FIPAG
FUNDO DE INVESTIMENTO E PATRIMÓNIO DO ABASTECIMENTO DE ÁGUA

# CONCEPT NOTE

| | |
|---|---|
| **Project Title:** | **Resilient Infrastructure: Region - South** |
| **Country:** | **Mozambique** |
| **Region:** | **South Region** |
| **Date:** | **September 2021** |

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## ABBREVIATIONS & ACRONYMS

| | |
|---|---|
| AfdB | African Development Bank |
| AURA | Water Regulatory Authority (*Autoridade Reguladora de Água)- former CRA* |
| CRA | Water Regulatory Council *(Conselho de Regulação de Águas) – see AURA* |
| CREE | Foreign Economic Relations Commission *(Comissão das Relações Economicas Externas* |
| EC | European Commission |
| EIB | European Investment Bank |
| EMP | Environmental Management Plan |
| ESIA | Environmental and Social Impact Assessment |
| FIPAG | Water Supply Investment Fund [Asset Holder & Operator] *(Fundo de Investimento e Património do Abastecimento de Água)* |
| GDP | Gross Domestic Product |
| HDI | Human Development Index |
| MDG | Millennium Development Goals |
| MTA | Ministry of Land and Environment *(Ministério da Terra e Ambiente)* |
| MEF | Ministry of Economy & Finance |
| MOPHRH | Ministry of Public Works, Housing and Water Resources |
| NWRDP | National Water Resources Development Project |
| NRW | Non-Revenue Water |
| O&M | Operations & Maintenance |
| PDO | Project Development Objective |
| RAP | Resettlement Action Plan |
| UGEA | Procurement Management Unit (*Unidade Gestora e Executora das Aquisições*) |
| WASIS | Water Services and Institutional Support Project |
| WHO | World Health Organisation |

# 1. INTRODUCTION

## A. Purpose of the Note & Structure

As an asset holder, FIPAG is responsible for water supply services across all major urban areas in Mozambique. In the Summary of 2019-20 Report & Accounts, customer numbers totalled 3.9m, with 510,000 connections. Across the country water was supplied to approximately 54% of the potential customers in the service area.

Given the scale of the country, which is approx. 780,000km$^2$in land area and around 2,300km in length from north to south, FIPAG has established four regional operational areas for more effective service delivery. These are as follows:

- North;
- Centre;
- South; and
- Maputo

In 2011, the Government of Mozambique approved the National Urban Water Supply & Sanitation Strategy (2011- 2025). The strategy re-affirmed delegated management as the framework for service delivery, whilst promoting commercial sustainability in FIPAG and the principle of private sector involvement in water supply. To deliver those policy objectives, the strategy supports greater efficiency by grouping of water supply assets in secondary and tertiary urban areas into operational regions, with operations on a commercial basis, and gradually transforming municipal operations into public-private companies. The policy demands the professionalization of operations, and technical and financial support to build operator capacity. Finally, the policy envisions service coverage of 80% of the urban population by 2030.

To achieve this objective, substantial investment is required in physical assets, the organisation and the personnel working within the various functions across the organisation. This Concept Note deals with the various investments required for the Southern region.

The Note is structured as follows:

- An outline of the regional context, background, issues and challenges
- An outline of the various projects to address these issues and challenges
- A summary of the various projects for the relevant operational region.

Within each of these sections are more detailed discussions of technical, financial, environment/social, resources and organisational issues. Also included are summary cost estimates, expected outcomes, programme/implementation timelines together with risks and mitigations. The latter include supporting activities to be delivered by other parties (e.g. the Government of Mozambique) or those already in hand or in place.

## 2. THE REGIONAL CONTEXT & BACKGROUND

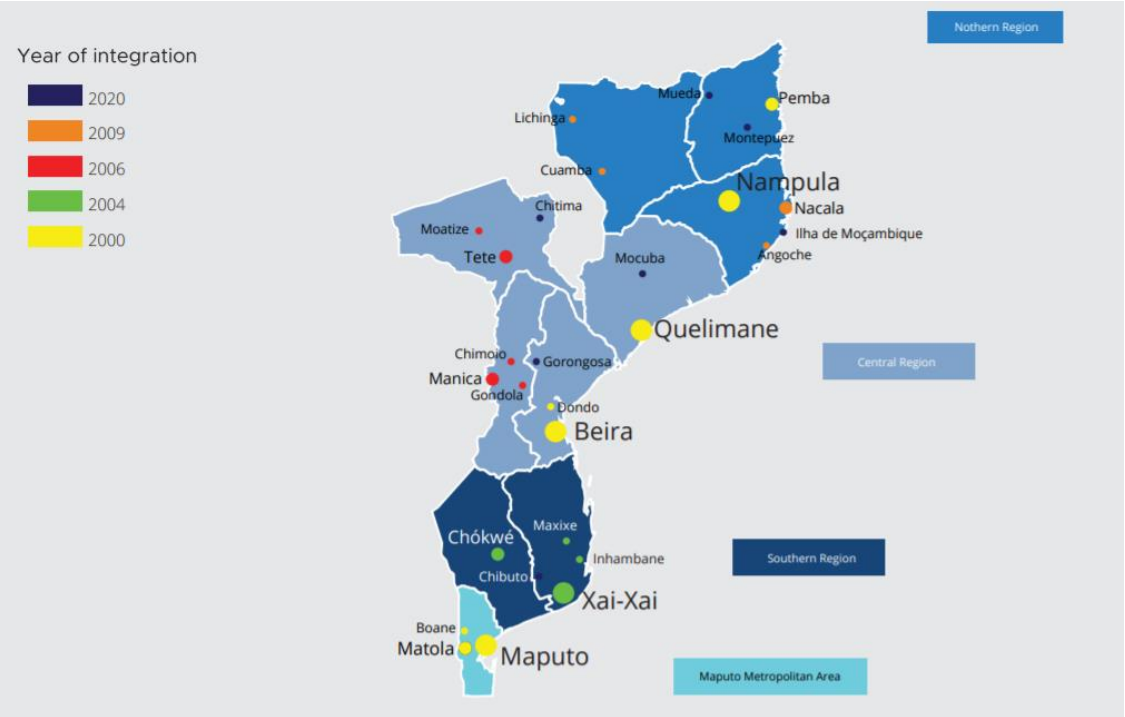
### A. Description

#### 1. Regional Characteristics

The FIPAG Sul (Southern) region of Mozambique consists of two provinces as shown in the table below;

| Province | Area in km² | Pop. in m (2017) |
|---|---|---|
| *Gaza* | 75,100 | 1.422 |
| *Inhambane* | 68,610 | 1.488 |

*source: 2017 Census: [http://www.ine.gov.mz/operacoes-estatisticas/censos/censo-2007/censo-2017](http://www.ine.gov.mz/operacoes-estatisticas/censos/censo-2007/censo-2017)*




***Inhambane***

All the province lies on the coastal plain bordering the Indian Ocean with a maximum height of 500m above sea level on its western border with Gaza Province. The province's climate is semi-arid, although the southern/eastern coastal area, where the main cities of Inhambane and Maxixe are located, has a sub-tropical climate.

The province has a population density of 21.7 persons per km² with most of this located along the coastal strip. The main activity is agriculture, with tourism along the coast. In economic terms, it is 5th in Mozambique with an HDI around just over the national average.

The capital is Inhambane City (82,000 in 2017), although Maxixe (120,000 in 2017), across the bay from Inhambane City, is the largest city in the province. FIPAG currently provides urban water supply in the ***Inhambane*** and ***Maxixe*** urban areas as well as a few smaller towns along the coast.

***Gaza***

This province lies directly to the north of Maputo province and most of the province lies in the basin of the Limpopo River, which runs from northwest to southeast, emptying into the Indian Ocean near Xai-Xai. Other rivers include the Changane River, a tributary of the Limpopo, forming part of the eastern boundary with Inhambane province. The Rio dos Elefantes (Olifants River) flows into the district from the west through the Massingir Dam, to empty into the Limpopo. The Save River forms the northern boundary of the province.

