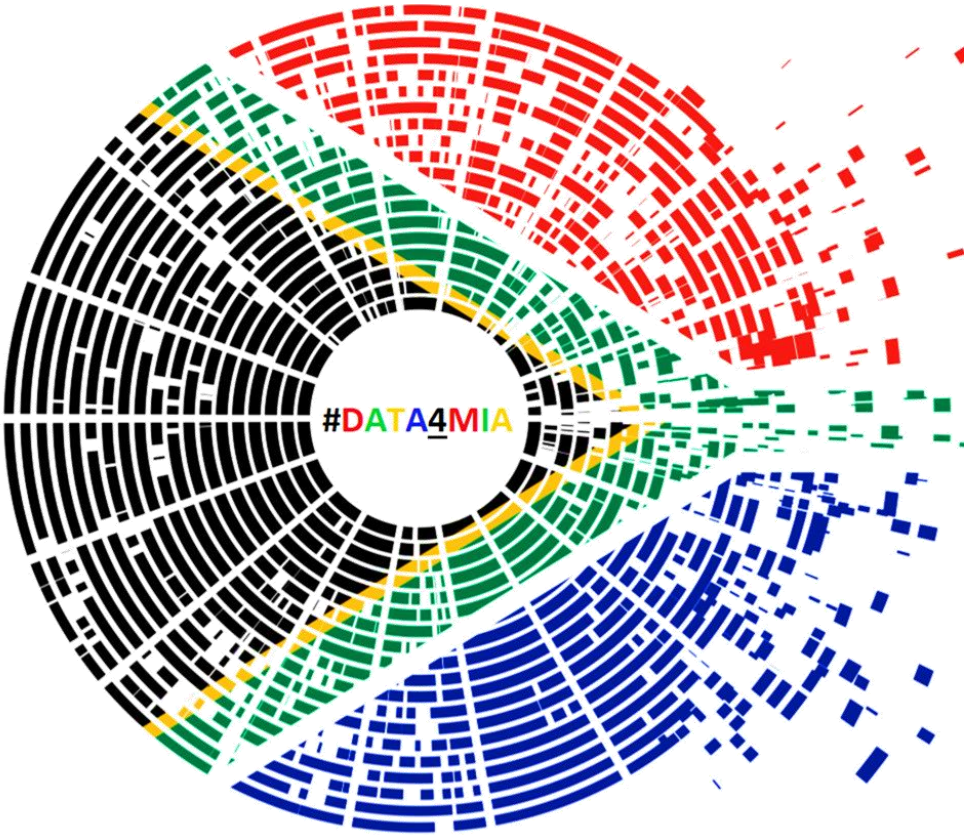
PUBLIC INFRASTRUCTURE UNIT COST GUIDELINE

cooperative governance
Department:
Cooperative Governance
REPUBLIC OF SOUTH AFRICA

MISA
MUNICIPAL INFRASTRUCTURE SUPPORT AGENT

MIPMIS
Municipal Infrastructure Performance Management Information System

URBAN & PUBLIC INFRASTRUCTURE
RESEARCH INITIATIVE



URBAN & PUBLIC INFRASTRUCTURE RESEARCH INITIATIVE – UCT

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Public Infrastructure Unit Cost Guideline 2021 Edition

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EDITORIAL POLICY

This document was subject to rigorous peer review by leading experts in the field, their contribution is hereby acknowledged. The reviewers were:

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FOREWORDS

Foreword by the Honourable Minister of CoGTA

Over the last few years, there has been frequent incidents of infrastructure projects that the community felt were overpriced. In some instances, there has been an inexcusable discrepancy between what has been built and the funds that have been spent. These incidents, both real and perceived, erode the confidence of the people in the government. Indeed, there are also incidences where adverse geotechnical properties of soil and other unforeseen circumstances result in genuine significant escalations of the cost of construction. In these incidences, the honours will be for the technical team to take us into their confidence with compelling explanations about the escalations. Even better, our oversight duties are done better if the potential escalation is discussed before, during and after the fact.

