

ITEM 3. DRAFT DECENTRALISED WATER MASTER PLAN – PUBLIC EXHIBITION**FILE NO: S087958****SUMMARY**

Sustainable Sydney 2030 committed the City of Sydney to environmental leadership. Central to achieving this was the objective to develop a Green Infrastructure Plan comprising five Master Plans as follows:

1. Decentralised Energy – Trigeneneration Master Plan;
2. Decentralised Energy – Renewable Energy Master Plan;
3. Advanced Waste Treatment Master Plan;
4. Decentralised Water Master Plan; and
5. Advanced Waste Collection Master Plan.

This report recommends that the draft Decentralised Water Master Plan (the Master Plan) be endorsed by Council for public exhibition. The Master Plan reviewed and revised the original water targets set within Sustainable Sydney 2030 and provided new targets for water efficiency, recycled water and stormwater water quality in the three sub-plans contained within the Master Plan.

The Decentralised Water Master Plan provides a blueprint for:

- reducing water demand by 10 per cent from 2006 mains water demand within the City of Sydney Local Government Area (LGA) by 2030 through water efficiency measures;
- reducing water demand within the City of Sydney's own buildings and operations by 25 per cent of 2006 mains water demand by 2030;
- replacing 10 per cent of 2030 mains water demand within the City of Sydney LGA with recycled water by 2030 and lobbying the NSW and Federal Governments to fund wastewater recycling projects to achieve 30 per cent water recycling across Sydney to achieve the national wastewater recycling target for metropolitan cities; and
- reducing 50 per cent of current levels of sediments and suspended solids and 15 per cent of nutrients currently discharged into the waterways from stormwater run-off generated within the City of Sydney LGA by 2030.

RECOMMENDATION

It is resolved that Council:

- (A) approve the draft Decentralised Water Master Plan 2012-2030, as shown at Attachment A to the subject report, for public exhibition; and
- (B) approve the three sub plans that form the technical appendices to the draft Decentralised Water Master Plan, being the draft Water Efficiency Plan, draft Recycled Water Plan and draft Water Sensitive Urban Design and Stormwater Infrastructure Improvement Plan, as shown at Attachments B, C and D, respectively, to the subject report, for public exhibition.

ATTACHMENTS

(Note – Attachments A, B, C and D will be circulated separately from the Agenda Paper and to Councillors and relevant senior staff only. A copy will be available for viewing on Council’s website and at the One Stop Shop and Neighbourhood Service Centres.)

Attachment A: Draft Decentralised Water Master Plan 2012-2030

Attachment B: Draft Water Efficiency Plan

Attachment C: Draft Recycled Water Plan

Attachment D: Draft Water Sensitive Urban Design and Stormwater Infrastructure Improvement Plan

BACKGROUND

1. In 2008, the City of Sydney launched Sustainable Sydney 2030 and committed Sydney to becoming a green, global and connected city. Central to this vision was the commitment to be internationally recognised as an environmental leader of outstanding performance.
2. Sustainable Sydney 2030 included the following commitments relevant to water management within the City:
 - (a) 10 per cent of water demand be supplied using water captured locally;
 - (b) a 50 per cent reduction in stormwater pollution currently being discharged to waterways; and
 - (c) promote water sensitive urban design.
3. In January 2011, the City engaged a consortium of GHD, Institute for Sustainable Futures (University of Technology, Sydney) and P3iC to develop the Decentralised Water Master Plan (the 'Master Plan').
4. Being one in a suite of five master plans that make up the Green Infrastructure Plan, the Decentralised Water Master Plan follows a similar format to the previous Decentralised Energy Master Plan - Trigeneration. The Decentralised Water Master Plan outlines the concept of integrated water cycle management, the need for change from the status quo, and provides solutions with indicative costing to help achieve more sustainable water outcomes.
5. The development of a robust evidence-based Master Plan required extensive analysis of various aspects of the urban water cycle within the city. The analysis makes use of unique combination of metering data, detailed floor space analysis and comprehensive scenario planning that allowed a new understanding of the city's urban water cycle.
6. Input from key stakeholder agencies was sought during the development of the Master Plan through a Stakeholder Reference Group established for the project. The agencies who participated in four meetings held through the development of the Master Plan included:
 - (a) Sydney Water Corporation;
 - (b) Metropolitan Water Directorate;
 - (c) NSW Office of Water;
 - (d) NSW Department of Planning & Infrastructure;
 - (e) NSW Office of Environment & Heritage;
 - (f) Sydney Metropolitan Catchment Management Authority;
 - (g) Independent Pricing and Regulatory Tribunal (IPART); and
 - (h) neighbouring councils including Marrickville Council, Woollahra Council and Leichardt Council.

