

# STRATEGIC RESEARCH PLAN

2015 - 2019



The Goyder Institute is a partnership model that brings together the State's leading water research capabilities through collaboration with the South Australian Government, led by Department for Environment, Water and Natural Resources, CSIRO, Flinders University, the University of Adelaide, the University of South Australia and the International Centre of Excellence in Water Resource Management.





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Front cover photo: Graham Green

# 1. The Strategic Intent of the Goyder Institute for Water Research

It is intended that the Goyder Institute will enhance the South Australian Government's existing capacity to develop and deliver science-based policy solutions and in doing so, underpin the sustainable development of the State.

The Goyder Institute's core function is to provide research and independent, expert advice for science-based water policy to the State Government. It is further intended that this will also strengthen the State's position as an international leader in water resource management. It is also the aim to instil confidence in the community that the best scientific minds available are being targeted at resolving the State's key water resource management issues.

The Institute will support:

1. Integration of research into policy that is adopted and makes a difference to water policy delivery on the ground.
2. Building effective human capacity in government and science agencies in South Australia to increase the cross-fertilisation of policy and science, with a focus on policy makers, government scientists and engineers, and research providers working more closely and effectively together.
3. Resilient water resource management in the face of climate change.
4. Key research outputs to include new data, new methods and new knowledge.

These four key outcomes should be 'organising principles' that are seen in the development, delivery and implementation of all Goyder Institute research.

Vision			
The Goyder Institute will continue to be held in high esteem as a Centre of Scientific Excellence providing research that delivers independent and expert science driven by the policy needs of the South Australian Government to achieve enhanced water resource management outcomes for South Australia.			
Mission			
To deliver high quality, independent and rigorous science to underpin evidence-based decision making in water resource management locally, nationally and internationally.			
Strategic Intent			
Excellence	Value	Impact	Collaboration
Delivery of independent, peer-reviewed, world-leading research that supports policy development, decision making and the advancement of science.	To maximise the returns on research investment through partnerships with the private sector, research institutions and all tiers of government by leveraging research investment and knowledge	To ensure evidence-based science outcomes support State Government decision making and policy development, and progresses scientific understanding.	Brings together diverse and relevant expertise to create an environment that inspires innovation and builds capability in water resources management.

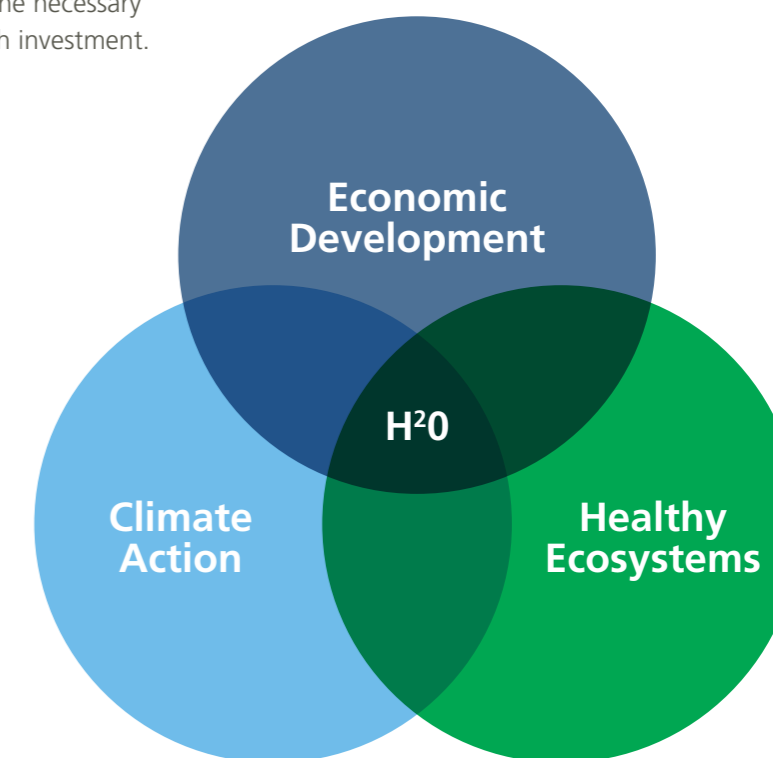
# 2. Purpose of the Strategic Research Plan 2015 – 2019

The Goyder Institute will provide leadership and direction in water sciences, engineering and socio-economic research for sound, evidence-based policy development that enables optimum water management in South Australia.

The *Goyder Institute's Strategic Research Plan* details the long-term strategic outcomes for this research, which will help ensure the water resources of the State of South Australia are sustainably managed for economic, social and environmental benefits. The Strategic Research Plan links the previous, ongoing and future research activities to the three targeted impact areas shown below. Within each Impact Area are focused programs that provide the necessary clarity and direction for new research investment.

Within each Impact Area there are programs that will be targeted for research investment in order to deliver specific outcomes and/or policy directions identified by government agencies and other water industry stakeholders.

Supported ongoing and new research projects will be expected to demonstrate how they contribute to a specific impact area and towards the long-term strategic outcomes of the Goyder Institute. Efforts continue to be concentrated on enabling fundamental research, applied research, implementation, tools and fit-for-purpose outcomes. This enables the Goyder Institute to arrive at a balanced and integrated R&D profile in all Impact Areas and research programs.



### 3. The Goyder Institute Model

The Goyder Institute is a collaboration between the State Government and research institutions that provides independence, transparency and confidence in the decision making process of government. The characteristics of the Goyder Institute model include:

The characteristics of the Goyder Institute model	
<b>Responsive, efficient and coordinated research</b>	Delivery of independent, peer reviewed, world-leading research that supports policy development, decision making and the advancement of science.
<b>Credible and trusted science</b>	The Institute provides rigorous, independent peer review to ensure quality and confidence in its science advice.
<b>Demand driven by investors</b>	State Government science, policy and water managers work directly with the research partners, as a collective, to define and scope the priority policy research questions. This ensures alignment of the research investments and delivery to meet government priorities.
<b>Innovation to implementation pathways</b>	Collaboration enables rapid progression along the R&D value chain by bringing together research, industry, government, and training providers.
<b>The best teams to tackle complex challenges</b>	Research outcomes are maximised by drawing upon experts from across all research partners and disciplines to work together on complex policy challenges and deliver innovative solutions.
<b>Building research capability</b>	By supporting researchers and water managers at various stages in their career development, the Goyder Institute is establishing the next generation of capability and capacity necessary to tackle the water resource challenges facing the State.
<b>Value to research partners</b>	Through partnership with government and the private sector, the ability to work on real world problems to find relevant solutions provides opportunity to enhance linkages to industry, international connections and attract the best students to our universities.