Nearly all the province lies on the coastal plain and only reaches 1000m above sea level along its western borders with South Africa and Zimbabwe. The climate is semi-arid, significantly drier than the central and northern provinces of Mozambique. Several rivers, such as the Changane, only flow on in the wet season. Only the coastal fringe, where the main city of Xai-Xai is located, has a sub-tropical climate.

The province is the second most sparsely settled in Mozambique with a density of 18.8 persons per $km^2$. The main activity is agriculture, with significant areas also consisting of national parks and some tourism along the coast. Much of the agriculture relies on irrigation water drawn from the Limpopo River.

Economically Gaza Province is ranks $6^{th}$ in Mozambique with an HDI around 98% of the national average. The Limpopo railway, which connects Zimbabwe and Botswana to the port of Maputo, runs north-south through the province, entering Zimbabwe at the border town of Chicualacuala.

The major urban areas are Xai-Xai (approx. 133,000 population), Chibuto (75,000) and Chokwe (65,000). FIPAG currently provides urban water supply in the ***Xai-Xai, Chibuto, Chokwe & Guija*** urban areas, along with several smaller settlements along the coast.

## 2. Specific city issues

Both provinces are sources of the migration to the Maputo region, although these provincial urban areas have grown as well over the past 10 years. Forecast increases are however lower at 1.1% (Inhambane) and 1.4% (Gaza) than those for the Northern region.

The table below shows the current and future populations in the service areas of each urban area. Actual growth rates will differ, driven by specific factors, whether local economic growth or forced displacement by natural disasters or civil disturbance.

*Table 1. Population growth to 2030 for Northern Region in FIPAG Water Supply Areas*

| City | Population | | |
|---|---|---|---|
| | 2020 (est.) | 2025 (fcst) | 2030 (fcst) |
| *Inhambane City* | 75,106 | 79,328 | 83,788 |
| *Maxixe* | 125,456 | 132,509 | 139,959 |
| *Xai-Xai* | 246,147 | 263,867 | 282,862 |
| *Chokwe (city only)* | 137,957 | 147,888 | 158,534 |
| *Chibuto* | 76,050 | 81,525 | 87,393 |

*Source: INE- 2017 Census*

In all cases, much of this growth is expected to be accommodated in informal settlement areas on the edges of the urban area. The remainder will occur within the existing built-up area, with increasing household sizes.

***Inhambane City & Maxixe***

Both settlements will be considered as one, given that they lie across Inhambane Bay from each other. Inhambane City is one of the oldest settlements on Mozambique's eastern coast, located on a peninsula in the Indian Ocean. With a relatively small population, Inhambane has a strong tourist focus, with both the historic settlement and the nearby Tofo and Praia de Barra beaches being significant attractions.

Maxixe, its sister city, is located on the main north-south highway and linked by ferry to Inhambane City. It is a much more industrial and commercial city, with large agro-processing and fish processing plants. Inhambane City is the political capital of Inhambane Province with Maxixe as the economic capital of Inhambane Province.

Population has increased in both these urban areas at a slower rate than in other regional centres, and is forecast to grow at only 1.1% per year until 2030. This is probably due to the much greater attractiveness of the Greater Maputo area some 450km to the south.

***Xai-Xai***

Xai-Xai is located only 200km north of Maputo, lying between the Indian Ocean and the Limpopo River; a distance of around 10km. The city itself is relatively low-lying and, like Chokwe, was badly affected by the 2000 Limpopo River flooding. This makes the surrounding coastal plan extremely fertile, and agro-processing is a major industry in the city. The city also has a significant tourism industry based at Praia do Xai-Xai with both beach and diving activities.

Similar to Maxixe, population growth has been slower rate than in other regional centres and is forecast to grow at only 1.4% per year until 2030. Again, this is probably due to the much greater attractiveness of the Greater Maputo area to the south.

***Chokwe***

The city is around 230km north of Maputo and inland from both Xai-Xai and Chibuto. Like both Chokwe is situated on the Limpopo River. This makes it vulnerable to flooding and since 2000 there have been 5 severe flooding events, some of which forced the temporary evacuation of many residents. Agriculture is the main economic activity, with salad crops and cattle local specialisms. Annual rainfall is much lower than in Xai Xai and is also very variable. As a result, there are many large irrigation schemes using water from the Limpopo.

The town is relatively small by FIPAG standards at 63,000 (2020), although clearly its vulnerability to flooding probably does makes it an attractive migration location only for seasonal agricultural work. This feature does however entail a different operational focus for water supply. The forecast growth rate for the town is 1.4% to 2030.

***Chibuto***

Sited close to the Limpopo River, the town of Chibuto lies equidistant from Chokwe and Xai-Xai in the middle of the fertile coastal plain. For many years, the main economic activity was agriculture, although recently exploitation of the local heavy sands for ilmenite (a titanium ore) has begun. This has resulted both in reductions in agricultural activity and displacement of people from the sand extraction areas.

Recent population growth has been slow and is forecast to be only 1.4% p.a. to 2030.

## B. Water sector – regional & local issues and challenges

### 1. Resources (e.g. dams, boreholes, transmission pipes etc)

***Inhambane City***

The area south of Inhambane is a peninsula between the Indian Ocean and the estuary of Maxixe. It consists of several dune ridges and valleys. There are several small river systems which have their source in the dunes and flow in north/west direction towards the estuary. One of these, the Guiua-river, is used as source for Inhambane with the intake point for a water treatment plant situated 7km south of the city.

The raw water quality is generally good, with some nitrate and ammonia, and turbidity which is removed by the filtration through the riverbank. Water was originally pumped via an artificial lagoon and bank filtration, but water is now also filtered via 5 slow sand filters before being chlorinated.

In 2013, the Artelia Report noted actual treatment plant production capacity of 11,000m$^3$/day with total plant capacity at 20,600m$^3$/day. A constraint on production was identified as insufficient raw water pumping capacity which were due to upgraded/replaced. The surface water resource is supplemented from 3 boreholes built nearby in 2011-2012. Other potential additional sources of surface water from the Matumba and Guiguacua rivers have been identified.

The production capacity in 2020 was 34,280m$^3$/day at the close of a US$3.25m project, these have included pump rehabilitation, additional boreholes and transmission pipe replacement.

Treated water is pumped via 18km of 300mm transmission pipe to the Guitambatuno and Muele distribution centres, where there are 6 ground reservoirs of 2,715 m$^3$ total capacity. The separate Tofo Beach system relies on groundwater via 5 boreholes producing around 1,400m$^3$/day. This water is disinfected prior to supply.

The current surface and ground water sources require better management to protect them from pollution. The artificial lagoon is subject to eutrophication and development of algae which require better monitoring. Algae growth does occur, but this is controlled by regular dredging. Groundwater quality is starting to be affected by poor sanitation.

The situation in Tofo has similar risks to those for Inhambane City: depletion, salinization, presence of iron (and manganese), and contamination from poor sanitation.

***Maxixe***

The source of Maxixe's water is surface water supplemented by groundwater. Water is abstracted from the Inhanombe River and sent to the water treatment plant. Treatment comprises pre-chlorination, aeration, coagulation and flocculation, filtration, and final disinfection. In 2012, the plant had a capacity of 5,200m$^3$/day andle on 2020, a capacity of 6,400m$^3$/day .

Ground water abstraction is from a well-field composed of 13 boreholes. Water from these is chlorinated and has three destinations; (i) direct to the main system, (ii) to the treatment plant to be mixed with surface water, and (iii) to local networks and stand posts. The total capacity of the boreholes was estimated to be 12,360m$^3$/day in 2012.

In 2020, the production capacity increased to 13,100m$^3$/day at the close of a US$2.2m project, these have included pump rehabilitation and transmission pipe replacement.