7. Preliminary input from community members was also sought during the development of the Master Plan through a Community Reference Group established for the project. Through a random selection process, 15 members of the City of Sydney community self-selected and volunteered to participate in four meetings held during the development of the Master Plan.
8. In addition to the stakeholder reference group, senior staff members from Sydney Water were also consulted throughout the development of the Master Plan.
9. The Decentralised Water Master Plan is the first step in achieving a more sustainable water management approach within the City of Sydney LGA by following the urban water hierarchy of reducing water demand (water efficiency) and re-using water (water recycling), while remedying the adverse impact of stormwater pollutants on our waterways.
10. The Master Plan identifies the city's vulnerability to climate change and its adverse impact on ageing water infrastructure and the water demands of a growing population as key drivers for developing decentralised water management solutions that are tailored to specific local needs and add value to centralised water services.
11. The Master Plan establishes an integrated water cycle management framework for planning water services within the City of Sydney LGA and for identifying decentralised water solutions for water, wastewater and stormwater management.
12. The Master Plan is underpinned by baseline data that sets out the current state of water demand (drinking and non-drinking), stormwater pollution levels and locally available water resources that could be tapped into for producing non potable recycled water.
13. The City has already been implementing actions within its own operations and facilities to reduce water consumption and its reliance on mains water. These actions include:
 - (a) retrofit of buildings and facilities with water efficient fixtures; and
 - (b) implementation of stormwater harvesting and re-use schemes to provide an alternative source of water for irrigation of parks and playing fields.
14. The City has also been integrating water sensitive urban design features, such as raingardens, swales, bio-retention units, into all its major capital works projects on streetscapes and public domains.
15. While leading its community by example on sustainable water management, the City seeks to capitalise on the synergistic opportunity provided by implementation of actions from the Trigeneration Master Plan, by facilitating water infrastructure and services for decentralised water solutions across our LGA in a strategic and systematic way taking an integrated city-wide view of opportunities. The Master Plan provides a road map to achieve the City's intent.

16. Through a rigorous analysis of high quality data owned by Council and obtained from Sydney Water, the Master Plan sets targets that are informed by a list of opportunities identified across the LGA for:
 - (a) water efficiency;
 - (b) water sensitive urban design (WSUD); and
 - (c) precinct scale and city-wide scale water recycling.

BASELINE AND ESTIMATED 2030 BUSINESS AS USUAL WATER BALANCE

17. The Master Plan used Council-owned floor space survey data, metered water consumption data from Sydney Water, spatial data on infrastructure (water, wastewater and stormwater) and flooding reports previously commissioned by the City.
18. The reference year used in the Master Plan was 2010. In that year:
 - (a) the City of Sydney LGA received a rainfall that amounted to 27.5 billion litres of rain water, out of which 21 billion litres of stormwater run-off made its way to stormwater drains and discharged into Sydney Harbour (11 billion litres), Cooks River (9 billion litres) and Centennial ponds (1 billion litres). The remaining 6.5 billion litres of rain water enters the groundwater system through infiltration from previous surfaces; and
 - (b) the residents, businesses and organisations consumed a total of 33.7 billion litres of mains water supplied by Sydney Water piped predominantly from Warragamba Dam. This resulted in an estimated 27.1 billion litres of wastewater making its way to the sewerage system. Of the remainder, 0.8 billion litres was lost as leakage within properties, 1.6 billion litres ended up in the groundwater system after being used for irrigation of gardens, parks and playing fields and 4.2 billion litres was lost to the atmosphere through evaporation from the air conditioning cooling towers.
19. Based on a rigorous statistical analysis of metered water consumption data from Sydney Water combined with the City's Floor Space Survey data and Capacity Study and other information from Sydney Water, estimations for the 2030 "business as usual" water balance were developed. Highlights from this modelling include:
 - (a) by 2030, water demand across the City of Sydney will rise by 30 per cent, compared to 2010. An estimated 44 billion litres of drinking quality water will be imported from Warragamba dam located 70 kilometres west of the city to meet this demand;
 - (b) in 2030, this would result in an estimated 34 billion litres of this demand being discharged as wastewater in the sewerage system;
 - (c) an estimated 54 per cent of this demand would be for water usage that does not require water of potable or drinking quality standard. This estimated demand provides a theoretical maximum that could be supplied with non potable or non-drinking quality recycled water from local sources such as stormwater, wastewater, sea water, groundwater and tunnel seepage water;

- (d) investigation of each of these local resources revealed that there was more water available than the potential recycled water demand, however this availability varied depending on the geographical location. Given that the water resources exceed demand, this provides an opportunity for optimising economic recycled water solutions within the city; and
- (e) in 2030, an estimated 23 billion litres of stormwater will be discharged into Sydney Harbour (12 billion litres), Cooks River (9.8 billion litres) and Centennial ponds (1.1 billion litres). This would include an estimated 2,500 tonnes of sediments, 550 tonnes of gross pollutants, 70 tonnes of total nitrogen and total phosphorous.

