GOVERNMENT OF WESTERN AUSTRALIA

Department of **Biodiversity, Conservation and Attractions**

**PARKS AND WILDLIFE SERVICE**

# Southern River Catchment Local Water Quality Improvement Plan Review Summary

August 2017

**Acknowledgements**
Thank you to the City of Gosnells, City of Armadale, South East Regional Centre for Urban Landcare (SERCUL) and the Armadale Gosnells Landcare Group (AGLG) for their contributions to the review of the Southern River Water Quality Improvement Plan (WQIP).

**Purpose and use of this document**
The Department of Biodiversity, Conservation and Attractions (DBCA), with the support of the organisations noted above, has reviewed the implementation of the Southern River Catchment WQIP. The purpose of this document is to summarise that review and inform future updates of the Southern River Catchment WQIP. The Swan Canning Water Quality Improvement Plan is proposed to be reviewed in 2018 and if undertaken any updated catchment modelling will be used to inform updates of the local WQIPs. It is intended that these documents will be used by partner organisations that will continue to have a role in implementation of the WQIPs.

**Front cover photo:** Wungong Interpretation sign. Photo – SERCUL.
Robin redbreast bush (*Melaleuca lateritia).* Photo – Kate Bush/DBCA

## Local Water Quality Improvement Plans

The Department of Biodiversity, Conservation and Attractions (DBCA) Parks and Wildlife Service works to reduce nutrients and other contaminants entering the Swan and Canning rivers.

DBCA (and previously the Swan River Trust) developed and invested in the implementation of local Water Quality Improvement Plans (WQIPs). The WQIPs were designed to provide stakeholders with a mechanism to prioritise recommendations and resources and seek funding to improve water quality in catchments contributing the greatest amount of nutrients and contaminants.

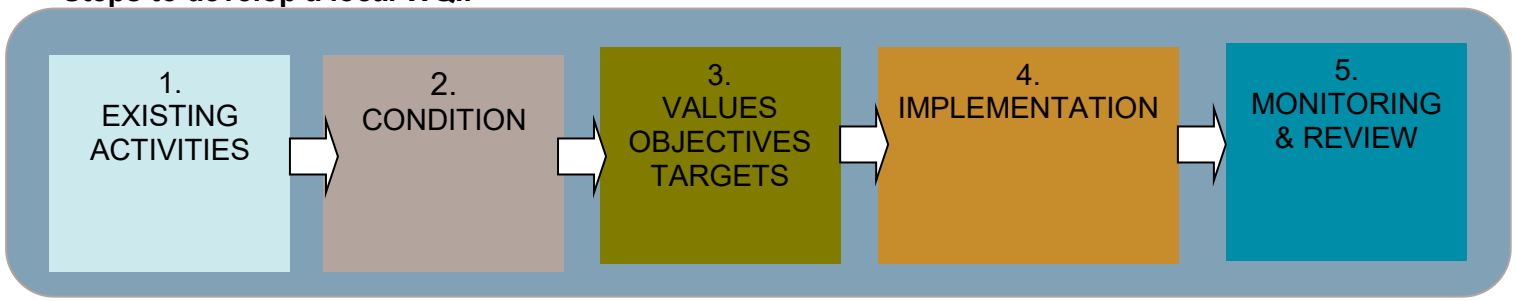
WQIP implementation takes a treatment train approach with actions falling into each of the following stages in the pathway of nutrients and non-nutrients from the source to the discharge point:

1. **Prevention** (Land use planning)
2. **Minimisation** (Ecoefficiency)
3. **Reduction** (Source control)
4. **Amelioration** (Conveyance and transmission)
5. **Treatment – Reuse – Disposal**

**Water Quality Improvement Plans:**

- identify water quality issues and hot spots;
- identify environmental values of water bodies and water quality objectives required to protect the values; and
- identify and commit to a set of cost-effective management measures to achieve and maintain those values and objectives.

**Steps to develop a local WQIP**



## Local WQIP Review

Ten local WQIPs were developed between 2008 and 2012 with strong involvement of key stakeholders. The implementation phase of the WQIPs is ongoing, however many of the actions are complete or require review. There are also actions that are still underway and others that will require an ongoing commitment and additional resources to maintain and improve water quality. This review assesses the Southern River WQIP, based on the achievements and stakeholder participation.

The monitoring associated with on-ground projects in the Swan Canning Catchment provides evidence that these types of projects are improving water quality. Monitoring the effects of non-structural WQIP actions, such as community education and behaviour change programs, and changes to policies and procedures, on catchment water quality is more complicated. Therefore, statistically linking WQIP actions to changes in catchment water quality is not attempted at this stage. Variations in annual flow, changes in catchment land uses, and the long timeframes required for some catchment management practices to affect water quality at the catchment discharge point are other factors that can contribute to discharge water quality.