## 4. Background

The Goyder Institute was established in 2010 to provide expert, independent scientific advice that underpins good policy decision making to support the security and management of South Australia's water supply.

The Institute is unique as a water research institute in Australia, as the State's specific water policy needs and challenges direct its research program. The Goyder Institute has been instrumental in being able to provide timely, credible scientific evidence and advice to underpin the Government's most significant strategic water initiatives.

The Goyder Institute has:

- Provided independent expert scientific advice for the negotiations of the Murray Darling Basin Plan.
- Developed an agreed set of climate change data projections for South Australia for adaptation planning, providing compelling evidence for the Government's investment in water security infrastructure for Adelaide. This data is publicly available on Enviro Data SA.
- Been tasked with undertaking independent socio-economic analysis and review for the Regional Impact Assessments of the Marine Park Sanctuary Zones to ensure credibility and transparency in the review process.

- Tested the feasibility for stormwater use and water sensitive urban design (WSUD) to diversify Adelaide water supply sources underpinning the State Stormwater Strategy and the State WSUD Policy. This will support the development of an Integrated Water Plan for Greater Adelaide and has enabled the government to facilitate community engagement in policy development.
- Developed new airborne geophysical data interpretation techniques to find potential groundwater resources for mining developments, supporting the Plan for Accelerating Exploration (PACE) and more reliable Aboriginal community water supplies. The value of these new geophysical interpretation techniques to the mining industry was demonstrated by Investigator Resources Ltd. in a statement to the Australian Stock Exchange on 4 March 2014. This cited the Goyder Institute's FLOWS project on Eyre Peninsula in their mineral and groundwater exploration programs for their Paris silver deposit project.
- Developed new techniques to manage the higher salt levels of recycled waste for irrigation expansion.
- Developed a process and framework for integration of surface water, groundwater and hydro-ecological relationships to enable a cohesive approach to water allocation planning and implementation.
- Developed an approach to assess the ecological health of the Lake Eyre Basin to inform periodic 'State of the Basin' reviews of the condition of the Lake Eyre Basin rivers and catchments.
- Engaged 120 FTE of researcher time in the Goyder Institute work over the five years to 2015.
- Supported 25 PhD students and three international Visiting Professors.

In its second term the Institute is committed to ensuring that the knowledge foundations developed in the first five years are available in appropriate formats for decision makers, managers and government scientists. This focus will utilise expertise from government, universities and the private sector to build a knowledge platform that targets the development of communication and extension products to support the needs of end users. This is to ensure relevance and utilisation of the valuable research outcomes and an ongoing living library of this valuable research.

## 5. Policy Drivers

Water is essential to the State's economic development and a sustainable environment in which to live. The increasing climate variability and a drier climate outlook will mean a scarcity of good quality water or less reliable water supplies in parts of the State. This poses a major risk to the development of the mining and agricultural sectors as well as town water supplies in some areas. Water security continues to remain a barrier to fully unlocking sustainable development across South Australia including in the mining and resources sector and agriculture industries.

The Research Program of the Goyder Institute is guided by State Government strategies, policy and implementation documents and agreements, the chief of which are set out here.

Fulfilling the Premier's economic priorities of "Unlocking the full potential of South Australia's resources, energy and renewable assets", "Premium food and wine produced in our clean environment and exported to the world", and "Adelaide, the heart of the vibrant State" will require an investment in research to develop new solutions that facilitate opportunities for sustainable industry development and promote stewardship of the State's environmental assets.

A number of other key State strategic priorities and plans have directed the development of this Strategic Research Plan and research programs conducted by the Goyder Institute. These are the State Strategic Plan targets for water sustainability; Water for Good actions on stormwater reuse; WSUD and integrated water use; the South Australia Regional Mining and Infrastructure Plan; the Murray Darling Basin Plan; and the South Australia's Vision – Pathways to 2050.

The Goyder Institute will focus on:

1. Economic development by supporting the Premier's economic priorities to deliver improved economic productivity and jobs, specifically:
  - a. Unlocking the full potential of South Australia's resources, energy and renewable assets,
  - b. Premium food and wine produced in our clean environment and exported to the world,
  - c. Adelaide, the heart of the vibrant state, and
  - d. Growth through innovation and the Knowledge State – attracting a diverse student body and commercialising our research.

2. State Government priority water security and environmental strategies, climate change mitigation and adaptation, marine park sanctuary zones, and implementation of the Murray Darling Basin Plan.
3. International engagement to support the South Australian Government's international strategies related to water management in order to create opportunities for new research partnerships and support the Government and private sector in delivering services and products.

These have all set targets for better water management of our water resources to optimise the economic use, meet critical human needs and provide the necessary environmental water requirements for healthy ecosystems and good water quality. To meet these targets and objectives, on-going research to provide new knowledge, information and management tools is required. Independent science also creates an accepted level of credibility in the South Australian Government's management of its water resources and the building of trust in the community and amongst competing stakeholders.

The Goyder Institute's Strategic Research Plan recognises that optimal results will be achieved through the development of strategic partnerships with regional communities, natural resource management boards, industry, local government, water authorities, other government agencies, and research organisations.



Photo: Claire Punter

## 6. Institute Objectives

In achieving this Strategic Intent, the Institute will have three broad objectives.

### 1. Policy Utility

The Goyder Institute Research Plan is to provide scientific knowledge to support policy objectives:

- Reliable and resilient water supplies that meet future needs;
- Water resource discovery and management for economic growth;
- Provision of environmental water to support ecological objectives;
- Proactive responses to climate change underpinned by the best available scientific understanding of climate trends; and,
- Effective water management policy and decision making that enhances community well-being.

### 2. Capacity Development

The Goyder Institute Research Plan is to build research leadership capacity in South Australia to inform integrated water management:

- Adaptive management systems and tools that can be adopted by policy makers in State Government;
- Develop capacity in State Government agencies and with mid- and early-career researchers, to build local capacity across all research programs and develop the next generation of water managers and scientists;
- Support the transition of postgraduate students into the workforce; and,
- Develop synergies across institutions to enhance our ability to deliver water management solutions for South Australia by building greater local capacity and connectivity to relevant expertise nationally and internationally.

### 3. Advancement of Science

- Creation of new knowledge and understanding of water science spanning biophysical, social, economic, technological and environmental disciplines;
- Enhance the international reputation of water research capability and expertise of the research partners; and,
- Further develop a critical mass of expertise in science domains relevant to South Australia's water challenges and opportunities.