WATER EFFICIENCY SOLUTIONS FOR THE FUTURE

- 20. Before providing any recycled water options, reducing water consumption via water efficiency should be a priority action undertaken by the City of Sydney, businesses, residents and visitors.
- 21. Using the business as usual scenario as a base case, analysis was undertaken to estimate the potential for improving water efficiency within:
 - (a) the Council's own properties and operations; and
 - (b) across the City's LGA within individual water using sectors.
- 22. The analysis showed that by 2030, Council could achieve a 25 per cent reduction in 2006 mains water use by implementing cost effective water efficiency actions. This reduction target is despite the anticipated increase in the Council's property portfolio holdings over this time period. Any water savings achieved through the building energy and water efficiency retrofit performance contract currently being implemented by the City will contribute to this reduction. Further water efficiency actions in Council properties, parks and playing fields will be undertaken in order to achieve the 25 per cent reduction potential. The Master Plan estimates that these actions would cost in the order of \$1 million above business as usual.
- 23. An analysis of major water users within the City's LGA highlighted that the following sectors presented the greatest water savings opportunity:
 - (a) Multi-residential apartment buildings;
 - (b) office buildings;
 - (c) air conditioning cooling towers; and
 - (d) hotels and restaurants.
- 24. Further cost benefit analysis, and consideration of water savings achieved from other efficiency programs across Australia yielded the following major findings:
 - (a) estimated water savings of 3.4 billion litres can be achieved by 2030 (based on 2006) through water efficiency. This translates to a 10 per cent reduction in 2006 City-wide water demand level;

- (b) this water saving potential is in addition to water efficiency that is expected to occur as a result of the Australia-wide water efficiency labelling scheme and water efficiency achieved in new buildings stock through NSW planning instruments such as BASIX;
 - (c) The Master Plan concludes that implementation of water efficiency programs to achieve a 10 per cent reduction would cost in the order of \$47 million over a period of 18 years (until 2030). The Master Plan suggests that development of these programs will require involvement and co-investment from State Government agencies such as the NSW Office of Environment and Heritage, Metropolitan Water Directorate and Sydney Water. Water efficiency is aligned with the NSW Government's policy objectives of climate change adaptation as well as the Metropolitan Water Plan.
25. The Master Plan proposes that Council endorse the following targets relating to water efficiency:
- (a) by 2030, the City will achieve a 25 per cent reduction in 2006 mains water use by implementing cost effective water efficiency actions within its own asset portfolio; and
 - (b) by 2030, the LGA will achieve 10 per cent reduction in 2006 City-wide water demand level.
26. The City is therefore committed to leveraging its funds to seek the involvement and investment from the key agencies to facilitate implementation of water efficiency across the LGA to achieve 10 per cent water savings on 2006 levels.

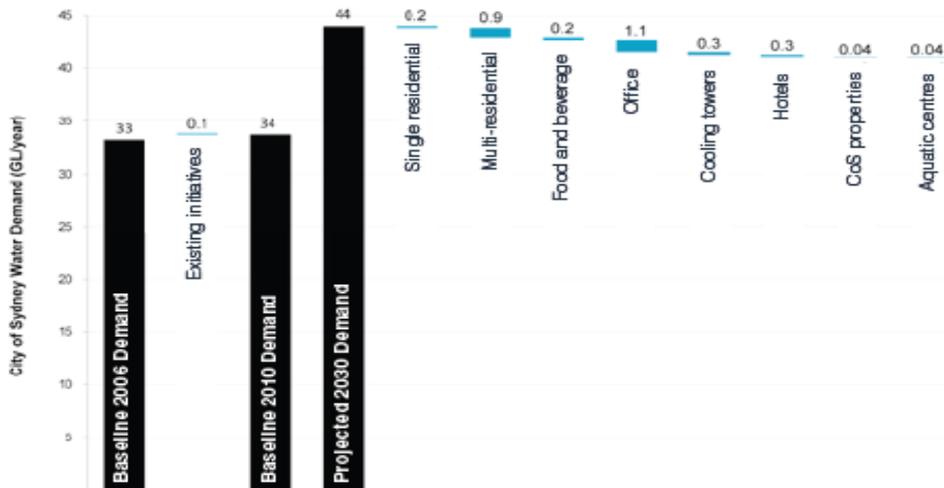


Figure 1: Waterfall chart showing the water efficiency actions that will achieve the City-wide efficiency target of achieving 10 per cent reduction on 2006 demand levels through water efficiency measures.

WATER RECYCLING

27. The Master Plan reviewed the target within Sustainable Sydney 2030 for 10 per cent local water capture to reduce the reliance on mains water. In doing so, the Master Plan has focused on identifying those water recycling opportunities that can meet recycled water demand with the City's LGA.

28. A water recycling target for Council operations has not been separately developed. This is because any water recycling undertaken by Council would be part of precinct schemes that have been identified as the optimal for LGA-wide recycled water provision.
29. As part of the Master Plan development process, local water resources that exist in close proximity to recycled water demand were identified and their availability quantified. Over 300 opportunities to capture local water resources exist across the city.
30. Further analysis was undertaken for screening this long list of opportunities by identifying those that could be scaled large enough to meet the recycled water demand at least cost and carbon footprint, while maximising other environmental benefits.
31. This resulted in 34 opportunities spread across 20 precincts in the City. These opportunities made use of roof water, stormwater, wastewater, grey water, black water and thermal desalination using low/zero carbon waste heat from trigeneration. Each of the opportunities is scaled to the local recycled water demand it is able to meet and makes use of one of the alternative local water resource available. Some precincts have more than one water source that they can tap into for producing recycled water demand.
32. Multi criteria analysis on 10 of the opportunities was undertaken to get an understanding of how each precinct opportunity ranked against the other on quantifiable and qualitative criteria. The multi-criteria analysis includes levelised cost of producing recycled water as one of the economic criteria, and provides the following major insights:
 - (a) sewer mining and thermal desalination are the most cost effective for producing recycled water at a City-wide and large precinct scale. The carbon footprint associated with their energy use is:
 - (i) zero (or near zero) in the case of thermal desalination by making use of waste heat recovered from trigeneration;
 - (ii) low in the case of sewer mining by making use of low carbon electricity produced by trigeneration;

