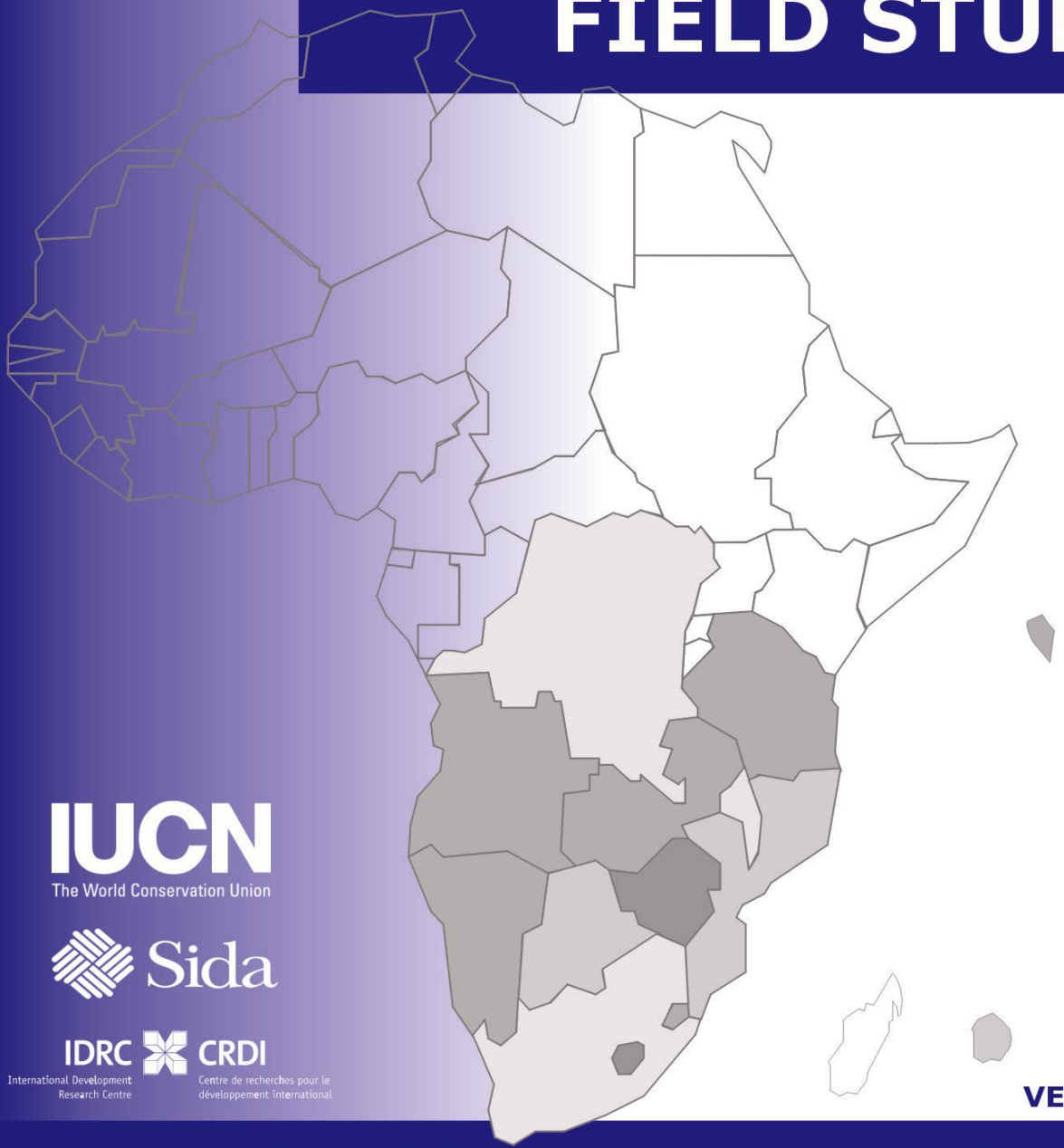
Water Demand Management

FIELD STUDY



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VERSION 1.1

Lusaka Water and Sewerage Company

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1. LUSAKA WATER AND SEWERAGE COMPANY LIMITED

Lusaka is the capital city of Zambia. It has an estimated population of two million people. The population growth in the city is about 6 %, which is double the national growth rate of 3 %.