As the President outlined the decision to focus on infrastructure development as a flywheel for economic rejuvenation, we are proud to present the Infrastructure Unit Cost Guideline as an essential contribution to ensuring that the infrastructure investment program happens with value for money as a virtue. As the nation rebuilds, maintains and upgrades public infrastructure, there is a need to avail a tool that will benchmark the unit costs of building infrastructure assets. The immediate benefits of this document, amongst others will be to;

1. Enable municipal engineers to be more precise in budgeting for capital expenditure
2. Enable the public, forensic investigators, and auditors to reconcile expenditure with value added by measuring and approximating the money spent against the infrastructure that is provided.
3. Cap exorbitant charges on infrastructure that characterises emergency work

The document has been compiled over 14 months through our formal partnership with the Urban and Public Infrastructure Research Initiative (UPIRI) at the University of Cape Town's Department of Civil Engineering. We thank the various experts and industry bodies that reviewed the document and made valuable input during the compilation of the document. South Africa has immediate fiscal limitations that were compounded by the COVID 19 pandemic. All sectors must pursue value for money in all their activities. This document is a bold step in ensuring this ideal is achieved. This synergy between government, higher education and industry must be deepened as we periodically update this document in the years to come. I thank the management team at MISA for their coordinating role alongside our partners at the University of Cape Town.

Dr Nkosazana Dlamini-Zuma, MP

Executive Authority of Cooperative Governance and Traditional Affairs

Foreword by the Honourable Deputy Minister of DCoG

The District Development Model calls us to greater collaboration through the breaking down of the silos within and outside of government; for the development of our country. This particular work is a practical example of the breaking down of these silos, for meaningful partnership that resolves some of our most pressing challenges as it pertains to infrastructure development. We are all on a drive to ensure that government expenditure is not wasteful and this guideline is one of many tools that will assist us in this regard.

The department (specifically) and government (in general) are hard at work cultivating partnerships that will help us to innovate and positively disrupt to realise our development agenda. This is all in an era where we begin to see infrastructure data and information as pre-requisites in the discipline of evidence-based decision making.

Ms. Thembi Nkadimeng, MP

Deputy Minister of Cooperative Governance

Message by the CEO of MISA

Infrastructure development is one of our key enablers in taking South Africa forward, but infrastructure development is a specialist field that requires due care and skill, that is regrettably sometimes not in place. In such instances we see the basic principles of public financial management (economy, efficiency, efficacy and propriety – fitness for purpose) being undermined in the context of public infrastructure development. This guideline is a tangible measure of support to ensure we develop infrastructure in a manner that is economical, efficient, effective and appropriate, while duly noting all the nuance and intricacy of this complex activity.

This work is but one element of our broader support package to local government, in line with our Constitutional obligation to support and strengthen the capacity of this critical sphere. Much work is underway to innovatively utilise data for enhanced support in public infrastructure development, we are grateful to our partners at UPIRI for their continued support and commitment.

Mr Ntandazo Vimba

Chief Executive Officer of the Municipal Infrastructure Support Agent

ACKNOWLEDGMENTS

This guideline was prepared by the University of Cape Town's Urban and Public Infrastructure Research Initiative (UPIRI) and the Municipal Infrastructure Support Agent (MISA) working with the Data for Municipal Infrastructure Assets (DATA4MIA) vacation programme students. The UCT UPIRI Team consisted of Mr Lubabalo Luyaba (project leader), Mr Patrick Mwaka (research lead), Gundo Maswime and Professor Pilate Moyo (lead reviewer).