- (b) stormwater harvesting is cost effective for small precinct scales and provides maximum environmental benefits. Along with thermal desalination it is also has the net lowest carbon intensity.

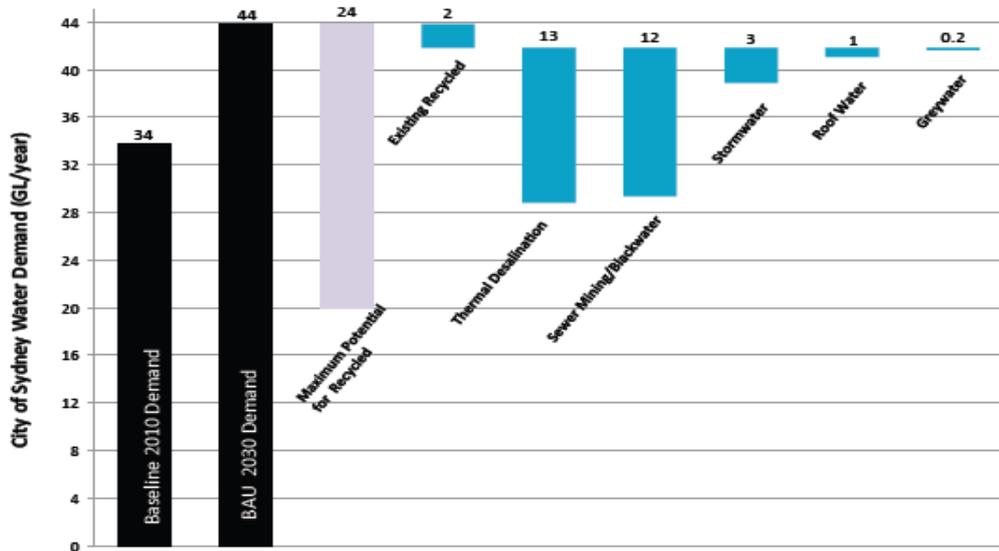


Figure 2: Waterfall chart showing the water recycling actions that will achieve the City-wide water recycling target.

- 33. Taking account of the most appropriate and cost effective recycled water schemes in different precincts and informed by the cost benefit analysis, the recommended targets for Council include:
 - (a) investing into precinct-scale schemes to produce 4 billion litres of recycled water by 2030. This translates to 10 per cent of 2030 water demand or 12 per cent of 2006 demand; and
 - (b) lobbying the NSW and Federal Governments to produce an additional 8 billion litres of recycled water by 2030.
- 34. To achieve this 10 per cent target, the Master plan estimates a cost to Council in the order of \$40 million. This would fund solutions such as thermal desalination using zero/low carbon waste heat from trigeneration and sewer mining or stormwater recycling.
- 35. Pending endorsement by Council of the final Decentralised Water Master Plan, the water services industry would then be engaged via a procurement process to further refine and deliver the most cost effective and environmentally beneficial water recycling scheme for the city. Using a procurement process similar to the city-wide trigeneration project may deliver recycled water solutions that exceed the City’s 10 per cent target but the City’s target will determine the maximum financial contribution to any resulting project with the balance funded by the private sector.

WATER RECYCLING SOLUTIONS

Roof Water

36. Roof water is rain water that runs off from the roof area of buildings and is diverted into large storage tanks before it reaches the stormwater system. As the water collected after the first flush is generally free of pollutants, no treatment is necessary if it is used for non-drinking purposes.

Stormwater

37. Stormwater is rain water that runs off all surfaces within the city, including roofs, roads, pathways, parks and other open areas. Stormwater treatment generally involves some form of filtration to capture the pollutants attached to the sediments, followed by disinfection. Vegetated systems can also be designed to use natural processes for filtering the pollutants with zero to low energy and chemical input.

Groundwater

38. Groundwater is naturally filtrated and stored in shallow or deep aquifers. Groundwater is accessed through boreholes for domestic and industrial purposes. Groundwater can also seep into tunnels and is then pumped and discharged into the stormwater system, but it could also be used as a source of recycled water. Both require water treatment processes similar to that used for stormwater recycling.

Sewer Mining

39. Sewer mining involves extraction of wastewater directly from the sewerage system or directly from the sewerage network of buildings before they connect to the City's network. This is called blackwater. In both cases, the wastewater is treated using a package treatment plant located close to the extraction point. Advanced waste treatment processes, such as membrane biofiltration, can remove not only the suspended solids, but also the high amount of organic and nutrient content.