## 7. Institute Governance

The Goyder Institute is delivered through a small head office that works with the Research Advisory Committee (RAC) to deliver a high-quality research program. The Institute Director and the RAC report to the Management Board, who provide oversight of the Institute operations, and where each of the research partners and State government have representation.

### Management Board

Independent Chairperson  
 The University of Adelaide  
 Flinders University  
 University of South Australia  
 CSIRO  
 Government of South Australia  
 ICE Warm

### Research Advisory Committee

The University of Adelaide  
 Flinders University  
 University of South Australia  
 CSIRO  
 Government of South Australia  
 SA Water  
 SARDI







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## 8. Research Advisory Committee

The Research Advisor Committee assists the Institute Director in the development of the Annual Research and Development Plan. The committee ensures that research activity is of a high quality and is linked to deliver against priority issues facing government in managing South Australia's water resources.

- To provide advice and support to the Institute Director in relation to the development of the Annual Research and Development Program and Budget;
- To endorse the draft Annual Research and Development Program and Budget;
- To provide advice to the Management Board on knowledge gaps associated with the overall research program of the Institute;
- To conduct periodic scientific reviews of priority Institute activities including annual scientific and other reports produced by the Institute, and make recommendations about the direction, content and details of future Institute activities;
- Identify and provide advice on linkages to relevant national and international research activities and recommend relevant strategic research alliances to the Management Board; and,
- To carry out such other functions as are identified in the Agreement as a function of the Research Advisory Committee, or determined by the Management Board from time to time.



Photo: Claire Punter

## 9. Research Focus

### 9.1. Economic Development

The focus of the Economic Development Impact Area is to address the relevant State Government priorities by:

- Providing science to underpin sustainable water resource management for existing water resource developments;
- Providing science to underpin identification of future sustainable water resource development opportunities; and,
- Identifying pathways and opportunities to facilitate use of research outcomes by the private sector.

Water continues to be a challenging State issue where independent science is needed to assist Government in addressing key economic and industry development imperatives, particularly in the mining and agriculture sectors. There are also regional communities – in particular, remote indigenous communities – where a secure water supply continues to be a key issue. Looking forward, there is potential for significant investment over the next 10 years in the mining, food and wine sectors. Collaborative, demand-driven research is required to underpin sustainable growth and productivity in these sectors and to enable South Australia to prosper.

Finding sustainable water resources to support mining development will enable the mining sector to grow whilst ensuring that key community and environmental assets are maintained. A state-wide strategic approach to the provision and sourcing of water will deliver the most cost-effective and prudent management of water supply and management of waste streams for mine sites, mining camps and outback communities that do not have reliable supplies of water.

The Northern Adelaide Plains is one of the premium food and wine regions of South Australia. There is opportunity for expansion of this region to provide new employment opportunities in the northern suburbs of Adelaide. Science can support this expansion through enhanced understanding of the utilisation of recycled water, stormwater and groundwater resources of varying qualities available in this region. The Goyder Institute can provide thought leadership in developing options for future industries and delivery of services that are visionary, integrated and sustainable.

#### 9.1.1. Policy Drivers and Key Questions

The primary strategies that guide investment within the Goyder Institute Economic Development Impact Area are:

- Unlocking the full potential of South Australia's resources, energy and renewable assets;
- The Knowledge State – attracting a diverse student body and commercialising our research;
- SA-India Strategy;
- SA-China Strategy;
- SA-SE Asia Strategy;
- Northern Adelaide Economic Development Plan;
- Regional Mining and Infrastructure Plan;
- Copper Strategy;
- Adelaide, the heart of the vibrant state;
- Premium food and wine produced in our clean environment and exported to the world; and,
- Water for Good.

The priority policy questions that have been identified within these strategies that require further research to inform planning and implementation are:

1. Identifying the availability of water resources and providing solutions to any barriers in using and accessing these sources, to support development of new industries and businesses in the Northern Corridor (defined as the coastal plains region between northern Adelaide and Whyalla).
2. Identifying available water resources in priority outback areas of South Australia, including the APY lands, Gawler Craton, and Braemar regions.
3. Understanding risks of unconventional gas exploration and production on water resources, in particular the requirement for water for hydraulic fracturing and risks associated with hydraulic fracturing.
4. Providing independent scientific advice on water-related issues in relation to considering nuclear fuel cycle options.
5. Coordinating South Australian research capacity in relation to the State's international initiatives.

## 9.1.2. Knowledge Gaps

The Economic Development impact area will be delivered through three programs: (i) Mining and Energy, (ii) Northern Corridor, and (iii) International Engagement. For each of these programs a series of research questions have been identified as gaps that need to be addressed in order to deliver against the policy directions.

Knowledge Gaps	
<b>Mining and Energy</b>	<ul style="list-style-type: none"> <li>• What is the potential for groundwater supply (quality &amp; quantity) in the northern parts of the State where there is currently limited information regarding the availability of water resources?</li> <li>• Cumulative effects methodology, developed as a priority for data-poor areas where there are significant mineral resource prospects</li> <li>• What is the connectivity between potential groundwater resources and dependent ecosystems?</li> <li>• Assessment of the risks associated with unconventional gas extraction (across the typical life cycle of a project) and hydraulic fracturing on water resources and other industries</li> <li>• What are the water resource implications in relation to the nuclear fuel cycle, subject to government decisions on potential nuclear waste storage?</li> <li>• Economically viable recovery of energy and nutrients from water and wastewater treatment processes</li> <li>• Low cost treatment options to enhance reuse of wastewater using a 'fit for purpose' approach</li> </ul>
<b>Northern Corridor</b> <i>(Northern Adelaide to Whyalla)</i>	<ul style="list-style-type: none"> <li>• Prepare a water roadmap for the Northern Corridor that includes requirements of new developments and triggers for water infrastructure investment</li> <li>• Use of technology to enable governance that ensures long-term sustainability for new irrigation districts</li> <li>• Assess different water availability scenarios and blending opportunities, for example use of water in the winter season, and management of mixed water sources with different qualities and reliabilities</li> <li>• Improving quality of recycled water for irrigation application and minimising long-term soil and plant impacts, and impacts on shallow water tables</li> <li>• Prediction of winter rainfall under a variable and changing climate to manage water application and maximise soil leaching</li> <li>• Understanding the water quality of mixed sources, particularly in the Northern Adelaide Plains, recognising other potential quality issues aside from salinity, such as nutrients and boron</li> <li>• Climate, soil productivity, water quality and quantity requirements of different crop varieties as an input to evaluate development scenarios in relation to optimising use of available resources, maximising output/production capacity and minimising environmental pollution</li> <li>• In-depth analysis of interacting biogeochemical soil processes to inform optimisation of water quality scenarios that will yield minimal long-term effects of dissolved ions and contaminants on soil and plant health</li> <li>• Understanding the ecological processes of key environmental assets in the Northern Corridor to support sustainable development of the region</li> </ul>
<b>International Engagement</b>	<ul style="list-style-type: none"> <li>• Support in delivering the Rajasthan Cooperative Water Action Plan under the South Australian Government and Rajasthan Government MOU</li> <li>• Facilitate research support in other international engagement opportunities as required</li> </ul>

