecological footprint is the significant increase in capital expenditure5 over the four years, and particularly in 2022-23. In annual dollar terms, total capital expenditures increased by about 30% between 2021-22 and 2022-23, and by about 20% between 2020-21 and 2021-22. This substantial growth in the Capital Improvement Program (CIP) over the time frame of these results covers the expansion of significant activities such as:

as wastewater treatment plant renewals
critical sewer upgrades
many other asset renewals, upgrades and system improvements
the Western Sydney Airport Growth Area, and the South-West, North-West and Greater Macarthur Growth Areas.

Figure 3-3: ECOLOGICAL FOOTPRINT 2022-23



The increase in capital development activity is planned to continue over the rest of this decade, and with this increase in activity there will be higher embodied footprints (both carbon and ecological) due to the materials, goods and services involved.

3.4 Embracing circular economy

Sydney Water's vision to create a better life with world-class water services recognises that managing our water, carbon, energy, materials and nature in a circular way is essential to a thriving city ecosystem.

We finalised our Circular Economy and Resource Recovery Strategic Blueprint, with a commitment to apply circular economy principles throughout our operations

We will realise this by delivering better outcomes through integrated water solutions that we will restore and regenerate natural environmental systems, keeping resources in use at their highest value, and economically design out waste and pollution. To achieve this, Sydney Water is continuing to extend our partnerships with customers, businesses, communities and all levels of government.

The Circular Economy precinct at Upper South Creek is Sydney Water's flagship opportunity to bring this strategic blueprint to life. The Precinct is being designed with a market and stakeholder-led approach to ensure that outcomes reflect market demand and our broader customer needs and interests.

We have made significant progress in the planning of this precinct with the completion of several feasibility studies on co-location of synergistic industry. These studies have helped narrow down the development opportunities for the site and have identified the key focus areas for the next phase of the Precinct development.

The Malabar Biomethane Project was commissioned in July 2023. This is a co-funded project by Jemena and ARENA and is the first project in Australia to blend biomethane sourced from a wastewater treatment plant directly into the gas network. The initial production of 95 Terajoules (TJ) of gas per year is expected to meet the needs of approximately 6,300 local homes.

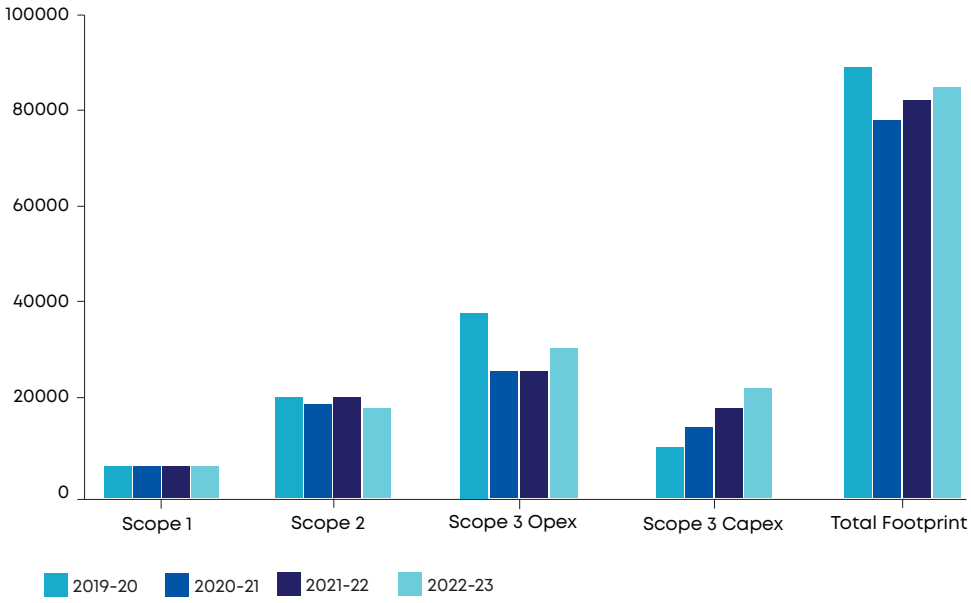
A macroalgae trial at Picton WRRF is a NSW-first circular economy pilot project using macroalgae to set a new standard in global wastewater management. This trial uses a native green macroalgae to further polish treated wastewater by reducing the levels of nitrogen, ammonia, phosphorus and harmful bacteria. It is a cost-effective, and chemical-free wastewater treatment process, with potential to reduce carbon emissions.

3.5 Net Zero Carbon

Sydney Water's circular economy approach will help us achieve Net Zero Carbon. Sydney Water's strategy recognises the importance of climate change abatement to enable our Thriving, liveable and sustainable cities strategic outcome. As part of our response to climate change, we have an internal target of Net Zero Carbon across our business by 2030, and across our supply chain by 2040. We know around two-thirds of our carbon footprint is related to our supply chain and we are working with our suppliers to ensure we reach our Net Zero Carbon goal by 2040. We will achieve our Net Zero Carbon emissions ambition through renewable energy projects and championing circular economy principles – particularly resource recovery in the form of energy, agricultural nutrients and much more. Some of our suppliers already measure their emissions and have their own Net Zero Carbon plan in place.

The total carbon footprint for 2022-23 was 798,000 t CO2-e (Scope 1, 2 and all Scope 3), with the breakdown shown in Figure 3-4. The largest contribution was from Scope 2 emissions, approximately 282,000 t CO2-e. The Scope 2 emissions (electricity), being approximately 282,000 t CO2-e in 2022-23, are the largest single component in the total emissions (see breakdown below). Scope 2 emissions, and energy-related emissions in general, are relatively more important here than those of the energy-related footprints within the total EF. In comparing the ecological and carbon footprint graphs, this means that indirect effects (within Opex and with Capex) are relatively less important compared to the other sources.

Figure 3-4: CARBON FOOTPRINT 2022-23



Direct (Scope 1) emissions vary between 6-8% of the total carbon footprint over the four years. Sydney Water electricity (Scope 2) emissions range 35-40% over the time period. In other words, total Scope 3 emissions are between 52% and 58% over the four years.

As described earlier, Sydney Water's Scope 3 Opex emissions have important components from WaterNSW and the desalination plant. Electricity emissions associated with bulk water supply decreased by nearly 50,000 t CO2-e from 2019-20 to 2020-21 (& then were similar again in 2021-22 and 2022-23). Whilst the supply to the desalination plant is regarded as being 100% renewable electricity, in formal greenhouse accounting terms there are still emissions associated with the plant's use of electricity.

Although there are many small components which collectively are significant, the important main contributions to Scope 3 Opex emissions are from:

- chemical purchases
- maintenance activities, such as asset repairs and equipment upgrades
- road freight of goods, and
- embodiments in building materials.

Despite the significant increase in capital expenditure from 2020-21 to 2022-23, Scope 3 Capex represents about 25% of the total carbon footprint in 2022-23, up from 17% in 2019-20.

There is rich detail in the full breakdown of the total carbon and ecological footprints. The next major initiative in this project is to incorporate more physical data to compliment the footprint completeness that is possible by harnessing the comprehensive Sydney Water expenditure data.

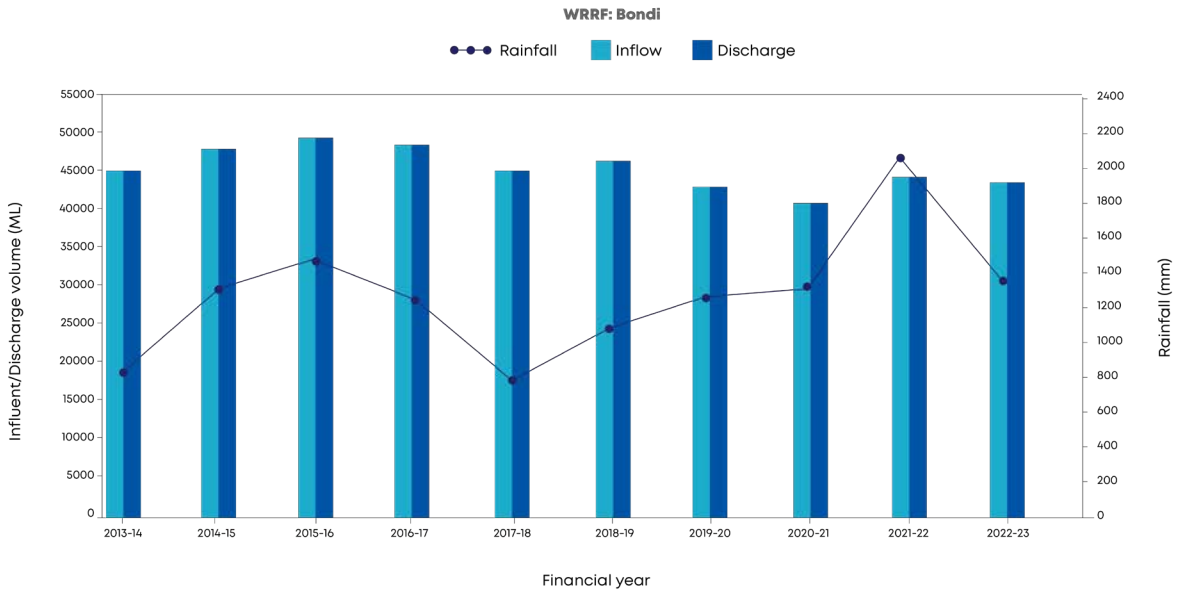
3.6 Wastewater treatment discharges – coastal facilities

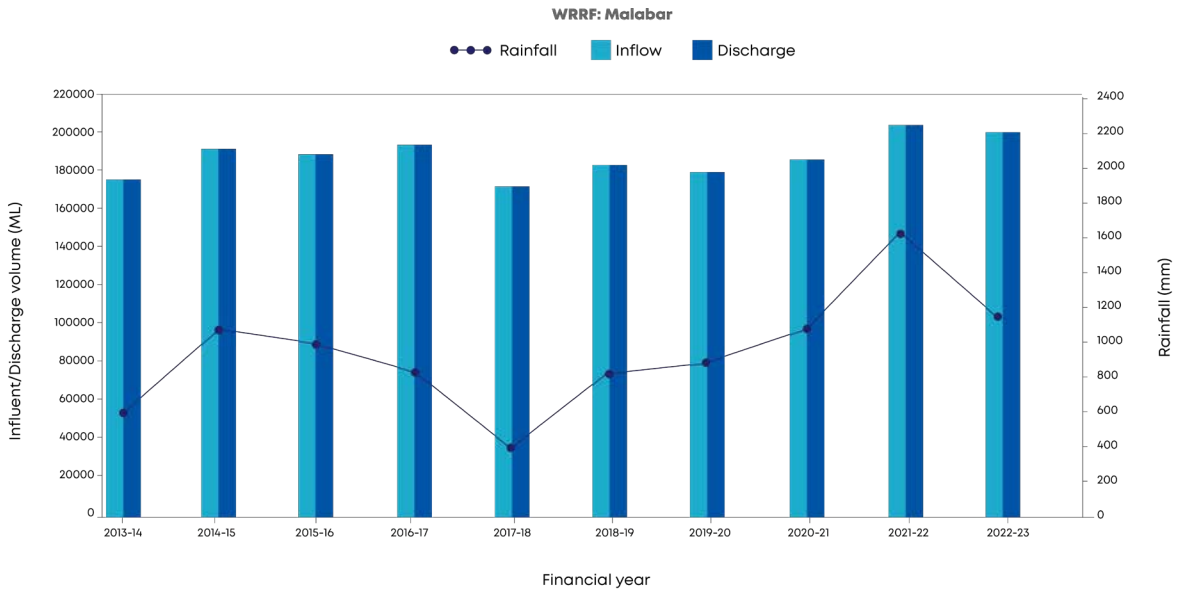
About 85% of wastewater collected by Sydney Water is treated at coastal Water Resource Recovery Facilities (WRRFs) before being released to the ocean. There are three major coastal WRRFs located at North Head, Bondi and Malabar and five smaller coastal facilities at Warriewood, Cronulla, Bombo, Wollongong and Shellharbour. We treat around 66% of Sydney's wastewater at the three largest WRRFs (North Head, Bondi and Malabar). These facilities disperse primary treated wastewater through deep ocean outfalls about two to four kilometres offshore, where the water is 60 to 80 metres deep. Strong ocean currents further dilute the treated wastewater. The deep ocean outfalls play a key role in keeping our beaches and swimming areas clean (Manning et al, 2019).

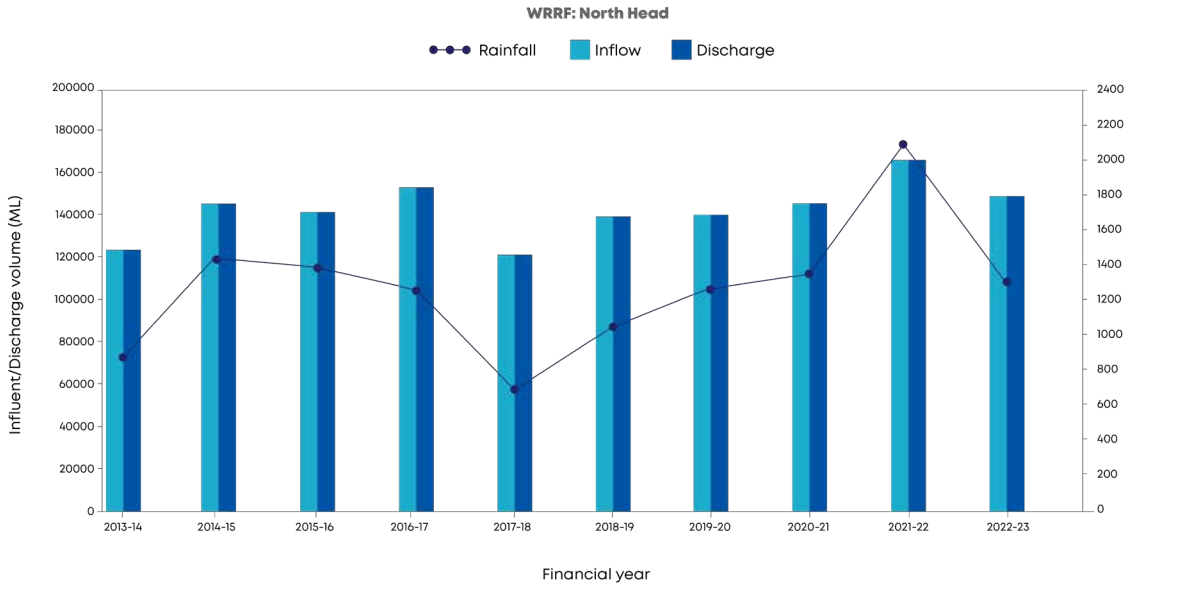
3.6.1 Inflow

The 2022-23 reporting year returned to more typical rainfall levels, following an extraordinary wet year in 2021-22.

