DISCUSSION PAPER

URBAN WATER SUPPLY IN PAPUA NEW GUINEA: OVERVIEW OF THE CHALLENGES

Lindsay Kutan
Ronald Sofe

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## Abbreviations & Acronyms

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
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<tbody>
<tr>
<td>GoPNG</td>
<td>Government of Papua New Guinea</td>
</tr>
<tr>
<td>ICCC</td>
<td>Independent Consumer and Competition Commission</td>
</tr>
<tr>
<td>NCD</td>
<td>National Capital District</td>
</tr>
<tr>
<td>NGOs</td>
<td>Non-government organisations</td>
</tr>
<tr>
<td>NRW</td>
<td>Non-revenue water</td>
</tr>
<tr>
<td>NWSHA</td>
<td>National Water, Sanitation and Hygiene Authority</td>
</tr>
<tr>
<td>PNG</td>
<td>Papua New Guinea</td>
</tr>
<tr>
<td>SOEs</td>
<td>State-Owned Enterprises</td>
</tr>
<tr>
<td>WaSH</td>
<td>Water, Sanitation and Hygiene</td>
</tr>
<tr>
<td>WHO</td>
<td>World Health Organization</td>
</tr>
<tr>
<td>WSS</td>
<td>Water Supply and Sanitation</td>
</tr>
<tr>
<td>WTP</td>
<td>Water Treatment Plant</td>
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</table>
Abstract

This paper highlights key challenges that impact management and delivery of water supply in urban centres in Papua New Guinea. Drawing on desktop review and stakeholder consultations, this paper reflects on international experience of changing landscape, standard practice and public policy objectives underpinning efficient, quality and reliable water supply. This paper discusses important reforms in the management of urban water supplies that have occurred over time, including current government policies, relevant legislation and reform initiatives such as the Water, Sanitation and Hygiene (WaSH) Policy. The key challenges mainly fall within the realm of governance, public policy consideration, water resource management, economic regulation arrangement and infrastructure capacity. To address these challenges, this paper makes suggestions, including the importance of political will to drive needed reform, and the need for strong performance incentives for the water utility companies.
1. Setting the scene

1.1 Background and scope

The Government of Papua New Guinea (GoPNG) has initiated important reforms over the years to drive positive change in management and delivery of water supply, sanitation and hygiene practices in order to improve development outcomes in PNG. However, ongoing critical issues are challenging the effort to promote and achieve improved accessibility, affordability and delivery of water supply to urban and rural populations.

In light of recent infrastructure development and the rapid pace of urbanisation in urban centres, understanding the challenges of water provision is paramount. According to the World Bank (2017), approximately 13 percent of PNG’s total population resides in urban centres. This proportion is set to increase. To contribute positively to economic prosperity, the urban population needs access to a safe and reliable water supply (as well as electricity and other essential services). Failure to address the challenges can adversely affect social wellbeing, economic growth and environmental conservation.

This study sought to explore the critical challenges impacting management and provision of water supply in the urban centres. The study was premised in the context that changes are inevitably taking place in the urban setting as social, economic and environmental factors come into play, which can affect how water is being managed and supplied to users.

Accordingly, the study aims were to:

• discuss current government policies, relevant legislation and reform proposals affecting sourcing, storage and delivery of water in urban or peri-urban areas; and,

• identify key challenges affecting sustainable, safe and efficient water supply, having regard to public policy objectives, resource management, infrastructure and economic regulation.

1.2 Method

The methods used in this study were desktop review and consultations with relevant stakeholders in Port Moresby and selected provincial towns in PNG. We used popular internet search engines (such as Google Scholar) to collect open access electronic materials that were relevant to this study. We downloaded government-endorsed policy documents (including the WaSH Policy and Development Strategic Plan) from relevant government department websites. In June and July 2018, we conducted face-to-face interviews with key stakeholders using a semi-structured interview approach to identify research themes in the responses. Some of the stakeholders we consulted were from Water PNG Limited, Eda Ranu, Independent Consumer and Competition Commission (ICCC) and the WaSH Program Management Unit of Department of National Planning & Monitoring. Given the nature of the study and budget limitations to conduct thorough research, this study was restricted to urban areas that are serviced by piped-water systems that draw on various water sources. Specifically, Port Moresby (National Capital District (NCD)), Alotau (Milne Bay), Lae (Morobe), Goroka (Eastern Highlands), and Rabaul (East New Britain) were selected as case studies. We selected these towns to provide an opportunity for regional participation in the study’s consultation process.

1.3 Essential characteristics of urban water supply

In general, the urban water sector is responsible for providing two distinct services to household and industrial (commercial) users:
• water supply (bulk water harvesting, storage, treatment, transmission, distribution and retail), and
• sewerage (transmission and distribution of wastewater and sewage, treatment and disposal).

This current study focused on water supply. A simple model of the urban water supply cycle, adapted from Merret (1997), can take the form indicated in Figure 1.

**Figure 1: Urban water supply cycle**

![Urban water supply cycle](image)

Source: Merret (1997)

As indicated in Figure 1, the water supply process comprises of extraction from source (underground or surface), storage (natural or artificial) to preserve and maintain supplies in droughts and periods of low rainfall, treatment to remove natural and other pollutants, and distribution to consumers via pipe network. Through this process, water is made available for human consumption, waste disposal, production of goods and services, and other uses. In essence, water is used for social and economic development as well as ecological sustenance.

Naturally, water has characteristics that make the provision of water different to the provision of other essential services. First and foremost, water is essential for life. It is central to livelihood, and indispensable for healthy and productive life. These characteristics make a compelling case to adopt objectives, policies and institutional arrangements that are different from those applied to electricity or telecommunication sectors.

Second, piped water services are often reticulated against gravity through large storage dams, treatment plants and network mains. To build such water networks, substantial capital investments are incurred as sunk cost which normally takes long period for cost recovery (Kessides, 2004). This is not viable for private entrepreneurs who seek fast returns on investments. This has implications for the prospect of competition in the sector.

Finally, water supply in urban settings is increasingly becoming a commodity where users pay for their access and consumption. However, the right to universally provide water has induced governments in developing countries to extend provision of service as public good but on sustainable basis to recover cost at a minimum (Mbuvi, 2012).
Global changes such as urbanisation and climate change are occurring at a fast pace, which requires adequate provision of quality water to support social welfare, economic growth and environmental conservation (Grafton et al., 2015). However, maintaining reliable quality water services in cities and towns in the face of these changes is a daunting challenge. According to the World Health Organization and UNICEF (2015), approximately 15 percent of the global urban population do not have access to safe drinking water. Increasing water demands, urbanisation and climate change pose considerable risk to global water system (Jenerette & Larsen, 2006). To cope with these global challenges, there is growing consensus among experts, policy makers and users for transition of urban water supply towards a more sustainable water delivery system (Daniell et al., 2005; Mitchell, 2006).

International experience shows that the challenges impacting use and access to water arise mainly from changing development patterns, climate, and social preferences and values (Grafton et al., 2015). These drivers relate to growing environmental concerns, financial value, and the role that access to water and sanitation plays in alleviating poverty and promoting development. Key drivers that impact the functioning of urban water supply in different parts of the world are further explored in the following sections.

2. Changing landscape in urban water supply — international experience

2.1 Rapid urbanisation, high cost and supply options

Population growth and rural-urban migration are the main factors responsible for rapid urbanisation. The rapid expansion of urban centres gives rise to increased use of water (Grafton et al., 2015). This puts pressure on the task of maintaining water supply in response to the growing demand. Satisfying this requirement often puts further strain on available resources to source water. As local conventional sources (such as groundwater and fresh running water) become insufficient, distant water resources are tapped through dam and piped transfer to meet increasing urban demand for water. However, according to Rinaudo and others (2015), this strategy has always ended up in conflict with rural communities who are the custodians of these non-urban water sources. In developed countries, non-conventional sources such as desalination or wastewater recycling have been used to meet growing demand, but this is costly for developing countries (Grafton et al., 2015).

