

**Table 5-8 Summary of Additional Bulk Infrastructure Required for Temba S/A**

Bulk Infrastructure	Location	Diameter (mm)	Unit	Quantity
Water Treatment Works	Kudube		Mld	48
	Temba		Mld	81
	Wallmannsthal		Mld	2.1
Reservoirs	Kudube/Temba		Ml	114
Pipelines		110	km	3.4
		250	km	4.5
		450	km	3.5
		600	km	4.0

### 5.5 Development Planning for the Eastern Zone

The Eastern Supply Zone comprises two Supply Areas, the Weltevreden Supply Area and the Bronkhorstspuit Supply Area. This Zone falls largely within the Olifants catchment and the main raw water sources are the Mkombo (Rhenosterkop) Dam on the Elands River in the north (supplemented by water from Loskop Dam) and the Premier Mine Dam on the Wilge River and Bronkhorstspuit Dam on the Bronkhorstspuit in the south. The Zone includes the rural farming areas of Bronkhorstspuit, Cullinan and Moretele 2 districts and the peri-urban area of the former Kwandebele.

Weltevreden WTW and Bronkhorstspuit WTW are linked via the main pipeline running through Kwandebele and there is some flexibility in deciding the split between the two treatment works. Prior to 1996, the yield of Mkombo Dam which is intended to be the main source of raw water to Weltevreden WTW was poor so water was imported from Loskop Dam to make up the shortfall. Following the heavy rainfall at the start of 1996, Mkombo Dam filled up and due to the large storage capacity (206 mcm), water supplies from the dam are assured into the next century. For this reason, the postponement of some of the strengthening work proposed under the Kwandebele Augmentation Scheme has been considered by DWAF and it is probably desirable that more demand than was assumed previously be met from Weltevreden which is located closer to the centre of demand and thus can meet the demand more cost effectively. For the purpose of the water balance and subsequent planning, the existing demarcation between the two Supply Areas was assumed and technical solutions prepared.

Using the existing demarcation, expansion of Weltevreden WTW by 9 Mld (giving 69 Mld capacity) and Bronkhorstspuit WTW by 19.4 Mld (giving 60.4 Mld) is required. The planning for the Kwandebele Augmentation Scheme shows increases in the capacity of Bronkhorstspuit WTW to 57 Mld by 1998 and 69 Mld by 2001. The proposals described below could be reworked if necessary to transfer the 9 Mld demand back to Bronkhorstspuit WTW in which case the demand in 2015 would coincide with the capacity included in the augmentation scheme.

#### 5.5.1 Weltevreden Supply Area

The Weltevreden Supply Area comprises Moretele 2 District and the northern part of Kwandebele. At present, the Moretele 2 is not served by a surface water system and relies heavily on groundwater supplies which are in many places inadequate in terms of quality or quantity. There is extensive existing water supply infrastructure serving the Kwandebele area as described above and the northern part is supplied from Weltevreden WTW which is operated by DWAF in the absence of a water board or an effective Third Tier organization.

The Supply Area is subdivided into four Supply Blocks, i.e. Bloedfontein, Kameelrivier, Mapoch and Waalkraal.

- (1) Bloedfontein Supply Block comprises the northern part of Mbibana, and the entire Moutse 1, and Moretele 2 Districts. The former two lie within the former Kwandebele while Moretele 2 formed part of Bophuthatswana. As a result, there is some existing water supply infrastructure in Moutse 1 and Mbibana while Moretele 2 relies completely on inadequate groundwater resources. It is proposed that a surface water scheme be implemented to serve Moretele 2 and the preferred option is that the area is supplied entirely from Weltevreden WTW.

Two alternatives that were considered comprised supplying the villages of Lefiso, Radijoko, Ramantsho, Semohlase and Moletsi from Weltevreden WTW as in the preferred option, while communities in the west of the Block would be served from either the MW treatment works at Temba or from a new water works treating water from Rust de Winter Dam. The water balance indicated that sufficient water resources are available to implement any of these options although water rights for irrigation from Rust de Winter Dam are held by Gauteng Province. Although these have not been taken up in recent years it is understood that a new scheme is now being implemented to use the water for irrigation. For this reason the preferred option of meeting the entire demand from Weltevreden which appears to be slightly more expensive than the Rust de Winter option is proposed. This option has the added benefit of utilising an existing (possibly extended), facility and not necessitating additional staffing and overhead costs associated with constructing an additional treatment works.

From Weltevreden, treated water is pumped to Bloedfontein Regional Reservoir (16 MI). This supplies Spitspunt Regional Reservoir (2.7 MI) via a booster pumping station which in turn supplies the surrounding villages in western Moutse 1 by gravity. The proposed new scheme comprises strengthening the pipework and pumps supplying Bloedfontein and Spitspunt reservoirs and providing 4.7 MI of additional capacity at Spitspunt. A new 450 mm diameter gravity pipeline is proposed running in a south-westerly direction as far as Ga-Ramantshane but booster pumps will be required subsequently at Ga-Ramantshane, Nokaneng, Bamokgoko and Phake B. The new system will extend as far as Pankop at the west end of Moretele 2 and service reservoirs will be provided as required to serve the communities en route. New service reservoirs are required in the parts of Moutse 1 to be supplied from the Spitspunt system.

The villages of Seghoko, Semohlase and Ramantsho fall within Moretele 2 but would be best served by extending the existing system to Loding which would require upgrading to absorb the additional demand. Six small new local service reservoirs (150 to 300 kl)

and a new pumping station at Ramantsho are also required in this area to provide the necessary assurance of supply.

Within Moutse 1, the construction of service reservoirs is proposed for communities which are at present served from the Bloedfontein Regional Reservoir without additional local storage. Fixed planning is in place to install gravity pipelines to Tweefontein and Witfontein Agricultural Holdings.

- (2) Kameelrivier Supply Block is located south-west of Weltevreden WTW and includes a relatively small peri-urban/rural area served from the treatment works via Leeuwfontein Regional Reservoir, and a rural farming area. New infrastructure comprises an extension of the existing pipeline to Morwe and provision of a service reservoir, a new pumped supply to a service reservoir at Leeuwfontein B.
- (3) Mapoch Supply Block comprises a small area located on the north side of the Kameel and Elands rivers and consists of the communities of Mapoch and Thabana which are served from Mapoch Regional Reservoir. New infrastructure proposed comprises only the strengthening of the pipeline to Thabana SR.
- (4) Walkraal Supply Block covers most of the northern half of Kwandebele and comprises the area south of the Kameel and Elands rivers as far as the boundary with the Bronkhorstspuit Supply Area. As the system is continuous with the Bronkhorstspuit system, this boundary is not fixed and considerable latitude is available in the Tweefontein area as to whether communities are supplied from Weltevreden or Bronkhorstspuit.

From Weltevreden WTW a 10km long 700 mm diameter rising main delivers into Walkraal Regional Break Pressure Tank and Reservoir (24MI). Both the main and the tank are adequate to accommodate the projected 2015 demands. From Walkraal, a further 10 km 600 mm diameter rising main supplies Moleti Regional Reservoir which is the main regional reservoir for the distribution system in this Block. Walkraal also supplies Siyabuswa SR (12 MI) and in addition a new gravity main and local reservoir are proposed to serve Kameelrivier D.

From Moleti Regional Reservoir, four secondary mains supply further regional and local service reservoirs. A 350 mm diameter main supplies most of Moutse 3, forking to supply Matatta and Nganeng in the north-east of the district and villages towards Thabakhubedu in the south. From the northern branch further new branch pipelines and service reservoirs are proposed to serve communities at Mthenti, Kuilsrivier and Mpeleng. Off this main is Stomp Regional Reservoir from which it is proposed to supply six new service reservoirs (sized nominally as 0.15 MI) to serve villages including Stomp, Mchipsisane, Kgobokwane and Maganaubuswa on the south bank of the Elands River. The 250 mm main to the south-east supplies Elandsdoorn Regional Reservoir from which a new supply to a reservoir at Uitspanning and a new extension and reservoir to serve Elandsdoorn B are proposed. A further three reservoirs and associated pipework to serve Elandsdoorn C, Denniton S/H and Kalofane are also included in the proposals.

Two further mains from Moleli Regional Reservoir supply the area to the north-west in a loop which includes Klipplaatdrift Regional Reservoir. Most of the infrastructure is existing but new additional service reservoirs are proposed for Marothobolong, Wolwekraal A, and Twolne (under gravity via a new pipe from Makola). Additional storage is also required to supplement the existing reservoir at Mabhoko.

From Moleli, the principle north-south trunk main continues as a 600 mm diameter pumped system as far as Kwaggafontein Regional Reservoir from which it continues at the same direction under gravity towards Tweefontein. From Kwaggafontein Regional Reservoir, a 200 mm main runs back in the opposite direction for about 5 km to Mathys Lyn from where it turns to the south-west and supplied Boekenhouthoek Regional Reservoir. New pipelines and reservoirs to supply Matshipe A and Die Bron from this regional reservoir are proposed. Most areas of Kwaggafontein are already served but it is proposed that a new branch pipeline and service reservoir (1.36 MI) be provided to serve Kwaggafontein D.

Table 5-9 below presents a summary of additional bulk infrastructure which will be required for the Weltevreden Supply Area to meet the projected 2015 primary water demand.

**Table 5-9 Summary of Additional Bulk Infrastructure Required for Weltevreden S/A**

Bulk Infrastructure	Location	Diameter (mm)	Unit	Quantity
Water Treatment Works	Weltevreden		Mfd	9
Clear Water PS	Weltevreden		kld	9,345
	Spitspunt		kld	8,848
Reservoirs	Spitspunt		MI	4.7
	Ga-Ramatshana		MI	4.8
Pipeline		110 to 200	km	156.2
		250 to 400	km	21.9
		450 to 600	km	27.5
		650 to 800	km	Nil

### 5.5.2 Bronkhorstspuit Supply Area

The Bronkhorstspuit Supply Area includes Cullinan and Bronkhorstspuit Districts and the southern part of Kwandebele to the south side of Kwaggafontein. The Area has been subdivided into two Supply Blocks, i.e. Bronkhorstspuit and Cullinan. The Kwandebele area is fed from Weltevreden WTW in the north and Bronkhorstspuit WTW in the south and the two systems are linked allowing the demarcation between the two plants to be adjusted according to water resources availability and other factors.

- (1) The Bronkhorstspuit Supply Block comprises Bronkhorstspuit and part of Kwandebele as described above and is supplied from Bronkhorstspuit WTW. The treatment works

is owned and operated by Bronkhorstspuit TLC and treats water abstracted from the Wilge River which in turn is regulated by Bronkhorstspuit Dam. Under the ongoing Kwandebele Augmentation Project, the yield of Bronkhorstspuit Dam has been increased by raw water transfer from the Grootdraai Dam via the Usutu-Vaal River GWS and there is planning to lay a raw water pipeline from the dam to the treatment works. The treatment works performs a local function but also supplies bulk water to the Ekandustria industrial area and Kwandebele. The augmentation project also provides for the strengthening of bulk potable supply mains in the southern Kwandebele area by additional main laying.

New infrastructure proposed for Bronkhorstspuit Supply Block comprises two additional service reservoirs at Ekandustria, 11 km of main from Tweefontein Regional Reservoir to supply a new reservoir to serve Klipfontein and Kameelpoort, and new service reservoirs to supply Tweefontein M (1.0 Ml) and Enkeldoringoog A (1.5 Ml).

- (2) The Cullinan Supply Block comprises mostly rural farming areas with a low population density which rely on groundwater. The only significant water supply scheme is at Cullinan where Magalies Water operates the treatment works which has recently been upgraded to 14.4 Mld. Raw water from the Premier Mine Dam on the Wilge River is pumped to a raw water storage reservoir at the treatment works. Treated water from the works is pumped into Cullinan Regional Reservoirs located nearby, from where a gravity line feeds to Refilwe SR and a pumping main supplies Zonderwater Regional Reservoirs and Rayton SR. From Zonderwater a gravity pipeline supplies two further service reservoirs. No significant new infrastructure is required within the Block and the treatment capacity is adequate to meet the projected demand in the target year. A slight shortfall in the capacity of Cullinan Regional Reservoir and pipelines and the service reservoir serving Elandia and Proteem is projected by the 2015 so upgrading just before the end of the planning horizon may be necessary.

Table 5-10 below presents a summary of additional bulk infrastructure which will be required for the Bronkhorstspuit Supply Area to meet the projected 2015 primary water demand.

**Table 5-10 Summary of Additional Bulk Infrastructure Required for Bronkhorstspuit S/A**

Bulk Infrastructure	Location	Diameter (mm)	Unit	Quantity
Water Treatment Works	Bronkhorstspuit		Mld	19.4
Clear Water PS			kld	Nil
Reservoirs	Ekaandustria		MI	20
	Cullinan		MI	0.8
Pipeline		110 to 200	km	156.2
		250 to 400	km	21.9
		450 to 600	km	27.5
		650 to 800	km	Nil

## 5.6 Cost Estimates

During the infrastructure planning, some schemes were identified which were already fixed planning. The costs for such schemes were included in the estimated costs for the purpose of the Study and are shown separately on the drawing entitled "Proposed Primary Water Supply Infrastructure Development Plan".

For planning and budgetary purposes, it will be necessary to divide the estimated capital costs between the role players responsible for water supply and sanitation within the Study Area. For this reason, costs were calculated separately for bulk and Third Tier functions using the cost models developed under Section 5.1. In respect of Third Tier costs, there is uncertainty surrounding the capacity of some local authorities to implement water supply projects. In addition, there is an absence of detail as to the exact area of jurisdiction of the various Third Tier organizations, and a lack of clarity as to the extent of involvement of the private sector or of other Government subsidy programmes. These factors prevented a more detailed division of capital costs into specific individual Third Tier organization.

Bulk infrastructure may be defined as the water supply facilities upstream of the flowmeter on the inlet to a service reservoir and comprises pipework, pumping stations, regional reservoirs, treatment works and raw water pipework. Third Tier or retail costs are associated with the provision of service reservoirs, and the downstream pipework, water towers, pumps and reticulation. For instances where a community is supplied directly from the regional reservoir, the retail costs would normally be for the facilities downstream of a flowmeter on the reservoir outlet.

The estimated capital expenditure that is required in order to ensure the water supply service-levels predicted for each community or supply unit for the year 2015 is summarised on the Planning Schematics for each individual Supply Block, and on the Cost Summary Sheets for each Supply Area. The total cost of the proposals for each Supply Area and Zone is described in Chapter 6. Bulk costs were broken down into treatment facilities, pipework, pumping stations and regional reservoirs while Third Tier costs were service reservoirs, pipework and reticulation.

The cost of reticulation was calculated on the Population and Demand spreadsheets. In these spreadsheets the number of properties within each town or village was identified from the population statistics; the development densities were then calculated from the settlement area and the number of properties; finally the reticulation cost per stand or plot was identified by applying the standard cost curves developed for this purpose as described in Section 5.1. Total reticulation costs for a specific settlement were arrived at by multiplying the number of properties for each design year by the unit reticulation cost applicable to the calculated settlement density.

An allowance was added to the sub-totals for both bulk and retail costs for engineering (15 %), VAT (14 %) and contingencies (20 %). The allowance for engineering is estimated on the basis of consultancy services for feasibility study, detailed design and construction supervision.

## **5.7 Recommendations on Sanitation Options**

### **5.7.1 Introduction**

The terms of reference for the JICA Study require a study on sanitation with a view to exploring sanitation options for the different levels of service of water supply adopted in the Study.

With regard to the provision of sanitation in the Study Area, the following were the major findings from the Situational Analysis:

- (1) Approximately 75 % of the total population in the Study Area use a toilet which falls below the RDP level of a VIP toilet. They comprise about 94 % of the population in non-urban areas and 44 % of the population in urban areas.
- (2) The percentage of households which are connected to mains sewerage is 56 % in urban areas and 22 % for the entire Study Area. There is virtually no mains sewerage in non-urban areas but about 6 % of households ( 4% of the total households in the Study Area) use septic tanks. With regard to the method of domestic wastewater treatment, approximately 72 % of households in the Study Area discharge domestic wastewater (toilet wastewater and other domestic wastewater) into the ground without treatment.

### **5.7.2 Recommended Sanitation Options**

A flow chart for the improvement of sanitation is shown in Figure 5-1.

Improvement of sanitation has two major components as follows :

- (1) improvement of the toilet itself; and
- (2) improvement of the method for domestic wastewater treatment.

With regard to the first component, it is an urgent priority that improvement to at least the level of RDP should be implemented as soon as practicable over the entire Study Area, as it is part of the short-term sanitation policy of the Government. It is estimated that the total capital cost to achieve this objective will be approximately 350 million Rand.

As for the second component, a careful approach both to the selection of treatment method and to the prioritisation of communities for implementation is required, which must take the following into account :

- (1) proximity of the community to both existing and planned mains sewerage;
- (2) level of water supply in the community in terms of per-capita water consumption rate and service level ( house connection, yard tap or communal tap);
- (3) affordability of households in the community;
- (4) institutional capacity of the community; and
- (5) topographic and environmental considerations.

The flow chart shown in Figure 5-1 has been prepared in accordance with the per-capita water consumption rates of 120 lcd for a house connection, 70 lcd for a yard connection and 30 lcd for a communal tap, which were adopted in the projection of domestic water demand for rural areas. It provides for both on-site and off-site treatment options of domestic wastewater which are suitable for this range of water consumption rates. Technical features of these options are as follows :

Option 1 : Only toilet wastewater will be treated using an on-site septic tank. Other domestic wastewater will be discharged directly into the absorption pit provided at the effluent of the tank.

Option 2 : Both toilet wastewater and other domestic wastewater will be treated using an on-site septic tank.

Option 3 : Both toilet wastewater and other domestic wastewater will be treated using an off-site STED (Septic Tank Effluent Drainage) system with an interceptor tank at each household.

It is recommended that urban areas be provided with mains sewerage.

## **5.8 Environmental Impact**

The Department of Water Affairs and Forestry (DWAF) follows a procedure of Integrated Environmental Management (IEM) for all proposed developments. This IEM procedure consists of certain successive levels of impact studies of which the Relevant Environmental Impact Prognosis (ROIP 1 - the Afrikaans acronym), which relates to a scoping and screening process, is the first. As part of this Study therefore, a ROIP 1 was prepared, a copy of which is included in Part G of the Data Book, and it is proposed that Phase 2 of the Study will include the preparation of a ROIP 2 which will involve a site investigation and input from appropriate specialists if necessary.



An Ecological Task Group is being formed comprising Provincial representatives responsible for environmental management and other interested parties which will address ecological concerns arising from the Study, identify and incorporate independent specialists and authorities, provide guidance in compliance with the IEM procedures and will ensure that environmental considerations receive the necessary attention in the decision making process during the Study and afterwards.

Inevitably, development leads to modifications in the environment and negative environmental impacts which often result from inappropriate management of development activities because of a lack of appreciation of the potential problems. All components of the environment that might be involved were identified so that appropriate ameliorative actions can be integrated with the project as a whole to obtain the best possible results.

Accent was placed on the impact of the proposed pipelines and other related surface structures as these were seen as the elements causing greatest concern. The construction of pipelines, reservoirs and treatment works could have an impact on the socio-economic aspects, i.e. land use, settlement, infrastructure and population, and the ecological aspects, i.e. the vegetation, fauna, habitat, changes in flow regime and changes in water quality. Relevant data was extracted from the situational analysis reports to provide baseline information.

The aspects addressed in the ROIP 1 report are:

- the effect of abstraction from dams and the rivers downstream of the dams.
- the impact of the construction of pipelines, pump stations, reservoirs and water towers. The main activities to be expected during the construction of the proposed developments are the following:
  - Pre-construction: Surveying, clearing of vegetation and construction of access routes.
  - During Construction: Typical activities will be clearing of vegetation, stripping and stockpiling topsoil, excavations, disposal of excess material, transport of pipes, drilling, blasting additions or alterations to existing infrastructure and the importation of foreign workers.
  - Post-construction and Operational Phase: Rehabilitation of disturbed areas, implementation and maintenance of the pipelines, reservoirs, water towers and pump stations.

The ROIP 1 concluded that:

- (1) The construction of pipelines and related infrastructure will not cause substantial disturbance. The environmental consequences associated with these impacts are not considered to be significant if managed during and after construction as stipulated in the environmental management plan.

- (2) The impacts of abstraction from dams on the dam itself and downstream of the dams are not considered to be significant, but with a large degree of uncertainty. By determining the in-stream flow requirements of the river, compensation water could then be released. This will influence the yield of the dam and need to be further investigated.

The ROIP 1 report recommended that the following be determined during Phase 2 for establishing the feasibility of the scheme:

(1) Social impacts

Undertake a socio-economic investigation to ascertain the following:

- (a) The social and economic impacts associated with construction disturbances on the farming activities along the pipeline routes:
- (b) This investigation should include meetings with the local communities to determine:
- i) the interested and affected parties
  - ii) the preferences of the communities to any options or alternative developments.

(2) Ecological impacts

Confirm the statement that the downstream impacts associated with the proposed scheme will be minimal in view of the existing degraded river stretches.

Investigate the need for a study of the status quo of the existing river stretches to be impacted upon. Aspects to be borne in mind with the in-stream impacts are:

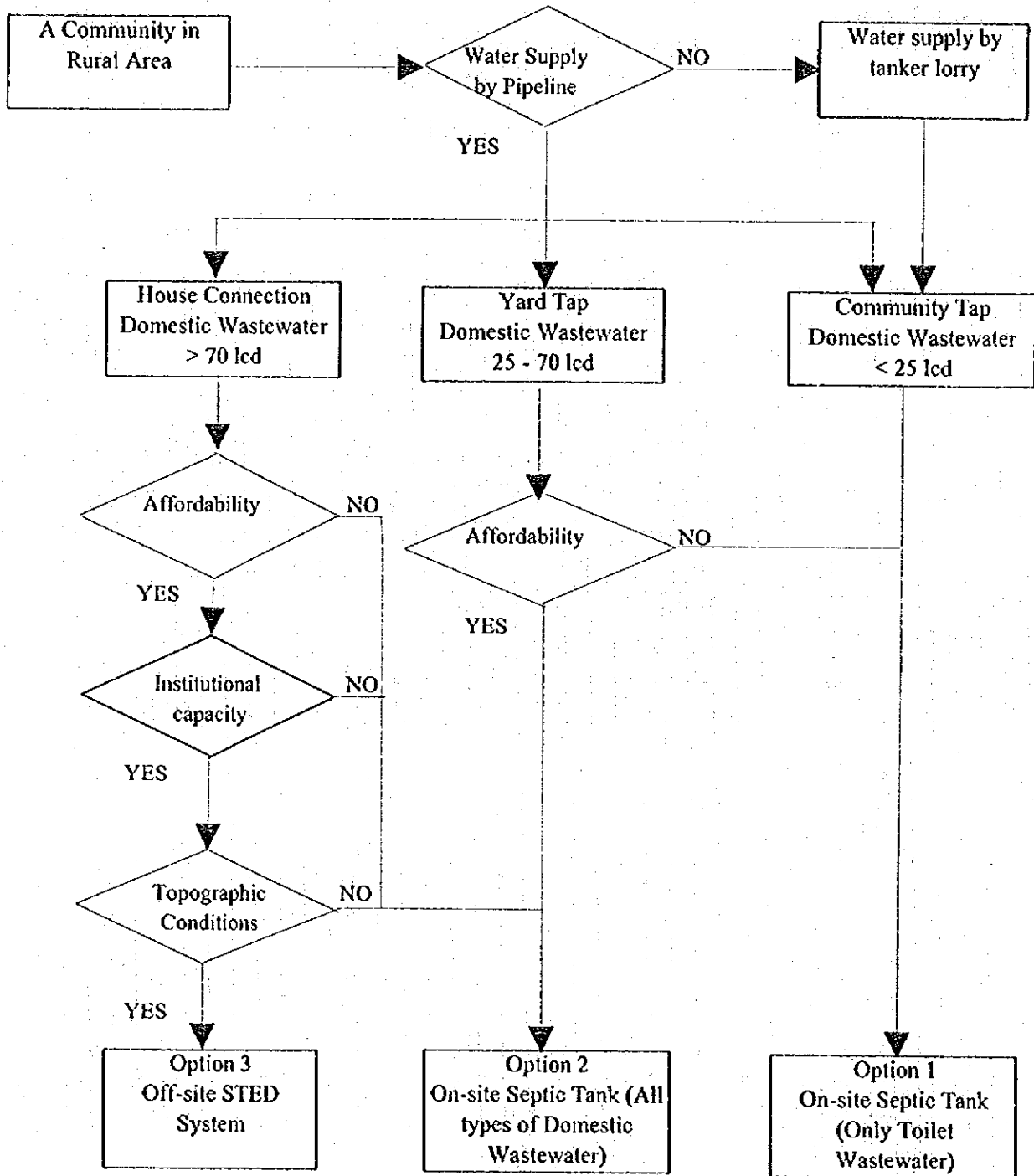
- flow regime and aquatic biota;
- riparian vegetation.