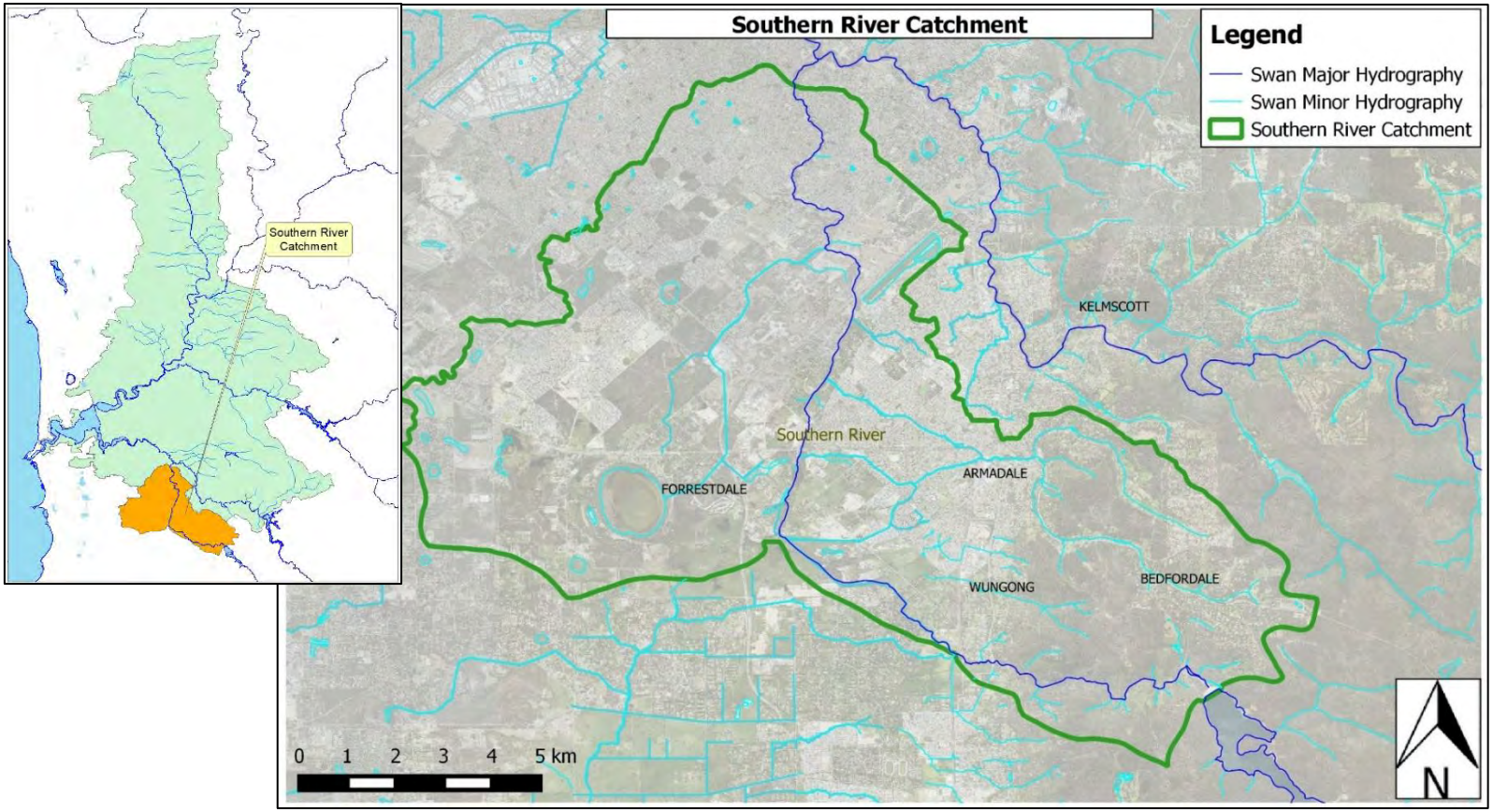
The Swan Canning River Protection Strategy supports the development and implementation of the Swan Canning and local WQIPs as an action to achieve nutrient load reduction targets and provides the framework for DBCA to update local WQIPs. This review will determine the local WQIPs to be updated based on the level of support from key stakeholders and need for further water quality improvement. Modelling of water quality improvement targets is proposed to occur as part of an update of the Swan Canning WQIP in 2018.


*Local WQIP front cover for illustration purposes only*

## Southern River Catchment

The Southern River Catchment includes Southern River and its tributaries, the Wungong River, Neerigen Brook and Forrestdale main drain. The Wungong River is dammed within its hills catchment and managed as a stormwater drain by the Water Corporation in the downstream stretch. The catchment covers an area of 149 square kilometres and is characterised by low lying areas and high groundwater levels, it contributes more water to the Canning River than any other monitored catchment. Many wetlands in the catchment have been filled and large areas of land that were semi-rural are becoming urbanised as Perth's population grows and demand for housing increases. Clearing of native vegetation has caused weed infestations, erosion and degradation by siltation and flow restrictions.