Augmenting water supply through developing and maintaining reticulated water systems (dams, reservoirs and pipe networks) requires substantial funding. Accordingly, substantial investment costs will be incurred as sunk cost (Kessides, 2004). Added to the cost of water supply production are compliance costs with regard to health and environmental standards in many parts of the world. Similarly, economic regulators are expecting fair returns on the investment of state water utilities, which may tempt utility companies to charge higher user fees. This is difficult to achieve in poor countries where user's capacity to pay for water services remains low (Makaudze & Gelles, 2015). However, to avoid paying higher fees or constraining access to a reliable water supply, many users bypass public water systems and resort to alternatives, notably bore wells, rainwater harvesting and grey-water recycling systems (Montginoul & Rinaudo, 2011).

2.2 Changing values and expectations

People value water in many different ways. Water is a vital and non-substitutable element of life for both humans and their environments. According to Grafton et al. (2015), people often have spiritual and emotional attachments to water, as well as relationships to it for specific needs such as drinking, washing, and growing food. As economic wealth and living standards of urban populations increase, these values and cultural relationships to water change. For example, users who pay for water would have expectations in terms of quality of the service and their rights to use water for purposes they consider important (for example, washing cars or landscaping). Customers of urban water systems typically expect greater reliability of supply, while irregular supply can be seen as an unbearable infringement on domestic comfort for which they pay. Consumers also expect water quality
(bacteriological and chemical) to improve as their sensitivity to health risks progressively rises. Meeting these expectations is a major challenge for water utilities, because they may not have the technical capacity to improve the performance of the systems they operate. Public utilities companies may also lack the financial means to provide the required investments, partly because only a fraction of the customer base has the capacity to pay for improved services (Grafton et al., 2015).

Water pricing is increasingly being used as a tool to recover cost or to promote efficient water use. However, this is opposed by some social groups who view treatment of water supply and sanitation as a basic right that should be freely accessible to all.

2.3 Climate change and adjustment

Climate change can have far-reaching impact on urban water supplies. For example, changes in temperature and rainfall patterns affect rivers and groundwater, the quality of surface water resources, and flood risk. When making decisions that are crucial for water provision, urban water sector players are mindful of climate variability, as well as the demographics of an area, urban development, water demand, energy prices, and technology considerations (Grafton et al., 2015).

Most urban water infrastructure will need to be adapted (capacity expansion) or operated differently to cope with the new weather and hydrological conditions. Capacity of the reservoirs, wastewater treatment systems, and other water infrastructure such as desalination and rainwater tanks, will have to be adjusted accordingly. But such adaptation will come at a cost to the service provider.

2.4 Conflicting ideologies

There are conflicting political ideologies to provide the urban water service as a public good or private good. There is a strong case for the urban water service to be considered a public good, where the government is solely responsible to finance, implement and regulate its delivery. This is consistent with international statements promoting human right to water (United Nations, 2010). However, in the 1990s, the recognition of the economic value of water triggered a neoliberal political ideology premised on market principle for management of water resources and services. Subsequently, international agencies, including the World Bank, International Monetary Fund, and World Water Council, pushed for private sector participation in the water sector. This is based on the assumption that private institutions are intrinsically superior to public institutions for efficient delivery of goods and services (Grafton et al., 2015).

Amid ongoing debate between these ideologies, there is a growing recognition that the expected outputs of the private sector in terms of efficiency gains and extension of coverage towards the poorest social groups have not materialised (Grafton et al., 2015). Private sector provision of water has also been increasingly contested by citizens and politicians, as evidence has highlighted the weakness of states to exercise regulatory control over private operators, particularly in weak democracies (Castro, 2007; Ohemeng & Grant, 2011). The ideological movement that seeks to reverse private sector involvement in water services delivery to citizens is gaining momentum throughout the world and becoming an important local political issue (Barraqué, 2012).
Over time, the task of providing water services to the urban centres falls mainly between remits of the state and the private utility companies. The state assumes the central role of providing water. However, in response to the inefficiencies of a publicly-run system, there is growing consensus of the role and importance of the private sector in providing water. Consequently, emphasis on commercialising the water supply emerged. Irrespective of how urban water supply is managed, economic regulation plays an integral part in ensuring efficiency and welfare improvement for the users. These paradigm shifts are further highlighted in the following discussions.

3.1 State provision and developmental objective

It is common that water supply systems are developed and run by a public water utility or a municipal (local) government. For example, in France, the remit of water supply provision has long been with the municipality or local authorities. Public water provision still dominates in Africa, Asia and Latin America (Rouse, 2007). Here, water is seen as a basic good and its provision must be sufficient, safe and affordable for every citizen, which deviates from market forces where the aim is to make profit. This fits with the perception that the public water supply system is capable of fulfilling public policy objectives, especially regarding health and social welfare. Availability of quality water in sufficient quantities is crucial to socio-economic development in any country. Each state’s participation (through regulating, administering, investing, maintenance, etc.) is expected to provide essential water infrastructure and services necessary to stimulate economic development and improve the livelihoods of all communities. This includes extending water services to poorer households (Fakir, 2007). The state entity is also mindful of the potential contribution and competitive advantage of the private sector, and accordingly considers harnessing public-private partnerships as and when required (Bagchi, 2000). At the heart of the state’s participation in the water sector is the motive to fulfil development objectives.

3.2 Free market principle and commercial objective

In response to shortcomings of public water provisions, reforms to allow private sector participation became a global discourse and practice. These reforms are believed to have started under Margaret Thatcher’s drive to privatise many public services in the UK in the 1980s, which then spread to other parts of the world (Rouse, 2007; Prasad, 2007). The privatisation drive was premised on the belief that the private sector is more efficient and cost-effective, and fosters a conducive climate for a water business to operate and prosper competitively. This is consistent with free market principles to determine water allocation and distribution in an efficient manner. Implemented within broader public-sector reforms aimed at improving public service delivery across government departments, the motive is to instill commercial discipline and management principles associated with typical private-sector firms. This provides opportunity to harness laws of supply and demand to determine prices for water and strict commitments to making profits. According to Chikozho and Mapedza (2017), two distinct features emerged from this reform:

- first is a situation where management of the water utilities in urban areas is delegated to the private sector through concession contracts or other contractual arrangements; and
- second is a strategy that retains management of the water utilities by a public agency, but concentrates on introducing management practices associated with the private sector.

In a nutshell, the emphasis is on reforming institutional set-up of the public water supply system by bringing in institutional arrangements and management practices associated with the private sector for public water companies to operate within and capitalise on the strengths of corporate models. Eventually, this paves way for introduction of open market where demand and supply determines provision of water services by interested entrepreneur without undue political or bureaucratic influence. Indeed, this approach has garnered much needed support from many international and bilateral donors and lending agencies who are proponents of private-sector involvement as means of removing politics from the sector and also a reliable source of investment
capital (Brown et al., 2009).

A key motive of the reform is to increase and strengthen autonomy of public water utilities and require them to manage water provision on a more commercial basis (Schwartz, 2008). This approach requires separation of regulatory tasks from service provision, creation of quasi-competition in the water sector in terms of service provision with cost-recovery tariff structure to allow fair return, customer-oriented focus, and increased accountability for the results produced by the water utility (Herrera & Post, 2014).

### 3.3 Role of economic regulation

Whether provision of urban water falls into free market hands or under state control, the existence of natural monopoly, high infrastructure costs, externalities, and social welfare concerns in the water sector create a strong rationale for economic regulation.