## 9.1.3. Policy Impact

The Goyder Institute research investment will enable policy that fosters state economic development by improving knowledge in the following areas:

- Identify and optimise secure, fit-for-purpose, water supply options for the Adelaide Northern Corridor, which support long-term sustainable development of agricultural and other new industries;
- Groundwater resources in the outback regions of the State are mapped, and the potential for the variable quality groundwater resource to be developed for fit-for-purpose uses is assessed;
- Risks to water resources related to development activities are quantified and potential solutions identified;
- Access to sustainable water supplies is not the limiting factor to the growth of the mining and agriculture sectors and other new industries;
- Optimisation of the economic and social outcomes from water use by a growing irrigation industry, while managing any environmental impacts;
- Industry that is resilient to water resource impacts of climate change, variability and extreme events;
- Water resource implications associated with industry driven land-use change are understood and management strategies developed; and,
- South Australia's water expertise supports the delivery of the Rajasthan Cooperative Water Action Plan and the International Centre of Excellence for Water Management.

## 9.2. Healthy Ecosystems

The Healthy Ecosystems Impact Area expands on the activities of the first five years of the Institute that included a significant focus on the Murray-Darling Basin, inland waters such as the South-East, Mount Lofty Ranges and Lake Eyre Basin, and socio-economic assessment of Marine Park Sanctuary Zones. These areas continue to be a priority for State Government in achieving optimal outcomes for the environment while also balancing social and economic outcomes in the context of a changing climate, stewardship and competing water demands.

The Healthy Ecosystems Impact Area will focus on:

- Furthering knowledge to support appropriate water quality and quantity for environmental assets to ensure resilient, connected and healthy ecosystems;
- Developing frameworks that integrate hydroclimate, hydrological, environmental and economic considerations in water management to achieve sustainability;
- Enhancing the scientific basis to test resource allocation scenarios for improved water planning outcomes and individual resource allocation decisions;
- Leadership in environmental flow science and in the communication of the research outcomes to environmental managers; and,
- Establishing an evidence base to inform and evaluate environmental management commitments, including social and economic factors, in addition to biophysical assessments.

## 9.2.1 Policy Drivers and Key Questions

- The government policies, priorities and primary strategies that guide investment within the Goyder Institute Healthy Ecosystems Impact Area are:
- Premium food and wine produced in our clean environment and exported to the world;
- Water for Good;
- Murray-Darling Basin Plan;
- Long-term and Annual Environmental Watering Plans for the River Murray;
- RAMSAR Wetlands of Significance;
- Lake Eyre Basin Intergovernmental Agreement;
- Marine Park Sanctuary Zone Legislation and Management Plans;
- Water Sensitive Urban Design Policy;
- SA Stormwater Strategy;
- Regional Mining Infrastructure Plan;
- Water Allocation Plans;
- South Australia's Climate Change Strategy;
- Adelaide Coastal Water Quality Improvement Plan;
- National Carbon Accounts, Carbon Neutral Adelaide; and,
- Adelaide International Bird Sanctuary.
- The priority policy needs that have been identified within these strategies that require further research to inform planning and implementation are:

### River Murray

1. Demonstration that environmental flows are leading to an improvement in environmental assets in South Australia and justification of flow scenarios to achieve the intended outcomes.
2. Optimisation of the delivery of River Murray environmental water that considers:
  - a. The best pattern of flow and use of structures to achieve environmental, industrial and public water supply outcomes
  - b. The threshold metrics of River Murray ecosystem limits
  - c. Predictive models of ecological response to different flow patterns or operations at time scales of 1-5 years
3. Science input and expert advice to support Murray Darling Basin Plan Implementation.
4. Planning for a drier Murray-Darling Basin.
5. Understanding the ecological and water quality implications in South Australia of a possible carp eradication program in the Murray Darling Basin.

### Coastal zones

6. Understanding the role of Marine Parks in assisting with maintenance of appropriate scales of connected populations. Spencer Gulf and Gulf St Vincent environmental and infrastructure impacts.
7. Identification of appropriate catchment interventions, for example through WSUD and stormwater management, which improve coastal water quality.

## 9.2.2. Knowledge Gaps

The Healthy Ecosystems impact area will be delivered through three programs focusing on (i) Catchments, (ii) Coasts and Marine, and (iii) Communities. For each of these programs a series of knowledge gaps have been identified that need to be addressed in order to deliver against the policy directions.

Knowledge Gaps	
<b>Catchments</b>	<p>River Murray</p> <ul style="list-style-type: none"> <li>• Demonstrate that Basin Plan environmental flows are leading to an improvement in the health of the environmental assets in SA</li> <li>• Development of tool(s) to assess the benefits of different river operations and planning scenarios to achieve multiple benefits and analyse trade-offs for different water users</li> <li>• Expert panel assessment of the likely ecological benefits in the SA River Murray of the package of efficiency and constraints measures</li> <li>• How can the uncertainty of saline groundwater travel times to the river and floodplain be reduced?</li> <li>• What ecosystem disturbance will occur with large mortality rates of carp, and what are the implications for water quality and native species?</li> </ul> <p>WSUD</p> <ul style="list-style-type: none"> <li>• How can WSUD be implemented to achieve water savings, improve water quality, enhance urban amenity and reduce heat island effects?</li> </ul>
<b>Coasts &amp; Marine</b>	<ul style="list-style-type: none"> <li>• Development of robust Marine Park Monitoring, Evaluation and Reporting plans</li> <li>• What is the level of connectivity between Marine Parks and how do they assist with gene flow for a range of species and trophic flows between habitats?</li> <li>• Deepen understanding of the interconnectedness of critical terrestrial-coastal ecosystem linkages: what are the downstream impacts from terrestrial developments on ocean ecosystems?</li> <li>• What data and knowledge is available to assess infrastructure, development and other impacts?</li> <li>• What are the levels of groundwater discharge required to sustain offshore groundwater dependent ecosystems, eg. Coffin Bay?</li> <li>• What role can stormwater management and WSUD play in safeguarding coastal water quality?</li> </ul>
<b>Communities</b>	<ul style="list-style-type: none"> <li>• What are suitable socio-economic indicators to assess the impact of Goyder Institute programs and other State government research investments?</li> <li>• What are effective approaches that build capability and engage communities to enable improved practices and transitions to new enterprises and/or scales of operation?</li> <li>• What are the socio-economic benefits of the Murray Darling Basin Plan?</li> </ul>