Grey Water

40. Grey water is wastewater from uses such as hand washing, showering and clothes washing, but excludes toilet waste and is therefore of a higher quality than sewage. Grey water is separated from the sewerage system of buildings by collecting it in a dedicated grey water collection network and is treated using filtration and disinfection processes.

Sea Water (Thermal Desalination)

41. Thermal desalination or distillation is the process of changing saline water into vapour using heat instead of electricity. Unlike conventional desalination plants, which use reverse osmosis and consume significant quantities of grid electricity, thermal desalination with cogeneration or trigeneration captures the waste heat from local electricity generation that would otherwise be rejected into the atmosphere at remote power stations and uses the zero carbon waste heat to distil sea water, leaving the low carbon generated electricity available to supply buildings in the City via the trigeneration network.

42. Although thermal desalination produces high purity distilled water of better quality than mains drinking water, it would be more cost effective to use the distilled water as non-potable recycled water, since chemicals and further treatment would be required to use distilled water as potable or drinking water.

STORMWATER POLLUTION REDUCTION

43. The Master Plan was focused on stormwater quality rather than flooding. However, the identification of opportunities was informed by the flood studies undertaken for different sub-catchments by mapping the flooding hotspots. An attempt was made to identify and prioritise the solutions that also had the ability to alleviate flooding.
44. The stormwater quality that has been investigated in the Master Plan is limited to those that are generated from stormwater which is within the jurisdiction and control of Council.
45. For this reason, an overview of the pollution issue arising from sewage overflows has been presented, but the solutions for it are beyond the direct control of the Council. Council as a key stakeholder is committed to influencing solutions by lobbying for improved reporting of sewage overflows
46. The topography of the area within the boundary of the City's LGA is such that when rain falls, the stormwater run-off drains to three different water bodies: Sydney Harbour in the north, Cooks River via Alexandra Canal in the south and Centennial Park ponds in the east.
47. Therefore, for the purpose of the Master Plan, the City's LGA was divided into three receiving water catchments: Sydney Harbour, Cooks River and Centennial Park. They are then sub-divided based on how the drainage system diverts the stormwater into the pits, pipes and channels to convey them to their respective discharge points. Together there are 11 sub-catchments.
48. Each of the three receiving water catchments has its own characteristics in relation to water use, flooding, land use and surface type. The amount of pollutant picked up by stormwater from the catchment depends on the catchment characteristics.
49. Catchment characteristics of the three catchments are as follows:
- (a) **Sydney Harbour** catchment is highly urbanised and spans the northern half of the City LGA, including the Central Business District (CBD). The catchment:
- (i) consumes 80 per cent of the total water used within the City. The majority of demand is accounted for by the multi-residential, food and beverage and office and commercial sectors;
 - (ii) is highly impervious with a surface area comprising largely roofs, roads, and hardstand surfaces. Overland flow paths have been obstructed through development resulting in localised flooding that impacts upon property, roadways and open space in the catchment;
 - (iii) is also characterised by pollution from sewer overflows during wet weather. Sydney Water estimates sewer overflows of 110 ML/y over 10 years in the Johnston's Creek, Darling Harbour, City Area, Woolloomooloo and Rushcutters Bay sub-catchments;

- (b) **Cooks River** catchment stretches south from Redfern and Newtown to Alexandria and Rosebery and includes the sub-catchments of Munni Street, Erskineville, Sheas Creek, Alexandra Canal and Rosebery. It includes the Alexandra Canal, which is the discharge point of the stormwater running off this catchment. The catchment:
- (i) has multi-residential, single residential and industrial sectors as the largest water consumers. A reduction in industrial water demand is expected as land is redeveloped into residential and commercial land use;
 - (ii) is highly impervious with surface area comprising roofs, roads and hardstand surfaces. Overland flow paths have been obstructed through development resulting in localised flooding events impacting property, roadways and open space;
 - (iii) has, from Sydney Water reports, sewer overflows of 6 ML/yr over 10 years in the Sheas Creek, Rosebery and Munni Street sub-catchments, which is significantly lower than the occurrence of the same in Sydney Harbour catchment;
 - (iv) is characterised by flooding on account of a combination of flat topography, high groundwater levels and ageing infrastructure;
- (c) **Centennial Park** catchment is bounded by Anzac Parade to the west and Lang Road to the east and is small compared to the other receiving water catchments within the City. The catchment:
- (i) contains land use which is predominantly parks, open space and residential with key recreation and entertainment areas including Centennial Park, Moore Park (and golf course), Sydney Cricket Ground and Fox Studios;
 - (ii) has water demand principally associated with the residential, commercial and food and beverage sectors. Single residential demand is greater compared to that in the other two catchments; and
 - (iii) includes 66 hectares of open space and gardens, which leads to different water quality issues compared with the largely impervious Sydney Harbour and Cooks River catchments. The Centennial Park ponds and Botany Wetlands provide a natural filter for nutrients, however algal blooms can occur, particularly during drought when the ponds are not well flushed.
50. A pollutant balance analysis was undertaken using the model for urban stormwater improvement conceptualisation or MUSIC software which is standard practice in the stormwater industry for water quality modelling. The modelling was undertaken for each of the receiving water catchments for an average annual rainfall (from average annual rainfall figures over the last 20 years).
51. For the reference year rainfall (2010 annual rainfall = 1,295 mm), the pollutant loading for each of the three catchments was as follows:
- (a) Sydney Harbour catchment discharges 1,700 tonnes of sediments and 33 tonnes of nutrients each year to Sydney Harbour;

