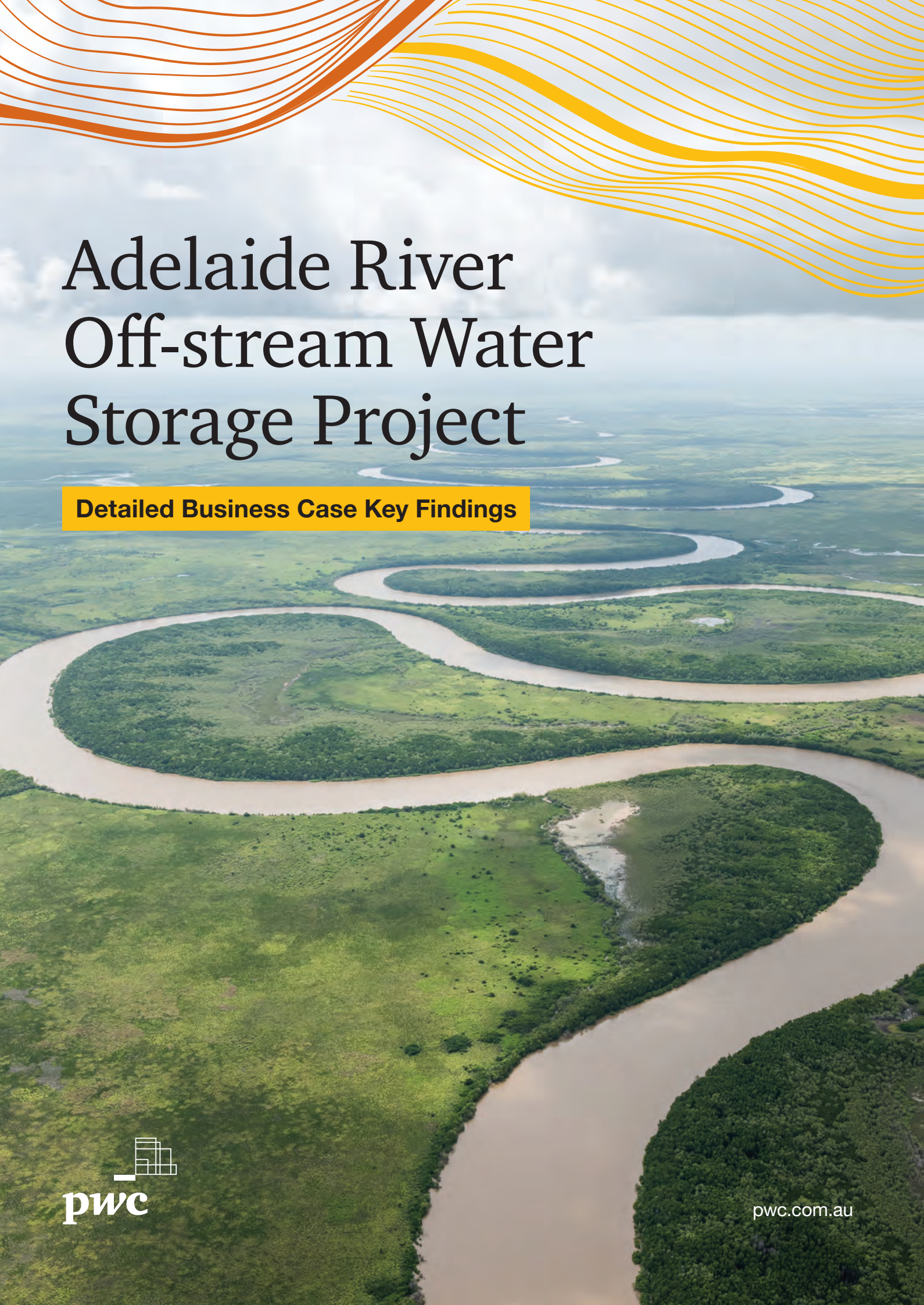
Adelaide River Off-stream Water Storage Project

Detailed Business Case Key Findings



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Contents

The greater Darwin region, and the broader Northern Territory (NT), has the potential to play a key role in the nation's economic recovery from the impacts of Coronavirus (COVID-19). The region is increasingly being recognised for its abundant and untapped resource potential and strategic location in Northern Australia.

01

Background and context

Fostering economic growth and development in the greater Darwin region and Northern Australia

Darwin's geographic proximity to South East Asia, continued integration into Asian markets and significant trade ties with many Asian partners, enables the region to enhance its economic link to global supply chains and become a service hub for many industries, including tourism, defence, mining, energy production and manufacturing and tropical horticulture.

The NT's developing economy has been challenged in recent years due to the transition from a major construction boom following key projects such as the $37 billion Ichthys liquefied natural gas (LNG) development and associated declining population and private investment, increasing unemployment and weakening growth in living standards. However, effective management through the COVID-19 pandemic has positioned the NT to capitalise on opportunities that are emerging for key regional towns and provide resilience and diversity to the Australian economy.

The greater Darwin region, and the NT more broadly, has the population scale, modern connected infrastructure, logistics chains, and industry and business capacity and capability to unlock its inherent potential and strengthen and sustain engagement in the Indo-Pacific region. Additionally, the NT has significant resources, unique cultural and natural assets and history, and opportunities that have the potential to create a thriving place to live, work and play.

There is significant opportunity for economic development and growth of the region and Northern Australia, driven by expanding opportunities across emerging gas enabled manufacturing (i.e. the Beetaloo Basin and Middle Arm Sustainable Development Precinct), and from the prospectivity and suitability for high value horticulture and agriculture in the Darwin rural region. There are also significant opportunities for renewable power generation, hydrogen production and carbon capture and storage that can contribute to key sustainable sectors.

This combination of economic opportunity and strategic advantage shows the potential Darwin has to become the economic engine room of the NT and Northern Australia more broadly. A thriving capital city in Northern Australia, Darwin leverages the NT's geographic advantage and proximity to the world's fastest growing economies, resource endowment, and land availability, to broaden the productive base of the country to accommodate new growth and ease pressures on other capital cities.

Territory Economic Reconstruction Commission

In response to the COVID-19 pandemic, the NT Government released the Territory Economic Reconstruction Commission Final Report (TERC Report) in November 2020 to guide the economic recovery of the NT. The TERC Report sets an ambitious goal for the NT to become a $40 billion economy by 2030, through increased private sector investment to grow key industries, jobs and create sustainable businesses.

Investment should be focused on projects that diversify the economy and focus on areas of comparative advantage and growing industries that can reinvigorate private investment, retain highly skilled capacity in regional economies, build resilience and assist in smoothing turbulent economic cycles.

Importantly, the TERC Report identified that a step change in the Territory's approach to water is needed to support the Territory's aspirations and plans for investment and economic growth.

The need for a secure and reliable water supply

Growth and economic development of the greater Darwin region and the NT is contingent on the provision of a safe, secure, reliable and sustainable water supply that can enable economic activity to support growth and provide water security across the region.

Currently, the greater Darwin region's reticulated network water is predominantly supplied from the Darwin River Dam (around 85%), which operates at or above its sustainable yield (and has for the past ten years).

Water supply is supplemented through groundwater resources (around 15%) however, this groundwater resource is largely over allocated (shown in the Figure 1).

Demand for water on the Darwin reticulated network is currently around 42,000 ML per annum (p.a).

Even in the absence of any substantial increase in economic activity, the economic prosperity and long run economic contribution of Darwin is compromised by the available water supply and a lack of redundancy within the system, as displayed in Figure 2.