Economic regulation is defined as regulation, enforcement mechanisms, incentives, and processes employed by governments in markets where there is no effective competition, to ensure accessibility, reliability and affordability of essential services such as water and electricity (Groom et al., 2006). Water provision is not highly contestable, and hence this puts little pressure on service providers to maintain service quality, operate efficiently to keep prices down, and serve marginal and less profitable areas (Mumssen & Triche, 2017). Economic regulation is therefore critical. According to Groom and others (2006), the main objectives of economic regulation of water services are as follows:

- all households have access to services at prices that reflect the cost of efficient services;
- the quality of service for households and other customers is appropriate: service is reliable, water for human consumption meets drinking water standards, effluents meet standards for reducing pollution;
- services are financially viable and sustainable, do not pose an excessive financial drain on public funds, and can attract necessary investment funding;
- services are managed and operated in an efficient and technically effective manner; and
- tariffs reflect the cost of providing efficient services and provide incentives to both operators and customers to reduce waste.

Affordability of services for low-income households presents a dilemma for economic regulation. The general view is that economic regulators should focus on ensuring the financial viability of the services, while governments should provide guidance on how to achieve universal access to water in a transparent manner.

The issue of poor access to water services in marginal communities remains a concern, particularly in developing countries (Grafton et al., 2015). The basic necessity of water supply and its benefits to public health and economic productivity make it imperative that all households have access to the service, including poor households with limited financial capacity (Mumssen & Triche, 2017). However, this makes it difficult amid reform initiatives to transform the water sector into a financially viable one, where private funding can be drawn in to finance costly infrastructure and thereby avoid reliance on public funds that can be allocated to other development projects.
4. Urban water sector in Papua New Guinea

4.1 Overview

PNG is blessed with an abundance of water resources. As shown in Table 1 below, like its neighbouring Pacific Island nations, PNG sources water mainly from fresh running streams or rivers (surface), the ground (bore), and through rain harvest.

Table 1: Main sources of freshwater for the Pacific Island nations

<table>
<thead>
<tr>
<th>Country</th>
<th>Water source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cook Islands</td>
<td>surface water, groundwater, rainwater harvesting</td>
</tr>
<tr>
<td>Federated States of Micronesia</td>
<td>surface water, groundwater, rainwater harvesting</td>
</tr>
<tr>
<td>Fiji</td>
<td>surface water, groundwater, rainwater harvesting, seawater desalination</td>
</tr>
<tr>
<td>Kiribati</td>
<td>groundwater, rainwater harvesting</td>
</tr>
<tr>
<td>Nauru</td>
<td>groundwater, rainwater harvesting</td>
</tr>
<tr>
<td>Niue</td>
<td>groundwater, rainwater harvesting</td>
</tr>
<tr>
<td>Palau</td>
<td>surface water, groundwater, rainwater harvesting</td>
</tr>
<tr>
<td>Papua New Guinea</td>
<td>surface water, groundwater, rainwater harvesting</td>
</tr>
<tr>
<td>Republic of the Marshall Islands</td>
<td>surface water, groundwater, rainwater harvesting, seawater desalination</td>
</tr>
<tr>
<td>Samoa</td>
<td>surface water, groundwater, rainwater harvesting</td>
</tr>
<tr>
<td>Solomon Islands</td>
<td>surface water, groundwater, rainwater harvesting</td>
</tr>
<tr>
<td>Tonga</td>
<td>surface water, groundwater, rainwater harvesting</td>
</tr>
<tr>
<td>Tuvalu</td>
<td>groundwater, rainwater harvesting, seawater desalination</td>
</tr>
<tr>
<td>Vanuatu</td>
<td>surface water, groundwater, rainwater harvesting</td>
</tr>
<tr>
<td>East Timor</td>
<td>surface water, groundwater, rainwater harvesting</td>
</tr>
</tbody>
</table>

Source: Falkland, 2011

The World Bank (2017) estimates approximately 13 percent of PNG’s population live in urban areas while the bulk of the populace lives in rural areas. The provincial towns and urban centres rely on these water sources to provide and sustain the urban population. Water usage in the urban centres mainly encompasses household (residential) and industrial consumptions.

Despite the abundant supply, the water supply and sanitation coverage in PNG is appalling. A recent assessment by the World Health Organization and UNICEF (2015) using Household Income and Expenditure and the Demographic Health Surveys reveals that PNG’s access to water and sanitation is the lowest in the Pacific, as depicted in Figure 2. Only nine percent of the population in PNG have access to piped water.
The WHO and UNICEF assessment also highlights a marked decline in the provision of piped water to residential premises from 61 percent in 1990 to 55 percent in 2012 in the urban sector. However, there appears to have been some improvement in accessibility of water services during the 12 years, as shown in Figure 3.

It is clear that PNG has not met its 2015 Millennium Development Goal targets and is facing a daunting challenge to reach its own targets of 70 percent access to safe water and sanitation by 2030 as envisioned in its
Strategic Development Plan and Vision 2050 (Brown et al., 2015).

Besides low rates of access to clean water, PNG WaSH related health statistics are also deplorable. Diarrhea and other water-borne and sanitation related illness are a major cause of morbidity in the country accounting for 28 percent of mortalities in children aged under 5 years (in 2009) and 12.8 percent of all mortality in the country (WHO and UNICEF, 2015). Poor access to water also spreads out to other development indicators. Lawrence (2017) observes that poor access to water supplies and sanitation contributes to loss of time, household income and productivity, which in turn affects business and economic activities in the country.

In effort to articulate and explain underlying factors giving rise to the country's dismal performance in water service provision, Brown et al. (2015) points out the following:

- water and sanitation have generally been low government priorities since independence;
- large rural population in often scattered and poorly accessible locations;
- no credible political leadership in water and sanitation sector compounded by non-existent dedicated ministry or authority for planning and coordination role;
- no sector policy or strategy to achieve the governments targets (until recently); and
- limited skilled water professionals and lack of funding support to the sector.

As with electricity and other essential services in PNG, urban water services are predominantly provided by the government — that is; state-owned enterprises (SOEs) and municipal authorities under subnational government — which have often been vertically-integrated monopolies. In providing the water services, these utilities are required to comply with relevant public policies relating to public health, environmental protection, water conservation, and economic regulations of SOEs.

4.2 Legislation relevant to the sector

Primary legislation relating to provision of water services in urban centres is the National Water and Sewerage Act (1986). The Act bestowed the then PNG Water Board responsibility to provide water and sanitation service and to take a lead role in planning, designing, constructing and managing the service, mainly in urban centres, as well as in rural areas where applicable. With elapse of time, the 1986 Act is being superseded by the newly endorsed National Water and Sewerage Act (2016). The amended Act makes provision for establishment of Water PNG Limited to replace the Water Board. Undertaking key functions required as that of the previous legislation, the 2016 Act requires Water PNG Limited to operate as a corporate company under the Companies Act (1997) and to liaise closely with provincial and district towns as required.

Moreover, the National Water and Sewerage Act (2016) makes provision for promoting and safeguarding water quality for public health, consumer and environment considerations, with reference to other appropriate legislations. That is, in undertaking its responsibilities, Water PNG Limited is to comply with the Public Health Act (1973), the Independent Consumer and Competition Act (2002; ICCC Act) and the Environment Act (2000). In principle, the Public Health Act is intended to ensure water quality standards and promote monitoring and regulation by the National Department of Health, while the Environment Act (2000) facilitates conservation and protection of water resources. Reference to the ICCC Act basically concerns consumer protection and economic regulation given the presence of state-owned utility firms in monopolistic markets. The Prices Regulation Act deals with regulation of prices for water and sanitation services provided by the state-owned utility firms (ICCC, 2015).