Figure 3-5: DEEP OCEAN OUTFALLS WRRFS INFLOW/DISCHARGE





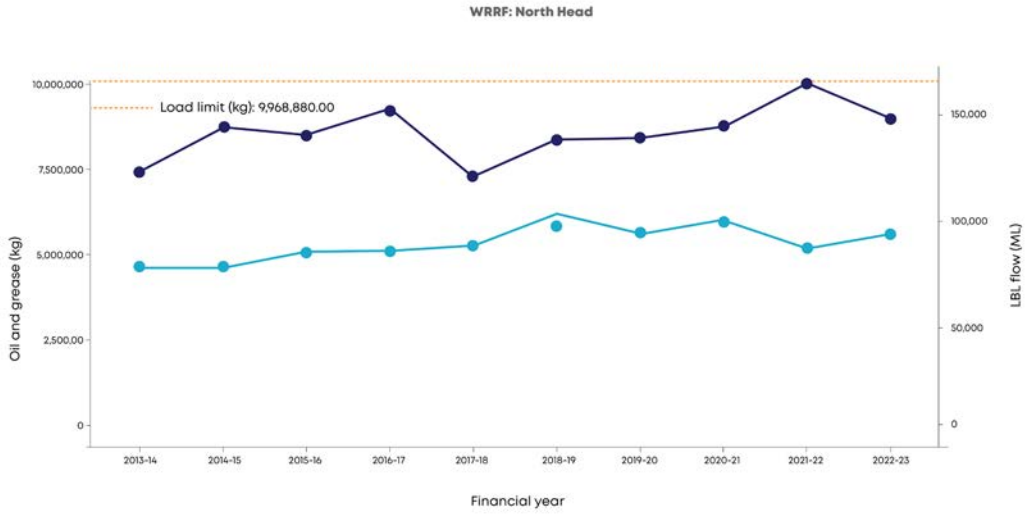


3.6.2 Oil and grease

The oil and grease concentration in the discharge from Bondi and North Head WRRFs was similar to 2021-22, whereas Malabar (Figure 36 oil and grease load, and the flow as per the protocol refer to STSIMP for further details) showed a slight increase in comparison to 2021-22. Sydney Water is continuing to collaborate with community and trade waste customers through community educational programs to reduce oil and grease discharges into the Sydney Water network.

In September 2022, Sydney Water commenced a program engaging with numerous food retail businesses within the Bondi catchment to ensure they have a connection agreement with Sydney Water and an approval to discharge commercial trade waste into the network system to aid in the reduction of oil and grease entering the Bondi wastewater system. The program targets the retail food sector, with an aim to ensure the appropriate management of trade wastewater at source, prior to entry into our wastewater network. Around 900 suspected non-compliant retail food business customers were identified and 257 new trade waste agreements executed between September 2022 and June 2023.

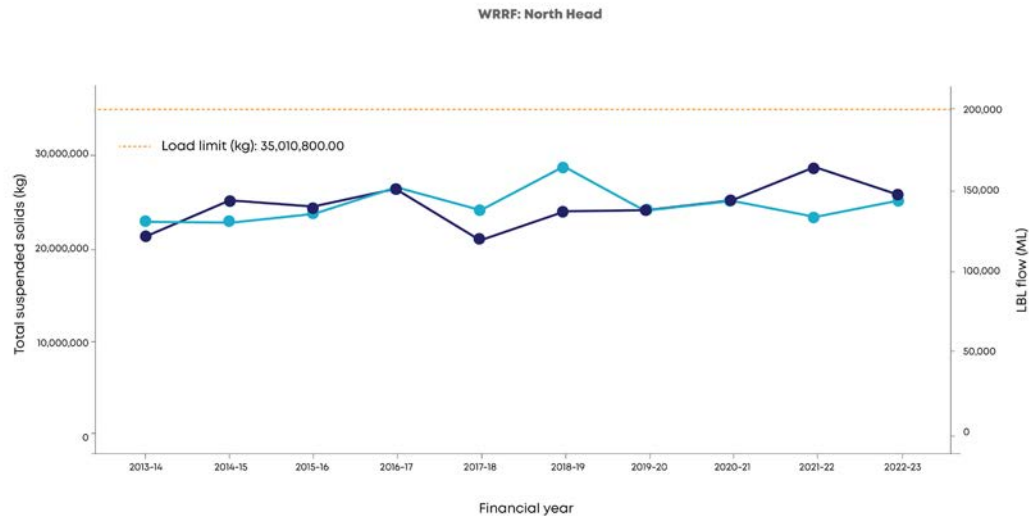
Figure 3-6: MALABAR WRRF OIL & GREASE LOAD



3.6.3 Total Suspended solids

There was minimal change in the total suspended solids (TSS) discharged from Bondi and North Head WRRFs compared to 2021-22. At Malabar WRRF, the increasing trend can be linked to operational issues with the primary sedimentation tanks. Work is in progress to complete asset maintenance activities.

Figure 3-7: MALABAR WRRF TOTAL SUSPENDED SOLIDS LOAD



3.7 Wastewater treatment discharges – inland facilities

About 16% of wastewater collected by Sydney Water is treated at inland WRRFs. Sydney Water's inland facilities discharge into the Hawkesbury-Nepean River system. Considerable urban growth is occurring across the Hawkesbury-Nepean catchment and is expected to continue for at least 30 years to accommodate Sydney's expanding population. This provides the opportunity to deliver water services in new and better ways.

To understand the potential impacts to wastewater services, water services and the environment, we use our water quality and hydrodynamic model of the Hawkesbury-Nepean catchment to test different catchment scenarios, environmental flows, wastewater treatment levels and land-use options over time.

We are working collaboratively with the NSW EPA to implement the regulatory framework for nutrient discharges into the Hawkesbury-Nepean River system. The objectives of this regulatory framework are to manage nutrient load inputs to the Hawkesbury-Nepean River from WRRFs at a level that contributes to meeting communities environmental values for the river. The insights from our Hawkesbury-Nepean water quality and hydrodynamic model will enable smarter solutions to achieve the regulated framework requirements. Community involvement and the new regulatory framework will drive the best balance of social, economic and environmental outcomes for the Hawkesbury-Nepean catchment area. The new framework will be implemented from 1 July 2025.

3.7.1 Total nitrogen (TN) and total phosphorus (TP)

Treated wastewater discharge limits for total nitrogen and total phosphorus loads from Sydney Water and Hawkesbury City Council are divided by WRRFs discharging into three river zones and several subzones. The WRRFs in these zones and the subzones are presented in Table 3-2.

3.7.1.1 Total nitrogen load discharge load exceedances

West Camden (Yarramundi Zone – Subzone 1) total nitrogen was 115,901.3 kg (compared to the limit of 91,980kg). West Camden WRRF experienced increased inflows from residential development within its catchment that caused the facility to operate above its design capacity and applied pressure to the biological treatment process. West Camden WRRF is currently being upgraded to service development in South-West Sydney.

3.7.1.2 Total phosphorus load discharge load exceedances

Picton WRRF total phosphorus load exceedance was largely influenced by extreme wet weather events in the first half of 2022-23. The EPA approved a licence variation to allow for greater flexibility in discharges to Stonequarry Creek. Requirements for various pollution studies and pollution reduction programs were also added to the licence, including additional recycling and reuse requirements for treated water. Sydney Water has commenced planning for the delivery of these studies and programs to improve treated water quality and increased reuse from Picton WRRF. Additionally, Sydney Water is also investigating a suitable long term water management strategy for Picton WRRF.

South Creek Bubble (Riverstone, St Marys and Quakers Hill WRRFs) exceeded the annual total phosphorus aggregate load limit of 2,300 kg/year (3,048.5kg discharged in 2022-23 was lower compared to 4,971.2 kg discharged in year 2021-22) (Table 3-2). This was largely due to the extreme wet weather events between 2 – 11 July and 28 September – 10 October 2022. St Marys WRRF contributed 32% of this total phosphorus aggregated load, whilst Quakers Hill WRRF contributed 64% and Riverstone WRRF contributed 4%. The Lower South Creek Treatment Program is providing new and upgraded wastewater infrastructure to improve the quality, capacity and reliability of these three facilities.

Zones	WRRF	Total Nitrogen (kg)		Total Phosphorus (kg)	
		Limits	Actual	Limits	Actual
Yarramundi Zone					
Subzone 1	West Camden	91,980	**115,901**	2,190	990
	Picton	4,400	4,322	80	**136**
Subzone 2	Winmalee	110,595	88,553	6,687	4,389
	Penrith	176,660	8,590	8,030	1,089
	Wallacia	12,410	2,137	1,606	37
Sackville Zone					
Subzone 1	Richmond	43,800	5,420	10,877	24
	North Richmond	7,118	3,076.2	803	105
Subzone 2	South Creek Bubble	222,000	144,993	2,300	**3,049**
	Riverstone	N/A	20,122	N/A	112
	St Marys	N/A	46,269	N/A	990
	Quakers Hill	N/A	78,603	N/A	1,947
Subzone 3	Castle Hill	72,270	37,818	2,300	1,075
	Rouse Hill	124,100	60,352	4,453	213
Berowra Zone					
	Hornsby Heights	72,270	13,942	2,300	409
	West Hornsby	80,300	22,375	4,643	1,061

Dark blue indicates exceedances

Figure 3-8: TOTAL NITROGEN RELEASED FROM INLAND WRRFs

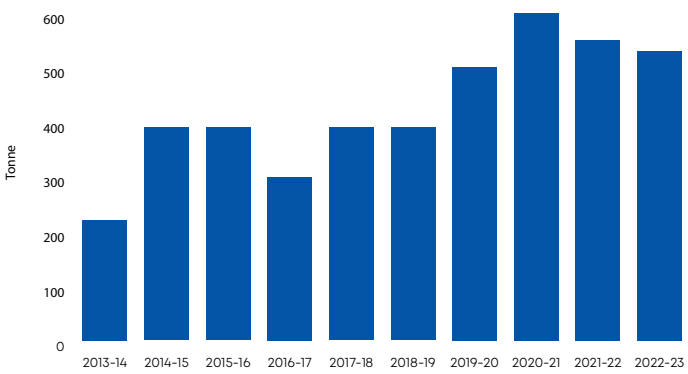
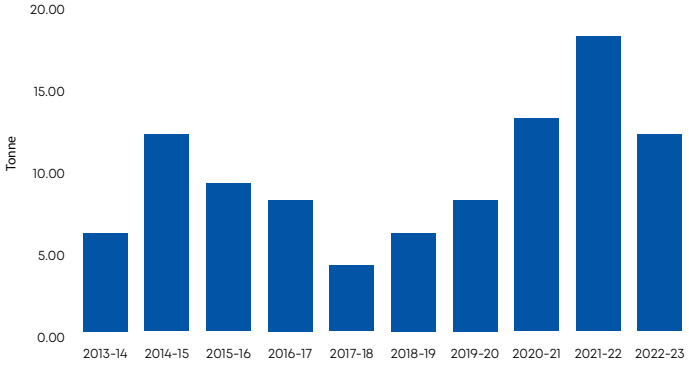


Figure 3-9: TOTAL PHOSPHORUS RELEASED FROM INLAND WRRFs



3.7.2 Hawkesbury-Nepean riverine environment

Water quality and phytoplankton

Under our Sewage Treatment System Impact Monitoring Program (STSIMP) (Sydney Water, 2023), the receiving water quality of the Hawkesbury-Nepean River was assessed via monitoring key nutrients chlorophyll-a, phytoplankton and other physico-chemical analytes. Thirteen sites along the Hawkesbury-Nepean River from the upstream freshwater reaches of the Nepean River were assessed. Another five sites were monitored at four major tributaries, South Creek, Cattai Creek, Colo River and Berowra Creek. Chlorophyll-a was chosen as a sole indicator for eutrophication impacts at key sites in estuaries.

The 2022-23 year was dominated by wet weather throughout the Hawkesbury-Nepean River catchment but eased from a peak in 2021-22. The total rainfall ranged from 907 mm (Lower Nepean River catchment) to 1,325 mm (Berowra Creek catchment) at various Sydney Water gauging stations. The impact of wet weather, along with the increasing/decreasing trends in the concentration of nutrient analytes in some of Sydney Water's WRRF may have influenced the nutrient concentrations at downstream receiving water sites, however little change was measured in Phytoplankton as chlorophyll-a.

Phytoplankton as chlorophyll-a, algal biovolume and species counts were relatively stable in 2022-23 in comparison to previous years. There were no significant changes in chlorophyll-a at 33 of 36 monitoring sites. Chlorophyll-a concentration increased significantly in the Nepean River downstream of Matahil Creek (West Camden WRRF), decreased upstream of North Richmond WRRF and decreased in the tributary downstream of Rouse Hill WRRF. The trends in the limited total phytoplankton biovolume data were relatively stable, increasing significantly at three upstream sites (tributary of West Camden WRRF, both tributary and river of Penrith WRRF) and one river site downstream of West Camden WRRF.

Overall, the 2022-23 median chlorophyll-a concentrations exceeded the ANZG (2018) guideline at 19 of 36 sites. The median chlorophyll-a concentration was within guideline limits mostly in the lower Hawkesbury River tributaries (upstream and downstream of our WRRF discharges).

Median toxic blue-green algae counts exceeded the NHMRC (2008) Amber Alert level at Stonequarry Creek downstream of Picton WRRF in 2022-23. Potentially toxic blue-green algae counts reached the NHMRC (2008) Red Alert levels on two occasions at this site in May 2023.

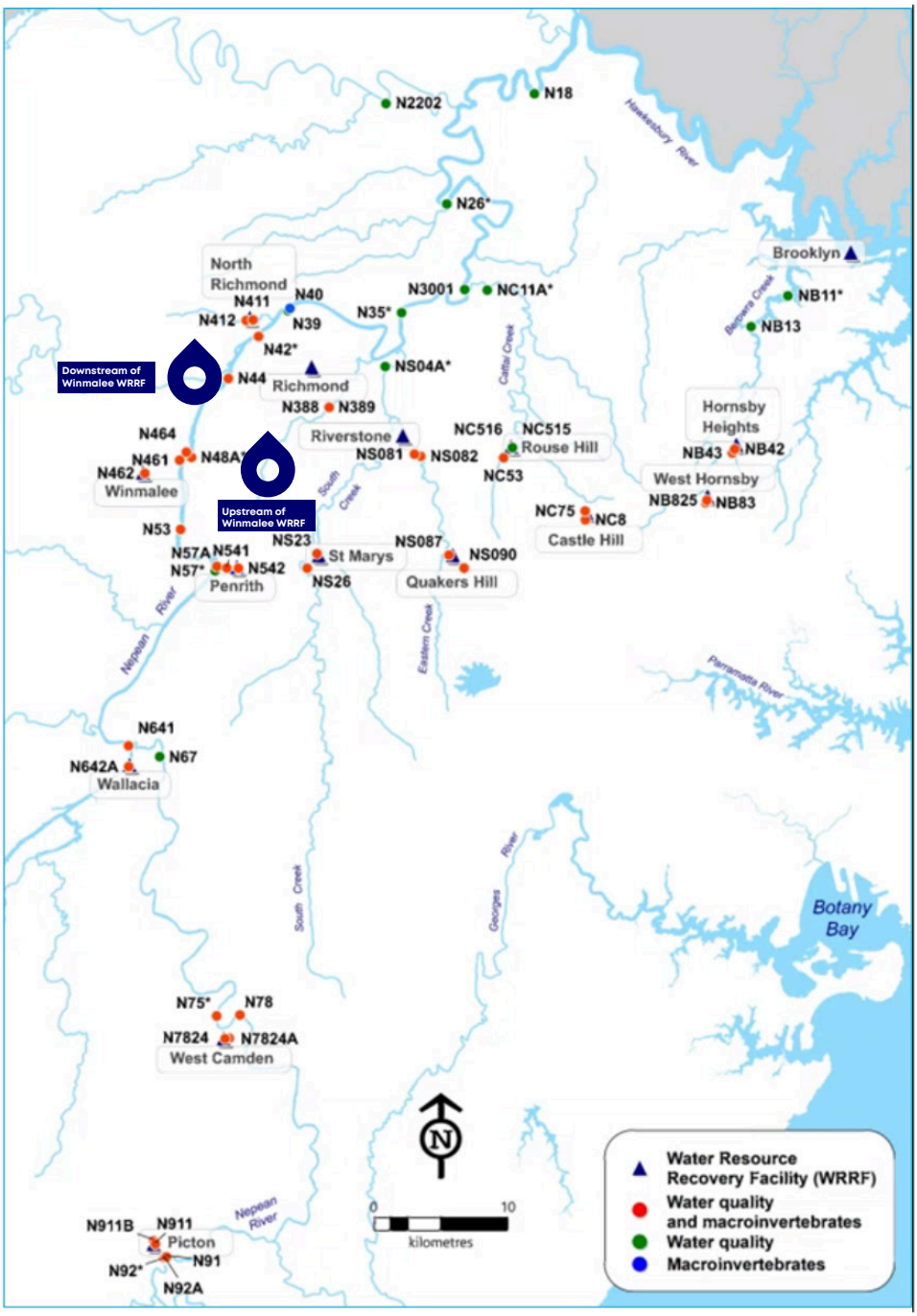
Stream health

Sydney Water monitors freshwater macroinvertebrate communities upstream and downstream of WRRF discharges to determine if stream health is altered by treated wastewater (Figure 3-10). A healthy stream is comprised of many different types of macroinvertebrate animals.