It is estimated that about 60 to 70 % of the population in Lusaka live in informal settlements or peri-urban areas.

The city covers an area of approximately 360 square kilometres. The Lusaka Water and Sewerage Company Ltd undertake the provision of water supply and sewerage services.

The Company was registered under the Companies Act in 1988 and is wholly owned by the Lusaka City Council.

The city derives its water supply from both surface (Kafue River) and groundwater (boreholes) sources.

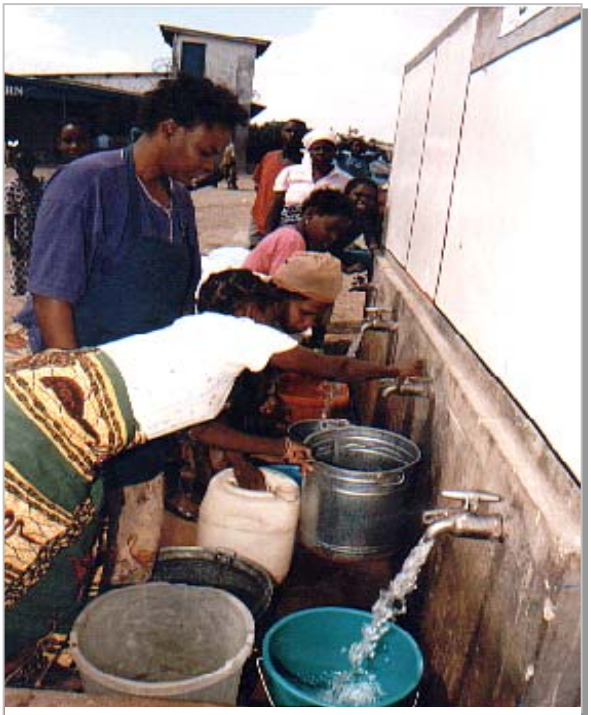
The current production rate averages 200 000 m^3/day with each source accounting for about 50 % of the supply.

The estimated water demand for the city is 290 000 m^3/day (Harza feasibility report).

LWSC head office

notes

2. THE GEORGE COMPLEX WATER SUPPLY SCHEME



Installed communal water points

The George Complex Water Supply Scheme (GCWSS) is located on the western side of Lusaka. It consists of seven densely populated compounds namely, ***George, Soweto, Kizito, Desai, Chikolokoso, Lilanda site 5*** and ***Paradise***. The complex is built over an area of approximately 4 800 square kilometres with a population of about 120 000.

Most of these compounds were developed spontaneously as squatter settlements in the 1960s, with some legalised and upgraded in the 1970s. Some of the compounds, however, were a result of regular planning by local authorities.

Like most of the peri-urban areas, the George Complex is characterised by high population density conditions, with most of the population in the low-income group.

Previously, water supply to the community was mainly through communal facilities and a few house connections. These facilities were limited in capacity and poorly maintained due to lack of finance. The facilities were also extensively vandalised, resulting in the breakdown of water supply facilities.

With the rapid growth rate of these compounds, the capacity of the facilities became inadequate and, therefore, the supply of water was erratic.

Consequently, members of the community resorted to alternative sources of water, which were not safe.

Some residents still draw water from shallow wells

notes

At the time, the alternative source of water was from shallow dugout wells, usually dug in the backyard of a particular household.

Shallow well water, though perceived as being cheaper, convenient and safe by the community, has been found to be contaminated. This contamination can be attributed to the fact that the main sewer disposal method in the area is through the use of pit latrines. These latrines are usually constructed in backyards and, in most cases, just adjacent to the shallow dugout wells, thereby rendering the shallow well water unsafe for domestic use. Continued use of this contaminated water by the community of George resulted in persistent outbreaks of cholera, diarrhoea and other waterborne diseases.