Figure 1: Greater Darwin region primary water supply sources

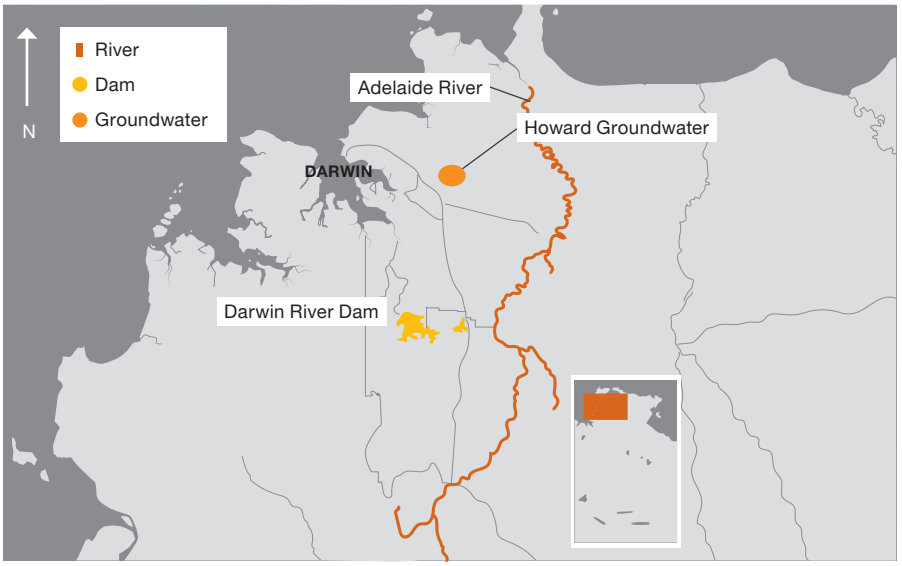
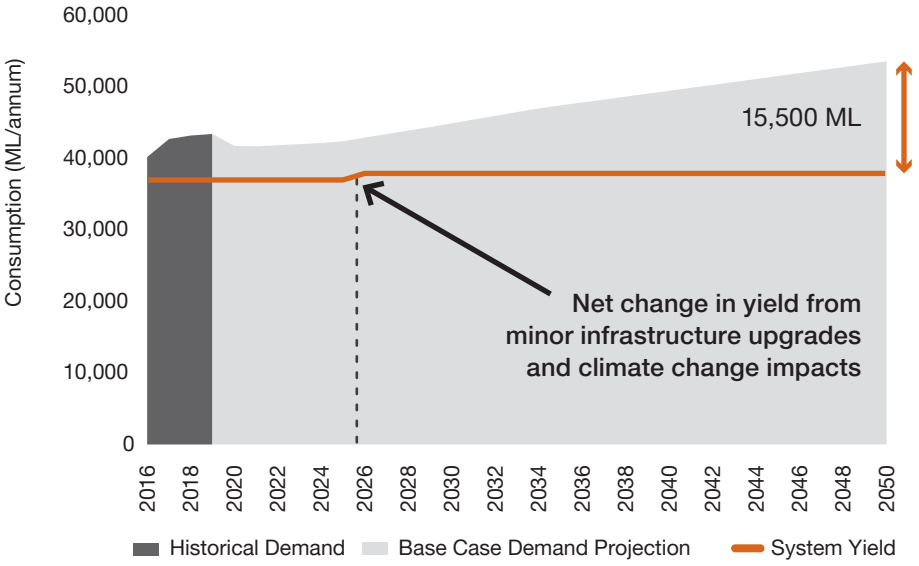
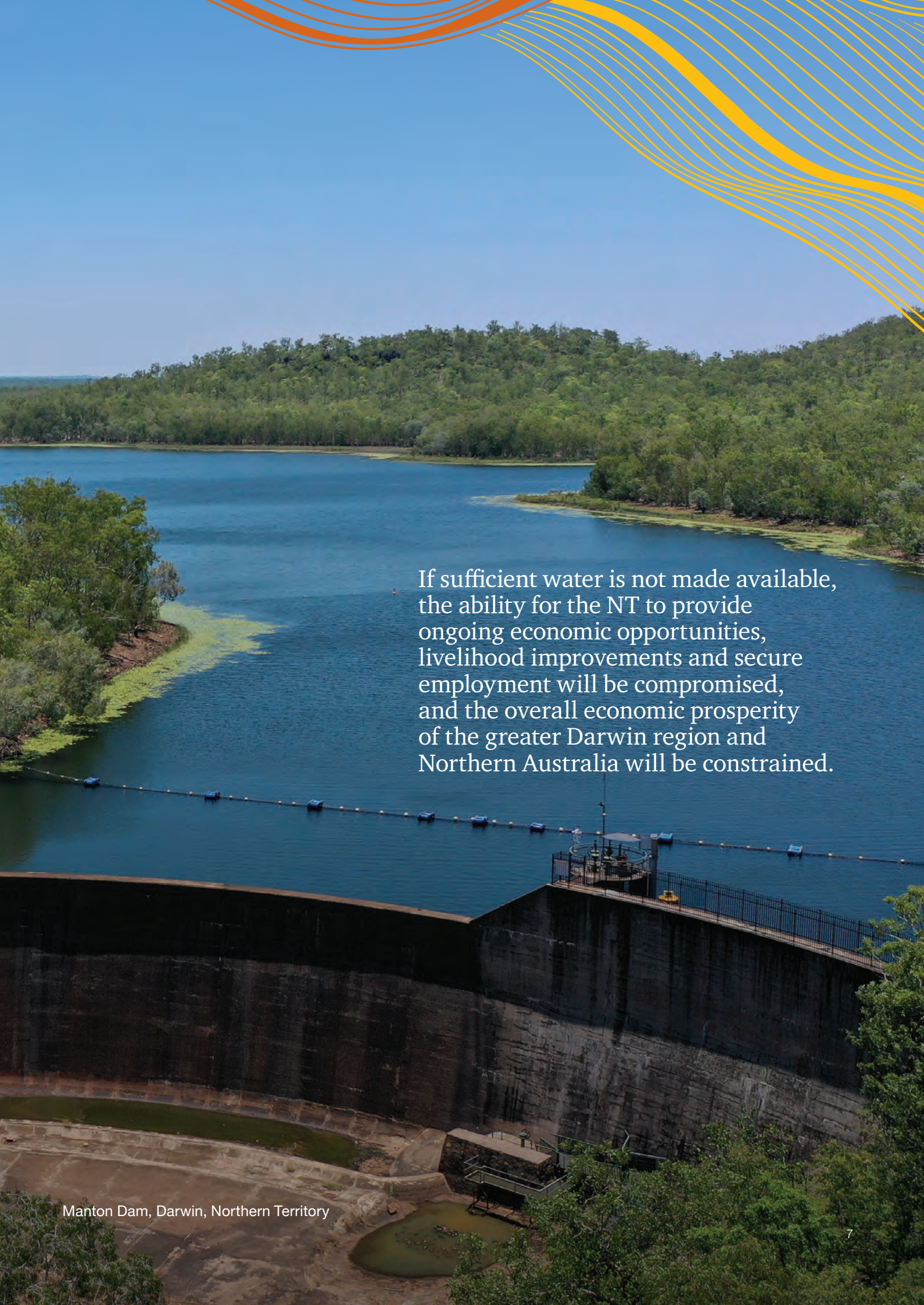


Figure 2: Water supply and demand





If sufficient water is not made available, the ability for the NT to provide ongoing economic opportunities, livelihood improvements and secure employment will be compromised, and the overall economic prosperity of the greater Darwin region and Northern Australia will be constrained.

Manton Dam, Darwin, Northern Territory

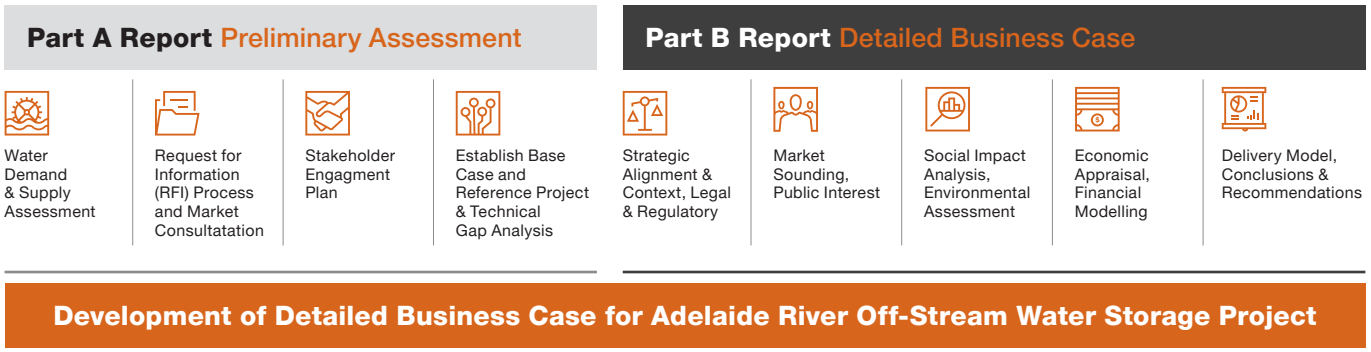
Finding a solution

In early 2020, the NT Government, in collaboration with Power and Water Corporation (Power and Water), identified a strategic need to address the supply and demand issues associated with water in the greater Darwin region. PricewaterhouseCoopers (PwC) was engaged to develop a Detailed Business Case (DBC) to investigate and evaluate potential water supply augmentations and interventions that respond to the expected future industrial, agricultural and horticultural, and urban demand.

This DBC investigated the opportunity to develop a new water source in the greater Darwin region. The DBC was funded by the Australian Government's National Water Grid Fund, administered by the National Water Grid Authority (NWGA). The DBC was delivered in two parts as illustrated in Figure 3.

The two part process aligns closely with best practice business case development standards, including Infrastructure Australia's Assessment Framework.

Figure 3: Development process for the AROWS DBC



Part A
Preliminary Assessment

PwC completed Part A: Preliminary Assessment in July 2020, which was endorsed by the NT Government to proceed to Part B: Detailed Business Case. The Preliminary Assessment:

- Confirmed the strategic need and priority for water supply augmentation in the greater Darwin region
- Investigated a range of infrastructure and non-infrastructure options to address this need
- Short-listed two options for consideration as part of a detailed business case assessment
- Provided a defendable rationale and justification for progression to the Detailed Business Case.

The complete report can be found online at **www.watersecurity.nt.gov.au.**

Part B
Detailed Business Case

This document outlines the findings of the Part B Report that relate to the two short-listed options.

02

Purpose

The purpose of the Detailed Business Case

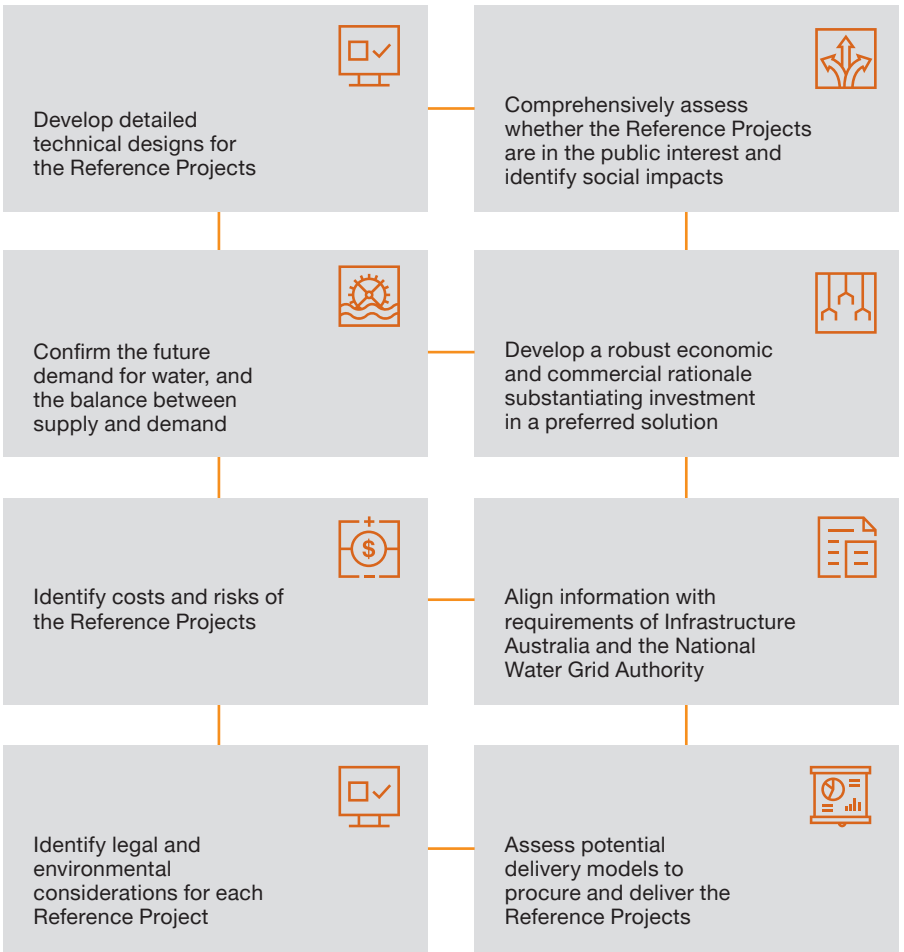
The DBC's overarching purpose was to assess the justification and viability of proceeding with the planning and delivery of the preferred solution from an NT Government perspective.