The report would not have been possible without the inputs of the DATA4MIA vacation students who undertook a significant portion of the data collection and analysis. The group comprised of:

- Mr Patrick Mwaka
- Mr "Alfie" Alfondre Arendse
- Ms Zusipe Mafentile
- Ms Ayanda Mafunda (graphics and editing)

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- The Municipal Infrastructure Support Agent (MISA), for supporting both UPIRI and DATA4MIA as a strategic partner providing access to much of the needed data and information.
- The Department of Cooperative Governance and Traditional Affairs (CoGTA) for the development of the 2010 Municipal Infrastructure: An Industry Guide to Infrastructure Service Delivery Levels and Unit Costs and its previous version (2007 and 2005).
- The South African Local Government Association (SALGA) and the Financial and Fiscal Commission (FFC) for the development of the 2015 Costing of Municipal Services to Inform DORA Allocations.

This being a periodically reviewed document, any inputs can be forwarded to the project lead at: LYBLUB001@myuct.ac.za

PREFACE

The revised report "Public Infrastructure Unit Cost Guideline" provides an updated and simplified version of the 2009/2010 report "An Industry Guide to Infrastructure Service Delivery Levels and Unit Costs". This work forms part of the University of Cape Town's (UCT's) Urban and Public Infrastructure Research Initiative (UPIRI) work on using data to enable evidence-based decision making in public and urban infrastructure development and management.

This document escalates the costs presented in the 2009/2010 document to 2020 costs, and tries to address the regional variations in labour, plant, material, and fuel costs within the country.

This document is intended to serve as a guideline for costing public infrastructure in South Africa for infrastructure planning and budgeting. The costs reflected in this guideline should therefore not be taken as actual costs as infrastructure development costs are not always predictable.

This document does not include a review of the basic levels of service and assumes that the general and specific input data to the 2009/2010 document is correct. In addition, some considerations noted in the 2015 SALGA and FFC Costing of Municipal Services to inform Division of Revenue Act (DORA) Allocations are not exhaustively addressed. These will be included in future publications of the guideline. This document also provides some guidance on how life cycle costing could be incorporated into infrastructure planning for further revisions of the guideline.

GLOSSARY

ACRONYM	DEFINITION
CAPEX	Capital Expenditure
CPAF	Contract Price Adjustment Formula
CPAP	Contract Price Adjustment Provisions
CPI	Consumer Price Index
CRC	Current Replacement Cost
CoGTA	Cooperative Governance and Traditional Affairs
DATA4MIA	Data for Municipal Infrastructure Assets
DDM	District Development Model
DM	District Municipality
DORA	Division of Revenue Act
DRC	Depreciated Replacement Cost
FFC	Financial and Fiscal Commission
GIS	Geographic Information System
GRAP	Generally Recognised Accounting Practice
IAS	International Accounting Standards
IDP	Integrated Development Plan
LGES	Local Government Equitable Share
LM	Local Municipality
LOS	Level of Service (Also known as Service Option)
MIG	Municipal Infrastructure Grant
MIPMIS	Municipal Infrastructure Performance Management Information System
MISA	Municipal Infrastructure Support Agent

MTEF	Mid-Term Expenditure Framework
NPV	Net Present Value
PPE	Property, Plant and Equipment
PPI	Production Price Index
PSP	Professional Service Provider
RUL	Remaining Useful Life
SALGA	South African Local Government Association
STATS SA	Statistics South Africa
UCT	University of Cape Town
UPIRI	Urban and Public Infrastructure Research Initiative