Some of the facilities provided at the GCWSS

As a result of the persistent cholera outbreaks, especially in the 1991-1992 wet season, the Zambian Government requested Grant Aid from the Japanese Government for the implementation of a water supply project, aiming at the alleviation of the incidence of waterborne diseases.

As a response to the request from the Zambian Government, a Basic Design Study was conducted in September 1993, the conclusion of which formed the basis of the Project. The conclusions were as follows:

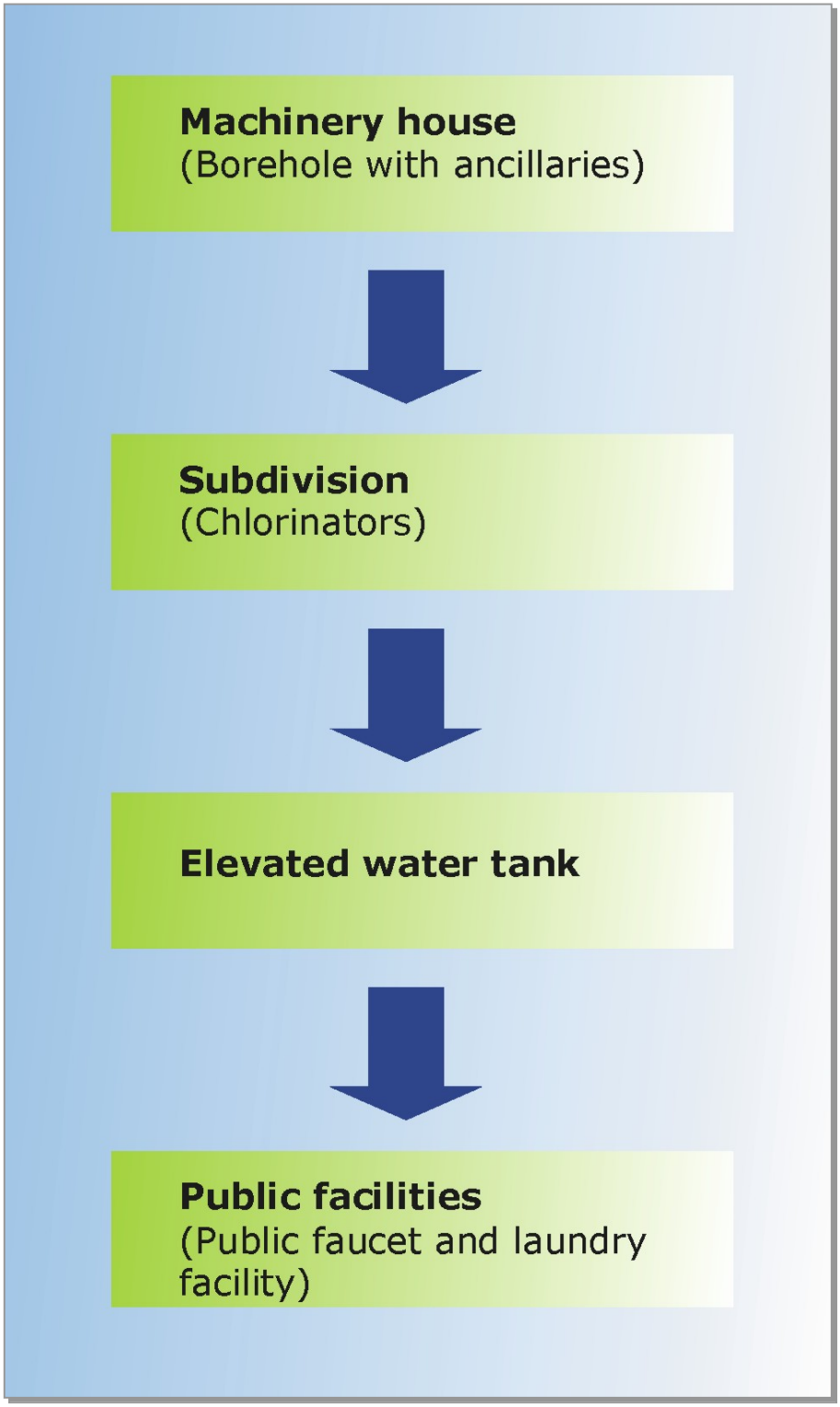
- An amount of 35 litres of water per person per day shall be supplied through communal taps.
- The Water source shall be groundwater from boreholes.
- Water rates shall be charged to the user community, and collected rates shall be utilised for the sustainable operation and maintenance of the water supply system.