To be undertaken if the scheme is proven to be feasible:

- Compile an Environmental Management Plan for the construction phase and draw up appropriate rehabilitation guidelines to mitigate the disturbance and aesthetic impacts caused by the construction of the pipeline and associated infrastructure.
- Alert the contractor and labourers to the ecological and social impacts associated with construction activities.
- Landscaping specification for the river and canal crossings.
- An archaeological and historical sites reconnaissance survey of the proposed pipeline routes is recommended.
- General rehabilitation measures.

- Identify birds and their nesting sites where appropriate.
- Fish survey where appropriate.
- Identification of exotic aquatics.
- Define suitable operating rule for dams taking into account the recreational and tourism activities as well as downstream ecological requirements.
- Determine the in-stream flow requirement of the rivers downstream of dams in order to determine the amount of water to be released as compensation water.
- Liaise with all interested and affected parties.

**Figure 5-1 : Flow Chart for Improvement of Sanitation**



## **CHAPTER 6 : OUTPUTS FROM INFRASTRUCTURE PLANNING PROCESS**

<b>6.</b>	<b>OUTPUTS FROM INFRASTRUCTURE PLANNING PROCESS</b>	
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## CHAPTER 6 OUTPUTS FROM INFRASTRUCTURE PLANNING PROCESS

### 6.1 Costs

The costs described in Section 5.6 are summarised in Tables 6-1, 6-2 and 6-3 for each Supply Area and Zone. Within the two tiers of organizations responsible for water supply, there is a further sub-division of costs that must be made for budgetary purposes. Under the RDP, Central Government will subsidise the capital cost of providing both bulk and retail level infrastructure for the portion up to the basic RDP level of service.

For bulk capital cost the apportionment was made pro-rata to the 2015 primary water demand for the RDP level of service, and to the predicted levels of service within the Supply Area under consideration. For retail level capital costs, the apportionment was achieved by establishing from the Population and Demand spreadsheets, those costs that are associated with reticulating all towns and villages within a specific Supply Area to the RDP level of service. The balance of the retail capital costs within the Supply Area were apportioned to the above RDP level of service portion.

Apportioned costs have also been identified separately for an Accelerated Investment Programme (priority projects), and for a Continuous Investment Programme (other upgrading and expansion projects) which are described in Section 6.2. These apportioned costs are shown in Table 6-4.

### 6.2 Programme and Disbursement Schedule

#### 6.2.1 Short and Medium Term Development Plan

Due to the very large total cost estimated to provide infrastructure to meet the water demands in the target year, it is necessary to prioritise the work for implementation. Based on the principle in the White Paper of some for all rather than all for some, those areas which are totally unserved by surface water schemes at present and in most cases rely on inadequate groundwater supplies were selected for priority implementation. Such communities are mostly located in the northern parts of the Study Area and three priority regional water supply schemes have been identified. These are Northern Mankwe, the Klipvoor area in northern Moretele 1 and Odi 1 districts, and the entire Moretele 2 District. It is proposed that a Feasibility Study be conducted for these three areas during 1997 to lead on to possible detailed design, securing of finance, construction and implementation by 2002.

#### 6.2.2 Long Term Development Plan

The balance of the capital works proposed comprises of some schemes to serve individual communities which are in a similar situation to those selected for the priority projects, and other upgrading work to strengthen existing infrastructure to meet the projected demand. While the former should also be considered for implementation in the near future, the latter type of project cannot practically be prioritised as implementation will be subject to the actual priorities of local and regional development and to political pressures. It has therefore been assumed that these upgrading and extension projects will constitute a Continuous Investment Programme which will be established by each of the role players. The period over which these projects shall be executed

should be considered on a case by case basis by the management of the role player concerned and will be dependent on the availability of finance, management capacity, other infrastructural priorities (such as electricity, housing etc), and other factors. This category also includes existing fixed planning which was included in the overall cost estimation for the provision of water infrastructure in the Study Area. The sources of funding and the timing for implementation of such schemes may or may not have been determined already by the particular implementing agency.

### 6.2.3 Outline Summary of the Infrastructural Development

The infrastructure development proposed is almost exclusively based on the use of surface water to meet primary water demand due to considerations of quality and availability. It is assumed that conjunctive groundwater use in Thabazimbi will continue and that the dolomitic aquifer will be used to supplement the surface water source in Koster towards the end of the planning horizon. Table 6-5 shows the principal water treatment works in each Supply Area, the existing capacity, and that required to meet the projected demands in 2015. It can be concluded that very significant expansion will take place at Vaalkop WTW, Brits WTW and Temba / Kudube WTW's. Both Kudube and Temba treatment works supply the southern part of Moretele 1 District and future planning could transfer part of this load between the works to suit water quality and space constraints. It is proposed to construct a new water treatment plant at Klipvoor Dam to serve the priority project in Central Zone. Concerning the imported water into the Rand Water and Bransdrivlei Supply Areas, it has been assumed that this will increase up to the limit of the capacity of the existing infrastructure. When this is reached options are available for relieving the demand in Soshanguve from Kudube (the preferred option proposed), relieving the Ga-Rankuwa demand from Brits or strengthening the existing supply. The latter option is undesirable when water is available locally. Three local options were evaluated for both the Klipvoor and Moretele 2 areas to determine the most preferable water source in each case.

### 6.3 Management Implications of Technical Solutions

The two significant outputs from the infrastructure planning progress which influence management of the water sector in the Study Area comprise estimated capital and O&M costs for the proposed works, and the zoning identified for the infrastructural planning which should inform the proposals for future business units of MW. Costs are addressed in the previous sections and developed further in the Capital Investment Plan and the future structure of MW is discussed in Supporting Report F and Chapter 8 of the Main Report.

The approach used for defining Supply Zones, Areas and Blocks is described in Section 2. These divisions not only lend themselves to current planning but are also appropriate to form the basis for the future management structure of MW and for future planning which needs to be done in a strategic context. The following considerations weigh in favour of following the zoning for the purpose of business units.

- (1) As described elsewhere, water resources management is best done on a catchment basis and water boards should play a major role in this as issues of water quality will be of major interest to them. As described in Section 2 the separate Zones were based on the water sources used at present and the optimum water resource to be used to supply the



currently unserved areas. It makes sense that water board management operates on a zonal basis and thus deals with the water resources system and infrastructure facilities within their Business Unit from a zone-wide perspective.

- (2) The Zones match well with the areas of jurisdiction of local government.
- (3) The existing east and west business units of MW fall within the Western and Central Zones used for planning with the exception of Cullinan WTW which is supplied from the Wilge River in the Olifants River Basin. The inclusion of Cullinan WTW within the Bronkhorstspuit / Weltevreden system in the Eastern Zone is therefore proposed.

From the technical proposals, the main centres of growth in water demand can be seen to be in the Brits, Valkop and Kudube / Temba areas. The strategic importance of the centres will increase. The increasing demands can be met due to the projected rising return flows in the Crocodile River system although the resulting adverse effect on water quality will require attention.

Also because of the proposed priority projects within the ESA, the role of Magalies Water in providing support to Third Tier institutions will be expanded.

**Table 6-1 : Summary of Costs from Infrastructure Planning - Western Zone**

	VAALKOP NORTH	VAALKOP SOUTH	BARNARD- SVLEI	KOSTER	ZONE TOTAL
<b>Bulk Supply Costs</b>					
<b>Direct Costs</b>					
WTW	41,666	21,667	0	423	63,756
Regional SR	16,067	15,920	0	0	31,987
PS	2,600	9,435	0	410	12,445
Pipelines	172,096	116,170	6,071	685	295,022
<b>Sub Total</b>	<b>232,429</b>	<b>163,192</b>	<b>6,071</b>	<b>1,518</b>	<b>403,210</b>
<b>Indirect Costs</b>					
Engineering	34,864	24,479	911	228	60,482
VAT	37,421	26,274	977	244	64,916
Contingency	60,943	42,789	1,592	398	105,722
<b>Sub Total</b>	<b>133,228</b>	<b>93,542</b>	<b>3,480</b>	<b>870</b>	<b>231,120</b>
<b>Bulk Total</b>	<b>365,657</b>	<b>256,734</b>	<b>9,551</b>	<b>2,388</b>	<b>634,330</b>
<b>Third Tier Costs</b>					
<b>Direct Costs</b>					
SR	9,206	3,956	2,828	1,036	17,026
Reticulation	84,350	92,423	24,440	3,120	204,333
Pipework	6,302	849	0	0	7,151
<b>Sub Total</b>	<b>99,858</b>	<b>97,228</b>	<b>27,268</b>	<b>4,156</b>	<b>228,510</b>
<b>Indirect Costs</b>					
Engineering	14,979	14,584	4,090	623	34,276
VAT	16,077	15,654	4,390	669	36,790
Contingency	26,183	25,493	7,150	1,090	59,916
<b>Sub Total</b>	<b>57,239</b>	<b>55,731</b>	<b>15,630</b>	<b>2,382</b>	<b>130,982</b>
<b>Retail Total</b>	<b>157,097</b>	<b>152,959</b>	<b>42,898</b>	<b>6,538</b>	<b>359,492</b>
<b>TOTAL</b>	<b>522,754</b>	<b>409,693</b>	<b>52,449</b>	<b>8,926</b>	<b>993,822</b>

**Table 6-2 : Summary of Costs from Infrastructure Planning - Central Zone**

	BRITS	KLIPVOOR	TEMBA	RAND	ZONE TOTAL
<b>Bulk Supply Costs</b>					
<b>Direct Costs</b>					
WTW	16,312	6,938	42,785	13,507	79,542
Regional SR	2,800	1,676	23,450	30,833	58,759
PS	312	931	0	3549	4,792
Pipelines	22,189	24,415	7,343	27,811	81,758
<b>Sub Total</b>	<b>41,613</b>	<b>33,960</b>	<b>73,578</b>	<b>75,700</b>	<b>224,851</b>
<b>Indirect Costs</b>					
Engineering	6,242	5,094	11,037	11,355	33,728
VAT	6,700	5,468	11,846	12,188	36,202
Contingency	10,911	8,904	19,292	19,849	58,956
<b>Sub Total</b>	<b>23,853</b>	<b>19,466</b>	<b>42,175</b>	<b>43,392</b>	<b>128,886</b>
<b>Bulk Total</b>	<b>65,466</b>	<b>53,426</b>	<b>115,753</b>	<b>119,092</b>	<b>353,737</b>
<b>Third Tier Costs</b>					
<b>Direct Costs</b>					
SR	4,980	3,180	39,243	49,500	96,903
Reticulation	34,109	19,475	37,353	174,920	265,857
Pipework	0	0	0	0	0
<b>Sub Total</b>	<b>39,089</b>	<b>22,655</b>	<b>76,596</b>	<b>224,420</b>	<b>362,760</b>
<b>Indirect Costs</b>					
Engineering	5,863	3,398	11,489	33,663	54,413
VAT	6,293	3,647	12,332	36,132	58,404
Contingency	10,249	5,940	20,083	58,843	95,115
<b>Sub Total</b>	<b>22,405</b>	<b>12,985</b>	<b>43,904</b>	<b>128,638</b>	<b>207,932</b>
<b>Retail Total</b>	<b>61,494</b>	<b>35,640</b>	<b>120,500</b>	<b>353,058</b>	<b>570,692</b>
<b>TOTAL</b>	<b>126,960</b>	<b>89,066</b>	<b>236,253</b>	<b>472,150</b>	<b>924,429</b>

**Table 6-3 : Summary of Costs from Infrastructure Planning - Eastern Zone**

	<b>WELTER- VREDEN</b>	<b>BRONKHORST SPRUIT</b>	<b>ZONE TOTAL</b>
<b>Bulk Supply Costs</b>			
<b>Direct Costs</b>			
WTW	2,984	6,471	9,455
Regional SR	3,158	10,773	13,931
PS	2,584	0	2,584
Pipelines	65,929	2,456	68,385
<b>Sub Total</b>	<b>74,655</b>	<b>19,700</b>	<b>94,355</b>
<b>Indirect Costs</b>			
Engineering	11,198	2,955	14,153
VAT	12,019	3,172	15,191
Contingency	19,574	5,165	24,739
<b>Sub Total</b>	<b>42,791</b>	<b>11,292</b>	<b>54,083</b>
<b>Bulk Total</b>	<b>117,446</b>	<b>30,992</b>	<b>148,438</b>
<b>Third Tier Costs</b>			
<b>Direct Costs</b>			
SR	14,703	2,967	17,670
Reticulation	214,101	77,495	291,596
<b>Sub Total</b>	<b>228,804</b>	<b>80,462</b>	<b>309,266</b>
<b>Indirect Costs</b>			
Engineering	34,321	12,069	46,390
VAT	36,837	12,954	49,792
Contingency	59,992	21,097	81,090
<b>Sub Total</b>	<b>131,150</b>	<b>46,121</b>	<b>177,271</b>
<b>Retail Total</b>	<b>359,954</b>	<b>126,583</b>	<b>486,537</b>
<b>TOTAL</b>	<b>477,400</b>	<b>157,575</b>	<b>634,975</b>

Figure 6-4 : Breakdown of Costs for RDP and Higher Level of Service

Zone	Supply Area	Cost (Million Rand)											
		Bulk						Retail					
		RDP		Above RDP		Total		RDP		Above RDP		Total	
Accelerated	Continuous	Accelerated	Continuous	Accelerated	Continuous	Accelerated	Continuous	Accelerated	Continuous	Accelerated	Continuous		
Western	Vaalkop N	12.625	6.274	39.978	306.780	52.603	313.054	11.872	40.016	27.892	77.316	39.764	117.332
	Vaalkop S	0	30.771	0	225.964	0	256.735	0	42.967	0	109.993	0	152.960
	Barnardsvllei	0	0.967	0	8.584	0	9.551	0	33.519	0	9.379	0	42.898
	Koster	0	0.834	0	1.554	0	2.388	0	1.194	0	5.344	0	6.538
	<b>TOTAL</b>	<b>12.625</b>	<b>38.846</b>	<b>39.978</b>	<b>542.882</b>	<b>52.603</b>	<b>581.728</b>	<b>11.872</b>	<b>117.696</b>	<b>27.892</b>	<b>202.032</b>	<b>39.764</b>	<b>319.728</b>
Central	Bris	0	6.276	0	59.190	0	65.466	0	17.695	0	43.8	0	61.495
	Klipvoor	31.787	0	21.639	0	53.426	0	23.180	0	12.459	0	35.639	0
	Rand Water	0	14.031	0	105.061	0	119.092	0	197.531	0	155.526	0	353.057
	Temba	0	37.489	0	78.264	0	115.753	0	93.039	0	27.462	0	120.501
	<b>TOTAL</b>	<b>31.787</b>	<b>57.796</b>	<b>21.639</b>	<b>242.515</b>	<b>53.426</b>	<b>300.311</b>	<b>23.180</b>	<b>308.265</b>	<b>12.459</b>	<b>226.788</b>	<b>35.639</b>	<b>535.057</b>
Eastern	Weltevreden	23.585	17.348	44.086	32.427	67.671	49.775	19.750	47.053	86.668	206.483	106.418	253.536
	Bronkhorstspuit	0	6.640	0	24.352	0	30.992	0	26.877	0	99.706	0	126.583
	<b>TOTAL</b>	<b>23.585</b>	<b>23.988</b>	<b>44.086</b>	<b>56.779</b>	<b>67.671</b>	<b>80.767</b>	<b>19.750</b>	<b>73.93</b>	<b>86.668</b>	<b>306.189</b>	<b>106.418</b>	<b>380.119</b>

**Table 6-5 : Proposed Expansion of Water Treatment Works in the Study Area**

Zone	Supply Area	Water Treatment Works	Existing Capacity* (M/d)	Proposed Capacity* (M/d)
Western	Vaalkop North	Vaalkop	120	295
	Vaalkop South	Bospoort	13.4	13.4
	Barnardsvlei	(Rand Water Importation)	(140)	(140)
	Koster	Koster Swartnuggens	1.3 1.0	2.4 +0.8 (Boreholes) 1.3
Central	Brits	Brits Hartbeespoort	60 10	85 22
	Klipvoor	Klipvoor	-	3.9 / 16.4**
	Rand Water	(Rand Water Importation)	(300)	(300)
	Temba	Temba Kudube Wallmannsthal	18 20 12	99 108 14
Eastern	Weltevreden	Weltevreden	60	69
	Bronkhorstspuit	Bronkhorstspuit Cullinan	41 14	61 14

Note: \* Capacities are quoted as summer peak demand.  
 \*\* Figures for Klipvoor WTW are based on continuous operation or 5 day / 8 hours per day operation

**APPENDIX 1**

**TO SUPPORTING REPORT E**

**PLANNING SCHEMATICS**

# PLANNING SCHEMATICS

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# VAALKOP NORTH SUPPLY AREA

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### **NEW INFRASTRUCTURE**

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**COST SUMMARY FOR INFRASTRUCTURE**

<b>NAME OF SUPPLY AREA :</b>	VAALKOP NORTH SUPPLY AREA	
<b>INCLUDING SUPPLY BLOCKS :</b>	1. Thabazimbi and Mokgalwaneng Supply Blocks 2. Sefikile Supply Block 3. Saulspoort Supply Block 4. Mogwase Supply Block 5. Ramokokstad Supply Block	
<b>POPULATION SERVED (2015) :</b>	259 285	
<b>AADD in mcm/a (2015) :</b>	52.646	
<b>BULK COST :</b>	<b>QUANTITY</b>	<b>COST (R million)</b>
<b>Water Purification Works</b>	<b>Ml/d (Additional required capacity)</b>	
1. Vaalkop WPW	115	41.666
<b>Pump Stations</b>	<b>Kl/d</b>	
<b>: Capital Cost</b>		
1. Vaalkop CWPS	150375	2.600
<b>B : Annual Energy Cost</b>		
1. Vaalkop CWPS		1.605
<b>Reservoirs (Regional)</b>	<b>Ml</b>	
1. La Patrie Reservoir	40	8.820
2. Elandsfontein	15	6.540
3. Spitskop	1.5	0.707
<b>Pipelines (Bulk)</b>	<b>km</b>	
1. 110/9 PVC	52.16	5.727
2. 125/9 PVC	12.72	1.779
3. 160/9 PVC	8.75	1.873
4. 200/12 PVC	38.50	12.506
5. 250/9 PVC	26.10	11.134
6. 315/9 PVC	5.15	2.405
7. 350 ST	73.10	39.647
8. 400 ST	36.00	21.359
9. 450 ST	12.40	7.960
10. 500 ST	24.70	17.834
11. 600 ST	25.50	22.032
12. 650 ST	6.00	5.598
13. 800 ST	16.50	22.242
<b>Sub Total Bulk Construction Cost</b>		<b>232.429</b>
<b>Engineering Fees (15 %)</b>		<b>34.864</b>
<b>VAT (14 %)</b>		<b>37.421</b>
<b>Project Contingency (20%)</b>		<b>60.943</b>
<b>TOTAL : Bulk Cost</b>		<b>365.657</b>
<b>Bulk Cost per Capita (Rands)</b>		<b>R1 410</b>

<b>SECONDARY COST :</b>	<b>QUANTITY</b>	<b>COST (R million)</b>
<b>Reservoirs (Service)</b>	<b>MI</b>	
1. Thabazimbi and Mokgalwaneng Supply Blocks	0.35	0.297
2. Sefikile Supply Block	0.65	0.562
3. Saulspoort Supply Block	4.7	2.268
4. Mogwase Supply Block	16.7	5.521
5. Ramokokstad Supply Block	0.7	0.558
<b>Water Towers</b>	<b>MI</b>	
N/A		
<b>Pump Stations (Secondary)</b>	<b>Kl/d</b>	
<b>A : Capital Cost</b>		
N/A		
<b>B : Annual Energy Cost</b>		
N/A		
<b>Pipelines (Secondary)</b>	<b>km</b>	
1. 110/9 PVC	12.500	1.375
2. 125/9 PVC	4.300	0.598
3. 140/9 PVC	1.500	0.255
4. 160/9 PVC	2.500	0.535
5. 400 ST	4.000	2.312
6. 500 ST	1.700	1.227
<b>Retiulation</b>	<b>km</b>	
1. Thabazimbi and Mokgalwaneng Supply Blocks		4.312
2. Sefikile Supply Block		5.975
3. Saulspoort Supply Block		58.597
4. Mogwase Supply Block		10.801
5. Ramokokstad Supply Block		4.665
<b>Sub Total Secondary Construction Cost</b>		<b>99.868</b>
<b>Engineering Fees (16 %)</b>		<b>14.979</b>
<b>VAT (14 %)</b>		<b>16.077</b>
<b>Project Contingency (20%)</b>		<b>26.183</b>
<b>TOTAL : Secondary Cost</b>		<b>157.097</b>
<b>Secondary Cost per Capita (Rands)</b>		<b>R606</b>
<b>GRAND TOTAL COST</b>	<b>MILLION RANDES</b>	<b>522.754</b>
<b>Grand Total Cost per Capita (R)</b>		<b>R2 016</b>

THABAZIMBI SYSTEM : EXISTING INFRASTRUCTURE

SHEET 1

Intermediate Demand	
Year	M3
2016	107
Cost	

Intermediate Demand	
Year	M3
2016	107
Cost	

Intermediate Demand	
Year	M3
2016	107
Cost	

Intermediate Demand	
Year	M3
2016	107
Cost	

Intermediate Demand	
Year	M3
2016	107
Cost	

Intermediate Demand	
Year	M3
2016	107
Cost	

Intermediate Demand	
Year	M3
2016	107
Cost	

Intermediate Demand	
Year	M3
2016	107
Cost	

Intermediate Demand	
Year	M3
2016	107
Cost	

Intermediate Demand	
Year	M3
2016	107
Cost	

Intermediate Demand	
Year	M3
2016	107
Cost	

Intermediate Demand	
Year	M3
2016	107
Cost	

Intermediate Demand	
Year	M3
2016	107
Cost	

Intermediate Demand	
Year	M3
2016	107
Cost	

Intermediate Demand	
Year	M3
2016	107
Cost	

Intermediate Demand	
Year	M3
2016	107
Cost	

Intermediate Demand	
Year	M3
2016	107
Cost	

Intermediate Demand	
Year	M3
2016	107
Cost	

Intermediate Demand	
Year	M3
2016	107
Cost	

Intermediate Demand	
Year	M3
2016	107
Cost	

Intermediate Demand	
Year	M3
2016	107
Cost	

Intermediate Demand	
Year	M3
2016	107
Cost	

Intermediate Demand	
Year	M3
2016	107
Cost	

Intermediate Demand	
Year	M3
2016	107
Cost	

FROM BRITSONS RESERVOIR  
Year = 30748 M3

TO LA PATRIE RESERVOIR

THABAZIMBI SYSTEM : EXISTING INFRASTRUCTURE

SHEET 2

Inhabitant demand	
Year	MS
2015	4810
Cost	

Gravity flow	
Cap =	300 mm
Diam =	300 mm
Length =	15000 m
Required capacity	Balance
2015	6815
Cost	-1271