The types of macroinvertebrates present will vary according to natural factors such as stream type, altitude and geographic region. The types present will also vary according to human disturbance, particularly water pollution. Sydney Water has assessed 'stream health' with the Stream Invertebrate Grade Number Average Level (SIGNAL-SG) biotic index tool. 'S' indicates Sydney region version and 'G' indicates taxonomy is at the genus taxonomic level. This tool provides a sensitivity score for a macroinvertebrate sample and can range from 1 - tolerant to 10 - highly sensitive.

In 2022-23, stream ecological health was assessed using macroinvertebrate index, SIGNAL-SG (Sydney genus). Impacts were detected in the tributaries downstream of Castle Hill, Hornsby Heights, West Camden, West Hornsby and Winmalee WRRFs. There was no indication that impacts extended beyond these immediate tributaries into the Hawkesbury-Nepean River. Sydney Water is upgrading Castle Hill, West Camden and Winmalee WRRFs to improve effluent quality.

Figure 3-10: STREAM HEALTH MONITORING SITES



3.8 Water and wastewater network discharges

We supply water and recycled water through over 23,600 km of pipes,165 pumping stations and 260 reservoirs. Our wastewater network consists of over 26,759 km of pipes and 695 wastewater pumping stations. We control over 455 km of stormwater channels. Weather conditions present challenges in managing this extensive network. During heavy rain, stormwater can enter the wastewater network through incorrect private connections and cracked pipes such as:

- downpipes from roof drains incorrectly connected into the wastewater system
- cross connections between stormwater and wastewater pipes
- faulty or damaged maintenance holes
- faulty valve or backflow prevention devices in emergency relief structures (ERS – a designed overflow point)
- faulty or low gully traps
- wastewater pump station wet wells inundated during localised flooding.

Examples of infiltration include cracks in pipes; displaced pipe joints and damaged maintenance holes and ERSs.

- Our network is designed with additional capacity to cope with higher flow during wet weather. However, if the combined wastewater and stormwater flow travelling through the network exceeds the capacity of the network, wastewater must be released to local waterways via designated emergency relief structures. This is called a wet weather overflow. These overflow points prevent wastewater from backing up into our customer's homes and businesses. During dry weather, due to dry soil conditions, tree roots seeking moisture enter through the pipes and cause blockages, which often result in dry weather overflows. Tree roots are the most common cause of blockages in the wastewater network. Inappropriate disposal of material into the network exacerbates these blockages as the material gets caught on the tree roots. Inappropriately disposed items in our wastewater network include 'non-flushable' wipes, sanitary products, oil and grease and construction debris.

3.8.1 Dry weather overflows

The most common cause for blockages in the wastewater network is tree roots. Pipe blockages due to structural faults are a small fraction of the total causes. Dry weather overflow volumes are measured when an incident is declared by Sydney Water. The total number of overflows, the estimated overflow volume and the proportion that reach a receiving waterway in each Sewer Catchment Area Management Plan (SCAMP) are reported to the EPA in our Annual Returns for each EPL. Each EPL has specified limits on the number of dry weather overflow incidents reaching waterways (Condition L7.4). Twelve systems have Condition L7.4 System Limits specified in their EPLs. Among these, eight were under or equal to their limits in 2022-23 while the remaining four systems exceeded their EPL limit.

During 2022-23 eight ocean wastewater systems discharged 13.3ML of wastewater from network dry weather overflows, whilst twelve large inland wastewater systems discharged 0.9 ML of wastewater from network dry weather overflows (Figure 3-11). The total volume of wastewater from dry weather overflows in 2022-23 from our inland wastewater catchments decreased by 51% compared to year 2021-22.

In 2022-23, Sydney Water experienced 7,644 blockages across all of its wastewater networks in relation to dry weather overflows (Sydney Water, 2023a). This was a 31% reduction in network blockages compared to 2021-22 due to an increase in preventative maintenance, installation of IoT sensors to proactively detect blockages and favourable weather conditions. The total number of wastewater overflows reaching waterways from these blockages was 284 (3.7% of total overflows). This was a 22% reduction when compared to 362 overflows reaching waterways in 2021-22. Five-year average (2018-23) of chokes per 100 km was 50 and below the limit of 81.

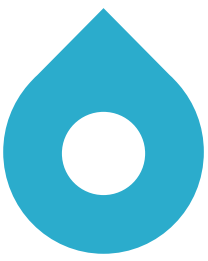
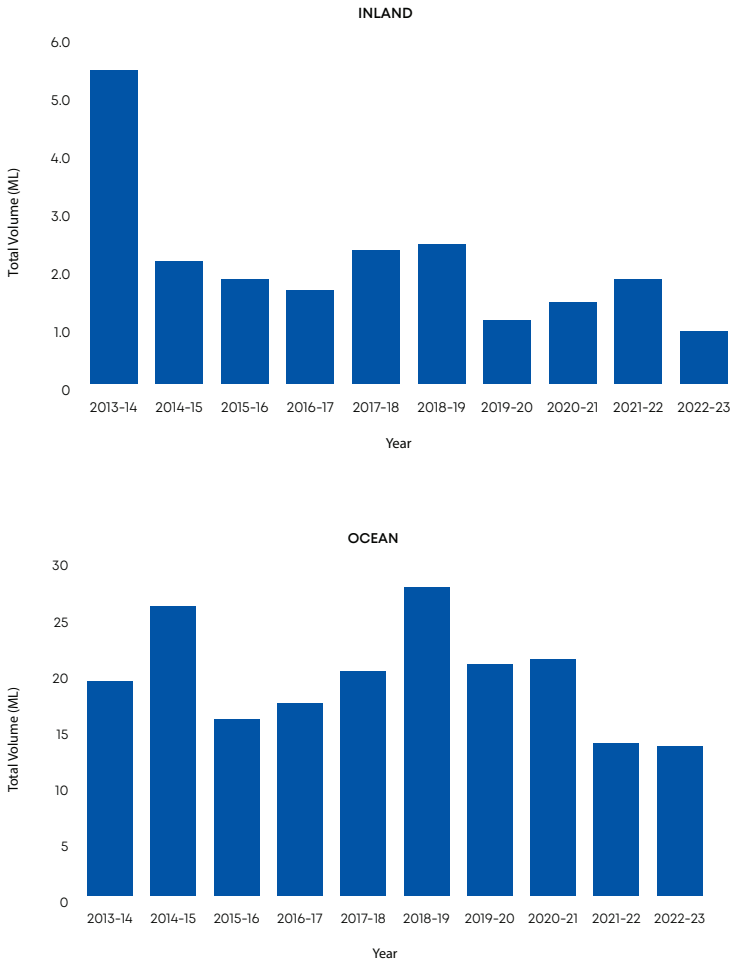


Table 3-3: RELATIVE PERCENTAGE OF CHOKE CAUSES FOR 2022-23

Cause	Contribution	Description
Tree roots	42.2%	Tree roots entering through cracks, joints, and private sewers
Soft choke	22.2%	Combination of residual solids, wet wipes, and sanitary products
Debris	16.7%	Debris from construction activity broken pipes and non-flushables
Fat / Grease	9.6%	Consolidated fat on pipe walls residential and commercial sources
Structural	4.4%	Issues with the actual pipes such as collapses
Non-specific	3.0%	Includes Other, Unknown and Source Unknown and missing data

Most chokes are caused by blockages in small diameter pipes and result from a combination of factors. The most prevalent cause of blockages in small diameter pipes is tree roots. The internal diameter of most pipes is 150mm or 225mm. While tree roots are still the most prevalent cause of chokes, there is an increasing trend in other types of chokes. There are various other factors causing chokes as seen from Table 3-3 above. These other causes are difficult to predict as many are driven by customer behaviour such as flushing plastics/wipes and disposing of fats, oils and grease from private properties.

Figure 3-11: PREVIOUS 10 YEARS OF DRY WEATHER OVERFLOW VOLUMES THAT REACHED WATERWAYS BY ALL OCEAN AND INLAND WASTEWATER SYSTEMS AND NUMBER OF INCIDENTS



Note: number of overflows that reach waterways per year is shown at the top of each bar, volume (ML) at the middle of bar

Key initiatives and improvement strategies for dry weather overflows including abatement activities and corrective actions

The key initiatives and improvement strategies that were undertaken in 2022-23 as scheduled investigations, works and activities to reduce the increased volume and frequencies of dry weather overflows are described below.

Reactive responses to overflows

Maintenance field crews provide a reactive environmental response to sewer chokes across our area of operations which involves establishing pollution controls (containment, signage, cordoning etc), clearing of blockages (mainly using high-pressure water jetting equipment) and clean-up. Timely and effective containment can prevent an overflow from reaching a waterway or reducing the area of waterway that is impacted.

Investigation programs/ Preventative maintenance

Maintenance Hole Inspection Program – We inspected 14,744 maintenance holes to determine their condition and remove tree roots and other blockages that may cause an overflow to the environment.

CCTV Level 1 and Level 2 – Dry weather overflow abatement investigation involves visual inspection of maintenance structures and remote inspection of pipes using CCTV cameras. When any of these inspections identify pipes in poor condition and requiring remediation, follow-on maintenance, repairs, or renewals are programmed to restore the integrity of the asset and prevent future blockages.

Root- cutting - We completed around 900 km of sewer cleaning and root cutting in 2022-23.

Continuous lining

Small diameter gravity sewers (150-300 mm) located in remote bushland areas are prone to tree root chokes caused by the high density of trees and are often situated adjacent to waterways. Due to their remote nature, these sewers have a higher probability to result in prolonged overflows and therefore more significant impacts to the environment. They are also difficult to safely access for workers and equipment.

In 2020-21, a continuous lining pilot project was completed in the Forestville Sewer Catchment Area Management Plan (SCAMP), consisting of relining 1.6 km of sewers in Garigal National Park. This pilot confirmed the practicality of continuous lining as a method to 'rebuild' sewers by continuous relining of the pipes, including lining through maintenance holes. Root removal was completed prior to installing liners. Where continuous lining was not practical (e.g. large level difference between maintenance hole inlets and outlets and tight bends), the maintenance holes were rehabilitated to provide a similar level of integrity, by identifying and repairing faults. IoT devices were also installed in maintenance holes where continuous lining was not practical. In 2022-23, nine continuous lining projects were initiated in bushland areas of the Cronulla and North Head wastewater systems. Planning work is underway, and construction is scheduled to commence within the Bangor SCAMP during the 2023-24 period.

Internet of Things (IoT)

Internet -of-Things (IoT) devices are now an important and permanent part of dry weather overflow abatement activities. These are low-cost devices, normally float switches, connected to the IoT network that monitors sewage levels in maintenance structures and alarm when sewage backs-up behind blockages.

In most cases there is enough time after alarm initiation for a maintenance crew to attend and clear the blockage before the wastewater system overflows.

IoT devices are installed in high flow pipelines where there is a higher risk of a blockage causing a large overflow that may impact local waterways. The methodology for selecting maintenance chambers for an IoT device also considers spatial data on sewer inverts and sewer gradient so that devices cover several chambers (given sewage will discharge from the lowest point first).

Artificial Intelligence (AI)

AICE (AI CCTV Expert) portal went into production in December 2022. This AI platform was developed in-house and minimises the time it takes to identify problems with our wastewater network. High priority repairs jobs can be issued to our maintenance crews far more efficiently.

Lost flow analysis at sewage pumping stations

Sydney Water's telemetry system (IICATS) is used to detect sewer blockages upstream of wastewater pumping stations by identifying abnormally low wet-well inflow rates. Blockages can be detected anywhere upstream of a wastewater pumping station, but the method relies on the amount of lost flow being statistically significant when compared to the normal total wastewater pumping station inflow. Where a blockage holds back a small proportion of the normal flow, the flow reduction cannot be differentiated from the natural variation in flows. Where an overflow has commenced, the duration and impact are significantly reduced. Many of the blockages identified have been in bushland where overflows are not in public view and could have run for days before being reported if they were not detected through lost flow analysis.

Customer campaigns

Non-degradable items mixed with fats, oils, and greases (FOGs) cause problems such as pipe blockages and pump failures that can lead to sewage overflows that impact the environment and our customers. Sydney Water runs targeted communications campaigns addressing the issues our wastewater system faces due to inappropriate disposal of bathroom and kitchen products.

3.8.2 Wet weather overflows

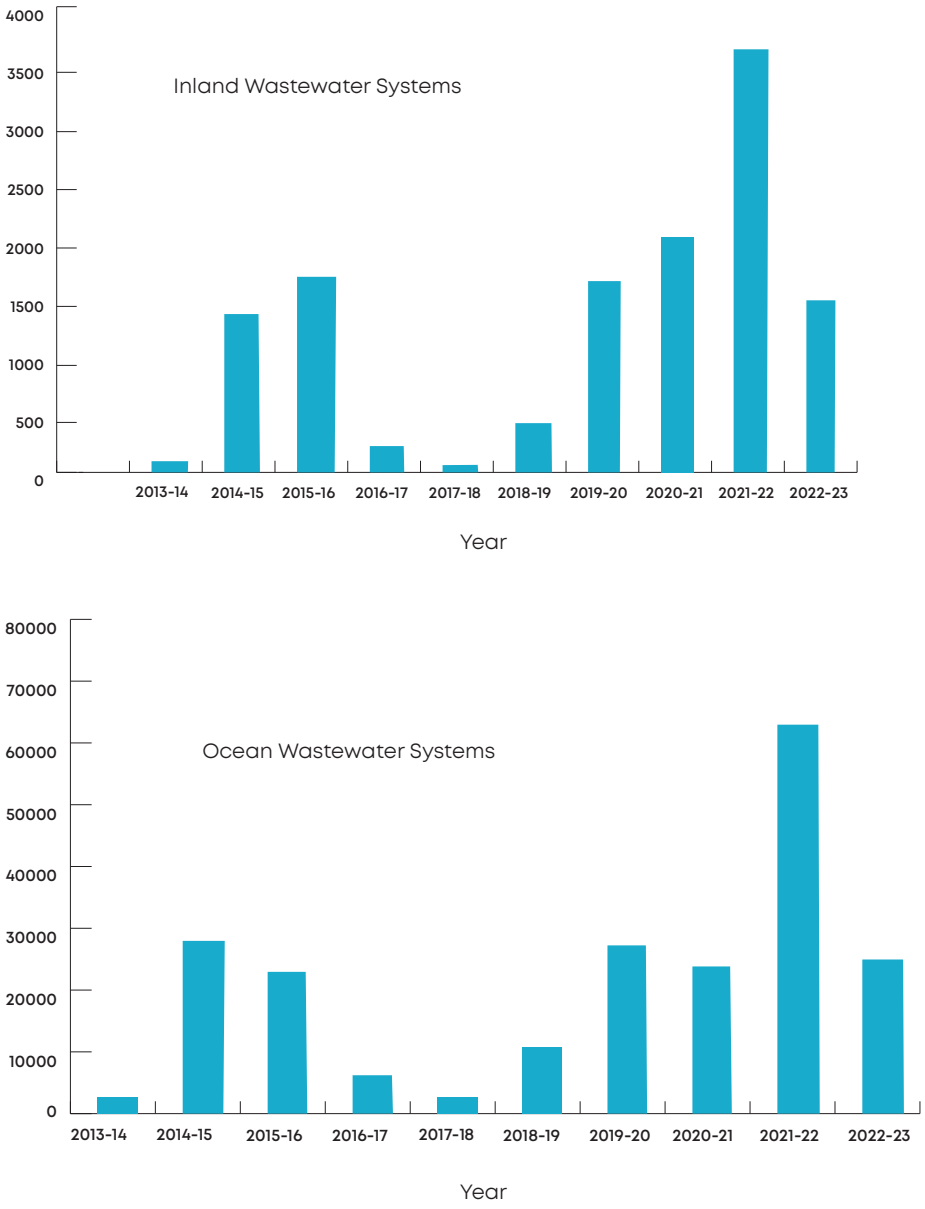
Wastewater overflows under wet weather conditions occur when the hydraulic capacity of our wastewater networks or WRRFs treatment capacities are exceeded due to excessive inflow and infiltration of stormwater. The primary sources of stormwater in the wastewater system comes from incorrectly connected private stormwater pipes and inflow into faulty Sydney Water assets. Saltwater ingress, particularly during large tidal events, is also known to affect assets located within the intertidal zone. Groundwater is similarly known to infiltrate the wastewater network where the watertable is high. The 2022-23 reporting year returned to more typical rainfall levels, following an extraordinary wet year in 2021-22. This resulted in a decrease in modelled wet weather overflow volume by 59% in the inland systems compared to the 2021-22 year. The modelled volume of wet weather overflows from the ocean systems decreased by 58% compared to the 2021-22 year.