The hydrogeology of the area is very similar to that of Inhambane consisting of several high dune ridges with the valley of the Inhanombe lying between. The sources of the river are in an area with sandstone and limestone aquifers. The river is eutrophic and water plants are an issue. Iron concentrations are relatively high, although not above the drinking water limit. Groundwater is drawn from the dunes, where salinity, Fe and Mn, and bacteriological quality

are also sources of concern. Treated surface water is currently mixed with groundwater to minimize water quality issues.

There are plans to develop large-scale agriculture in the Inhanombe catchment which would increase the already worrying contamination of the river from organic sources and increase the eutrophication problem. The use of water for irrigation may also diminish water availability for Maxixe.

Whilst there appears adequate raw water resource and treatment capacity, the issues for Maxixe are more around water quality. On-going monitoring is required to maintain distributed water quality and identify requirements for further treatment if necessary. FIPAG will also take part in any integrated water resources management planning for the river. Finally, it may also be necessary to identify new water sources further away from Maxixe.

***Xai-Xai***

In the Xai-Xai area, the water supply system covers both the city of Xai-Xai and part of the districts of Limpopo and Chongoene.

As in Maxixe and Inhambane, Xai-Xai is supplied by groundwater drawn from an aquifer in the dune sands. In Xai-Xai these abstraction boreholes are scattered across the urban area with a current daily production of 31,800$m^3$/day. The sole treatment is chlorination.

55km of 140mm transmission main supplies water to 9 distribution centres located across the urban area. 3 further small systems serve Chicumbane, Chongoene and Matchelene. 2 of these are supplied by groundwater whilst one abstracts from the Limpopo River.

In the near term, there appear to be adequate water resource. The main issue for Xai-Xai is related to the relatively shallow depth of the aquifer below the urban area. The maximum depth is 45m, with the Indian Ocean on one side and the Limpopo River sediments on the other. Although there is a risk of saline intrusion, the main issue is bacteriological contamination from poor sanitation across the urban area.

Furthermore, the environment around Xai-Xai is much degraded by human influence. Much of the coastal forest has been replaced by agriculture and the coast is relatively urbanized. This makes finding alternative water sources a greater challenge. Abstracting from the Limpopo River would also have a significant impact on the estuarine environment.

The abstraction assets themselves are becoming life-expired and require replacement and/or rehabilitation.

***Chokwe***

The Chokwe water supply system covers the city of Chokwe and part of the district of Guija.

Water from aquifers between 109m and 130m below the surface provide Chokwe's supply. In 2020, the production was of 10,680$m^3$/day from 7 active boreholes located around the urban area, with maximum installed capacity estimated at 13,230$m^3$/day. Treatment consists of disinfection using chlorine.

Water is then pumped via 27km of transmission main to 3 DCs with a total storage capacity of 800m$^3$.

FIPAG also has 7 smaller systems in the villages of Lionde, Massvesse, Conhane, Nwachicoluane, Mapapa, Guijá and Xilembene. All the systems except Xilembene used groundwater, however saline intrusion due to over-exploitation is now prevalent in 5 of these located to the south-east and they have since been connected via a 6km long pipe to the main Chokwe system. In Xilembene water is drawn from the Limpopo River, sent to a settling reservoir and then to a compact treatment plant before being pumped to a water tower.

The Chokwe aquifers lie under thick deposits of fluvial deposits containing saline water. The fact that the abstracted water is not saline indicates that the aquifer is well protected by a clay layer. It is assumed that the aquifers are recharged laterally from the continental plateau at the south-west side of the river plain via fault systems in these layers but the overall geo-hydrological situation is not well known.

Water demand in Chokwe already exceeds supply and there is a significant risk that over-exploitation of groundwater could lead to salinization and loss of the complete resource. Further hydrological analysis to identify both local limits and alternative supply sources is required.

The prevalence of flooding also has an impact on water supply with both assets in place and spares stocks being affected in past events. Increasing supply resilience by improving borehole and pump protection should also be a priority.

***Chibuto***

Information in Chibuto is much more limited as it only came into FIPAG control in 2020. Water is abstracted from the Chongoene River and treated at a plant with 2,450m$^3$/day capacity, although it has a 3,000m$^3$/day design capacity. The treated water is transferred around 8.5km to Chibuto.

The Chongoene River is both highly seasonal in its flow, often drying up in its upper reaches and badly affected in its lower reaches by agricultural activities such as abstraction for irrigation and eutrophication/excessive plant growth from fertiliser run-off. Whilst population growth in Chibuto is low, water demand already appears to exceed supply. The limited and polluted raw water source is clearly a major risk to safe supplies and identification of both remedial works to the assets and alternative water resources would seem a priority.

**2. Technical (e.g. distribution infrastructure, coverage, quality and quantity, physical water loss)**

***Inhambane City***

The Inhambane City supply network has 2 distribution centres at Guitambatuno and Muele, with storage capacity consisting of 6 ground reservoirs of 2,710m$^3$ total capacity. Distribution pipe diameters range from

50mm to 350mm (50% is 63mm and 75mm) with the main materials being PVC (90%), and HDPE (7%). Total network extent is 233km.

The number of active legal connections has remained stable over the 2016-2020 period at around 13,500 with active stand-posts also stable at 16 over the same period. Around 71,500 people are now served, with approx. 4,800 from stand-posts.

Coverage has fallen slightly between 2016 and 2020 but remains over 82% andfor those on the system average hours of supply are 18 per day. There has been a significant increase in failed water quality tests since 2016. Whether this is due to increased frequency of testing or more failures is not evident, however this does clearly show the issue of contamination.

Non-revenue water has averaged around 32% over the past 5 years with significant fluctuations probably related to treated water scarcity and billing. In 2016, water into supply was 3,233,000$m^3$/year and has fallen slightly to 3,100,000$m^3$/year in 2020. Over the same period, billed volumes fell from 2,256,000$m^3$/year to 1,989,000$m^3$/year.

For the Inhambane network, the issues can be summarised as follows:

- Maintaining raw water quality and improving treatment processes;
- Enhancing the water transmission and distribution networks to keep pace with population growth and improve water quality at the customer tap; and
- Maintaining the relatively low levels of non-revenue water to both increase revenues and ensure maximum use of scarce water resources.

***Maxixe***

Treated water from the plant is pumped around 10km via 2x 315mm PVC pipes to 2 distribution centres at Bato and Rumbane, where there are 5 ground reservoirs with a total capacity of 1,650 $m^3$. Bato DC also has a 250$m^3$ capacity water tower.

Distribution pipe diameters range from 50mm to 250mm (56% is 63mm and 75mm) with the main materials being PVC (95%) and HDPE (5%). Total network extent is 402km.

The number of active legal connections has increased slightly from 13,740 in 2016 to 14,560 in 2020 period active stand-posts falling from 30 to 20 over the same period. Around 77,200 people are now served, with approx. 6,000 from stand-posts.

Coverage has remained broadly stable between 2016 and 2020 but currently stands at 66%. For those on the system, average hours of supply are 12 per day with average system pressures at 6 bar. As in Inhambane, there are a significant number of failed water quality tests between 2016 and 2020. Whether this is due to increased frequency of testing or more failures is not evident, however this does clearly show the issue of contamination.

Non-revenue water has risen from 35% in 2016 to 57% in 2020. In 2016, water into supply was 2,853,000$m^3$/year and has risen to 4,110,000$m^3$/year in 2020.

Over the same period, billed volumes fell from 1,864,000m$^3$/year to 1,779,000m$^3$/year. The condition of the network and meters as being extremely poor, which is supported by these NRW values. This is likely due to the rapid ageing of the distribution network.

For the Maxixe network, the issues can be summarised as follows:

- Monitoring of raw water quality and improving treatment processes to maintain water quality at the customer tap,
- Urgent rehabilitation of the water transmission and distribution networks to reduce water losses and increase revenues.

***Xai-Xai***

As noted above, there are 9 DCs in the urban area, with some 5,830m$^3$ of storage capacity. The total reported distribution network length in 2020 was 612km. Diameters and materials are similar to Maxixe and Inhambane.