Flow demand	
Year	MS
2015	9000
Cost	

Gravity flow	
Cap =	12165 mm
Diam =	400 mm
Length =	92000 m
Required capacity	Balance
2015	14415
Cost	-2206

Flow demand	
Year	MS
2015	843
Cost	

Gravity flow	
Cap =	12165 mm
Diam =	400 mm
Length =	3000 m
Required capacity	Balance
2015	15186
Cost	-3006

Inhabitant demand	
Year	MS
2015	12000
Cost	

Gravity flow	
Cap =	2000 mm
Diam =	400-550 mm
Length =	4200 m
Required capacity	Balance
2015	53978
Cost	-13370

Inhabitant demand	
Year	MS
2015	628
Cost	

Gravity flow	
Cap =	400-550 mm
Diam =	400 mm
Length =	400 m
Required capacity	Balance
2015	33 378
Cost	-13010

Inhabitant demand	
Year	MS
2015	18000
Cost	

Gravity flow	
Cap =	400 mm
Diam =	200 mm
Length =	1700 m
Required capacity	Balance
2015	27000
Cost	-22928



SAULSPOORT : EXISTING INFRASTRUCTURE

SHEET 1

Gravity line (secondary)	
Cap =	0 IGD
Diem =	mm
Length =	3100 m
Required capacity	72
2015	72
Estimated cost	-72
Municipal demand	
Year	IGD
2015	16
Cost	

Gravity line (secondary)	
Cap =	0 IGD
Diem =	mm
Length =	5500 m
Required capacity	207
2015	207
Estimated cost	-207
Municipal demand	
Year	IGD
2015	30
Cost	

Gravity line (secondary)	
Cap =	0 IGD
Diem =	mm
Length =	1500 m
Required capacity	347
2015	347
Estimated cost	-347
Municipal demand	
Year	IGD
2015	31
Cost	

Gravity line (secondary)	
Cap =	IGD
Diem =	mm
Length =	4500 m
Required capacity	196
2015	196
Estimated cost	-196
Municipal demand	
Year	IGD
2015	35
Cost	

Gravity line (secondary)	
Cap =	0 IGD
Diem =	mm
Length =	2500 m
Required capacity	504
2015	504
Estimated cost	-504
Municipal demand	
Year	IGD
2015	69
Cost	

Municipal Reserve	
Cap =	M
TWL =	1135 m ASL
BWL =	1132 m ASL
Required capacity	0.112
2015	-0.112
Estimated cost	

Gravity line (C/S)	
Cap =	IGD
Diem =	mm
Length =	2500 m
Required capacity	168
2015	168
Estimated cost	-168

Municipal Reserve	
Cap =	M
TWL =	1138 m ASL
BWL =	1135 m ASL
Required capacity	3.124
2015	-3.124
Estimated cost	

Gravity line (secondary)	
Cap =	IGD
Diem =	mm
Length =	4000 m
Required capacity	137.44
2015	137.44
Estimated cost	-137.44

Municipal demand	
Year	IGD
2015	95
Cost	
Chrome mine demand	
Year	IGD
2015	3000
Cost	

SAULSPOORT : EXISTING INFRASTRUCTURE

SHEET 2

Required demand	
Year	M/G
2015	96
Cost	

Municipal Reservoir	
Cap =	M
TWL =	1075 m ASL
BWL =	1070 m ASL
Required capacity	Balance
2015	-0.098
Estimated cost	

Gravity line, C15	
Cap =	M/G
Diam =	mm
Length =	3100 m
Required capacity	Balance
2015	4854
Estimated cost	

Gravity line (secondary)	
Cap =	0 M/G
Diam =	mm
Length =	3700 m
Required capacity	Balance
2015	14
Estimated cost	

Farmhouse demand	
Year	M/G
2015	3
Cost	

Municipal Reservoir	
Cap =	M/G
TWL =	1144.6 m ASL
BWL =	1141.6 m ASL
Required capacity	Balance
2015	-0.14
Estimated cost	

Gravity line, C16	
Cap =	M/G
Diam =	mm
Length =	4700 m
Required capacity	Balance
2015	5001
Estimated cost	

Gravity line, C17	
Cap =	0 M/G
Diam =	mm
Length =	3700 m
Required capacity	Balance
2015	209
Estimated cost	

Supporting Reservoir	
Cap =	M
TWL =	1144.6 m ASL
BWL =	1141.6 m ASL
Required capacity	Balance
2015	0.14
Estimated cost	

Mapping demand	
Year	M/G
2015	136
Cost	

Nipending demand	
Year	M/G
2015	24
Cost	

Nipending Reservoir	
Cap =	M
TWL =	1126 m ASL
BWL =	1120 m ASL
Required capacity	Balance
2015	-0.050
Estimated cost	

Gravity line, C12	
Cap =	M/G
Diam =	mm
Length =	2400 m
Required capacity	Balance
2015	5445
Estimated cost	

Gravity line, C13	
Cap =	M/G
Diam =	mm
Length =	1500 m
Required capacity	Balance
2015	5237
Estimated cost	

Gravity line, C18	
Cap =	0 M/G
Diam =	mm
Length =	1900 m
Required capacity	Balance
2015	209
Estimated cost	

Gravity line to Gas Reservoir	
Cap =	M/G
Diam =	mm
Length =	8400 m
Required capacity	Balance
2015	5481
Estimated cost	

TO SHEET 4

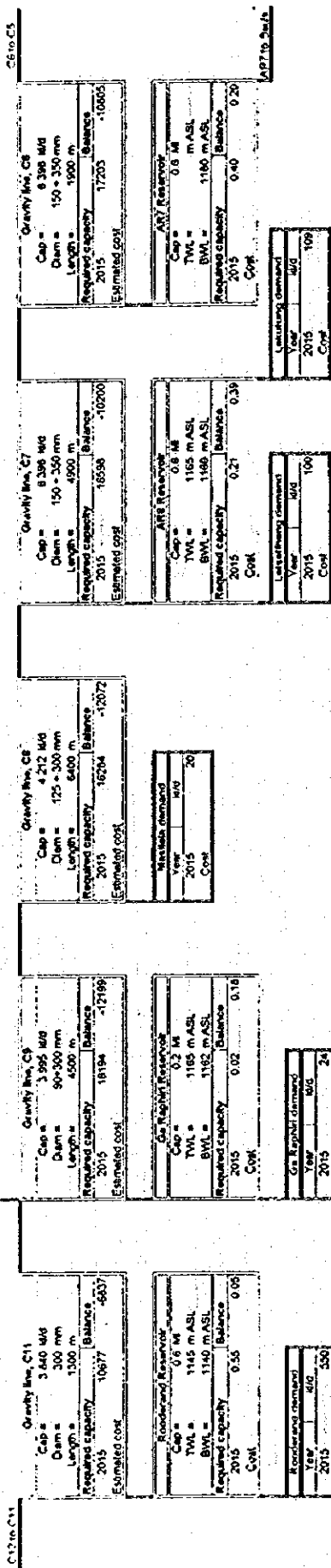




SAULSPOORT : EXISTING INFRASTRUCTURE

SHEET 4

FROM SHEET 2



SAULSPOORT : EXISTING INFRASTRUCTURE

SHEET 5

TO LA PATRIE RESERVOIR

Gravity line C1	
Cap =	7 095 kld
Diam =	200 x 350 mm
Length =	3500 m
Required capacity	20x51
2015	Balance
Estimated cost	-13356

ART Reservoir	
Cap =	0.5 M
TWL =	1162 m ASL
BWL =	1150 m ASL
Required capacity	0.26
2015	Balance
Cost	0.34

Landfill demand	
Year	kld
2015	260
Cost	

Gravity line C2	
Cap =	7 095 kld
Diam =	200 x 350 mm
Length =	3500 m
Required capacity	20x51
2015	Balance
Estimated cost	-12966

ART Reservoir	
Cap =	2 250 kld
Diam =	150 mm
Length =	6000 m
Required capacity	1448
2015	Balance
Estimated cost	644

ART Reservoir	
Cap =	0.6 M
TWL =	1120 m ASL
BWL =	1125 m ASL
Required capacity	0.96
2015	Balance
Cost	-0.36

Manufacture demand	
Year	kld
2015	900
Cost	

Landfill demand	
Year	kld
2015	64
Cost	

Gravity line C3	
Cap =	6 336 kld
Diam =	150 x 350 mm
Length =	1300 m
Required capacity	16615
2015	Balance
Estimated cost	-12217

ART Reservoir	
Cap =	0.6 M
TWL =	m ASL
BWL =	1160 m ASL
Required capacity	0.54
2015	Balance
Cost	0.26

Gravity line C4	
Cap =	6 336 kld
Diam =	150 x 350 mm
Length =	5500 m
Required capacity	17604
2015	Balance
Estimated cost	-11410

ART Reservoir	
Cap =	0.6 M
TWL =	m ASL
BWL =	1160 m ASL
Required capacity	0.40
2015	Balance
Cost	0.20

Saulspoort demand	
Year	kld
2015	1345
Cost	

**MOGWASE SYSTEM : EXISTING INFRASTRUCTURE**

SHEET 1

Year	2015
Cost	1889

Cap	0 M
TWL	1125 m ASL
BWL	1120 m ASL
Required capacity	158
2015	-189
Balance	

Cap	0 M
TWL	1145 m ASL
BWL	1140 m ASL
Required capacity	0.18
2015	0.18
Balance	0.18

Year	2015
Cost	176

Cap	0 M
TWL	1105 m ASL
BWL	1100 m ASL
Required capacity	119
2015	-119
Balance	

Year	2015
Cost	0

Year	2015
Cost	11054

Cap	0 M
TWL	1070 m ASL
BWL	1063 m ASL
Required capacity	184
2015	3.16
Balance	

Cap	15.459 M
TWL	450 mm
BWL	2000 m
Required capacity	14489
2015	14489
Balance	960

Cap	1 M
TWL	1125 m ASL
BWL	1120 m ASL
Required capacity	8.81
2015	-8.81
Balance	

Year	2015
Cost	807

Year	2015
Cost	6000

Cap	7.909 M
TWL	350 mm
BWL	3200 m
Required capacity	14489
2015	-2530
Balance	

Cap	7.909 M
TWL	350 mm
BWL	3200 m
Required capacity	16561
2015	-8672
Balance	

SUN CITY DEMAND ONLY

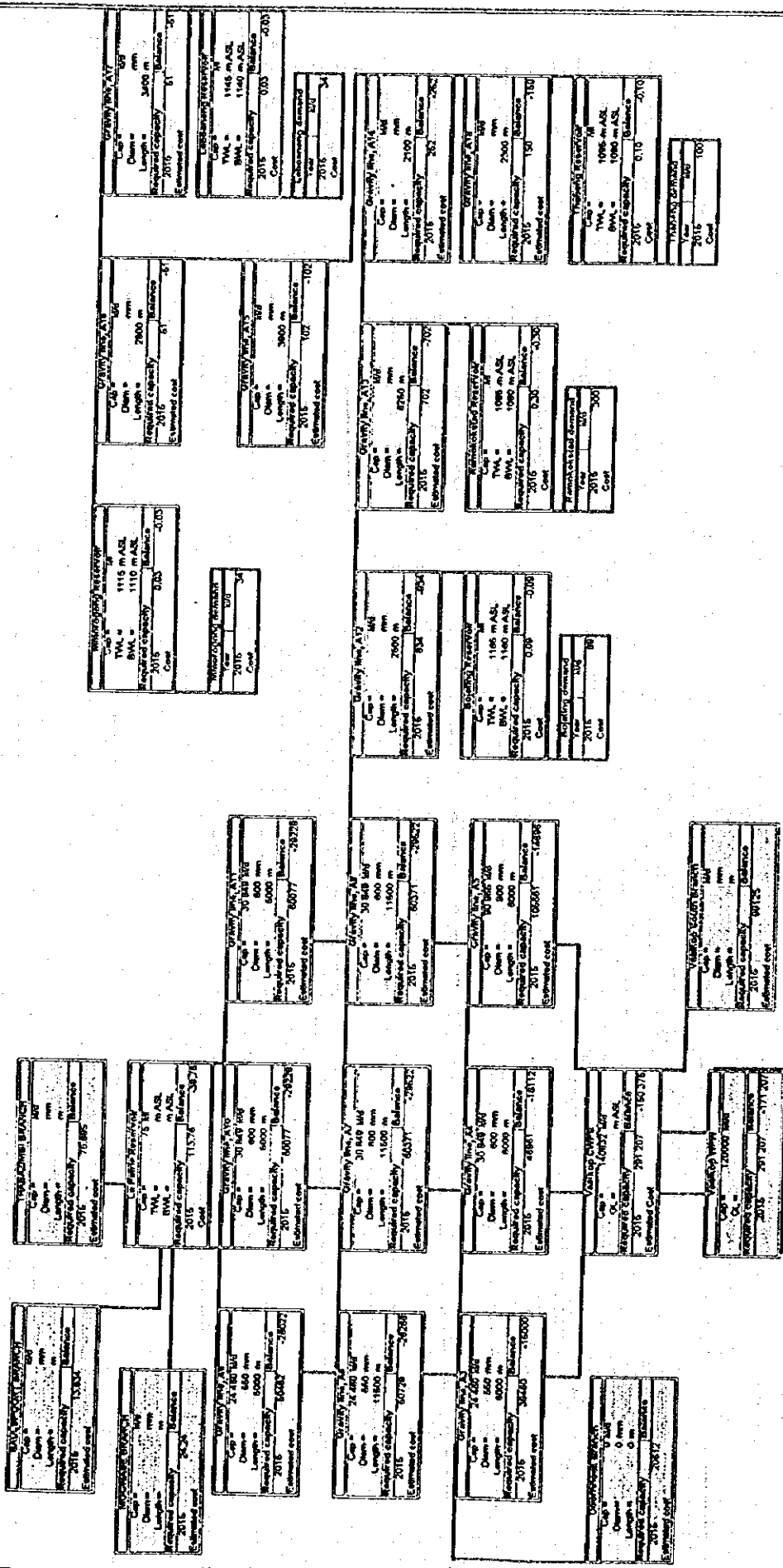
MOGWASE SYSTEM : EXISTING INFRASTRUCTURE

SHEET 2

TO LA PATRIE RESERVOIR OL = 1210m																																							
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TO VAALKOP PIPELINE  
SL = 1220

VAALKOP / LA PATRIE SYSTEM : EXISTING INFRASTRUCTURE



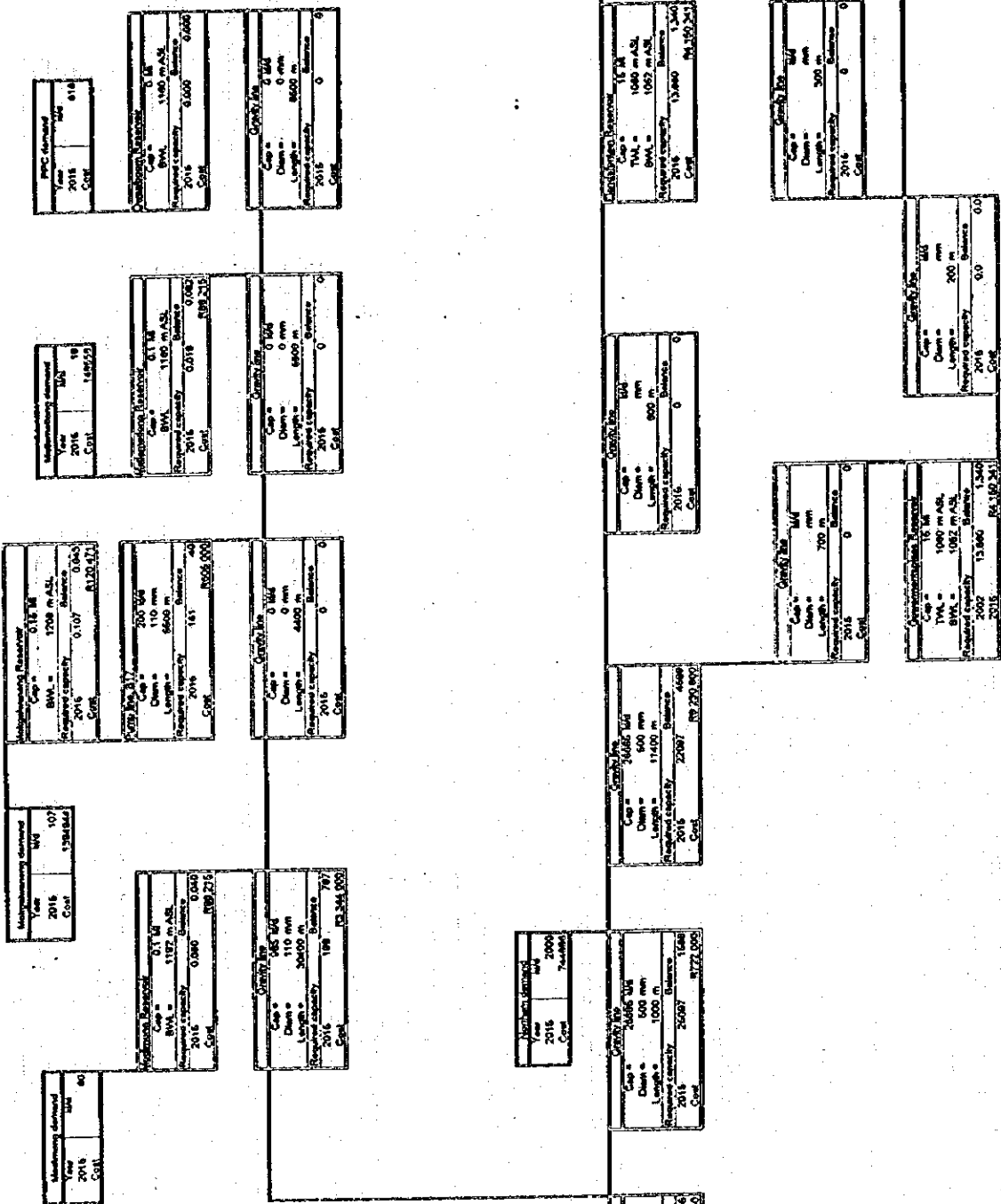
**THABAZIMBI SYSTEM : NEW INFRASTRUCTURE**

**SHEET 1**

Cost	R	0
Value	R	8 320 891
Primary Reservoir	R	60 205 950
Secondary Reservoir	R	298 800
Water Tanks	R	0
Pipes	R	1 227 860
Structures	R	4 312 786
<b>TOTAL</b>	<b>R</b>	<b>5 927 097</b>

FROM SPITSELOP RESERVOIR 30748 M3

TO LA PATRIE RESERVOIR



Multiplying factor	
Year	2016
Cost	1.00

Storage Reservoir	
Capacity	0.00 M3
Year	2016
Cost	0.00

Pipe	
Capacity	0.00 M3
Year	2016
Cost	0.00

Storage Reservoir	
Capacity	0.00 M3
Year	2016
Cost	0.00

Pipe	
Capacity	0.00 M3
Year	2016
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Storage Reservoir	
Capacity	0.00 M3
Year	2016
Cost	0.00

Pipe	
Capacity	0.00 M3
Year	2016
Cost	0.00

Multiplying factor	
Year	2016
Cost	1.00

Storage Reservoir	
Capacity	0.00 M3
Year	2016
Cost	0.00

Pipe	
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Year	2016
Cost	0.00

Storage Reservoir	
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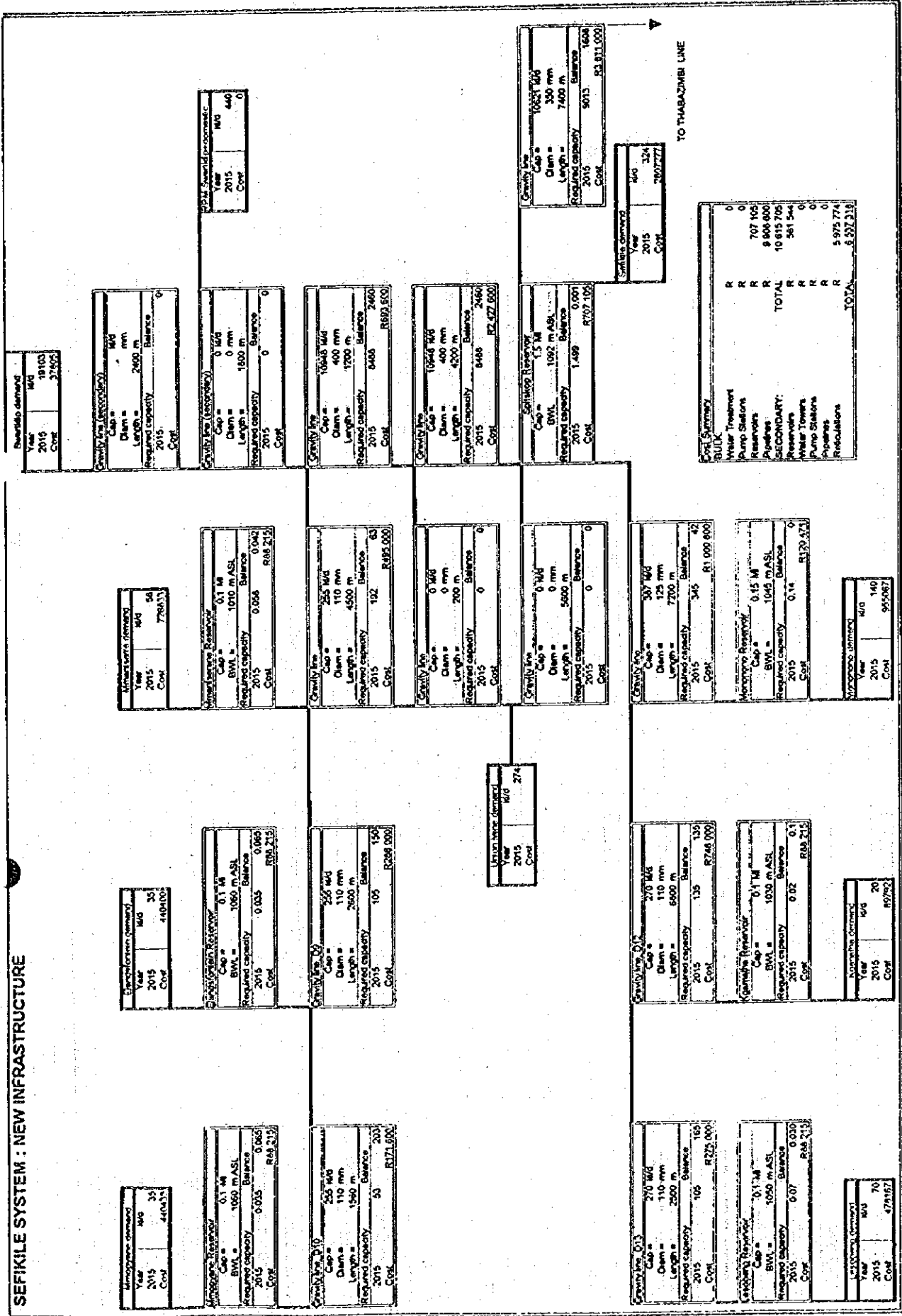
THABAZIMBI SYSTEM : NEW INFRASTRUCTURE

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**SEFIKILE SYSTEM : NEW INFRASTRUCTURE**



Quantity demanded	
Year	MGD
2015	18103
Cost	37495

Gravity line (Gravity)	
Cap =	MG
Diam =	mm
Length =	2490 m
Required capacity	Balance
2015	0
Cost	0