Another legislation that has considerable impact in the provision of water and sanitation services in the nation’s capital, Port Moresby, is the NCD Water Supply and Sewerage Act (1996). The Act was introduced at a time when the city was experiencing severe disruptions in water supply (Kaman, 2003).

On the sub-national level, the Organic Law on Provincial Governments and Local-Level Governments (1998) decentralise responsibility to provincial or local level government to participate in making laws on provision of
water in respective jurisdiction. Pursuant to this legislative provision, the municipal authorities are firm on the responsibility to supply water in certain towns in the country, despite calls to relinquish the role to the state-owned water entities.

4.3 Development plan

In its long-term development strategic framework (PNG Vision 2050), GoPNG envisages improved service delivery and access to clean water through development of water supply infrastructure (Independent State of Papua New Guinea, 2007).

In addition, the PNG Development Strategic Plan (2010–2030) aims to promote and guide PNG to a path of sustainable economic growth, and to achieve economic prosperity and a high quality of life for all citizens. With regard to the water sector, GoPNG recognises that access to better water and sanitation services is problematic and thus envisages the need to broaden access to reliable and affordable utility services (Department of National Planning & Monitoring, 2010). As shown in Table 2, the 2030 target is that 70 percent of the population will have access to improved water source and sanitation.

Table 2. Key strategic areas

<table>
<thead>
<tr>
<th>Key indicators</th>
<th>Baseline information</th>
<th>2030 target</th>
</tr>
</thead>
<tbody>
<tr>
<td>Access to improved water source</td>
<td>39% of total population</td>
<td>70% of population</td>
</tr>
<tr>
<td>Access to improved sanitation</td>
<td>44% of population</td>
<td>70% of population</td>
</tr>
</tbody>
</table>

Source: Department of National Planning & Monitoring (2010, p. 74).

The strategic plan emphasises that better access to safe and clean water will be critical to address water borne diseases and improve the dismal level of access to better quality water. According to the Department of National Planning & Monitoring (2010), only nine percent of the population in PNG has access to piped water.

4.4 Urban water provision

This section provides an overview of operations of Eda Ranu and Water PNG Limited, as state-owned entities responsible for water provision in selected towns. Where these state entities are not operating, the municipal (town) authorities are taking charge. A brief coverage on water supply profile under remit of these entities is also highlighted.

4.4.1 Eda Ranu

Eda Ranu was established following enactment of the NCD Water and Sanitation Act (1996) and took charge of the role of providing water and sewerage services in Port Moresby. Prior to that, the Act provides for creation of state-owned water company, named NCD Water and Sewerage Pty Ltd, to provide the essential service for the metropolitan residents. In the course of its start-up, the newly formed company agglomerated with a Malaysian company, JC-KRTA, to operate under the name Eda Ranu. According to Kaman (2003), it was a concessionaire based on a Build-Operate-Transfer arrangement, to source expertise and private capital for efficient operations and construction of critical infrastructure over a period of 22 years (which expires in 2019). As highlighted in Section 4.2, this was in response to concerns at that time that network of water and sewerage services were stretched beyond limits and there were frequent water supply disruptions.

During the stakeholder consultations, it was noted that Eda Ranu operates within the nation’s capital boundary and supplies approximately 180 million litres of water daily. The company sources water from Sirinumu dam in Sogeri, Central Province and transports it to its main water treatment plant at Mt Eriama, from where it is distributed to a number of reservoir tanks for consumption. Recently, a merger between the company and Water PNG Limited has been announced (“Duma announces merger of water utilities”, 2018). While the restructure in the management of the water utility is to be finalised, there is no doubt that the booming population and expansion of the city is straining the existing water network and infrastructure.
4.4.2 Water PNG Limited

Operated initially as Water Board, Water PNG Limited was formed after the passing of the National Water Supply and Sewerage Act in 1986. It is noted in the Kumul Consolidated Holdings website that the creation of Water PNG Limited resulted from actions by successive governments to streamline management practices in line with commercial objectives for better delivery of water services. To date, Water PNG Limited operates on a commercial basis under the Kumul Consolidated Holdings (previously Independent Public Business Corporation) who is the trustee owner of state assets and investments.

Currently, Water PNG Limited services 14 urban towns, and seven districts, serving mainly urban and peri-urban residents. The towns include Alotau, Kavieng, Kimbe, Kokopo, Kundiawa, Lae, Madang, Mt Hagen, Wabag, and Wewak. The district towns include Kainantu, Maprik, Bereina, and Kwikila. Figure 4 shows the presence of Water PNG Limited throughout the country.

Figure 4: Snapshot of Water PNG Limited operations in PNG

In terms of supply profile under Water PNG Limited, conventional water goes through a number of stages before it reaches users (consumers). It starts from water source to storage tanks, gets treated to drinkable standards at the water treatment plants (WTPs) and then is diverted to service reservoirs before being distributed via pumps or gravity feed to water mains or networks of reticulated pipes for consumption. A typical reticulated network is illustrated in Figure 5, taking the case of Alotau (where Water PNG Limited operates) from source, treatment, reservoir and to distribution.
Figure 5: Alotau piped water network

Source: Water PNG Limited

Water required to meet demands of the towns and districts where Water PNG Limited operates is drawn from the local river, spring and ground water catchments which are then treated at treatment plants. Taking the case of the selected provincial towns where there is presence of Water PNG Limited, water is mainly sourced from the bores, transported to storage tanks before being treated and distributed for consumption. In terms of consumption rate, it varies from 3 to 4 million litres of treated water each by both residential and industrial users. It appears there is stringent quality check and treatment process executed by the company to ensure delivery of drinking water. The pipe network is based on gravity pull but in certain cases where water has to be transmitted uphill, electric pumps are used.

A brief water profile of case-studied towns under the remit of Water PNG Limited is presented below:

- **Alotau** — Water PNG Limited provides over 2.5 million litres of treated water each day to residents of Alotau town. Most of the water required to meet Alotau township demand is drawn from the Goilawaligina Creek and the Koiabule Bores. Water from the Goilawaligina Creek and the Koiabule Bores is then treated at the Garuboi WTP. The Garuboi WTP was commissioned in 1988. It contains facilities for chlorination, contact and storage tanks, laboratory for water quality testing and sampling of all water drawn from the Goilawaligina Creek and the Koiabule Bores.

- **Kokopo (Rabaul)** — Water PNG Limited provides over 3.33 million litres of treated water each day to residents of Kokopo town in East New Britain. Most of the water is drawn from exclusively underground aquifiers through seven bore wells fielded at Vunabosco area, a short drive from the town. Water from the seven bore wells at Vunabosco is then treated at the Vunabosco WTP. Constructed in 2000, the Vunabosco WTP undertakes collection, chlorination, and distribution of all water drawn from the Vunabosco bore field. After treatment to drinkable standard, the water is piped to storage tanks within the town and intermittently distributed for consumption.

- **Lae** — Water PNG Limited provides over 30 million litres of treated water each day to residents of Lae City and surrounding areas. Water required to meet Lae City’s demand is drawn from the seven bores located at Taraka (along the perimeter boundary of the PNG University of Technology). Water drawn from these bores is then treated at the Taraka WTP and distributed via two main trunk systems, the high-pressure and low-pressure systems. The Taraka WTP was commissioned in April 1982. It contains facilities for the chlorination, storage and transfer of all water drawn from the Taraka Bore system. Greater proportion of water usages is driven by industrial demand where water is used for production purpose.

### 4.4.3 Municipal (town) authorities

As indicated earlier, there are exceptional cases of water supply provided by municipal authorities in provincial

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1 An extended extract for other provincial towns under Water PNG, which is compiled from materials available at the company website, is provided in Appendix A.
towns where neither Water PNG Limited nor Eda Ranu is present. This is the case for Goroka where the town authority, Goroka Urban Local Level Government is responsible for the water and sanitation services.