The number of active legal connections has increased slightly from 26,830 in 2016 to 30,090 in 2020 period with active stand-posts falling from 27 to 20 over the same period. Including the Chongoene area, around 160,000 people are now served, with approx. 8,100 via stand-posts.

Coverage has remained broadly stable between 2016 and 2020 but currently stands at 65%. FIPAG state that (for those on the system) average hours of supply are 20 per day with although average system pressures are low at 3 bar. As in Inhambane and Maxixe, there are a significant number of failed water quality tests between 2016 and 2020. The Artelia Report outlined the testing regime in operation in 2013, and clearly the issue of contamination has continued to grow.

Non-revenue water has risen from 49% in 2016 to 63% in 2020. In 2016, water into supply was 7,876,000m$^3$/year and has risen by 30% to 10,379,000m$^3$/year in 2020. Over the same period, billed volumes fell from 4,029,000m$^3$/year to 3,852,000m$^3$/year. It is evident from the 30% increase of water into supply in 5 years, the low system pressures and increasing NRW values that the distribution network is ageing rapidly.

For the Xai-Xai network, the issues can be summarised as follows:

- Monitoring of raw water quality and improving treatment processes to maintain water quality at the customer tap,
- Planning for rehabilitation of the water transmission and distribution networks to reduce water losses, increase revenues and provide for population growth,
- Identification of alternative water sources to increase supply resilience and keep pace with population growth.

### *Chokwe*

From the 3 distribution centres in Chokwe City, water is distributed to both the city and the 5 outlying settlements via 295km of pipes. These vary in diameter from 50mm to 110mm (85% 75mm or smaller), 98% of which is PVC.

The number of active legal connections has increased slightly from 13,375 in 2016 to 21,355 in 2020 period with active stand-posts remaining stable at 34 over the same period. The increase in connections is doubtless due to the addition of the 5 outlying areas and FIPAG estimate that around 123,000 people are now served, with approx. 10,200 via stand-posts.

Coverage has increased from 72% in 2016 to 88% in 2020, although other calculation methods indicate coverage is 80%. Nonetheless, this is at or above the Government coverage target of 80% of urban populations.

For those on the system, average hours of supply are 23 per day. In Xai-Xai it is likely that the average system pressure is low. Water quality testing between 2016 and 2020 appears very limited despite the issues of saline intrusion, flooding incidents and potential agricultural contamination.

Non-revenue water in Chokwe City is reportedly low although it has risen from 21% in 2016 to 29% in 2020. There are higher levels (up to 42%) in the recently connected settlements. In 2016, water into supply was 3,014,000$m^3$/year and has risen slightly to 3,360,000$m^3$/year in 2020. Over the same period, billed volumes were stable at between 2,382,000$m^3$/year (2016) and 2,381,000$m^3$/year (2020). The condition of the Chokwe City network and meters is considered as being good which is borne out by the NRW values. The system received a US$5.2m investment in 2008, and a further US$2.1m was spent in 2020 in Xilembene.

For the Chokwe network, the issues can be summarised as follows:

- Monitoring of raw water quality and improving treatment processes to maintain water quality at the customer tap,
- Identification of alternative water sources to increase supply resilience and keep pace with population growth,
- Planning for rehabilitation of the water transmission and distribution networks to reduce water losses, increase revenues and provide for population growth,
- Increasing network and supply resilience from flooding events.

### *Chibuto*

The recent incorporation of the Chibuto supply system into FIPAG means that data in the network is limited. There are in total 12km of transmission mains, with 5 storage reservoirs with total capacity of 1950$m^3$. The length of distribution main is variously reported at 63km and 75km, with no data on diameters or materials.

The number of active legal connections has reported in 2020 as 3,077 with 16 active stand-posts. Around 21,000 people are served, with approx. 4,800 via stand-posts. With a population of 76,000, this generates a coverage of around 27%.

For those on the system, average hours of supply are 12 per day with average system pressures of 6 bar.

In 2020, non-revenue water in Chibuto was reportedly 74%, with water into supply at 883,300m$^3$/year and billed volumes at 231,200m$^3$/year. The Chibuto network and meters are considered as being poor, an assessment which is borne out by the NRW values. All the assets are clearly life-expired, and management processes appear also to have completely collapsed.

For the Chibuto network, the issues can be summarised as follows:

- Rehabilitation of the water treatment, transmission and distribution networks to improve services, reduce water losses and increase revenues (as a priority)
- Monitoring raw water quality and improving treatment processes to improve water quality,
- Identification of alternative water sources to increase supply resilience and keep pace with population growth.

### 3. Financial & organisational (e.g. commercial water loss, financial situation, capacity)

The table below shows the reported billings and collections for the Southern Region urban areas up to August 2020.

*Table 2. Billings and Collections figures*

| **Revenue in US$** | Billing | | | | Collection | | | |
|---|---|---|---|---|---|---|---|---|
| US$ 1 = MZN 60 | Residential | Non-res | Stand-posts | Totals | Residential | Non-res | Stand-posts | Totals |
| Xai-Xai | 2,419,171 | 531,457 | 1,236 | 2,962,988 | 2,279,079 | 448,587 | 1,073 | 2,728,739 |
| Chókwè | 1,348,583 | 254,050 | 1,959 | 1,604,592 | 1,227,818 | 198,336 | 3,096 | 1,429,250 |
| Chibuto | 248,830 | 20,001 | 316 | 269,148 | 158,640 | 13,255 | 133 | 172,028 |
| Inhambane city | 1,102,502 | 343,418 | 502 | 1,446,422 | 1,004,289 | 351,168 | 403 | 1,355,860 |
| Maxixe | 1,188,993 | 164,499 | 1,309 | 1,354,801 | 1,061,320 | 142,260 | 1,692 | 1,205,271 |
| **Southerm Region** | 6,308,080 | 1,313,425 | 5,322 | 7,637,951 | 5,731,146 | 1,153,606 | 6,397 | 6,891,149 |

These values provide the collection ratios shown in the table below.

| | **Collection ratio (in %)** | | | |
|---|---|---|---|---|
| | Domestic | Industrial | Stand-posts | Total |
| Xai-Xai | 94 | 84 | 87 | 92 |
| Chokwe | 91 | 78 | 158[1] | 89 |
| Chibuto | 64 | 66 | 42 | 64 |
| Inhambane city | 91 | 102[1] | 80 | 94 |
| Maxixe | 89 | 86 | 129[1] | 89 |
| **Southern Region** | 91 | 88 | 120[1] | 90 |

*Note 1: collection of arrears.*

## 3. PROJECTS TO ADDRESS THESE CHALLENGES

### A. Description and components (for each city)

***Inhambane City***

With coverage over 80% and NRW at 32%, Inhambane City may seem to need only minimal attention. This would be unwise as the ability of the system to meet future demand relies on (a) protection and expansion of the raw water resources and (b) implementation of a systematic NRW programme to continue to control and reduce physical water losses.

As part of this, FIPAG is undertaking a US$1.22m project to:

- Construct 5 new boreholes in Malembuane;
- Construction of a semi-buried reservoir with a capacity of 500m³;
- Construction of a pressure tower with a capacity of 100m³;
- Laying of two lines of 7.4 km with DN250mm; and
- Construction of a chlorination point.

There are a range of other projects under development, which include adding further storage across the network, linking the new boreholes at Malembuane with the Tofo Beach system and upgrading the Tofo Beach treatment plant to address iron. There are also plans to replace up to 300km of distribution network, install 25 bulk meters and 40 pressure monitoring points.

These projects, if implemented, will assist in addressing the main issues for the urban area. The impact of COVID-19 on these works has not been reported.

***Maxixe***

The main challenges for Maxixe are around primarily operational in nature; improving the quality of water supplied, along with rehabilitation and upgrade of the networks to reduce physical water losses. In the longer term, as alternative uses compete for water and sanitation issues increase contamination, further raw resources may be necessary.