Gravity line (Gravity)	
Cap =	0 MG
Diam =	0 mm
Length =	1800 m
Required capacity	Balance
2015	0
Cost	0

Gravity line	
Cap =	1648 MGD
Diam =	400 mm
Length =	1700 m
Required capacity	Balance
2015	9488
Cost	R892,500

Gravity line	
Cap =	10246 MGD
Diam =	400 mm
Length =	4200 m
Required capacity	Balance
2015	9488
Cost	R2,427,600

Gravity line	
Cap =	1.5 M
Diam =	152 m ASL
Length =	1,499
Required capacity	Balance
2015	1,499
Cost	R197,100

Gravity line	
Cap =	16321 MGD
Diam =	300 mm
Length =	7400 m
Required capacity	Balance
2015	9013
Cost	R3,811,000

TO THABAZIMBI LINE

Cost Summary	
BULK	R
Water Treatment	R
Pump Stations	R
Reservoirs	R
Pipelines	R
SECONDARY:	R
Reservoirs	R
Water Towers	R
Pump Stations	R
Pipelines	R
Regulators	R
TOTAL	R 5,975,774

Dimensions (demanded)	
Year	MGD
2015	56
Cost	78633

Minimum Reservoir	
Cap =	0.1 M
BWL =	1010 m ASL
Required capacity	Balance
2015	0.056
Cost	R98,215

Gravity line	
Cap =	25 MGD
Diam =	110 mm
Length =	4500 m
Required capacity	Balance
2015	192
Cost	R495,000

Gravity line	
Cap =	0 MGD
Diam =	0 mm
Length =	700 m
Required capacity	Balance
2015	0
Cost	0

Gravity line	
Cap =	0 MGD
Diam =	0 mm
Length =	5600 m
Required capacity	Balance
2015	0
Cost	0

Gravity line	
Cap =	307 MGD
Diam =	125 mm
Length =	7700 m
Required capacity	Balance
2015	345
Cost	R1,000,800

Minimum Reservoir	
Cap =	0.15 M
BWL =	1045 m ASL
Required capacity	Balance
2015	0.14
Cost	R120,475

Volume (demanded)	
Year	MGD
2015	140
Cost	95582

Bach Green (demanded)	
Year	MGD
2015	35
Cost	440100

Bach Green Reservoir	
Cap =	0.1 M
BWL =	1050 m ASL
Required capacity	Balance
2015	0.035
Cost	R80,215

Gravity line (G)	
Cap =	255 MGD
Diam =	110 mm
Length =	2600 m
Required capacity	Balance
2015	105
Cost	R298,000

Union line (demanded)	
Year	MGD
2015	274
Cost	

Gravity line (G)	
Cap =	270 MGD
Diam =	110 mm
Length =	6600 m
Required capacity	Balance
2015	135
Cost	R748,000

Gamma Reservoir	
Cap =	0.1 M
BWL =	1030 m ASL
Required capacity	Balance
2015	0.02
Cost	R68,215

Volume (demanded)	
Year	MGD
2015	20
Cost	89782

Minimum (demanded)	
Year	MGD
2015	35
Cost	440100

Minimum Reservoir	
Cap =	0.1 M
BWL =	1050 m ASL
Required capacity	Balance
2015	0.035
Cost	R80,215

Gravity line (G)	
Cap =	255 MGD
Diam =	110 mm
Length =	1500 m
Required capacity	Balance
2015	50
Cost	R174,600

Gravity line (G)	
Cap =	270 MGD
Diam =	110 mm
Length =	2500 m
Required capacity	Balance
2015	105
Cost	R225,000

Gamma Reservoir	
Cap =	0.1 M
BWL =	1050 m ASL
Required capacity	Balance
2015	0.07
Cost	R68,215

Volume (demanded)	
Year	MGD
2015	70
Cost	479167

SAULSPOORT : NEW INFRASTRUCTURE

SHEET 1

Gravity line (secondary)	
Cap =	220 k/d
Diam =	110 mm
Length =	3300 m
Required capacity	72
2015	Balance 148
Estimated cost	R363 000

Mogoditshane demand	
Year	k/d
2015	30
Cost	379750

Gravity line (secondary)	
Cap =	220 k/d
Diam =	110 mm
Length =	5500 m
Required capacity	207
2015	Balance 13
Estimated cost	R905 000

Mogoditshane demand	
Year	k/d
2015	30
Cost	379750

Gravity line (secondary)	
Cap =	423 k/d
Diam =	140 mm
Length =	1500 m
Required capacity	347
2015	Balance 77
Estimated cost	R255 000

Mogopaielo demand	
Year	k/d
2015	31
Cost	360720

Gravity line (secondary)	
Cap =	183 k/d
Diam =	126 mm
Length =	4300 m
Required capacity	158
2015	Balance 26
Estimated cost	R597 700

Mantliso demand	
Year	k/d
2015	35
Cost	436667

Gravity line (secondary)	
Cap =	180 mm
Diam =	2500 m
Length =	504
Required capacity	103
2015	Balance R535 000
Estimated cost	

Mogopaielo Reservoir	
Cap =	0.15 Ml
TWL =	1135 m ASL
BWL =	1132 m ASL
Required capacity	0.112
2015	Balance 0.008
Estimated cost	R120 871

Mogopaielo demand	
Year	k/d
2015	69
Cost	310633

Gravity line C38	
Cap =	201 k/d
Diam =	110 mm
Length =	2500 m
Required capacity	168
2015	Balance R275 000
Estimated cost	

Mogopaielo Reservoir	
Cap =	3.5 Ml
TWL =	1138 m ASL
BWL =	1135 m ASL
Required capacity	3.124
2015	Balance 0.378
Estimated cost	R1 356 109

Gravity line (secondary)	
Cap =	14041 k/d
Diam =	400 mm
Length =	4000 m
Required capacity	13748
2015	Balance 204
Estimated cost	R2 312 000

Mogopaielo demand	
Year	k/d
2015	65
Cost	370817

Chrome Mine demand	
Year	k/d
2015	3000
Cost	

SAULSPOORT : NEW INFRASTRUCTURE

SHEET 2

Multi-line Reservoir	
Year	W/d
2015	98
Cost	429 000

Multi-line Reservoir	
Cap	0.1 Ml
TWL	1075 m ASL
BWL	1070 m ASL
Required capacity	Balance
2015	0 098
Estimated cost	R88 715

Gravity line, C36	
Cap	6013 kld
Diam	350 mm
Length	3100 m
Required capacity	Balance
2015	4854
Estimated cost	R1 598 500

Gravity line (secondary)	
Cap	189 kld
Diam	110 mm
Length	3700 m
Required capacity	Balance
2015	14
Estimated cost	R407 000

Remobilisation demand	
Year	W/d
2015	3
Cost	36187

Manufacturing	
Year	W/d
2015	0
Cost	79750

Gravity line, C36	
Cap	6013 kld
Diam	350 mm
Length	4700 m
Required capacity	Balance
2015	5001
Estimated cost	R2 420 500

Gravity line, C36	
Cap	271 kld
Diam	125 mm
Length	3700 m
Required capacity	Balance
2015	209
Estimated cost	R514 300

Merging Reservoir	
Cap	0.15 Ml
TWL	1144.6 m ASL
BWL	1141.6 m ASL
Required capacity	Balance
2015	0.14
Cost	R120 471

Merging demand	
Year	W/d
2015	136
Cost	1138278

Outstanding demand	
Year	W/d
2015	24
Cost	208917

Non-line Reservoir	
Cap	0.1 Ml
TWL	1125 m ASL
BWL	1120 m ASL
Required capacity	Balance
2015	0.030
Estimated cost	R85 215

Gravity line, C42	
Cap	6013 kld
Diam	350 mm
Length	2400 m
Required capacity	Balance
2015	5445
Estimated cost	R1 236 000

Gravity line, C37	
Cap	6013 kld
Diam	350 mm
Length	1900 m
Required capacity	Balance
2015	5237
Estimated cost	R772 500

Gravity line, C38	
Cap	271 kld
Diam	125 mm
Length	1900 m
Required capacity	Balance
2015	209
Estimated cost	R294 100

TO SHEET 4

Gravity line to Gra Resoid	
Cap	6013 kld
Diam	350 mm
Length	8400 m
Required capacity	Balance
2015	5481
Estimated cost	R4 326 000



SAULSPOORT : NEW INFRASTRUCTURE

SHEET 4

FROM SHEET 2

Gravity line Requirements	
Diem =	mm
Length =	m
Required capacity	m <sup>3</sup> /d
2015	0
Estimated cost	

Gravity line, C1	
Cap =	14 817 m <sup>3</sup>
Diem =	500 mm
Length =	6400 m
Required capacity	Balance
2015	12072
Estimated cost	R4 670 800

On Right Reserve	
Cap =	0.00 m <sup>3</sup>
Diem =	1180 m ASL
Length =	1180 m ASL
Required capacity	Balance
2015	0.00
Cost	0.00

On Right demand	
Year	m <sup>3</sup> /d
2015	24
Cost	229334

Gravity line, C3	
Cap =	14 817 m <sup>3</sup>
Diem =	500 mm
Length =	6400 m
Required capacity	Balance
2015	12072
Estimated cost	R4 670 800

On Right Reserve	
Cap =	0.00 m <sup>3</sup>
Diem =	1180 m ASL
Length =	1180 m ASL
Required capacity	Balance
2015	0.00
Cost	0.00

On Right demand	
Year	m <sup>3</sup> /d
2015	20
Cost	195246

Gravity line, C7	
Cap =	11 180 m <sup>3</sup>
Diem =	450 mm
Length =	1800 m
Required capacity	Balance
2015	10200
Estimated cost	R3 145 800

On Right Reserve	
Cap =	0.00 m <sup>3</sup>
Diem =	1180 m ASL
Length =	1180 m ASL
Required capacity	Balance
2015	0.00
Cost	0.00

On Right demand	
Year	m <sup>3</sup> /d
2015	100
Cost	870427

Gravity line, C9	
Cap =	11 180 m <sup>3</sup>
Diem =	450 mm
Length =	1800 m
Required capacity	Balance
2015	10905
Estimated cost	R1 218 800

On Right Reserve	
Cap =	0.00 m <sup>3</sup>
Diem =	1180 m ASL
Length =	1180 m ASL
Required capacity	Balance
2015	0.00
Cost	0.00

On Right demand	
Year	m <sup>3</sup> /d
2015	100
Cost	314713

218 to C20

Gravity line, C20	
Cap =	900 m <sup>3</sup>
Diem =	110 mm
Length =	5600 m
Required capacity	Balance
2015	237
Estimated cost	R605 000

Gravity line, C21	
Cap =	900 m <sup>3</sup>
Diem =	110 mm
Length =	3700 m
Required capacity	Balance
2015	53
Estimated cost	R407 000

On Right Reserve	
Cap =	0.2 m <sup>3</sup>
Diem =	1200 m ASL
Length =	1200 m ASL
Required capacity	Balance
2015	0.18
Cost	R150 246

On Right Reserve	
Cap =	0.1 m <sup>3</sup>
Diem =	1200 m ASL
Length =	1180 m ASL
Required capacity	Balance
2015	0.04
Cost	R86 215

On Right demand	
Year	m <sup>3</sup> /d
2015	17
Cost	180786

On Right Reserve	
Cap =	0.00 m <sup>3</sup>
Diem =	1180 m ASL
Length =	1180 m ASL
Required capacity	Balance
2015	0.00
Cost	0.00

On Right Reserve	
Cap =	0.00 m <sup>3</sup>
Diem =	1180 m ASL
Length =	1180 m ASL
Required capacity	Balance
2015	0.00
Cost	0.00

On Right demand	
Year	m <sup>3</sup> /d
2015	19
Cost	187322

Cost Summary	
Water Treatment	R 0
Pump Stations	R 484 524
Reservoirs	R 44 865 077
Secondary	R 2 288 015
Water Towers	R 0
Pump Stations	R 0
Reservoirs	R 5 074 700
Water Towers	R 88 987 184
Substations	R 0
<b>TOTAL</b>	<b>R 95 839 840</b>

**SAULSPOORT : NEW INFRASTRUCTURE**  
SHEET 5

TO LA PATHE RESERVOIR

Gravity line, C1	
Cap =	14 917 M€
Diam =	500 mm
Length =	3500 m
Required capacity	Balance
2015	13304
Estimated cost	R2 927 000

AS1 Reservoir	
Cap =	Estm
TWL =	1185 m ASL
BWL =	1180 m ASL
Required capacity	Balance
2015	0.00
Cost	0.00

Zandfontein Reservoir	
Year	M€
2015	280
Cost	2097333

Gravity line, C2	
Cap =	14 917 M€
Diam =	500 mm
Length =	3500 m
Required capacity	Balance
2015	12090
Estimated cost	R2 927 000

Gravity line, C4	
Cap =	Estm
Diam =	6000 mm
Length =	0
Required capacity	Balance
2015	0
Estimated cost	0

A12 Reservoir	
Cap =	0 x M€
TWL =	1130 m ASL
BWL =	1125 m ASL
Required capacity	Balance
2015	0.38
Cost	R256 024

Middelburg Reservoir	
Year	M€
2015	500
Cost	982473

Langenhout Reservoir	
Year	M€
2015	84
Cost	708762

Gravity line, C3	
Cap =	14 917 M€
Diam =	500 mm
Length =	3500 m
Required capacity	Balance
2015	12217
Estimated cost	R836 800

A13 Reservoir	
Cap =	Estm
TWL =	m ASL
BWL =	1180 m ASL
Required capacity	Balance
2015	0.00
Cost	0.00

Gravity line, C5	
Cap =	14 917 M€
Diam =	500 mm
Length =	3500 m
Required capacity	Balance
2015	11410
Estimated cost	R3 971 000

A15 Reservoir	
Cap =	Estm
TWL =	m ASL
BWL =	1180 m ASL
Required capacity	Balance
2015	0.00
Cost	0.00

SAULSPOORT Reservoir	
Year	M€
2015	1345
Cost	14854733

**MOGWISE SYSTEM : NEW INFRASTRUCTURE**

**SHEET 1**

Ledig demand	
Year	kl/g
2015	1689
Cost	5260487

LEBKG Reservoir	
Cap =	2 MI
TWL =	1125 m ASL
BWL =	1120 m ASL
Required capacity	Balance
2015	1.69 0.31
Cost	642 047

Gravity line, E6	
Cap =	803 kl/g
Diam =	110 mm
Length =	5000 m
Required capacity	Balance
2015	264 639
Estimated cost	R560 000

Gravity line, E8	
Cap =	5 652 kl/g
Diam =	200 mm
Length =	6500 m
Required capacity	Balance
1998	735 4517
Estimated cost	R2 073 900

MARQIESRAAL Reservoir	
Cap =	0.2 MI
TWL =	1145 m ASL
BWL =	1140 m ASL
Required capacity	Balance
2015	0.18 0.02
Cost	150 284

Mehobos / Blaise Goid	
Year	kl/g
2015	170
Cost	206507

PMA'SHMA Reservoir	
Cap =	1 MI
TWL =	1100 m ASL
BWL =	1100 m ASL
Required capacity	Balance
1998	0.48 0.51
Cost	

Phutsho demand	
Year	kl/g
2015	1194
Cost	0

Estimated Cost Summary	
BULK	
Pipelines	40 349 300
Reservoirs	
SECONDARY	
Pipelines	5 520 801
Reservoirs	10 801 475
Reculabans	
Total 1999 Cost	56 671 577

Sun City demand	
Year	kl/g
2015	11054
Cost	180468

DOORHOKK Reservoir	
Cap =	0 MI
TWL =	1070 m ASL
BWL =	1063 m ASL
Required capacity	Balance
2015	0.00 0.00
Cost	

Gravity line, E9	
Cap =	0 kl/g
Diam =	0 mm
Length =	2000 m
Required capacity	Balance
2015	0 0
Estimated cost	

CHARENG Reservoir	
Cap =	6 MI
TWL =	1125 m ASL
BWL =	1120 m ASL
Required capacity	Balance
2015	6.61 0.39
Cost	2 052 235

Chareng / Bala	
Year	kl/g
2015	807
Cost	3328071

Boschhokk Plate	
Year	kl/g
2015	9000
Cost	

Gravity line, E5	
Cap =	7 808 kl/g
Diam =	300 mm
Length =	3200 m
Required capacity	Balance
2015	6590 1318
Estimated cost	R1 845 000

Gravity line, E8	
Cap =	11 258 kl/g
Diam =	400 mm
Length =	3000 m
Required capacity	Balance
2015	8672 2584
Estimated cost	R1 848 800

Sun City demand only

MOGWASE SYSTEM : NEW INFRASTRUCTURE

SHEET 2

TO LA PATRIE RESERVOIR  
OL = 1210m

Gravity line, E3	
Cap =	8 077 kU6
Diam =	350 mm
Length =	12000 m
Required capacity	Balance
2015	6590
Estimated cost	R6 180 000

Overhead Branch	
Cap =	7 909 kU6
Diam =	350 mm
Length =	16000 m
Required capacity	Balance
2015	8872
Estimated cost	R8 240 000

Doombeek Branch	
Cap =	2 044 kU6
Diam =	200 mm
Length =	17000 m
Required capacity	Balance
2015	1172
Estimated cost	R5 423 000

Gravity line, E2	
Cap =	5 077 kU6
Diam =	350 mm
Length =	9000 m
Required capacity	Balance
2015	7675
Estimated cost	R4 944 000

MOGWASE Reservoir	
Cap =	0 Mi
TWL =	m ASL
BWL =	m ASL
Required capacity	Balance
2015	0.00
Cost	0.00

Mogwase/Tabete-a	
Year	kU6
2015	1035
Cost	975800

Gravity line, E1	
Cap =	34 014 kU6
Diam =	600 mm
Length =	6000 m
Required capacity	Balance
2015	28280
Estimated cost	R5 164 000

Gravity line, E9	
Cap =	21 584 kU6
Diam =	400 mm
Length =	7400 m
Required capacity	Balance
2015	16234
Estimated cost	R4 277 200

Gravity line, E10	
Cap =	0 kU6
Diam =	0 mm
Length =	10080 m
Required capacity	Balance
2015	0
Estimated cost	0

BOOIRELO Reservoir	
Cap =	7.5 Mi
TWL =	1105 m ASL
BWL =	1100 m ASL
Required capacity	Balance
2015	7.43
Cost	2 436 195

Booirelo Demand	
Year	kU6
2015	12431
Cost	

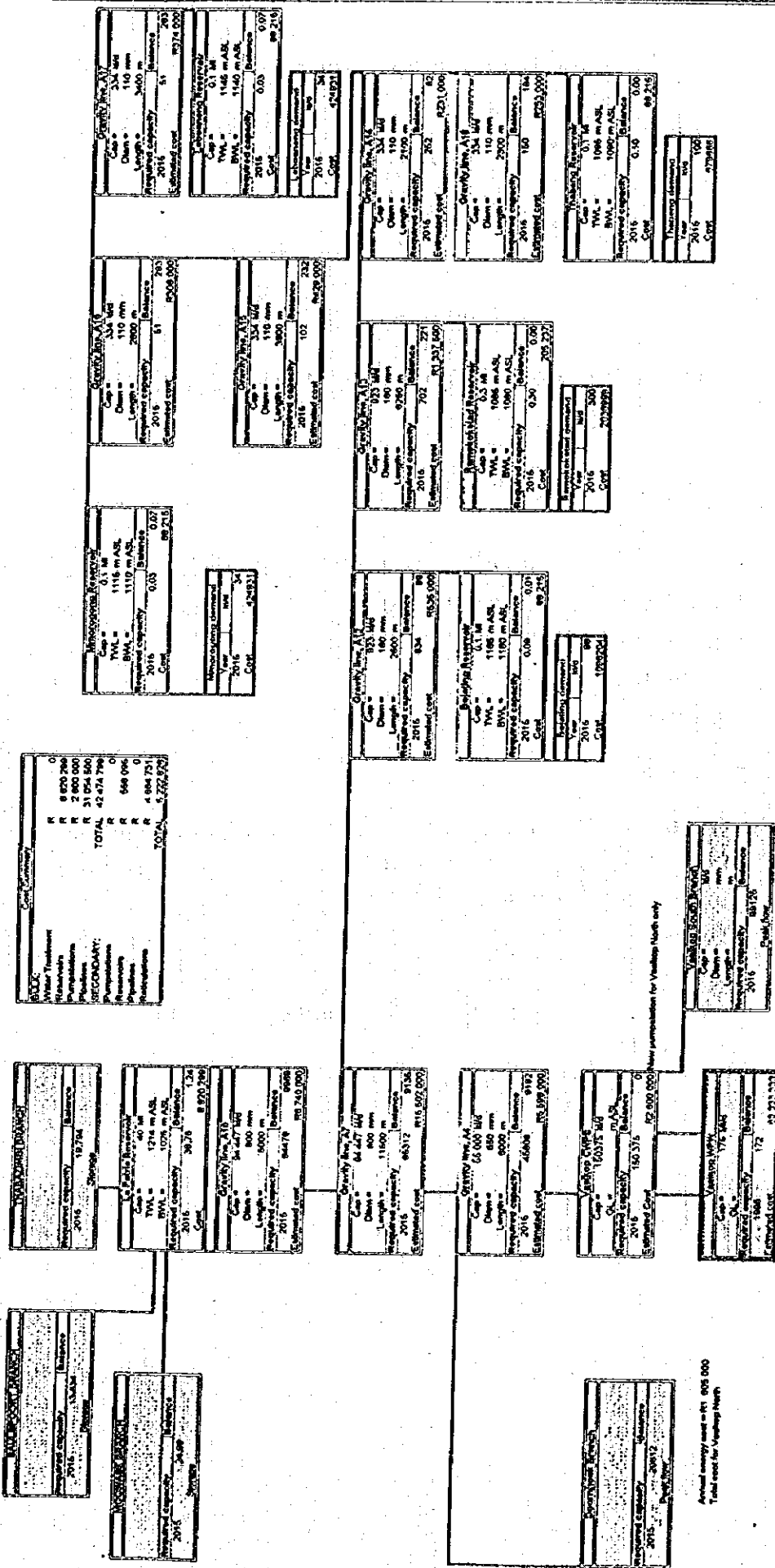
MONAKATO Reservoir	
Cap =	0 Mi
TWL =	1040 m ASL
BWL =	1035 m ASL
Required capacity	Balance
2015	0.00
Cost	0.00

Monakato/Mate	
Year	kU6
2015	1106
Cost	726104

TO VAALKOP PIPELINE  
SL = 1220



VAALKOP / LA PATRIE SYSTEM : NEW INFRASTRUCTURE



# VAALKOP SOUTH SUPPLY AREA

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<b>COST SUMMARY FOR INFRASTRUCTURE.....</b>	<b>W-27</b>
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### **EXISTING INFRASTRUCTURE**

<b>BETHANIE SUPPLY BLOCK.....</b>	<b>W-29</b>
<b>VAALKOP SOUTHERN SUPPLY BLOCK.....</b>	<b>W-30</b>
<b>BOSPOORT SUPPLY BLOCK.....</b>	<b>W-31</b>