The DBC assessed two Reference Projects and recommended a preferred solution to progress to the next phase, based on a thorough investigation of costs, benefits, risks, legal and environmental approval requirements, and public interest considerations. The purpose of the DBC is outlined in Figure 4.

The DBC provides recommendations to the NT Government on the preferred water supply infrastructure solution over the short, medium and long term, including the timing for development.

Figure 4: Purpose of the DBC

Provide conclusive evidence of investment viability and certainty of expected outcomes



03

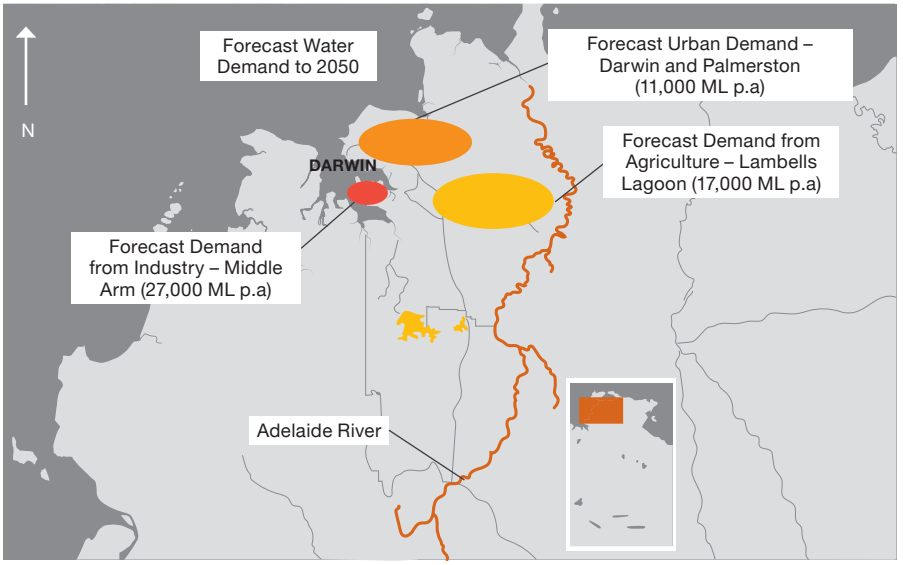
The challenge and the opportunity

Sector specific forecast water demand assessment

Building on the findings of the Preliminary Assessment (Part A), a comprehensive assessment of the existing water supply and forecast water demand found that there are three key demand factors, illustrated in Figure 5.

This assessment was underpinned by significant stakeholder consultation across industry and government, with consideration of market trends and the strategic priorities of government.

Figure 5: Forecast water demand and supply sources



Urban demand (challenge)

There is a significant near term water security risk for the greater Darwin region as the reticulated network is currently operating above its sustainable yield.

With no intervention, there is an emerging risk to urban water security.

By 2050, it is forecast that an additional supply of 11,000 ML p.a is required to supply forecast population growth in the Darwin region.

Another key issue facing the region is climate change. Over time, population growth and long term economic growth will increase water demand whilst climate change will decrease yield due to higher evaporation rates and increased variability in rainfall patterns.

Demand from Industry (opportunity)

Demand from industry is expected to be driven largely by the development of highly prospective oil and gas fields both onshore (e.g. Beetaloo Basin) and offshore (e.g. Petrel/Tern/ Frigate). The industrial demand is forecast to be accommodated at the Middle Arm Sustainable Development Precinct (Middle Arm Precinct) which is a key strategic priority of the NT Government.

The Middle Arm Precinct is a 1,500 hectares (ha) to 2,300 ha sustainable development precinct located on the Middle Arm peninsula in Darwin Harbour. The Precinct will accommodate downstream gas processing, mineral processing, renewable energy and related developments.

To enable development at the Middle Arm Precinct, significant volumes of water are required. It is forecast that industrial users at the Precinct will require an additional 27,000 ML p.a. of water by 2050.

Demand from agricultural and horticultural expansion (opportunity)

There is land suitable for high value agriculture and horticulture across the Darwin region.

However, production in the Darwin region continues to be constrained by a lack of available groundwater.

The provision of additional water is estimated to be able to unlock approximately 2,000 ha of greenfield development. Feedback from industry stakeholders confirmed that this development could be achieved through the development of an agricultural precinct at Lambells Lagoon.

It is also expected that it will support growth (brownfield expansion) on existing agricultural and horticultural properties and producers (who are in close proximity to the water source), which are currently constrained due to oversubscribed groundwater resources and a lack of reliable water.

In total, it was forecast that agricultural users will demand an additional 17,000 ML p.a. of water by 2050.

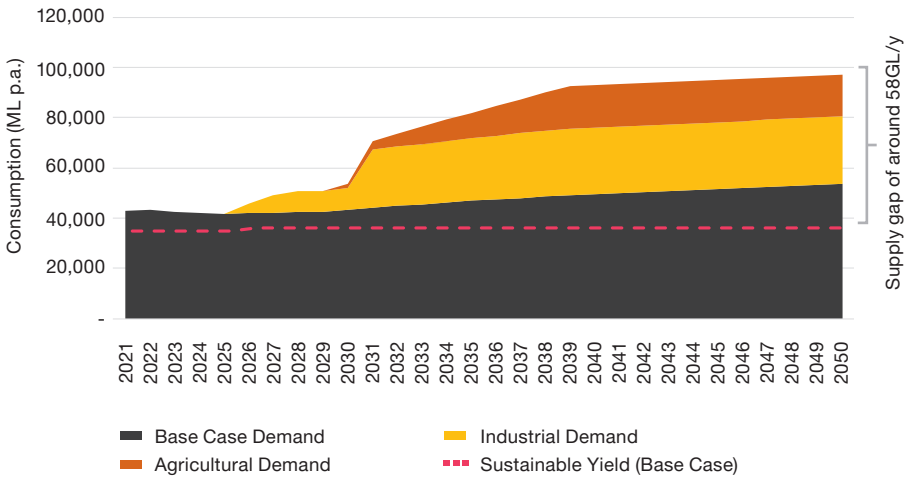
Overall Water Demand and Supply Assessment

The total demand for water in the greater Darwin region is expected to more than double from 2021 to 2050, increasing from 42,000 ML p.a. to almost 100,000 ML p.a by 2050, as shown in Figure 6.

The current sustainable yield of the reticulated network is significantly below both the water demand required for economic growth, as well as base case water demand to sustain current levels of population and economic activity. This demonstrates both the immediate need to act to ensure near-term economic activity and population can be supported, as well as demonstrate that a substantial increase in water supply is required and justified based on the best-estimates of potential demand if water is available.

Water is a critical enabler for economic development and growth, particularly in regional communities. Water availability is essential to attract other investment and is a critical enabler of economic growth and sustainability for a region.

Figure 6: Total water demand



If sufficient secure and reliable water is not provided in the greater Darwin region the demand opportunities outlined will not be able to be delivered and the economic prosperity and security, living standards and employment availability in the Territory and its broader contribution to the nation's productivity will be compromised.

Fogg Dam, Darwin, Northern Territory

04

A comprehensive Options Assessment

In consultation with the NT Government and technical consultants, a comprehensive long list of options was developed and investigated in response to the key problems and opportunities identified in the Preliminary Assessment.

The long list included a combination of water storage and supply options, including:

Recycled water

Water recycling provides a sustainable water supply option that can be implemented at individual locations to supplement current water supply.

Desalination

Desalination plants provide a climate-resilient and sustainable disaggregated water supply option and can be constructed for a variety of purposes and scales.

Manton Dam Return to Service (RTS)

Manton Dam, located 50km southeast of Darwin, was constructed in the early 1940s and has an overall storage capacity of 14,000 ML, with the potential to yield approximately 7,300 ML p.a. Manton Dam was Darwin's primary water source until the commissioning of Darwin River Dam in 1972. Since this time, Manton Dam has been placed into care and maintenance, and used for recreational purposes.

In-stream dam

A number of in-stream dams have been suggested and investigated to differing extents over the last 20 years and most recently reviewed in the CSIRO 2018 report Water Resource Assessment for the Darwin Catchments.

Adelaide River Off-stream Water Storage (AROWS)

AROWS is a proposed new reservoir located to the West of the Adelaide River. The area would store water harvested from the Adelaide River during the flows in the wet season. The AROWS project can be delivered at different scales and can be staged to reach the ultimate capacity.

As an off-stream development, AROWS has a lower environmental impact compared to an in-stream option.

Figure 7: Options assessment process

The figure below demonstrates the approach to the options assessment and the method used at each stage.