The Southern River Catchment was identified as a priority catchment for water quality improvement due to elevated levels of nitrogen, phosphorus and non-nutrient contaminants.



## Southern River WQIP Review Summary

The Southern River WQIP has a total of 26 actions, 81 percent of those have been addressed: including seven that have been completed; three well on track to completion; 12 are actions that are ongoing; and two have been implemented to some degree but will require further investment for catchment-wide implementation. There are five actions that have had little or no progress (see Appendix 1 for details).

**Completed Urban Waterways Renewal projects:**

- Riverside Lane Living Stream
- Wungong River Living Stream
- Grovelands Reserve treatment basin
- Third Avenue and Seville Grove bioretention systems
- Strawberry Drive treatment basin

There have been several restoration projects and advances in land use planning processes in the Southern River Catchment since the development of the WQIP.

The City of Armadale has produced the *City of Armadale water resource management for land development position pape*r. This goes beyond the Better Urban Water Management Framework by addressing risks and situations specific to the area. The City has also begun the *Forrestdale Central, Forrestdale East and Erade Structure Plan Areas Post Development Monitoring Program.*

The Cities of Gosnells and Armadale work in partnership with and provide ongoing support to the Armadale Gosnells Landcare Group (AGLG) and several community groups that participate in restoration activities in the catchment. AGLG involved 21 school groups in projects in the region over 2015-16.

The Southern River WQIP has helped provide clear expectations to developers and consultants working in the catchment. Local government officers have used the WQIP when assessing management plans and Urban Water Management Plans that are submitted to the councils. Officers at the Cities of Gosnells and Armadale support the review of the Southern River WQIP and have provided suggested improvements for the development of an updated WQIP.

The Southern River median total phosphorus concentration is passing the short-term target (0.2mg/L) but failing the long-term target of 0.1mg/L. Southern River median total nitrogen concentration is also passing the short-term target (2mg/L) but failing the long-term target (1mg/L) (Departments of Water and Parks and Wildlife, Swan Canning Catchment Nutrient Report Update 2015).

There has been considerable investment from State, Federal and local governments and the community in delivering the Southern River WQIP actions. The Southern River Catchment is still a priority for water quality improvement and as a major tributary to the Canning River with major land use changes underway; there is justification for this WQIP to be updated.

| Local WQIP Action Review Summary | | | | | | |
|---|---|---|---|---|---|---|
| **WQIP catchment** | Release date | Total number of actions | Actions fully achieved or on track | Actions implemented but ongoing commitment required | Actions with little or no progress | **% of actions being implemented** |
| **Southern River** | Sep 2009 | 26 | 7 | 14 | 5 | **81** |

| Summary of investment in WQIP | | | | | |
|---|---|---|---|---|---|
| | DBCA initial WQIP investment | Other State Government | Federal Government | Local Government and Community | **Total Investment** |
| Investment in Southern River WQIP projects | $125,000 | $1,017,000 | $1,155,600 | $90,935 | **$2,388,535** |

## Future priorities and actions – Southern River Catchment

- Implement the Swan Canning River Protection Strategy.
- Involve all relevant areas of the local governments in the development of an updated WQIP (Council, Environment, Engineering, Planning, Maintenance and ground staff)
- Further investigate the risks associated with infiltration-at-source in areas of high groundwater and high nutrients. Involve the Department of Water and Environmental Regulation (DWER).
- Continue to take opportunities to retrofit existing drainage systems in line with Water Sensitive Urban Design (WSUD) principles.
- Ensure all new developments are in line with Perth's transition to a water sensitive city.
- Restore river foreshores and buffers for ecological and community benefit (for example, the City of Armadale has provided seed funding for the rehabilitation of a 2.7km stretch of the Wungong River).
- Catchment water quality monitoring to inform land-use planning decisions and to ensure the State Planning Policy 2.10 (Swan Canning River System) requirement for developers to maintain or improve water quality is upheld.
- Investigate resourcing options to introduce Light Industry Audits to the proposed mixed business/light industry area in the Southern River Catchment once occupied.
- Reduce councils' nutrient outputs through local management practices and by providing up-to-date training to all staff involved in fertiliser application, grounds keeping and maintenance of drainage infrastructure.
- Discourage the planting of deciduous trees near drainage infrastructure to reduce organic loads and excessive nutrients entering stormwater in Autumn when the rivers are susceptible to algal blooms.
- Increase community awareness, education and involvement in catchment management to reduce nutrient and contaminant outputs.
- Ensure all new developments are connected to sewer.
- Aim for infill sewer to all existing urban areas.