### **NEW INFRASTRUCTURE**

<b>BETHANIE SUPPLY BLOCK.....</b>	<b>W-32</b>
<b>VAALKOP SOUTHERN SUPPLY BLOCK.....</b>	<b>W-33</b>

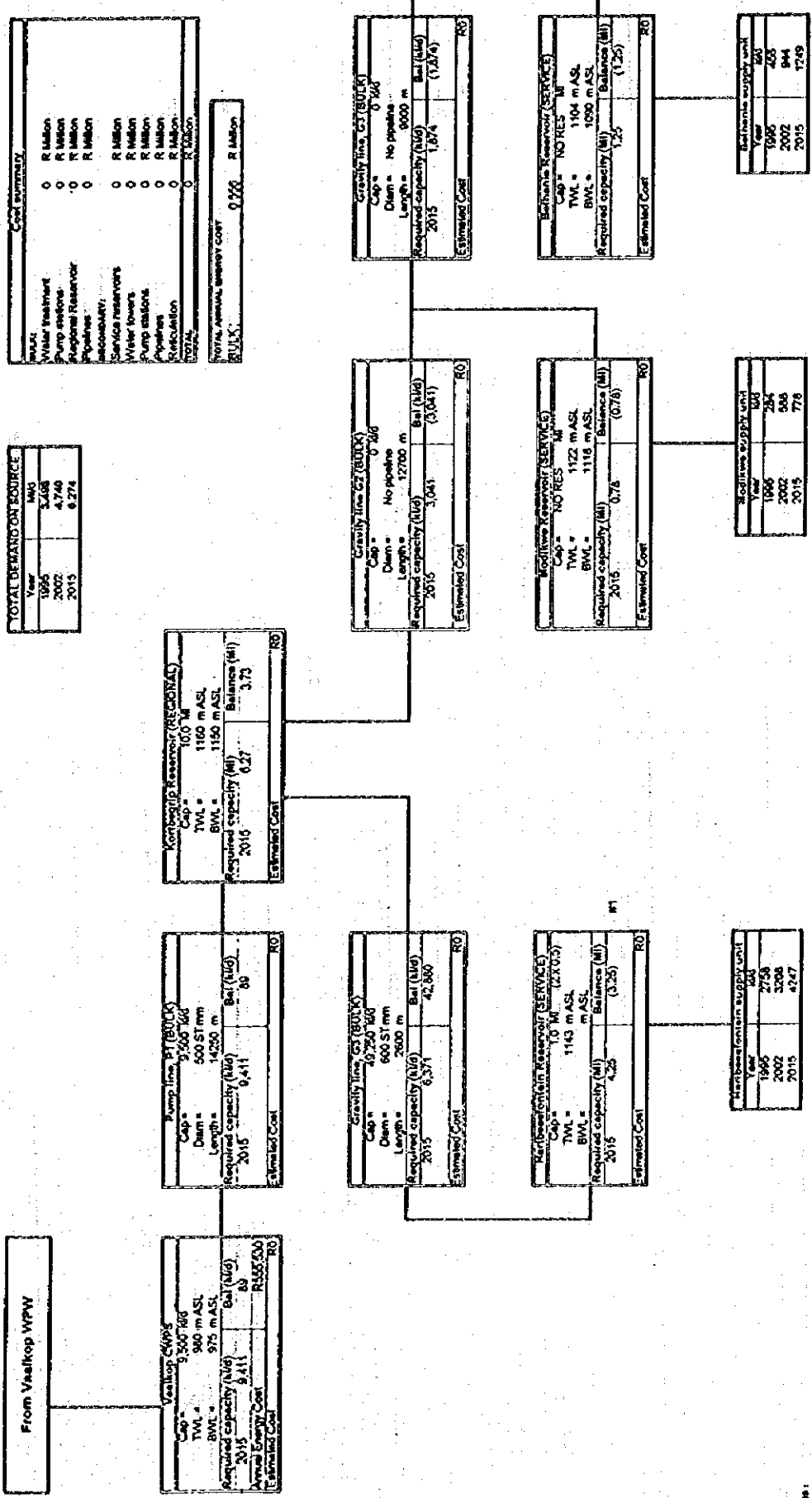
**NOTE: NO NEW CAPITAL WORKS HAVE BEEN PROPOSED FOR  
BOSPOORT SUPPLY BLOCK.**

## COST SUMMARY FOR INFRASTRUCTURE

NAME OF SUPPLY AREA :	VAALKOP SOUTH SUPPLY AREA	
INCLUDING SUPPLY BLOCKS :	1. Bethanie Supply Block 2. Vaalkop Southern and Bospoort Supply Blocks	
POPULATION SERVED (2015) :	305,247	
AADD In mcm/a (2015) :	26.72	
<b>BULK COST :</b>	<b>QUANTITY</b>	<b>COST (R million)</b>
Water Purification Works	KI/d (SDD)	
1. Vaalkop WPW	60,000	21.667
Pump Stations	KI/d (SDD)	
<b>A : Capital Cost</b>		
1. Vaalkop CWPS	100,000	7.500
2. Townlands Booster PS	45,000	1.935
<b>B : Annual Energy Cost (Not Incd with Total)</b>		
1. Vaalkop CWPS	-	4.103
2. Townlands Booster PS	-	0.590
Reservoirs (Regional)	MI	
1. Bospoort Reservoir	2 x 35 = 70 MI	15.920
Pipelines (Bulk)	km	
1. 110/9 PVC	5	0.445
2. 160/9 PVC	0.5	0.087
3. 250/9 PVC	9	3.456
4. 315/9 PVC	14	8.106
5. 450 ST	10	6.420
6. 700 ST	7.2	7.214
7. 800 ST	2.3	3.100
8. 950 ST	1.9	3.137
9. 1000 ST	45.73	79.936
10. 1050 ST	1.95	3.559
11. 1100 ST	0.37	0.710
<b>Sub Total Construction Cost</b>		<b>163.193</b>
<b>Engineering Fees (15 %)</b>		<b>24.479</b>
<b>VAT (14 %)</b>		<b>26.274</b>
<b>Project Contingency (20%)</b>		<b>42.789</b>
<b>TOTAL : Bulk Cost</b>		<b>256.735</b>
<b>Bulk Cost per Capita (Rands)</b>		<b>R841</b>

SECONDARY COST :	QUANTITY	COST (R million)
Reservoirs (Service)	MI	
1. Modikwe Reservoir	2 x 0.6 = 1.2	0.699
2. Bethanie Reservoir	2 x 0.9 = 1.8	0.955
3. Thlabane Upper Reservoir	5	1.784
4. Mabitse Reservoir	1	0.518
Water Towers	MI	
N/A	NIL	NIL
Pump Stations (Secondary)	Kl/d	
A : Capital Cost	NIL	NIL
N/A	NIL	NIL
B : Annual Energy Cost (Not Inc'd with Total)	NIL	NIL
N/A	NIL	NIL
Pipelines (Secondary)	km	
1. 140/9 PVC	6.2	0.849
Reticulation	km	
1. Bethanie Supply Block		12.347
2. Vaalkop Southern and Bospoort Supply Blocks		80.076
Sub Total Construction Cost		97.228
Engineering Fees (15 %)		14.584
VAT (14 %)		15.654
Project Contingency (20%)		25.493
TOTAL : Secondary Cost		152.960
Secondary Cost per Capita (Rands)		R501
GRAND TOTAL COST		409.695
Grand Total Cost per Capita (R)		R1,342

# BETHANIE SUPPLY BLOCK: EXISTING INFRASTRUCTURE



**TOTAL DEMAND ON SOURCE**

Year	1995	2002	2015
Ml	3,268	4,740	6,274

**Cost Summary**

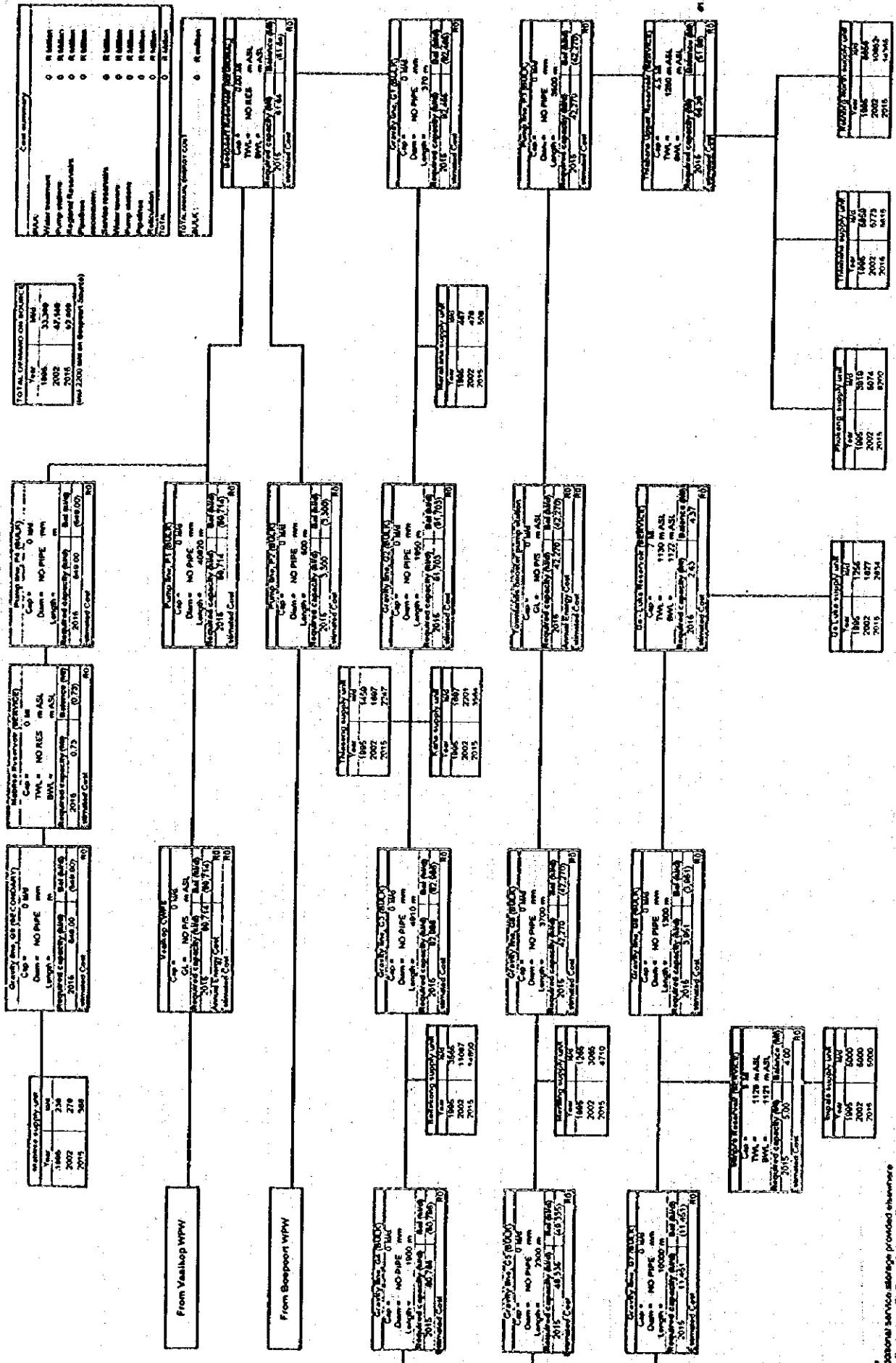
Water treatment	0	R Milion
Pump stations	0	R Milion
Regional Reservoir	0	R Milion
Pipelines	0	R Milion
Secondary	0	R Milion
Service reservoirs	0	R Milion
Water towers	0	R Milion
Pump stations	0	R Milion
Pipelines	0	R Milion
Reservoirs	0	R Milion
TOTAL	0	R Milion

**TOTAL ANNUAL ENERGY COST**

**R155,530**

notes:  
#1 Storage for Hartbeestfontein provided in Korbeypip Reservoir

# VAALKOP SOUTHERN SUPPLY BLOCK : EXISTING INFRASTRUCTURE



Year	1986	2002	2015
Capacity (m³/s)	33.246	47.146	57.646
Estimated Cost			

Year	1986	2002	2015
Capacity (m³/s)	33.246	47.146	57.646
Estimated Cost			

Year	1986	2002	2015
Capacity (m³/s)	33.246	47.146	57.646
Estimated Cost			

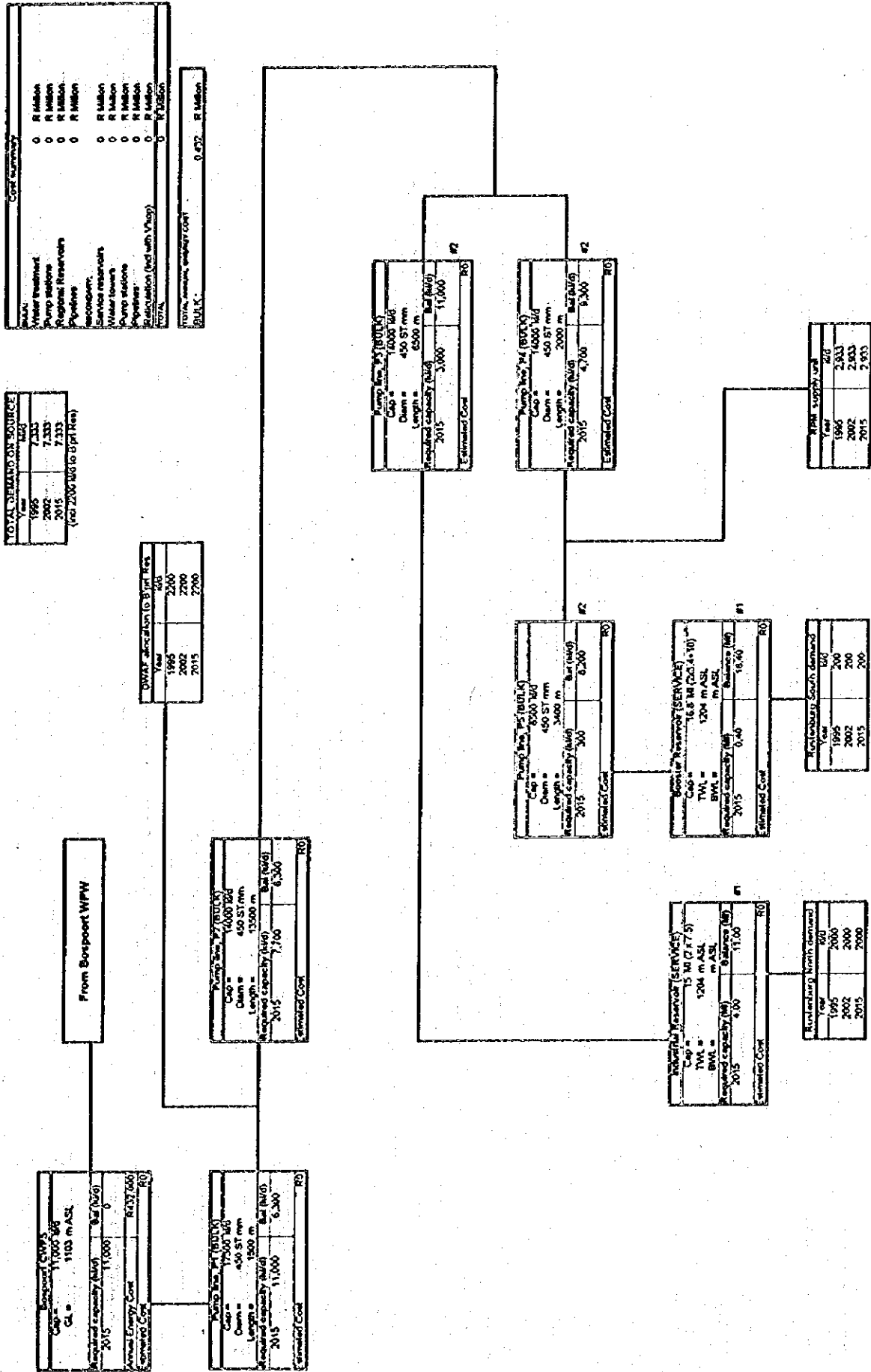
Year	1986	2002	2015
Capacity (m³/s)	33.246	47.146	57.646
Estimated Cost			

Year	1986	2002	2015
Capacity (m³/s)	33.246	47.146	57.646
Estimated Cost			

Year	1986	2002	2015
Capacity (m³/s)	33.246	47.146	57.646
Estimated Cost			

Additional service storage provided elsewhere by Rustenburg T.C and before Rustenburg T.C

# BOSPOORT SUPPLY BLOCK : EXISTING INFRASTRUCTURE



some:  
 #1 Industrial and Booster reservoirs also provide storage for supplies from other supply blocks.  
 #2 Intermittent pumping to either Rusdenburg North OR Rusdenburg South, with low load factor.

# BETHANIE SUPPLY BLOCK : NEW INFRASTRUCTURE

TOTAL DEMAND ON SOURCE	
Year	M3
1996	3,148
2002	4,348
2015	8,574

Cost Summary	
Water Treatment	0.000 R Million
Water storage	0.000 R Million
Regional Reservoirs	0.000 R Million
Transmission	10.609 R Million
Interconnect	1.684 R Million
Service Reservoirs	0.000 R Million
Water towers	0.000 R Million
Pump stations	0.000 R Million
Valves	17.347 R Million
Construction	28.810 R Million
<b>TOTAL PROJECT ENERGY COST</b>	<b>0.000 R Million</b>

TOTAL DEMAND ON SOURCE	
Year	M3
1996	3,148
2002	4,348
2015	8,574

From Vaaltop W/PW	
Cap =	0.000
TWL =	940 m ASL
BWL =	975 m ASL
Length =	0.000 m
Required capacity (M3)	0.000
2015	0.000
Estimated Cost	0.000

North West (NW) Reservoir (REGULATORY)	
Cap =	0.000
TWL =	1190 m ASL
BWL =	1130 m ASL
Length =	0.000 m
Required capacity (M3)	0.000
2015	0.000
Estimated Cost	0.000

North West (NW) Reservoir (REGULATORY)	
Cap =	0.000
TWL =	1190 m ASL
BWL =	1130 m ASL
Length =	0.000 m
Required capacity (M3)	0.000
2015	0.000
Estimated Cost	0.000

Grassy Run 07 (BUCK)	
Cap =	1200 M3
Diam =	3159 PVC mm
Length =	12700 m
Required capacity (M3)	3,041
2015	1,540
Estimated Cost	R7,503,300

Grassy Run 07 (BUCK)	
Cap =	1200 M3
Diam =	3159 PVC mm
Length =	12700 m
Required capacity (M3)	3,041
2015	1,540
Estimated Cost	R7,503,300

North West (NW) Reservoir (SERVICE)	
Cap =	0.000
TWL =	1143 m ASL
BWL =	1100 m ASL
Length =	0.000 m
Required capacity (M3)	0.000
2015	0.000
Estimated Cost	0.000

North West (NW) Reservoir (SERVICE)	
Cap =	0.000
TWL =	1143 m ASL
BWL =	1100 m ASL
Length =	0.000 m
Required capacity (M3)	0.000
2015	0.000
Estimated Cost	0.000

North West (NW) Reservoir (SERVICE)	
Year	M3
1996	2755
2002	3208
2015	4747

North West (NW) Reservoir (SERVICE)	
Year	M3
1996	2755
2002	3208
2015	4747

Grassy Run 07 (BUCK)	
Cap =	1200 M3
Diam =	3159 PVC mm
Length =	12700 m
Required capacity (M3)	3,041
2015	1,540
Estimated Cost	R7,503,300

Grassy Run 07 (BUCK)	
Cap =	1200 M3
Diam =	3159 PVC mm
Length =	12700 m
Required capacity (M3)	3,041
2015	1,540
Estimated Cost	R7,503,300

North West (NW) Reservoir (SERVICE)	
Cap =	0.000
TWL =	1104 m ASL
BWL =	1000 m ASL
Length =	0.000 m
Required capacity (M3)	0.000
2015	0.000
Estimated Cost	0.000

North West (NW) Reservoir (SERVICE)	
Cap =	0.000
TWL =	1104 m ASL
BWL =	1000 m ASL
Length =	0.000 m
Required capacity (M3)	0.000
2015	0.000
Estimated Cost	0.000

North West (NW) Reservoir (SERVICE)	
Year	M3
1996	450
2002	844
2015	1740

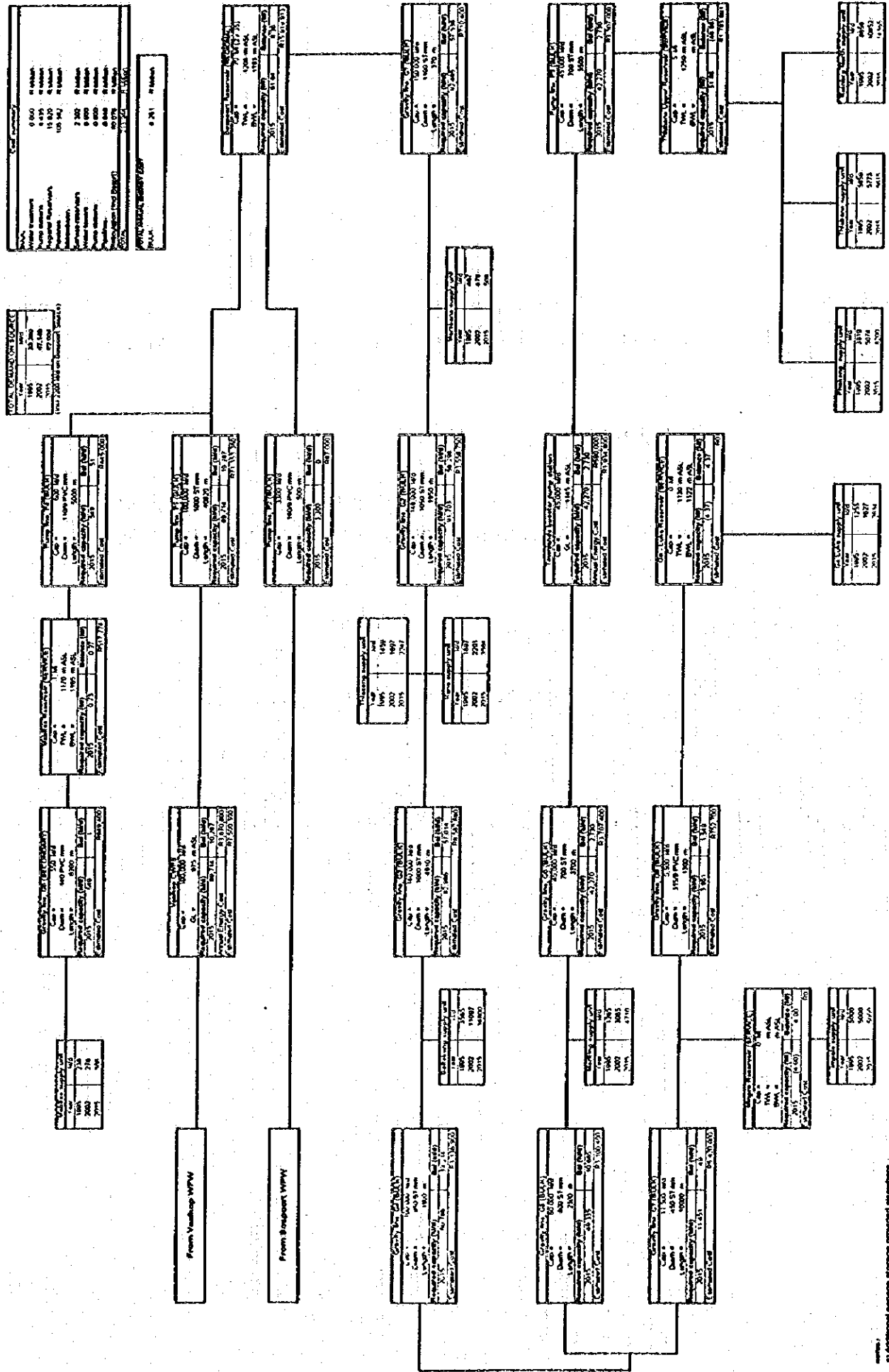
North West (NW) Reservoir (SERVICE)	
Year	M3
1996	450
2002	844
2015	1740

NOTES:

#1 Storage for North West Reservoir provided in North West Reservoir.