Due to the large expanse of the targeted area, it was divided into eight areas, each of which was to have an independent water supply system. Each water supply system would consist of the following:

- A borehole as the water source
- Transmission pipe from the borehole to the elevated water tank
- Water treatment facilities (chlorinators)

notes

- Elevated water storage tank with a capacity of 300 m^3
- Distribution pipeline from the elevated water tank to the various supply points
- Public faucets and laundry facilities



notes

The implementation of the Project was subdivided into four phases:

- **Phase I** - covering Area 1, which consists of areas that had the highest incidents of cholera
- **Phase II** - covering Areas 2, 3 and 4
- **Phase III** - covering Areas 5 and 6
- **Phase IV** - covering Areas 7 and 8

The Exchange of Notes between the Zambian Government and the Japanese Government for the implementation of the Project was signed on 20 April 1994.

Table 1: George Town Complex water supply system statistics

ITEM	QUANTITY	DETAILS
Boreholes	8	(50-70 m^3/hr)
Elevated tanks	8	(300 m^3)
Subdivisions	8	(with 2 chlorinators)
Public faucets	375	
Laundry facilities	375	

Currently, all the phases of the project have been completed and the water supply systems have been in operation since July 1995.

It is estimated that approximately 120 000 people now have access to an adequate, stable and safe supply of potable water.

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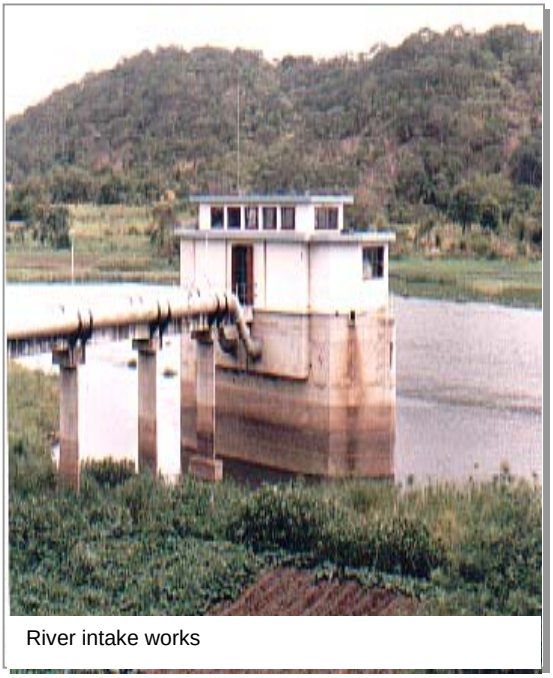
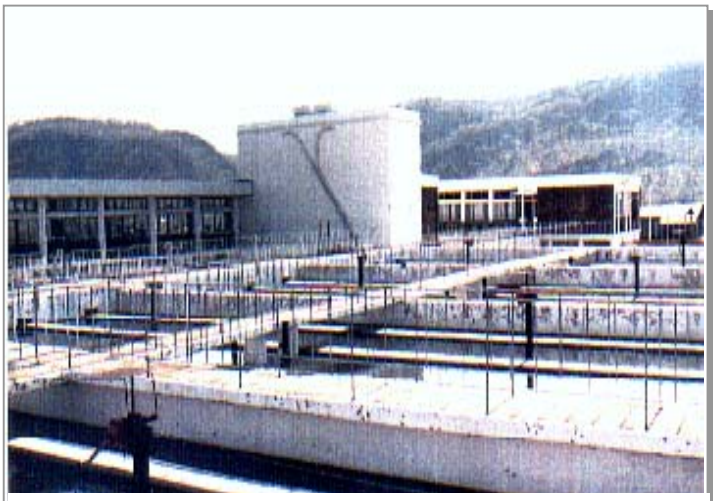
3. IOLANDA WATER TREATMENT PLANT, KAFUE, ZAMBIA.