KEY DEFINITIONS

Phrase	Definition
Asset	A resource owned or controlled by an entity as a result of past events and from which future economic benefits or service potential are expected to flow to the entity.
Capital Expenditure	Expenditure used to create new assets, increase the capacity of existing assets beyond their original design capacity or service potential, or to return the service potential of the asset or expected useful life of the asset to that which it had originally. CAPEX increases the value of capital asset stock.
Capital Upgrading	Enhances the service potential of the asset or the economic benefits that can be obtained from use of the asset and may also increase the life of the asset beyond that initially expected.
Corrective Maintenance	Maintenance carried out after a failure has occurred and intended to restore an item to a state in which it can perform its required function. Corrective maintenance can be planned or unplanned.
Current Replacement Cost	The cost the entity would incur to acquire the asset on the reporting date. The cost is measured by reference to the lowest cost at which the gross future economic benefits could be obtained in the normal course of business, or the minimum it would cost to replace the existing asset with a new modern equivalent asset with the same economic benefits allowing for any differences in the quantity and quality of output and in operating costs.
Deferred Maintenance	The portion of planned maintenance work necessary to maintain the service potential of an asset that has not been undertaken in the period in which such work was scheduled to be undertaken.
Demand Management	The active intervention in the market to influence demand for services and assets with forecast consequences, usually to avoid or defer CAPEX expenditure. Demand management is based on the notion that as needs are satisfied expectations rise automatically and almost every action taken to satisfy demand will stimulate further demand.
Depreciated Replacement Cost	The replacement cost of an asset less accumulated depreciation calculated on the basis of such cost to reflect the already consumed or expired economic benefits of the asset.

Depreciation	Depreciation is the systematic allocation of the depreciable amount of an asset over its useful life.
Disposal	Actions necessary to decommission and dispose of assets that are no longer required.
Economic Life	The period from the acquisition of the asset to the time when the asset, while physically able to provide a service, ceases to be the lowest cost alternative to satisfy a particular level of service. The economic life is at the maximum when equal to the physical life, however obsolescence will often ensure that the economic life is less than the physical life.
Facility	A complex comprising many assets (e.g. a water treatment plant) which represents a single management unit for financial, operational, maintenance or other purposes.
Financing Costs	Includes annual interest costs and capital repayments (principal amount) for the investment over the period of the loan.
Infrastructure Assets	Stationary systems forming a network and serving whole communities, where the system as a whole is intended to be maintained indefinitely at a particular level of service potential by the continuing replacement and refurbishment of its components.
Inventories	Inventories are assets: (a) in the form of materials or supplies to be consumed in the production process; (b) in the form of materials or supplies to be consumed or distributed in the rendering of services; (c) held for sale or distribution in the ordinary course of operations; or (d) in the process of production for sale or distribution.
Life Cycle	The time interval that commences with the identification of the need for an asset and terminates with the disposal of the asset. .
Life Cycle Cost	The total cost of an asset throughout its life including planning, design, construction, acquisition, operation, maintenance, renewal and disposal costs.
Maintenance	All actions intended to ensure that an asset performs a required function to a specific performance standard(s) over its expected useful life by keeping it in as near as practicable to its original condition, including regular recurring activities to keep the asset operating, but specifically excluding renewal.
Property, Plant and	Property, plant and equipment are tangible items that: (a) are held for use in the production or supply of goods or services, for rental

Equipment (PPE)	to others, or for administrative purposes; and (b) are expected to be used during more than one reporting period.
Remaining Useful Life	The time remaining until an asset ceases to provide the required service level or economic usefulness.
Renewal	Expenditure on an existing asset which returns the service potential of the asset or expected useful life of the asset to that which it had originally.

These definitions apply to the use of terms in this document only.

EXECUTIVE SUMMARY

The Public Infrastructure Unit Cost Guideline 2020 is updated by the University of Cape Town's Urban and Public Infrastructure Research Initiative (UPIRI), Data for Municipal Infrastructure Assets (DATA4MIA) and the Municipal Infrastructure Support Agent (MISA). The objective is to provide a market related unit cost for each level of service. While this guideline retains the broad scope of the 2010 CoGTA Industry Guide, it has been simplified to ensure increased user-friendliness and ease of future updates.