The Goroka Urban Local Level Government provides approximately three million litres of treated water daily to urban and peri-urban residents in the town. The water required to meet the demand is drawn from Zogizo river, running near the township. Water catchment, situated at Komiufa (a village near the town), diverts the flow of water to a state-of-the-art WTP that was recently constructed by the Japan International Cooperation Agency. The treatment plant does necessary treatment including chlorination, flocculation, sedimentation, and filtration before the water is piped to main storage tanks situated within the town at a higher altitude to allow gravity feed to distribute water into the mains for consumption.

At the time of the study, there was a proposal of take-over of the operations by the Water PNG Limited. According to local news agent, GoPNG have issued directives to Water PNG Limited to move in and take over the role of water provision in the town (Mou, 2017). However, it was obvious during the consultation that the municipal authority is firm to retain the role in the interest of generating internal revenue for the local level government to support other essential town service provisions such as routine road maintenance within town vicinity roads and collection (disposal) of rubbish. Meanwhile, the Eastern Highlands Provincial Government has recently signed an agreement worth about K100 million with the Chinese Government for the upgrade of the Goroka water supply system (Per, 2018).

### 4.5 Reform initiatives

The following sections briefly highlight development and contents of WaSH Policy and the proposed establishment of a central coordinating agency, National Water, Sanitation and Hygiene Authority (NWSHA), as part of reform in the sector.

#### 4.5.1 The Water Sanitation and Hygiene (WaSH) Policy

In 2015, GoPNG announced the Water Sanitation and Hygiene (WaSH) Policy. A dedicated working group (Taskforce) led by the Department of National Planning & Monitoring, and other key players in the water sector, played a critical role in its conception and development. In its endeavour to design a well-articulated policy with clear linkage to the country’s development aspirations, the Taskforce considered existing targets included in the PNG Vision 2050, Development Strategic Plan, the Medium-Term Development Plan, corporate plans of the SOEs and the Millennium Development Goals (World Bank, 2014).

Now at the stage of its implementation, the WaSH policy aims to contribute towards improving the quality of life, specifically through reduction in water-related diseases, improved health and economic opportunities, and increased equity of services between rural, peri-urban and urban areas including the disadvantaged population (Department of National Planning & Monitoring, 2015). It is noted that the WaSH Policy articulates necessary targets and fundamental principles of service delivery, and stresses the importance of addressing underlying constraints to enable effective delivery of the water service.

With regard to urban water context, one of the policy targets is to enable 95 percent of the urban population to have access to safe and reliable water supply before 2030. In order to achieve the target, key strategies identified include improved sector coordination and leadership through the establishment of NWSHA, increased WaSH sector funding, appropriate technology promotion, enhanced private sector participation and partnership, and sector capacity building and training. These strategies are responding to the fundamental issues (highlighted in Section 4.1) the water sector has been facing over the years. As Brown et al. (2015) point out, notable issues include low government prioritisation of the water sector since independence, absence of credible political leadership (compounded by non-existent dedicated body for planning and coordination role), low numbers of skilled water professionals, and lack of funding support to the sector.

Finally, the policy notes resource implications in terms of the investments required to establish a central coordinating agency, the investments in infrastructure and the additional human resources required, along with an implementation schedule. This aims to help address many of the current and future problems — inadequate
water supply, unreliable water quality, financially burdened water supply system, unacceptable water loss, inadequate governance and lack of resources and capacity to manage water resources and supply system.

4.5.2 National Water, Sanitation and Hygiene Authority (NWSHA)

One of the key outcomes of the WaSH Policy is the establishment of NWSHA whose responsibility would include policy planning, coordination and implementation, sourcing and mobilisation of funding, undertaking of the sector’s regulations, and overall monitoring and evaluation of WaSH sector development.

It is perceived that water and sanitation service delivery in PNG has been constrained by the lack of an effective organisational framework. In spite of the roles played by the National Department of Health and Kumul Consolidated Holdings in influencing delivery of quality water and safe sanitation practices, and exerting corporate control over the SOEs respectively, absence of central policy making body for the sector over rgw SOEs respectively, World Bank (2014) reveals the absence of central policy. The proposed establishment of a central entity to oversee policy formulation, coordination and execution (NWSHA) therefore perfectly fills the void.

While the draft legislative bill is to be tabled in Parliament for its enactment, Department of National Planning & Monitoring (2015) outlines the NWSHA’s role with respect to urban context, which include:

- providing support to existing and new operators to develop and implement plans to extend service provision to new urban areas through identifying potentially commercial locations and assisting with funding sources and appropriate service provision approaches;
- ensuring that all new interventions in urban areas include clearly identified strategies for providing services to poor and urban settlement areas; and
- developing and assisting in implementing specifically targeted strategies, in partnership with service providers, to ensure services are developed and improved to currently unserved customers in existing territories, particularly urban settlements. Developing strategies include exploring community service obligation funding, identifying alternate funding sources, and assisting SOEs and other service providers address non revenue water issues.

4.6 Economic regulatory arrangements

The urban water sector in PNG exhibits natural monopoly characteristics, and dominance of water utilities. As highlighted earlier, substantial costs are incurred to construct reticulation networks and water supply infrastructure, which exacerbate barriers of entry for potential market players. Thus, economic regulation is applied by the ICCC where price charged by Eda Ranu and Water PNG Limited is regulated.

In general, the ICCC Act (2002) and the Prices Regulation Act are applied to prohibit charging of discriminatory prices or anti-competitive behaviours conducted by the supplier of declared goods and services. Here, water and sewerage are declared services, hence Eda Ranu and Water PNG Limited are subject to price control to avoid excessive pricing, most likely to arise from a position of substantial degree of market power. For price control order, pursuant to Section 21(2)(a) of the Prices Regulation Act, the ICCC takes into account the need to protect consumers of the declared goods or services from the misuse of market power (ICCC, 2015). There is discussion to migrate from the existing price control regime to a regulatory contract regime similar to that of the electricity and sea port industries. This is subject to legislative amendment in the National Water and Sewerage Act (2016) to enable such change.

As highlighted in Section 4.4, GoPNG have proposed merging Eda Ranu and Water PNG Limited into a single entity. In accordance with due process, the proposed merger will be assessed under the ICCC’s clearance and/ or authorisation provision to determine the likely effect the transaction would have relating to substantially lessening competition in a market and public benefit tests.
5. Key challenges for urban water supply in PNG

This chapter discusses key issues that impact management and provision of water services in urban centres in PNG. It is based on review of available literature and stakeholder consultations with water utility representatives, policy practitioners, regulators, development partners, and provincial administrators throughout the selected provincial towns.

5.1 Public policy challenge

The absence of water specific national policy, legislation, and implementation plans prior to WaSH Policy announcement, as highlighted in Section 4.5, means that the government priorities for the water sector remain disarrayed and distorted. Further, the roles and responsibilities of government agencies to initiate, coordinate and oversee projects in the water sector were not clearly defined, and the resources were not used well.

As Bridgman and Davis (2004) put it, public policy is an authoritative response by government to public issues or problems that provides leadership, direction, coordination, and resources. The recently launched WaSH Policy and the imminent establishment of NWSHA endeavour to fulfil aspirations of improved and safer water supplies, thereby enhance prospect of accomplishing the goals enshrined in the country’s long-term sustainable development plans and vision statement. However, challenges of implementation, misalignment and poor governance cannot be underestimated.