River intake works

One of the sources of water for the city of Lusaka is the Kafue River, located approximately 65 kilometres south of Lusaka.

The water treatment works were constructed in the early 1970s. They comprise an intake water treatment plant, high lift pumping station and a rising main to Lusaka, terminating at the Chilanga booster pumping station.



Water treatment plant

From Chilanga the water is pumped to Lusaka via another rising main.

These water facilities were constructed to supply 110 000 m^3/day.

3.1 Intake and raw water mains

The intake consists of a tower, constructed offshore and connected by a bridge to the riverbank. The tower has four inlet ports located at two separate levels. The inlets are equipped with bar screens. The river water from the inlet ports is directed to the ends of the intake tower through travelling screens to the pump wet wells.

A header joins the pump discharges and raw water flows from the intake tower through two pipelines (675 mm diameter steel pipes) across the bridge to the shore and to the treatment plant.

Four wet well pumps are installed at the intake, with three pumps on duty (capacity 126 000 m^3/day) and one on standby.

notes

3.2 Water treatment plant

The water treatment plant is designed to produce approximately 110 000 m^3/day of treated water.

The plant is supplied with raw water from the river via two 675 mm diameter steel pipelines from the intake structure. The pipelines are interconnected at the intake/pump structure, but individually feed each of the two flash mix tanks at the treatment plant.

The water treatment plant uses a conventional treatment process of flash mixing of alum as a coagulant chemical. Two flash mix tanks (27.6 m^3/tank) with a hydraulic detention time of 43 seconds at 110 000m^3/day with inlet baffle plates and an inlet weir are employed.

Thirty sedimentation basins (blanket type) for flocculation of the up-flow sludge are used. Each unit has a volume of 216 m^3 and a surface area of 76 m^2. The design up-flow rate is 1.8 m^3/m^2/hr at 110 000 m^3/day.

Twenty single media rapid sand filters operating at a filtration rate of 4.85 m^3/m^2/hr with gravel support layer and perforated lateral under drain system are used. Each filter has a surface area of 47.25 m^2. The filters are cleaned by backwashing.

