Independent Water Production and Producers in South Africa

Final report and guidelines towards the introduction of IWP in South Africa

Report to the
Water Research Commission

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EXECUTIVE SUMMARY

President Cyril Ramaphosa, in his budget speech of 2020 mentioned and highlighted the need for independent water producers to play a role in ensuring South Africa's water security future. This was a relatively new concept and institutional modality in the South African water landscape. The Water Research Commission (WRC) initiated a study to unpack and understand this opportunity, within the South African water legislation and institutional context, as well as exploring the route to the introduction of independent water producers in South Africa.

> An Independent Water Producer is understood to be an entity, which is not a publicly owned water utility, but which owns and operates facilities to produce water for sale to customers. Customers can include utilities, central government, municipalities and end users, like industry or farmers.

This study undertook a literature review of international experience of IWPs, local experience and the South African water sector landscape and legislation. It then analysed the key areas of Legislation; Regulatory mechanisms; Capacity requirements; Institutional dynamics; Financial; and Social Aspects.

The study found that there are two broad pathways that exist for the introduction of IWP in South Africa. These are the introduction of IWP within the existing legislative and institutional framework or amending the current legislative framework to allow for the introduction of IWP within the existing water value chain.

Amending the existing legislative framework will require Ministerial approval and compliance with the consultation and other existing processes to amend legislation. However, the introduction of IWP within the existing legislation framework may still require the introduction of additional regulations to prevent unintended consequences.

The opportunity for IWP exists in South Africa, particularly around desalination, wastewater reuse, and small-scale production for industry. However, for IWP to contribute to addressing South Africa's water challenges of adequate skills, finance, and water resilience, significant work needs to be done to address areas of institutional weakness in the water sector. Some of Water Boards and WSAs could currently be reliable customers for IWPs, with the majority of water sector institutions being considered investment partners.

IWP could be implemented either by focusing on those Water Boards and WSAs that:

- Have strong credit ratings;
- Are developing programmes associated with specific type of projects, such as seawater desalination or wastewater reuse; and
- Streamline processes around procuring these projects and bringing them online.

An alternative approach would be to develop a single off-taker with sovereign guarantees to purchase water on behalf of Water Boards and WSAs from IWP at scale for distribution into the networks and free up water upstream in the value chain. This would require institutional restructuring at a national level. However, it may be possible to incorporate this into the development of the NWRIA.

Industry will develop its own water supply to ensure security of supply in the appropriate conditions. This additional supply and possible redundancy is useful for building resilience in the broader water sector and the national economy. However, it does pose threats to municipal revenue. Restrictions and uncertainties created in the regulations around water sector intermediaries are the biggest

barrier to industry doing this and should be improved. However, these activities should not be subsidised through public funds.

This study raises several questions and positions on the role and inclusion of IWPs in the water sector. A key position is what is independent? Any issues of licencing and allocation of the resources raises the conflict of this independence.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF ABBREVIATIONS

DFI	Development Finance Institutions
DTI	Department of Trade and Industry
DWS	Department of Water and Sanitation
IPP	Independent Power Producer
IWP	Independent Water Procedure
MFMA	Municipal Finance Management Act
NEMA	National Environmental Management Act
NWA	National Water Act
PFMA	Public Finance Management Act
REIPPP	Renewable Energy Independent Power Producers Programme
SASTEP	South African Sanitation Technology Enterprise Programme
SLA	Service Level Agreement
SMMEs	Small, Medium and Micro Enterprises
SONA	State of the Nation Address
ToR	Terms of Reference
WRC	Water Research Commission
WSA	Water Service Authority

1. INTRODUCTION

The president of South Africa highlighted the potential role the independent water production and by implication, the establishment of Independent Water Producers (IWP) as a mechanism to deal with some of the challenges facing water production, in his 2020 State of the Nation Address (SONA) and he repeated this intention in his 2021 address. IWP is a fairly new concept in a South African context.

This report presents the proposed position of IWP in a South African context. The position is an output of existing literature, as well as interviews with key stakeholders. The findings from the report will be presented at a workshop in order to obtain feedback. There will be additional one on one interviews conducted with the feedback obtained being used to finalise the findings and recommendations guiding the implementation of IWP in South Africa.

1.1 Scoping the problem statement

IWP as a solution

Independent water producers have the potential to make a contribution to addressing some of the issues identified, through a number of different approaches. The most common approach to independent involvement in water provision is through management contracts and concession to operate, maintain and expand distribution systems. These have potential to address increasing access to basic supply, reducing water losses and improving asset condition.

Independent water producers also have the potential to play a role in the development of alternative sources of water, such as seawater desalination, groundwater use and wastewater treatment for reuse. They could also support industry in directly providing water to meet its production requirements, and in some cases already do. The private sector also plays a crucial role in the investment in, and the construction of infrastructure and this role could be expanded.

In order to understand the role that independent water providers can play in South Africa it is important to understand the South African water institutional landscape and legislation as well the experience elsewhere of the use of independent water providers.

National Treasury has indicated that a comprehensive management strategy needs to be developed targeting investment in water resource development, bulk water supply and wastewater management, as well as the application of lessons from the country's renewable energy independent power producers programme (National Treasury, 2019). Thus, it is expected that the role of the IWP will need to be understood in line with the proposed framework.

Key questions that were considered during the course of the study included:

- When used elsewhere in the world, has independent water production been successful? What have been the key causes of success and failure?
- When independent water providers have been used in South Africa, what has the experience been?
- Where in the South African water value chain could independent water providers be used effectively?
- What does South African legislation and regulation allow for in terms of independent water production? What changes would need to be made to enable successful independent water production?

Approach to the study

This review report forms the deliverable associated with the analysis phase of the study, consisting of a literature review of international experience of independent water production, local experience and the South African water sector landscape and legislation. This phase of the project will focussed on the analysis of key factors identified in the review report. This was included in key informant interviews[1] and the following key areas of analysis were covered:

1. Legislation;
2. Regulatory mechanisms;
3. Capacity requirements;
4. Institutional dynamics;
5. Financial; and
6. Social.

This report has been structured to provide the context for IWP and thereafter outlining the findings from the analysis of the abovementioned areas. Section 9 of the report outlines the potential options for IWP in South Africa and Section 10 presents the preliminary roadmap for implementation. These outputs will be presented at a workshop during the next phase of the study.

2. THE CONTEXT

This section of the report outlines the broader context within which the analysis for the introduction of IWP was considered.

2.1 The challenge

The South African water sector is currently faced with several challenges. These are outlined further below.

Water security

South Africa has been facing serious water problems especially in the Northern and Eastern Cape provinces. These challenges have resulted in several small towns being threatened by total water supply failures and livestock farmers facing financial ruin. Municipalities' inability to supply people with clean drinking water has led to farmers taking matters into their own hands and people protesting in various parts of the country. Similarly, droughts in the Western Cape and KwaZulu-Natal have created water supply challenges for industries that use water intensely, such as mining, smelting, canneries and other food and beverage suppliers, where municipalities have been forced to raise costs and limited supply. Several commercial entities within these industries, have put in place their own supply mechanisms to counteract this**.**

Challenges experienced

Some of the challenges that have been identified within the water sector include: (Department of Water and Sanitation, 2018):

- Over 3 million people do not have access to a basic water supply service and 14.1 million people do not have access to safe sanitation;

[1] Proposed questions to key informants are presented in Appendix C.

- Only 64% of households have access to a reliable water supply service;
- 56% of wastewater treatment works and 44% of water treatment works are in a poor or critical condition. 11% are dysfunctional;
- 41% of municipal water does not generate revenue whilst 35% is lost through leakage;
- Municipalities lose 1 660 million m^3 through non-revenue water. This amounts to R9.9 billion at a unit cost of R6/ m^3; and
- R33 billion more is needed each year for the next 10 to achieve water security.

The capital funding gap

Part of the challenge for municipalities is the lack of capital investment in infrastructure, and inadequate provision towards operations and maintenance of the water and sanitation network (Engineering News, 2020). This has resulted in poorly performing networks that are unable to achieve the Expected Useful Life of the assets.

The lack of capital investment in infrastructure can be attributed to:

- Inability of municipalities to collect revenue from the provision of water services;
- Poor governance and financial management within municipalities;
- Competing priorities for limited funding that is available; and
- Water is considered to be under-priced.

The NWSMP indicates that a further R33 billion is required annually for the next ten years in order for South Africa to achieve a water secure future. However, the NWSMP also states that the ability to raise funding in the sector is constrained as TCTA, larger water boards and metropolitan municipalities have the ability to raise funding for capital investment.

Water Governance

The Auditor General has raised flags about water governance at both the national and municipal level over a number of years. The 2018/2019 MFMA report found that in terms of water infrastructure:

- 41% of municipalities had no policy on water and sanitation maintenance;
- 36% did not establish standard procedure for assessing water infrastructure; and
- 33% had no condition assessments to inform maintenance.

36% of municipalities also had water losses of over 30% and 12% of municipalities did not disclose water losses. In total in June 2019, South African municipalities were R6.24 billion rand in arrears to water boards. With Mpumalanga, Limpopo and Northwest the worst offending provinces. 11% of water infrastructure projects suffered from underspending, but 18% suffered from supply chain management irregularities.

Framing the potential solution

The National Water and Sanitation Masterplan (NWSMP) has been developed to address the challenges identified within the sector and enhance water security. The NW&SMP is based on five key objectives that define a ‘new normal’ for water and sanitation management in South Africa:

- Resilient and fit for use water supply;
- Universal water and sanitation provision;

- Equitable sharing and allocation of water resources;
- Effective infrastructure management, operation and maintenance; and
- Reduction in future water demand.

The NWSMP also states that the current challenges in the water and sanitation sector threatens the health and wellbeing of South Africans, whilst also negatively affecting economic growth and the environment. It is therefore crucial that these challenges can be addressed. The diagram below provides an indication of the current mix of water sources in South Africa and the proposed long-term mix as per the NWSMP.

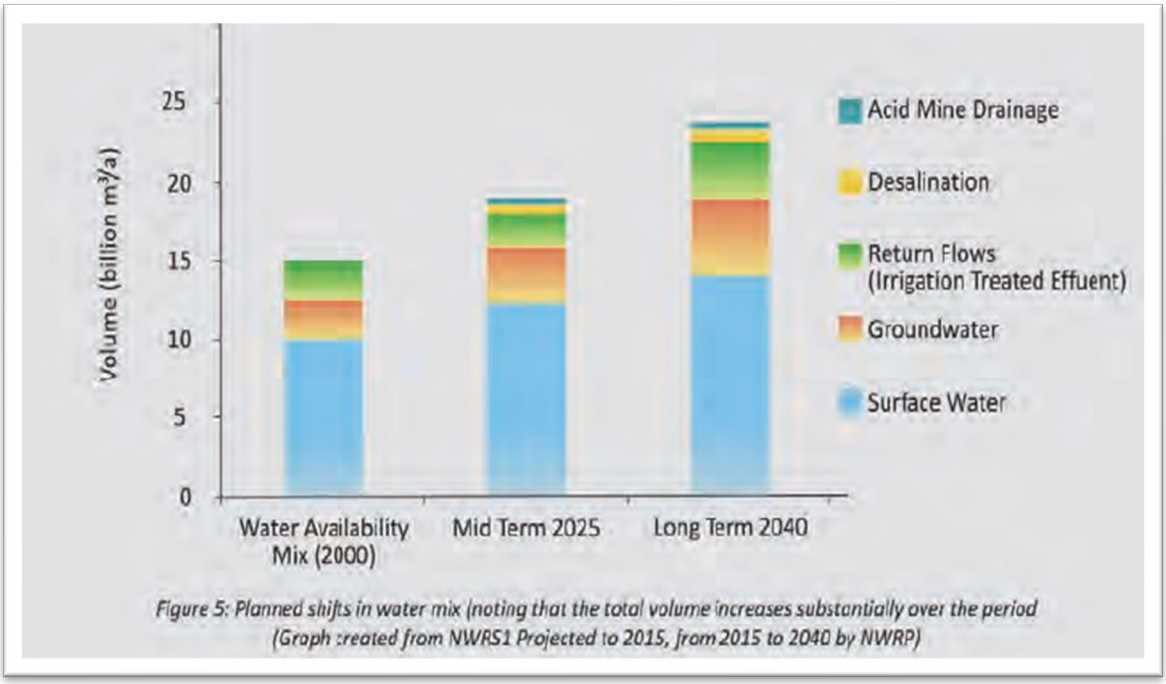

Figure 5: Planned shifts in water mix (noting that the total volume increases substantially over the period (Graph created from NWRS1 Projected to 2015, from 2015 to 2040 by NWRP)

Figure 1: Current and proposed future water mix

Source: DWS (2018)

The diagram above indicates that desalination, acid mine drainage and water reuse are areas that have been identified to improve South Africa's water mix. The table below provides an indication of the additional water that is expected to be added to the system over the long term.

Table 1: Sources of water to be added to the system

Source	2030 projection (million m^3)
Increased surface water yield	874
Increased ground water use	405
Desalination (including treated AMD)	588
Re-use	110
Total water to be added	**1 977**

The table above highlights that conventional water sources (surface water and ground water) are expected to be supplemented with the development of alternative water sources (desalination and reuse). The Department of Water and Sanitation (DWS) says

that the “growing crisis” in the water sector” is beginning to encourage decision-makers to see private sector participation as a pragmatic and beneficial response” (Department of Water and Sanitation, 2018) and it can therefore be expected that the private sector would be involved in the development of these sources. The sector would always have a social impact, and without water “no economic development can take place”. Funders required “bankable projects” and have “indicated the need for an enabling environment to mobilise larger private sector investment”.

Previous work by Bosch Capital, suggests caution, however, about the willingness of investors to invest in water sector projects, owing to the poor credit enforceability in the water market (Paladh, Baloyi, Foster, WIC Report). This is the case for large scale infrastructure projects, and projects that are not tied to an alternative revenue stream, as is commonly the case in IWP projects elsewhere in the world (Vuyo Ntoi, key stakeholder interview, 2020).

There may therefore be an opportunity to consider the establishment of an Independent Water Producer (IWP) that is able to deliver some of the interventions that have been identified in the NWSMP. This paper further explores the position of the IWP within the water value chain, as well as, identifying the next steps needed for the successful establishment of IWP.

2.2 Experience with IWP

This section of the report summarises the local and international experience associated with IWP as is based on a desktop review of available data. Further information for the literature review is presented in Par 17.3.

International experience

The international experience of private involvement in water production has typically involved private participation in the public service provision through development and management of supply and network schemes and operating contracts. Recent droughts in Australia, California and Spain, as well as increasing development in Dubai, Abu Dhabi and Israel has seen a rise in seawater desalination plants, many of which are owned and independently operated for supply to cities and industries. These operations typically have long terms offtake agreements with the independent operator.

The international experience of these desalination projects has been varied, with viability depending heavily on contextual factors including:

- Scale;
- Quality of feedwater;
- Location of plant;
- Extent of environmental regulation;
- Cost and availability of energy; and
- The extent of drought.

The current global average cost of desalination is $1.21 per kl, with costs in mature markets dropping to around $0.50 per kl and below (Bosman, 2021). Imported water, shipped by barges, is crucial to survival of some island nations in and around the Caribbean.

South African experience

Private sector involvement in the South African water sector has largely been through private sector participation in the public water distribution system. This has been in the form of contracts that have been initiated by the public sector and require compliance

with the National Water Act, either short terms management contracts for the operation and maintenance of existing infrastructure, or long-term concessions for the development, renewal and operation of supply schemes. The Dolphin Coast and Mbombela concessions have been local cases that are considered a qualified success. Similar PPP concessions are increasingly being used and considered for wastewater treatment, both for treated effluent for industrial use and for potable reuse

Private sector involvement in the production of water, rather than distribution has used extensively at small scale in South Africa by private industry. Use increases during times of drought, with high levels of uncertainty of supply and high municipal tariffs being implemented as part of water demand management initiatives by WSAs. The technologies used by the private sector are typically:

- Groundwater extraction and treatment,
- Seawater desalination at the coast; and
- Wastewater treatment.

The scale of these projects are small, however, when compared to bulk supply, and costs are high and variable, depending on quality of feedwater, the cost of energy, and the quality of water required. Some plants operate continuously, while other have been built, used and mothballed when municipal water tariffs drop (Western Cape Department of Economic Development and Tourism, 2020).

There are also cases in South Africa of independent producers playing a role in production for public water services authorities, such as the development of 10 Ml/Day desalination plant by MEB to supply the King Cetshwayo District Municipality.

Cooperative schemes such as Water User Associations which operate independently, through a mandate from the National Water Act, to supply raw water to farmers, industry and water service authorities, demonstrate a possible model for IWPs in South Africa, if a given contexts demonstrates a viable business case using conventional production methods.

The established institutional and regulatory frameworks and the weak financial standing of many Water Service Authorities in South Africa make this a challenging space for independent water producers to enter, as transaction costs are high and customers' ability to pay is uncertain. Without programmatic support, which will allow both IWPs and their customers to learn through the implementation of projects, reduce transaction costs and institutional barriers, and secure reliable revenue streams for producers, independent water production in South Africa is likely to remain focussed on securing small scale water supply for specific commercial contexts, as opposed to large scale supply for the public and contributing to nation water security.

2.3 Defining IWP

The concept of an independent water producer is not a widely used one in the international literature. It is most commonly use in relation to independent water and power producers in relation to generating desalination and electricity plants in the Middle East. Private water production in relation to the provision of water to communities from village to city scale, is common but these producers are rarely referred to as independent water producers. The definition we use is therefore drawn from an adaption of the definition of independent water and power producers, independent power producers, and tested with through stakeholder interviews.

An independent water producer is understood to be an entity, which is not a publicly owned water utility, but which owns and operates facilities to produce water for sale to customers. Customers can include utilities, central government, municipalities and end users, like industry or farmers.

The definition is very broad, which potentially limits its usefulness when being applied for programmatic infrastructure delivery purposes, as implied by the President's speech and envisioned by National Treasury. This is because water production is a very context and technology specific exercise and can occur at vastly different scales from a solution within a small village to an intervention that can services a large city or region. To increase the usefulness of this broad definition for the South African case this analysis focusses on options in the South African context around which IWP could be adopted to improve infrastructure, service delivery and water security.

Are IWPs PPPs?

South Africa defines public-private partnerships at 2 scales and in terms of two pieces of legislation, the Public Finance Management Act (PFMA) and the Municipal Financial Management Act. The PFMA governs national and provincial government departments and entities and would the apply to the Department of Water and Sanitation, TCTA and Water Boards, while the MFMA governs municipalities and their entities and would apply to Water Service Authorities, and in some cases Water Service Providers. The definitions are different for each and are outlined in the table below.

Table 2: PPP definitions

PFMA PPP definition	**MFMA PPP Definition**
A commercial transaction between an institution and a private party in terms of which the private party: a) The private party performs an institutional function on behalf of the institution; and/or b) Acquires the use of state property for its own commercial purposes; and c) Assumes substantial financial, technical and operational risk in connection with the performance of the institutional function and/or use of state property; and d) The private party receives a benefit from performing the institutional function or from utilising state property, either by way of: i) consideration to be paid by the institution which derives from a revenue find or, where the institution is a national government business enterprise or a provincial government enterprise, from the revenues of such institution; or ii) charges or fees to be collected by the private party from users or customers of a service provided to them, or iii) a combination of such	A commercial transaction between a municipality and a private party in terms of which the private party: a) Performs a municipal function for or on behalf of a municipality, or acquires the management of use of municipal property for its own commercial purposes, or both performs a municipal function for or on behalf of a municipality and acquires the management or use of municipal property for its own commercial purposes; and b) Assumes substantial financial, technical and operational risks in connection with: i. The performance of the municipal function; ii. The management or use of the municipal property; or iii. Both, and c) Receives a benefit from performing the municipal function or from utilising the municipal property or from both, by way of – i. Consideration to be paid or given by the municipality or a municipal entity under the sole or shared control of the municipality; ii. Charges or fees to be collected by the private party from users or customers of

PFMA PPP definition	MFMA PPP Definition
compensation and such charges or fees.	a service provided to them; or iii. A combination of the benefits referred to in subparagraphs (i) and (ii)

To be defined as a Municipal PPP a transaction must deal with the performance of a municipal function. This has implications for possible non-potable provision IWPs, as the functions of municipalities in terms of the South African Constitution are “water and sanitation services limited to potable water supply systems and domestic waste-water and sewage disposal systems”.

Given these definitions it is likely that IWPs performing function for either public or municipal entities will fall under the definition of PPPs because:

- They will be performing the function of the institution on its behalf;
- They will be assuming substantial financial, technical and operational risk as the owners and operators of the facilities used to perform the function; and
- Will be paid by the institutions or its customers.

This means that they will be subject to Regulation 16 in terms of the PFMA or the PPP regulations in terms of the MFMA, both of which require fairly onerous processes.

However not all IWP will be PPPs, where the service is conducted for private parties, such as industrial clients, these will not be PPPs.

3. THE LEGAL AND REGULATORY LANDSCAPE

The water sector is governed by a number of key pieces of legislation, including the National Water Act, and the Water Services Act. Water sector institutions, such as water boards and municipalities are also governed by other legislation governing public finance and the roles of local government, including the Public Finance Management Act, the Municipal Finance Management Act, and the Municipal Systems Act. The impact of water production on the environment is also regulated through the National Environmental Management Act and other associated legislation. Key elements of the legislation are outlined in the table below, followed by a discussion of their implications for IWP.

Table 3: Key Legislation in the water sector

Key Acts	Description of the Act	Key Regulations	Description of the regulations
National Water Act, 1998 (NWA)	The National Water Act (Act No. 36 of 1998) (NWA) was promulgated to ensure that the nation's water resources are protected, used, developed, conserved, managed and controlled in ways which take into account amongst other factors: promoting equitable access to water; redressing the results of past racial and gender discrimination; promoting the efficient, ***sustainable and beneficial use of water in the public interest***; facilitating social and economic development; protecting aquatic and associated ecosystems and their biological diversity; and meeting international obligations. The National Government, acting through the Minister, has the power to regulate the use, flow and control of all water in South Africa. Therefore, the Department of Water and Sanitation (DWS) is the lead regulatory agent and manages all areas of the Act that pertains to water use and disposal. In terms of the NWA, water use licenses will be required where water is being used in instances as typically indicated below. Water uses include: 1. Taking from a water resource; 2. Storing water; 3. Impeding or diverting the flow of water in a watercourse; 4. Discharging waste or water containing waste into a water resource through a pipe, canal, sewer or other conduit; 5. Disposing of waste in a manner which may detrimentally impact on a water resource; 6. Disposing in any manner of water which contains waste from, or which has been heated in, any industrial or power generation process; and 7. Altering the bed, banks, course or characteristics of a watercourse.		
The Water Services Act, 1997	The Water Services Act (Act No. 108 of 1997) provides for the right to basic services, which includes the right to have access to clean potable water and basic sanitation. The WSA applies to all users of water, without		

Key Acts	Description of the Act	Key Regulations	Description of the regulations
	exception. Key definitions and clauses from the Act, pertinent to water to energy projects are noted below. “industrial use” means the use of water for mining, manufacturing, *generating electricity*, land-based transport, construction or any related purpose; Section 7. Industrial use of water: Subject to subsection (3), no person may obtain water for industrial use from any source other than the distribution system of a water services provider nominated by the water services authority having jurisdiction in the area in question, without the approval of that water services authority. Section 11. Duty to provide access to water services: Every water services authority has a duty to all consumers or potential consumers in its area of jurisdiction to progressively ensure efficient, affordable, economical and sustainable access to water services.		
Public Finance Management Act, 1999	The Public Finance Management Act No. 1 of 1999 (PFMA), which must be read with the Public Finance Management Amendment Act (Act No. 29 of 1999). The PFMA applies to national departments and public entities. The Act is under the custodianship of the Minister of Finance, and it is administration is under the National Treasury. The PFMA deals with all aspects of national and provincial public entities: 1. Governance; 2. Budgeting and fiscal allocations; 3. Financial administration; 4. Financial reporting; and 5. Borrowing powers. Public entities are broken categorized into a number of schedules, which distinguish between constitutional entities, major public entities, national & provincial public entities, and national & provincial business entities.	National Treasury Public Finance Management Act Regulation 16	Defines and prescribes a process to be followed by public entities seeking to enter into a public-private partnership.

Key Acts	Description of the Act	Key Regulations	Description of the regulations
	Department of Water and Sanitation, the Trans-Caledon Tunnel Authority, and water boards are governed by the PFMA.		
Local Government Municipal Systems Act, 2000 (MSA)	Governs the provision of municipal services. Section 76-78 are intended to ensure that municipalities select the most appropriate mechanism for delivery of municipal service, internal (the municipality itself) or external (anybody else, **including IWPs**).		Prescribes a process (section 78) that must be followed before a municipal council approves an external mechanism and the associated transactions.
Local Government: Municipal Financial Management Act (2003) (MFMA)	The MFMA governs local government finances, including procurement, supply chain management, contracting, and revenue and expenditure management. Section 120 requires a municipality entering into a PPP must demonstrate (1) Value for money (2) affordability to the municipality (3) transfer of appropriate technical, operational and financial risk to the private party. Recommendation must also be sought from National Treasury, DCoG, the line department (DWS) and other relevant organ of state. Section 33 – Requirements for multi-year commitment – municipal manager needs to secure public participation, council approval, and endorsement by National Treasury for contract longer than three-year financial implications. Financial obligations for each year of the contract, their impact comment and the view of National Treasury, provincial treasuries, DCoG and the Line departments.	MFMA PPP Regulations, 2005 –	The MFMA PPP regulations outline the process for implementing PPPs. The process breaks up PPP into 4 phases (1) Inception (2) Feasibility study (3) Procurement (4) Contract management. National treasury view and recommendations must also be sought at 4 stages.
		MFMA Municipal Supply Chain Management Regulations, 2005	The SCM Regulations govern the procurement of goods and service by municipalities, including solicited and unsolicited bids.