Table 3-4: LIST OF WET WEATHER OVERFLOW NON-COMPLIANCES BY EPL CLAUSE (2022-23)

Wastewater system EPL Clause	Non-compliant systems
L7.1 Ongoing use and development of a high-quality Hydraulic System Sewer mode	Nil
L7.2 Wet weather overflow limits	North Richmond, Riverstone, Rouse Hill, Shellharbour, St Marys, West Camden and Wollongong
O4.8 I Comparison of modelled wet weather overflows	Malabar
O4.10 Wet weather partial treatment discharges	Fairfield (Malabar)

Thirteen systems complied with key EPL conditions (L7.2, O4.8I, O4.9 and O4.10). The complying systems were Bombo, Bondi, Castle Hill, Cronulla, Hornsby Heights, Penrith, Quakers Hill, North Head, Richmond, Wallacia, Warriewood, Winmalee and West Hornsby. Two systems (Picton and Brooklyn-Dangar Island systems) don't have conditions and hence were not assessed for EPL compliance. The frequency of wet weather overflows from the reticulation system of seven systems exceeded the L7.2 limits i.e. maximum number of overflows per 10 years (Table 3-4). The modelled wet weather overflow frequency for the Malabar system in 2022-23 was 294 overflow events in 10 years, exceeding the benchmark value of 238 overflow events in 10 years (Condition O4.8c). The partial treatment capacity of the Fairfield stormwater plant in the Malabar system exceeded the benchmark limits of allowable discharges (maximum of 50 overflows in 10 years, Condition O4.9). There were 85 overflows from this stormwater plant in the last 10 years to 2022-23 The non-compliances have been investigated and actions put in place to help identify and deliver works to bring the systems back into compliance. Further details are provided in the report Sydney Water 2023b

Figure 3-12: Previous 10 years of Modelled wet weather overflow volumes by all inland and ocean wastewater systems



Wet weather overflow abatement program (WWOA)

In order to reduce wastewater overflows that occur due to the infiltration of stormwater into the wastewater network, Sydney Water is tackling the problem at the source. Wet weather Our current wet weather overflow abatement program is made up of three work packages:

- Stage 1 - inflow management - involves rectifying emergency relief structures (ERS's) by installing backflow prevention valves. These valves prevent stormwater from flowing into the wastewater system from the overflow discharge pipe.
- Stage 2 - infiltration management - focuses on reducing infiltration through damaged pipes and maintenance holes. This stage targets assets that are in high infiltration areas. Rectification works include pipe lining, maintenance hole repairs and installation of anti-infiltration devices ("rain stoppers") in maintenance holes that are at risk of stormwater ponding or overland stormwater flow and flooding.
- Stage 3 - Private properties - focuses on implementing a smoke testing and private property inspection program to identify plumbing faults and rectifying these issues where they contribute large volumes of stormwater to the wastewater system. Rectification works include repairing faulty overflow relief gullies and redirecting roof drainage connections from wastewater to the stormwater system.

3.9 Stormwater network discharges

Stormwater assets help protect people and property from flooding, and form part of our urban waterways. Our stormwater network is a small (455 km), but critical part of the metropolitan drainage system, draining 15% of Sydney's urban area. Local councils own and maintain most of the city's stormwater assets. Poor quality stormwater is highly detrimental to waterway health and amenity.

In 2022-23 we removed silt and rubbish from over 75 stormwater quality improvement devices which prevented 3,841 m3 of debris (compared to 1,659 m3 in 2021-22) and 1,159 tonnes of sediment (compared to 1,301 tonnes in 2021-22) from entering Sydney's waterways. We also removed 449.6 tonnes of silt and debris from our stormwater channels in 2022-23. We also take the opportunity to improve waterway health and amenity by naturalising stormwater assets in suitable locations when they reach the end of their structural life.

3.9.1 Naturalisation & Waterway Health

We are progressively converting degraded concrete open channel stormwater assets to a semi-naturalised state. This can provide enhanced biodiversity and enable the creek line to become an asset that can be enjoyed by the local community. Some projects include:

- Muddy Creek Naturalisation Project – Rockdale (1.6 km creek bank). On-ground works began October 2022. Project forecast for completion by late 2024.
- Iron Cove Creek Naturalisation Project – Haberfield (400 m creek bank). Iron Cove Creek draft scope of services and the Technical Specification document are currently being produced by Sydney Water.
- Whites Creek Naturalisation Project – Annandale (300 m creek bank). Design work being undertaken. Project delivery is scheduled post 2025.
- St Lukes Park Naturalisation Project – Canada Bay (1.4 km creek bank). Detailed design work being undertaken. Project delivery is scheduled post 2025.

Sydney Water is also implementing Waterway Health Improvement Projects (WHIPs), including construction of new wetlands and stormwater quality improvement devices. Some projects include:

- Milson Park WHIP – Operational completion August 2023. Two new SQIDs, bioretention, stormwater pumping station & swales.
- Parkside Drive WHIP – Operational completion September 2023. Three new SQIDs, bioretention basins & swales.
- Deakin Park, Silverwater – Preliminary design report completed.
- Surrey Street Chain of Parks, Guildford - Preliminary design report completed.

Efficient and sustainable resources reuse

04

We recognise the critical value of water as a precious resource. We are developing a diverse and adaptive baseline water conservation program that has the capability to deliver the water saving aspirations identified in the Greater Sydney Water Strategy (GSWS), and scale efforts in times of drought. Initiatives that fall under the program are designed to be economically viable and environmentally sustainable without compromising the value provided to customers and the community.

4.1 Develop and implement water conservation program

The Greater Sydney Water Strategy (GSWS), developed by the Department of Planning and Environment (DPE) in partnership with Sydney Water and WaterNSW, flagged a response to the challenge of providing sufficient water to meet all customer and community needs.

This includes upgraded drinking water supply, integrated water cycle management and water conservation. Our approach to water conservation is based on delivering the following outcomes:

- Sustainable and efficient management of our resources
- Developing water resilient and water smart communities
- Enabling liveability outcomes for the community

We place a high priority on water conservation as part of a range of measures to ensure a resilient and secure water supply for Greater Sydney. In 2022-23, our water conservation program had six key focus areas.

The water conservation activities during 2022-23 achieved a total water efficiency of 1,473 ML in annual savings. Leakage-management programs have ensured that Sydney Water manages drinking water supply efficiently, minimising water loss from our assets and potentially delaying investment in new large-scale supply infrastructure. We produced around 40,000 ML of recycled water in 2022-23, resulting in a reduction in drinking water demand of around 12,000 ML. Although the production was higher, the demand for recycled water was lower than previous year due to wetter weather. Leakage management programs ensure Sydney Water manages drinking water supply efficiently, minimising water loss from our assets. The rolling 12-month leakage result of 129 ML/d is outside the range of the Economic Level of Leakage (ELL) band due to a significant step change in the three quarters, Q4 21-22 to Q2 22-23. Water leakage then returned to normal levels over the first half of 2023 (Q3 and Q4 of the reporting period). Adopting an Economic Level of Leakage (ELL) based approach aims to ensure that proactive leak-reduction activities are cost effective and represent best value for our customers. In 2022-23, the total length of mains inspected for leaks decreased (13,923 km compared to 15,455 km in 2021-22) under the active leak detection program. We are continuing to work on identifying target areas to improve the effectiveness of the program.
Our existing recycled water schemes helped produce 39.8 GL of recycled water, contributing to a reduction in drinking water demand of 11.9 GL. There are substantial greenfield and infill development areas throughout Sydney that present challenges and opportunities to leverage limited system capability and use water differently. For example, a new WRRF at Upper South Creek is being built to service the Western Sydney Aerotropolis, which provides an opportunity to supply recycled water within the Western Sydney Aerotropolis Growth Area and to the new Western Sydney International Airport.

Key highlights from 2022-23 include:

- Various Waterfix® programs,
- The launch of 2022 Water Efficiency Grants and Pool Cover Rebate Pilot Program in April 2022 – Sept 2022 approved 130 applications resulting in 4.29 ML per year in water saving.
- Inefficient Washing Machine Replacement pilot program was conducted. Following an assessment, a new initiative to replace inefficient water machines will be delivered as pilot in 2022-23.

Research and innovation programs are designed to increase water savings and reduce drinking water demand. We continue to become water-wise and save water. We have implemented a series of programs including Recycled Water and Soil Interaction, Arboretum and recycled water project. Sydney Water is currently piloting several options to understand which of the multiple emerging technologies are the most appropriate for water leaks and therefore water conservation. Refer to Water Conservation report for more details.

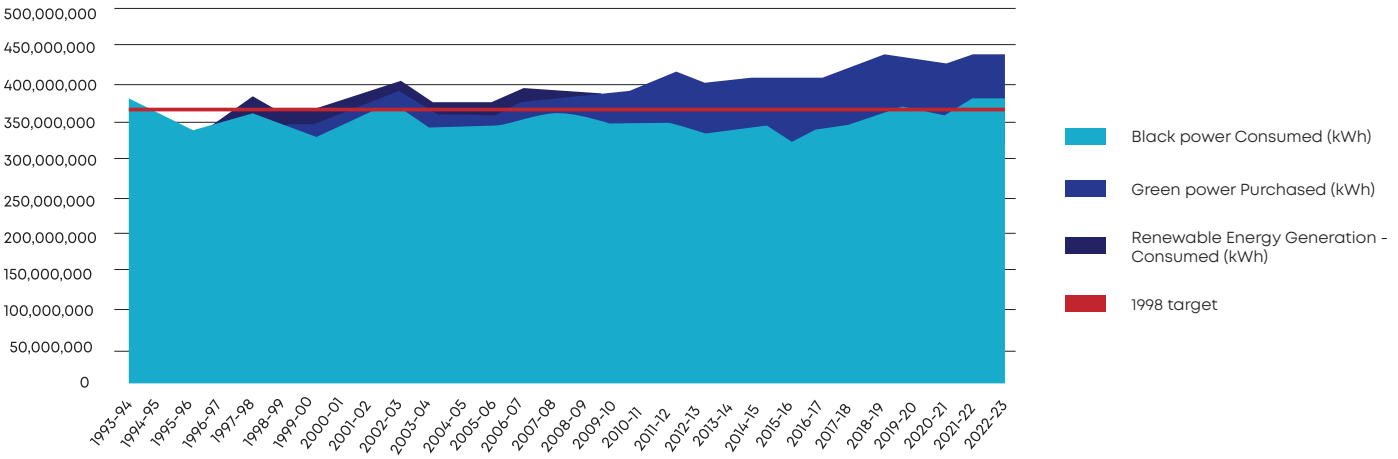
4.2 Maintain our grid-sourced electricity demand below 1998 levels

Sydney Water's goal is to achieve grid electricity consumption equivalent to 1998 levels (366 GWh). In 2022-23, we consumed 388 GWh, therefore our consumption was above the internal benchmark by 21 GWh.

The grid electricity consumption remained high due to the following factors:

- Residual wet weather impacts following higher-than-average rainfall in 2022. 2022 was the wettest year on record for Greater Sydney, leading to increased electricity consumption for Sydney Water's wastewater pumping stations.
- Sydney Water's self-generated renewable energy remains well below maximum production capacity. This is due to key cogeneration and hydro assets being offline due to project delivery challenges. Malabar Cogeneration replacement and North Head Hydro refurbishment were all progressed and on track for commissioning in 2023-24. Prospect Hydro did not operate for the entirety of 2022-23, however actions progressed to manage risks so that the asset will be operational in 2023-24. The Sydney Desalination Plant (SDP) remained operational for the duration of 2022-23 but does not directly contribute to Sydney Water's grid electricity consumption.

Figure 4-1: ENERGY USAGE BY SOURCE



Our fuel usage increased in 2022-23 due to a significant increase in major projects and capital works. These works included planned asset renewals, works to address wet weather impacts to Sydney Water assets in 2021-22 and residual works post-COVID. In Q2 and Q3 of 2022-23, there was relatively high stationary diesel consumption due to the commissioning of the Thermal Hydrolysis Process boiler at St Marys WRRF. Thermal Hydrolysis was installed to produce higher quality biosolids and now that the plant has been commissioned, the boiler will be fuelled using biogas from the anaerobic digesters onsite.

Gas consumption increased in 2022-23 due to higher-than average use at multiple sites throughout Sydney Water's operations. These sites include Potts Hill Depot, West Hornsby WRRF, Warriewood WRRF, and West Ryde laboratories. This is despite process improvements at numerous other sites, including West Camden WRRF and Homebush Office. The reasons for variable consumption differ from site-to-site.

Sydney Water's on-site renewable energy generation (51,239,023 kWh) was equivalent to 11.8% of total energy consumption in 2022-23. Renewable generation was lower than the previous two years. This is attributable to several factors including:

- Reduced renewable energy production due to residual impacts of rainfall events in 2022.
- Malabar Cogen units being taken offline resulting in reduced overall production,
- Prospect Hydro remained offline due to pipeline maintenance,
- North Head hydro upgrade extended due to wet weather.

4.3 Bioresources

While providing water, wastewater, recycled water and storm water services to our customers, we inevitably generate a range of byproducts that have some beneficial value. While some products are unlikely to have value (such as wipes and other sewage litter), others do have product value (with adequate treatment, sorting or processing). These 'bioresources' are collected at various stages of the process – during transport and treatment of water, wastewater or stormwater. Sydney Water's biosolids are an excellent example of how the end product of our wastewater treatment can be recovered and reused as a valuable resource in the agricultural and forestry industries. Biosolids are the nutrient-rich organic material produced from wastewater treated at our WRRFs.