Following a shortlisting process of the long list, a multi-criteria assessment (MCA) was completed on nine options and the base case. The nine options were:

Table 1: Preliminary Assessment options

Option	Description	Consideration of the Option
Option 1 **Do minimum**	The do minimum scenario included a range of non-infrastructure and low-cost initiatives which could be implemented to reduce water consumption across both the reticulated supply and groundwater e.g. demand management strategies, improved management of groundwater applications, water tanks etc.	The option will only result in a relatively small increase in water availability over the long-term and does not provide sufficient water to ensure long-term urban water security or enable either industrial or agricultural / horticultural development. The option could be bundled with an infrastructure option to provide an integrated response positively influencing both water demand and water supply to ensure the greatest impact from any capital investment.
Option 2 **Recycled water**	The primary opportunity is a 5,000ML p.a expansion at the Palmerston Waste Stabilisation Ponds (WSP).	Given its location, the Palmerston WSP has the potential to provide raw water to industrial users at Middle Arm but would be limited in its ability to provide raw water to other potential users. Recycled water is lower quality than potable water and therefore there may be concerns for some industrial users that require high quality water for use in their operations. Recycled water is typically also substantially more expensive than potable water.
Option 3 **Do minimum and disaggregated supply**	This option combines the low cost 'Do Minimum' Option 1 with a combination of disaggregated water supply options, including the recycled water infrastructure from Option 2 and a small-scale desalination plant to provide water for industrial use.	This option represents a lower cost initiative relative to larger-scale infrastructure options. Recycled water and desalination facilities can be developed in a relatively short time frame, providing a more immediate supply option to satisfy short-term supply constraints while more comprehensive long term supply options are developed. While this option could support some industrial development, it does not provide sufficient supply to meet the identified long-term requirements for industrial and agricultural / horticultural growth more broadly.
Option 4 **Manton Dam RTS and AROWS 1a**	This option includes the Manton Dam RTS Project and the smallest AROWS development (1a). This option could provide approximately 17,500 ML p.a.	This option would only service forecast population growth over the short to medium term and does not provide additional water supply to unlock opportunities for either industrial or agricultural / horticultural development.
Option 5 **Manton Dam RTS and AROWS 1c**	Similar to Option 4, this option includes the delivery of both Manton Dam RTS and the AROWS project. Under this option however, the AROWS stage 1c provides for an additional 30,700 ML p.a. This option provides a total of 38,000 ML p.a.	This option would service forecast population growth over the short to medium-term and has the ability to support some industry. However, it does not provide additional water supply to unlock significant opportunities in either industrial or agricultural / horticultural development.

Table 1: Preliminary Assessment options

Option	Description	Consideration of the Option
Option 6 **Desalination**	The majority of desalination plants in Australia are reverse osmosis (RO) desalination plants, and for the purposes of this assessment, a 60,000ML p.a RO-style plant has been assumed. A plant this size is consistent with the fully developed AROWS options, and at this scale, the desalination plant would be able to provide sufficient water to meet future urban water security, industrial and agricultural / horticultural water requirements.	Desalination offers a climate-resilient water supply source that has a relatively short-term delivery timeframe relative to other large infrastructure options. Additionally, there is more flexibility in the location and staging of a desalination plant depending on demand requirements. Desalination plants have both high operating and capital cost and require large amounts of energy to operate. This results in a very high cost of water that would likely be cost prohibitive for many users if charged at a cost recovery rate.
Option 7 **AROWS 3**	This option represents the AROWS project sized to provide sufficient water for urban, industrial and agricultural / horticultural users. AROWS 3 can supply around 60,200 ML p.a. Unlike the other AROWS options, this option does not include the Manton Dam RTS and instead seeks to accelerate the AROWS project to avoid the need for the Manton project.	This option enables sufficient yield to provide long-term urban water security for the greater Darwin region and provide water for both industrial and agricultural / horticultural development. Given the scale of the AROWS 3 project, and the likely approvals and development timeframe, there is a risk that it could not be delivered within the five year timeframe, to be operational by 2025/26, when additional water supply for urban water security is forecast to be required.
Option 8 **In-stream dams**	A number of in-stream dams have been suggested and investigated to differing extents over the last 20 years and most recently reviewed in the CSIRO 2018 report Water Resource Assessment for the Darwin Catchments. These potential in-stream dams include Marrakai Dam, Mount Bennett Dam and Upper Adelaide River Dam.	The dam options are all located large distances from the greater Darwin region and will require significant investment in pipe networks and high ongoing water transport costs. All three dam sites will also have long development times given the likely approvals requirements and high environmental and cultural impact risks.
Option 9 **Manton Dam RTS and AROWS 3**	This option represents the maximum sized AROWS project which could provide sufficient water for urban, industrial and agricultural / horticultural users and alleviate near-term water security risks. In total, this option can provide 67,500 ML p.a.	The inclusion of Manton Dam RTS, and its shorter delivery timeframe, means that immediate water security can be provided for. The major cost drivers for the AROWS project, such as the spillway and other core infrastructure, are consistent across the various sizes of the AROWS projects. Incremental cost increases occur largely through increased pumping and piping required. Therefore, achieving significant increases in yields can be achieved at relatively low cost for the larger AROWS options and represent significant economies of scale.

05

Shortlisting the options

Comprehensive short-listing process

Following the shortlisting of options through a detailed MCA process, five options were subsequently assessed using a Rapid Cost Benefit Analysis approach to determine the options for progression to the DBC.

Figure 8 outlines the options assessment process and the options progressed at each stage.

The comprehensive short-listing process identified two options (or Reference projects) for consideration in the DBC.

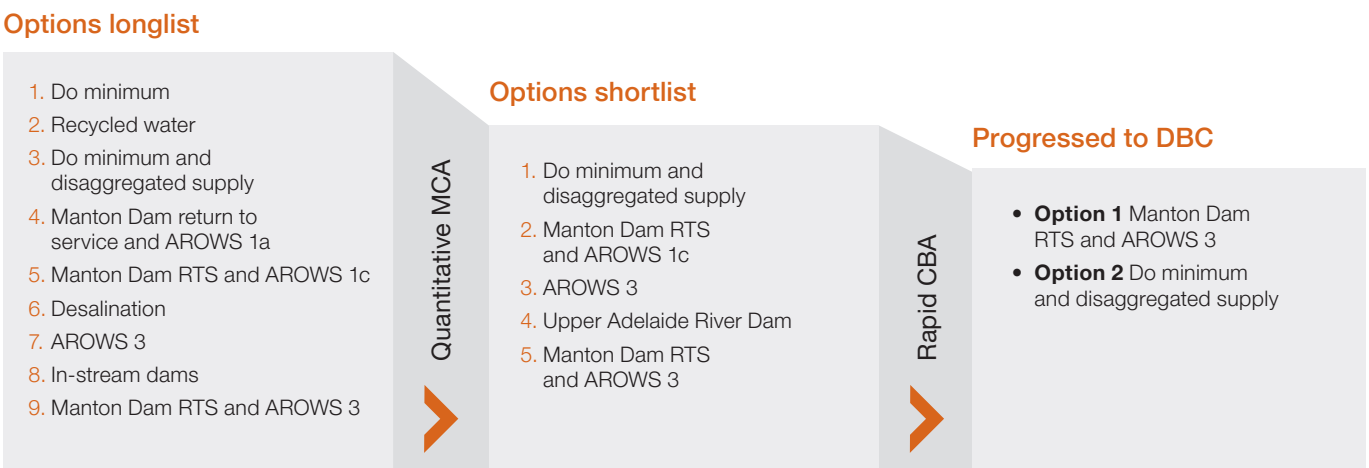
Option 1

- Manton Dam RTS to be implemented in the short term to overcome the impending urban supply shortfall and provide short-term supply security to support investment decisions from industry.
- Delivering AROWS would provide 60,200 ML p.a. of additional water providing further urban water security in the long term and will assist in realising growth in industrial demand and providing opportunities for the agricultural and horticultural sector.

Option 2

- Disaggregated water supply was investigated as an alternative lower capital cost option.
- This option includes delivery of a small-scale desalination plant at Middle Arm and development of a recycled water plant to treat waste water from the Palmerston Waste Water Treatment Plant.

Figure 8: Options shortlisting process



Non-infrastructure options

Demand management options were investigated as part of the options analysis, however, were not found to be a long-term solution in isolation.

In addition to the built infrastructure options, demand management and water efficiency programs will form a critical component of managing the water supply and demand balance in the greater Darwin region, and the Territory more broadly, to ensure sustainable use of a scarce resource. This includes ensuring appropriate and sustainable use of water across residential, industrial and government users and appropriate consideration of re-use requirements for industry.

Demand management and water efficiency is a major policy issue that needs to be addressed at a Territory wide level, and the NT Government is currently in the process of developing a Northern Territory Strategic Water Plan, led by the Office of Water Security, to respond to these challenges.

Power and Water Corporation's Living Water Smart initiative will be an important ongoing program to ensure the continued focus on water efficiency across all sectors.

Irrigation system on field

Mango plantation, Darwin, Northern Territory

06

Reference Projects

Option 1

Manton Dam RTS and AROWS

The option is proposed to be delivered in stages to meet short, medium and long-term demand.

Stage 1

Manton Dam RTS and Strauss Water Treatment Plant (WTP)

Manton Dam was constructed in the early 1940s and was Darwin's primary source of water until the construction and commissioning of the Darwin River Dam in 1972. The dam is not currently used as a source of drinking water, with the reservoir opened in 1988 for recreational use.

The Manton Dam RTS project involves refurbishing the existing intake tower and construction of a new pumping station, pipeline and water treatment plant.

The Strauss WTP is proposed to be located on the corner of Cox Peninsula Rd and the Stuart Highway in an existing utility zoned location.

Stage 2
AROWS and expansion of Strauss WTP

The AROWS project is located approximately five kilometres directly north of Lake Bennett, adjacent to the Adelaide River. The reservoir is made up largely of a natural ridge formation (that can hold water), with the construction of two main dam structures (at low points) to capture and store the water.

Importantly, AROWS is not a conventional (in-stream) dam. Rather, the water is pumped (subject to strict water license conditions that protect environmental and Aboriginal water requirements) from the Adelaide River during wet season flows into the reservoir. There is no dam wall that would restrict the flow of the Adelaide River, which significantly reduces the environmental impacts on the ecosystem.

Overall, this is considered a complete solution for the Darwin region that can deliver on three key objectives:

- Ensure long term water security for the Darwin region
- Enable industrial activities at the Middle Arm Precinct
- Enable development of an agricultural precinct at Lambells Lagoon.

Table 2: AROWS and Manton Dam RTS parameters

Table 2 provides a summary of the key technical parameters and major infrastructure elements included under each component of this option, and the planned development timeframe.