FIPAG have plans to address these issues by:

- Improving the efficiency of the surface treatment plant for increased volumes and water quality; and
- Construction of 24 boreholes at Nhamaxaxa, with a 1000m³ reservoir, and transmission pipes

For the network, there are a range of projects under development and/or in progress, which include adding further storage across the network, pump replacement/upgrades, and network replacement. These will address physical losses and help to meet future water demand to be met. The impact of COVID-19 on these works has not been reported.

***Xai-Xai***

From a resource volume perspective, Xai-Xai appears to be well-placed. From a resource quality perspective, Xai-Xai appears to be facing significant issues. The shallowness of the aquifer, the location of the urban area between the ocean and the river and the poor sanitation are present major risks for continued use of the resource and water quality.

There are projects in preparation/under development for the urban area. These appear however to relate to continued exploitation of the aquifer with associated infrastructure (i.e. transmission pipes and storage) with the objective of increasing coverage.

In terms of addressing the water quality issues, there are plans to bring into use new boreholes in the less-risky areas of the aquifer around Marien Ngoaby 10km to the north-east of the urban area.

From a networks and physical loss reduction perspective, there are plans to significant extra storage and install or replace up to 300km of the distribution network across the urban area. A total budget of US14.3m is indicated for these works, although there is no timeline for completion.

It should be noted that with an 30% increase in NRW in 5 years the actual volumes of water reaching the customer are in danger of becoming dis-connected from the volumes abstracted. If the local FIPAG operational response is merely to increase the rate of abstraction, then it seems reasonably likely that the aquifer will collapse and thus a relatively manageable situation of adequate supply becomes a catastrophe. Reducing physical losses has to be a priority in Xai-Xai for the long-term security of the resource.

***Chokwe***

As in Inhambane City, the situation with regards to coverage and NRW appears satisfactory and little investment is required. There are studies to investigate up to 11 new boreholes across the area, with improved disinfection systems (hypochlorite), 16km of transmission pipe and 5 new storage reservoirs with a total capacity of 6,100$m^3$. At proposed capacities of 80$m^3$/hour, these boreholes may well be sufficient to address the increasing demand from population growth and continued system expansion towards 100%.

There is also much activity proposed for distribution, with plans to install over 190km of new network to extend the service in Chokwe City and the adjacent settlements. Also proposed is the repair, replace or rehabilitate up to 40km of the existing pipes.

It would be expected in developing this new infrastructure that due regard has been given to asset resilience the flooding risks. It is also not evident whether there has been research into the sustainability of the aquifer under a potential 100% increase in abstraction.

***Chibuto***

Acting on the premise that the entire infrastructure in Chibuto is life-expired, FIPAG is developing a comprehensive plan for almost total repair/renewal of the infrastructure. Proposed works reach from the abstraction point on the Chongoene River, transferring the existing treatment plant to near the abstraction point, repairing and duplicating the existing transmission pipes, 4 new storage reservoirs, up to 270km of pipe replacement and extensive work on pumps, power supplies and other electro-mechanical equipment.

Moving the treatment plant closer to the river may also expose it to flooding.

**B. Rationale/technical areas to be addressed (incl. critical/steady state/growth components)**

As part of a review of the investment programme for the urban areas it served in the Southern region, an overall water demand model was created. This model used FIPAG data for each of their service areas as follows:

- the current and forecast populations for the areas served by FIPAG (note: these do not correspond exactly with INE forecasts for those urban areas and districts);
- the current number of domestic, industrial, commercial and municipal connections;
- the current number of stand-posts;
- the current asset infrastructure in place e.g. reservoirs and well-fields, treatment plants, transmission pipes, storage reservoirs & distribution networks lengths; and
- the current level of non-revenue water (physical and commercial losses).

Consumption and engineering assumptions. These were as follows:

| | |
|---|---|
| Conventional system coverage in 2030 | *80% (75% by individual connections, 25% by stand-posts)* |
| Total reserve capacity | *1 day's production* |
| Household size | *5.3 people* |
| No. of people served by stand-post | *300* |
| Consumption – current average | *90 litres /capita/day* |
| Consumption – new /future | *110 litres /capita/day* |
| Consumption @stand-post | *20 litres/capita/day* |
| Hours of supply | *24* |
| Maximum day demand production factor | *1.1* |
| Production capacity | *24h/day* |

Using this data and assumptions, water demand forecasts for each urban area were developed that meet the **80%** coverage through conventional system and **20%** coverage through point sources by 2030. Included in these water demand forecasts were FIPAG NRW targets for the relevant region as reviewed in the Sustainable Services NRW Concept Note. For the Southern region, the 2030 target for NRW is 28% of water into supply.

The outcomes of this water demand assessment are shown in the table below.

*Table 3 – 2030 water demand projections with installed treatment capacities: 80% coverage*

| Forecast water demand & current available/installed capacity | | 2020 | 2024 | 2030 |
|---|---|---|---|---|
| | *(m3/day)* | | | |
| **PROVINCIA** | **DISTRITO** | *Current available treatment capacity* | **Water Demand Projections** | |
| Inhambane | INHAMBANE | 9,500 | 31,500 | |
| Inhambane | MAXIXE | 10,000 | 18,500 | 23,500 |
| Gaza | XAI-XAI | 31,800 | 67,800 | 77,800 |
| Gaza | CHOKWE | 17,500 | 24,500 | |
| Gaza | CHIBUTO | 5,300 | 20,300 | 30,300 |

The red text/pink shading shows where the current installed infrastructure runs out of capacity to supply the relevant population in that urban area.

For the two urban areas of Inhambane City and Maxixe, water treatment capacity and demand appear to be reasonably matched to 2030. It should be noted however that this outcome is only achieved through a 50% reduction in NRW in Maxixe.

Current treatment capacity in Xai-Xai appears to be adequate in the short term although again this is dependent on a 55% reduction in NRW from its current reported level of 63%. In reality, given the timescale for such an impact, Xai-Xai will probably begin to reach its treatment capacity limit somewhat sooner than 2027.

For the remaining two towns in Gaza Province, Chokwe and Chibuto, demand rapidly out-strips treatment capacity. Allied with the risk of flooding and potential aquifer pollution issues, expansions in treatment capacity and process upgrades should be considered soon even before population growth is taken into account.

The main constraint identified in this model is treatment capacity. Whilst this aspect is important, there are associated downstream issues such as storage capacity that would also need to be addressed in the event of an increase in treatment capacity.

This model does however assume that there would be adequate raw water resource to supply any upgraded treatment capacity. No assessment has been undertaken of water resources in the work for this Note, and any

reference herein refers to work in this area found in the Artelia 2013 report. As reported in earlier sections, for several of these urban areas the issue of raw water resource is critical and requires further investigation.

## C. Results, objectives, outputs and outcomes

The table 4 below shows for each of the Southern Region urban areas the increase in numbers of people served by 2030 with 80% coverage, separated into individual connections and stand-posts.

*Table 3. 2030 served population by urban area with 80% coverage.*

| | | POPULATION SERVED | | | | |
|---|---|---|---|---|---|---|
| | | Connections | | Stand Posts | | |
| PROVINCE | SERVICE AREA/CITY | 2020 | 2030 | 2020 | 2030 | |
| Inhambane | INHAMBANE | 59,890 | 94,035 | 4,800 | 6,002 | |
| | MAXIXE | 72,541 | 95,008 | 6,300 | 31,669 | |
| | *Total* | ***132,431*** | ***189,044*** | ***11,100*** | ***37,672*** | **88%** |
| Gaza | XAI-XAI | 149,646 | 218,086 | 5,700 | 24,232 | |
| | CHOKWE | 109,477 | 114,367 | 10,200 | 28,592 | |
| | CHIBUTO | 16,197 | 50,357 | 4,200 | 16,786 | |
| | *Total* | **275,319** | **382,809** | **20,100** | **69,609** | **96%** |

More importantly, the following table identifies some of the additional infrastructure required to achieve this 80% coverage target by 2030 [Note: some aspects such as transmission mains and storage reservoirs have been omitted].