We have been consistently achieving 100% beneficial use of biosolids for agricultural and horticultural purposes. 2022-23 saw Sydney Water beneficially reuse 39,547 dry tonnes of biosolids, with 59% being sent direct to agricultural land application, 25% reprocessed through compost markets, 16% directed to application in forestry and 1.2% utilised as liquid biosolids for agriculture land application at Picton WRRF farm

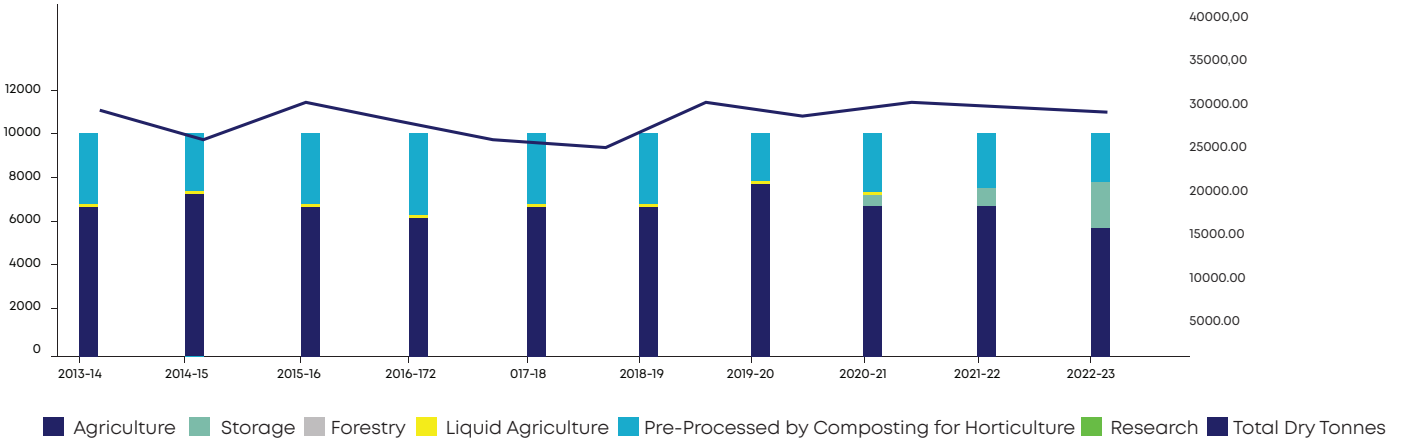
Figure 4-2 Sydney Water is investigating the carbon impacts and benefits that these products are having on different markets. We have completed a carbon study, which identified that applying biosolids to new sustainable forestry, or applying biosolids that were converted to biochar, both resulted in positive soil carbon sequestration benefits. However, our current biosolids management practices do have carbon emissions. Further investigation is required to look at the whole of life, production and end use of biosolids products before changing our current practices.

The success of the biosolids program has driven Sydney Water to examine other end products from our processes with the view to expand our recovery products. For example, over the past 12 months we have started programs that examine meaningful recovery pathways for grit and silt that is removed from our WRRFs and our wastewater networks. This project is currently at an analysis stage. Sydney Water is looking at the best available pathways to move these products from landfill to a resource recovery market (Table 4-1) and has been engaging with the NSW EPA regarding a resource recovery exemption.

Table 4-1: BIORESOURCES REUSED

Cause	Description
Wastewater	Biosolids
Water	Water treatment sludges
Land Management	Vegetation (pruning, clearing) Construction spoil Drilling mud

Figure 4-2: BIOSOLIDS PRODUCED AND PERCENTAGE USAGE



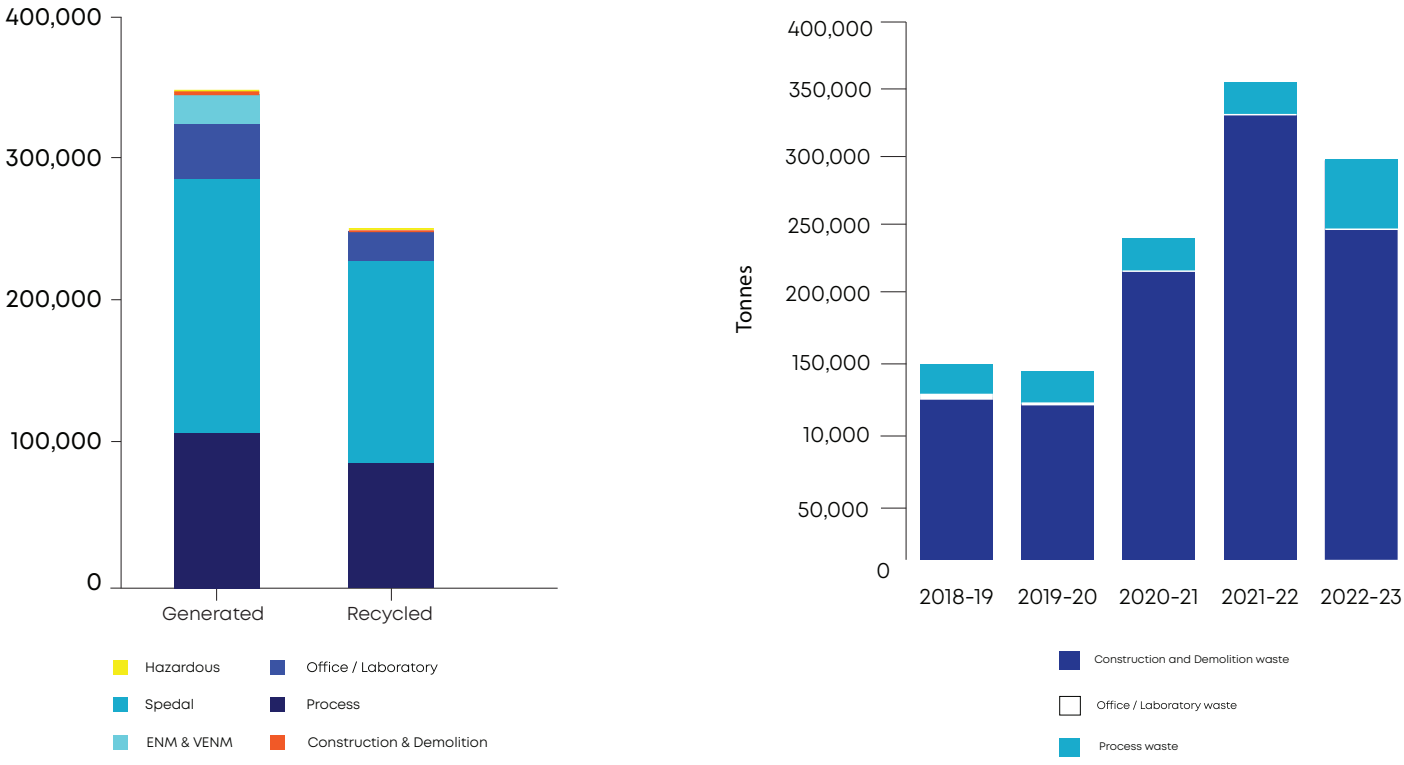
4.4 Waste

In 2022-23, Sydney Water generated 345,748 tonnes of solid waste which was similar to waste generated in 2021-22. (see Figure 4-3), with 80% of this waste reused onsite, offsite or sent for recycling). The overall recycling rate for 2022-23 was 79% (similar to 2021-22).

Sydney Water generates waste across two sectors. Commercial and industrial waste is generated by our operations and includes waste from water filtration plants and WRRFs. It also includes waste generated from maintenance programs and waste from our offices. We also generated significant waste from our major project works. Our construction and demolition activities were responsible for 84% (290,319 tonnes) of the total waste generated and were the major contributor to the overall generation of waste in 2022-23. Of the waste generated from our construction and demolition activities, 84% (242,924 tonnes) was recycled or reused.

This significant increase is attributable to 62% of construction and demolition waste being virgin excavated natural material (VENM) and excavated natural material (ENM).

Figure 4-3: WASTE GENERATED IN 2022-23 BY CATEGORIES



As shown in **Figure 4-3**, special waste (asbestos-contaminated waste) amounted to 13,775 tonnes, whilst 1,972 tonnes were classified as hazardous waste. Of the total amount of waste generated, about half (177,351 tonnes) was virgin excavated natural material (VENM) and excavated natural material (ENM). Over 95% of this material was recycled or reused. Most of this material was generated from our major project works.

Figure 4-4: FIVE-YEAR TRENDS PERCENTAGE WASTE RECYCLED BY CATEGORIES

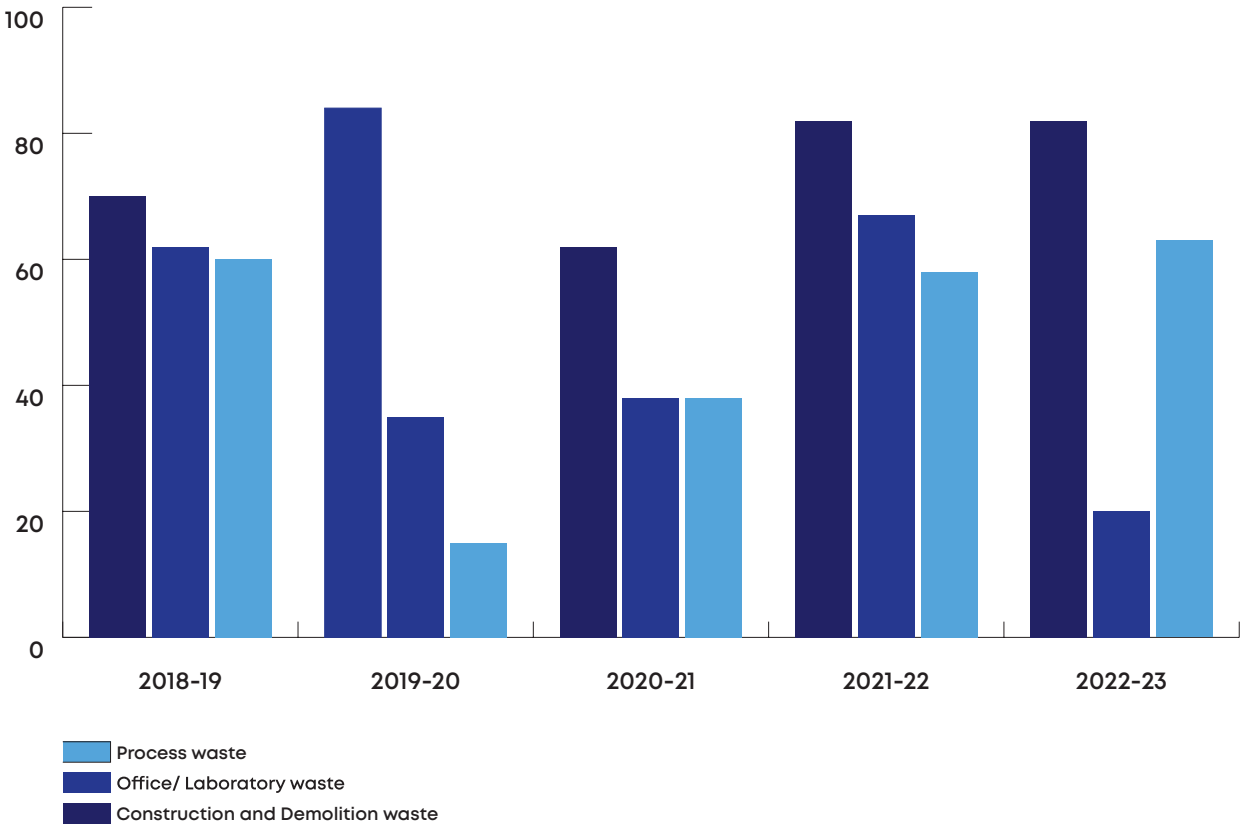


Figure 4-4 shows that the percentage of overall quantities of waste reused/ recycled are slightly lower (274,082 tonnes) compared to the previous year, however, higher than prior years. All types of waste generated by our activities have been grouped into three categories –

- Construction and demolition – includes waste generated through our construction and demolition activities.
- Office/ Laboratory – includes waste generated at our office sites and also includes the laboratory waste
- Process – includes waste generated through our processes such as wastewater and water treatment processes, incident clean up processes as well as regular activities to maintain our networks

05 Community involvement

5.1 Community involvement projects

Sydney Water engages with the community through various awareness and education programs focusing on water literacy and conservation. During 2022-23, our Community Education Team engaged with nearly 50,000 children and adults through the Wonders of Water Discovery Van. This mobile education vehicle helps us educate our community on the water cycle and the circular economy, including how water is captured, treated and distributed.

5.1.1 Our Water, Our Voice

Our Water, Our Voice customer engagement program began in July 2022 and is due to be completed in May 2024. It is the largest customer engagement program in the history of Sydney Water with over 6,000 participants to date. The program includes five phases of engagement: 1. Capturing customer priorities, 2. Capturing customer service insights, 3. Customer insights for better business planning, 4. Customer recommended contract and price proposal and 5 and 6. Customer outcomes and measures.

The top environmental priorities that customers identified were to: Maintain clean, safe waterways and water recreation areas by reducing pollution; Minimise leaks and breaks in the network to reduce water loss; Improve natural waterways and habitats to protect the environment; Improve stormwater management, storage and capture to reduce water loss to the ocean; Contribute to a cooler environment and more pleasant green public spaces through trees and vegetation; and Reduce carbon emissions to net zero by 2050 or sooner via energy-efficient operations and renewable energy. This indicates that customers attitudes are changing from previously being focused on drinking water usage, taste and smell to now having a greater focus on drought resilience and water conservation, and pollution reduction.

5.1.2 Community events

Several key events were held during 2022-23 including the SCG 'Pink Test' (through Cricket NSW sponsorship), Ramadan Nights at Lakemba (241,000 visited), the Royal Easter Show and World Pride events (110,000 attendees). At these events, we engaged with visitors to share key messaging around water conservation, encouraged people to drink tap water and visit the Waterwise Website. Branded water bottles and water conservation show bags (with shower timer and water conservation fact sheet) were also distributed by volunteers to increase awareness of the importance of water conservation.

5.1.3 Water efficiency campaigns

Turn it Off Bob

The 'Turn it off Bob' campaign reached 92 million impressions, with two million seeing the ads on TV. The campaign has significantly increased awareness of day-to-day water usage in and around the home. The campaign's key strength is its novelty and attention-grabbing style, which supports the campaign's objectives.

Save it With Me

Australian Canoe slalom eight-time world champion and Olympic gold medallist Jess Fox was launched as a Sydney Water Ambassador on the importance of water conservation. From November to December 2022, Jess featured in an all-new campaign #saveitwithme, explaining why water is so precious and shared her passion for protecting our waterways. The advertisements, delivered across television and social media platforms, were seen 22,697,209 times by our customers and more than 50 media stories resulted from the campaign.

Water efficiency campaigns

Community events

5.1.4 Wastewater campaign

The last significant wastewater campaign that Sydney Water launched was the education campaign (It's Best to Bin It) during October to December 2021, relating to what should and should not be flushed down the toilet or put down the sink. The Community Sentiment monitor has highlighted that past wastewater campaigns are losing their impact without further investment and without education, these behaviours will continue. Additional wastewater campaigns will be developed in early 2024.

The consequences of not disposing of bathroom waste correctly, combined with putting inappropriate items down the sink, costs customers money and harms the environment. Results from the related 'It's Best to Bin It' campaign showed:

- 75% of consumers would consider putting only the 3Ps down the toilet and binning everything else,
- 57% of consumers intend to learn more about what they can and cannot put down the toilet and 59% of consumers intend to learn more about what they can and cannot put down the sink, and
- 45% of consumers would consider sharing the advertisement within their social network.

In May 2022, Standards Australia released a 'flushability' standard, and Sydney Water is actively helping educate consumers on products that meet this new standard.

5.1.5 Aqua Allies

In August 2022, a new education program to activate the next generation of water ambassadors was introduced. The Aqua Allies is a free, in-school learning experience that was designed by qualified teachers for Years 1 to 6. This program encourages students to go on an exploration of all things water and covers interacting with water, where water comes from, where does wastewater go and how they can care for water and use water more sustainably.