Key Acts	Description of the Act	Key Regulations	Description of the regulations
NEMA: Integrated Coastal Management Act 2008	The ICMA S83(1)f-g governs wastewater discharge into the marine environment.		

3.1 The National Water Act

In terms of limitations in the National Water Act around independent water production a number of studies (Kalebaila, Ncube, Swartz, Marais, & Lubbe, 2020) (Western Cape Department of Economic Development and Tourism, 2020) have identified the lack of regulatory certainty around desalination and wastewater reuse as a barriers to private investment in these technologies. This has four forms:

1. Currently the Act does not list use of seawater or wastewater reuse as lawful or generally authorised water uses so there is some uncertainty around licencing (Kalebaila, Ncube, Swartz, Marais, & Lubbe, 2020). However, Fischer et al. (2019) identify that is likely that desalination activities will trigger some listed activities requiring water use licensing. Some cases have not required a license, but some might (PDG, 2019). However, leaving desalination and reuse unaddressed in the legislation, leaves investors uncertain about future regulatory change;
2. There is a grey area of responsibility for desalination, as a means of the production of water, and seawater, as a developable water resource which has not been resolved. Does it lie with national government as a resource development activity, or local government as a supply augmentation activity? This has implications for municipalities looking to make decisions to augment supply, and IWPs in providing those supply options (Western Cape Department of Economic Development and Tourism, 2020). This needs to be addressed through national policies and institutional reform;
3. The idea of a circular economy is not incorporated into the NWA, it understands the water value chain in a linear way from resources, treatments, use, treatment, discharge (PDG, 2019); and
4. The NWA ensure the rights of downstream users (often farmers) and water for the ecological reserve, which limits the opportunities for reuse projects in inland municipalities (Kalebaila, Ncube, Swartz, Marais, & Lubbe, 2020).

Providing certainty in the National Water Act for use of water from non-traditional water sources could help enable IWP, by providing investors with regulatory clarity and certainty about rights to use, licensing and roles and responsibilities of key institutions.

Implications for IWP

All IWP bulk production activities will require a water license, except, potentially seawater desalination.

3.2 Water Services Act

The Water Services Act deals with the registration and duties of water service providers and water service intermediaries. Water services providers are covered under section 22 and 23 of the Act and include those providing water to consumers and other water services institutions, whereas water services intermediaries provide water services incidentally to a primary contract need to comply the sections 24 to 27 of the WSA. An IWP providing water to a WSA would be a WSP, a business providing its own water and water to its neighbours and workers would be and WSI. Both require approval of the relevant water services authority.

Experience of WSI agreements suggest that they are complicated, and municipalities are reluctant to use them (Western Cape Department of Economic Development and Tourism, 2020). Further, WSI agreements in particular are subject to strict controls from the water service authority which may rescind their rights to operate. This has been the

case in the City of Cape Town where the water services authorities has rescinded the rights of intermediaries to operate before those intermediaries have been allowed to collect a return on investments made in water infrastructure. These investments were mostly made during the 2015-2018 drought (KSI, 2021)

IWPs registering to become WSIs or WSPs need certainty that they will have adequate time periods to operate to collect a return on their investment. More certainty would need to be introduced into regulations and framework approvals for WSPs and WSIs to give investors' confidence that water service authorities will not remove their right to operate.

Section 51 of the WSA outlines the possibility of using water services committees as a mechanism to provide water when water services authorities are unable to. These committees could be potential users of IWPs.

The WSA also provides for the establishment of Water Boards to provide water services to other water services institutions within its service area. Section 31.2.e of the WSA allows for Water Boards to enter into contracts with third parties to perform any duties of the Water Boards except for an allowance to set general conditions, such as tariffs. This suggests that IWP could possibly provide a service to a Water Board.

Implications for IWP

The WSA applies to all users of water, without exception, and will apply to IWPs and their customers.

3.3 Municipal Systems Act

In terms of the Municipal Systems Act, water production is likely to be considered municipal function when a municipality chooses to undertake supply augmentation as it would fall under the definition of "potable water supply systems" which is included as a function of municipalities in the South African constitution (PDG, 2019). This means that before engaging an IWP to fulfil a municipal function a municipality would need to undertake a Section 78 process. A section 78 process can be onerous, and includes public consultation, a feasibility study. This could create a barrier to the adoption of IWPs as the process is long and needs to navigate both local politics and get national approvals.

3.4 The MFMA

Section 33 of the MFMA poses a potential barrier to the uptake of IWP contracts because IWPs will require long term offtake agreements before making an investment. This is an onerous process requiring public participation and National Treasury approvals, Research suggest that some municipal councils and officials are reluctant to pursue Section 33 process because of onerous nature of the process, National Treasury's possible response, and the changing nature of local politics. However, National Treasury considers these contracts of potential benefit to municipalities while others consider it fairly easy to manage (PDG, 2019).

IWPs will be cautious about the length of this process, as these increase project lead times and development costs. Measures would need to be undertaken to shorten and streamlines this process to increase potential investor appetite. This could potentially be facilitated by a streamlined process for national approvals.

MFMFA PPP Regulations:

Through ownership of infrastructure (and holding risk) and accruing fees from municipalities it is likely that IWPs will meet the definition of a Municipal PPP when transacting with municipalities, and the Municipal PPP Regulations in terms of the MFMA would be applied. These are considered to be unnecessarily complex by some private and public sector parties, and this is thought to be the main reason for poor uptakes. Municipalities prefer to use grants own funds or neglect to develop the infrastructure. Municipal officials consider it too onerous, so project are not conceptualised as PPPs. The regulations take 3 to 6 years to navigate which leads to a risk of overlapping with political or organisational change (National Business Initiative, 2019). This same process is required to be followed by any PPP regardless of size, financial and time cost of meeting the requirements is a high proportion of costs for smaller projects, which increases the likelihood that only large projects will PPP investors, limiting the possible application to a selection of municipalities (PDG, 2019).

The resulting combination of PPP regulations and the MSA s78 process mean that private companies transacting with municipalities seek to package projects that avoid the triggers of these regulations, which can lead to sub-optimal technical and financial solutions (PDG, 2019).

It is likely that many IWP projects where the WSA is the off-taker will trigger the MFMA PPP regulation. Where this happens IWP and WSAs will be required to undertake the MFMA PPP process, which could discourage investment. For wide scale take-up of IWPs, a means of shortening this process is likely to be required. Some learning from the REI4P programme may be applicable to addressing these challenges (pre-specified terms of contracts, centralising national approvals required).

Implications for IWP

When long term off-take agreements are entered into, IWPs are likely to be PPP. IWPs serving WSAs will require a Section 33 approval.

MFMA Municipal Supply Chain Management Regulations

IWPs could potentially offer unique solutions to municipalities, which municipalities may be unaware existed in the market. This means that they are unlikely to prepare projects oriented to using these solutions. In these instances, IWPs may seek to make unsolicited bid to municipalities, offering them a mean to improve their access to water, and could be an effective way to introduce innovation in the water sector.

The Municipal Supply Chain Regulations legislate when unsolicited bids can be accepted. Unsolicited bids may be considered if the product or service (1) is a demonstrably or proven unique innovative concept (2) will be exceptionally beneficial or have exceptional cost advantages for the municipality of municipal entity (3) the person who made the bid is the sole provider of the product or service (4) the reasons for not going through the normal bidding process are found to be sound by the municipal manager. National and provincial treasury and public comment must also be sought.

Proving to be both unique and exceptionally beneficial sets a high bar for unsolicited bids and the approvals place significant risk on a municipal manager. These conditions for unsolicited bids limit the possible entry points for innovative and alternative technologies that IWP may bring to the municipal environment (PDG, 2019; KSI, 2021).

Other than unsolicited bids, complex regulations mean procurement processes takes a long time and drives up transaction costs, with multiple rounds for any given infrastructure project (PDG, 2019; KSI, 2021).

If IWPs are to bring innovative solutions to water production in WSA, it is likely that more flexibility around unsolicited bids may be required to allow unique technologies to enter the market. This flexibility should allow the processes involved to happen quicker and limit the personal risk to municipal officials involved in decision making.

Implications for IWP

IWPs using innovative technologies, in particular, may seek to use unsolicited bids.

3.5 NEMA

Most IWP production is likely to trigger the listed activities in terms of NEMA, both conventional production and alternative approaches. The construction of dams, reservoirs and water transfer infrastructure would all trigger listed activities under NEMA. The construction of desalination plants is also always likely to trigger the need for environmental impact assessments and approvals.

NEMA's Integrated Coastal Management governs activities along the coastline, but currently does not address desalination directly, and thus poses a risk to investment in desalination plants. Clarity around the development of desalination plants in terms of NEMA and the Integrated Coastal Management Act in particular needs to be provided and would assist in giving investors conference in desalination projects. However, in spite of the lack of clarity around desalination, however, key stakeholders interviewed felt that site selection could help overcome environmental legislative barriers.

Environmental legislation does not pose specific barriers to the introduction of IWPs but does pose the same barriers as it does to other water projects, which can delay development (KSI, 2021). These do raise project costs, but it is likely It is likely investors would anticipate this in their planning.

Implications for IWP

Seawater desalination IWPs will likely require approval to discharge brine in marine environments.

3.6 Municipal Bylaws

The Water Services Act requires water service authorities to make bylaws, including covering whether the authority requires registration of water services intermediaries or classes of intermediaries.

In practice, bylaws vary from municipality to municipality (Western Cape Department of Economic Development and Tourism, 2020). This makes it harder for those looking to operate as water service intermediaries to navigate the regulatory environment in different projects, reducing their efficiencies. Some bylaws also give municipalities powers to terminate agreements at short notice, on their own terms, creating uncertainty for those seeking to invest in developing water production infrastructure.

This is often seen to be beneficial to municipal water businesses as they can protect their revenues which are important to maintaining water supply to other consumers. The wider water network also needs to be maintained even if there are pockets of consumers accessing their own sources of water. Adherence to bylaws can prove challenging to

consumers in municipalities that are experiencing challenges in delivering water services.

3.7 Legal and Regulatory Summary and Conclusion

Water is a tightly regulated sector, however, there are gaps in the legislation, which does not anticipate the emergence of new modes of production in the South Africa water sector, such as desalination and wastewater reuse. These gaps need to be clarified, particularly if seeking private sector investment in infrastructure in these modes of production, to give investors regulatory certainty.

Beyond water sector regulation the regulation of public entities and municipalities seeking to do business with the state is severe, slow and difficult to navigate, which significantly increase transaction cost. If the use of IWPs is to be encouraged, means to reduce the complexity and timeframes for these processes need to be found. Learning from South Africa's IPP experience could add value here.

Few stakeholders see environmental regulation as a significant barrier to overcome for IWPs, noting that South Africa's environmental regulation is unlikely to raise cost so significantly the IWPs become unviable, as they have in other part of the world, such as desalination in Australia (KSI, 2021).

4. THE INSTITUTIONAL LANDSCAPE

The water sector has a large number of institutions playing different roles seeking to ensure that water is provided to South Africans. The water sector institutional map is provided in the figure below.

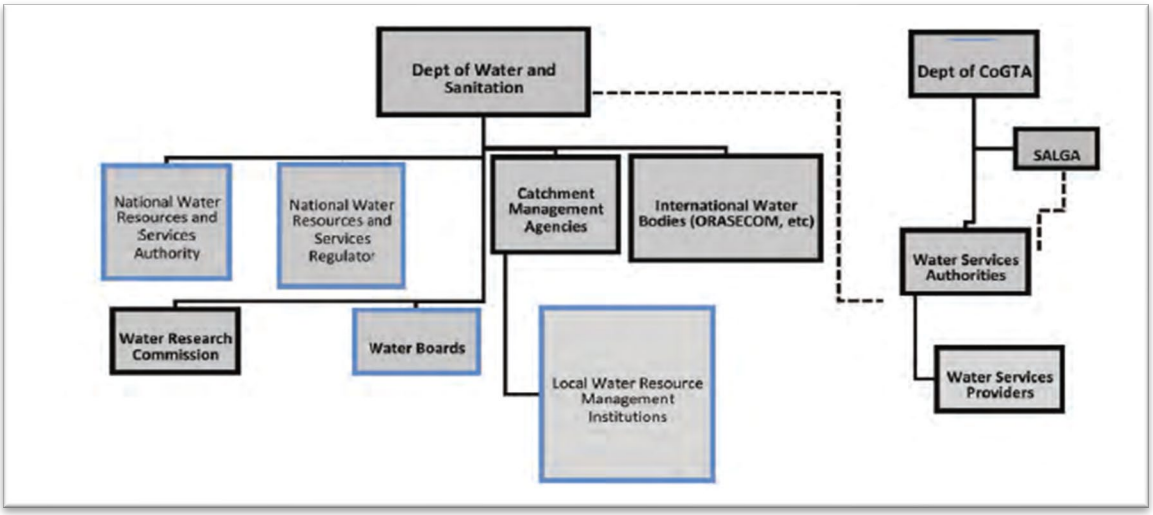

Figure 2: Proposed institutional arrangements for the water sector

Source: DWS (2018)

Some of these institutions are potential customers of IWPs, while others play supporting roles to those potential customers, providing bulk water, regulation, setting policy and financing water activities. Because of these interdependencies between water sector institutions, the health of one has knock effects for others, and has implications for IWP opportunities.

4.1 Institutional mandates

There mandates of the institutions involved in the water sector are outlined in the table below. The state of these institutions and their potential impact on IWP opportunities is outlined in discussion beneath the table.

Table 4: IWP opportunities

Institutions	Mandates
National Department of Water and Sanitation	DWS is responsible for oversight and regulation of water services and has the responsibility to ensure that water resources are protected, used, developed, conserved, managed and controlled in a sustainable and equitable manner for all persons. DWS is also responsible for water resources planning and planning for major supply infrastructure.
National Water Resources Infrastructure Agency	This has yet to be established but is proposed to be a wholly state owned entity responsible for the funding, further development, alteration, maintenance, refurbishment, operation and management of national water resources infrastructure, and could incorporate TCTA.
Trans-Caledon Tunnel Authority (TCTA)	TCTA is responsible for developing major water infrastructure, including managing the financing construction of dams and recovering the cost through raw water sales (often guaranteed by DWS).
Water Boards	Water boards are responsible for bulk water provision to municipalities, some bulk wastewater activity and some water retail and service provision. Some own and operate water resource infrastructure.
Water Service Authorities	Water service authorities are municipalities responsible for ensuring access to water services.
Water Service Providers (WSPs)	WSPs are entities that provide the services under contract to water service authorities. This can cover a portion or the whole of a WSA's geographic mandate. A water services authority can be a WSP.
Water User Associations (WUA)	WUAs are cooperative associations of individual water users who undertake water-related activities for their mutual benefit (often farming related). They can be sectoral or multi-sectoral. WUAs can manage their own infrastructure or state-owned infrastructure.
Private Sector	Possible producer of water
Industrial consumers	Possible customer or IWP
Economic Regulator	Responsible for ensuring the development, implementation, monitoring and review of regulations across the water value chain and in accordance with the NWA, WSA and associated policies (DWS, 2018)

4.2 Institutional Analysis

DWA

The Department of Water and Sanitation is a national department that face several challenges that make driving change policy and in infrastructure configuration difficult. These challenges include:

- Leadership instability: Characterised by frequent changes of minister, high levels of turnover of director-general, suspensions of deputy director generals, and high

numbers of official in acting positions at senior leadership level (AGSA, 2018) (Toxopeus, 2019);

- High vacancy rates of 25% at senior management level (AGSA, 2018);
- High levels of unauthorised, irregular and fruitless and wasteful expenditure in both DWS and its Water Trading Entity, with little evidence of ability to address the issues and improve weaknesses in supply chain management (AGSA, 2018);
- High overdraft use;
- Increasing use of water boards as implementing agents for infrastructure development, without adequate management and monitoring controls, and a reduction in the allocation of projects allocated to the water trading entity; and
- Receiving qualifies audits from the Auditor General (Toxopeus, 2019)

These conditions suggest weak levels of internal controls, and limited control and accountability for implementation, and limited capacity to address these financial and governance issues.

From a technical perspective, there is also a shortage in critical engineers in the National Water Resource Infrastructure Branch, where in 2018 only 7 of the 13 critical mechanical and electrical engineering posts were filled, and 5 of the 8 head of unit posts were vacant during the performance audit (Toxopeus, 2019).

The department has also struggled to manage its finances properly with both the department and the Water Trading Entity having difficulty paying its creditors on time, including implementing agents like the TCTA and the water boards, which has a negative impact on service delivery (AGSA, 2018).

Key IWP finding:

The shortage of engineering capacity within DWS combined with its intention to diversify water resources as outlined in the 2018 water and sanitation masterplan, make the use of IWPs a strategic way of diversifying resources. However, the use of IWP will require:

1. Reliable finance sources that give investors' confidence; and
2. High levels of cooperation and buy-in between reliable partners will be required between DWS and other stakeholders to implement an IWP programme at bulk scale, from policymaking to project implementation.

These conditions will allow for security of investment and guard against the prevalence of a single set of interests and allow for fair deal-making.

Institutional and financial instability at DWS poses a significant risk to generating cooperation and confidence in the development of water projects at the national scale, particularly for private investors and where projects are going rely on payments by the DWS. It is likely that intergovernmental structures or partnerships will need to be put in place focussed on IWPs to give investors' confidence that their investments are secure.

NWRIA

The NWRIA is not yet fully established but the intention is to establish the agency to address the fragmentation of national infrastructure investment, implementation, operations and maintenances between DWS, TCTA and Water User Associations. The strategic intent of the State is to use the NWRIA as an integrated vehicle for accelerating universal access. The NWRIA will be a merger of three existing entities in the water sector: (DWS, 2021)

- National Water Resource Infrastructure Branch;
- Water Trading Entity; and
- Trans-Caledon Tunnel Authority.

Key IWP finding

Could the NWRIA be an off-taker from an Independent Water Producer?

TCTA

TCTA is potentially a key role player in the development of IWPs, as a manager of bulk resource development project for DWS. It funds project both through grants and raising external finance. TCTA does not suffer from the institutional instability or DWS but relies on payments from DWS for projects it develops on DWS behalf, and because of this it is vulnerable to instability within DWS. Currently, TCTA

- Lacks significant liquidity buffer to cater for external events, such as lower water sales volumes, Covid-19, and non-payment (TCTA, 2020);
- Has received qualified audits in recent years, that have impacted on its ability to raise finance; and
- Effectively relies on treasury guarantees for finance.

It is expected that TCTA would be a key stakeholder in an IWP programme.

Water Board

South Africa's water boards are a potential off-taker of water from IWPs, particularly through conventional bulk production technologies and possibly desalination and wastewater re-use. However, the current institutional capacity, governance and financial strength of water boards create challenges that would need to be addresses for investment in IWPs.

Among South Africa's nine water board there is variable strength of governance, some do not have formally constituted boards, and some have vacancies in CEO positions (Toxopeus M. , 2019). They have struggled to achieve clean audits, with only 3 receiving clean or unqualified audit opinions from the auditor general.

Only a few water boards are technically and financially strong. Strength is associated with serving one or more major city. Smaller water boards are technically and financially stretched, serving economically weaker and less dense areas (HSF, 2018). DWS's financial challenges also pose a risk to water boards as they are forced to pay for DWS projects, when DWS does not pay them. Similarly municipal financial weakness is a significant threat to water boards, as the bulk of revenue is generated through municipal and departmental accounts, and failure to pay affects the functioning of water boards. DWS and SALGA's joint portfolio briefing on water board tariffs in June 2021 has identified the following key challenges in water boards:

- Amatola Water Board in financial distress requiring intervention, with the need to manage rising staff cost;
- Bloem Water Board is in financial distress and requires interventions, has in unresponsive key off-taker in Mangaung Metropolitan municipality which owes the water board over R1 billion, lack creditworthiness and is unable to fund its capex plan;

- Lepelle Northern Water Board is in financial stress, with cash flow problems due to non-payment by municipalities, CAPEX cannot be funded, need to ensure its business model allows for cross-subsidisation;
- Magalies Water Board plans using unrealistic revenue growth projects in light slow growth in volume of water sold, and has excessively high increases in labour costs;
- Mhlatuze Water Board has high overheads, particularly labour in its CAPEX plan instead of infrastructure, and has a controversial costing model;
- Overberg Water Board is dependent on industrial and agricultural clients for survival and under-charges on its tariffs, meaning it does not recover costs;
- Rand Water Board struggle to spend its CAPEX budget;
- Sedibeng Water Board has a huge CAPEX plan it is unable to secure funding for, is currently owed R 4 billion by creditors, of which R2 billion is owed by Matjhabeng Local Municipality; and
- Umgeni Water Board has high increases in operating costs of over 20% average for the last three years (Department of Water and Sanitation; SALGA, 2021).

Key IWP finding:

The status quo in water boards suggests that there will be little confidence in water boards as off-takers of water from IWPs amongst investors. Umgeni Water and Rand Water are possible exceptions to this, with Rand Water in particular having potential, given its strong financial position but difficulty in spending capital budgets.

However, a key stakeholder interview with a member of senior leadership of a coastal water board suggested that it was unlikely that water boards would procure water from IWPs, and particularly desalination IWPs, arguing that it would make more sense for desalination IWPs to directly supply the WSA, because of the infrastructure and pumping implications of desalination (KSI, 2021).

WSAs

South Africa has 144 water service authorities, all of these are either district, local or metropolitan municipalities and are therefore subject to the same governance, finance and capacity challenges that municipalities in South Africa have.

Municipalities in South Africa have high political and senior management turnover. This threatens longer term projects as they high levels of political support from local councils and institutional knowledge is regularly lost. This can derail projects, external or internal and so is a potential risk for an IWP and its investors negotiating with a WSA.

Engineering capacity is also low and has been in decline, with Lawless (2017) reporting that the number of registered professional engineers employed in South African local government as a whole declining from 455 in 2005 to 294 in 2015. This makes long term infrastructure planning and implementation a challenge. Many municipalities do not have their required masterplans in place, or they are inaccurate or out of date or not adhered to (PDG, 2019).

Similarly, this makes project preparation and management a challenge for water service authorities and has developed a perception that municipal officials either lack the skills of the time to package projects, draft adequate terms of reference for projects, evaluate proposals and monitor contracts once they are in place (PDG, 2019).

Administrative and financial capacity is also weak, which creates a risk of poor contract management affects the business cases when considering investing projects where a WSA is the key customer. A lack of accountability and internal controls is a common and consistent challenge in local government (Toxopeus M, 2019).

Municipalities are also in significant debt to water boards, owing over R8 billion, of mostly long-term debt (AGSA, 2021), and are owed R143.2 billion by consumers, mostly by households. In the 2019-20 financial year municipalities were also responsible for at least R26 billion of irregular expenditure (AGSA, 2021).

Key IWP findings:

The twin capacity and financial challenges at municipalities suggest providing both opportunities and barriers to the introduction of IWPs. The lack of engineering capacity and the poor availability of finance for projects mean that private engineering skills and private finance may offer solutions. But for investment to take place investors will need assurance of returns, and weak financial capacity and contract management will discourage investment. This means that IWPs will likely prefer to do business with those municipalities looking to augment water supply, but in a financially sound state. Internal to municipalities, external projects become more easily accepted if the finance for internal projects is not available (PDG, 2019)

Key stakeholders also identified the need to address challenging internal politics in local government around charging for services and changing modes of operation that will need to be anticipated, and the work that will need to be done to address break down the barriers to change that may slow the introduction of IWPs either as water services providers or as water services intermediaries (KSI, 2021).

Another institutional factor within local government is the response of local government unions introducing IWPs as private external providers. Section 78 of MSA is designed to protect interests of municipal employees. External delivery mechanisms have met with political resistance in the past from municipal unions, though this appears to be declining, but is still perceived as a threat by municipal political leadership. These issues can be resolved by proactive engagement between labour and private sector partner, sometimes through agreements to by the private partner to hire the municipality's employees (PDG, 2019). Any efforts to introduce IWPs should anticipate this as a potential barrier.

In terms of technologies, developing conventional surface water resources is challenging for WSAs as it requires significant amounts of land near the urban areas (KSI, 2021). Therefore, IWPs are likely best suited to groundwater abstraction and treatment, desalination, wastewater reuse and other technologies.

Water User Association

Water User Associations are cooperative and operate on the basis of users pooling their resources to address local needs for the mutual benefit of the users. They primarily serve agricultural users of water, particularly commercial farmers and seek to supply water and break even. Capacity in WUAs is variable some are well run and break even, while others struggles with technical capacity, poor levels of customer payment and governance issues.

The key informant interview suggest that Water Users Associations users often have to re-negotiate payment and supply terms, partly due to the uncertain nature of the agricultural business, partly due to ability to pay of other users in the association. Even

well run WUAS have needed financial support from government to cover users' payment defaults and fund infrastructure repayments (KSI, 2021).

It was suggested in the key stakeholder interview that users in an association may resent profit extraction by an IWP providing them an essential service, particularly given the levels of uncertainty in users business models (i.e. farmers – affected by climate variability and are price takers).

Key IWP finding:

IWPs may play a have a role to play in producing water for water users' associations. However, this would be contingent on the business case in each WUA, and the WUAs and its member ability and willingness to pay for a private company to produces water for profit. Members of WUAs would need to be engaged to assess the acceptability of using IWPs in production.