*Table 4. Asset requirements by Sourthern region urban area with 80% coverage by 2030.*

| | | Assets | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Intakes+WTP (m3/day) | | Distribution Networks (km) | | Connections | | Stand Posts | |
| PROVINCE | SERVICE AREA/CITY | 2020 | 2040 | 2020 | 2030 | 2020 | 2030 | 2020 | 2030 |
| Inhambane | INHAMBANE | 10,816 | 12,561 | 233 | 248 | 13,350 | 14,861 | 16 | 17 |
| | MAXIXE | 11,969 | 12,376 | 402 | 418 | 14,239 | 15,844 | 20 | 93 |
| | *Total* | ***22,785*** | ***24,937*** | ***635*** | ***666*** | ***27,589*** | ***30,705*** | ***36*** | ***110*** |
| Gaza | XAI-XAI | 31,800 | 38,861 | 612 | 798 | 29,424 | 48,033 | 20 | 94 |
| | CHOKWE | 10,000 | 18,690 | 295 | 325 | 20,938 | 23,930 | 34 | 106 |
| | CHIBUTO | 3,000 | 7,560 | 63 | 132 | 3,007 | 9,894 | 16 | 58 |
| | *Total* | **44,800** | **65,111** | **970** | **1,255** | **53,369** | **81,856** | **70** | **258** |

In this model, it should be noted when the 2030 water demand forecast was not met by the current (2020) installed capacity, the requirements for new abstraction, treatment plants, storage reservoirs and transmission main were based on 2040 water demand forecasts (see Table 2).

This is because general water engineering practice is to provide for longer periods than 5 years and infrastructure of this type is generally 'lumpy' in its implementation rather than linear.

## D. Cost estimates

Current (2020) capital costs were estimated for the following new asset infrastructure:

- Water treatment by source: surface water, borehole ($Cl_2$ disinfection only) and borehole (Fe & Mn removal and disinfection)
- Ground reservoirs (by volume from 1,000$m^3$ to 10,000$m^3$)
- Transmission mains (by diameter)
- Elevated storage (towers @average capacity of 250$m^3$) and pumping stations
- Distribution networks (by diameter)
- Individual connections and stand-posts

These were used to develop estimates for the costs of the required new assets to meet the 2030 coverage target of 80%. These are shown by urban area in Table 6 below.

*Table 6. New asset costs by urban area with 80% coverage by 2030.*

| NEW ASSET COSTS (BY URBAN AREA) | | | Cost by Asset Type (in US$ 2020 values) | | | | |
|---|---|---|---|---|---|---|---|
| | | | Intakes+WTP | Transmission M | Storage | Distrib | Connections |
| **PROVINCE** | **SERVICE AREA/CITY** | **150,799,074** | **23,920,000** | **67,275,000** | **19,365,000** | **30,200,000** | **10,039,074** |
| Inhambane | INHAMBANE | **25,549,068** | 4,900,000 | 11,740,000 | 3,515,000 | 4,800,000 | 594,068 |
| | MAXIXE | **22,276,824** | 6,500,000 | 4,410,000 | 3,500,000 | 6,000,000 | 1,866,824 |
| | ***Total*** | ***47,825,892*** | ***11,400,000*** | ***16,150,000*** | ***7,015,000*** | ***10,800,000*** | ***2,460,892*** |
| Gaza | XAI-XAI | **45,967,342** | 4,320,000 | 24,500,000 | 3,000,000 | 10,000,000 | 4,147,342 |
| | CHOKWE | **21,426,397** | 1,000,000 | 12,600,000 | 4,000,000 | 2,400,000 | 1,426,397 |
| | CHIBUTO | **35,579,443** | 7,200,000 | 14,025,000 | 5,350,000 | 7,000,000 | 2,004,443 |
| | ***Total*** | ***102,973,182*** | ***12,520,000*** | ***51,125,000*** | ***12,350,000*** | ***19,400,000*** | ***7,578,182*** |

The model also included the costs of existing asset renewal in line with current FIPAG policies for each asset type. The analysis also considered FIPAG's own assessment of the condition of its assets by urban area. The totals are shown in Table 7 below:

*Table 7. Asset renewal costs by urban area with 80% coverage by 2030.*

| ASSET RENEWAL COSTS (BY URBAN AREA) | | | Cost by Asset Type (in US$ 2020 values) | | | | |
|---|---|---|---|---|---|---|---|
| | | | Intakes+WTP | Transmission Mains | Storage | Distribution | Connections |
| **PROVINCE** | **SERVICE AREA/CITY** | **47,460,234** | **17,090,413** | **11,062,959** | **11,062,959** | **11,062,959** | **5,008,342** |
| Inhambane | INHAMBANE | **9,916,947** | 2,912,532 | 3,650,064 | 829,963 | 1,794,100 | 730,287 |
| | MAXIXE | **8,722,906** | 3,516,072 | 915,192 | 833,253 | 2,478,000 | 980,389 |
| | ***Total*** | **18,639,852** | **6,428,605** | **4,565,256** | **1,663,216** | **4,272,100** | **1,710,676** |
| Manica | XAI-XAI | **15,363,639** | 6,338,376 | 2,213,587 | 261,736 | 4,712,400 | 1,837,540 |
| | CHOKWE | **11,054,137** | 3,171,000 | 3,914,988 | 668,760 | 2,065,000 | 1,234,389 |
| | CHIBUTO | **2,402,605** | 1,152,432 | 369,127 | 126,109 | 529,200 | 225,737 |
| | ***Total*** | **28,820,381** | **10,661,808** | **6,497,703** | **1,056,605** | **7,306,600** | **3,297,666** |

It should be emphasised that these cost estimates do not include the budget(s) for any project(s) currently under construction within the Southern region. Several outline studies have been undertaken/are underway for further projects in the region to address the water demands in the various urban areas.

This Concept Note does not contain details of those studies. From a brief cursory review of what has been provided, it is evident however that any proposed project will seek to improve the service to FIAPG customers. The limitations on delivery are those of resources (mainly water), finance and expertise.

## E. Programme/implementation timeline

As part of model development, it was necessary to assume an expenditure profile for works to meet the growth in demand. The assumption used is shown in the table below.

| 2022 | 2023 | 2024 | 2025 | 2026 | 2027 |
|---|---|---|---|---|---|
| 5% | 10% | 25% | 25% | 25% | 10% |

It should be emphasised that this is a general profile for demand modelling purposes not a profile for any project in any city. These would be developed as needed for specific projects.

## F. Environmental & social aspects (incl. SDG aspects)

The main interventions identified include surface water abstraction works, expanding water supply intakes, borehole drilling, construction of water treatment plants, transmission mains, storage and water distribution networks.

These activities are considered likely to generate significant and irreversible environmental and social impacts. All projects should include mitigation measures to minimize the impacts; inter alia, noise vibrations, generation and disposal of construction waste, health and safety risks for contracted workers involved in construction activities, health risks and community safety.

These activities may be also associated with soil erosion and degradation, dust emissions of increased road traffic and construction activities within the community, workflow, physical and economic displacement of PAPs and risks related to Gender Based Violence (GBV).

All proposed projects must be preceded by an Environmental and Social Impact Assessment (ESIA). Thus will include the Environmental and Social Management Plan (ESMP) according to the Mozambican Environment Law (Law No. 20/97 of 1 October) and other international Environmental & Social Safeguards including those from the financier.

These policies are based on the precautionary principle that focuses on preventing the occurrence of significant or irreversible negative environmental impacts, regardless of the existence of scientific certainty about the occurrence of such impacts on the environment.

The environmental policies define the procedures for assessing the environmental impact as a preventive tool in the environmental management of projects. They also support the Government of Mozambique in making

decisions regarding the granting of the environmental licenses for project development.