5.2 Customer satisfaction, awareness, and behaviour

We know that the work we do impacts our customers and the community in different ways. Good community and stakeholder engagement allows us to explain proposals and build water literacy. It also gives us the opportunity to share their knowledge, issues and support programs. In addition, we can understand and respond to community and stakeholder views. The below two tools are used to monitor community engagement activities.

5.2.1 Brand Tracker

Sydney Water's Brand Tracker continues as an effective measuring tool to measure community engagement and sentiment. Launched in July 2020, it measures customer satisfaction, awareness, reputation, price perception and behaviour. These are all collectively termed 'customer advocacy'. The customer categories measured in the customer advocacy metric includes residential customers and businesses.

Sydney Water's Brand Tracker showed 69% of the 3,259 people surveyed plan to reduce water usage in and outside the home, 46% intend to use less water in the bathroom and 41% said they would use less water in the kitchen. The Brand Tracker Customer Promises related to the environment are summarised in Table 5-1. At a quarterly level, the 2022-23 figures are largely stable against prior data. There is some fluctuation in the Customer Promises related to environment, however, this is not significantly different. There have been some slight decreases being driven by Residents, with the 18-34 year old age band (including students and full/part-time workers) having decreased their perceptions regarding 'Sustainability' Moments that Matter (environmentally sustainable organisation). This may impact Enterprise Advocacy moving forward.

Table 5-1 Brand Tracker Customer Promises related to environment longterm and 2023 OVERVIEW

	YEARLY			RESPONSE FY 2022-23				TREND
Customer trusts Sydney Water to	2020-21	2021-22	2022-23	Q1	Q2	Q3	Q4	
make it easy to be smart with their water usage Waterwise	52%	53%	50%	50%	49%	52%	49%	Stable
make it easy to look after the environment	47%	49%	46%	47%	45%	47%	46%	Stable
always protect the environment. Environmentally focused	59%	60%	57%	58%	56%	58%	57%	Stable
be an environmentally sustainable organisation	55%	58%	54%	54%	53%	55%	54%	Stable

5.2.2 Community Sentiment Monitor

This survey provides a snapshot of what is working well and the challenges and opportunities. One of the key challenges that Sydney Water faces is that more than half of our customers (55%) believe that it is okay to flush items other than human waste and toilet paper, down the toilet (Table 5-2), including tissues, hair, leftover milk and tampons. Social media and digital campaigns have attempted to address this behaviour, however, as noted above, there has not been recent investment in wastewater campaigns with a shift towards water conservation campaigns.

Table 5-2 COMMUNITY SENTIMENT MONITOR 2023 OVERVIEW

	RESPONSE FY 2022-23			
Apply to flush own the toilet	Q1	Q2	Q3	Q4
Believe that it is okay to flush (items other than human waste and toilet paper)	52%	52%	55%	55%

06 Glossary

Term	Definition
biochar	Charcoal produced from plant matter and stored in the soil as a means of removing carbon dioxide from the atmosphere.
catchment	Catchment boundaries are marked on the system map
chokes/network blockage	A choke is a sewage overflow caused by a full or partial blockage. Chokes can occur in wet or dry weather. Choke is the sub-set of blockages where an overflow has occurred.
controlled overflow	Wastewater overflow from designated- de-signed overflow structures
dry weather overflow	An overflow in the reticulation system not caused by wet weather, as determined by the hydraulic sewer system model.
effluent	Sewage that has received all the designed treatment processes at the WRRF.
Environmental Impact Index (EII)	A measure of Sydney Water's overall environmental impact aligned with Sydney Water's significant environmental aspects.
greenfield	Denoting or relating to previously undeveloped sites for commercial development or exploitation.
incident	Within the context of this report 'incident' typically refers to environmental incidents where there is an actual or potential overflow to waterway, or other environmental harm. It is sometimes used to specifically refer to confirmed overflows to waterways.
Internet of Things (IoT)	The interconnection via the internet of computing devices embedded in everyday objects, enabling them to send and receive data.
maintenance hole	The most common type of maintenance structure in wastewater networks, used to access, inspect, and maintain the network. Previously called manholes.
material harm incident (MHI)	An incident that results in actual or potential harm to the health or safety of human beings or to ecosystems that is not trivial refer to section 147 of the Protection of the Environment Operations Act 1997) and is required to be notified as per Section 148 of the Protection of the Environment Operations Act 1997.

Term	Definition
reticulation system	Part of the sewage treatment system which collects and transports sewage to the WRRF and includes all sewer pipes (whether greater or less than 300mm diameter), access chambers, vent shafts, directed overflow structures and sewage pumping stations, but does not include the WRRF.
SCAMP	Sewer Catchment Asset Management Plan
sewage	All material received in the wastewater reticulation system.
WRRF	Water Resource Recovery Facility/ previously referred to as sewage treatment plant
Sewer/ sewer main	Sewer/ sewer main Generally, refers to sewer pipes. Sometimes used to refer to pipes and structures collectively
structure	Maintenance structures in the wastewater networks including, maintenance holes, lamp holes, verticals, and maintenance shafts
total suspended solids (TSS)	The dry weight of suspended particles, that are not dissolved, in a sample of water that can be trapped by a filter that is analysed using a filtration apparatus known as sintered glass crucible.
uncontrolled overflow	Wastewater overflow from a point in the network not designated/designed as an overflow structure.
Wastewater	Wastewater is frequently used as an alternative to sewage or sewerage.
waterway	The whole or any part of any river, stream, lake, lagoon, swamp, wetlands, natural or artificial watercourse, dam, or tidal waters (including the sea), but does not include watercourses that are dry at the commencement of the overflow, or underground pipes, channels or gutters designed to receive or pass rainwater.
wet weather overflow (wwo)	An overflow in the wastewater reticulation system caused by wet weather as determined by the hydraulic sewer system model.

07 References

References

Sydney Water, October 2022, Annual Report,

ANZECC, 2000. Australian and New Zealand Water Quality Guidelines for Fresh and Marine Waters, Australian and New Zealand Environment and Conservation Council.

ANZG 2018. Australian and New Zealand Guidelines for Fresh and Marine Water Quality. Australian and New Zealand Governments and Australian state and territory governments, Canberra ACT, Australia. https://www.waterquality.gov.au/anz-guidelines

Dry Weather Sewage Overflow Audit Report Independent Review, March 2019

BeachWatch program (DPIE). https://www.environment.nsw.gov.au/research-and-publications/publications-search/state-of-the-beaches-2021-22

Manning, S., Dixon, J., Birch, G.F. and Besley, C.H. 2019. Deepwater ocean outfalls: a sustainable solution for sewage discharge for mega-coastal cities (Sydney, Australia): Influences on beach water quality. Marine Pollution Bulletin, 145, pp. 691-706.

Sydney Water, 2023, STSIMP Data Report, 2022-23 Sewage Treatment System Impact Monitoring Program, Volume 1 Data Report 2022-23, Sydney Water, December 2023.

Sydney Water, 2023a. Annual Sewage Treatment System Performance Report 2022-23 - Environment Protection Licences Condition R5.5 b) and c) Reticulation System Dry Weather Overflows and Cronulla EPL U3.6, North Head EPL U9.6. Sydney Water, September 2023

Sydney Water, 2023b. Sewage Treatment System Licence, Annual Sewage Treatment System Performance Report - Wet Weather Overflow, 2022–23, Sydney Water, September 2023

08 Appendix

Executive summary

Figures

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Executive summary

At Sydney Water, caring for and protecting our environment is a core value of everything we do.

Sydney Water is governed by the Sydney Water Act 1994 (the Act). The Act and our Operating Licence require us to report each year on indicators of the direct impact our activities have on the environment.

The Environment Performance Indicators Report 2022-23 details our performance against the environmental indicators required to be reported to the Independent Pricing and Regulatory Tribunal (IPART) in accordance with clause 8.1.4 of the Operating Licence Reporting Manual (April 2022). These include:

- 10 environmental indicators set by IPART
- 15 National Water Initiative (NWI) indicators relating to the environment, from the National urban water utility performance reporting framework (National urban water utility performance reporting framework: Indicators and definitions handbook, January 2018).

The NWI indicators are part of the National Urban Water Utility Performance Reporting Framework. The NWI is a shared commitment by Australian State and Federal Governments to improve water resource management and use water resources more efficiently. Data from all Australian water utilities is collated annually and published in a National Performance Report prepared by the Bureau of Meteorology (BoM). The report provides a national comparative 'report card' that enables consumers and governments to assess how well water utilities are performing.

Sydney Water's performance against the environmental indicators has been stable and improving for some indicators, despite the challenging heavy rainfall during the first half of 2022-23. Key points include:

- A decrease in total wastewater flows received and treated by our Water Resource Recovery Facilities compared to 2021-22, however, wet weather flows were still high due to La Niña wet weather events.
- A decrease in uncontrolled and controlled dry weather wastewater overflows partly attributable to increased preventative maintenance programs and favourable climate and weather conditions.
- Gross greenhouse gas emissions were slightly lower mainly due to the grid electricity emission factor for NSW decreasing from 0.79 to 0.73 in 2022-23.
- Electricity consumption was consistent compared to 2021-22 and remains higher than historical usage. This was mainly attributable to wet weather as a greater amount of energy was required to operate our wastewater pumping stations.
- Sydney Water's goal is to achieve grid electricity consumption equivalent to 1998 levels (367 GWh), 2022-23 consumption did not meet this benchmark by 21 GWh due to increased energy consumption and lower renewable energy production.
- Renewable energy generation was lower than previous years. Significant rainfall reduced the efficiency of renewable energy generation due to operational limitations and maintenance issues.
- 100% of biosolids generated from our Water Resource Recovery Facilities were beneficially used.
- Sydney Water generated 345,748 tonnes of waste which was similar compared to 2021-22.
- The overall recycling rate for 2022-23 was 79%, similar to 80% in 2021-22. A significant proportion of the waste generated was excavated natural material which was recycled.
- In 2022–23, there was a net loss of native vegetation, with a total of 6.22 hectares of native vegetation cleared and 4.50 hectares revegetated or rehabilitated.
- The total area of land owned by Sydney Water that had natural area restoration work conducted in 2022-23 was 37.02 hectares, compared to 14.15 hectares in 2021-22.
- Sydney Water will continue to improve its environmental performance and resilience, so that we can create a better life with world-class water services.

- Sydney Water generated 345,748 tonnes of waste which was similar compared to 2021-22.
- The overall recycling rate for 2022-23 was 79%, similar to 80% in 2021-22. A significant proportion of the waste generated was excavated natural material which was recycled.
- In 2022–23, there was a net loss of native vegetation, with a total of 6.22 hectares of native vegetation cleared and 4.50 hectares revegetated or rehabilitated.
- The total area of land owned by Sydney Water that had natural area restoration work conducted in 2022-23 was 37.02 hectares, compared to 14.15 hectares in 2021-22.

Sydney Water will continue to improve its environmental performance and resilience, so that we can create a better life with world-class water services.

1. Our environment indicators

Table 1: List of the environment indicators

Category	Indicator
Wastewater treatment and system discharges	**NWI IE1** Volume of wastewater treated to a primary level (ML) **NWI E1** Percentage of wastewater treated to a primary level (%) **NWI IE2** Volume of wastewater treated to a secondary level (ML) **NWI E2** Percentage of wastewater treated to a secondary level (%) **NWI IE3** Volume of wastewater treated to a tertiary level (ML) **NWI E3** Percentage of wastewater treated to a tertiary or advanced level (%) **IPART E3** Total number of controlled wastewater overflows that occur in dry weather that are discharged to the environment, per km of sewer main **IPART E4** Total number of uncontrolled wastewater overflows that occur in dry weather that are discharged to the environment, per km of sewer main
Greenhouse gas emissions	**NWI IE9** Net greenhouse gas emissions: water supply (tonnes CO2 equivalents) **NWI E9** Net greenhouse gas emissions per 1,000 properties: water supply (tonnes CO2 equivalents per 1,000 properties) **NWI IE10** Net greenhouse gas emissions: wastewater (tonnes CO2 equivalents) **NWI E10** Net greenhouse gas emissions per 1,000 properties: wastewater (tonnes CO2 equivalents per 1,000 properties) **NWI IE11** Net greenhouse gas emissions: other (tonnes CO2 equivalents) **NWI E11** Net greenhouse gas emissions per 1,000 properties: other (tonnes CO2 equivalents per 1,000 properties) **NWI IE12** Total net greenhouse gas emissions (tonnes CO2 equivalents) **NWI E12** Total net greenhouse gas emissions per 1,000 properties (tonnes CO2 equivalents per 1,000 properties)

Category	Indicator
Energy	**IPART E1** Total energy consumption by the water utility (electricity, fuel and gas) in units provided on energy bills **IPART E2** Electricity consumption from renewable sources or generated by the water utility expressed as a total percentage of electricity consumption
Biosolids	**IPART E5** Estimated total mass of biosolids produced by the water utility **NWI E8** Percentage of biosolids reused (%)
Waste	**IPART E6** Percentage of solid waste recycled or reused expressed as a percentage of solid waste generated (%) **IPART E7** Estimated total mass of solid waste generated by the water utility
Native Vegetation	**IPART E8** Total area of clearing of native vegetation **IPART E9** Total area of native vegetation rehabilitated, including due to replanting, weeding and protection by the water utility **IPART E10** Total area of native vegetation gain due to rehabilitation, replanting, weeding and protection by the water utility

2. Wastewater treatment and system discharges

Indicator	2018-19	2019-20	2020-21	2021-22	2022-23
NWI IE1 Volume of wastewater treated to a primary level (ML)	341,249	338,884	343,986	388,757	360,888
NWI E1 Percentage of wastewater treated to a primary level	68%	67%	63%	62%	64%
NWI IE2 Volume of wastewater treated to a secondary level (ML)	44,788	42,255	60,173	76,803	65,242
NWI E2 Percentage of wastewater treated to a secondary level	9%	8%	11%	12%	12%
NWI IE3 Volume of wastewater treated to a tertiary level (ML)	116,728	121,266	137,845	163,063	141,430
NWI E3 Percentage of wastewater treated to a tertiary or advanced level	23%	24%	25%	26%	25%
IPART E3 - Total number of controlled wastewater overflows that occur in dry weather that discharged to the environment, per km of sewer main[6]	0.002	0.002	0.001	0.001	<0.001
IPART E4 - Total number of uncontrolled wastewater overflows that occur in dry weather that discharged to the environment, per km of sewer main[7]	0.021	0.035	0.031	0.022	0.017

Volume of treated wastewater

During 2022-23, the Water Resource Recovery Facilities (WRRFs) treated a total volume of 567,560ML compared to 628,623ML during 2021-22 (10.8% decrease). There was a decrease in total wastewater flows received and treated, however, wet weather flows were still high due to La Niña wet weather events during the first half of the year. There have been changes to the volume of flow received at our WRRFs due to

- Change in community work patterns due to working from home arrangements affecting the distribution of wastewater flows
- Development across our area of operations
- Rainfall distribution across the catchments.

This has resulted in different levels of treatment provided to the flows at our WRRFs. We are upgrading the capacity of several of our WRRFs to service growth. In addition to servicing growth, we are also upgrading our Inland WRRFs to meet regulatory requirements for total nitrogen and total phosphorus required by the Hawkesbury Nepean Nutrient Regulatory Framework. This is to reduce the pressures on the Hawkesbury Nepean River from current and projected urban development in Western Sydney. The various WRRF upgrades are expected to be completed over the next 10 years.

Number of wastewater overflows/system discharge

In 2022-23, Sydney Water operated 26,759 km of wastewater main network. There were:

- 12 controlled dry weather network overflows (from designated - designed overflow structures);
- 466 uncontrolled dry weather network overflows.