Element	Manton Dam RTS	AROWS
Annual yield	7,300 ML p.a.	60,200 ML p.a.
Development timeframe	3-4 years	7-10 years
Major infrastructure elements	• New pump station at Manton Dam to pump water to Strauss WTP • New pipeline from Manton Dam to Strauss WTP • New pipeline from Strauss WTP to Middle Arm • Strauss WTP Stage 1.	• Two dams and two saddle dams within the AROWS basin • Pumping infrastructure and pipelines for extraction from Adelaide River • New pipeline from AROWS to Strauss WTP • New Pipeline to Lambells Lagoon agricultural precinct • Strauss WTP Stage 2.

Figure 9: Option 1 - AROWS and Manton Dam RTS

Figure 9 displays the location of the proposed projects.

Option 2

Disaggregated water supply

The option is proposed to be the alternative Reference Project and includes delivery of a small-scale Desalination Plant at Middle Arm and the development of a recycled water plant (RWP) to treat wastewater from the Palmerston WSP.

The Desalination Plant and RWP provides a targeted infrastructure solution to produce additional water for specific discrete uses, including industrial use at the Middle Arm Precinct.

This option would only deliver one of the key objectives:

- Enable industrial activities at the Middle Arm Precinct.

Importantly, the detailed assessment of this alternative, lower level intervention, allows for comparison against Option 1, which is consistent with best-practice business case development standards.

Under this option, additional water source projects would be required to ensure urban water supply growth and security.

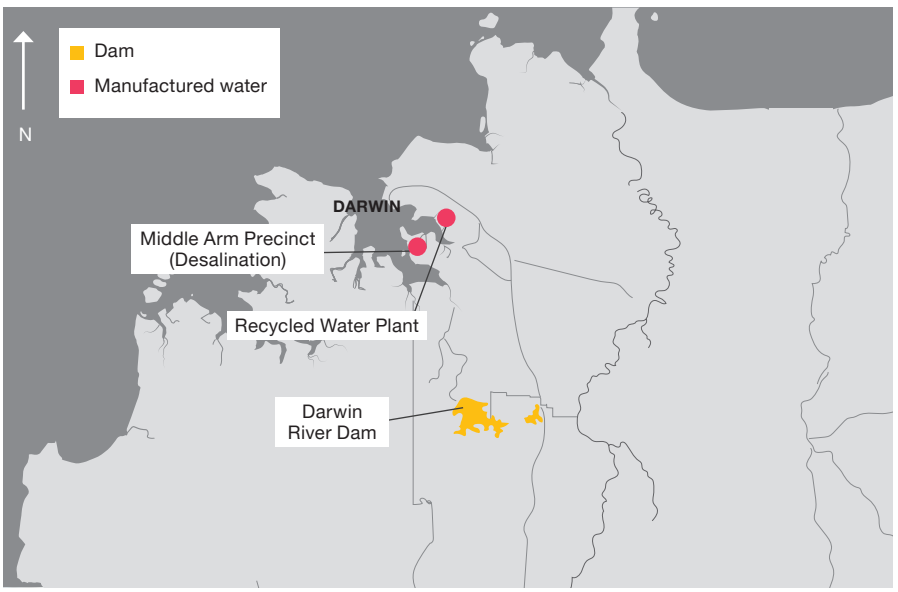
Table 3: Disaggregated water supply

Table 3 provides a summary of the key technical aspects of Option 2.

Element	Desalination Plant	Recycled Water Plant
Annual yield	12,000 ML p.a.	5,000 ML p.a.
Development timeframe	5-6 years	3-4 years
Major infrastructure elements	• Desalination plant on Middle Arm • Intake and brine discharge pipelines to desalination plant • Pipelines from desalination plant to demand nodes around Middle Arm Precinct.	• Recycled water plant at Palmerston WSP • Pipeline from recycled water plant to Middle Arm.

Figure 10: Option 2 – Disaggregated Water Supply

Figure 10 displays the location of the proposed projects.



07

Project appraisal

To further understand the impacts of each option, a comprehensive cost, environmental and regulatory analysis was undertaken.

The DBC determined that there were no major environmental or legislative concerns that would prevent either Reference Project from proceeding to the next phase, however there are environmental and legislative considerations which will need to be considered if this Project were to progress under either option. The following section outlines key outcomes for both Reference Projects.

Adelaide River, Darwin, Northern Territory

Option 1

Manton Dam RTS and AROWS

Cost	**Capital Cost (P90 risk adjusted)**	$1,450.00m
	Operating Cost (p.a.)	$34.81m
	Levelised cost of water	$1,686.90/ML

	Manton Dam RTS	AROWS
Environmental Assessment	• Manton Dam RTS is a modest project with little potential biophysical environmental impact. However, assessment of the recreational values and impact to downstream watercourses will be required. • The DBC recommends that an Environmental Referral be submitted to the NT Environmental Protection Authority (NT EPA) for consideration prior to Manton Dam RTS being delivered.	• The AROWS project is large and complex with numerous approval requirements. The main considerations from an environmental approval point of view will be: – The potential existence of threatened species within and nearby to the basin; – Impact of water extraction on the Adelaide River. • Due to the above, the DBC found that AROWS will require assessment under NT's EPA and the Commonwealth's *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act). • The DBC also recommends that a Water Allocation Plan (WAP) be completed for the Adelaide River Catchment. – This will provide stakeholders and the community the opportunity for input into the values that the water source should support, and provide transparency of sustainable yield from the Adelaide River. – This will include consideration of other beneficial users including the Strategic Aboriginal Water Reserve and recognised cultural water requirements.
Legal and Regulatory Assessment	The Manton Dam RTS project does not raise any significant legal or regulatory issues. There are a range of standard project development processes for Manton Dam RTS including: • Environmental considerations • Sacred Site clearance • Heritage assessment. The location of the Strauss WTP will require a change of tenure from Crown Land to facilitate the projects development.	The AROWS project has a range of different legal and regulatory considerations (Environmental legislation is covered above). The key considerations are provided below: **Native Title Act 1993 (Cth)** • There is potential for native title considerations to arise from the development of AROWS. • The DBC recommends the NT Government consult with the Northern Land Council as part of the project development. **Northern Territory Aboriginal Sacred Sites Act 1989 (NT)** • Power and Water Corporation has an existing AAPA Certificate for preliminary investigations and environmental surveys. • The DBC recommends that further assessment of Sacred Sites should be considered as the project is developed. **Control of Roads Act 1953 (NT)** • The development of AROWS will have a direct impact on the Marrakai Road. • The DBC recommends that further work be completed on identifying how the Marrakai Road will be affected, including consideration of alternative routes. **Water Act 1992 (NT)** • AROWS will interfere with waterways and take water from another waterway. • The DBC found that two key permits will be required for AROWS to operate: – Obtain a permit for the interference with the waterways by making an application under section 41 of the Water Act to the Controller – Obtain a water extraction licence by making an application under section 45 of the Water Act to the Controller.

Option 2

Disaggregated water supply

Cost		
	Capital Cost (P90 risk adjusted)	$633.10m
	Operating Cost (p.a.)	$39.51m
	Levelised cost of water	$4,738.31/ML

	Desalination	**Recycled Water Plant**
Environmental Assessment	• The Desalination Plant will require assessment under the NT EPA and the Commonwealth's EPBC Act (if federally listed threatened or migratory species could be impacted). • The largest issues of concern are impacts due to land clearing (and impacts to threatened species) and the discharge of brine into the Darwin Harbour. – The DBC recommends that studies are undertaken to determine the impact of either of these issues and assist in understanding the environmental impact prior to referring the project to the NT EPA.	• The recycled water plant is a modest project, using largely already disturbed areas. • The main environmental consideration will be any wastewater discharge going into the Elizabeth River. This is not expected to raise any major concerns. – The DBC considered that this Project is unlikely to have a significant environmental impact, and unlikely to require assessment under the NT EPA or the Commonwealth's EPBC Act.
Legal and Regulatory Assessment	Desalination does not raise any significant legal or regulatory issues (aside from Environmental approval discussed above). Overall, the project will need to consider the below: • Approval will be required under the NT Planning Act for clearing of native vegetation to construct each project and supporting infrastructure. Clearing of greater than 1 hectare of native vegetation triggers the requirement for approval. • An EPA and Environmental Protection Licence (EPL) are required under the Waste Management Pollution Control Act for construction and operation of facilities that involve listed waste collecting, transport, storing, recycling, treating or disposing. • The proposed discharge of brine to the Elizabeth River will either require a Waste Discharge Licence (WDL) under the Water Act or an Environmental Protection Approval and Licence (refer below). • A WDL may also be required for disposal of dredge material (spoil), if dredging is required for construction of the intake and discharge pipelines. The assessment process and issue of a licence typically takes three to four months. • Sacred Site and Heritage assessments will be required.	Recycled Water Plant also does not raise any significant legal or regulatory considerations. Overall, the project will need to consider: • Compliance with the Public and Environmental Health Act 2011. The Code of Practice for Water Recycling (the Code) is a process document under the Act and provides proponents of recycled water schemes with advice on how to demonstrate compliance with the Australian Guidelines for Water Recycling 2006 (AGWR) for low exposure and high exposure recycled water schemes. • The water recycling process will produce solid waste/ sludge that is classified as a listed waste under the Waste Management Pollution Control Act. • Sacred Site and Heritage assessments will be required.

08

Stakeholder Engagement, Public Interest and Social Impact

Stakeholder Engagement

PwC engaged with a range of stakeholders and community members during development of the DBC.

The engagement and consultation process focused on increasing awareness and understanding of the Project, its current planning phase, potential risks and impacts, and the next steps, and the findings from this process have informed the reference design/s. The views of the stakeholders engaged with have also been considered as the DBC has been developed.

The direct stakeholder engagement undertaken during the DBC built on the consultation completed during the Preliminary Assessment and targeted the following stakeholder groups:

- Greater Darwin region community
- NT Government departments
- Agricultural off-takers
- Industry water off-takers
- Contractor market participants.

In addition, PwC and the NT Government engaged with special interest stakeholders with specific interest in the project including:

- Northern Land Council
- Environment Centre NT
- Amateur Fishing Association of the Northern Territory.

PwC also received written submissions, considered as part of the DBC, from:

- Local Government Association of the Northern Territory
- Litchfield Shire Council.

Public Interest Assessment

The Public Interest Assessment considered the public interest impacts of the Project, to confirm whether the Reference Project/s will provide, on balance, equitable outcomes for all stakeholders.