Industrial users

Industrial users of water need water security to ensure that they can continue to run, and in times of shortage will make provision to ensure security of supply. This typically takes the form of developing groundwater sources, desalination capacity and finding ways to incorporate treated wastewater into their processes. Currently this is limited to their own use. They are typically price sensitive and will purchase water from WSPs provided that it is cheaper than they can produce it for and will switch away from their own production if municipal prices drop below the cost they can produce for, even if they have invested in infrastructure (Western Cape Department of Economic Development and Tourism, 2020). Typically, they appoint a private provider to install and operate water production plant on their behalf, in essence an IWP on a small scale. They are also required to sign water service intermediary agreements with water service authorities when they are producing potable water used by their employees.

The cost of water from IWPs can be reduced through scale. To purchase sufficient bulk water to make an IWP at scale viable you likely need a grouping of industry within a small geographic area near the water source, making the opportunity site specific to site with significant industrial concentration. However, industrial planning timeframes are typically significantly shorter than Water board and WSA infrastructure timeframes. An IWP would need to be prepared to make an investment in water infrastructure on shorter timeframes than traditional water providers, unless WSAs are also an off-taker (KSI, 2021).

Key informant interviews suggest that there may be some reluctance on the part of industry to invest in water production based on experiences engaging with water sector institutions through the drought in the Western Cape. Key points of contention identified are:

- WSAs ending water service intermediary agreements before investors realise the return on investment to pay off the infrastructure developed in time of scarcity; and
- Long lead times when trying to partner with water service authorities on project that both secure industrial supply and augment supply to water service authorities (KSI, 2021).

In terms of capacity, private industry will draw on capacity in the South Africa and international engineering firms and can do so with greater speed and agility than public sector institutions due to reduced compliance requirement in supply chain.

Key IWP finding:

IWPs can play a role in providing water to industry, and in recent times of scarcity have done so. However, in order to do so in a manner that realising economies of scale IWP would need to supply groups of nearby industries. They would also need the approval of the relevant water service authority. Key stakeholders' interviews suggest that some water service authorities would welcome this as an opportunity to reduce their operation and maintenance responsibility, while others are reluctant to cede control, understanding that they have the ultimate responsibility for ensuring water quality (KSI, 2021).

Key to investment in IWPs would be certainty around permissions to operate that allow for a return on investment to be accrued. Redundant capacity to ensure that industries can operate in times of scarcity is to the benefit of municipalities (Western Cape Department of Economic Development and Tourism, 2020).

Private Providers

South Africa has a number of world class engineering firms operating in its market. There is also a significant number of local and international firms operating in the water treatment space. The local presence of these firms is lack significant experience in dealing with large scale IWP appropriate technologies but has experience at smaller scales. However, private firms and access international skill and experience fairly easily and can develop local skills over time through application.

Transaction advisory capacity exists in South Africa, but limited experience but with relatively little IWP type water experience in South Africa, so capacity may need to be pooled for effective application of IWP projects.

The REI4P has shown that there is plenty of private sector finance available for the right infrastructure projects when the appropriate conditions are in place.

Economic Regulator

There has been significant debate in South Africa over a long period of time about the need for an economic regulator for water (Palmer, Moodley, & Parnell, 2017). Stakeholder engaged in this study were divided about whether a regulator was necessary in the context of IWP. Some felt that a regulator would give investors more confidence, while other felt that it would be difficult to establish and capacitate a regulator, and ensure it had adequate data to make decision, and that even once that had been done, it was still possible to "game" regulators (KSIs, 2021). Others felt that the job of economic regulation sat appropriately in the Department of Water and Sanitation at national level.

Relatively low water tariffs by international standards means that regulation is a low priority for consumers and off-takers from water boards, in particular (Palmer, Moodley, & Parnell, 2017).

The experience of the introduction of an economic regulator, NERSA, in the electricity sector has seen mixed results in South Africa. In its early years, it lacked capacity to effectively regulate Eskom, but its introduction did expose Eskom's pricing strategies to public scrutiny, leading to progress in effort to reform the electricity sector, despite being relatively ineffective in its primary role (Ting & Byrne, 2019).

Key IWP finding:

It is not clear that an independent economic regulator would improve regulation in the water sector. However, it may increase transparency and public scrutiny of water pricing strategies, which may lead to a stronger institutional drive to reforming water production in South Africa.

Institutional summary conclusion

The water sector institutional landscape has a large number of players and strict regulation over their roles. The diagram below provides a summary of the different role players as related to IWP.

Table 5: Institutional summary analysis

Institution	Skills	Governance	Ability to attract investors	Credibility as an off-taker
DWS				
TCTA				
Umgeni Water, Rand Water				
Other Water Boards				
Metropolitan Municipalities				
Intermediate cities				
Other WSAs				
WUAs				
Industrial Users				

Weak
Strong
Variable

Key players in that landscape including DWS, some water board and many water services authorities are currently in financial and organisational distress for various reasons including, weak governance, poor financial management and controls, bad debts, political instability and low engineering and project management capacity. These factors create an opportunity for independent water producers to play a role, bringing in management and technical capacity and being able to source finance.

However, they also create a significant challenge. Private investment decisions are based on the ability of customers to pay for the services provided by the infrastructure and there are limitations on the ability to pay throughout South Africa's water value chain, from end user households to water services authorities, to water boards, to DWS and the Water Trading Entity. The combination of poor financial standing of these institutions, and weak governance in many of them make investments in water infrastructure unappealing. To overcome this a coordinated programme with high levels of project management capacity, high levels of political buy-in and backed by financial guarantees, most likely from National Treasury would be required.

The institutional landscape, suggest that the opportunity for IWPs exists primarily in financially sound and institutionally stable water boards and water service authorities, or

to conglomerations of industry, where investors can be confident that their primary off-taker will be able to pay for the water provided.

While some water services authorities will have the capacity to develop their own supply augmentation schemes, including through IWPs, it is likely that many would need, and welcome technical assistance to do so.

5. THE FINANCIAL LANDSCAPE

This section of the report outlines the financial challenges experienced by institutions.

5.1 The capital funding gap

The diagram below provides an indication of the estimated capital funding gap in the water and sanitation sector.

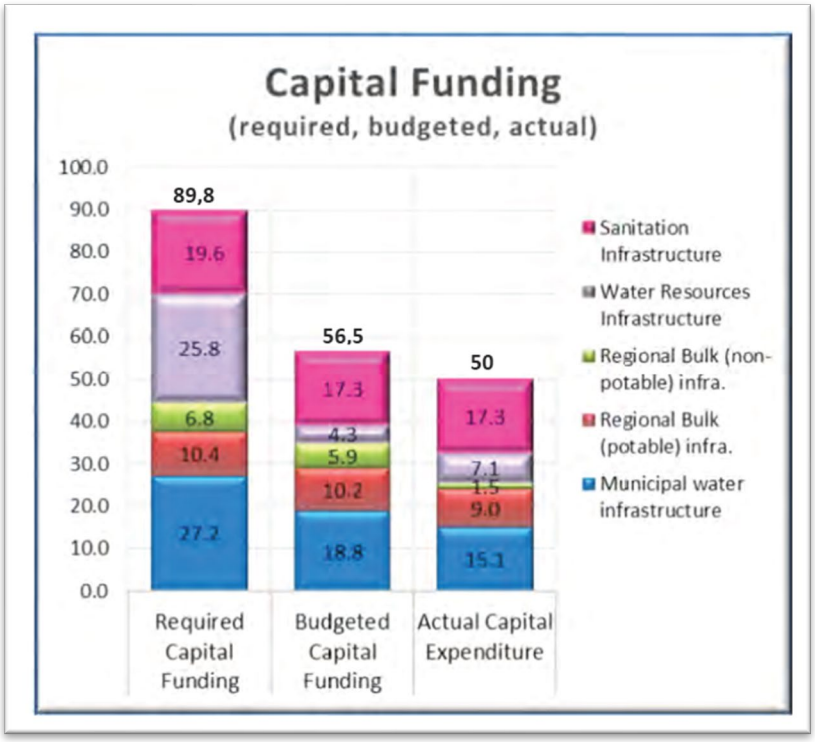

Figure 3: Estimated Funding Gap

Source: DWS (2018)

The diagram above indicates that the greatest need for funding is at a municipal level followed by water resource infrastructure development. The funding gap can be expected to increase because of:

- Poor project planning;
- Construction delays;
- Poor contract and financial management;
- Unrealistic expectations from End Users; and
- Natural disasters, vandalism and theft of infrastructure.

The capital funding gap includes a funding requirement for renewal of existing infrastructure. This includes municipal infrastructure (treatment works, pump stations, reticulation networks, etc.) that could deteriorate further if funding is not realised, resulting in regular service interruptions and a downward spiral of customer dissatisfaction, non-payments, protest and vandalism (Department of Water and Sanitation, 2018).

5.2 The need for funding

The capital investment is required on the following priority needs:

- Backlog in basic water and sanitation services;
- Critical refurbishment backlogs;
- Critical renewals of aged infrastructure;
- Provision for water resource developments; and
- Provision of new bulk, connector and reticulation infrastructure to meet the demands of population growth and agreed water use extensions aimed at promoting economic growth.

However, the ability to raise capital funding from the market is constrained due to limited capacity within the water and sanitation sector to access funding. This capacity constraint is underpinned by:

- A lack of suitably skilled resources;
- Low credit ratings; and
- Non-ringfencing of municipal revenues at a municipal level.

The sector has identified the following interventions to close the capital funding gap. These interventions include:

- A reduction in costs associated with the provision of water and sanitation services;
- Increasing revenue through the implementation of suitable tariffs and revenue management;
- Increasing fiscal transfers and government support; and
- Increasing the ability to attract loan funding from the private sector.

There is thus the potential to position IWP in a manner that is able to attract additional funding to the sector whilst enhancing water security. However, there is a further challenge in protecting the interests of municipalities by reducing the loss of revenue that this intervention could produce.

5.3 Loss of municipal revenue

Municipalities are required to be financially sustainable through the recovery of tariffs for the provision of services. Municipalities are provided with capital and operating subsidies for the provision of free basic services to indigents.

The recent drought in the City of Cape Town highlighted that whilst restrictions were introduced to reduce consumption, the lower water use led to a decrease in municipal revenue. During this period, the city had to manage the fixed costs associated with existing infrastructure and staff, as well as increased expenditure to introduce demand management measures and augment water supply. (National Treasury, 2018)

The experience with the City of Cape Town is like that experienced by other municipalities through the introduction of energy efficiency interventions. The energy efficiency interventions resulted in a reduction of revenue collected from the provision of electricity and resulted in a funding shortfall. Therefore, the introduction of IWP would have to be managed to avoid a negative impact on already constrained municipal revenue collection.

5.4 The opportunity

The table below provides an indication of water tariffs for bulk water users in Metropolitan municipalities.

Table 6: Tariffs for metropolitan municipalities

Organisation	Description	2021 / 2022	Source & Comment
Buffalo City	Bulk / Industrial Supply	19.54	Buffalo City Metropolitan Municipality Tariff Book Index (p. 13)
City of Cape Town	Industrial	32.65	CoCT Tariffs, Fees and Charges Book (p. 198)
City of Johannesbug	Commercial/ Industrial	48.03	Tariff is for consumption up to 200 kl per month. Thereafter R50.67 will apply. Assumed that the tariffs quoted included VAT. City of Johannesburg: Consolidated 2021/22 FY Tariff Reports (p. 16)
eThekwini	All other classes of consumer that have a	45.60	Water User Charge 2021 - 2022 (p.1)
Ekurhuleni	Business and other Uses	29.17	Tarriff of R29.17 for first 5 000 kl consumed in 2020/21. Thereafter R29.64 up to 25 000 kl per month up to R30.92. Website did not provide tariffs for 2021 / 2022.
Mangaung	Consumers	IBT with R0 per kl for first 6kl increasing to R17 per kl for consumption above 50 kl per month	General Tariffs 2021/22 - 2023/24 (p. 28)
Nelson Mandela Bay	Treated water for commercial and	20.86	2021 - 22 Nelson Mandela Bay Municipality Tariff Book Index
City of Tshwane	Non-Residential	IBT with R28.23 for the first 10 000 kl per month, decreasing to R26.79 per kl up to 100 000 kl per month and thereafter R24.97	Draft 2021/22 Medium Term Revenue and Expenditure Framework for the City of Tshwane

The table above indicates that the industrial tariffs for Metropolitan municipalities range from R19.54 per kilolitre is Buffalo City to R48.03 per kilolitre in the City of Johannesburg. The bulk water tariffs for Water Boards are presented in the table overleaf.

Table 7: Water board tariffs

Organisation	2021 / 2022 (R/kl) - Excl. VAT	2022 / 2022 (R/kl) - Incl. VAT
Amatola Water	13.91	16.00
Bloem Water	9.91	11.40
Lepelle Northern Water	8.28	9.52
Magalies Water	9.43	10.84
Mhlatuze Water	5.54	6.37
Overberg Water	8.27	9.51
Rand Water	10.67	12.27
Sedibeng Water	10.40	11.96
Umgeni Water	8.78	10.10

The table above highlights that bulk water tariffs are increasing annually. It should also be noted that the tariffs under drought conditions are significantly higher than those indicated in the table above.

The table above provides an indication that the financial proposition for IWP will need to be competitive to the tariffs outlined above. The international experience suggests that IWP are able to achieve cost effective tariffs. However, this would need to be tested in a South African context given the contextual raw water, technology and electricity requirements.

The value proposition of IWP also extends beyond the proposed tariff as there is an opportunity to enhance water security. Therefore, there may be an opportunity to consider paying a premium for the service provided.

6. AN OUTLINE OF AVAILABLE TECHNOLOGIES

The definition of IWP outlined above is not specific to any water production process or technology. IWPs lend themselves to certain technology where ownership of assets and control of water resources can be clearly delineated and defined.

6.1 Technologies for IWP

Some possible water production approaches that could potentially be used by IWPs are outlined below.

Table 8: Technical solutions for IWP

Technological solution	Description	Application and Users	Environmental implication and risks
Increasing surface water			
Bulk dams and reservoirs	Conventional water storage, abstraction and treatment	Production for WSAs and Water Boards	Possible over abstraction Impacts on flow rates for downstream users
Increasing groundwater			
Ground water abstraction and treatment	The abstraction and treatment of groundwater through a number of technological approaches including desalination and chemical purification.	Production for WSAs Production for private industry Production for residential and commercial users	Over abstraction Contamination
Desalination			
Seawater desalination	The abstraction and purification of seawater using either membrane filtering or distillation	Production for Coastal WSAs Production for private industry	Seawater abstraction Brine disposal Construction on plant, inlets and outlets on shoreline
Treatment of acid mine water	The treatment of acidic mine water through a number of processes including eutectic freeze crystallisation and others.	Production for WSAs Production for industry	Brine disposal
Reuse			
Treatment of wastewater to potable water	The treatment of municipal or industrial wastewater through a number of technologies including filtration, chemical purification, and desalination to drinking water quality.	Production for WSAs (primarily coastal) Production for private industry	Impacts on ecological reserve Impacts on river flow rates for downstream users

Technological solution	Description	Application and Users	Environmental implication and risks
		Production for residential and commercial users	
Emerging innovations			
Water from icebergs	The importing of icebergs to melt into potable water systems.	Production for WSAs (City of Cape Town likely the only viable)	Changing water temperature at entry point to system
Water from air	Abstracting water from air using dehumidifying processes, condensation or fog capture	Production for residential and commercial users	Contingent on air quality

6.2 Water already in the network

As outlined previously in this report South Africa has experience of the private sector playing a role in water service provision, through management contract and concession to operate maintain and upgrade water and sanitation infrastructure for water services authorities. These activities largely fall outside of out definition of independent water producer, because they are largely concerned with the provision of the service and there is limited private ownership of the infrastructure. This report therefore does not deal directly with this kind of private provision.

Despite this there remains a significant role that the private sector can play in improving water service provision. All stakeholders' interviews have agreed that this is the case even when they were sceptical about the role of the private sector in water production through IWP. There is significant work to be done to ensure we are more efficient with the water that is produced and distributed through network systems.

Potential roles include water network operation and maintenance, operation and maintenance of water treatment works, and wastewater treatment works, leak detection, pressure management and other work to reduce water loss. Many of these roles could be a managed through performance-based contracts, allowing for the public sector to reduce risk. However, it is likely that contract management capacity will need to be improved.

6.3 Conclusion

There are both IWP and other private sector service provision opportunities in the South African water sector. This report focusses on the IWP opportunities. IWP opportunities exist through a number of technologies, some well-established either in South Africa or internationally, some emerging and some untested. The regulatory, institutional, governance and financial arrangement that would be required for an IWP project often vary considerably on the basis of the technology, largely because of the location specific nature of water production and the scale and cost at which they are able to produce water, meaning it is only viable at specific points in the value chain.

7. THE SOCIAL LANDSCAPE

Water is a public good and social acceptance about the source of water and its delivery and cost are important elements when considering changes to its mode of production and delivery. Privatisation has in the past been a contested part of attempts to reform public services. Different technologies for water production also pose concerns for different communities in South Africa.

7.1 Acceptance

There is limited data available on the likely overall social response to Independent Water Production in South Africa. The best available data on overall public acceptance of independent water provision is a survey conducted by the National Business Initiative in 2017 testing public acceptance of water being supplied to households through partnerships between municipalities and private companies, and water being provided by private companies. The results of the survey suggest that households prefer public provision of water, with only 67% of households showing satisfaction with water provided by a PPP compared to 80% with water provided by government. For private provision satisfaction drops slightly below 65%. While private provision produces lower levels of expected satisfaction, these levels are still high, suggesting that households are largely indifferent to where their water comes from (NBI, 2019).

Other social resistance is unlikely to be social resistance to IWP in general in unlikely except possibly from two areas:

1. Public sector unions concerned about job losses, or political leaders concerned about the reaction of unions. Recent research argues that union resistance to privatisation has diminished in recent years (PDG, 2019); and

2. If the IWP collects tariffs from households directly (this was not accounted for in the survey above).

Other social acceptance issues are unlikely to be generalised amongst IWPs but rather associated with the technologies of water production. Reuse of wastewater particularly has social sensitivities that need to be address, which public concerns about the safety of reuse of wastewater and religious concerns for some. However, experience suggests that social acceptance can be developed through widespread and persistent public awareness campaigns. Experience in Beaufort West, in the Western Cape, suggests that focus on awareness in schools was particularly effective (Marais, 2012). In addressing religious concerns amongst members of the Muslim community on whether this infringes on their beliefs was also addressed in Beaufort West through consulting legislation in Saudi Arabia, as a source of Islamic legislation (Marais 2012), which demonstrated permissibility. Political buy to develop public acceptance is also in necessary, and communication strategies important (Marais, 2012).

It is likely that there will be social acceptance of Independent Water Production in South Africa, however, some technologies will need significant work done in communities to provide assurances of safety and acceptability of the water produces, particularly wastewater for potable reuse.

7.2 Willingness and ability to pay

Willingness and ability to pay is an important factor in considering IWP, as investors will require confidence in that the off-takers of the IWP will be able to meet their contractual obligations. Social willingness and ability to pay plays a key role is securing the ability of off-takers to settle their bill with the IWP, particularly when that off-taker is a WSA, with the constitutional responsibility to provide water to the public even when the public can't pay. For a consumer to be willing to pay the price of the service must be both affordable and acceptable (under a maximum price that the consumer is prepared to pay for the service (Walsh, Shai, & Mbangata, 2019).

Research suggests that municipalities in South Africa have significant numbers of consumers who are either unwilling or unable to pay for water at current municipal prices (often considered to be below the cost of water) (Walsh, Shai, & Mbangata, 2019). This is typically due to low incomes or high levels of consumption or a combination of both. A significant proportion of municipalities are owed large sums by their consumers, who are unlikely to ever be able to pay these debts. These debts contribute to municipalities own debt and inability to pay service providers within 30 days. This is a risk to private partners, who, without revenue assurances would be reluctant to invest (PDG, 2019). This can be potentially ameliorated by offtake agreements with private sector but would require concentrations of industry at appropriate scale (PDG, 2019).

Ability and willingness to pay for water in South Africa could discourage investment in IWPs, as low payment rate threaten the financial standing of WSAs, the strength of which will be a determinant on willingness to invest in water projects.

Cross subsidisation of water services of non-paying customers by non-poor residential and non-residential customers, this makes ring fencing revenues for specific infrastructure to repay debt unattractive to municipalities. This can be resolved through payment by the private partner to the municipality to cover the previous cross-subsidisation from industrial to residential customers.

7.3 Backlog

South Africa still has a 13% backlog of households that have inadequate access to water (Mnisi, 2019). This backlog is largely concentrated in rural areas in the Eastern Cape, Limpopo and KwaZulu-Natal, where municipalities struggle to perform, high proportion have significant irregular expenditure and qualified financial audit reports (AGSA, 2021). IWPs are unlikely to be able to significantly improve the backlog of water connection in these municipalities, as the business case for investment will be weak. Where these municipalities have some strong and large customers, IWP could potentially play a role and supply services to those not yet connected by cross-subsidizing poorer households with revenue from the larger customers. However, this would likely require a significant role for IWP beyond just water production and include service provision and billing.

Where water is constrained IWPs could provide water for key municipal customers and free up municipal water for households that are underserved and lack the ability to pay, but the loss of municipal revenue would need to be accounted for in the contracting mechanism with the IWP (PDG, 2019).

IWP could play a role in reducing backlogs where there is a financially sound municipality that needs assistance providing water to remote settlements. IWPs could produce and distribute water at the remote settlement through package plants and small reticulation networks, as water service providers contracted by the WSA. However, it is likely the ability to pay within these settlements would be low and would require the WSA to subsidise the service and be the party responsible for paying the IWPs, rather than households.

It is likely that IWP will have a limited role to play in reducing backlogs where weak municipalities are struggling to make and maintain connections. IWPs may have a role to play in providing water to remote settlements in financially sound municipalities as water service providers or waters service intermediaries.

7.4 The right to access

The rights of access to water for everyone is enshrined in Section 27 of the Bill of Rights. The state must take reasonable legislative and other measures, within its available resources to achieve the progressive realisation of each of these rights. Therefore there may be concerns that the introduction of an Independent Water Producer could result in an infringement of these basic rights by reducing access through the introduction of a tariff that may be unaffordable to certain segments of water users.

However, it could also be argued that the poor delivery of water services by WSAs currently impact on the right of access to water by everyone. Right of access to water is impacted by both the ability to provide infrastructure (backlog eradication) and the ability to operate and maintain infrastructure. The latter results in the interruption of supply of water for periods of time, as well as, impacts on the tariff and water security through the water losses and inefficiencies in the system.

The Green Drop audits have highlighted that a large proportion of WWTW are operating below the required standard. This has a negative impact on the receiving environment, as well as, potential health implications on the communities in the areas that are reliant

on the water sources. It could therefore be argued that the poorly performing WWTW impact directly on Section 24 of the Bill of Rights that specifies that everyone has the right to an environment that is not harmful to their health or wellbeing.

Given the relatively infancy of the IWP concept, it may be possible to use the opportunity to position IWP in manner that addresses some of the inherent challenges in the water sector whilst still protecting the rights to access of water by users, and unaffordable tariffs.

7.5 Social Summary Conclusion

It is unlikely that there would be significant social rejection of introducing IWPs in Africa. Household attitudes appear amenable to private roles in water production and provision, and experiences suggests that socially challenging technologies

Given the relatively infancy of the IWP concept, it may be possible to use the opportunity to position IWP in manner that addresses some of the inherent challenges in the water sector whilst still protecting the rights to access of water by users, and unaffordable tariffs. Given experience of introducing alternative technologies, particularly wastewater treatment for potable reuse, social acceptance challenges are likely to be able to be overcome through work to educate citizen about the safety of the technology.

A greater social challenge of IWP is the willingness and ability to pay of households for water which damages the investment case, potentially limiting IWP opportunities to economically strong areas of the country.

8. USING THE IPP EXPERIENCE TO GUIDE IWP POSSIBILITIES

The South African Renewal Energy Independent Power Producers Programme (REIPP) was launched in 2011 with a target of producing 17 800 MW of electricity from renewable energy sources by 2030. To date the programme is widely acknowledged to be very successful with: (Nomjana, 2020)

- 6 329 MW of electricity being produced from 102 projects;
- R209.4 billion being attracted from sector investors; and
- More than 38 000 full time jobs created.

The competitive bidding process in REIPP has also resulted in the average bid price procured from wind technology projects decreasing from 151c/kWh in Round 1 to 68c/kWh in Round 4. Similarly, solar PV bid prices decreased from 329c/kWh in Round 1 to 82c/kWh in Round 4.

It is therefore assumed that given the similar challenges within the energy and water sectors and the benefits of REIPP, IWP could benefit from being structured in a manner that creates similar benefits. This section of the paper explores some of the critical success factors associated with REIPP.

8.1 Critical success factors of REIPP

Significant work has been undertaken to understand the factors that have contributed to the success of South Africa's Renewable Energy Independent Power Producers Programme, and these offer learning offer guidance as to what would need to be in place for IWP to work in South Africa. These are summarised in the table below, along with the implication of these for IWP. These lessons address the markets environment required, institutional arrangements and the institutional and financial capacity required for investments of this nature. They give direction to the work that would need to be done to achieve these market conditions.