Dry weather wastewater overflows are generally caused when pipes are blocked by foreign matter (tree roots, fats and grease, wet wipes, etc) or pipes collapse downstream of either a designed overflow structure or other outlet resulting in an uncontrolled discharge to the environment. In 2022-23, the total number of uncontrolled wastewater overflows during dry weather decreased (from 582 in 2021-22), partly attributable to an increase in preventative maintenance work and favourable climate and weather conditions. The number of controlled overflows also decreased (from 36 in 2021-22).

With more urbanisation and population growth, the pressure on our wastewater network and waterways increases. Sydney Water is focused on minimising the occurrence of chokes 8in the wastewater system and the risk to the environment from wastewater overflows through a series of preventative programs that include:

- Root Cutting Program (897 km of wastewater mains covered in 2022-23);
- Maintenance Hole Inspection Program (16,120 maintenance holes inspected in 2022-23);
- Internet of Things Project (7,165 sensors installed in 2022-23);
- CCTV Inspection Program (867 km of sewer pipe inspected in 2022-23); and
- Canine Leak Detection Program for wastewater (41 investigations in 2022-23).

Our environmental performance is reported to the NSW Environment Protection Authority (EPA) every year. To know more about Sydney Water's sewage treatment system licences issued by the EPA, please see the EPA website and the public register at www.epa.nsw.gov.au.

3. Greenhouse gas emissions

Indicator	2018-19	2019-20	2020-21	2021-22[2]	2022-23[6]
NWI IE9 Net greenhouse gas emissions: water supply (tonnes CO2 equivalents)	125,626	119,083	119,145	110,951	105,468
NWI E9 Net greenhouse gas emissions per 1,000 properties – water supply (tonnes CO2 equivalents per 1,000 properties)	62	58	57	54	51
NWI IE10 Net greenhouse gas emissions: wastewater (tonnes CO2 equivalents)	217,892	218,569	191,347	226,517	204,476
NWI E10 Net greenhouse gas emissions per 1,000 properties: wastewater (tonnes CO2 equivalents per 1,000 properties)	111	109	94	112	100
NWI IE11 Net greenhouse gas emissions: other (tonnes CO2 equivalents) [3]	21,239	20,886	25,278	25,622	27,188
NWI E11 Net greenhouse gas emissions per 1,000 properties: other (tonnes CO2 equivalents per 1,000 properties) [4]	11	10	12	12	13
NWI E12 Total net greenhouse gas emissions (tonnes CO2 equivalents)	359,074	358,537	335,770	363,089	337,132
NWI E12 Total net greenhouse gas emissions per 1,000 properties (tonnes CO2 equivalents per 1,000 properties) [5]	178	175	161	175	162

[1] Data excludes the Sydney Desalination Plant. It continues to offset 100% of its electricity consumption with renewable energy. Scope 3 emissions are excluded. Scope 3 emissions are defined in the Greenhouse Gas Protocol, www.ghgprotocol.org. For the purposes of this submission, BOOT plants and Contractor emissions are included as Scope 1 and 2 emissions as appropriate.

[2] Data for NWI E9, E10, E11 and E12 indicators for the previous financial year are updated after the National Greenhouse and Energy Reporting (NGER) audit on 31 October 2022. The total greenhouse gas emissions for FY2021-22 increased by approximately 10,000 tonnes of CO2e due to revised fugitive emissions totals.

[3] Includes the surrender of NSW Greenhouse Gas Abatement Certificates (NGACs) to offset greenhouse gas emissions. No NGACs have been surrendered for the past 5 years, however the option is available to Sydney Water and this is where those surrendered certificates would be captured.

[4] Includes recycled water use.

[5] Total net emissions do not equal the sum of NWI E9, NWI E10 and NWI E11 as the numbers of properties with water and wastewater services differ. NWI E10 is calculated using the number of properties supplied with wastewater services. NWI E9, E11 and E12 are calculated using the number of properties supplied with water services.

[6] Data will be finalised after the NGER audit and will be updated in the following year report

Sydney Water's operational greenhouse gas emissions

Sydney Water reports its greenhouse gas emissions (that is, the equivalent carbon dioxide (CO2–e) emissions) by measuring its electricity, fuel and gas consumption and fugitive gas emissions (NWI E9 and E10). Emissions reported in NWI E11 include emissions from corporate overheads and the surrender of carbon offsets.

In 2022-23, our net greenhouse gas emissions were 337,132 tonnes CO2–e (tCO2-e), which is slightly lower (~5%) compared to 2021-22. Factors affecting the emissions in 2022-23 include:

- The grid electricity emission factor for NSW decreased from 0.79 to 0.73 in the 2022-23 reporting period as updated and published by the Clean Energy Regulator due to grid decarbonisation (increased renewable energy) in the network. Consequently, Sydney Water's carbon emissions from grid electricity consumption decreased accordingly.
- Sydney Water's self-generated renewable energy slightly decreased (3%) and remained well below maximum production capacity. This was due to key cogeneration and hydro assets being offline because of project delivery challenges. Malabar Cogeneration replacement and North Head Hydro refurbishment were all progressed and are on track for commissioning in 2023-24. Prospect Hydro did not operate in 2022-23, however actions are progressed to manage risks so that the asset is operational in 2023-24.
- Sydney Water's carbon emissions from contractor fuel consumption increased by 2,000 tonnes CO2-e (28% increase) due to a significant increase in major projects and capital works.

Figure 5: Greenhouse gas emissions per 1000 properties

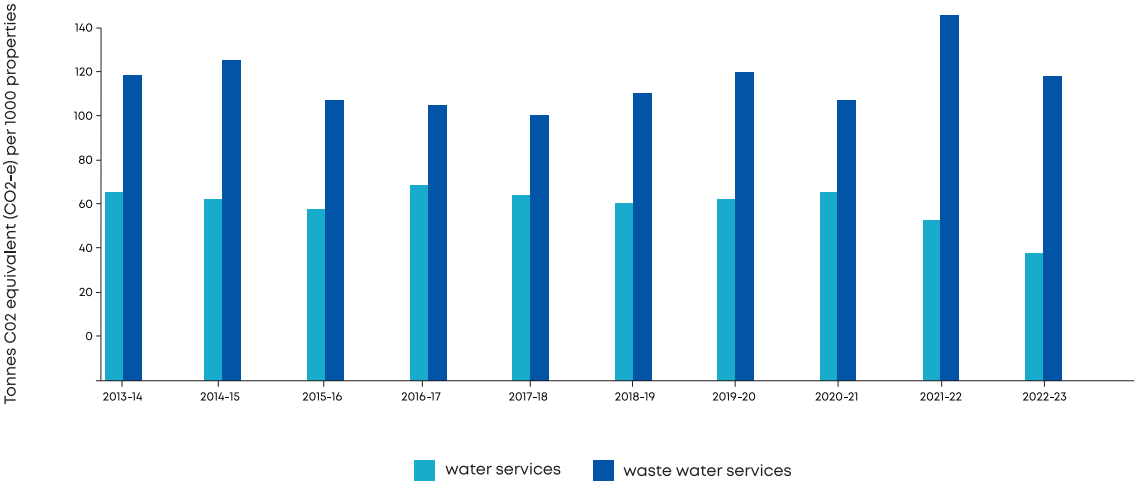


Figure 5 includes total Scope 1 and Scope 2 emissions (i.e. purchased electricity, fuel combustion and fugitive emissions). Carbon offsets from the surrender of NGACs are not included. Data excludes the Sydney Desalination Plant (SDP) and build-own-operate-transfer (BOOT) contractors. SDP continues to offset 100% of its electricity consumption with renewable energy. Results use emission factors published by the Commonwealth Department of the Environment in the National Greenhouse Accounts (NGA) Factors. Sydney Water uses the Scope 1 and Scope 2 emissions factors as used for National Greenhouse and Energy Reporting.

A comparison of greenhouse gas emissions per 1,000 properties for water and wastewater services is shown in **Figure 5**. Greenhouse gas emissions for water supply (NWI E9) in 2022-23 was marginally lower than the previous year. This can be attributed to an increase in water supply from the desalination plant (which offsets 100% of its electricity consumption with renewable energy).

Greenhouse gas emissions for wastewater collection and treatment (NWI E10) decreased compared to 2021-22 (wet year) and was similar to historical performance.

To know more about National Greenhouse and Energy Reporting (NGER), please see the Australian Government's Clean Energy Regulator website at www.cleanenergyregulator.gov.au. A detailed breakdown of GHG activities can be found in Figure 5.

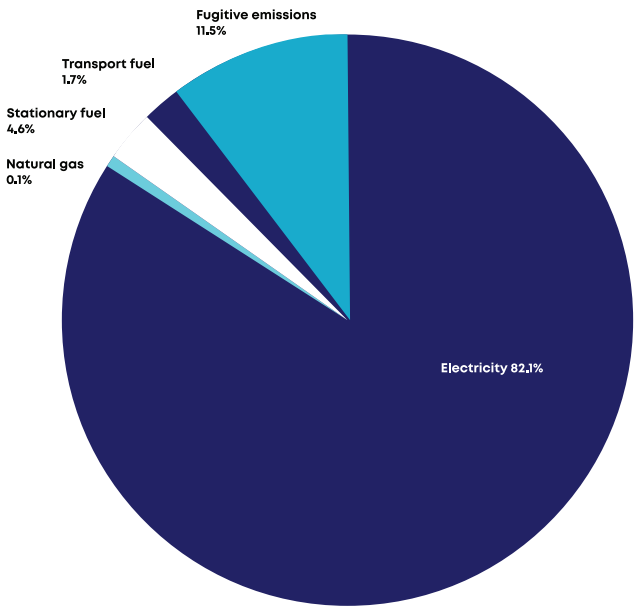
Figure 6:

Table 2: Sydney Water's greenhouse gas emissions by fuel type in 2022–23

Source	Tonnes CO2 equivalent in 2022-23	% of total	Variance compared to 2021-22
Electricity	283,120	82.1	(-7.2%)
Natural gas	305	0.1	(13.3%)
Stationary fuel	15,517	4.5	(14.9%)
Transport fuel	5,834	1.7	(2.7%)
Fugitive emissions	38,862	11.6	(3.3%)
Sub-total tonnes CO2–e (gross)	344,379	100	(5.1%)
Surrender of carbon credits	-	-	-
Contractor emissions	259		(27.4%)
Total tonnes CO2-e (net)	344,638		<<(5.1%)

[1] This value includes all of contractors' electricity consumption. Contractors' fuel consumption is included in Stationary fuel.

Figure 6: Greenhouse gas emissions by fuel type



4. Energy

Indicator	Unit	2018-19	2019-20	2020-21	2021-22[1]	2022-23
IPART E1 - Total energy consumption by the water utility in units provided on energy bills [2]	Electricity (kWh)	372,070,420	377,262,267	365,364,977	386,380,778	387,835,385
	Fuel (L)[3]	2,280,393	3,127467	4,439,968	4,935,414	5,918,175
	Gas (MJ)	5,458,816	7,026,228	6,364,680	5,235,915	5,927,892
IPART E1 - Total energy consumption by the water utility – electricity -in units provided on energy bills (kWh) – including SDP and BOOT [4]		N/A	606,502,995	474,826,264	496,246,171	662,477,584
IPART E2 Electricity consumption from renewable sources or generated by the water utility expressed as a total percentage of electricity consumption - excluding SDP and BOOT		17.5%	15.5%	15.7%	12.2%	11.8%
IPART E2 Electricity consumption from renewable sources or generated by the water utility expressed as a total percentage of electricity consumption. - including SDP and BOOT		17.5%	41.2%	28.5%	25.8%	42.5%

[1] 2021-22 data has been updated retrospectively, following 3rd party audit review prior to NGERs submission through the Clean Energy Regulator.
[2] Electricity consumption data only includes energy used by assets under Sydney Water's control.
[3] In 2019-20, Sydney Water engaged the Regional Delivery Consortium (RDC), as a partner to deliver design, construction, maintenance and facilities management. Fuel consumption includes RDCs data in addition to other third-party service providers. In 2022-23, the Contractors' fuel consumption is 3,521,627 litres, which accounts for 59.5% of total fuel consumption at Sydney Water.
[4] The reporting matrix changed in 2019-20 after the 2018-19 audit review. E1 reporting from 2019-20 now includes electricity consumption by build-own-operate-transfer (BOOT) contractors and Sydney Desalination Plant (SDP). Previously these sources were not included. The total BOOT, Contractor, and SDP electricity consumption in 2022-23 is: 274,642,199 kWh, which accounts for 41.5% of total electricity consumption at Sydney Water throughout the year.
[5] Total electricity consumption includes SDP and BOOT contractors' data per E1 requirement. For 2022-23, the electricity generated from renewable resources for BOOT contractors is 31.6% and SDP is 100% offset by renewable energy. Sydney Water (excluding SDP

IPART E1 – energy consumption electricity, fuel, and gas

Electricity consumption:

Electricity consumption at Sydney Water operations (387,835,385 kWh, excluding SDP and BOOT contractors) was consistent with consumption in 2021-22, and remains higher than prior historical figures. Figure 7 shows a comparison of this year's performance with previous years.

Sydney Water's goal is to achieve grid electricity consumption equivalent to 1998 levels (367 GWh). In 2022-23, consumption was above the internal benchmark by 21 GWh.

Grid electricity consumption remains high due to the following factors:

- Residual wet weather impacts following higher-than-average rainfall in 2022. 2022 was the wettest year on record for Greater Sydney, leading to increased electricity consumption for Sydney Water's wastewater system.

- Sydney Water's self-generated renewable energy remains well below maximum production capacity. This is due to key cogeneration and hydro assets being offline due to project delivery challenges. Malabar Cogeneration replacement and North Head Hydro refurbishment were all progressed and on track for commissioning in 2023-24. Prospect Hydro did not operate for the entirety of 2022-23, however actions progressed to manage risks so that the asset will be operational in 2023-24. The Sydney Desalination Plant (SDP) remained operational for the duration of 2022-23. While this does not contribute to Sydney Water's grid electricity consumption, the continuous operation of SDP is indicative of operational constraints throughout the water system.

Fuel consumption:

Sydney Water's fuel usage increased in 2022-23 due to a significant increase in major projects and capital works. These works included planned asset renewals, works to address wet weather impacts to Sydney Water assets in 2021-22 and residual works post-COVID. In Q2 and Q3 of 2022-23, there was relatively high stationary diesel consumption due to the commissioning of the Thermal Hydrolysis Process boiler at St Marys WRRF. Thermal Hydrolysis was installed to produce higher quality biosolids and now that the plant has been commissioned, the boiler will be fuelled using biogas from the anaerobic digesters onsite.

Gas consumption:

Gas consumption increased in 2022-23 due to higher-than-average use at multiple sites throughout Sydney Water's operations. These sites include Potts Hill Depot, West Hornsby WRRF, Warriewood WRRF, and West Ryde laboratories. This is despite process improvements at numerous other sites, including West Camden WRRF and Homebush Office. The reasons for variable consumption differ from site-to-site.

IPART E2

Total electricity consumption from renewable sources or generated by Sydney Water can be divided into three parts:

• Sydney Water operations: Sydney Water's on-site renewable energy generation (51,239,023 kWh) was 11.8% of total energy consumption in 2022-23. Renewable generation is well below capacity and historical performance. Several factors affected the results for 2022-23 including:

  – Residual impacts of rainfall events in 2022 reduced the efficiency of renewable energy generation at our WRRFs due to variable wastewater quality. See commentary for IPART E1.

  – One of the three Malabar Cogen units experienced fire and cylinder failure in 2019. The Malabar WRRF continues to operate with just two cogeneration units that are at the end of asset life and exhibited reduced overall production. Replacement of key components resulted in the Cogen Units being taken offline multiple times throughout the year and has compounded the poor performance. The project for Cogen replacement has been delayed into 2023-24.