## Southern River Case Study: Wungong River Restoration Project, Riverside Lane, Wungong River Basin

The Riverside Lane Foreshore and Floodplain Restoration Project is located along the foreshore of the Wungong River. A biofiltration basin was constructed to receive and treat urban stormwater from a local drain before it enters the river. The accompanying revegetation of a large foreshore area helps restore natural diversity and provide habitat for native fauna. The site is now a place for people to enjoy nature, and provides educational opportunities in environmental restoration and management. The City of Armadale has named the reserve after the late Cam Clay in honour of his dedicated service to local landcare.

Several community and school planting days were held to help plant the 54,000 native seedlings that went into the site. The Southern River WQIP provided an important framework for the project being part of the Urban Waterways Renewal Program and receiving funding from the Australian Government. Major project partners included the South East Regional Centre for Urban Landcare (SERCUL), the (then) Department of Water (now DWER), the (then) Swan River Trust (now DBCA), City of Armadale, and the Armadale Gosnells Landcare Group (AGLG).

After the success of the initial project, the City of Armadale extended the project area to incorporate a second biofilter, an additional 670 metres of foreshore restoration, and two bioretention basins to the northwest of Lake Road.

*Wungong Basin soon after planting, 2016. Photo courtesy of SERCUL*

# Wungong River Restoration Project, Riverside Lane

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| Volunteer contribution | 855 hours |
| Area of project site | 2.4 ha |
| Volume of rubbish and sediment removed from site | 150 $m^3$ |
| Volume of soil amendment applied | 230 $m^3$ |
| Number of seedlings planted | 54,000 |
| Number of community days | 5 |
| Number of school kids that helped | 80 |
| Length of Wungong River foreshore rehabilitated | 415 m |
| Cost of project | $290,000 |

*February 2010*

*June 2016*

## Appendix 1: Southern River Catchment WQIP – Action Review

| Tally and explanation of action review categories – Southern River Catchment | | | |
|---|---|---|---|
| **Total number of actions** | **26** | **Percentage** | **Explanation** |
| **Action achieved** | 4 | 15.4 | The action has been completely fulfilled |
| **Action on track** | 3 | 11.5 | Significant progress has been made and the action is likely to be completed in the near future. |
| **Ongoing action** | 12 | 46.2 | This action will require ongoing commitment or maintenance. |
| **Projects/Programs implemented** | 2 | 7.7 | There are projects or programs in place that address this action, however significantly more investment is required to enable catchment wide implementation. |
| **Little or no progress** | 4 | 15.4 | Little or no progress has been made on this action. This can be for various reasons. |
| **No longer relevant or viable** | 1 | 3.8 | Can be for various reasons. |
| **Summary categories** | | | |
| **Total number of actions** | **26** | **Percentage** | **Explanation** |
| **Action fully achieved or on track to being achieved** | 7 | 26.9 | First two categories above combined |
| **Action implemented but ongoing commitment required** | 14 | 53.8 | Second two categories above combined |
| **Little or no progress** | 5 | 19.2 | Last two categories above combined |

| Treatment train approach | Management strategies | Implementation actions | Lead organisations | Supporting partners | Status comments | Review category |
|---|---|---|---|---|---|---|
| **1. Prevention** Land use and planning | **1.1** Review planning framework and targets | **1.1.1** Use the Better Urban Water Management Framework to assess monitoring of data against targets, objectives and procedures in the Southern River Integrated Land and Water Management Plan | Department of Planning, Lands and Heritage (DPLH), Department of Biodiversity, Conservation and Attractions (DBCA - previously Swan River Trust and Department of Parks and Wildlife), Armadale Redevelopment Authority (ARA) | CoA, CoG, Western Australian Local Government Association (WALGA), CSIRO, Water Corporation (WC), Department of Water and Environmental Regulation (DWER – previously Department of Water) | • The DWER, CoA and CoG were identified as the lead organisations for this action after publication of the WQIP.<br>• The Better Urban Water Management Framework provides the framework for consideration of water in each stage of the planning system rather than as a document to assess against.<br>• The Land and Water Management Plan for Southern River contains a guide as to what should be monitored pre and post development. In terms of land use change (post development monitoring), this has commenced at a sub-catchment scale for development areas in North Forrestdale. The *Forrestdale Central, Forrestdale East and Erade Structure Plan Areas Post Development Monitoring Program* has also commenced, with oversight from the City of Armadale. This is funded by the Developer Contribution Scheme. The MRA has implemented a similar program in the Wungong development area.<br>• CoG - Adhering to the Better Urban Water Management Framework is a requirement of DWER and is standard practice at the CoG. For updated WQIPs a better action may be for DWER to 'seek to improve Better Urban Water Management'. For WQIP updates be clear where the local government's role is to regulate the private sector as opposed to enacting the actions directly.<br>• CoA has produced the *City of Armadale water resource management for land development, a position paper*. This goes beyond Better Urban Water Management Framework by addressing risks and situations specific to the CoA such as shallow groundwater. | |