Table 9: Factors contributing the success of the IPP (Eberhard & Naude, 2017)

Factor	Details	IWP Implications
Country level		
Stable country context	Stable macroeconomic policies Legal system allows contracts to be enforced, laws to be upheld, arbitration Good repayment record and investment-grade rating Previous experience with private investment	IWP will require the same stable country context as IPPs. This is made more complex by the fact that there would be multiple off-takers rather than a single offer to guarantee
Clear policy framework	Framework enshrined in legislation Framework that clearly specifies market structure and roles and terms for private and public sector investments (generally for single-buyer model, since wholesale competition is not yet seen in the African context) Reform-minded "champions" to lead and implement framework with a long-term view.	Water sector legislation would need to be amended to provide clear framework for independent water production and the technologies it uses. Programmes to implement IWP would need champions and a long term framework.
Transparent, consistent, and fair regulation	Transparent and predictable licensing and tariff framework Cost-reflective tariffs Competitive procurement of new generation capacity required by regulator	Measures would need to be introduced to ensure transparent and predictable licensing and tariff setting. This may require the introduction of a regulator. Procurement needs to be competitive.
Coherent sector planning	Power planning roles and function skilled, resourced, and empowered Planning function skilled, resourced, and empowered Fair allocation of new build opportunities between utility and IPPs Built in contingencies to avoid emergency power plants or blackouts	Skills and resources would need to enhance in water sector planning, and decision makers in planning empowered to take evidence-based decisions. There would need to be a fair allocation of opportunities to IWPs.
Competitive bidding practices	Planning linked to timely initiation of competitive tenders/auctions. Competitive procurement process adequately resourced and fair and transparent.	Procurement processes would need to be timely, linked to underlying planning and transparent, wherever IWP is applied.
level Project		

Factor	Details	IWP Implications
Favourable equity partners	Local capital/ partner contribution where possible Risk appetite for project Experience with developing country project risk Involvement of a DFI partner (and/or host country government) Reasonable and fair ROE Development-minded firms	Equity partners would need to be found with a risk appetite to invest in IWPs. DFIs would need to be involved
Favourable debt arrangements	Competitive financing Local capital/markets that mitigate foreign exchange risk Risk premium demanded by financiers, or capped by off-taker matches country/ project risk Some flexibility in terms and conditions (possible refinancing)	Project debt finance arrangement would be largely similar. WSAs as off-takers may increase risk premium for IWPs.
Creditworthy off-taker	Adequate managerial capacity Efficient operational practices Low technical losses Commercially sound metering, billing, and collections Sound customer services	Contract management capacity would need to be developed in off-takers Operational efficiencies would need to be improved in off-takers, particularly some WSAs (including metering, billing and collections).
Secure and adequate revenue stream	Robust PPA (stipulates capacity and payment as well as dispatch, fuel metering, interconnection, insurance, force majeure, transfer, termination, change-of-law provisions, refinancing arrangements, dispute resolution, and so on) Security arrangements where necessary (escrow accounts, letters of credit, standby debt facilities, hedging and other derivative instruments, committed public budget and /or taxes/levies, targeted subsidies and output-based aid, hard currency contracts, indexation in contracts)	Off-take agreements between IWPs and the off-taker would need to be robust. Off-takers would need to be able to demonstrate the ability to provide a secure revenue stream to IWPs.
Credit enhancements and other risk management and mitigation measures	Sovereign guarantees Political risk insurance (PRI) Partial risk guarantees (PRGs) International arbitration	It is likely that IWP off-takers would require sovereign guarantees, particularly given the uncertain revenue streams of most water off-takers.

Factor	Details	IWP Implications
Positive technical performance	Efficient technical performance high (including availability) Sponsors who anticipate potential conflicts (especially related to O&M and budgeting) and mitigate them	Capacity for attention to O&M and budgeting in contract management by off-takers would need to be developed.
Strategic management and relationship building	Sponsors who work to create a good image in the country through political relationships, development funds, effective communications, and strategic management of their contracts, particularly in the face of exogenous shocks and other stresses	Significant work would need to be done to create the required relationships to develop IWP in South Africa, considering the array of stakeholders.

8.2 Why IWP is different from IPP

This analysis has sought to draw lessons from the Renewable Energy Independent Power Producers Procurement Programme (REIPPPP/REI4P). While these lessons are to some extent generalisable to water there are limitations to the extent to which comparisons can be drawn as:

- Water is location specific: Water is significantly more location specific than electricity, as a water source is required;
- Water is much more expensive to move than electricity: Water pipelines infrastructure is considerably more expensive to develop than electricity grid infrastructure. This place further limits on location;
- Water production inputs for many technologies are highly variable: Source water quality both determines the viability of production, through the cost of treatment, and is variable, so good longitudinal data is required for investment decisions. This limits locations and creates uncertainties and increases the requirement for feasibility studies;
- Water quality issues and contamination have the potential to cause harm to other consumers; and
- The water sector has significantly more institutions and potential off-takers than the power sector, which increases the complexity of finding and packaging bankable projects.

8.3 Conclusion

The REI4P has been successful in South Africa at creating an investment environment in South Africa that has both attracted the private sector to make investment and contributed to South Africa's development objectives. However, this has at time been challenged by politics and institutions seeking to delay progress (Ting & Byrne, 2019). An important part of creating this environment has been having a single off-taker whose credit is guaranteed.

While similar investment condition could be created for the water sector, the sector has a more complex institutional environment, with potentially multiple off-takers, with varying levels of institutional capability, stability and creditworthiness. This coupled with the highly location specific nature of water production constrict flexibility in creating this environment. However, if a potential single off-taker, such as the Water Trading Entity or NWRIA could become a focal point for IWP, this could help to simple the institutional

landscape and investment environment. This off-taker would need to be able to convince investors of its financial soundness.

The REI4P have also been successful in increasing efficiency in procurement process through having a centralised offices dealing with professional advisory services, procurement management services; and monitoring, evaluation and contract management services using pre-specified contracts, which would also aid IWP, whether there are multiple or single off-takers.

9. SUMMARY FOR IWP IN SOUTH AFRICA

This section of the report provides a summary of the analysis completed to date and provides an indication of the areas that may be suited for the introduction of IWP in South Africa.

9.1 A summary of the context

A review of the literature and engagement with key stakeholders suggest that there are both IWP and other private sector service provision opportunities in the South African water sector. IWP opportunities exist through a number of technologies, some well-established either in South Africa or internationally, and others that are emerging and are untested. This section of the report outlines the key contextual elements that will guide the position of IWP in the South African water value chain.

Strengths

South Africa has high performing WSAs and water boards that could procure from IWPs in the short term. South Africa also has significant engineering capability in the private sector and access to international skills, and has demonstrated the ability to create the right market conditions as demonstrated through the REI4P programmes

Weaknesses

Many South African water institutions are weak and in financial stress, with customers with poor payment records. These are red flags that will deter investment that relies on these institutions as off-takers.

There is limited transaction advisory experience in water sector projects in South Africa, although this could be developed as additional projects are completed or through the inclusion of international experts.

Onerous procurement regulation significantly increases the costs of developing projects and increase the timelines for project by years. Water sector regulation also gives little certainty to investor about their right to operate the asset over a reasonable period of time.

Opportunities

Desalination and wastewater treatment in high functioning WSAs presents the strongest short- and medium-term opportunities for IWP. Work is already being done by the DBSA towards establishing a programme for wastewater treatment PPPs and should continue and be supported.

Threats

Political and institutional instability in the water sector generally and WSAs specifically pose the biggest threat the implementation of IWPs. This both threatens the business case for IWP and also makes navigating long regulatory processes more challenging, as they become vulnerable to changes in key role-players.

Regulation

Water is a tightly regulated sector, however, there are gaps in the legislation, which does not anticipate the emergence of new modes of production in the South African water sector, such as desalination and wastewater reuse. These gaps need to be clarified, particularly if seeking private sector investment in infrastructure in these modes of production, to provide investors with regulatory certainty.

Beyond water sector regulation, the regulation of public entities and municipalities seeking to do business with the state is severely slow and difficult to navigate, which significantly increase transaction costs. If the use of IWPs is to be encouraged, a means to reduce the complexity and timeframes for these processes need to be identified. Learnings from South Africa's IPP experience could add value here.

Few stakeholders see environmental regulation as a significant barrier to overcome for IWPs, noting that South Africa's environmental regulation is unlikely to raise cost so significantly the IWPs become unviable, as they have in other part of the world, such as desalination in Australia (KSI, 2021).

Regulatory Position

Gaps in the National Water Act relating to desalination and wastewater treatment need to be addressed to account for their development as a water resource to give certainty to private investors seeking to make investments in water production.

Regulation around water services committees and intermediaries should be reviewed to give investors certainty about the possibility of a return on investment and limit the ability of WSA to revoke permissions once investments have been made.

Work should be done to reduce the complexity and time delays of introducing external service mechanisms, supply chain management and PPPs in WSAs. This may involve the development of a specific IWP coordinated programme towards streamlining procurement.

Institutions

The water sector institutional landscape has a large number of players and strict regulation over their roles. Key players in that landscape including DWS, some water board and many water services authorities are currently in financial and organisational distress for various reasons including, weak governance, poor financial management and controls, bad debts, political instability and low engineering and project management capacity. These factors create an opportunity for independent water producers to play a role, bringing in management and technical capacity and being able to source finance.

However, they also create a significant challenge. Private investment decisions are based on the ability of customers to pay for the services provided by the infrastructure and there are limitations on the ability to pay throughout South Africa's water value chain, from end user households to water services authorities, to water boards, to DWS and the Water Trading Entity. The combination of poor financial standing of these institutions, and weak governance in many of them make investments in water infrastructure unappealing. To overcome this a coordinated programme with high levels of project management capacity, high levels of political buy-in and backed by financial guarantees, most likely from National Treasury would be required.

The institutional landscape, suggest that the opportunity for IWPs exists primarily in financially sound and institutionally stable water boards and water service authorities, or

to conglomerations of industry, where investors can be confident that their primary off-taker will be able to pay for the water provided.

While some water services authorities will have the capacity to develop their own supply augmentation schemes, including through IWPs, it is likely that many would need, and welcome technical assistance to do so.

Institutional position

IWP should be prioritised in the short term for those water sector institutions that are financially sound and institutionally stable that need to augment their water supply, particularly desalination and wastewater treatment.

Possibilities should be explored about developing a single off-takers for IWPs to simplify procurement processes, off-take agreements and the requirements for credit guarantees.

Clarity should be given about the restructuring of the National Water Resource Infrastructure Branch, and the agency it may become and the implications for the Water Trading Entity and TCTA. The NWRIA has the potential to be a single off-taker if established within a clear and certain framework and the financial challenges of the Water Trading Entity resolved.

Social

It is unlikely that there would be significant social rejection of introducing IWPs in Africa. Household attitudes appear amenable to private roles in water production and provision, and experiences suggests that socially challenging technologies

Given experience of introducing alternative technologies, particularly wastewater treatment for potable reuse, social acceptance challenges are likely to be able to be overcome through work to educate citizen about the safety of the technology.

A greater social challenge of IWP is the willingness and ability to pay of households for water which damages the investment case, potentially limiting IWP opportunities to economically strong areas of the country.

The subsequent sections of this chapter of the report outlines the two broad positions available pathways available for the introduction of IWP, as well as the potential options within these pathways that are available for the introduction of IWP in South Africa.

9.2 The broad pathways for IWP

There are two broad pathways that existing for the introduction of IWP in South Africa. These are the introduction of IWP within the existing legislative and institutional framework or amending the current legislative framework to allow for the introduction of IWP within the existing water value chain.

Amending the existing legislative framework will require Ministerial approval and compliance with the consultation and other existing processes to amend legislation. However, the introduction of IWP within the existing legislation framework may require the introduction of additional regulations to prevent unintended consequences.

The potential implications of these broad pathways are outlined in each of the options that are specified below.

9.3 Option 1: Conventional bulk production (ground and surface water)

Conventional bulk production IWPs would involve the ownership of water source and the associated bulk production infrastructure (treatment works and bulk pipelines) by the independent water producer. The IWP would also manage the operation and maintenance of the infrastructure and would assume the risk associate with this. These IWPs would require long term offtake agreements with its customers. It is likely that these IWP operations would take the form of a PPP, most likely under the PFMA and Regulation 16 (although potentially also under the MFMA). Under current legislation the IWP could not own the resource where from which they source their water.

Potential Impact

The potential impact of using IWPs for conventional bulk production will depend on the scale at which this will implemented. Smaller schemes will shorter delivery periods with impact being at a local level, as compared to larger regional schemes. The impact of this option is also moderated by the fact that it does not increase the resiliency of the system as supply options remain undiversified and the system remains vulnerable to droughts.

It should also be noted that most of the economically feasible sites in and around the major towns and development nodes in South Africa have been exploited. Therefore, any new development would require a higher cost than existing infrastructure and would be located further away from economic centres that are experiencing water security challenges.

Institutional complexity

Conventional bulk production (ground and surface water) has a layer of institutional complexity as IWP will essentially be performing the same function that TCTA, Water Boards, WSAs and some WUAs perform, essentially becoming competitors to these institutions. It is also likely that these IWP will need to directly link into the bulk network of these competitors, which risks creating institutional friction.

The introduction of another institution that duplicates the role of existing institutions also increases the overall costs of providing water services to the end consumer.

Regulatory complexity

IWPs operating in conventional bulk production spaces would need water use licences and would need to comply with the National Water Act. They would have limited control over the water resource which determines their ability to supply their customers.

Skills availability

Given the conventional nature of these projects, there are adequate private sector technical skills available for the development of these types of solutions in South Africa. International expertise could also be sourced internationally through existing multinational by the private sector if required.

There is a need to enhance contract management skills in some water services authorities to ensure that the long-term contracts can be correctly monitored and enforced.

9.4 Option 2: Desalination for bulk water production

IWPs would be the owner of the desalination infrastructure by the independent water producer. The IWP would also manage the operation and maintenance of the infrastructure and would assume the risk associate with this activity. These IWPs would

require long term offtake agreements with large public sector off-takers such as water boards, and WSAs. It is likely that these IWP operations would take the form of a PPP.

Potential Impact

IWP using desalination for bulk water production can have a significant impact in the areas in which they are needed. Potential sites that are being considered in South Africa include cities and large town where there are both economically strong municipalities and significant industrial customers.

IWP using desalination would be particularly effective in coastal areas that are prone to drought or are expected to experience reduced annual rainfall or increased surface water evaporation as a result of climate change. Climate change will particularly reduce rainfall at the coast in the Northern Cape, Western Cape and Eastern Cape, as well as parts of KwaZulu-Natal (Water Research Commission; South African Weather Service, 2017). Introducing IWP for desalination in these contexts can increasing water security and resilience to drought by diversifying the by diversifying the water mix.

Introducing IWP using desalination for bulk water production could also increase the availability of water in non-coastal areas thus increasing resiliency. Typically, these projects are expected to be large and would impact positively on the economy as industry and businesses are more secure about their water supply.

The energy intensive nature of desalination, particularly reverse osmosis, also presents cogeneration opportunities with electricity provision, enabling desalination alongside independent power production projects, particularly solar, wind and natural gas projects.

Institutional complexity

IWP using desalination would be simpler to implement as compared to Option 1 as there are currently no large institution that has been tasked with unlocking the desalination potential in the country. Whilst there have been several institutions that are considering the implementation of desalination opportunities, there has been limited uptake due to the costs and complexity associated with these projects.

In addition, the off-taker from the IWP is expected to be a Water Board or large WSA. Institutional complexity is also reduced as these institutions are empowered to execute on their mandates whilst being supported by the Independent Water Producer.

The institutional complexity could be increased by increasing the number of parties that are involved in the transaction (multiple WSAs or a WSA and industrial off-takers) and if the transaction results in reduced demand by a water service authority from its water board, reducing water board revenues.

Regulatory complexity

The regulatory complexity that will need to be overcome for the implementation of Option 2 are the elements of the MFMA and Municipal Systems Act outlined in the legal and regulatory section, and their associated regulations. These include the requirements for:

- Long term contracts;
- Adherence to Section 78 processes; and
- Adherence to any PPP regulations that may be triggered.

The National Water Act does not include the regulation of the treatment of seawater to be converted to potable water or for industrial purposes. Additional regulatory complexity

may be created by amendments to the National Water Act to address desalination. Site specific environmental regulatory complexity may also need to be considered.

Skills availability

There have been limited large scale desalination projects undertaken in South Africa, therefore the technical skills base is expected to be limited. However, there have been several examples of projects being completed internationally with smaller scale plants haven been built and operated for use by industry in Mossel Bay, Saldana Bay and Richards Bay. It is therefore expected that the South African skillset would have to be supplemented with experienced international resources.

There is a need to enhance contract management skills in some water services authorities to ensure that the long-term contracts can be correctly monitored and enforced.

9.5 Option 3: Wastewater treatment for reuse

Wastewater treatment IWPs in this context would involve the ownership of the treatment works infrastructure by the independent water producer and the distribution network to the customer. The IWP would also manage the operation and maintenance of the infrastructure and would assume the risk associated with this. These IWPs would require long term offtake agreements with off-takers most likely WSAs, but potentially water boards or industry.

IWP is this context would most likely be reliant on a WSA for this unless a large wastewater producer could be sourced. The IWP may need to take over management of WSA wastewater treatments plant to ensure effluent quality is suitable for potable water production. It is likely that these IWP operations would take the form of a PPP given the likelihood need to integrate into a municipal network unless a large industrial or commercial customer could be sourced.

Potential Impact

IWP has for wastewater treatment has significant potential impact in areas where:

- Reliable wastewater systems exist;
- End Users (households, industry of WSAs) are in relatively close proximity and are close to end-users (households, industry or reservoirs); and
- End Users are in a financially sound position.

There is particular potential for this option in coastal where downstream users need not be considered as effluent is discharged into the ocean, and the environmental requirements may not be as stringent for discharge in the ocean.

Introducing IWP for reuse can increasing water security and resilience to drought by diversifying the by diversifying the water mix. However, the impact of this is not as significant as Option 2 as wastewater produced under drought conditions is expected to decrease thereby reducing the volume available for production. There may be an additional limitation in the discharge of effluent from wastewater treatment works has to be returned to the river to maintain flowrates for downstream users and other environmental reasons.

However, introducing IWP for reuse would ensure that could also increase the availability of water in non-coastal areas thus increasing resiliency. Typically, these projects are

expected to be large and would impact positively on the economy as industry and businesses are more secure about their water supply.

Institutional complexity

There is institutional complexity associated with this option as WSAs are responsible for wastewater treatment works within the areas of jurisdiction. IWPs treating wastewater will be required to rely on water service authorities for input water at reliable quality levels. This means that the WSA need a functional and well maintained water and sewerage network as well as treatment works. This may prove challenging as 57% of works in South Africa are not well run according to the last Green Drop and the enforcement of wastewater regulations is unreliable (Kalebaila, Ncube, Swartz, Marais, & Lubbe, 2020).

It is also likely that IWPs operating in this context will trigger PPP processes in terms of the MFMA Regulations, particularly if treatment works need to be taken over and run by the IWP.

Other institutional challenges are expected to be similar to that of Option 2.

Regulatory complexity

The regulatory complexity that will need to be overcome for the implementation of Option 2 are the elements of the MFMA and Municipal Systems Act outlined in the legal and regulatory section, and their associated regulations. These include the requirements for:

- Long term contracts;
- Adherence to Section 78 processes; and
- Adherence to any PPP regulations that may be triggered.

Additional regulatory complexity may be created by amendments to the National Water Act and the need to maintain flow rates and ensure downstream user and the ecological reserve have sufficient water.

A further regulatory challenge is that SANS241 does not currently deal with water quality standards associated with wastewater treatment for potable use and regulation around this would need to be developed.

Skills availability

Private industry will draw on capacity in the South Africa and international engineering firms as evidenced by the City of Cape Town that is currently developing a project of this nature called the Faure New Water Scheme to produce 100 Ml/day. The private sector firms are expected to react to challenges with greater speed and agility than public sector institutions due to reduced compliance requirement in supply chain.

There is a need to enhance contract management skills in some water services authorities to ensure that the long-term contracts can be correctly monitored and enforced.

9.6 Option 4: Community management through water services committees

IWPs in this context would involve the contracting of an IWP by a water services committee in terms of Section 51 of the Water Services Act where WSAs are unable to provide the service. The IWP could build operate and maintain new water production infrastructure, likely groundwater abstraction and treatment, wastewater treatment or seawater desalination and would assume the risk associate with this. It could also

potentially manage, operate and maintain existing water infrastructure. These IWPs would likely be moderately sized and required medium term off-take agreements to generate a return on investment.

Potential Impact

IWPs operating on behalf of water services committees have the potential to address service failures by chronically dysfunctional water service authorities implement solutions that improve water security. This could improve access to water in South Africa and improve water local water infrastructure.

IWPs could have significant social impact in dysfunctional water service authorities through enabling water services committees. Secure water supply would improve economic and social outcomes for those served and IWPs, could employ local people to assist with maintaining infrastructure.

Communities are unlikely to object to private provision with public provision is dysfunctional, although this could be contingent on the bill collection mechanisms put in place.

Institutional complexity

Water services committees required the approval of the Minister of Water and Sanitation and the water service authority, and consultation with the local community. Local politics may pose a significant challenge to getting approvals from the local water service authority to form a water services committee.

It is possible that the water services committee would seek to operate the water services authority's infrastructure in order to provide water to its designated area, which may pose challenges and require significant investment by the water services committee should the infrastructure be dysfunctional.

Regulatory complexity

The regulatory complexity lies in the requirements of the minister to consult the local community and the water services authority, the minister for local government and the province. This is potentially a long process, with few guarantees of establishing a water services committee.

The other regulatory barrier is the Minister's ability to disestablish water services at short notice, at which points the assets of the committee vest in the Minister.

Skills availability

Significant technical skills in the private sector exist to deliver water at this scale in South Africa.

Water services committees may need capacitation in order to manage IWP contracts.

9.7 Option 5: Emerging innovations

IWPs using emerging innovation will be structured in a way that best responds to the technology. They could supply potentially at any scale, which any type of off-taker. If that off-taker is a public institution there is a high possibility that the IWP will need to be procured through an unsolicited bid.

Potential Impact

The potential impact of emerging technologies varies greatly in terms of both timelines and scale.

Supporting emerging innovations align with national objectives around development of innovation and technology development as well as diversification of water supply.

Institutional complexity

The institutional complexity of emerging innovations lies primarily in the perceptions of risk amongst decision makers and accountable officials in the relevant water sector institutions. These decision makers face significant risks should innovations that they procure fail. IWPs can avoid this by taking on risk, including financing infrastructure required to connect their technologies to appropriate point in the water systems, and asking the off-take to only pay for water received. For example, a proposal was made to the City of Cape Town to supply the city during the 2015-2018 drought with water from icebergs, this would require additional infrastructure to be built to allow water to be supplied into the City of Cape Town water system. Transferring the cost of building and maintaining this infrastructure to the IWP ameliorate this risk to officials.

Regulatory complexity

If an innovation is marketed as supplying water to a water service authority through an IWP it is likely that that innovation will encounter the MFMA SCM regulation regarding unsolicited bids, which is a slow process and contingent on the satisfying the concerns of municipal accounting officer. In some instance they may also trigger PPP regulations.

Other regulatory concerns are likely to be innovation specific and related to the quality of water produces and the environmental impact of the production process.

Skills availability

The availability of skills to develop innovation from a concept into viable, scalable solutions is a challenge in South Africa, however innovators linking with suitable partners, such as established engineering firms offers a means to overcome this and implement innovations at scale.

9.8 Managing the funding risk

It is expected that the introduction of IWP in a South African context should be structured in a manner that is able to attract private sector investment. The factors that will impact on securing this investment are further discussed below.

The customer

An investor will assess the credibility of the customer of the IWP when making an investment. The customers that have been identified for IWP include:

- WSAs and Water Boards;
- Industrial and Agricultural Consumers; and
- Communities and households.

It is likely that only the large WSAs and Water Boards that serve areas that have strong economic bases would attract investment. Investment in the remaining institutions would require guarantees to be provided by National Treasury.

IWPs serving communities and households may find more difficult to attract investment and this would depend on the willingness of communities to pay for the services provided and the ability of the IWP to collect revenue.

The price point

The is a view that the current water tariffs may not fully reflect the cost of water produced in South Africa and IWP producing water at a higher price than existing solutions may result in the higher prices being challenged. Conversely, conversations with key stakeholders suggest that the low price of water may result in investors being reluctant to invest in the sector. (KSI, 2021).

Site specific costs are also expected to have a significant impact on the cost of water production. The costs of producing the water and transporting the water to the identified customer would need to be carefully evaluated before an investment decision can be made.

Communities scale interventions may also result in a higher unit cost of water to the customer, thereby making them more expensive. Costs could be reduced by aggregating several smaller schemes and customers together thereby reducing the unit cost of water and making the investment more robust.

Contractual certainty

Private funding will depend on the ability of the water services committee to sign offtake agreements that will last long enough for IWPs and their funders to recover their investment. For small scale plant this could be achieved within a few years, but larger plants will require bigger investments and longer offtake agreement. An investor would expect that the contract entered into by the IWP will honoured for the duration of the contract.

This is seen to be a particularly challenging area for an investor in a project that is undertaking by a Water Services Committee (Option 4). It is the right of the Minster to disestablish a water services committees if he or she is convinced that the water services authority can provide the water service.

Declining municipal revenue

It may be possible to attract private sector investment if IWP produces water to be sold to industrial or commercial agricultural customers. However, this could result in a decline on revenue for WSAs or WUAs and would have to be carefully considered.

An intervention that redirects revenue from a municipal customer (households and industrial) towards IWP could have a significant negative impact on the finances of the WSA. This would further impact on the services provided by the WSAs in the provision of water services (particularly indigent households) and other social services that are offered and cross subsidized from water and sanitation tariffs.

Social considerations

It is unlikely that there would be significant social rejection of introducing IWPs in Africa. Household attitudes appear amenable to private roles in water production and provision, and experiences suggests that socially challenging technologies

Given the relatively infancy of the IWP concept, it may be possible to use the opportunity to position IWP in manner that addresses some of the inherent challenges in the water sector whilst still protecting the rights to access of water by users, and unaffordable tariffs.