The public interest assessment demonstrated that, on balance, both Reference Projects would provide equitable outcomes for all impacted stakeholders.

It has shown that Option 1 overall would provide more benefit to a greater range of stakeholders as it would provide additional water supply for industrial, agricultural and urban users, whereas Option 2 would only provide benefit to industrial users.

Overall, there are no public interest issues that would prohibit either option from proceeding to the next phase.

The NT Government will be required to continue to monitor any potential public interest impacts that arise during the project development and implementation phase and ensure ongoing compliance with NT and Federal legislation.

The Public Interest Assessment found that community engagement will be important during the detailed design stage and consideration should be given to all the public interest matters as the Project progresses.

Social Impact Evaluation (SIE)

The SIE assessment considered the positive and negative implications of the Project for the greater Darwin region and the NT. It also identified opportunities to create additional social value and potential mitigations for negative impacts.

The SIE demonstrated that on balance, the positive impacts outweigh the negative.

However, the negative impacts will need to be carefully considered by the NT Government in the development of the project/s. Some of these include:

- Impact of the project on Aboriginal heritage and other land considerations
- Environmental impacts
- Potential loss of recreation.

The DBC assessment found that following mitigation, these negative impacts can be responded to appropriately.

Overall, the Project/s are expected to create significant value and benefit to the greater Darwin region community and Project stakeholders, and on balance, the Project overall will have a positive social impact.

09

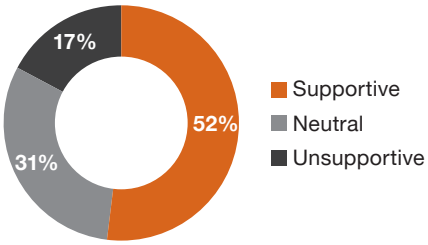
Community feedback

To understand community sentiment surrounding the reference projects, a 'Have Your Say' process was conducted by the NT Government in June/ July 2021 through an online survey. Overall, there were 207 completed surveys from this process.

Based on the survey outcomes, the three most important issues government should take into consideration when investing in new water infrastructure were:

- Environmental impacts
- Economic growth
- Cost to the taxpayer

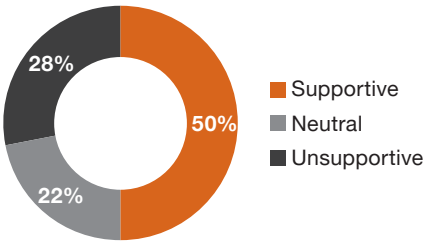
Manton Dam RTS



The majority of respondents were supportive of Manton Dam RTS, only 17% of respondents did not support this option

A majority of the unsupportive responses cited recreation on Manton Dam as the main driver behind their negative response. Therefore, the consideration of continued recreation on Manton Dam if it is used as a drinking water source is an important factor.

AROWS

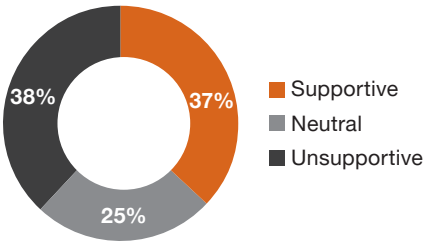


The majority of the unsupportive responses were due to perceived environmental concerns or issues with the project based on current information and/or their understanding of the project.

A number of respondents referred to the project as a dam and likened its impact to and/or compared its impact to an instream dam, which demonstrated that their may be insufficient community understanding of how the AROWS project functions and how it has a significantly reduced environmental impact compared to an instream dam.

As the project will be required to progress through a comprehensive environmental approval process, and demonstrate that its impact is with tolerable limits, a number of negative comments in relation to its environmental impact should be mitigated and addressed through this process.

Disaggregated water supply



Supportive respondents stated that this was dependent on the final cost of the option and/or supply through renewable energy sources.

The majority of neutral and unsupportive responses were cautious about the cost of water from desalination and recycling as well as a general view that there should be better use of Darwin's high rainfall during the wet season and demand management activities before needing to develop high cost manufactured water.

There was a greater level of support for recycled water than desalination as part of demand management and circular economy type initiatives.

10

The viability and economic performance of the short-listed projects

A comprehensive, whole-of-life economic analysis of the two Reference Projects was undertaken to provide a comparison and subsequent assessment of the economic benefits of each option.

Both Reference Projects will provide a range of benefits across the region. A cost benefit analysis (Table 4) evaluated these benefits in terms of the benefits delivered to industrial, agricultural and horticultural, and urban users in the NT. Each of these benefits were quantitatively and qualitatively analysed and classified in terms of:

Benefits to urban users

Increased water security and availability of water supply to support urban population, monetised through the willingness to pay of urban users for water.

Benefits to industrial users

Greater water supply enables increased industrial development and output above the base case. The benefit of this additional supply of water to industrial users is monetised by the industry willingness to pay for bulk water supply.

Benefits to agricultural and horticultural users

Increased agricultural/horticultural crop output and production of higher value crops and horticulture, monetised through total net profit.

Table 4: Cost benefit analysis results (present value, p50, $million, 7% discount rate)

Table 4 displays the cost benefit analysis results for the two Reference Projects.

	Option 1 AROWS and Manton Dam RTS	Option 2 Disaggregated Supply
Costs		
Capital costs	720.81	374.53
Operating costs	287.37	339.68
Total Costs	1,008.18	714.21
Benefits		
Urban user benefits	188.77	-
Industrial user benefits	482.42	336.27
Agricultural user benefits	381.04	-
Total Benefits	1,052.23	336.27
Benefit-cost ratio @ 7%	1.0	0.5
Benefit-cost ratio @ 4%	1.7	0.6

11

The recommended infrastructure solution

The DBC has concluded that based on the detailed assessment of both options, Option 1 was confirmed as the superior infrastructure solution to meet the Darwin region's water requirements of the short, medium and long term.

The over-arching key findings include:

- Option 1 returns a BCR of 1, with an NPV of $44 million and therefore is an economically viable project as the monetised economic benefits realised through delivery of Option 1 outweighs the costs.
- The levelised cost of water of the incremental water supply realised for each option, using an economic real discount rate of 7 per cent, is:
  - Option 1 - $1,686.90/ML
  - Option 2 - $4,738.31/ML.
- Option 1 provides almost 400% as much water (67,500 ML p.a compared to 17,000 ML p.a) as Option 2 for a 45% increased capital cost (discounted) – providing water for greater industrial demand as well as to urban and agricultural users.
- Option 2 was brought forward as a low risk project with a short timeframe for delivery. However, it was found to require a full EIS with a longer than anticipated timeframe.
- Option 2 has a materially higher operating cost per ML of water produced due to the high energy requirements for both desalinated and recycled water.
- Option 2 was investigated in the DBC as an alternative lower capital cost option however, the analysis demonstrated that it is cost prohibitive.
- The annual yield of AROWS is 60,200 ML p.a and Manton Dam RTS is 7,300 ML p.a, sufficient to supply the forecast demand and support major water-dependant industrial or agricultural/horticultural development and realise the potential economic growth.
- The BCR of Manton Dam RTS and AROWS is 1 and has the potential to unlock substantial benefits that are nationally significant, whilst providing long term water security for Australia's northern most capital city.

Overall, the combination of Manton Dam RTS and AROWS has been confirmed as the most cost effective and economically viable infrastructure solution to meet the needs of the greater Darwin region.

The projects can provide safe, secure, reliable and sustainable water supply to enable economic activity to support growth and provide water security across the region over the long term.

Manton Dam RTS is an important, low-risk capital project that can provide resilience in the water supply system and enable economic growth in the short-term.

AROWS is a critical long term infrastructure solution that can more than double the water supply in the Darwin region with significantly lower environmental impacts than conventional instream dams.

AROWS provides a step change in water supply to support the Territory's aspirations and plans for investment and economic growth over the long term.

Benefits for Darwin and the NT

Assessment of the project's economic, social, environmental and business benefits have identified that the Manton Dam RTS and AROWS will deliver significant and tangible benefits to the Darwin economy and across the NT more broadly. An overview of the anticipated benefits is shown below.

Overview of AROWS and Manton Dam RTS benefits:

- Nationally significant project that support key Commonwealth Government priorities
- Promotes economic development and diversification in the region
- Improved investment attraction to the region
- Increased regional social and economic resilience
- Increased agricultural output
- Increased employment opportunities
- Improved environmental resilience of the water supply
- Increased certainty of long-term water supply for urban users
- Improved social and economic outcomes for the Indigenous community
- Reduced capital establishment costs compared to self-managed water supply
- Local utility and service improvements
- Improved ability to attract onshore oil and gas investment
- Greater crop output and the development of high-value crops and horticulture
- Secure water supply for long-term agricultural certainty
- Additional demand for existing services during construction and operations
- Higher value land use within the region
- Reduced operational costs compared to self-managed water supply
- Provides an economically viable project with a BCR greater than 1

Responding to the challenges and opportunities

Outlined below is a summary of how the AROWS and Manton Dam RTS option responds to the challenges and opportunities identified through the DBC. Overall, based on the analysis undertaken in the DBC, Option 1 – AROWS and Manton Dam RTS best responds to the identified problems and opportunities and does so in an economically and financially efficient manner.