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| | | **1.1.2** Develop a research focused monitoring program to determine effectiveness of best management practices for Water Sensitive Urban Design (WSUD) trialled in new developments such as Wungong Urban Water Project | | | • CoG invests in the sampling, analysis and interpretation of water quality data from waterbodies in the City to assist with understanding and managing nutrient and other water quality issues. A new contract for this work will start in 2017.<br>• A post-development monitoring program of BMPs through the UWR Program was completed (*Department of Water 2014, Urban Waterways Renewal: monitoring and evaluation of urban stream restoration, Swan Canning Catchment, Final Project Report January 2014)*.<br>• A soil amendment trial by DWER (then DoW), (with support from the then Department of Parks and Wildlife and State NRM) in the Abingdon stage of the Bletchley Park Estate Development included a comprehensive monitoring regime.<br>• UWA Environmental Systems Engineering students' final year project 2012: "Optimising Water Sensitive Urban Design (WSUD) for integrated management of water quantity, water quality, and ecological diversity in the Southern River Catchment" Report from UWA or City of Gosnells. | |

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| | **1.2** Implement local planning policies, strategies and planning conditions that incorporate best management practices | **1.2.1** Examine planning mechanisms to help control and manage sediment from urban development | | | • The Sediment and Erosion Project was delivered in the period 2009 to 2012. The first step was engaging a consultant to complete a detailed investigation into planning, statutory and policy mechanisms for controlling and enforcing management of erosion and sedimentation, resulting in the report *Essential Environmental 2010, Southern River Sediment and Erosion Project Report, prepared for the Swan River Trust, March 2010*.<br>A Sediment and Erosion Project Officer was employed, housed at the City of Gosnells, from June 2010 to July 2012 and reviewed and concluded on the most appropriate mechanisms for sediment control, using six case studies as an example, across the Cities of Armadale and Gosnells.<br>• The Sediment Taskforce was established in 2014 and is administered by Perth NRM (with funding from DBCA to 2018). Member organisations contributing to the Taskforce include CoA, CoG, City of Kwinana (CoK), WALGA, Master Builders Association (MBA), Housing Industry Association (HIA), Urban Development Industry of Australia (UDIA), DBCA, DWER, SERCUL, Main Roads WA, WC, Department of Communities (Housing).<br>• A two-year research project is underway supervised by UWA Professor Carolyn Oldham through the CRC for Water Sensitive Cities to quantify sand/soil loss from subdivisions and individual dwelling construction phase. The research is funded jointly by the member organisations of the Sediment Task Force. CoA and CoG have also assisted the student to find suitable test sites. The Heron Park estate in Armadale is to be a case study site.<br>• CoA has in place Local Planning Policy PLN2.5 Erosion Prevention and Sediment Control under the Town Planning Scheme. | |
| | | **1.2.2** Developers to prepare and implement erosion and sediment control plans as part of condition for approval | | | • CoA - local planning policy (PLN2.6) addresses this action and conditions are applied where it is appropriate.<br>• CoG - WAPC standard condition is now available for the Swan River Trust Development Control Area. Erosion management is being addressed through Construction Environmental Management Plans (CEMPs). | |

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| | | **1.2.3** Implement WSUD into new developments and retrofitting of drainage systems | | | • Opportunities are taken as they arise.<br>• The Southern River Urban Waterways Renewal (UWR) projects included five sites where urban drains were retrofitted in accordance with WSUD principles (Riverside Lane living stream, Wungong River living stream, Grovelands Reserve treatment basin, Third Avenue and Seville Grove bio-retention system, Strawberry Drive treatment basin).<br>• CoA - apply conditions to new developments requiring WSUD be incorporated. Retrofitting is more difficult and does not really sit under the Land Use Planning heading.<br>• CoA - Wungong River Concept Plan is currently being completed for a 2.7km stretch of foreshore between Armadale Road and Champion Drive. This will consider opportunities for retrofitting of urban drains that are tributaries to the River. | |
| | | **1.2.4** Assess funding requirements to implement retrofitting of drainage in existing urban areas | | | • Seed funding has been provided by the CoA to restore a 2.7km stretch of the Wungong river.<br>• Continual prioritisation of sites for urban WSUD options is occurring in line with funding opportunities. | |
| | | **1.2.5** Incorporate roof runoff treatment and harvesting into development conditions | | | • This action has not been formalised by the Cities and is unlikely to be pursued.<br>• Roof runoff is generally infiltrated through soak-wells. No harvesting occurring (except by individuals with rainwater tanks). | |