10. CONCLUSION AND WAY FORWARD

This section of the report outlines the conclusion of this paper and the proposed way forward towards the implementation of IWP in South Africa.

The opportunity for IWP exists in South Africa, particularly around desalination, wastewater reuse, and small-scale production for industry. However, for IWP to make a contribution to addressing South Africa's water challenges, of adequate skills, finance, and water resilience significant work is likely to be needed to be done to address areas of institutional weakness in the water sector. A small number of water boards and WSAs could currently be reliable customers for IWPs, the majority of water sector institutions are investment partners.

IWP could be implemented either by focusing on those water boards and WSAs that:

- Have strong credit ratings;
- Are developing programmes associated with specific type of projects, such as seawater desalination or wastewater reuse; and
- Streamlining process around procuring these and bringing them online.

An alternative approach would be to develop a single off-taker with sovereign guarantees to purchase water on behalf of Water Boards and WSAs from IWP at scale, for distribution into the networks and free up water upstream in the value chain. This would require institutional restructuring at a national level. However, it may be possible to incorporate this into the development of the NWRIA.

Industry will develop its own water supply to ensure security of supply security in the appropriate conditions. This additional supply and possible redundancy is useful for building resilience in the broader water sector and the national economy. However, it does pose threats to municipal revenue. Restrictions and uncertainties created in the regulations around water sector intermediaries are the biggest barrier to industry doing this and should be improved. However, these activities should not be subsidised through public funds.

10.1 Key questions to be addressed

The table below further summarises the emerging position of IWP and identifies key questions that will need to be considered in confirming the position of IWP in South Africa. These will be explored with stakeholders during the proposed workshop and further engagements.

Table 10: Emerging positions and key questions

Emerging position	Key questions to be addressed
Position 1: IWP means the production of water by a private company, for own use or sale to and off-taker. It is not useful to narrow this definition, except for programmatic purposes, and in the programming process to introduce IWP at the identified areas in the South African water value chain.	Is this an appropriate definition? Is narrowing the definition per program a useful way to apply IWP in South Africa?
Position 2: In most instances, the model for IWPs providing water to government agencies, is likely to be a PPP arrangement, and programmes should be established in the appropriate branches of government to enable these arrangements at the various points in the water value chain.	Are PPPs the most viable approach to IWP in South Africa? Where should programmes to enable IWPs be located organisationally?
Position 3:	Should we apply a differentiated programmatic approach?

Emerging position	Key questions to be addressed
Pursuing IWP would require different programmatic approaches depending on scale and the point in the water value chain. This includes a programme toward: • The procurement IWPs for resource development and bulk production for appropriate water boards and WSAs. • Enabling WSA to appoint IWPs to treat wastewater for reuse. • Allowing IWPs to pilot and scale emerging technologies and strategies. • Enabling community self-provision through water committees and IWPs, using section 51 of the Water Services Act	Are these the appropriate programmatic approaches to take?
Position 4: An economic regulator would be ideal, and assist IWPs and build confidence for IWP investment, however it needs to be highly capacitated, and be backed by a long track record of good data, which may not yet exist. The development of the track data should be a sector priority towards the establishment of a regulator.	Is there a need for a regulator? What should be considered for the introduction of a regulator? This can include the need for independence, contractual obligations and risks.
Position 5: Emerging Innovations should be further explored for IWP with proof of concept required before being scaled	Can these innovations provide opportunity for IWP in future? How can this opportunity be unlocked?
Position 6: The appropriate form of regulation of the of independent water production should be explored, whether this should fall under the National Water Act and the Department of Water and Sanitation, or the Department of Trade and Industry, or the Department of Environmental Affairs. This should also consider whither this regulation should be determined technology or resource used.	Who should regulate IWPs? Should regulation of IWPs be contingent on the technology used? Should regulation of IWPs be contingent on the water source used?

10.2 Towards the implementation of IWP in South Africa

Based on the emerging position of IWP, the table below outlines the emerging framework for the way forward to enable the introduction of IWP in South Africa. It outlines the initial steps that would need to be taken and the key principles that need to be considered within each of the identified steps.

Table 11: Emerging framework for implementation

Steps	Key principles
Investigate regulatory implications for the preferred programmes	The principle of this step is to establish which is the correct regulatory domain for IWP the Department of Water Affair and the National Water Act, the Department of Environmental Affair and the National Environmental Management Act of the Department of Trade and Industry.
Establish a regulator	The establishment of the regulator should be done in a way that ensures alignment with current processes to establish a water

Steps	Key principles
	regulator beyond just IWP and considers the wider institutional framework. The principles of the regulator are to: • Ensure credible quality control of water being used and entering the South African Water System. • Ensure low negative impact on municipal business models to ensure that the introduction of IWP does harm democratic local government. • Ensure IWP has limited environmental impacts that might threaten South African water ecosystems.
Establish IWP Procurement Programmes	**Process** The process principles of the establishment of an IWP Procurement Programmes are: • To ensure a proven market for independent water production so that efforts to establish IWP opportunities is not wasted. • To establish a credible, reliable and fair framework for public procurement from independent water producers to give appropriate confidence in the projects. **Commercial** The commercial principles of the programme are: • To ensure credible off-takers of water produced by IWP to provide security and credibility for the required investment. • To establish bankability of IWP projects to attract the required investment. • To support producers and off-takers to prepare transactions in a complex governance framework.
Investigate emerging innovations for water production	The principle of this process is to ensure technologies used are proven before use to maintain reliable water production and water quality, while preventing investment losses.
Investigate the further use of Section 51 of the Water Services Act to enable independent community water provision in a sustainable way	This process should enable communities to provide their own water and sanitation, through water committee, where municipal service provision fails, and allow them to choose the manner in which they do so but ensuring that it is done in a sustainable way.

10.3 Feedback received from the workshop

Feedback received from the workshop convened on 08 March 2022 to key stakeholders are presented in this section of the report. The feedback has been consolidated around key themes that were raised during the discussion.

Production of water

It was noted that water is not typically produced but is rather treated to an applicable standard for a particular use. However, this is not seen to materially affect IWP as the assumption is that the use of the word ‘production’ assumes that the water is being treated and sold to a customer for a particular use.

Revenue collection

It was noted that sustainable revenue collection and management in the water sector is a significant challenge with the disestablishment of Sedibeng Water due to the non-payment by water users. The non-recovery of revenue would be a significant risk to the investment being made in IWP and should be carefully assessed prior to implementation.

It may therefore be prudent to establish IWP in areas that are economically stronger and are able to recover revenue for the provision of water services. It is unlikely, at this stage, that revenue collection from the customers of WSAs would be a service provided by IWP.

Public private partnership

The establishment of IWP may require a long term contract as it is unlikely to secure a large investment in infrastructure without this being in place. This would effectively be considered a PPP. However, it was noted that this process can be challenging and that there are instances in which Water Boards are struggling to secure shorter term contracts with WSAs.

Location of IWP in the value chain

It was noted that desalination may be a possible opportunity to consider the introduction of IWP. This is currently not regulated by the National Water Act and will not be negatively impacted by the drought.

It was also noted that a large proportion of wastewater treatment works are dysfunctional and that this could also be an opportunity for IWP. These could be implemented through the use of long-term contracts. Sea outfalls may also provide a viable option.

It was also noted that there are some institutions that are providing the services as those envisaged by IWP. Duplication of institutions should be avoided as this will increase the cost to the end user.

Emerging innovations

Fog harvesting is a potential opportunity for IWP. This is not currently regulated by the National Water Act and can be harvested. However, there may be a regulatory requirement in precipitation in an area may be negatively affected.

Rural schemes

There is a need to address the provision of water services in rural areas. The majority of schemes contain indigent communities that are unable to contribute to municipal income. There is a concern that utilizing IWP in this area could impact negatively on these communities' ability to access water.

It was also noted that the African Water Facility together with the WRC have supported the demonstration to operationalise community-led Multiple Use water Services (MUS) in South Africa. This project facilitated decision making by communities and provided technical and institutional advice and capacity development. There may be a link between MUS and IWP depending on the nature of the involvement of the public sector.

Way forward

It was noted that further discussions around the introduction of IWP were required and that the study was an excellent starting point. It may also require allowing private industry to produce water for their own needs, as well as other customers as a pilot study before implementation at a broader scale.

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12. INTERNATIONAL LITERATURE REVIEW

12.1 What is independent water production and what is an independent water producer?

For the purposes of this study independent water production is understood as the involvement of independent entities participating in the delivery of water at any point in the value chain. This can include resource development, treatment, distribution and wastewater collection, treatment and disposal.

An independent water producer is an entity, which is not a publicly owned water utility, but which owns and/or operates facilities to produce or treat water for sale to utilities, central government buyers, municipalities and end users.

Independent water producers take several forms. The most common implementation model is a form of public private partnership, where a private company will take over the management of a treatment and distribution water system. The extent of the responsibility can vary from just operating the service to building and maintaining the assets in the system as well as operating the service, and potentially training public utilities and transferring operations to them at some point in the future. This type of independent production typically happens at the large municipal or city scale.

At a smaller town or village scale an independently owned and operated water production system is not uncommon, particularly in the United States (Perard, 2009). It is also not uncommon for industry to extract its own raw water from groundwater or the ocean and treat it for its own use. In these cases, they often contract the treatment process to a third party. Both might be considered independent water producers.

An Independent Water and Power Producer (IWPP) is similar to an independent water producer but with a unified process to also produce electricity. Water and power are a common combination because water treatment is an energy intensive process, so using excess energy created in power production creates efficiencies in the treatment of water, particularly in coastal and water scarce areas for desalination.

12.2 Overview

Independent water production has been a feature of the provision of urban water services for nearly 250 years, since concessions for water distribution were awarded in Paris from the aftermath of the French Revolution (Perard, 2009). In the time since, water utilities have emerged independently in many cities and towns or been privatised, particularly in the United States. Similarly, during that period, water utilities have also been established by governments and private systems nationalised or municipalised. Trends towards privatisation and independent production or municipalisation or public productions have tended to follow public management trends, with privatisation and the introduction of public private partnerships common from the late 1980s to early 2000s (Lobina, 2015), and trend towards municipalisation increasing since then. Typically, these trends start with developing countries following suit in later stages of the trend. The choice between public and private is not fixed, it has been dynamic over long periods of time, in terms of both ownership and management of water supply (Perard, 2009).

In France operation of water systems has been private since creation, in 1782. Veolia won its first municipal contract in 1853. Private or public water provision is not a once and for all decision. Mexico has a long history of water concessions, with Pueble, Saltillo and Monterrey awarding concessions in 1855 1899 and 1904. The government took over supply in the 1940s and, was in the 1990s considering re-introducing private provision (Perard, 2009). In London, private water companies were nationalised in 1903 and grouped under the single Metropolitan Water Board, which was then privatised in 1989 (Perard, 2009). In the US most water companies started as private enterprises and were gradually switched to public ownership through the 19th century. As of 2005 about 50%

of waterworks in the US are privately owned, down from 58% in the late 80, but up from 44% in the 1970s. Privately owned water providers have been particularly important in small communities in the US (Perard, 2009).

In 2005, it was estimated that $450 billion of revenue was generated by public and private water utilities. In 2006 it was estimated that $17 trillion would be required to replace water infrastructure globally over the following 20 years (Perard, 2009), suggesting significant scope for the private sector to be interested in providing water. Yet independent water producers supply over 50% of the population in only 5 countries, Chile, the Czech Republic, France, Malaysia and England. It is low to non-existent in 17 out of 30 OECD countries. The experience of delegation of water supply to the private sector varies widely from country to country, even among OECD countries (Perard, 2009).

Forms of private sector players operating in the water and sanitation sector are diverse and fragmented, including international operators, local and regional actors, private sector firms whose core activity is not water, including large users such as beverage and mining firms, financiers and JVs and public private partnership. In a number of countries small scale private providers have helped alleviate deficiencies in service provision, where supply has failed to keep pace with rapid population growth and urban migration. Increasingly independent participation risk-sharing arrangements are very context specific, covering divestiture (full privatisation of the network and its assets) to non-financial forms of participation, through the involvement of community-based organisations (OECD, 2009).

The recent global trend seems to be towards re-municipalisation in water and wastewater services, and away from privatisation. Between 2000 and 2015 there were 235 cases of re-municipalisation in 37 countries, covering a population of over 100 million (Lobina, 2015). Cases are more concentrated in high-income countries, where 184 re-municipalisations took place, with 51 in low and middle-income countries. France, perhaps the spiritual home of private water supply, and home of international water conglomerates Suez and Veolia, leads with 94, followed by the US with 58 cases. Other notable cases include Accra, in Ghana, Bogota in Columbia, Buenos Aires in Argentina, Kuala Lumpur in Malaysia and Dar-es-Salaam in Tanzania (Lobina, 2015).

Unlike other network and utility services such as electricity, telecoms and waste-removal, for which trends towards privatisation have been more consistent, water provision has consistently swung back and forth between public and private provision (Perard, 2009).

This is most likely because water is a basic human right, meaning private failure to deliver on their contracted obligations creates a public responsibility to correct it, and if the cost of providing water is higher than the prices that many users can afford to pay, the business case for independent water production becomes unviable financially.

Water provision, as a networked service is also more capital intense than other utilities, requiring longer term commitments for returns to be realised. This raises the risks of political and policy changes impact on returns. The complexity and evolution of contracting arrangements for water services has also played a role in the failure of private water production in some cases, providing room for significant learning and improvement of these arrangements but often at significant cost.

Meta-studies (studies of collections of studies) and econometric research on private or public water provision suggest that private or public provision in and of it itself has no significant effect on the quality or efficiency of water services (Perard, 2009). Success in the provision of water services, whether public or private depends on other factors, such as quality of governance, institutional and regulatory frameworks, finance, political acceptability and an ethical and public-spirited approach by all parties to the provision of the service (OECD, 2009; Perard, 2009). This means that the decision to provide water

services publicly or privately should not come down to the perceived efficiencies or inefficiencies of one approach or the other, but rather about the supporting arrangements for implementing one or the other (OECD, 2009).

12.3 The typical approaches to independent water provision

Public Private Partnerships

Overwhelmingly the most common form of independent water production takes is public-private partnerships (PPPs). Typical forms of public-private partnership include:

Service contracts

Where individual aspects of infrastructure provision such as meter reading, pumping station operation and solid waste transport are contracted out to a private contractor for a specified period.

Management contracts

Where for a fee, a private management team runs a public operation, wholly or in part, for a short period, often 5 years. The fee is often performance based, or a profit share. These short-term contracts do not link investment to service provision. They focus on improving service to existing customers rather than reaching new underserved customers, such as the urban poor.

Lease contracts

Where typically, full control is given to the private operator over the supplying of services and recovering of tariffs, in exchange for payment for the use of the fixed assets, which remains the responsibly of the public agency. Small improvements to the assets and service are the responsibility of the operator, but major investment remain the responsibility of the government. Leases are usually up to 15 years.

Build Operate Transfer Contracts (BOT)

These are typically used for specific, large, one-off investments in water production, wastewater treatment, and sanitary landfills. Contracts typically last up to 30 years, the length depending on the size of the investment that has to be amortised. The operator sells or treats guaranteed amounts of water of waste in exchange for guaranteed prices.

Concessions

These contracts transfer all responsibility for capital investment, operations and maintenance to a private operator. The fixed assets remain the property of government and the operator pays a fee to use them. These contracts typically last about 25 years.

Divestiture

In which existing operations and assets are sold to the private sector, with a time limited licence. The Chilean example is a rare case of this at a national scale (Franceys & Weitz, 2003).

The analysis phase of the project will outline in more detail where each of these have been applied, for how long, under what fee structure and how successfully.

Partners

Independent partners for PPPs also vary, they can include:

- Micro-enterprises (vendors);
- Not-for-profit service (NGOs) e.g. Salabh international providing showers, soap and storage in India for a small fee. Government paid for construction of the facilities, and user charge cover the operating costs. 4 000 toilets block have been developed in India with sanitation services being delivered to 10 million

people. Informal private sector supply of water sanitation also vibrantly delivered, but susceptible to criminal gangs taking control and profiteering. The result is that prices are often between 10 and 20 times higher. This suggests that there is a "willingness to pay", though the power dynamic of willingness to pay in an extortionate arrangement is poor;

- National service contractor; and
- International private operators, such as Suez and Veolia. (Franceys & Weitz, 2003).

The international experience of PPPs has led to significant learning about how to approach partnering for successful delivery of the service being provided. Key lessons include:

- The partnership aspect is important, PPPs should not be a code for privatisation, partners need to decide together and act together. The partnership also needs to include participatory development and to benefit the underserviced;
- Devolving to a private operator introduces both additional economic and environmental regulation, so public bodies need to ensure the capacity is in place to do this. The public provider, therefore, is still required to achieve internal reforms and a functional regulator in place (Franceys & Weitz, 2003);
- Success depends on the strength of financial projections in the business case, as risk ultimately remains contingent on the public sector should the partnership fail. (Johnson, 2005);
- High standards of transparency from the public sector about the state of infrastructure and revenue is important for overcoming any information asymmetries that private partner may suffer from entering a partnership (OECD, 2009);
- High standards of ethic amongst both private and public partners are essential to realise any potential efficiencies from entering into a PPP (OECD, 2009);
- There are benefits to the public when private sector (for profit or not for profit) has space to be creative and innovative, particularly in engaging with underserved communities (Franceys & Weitz, 2003); and
- It is necessary to have cost-reflective tariffs for PPPs to succeed (Franceys & Weitz, 2003).

12.4 International experience with Independent Water Production

The Middle East and North Africa (MENA) region is the driest region in the world with renewable water resources of less than 1 000 m^3/person/year as defined by the World Health Organisation (WHO). The trend for implementing cogeneration (Power and Water) projects in the region is that these are project financed by an Independent Water and Power Producer (IWPP). The developer owns a portion of the stakes and partners a public entity in a company set up specifically for the purpose of project implementation and operation. (Martinez Beltran & Koo-Oshima, 2004)

The IWPP model was first implemented by Abu Dhabi for the Taweela A2 project in 1998. Since then, the model has been adopted with certain variations by other countries in the Middle Eastern region, including Qatar Bahrain, Saudi Arabia, Kuwait and Dubai (Simpson & Michelis, 2014)

United Arab Emirates

In 2016, the United Arab Emirates assigned specific water development competencies to the Ministry of Energy. This resulted in the implementation of a 22 MIGD desalination plant to be located in the Emirate of Ras Al Khaimah and a 45 MIGD facility in the Emirate of Umm Al Quwain. These projects are both cogeneration power and water production facilities that are entirely privately financed. (Latham & Watkins, 2016)

The UAE established the Ministry of Electricity and Water in 1972, later merging it with the Ministry of Oil and Mineral Resources in 2004 to form the MOE. The MOE was restructured in 2014, and established two departments that oversee the water sector: (Latham & Watkins, 2016)

1. Electricity and desalinated water department, which primarily proposes policies and legislation relating to the desalinated water sector; and
2. Regulation and control department, which, among other things, regulates and licenses desalinated water production and distribution facilities in those Emirates where Federal Electricity and Water Authority (FEWA) provides water services.

Although the MOE is a federal government entity, in practice its efforts are focused on assisting FEWA with developing water supplies in the Northern Emirates.

Abu Dhabi

Independent water and power producers (IWPPs) are major players in the Abu Dhabi water and electricity sector and as of 2013 account for nearly all of the total generation and desalination capacity in the sector. IWPPs sell their capacity and output to the Abu Dhabi Water and Electricity Company (ADWEC), the single buyer, under long-term power and water purchase agreements (PWPAs). These PWPAs usually have a term of 20 years from the commencement of the commercial operation date of these production companies. Each IWPP in the sector is required by law to be licensed by the Bureau to carry out either electricity generation, water desalination or both in co-generation facilities. (Regulation & Supervision Bureau, n.d.)

The diagram below provides an indication of the typical contractual agreement for an IWPP (Regulation & Supervision Bureau, n.d.)

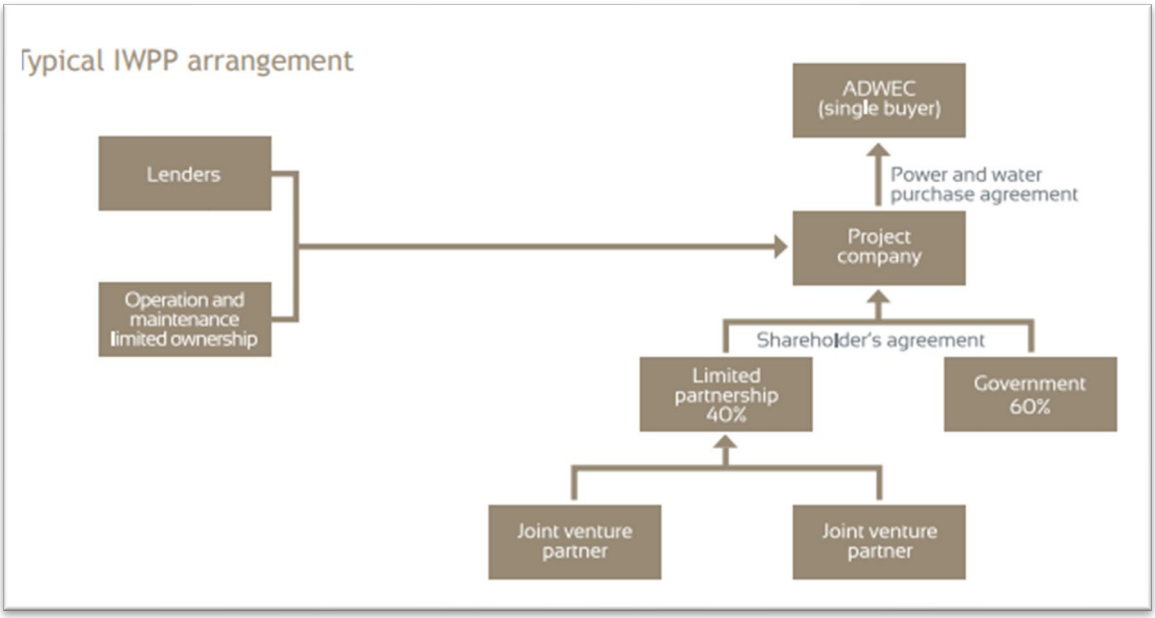

Figure 4: Typical IWPP arrangement in Abu Dhabi

The structure above results in the IWPP a low-risk transaction by allocating respective risks to the best party to manage the risks.

Abu Dhabi Water and Electricity Authority

Abu Dhabi established the Abu Dhabi Water and Electricity Authority (ADWEA) and its own regulation and supervision bureau (AD-RSB) in 1998. ADWEA's primary responsibility is to develop power and water supplies for the Emirate of Abu Dhabi. All new water production capacity should, insofar as possible, be designed, built, financed, owned and operated through the utilization of private sector funds (domestic or foreign). (Latham & Watkins, 2016)

ADWEA provides support for independent water and power projects in three keyways: (Latham & Watkins, 2016)

1. Can enter into binding commitments with the private sector regarding the funding of public sector participation in such projects (including providing support for ADWEC's payment obligations under any water purchase agreement);
2. Leases or procures the lease of land the Government of Abu Dhabi owns, for the implementation of such projects and related usage rights; and
3. Provides assistance (including liaising with governmental authorities) with the procurement of governmental consents and permits required for implementing such project.

Abu Dhabi Water and Electricity Company

IWP cannot, unless exempt, sell water production capacity or output to any person or entity other than the Abu Dhabi Water and Electricity Company (ADWEC).

Dubai

Dubai established the Dubai Water and Electricity Authority (DEWA) in 1992 and its own regulation and supervision bureau (DS-RSB) in 2010 (Latham & Watkins, 2016).

Dubai Water and Electricity Authority

DEWA's primary responsibility regarding the water sector is to develop, own, operate and maintain water desalination plants and water distribution networks in Dubai. To support those responsibilities, DEWA is: (Latham & Watkins, 2016)

- Authorized to purchase water from third parties;
- Develop water desalination plants solely or in partnership with third parties; purchase and sell fuel to those entities licensed to produce water;
- Invest and borrow funds with or without guarantee (subject to the Ruler's prior approval); and
- Grant usufruct or other rights relating to land associated with water production facilities.

DEWA issued a Request for Proposal (RFP) for the Hassyan Sea Water Reverse Water Reverse Osmosis Plant using the IWP model and invited interested parties with experience in building and operating similar projects to submit proposals by 03 August 2020 (Energy Review, 2020). The resulting submissions resulted in the project achieving a new world record for the lowest water levelised tariff of 0.277 US$ per cubic metre

(R4.23/m^3)[2] for the 120 million gallons per day facility (Approximately 454 Ml/day) (Smart Water Magazine, 2020). The project is expected to commence production in 2024.

Australia

The Australian experience of attempting to repeat the co-generation of water and energy seen in the Middle East has had mixed success. Severe low rainfall in the period 2000-2010 encouraged a number of cities in Australia to establish desalination plants. These cities included Queensland, Perth and Adelaide. These were often linked to renewable energy plants, particularly wind energy. Similarly, solar PV plants are used to power desalination for smaller scale remote communities. The most successful of the city scale plants is likely the Perth Seawater Desalination Plant which is a 130 ML per day plant operating at close to capacity and supplying about 17% of Perth's metropolitan regions. It is powered by an 80MW wind farm and consumes 180 GWh/year, with the surplus of the farms 270GWh/year capacity contributing to the general power grid.

Other desalination projects at the city scale have been less successful, with most operating at minimum capacity, except at times of drought. Most are operated in PPP arrangement with Australian subsidiaries of international water companies, including Veolia and Suez.