- (b) Cooks River catchment discharges 1,300 tonnes of sediments and 25 tonnes of nutrients each year to the Cooks River; and
 - (c) Centennial Park catchment discharges 180 tonnes of sediments and 3.3 tonnes of nutrients each year to the ponds in Centennial Park.
52. Industry best practice suggests that integrating water sensitive urban design elements, such as vegetated and ecologically engineered bio-retention units, swales and wetlands across the city sub-catchments, along with gross pollutant traps downstream, can provide the reduction in stormwater pollutants.
53. Opportunities for reducing the pollutants through integration of water sensitive urban design (WSUD) across the city sub-catchments were identified as follows:
- (a) redevelopment – integrating WSUD within new developments through planning instruments such as development controls;
 - (b) retrofitting – retrofitting WSUD into existing public open space and drainage infrastructure;
 - (c) renewal of urban assets – incorporating WSUD during the renewal of urban assets such as footpaths and roads; and
 - (d) reuse of stormwater harvested from sub-catchments.
54. Pollutant removal capacity was modelled and estimated for each opportunity. Modelling was undertaken for all four key pollutants (sediments, gross pollutants, total nitrogen and total phosphorous) that are used for assessing stormwater pollution from urban catchments.
55. Informed by the cost and benefits of the opportunities, the City of Sydney is committed to achieving 50 per cent city-wide reduction in current estimated levels of sediment load. This will result in 15 per cent reduction in current estimated levels of total nitrogen load. The actions that will achieve these reductions include:
- (a) incorporating WSUD in:
 - (i) redevelopments via planning controls;
 - (ii) major upgrades and renewals of footpaths and roads;
 - (iii) major park upgrades; and
 - (b) retrofitting gross pollutant traps in strategic locations on the drainage network.

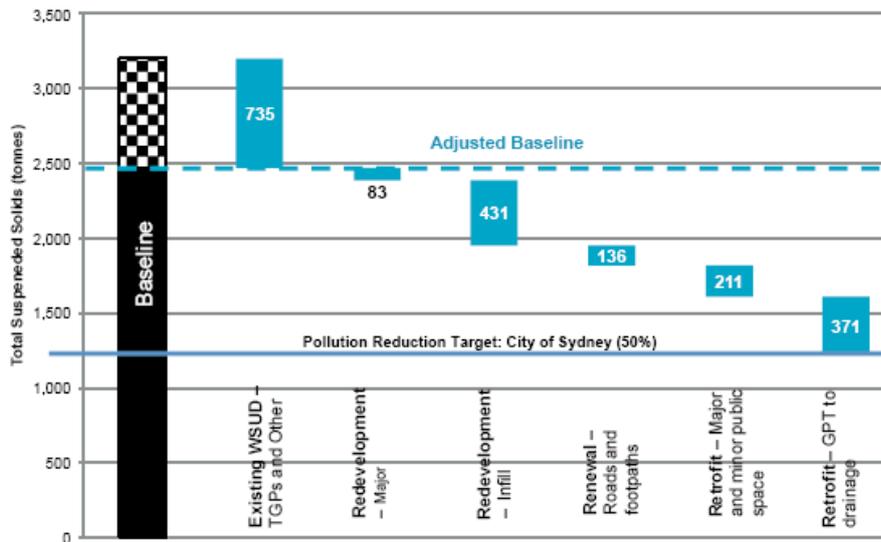


Figure 3: Waterfall chart showing the actions that will achieve the city-wide stormwater pollution reduction target of achieving 50% reduction in total suspended solids being discharged to waterways.

56. To achieve this 50 per cent pollution reduction target, the Master Plan estimates a cost to Council in the order of \$5 million. This would fund solutions such as
- (a) introducing planning instruments and putting other approval processes in place to incorporate WSUD elements in redevelopment;
 - (b) installing gross pollutant traps to the drainage system in strategic locations; and
 - (c) incorporating WSUD elements such as raingardens and swales within road, footpath and public domain (parks and open space) renewals.

POWER STATIONS WATER DEMAND AND TRIGENERATION

57. Grid electricity power stations use and consume significant quantities of water (Source: Australian Government Water and the Electricity Generation Industry 2009 <http://www.nwc.gov.au/publications/waterlines/water-and-the-electricity-generation-industry-implications-of-use>).
58. Approximately 65% of the generating capacity in the Australia’s National Electricity Market currently depends on freshwater for cooling (to reject waste heat into the atmosphere) in fossil fuel power stations. A typical 1000MW coal fired power station consumes 17GL/year. To this must be added the 3.8GL/year of water used by electric air conditioning cooling towers across the four low carbon zones of the city.