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| | **1.3** Water Quality Monitoring Program | **1.3.1** Seek funding to continue water quality monitoring program | Perth NRM, DWER | CoG, CoA, South East Regional Centre for Urban Landcare (SERCUL), DWER, CSIRO | • Funding for regional water quality monitoring officer (based at SERCUL) was secured for 2012-13. Then partially captured by Southern River UWR projects water quality monitoring.<br>• The CoG assessed its water quality monitoring regime to improve robustness and the ability for the information to be compared to other monitoring occurring within the catchment. CoG retrospectively assessed nine years of WQ data from waterbodies and continues to conduct long term water quality monitoring in their LGA.<br>• The Urban Drainage Partnership Agreement worked towards consolidating and understanding all water quality monitoring occurring throughout the Swan Canning Catchment.<br>• CoG contracts the sampling, analysis and interpretation of water quality data from waterbodies in the City to assist with understanding and managing nutrient and other water quality issues. A new contract is to be commenced in 2017.<br>• CoA - the Developer Contribution Scheme provides for monitoring in the North Forrestdale area - 33 bores plus surface water sites. In addition, developers are fulfilling monitoring requirements for new development area at a sub catchment scale. CoA is not monitoring council drains or compensation basins. | |

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| **2. Minimisation** Ecoefficiency | **2.1** Light Industry Survey and Auditing Program | **2.1.1** Investigate expansion of the Light Industry Survey and Auditing Program to progressively incorporate all small to medium enterprises in the Southern River Catchment | SERCUL, CoA, CoG, DWER (previously Environment and Conservation, then Environment Regulation), Perth NRM | DWER | • DBCA and DWER are partnering with the CoG to audit light industrial premises in other catchments as part of the NLP funded 2015-17 Light Industry Program. Audits began in 2015. There will likely be a need to audit light industry in the Southern River Catchment once the new business park is established, The current program did not include Southern River Catchment because other catchments of the Swan Canning with large concentrated areas of light industry were prioritised over Southern River which didn't have a large dedicated light industrial area at the time.<br>• The industrial area in the CoA is Kelmscott. The Environmental Health Officers respond to complaints but do not have a pro-active program for inspecting light industrial premises.<br>• SERCUL - Completed a Mycelex Hydrocarbon Track and Trace Project in 2012 on behalf of the CoA and provided results to the DWER. | |
| | | **2.1.2** Develop and implement Sustainable Industrial Development Guidelines | | | • *Perth Region NRM 2010, Guidelines for Industrial Development*, funded through Australian Government with contributions from DoP, CoG, Kwinana Industries Council (KIC) and Landcorp. The guidelines have been made available to LGs. The guidelines are being used in the planning and development of new industrial areas in the new mixed business/ light industrial area in Southern River. The guidelines were developed as part of the Light Industry Program.<br>• The Western Australian Planning Commission and the CoG have approved a Structure Plan for the proposed 44-hectare mixed business/ light industrial area in Southern River. The land will be developed to the highest standards to ensure stormwater drainage does not adversely impact upon surface and groundwater or the adjacent wetland/bushland areas. A Local Water Management Strategy has been prepared and approved for this site.<br>• No further action on this by CoA. | |

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| **3. Reduction** Source control | **3.1** Soil and sediment best management practice trial | **3.1.1** Develop and implement trial of best management practice to reduce sediment before entering the Southern and Wungong rivers and their tributaries | DBCA, SERCUL | CoA, CoG, developers, WC, CSIRO, Perth NRM, DWER | • UWR Southern River Projects in the City of Armadale are using BMPs to reduce sediment into Wungong River. This is particularly relevant to the Williams St Main Drain project which includes a riffle/drop structure that is designed to enable sediment to settle out. These projects were subject to monitoring for the first couple of years after construction until the UWR Program grant funding ended.<br>• CoG trialled Templug inserts in drains on Federation Parade, above the Canning River in Pioneer Park, however no further implementation has occurred.<br>• DBCA is providing support to the Sediment Task Force for a part-time officer based at Perth NRM for two years 2016-2018 to implement the Sediment Task Force Action Plan and coordinate the student research project into sand drift from building sites<br>• Sediment Task Force member organisations are jointly funding the research project and CoA have assisted in on-ground site selection - a full-time Masters student through the CRC for Water Sensitive Cities will quantify sand and soil losses from Heron Park development site in Armadale over 2017 and 2018. The findings will potentially support sediment reduction promotion and enforcement. | |
| | | **3.1.2** Trial soil amendments in situ to determine effectiveness in reducing nutrient run off and groundwater contamination | | | http://www.clw.csiro.au/publications/waterforahealthycountry/).<br>• DWER (then DoW), with support from DBCA (then Swan River Trust) and State NRM, trialled soil amendments around sub-soil drains in a new urban development to reduce impact of legacy groundwater nutrients. Project completed 2012 -2015 in Abingdon stage of Bletchley Park Estate, Southern River. Summary reports on significant findings of monitoring data by ChemCentre. Final project report: Department of Water 2016, *Iron Man Gypsum amendment of subsoil drains to treat nutrients in urban groundwater discharge,* Water Science technical series report 78, October 2016, Government of Western Australia.<br>• Barron O, Barr A (2009) 'Effect of urban development on water balance in the Southern River catchment.' CSIRO: Water for a Healthy Country National Research Flagship, Perth. | |