# VAALCO SOUTHERN SUPPLY BLOCK : N-L-W INFRASTRUCTURE



\*Additional storage provided elsewhere by Rubenbug LLC and Baringer Trial Authority

# **BARNARDSVLEI SUPPLY AREA**

## **TABLE OF CONTENTS**

**COST SUMMARY FOR INFRASTRUCTURE..... W-35**

### **EXISTING INFRASTRUCTURE**

**BARNARDSVLEI WESTERN SUPPLY BLOCK..... W-37**

**BARNARDSVLEI EASTERN SUPPLY BLOCK..... W-38**

### **NEW INFRASTRUCTURE**

**BARNARDSVLEI EASTERN SUPPLY BLOCK..... W-39**

**NOTE: NO NEW CAPITAL WORKS HAVE BEEN PROPOSED FOR  
BARNARDSVLEI WESTERN SUPPLY BLOCK.**

<b>COST SUMMARY FOR INFRASTRUCTURE</b>		
<b>NAME OF SUPPLY AREA :</b>	BARNARDSVLEI SUPPLY AREA	
<b>INCLUDING SUPPLY BLOCKS :</b>	1. Barnardsvlei Western Supply Block 2. Barnardsvlei Eastern Supply Block	
<b>POPULATION SERVED (2015) :</b>	406,832	
<b>AADD In mcm/a (2015) :</b>	42.16	
<b>BULK COST :</b>	<b>QUANTITY</b>	<b>COST (R million)</b>
<b>Water Purification Works</b>	<b>Kl/d (SDD)</b>	
N/A	NIL	NIL
<b>Pump Stations</b>	<b>Kl/d (SDD)</b>	
<b>A : Capital Cost</b>		
N/A	NIL	NIL
<b>Annual Energy Cost (Not Inc'd with Total)</b>		
N/A	NIL	NIL
<b>Reservoirs (Regional)</b>	<b>Ml</b>	
N/A	NIL	NIL
<b>Pipelines (Bulk)</b>	<b>km</b>	
1. 300 ST	13	6.071
<b>Sub Total Construction Cost</b>		6.071
<b>Engineering Fees (15 %)</b>		0.911
<b>VAT (14 %)</b>		0.977
<b>Project Contingency (20%)</b>		1.592
<b>TOTAL : Bulk Cost</b>		9.551
<b>Bulk Cost per Capita (Rands)</b>		R23

SECONDARY COST :	QUANTITY	COST (R million)
Reservoirs (Service)	MI	
1. Majakaneng Reservoir	7	2.310
2. Segwaelane Reservoir	1	0.518
Water Towers	MI	
N/A	NIL	NIL
Pump Stations (Secondary)	KI/d	
A : Capital Cost		
N/A	NIL	NIL
B : Annual Energy Cost (Not Incl'd with Total)		
N/A	NIL	NIL
Pipelines (Secondary)	km	
N/A	NIL	NIL
ReCirculation	km	
1. Barnardsvlei Western Supply Block		15.789
2. Barnardsvlei Eastern Supply Block		8.651
Sub Total Construction Cost		27.268
Engineering Fees (15 %)		4.090
VAT (14 %)		4.390
Project Contingency (20%)		7.150
<b>TOTAL : Secondary Cost</b>		<b>42.898</b>
Secondary Cost per Capita (Rands)		R105
<b>GRAND TOTAL COST</b>		<b>52.449</b>
<b>Grand Total Cost per Capita (R)</b>		<b>R129</b>

# BARNARDSVLEI WESTERN SUPPLY BLOCK : EXISTING INFRASTRUCTURE

Year	MAL
1996	41,458
2002	64,737
2015	79,796

Cost Summary	
Water Treatment	0 \$ Millions
Pump Stations	0 \$ Millions
High Pressure Pipelines	0 \$ Millions
Transmission	0 \$ Millions
Service Reservoirs	0 \$ Millions
Other Reservoirs	0 \$ Millions
Pump Stations	0 \$ Millions
Transmission	0 \$ Millions
Reservoirs	18,796 \$ Millions
<b>Total</b>	<b>18,796 \$ Millions</b>

B.M.A.C.	
0.000	0 \$ Millions

From Local W. Supply Source	
Cap = 400 ST MM	700
Length = 3,000 m	
2015	21,054
Estimated Cost	700

Grady Ave. (21000)	
Cap = 400 ST MM	700
Length = 8500 m	
2015	71,327
Estimated Cost	700

Grady Ave. (21000)	
Cap = 400 ST MM	700
Length = 9500 m	
2015	84,981
Estimated Cost	700

Grady Ave. (21000)	
Cap = 400 ST MM	700
Length = 9400 m	
2015	81,674
Estimated Cost	700

Grady Ave. (21000)	
Cap = 400 ST MM	700
Length = 1000 m	
2015	17,25
Estimated Cost	700

Orange Hill = 1,360 m ASL

Riverside Reservoir Supply Unit	
Year	2015
1996	4766
2002	8971
2015	8680

Riverside Reservoir Supply Unit	
Year	2015
1996	10450
2002	14034
2015	16550

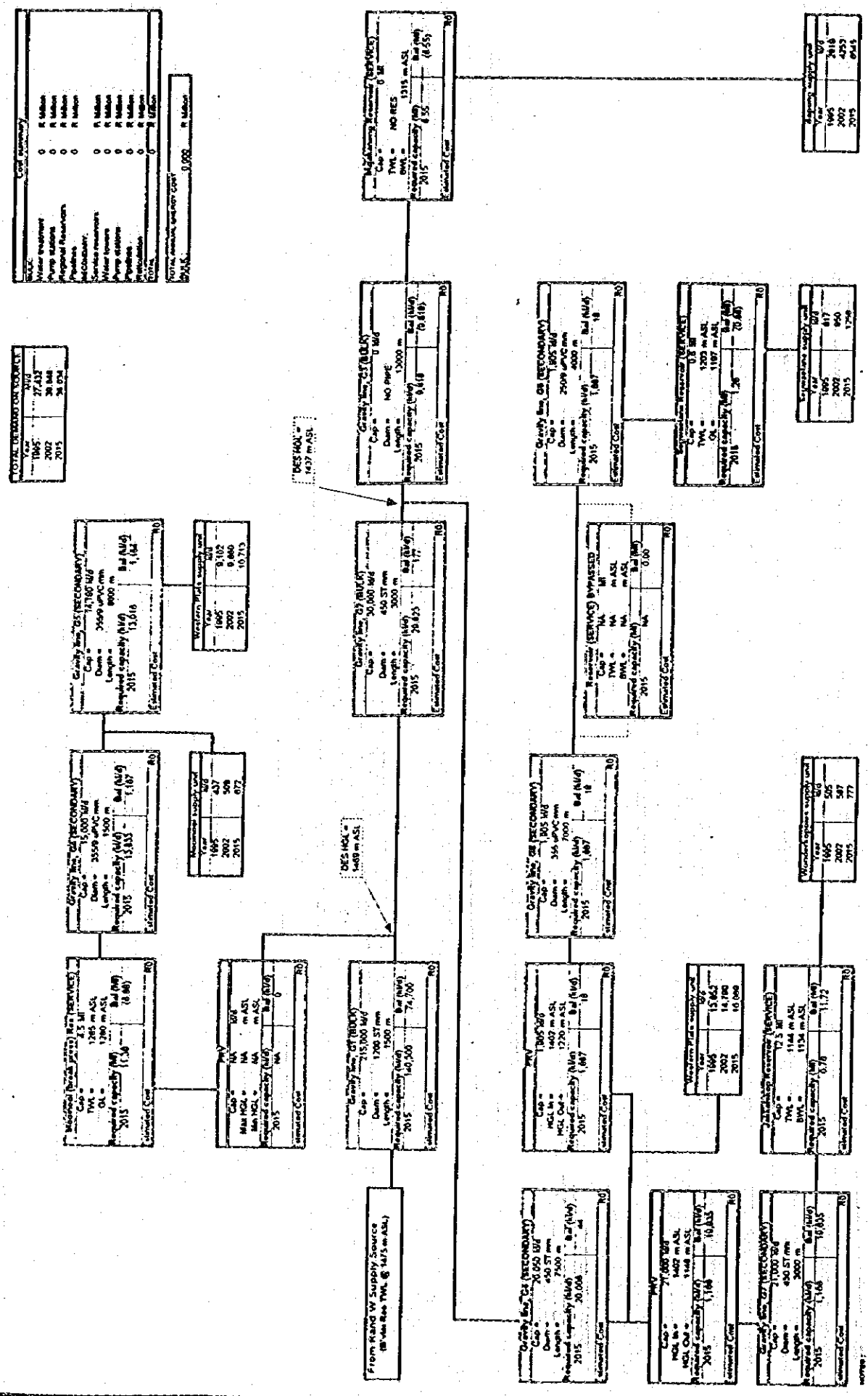
Riverside Reservoir Supply Unit	
Year	2015
1996	3403
2002	3403
2015	4197

Riverside Reservoir Supply Unit	
Year	2015
1996	21618
2002	306
2015	3200

Riverside Reservoir Supply Unit	
Year	2015
1996	1475
2002	16271
2015	1775

Notes: Other reservoirs provide storage for Rustenburg South.

# BARNARDSVILLE EASTERN SUPPLY BLOCK : EXISTING INFRASTRUCTURE



TOTAL DEMAND ON VOLUME

Year	2015	2022	2035
2015	27,437	28,148	28,794

COST SUMMARY

Water treatment	0	R. Million
Pump stations	0	R. Million
Regional Reservoir	0	R. Million
Pipes	0	R. Million
Electricity	0	R. Million
Service reservoirs	0	R. Million
Water towers	0	R. Million
Pump stations	0	R. Million
Valves	0	R. Million
Conduits	0	R. Million
TOTAL	0	R. Million

TOTAL estimated supply cost: 0.098 R. Million

DES (HOL)

Year	2015	2022	2035
2015	0.102	0.102	0.102
2022	0.102	0.102	0.102
2035	0.102	0.102	0.102

DES (HOL)

Year	2015	2022	2035
2015	0.102	0.102	0.102
2022	0.102	0.102	0.102
2035	0.102	0.102	0.102

Gravity Box #27 (BEEPERVICES)

Cap = 1,000 M3
Dim = 450 ST mm
Length = 1,000 m
Bas (ASL) = 70.418
Bas (M) = 70.418
Required capacity (M3) = 8,418
2015
Estimated Cost

Gravity Box #28 (BEEPERVICES)

Cap = 1,000 M3
Dim = 450 ST mm
Length = 1,000 m
Bas (ASL) = 70.418
Bas (M) = 70.418
Required capacity (M3) = 8,418
2015
Estimated Cost

Gravity Box #29 (BEEPERVICES)

Cap = 1,000 M3
Dim = 450 ST mm
Length = 1,000 m
Bas (ASL) = 70.418
Bas (M) = 70.418
Required capacity (M3) = 8,418
2015
Estimated Cost

Western Platnum Mine supply cost

Year	2015	2022	2035
2015	617	640	1,708
2022	617	640	1,708
2035	617	640	1,708

Gravity Box #24 (SECONDARY)

Cap = 3,000 M3
Dim = 500 ST mm
Length = 3,000 m
Bas (ASL) = 11.77
Bas (M) = 11.77
Required capacity (M3) = 20,425
2015
Estimated Cost

Gravity Box #25 (SECONDARY)

Cap = 3,000 M3
Dim = 500 ST mm
Length = 3,000 m
Bas (ASL) = 11.77
Bas (M) = 11.77
Required capacity (M3) = 20,425
2015
Estimated Cost

Gravity Box #26 (BEEPERVICES)

Cap = 1,000 M3
Dim = 450 ST mm
Length = 1,000 m
Bas (ASL) = 70.418
Bas (M) = 70.418
Required capacity (M3) = 8,418
2015
Estimated Cost

Gravity Box #21 (TIBOOK)

Cap = 1,000 M3
Dim = 450 ST mm
Length = 1,000 m
Bas (ASL) = 70.418
Bas (M) = 70.418
Required capacity (M3) = 8,418
2015
Estimated Cost

Western Platnum Mine supply cost

Year	2015	2022	2035
2015	57	508	872
2022	57	508	872
2035	57	508	872

Gravity Box #22 (BEEPERVICES)

Cap = 1,000 M3
Dim = 450 ST mm
Length = 1,000 m
Bas (ASL) = 70.418
Bas (M) = 70.418
Required capacity (M3) = 8,418
2015
Estimated Cost

Gravity Box #23 (SECONDARY)

Cap = 3,000 M3
Dim = 500 ST mm
Length = 3,000 m
Bas (ASL) = 11.77
Bas (M) = 11.77
Required capacity (M3) = 20,425
2015
Estimated Cost

Gravity Box #27 (BEEPERVICES)

Cap = 1,000 M3
Dim = 450 ST mm
Length = 1,000 m
Bas (ASL) = 70.418
Bas (M) = 70.418
Required capacity (M3) = 8,418
2015
Estimated Cost

Western Platnum Mine supply cost

Year	2015	2022	2035
2015	85	87	77
2022	85	87	77
2035	85	87	77

Gravity Box #28 (BEEPERVICES)

Cap = 1,000 M3
Dim = 450 ST mm
Length = 1,000 m
Bas (ASL) = 70.418
Bas (M) = 70.418
Required capacity (M3) = 8,418
2015
Estimated Cost

Western Platnum Mine supply cost

Year	2015	2022	2035
2015	12,842	14,186	10,000
2022	12,842	14,186	10,000
2035	12,842	14,186	10,000

Gravity Box #29 (BEEPERVICES)

Cap = 1,000 M3
Dim = 450 ST mm
Length = 1,000 m
Bas (ASL) = 70.418
Bas (M) = 70.418
Required capacity (M3) = 8,418
2015
Estimated Cost

From Rand W Supply Source  
18-Val Res PWS @ 1475 m ASL

Cap = 1,000 M3
Dim = 450 ST mm
Length = 1,000 m
Bas (ASL) = 70.418
Bas (M) = 70.418
Required capacity (M3) = 8,418
2015
Estimated Cost

Gravity Box #30 (BEEPERVICES)

Cap = 1,000 M3
Dim = 450 ST mm
Length = 1,000 m
Bas (ASL) = 70.418
Bas (M) = 70.418
Required capacity (M3) = 8,418
2015
Estimated Cost

Gravity Box #31 (BEEPERVICES)

Cap = 1,000 M3
Dim = 450 ST mm
Length = 1,000 m
Bas (ASL) = 70.418
Bas (M) = 70.418
Required capacity (M3) = 8,418
2015
Estimated Cost

Gravity Box #32 (BEEPERVICES)

Cap = 1,000 M3
Dim = 450 ST mm
Length = 1,000 m
Bas (ASL) = 70.418
Bas (M) = 70.418
Required capacity (M3) = 8,418
2015
Estimated Cost

Notes: Western Platnum Mine has separate surface storage facilities for mining purposes.



# **KOSTER SUPPLY AREA**

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**COST SUMMARY FOR INFRASTRUCTURE..... W-41**

### **EXISTING INFRASTRUCTURE**

**KOSTER & SWARTRUGGENS SUPPLY BLOCK..... W-43**

### **NEW INFRASTRUCTURE**

**KOSTER & SWARTRUGGENS SUPPLY BLOCK..... W-44**



## COST SUMMARY FOR INFRASTRUCTURE

NAME OF SUPPLY AREA :	KOSTER	
INCLUDING SUPPLY BLOCKS :	KOSTER AND SWARTRUGGENS	
POPULATION SERVED (2015) :	21 558	
AADD in mcm/a (2015) :	1.173	
<b>BULK COST :</b>	<b>QUANTITY</b>	<b>COST (R million)</b>
Water Purification Works	M/d (Additional required capacity)	
	1.266	0.423
Pump Stations	K/d	
A : Capital Cost	1933	0.410
B : Annual Energy Cost		0.238
Reservoirs (Regional)	Ml	
	0	0.000
Pipelines (Bulk)	km	
140/9 uPVC	5.00	0.685
Sub Total Bulk Construction Cost		1.518
Engineering Fees (18 %)		0.228
VAT (14 %)		0.244
Project Contingency (20%)		0.398
<b>TOTAL : Bulk Cost</b>		<b>2.388</b>
Bulk Cost per Capita (Rands)		R111
<b>SECONDARY COST :</b>	<b>QUANTITY</b>	<b>COST (R million)</b>
Reservoirs (Service)	Ml	
	2	1.036
Water Towers	Ml	
	N/A	
Pump Stations (Secondary)	K/d	
A : Capital Cost	N/A	
B : Annual Energy Cost	N/A	
Pipelines (Secondary)	km	
	N/A	
Reticulation	km	

		3.120
<b>Sub Total Secondary Construction Cost</b>		<b>4.156</b>
Engineering Fees (18 %)		0.623
VAT (14 %)		0.669
Project Contingency (20%)		1.090
<b>TOTAL : Secondary Cost</b>		<b>6.538</b>
Secondary Cost per Capita (Rands)		R303
<b>GRAND TOTAL COST</b>	<b>MILLION RANDB</b>	<b>8.926</b>
<b>Grand Total Cost per Capita (R)</b>		<b>R414</b>

KOSTER SUPPLY AREA : EXISTING INFRASTRUCTURE

Koster Demand			Kosters demand		
Year	MGD	Cost	Year	MGD	Cost
2015	266		2015	105	545
Cost			Cost		

Koster Demand		
Year	MGD	Cost
2015	266	
Cost		

Koster Demand		
Year	MGD	Cost
2015	266	
Cost		

Koster Demand		
Year	MGD	Cost
2015	266	
Cost		

Koster Demand		
Year	MGD	Cost
2015	266	
Cost		

Koster Demand			Kosters demand		
Year	MGD	Cost	Year	MGD	Cost
2015	301		2015	186	
Cost			Cost		

Koster Demand		
Year	MGD	Cost
2015	301	
Cost		

Koster Demand		
Year	MGD	Cost
2015	301	
Cost		

Koster Demand		
Year	MGD	Cost
2015	301	
Cost		

Koster Demand		
Year	MGD	Cost
2015	301	
Cost		

Koster Demand		
Year	MGD	Cost
2015	301	
Cost		

Koster Demand		
Year	MGD	Cost
2015	301	
Cost		

**KOSTER SUPPLY AREA : NEW INFRASTRUCTURE**

Reservoir demand	
Year	M3
2015	631
Cost	1410000

Cap =	1 M
TWL =	1822 m ASL
BWL =	1822 m ASL
Required capacity	0.22
2015	0.22
Estimated cost	517,774

Cap =	1.05 M
GL =	1822 m ASL
Length =	2000 m
Required capacity	0.000
2015	0.000
Estimated cost	369,000

Cap =	1050 M3
GL =	1790 m ASL
Length =	1500 m
Required capacity	0
2015	0
Estimated cost	100,000

Cap =	1043 M3
GL =	1788 m ASL
Length =	1500 m
Required capacity	0
2015	0
Estimated cost	1,043,000 per year

Cap =	1043 M3
GL =	1788 m ASL
Length =	1500 m
Required capacity	0
2015	0
Estimated cost	1,043,000

Smartmeters demand	
Year	M3
2015	200
Cost	0

Cap =	1 M
TWL =	1785 m ASL
BWL =	1785 m ASL
Required capacity	0.81
2015	0.81
Estimated cost	517,774

Cap =	100 M3
GL =	1170 m ASL
Length =	500 m
Required capacity	0
2015	0
Estimated cost	0

Cap =	100 M3
GL =	1170 m ASL
Length =	500 m
Required capacity	0
2015	0
Estimated cost	20,000

Cap =	100 M3
GL =	1170 m ASL
Length =	500 m
Required capacity	0
2015	0
Estimated cost	1,626 per year

Reservoir demand	
Year	M3
2015	945
Cost	1400000

Cap =	1 M
TWL =	1785 m ASL
BWL =	1785 m ASL
Required capacity	0.81
2015	0.81
Estimated cost	517,774

Cap =	100 M3
GL =	1170 m ASL
Length =	500 m
Required capacity	0
2015	0
Estimated cost	0

Cap =	100 M3
GL =	1170 m ASL
Length =	500 m
Required capacity	0
2015	0
Estimated cost	20,000

Cap =	100 M3
GL =	1170 m ASL
Length =	500 m
Required capacity	0
2015	0
Estimated cost	1,626 per year

Cost Summary	
Water Treatment	R 423 333
Reservoirs	R 410 000
Pumpstations	R 665 000
Pipelines	TOTAL 1 518 333
SECONDARY:	
Pumpstations	R 1 035 547
Reservoirs	R 120 340
Pipelines	R 3 120 340
Reticulations	TOTAL 4 155 887

**BRITS SUPPLY AREA**

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**COST SUMMARY FOR INFRASTRUCTURE..... C-2**

**EXISTING INFRASTRUCTURE**

**BRITS SUPPLY BLOCK..... C-4**

**NEW INFRASTRUCTURE**

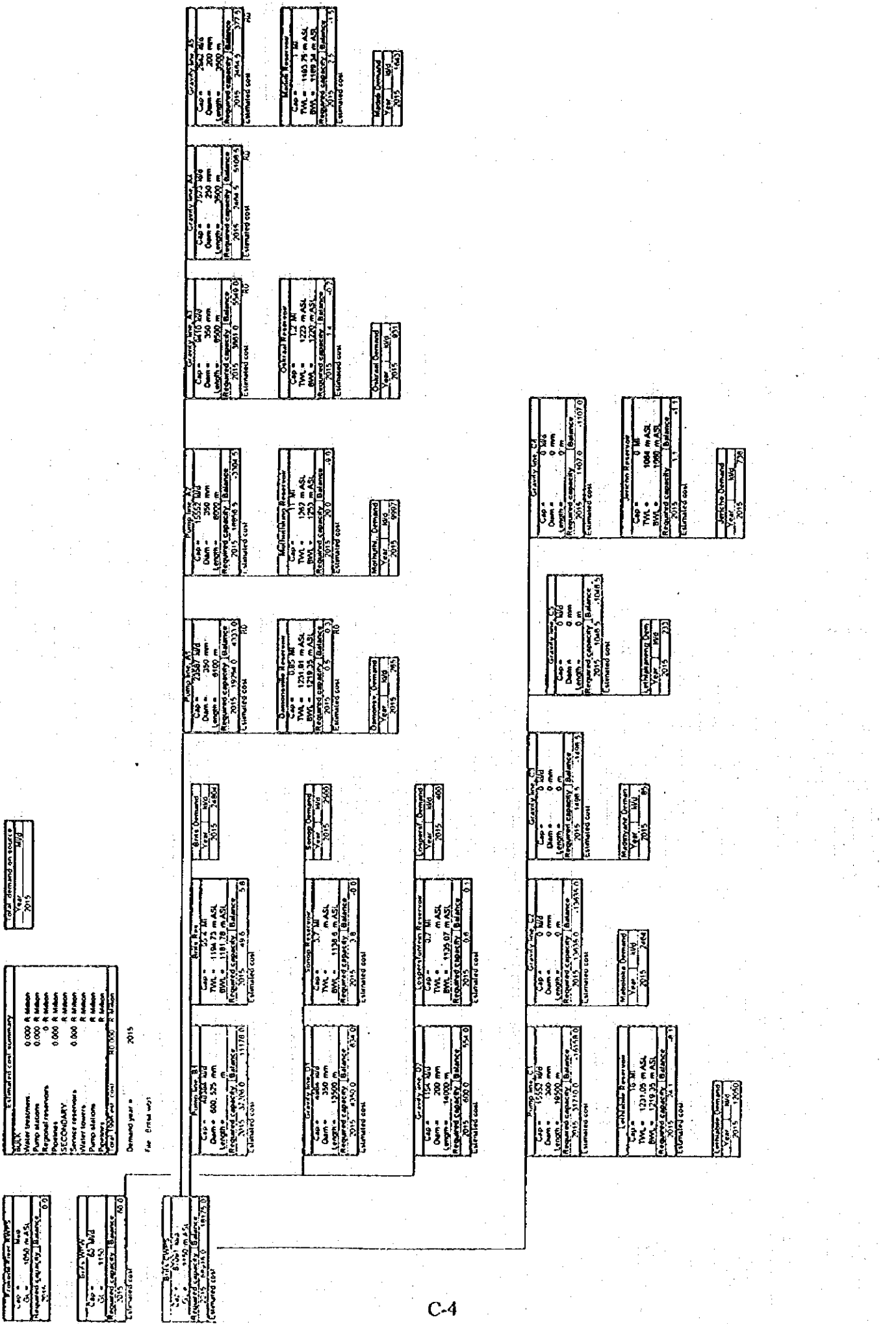
**BRITS SUPPLY BLOCK..... C-5**

## COST SUMMARY FOR INFRASTRUCTURE

NAME OF SUPPLY AREA :	BRITS	
INCLUDING SUPPLY BLOCKS :	1. Brits 2. Hartebeespoort	
POPULATION SERVED (2015) :	236 899	
AADD in mcm/a (2015) :	25.931	
<b>BULK COST :</b>	<b>QUANTITY</b>	<b>COST (R million)</b>
Water Purification Works	Ml/d (Additional required capacity)	
Brits	25	12.500
Hartebeespoort	11.6	3.812
Pump Stations	Kl/d	
<b>A : Capital Cost</b>		
1. Brits CWPS		0.312
Annual Energy Cost		
1. Brits CWPS		1.754
Reservoirs (Regional)	MI	
	10	2.800
Pipelines (Bulk)	km	
1. 200/9 PVC	17.40	5.271
2. 200 ST	6.00	2.004
3. 300 ST	7.80	3.643
4. 400 ST	19.50	11.271
<b>Sub Total Bulk Construction Cost</b>		<b>41.613</b>
Engineering Fees (15 %)		6.242
VAT (14 %)		6.700
Project Contingency (20%)		10.911
<b>TOTAL : Bulk Cost</b>		<b>65.466</b>
Bulk Cost per Capita (Rands)		R276
<b>SECONDARY COST :</b>	<b>QUANTITY</b>	<b>COST (R million)</b>
Reservoirs (Service)	MI	
	14.7	4.980
Water Towers	MI	
N/A		
Pump Stations (Secondary)	Kl/d	