59. The Decentralised Energy Master Plan – Trigeneration identifies 477MWe of trigeneration and cogeneration across the Local Government Area (LGA) and a reduction in electricity demand from 912MWe to 370MWe across the four low carbon zones, a reduction of 659MWe or taking account of the avoided grid losses a reduction of 714MWe. This would reduce water demand from coal fired power stations by 12.1GL/year compared with the expected additional water use by trigeneration of 2.6GL/year, a net reduction in water consumption of 9.5GL/year, equivalent to a 22 per cent reduction in the City's LGA 2030 potable and non-potable water demand.
60. The City's Trigeneration Master Plan, together with the 10 per cent target to reduce mains water demand through water efficiency measures, will reduce water demand currently supplying the city's energy and water demands by 32 per cent by 2030.

ENABLING ACTIONS

61. Twelve enabling actions to deliver the Decentralised Water Master Plan are identified in the Master Plan. Some of the enabling actions such as introducing rate variations, may have financial implications for Council. A further report will be submitted to Council covering these particular enabling actions.

CASE STUDIES

62. The Decentralised Water Master Plan identifies more water recycling solutions than will be required to deliver the Master Plan. In order to assess the performance of the various water recycling solutions, case studies were carried out into 10 recycled water schemes in the city. Multi-criteria analysis was assessed on a number of factors ranging from demand opportunity, footprint, levelised cost and network/supply effectiveness to net carbon intensity for the following case studies:
 - (a) Johnstons Creek Sewer Mining;
 - (b) City Wide Sewer Mining;
 - (c) Darling Harbour Sewer Mining;
 - (d) Barangaroo Sewer Mining;
 - (e) Greater Green Square Sewer Mining;
 - (f) Wentworth Park Stormwater Harvesting;
 - (g) Waterloo Oval Stormwater Harvesting;
 - (h) Sydney Park Stormwater Harvesting;
 - (i) Moore Park Roof Water Harvesting; and
 - (j) Barangaroo Thermal Desalination.

63. The multi-criteria analysis showed that:
- (a) stormwater harvesting schemes do not perform as well as network/supply effectiveness, but perform very well on net carbon intensity;
 - (b) sewer mining schemes perform well on network/supply effectiveness, but perform poorly on net carbon intensity due to their energy intensive treatment process; and
 - (c) Barangaroo thermal desalination performs well on net carbon intensity and synergistic use of resources, as the scheme will make use of the zero carbon waste heat from trigeneration.

KEY IMPLICATIONS

Strategic Alignment - Sustainable Sydney 2030

64. Sustainable Sydney 2030 is Council's plan to make Sydney green, global and connected by 2030, reflecting our resident's aspirations for the City's LGA. It includes 10 strategic directions to guide the future of the City, as well as 10 targets against which to measure progress. This Master Plan is aligned with the Sustainable Sydney 2030 strategic directions and objectives.
65. Direction 2 provides a road map for the City to become A Leading Environmental Performer – Council is taking a leadership position by setting City-wide targets for water efficiency, water recycling and stormwater pollution reduction. None of the targets are a mandatory requirement for Council. However, the City has chosen to leverage its scope of influence in initiating a study that identifies the opportunities for integrated water cycle management from the perspective of the community and environment. The Master Plan provides a sound evidence base for facilitating decentralised water solutions and opening a discussion on collaboration:
- (a) Objective 2.1 seeks to increase the capacity for local energy generation and water supply within City boundaries as part of:
 - (i) Green Transformers (co-location of trigeneration, recycled water treatment and waste collection/utilisation); and
 - (ii) The Green Infrastructure Plan comprising decentralised energy, recycled water, advanced waste treatment facilities and automated waste collection.
 - (b) Objective 2.4 seeks to demonstrate leadership in environmental performance through the City's operations and activities.
66. Direction 4 - A City of Walking and Cycling – the Master Plan identifies opportunities for incorporating WSUD in streetscape renewals as well as water recycling. The WSUD elements, being vegetated, often improve the microclimate. Availability of stormwater means that more green spaces can be added. These opportunities in the Master Plan are expected to result in cooler microclimate which contributes to improving the City for cycling and walking.

Organisational Impact

67. Actions arising from implementation of the Decentralised Water Master Plan are anticipated to have following impacts:
- (a) a new service by Council involving rolling out water efficiency programs has implications for staff time. This is because it is anticipated that staff time will be required for researching, designing, implementing, monitoring and evaluating new programs targeted to new sectors (e.g. office buildings, cooling towers);
 - (b) embedding WSUD in redevelopment has implications for workload increase and staff up-skilling required for assessing the WSUD designs submitted by the developers; and
 - (c) water recycling schemes are likely to be implemented through a procurement process to provide decentralised water services to the City. This engagement with the industry will be subject to normal Council approval process.