5.1.1 Implementation and alignment issue

As noted earlier, the development of the WaSH Policy filled a vacuum with prescriptions that promote reforms in water governance and management. However, the policy is based on the assumption that there are adequate resources and capacity to implement it in parallel with the relevant legislations. Conventionally, it requires substantial number of professionals engaged in the implementation of policy, planning, and management of water resources with priorities on environmental impacts of water supply extraction and effluent treatment systems and controlling demand through long-established market mechanisms. This stretches beyond the typical task of replacing water mains or patching up leakages. In implementing the WaSH Policy, it is important to recognise local contexts, capacities, strengths and diversity.

While every effort is made to undertake necessary tasks in accordance with the WaSH Policy, the proposed NWSHA has a risk of operating in isolation and duplicating roles that are undertaken by existing institutions. For instance, one that appears controversial is the provision that the NWSHA will undertake economic regulation of water services. This has been the role of the ICCC, who over time had accumulated industry experience, expertise and economies of scale on regulatory matters.

Further, in reviewing the implementation of the WaSH Policy, World Bank (2014) cautions on the limited prospect of policy coordination across different players in the sector, even if there is sector-wide policy making function undertaken by the NWSHA. Failure to address this will give rise to lack of alignment between national policy and provincial or district implementation and therefore absence of momentum to drive policy implementation.

5.1.2 Ongoing governance issue

Water governance broadly encompasses improved transparency, accountability, equity and efficiency in the management and use of water resources. Solanes and Jouravlev (2006) show that impaired governance is a main obstacle to better and more equitable and improved water supply in urban centres. In identifying the challenges in water governance of Pacific Island nations including PNG, White and Falkland (2015) attribute to issues of very limited resources, no economies of scale, and coping with the complex cultural, social, and institutional changes stemming from the transition from subsistence to urban living. Development efforts in PNG have been continually hampered by weak governance (Hayward-Jones, 2016). It will be a daunting task to strengthen governance in the water sector to ensure efficient and quality supply of water to the growing population in towns.
and peri-urban centres.

There is growing recognition that water plays an important role in enhancing development indicators and improving livelihood (AusAID, 2003; Grey & Sadoff, 2006). To harness that, development strategy with emphasis on improved management efficiency, institutional reforms and community participations are increasingly taking precedence. Yet, inherent structural constraints owing to institutional and governance weakness have long held PNG back from capitalising on development opportunities (May, 2009).

5.2 Water resource challenges

Urban centres in PNG draw on piped network and the treated water supply system, sourced mainly from bore (underground) and surface water. For example, where consultations were conducted, Alotau, Lae and Rabaul source bore water while Port Moresby and Goroka draw on fresh running water. On the other hand, it was reported that urban residents with limited and poor access to the water mains use rain water collected in tanks within premises.

Ownership issues, water quality, and reserve sufficiency are fundamental challenges of a sustainable water system. These challenges are briefly discussed here.

5.2.1 Conflict of landowners’ interests

A recurring development constraint in PNG is land tenure issues under customary ownership. This often stems from widespread customary rights and tradition that land ownership implies resource ownership, including that of underground and fresh surface water. Approximately 97 percent of the land in PNG is held under customary ownership, and this land has substantial potential for national development. Lawrence (2017) affirms that uncertainty in land tenure in urban centres of PNG is a critical constraint to establishing an effective system for water storage, transmission and distribution.

Public policy promoting transfer of ownership of water resources to the government risks infringing landowner property-use rights. Whenever the government takes over control of land to access water resources for service provision to urban communities, the supposed owner of the water resource stand to sacrifice their traditional rights, inheritance and social security systems. Water for public use can be at the expense of traditional landowners.

Given the deep-rooted belief that land ownership also confers water ownership, construction of catchment, reservoir and mains on customary land often triggers conflict between the landowners and the water utilities (Low, 2011). This poses risks to extraction, storage and distribution of water for urban provision, let alone the threat of vandalism of water infrastructure, and consequent disruption of services. A classic example is the never-ending tussle between Eda Ranu and Koiari landowners of Sirinumu (Sogeri) where water for the Port Moresby system is drawn from. Recently the landowners threatened to shut down the water service should Eda Ranu and GoPNG fail to respond to their compensation demand for use of their resources (“Koiari LO’s give 48 hours deadline or city suffers”, 2018).

The process of identifying and securing adequate water reserves tends to consider local community needs, culture, land tenure, and land use requirements. In most cases, extracting water via catchment or drilling takes place on customary land. As discussed earlier, there is risk of conflict between local communities and water utilities or municipal authorities. Failure to meaningfully resolve such conflicts can easily lead to access to water reserves, which are the source of the entire water supply system, being blocked. Stakeholders revealed during our consultations that water utility companies have often paid commercial rentals and compensation to landowners to manage complex landownership issues in the interest of establishing or retaining niche water reserves to ensure sufficient and quality supply of water to urban consumers. At times, it has been a struggle to put up with these expectations.

5.2.2 Poor quality of water reticulation

Irrespective of the sources, ensuring water quality that is fit for public consumption is crucially important. It was noted during our consultations that water utility companies place upmost priority on quality and thus
embark on meticulous strategies to eradicate every trace of contamination along the reticulation system through appropriate treatment from extraction to consumption. However, there have been occurrences of poor quality of water reticulation. For example, in 2016, the Goroka water supply system was inundated with murky water (Alphonse, 2016). For private bore operators and tank users, this remains a grey area. Potential sources of water contamination include human settlements, agriculture, livestock rearing, the use of chemicals and fertilisers, mining, forestry, and waste disposal. As urban populations increase, the water supply cycle is susceptible to the contamination risks.

Treated water is integral to water quality in a reticulated system for urban supplies. Water utilities and municipal authorities perform basic treatment that encompass flocculation, sedimentation, filtration, and disinfection, if necessary. During our consultations, the service providers claimed to have WTPs that conduct necessary treatment in accordance with the established standards.

Nonetheless, it is an ongoing challenge to maintain the available resources, supplies, and capacity necessary to manage water treatment facilities, which are usually operated by mechanical equipment and maintained by use of chemicals. These treatment systems also require power supply, which is sometimes costly and unreliable when there are frequent electricity outages.

As discussed, residents from urban centres mainly source water via reticulated systems, wells, and rainwater tanks for both potable and non-potable use. The quality of water from wells and rainwater is a growing concern. In certain cases, quality checks and inspections on private bores are carried out to ensure safety standards. Yet, there is growing concern about the use of other non-reticulated water sources, such as rainwater tanks, which can be easily contaminated.

5.2.3 Handling sewage and wastage

While beyond the scope of this study, the issue of safe handling and disposal of sanitation and wastewater generated from urban dwellers emerged in the discussions with the stakeholders. It appears that much of the government focus is on maintaining and rehabilitating potable water for urban residents. A common problem that was highlighted in our consultations is the ageing infrastructure to take care of the sewage and wastewater within the residency boundaries, which give rise to frequent blockages and sewage leaks. Media reports have revealed this as an ongoing issue ("Sewerage leak an issue", 2017; John, 2016). Where there is no proper connection to the urban sanitation systems, households use rather basic septic tanks and compost toilets. In any case, leakage of sewage and adequate water disposal pose major health and contamination risks.

5.3 Water management challenge

The ever-growing population, rural-urban drift, increase in economic activities and modernised standard of living in urban centres are exerting enormous pressure on how water is managed and supplied. These changes and their drivers are part of the global trends discussed in earlier chapters. Associated with this are the ongoing water losses from the pipeline system within the urban network, which imposed significant cost. These challenges are further discussed here.

5.3.1 Lack of data on water demand

A properly designed urban water supply system is one that can acquire adequate information about the expected demand for water and losses from the system. For example, household pipeline metering and data from institutional and industrial water use would provide invaluable insights of the nature of peak water hours and usage volume. However, it was evident from the stakeholder consultations that such information is not available, indicating yawning breakdown in compiling data of water demand and related statistics.