Photo: Graham Green

### 9.2.3. Policy Impact

The Goyder Institute research investment will enable policy that promotes the long-term sustainability of healthy ecosystems by improving knowledge in the following areas:

- Underpin the implementation of the Murray-Darling Basin Plan by providing new and improved scientific knowledge;
- Support the management of environmental water that maximise environmental benefits through effective and efficient delivery of environmental water managed under the Murray-Darling Basin Plan;
- Demonstration that environmental flows are leading to an improvement in the health of environmental assets in South Australia;
- Deliver a real-time climate risk management system for industry and the environment dependent on River Murray flows;
- Provide a robust ecological and socio-economic evaluation framework for assessment of the effectiveness of Marine Parks and Sanctuary Zones; and,
- Provide improved knowledge and tools to support stormwater management initiatives that reduce impacts on coastal water quality and maximise cost-effective use of stormwater in the urban environment.

### • 9.3. Climate Action

The Climate Action Impact Area will further the application of the SA Climate Ready data to address key policy challenges in implementing the State's Climate Change Strategy. These include:

- Applying the SA Climate Ready data to improve the understanding of risks, vulnerabilities and opportunities associated with climate change in South Australia;
- Developing tools that water and environmental managers in South Australia can use to develop the most appropriate mitigation strategies that incorporate an integrated assessment of climate change on water resources;
- Providing a science base to support achieving carbon neutrality; and,
- Undertaking risk assessments of water and related natural resources in the catchment and coastal zone.
- Providing a science base to support achieving net zero emissions in the State through bio-sequestration

### 9.3.1 Policy Drivers and Key Questions

The government policies, priorities, and primary strategies that guide investment within the Goyder Institute Climate Action Impact Area are:

- Adelaide, the heart of the vibrant State;
- South Australia's Climate Change Strategy 2015 - 2050: Towards a low carbon economy;
- Carbon Neutral Adelaide - A shared vision for the world's first carbon neutral city;
- Prospering in a Changing Climate: A Climate Change Adaptation Framework for South Australia.
- Water for Good - Water security planning;
- Adelaide International Bird Sanctuary; and,
- Premium food and wine produced in our clean environment and exported to the world.

The priority policy questions that have been identified within these strategies that require further research to inform planning and implementation are:

1. Assessment of the carbon sequestration opportunities in South Australia with a focus on:
  - a. Coastal environments as carbon sinks
  - b. Carbon sequestration through soil and vegetation within South Australia
  - c. Carbon intensity of water and wastewater treatment
  - d. Optimisation of carbon offsets, taking into consideration water requirements and socio-economic factors

2. Identification of research required to support implementation of regional climate change adaptation plans.
3. Application of Climate Ready SA to assess potential future climate scenarios of rainfall patterns and temperature in each SA NRM region and across industry sectors.
4. Identification of the frequency of water supply stress situations under water plans, and how regional communities are impacted, accounting for forecast conditions and potential extreme climate conditions.
5. Identification of future water supply options for Adelaide metropolitan region beyond 2015.
6. Development of targeted decision support tools that support real-time risk management of water resources, irrigated agriculture, and natural resources in response to the identification and onset of drought conditions.
7. Alignment of climate change adaptation planning with forecast changes in rainfall intensity and the frequency of extreme rainfall events at a local or sub-regional scale.
8. Alignment of climate change impact planning in public health, infrastructure, agriculture and other sectors with projected changes in frequency and duration of periods of extreme heat.
9. Development of improved understanding of the social (including health), economic and environmental benefits of water use to ameliorate impacts of heatwaves.
10. Support communication of climate data, and the value of climate data analysis, to key stakeholders reliant on this information.
11. Identify key investment priorities that are sensitive to climate-change driven water limitations.

### 9.3.2. Knowledge Gaps

The Climate Action Impact Area will be delivered through three programs: (i) Water Security, (ii) Carbon Neutral, and (iii) Extreme Events. For each of these programs a series of knowledge gaps have been identified that need to be addressed in order to deliver against the policy questions.

Knowledge Gaps	
<b>Water Security</b>	<ul style="list-style-type: none"> <li>• Develop hydrologic metrics/indicators that enable greater robustness in annual/seasonal hydroclimate prediction for production systems, natural environments and communities</li> <li>• Develop plausible scenarios for future water metrics for impact-adaptation-vulnerability assessment and adaptation in different sectors (eg. Long-term averages, dry-wet spells, multi-year droughts, low flows and connectivity, storages and water security) and regions (case studies may be in River Murray, Northern Corridor, Mount Lofty Ranges)</li> <li>• How water management plans affect water supplies and the ability of regional communities to adapt in drought stress situations, considering historic variations in conditions and potential extreme climate conditions</li> <li>• Drought monitoring and detection diagnostic tools to support water planning strategy, agricultural risk management and natural resource planning in periods of drought or unusual water supply constraints, identifying indicators of need to trigger adaptive management responses</li> <li>• Assessment of potential WSUD interventions and scenarios to inform optimisation of on-ground works that achieve the greatest economic, environmental and social return</li> <li>• Identification of key investment priorities that are sensitive to climate-change driven water limitations</li> <li>• Quantifying risks relating to water management and identifying key tipping points</li> </ul>
<b>Climate Change and Carbon Neutral Adelaide</b>	<ul style="list-style-type: none"> <li>• Evaluation of the opportunities for carbon sequestration through soil and vegetation within South Australia</li> <li>• What are the carbon intensities of different water sources?</li> <li>• Understanding the value of coastal environments as carbon sinks, including the opportunities from, and needs of, on-shore and near-shore coastal vegetation management and restoration of seagrass meadows</li> <li>• What is the spatial extent and condition of coastal environments and their potential levels of carbon emission and sequestration (for carbon accounting)?</li> <li>• The potential for carbon offsets from coastal environments</li> <li>• Development of tools and information to support assessment of the optimum mix of carbon offsets achievable</li> </ul>
<b>Extreme Events</b>	<ul style="list-style-type: none"> <li>• Assessment of the predicted changes to rainfall characteristics (eg. intensity and frequency) and implications for water security, in particular the effect on reliability of water harvesting and yield in managed aquifer recharge schemes</li> <li>• Prediction of extreme rainfall events that are critical to infrequent groundwater recharge events</li> <li>• Can extreme weather conditions be predicted, e.g. number of consecutive extreme hot days that causes high risk to agriculture, human and environmental health, WSUD, socio-economics, bushfires?</li> <li>• What are the predicted changes to night-time temperatures and the impacts for agriculture?</li> <li>• What role can urban irrigation play in ameliorating the social, environmental and economic impacts of extreme hot days in a cost-effective way?</li> </ul>