Risks

68. The main risk associated with the Decentralised Water Master Plan is not achieving the targets in the given time-frame.
69. The treatment strategies that were employed to mitigate this risk include:
- (a) using a sound evidence-base, consisting of primary data on metered water consumption and floor space survey;
 - (b) making use of scientific models and analytical methods to achieve rigour in the analysis; and
 - (c) undertaking cost benefit analysis to get estimates of the cost of implementation.

Social / Cultural / Community

70. The Master Plan identifies solutions for increasing the supply of water through local water capture building resilience and adding value to the current centralised water supply system.
71. Availability of recycled water locally means that more urban green spaces can be watered and maintained, increasing the well-being and liveability of the City.
72. Water efficiency programs will help the residents and businesses in achieving savings on their water bills and in the area of improving water efficiency of hot water end use, savings on power bills will also be achieved through associated energy savings.

Environmental

73. The Master Plan provides a road map for achieving the following environmental outcomes:
- (a) reduced reliance on mains water due to reduction in demand achieved by water efficiency and water recycling; and
 - (b) improved health of waterways on account of a reduction in stormwater pollutant load being discharged.
74. The reduction in greenhouse gas emissions against mains water supplied from the Warragamba Dam and Sydney Desalination Plant at Kurnell will depend on the water recycling solutions selected to deliver the Master Plan targets.

Economic

75. The solutions identified in the Master Plan for water efficiency, water recycling and stormwater pollution reduction are achieved at a cost. However, they provide added value in the form of social and environmental benefits.
76. The whole-of-society cost for the projects can be shared amongst the stakeholders and beneficiaries.
77. When developing and implementing the projects and programs, every effort will be made by the City to facilitate sharing of cost amongst the stakeholders in proportion to the benefits received, in order to ensure sustainability and viability of the projects and programs.

BUDGET IMPLICATIONS

78. The Master Plan outlines the estimated cost to Council of the major water projects and programs that would contribute toward achieving the set targets, as follows:
- (a) City of Sydney organisation assets – \$1 million over business as usual capital expenditure on City assets to achieve the 25 per cent water efficiency reduction target;
 - (b) Water Efficiency Programs – \$47 million over 18 years to implement water efficiency programs within the local government area. Note that State and Federal funding will be required to meet this cost;
 - (c) Recycled water – \$40M contribution by Council to provide 10 per cent recycled water within the local government area by 2030; and
 - (d) Water quality – \$5 million contribution by Council to achieving the 50 per cent pollution reduction target.
79. Council's Long Term Financial Plan (10 years) includes a funding allocation of \$24M for actions contributing towards the recycled water target in the Master Plan. City infrastructure funding is also allocated for Council to contribute toward the water quality target. Funding for undertaking water efficiency programs is also allocated, however other government agencies will need to significantly contribute to achieve the targets outlined in the Master Plan.

80. Specific project or program funding required to achieve the Master Plan targets will be subject to normal Council budgeting and procurement approvals. It should be noted that further funding may be allocated by Council in the time period beyond the 10 years of the Long Term Financial Plan to meet the 2030 water targets.

RELEVANT LEGISLATION

81. The Water Industry Competition Act 2006 permits third parties other than Sydney Water, such as local councils and private agencies, to develop, build, operate, maintain and retail decentralised water services.
82. The designs and plans of recycled water schemes of the scale suggested in the Master Plan generally require approval by the Independent Pricing and Regulatory Tribunal (IPART).
83. The Water Industry Competition Act 2006 establishes a licensing regime for the private sector to develop, build, operate, maintain and retail decentralised water services. Council does not require a licence in relation to water industry infrastructure situated within its area of operation. Consultation with the NSW Government indicates that this exemption may be reviewed in the near future.

CRITICAL DATES / TIME FRAMES

84. Exhibiting the Master Plan from July 2012 would meet the expectations of the key stakeholders who were consulted during its development.

PUBLIC CONSULTATION

85. Input from key stakeholder agencies was sought during the development of the master plan through a Stakeholder Reference Group established for the project. The agencies who participated in four meetings held through the development of the master plan included:
- (a) Sydney Water Corporation;
 - (b) Metropolitan Water Directorate;
 - (c) NSW Office of Water;
 - (d) NSW Department of Planning & Infrastructure;
 - (e) NSW Office of Environment & Heritage;
 - (f) Sydney Metropolitan Catchment Management Authority;
 - (g) Independent Pricing and Regulatory Tribunal (IPART); and
 - (h) Neighbouring councils including Marrickville Council, Woollahra Council and Leichardt Council.
86. Preliminary input from community members was also sought during the development of the Master Plan through a Community Reference Group established for the project. Through a random selection process, 15 members of the City of Sydney community self-selected and volunteered to participate in four meetings held during the development of the Master Plan.

87. One of the key inputs from Community Reference Group was on the trade-off the members of community were willing to accept in making use of public open space for storage of recycled water. The Community Reference Group members provided their input by stating:
- (a) what proportion of public open space is reasonable to utilise for storage of recycled water; and
 - (b) that the willingness for sharing open space with recycled water facilities would be enhanced if the community was informed about it well before commencement of works.
88. This input from the community helped the consultants to make reasonable assumption about the footprint area available in the feasibility analysis for recycled water schemes in each precinct.

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