United States

Private water companies have existed in the United States for more than 200 years and number in the thousands today. In the United States about 1 in 6 Americans gets drinking water from privately owned water systems (Moore A. , 2003). These privately owned systems serve more than 73 million Americans. Outside of privately owned systems, roughly 1 out of every 25 communities in the rest of the nation has a publicly owned but privately operated water utility. (Moore A. , 2003)

Data from Public Works Financing shows that 5 391 private water contracts came up for renewal from 2000-2015 and 97 percent were renewed within the industry. According to the National Association of Water Companies (NAWC), more than 2 000 facilities operate in public-private partnership contract arrangements. Interest in privatizing public water services is an outgrowth of political forces and public policies favouring privatization of public services generally, and water resources specifically (Micheal, 2020). A growing number of contracts to privatize public water services is an indicator that privatization has become increasingly attractive to many public water institutions. States have enabled this by enacting statutes authorizing municipalities and other public entities to enter into contracts with private entities to supply water to the public.

However, there has also been a trend towards re-municipalisation in the US. From 2007 to 2013, the population served by privately owned community water systems fell by 7 million, whilst the population served by municipal government grew by 17 million (Grant, 2015). Local governments are expanding services and buying private systems, which occurs with growth in cities, as they consolidate systems in newly incorporated areas. Between 2000 and 2015 major water companies lost 169 contracts to municipalisation or nearly 15% of all private water contracts in the United States. Re-municipalisation happens through contract expiry or termination, sometimes for cause (failure to fulfil contract) sometimes for convenience. Often a termination settlement is negotiated.

The leading reasons for re-municipalisation in the US include:

- Saving money, cutting costs by an average of 21 percent between 2007 and 2010. Cases include:

[2] Based on an exchange rate of 1 US$ = R15.26

    - Coeburn Virginia, where the water contract with Veolia cost 96% of the town's budget and re-municipalisation cut costs by 28%; and
    - Fairfield and Suisun, California, cancelled a 30-year contract with United Water. This resulted in costs being reduced by 7% in the first year and a further 10% to 15% reduction in costs expected in subsequent years. Contractors had struggled to maintain adequate staffing and management, with five different plant managers and a vacant maintenance manager position.
- Improving service, particularly customer service and maintenance. Cases include:
    - Cameron, Texas, which voted to cancel its contract with Severn Trent, after 4 years. The contract had intended to cut cost and improve service delivery, through better staff training and system upkeep. However, performance dropped, particularly water quality, which began to require boiling before drinking. Cameron paid $64 000 to terminate the contract early.
- Public control to better manage water and public resources, such as coordinating city infrastructure management maintenance times, and the ability to share resources between city departments. Cases include:
    - Cave Creek, Arizona, 2008, privately owned since inception, but saw intermittent outages and system maintenance declining (Grant, 2015).

Atlanta, Georgia

In January 1999, the city of Atlanta, Georgia, entered into a 20-year contract with United Water Resources Inc. to run its drinking water system, driven by a lack of investment and large population growth (National Research Council, 2002). The city had reached a situation where it was losing $50 million a year, by meeting its water provision obligations, to a growing population with dilapidated infrastructure. It was also struggling to meet federal environmental standards and faced lawsuits from the federal government (Ohemeng & Grant, 2011). Consultant were hired to assess the water and wastewater operating options and recommend a cost saving approach. The option chosen prioritised solving a fiscal crisis rather than dealing with water supply or quality issues caused by the dilapidated infrastructure, through handing over operations and billing to United Water, while retaining the responsibility for capital water planning (Ohemeng & Grant, 2011).

In 2003, because hundreds of residents had complained of brown water and poor service delivery since the city agreed to the privatization contract, a lack of promised capital investment and failure to generate cost savings, Atlanta terminated its contract with United Water (Ohemeng & Grant, 2011). At the time, this was the nation's largest public-private partnership contract but Mayor Shirley Franklin, who took office after the deal was signed, cancelled the contract.

Atlanta Georgia has found itself in a water crisis due to legal and political institutions' accommodation of consumer demand for both water and energy produced by a growing population particularly in the sprawling Atlanta metropolitan area. These users include:

- Recreational users of water;
- Agricultural irrigators;
- Power generators; and
- Industries like pulp and paper mills, textiles, chemical manufacturing facilities, and the mining industry.

Carlsbad, California

The City of Carlsbad, California, opened the Claude 'Bud' Lewis Carlsbad Desalination Plant in 2015. It is owned by Aberdeen Standard Investments, a UK-based asset management company and was developed and is managed by Poseidon Water, a private firm. It desalinates and treats cooling water from the adjacent Encina Power Plant which Encina abstracts from the ocean, using reverse osmosis combined with other filtration and treatment processes, and supplies the San Diego County Water Authority (SDCWA). It produces 189 Ml/day at a cost of about $1.86 per cubic metre, including some capital repayments (Advisian Working Group, 2021). It cost $1 billion to build and provides about 7% of the required water for the San Diego region.

The project was financed through raising bonds, which were poorly rated by the Fitch, receiving the lowest investment grade rating (Barringer, 2013). It was developed under a 30-year long term, fixed price water purchase contract with 9 public water agencies in San Diego (Water Technology, 2021).

The plant has faced a number of challenges, including a lawsuit against SDCWA, largely around environmental concerns, including increased salinity of water offshore, concern for a nearby estuary and carbon intensity of the water production due to energy requirements. Plans for carbon offset and stewardship of the estuary, however, have been put in place (Water Technology, 2021).

Despite being relatively early in its operating life, the plant is largely successful, in part because of prevailing drought conditions in southern California making desalination a comparatively cheap source of water.

Chile

Chile has entirely privatised the provision of water and sanitation services. Chile is known as a water privatization success story due to its high coverage of drinking water and sanitation under a fully privatized system. (Civicus, 2020)

The privatisation of water sources in Chile dates back to the Pinochet dictatorship of 1973 to 1990. The 1980 Constitution enshrined the private ownership of water. This was maintained, and even deepened, following the democratic transition, since sanitation was also privatised. The privatisation process of sanitation began in 1998, under the administration led by Eduardo Frei Ruiz-Tagle, a Christian Democrat politician. However, people in Chile pay the highest rates in Latin America for drinking water, which is owned by large transnational corporations. Overall, the Suez group, Aguas de Barcelona, Marubeni and the Ontario teachers' pension fund administrator from Canada control 90 per cent of the drinking water supply (Civicus, 2020).

Despite being privatised, the municipal system subsidises water to the poor, and 99.8% of the population have pipe water to their premises, and 96% have improved sanitation coverage, with at least 78% of this being waterborne. The subsidies are means tested, with the municipality paying a portion of the water bill for households that qualify. The service quality is high, and significant investment is being made in the treatment of wastewater, with the goal of treating 100% of wastewater. Water losses within the network is approximately 34% (Ferro & Mercadier, 2016) whilst average per capita consumption exceed 190 litres per person per day.

The 1980 Chilean Constitution states that the rights of individuals over water, recognised or constituted in accordance with the law, grants their bearers ownership over it. In 1981, the Water Code established that water is a national good for public use but also an economic good. Water ownership was separated from land ownership, so that there are water owners who have no land and landowners who have no water rights. It is the state's prerogative to grant rights for water use. These rights fall into two categories: water rights for consumption use and water rights for non-consumptive use, such as

generating electricity. In the first category, 77% of the rights are held by the agricultural and forestry sector, 13% by the mining sector, 7% by the industrial sector and approximately 3% by the health sector.

As for the rights for the use of water that is not consumed, 81 per cent are in the hands of an Italian public-private company. The owners of exploitation rights can sell, or lease water use in the marketplace (Civicus, 2020).

The government of current President Sebastián Piñera has been accused of auctioning off rivers. The Piñera government came into power with the objective of underpinning the legal certainty of water rights ownership, and his cabinet includes several ministers who own rights to water use. The most prominent of which owns the equivalent of the continuous water supply used by approximately 17 million people (Civicus, 2020).

12.5 The international experience – a meta-analysis

Perard: The choice between public and private water supply

It is commonly argued that private enterprises are more efficient than state owned enterprises. This is variously attributed to inherent efficiency of private ownership, or to competition, regulation and ownership, with competition and regulation being the factors of greater influence. This is particularly true in fully competitive markets.

Water, however, is a natural monopoly, and not easily transformed into a fully competitive market. The network cannot be duplicated, and fragmentation reduces economies of scale. Direct competition is not efficiently possible.

Bidding processes for tenders and concessions (competition for the market) seek to introduce competition, but are hampered by collusion, asymmetric information, incumbent advantages and problems in pricing assets (Perard, 2009). In the water market the number of bidders is usually small, and contracts are usually incomplete (there are variabilities in contract). This is not competition in the sense that economists expect will bring efficiency, as competition for the market is not a substitute for direct competition.

Other than efficiency, corruption is sighted as an argument that supports the introduction of independent water production. In corruption terms there are three risks:

- The under-pricing of public inputs to the private sector;
- The over-pricing of private outputs to the public; and
- The subsidy of the private by the public.

The change in ownership between public and private does not directly address any of these problems.

Edouard Perard's meta-analysis research on public versus private participation in water supply review suggest that private supply does not systematically have a positive effect on efficiency in water production (Perard, 2009).

Perard analysed a sample of 22 econometrically tested examples and 51 case studies, to assess the impact of private ownership on efficiency in water production and provision. The results found that 31 cases performed better under private ownership while, 16 performed better under public ownership (or worse under private ownership), and for 26 cases it had no effect (Perard, 2009, p. 200).

Further, monopolistic infrastructures, he found that in 16 cases, 6 were better in private hands, 5 were neutral and 5 were better in public hands.

Similarly, in a test on 110 African water utilities from 1998 to 2001 found no significant differed between public and private water operators in terms of cost once environmental factors had been accounted for (Kirpatrick, Parker, & Zhang, 2006). A similar study on

50 Asian firms, in 19 countries found no statistical difference between public and private water operators (Perard, 2009).

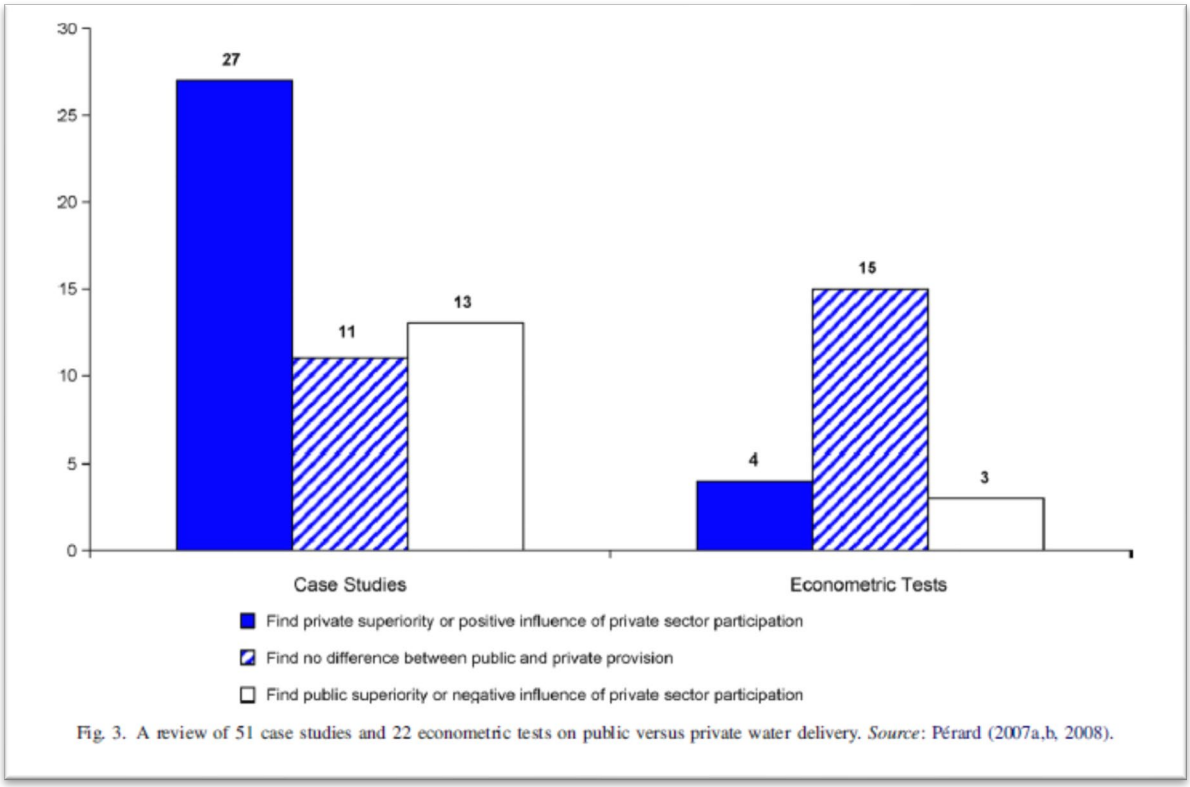

Fig. 3. A review of 51 case studies and 22 econometric tests on public versus private water delivery. *Source*: Pérard (2007a,b, 2008).

Figure 5: (Perard, 2009) Water utility performance by ownership type

This means that the choice of whether or not to use private water delivery is not simply a question of efficiency. Further, the research found that employment and motivator for public provision and reducing public costs of wages as a motivator for privatization were spurious argument and largely irrelevant to the decision-making process (Perard, 2009).

Perard argues that this means that governments and municipalities choose to operate water utilities themselves or outsource them to independent entities for different reasons.

He proposes that there are four components to these reasons:

1. The difference in the cost of funds;
2. The transaction costs of outsourcing;
3. The difference in efficiency; and
4. The potential political costs of privatizing. These fluctuate over time and depend on the local context.

Perard's four factors:

1. A difference in the cost of funds:

   Perard argues that the costs of funds differ because the sources of funds are different, and the financial structure of the government and the private sector are also different. The cost of capital for the state is the weighted average of the social cost of taxes and the cost of borrowed funds. For the firm, the cost of capital is the weighted average of the cost of debt and equity.

Local governments seeking to distribute water are balancing competing priorities, such as:

- Keeping water tariffs low;
- Keeping water service and quality high;
- Keeping taxes low;
- Keeping municipal deficits low;
- Maintaining public employment; and
- Providing subsidies and rebates.

The public sector can distribute water by providing the service directly or by outsourcing to the private sector. Tariffs and levels of service are usually established in contracts with private providers, and these can also be designed to retain the ability subsidise provision to certain consumers. Contracts can also set minimum employment number. Also, savings from private supply can also be distributed to the public in some form, either through subsidised water or in other services or rebates.

Therefore, the local government, might consider privatising, if the private sector proposes to pay a higher concession fee (or bid in cases of divestiture) than the expected cash flows the public sector could get from running the activity with the same tariff and service levels. Or if the private sector proposes to pay a concession fee equivalent to the expected future cash flows the public sector could get by running the service, but with better tariff/service ratios than the public sector could offer. The question becomes, can the local government get a higher return for the service at the same quality if uses a private provider, or can the local government get the same return for a better quality of service if it uses a private provider?

Alternatively, before switching from private to public, the local government should consider municipalisation if:

- It considers that the present value of cash flows that could be generated by providing water supply directly is higher than the concession fee the private sector is willing to pay with the same level of tariff and service; and
- It considers that the present value of cash flows it could get by providing water supply is equivalent to the concession fee the private sector is willing to pay but it could prove a better tariff service ratio to users than the private sector.

But, other factors, such as experience and available expertise may influence the decision. If the efficiency argument holds then the following questions are raised:

- Why do water firms remain mostly public?
- Even if in other industries they have privatised?

And if government's aim to maximize their electoral support, then they take into account the electoral consequence (or political cost) of privatisation.

2. Difference in efficiency

Differences in efficiency in the water sector are most likely to be derived from differences in technical and management knowledge rather than the profit motive because of the lack direct competition inherent in single network services. This makes the choice of going public or private on the basis of efficiency

contingent on the technical and management knowledge of a public entity as compared to its possible private providers.

3. Transaction costs of delegating water supply

   The transaction costs of outsourcing have two parts:

   Firstly, at the decision to outsource, information asymmetry means high costs to the public sector of bid evaluation and due diligence processes, which are of extreme importance. Poor quality of information about the existing system is the most common feature of the failed concessions outlined above, and feature in South Africa's failed concessions discussed in subsequent sections of this report. In infrastructure projects these costs are typically 3-5% of the total project costs but can reach up to 12% in some cases (Perard, 2009).

   Secondly, during the period of an outsourced contract, local governments face problems of asymmetry of information and incomplete contracts, which lead to significant agency costs. This results in constant monitoring of private operators and regular renegotiations. Research suggests that nearly three quarters of water and sanitation concession contracts get renegotiated, often within two years of the award (Perard, 2009). The costs of monitoring and renegotiating are ultimately paid by the user through tariffs, taxes or service reductions.

   It is likely that the recurring transaction costs of outsourcing water supply is likely a reason for continued public provision.

4. Potential political costs of independent water supply

   Independent water supply relies on the opinion of voters (as opposed to the ideology of parties). Elected officials consider potential political consequences of independent water production, based on the opinion of voters. Voter perception of independent water production becomes important regardless of the economic rationality of it.

Perard's conclusion

Ultimately Perard concludes that mechanisms that can lower the costs of funds will increase the attractiveness of private water sector investments and enhance competition between public and private, resulting in gains in efficiency. Similarly, better design of institutional arrangements in the public sector can lower transaction costs by reducing the need for monitoring activities and the probabilities of contract renegotiations. This can moderate the costs of private investment in infrastructure.

12.6 OECD Checklist for private participation

The Organisation for Economic Co-operation and Development (OECD) has examined private or independent participation in the water sector and has studied several countries experiences. These countries include member and non-member countries. The OECD has developed a checklist for governments and municipalities considering introducing private production based on five pillars. These pillars correlate to the four factors identified by Perard (OECD, 2009) and are:

1. Deciding on the nature and modalities of private sector participation;
2. Providing a sound institutional and regulatory environment for infrastructure investment;
3. Ensuring public and institutional support for the project and choice of financing. This includes alignment of goals and strategies, as well as capacity at all levels;
4. Making the co-operation between the public and private sectors work in the public interest; and

5. Encouraging responsible business conduct by the private sector party.

The OECD assessment of private sector participation in the water sector

In several countries, small scale private providers have helped alleviate deficiencies in service provision. This arrangement has failed to keep pace with rapid population growth and urban migration. Increasingly risk-sharing arrangements are very context specific, covering divestiture to non-financial forms of participation (OECD, 2009). However, the private sector participation has produced challenges, including:

- Expected flow of private investment not materialising – because of poor understanding of risk and opportunities in a complex sector and inadequate framework conditions and the sector involving high fixed costs coupled with long term, irreversible investments;
- Water and sanitation are managed at local level, exposing the private sector to sub-sovereign risk;
- The organisation of the sector is complex, due to the number of stakeholders, and the segmentation of responsibilities across government tiers and agencies;
- The necessarily long term relationship exposes the partners to a number of risks, including contractual, regulatory and foreign-exchange risk;
- A sound regulatory and policy framework with adequate allocation of risk and improved accountability. This has proven difficult in many countries, where despite intense efforts, regulatory frameworks remain incomplete; and
- Water sector in most countries is characterised by a multiplicity of government agencies, responsible for implementation and oversight, often resulting in an unclear allocation of responsibilities across stakeholders, across government and across public private partners. Balancing flexibility requirements of long term commitments with the regulatory stability is required, but this is a significant challenge (OECD, 2009).

Coupled with the challenges identified above, water is a basic need, with important implications for health, gender equality, and environment which justify government interventions. The impact on these elements make many governments and communities uneasy about private control. The OECD identifies the key to successful private participation as harnessing the efforts of diverse private players requires a focus on aspects that go “beyond money” and protects the public interest.

The OCED recommends:

- Clarifying the ultimate objectives for service provision and the contribution that the private sector can make, including the roles and responsibilities of the diverse private partners and defining the modalities of their involvement for partnerships tailor made to local specificities, with incentives for sustainable cooperation in the public interest;
- Developing a conducive framework based on high quality regulation and political commitment, including commitment to fight corruption. This must have a clearly defined allocation of roles and responsibilities for authorities and clearly defined coordination mechanism to support effective implementation of regulations and contractual provisions. This should be the case regardless of public or private provision;
- Rooting partnerships in strong accountability mechanisms through clear and consistent output-based contractual arrangements, monitoring and relations based on information-sharing and consultation with stakeholders; and

- Ensuring that private actors have a responsibility in ensuring the sustainability of partnerships, including participating in good faith, with commitment, promoting integrity communicating with consumers and effectively managing the social and environmental consequences of their actions (OECD, 2009).

The checklist

Based on the analysis, the OECD proposes that governments and municipalities considering independent water production should ensure the following:

Table 12: Considerations for IWP

Pillar	Elements
Deciding on the nature and modalities of private sector participation	• Make sure it is an informed and calculated choice • Make sure of the financial sustainability of infrastructure projects • Apply tailor made models of private sector involvement on a case-by-case basis • Preserve fiscal discipline and transparency
Providing a sound institutional and regulatory environment for infrastructure investment:	• Enabling environment – public sector remains the enabler of the quality of business climate and of corporate governance. These depend on legislation administrative and policy practices, clear and separate roles for state entities. Institutional continuity and consistency between central and municipal government. • Fight against corruption • Create a competitive environment and level the playing field, with strong expertise to evaluate bids, being aware of trade-offs in bids. • Facilitating access to financial market
Ensuring public and institutional support for the project and choice of financing – goal, strategies and capacity at all levels	• Consultation and developing buy-in with stakeholders • Empower authorities responsible for privately operated infrastructure projects • Clear and broadly understood objectives and strategies • Mechanisms for cross-jurisdictional co-operation
Making the co-operation between the public and private sectors work in the public interest:	• Establish communication and consultation with the private sector • Ensure full disclosure of project-related information • Ensure fair, non-discriminatory and transparent awarding of contracts • Use output/performance-based contracts • Develop competent, well-resourced and independent regulatory bodies • Allow for good faith, transparent and non-discriminatory renegotiations

Pillar	Elements
	• Ensure dispute resolution mechanisms are in place
Encouraging responsible business conduct:	• Ensure responsible business conduct by both the state and private parties • This should be based on good faith and commitment • Fight against corruption • Have open and transparent communication with consumers • Maintain awareness and responsibility for the social consequence of actions.

12.7 Conclusion

Independent water production has been used for over 200 years, with utilities moving through cycles of being privatised and nationalised and municipalised throughout that time. Research into the superior effectiveness of one public or private provision of water shows that both can be effective, and both can fail, with no statistically significant advantage of one over the other. Success in water provision relies rather on governance, regulation, finance, public support and public and business ethics regardless if the provider is a public or private entity.

IWP has been most consistently used and successful implemented when providing water at a smaller scale, to small towns, rural communities and directly to specific industries. However, it has also been successfully implemented at the city utility scale including in developing countries, in cases such as Manilla, in the Philippines, throughout Chile, and the Middle East where performance and coverage have improved with independent management and ownership of water systems.

However, there have been significant failures, requiring the cancellation of long-term concession, and the payment of cancellation fees, or repurchasing of assets by governments and municipalities, and service and asset maintenance levels dropping.

In areas that innovative IWPs have been successfully implemented, it is common to provide a second utility service in conjunction with treating and providing water. This is particularly the case with high energy use water treatment technologies such as desalination, as is the case in the Middle East. These has mainly been in the form of large-scale desalination projects. The large-scale projects have been able to attract finance from private sector investors and include a long term off-take agreement with a credible party.

A key lesson that can be learnt from the experience with IWP in the Middle East is the benefit that can be derived from a long-term strategy in developing a successful programme Government sets a clear strategy and established a regulatory regime which facilitates private investments and ensures fair regulatory oversight. (Simpson & Michelis, 2014)

In Abu Dhabi for instance, the Emirate has since 1998, issued comprehensive polices to regulate the power and water sectors, including the provision of guidelines for the development of IWPPs, developing a regulatory regime and establishing an independent regulator named the Regulation and Supervision Bureau. Political support is essential as strategy is notably driven by realities, although politics is often the enemy of strategy. (Simpson & Michelis, 2014)

What is clear from the international literature review, is that independent water production can viably happen at any point in the water value chain from abstraction and

treatment, such as in the Middle East, to distribution and wastewater treatment through concessions. However, the regulatory environment is key to ensure successful implementation. The regulatory environment needs to be clear and definitive about roles and responsibilities of various player, and ideally not overly complex. Information needs to be shared as transparently as possible between partners and with regulators. Independent water producers also need to be financially robust, particularly when providing water to the public at a large scale, in order to fulfil their contractual requirement and whether economic storms. Similarly, IWPs operate most successful when the ability to pay amongst consumers is high, and cost-reflective tariffs can be charged.

13. PSP EXPERIENCE IN SOUTH AFRICA

Since the advent of democracy in South Africa and democracy in South African local government in particular, a number of experiments with independent water production have been tried by the public sector, primarily through the use of management contracts, concessions and public-private partnerships. This is deemed, in terms of this study, to be private sector participation.

Further, at times of water shortage particularly, private enterprises have established their own water supply mechanisms when public supply is no longer capable of fulfilling demand at a competitive tariff. This was particularly the case with industry during the severe drought in the Western Cape between 2016 and 2018. These instances, however, are limited to supply for own use, by legalisation.

13.1 Lukhanji and Amahlathi

In Lukhanji Local Municipality (now part of Enoch Mgijima Local Municipality) and Amahlathi Local Municipality, the operation of the water systems were outsourced to Water and Sanitation Services South Africa (WSSA), a Southern African subsidiary of Suez. These contracts were concluded in the early 1990s, just before South Africa's first democratic election in 1994, and before the introduction of the democratic system of local government, including the Municipal Systems Act and Municipal Finance Management Act (Mbazira, 2006).