Undoubtedly, the demand to use water is increasing, driven not only by its natural characteristics of sustaining livelihoods but by the increasing pace of urbanisation. As it stands, the case study cities and towns (Port Moresby, Alotau, Lae, Rabaul and Goroka) epitomise a thriving municipal hub with increasing movement of people and industrialisation. Port Moresby is a case in point. A growing number of well-to-do urban residents in the nation's
capital have ventured into building residential houses on the outskirts of the city where most of the land is still under customary ownership. This has given rise to a corresponding appetite to access basic amenities including electricity and water. As it is, water utilities are constrained to expand services into these areas (“Eda Ranu survey points out problems”, 2018). This compels residents to resort to alternative water sources besides reticulated water such as bore water, rainwater and water from private sources.

Water is often rationed in the event of dry seasons or scheduled maintenance to address mechanical issues, water quality concerns and infrastructure threats (pipeline breaks or pump failures). For example, Eda Ranu in Port Moresby normally puts out notices in advance of such scheduled rationing in the event of maintenance activities (“Water rationing for city residents”, 2016). Irrespective of water demand, rationing does limit water supply to domestic and industrial areas during the scheduled period. It requires users to manage their water usage.

5.3.2 Uncontrolled settlements putting pressure on water use

The sprawling urban population in PNG is a natural phenomenon, triggered largely by the alarming rural-urban drift in a bid to access improved social services and better employment prospects. This is compounded by the cultural obligations to attend to extended families by way of providing accommodation for relatives coming from rural areas. The increase in population growth effectively constrains dwelling space within urban jurisdictions, and so the spillovers find their way encroaching and squatting illegally on peri-urban areas. The increasing demand for water use by residents of settlements puts further pressure on existing capacity of water utility companies to provide adequate access to reticulated water. In unfavourable cases where access is constrained, settlers may resort to pipe tampering or illegal connection to access drinking water to survive in the cities and towns.

5.3.3 Non-revenue water

Where there is a high demand for water, there is also a risk of water loss. Non-revenue water (NRW), a popular term used to describe water loss, constitutes leakages from water supply pipelines, water usage from non-metered connections, illegal connection and theft. The water utilities admitted that tracing and accounting for the losses from production (volume of water produced) to water taps (volume of billed consumption) is a daunting challenge, one that requires pragmatic solution. As it is, NRW remains a big problem in urban water supply and is exacerbated by deteriorating water supply system and uprisings of uncontrolled settlement within peri-urban areas of the municipal towns in the country.

From the stakeholder consultation, NRW on average stands at 52 percent, which is relatively high. According to International Water Associations (2017) in Yazid et al. (2017), the NRW for developed nations ranges from 5–10 percent. But taking the case of Port Moresby, Eda Ranu endured NRW up to 54 percent, which is largely attributable to settlement and villages (James, 2017). The consequence of NRW is the loss of revenue by water utilities to sustain operations or invest in infrastructure to improve water provision in urban centres.

One issue that emerged during the stakeholder discussion on NRW is a prevailing culture of non-payment of utility services such as water. There is a general perception that water is a public good or basic necessity and therefore its provision ought to be without any fee. This perpetuates the ‘free handout’ mentality that makes provision of basic services unsustainable. Perhaps another factor that can explain this is the non-affordability issue. A significant number of households living in settlements cannot afford to pay the water bill in proportion to the water usage as compared to the working-class residents in established suburbs.

5.4 Infrastructure gap

One of the main issues that confront state water utilities is the aging and dilapidated water infrastructures (catchment, storage, treatment and supply mains). Besides refurbishing of water treatment facilities in recent times, most of the water infrastructure network in the country were constructed during the pre-and post-independence era. Taking Port Moresby as a case in point, the last major upgrade on the National Capital District Commission water and sewerage network was carried out by the Australian Department of Housing and Construction in early 1970s where back then the population was a fraction of today’s figure (Brown et al., 2015).
To date, these infrastructures are now past their operational efficiency and capacity to adequately meet the increasing usage of water in urban centres. As discussed earlier, escalating water demand means high water consumption, which in turn puts pressure and strains capacity of dilapidated water supply infrastructure. Yet, the investment in the sector remains relatively low (Lawrence, 2017). It is obvious that the water utilities are being trapped in an unfortunate situation of weak performance incentives, low willingness of consumers to pay, high water loss, and insufficient funding for maintenance, ultimately leading to deterioration of water assets. Water utilities and the municipal authority are in dire need of securing financial resource to fund the needed development and expansion of water infrastructure within respective jurisdictions.

5.5 Issue with economic regulation

While the overall objective of economic regulation is to promote efficiency and welfare improvement, the external factors notably high population growth, increasing demand and ongoing water losses, present yet another daunting challenge for the ICCC. Under the existing price control regime, Eda Ranu and Water PNG Limited are not responding positively to incentives to reduce the costs.

In its recent water price review, the ICCC notes that the operating expenditure for both utilities have been increasing at rates far higher than inflation (ICCC, 2015). From a regulatory perspective, accruing high costs for operational matters of the regulated entities would mean enhanced ability to deliver higher level of services. However, this is not the case, according to ICCC’s assessment. Eda Ranu and Water PNG Limited are yet to demonstrate any improved level of service as a result of the increased spending (ICCC, 2015).

Interestingly, the high operational costs beg the question of who would then be responsible for such financial outlay. It appears there is a real struggle to enforce regulatory requirements to ensure fair pricing and service improvement in water provision. This is compounded by the fact that the majority of the SOEs in PNG are struggling to perform financially to deliver service efficiently. Recent study indicates that SOEs return on equity was less than five percent between 2002–2012, which is well below commercial returns (Asian Development Bank, 2014).

Universal and affordable access to water services is an important government objective for the purpose of efficiency and equity reasons, as articulated and advocated in the WaSH Policy. This is clearly a development objective and not a commercial, profit-oriented objective. As state-owned water utilities, Eda Ranu and Water PNG Limited are supposed to operate on commercial basis with strict business discipline to ultimately make profit. This may pose difficulty to achieve the government objective.
6. Concluding remarks

The GoPNG sets an ambitious goal of improving accessibility, cost and delivery of water supply in urban centres in PNG. The implementation of the WaSH Policy is critical in promoting needed reforms in water governance and management to fulfil aspiration of improved and safer urban water supplies. However, there are risks of duplication in institutional functions, policy misalignment and implementation setback.

Ensuring urban water supplies sourced from underground and surface water are tested in accordance with quality standards and fit for consumption is crucially important. There is ongoing challenge to maintain resources availability, supplies, and capacity necessary to manage water treatment facilities. A growing concern is high risk of contamination from untreated water sources that are alternatives to the reticulated water system. Sourcing water for urban consumption often takes place on customary land, which can provoke conflict between local communities, and water utilities and municipal authorities.

The fast-growing population, ongoing rural-urban drift for improved service and opportunities, boom in economic activities and rising modernised standard of living in urban centres are exerting enormous pressure on existing capacity and management of water supplies. Water utilities are constrained to expand services to peri-urban areas where demand continues to heighten. Yet, non-revenue water continues to be a big problem, exacerbated largely by deteriorating water supply system and uprising of uncontrolled settlement.

Much of the urban water supply infrastructure (catchment, storage, treatment and supply mains) has aged over time and stretched adversely beyond operational efficiency and capacity, poising high risk in face of burgeoning demand for water use. While universal and affordable access to water services is an important government objective for the purpose of efficiency and equity reasons, the current commercial, profit oriented objectives of the state-owned water utilities are not supportive of it.