		Responded to by AROWS & Manton Dam RTS?	How AROWS and Manton Dam RTS responds
01	Darwin water supply over the medium term (5+ years) is not sufficient to provide the Level of Service that Power and Water offer or support increased population growth in the urban areas	✓	AROWS and Manton Dam RTS will provide sufficient water to support future population growth
02	Regional reliance on one primary water source increases the exposure of the water supply to environmental and seasonal factors and climate change which poses water security risks due to a lack of redundancy	✓	AROWS and Manton Dam RTS will provide two additional water sources, significantly increasing resilience
03	Groundwater in the Darwin rural region is oversubscribed creating water reliability, security and environmental risks and inhibiting further strategic land development	–	AROWS will provide water for brownfield agricultural development. The DBC recommends further demand management, and regulatory reform activities
04	The strategic positioning and development of additional cost effective and efficient water supply can enable increased high-value agricultural and horticultural production in the greater Darwin region	✓	AROWS and Manton Dam RTS will provide sufficient water to enable agricultural and horticultural development
05	Potential industrial growth, specifically the Middle Arm precinct, is constrained by current water availability in the Darwin region	✓	AROWS and Manton Dam RTS will provide sufficient water to enable and support the development of Middle Arm
06	Inefficient water consumption by urban, industrial and agricultural water users results in higher water consumption impacting water availability to potential new users	✗	AROWS and Manton Dam RTS will not directly address this. The DBC recommends further demand management activities
07	Potential efficiencies gained in water consumption may be offset by the impacts of climate change on increased water usage leading to a lack of resilience in the Darwin region water supply	✓	Additional water sources will increase the climate resilience of the water supply

AROWS

sustainable, long-term infrastructure solution

e AROWS project is an novative approach that ovides complementary tcomes of water availability d environmental sustainability.

ically, water supply projects the scale of AROWS require mming of river systems leading degraded environmental values. e AROWS project will only extract ter from the Adelaide River ring wet season flows and store s water for later use in a natural sin that is only slightly modified.

y characteristics of e project include:

There is no dam infrastructure that restricts the flow of the Adelaide River. There are four dam structures at low points to secure water within the proposed basin (highlighted in orange on Figure 11).

Water extraction from the Adelaide river would only occur during the wettest months (around January to March). There is no extraction during the remaining months of the year.

Water extraction will be governed by strict regulations, enforced under the *Water Act 1999* (NT).

The total amount of water that is able to be extracted will be informed by a comprehensive environmental assessment to ensure the sustainability of the project.

- The water will be treated at the Strauss Water Treatment Plant prior to distribution to customers. This will ensure water quality standards are met.
- Current modelling shows that when full, AROWS will hold around 250,000 ML of water and supply 60,200 ML per year. By comparison, Darwin River Dam holds around 290,000 ML and can only supply 32,000 ML per year.
- The Adelaide River Catchment is one of the largest catchments in the Darwin region, which means that the water availability is extremely reliable each year.

As the climate continues to change, AROWS can provide a secure and reliable source of water to the Darwin region.

- There is unlikely to be any impact on fishing accessibility for the Adelaide River.
- The recommended solution delivers a sustainable and robust reticulated network for the Darwin region, with multiple sources to provide increased resilience and capacity over the long term. A high level overview of the recommend greater Darw region's water supply network solution is shown in Figure 11.

Figure 11: Schematic design of recommended solution for the greater Darwin region water supply network

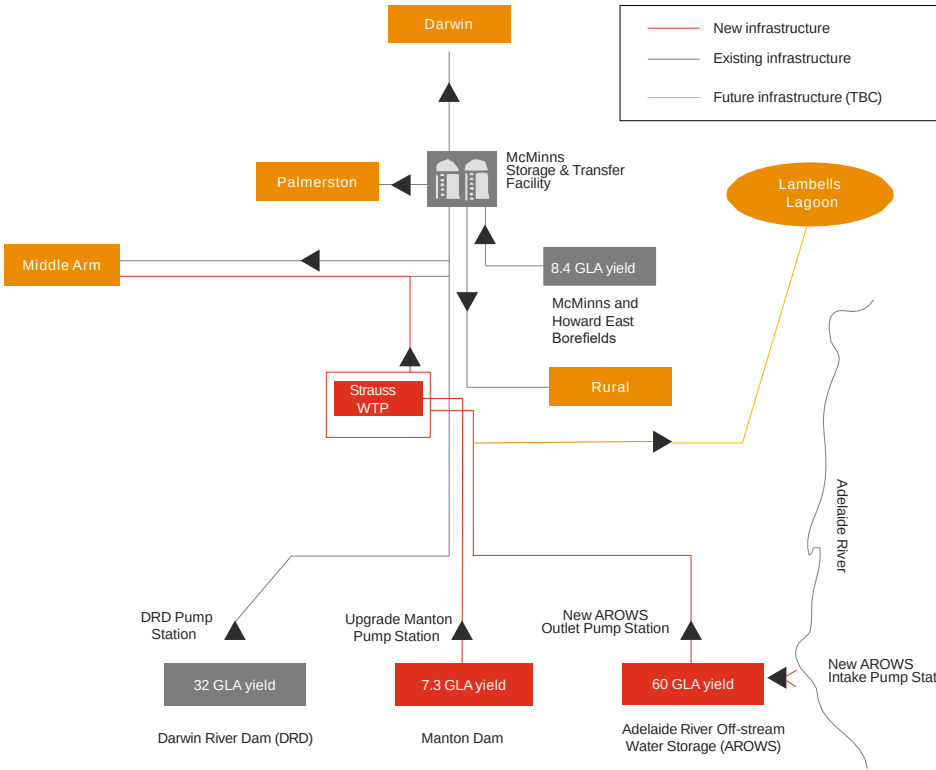
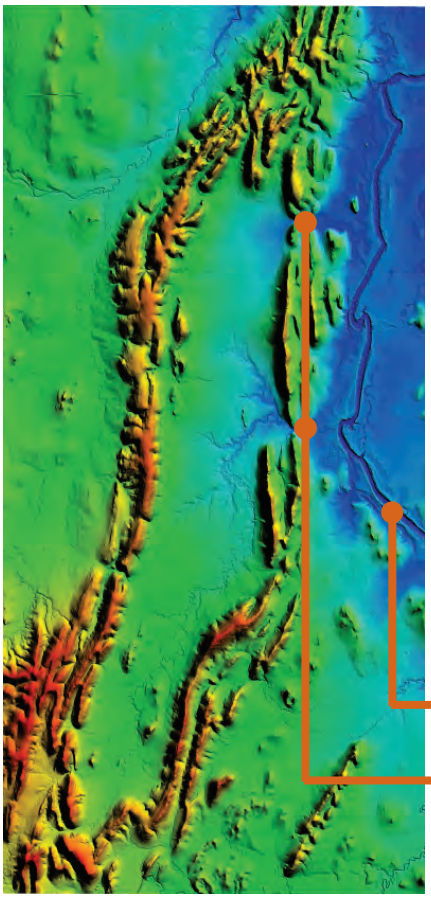
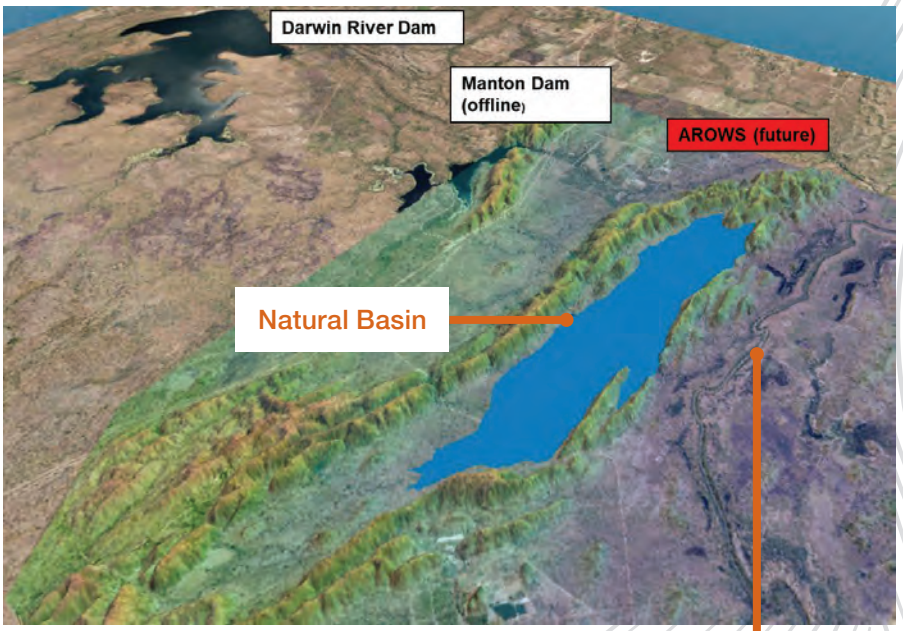


Figure 12: The natural geographical advantages of the AROWS project are demonstrated below

Existing Geographical Characteristics



A natural basin adjacent to the Adelaide River



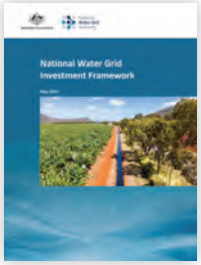
Adelaide River

Dam structures at low points to secure water in the basin

13

Strategic alignment of the recommended solution

There is a clear strategic and policy intent from across all levels of government to support, develop and grow the economy in Northern Australia, the NT and the greater Darwin region. However, it is recognised that to enable this growth, investment and support is required.



National Water Grid Investment Framework

The NWGA is working in partnership with Australia's states and territories to identify, plan and deliver a program of national water infrastructure investments that will improve the reliability and security of water for Australia's regions and agriculture and primary industry sectors.

The NWGA's National Water Grid Investment Framework (May 2021) underpins the Commonwealth Government's investment in nationally significant infrastructure and this framework provides a clear, long-term, strategic approach to investment in the next generation of Australia's water infrastructure. This framework identifies which projects the fund will invest in, one of these being this DBC.

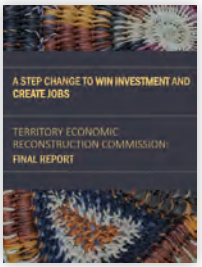
The findings of the DBC support the objectives of the Investment Framework by supporting primary industries and unlocking potential, promoting the growth and sustainability of regional economies and building resilience.

Infrastructure Australia Priority List

Infrastructure Australia is responsible for strategically auditing Australia's nationally significant infrastructure and developing 15 year rolling infrastructure plans that specify national and state level priorities.

Infrastructure Australia also delivers a prioritised list of nationally significant investments each year - the Infrastructure Priority List. The 2021 Priority List includes greater Darwin region water supply infrastructure upgrades as a priority initiative in the list for the medium term (5 to 10 years). The Priority List notes that failure to expand Darwin's water supply will increasingly constrain population and economic growth and is also likely to impact on business and investor confidence.