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| | | **3.1.3** Develop guidelines to prevent nutrients in groundwater from reaching surface waters | | | • No guidelines developed. However, the City of Armadale has published the *City of Armadale water resource management for land development – A position paper*. Which covers this subject.<br>• CRC for WSC study at the Glades: Groundwater Balance Study looks at understanding how nutrients are transported from the surface to the receiving waters including groundwater.<br>• In developing guidelines consideration may be given to *Department of Biodiversity, Conservation and Attractions Corporate Policy Statement No. 50 Planning for Dewatering affecting the Swan Canning Development Control Area*, March 2017. | |
| | **3.2** Reduce council outputs through local management practices | **3.2.1** Extend soil and leaf nutrition testing, use of soil amendments and irrigation water efficiency to all public open spaces across the catchment | CoA, CoG | DWER, DBCA, developers, SERCUL, Armadale Gosnells Landcare Group (AGLG) | • CoG - conducts soil and leaf tissue analysis on all sports fields and arranging for moisture testing on sports fields and irrigated parks.<br>• Soil amendments have been trialled in Southern River Catchment new urban development. NIMPs are imposed on developments close to wetlands/rivers.<br>• CoA – conducts annual soil and leaf nutrient analysis across broad acre turf as a minimum and have moisture probes across the active sports fields. NIPs are imposed on developments close to wetlands/rivers<br>• CoA and CoG are not part of the Waterwise Councils Program. | |
| | | **3.2.2** Implement water conservation plans | | | • CoA - has a lessee operating its sole golf course and included the requirement for an EMS to guide maintenance and environmental compliance.<br>• CoA has installed soil moisture probes across all active sports fields to report soil moisture, temperature and EC to a cloud based monitoring system. The City installed subsoil lysimeters under some active sports fields to collect leachate for analysis. City-wide monitoring of groundwater quality is undertaken on an annual basis at the end of each water year.<br>• CoA has commenced installation of telemetry systems to all bore heads to monitor groundwater abstraction in 'real-time' for reporting to a cloud-based monitoring system.<br>• CoA manages groundwater under two separate Operating Strategies, specific to Armadale Golf Course and the Perth Armadale Water Sub Area. | |

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| | | | | | Both strategies are currently under review by the City and DWER. The CoA's Water Conservation Plan 2009 is also in the early stages of review.<br>• CoG - Implementing Water Conservation Plan, however Water Conservation Plans don't always translate to what is happening on the ground. For example, temporary scheme water meters are put on and used for developments installing new parks and gardens while the land is being sold. | |
| | | **3.2.3** Encourage the use of local plants in landscaped areas | | | • The CoA has adopted Local Policy ENG14 'Landscaping' that promotes the use of native vegetation.<br>• CoA - 50% of all new developments native vegetation and promotes Water Wise Landscaping.<br>• CoG has a landscaping policy in place. | |
| | | **3.2.4** Council premises such as works depots should extend beyond compliance with current environmental legislation and demonstrate best management practices | | | • The CoA depot is currently Green stamp accredited. • CoG Operations Centre is in Maddington, outside of the Southern River Catchment. CoG is planning a new Operations Centre, which will incorporate best practices. | |
| | **3.3** Reduce outputs by developers | **3.3.1** Implement sediment reduction program developed through trial outcomes and learnings | Developers, CoA, CoG, AGLG, ARA | DBCA, SERCUL, DWER | • SEPCOM Project finalised but recommended changes to practices have not been implemented. The Cities of Armadale and Gosnells are looking for support from WALGA to help facilitate change Perth-wide as part of the Sediment Task Force.<br>• The Sediment Task Force is jointly funding a full-time Masters student through the CRC for Water Sensitive Cities to quantify sand and soil losses from Heron Park development site in Armadale. The findings will potentially support sediment reduction promotion and enforcement. | |