<b>A : Capital Cost</b>		
	N/A	
<b>B : Annual Energy Cost</b>		
	N/A	
<b>Pipelines (Secondary)</b>	km	
	N/A	
<b>Reticulation</b>	km	
<b>Brits and Hartebeespoort</b>		34.109
<b>Sub Total Secondary Construction Cost</b>		39.089
<b>Engineering Fees (16 %)</b>		5.863
<b>VAT (14 %)</b>		6.293
<b>Project Contingency (20%)</b>		10.249
<b>TOTAL : Secondary Cost</b>		61.495
<b>Secondary Cost per Capita (Rands)</b>		R260
<b>GRAND TOTAL COST</b>	<b>MILLION RANDB</b>	<b>126.960</b>
<b>Grand Total Cost per Capita (R)</b>		<b>R536</b>

**Bins Supply Block : 1996 Existing Infrastructure**



Total Demand on Node	
Year	2015
Value	4171

Estimated Cost Summary	
Water treatment	0.000 R Million
Pump stations	0.000 R Million
Regional reservoirs	0.000 R Million
Reservoirs	0.000 R Million
SECONDARY	0.000 R Million
Storage reservoirs	0.000 R Million
Pump stations	0.000 R Million
Reservoirs	0.000 R Million
Storage reservoirs	0.000 R Million
Year 1996 cost	10,000 R Million
Demand year =	2015
File (Print out)	

Pump Intake 1	
Cap	1000 m ASL
Diam	200 mm
Length	0 m
Required Capacity Balance	0.0
Year 2015	0.0
Year 2016	0.0

Gravity Intake 1	
Cap	1150 m ASL
Diam	200 mm
Length	1175 m
Required Capacity Balance	60.0
Year 2015	60.0
Year 2016	60.0

Pump Intake 2	
Cap	1150 m ASL
Diam	200 mm
Length	1175 m
Required Capacity Balance	60.0
Year 2015	60.0
Year 2016	60.0

Gravity Intake 2	
Cap	1194.75 m ASL
Diam	200 mm
Length	0 m
Required Capacity Balance	5.8
Year 2015	49.6
Year 2016	5.8

Gravity Intake 3	
Cap	1194.75 m ASL
Diam	200 mm
Length	0 m
Required Capacity Balance	5.8
Year 2015	49.6
Year 2016	5.8

Gravity Intake 4	
Cap	1194.75 m ASL
Diam	200 mm
Length	0 m
Required Capacity Balance	5.8
Year 2015	49.6
Year 2016	5.8

Gravity Intake 5	
Cap	1194.75 m ASL
Diam	200 mm
Length	0 m
Required Capacity Balance	5.8
Year 2015	49.6
Year 2016	5.8

Gravity Intake 6	
Cap	1194.75 m ASL
Diam	200 mm
Length	0 m
Required Capacity Balance	5.8
Year 2015	49.6
Year 2016	5.8

Gravity Intake 7	
Cap	1194.75 m ASL
Diam	200 mm
Length	0 m
Required Capacity Balance	5.8
Year 2015	49.6
Year 2016	5.8

Gravity Intake 8	
Cap	1194.75 m ASL
Diam	200 mm
Length	0 m
Required Capacity Balance	5.8
Year 2015	49.6
Year 2016	5.8

Gravity Intake 9	
Cap	1194.75 m ASL
Diam	200 mm
Length	0 m
Required Capacity Balance	5.8
Year 2015	49.6
Year 2016	5.8

Gravity Intake 10	
Cap	1194.75 m ASL
Diam	200 mm
Length	0 m
Required Capacity Balance	5.8
Year 2015	49.6
Year 2016	5.8

Gravity Intake 11	
Cap	1194.75 m ASL
Diam	200 mm
Length	0 m
Required Capacity Balance	5.8
Year 2015	49.6
Year 2016	5.8

Gravity Intake 12	
Cap	1194.75 m ASL
Diam	200 mm
Length	0 m
Required Capacity Balance	5.8
Year 2015	49.6
Year 2016	5.8

Gravity Intake 13	
Cap	1194.75 m ASL
Diam	200 mm
Length	0 m
Required Capacity Balance	5.8
Year 2015	49.6
Year 2016	5.8





# **KLIPVOOR SUPPLY AREA**

## **TABLE OF CONTENTS**

<b>COST SUMMARY FOR INFRASTRUCTURE.....</b>	<b>C-7</b>
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### **NEW INFRASTRUCTURE**

<b>KLIPVOOR WEST SUPPLY BLOCK.....</b>	<b>C-9</b>
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<b>MORETELE NORTH &amp; KLIPVOOR EAST SUPPLY BLOCKS</b>	
<b>.....</b>	<b>C-10</b>

**NOTE : THERE ARE CURRENTLY NO SURFACE WATER SUPPLY  
INFRASTRUCTURE IN KLIPVOOR SUPPLY AREA.**

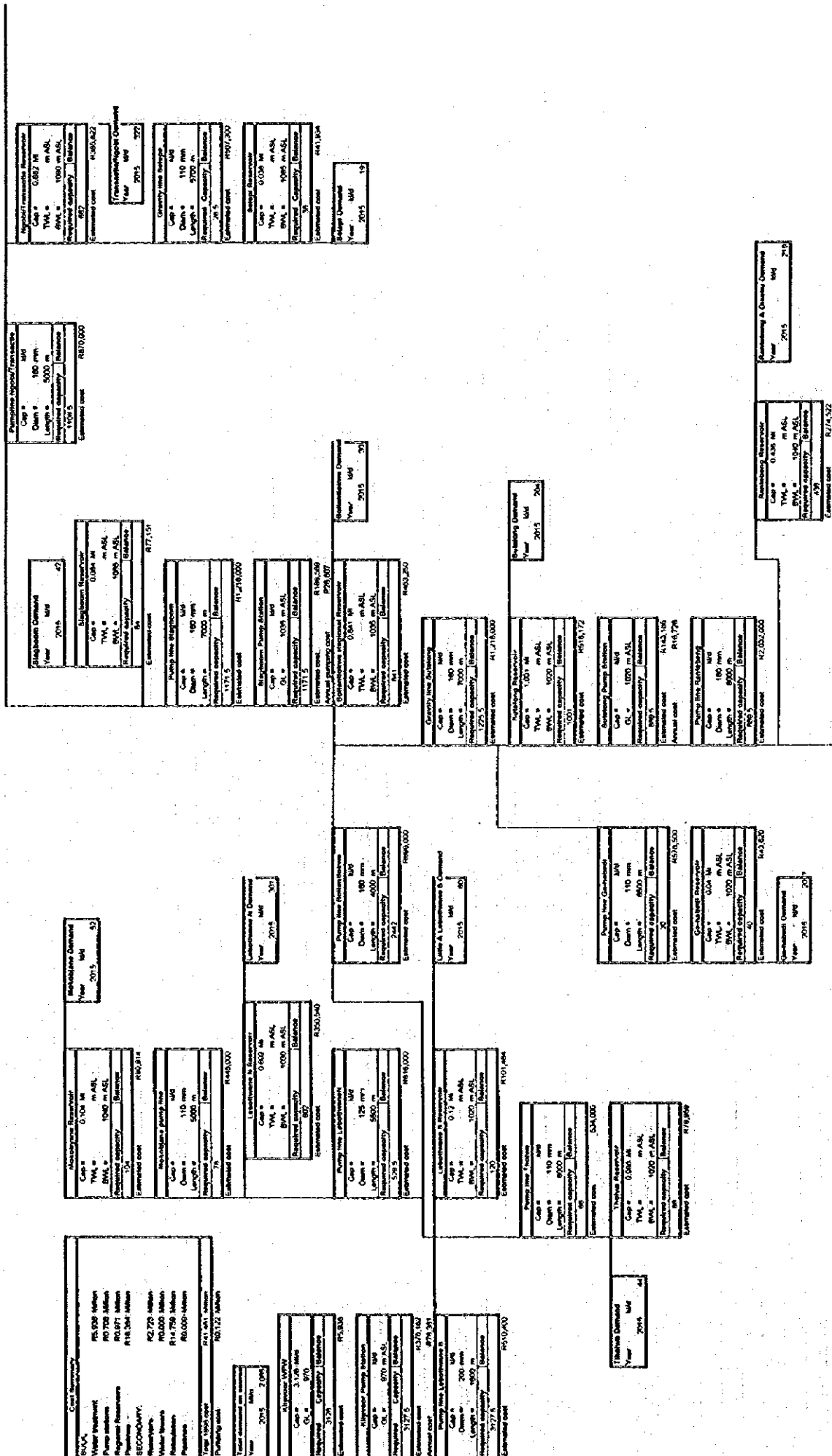
<b>COST SUMMARY FOR INFRASTRUCTURE</b>		
NAME OF SUPPLY AREA :	KLIPVOOR SUPPLY AREA	
INCLUDING SUPPLY BLOCKS :	Moretele North Klipvoor East Klipvoor West	
POPULATION SERVED (2015) :	53,414	
AADD in mcm/a (2015) :	0.94	
<b>BULK COST :</b>	<b>QUANTITY</b>	<b>COST (R million)</b>
Water Purification Works	MI/d (SDD)	
Klipvoor	3,878	R6,938
Pump Stations	KI/d (SDD)	
<b>A : Capital Cost</b>		
Klipvoor West	731	R0,226
Klipvoor East	3,127	R0,376
Slagboom	1,171	R0,186
Sutelong	889	R0,143
Sub-total	5,187	R0,934
<b>B : Annual Energy Cost (Not Incl'd with Total)</b>		
Klipvoor West		R0,031
Klipvoor		R0,076
Slagboom		R0,028
Sutelong		R0,016
Sub-total		<b>R0,151</b>
<b>Reservoirs (Regional)</b>	MI	
Klipvoor West	1.3	R0,705
Sutelong	1	R0,518
Bollantlokwe	0,841	R0,453
Sub-total	1,841	<b>R1,676</b>
<b>Pipelines (Bulk)</b>	km	
110 dia	112.6	R10,907
125 dia	20.9	R3,059
140 dia	12.8	R2,538
160 dia	31	R6,032
200 dia	5.7	R1,879
Total		<b>R24,415</b>
<b>Sub Total Construction Cost</b>		<b>R33,960</b>
Engineering Fees (15 %)		R5,094
VAT (14 %)		R5,468
Project Contingency (20%)		R8,904
<b>TOTAL : Bulk Cost</b>		<b>R53,426</b>
<b>Bulk Cost per Capita (Rands)</b>		<b>R1,000,222</b>

<b>KLIPVOOR SUPPLY AREA</b>		
<b>SECONDARY COST :</b>	<b>QUANTITY</b>	<b>COST (R million)</b>
<b>Reservoirs (Service)</b>	Ml	
Klipvoor East, Moretele N	3.74	R2.723
Klipvoor West		R0.457
Sub-total		R3.180
<b>Water Towers</b>	Ml	
	NIL	NIL
<b>Pump Stations (Secondary)</b>	Kl/d	
<b>A : Capital Cost</b>	NIL	NIL
<b>B : Annual Energy Cost (Not Incl'd with Total)</b>	NIL	NIL
<b>Pipelines (Secondary)</b>	km	
<b>Reticulation</b>	km	
Klipvoor West		R4.716
Moretele		R4.379
Klipvoor North		R10.379
Sub-total		R19.474
<b>Sub Total Construction Cost</b>		R22.654
<b>Engineering Fees (15 %)</b>		R3.398
<b>VAT (14 %)</b>		R3.647
<b>Project Contingency (20%)</b>		R5.940
<b>TOTAL : Secondary Cost</b>		R35.639
<b>Secondary Cost per Capita (Rands)</b>		R667.227
<b>GRAND TOTAL COST</b>		R89.065
<b>Grand Total Cost per Capita (R)</b>		R1,667.449



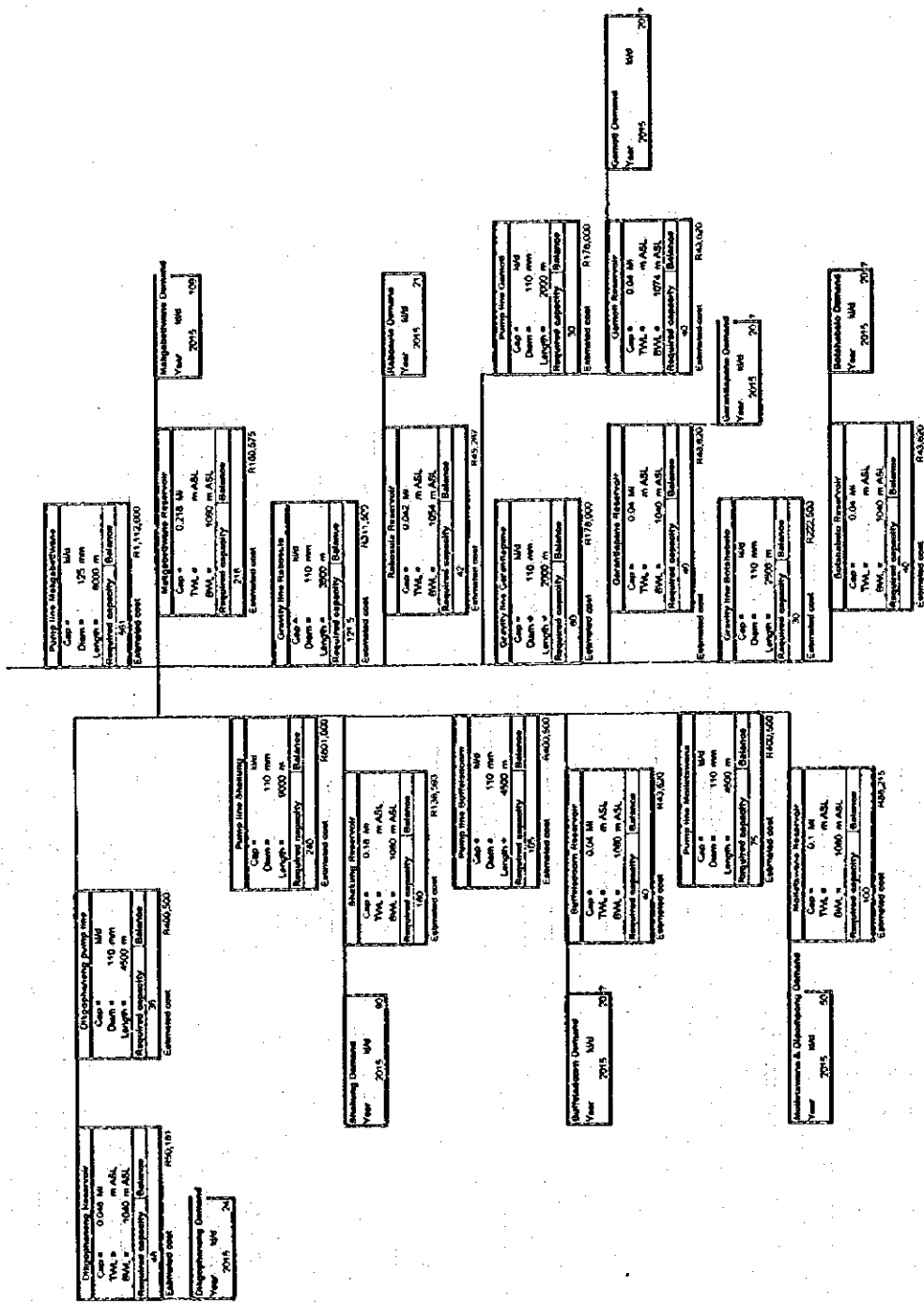
Klipproor supplying Moretele North and Klipproor East (proposed planning to meet 2015 demand)

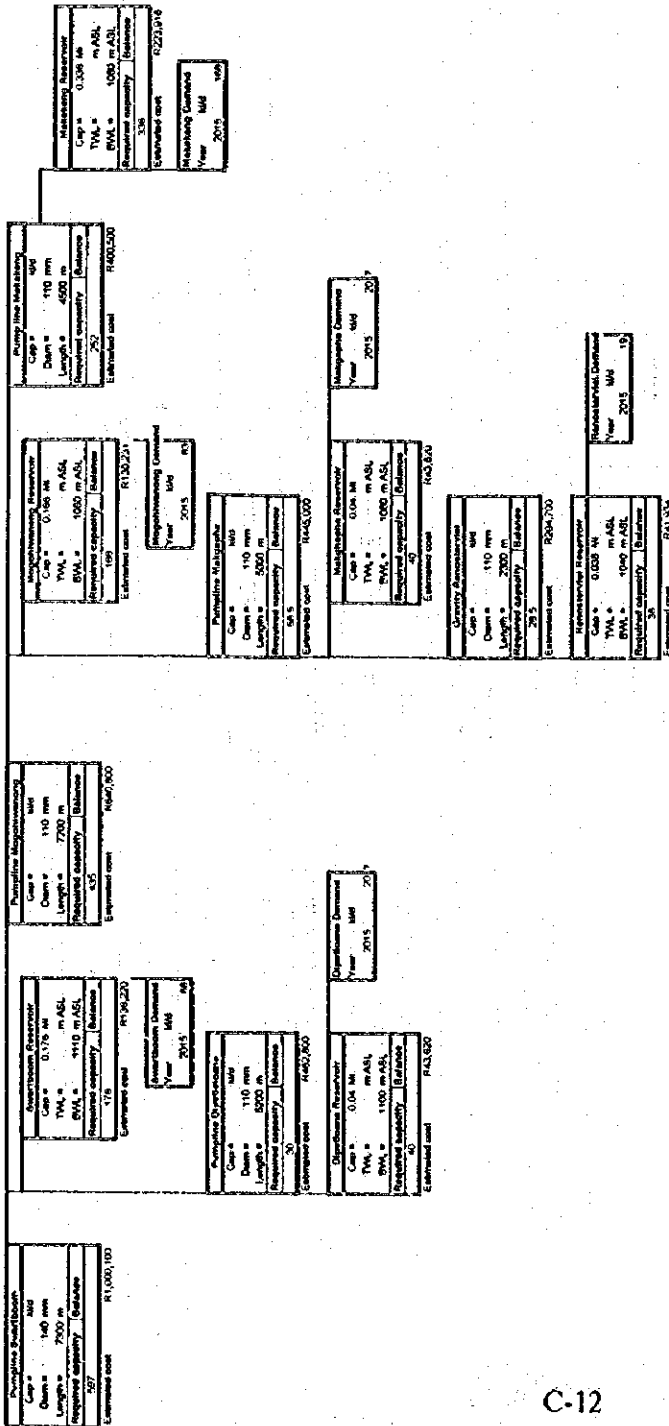
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06-Nov-06



Sheet 1

Page 1







# **RAND WATER SUPPLY AREA**

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**COST SUMMARY FOR INFRASTRUCTURE..... C-14**

### **EXISTING INFRASTRUCTURE**

**RAND WATER SUPPLY BLOCK..... C-16**

### **NEW INFRASTRUCTURE**

**RAND WATER SUPPLY BLOCK..... C-17**

<b>COST SUMMARY FOR INFRASTRUCTURE</b>		
<b>NAME OF SUPPLY AREA :</b>	<b>RAND WATER SUPPLY AREA (Note: Import from Temba Supply Area to Soshanguve SR)</b>	
<b>INCLUDING SUPPLY BLOCKS :</b>		
Rand Water Supply Area		
<b>POPULATION SERVED (2015) :</b>	2,068,587	
<b>AADD in mcm/a (2015) :</b>	79.22	
<b>BULK COST :</b>	<b>QUANTITY</b>	<b>COST (R million)</b>
<b>Water Purification Works</b>	<b>ML/d (SDD)</b>	
Kudube WTW *	41	R13.507
<b>Pump Stations</b>	<b>KL/d (SDD)</b>	
Kudube *	41,218	R3.549
<b>A : Capital Cost</b>		
Sub-total		<b>R17.056</b>
<b>B : Annual Energy Cost (Not Incl'd with Total)</b>		
Rand Water Variable cost		R101.060
Sub-total		<b>R101.060</b>
<b>Reservoirs (Regional)</b>	<b>ML</b>	
Hartbeeshoek	138	R22.860
Kudube *	45	R7.973
Sub-total		<b>R30.833</b>
<b>Pipelines (Bulk)</b>	<b>km</b>	
110 dia	7	R0.623
140 dia	2	R0.274
200 dia	4	R1.032
300 dia	6.5	R2.554
450 dia	0	R0.000
600 dia	27	R23.328
Total		<b>R27.811</b>
<b>Sub Total Construction Cost</b>		<b>R75.700</b>
<b>Engineering Fees (15 %)</b>		<b>R11.355</b>
<b>VAT (14 %)</b>		<b>R12.188</b>
<b>Project Contingency (20%)</b>		<b>R19.849</b>
<b>TOTAL : Bulk Cost</b>		<b>R119.092</b>
<b>Bulk Cost per Capita (Rands)</b>		<b>R57.572</b>

<b>RAND WATER SUPPLY AREA</b>		
<b>SECONDARY COST :</b>	<b>QUANTITY</b>	<b>COST (R million)</b>
<b>Reservoirs (Service)</b>	MI	
	303.747	R49.500
<b>Water Towers</b>	MI	
	NIL	NIL
<b>Pump Stations (Secondary)</b>	KV/d	
<b>A : Capital Cost</b>	NIL	NIL
<b>B : Annual Energy Cost (Not Incl'd with Total)</b>	NIL	NIL
<b>Pipelines (Secondary)</b>	km	
<b>Reticulation</b>	km	
		R174.920
<b>Sub Total Construction Cost</b>		R224.420
<b>Engineering Fees (15 %)</b>		R33.663
<b>VAT (14 %)</b>		R36.132
<b>Project Contingency (20%)</b>		R58.843
<b>TOTAL : Secondary Cost</b>		R353.057
<b>Secondary Cost per Capita (Rands)</b>		R170.675
<b>GRAND TOTAL COST</b>		R472.149
<b>Grand Total Cost per Capita (R)</b>		R228.247