The contracts sought to provide an affordable and acceptable standard of service, with the expectation that the municipalities would save money, and relieve the municipality of a technical burden. The Lukhanji contract had a 25-year period, and later added coverage of Ezibeleni and Mlungisi. The Amahlati contract had a 10-year period, which continued after the period to run on an annual and then month to month basis and was subject to a MSA Section 78 process in 2004/5.

The Lukhanji contract ran to the satisfaction of all parties but came under pressure because of a cash-flow crisis. Water tariffs had increased by 15% per year by 2002 and consumer debt had risen by 1999 to R35 million (Mbazira, 2006).

Service levels improved after the implementation of the contract, but the municipalities struggled with the financial burden of the contracts. Taking debt collection measures was necessary, including the use of pre-paid meters, water restrictors and debt recovery. These measures have limited access to water. At the same time poor marketing of the municipalities indigent policies meant that fewer resident received the benefits of reduced tariffs than should have (Mbazira, 2006).

The contracts with WSSA were for the management operation and maintenance of the system, rehabilitation of the existing systems, keeping and updating all records required for the proper management of the systems and other responsibilities agreed by the parties. Importantly this contract meant that the municipalities did not transfer ownership, but the contract did require some capital investment by the service provider, in

rehabilitating the systems (Mbazira, 2006). Billing consumers remained the responsibility of the municipalities, thus financial risk remained with the municipalities, as the contract payments still needed to be made to the service provider whether or not customers paid the municipality. At one-point Lukhanji's outstanding debts were growing by R1 million a month, upwards of R95 million in total. Amahlati was more resilient, as it had a higher proportion of non-indigent customers, who were able to pay water bills (Mbazira, 2006). However, WSSA became dissatisfied with the way in which the municipalities were managing customers and expressed desire to take over management of this activity, anticipating that they could be more effective in getting consumers to pay (Mbazira, 2006).

The contracts had confidentiality clauses, requiring written approval by the contractor for municipalities to share information about the contracts with third parties, limiting transparency about the contract, a clause which would not be acceptable under the democratic local government legislation.

13.2 iLembe (Borough of Dolphin Coast)

The Borough of Dolphin Coast (now part of iLembe District Municipality) initiated one of the first two water concessions in South Africa (along with Mbombela (Nelspruit)). It was entered into in 1999, in an area that had a serious infrastructure backlog, with about 50% of the population living in informal settlements. It was estimated that R230 million capital investment would be needed to meet the backlog (Johnson, 2005). The concession model was used because the municipality had budget restrictions, lacked credit worthiness and had a dearth of technical and management expertise. Siza Water, a local company formed by French utilities company Saur, was awarded the concession.

The concession ran into serious financial difficulties after 2 years, and Siza Water failed to make a scheduled payment to the municipality. The financial shortfall was traced to incorrect growth projections, with growth failing to increase as expected, coupled with increasing bulk water costs, and the poor state of the existing infrastructure (Johnson, 2005). The concession contract protected Siza Water from increases in the cost of bulk water, allowing for tariff increases, but it also placed infrastructure status risk with the concessionaire, and the concessionaire was not permitted to increase tariffs on the basis of the poor state of infrastructure in terms of the contract. The council also had the right to veto an increase in tariff on the basis of a review due to inaccurate growth projections (Johnson, 2005). This meant that while Siza Water could increase tariffs to match increasing bulk water costs, it could not protect itself from losses due to poor infrastructure performance or poor projections, both possibly a function of information asymmetries between the municipality and bidders for the concession.

Because of the commercial difficulties the community experienced 15 and 12% increases in tariffs in the second and third years of the contract. This was alongside other financial relief given to the company by the municipality, by reducing its monitoring fee by 50% and reducing its electricity charge by 7%. Monitoring was seen as subservient to commercial viability of the concessionaire. This had an impact on contract monitoring further down the line (Johnson, 2005). Capital investment was reduced by half, reduced in the first five years from the original R21.6 million in the contract to R10 million, fundamentally weakening on of the original purposes of the contract, which was access to capital for a municipality with poor credit worthiness.

Despite contractual remedies for most of these issues being available, they were not used, because the municipality felt that they would not be able to run the system without the private contractor, who were considered to have done a good technical job, despite the commercial struggles (Johnson, 2005). The concession did not in real terms protect the municipality from risk, despite significant risk protection being written into the contract. The contract was renegotiated as a result of serious difficulties experienced during contract implementation, but as of 2020 Siza Water continues to supply water

service the Dolphin Coast of iLembe municipality. Siza Water, however, is now owned by South African Water Works.

13.3 Mbombela (Nelspruit)

The Nelspruit Transitional Local Council signed the first water concession in the country in 1999. It was roughly 5 times the size of the Dolphin Coast concession (Johnson, 2005). The 30-year concession sought to inject capital and management resources into the water and sanitation operations (Bender & Gibson, 2010). The municipality had previously serviced a small white population. With the introduction of democratic local government, the population served by Nelspruit rose from 24 000 to 230 000, a near 1000% increase. However, municipal income only grew by 38%, as over half of the population were indigent. There was a massive infrastructure backlog, and tariff income was not going to be able to cover the required investment (Johnson, 2005).

The Greater Nelspruit Utility Company (now Silulumanzi), a consortium made up of BiWater Capital (Netherlands), BiWater Operations (South Africa) and Sivukile was appointed as the concessionaire (Bender & Gibson, 2010). The concession area was dramatically increased soon afterward because of changes to the municipal boundaries, as the Nelspruit Transitional Council become Mbombela Local Municipality. The concession also met significant community resistance against privatisation early on. BiWater's partner, responsible for community engagement and communication had failed to deliver expected performance, and this coupled with harsh credit control mechanisms, and perceived higher cost of water helped to encourage community resistance. This resistance led to payment boycotts, intimidation of BiWater employees and vandalism (Johnson, 2005).

The contract obliged the concessionaire to perform its service obligations to particular levels, subject to certain conditions, including consumers paying tariffs in accordance with prescribed tariffs. This was impact by the introduction of the national policy for free basic services, leading to a renegotiation of the contract. Further provisions in the contract, allowed that the concessionaire to manage this risk by reducing its capital expenditure programme. The effective result was that the capital works programme in the contract was reduced in the early years of the contract by about half, with the concessionaire rather focussing on stabilising financial performance and renegotiation rather than capital investment (Bender & Gibson, 2010). Johnson (2005) argues that in terms of the contract the municipality went beyond its contractual obligation to save the contract.

Bender and Stewart (2010) argue that the Mbombela concession is a qualified success, with almost every household having access to water, although not 24-hour supply. In many cases, water and effluent qualities are high, with the systems achieving Blue and Green Drop awards. There has been good investment in expanding and upgrading the existing system and spending of capital grant funding is at high level. In 2010, tariff levels were also still low compared to other similar municipalities. The challenges are that 24-hour supply of water had not been achieved in 68% of households by 2010, due to an under-capacity treatment plant and illegal connections. The municipality does not have adequate contract monitoring capability, because of limited skill rather than limited resources, and there is significant dependency on public funds to serve poorer areas of the concession, through the renegotiated contract allowing the concessionaire to receive operating subsidies as partial payment for unpaid bills, so the municipality continues to bear significant risk.

Silulumanzi continues to operate the concession, however, BiWater sold its shares in 2010 to Sembcorp, a Singaporean company, which subsequently sold its shares on to South African Water Works in 2018. That sale is now being challenged in the South African high court by an unsuccessful local minority bidder.

13.4 Western Cape Drought

In response to water restrictions and tariff increases induced by the 2016-2018 drought in the Western Cape, a number of companies found means of providing their own water, typically for production purposes, for example PPC Cement building a treatment plant for saline mine water to produce 20kl/day (GreenCape, 2018). For the most part the decision to do this was a business one, driven by two factors, the need to ensure supply to continue operations, and the municipal tariffs rising above the cost to supply themselves.

The raw water for treatment was mainly sourced from boreholes (groundwater), or, if it was a coastal industry, abstracted from the sea. Both these sources typically needed to include some form of desalination in their treatment procedures. Old Mutual treats its own blackwater and buys greywater from the City of Cape Town as its source of raw water.

The cost of desalination and treatment depends largely on water quality, and the energy required to treat water of a given quality and the scale of the plant. Bersch & du Plessis (2017) estimate that the minimum possible cost for desalination in the Western Cape at 150 Ml/day is R10.96/kl. However, anecdotal evidence suggested that at the scale industry use and the water quality available to them this rises to at least R20/kl. Raw water quality varies widely form location to location, and at different times, change the costs to treat to the required standards. The City of Cape Town paid R39/kl to Quality Filtration Systems for desalinated water from a 2Ml plant at the V&A Waterfront, with disputes over water quality compromising the contract. At the peak of the drought the City of Cape Town's industrial and commercial tariff had reached R50/kl, but this only lasted for 6 months (GreenCape, 2019), it is now R31/kl (City of Cape Town, 2020). This suggests that there may be a business case for industry to supply their own water, if they can find a raw water source at the required quality.

For the most part companies simply treated water to the standard required for their industrial production processes, but some, such as Old Mutual, chose to treat and supply to drinking water standards for potable use in their large office parks (GreenCape, 2018). Few were willing to take on the additional risk of supplying drinking water to their staff or near neighbours. Most firms outsourced the treatment and monitoring of water to firms who were able to build and operate then plant, in some instances these were package plant.

GreenCape (2020) argues that the biggest opportunity for investment in water provision in South Africa will be the supply of water to the municipal market through re-use of wastewater, groundwater resource development and seawater desalination. Other opportunities include introducing efficiencies to wastewater treatment, particularly energy efficiency. There is an estimated market size of 2 500 Ml/day for cities for water re-use, with capital investment opportunities of R50 billion. These opportunities are likely to take the form of PPPs or engineering, procurement, construction and commissioning projects, depending on the capacity of the municipality involved (GreenCape, 2020).

13.5 Contracting

The experience of entering into PPPs for the provision of water services has revealed important lessons about contract that should be considered in future arrangements. Johnson (2006) analysed 15 municipal outsourcing contracts in South Africa, including 9 water service contracts. The types of contracts covered government to private, government to government, long term concessions, and government to community-based organisation.

Typically, contracts are long (up to 600 pages) and inaccessible to the reader with complex legal language. This often makes it difficult to understand the rationale behind the contracts. This affects public participation and transparency, making commenting

and monitoring of contracts difficult. Johnson found that they needed to be simplified, a finding also support by Bender and Gibson (2010).

Concession or lease contracts were typical contracts for introducing private investment into public infrastructure. They were particularly complex and included risks such as a loss of accountability and monopoly pricing once a concession had been won. The water concession contracts involving capital investment also needed to be renegotiated just a few years after being entered into, with the outcome being reduction or suspension of the capital investment requirements of the concessions, because of financial limitations of the concessionaires (Johnson, Outsourcing of Basic Municipal Services: Contract Analysis, 2006). Early renegotiation is a common feature of concession contract because of information asymmetries.

Efficiency as an often-cited driver of independent provision is difficult to tie down into a contract. Procurement process should ensure that the contractor has the necessary skills and expertise to fulfil the contract and perform to a particular standard. The contract should contain clear performance targets, penalties for non-performance and possibly incentives for excellent service. This should provide an objective test of efficiency and requires strong monitoring. Detailed performance indicators and options for benchmarking tests have been trialled in South African water services contracts.

Outsourcing offers potential to transfer skills from a service provider to an under-capacitated municipality or government entity. Contracts should provide a clear programme mapping out how skills transfer will take place, by whom and when, identifying who will be trained and how effectiveness will be tested. Previous water provision contracts have had limited skills transfer requirements, and these have lacked sufficient detail.

Risk transfer is another often-cited driver of introduction of independent producers into the provision of water. Risk categories applicable to outsourcing include construction risk, financial risk, demand risk operational risk, political risk and risk associated with changes of law. Identification, costing and allocation of risk is a complex exercise, but critical to ensure appropriate allocation of risks for a sustainable and effective contract. Inappropriate risk allocation could place the municipality under financial pressure or impact on value for money and affordability. South African contracts typically have provided for risk and contractors take on the work at their own risk, but these risk provisions are often not enforced, in some cases because the municipality lack the financial or technical capability to take over the outsourced service. This mean that the municipality continue to bear significant risk that contractually should be borne by the contractor.

Lastly, if the service provider is a private company this poses a threat to accountability. For instance, a situation may arise where the municipality requires the service provider's written approval of a policy to support indigent consumer through a tariff reduction. Some contracts refer decision making on contractual issues to independent panels, structures with no political accountability.

13.6 A new model for service delivery?

Residents in Maluti-a-Phofung Municipality have experienced challenges to access water since the early 2000s. These challenges have been caused by water resource constraints and a lack of financial and human resources to effectively manage infrastructure and deliver services to end uses (SERI, 2020). After a period of time in which water was not being supplied by the municipality, a local resident purchased and installed a pump at the municipal water treatment works (Lindeque, 2019). This led to the formation of a coalition of residents and community leaders – known as the Harrismith Water Heroes – that has taken it upon themselves to fix the water infrastructure in the area (SERI, 2020).

The Water Heroes purchased and installed new pumps, as well as repair pipes and purchase chemicals for water production. The coalition refer to themselves as a, 'non-profit service delivery organisation' that has made a significant contribution to resolving many service delivery issues in the area by effectively positioning themselves as a WSP. The model implemented by the Water Heroes but there are concerns around if this model could be actioned by other communities that also experience challenges with the delivery of water services. These challenges are presented in the table below. (SERI, 2020)

Table 13: Risks with the Water Heroes Model

Risk	Description
Procedural	Non-compliance with municipal regulations for the establishment of WSP
Political	Opposition political faction could mobilise residents to bypass legitimate municipal structures
Financial	The manner in which the WSP receives funding to undertake the proposed services in an effective and compliant manner
Operational	Ensuring compliance with required water quality standards and ensuring accountability

The sustainability for the Water Heroes Model should be considered, as municipalities receive grant funding from National Treasury for the provision of water services. This is then supplemented with the municipality's ability to attract other sources of funding for the services that are provided. However, it a WSP was unilaterally introduced into a municipality, the contracting method with the service provider would need to be compliant with the relevant regulations. The risk of private sector funding being directed to the WSP could result in the municipality facing severe cashflow risks.

The above model must be viewed in connection with a recent High Court ruling that granted a civil rights group application to have the Makana Municipality council dissolved as it had failed to provide adequate services and properly manage its operations. This has introduced a precedent in which communities can legally challenge municipalities for poor service delivery.

14. INDEPENDENT POWER PRODUCERS

The water sector suffers from an infrastructure backlog and could benefit from applying lessons from the successful Renewable Energy Independent Power Producers (REIPP) Programme (National Treasury, 2019). This section of the report highlights the key elements of this programme and some lessons learnt. This will assist the study in positioning IWP in a South African context.

14.1 What is an independent power producer?

An Independent power producer (IPP) or non-utility generator (NUG) is an entity that is not a public utility but owns facilities to generate electric power for sale to utilities and end users. NUG's may be privately held facilities, corporations, cooperatives such as rural solar or wind energy producers, and non-energy industrial concerns capable of feeding excess energy into the system. (Wikipedia, 2020)

An Independent Power Producer is any entity that owns or operates an electricity generating facility that is not included in an electric utility's rate base. This term includes, but is not limited to, co-generators and small power producers and all other nonutility

electricity producers, such as exempt wholesale generators, who sell electricity. (OpenEI, 2012)

An Independent Power Producer is an entity, which is not a public electricity utility, but which owns and or operates facilities to generate electric power for sale to a utility, central government buyer and end users. IPP's may also be privately held facilities, such as rural solar or wind energy producers, and non-energy industrial concerns generating electric power for on-site use and who may also be capable of feeding excess energy into the distribution or transmission grid system. (SAIPPA, n.d.)

14.2 What is the REIPPP?

Independent Power Projects are defined as power projects that mainly are privately developed, constructed, operated and owned, have a significant proportion of private finance, and have a long-term power purchase agreement (PPA) with a utility or another off-taker (Eberhard, Gratwick, Morella, & Antmann, 2016).

The South African REIPPP is a competitive tender process that was designed to facilitate private sector investment into grid-connected renewable energy generation in South Africa. IPPs are invited to submit bids for the following types of projects when bid windows are opened: (Eberhard & Naude, 2017).

- Onshore wind;
- Solare Photovoltaic;
- Concentrated Solar Power;
- Small Hydro;
- Biogas; and
- Landfill gas.

The bids must first qualify for evaluation by meeting minimum compliance requirements, after which they are evaluated based on price (bid tariff) and economic development criteria.

The REIPPP programme was launched in 2011 to effectively implement the vision of the Integrated Resources Plan (IRP) 2010, with the target of producing 17 800 megawatts (MW) of electricity from renewable sources by 2030 (Nomjana, 2020). The programme has been designed to not contribute the electricity shortage in South Africa but also create a positive contribution towards socio-economic and environmentally sustainable growth (IPP Projects, n.d.).

How does the REIPPP Programme work?

The generation capacity allocated to each technology is in accordance with the Ministerial Determinations and is indicated in the table below.

Table 14: Maximum capacity allocation per technology

Technology	Capacity (MW)
Onshore Wind	6 360
Concentrated Solar Thermal	1 200
Solar Photovoltaic	4 725
Biomass	210
Biogas	110
Landfill Gas	25
Small Hydro	195
Small Projects	400
Solar Parks	1 500
Total	**14 725**

Source: IPP Projects, n.d.

The determined capacity is procured through a continuous programme of bid windows that is prompted by the release of a Request For Proposals (RFP) to the market. The RFP contains all the information required and criteria to participate in the tender process. The award of Preferred Bidder is a competitive process with strict qualification and evaluation criteria (IPP Projects, n.d.).

The following approvals are required to be obtained for signing of projects: (Independent Power Producer Office, 2014)

- Minister of Finance;
- Government Support Framework Agreement in support of Eskom;
- NERSA approval; and
- Eskom approval.

The IPP Office

The IPP office was established to deliver on the objectives of REIPPP programme. The services provided by the IPP office include: (IPP Projects, n.d.)

- Professional advisory services;
- Procurement management services; and
- Monitoring, evaluation and contract management services.

14.3 Lessons learnt from the REIPPP

The REIPP Programme is generally considered to be a success. This section of the report outlines some of the reasons that it is considered to be a success, as well as proposed enhancements that could further increase the effectiveness of the programme.

Success of the REIPPP programme

Up to 2019, 6 422 MW has been procured from 112 renewable energy independent power producer projects over seven bid windows. Private sector investment in the programme amounts to R210 billion to date, of which R42 billion has been sourced from international investors and funders (National Treasury, 2020)

The programme has resulted in South Africa achieving more investment via IPPs than in the rest of Sub-Saharan Africa over the past two decades. Bid tariffs have fallen sharply over the course of the programme and the most recently awarded projects are amongst the lowest priced grid connected renewable energy projects in the world. The programme is considered one of the top ten renewable energy programmes in the world. (Eberhard & Naude, 2017). Some of the factors that have contributed to a successful IPP programme at a country and project level are presented in the table below.

Table 15: Factors contributing the success of the IPP

Factor	Details
Country level	
Stable country context	Stable macroeconomic policies Legal system allows contracts to be enforced, laws to be upheld, arbitration Good repayment record and investment-grade rating Previous experience with private investment
Clear policy framework	Framework enshrined in legislation Framework that clearly specifies market structure and roles and terms for private and public sector investments (generally for single-buyer model, since wholesale competition is not yet seen in the African context) Reform-minded "champions" to lead and implement framework with a long-term view
Transparent, consistent, and fair regulation	Transparent and predictable licensing and tariff framework Cost-reflective tariffs Competitive procurement of new generation capacity required by regulator
Coherent power sector planning	Power planning roles and function skilled, resourced, and empowered Planning function skilled, resourced, and empowered Fair allocation of new build opportunities between utility and IPPs Built in contingencies to avoid emergency power plants or blackouts
Competitive bidding practices	Planning linked to timely initiation of competitive tenders/auctions Competitive procurement process adequately resourced and fair and transparent
Project level	
Favourable equity partners	Local capital/partner contribution where possible Risk appetite for project Experience with developing country project risk Involvement of a DFI partner (and/or host country government) Reasonable and fair ROE Development-minded firms

Factor	Details
Favourable debt arrangements	Competitive financing Local capital/markets that mitigate foreign exchange risk Risk premium demanded by financiers, or capped by off-taker matches country/project risk Some flexibility in terms and conditions (possible refinancing)
Creditworthy off-taker	Adequate managerial capacity Efficient operational practices Low technical losses Commercially sound metering, billing, and collections Sound customer services
Secure and adequate revenue stream	Robust PPA (stipulates capacity and payment as well as dispatch, fuel metering, interconnection, insurance, force majeure, transfer, termination, change-of-law provisions, refinancing arrangements, dispute resolution, and so on) Security arrangements where necessary (escrow accounts, letters of credit, standby debt facilities, hedging and other derivative instruments, committed public budget and /or taxes/levies, targeted subsidies and output-based aid, hard currency contracts, indexation in contracts)
Credit enhancements and other risk management and mitigation measures	Sovereign guarantees Political risk insurance (PRI) Partial risk guarantees (PRGs) International arbitration
Positive technical performance	Efficient technical performance high (including availability) Sponsors who anticipate potential conflicts (especially related to O&M and budgeting) and mitigate them
Strategic management and relationship building	Sponsors who work to create a good image in the country through political relationships, development funds, effective communications, and strategic management of their contracts, particularly in the face of exogenous shocks and other stresses

The important of independent regulation

The establishment of independent regulators has been the most widespread power sector reform element in Sub-Saharan Africa. Transparent, fair and accountable regulators that produce credible and predictable regulatory decisions are necessary for creating the certainty around market access, tariffs and revenues that encourages investment. (Eberhard et al., 2016).

It is also noted that the Department of Water and Sanitation (DWS) is currently in the process of establishing an Independent Water Regulator to improve the overall efficiency and effectiveness of water provision and ensure appropriate price setting (National Treasury, 2019).

Reforms to attract IPPs

The key reform elements that can assist African countries attract IPPs are outlined in the table below.

Table 16: Elements to attract IPPs to African countries

Element	Description
Systematic and dynamic power sector planning.	Sound planning is paramount and means that countries are able to correctly project future electricity demand, decide on best supply and anticipate how long it would take to procure, finance and build the required generation capacity.
Competitive procurement of IPPs ensure that projects are implemented transparently and at the lowest cost.	A lack of competition in procuring new generation capacity has extensive drawbacks. These includes project outcomes such as higher prices and unravelling contracts, as well as negative impact on the overall governance of the electricity sector and investment climate.
Direct negotiations can be considered in certain instances.	If unsolicited bids are considered, the country should have an effective systems and capabilities to evaluate projects and negotiate favourable contracts in a transparent manner.
Financial viability of utilities is crucial to attract IPP investments.	IPP contracts need to be with financially viable off-takers. These off-takers can be utilities or large customers. Most IPPs are project financed and their bankability rests on secure revenues.
Reforms improving the investment climate remain important.	Having a regulator in place provides an oversight role. The financial sustainability of utilities and key aspects are enhanced by sound economic regulation that is transparent, credible and consistent.

Source: Eberhard et al. (2016)

15. HOW DOES SOUTH AFRICA COMPARE TO OTHER COUNTRIES?

South Africa's experience with the independent production of water has been largely similar to the international experience. The primary modalities have been water service management contracts and concessions to operate, maintain, rehabilitate and extend systems. There has also been some smaller scale independent water production for industry, but this has been limited by the costs of extracting and treating water and legislation governing the sourcing of water services and water for industrial uses. The analysis phase of the project will compare the experiences in more analytical detail.

The international literature does not definitively identify either public or private provision of water as preferable, demonstrating that neither is inherently more efficient. Rather it suggests that there are four key issues that affect whether public or private water provision will be successful. Broadly, they are governance, finance, public perception and ethics. This correlates with South Africa's own experiences, where private production has tended to be a qualified success, providing high technical standards, but often failing to be financially successful for private partners, and consequently municipalities, in large part due to information asymmetries in the bidding processes leading to unreliable financial projections.

15.1 Governance, administration, legislative, and regulatory, complexity and capacity

Both public and private provision have a higher chance of success when governance is strong. This involves a high-capacity administration, relatively simple legislative and regulatory frameworks with clear, non-overlapping responsibilities, both between public bodies and between public bodies and private providers or partner.

The South African regulatory and legal landscape has been identified as complex, with overlapping legislation and regulation, and overlapping responsibilities of players. This has led to highly complex and opaque contracting arrangements where independent provision has been tried, as in the case of Mbombela and Dolphin Coast. Improved clarity in legislation is likely to be required to simplify this and lower the costs of doing business with the South African state and improve transparency and public accountability of water provision arrangements.

The legislative framework as well as the market opportunity make it likely the independent water producers are going to need to do business with water service authorities. However, the Auditor General's report identifies capacity in most municipalities is low, particularly in relation to water management, maintenance and policy, with large proportions not having a policy in place to undertake conditional assessments of their waster infrastructure. This suggests that municipalities are going to struggle to provide adequate information to bidders, evaluate bids and monitor contracts that they might enter into.

15.2 Finance

Strong financial arrangements are required to ensure successful independent water producers. This means that there needs to be a strong business case for the independent producers, based on reliable information. At the small scale this is driven by the cost of abstraction and treatment when compared to municipal tariffs. For the utility scale this is often dependent on the municipal population's ability to pay, which is a challenge for South Africa's municipalities struggling most to provide adequate water.

Further, for utility scale provision the independent provider should have sufficient financial resources to survive unforeseen short-term financial losses. This has been a challenge in both international and South African concessions, particularly where information asymmetries have led to a poor understanding of the condition of a network and its consumers' ability to pay for services when the initial bid was submitted.