A range of Environmental and Social instruments will be prepared as appropriate. These are as follows;

(i) Environmental and Social Management Framework (ESMF) due to the size of project area;
(ii) Environmental and Social Impact Assessment/ESMP when the projects have been defined and for the environmental licensing following the Mozambican legislation;
(iii) Resettlement Policy Framework (RPF) and subsequently the Resettlement Action Plan to address the physical and economic displacement of Project Affected People (PAP);
(iv) Gender Based Violence and Sexual Harassment (GBV/ SH) Plan;
(v) Stakeholder Engagement Plan (SEP) including the Grievance Redness Mechanism (GRM).

Conducting an Environmental and Social Impact Assessment involves the following key steps:

1) Screening and classification by the Ministry of Land and Environment (MTA),
2) Preparation of a Pre-Feasibility Study and Environmental Scoping (EPDA) and preparation of a Terms of Reference (ToR) for the ESIA;
3) Preparation of the ESIA, including an Environmental and Social Management Plan (ESMP) and Resettlement Action Plan after the approval of the EPDA and ToR.

FIPAG has significant experience of preparing and presenting ESIA's as part of the Greater Maputo Water Supply Master Plan Project Phase II (GMWSP II). This experience will prove invaluable for application on other projects in the Southern Region as appropriate.

### G. Risks & mitigations (city-specific if required)

FIPAG has developed a standard framework for assessing high-level risks and identifying suitable mitigations. For each specific project, a more detailed risk assessment and mitigation process would be developed and implemented, in the table below.

| RISK LOG FRAME APPROACH | | | | | |
|---|---|---|---|---|---|
| FACTOR/ RISK | COMMENTS | RISK CHARACTERIZATION | | | MITIGATION MEASURES |
| | | PROBABILITY | SEVERITY | RISK TYPE | |
| EXTERNAL FACTOR/ RISK<br>*Absence of alternative sources and redundancy of water supply systems* | | High Probability<br>4 | Strong<br>4 | Extreme | Planned measures to strengthen the capacity of sources and establish links to ensure alternative supply solutions in vulnerable systems. |
| EXTERNAL FACTOR/ RISK<br>*Unsustainability of interventions due weak territorial ordering and projection of urban settlements* | | Possible<br>3 | Moderate<br>3 | Moderate | The implementation of the planned actions should be preceded by water supply master plans aligned with the urban expansion plans, with a strong involvement of the municipalities. |
| EXTERNAL FACTOR/ RISK<br>*Coastal location and vulnerability of urban settlements to natural disasters such as erosion affecting the distribution network, saline intrusion and reduction of recharge rates in aquifers.* | | High Probability<br>4 | Strong<br>4 | Extreme | The water supply master plans will include risk mitigation measures/ reduction and capacity building in systems management, including water sources. |
| EXTERNAL FACTOR/ RISK<br>*Poor maintenance capacity reducing equipment life and efficiency.* | | Possible<br>3 | Strong<br>4 | High<br>12 | An institutional capacity building plan will be developed, including regular staff training and retention strategy, maintenance planning and equipment performance audit. |
| EXTERNAL FACTOR/ RISK<br>*High level of non-revenue water reducing the financial sustainability of water supply operations.* | | Almost Certain<br>5 | Extreme<br>5 | Extreme | The actions for services expansion will be anchored to non-revenue water programs and community education. |
| EXTERNAL FACTOR/ RISK<br>*Climate change affecting water supply infrastructures.* | | Possible | Moderate | Moderate | The interventations will include incorporating resilience actions towards impact of climate change. |

# 4. REGIONAL SUMMARY

## A. Summary cost table

The various requirements to meet water demand and the objective of 80% coverage service area populations in the urban areas served by FIPAG are summarised for the region by province in the table 8 below.

*Table 5. Total estimated new & renewal costs by province with 80% coverage by 2030.*

| Value (in US$m) | Extension Works | Renewal Works | Desalination Plant | Secured Projects |
|---|---|---|---|---|
| Inhambane | 47,825,892 | 19,720,093 | | |
| Gaza | 102,973,182 | 28,049,481 | | |
| Xai-Xai | | | 30,000,000 | |
| **Total** | **150,799,074** | **47,769,574** | **30,000,000** | **228,568,648** |

As noted in the previous section it should be emphasised that these cost estimates do not include the budget(s) for any project(s) currently under construction within the Southern region. Several outline studies have been undertaken/are underway for further projects in the region to address the water demands in the various urban areas.

Any proposed project will seek to improve the service to FIAPG customers. The limitations on delivery are those of resources (mainly water), finance and expertise.

## B. Summary technical results, objectives, outputs and outcomes – with contribution to regional/national measures

The technical results for various indicators are summarised below at the national level, with the Southern regional contribution to these listed separately. There is no attempt to list these indicators by specific urban area; this would be done for each project as it is developed.

| Indicator by 2030 | National | Southern Region |
|---|---|---|
| Total connections | 1,200,000 | 143,000 |
| Additional connections | 480,000 | 63,000 |
| Total population served | 9,000,000 | 760,500 |
| Additional population served | 2,500,000 | 332,500 |
| Coverage by conventional system | 80% | 80% |
| Additional coverage by point sources | 20% | 20% |
| Network length (km) | 15,000 | 2,600 |

## C. Summary financial outcomes (revenue growth, OPEX changes, P&L etc)

The financial impact of the various actions to meet water demand and the objective of 80% coverage service area populations in the urban areas served by FIPAG are summarised at the national level in the table below.

| SUMMARY FINANCIAL OUTCOMES - RATIOS | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2,020 | 2,021 | 2,022 | 2,023 | 2,024 | 2,025 | 2,026 | 2,027 | 2,028 | 2,029 | 2,030 |
| Revenue Growth Rate | -16% | 24.4% | 5.4% | 4.1% | 3.1% | 3.1% | 3.1% | 3.1% | 3.1% | 3.1% | 3.1% |
| OPEX Variations | -6% | 2.1% | 6.5% | 5.0% | 4.9% | 4.9% | 5.0% | 5.0% | 5.0% | 5.1% | 3.7% |
| Operating cost coverage rat | 89% | 73% | 74% | 74% | 75% | 77% | 78% | 80% | 81% | 82% | 83% |
| **Debt Service Coverage Rat** | | | | | | | | | | | |
| Minimum | 1.5 | 1.5 | 1.5 | 1.5 | 1.5 | 1.5 | 1.5 | 1.5 | 1.5 | 1.5 | 1.5 |
| Projection | -0.03 | 2.74 | 2.86 | 2.73 | 2.73 | 2.05 | 2.02 | 1.98 | 0.73 | 0.71 | 0.71 |

*Revenue Growth Rate*

The expected revenue growth rate fell by 16% between 2019 and 2020, due to the COVID-19 pandemic. This situation influenced the forecast for the year 2021, which ends up with an increase of about 24% (which seems high). From 2022 onwards, growth is forecast to return to trend levels of 5.4%, 4.1% and 3.1% to 2024, and from 2025 onwards, the growth rate is fixed in 3.1% until 2030.

*Operating Cost Coverage Rate*

The operating cost coverage ratio normally ranges between 60% and 80%. Lower values indicate good cost control. For 2020, the percentage was higher, due to loss of revenue caused by the pandemic. From 2021, the coverage ratio is expected to be within the accepted limits, except from 2028 to 2029 which it is forecast to be above the accepted range.