### 9.3.3. Policy Impact

The Goyder Institute research investment will enable policy that addresses key challenges in furthering the State's Climate Change Strategy, including:

- Support development of a Carbon Sequestration Strategy for SA;
- New science that supports the achievement of Carbon Neutral Adelaide by identifying carbon offsets to meet the carbon neutral targets;
- An evidence base to support decision making in key sectors that are susceptible to climate change;
- An informed basis for Integrated Urban Water Management to adapt to climate change and future metropolitan Adelaide water supply sources once the desalination plant output has been fully utilised post-2050;
- Improved efficiency and effectiveness of water and water-dependent investments in South Australia;
- Industries to have the best available knowledge to take up carbon sequestration economic opportunities;
- A robust evidence base that tests the assumptions underpinning climate and water resource strategies, and identifies risks to current management actions, strategies, and options to minimise climate impacts;

- Tools that enable decision makers to assess the impact of different climate scenarios for different sectors with confidence;
- The current understanding of climate change assumptions is tested and validated;
- Quantification of the carbon sequestration potential of coastal wetlands and seagrass beds towards achieving targets set by the State Climate Change Strategy. Evaluate the potential role of the Adelaide International Bird Sanctuary in this;
- The resilience of water infrastructure, with a focus on the Northern Corridor, and sufficient environmental water is assessed to determine the level of long-term water security for industry and urban settlements; and,
- Identification of the extent, condition and carbon budget of coastal environments to inform national and state carbon accounting.

## 9.4. Knowledge Adoption and Extension

To further improve the collaborative approach to science and policy integration in Goyder Institute projects and to assist in capacity building within stakeholder agencies, a dedicated Knowledge Management Steering Committee will comprise decision makers and communications experts to oversee the development of a knowledge management strategy. The strategy will identify focused activities that are appropriate for the topic, audience and outcomes sought. This will ensure that the Goyder Institute science is available in an accessible and meaningful format to enable an enduring legacy of the expert science within partner organisations and other stakeholders. Government and industry champions will be integral to the development and delivery of the research program and communication strategy in order to inform the development of the most appropriate communication products for decision makers.

An important part of the knowledge management strategy of the Goyder Institute is the development of a common framework for data management and models. Together with the Australian National Data Service (ANDS), a set of consistent processes has been established to ensure research data arising from Goyder Institute funded projects are well described, stored and discoverable through Research Data Australia (RDA). This approach will help ensure that research data are securely stored and accessible into the future. Data and knowledge generated by projects will also be incorporated into the DEWNR corporate information system and made available through the principle of open data access.

## 10. Annual Research and Development Program & Budget

Each Research Program will be implemented through an integrated set of research projects with associated research project plans. An annual rolling portfolio of projects will be developed by the Director in consultation with the Research Advisory Committee and approved by the Goyder Institute Management Board. Each research project will have a project leader or leaders.

Each financial year, the Goyder Institute will produce an update of the Annual Research and Development Program and Budget to be approved by the Management Board. This Annual Program describes the development and progress of individual Project Plans that will be the mechanism for achieving the outputs required to contribute to each impact area and their programs. The portfolio of Project Plans will be formulated under the direction of the Institute Director, in consultation with the Research Advisory Committee. The individual project plans and the annual research program may be varied and updated annually as policy priorities dictate. The long-term Impact Areas are likely to only require minor adjustments from time to time depending on changes in policy or other unforeseen social issues.

The Director is responsible for the overview of all research projects and working with the project leaders. The emphasis is on managing and delivering to stakeholders and reporting to the Management Board on progress and outcomes.

Minor modifications to project plans, which do not significantly alter the proposed outcomes and do not have significant financial consequences for the project, may be approved by the Director. The Director may consult the Research Advisory Committee about these modifications.

Major modifications to project plans that involve financial consequences will be prepared in consultation with the Director and the Research Advisory Committee. These modified project plans will be presented to the Management Board by the Director for approval. An overview of the project planning and development process is outlined in Figure 1 on the following page.