Following completion of the Preliminary Assessment in mid-2020, it was submitted to IA, who accepted it and the associated Stage 2: Options Assessment. IA subsequently agreed to the Project being progressed to Stage 3 of IA's Assessment Framework (this DBC).



The Territory Economic Reconstruction Commission Report

The Territory Economic Reconstruction Commission (TERC) Report details the commission's advice on key strategies, approaches and actions that will increase private sector investment, to grow industry, jobs and business opportunities. The TERC Report addresses the requirement for a step change in the NT's approach to water to support the NT's aspirations and plans for investment and economic growth.

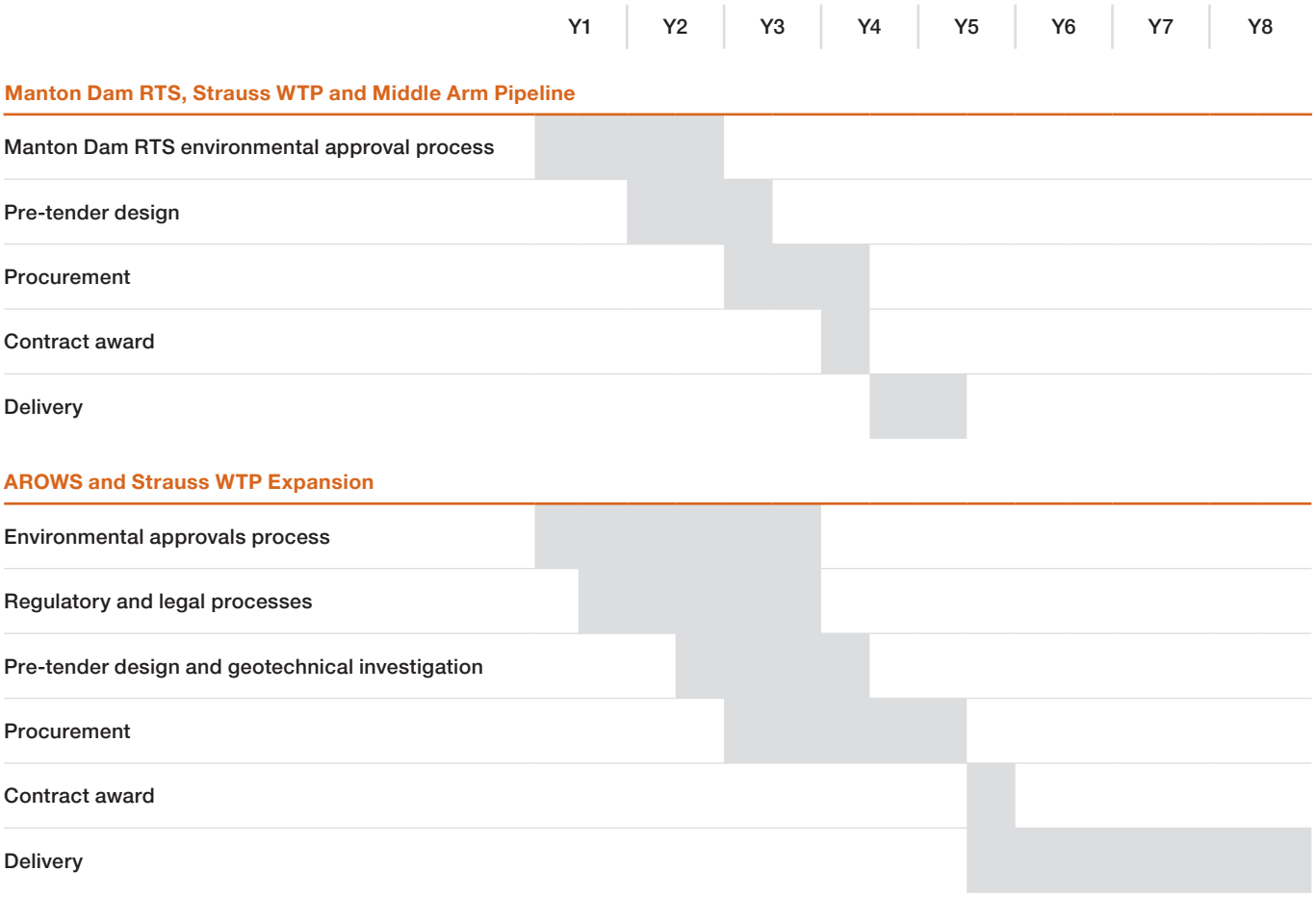
Access to water is required for economic use and investment, as most projects require water access as a fundamental input and to secure funding. It is also essential for the NT's growth sectors, specifically the agriculture, horticulture and industrial sectors.

One of the TERC Report's recommendations to leverage the NT's access to water is to 'accelerate work to deliver infrastructure solutions for future water demand'. An available water supply will be critical to support the broader actions identified in the TERC Report.

14

Indicative project development timelines

The proposed approvals and delivery process for Manton Dam RTS and AROWS is outlined below.



The proposed time frame is indicative and is subject to change

15

Conclusions and key findings

The Preliminary Assessment and DBC have confirmed there is a definite need and rationale for water supply intervention in the greater Darwin region.

It is clear that there is a demonstrated strategic and policy intent from all tiers of government to support, develop and grow the economy in Darwin and the NT.

The NT Government's aspiration to realise a $40 billion NT economy by 2030 is essential to ensuring the long term economic security, productivity and prosperity of the NT and its regional communities.

There is an opportunity to deliver new water supply infrastructure to enable the realisation of the growth opportunities in the NT and leverage the NT's natural resources, including gas and renewable energy. The Project would unlock the economic potential of the region by increasing industrial and agricultural development opportunities and promoting the growth and security of the economy.

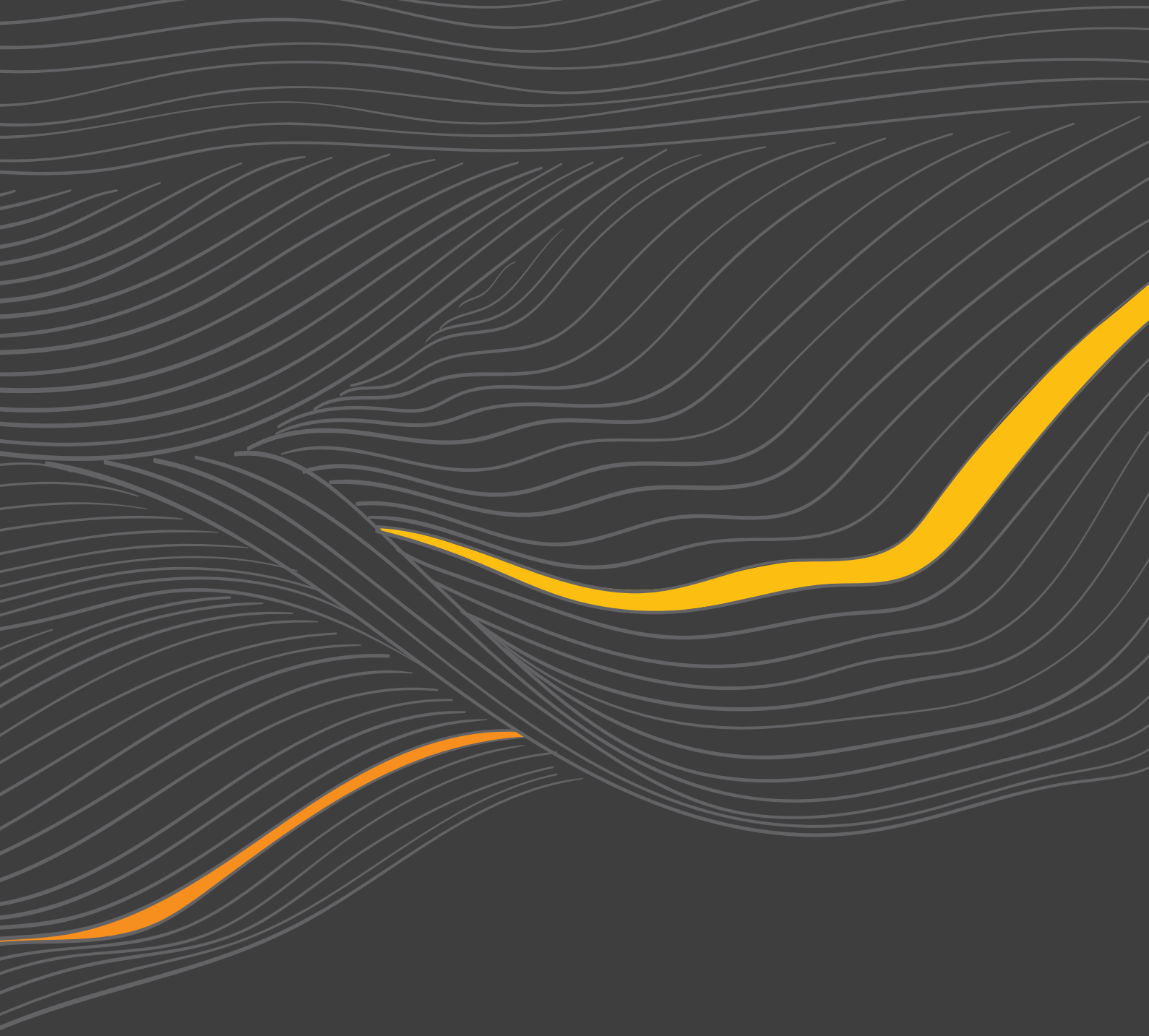
The Territory Economic Reconstruction Commission has identified that a step change to win investment and create jobs is required to significantly shift the economic curve upwards in the Territory given the economic situation both prior to and arising from COVID-19.

The attraction of new investment will create jobs, improve wages and living standards, drive population growth and ultimately result in economic security and a greater economic contribution to the Australian economy. Without a significant investment to increase water supply in the greater Darwin region this will not be delivered.

With a BCR of 1 (7%), the Manton Dam RTS and AROWS projects represent an economically viable infrastructure solution to provide water security to the Darwin region for the next 50 years.

The development and delivery of the AROWS and Manton Dam RTS project is critical to the economic sustainability and future of the greater Darwin region and the broader NT.

Darwin River Dam, Darwin, Northern Territory



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