Continued political support is necessary to drive the needed reform in the water sector. For successful implementation of the WaSH Policy, the government must ensure that implementing agents have necessary resources, appropriate managerial skills, and information. In addition, strong performance incentives for the water utility companies backed by willingness of consumers to pay and sufficient funding module is needed to maintain and refurbish the water infrastructure. Further, promotion and enforcement of effective economic regulation to reduce costs for water utilities and create incentives for improved service delivery at affordable rates is needed.
References


### A. Profile of Water PNG Limited operations in other provincial PNG towns, referenced in Chapter 4.

<table>
<thead>
<tr>
<th>Town</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Daru</td>
<td>Water PNG Limited provides over 40,000 kilolitres of treated water each day to residents of Daru town. Most of the water required to meet Daru township demand is drawn from the Binaturi River on the mainland and pumped to Daru Island through submarine pipes. Water from the Binaturi River is then treated at the Daru water treatment plant (WTP). The treated water is pumped to two storage tanks; one at the treatment plant and the other an elevated tank located at a hill next to the Daru Police station. This is then distributed to the residents on Daru Island. Water is not supplied on a 24/7 basis but rather rationed to supply only 8 hours in one day. The Daru WTP was commissioned in 1971. It contains a flush mixer and two pressure filters.</td>
</tr>
<tr>
<td>Kavieng</td>
<td>Water PNG Limited provides over 18.2 million litres of treated water each day to residents of Kavieng town. Most of the water required to meet Kavieng township demand is drawn from the Vual Treatment Plant Bores (5 × bores). Water from these 5 bores is then treated at the Vual WTP. The Vual WTP was commissioned in the 1960s. It contains facilities for chlorination only.</td>
</tr>
<tr>
<td>Kimbe</td>
<td>Water PNG Limited provides over 2.6 million litres of treated water each day to residents of Kimbe town. Most of the water required to meet Kimbe township demand is drawn from bores. Water from the bores is then treated at the Kimbe WTP. The Kimbe WTP was commissioned in 1987. It contains facilities for the chlorination of all water drawn from the Kimbe Town Bore Field.</td>
</tr>
<tr>
<td>Kundiawa</td>
<td>Water PNG Limited provides over 1.2 million litres of treated water each day to residents of Kundiawa town. Most of the water required to meet Kundiawa township demand is drawn from the Monguma River. Water from the Monguma River catchment is then treated at the Kundiawa WTP. The Kundiawa WTP was commissioned in 1987. It contains facilities for chlorination only as the water is drawn from spring. Currently, the Kundiawa system is not supplying water 24/7 due to: • Abundant intake of the Urr Spring due to compensation claims from landowners • Alternate Water Source from Monguma is not sufficient to meet demand thus water supply is rationed. Water is supplied 9 hours per day.</td>
</tr>
<tr>
<td>Lorengau</td>
<td>Water PNG Limited provides over 0.8 million litres of treated water each day to residents of Lorengau town. Most of the water required to meet Lorengau township demand is drawn from the Lorengau River. Water from the Lorengau River is then treated at Gaten Tingou WTP. The Gaten Tingou WTP was commissioned in 2002. It contained facilities for the chlorination, filtration and storage of all water drawn from the Lorengau River system.</td>
</tr>
<tr>
<td>Madang</td>
<td>Water PNG Limited provides over 10 million litres of treated water each day to residents of Madang town. Most of the water required to meet Madang township demand is drawn from the Gum River. Water from the Gum River is then treated at Panim WTP. The Panim WTP was commissioned in 2000. It contained facilities for the pre-chlorination, flocculation, sedimentation, filtration and post chlorination of all water drawn from the Gum River system.</td>
</tr>
</tbody>
</table>
Mt Hagen

Water PNG Limited provides over 0.6 million litres of treated water each day to residents of Mt Hagen town. Most of the water required to meet Mt Hagen township demand is drawn from the Kum River. Water from the Kum River is then treated at Rabiamul full WTP. The Rabiamul full WTP was commissioned in 1982. It contains facilities for the pre-chlorination, coagulants (through flush Mixture), coagulation/flocculation, sedimentation, filtration and post chlorination of all water drawn from the Kum River system.

Popondetta

Water PNG Limited provides over 2.1 million litres of treated water each day to residents of Popondetta town. Most of the water required to meet Popondetta township demand is drawn from the Bangoho River. Water from the Bangoho River is then treated at the Popondetta WTP. The Popondetta WTP was commissioned in 1987. It contains facilities for the chlorination, correcting turbidity and pH levels of all water drawn from the Bangoho River system.

Wabag

Water PNG Limited provides over 7 million litres of treated water each day to residents of Wabag town. Most of the water required to meet Wabag township demand is drawn from the Pakip River. Water from the Pakip River is then treated at the Sangurap WTP. The Sangurap WTP was commissioned in 2009. It contains facilities for the chlorination of all water drawn from the Pakip River system.

Wewak

Water PNG Limited provides over 7 million litres of treated water each day to residents of Wewak town. Most of the water required to meet Wewak township demand is drawn from the Brandi River. Water from the Brandi River is then treated at the Brandi WTP. The Brandi WTP was commissioned in the 1970’s. It contains facilities for cleaning, filtration and chlorination systems required for human consumption. The treated water is pumped into a reticulation system that services 4 reservoir tanks and a pipeline system to over 3,000 listed customers in Wewak town.

Source: Water PNG

B. Stakeholders consulted

With sincere gratitude, we acknowledge the time and input of all the stakeholders consulted listed below.

<table>
<thead>
<tr>
<th>Organisation</th>
<th>Representative(s)</th>
<th>Title</th>
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<tbody>
<tr>
<td>Water PNG Limited</td>
<td>Kila Gare</td>
<td>Manager - Strategic Planning Port Moresby headquarters</td>
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<tr>
<td></td>
<td>Oi Naime</td>
<td>Business Centre Manager - Alotau</td>
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<tr>
<td></td>
<td>Ilai Kaku</td>
<td>Business Centre Manager - Rabaul / Kokopo</td>
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<td></td>
<td>Martin Bigiglen</td>
<td>Business Centre Manager - Lae</td>
</tr>
<tr>
<td>Eda Ranu</td>
<td>Dr Fifaia Maitainaho</td>
<td>Chief Operating Officer</td>
</tr>
<tr>
<td></td>
<td>Pipi Dai Boi</td>
<td>Manager - Planning &amp; Development</td>
</tr>
<tr>
<td></td>
<td>Roy Serep</td>
<td>Policy Analyst</td>
</tr>
<tr>
<td>Department of Health</td>
<td>Joel Kolam</td>
<td>Manager - Environmental Health</td>
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<tr>
<td>WaterAid PNG</td>
<td>Mark Wolfsbauer</td>
<td>Program Director</td>
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<td>Penny Dutton</td>
<td>Country Director</td>
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<tr>
<td>Department of National Planning &amp;</td>
<td>Täkele Tuna</td>
<td>National Coordinator</td>
</tr>
<tr>
<td>Monitoring (WASH PMU)</td>
<td></td>
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<tr>
<td></td>
<td>Clara Momoi</td>
<td>Monitoring &amp; Evaluation Officer</td>
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<tr>
<td>Department of Treasury</td>
<td>Stephanie Huasi</td>
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<td>Organisation</td>
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<tr>
<td>ICCC</td>
<td>Jack Timi</td>
<td>Executive Manager - Pricing and Productivity Division</td>
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<tr>
<td></td>
<td>Junior Hasu</td>
<td>Manager - Pricing and Productivity Division</td>
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<tr>
<td>Asian Development Bank</td>
<td>David Hill</td>
<td>Country Director</td>
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<tr>
<td>Goroka Urban Local Level Government</td>
<td>Harold Abori</td>
<td>Town Manager</td>
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<tr>
<td>Milne Bay Provincial Administration</td>
<td>Michael Viula</td>
<td>Deputy Provincial Administrator</td>
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