*OPEX*

Operating costs are forecast to increase annually by a constant 5% rate. There was a sharp reduction in this rate of increase to 2.1% between 2020 and the forecast for 2021 in the table below. In addition, from 2019 to 2020 there was also a fall due to the pandemic.

| SUMMARY OF PROFIT & LOSS | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2,020 | 2,021 | 2,022 | 2,023 | 2,024 | 2,025 | 2,026 | 2,027 | 2,028 | 2,029 | 2,030 |
| Operating Revenue | 2,141,164,627 | 2,664,460,932 | 2,809,470,903 | 2,923,700,886 | 3,015,573,754 | 3,110,183,186 | 3,207,552,478 | 3,308,042,708 | 3,411,786,965 | 3,518,923,018 | 3,629,536,914 |
| Operating Expenses | 1,900,375,630 | 1,939,570,055 | 2,065,236,719 | 2,168,679,328 | 2,274,494,258 | 2,386,424,783 | 2,504,820,670 | 2,630,137,690 | 2,762,761,403 | 2,903,063,692 | 3,011,439,435 |
| **Operating Results** | **240,788,998** | **724,890,877** | **744,234,184** | **755,021,558** | **741,079,496** | **723,758,403** | **702,731,808** | **677,905,018** | **649,025,562** | **615,859,326** | **618,097,480** |
| Financial result | (250,048,435) | | | | | | | | | | |
| **EBITDA** | (9,259,437) | 724,890,877 | 744,234,184 | 755,021,558 | 741,079,496 | 723,758,403 | 702,731,808 | 677,905,018 | 649,025,562 | 615,859,326 | 618,097,480 |
| Depreciation | 291,442,899 | 507,000,000 | 452,185,171 | 455,075,373 | 458,047,803 | 461,032,309 | 464,114,436 | 467,380,527 | 470,749,178 | 474,225,867 | 477,816,470 |
| Total interest expenses | 60,883,255 | 56,268,639 | 51,654,024 | 57,212,460 | 52,371,777 | 68,048,310 | 62,423,709 | 56,799,109 | 108,813,097 | 103,785,362 | 99,073,435 |
| **Net earnings** | **(361,585,591)** | **161,622,238** | **240,394,989** | **242,733,725** | **230,659,916** | **194,677,784** | **176,193,662** | **153,725,382** | **69,463,287** | **37,848,096** | **41,207,576** |

*Revenue Growth*

The growth of sales by almost 59% until 2030 can be explained as follows:

- ✓ Over the period up to 2030, new connections will increase by 145,500.
- ✓ The current customer base will grow from 594,070 active connections to approximately 739,600.
- ✓ The coverage rate is currently (2020) at around 54%, but the forecast until 2030 is to maintain it, therefore, it will increase the population growth forecasted by INE in more than 50% from 2020 to 2030.
- ✓ In 2020 FIPAG had about 10,415km of network. By 2030 this is expected to increase to 15,082km, an increase of about 45%. Extending the network allows more customers to be connected.
- ✓ The tariff will increase 2% annually from 2021 to 2030. This increase will be applied across all FIPAG Operational Companies.

## D. Supporting measures for delivery & risk mitigation (e.g. tariffs, organisational changes)

***Sustainability Support Measures Based on Tariff Adjustments***

The new Tariff Schedule and the proposed tariff adjustments will allow:

- ✓ Full recovery of operation and maintenance costs;
- ✓ Recovery of investments in the medium term; and
- ✓ Promotion of decentralization of services and guarantee of sustainability.

Thus, a tariff proposal is presented, focused on the cost and investment coverage targets previously mentioned and corrected for the effects of inflation.

Despite the adjustments applied, given the revenues generated by the companies, it has not been possible to cover the costs related to the operation of the companies and the payment of the debt service, since the cost of limited cross-subsidy and conditions of financial equilibrium, the systems are conditioned to provide continuity of these services, putting pressure on the installed capacity of the systems.

### *Adjustment Impact*

The adjustment process is designed to deliver the following outcomes:

- Continuation of the subsidy for an additional 1.5 million people in the social bracket, thus contributing to the maintenance of the basic food basket.
- Improvements in the efficiency in the provision of services, reductions in losses and increased hours of service and water quality.
- Creation of favourable conditions to attract investment and participation from the private sector.
- Guaranteeing the payment of the debt service of approximately US$9.8m per year.
- Supporting the smaller scale water supply systems that are or have been rehabilitated and operate under the delegated management regime.
- Continue to guarantee coverage of costs from the current 70% to 86%.

### *Management Process Support & Risk Management*

| RISK LOG FRAME APPROACH | | | | |
|---|---|---|---|---|
| FACTOR/ RISK | RISK CHARACTERIZATION | | | Mitigation Actions |
| | PROBABILITY | SEVERITY | RISK TYPE | |
| EXTERNAL FACTOR/ RISK or Risk Title | Possible | Strong | High | The Government of Mozambique (GoM) has implemented measures austerity, to minimize the effects; In 2019, FIPAG implemented cost / expense containment measures to ensure the continuity of the operation. |
| *Change in the country's political and macroeconomic situation* | *3* | *4* | | |
| INTERNAL FACTOR/ RISK | Unlikely | Low | Low | FIPAG, established the ethics and anti-corruption committee at central and operational levels; FIPAG will publish its performance (report of accounts) for public knowledge, in an efficient and continuous manner. |
| *Governance* | *2* | *2* | | |
| EXTERNAL FACTOR/ RISK | Possible | Moderate | Moderate | The government approved the decree that encourages the participation of the private sector in the strategic initiatives of the DMF and the creation of Regional Societies; FIPAG approved the new organic statute to respond to the current institutional changes. |
| *Weak implementation of DMF strategic options* | *3* | *3* | | |
| INTERNAL & EXTERNAL FACTOR/ RISK | High Probability | Strong | Extreme | The Government has encouraged the search option capabilities through PPPs and other internal investment options; FIPAG has been sharing projects with other financing coverage with other partners; FIPAG has prepared pre-feasibility studies and economic analyzes to guide future investments. |
| *Lack of resources for projects implementation* | *4* | *4* | | |
| EXTERNAL FACTOR/ RISK | Possible | Moderate | Moderate | FIPAG, has observed the adjustments tariff rates in compliance with the cycle approved by the government. The last tariff adjustment took place in 2018. |
| *Non-adjustment of water tariffs* | *3* | *3* | | |
| EXTERNAL FACTOR/ RISK | Almost Certain | Strong | Extreme | The Government, through the water sector, has coordinated efforts to respond to the insufficiency of resources, through financing from other sources of resources (eg water desalination); FIPAG has prepared pre-feasibility studies and Master Plan, to answer and guide current demands in terms ofsources. |
| *Insufficiency of water resources to ensure sources of water abstraction (Climate changes - Droughts and Floods)* | *5* | *4* | | |
| EXTERNAL FACTOR/ RISK | Possible | Moderate | Moderate | FIPAG has been developing internal strategies to involve the private sector in systems management in order to engage new financing opportunities and fill the existing deficit |
| *The water sector has been experiencing a retraction of funding to invest in the expansion of water supply(difficulties in finding other alternative sources of funding)* | *3* | *3* | | |

## 5. FINAL REMARKS

The estimated budget to achieve the objectives above mentioned is estimated at **247.02 M USD**. The summary of investment needs (table 9) below details the budget proposed.

*Table 6. The southern regional proposed budget*

| SOUTH REGION | TOTAL (Million USD) |
|---|---|
| RESILIENT INFRASTRUCTURE - WATER SUPPLY | $ 228.57 |
| RESILIENT INFRASTRUCTURE - DAM | $ 0.00 |
| SUSTAINABLE SERVICES- NRW | $ 12.50 |
| SUSTAINABLE SERVICE - ENERGY EFFICIENCY | $ 3.50 |
| SUSTAINABLE SERVICE - OTHERS | $ 0.00 |
| CAPACITY BUILDING | $ 2.45 |
| TOTAL WATER SUPPLY | $ 247.02 |
| TOTAL WATER RESOURCES (DAM) | $ 0.00 |
| TOTAL | $ 247.02 |

The implementation of this project will increase coverage to 80% in 2030 allowing for an additional 332,500 people to have access to safe drinking water. It will also increase the hours of supply to 24 hours per day and will allow those water supply systems to meet current and future demands through the (a) protection and expansion of the raw water resources and (b) implementation of a systematic NRW programme to continue to control and reduce physical and commercial water losses. Therefore, the implementation of the current project is essential for the Economic and Social development of the region.