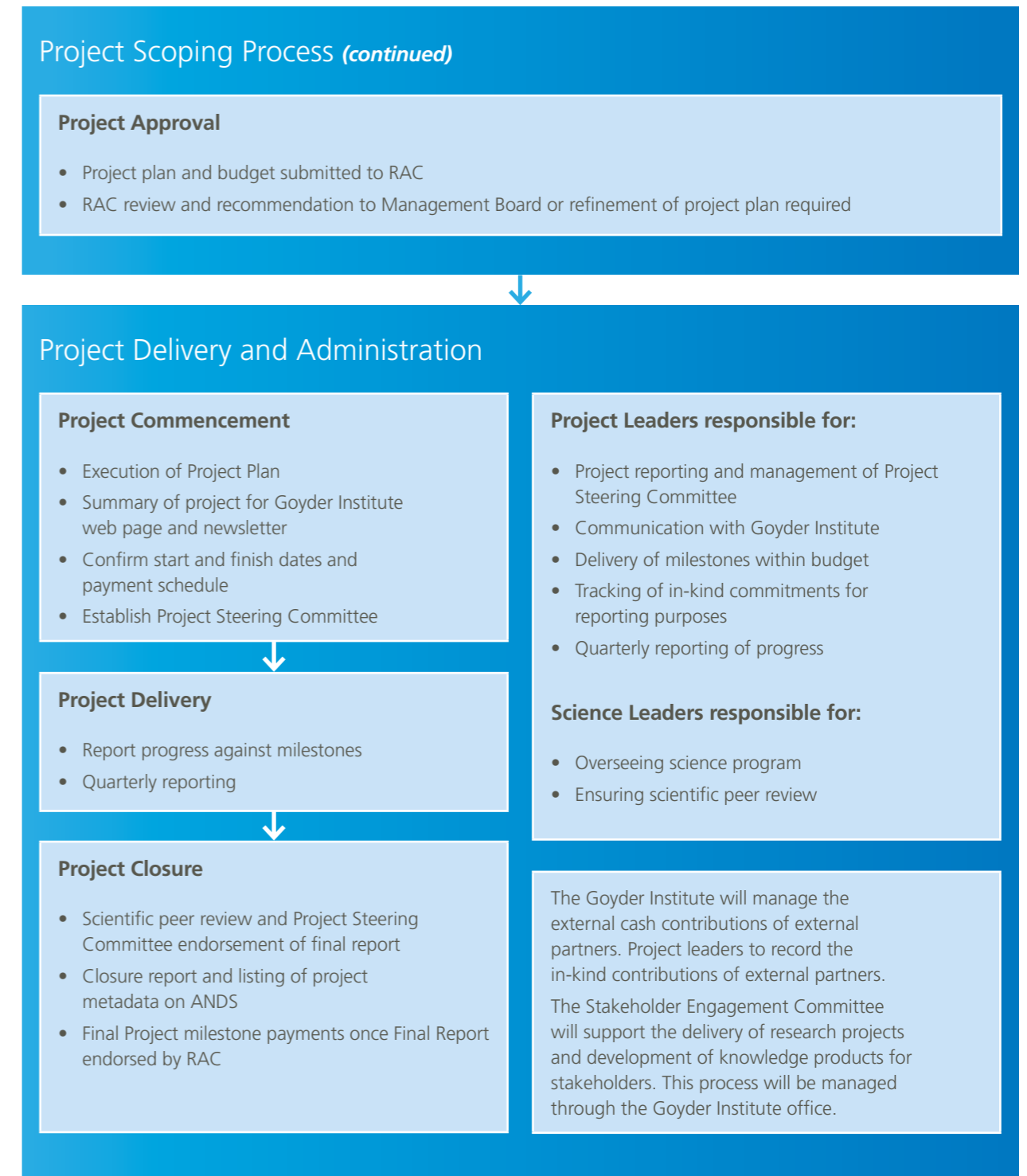
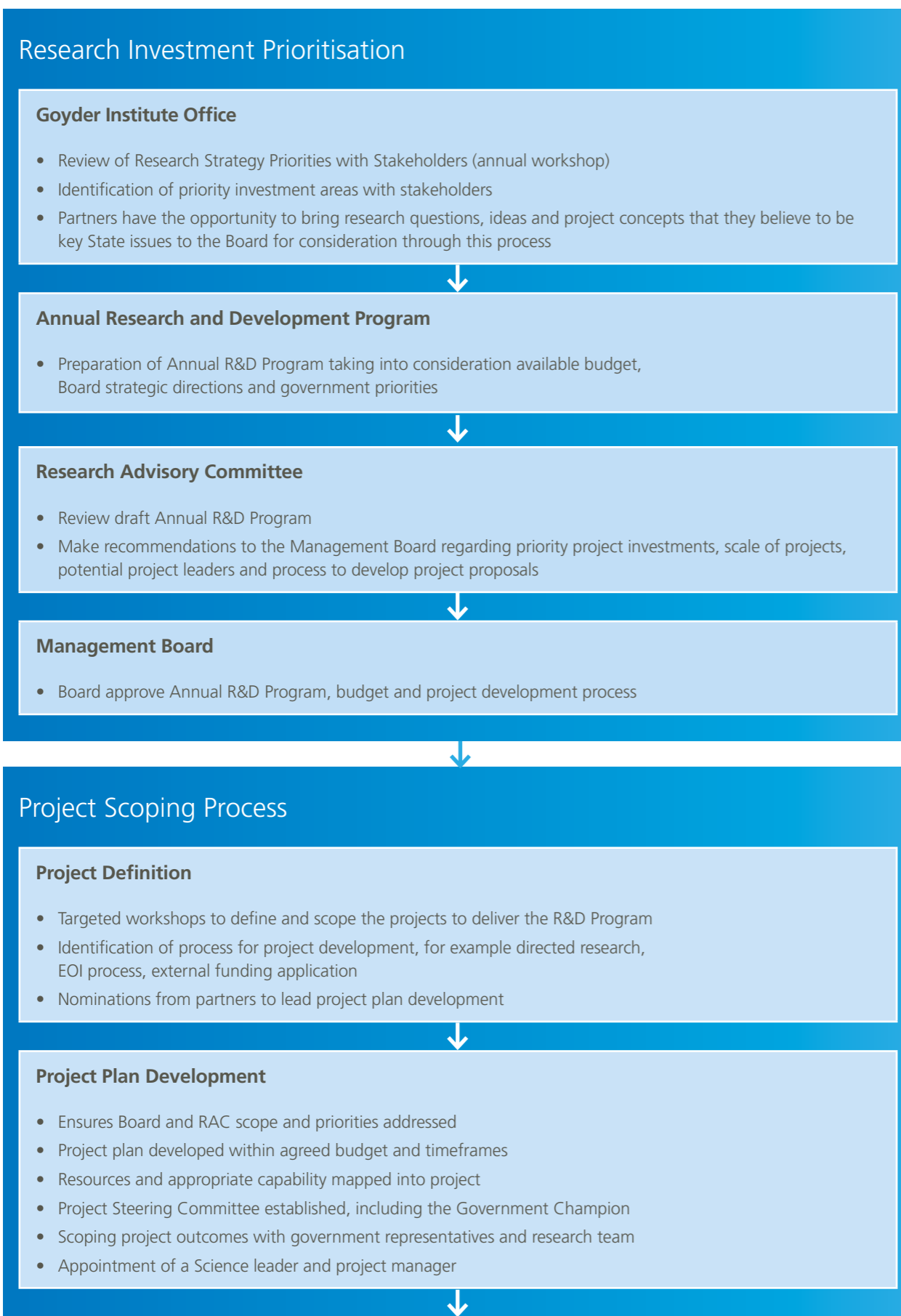


Figure 1. Overview of the Goyder Institute research prioritisation and project development process.



## 11. Investment and Operational Principles

All projects within each of the three Impact Areas will be integrated, involving multiple partners, and where relevant, inter-disciplinary. Particular projects may also cut across multiple impact areas (although each will have a primary impact area to which they belong).

All Impact Areas are expected to deliver science that can be used to support policy development in priority areas and contribute towards improved decision making capability of State Government as described in the relevant science impact area.

The science impact areas and programs will be reviewed annually to assess the priority of future research investment and identification of new programs if a significant research gap is identified, and will form the basis for reporting back to Government on Goyder Institute outcomes.