  – Prospect Hydro remained offline in 2022-23 due to operational constraints to manage water quality risks. Works are underway to restore operations in 2023-24.

  – North Head Hydro was out of service for the entirety of the 2022-23 due to maintenance for excessive vibration following the upgrades in 2021-22. Operations are expected to resume in 2023-24.

  – Sydney Water's overall efficiency of renewable energy production was 10% lower (60%) than historical performance due to the issues identified above.

• SDP: the electricity consumption at SDP is 100% offset by renewable sources (wind power). SDP's operations increased in 2022-23 to minimise the impacts of poor raw water quality events in 2022.

• BOOT contractors: Illawarra Water Filtration Plant continues to operate its onsite Hydro to provide renewable energy generation. This energy supplied an estimated 100% of Illawarra's onsite demand in 2022-23, with additional energy exported to the grid.

Figure 7: Summary of IPART E1 & E2

5. Biosolids

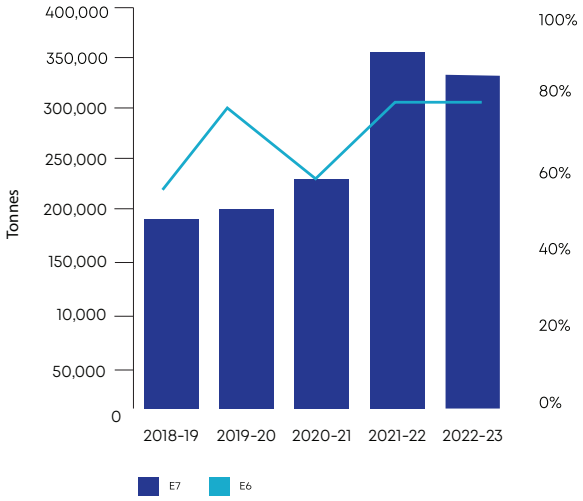
Indicator	2018-19	2019-20	2020-21	2021-22	2022-23
IPART E5 Estimated total mass of biosolids produced by the water utility (dry tonnes)	41,379	39,918	40,924	40,241	39,672
NWI E8 Percentage of biosolids reused	100%	100%	100%	100%	100%

Biosolids are the nutrient-rich organic material produced when we treat wastewater at our WRRFs. Variations in wastewater treatment processes, population and flows to our WRRFs can all affect annual totals. Totals may also include biosolids produced in the previous reporting period, as we don't record totals until after the biosolids are removed from storage facilities.
Sydney Water has consistently achieved 100% beneficial reuse of biosolids. Biosolids are beneficially used for direct land application in agriculture and forestry or re-processed to produce compost.
To know more about the use of biosolids, visit www.sydneywater.com.au

6. Waste

Indicator	2022-23
IPART E6 Percentage of solid waste recycled or reused expressed as a percentage of solid waste generated (%)	79%
IPART E7 Estimated total mass of solid waste generated by the water utility (tonnes)	345,748

Figure 8: Five-year trends for E6 and E7



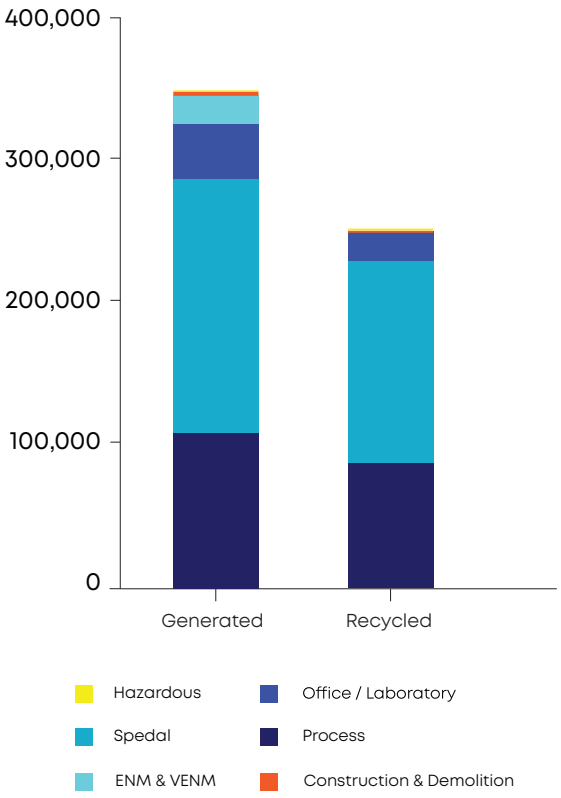
IPART E6 and IPART E7

In 2022-23, Sydney Water generated 345,748 tonnes of solid waste, which was similar compared to 2021-22 (see **Figure 8**). Of this waste, 79% per cent was reused onsite, offsite or sent offsite for recycling. The overall recycling rate for 2022-23 was similar to 2021-22 (80%).

Our construction and demolition activities were responsible for 84% (290,319 tonnes) of the total waste generated and were the major contributor to the overall generation of waste in 2022-23. Of the waste generated from our construction and demolition activities, 84% (242,924 tonnes) was recycled or reused. This is attributable to 62% of construction and demolition waste being virgin excavated natural material (VENM), excavated natural material (ENM) and Vegetation (excluding wood). Over 95% of this material was recycled or reused.

Figure 9 shows waste generated in 2022-23 by categories. Special waste (asbestos-contaminated waste) amounted to 13,775 tonnes, whilst hazardous waste amounted to 1,972 tonnes. The total amount of process waste generated was 53,034 tonnes. Construction and demolition, ENM and VENM waste were the major contributors.

Figure 9: Waste generated in 2022-23 by categories



A consistent trend in waste generation is evident in 2022-23 compared to previous years is shown in Figure 10. Though there was some increase in process waste whereas office/ laboratory waste generation is similar compared to previous years.

Figure 10: Five-year trends waste generated by categories

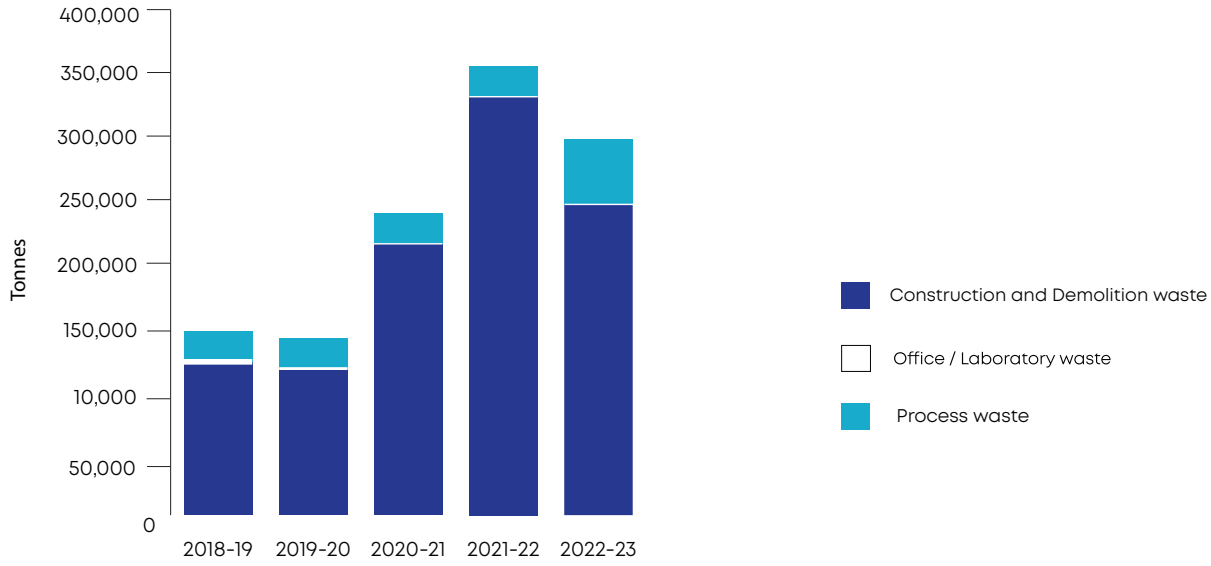


Figure 11. shows that the overall quantities of waste recycled are slightly lower (274,082 tonnes) compared to the previous year, however, higher than prior years. All types of waste generated by our activities have been grouped into three categories –

- Construction and demolition – includes waste generated through our construction and demolition activities.
- Office/ Laboratory – includes waste generated at our office sites and also includes the laboratory waste.
- Process – includes waste generated through our processes such as wastewater and water treatment processes, incident clean up processes as well as regular activities to maintain our networks.

Construction and demolition waste was the major contributor to the overall recycled figure. Office / laboratory recycled quantities were lower compared to previous years, as there were less wooden pallets used and therefore recycled in 2022-23. Sydney Water is committed to reducing the quantity of waste we generate that gets sent to landfill, as can be seen in the overall consistent and improving trends in recycling rates.

7. Native vegetation

Sydney Water recognises the importance of maintaining and enhancing biodiversity values through all stages of the project lifecycle. Biodiversity is vital for supporting liveability, and supplying us with clean air, healthy waterways and healthy ecosystems. Our cities' unique natural landscapes are increasingly valued by communities for recreation and for the natural habitats they support. We are committed to protect, restore and enhance our natural environment. We will look for opportunities to maintain and enhance biodiversity values across our project life cycle. We will avoid, minimise and mitigate the impacts of native vegetation removal on biodiversity values before offsetting the residual impacts. The minimum area of native vegetation reported for each project is 0.01 hectares (ha), or 100 square metres. The scale and scope of capital works, the natural and built characteristics of a site, and the timing of reporting influence Sydney Water's performance (refer to Figure 12 Figure 13 Figure 14 for historical performance).

Indicator	2022-23
IPART E8 Total area of clearing of native vegetation (ha)	6.22
IPART E9 Total area of native vegetation rehabilitated, including due to replanting, weeding and protection by Sydney Water (ha) #	41.52
IPART E10 Total area of native vegetation gain due to rehabilitation, replanting, weeding and protection by Sydney Water (ha) ^	-1.72

Indicator changed from 2017-18, from this year onwards data also includes rehabilitation projects for Sydney Water owned and managed properties.
^ Data reflects either the net gain or loss of native vegetation annually from capital works projects only.

Capital works and major projects

Sydney Water carries out capital works to renew and upgrade its assets, deliver government programs, and support urban growth. Since 2018-19, a cumulative total of 23.9 ha of native vegetation has been cleared and 11.56 ha has been revegetated or rehabilitated through construction project work. Most of the clearing is temporary, with the disturbed land revegetated through site restoration with native species

Figure 12: Total area of native vegetation cleared since 2013-14

In 2022–23, there was a net loss of native vegetation, with a total of 6.22 ha of native vegetation cleared and 4.50 ha revegetated or rehabilitated. Muddy Creek stormwater naturalisation and Austral Leppington water and wastewater servicing projects cleared the most, removing 5.8 ha to install infrastructure. As capital works projects often take longer than 12 months, there is a lag between reporting data on upfront clearing and reporting the completion of rehabilitation, restoration or replanting works.

Figure 13: Total area of native vegetation rehabilitated since 2013-14

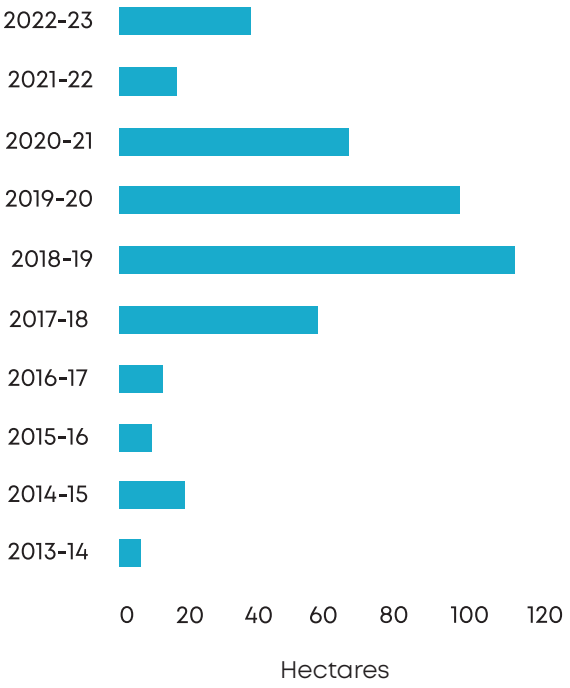
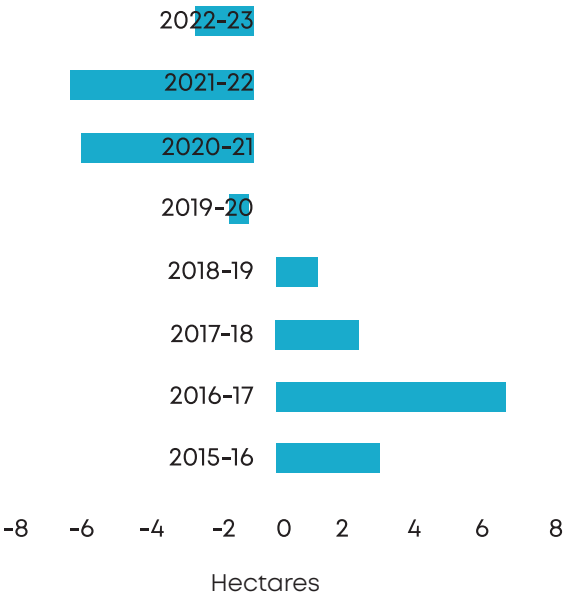


Figure 14: Total area of native vegetation gained since 2015-16

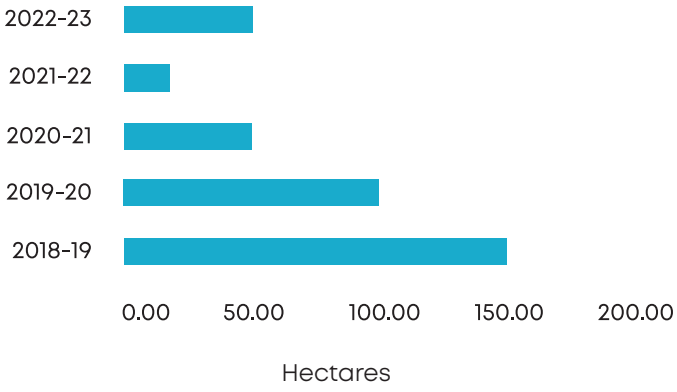


The Austral Leppington water and wastewater servicing project cleared 0.77 ha of Existing Native Vegetation (ENV) in non-certified land within the Growth Centres. Sydney Water has a deed of agreement to purchase the required biodiversity credits from Greater Sydney Parklands when they become available.

Sydney Water owned and managed properties

Sydney Water owns over 3,000 properties across its area of operations, including properties with threatened native vegetation, threatened ecological communities and locations with threatened fauna. We also manage 450 ha of riparian lands, wetlands and naturalised stormwater assets.

Figure 15: Land areas with natural restoration works for Sydney Water owned and managed properties



The total area of land owned by Sydney Water that had natural area restoration work conducted in 2022-23 was 37.02 hectares. These projects were undertaken under our Property Environmental Management Plans (PEMP), Plans of Management and in response to requirements to undertake weed control works and stormwater naturalisation works. This increase is mainly attributable to an increase in the area managed as part of our PEMP program (33.5ha compared to 8.3ha in 2021-22). Figure 15 shows the five-year trend of natural restoration works conducted on Sydney Water properties.

References

1. IPART (April 2022) Sydney Water Reporting Manual, Operating Licence 2019-2023

2. Bureau of Meteorology (January 2018) National Urban Water Utility Performance Reporting Framework: Indicators and definitions handbook

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