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| | | **3.3.2** Annual reporting on monitoring against water quality targets in the relevant District Water Management Strategy | | | •CoA - The *Forrestdale Central, Forrestdale East and Erade Structure Plan Areas Post Development Monitoring Program* has also commenced, with oversight from the CoA. This is funded by the Developer Contribution Scheme. The MRA has implemented a similar program in the Wungong development area. | |
| | **3.4** Reduce community outputs by building community capacity | **3.4.1** Educate the community to use soil amendments and sustainable landscaping practices | AGLG, SERCUL, DBCA | CoA, CoG, developers, Phosphorus Action Group, WC | • SERCUL on behalf of CoA through the developer Contribution Scheme completed the North Forrestdale study. This has not been applied to other developments.<br>• Around 200 households in the North Forrestdale area would have received information through the North Forrestdale Behaviour Change study.<br>• The Switch Your Thinking Program provided oversight over the delivery of numerous Great Gardens Workshops in the CoA and this program is ongoing.<br>• Great Gardens through (then) Department of Parks and Wildlife over 3 years ended 2015-16.<br>2016-17 - Riverwise Gardens (new program funded by DBCA) | |
| | | **3.4.2** If the North Forrestdale behaviour change study is successful investigate expansion to educate the community on the use of Fertilise Wise products | | | • DBCA support Fertilise Wise Training for turf managers over the Swan Canning Catchment delivered by SERCUL. | |

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| | | **3.4.3** Raise community awareness through involvement in revegetation activities | | | • CoA supports 13 Friends-of Groups and works in partnership with the AGLG.<br>• CoG provides opportunities for community involvement in revegetation activities where possible but there could be more emphasis on catchment issues and water quality benefits as participants often are only aware of the biodiversity improvements. The Phosphorus Awareness Program provides some catchment focus at community events, however more could be done. GoG also works in partnership with the AGLG.<br>• AGLG provides many opportunities for community participation in revegetation work and coordinates school groups and community events over the winter months when it is best to be planting - as an example in 2015-16 year 69 community work days were organised, over 7500 volunteer hours were clocked, 2000 school kids participated from 21 schools.<br>• SERCUL provides community involvement opportunities within this catchment, through the Phosphorus Awareness Program and at restoration sties. | |

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| **4. Amelioration** Conveyance and transmission | **4.1** Nutrient intervention and improved drainage | **4.1.1** Develop a series of nutrient-stripping and living stream projects targeting high nutrient sites | SERCUL (identified as lead once funding was secured) | DWER, WC, CoA, CoG, DBCA, SERCUL, AGLG, CSIRO | • The UWR Southern River Projects targeted high nutrient areas. The selected sites offered the opportunity to install treatment interventions in combination with river restoration techniques to improve water quality and environmental values within this catchment. Williams St Main Drain, Grovelands Basin, Third Ave, Strawberry Drive Basin, Riverside Drive, and the Wungong River.<br>• Stormwater BMP biofilters at the Glades being monitored.<br>• AGLG - Newell Loop site was completed however after handing the site back to WAPC it has gone backwards a bit as appropriate maintenance hasn't been carried out. The Shearwater Ave / Southern Wood Park Living Stream project (300m stretch), which started about 10 years ago and has had Swan Alcoa Landcare Program (SALP) grants and other funding, is now finished and the work had moved along to Southern River itself for about a 50m stretch on either side.<br>• The CoG and DBCA's Riverbank project planned for the confluence of the Canning and Southern rivers is for about a 100m stretch of weed removal and planting.<br>• The Wungong River has also been a focus for the AGLG, State NRM funded dampland constructed - ties in with the UWR project and has had community groups involved for around 15 years. | |
| | | **4.1.2** Develop and implement a Critical Habitat Study into Southern and Wungong rivers to identify and prioritise sites requiring nutrient reduction to achieve ecological restoration | ARA, DBCA | DWER, WC, CoA, CoG, DBCA, SERCUL, AGLG, CSIRO | • SERCUL - Some additional prospective sites included on register.<br>• CoA - No Habitat Study but the 2.7km stretch of restoration along the Wungong River has had seed funding provided and will improve habitat.<br>• UWR future planning workshop developed priorities in all UWR catchments.<br>• Southern River confluence with Canning River a priority site for biodiversity conservation (with value added water quality outcomes). | |

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| **5. Treatment - Reuse - Disposal** | **5.1** Full connection to infill sewerage | **5.1.1** Full connection of existing industrial areas to infill sewerage and infrastructure to connect new residential and industrial areas | WC | CoA, CoG | • All new developments are connected to sewer, however no progress on retrofitting existing areas, the WC has not identified this area in its current infill sewerage program.<br>• The CoA attempted to have the old Forrestdale town site connected to sewer, but this was not possible.<br>• A process for local governments to enforce connection when a sewer is available to a property was identified through the Canning Plain WQIP project however no further implementation has been reported. | |
| | | **5.1.2** Increase management and maintenance of infrastructure to reduce sewage spills to the stormwater system | | | • SERCUL have met with WC several times regarding specific sites and contingency plans that WC are developing for these sites during major event. Significant investment has been made in reducing wastewater spills to the environment. | |