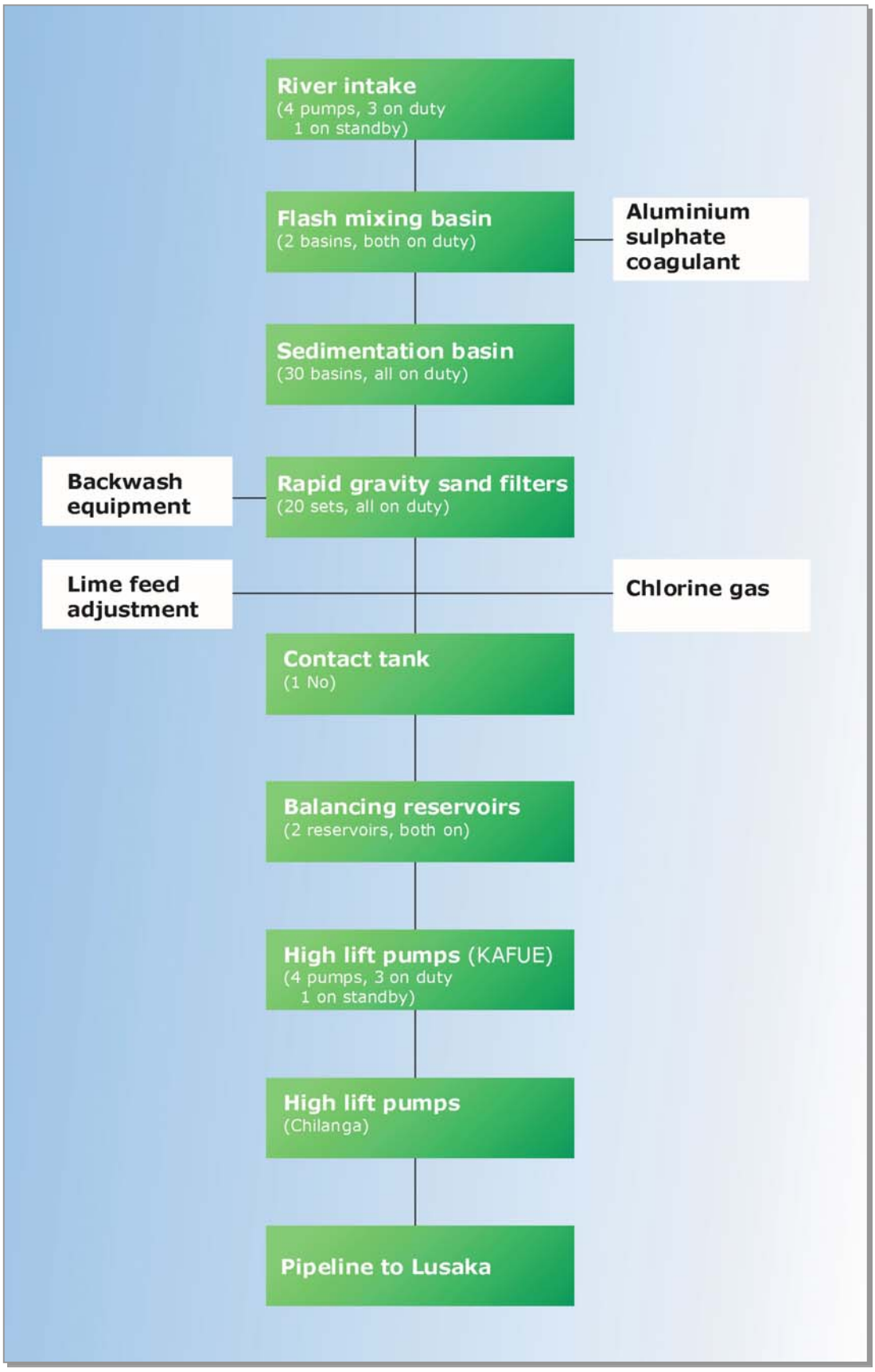
A four pas chlorine contact tank with a volume of 181 m^3 is used. It also serves as a reservoir for backwash water.

Two balancing reservoirs with a total capacity of 4 500 m^3 serve as supply for the high lift pumps and as a plant area water supply source.

A single ton cylinder chlorine system with a dual chlorinator (manually adjustable to meet plant flow rates and desired chlorine residuals at the balancing reservoirs) is used. A lime feed system for post-treatment pH control is also used.

notes

Iolanda water works (Kafue): process flow chart



notes

3.3 Pumping and rising main

Iolanda water works, Kafue, Zambia

Four high lift pumps, each with a capacity of 1 500 m^3/hour at a total head of 242 m, are used at both Kafue and Chilanga Booster Pump Stations. In normal operation, three pumps are on duty and one is on standby. The rising main extends from the booster pumping station at the Iolanda Water Treatment Plant (WTP) site to the Stuart Park Reservoirs in Lusaka, a total of approximately 50 kilometres.

The rising main is in two sections. The first section extends from Iolanda WTP to a receiving balancing reservoir located south of Chilanga. A booster station at the Chilanga site boosts the flow into the second section of the rising main to the Stuart Park Reservoirs in Lusaka.

Rapid gravity sand filters

notes