The Investment by the Goyder Institute will consider the following principles in the development of projects and prioritisation of activities:

- Research will directly contribute to meeting a priority set by State Government;
- Research will demonstrably support the capacity of State Government to implement adaptive management processes in water management;
- Research will build capacity inside State Government to develop better policies, and inside research organisations to undertake better science;

- Investment will be towards the best initiatives amongst the research partners that have a demonstrated capacity to achieve the highest standards in science;
- The highest return in terms of outcomes achieved per dollar invested will be supported;
- All partners have had the opportunity to engage in project development;
- Each project proposal to include team members from at least two research partners;
- Investment will result in high-quality research outcomes that are delivered in a format that is readily adopted into policy and decision making;
- There must be a clear and funded pathway for knowledge and technology transfer to ensure that research outcomes are adopted;
- Project leaders will have a demonstrated excellence in project management;
- Where possible, opportunities for student participation will be considered in project delivery;
- Projects should address at least two impact areas;
- A knowledge management strategy will be devised during project development;
- Administrative overheads will be kept to a minimum; and,
- Preference will be given to projects with a significant proportion of external funding (co-investment) that contributes to the strategic objectives of the Institute.

The Goyder Institute is to provide guidance and direction in establishing an integrated research profile for water research in South Australia. It will promote cooperation between the research partners and promote exchange of knowledge to increase synergies and to avoid unnecessary overlap and duplication. The Institute, oversighted by the Research Advisory Committee, will monitor and review the quality of the research outputs and review the end products to meet stakeholder requirements.

All projects will follow the operational principles of the Institute in that:

- Peer review of scientific outcomes is required to ensure science excellence;
- Scientific research and interpretation will be undertaken and reported free from political interference or bias; and,
- Researchers will respect the need for confidentiality in whatever form it is requested by the Director or the Management Board.

## 12. Investment Profile

The science impact areas will be designed to ensure that the Goyder Institute continues to deliver relevant outcomes for government in the short, medium and long term whilst retaining the flexibility to respond to changing pressures and priorities over time.

No more than 30% of the total budget will be committed in the first year of the Institute, and no more than 70% in the second year. Up to five hundred thousand dollars (\$500,000) will be kept aside for special projects that may require immediate and unplanned investment up to and including year three of the Institute.

Project proposals will not contain contingency budgets. This will remain at the discretion of the Management Board.

Proposed Investment by Project Scale as a percentage of research funding:

Research Project Duration	Total Investment
Short Term Projects <1 year	10-15%
Medium Term Projects 1-3 years	25-30%
Long Term Projects 3 years	55-60%

Proposed Investment per each of the three Impact Areas and Goyder Institute Administration:

Research Impact Area	Cash Contributions	Matching Partner Contributions	Other*	Total
Economic Development	\$3,600,000	\$3,600,000	\$2,400,000	\$9,600,000
Healthy Ecosystems	\$2,000,000	\$2,000,000	\$1,200,000	\$5,200,000
Climate Action	\$1,000,000	\$1,000,000	\$300,000	\$2,300,000
Knowledge Management	\$400,000	0	0	\$400,000
Administration	\$2,000,000	0	0	\$2,000,000

\*Target for external cash funding

Where there are opportunities, the Goyder Institute will engage in research consultancies on a case-by-case basis on a full-cost recovery basis. This activity has not been considered in the above investment profile and is subject to the availability of expertise. The Goyder Institute will not compete with its partners in relation to submitting applications in competitive funding calls.

## 13. Business Development and Co-funding

The Goyder Institute shall identify opportunities for co-investment that will complement and build upon the \$8,000,000 State and matching contributions from Research Partners in order to generate science and management outcomes with greater impact. A target of 30% external co-investment across the research portfolio is being sought for the second term of the Goyder Institute. In seeking these opportunities, the proposed co-investment must align with the Policy, Capability and Science objectives of the Goyder Institute and aim to build effective local, national and international partnerships.

Where opportunities arise, the Goyder Institute will position itself to partner with other organisations and collaborations where there are benefits to partners that would not be available to any partner on its own.

Project proposals will be developed through the Research Advisory Committee and be consistent with the priorities identified in the Annual R&D Program and Budget approved by the Management Board. These priority research areas will be defined and scoped in consultation with government, research partners and other key external stakeholders through dedicated workshop sessions. This targeted approach is to ensure that major research investment is well aligned with government priorities whilst ensuring scientific rigour and excellence and that the best teams from across organisations are involved in delivery.

Other approaches, such as Expressions of Interest selected based on merit, may be considered where there are opportunities to support partners in applications for competitive funding that are aligned with Goyder Institute priorities. These may include ARC Linkage and research funding through peak industry bodies.

## 14. Research Leaders

The development of large, integrated research project areas will require experienced leadership and facilitation. Research Leaders will be selected by giving consideration to the following criteria:

- Credibility (seniority and track record);
- Understand and support of the principles of Goyder Institute;
- Previous experience in managing cross-agency, multi-disciplinary programs and projects;
- Understand the context within which the results will be used;
- Demonstrated experience in transferring outputs into outcomes; and,
- Research Leaders will be recommended by the RAC.

## 15. Measuring Performance

Progress against the Institute's strategic intent will be measured against a set of high-level performance indicators annually, with a further set of operational level indicators identified annually in the Annual R&D Plan. A review will be conducted in the third year of the Institute to quantify the impact and benefits of the Goyder Institute research program.

Strategic Intent	KPI	Measure
Excellence	<ul style="list-style-type: none"> <li>• Highest quality of science</li> </ul>	<ul style="list-style-type: none"> <li>• Goyder Institute research supports success in attracting of Category 1 grants by research partners</li> <li>• Publication quality</li> </ul>
Value	<ul style="list-style-type: none"> <li>• Investment made by the Institute and its research partners attracts external funding</li> <li>• Administration costs are maintained at or below 15% of funding</li> </ul>	<ul style="list-style-type: none"> <li>• Level of external cash funding across the R&amp;D portfolio</li> </ul>
Impact	<ul style="list-style-type: none"> <li>• Scientific evidence base influences decision making</li> <li>• New jobs created</li> </ul>	<ul style="list-style-type: none"> <li>• Survey at completion of each project to identify uptake and usage of research outcomes</li> <li>• Results against government priorities</li> <li>• Direct new positions identified in project proposals</li> <li>• Indirect employment assessed at the end of each project</li> <li>• Movement of students into the workforce</li> </ul>
Collaboration	<ul style="list-style-type: none"> <li>• All research teams have representation from more than one organisation</li> <li>• New partnerships</li> <li>• Cross-disciplinary, culturally diverse and gender balanced</li> </ul>	<ul style="list-style-type: none"> <li>• Diversity of project teams identified in project plan</li> <li>• Total number of partnerships</li> <li>• Number of new partnerships</li> </ul>

## 16. Reporting and Review

A report against each science impact area will be prepared each year by the Research Advisory Committee against the performance indicators, project progress and financial performance.



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