\* indicates cost which arise in the Temba Supply Area to meet the projected demand in the Rand Water Supply Area

Rand Water Supply Area (Note: Soshanguve partly supplied from Kudube WTW (Existing and fixed planning tested against 2015 demands))

08-Nov-14  
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Owned on source	Year	2015	238 055
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Assumed existing pipeline velocity	1.5
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Makanyeng Demand	Year	2015	810
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Makanyeng Reservoir	Cap =	M
TWL =	m ASL	
BWL =	1150 m ASL	
Required capacity	Balance	
1678	1678	
Estimated cost		

Makanyeng Pipeline	Cap =	0 k/d
Diam =	2000 mm	
Length =	2000 m	
Required capacity	Balance	
1221	1221	
Estimated cost		

Northgate Demand	Year	2015	1050
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Northgate Reservoir	Cap =	M
TWL =	m ASL	
BWL =	1130 m ASL	
Required capacity	Balance	
2180	2180	
Estimated cost		

Northgate Pipeline	Cap =	0 k/d
Diam =	4000 mm	
Length =	4000 m	
Required capacity	Balance	
2656	2656	
Estimated cost		

Klipgat Demand	Year	2015	3265
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Mabopane Demand	Year	2015	2525
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Klipgat Waterford Demand	Year	2015	3778
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Soshanguve Demand	Year	2015	6315
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Soshanguve Demand	Year	2015	233
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Soshanguve Reservoir	Cap =	50 M
TWL =	m ASL	
BWL =	1220 m ASL	
Required capacity	Balance	
20700	21733	
Estimated cost		

Soshanguve Pipeline	Cap =	275022 k/d
Diam =	300+1200 mm	
Length =	4200 m	
Required capacity	Balance	
200451	28041	
Estimated cost		

Kaputeles Demand	Year	2015	1670
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Outfall Reservoir	Cap =	M
TWL =	m ASL	
BWL =	m ASL	
Required capacity	Balance	
3340	2143	
Estimated cost		

Outfall Pipeline	Cap =	2706 k/d
Diam =	160 mm	
Length =	7500 m	
Required capacity	Balance	
2505	-191	
Estimated cost		

Garekhu Demand	Year	2015	15910
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Kamekolein Demand	Year	2015	0
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Phabon/Emecus Demand	Year	2015	3471
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Delabule Reservoir	Cap =	M
TWL =	m ASL	
BWL =	1300 m ASL	
Required capacity	Balance	
38778	38778	
Estimated cost		

Kamekolein Pipeline	Cap =	83448 k/d
Diam =	900 mm	
Length =	9000 m	
Required capacity	Balance	
34445	-4903	
Estimated cost		

Garekhu Inc Tshware Demand	Year	2015	18228
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Mogale Reservoir and Water Tower	Cap =	18 M
TWL =	1271 m ASL	
BWL =	m ASL	
Required capacity	Balance	
39332	23332	
Estimated cost		

Mogale Branch Pipeline	Cap =	26612 k/d
Diam =	450 mm	
Length =	6500 m	
Required capacity	Balance	
22478	883	
Estimated cost		

Klip/Kruifontein N Pipeline	Cap =	226022 k/d
Diam =	900+1200 mm	
Length =	7500 m	
Required capacity	Balance	
273508	-5454	
Estimated cost		

Klip/Kruifontein Reservoir	Cap =	63 M
TWL =	m ASL	
BWL =	1200 m ASL	
Required capacity	Balance	
41820	-18382	
Estimated cost		

Klip/Kruifontein Demand	Year	2015	2610
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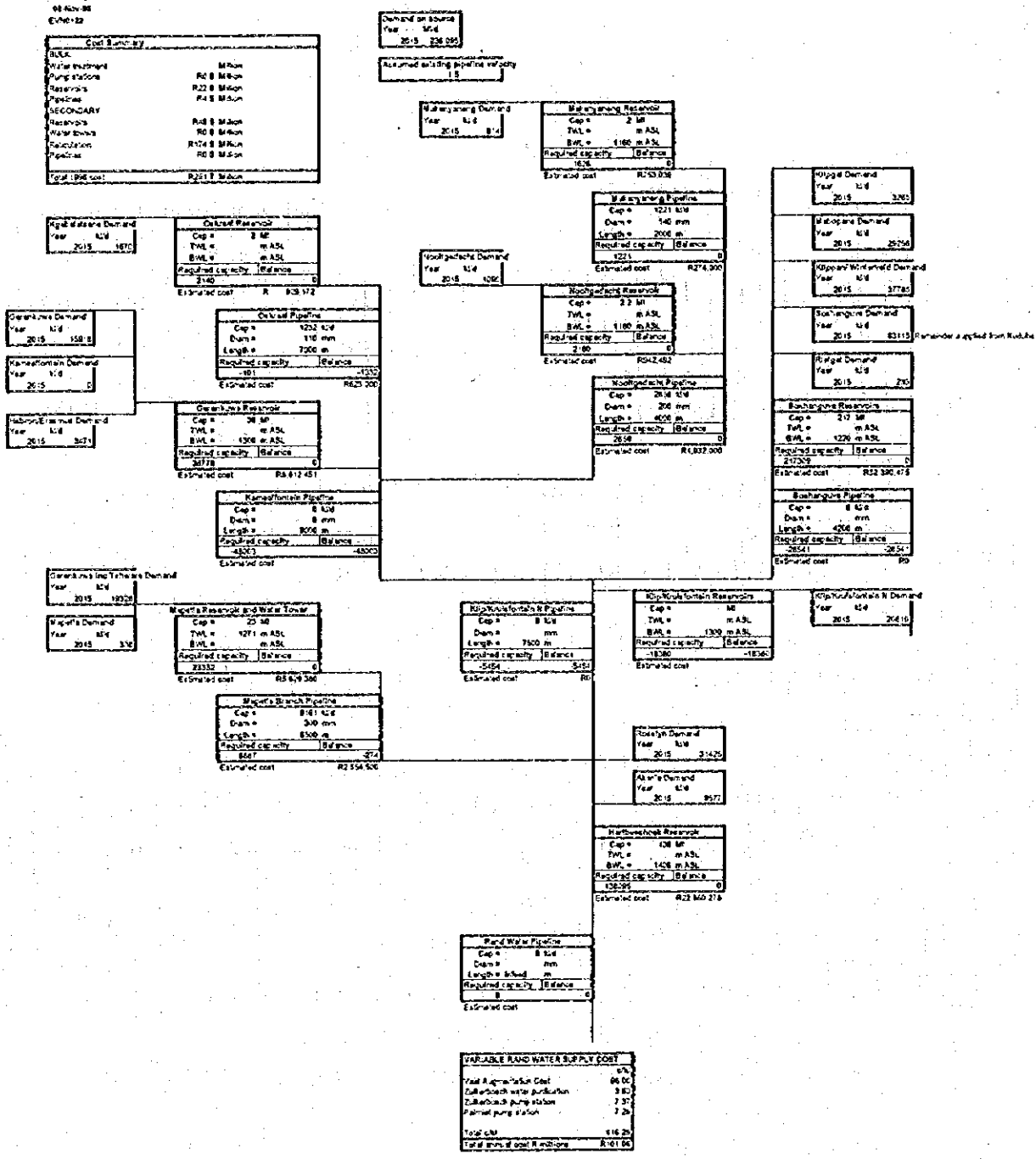
Roselyn Demand	Year	2015	3142
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Abate Demand	Year	2015	857
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Harbeeshoek Reservoir	Cap =	100 M
TWL =	m ASL	
BWL =	1407 m ASL	
Required capacity	Balance	
238255	-138255	
Estimated cost		

Rand Water Pipeline	Cap =	300000 k/d
Diam =	900+1400 mm	
Length =	8100 m	
Required capacity	Balance	
300000	0	
Estimated cost		

Rand Water Supply Area (Note: Soshanguve partly supplied from Kudube WTW (Proposed planning to meet 2015 demands))



# TEMBA SUPPLY AREA

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<b>COST SUMMARY FOR INFRASTRUCTURE.....</b>	<b>C-19</b>
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### **EXISTING INFRASTRUCTURE**

<b>KUDUBE NORTH SUPPLY BLOCK.....</b>	<b>C-21</b>
<b>KUDUBE SOUTH SUPPLY BLOCK.....</b>	<b>C-22</b>
<b>WARMBATHS/NYLSTROOM SUPPLY BLOCK.....</b>	<b>C-23</b>

### **NEW INFRASTRUCTURE**

<b>KUDUBE NORTH SUPPLY BLOCK.....</b>	<b>C-24</b>
<b>KUDUBE SOUTH SUPPLY BLOCK.....</b>	<b>C-25</b>
<b>WARMBATHS/NYLSTROOM SUPPLY BLOCK.....</b>	<b>C-26</b>

**NOTE :** ONLY EXPANSION OF WALLMANNSTHAL WTW IS PROVIDED REGARDING NEW CAPITAL WORKS IN WALLMANNSTHAL SUPPLY BLOCK SO PLANNING SCHEMATICS ARE NOT PROVIDED.

<b>COST SUMMARY FOR INFRASTRUCTURE</b>		
<b>NAME OF SUPPLY AREA :</b>	<b>TEMBA SUPPLY AREA (Note: Water exported to Soshanguve SR from Kudube)</b>	
<b>INCLUDING SUPPLY BLOCKS :</b>		
Kudube North		
Kudube South		
Warmbaths/Nylstroom		
Wallmannsthal		
<b>POPULATION SERVED (2015) :</b>	805,884	
<b>AADD in mcm/a (2015) :</b>	56.12	
<b>BULK COST :</b>	<b>QUANTITY</b>	<b>COST (R million)</b>
<b>Water Purification Works</b>	<b>M/d (SDD)</b>	
Kudube WTW	48,000	R16.143
Wallmannsthal	2,115	R0.698
Temba WTW	81,000	R25.944
Sub-total		<b>R42.785</b>
<b>Pump Stations</b>	<b>K/d (SDD)</b>	
<b>A : Capital Cost</b>		
<b>B : Annual Energy Cost (Not Incl'd with Total)</b>		
<b>Reservoirs (Regional)</b>	<b>MI</b>	
Kudube/Temba	114	R23.450
<b>Pipelines (Bulk)</b>	<b>km</b>	
110 dia	3.4	R0.303
250 dia	4.5	R1.769
450 dia	3.5	R2.247
600 dia	4	R3.024
<b>Total</b>		<b>R7.343</b>
<b>Sub Total Construction Cost</b>		<b>R73.578</b>
<b>Engineering Fees (15 %)</b>		<b>R11.037</b>
<b>VAT (14 %)</b>		<b>R11.846</b>
<b>Project Contingency (20%)</b>		<b>R19.292</b>
<b>TOTAL : Bulk Cost</b>		<b>R115.753</b>
<b>Bulk Cost per Capita (Rands)</b>		<b>R143.635</b>

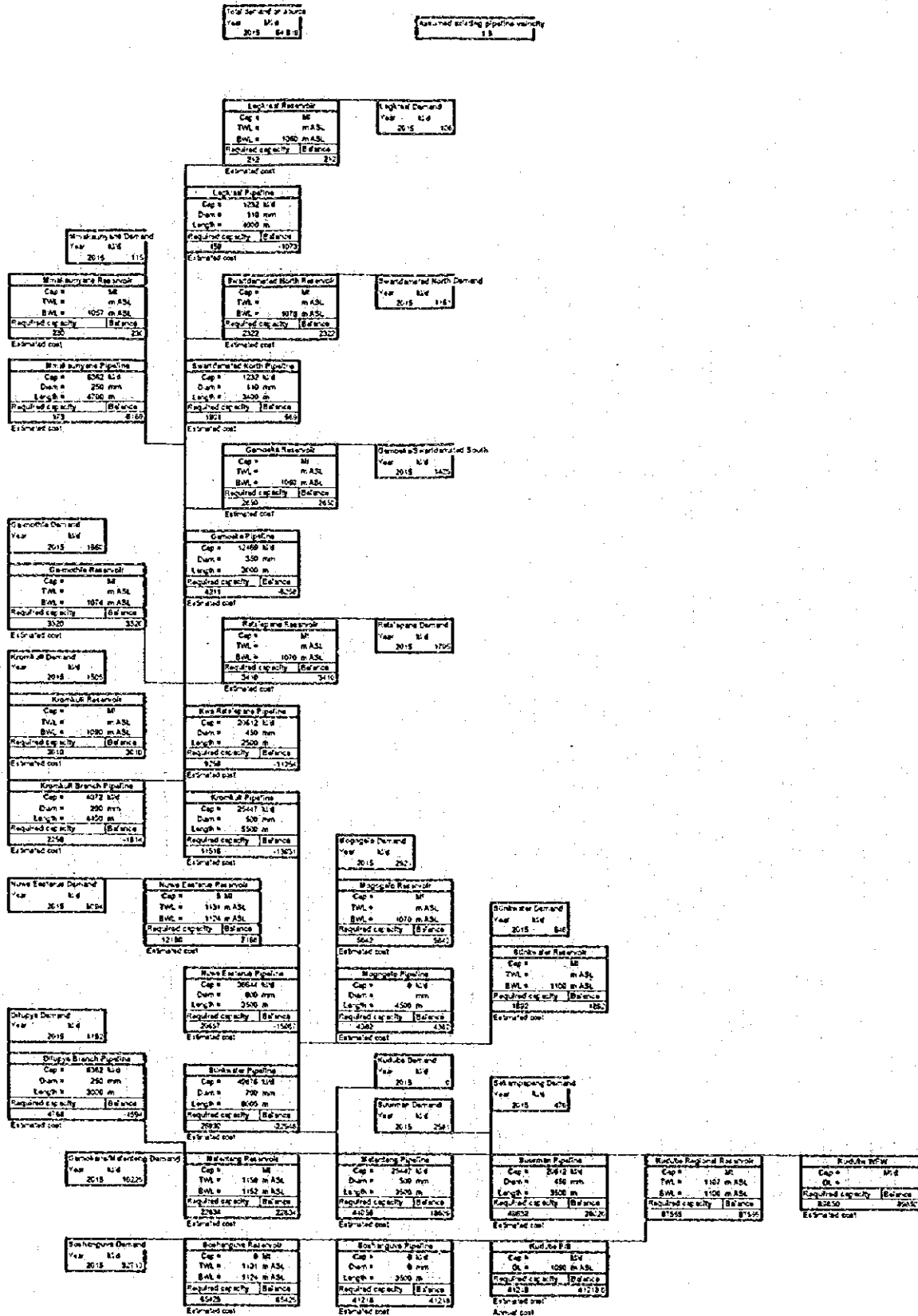
<b>TEMBA SUPPLY AREA</b>		
<b>SECONDARY COST :</b>	<b>QUANTITY</b>	<b>COST (R million)</b>
<b>Reservoirs (Service)</b>	MI	
Kudube North	23.886	R9.143
Kudube South	118.242	R30.100
Sub-total	142.128	R39.243
<b>Water Towers</b>	MI	
	NIL	NIL
<b>Pump Stations (Secondary)</b>	K/d	
<b>A : Capital Cost</b>	NIL	NIL
<b>B : Annual Energy Cost (Not Incl'd with Total)</b>	NIL	NIL
<b>Pipelines (Secondary)</b>	km	
<b>Reticulation</b>	km	
Kudube North		R23.803
Kudube South		R13.550
Sub-total		R37.353
<b>Sub Total Construction Cost</b>		R76.596
<b>Engineering Fees (15 %)</b>		R11.489
<b>VAT (14 %)</b>		R12.332
<b>Project Contingency (20%)</b>		R20.084
<b>TOTAL : Secondary Cost</b>		R120.501
<b>Secondary Cost per Capita (Rands)</b>		R149.527
<b>GRAND TOTAL COST</b>		R236.254
<b>Grand Total Cost per Capita (R)</b>		R293.161





Kudube South (Note: Soshanguve partly supplied from Kudube WTW (Existing and fixed planning tested against 2015 demand))

01 Nov 08  
E:\N6123



**Warmbad and Nylstroom (Fixed and existing tested against 2015 demand)**

05-Nov-96  
EVN0118

Total demand on source		
Year	M/d	
2015	14571	

Belabela		
Year	k/d	
2015	2821	

Warmbaths		
Year	k/d	
2015	6677	

Warmbaths Reservoir		
Cap =	Ml	
TWL =	m ASL	
BWL =	1105 m ASL	
Required capacity	Balance	
	18596	

Estimated cost

Nylstroom		
Year	k/d	
2015	4077	

Phaganeng		
Year	k/d	
2015	1183	

Nylstroom Reservoir		
Cap =	Ml	
TWL =	m ASL	
BWL =	1105 m ASL	
Required capacity	Balance	
	9317	

Estimated cost

Pump line from Warmbaths		
Cap =	12469 k/d	
Diam =	350 mm	
Length =	28000 m	
Required capacity	Balance	
	7860 -4609.0	

Estimated cost

Pienars River		
Year	k/d	
2015	33	

Pump line from Temba/Kudube		
Cap =	20612 k/d	
Diam =	450 mm	
Length =	53000 m	
Required capacity	Balance	
	21856.5 1244.5	

Estimated cost

**Temba/Kudube CW Pumping Station**

Cap =	k/d	
GL =	1105 m ASL	
Required capacity	Balance	
	21856.5	

Estimated cost

**Temba/Kudube Regional Reservoir**

Cap =	0 Ml	
TWL =	m ASL	
BWL =	1105 m ASL	
Required capacity	Balance	
	14571 14571.0	

Estimated cost

Temba/Kudube WPW		
Cap =	0 M/d	
GL =	1105	
Required Capacity	Balance	
	21856.5 21856.5	

Estimated cost

**Kudube North (Proposed planning to meet 2015 demand)**  
 65 No: 86  
 E/04/04

Cost Summary	
BUK	
Water treatment	R16 732 M/ton
Pump stations	R0 300 M/ton
Reservoirs	R9 803 M/ton
Pipelines	R0 000 M/ton
SECONDARY	
Storage Reservoirs	R5 148 M/ton
Water towers	R0 000 M/ton
Reculation	R23 802 M/ton
Pipelines	R0 300 M/ton
<b>Total 1992 cost</b>	<b>R61 542 M/ton</b>

Total Demand on source	
Year	M/ton
2015	43 035

Assumed existing pipeline velocity	
Year	M/ton
2015	1.5

Lesetlha and Kgomo-Kgomo Demand	
Year	M/ton
2015	214

Kwamekhase Demand	
Year	M/ton
2015	0

Kwamekhase Reservoir	
Cap =	0 M
TVA =	m ASL
BVA =	1080 m ASL
Required capacity	Balance
Estimated cost	0.00

Kgomo-Kgomo Reservoir	
Cap =	0 426 M
TVA =	m ASL
BVA =	1040 m ASL
Required capacity	Balance
Estimated cost	R265.097

Pipeline Kwamekhase	
Cap =	0 M
Den =	mm
Length =	4000 m
Required capacity	Balance
Estimated cost	R24.6

Pipeline Kgomo-Kgomo	
Cap =	400 M
Den =	mm
Length =	3500 m
Required capacity	Balance
Estimated cost	R375.5

Kwamekhase Demand	
Year	M/ton
2015	26

Kwamekhase Reservoir	
Cap =	0 562 M
TVA =	m ASL
BVA =	1000 m ASL
Required capacity	Balance
Estimated cost	R132.467

Kwamekhase Reservoir	
Cap =	0 124 M
TVA =	m ASL
BVA =	1000 m ASL
Required capacity	Balance
Estimated cost	R140.74

Kwamekhase Demand	
Year	M/ton
2015	65

Kwamekhase Pump Line	
Cap =	M/ton
Den =	mm
Length =	9000 m
Required capacity	Balance
Estimated cost	R540.73

Kwamekhase Pump Line	
Cap =	M/ton
Den =	mm
Length =	4000 m
Required capacity	Balance
Estimated cost	R247.7

Kwamekhase Demand	
Year	M/ton
2015	3055

Kwamekhase Reservoir	
Cap =	7 31 M
TVA =	m ASL
BVA =	1050 m ASL
Required capacity	Balance
Estimated cost	R2 368.619

Kwamekhase Reservoir	
Cap =	0 348 M
TVA =	m ASL
BVA =	1000 m ASL
Required capacity	Balance
Estimated cost	R230.037

Kwamekhase Demand	
Year	M/ton
2015	174

Upper Kwamekhase Demand	
Year	M/ton
2015	276

Kwamekhase WFW	
Cap =	0 370 M
GL =	
Required capacity	Balance
Estimated cost	

Kwamekhase Branch Pump Line	
Cap =	M/ton
Den =	mm
Length =	3000 m
Required capacity	Balance
Estimated cost	R125.4

Kwamekhase Pump Line	
Cap =	M/ton
Den =	mm
Length =	2500 m
Required capacity	Balance
Estimated cost	R287

Kwamekhase Demand	
Year	M/ton
2015	751

Kwamekhase Pipe Line	
Cap =	M/ton
Den =	110 mm
Length =	1500 m
Required capacity	Balance
Estimated cost	R319

Kwamekhase Swart Reservoir	
Cap =	104 M
Year	2015
Estimated cost	2968

Kwamekhase Pipeline	
Cap =	M/ton
Den =	mm
Length =	10500 m
Required capacity	Balance
Estimated cost	R707

Kwamekhase Demand	
Year	M/ton
2015	3076

Kwamekhase Demand	
Year	M/ton
2015	114

Kwamekhase Demand	
Year	M/ton
2015	345

Kwamekhase Reservoir	
Cap =	8 83 M
TVA =	m ASL
BVA =	1050 m ASL
Required capacity	Balance
Estimated cost	R2 715.936

Kwamekhase Demand	
Year	M/ton
2015	950

Kwamekhase Reservoir	
Cap =	2 M
TVA =	m ASL
BVA =	1080 m ASL
Required capacity	Balance
Estimated cost	R582.087

Kwamekhase West Demand	
Year	M/ton
2015	436

Kwamekhase West Reservoir	
Cap =	0 58 M
TVA =	m ASL
BVA =	1080 m ASL
Required capacity	Balance
Estimated cost	R513.788

Kwamekhase Pipeline	
Cap =	M/ton
Den =	mm
Length =	3000 m
Required capacity	Balance
Estimated cost	R735.68

Kwamekhase Demand	
Year	M/ton
2015	1004

Kwamekhase Demand	
Year	M/ton
2015	655

Kwamekhase Demand	
Year	M/ton
2015	2197

Kwamekhase Reservoir	
Cap =	4 354 M
TVA =	m ASL
BVA =	1100 m ASL
Required capacity	Balance
Estimated cost	R1 815.298

Kwamekhase Pipeline	
Cap =	M/ton
Den =	mm
Length =	7500 m
Required capacity	Balance
Estimated cost	R573

Kwamekhase Demand	
Year	M/ton
2015	16414

Kwamekhase Demand	
Year	M/ton
2015	3717

Kwamekhase Reservoir	
Cap =	M
TVA =	1107 m ASL
BVA =	1100 m ASL
Required capacity	Balance
Estimated cost	R963.182

Kwamekhase Demand	
Year	M/ton
2015	1422

Kwamekhase Demand	
Year	M/ton
2015	2307

Kwamekhase WFW	
Cap =	M/ton
GL =	
Required capacity	Balance
Estimated cost	R18 732.120

Kwamekhase Demand	
Year	M/ton
2015	15414

Kwamekhase Demand	
Year	M/ton
2015	175

Kwamekhase Demand	
Year	M/ton
2015	1376

Kwamekhase Demand	
Year	M/ton
2015	190

Kwamekhase Demand	
Year	M/ton
2015	283