15.3 Public acceptance of provider

Public acceptance of the provider, particularly in the short term, is a key factor in determining the success of an independent provider supply to the public. It is a key contributor to willingness to pay, and therefore underpins the business case of independent provision, and is important given that water is basic need and human right. The latter of these also creates a responsibility for transparency in all aspects of provision, which is sometime undercut by both public and private sector practises.

South Africa's experience of public acceptance of the provision of water by private providers in Mbombela suggests that this may at times be a hurdle for independent water providers. However, this can be overcome by confidence in government monitoring as well as track record of providers. While independent electricity provision is considerably different to water provision, increasing public acceptance in South Africa of IPPs suggest that independent water provision could gain acceptance at some points in the value chain.

15.4 Private and public sector ethics, social commitment and cooperation

The final key issue that can contribute to the success of independent water provision, is the question of public and private sector ethics, the social commitment of the private provider and the consistent cooperation of the public sector.

South Africa's recent experience suggests that this might be an area of concern. Both the public and private sector have suffered from significant ethics failures, particularly around state contracts and the provision of public assets, as the State Capture Commission of Inquiry and case like collusion in the construction 2010 World Cup Stadiums demonstrate. Many municipalities have also developed reputations of being unreliable partners, which will give cause for concerns for both independent producers and the communities they serve.

15.5 Conclusion

South Africa's water market presents a complex environment for independent water producers to enter into. It has a complex legal framework, a large indigent population, weak municipalities, a potentially sceptical public and a dubious record in public-private contracting. However, there is significant potential for independent providers to enter the market, particularly to develop alternative sources of water, such as wastewater reuse, seawater desalination and groundwater extraction and treatment.

These opportunities will require working with municipalities, so it is likely that independent operators will likely choose to work only with reliable municipalities, or with municipalities receiving some form of support from other spheres of government, most likely in form of capacity support. Even in the cases where independent water producers would seek to provide industry directly, approval from water service authorities would be required. Work will need to be done, particularly to simplify the legislative and contracting arrangements, remove information asymmetries and develop real capacity in municipalities, but it is likely that independent water providers have some role to play in the future provision of water in South Africa

16. OTHER WATER SOURCES OUTSIDE OF THE NATIONAL WATER ACT

The National Water Act defines a water resource as a “watercourse, surface water, estuary or aquifer”. The Act also allows for the Minister to:

- Make regulations limiting or restricting the purpose, manner, or extent of water use;
- Require that the use of water from a water resource be monitored measured and recorded and
- Require that any water use be registered with the responsible authority.

The implication of these requirements is that any water produced out of a water resource is subject to control be the Minister for Water Affairs. This regulation severely limits the role that independent water production can play in producing water from water resources as defined by the act.

Therefore, water production using water from sources that are not considered water resources offers an opportunity outside of the governance of the Minister for Water Affairs. This allows for complete independence ensures the full control of the resource by the independent producer. This gives these producers greater security over the supply chain of their product. These possibilities include seawater (not from an estuary) and other innovative approaches to water such as

- Water from air technologies;
- Water from icebergs, as well as;
- Imported water.

This section begins to explore some of these approaches. Seawater has been covered in the previous section sections as desalination is fairly well understood typically required linking into the existing network. This is increasingly the focus of potential regulation, either by the Minster of Water Affairs or the Minister of Environmental Affairs, where it will have impacts of coastal waters.

16.1 Water from icebergs

The possibility of sourcing potable water from icebergs received significant media attention and was seriously explored by some marine players during the Western Cape drought form 2016-2018. The concept has been around for over one hundred years and has been seriously considered for bulk water supply since the 1970s, but never been attempted. It involves lassoing an iceberg new the Antarctic, and towing is it to an offshore location and harvesting the iceberg for water. The proposed Cape Town project was expected to able to deliver in the region of 150 Ml/day of water (with a 1km by 0.5km by 0.25km iceberg) (Sloane, 2018), which would last about a year and provide about 20% of the City of Cape Town’s water supply (Winter, 2019). The key innovation used is a net made from Dyneema to harness and to the iceberg to been towed by two tankers and two tugboats.

It is an expensive endeavour however, as this is an untested technology, with significant costs attached, with and expected cost of upwards of $200 million (Winter, 2019) in its first iteration. Large scale customers would need to be secured to make this approach financially viable, and the water is likely to cost significantly more than municipal water at current prices (R29/kl as opposed to R5.20/kl before the cost of infrastructure to melt water into the system) (Mall and Guardian, 2018). It is noted that drought conditions will increase the price and reduce water available for supply, which may result in these options being explored.

There are unlikely to be significant social or water quality implications to the use of icebergs for water as icebergs produce water of a high quality and would likely have

limited negative effects on the water system, if used and disposed of in conventional ways. It is possible that the water could contain biological contaminants, however, and this would need to be monitored.

The consequences of storing a large iceberg offshore are unknown and untested is terms of impact on the local marine environment the local weather systems. These effects can be modelled to indicate likely impact for environmental authorisation, but actual impact would be unknown until implementation.

As icebergs are not considered a water resource in terms of the water act and therefore a water use licence will not be required. Environmental authorisation would be required to store an iceberg offshore. Further legal implication would depend on who the customers are and if and where the water enters the local municipal water systems.

16.2 Atmospheric water generation

The production of water form air is both an ancient and modern technology. The erection of structures to encourage and capture condensation and fog is a practice developed by ancient civilization. In more recent years, devices have been developed to turn water vapour into air using a variety of cooling technologies.

There are a variety of approaches for atmospheric water generation from fog catching to dehumidification to wet desiccation. The scale is typically small, with current common devices being “water cooler” scale or portable devices designed to support military units operating in arid field conditions.

The quality of water is dependent on air quality and high levels of pollution in the air will mean water that requires more purification, though there is limited microbial and faecal concern, but it is also prone to high levels of heterotrophic bacteria. It is most commonly used as a water source by military. The technologies are very energy intense, often several order of magnitude more intense than reverse osmosis, and so produce relatively expensive water (Peters, Blackburn, & Armedion, 2013). There are traditional energy free approach to extracting water from air, but these tend also tend be at small scale and are dependent on atmospheric conditions. Severe water shortages would likely be required before atmospheric water generation become economically viable.

There are unlikely to be any social implication to the use of water from air, provided there is treatment assurance, but owing to its energy intensity it is likely to likely to have a high carbon footprint, compared to most other water production techniques (Peters, Blackburn, & Armedion, 2013).

Since air as a water resource is not governed by the National Water Act, water produced would only face regulatory control if used as drinking water or once it enters the water system beyond the domestic scale, as potable, grey, or wastewater. Significant improvements in the scale and efficiency of technologies is likely required before this becomes a regulatory issue.

16.3 Importing water

Water drawn from resources outside of South Africa would also fall outside of the National Water Act’s definition of a water resource, meaning that if an independent producer can secure a source outside of the country’s border the opportunity to import water may exist.

There are multiple options for importing water. It could be done through the construction of pipelines to water resources in neighbouring country, such as the Lesotho Highlands Water Project, or could be done through the use of tanker trucks, trains or ships. Marine transport of water is used Bahamas where smaller barges are used to transport nearly 20 billion kilolitres of water a day between islands (Organisation of American State, n.d.), while projects to ship water from Alaska to India and the Middle East using 300 billion

kilolitres vessels and nearly 45000 billion kilolitres per year have been explored (Deccan Herald, 2010).

The economic case for importing water is contingent on the cost of local water as well as other means of generating water and the cost of the chosen means of importing. The Bahaman case suggest that the key to the economic viability of the business model is consistent continuous supply over the long term. Appropriate loading and unloading facilities are required, and these are capital intense to construct. The model does, however, benefit from scale. Pipelines are similarly capital intense to construct. The business case for importing by road tanker will be contingent on the distance travelled, however international experience suggests that even relatively short distances travelled by tanker produce water at a relatively higher cost than other technologies including reverse osmosis (DownToEarth, 2004).

Imported water is unlikely to have any particular local social implications, provided that assurance on water quality is provided. There may be social or political implications, depending on the impact on the water systems at the source. The transporting water by tanker is likely to have a significant carbon footprint, as fossil fuel will be used to transport the water, at least in the medium term.

The environmental impact of imported water is likely to depend on its entry point into the local system. For instance, the Lesotho Highlands Water Project, despite importing high quality water, has negatively impacted on biological communities in the Ash/Liebenbergsvlei system it enters (Lepono, Du Preez, & Thokoa, 2003). The assessment of this impact falls outside normal water quality monitoring standards. Water imported by tanker may have similar biological differences from local water but are likely only to enter the local systems through disposal into the sewerage system, and therefore may lead to a need for additional monitoring and treatment of wastewater.

Imported water is not governed by the National Water Act, so water produced would only face regulatory control if used as drinking water or once it enters the water system beyond the domestic scale, as fresh water in a water resource (as is the case with the Lesotho Highlands Water Project) or as potable, grey, or wastewater provided directly to a customer.

17. APPENDIX A: APPROACH AND METHODOLOGY

This section of the document details the approach and methodology that will be employed to meet the project objectives.

17.1 Phase 0: Confirmation of appointment/Letter of Award and Upfront Payment

WRC shall confirm the award of the contract in writing, followed by a signed Service Level Agreement (SLA)/Letter of Award between the parties. Thereafter 20% of the project value shall become due and payable prior to commencement of work on the project.

17.2 Phase 1: Inception

The project team shall convene a kick-off meeting with the Water Research Commission. The Kick-off meeting should be completed within a period not exceeding 15 days from the date of tender award. This meeting will be used to confirm the process, timelines, scope and deliverables of the project. Notes of the meeting and any changes to the project plan shall be captured in an inception report. The inception meeting should also be considered as a first reference group meeting.

Phase 1 Deliverable: Inception Report

17.3 Phase 2: Literature review and stakeholder engagement

Phase 2 of the study shall include a desktop literature review and stakeholder engagement. The literature review and desktop analysis will be structured around the current planning framework in South Africa, as well as the identified technology applications.

International literature review

The international literature review will focus on the international experience of independent water producers at various point in the water cycle: large scale production of bulk water, smaller scale production within the connector infrastructure chain, small scale production and distribution for specific water users and the treatment of effluent for re-use.

The international literature review will focus on countries with similar climates, similar user profiles (types of users, industry profiles and household profiles) and similar water rights, and similar levels of economic development.

Local literature

The private sector already plays a role in the distribution of water to communities in some municipalities in South Africa with tankers companies providing services to municipalities. The recent drought in the Western Cape has also seen a proliferation of independent players in the water production and distribution system as municipalities and business have sought to find reliable and cost-effective sources water. This has also led to a proliferation of literature on the role private players can play in the water production in South Africa, and this literature will also be reviewed (Western Cape Department of Economic Development and Tourism, 2019) (Greencape, 2020).

The experience of introduction in independent power producers into the South African electricity market will also offer lessons for the introduction of private role-players into utilities monopolies in South Africa, particularly around mechanisms for introduction into system and cost structures over time, and literature on this will be reviewed.

Review of legislation

The review phase will also include a high-level review of key legislation and regulation relating to the production and distribution of water and public finance. The purpose of this review is to lay the groundwork for the detailed legislative and regulatory analysis to come during the analysis phase. Legislation review during this phase will include”

- The Constitution;
- The National Water Act;
- The National Water Services Act;
- The Public Finance Management Act;
- The Municipal Finance Management Act; and
- National Treasury Supply Chain Management Regulations.

Key stakeholder interviews

The review will also include up to 15 key stakeholder interviews. These interviews shall be informed by the findings of the international and local literature review and will include key role-players in water production and distribution, local government, national government, water users (both business and households), and private water producers to provide a whole-of-sector perspective on the introduction of private water producers. The stakeholders that have been identified at this stage are:

- National Department of Water and Sanitation;
- National Treasury;
- SALGA;
- At least one water board;
- At least one metropolitan municipality;
- The National Business Initiative;
- Community Organisation Resource Centre/ Slum Dwellers International;
- Green-Cape;
- Business Unity South Africa;
- 2 Independent Water Producers;
- 2 large scale water concession operators; and
- An independent water sector expert such as Ian Palmer or Rolfe Eberhard.

As far as possible all interviews will take place via teleconference to reduce travel costs and avoid possible Covid-19-related delays. The development of the questionnaire and selection of stakeholders will be conducted with input and agreement from the WRC.

Review report

A review report will be produced as an output from the review phase of the project. The report shall include the synthesised findings from the review phase and will discuss the global experience of the impact and role of independent water producers along with the local experience to this point in time. Consideration will also be given to the potential benefits and risks of independent water production, and challenges facing the introduction of independent water production in South Africa.

17.4 Phase 3: Analysis

The Terms of Reference outlines 4 key areas of analysis of the concept of independent water production and IWP in the South African context:

1. Legislation;
2. Regulation mechanisms;
3. Capacity requirements; and
4. Institutional dynamics.

The analysis phase will analyse the implications of these 4 areas for independent water production and IWPs. It will do this in relation to the points where IWPs may play a role in the water production and distribution cycle (below). It is envisioned that IWPs could potentially play a role at the following 6 points in the cycle:

1. Bulk production for a water board;
2. Bulk production for a municipality or water service authority;
3. Bulk production directly for specific customers (such as mining and heavy industry);
4. Small scale production or distribution for selected customers of the water service authority or municipality (such as a suburb or specific settlement or industrial area);
5. Small scale production or distribution for directly to businesses or communities; and
6. Treatment of effluent or grey water for recirculation in bulk reserves.

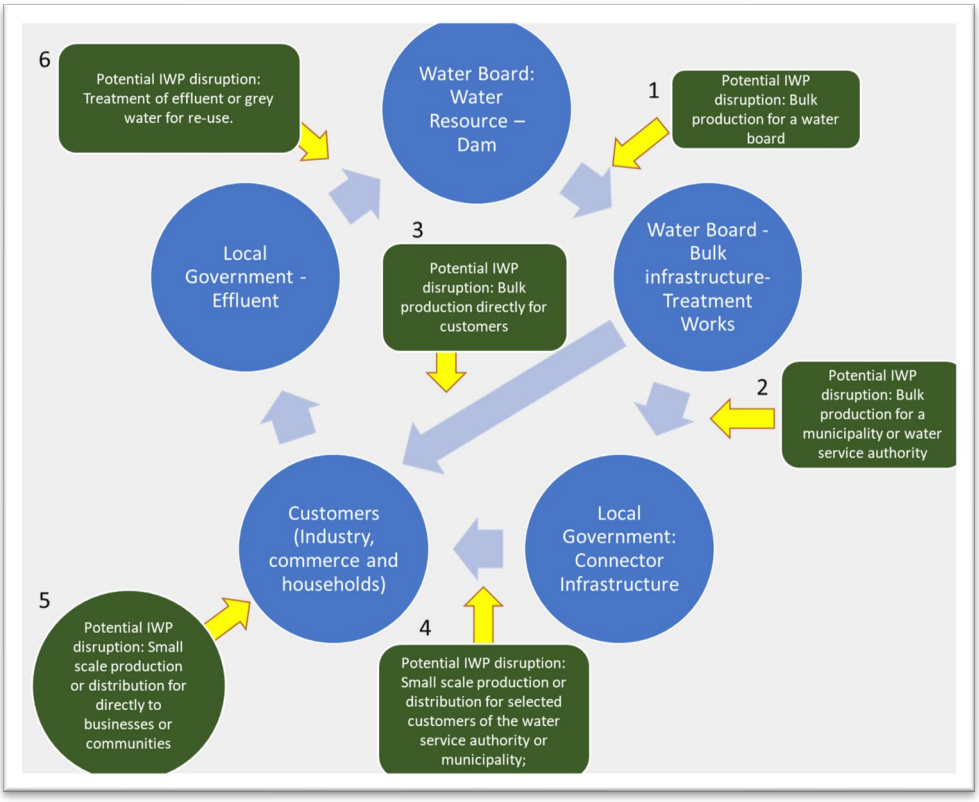

Figure 6: The Water Production and Distribution Cycle

The analysis phase will analyse the legislative, regulation mechanism, capacity requirements and institutional dynamics for IWP at each of these 6 points in water production cycle.

For each of the 6 points indicated above, the analysis will include the items discussed in the table below.

Table 17: Analysis parameter

Item	Comment
Legislative analysis	An analysis of the legislation governing this aspect of the water production and distribution cycle, identifying what activities are currently permitted at this point in the cycle and what would need to change in legislation for an IWP to play role at this point
Regulation analysis	An analysis of the regulation governing this aspect of the water production and distribution cycle, what would need to change for IWPs to operate at this point in the cycle and how regulation could be used to encourage IWPs to operate at this point in the cycle.
Capacity requirements analysis	An analysis of the capacity requirements for IWPs to operate at this point in the cycle in terms of both the IWP and the entity governing this point of the cycles. This will be done in terms of: • Human resource capacity requirements; and • Infrastructure capacity requirements.
Institutional dynamics analysis	The institutional dynamics analysis will look at the existing institutional arrangements at each point in the cycle as well as the required institutional arrangements for IWPs to operate at this point. In addition, this analysis will include a financial analysis to understand the impact of the introduction of IWPs into the water production and distribution cycle on the other role-players in the cycle financially, particularly water boards and water service authorities, and how any negative impacts might be offset.
Strategic Analysis	The strategic analysis will look at various consideration for the implementation of an IWP programme within the South African water and sanitation landscape, including: • Pricing structure/tariff determination; • Procurement; and • Socio-economic aspects such as participation of SMMEs and BBB-EE.

The outcomes from Phase 3 of the study shall be presented as an Analysis Report.

Phase 3 Deliverable: Analysis Report

17.5 Phase 3: Dialogue, Guidelines and project closeout

The findings from the review and analysis phases of the study will be summarized and presented at an online dialogue. The dialogue will also be an opportunity to workshop

and validate the review and analysis findings towards the production of guidelines. Members of the reference group will also be invited to the dialogue.

After the dialogue guidelines for guidelines on the institutional modalities for IWP in South Africa covering legislation, regulation mechanisms, capacity requirements will be developed.

Phase 4 Deliverable: Guidelines on institutional modalities for application in South Africa

17.6 Deliverables Schedule

Table 18: Deliverable schedule and status

Description Title	Financial Year	Target Date
Inception Report	2020/21	01 October 2020
Review Report	2020/21	28 Feb 2021
Analysis Report	2020/21	15 March 2021
Dialogue	2021/22	15 April 2021

The above deliverables schedule is based on the 8 months' timeline.

18. APPENDIX B: ADDITIONAL CONSIDERATIONS

The following additional considerations were included in the proposal submitted to the Client. These have been included in the report to ensure that the study considers the items during the duration of the study.

18.1 Policy

Policy outcomes that could be affected are that Department of Water and Sanitation may focus on procuring the services of IWPs in certain context as a preferred method of water delivery.

National Treasury could establish a funding mechanism that would drive the implementation of these projects with a view that it could result in savings on municipal operations budget as well as providing an additional revenue stream to local government.

The project team is aware that the development of projects in local government, especially in small, rural and under-resourced municipalities, is a major challenge in South Africa due to challenges which include the lack of technical capacity for project implementation, poor governance and inadequate financial resources. From a policy perspective it is thus crucial that any efforts to implement innovative water production approaches should benefit these municipalities and this will be explored.

18.2 Innovation

This project by its very nature is considered to be very exciting and innovative. Another form of innovation may involve the establishment of strategic partnerships to implement new technologies, i.e. private sector companies (e.g. mining and industrial companies) can partner with local municipalities and/ water boards to deliver new water solutions, thus lowering the investment capital requirement and leveraging on the transfer skills for operation and maintenance – thus creating some form of private public partnership (PPP).

The implication of the innovation is that it could result in highly functional and efficient water production system in South Africa.

19. ALL IDENTIFIED OPPORTUNITIES FOR IWP IN THE SOUTH AFRICAN WATER VALUE CHAIN

The table below outlines the emerging recommendations for the introduction of independent water producers in South Africa at particular points in the water value chain:

Point in value chain	Production process	Customers	Comments	Recommendation	Potential impact
Bulk production and treatment for water board	Seawater desalination	Water boards	Abstraction of sea water does not require a water use license, simplifying the regulatory regime; Requires compliance with procurement regulations. PPP or long-term contract with offtake agreements are the likeliest delivery models; and Could benefit from electricity cogeneration opportunities.	This is the most significant IWP opportunity. This solution will be attractive to water boards and cities that expected to experience increasing drought conditions associated with climate change. The development of these solutions could draw on the experience through the implementation of the Middle East's IWP model and independent seawater desalination experience in the USA. This opportunity will require the introduction of a regulator, as well as a structured programme that is supported centrally to provide market stability.	High
Bulk production and treatment for municipality or water service authority	Seawater desalination	Water service authorities; Municipalities	Same as above	Same as above	High

Point in value chain	Production process	Customers	Comments	Recommendation	Potential impact
Distribution for water service authority	Network operation, maintenance and rehabilitation	Water service authorities; Municipalities	Roles for independent water producers have already been explored and experimented with at this point in the value chain in South Africa (Mbombela, Dolphin Coast).	Further work to explore this option is not required, as its potential and drawback are well documented	Low
Community scale production for water service authority	Seawater desalination; groundwater abstraction and treatment,	Water service authorities	Independent water producers could assist WSAs in providing water at the community scale, when communities are difficult to connect to a municipal network through seawater desalination and extraction and treatment of groundwater; The economic case for this approach will not be as strong as for bulk water production, as the same economies of scale will not be reached (particularly for desalination) but it could ensure that communities that would be expensive to connect to the grid could have access to water; and The desalination approach would not require a WUL, while the ground water approach would.	The opportunity should be explored to provide difficult to service communities with desalinated seawater where appropriate. Proposed IWP programme should include support for these kinds of arrangements, although should not be the core focus. The role of the regulator in monitoring these arrangements should be defined.	Medium
Bulk production and treatment directly for specific customers	Seawater desalination	Industries	Currently being explored by industry; Would require compliance with NEMA but not NWA; Permission from WSA would be required if supply was to be provided to multiple customers; and This would be dependent on the business case.	The opportunity for IWPs to desalinate to sell water to industrial customers should be explored in a more structured and coherent manner. This is currently being done on an individual company basis based on business requirements.	Medium

Point in value chain	Production process	Customers	Comments	Recommendation	Potential impact
				This will also require the introduction of a Regulator to monitor standards, pricing and the impact on municipal revenue.	
Small scale production or distribution for direct provision to business or communities	Seawater desalination, groundwater abstraction and treatment	Commercial properties, Homeowners associations	Both independent desalination and groundwater treatment to potable standards could be used to directly service commercial properties and homeowners' associations; Groundwater treatment would require a WUL, seawater desalination would not; These solutions are likely best explored in water scarce areas as costs are likely to be high due to relatively small scale of plant; This is a moderate opportunity.	The opportunity for IWPs to desalinate seawater or treat groundwater to sell water to commercial customers and homeowners associations could be explored in a more structured and coherent manner. This is currently being done on an individual company basis based on business requirements. This will also require the introduction of a Regulator to monitor standards, pricing and the impact on municipal revenue.	Low
Treatment of effluent for recirculation in bulk reserves or re-use	Wastewater reclamation	Water service authorities (Water boards?)	Wastewater reclamation is increasingly common worldwide; Is being explored in drought-stricken areas of the Western Cape; most appropriate for coastal urban areas where rivers will not be affected by reduced outflows; Requires reliable sewerage network to supply wastewater; Owing to need of reliable sewerage network, information asymmetries complicate the business case for independent roles in wastewater treatment;	The use of PPPs for the reclamation of wastewater for recirculation and reuse should be further explored; Standards for wastewater treatment for potable reuse in South Africa should be developed; the likely increase in future wastewater reclamation needs should be anticipated and supported by	High

Point in value chain	Production process	Customers	Comments	Recommendation	Potential impact
			PPP are most likely the best model for implementation; Requires monitoring beyond SANS241	the previously proposed IWP programme	
Treatment of effluent for industrial use	Wastewater reuse	Industries	Is being explored in drought-stricken areas of the Western Cape; Most appropriate for coastal urban areas where rivers will not be affected by reduced outflows; Industries are only likely to generate enough wastewater for their own reuse, though could possible also serve neighbouring industries. Small scale means costs are likely to be high.	The opportunity for IWPs to treat wastewater to sell water to industrial customers should be explored in a more structured and coherent manner. This is currently being done on an individual company basis based on business requirements. This will also require the introduction of a Regulator to monitor standards, pricing and the impact on municipal revenue.	Medium
Alternative water sources					
Bulk Production	Water from icebergs	Water boards and water service authorities	Likely to require a large, guaranteed buyer of the WSA scale Unknown environmental impact on the local coastal environment and weather systems High water quality High cost of water	The opportunity exists for icebergs to be used as a water source by independent water producers, but this is a high-cost exercise and will require a large scale off-take, requiring a large amount of water in a single year.	High
Small scale production or distribution for direct	Atmospheric water generation		Most successfully delivered at small scale Very energy intensive Quality dependent on air quality	IWPs could use atmospheric water generation to produce water. However, currently	Low

Point in value chain	Production process	Customers	Comments	Recommendation	Potential impact
provision to business or communities			Very high cost of water due to energy intensity	technologies only produce water at a relatively small scale and at high energy costs. Quality will need to be closely monitored, as it is dependent on air quality.	
Bulk production or small scale production or distribution for direct provision to business or communities	Importing water		Most viable through pipelines or marine tankers Economic case made viable by scale due to high capital costs Possible environmental impact on the local water system	The potential to import water as an IWP exists. This is currently a high cost and capital intensive exercise and will require some capital investment in local infrastructure to be done efficiently. This will require a monitoring regime to be put in place to monitor the biological effects of imported water on local eco-systems.	High