The update of unit costs per province was carried out using the escalation cost methodology. The relevant indices were obtained from the Statistics South Africa website. These indices are based on costs of labour, plant, materials, and fuel/transport. The indices were converted to a base year of 2016 (indices published between 2016 and 2021 were to the base year of 2016; thus converting from the August 2009 indices to 2016 proved more efficient) whereby the Production Price Index (PPI) was used for fuel, Consumer Price Index (CPI) was applied to labour and Contract Price Adjustment Provisions (CPAP) to the plant and material components. The Contract Price Adjustment Factors (CPAF) were obtained from Statistics South Africa. These were utilized to escalate the August 2009 prices for each of the Level of Service components. The preliminary and general charges, construction costs and construction margin are all accounted for in the calculation of service unit costs with the exclusion of professional service fees and VAT. The "location" factor was utilized to explain the variances compared to Gauteng.

The adjusted unit costs show that there is a sizeable difference in costs of levels of service between provinces in South Africa. These cost differences can be accredited to numerous factors including:

1) the level of competition in the material and plant material market. In regions with a high supply chain, the unit costs tend to decrease due to the high level of competition,
2) the labour index differentiates across the provinces. This means that pressure felt by labour employers in different regions varies irrespective of whether they require the same skill set of employees and,
3) regional disparities regarding locally produced materials, result in outsourcing of materials from other provinces therefore increasing fuel/transportation costs of providing a service.

In conclusion, the update of the CoGTA Industry Guide to Infrastructure Unit Costs will enable both the public and private sectors to reasonably allocate budgets and assess the viability of public infrastructure projects. The escalation cost methodology will allow future enhancement of this guideline in a relatively straightforward manner, assuming the results of this publication produce reliable estimates of costs. Should it be determined that a review of the methodology is required, this will be undertaken subject to the availability of funds to undertake the work.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF EQUATIONS

1 INTRODUCTION

1.1 Background

In 2007, the Department of Cooperative Governance and Traditional Affairs (COGTA) then Department of Provincial and Local Government – DPLG; developed the 2007 document "An Industry Guide – Infrastructure Service Levels and Unit Costs". The 2007 document was then updated with the June 2010 publication "Municipal Infrastructure - An Industry Guide to Infrastructure Service Delivery Levels and Unit Costs". The 2010 document sought to provide a practical and current (August 2009) nation-wide system of guidelines that enable and support high level infrastructure planning for municipalities, service providers and provincial/national government in terms of the provision of weighted infrastructure development and service provision cost values (CoGTA, 2010). The cost values developed reflected the regional variances within the country for labour, material, fuel, and plant costs. The costs covered all reasonable construction costs, but excluded VAT, and professional services fees.

In 2020 and 2021, the UCT Urban and Public Infrastructure Research Initiative (UPIRI) and the Municipal Infrastructure Support Agent (MISA) through DATA4MIA; undertook to update the guideline document. This updated guideline document aims to reflect the changes that have occurred since the last update in 2010.

1.2 Context and Objectives

In South Africa government and in particular municipalities are responsible for the provision of at least a basic level of infrastructure service to all communities, particularly the poorest members of the community. The infrastructure services commonly provided by the municipalities include:

- Water supply,
- Sanitation,
- Public transport,
- Roads,
- Electricity,
- Stormwater drainage,
- Solid waste disposal,

- Emergency services,
- Community recreational and administrative facilities.

Infrastructure providers have a number of delivery options to choose from when providing services. This guideline aims to:

- Provide first order cost estimates to enable municipalities to compare different alternatives when planning to provide a service;
- Provide a baseline against which all government (national, provincial and local), service providers and communities can evaluate the reasonableness and rationality (read: economy / value for money) of the cost of various infrastructure units;
- Influence the allocation of the Municipal Infrastructure Grant (MIG) and the Local Government Equitable Share (LGES) in a manner that addresses regional variances in the cost of provision of a basic level of service; and
- Contribute to improving the quality of life for all by enabling the efficient development of public infrastructure.

1.3 Scope, Assumptions and Limitations

The guidelines scope is limited to the infrastructure costed in the 2010 version of the guideline.

The following assumptions are cautiously made:

- The bill of quantities used for the different infrastructure assets in the 2010 guideline document were reasonably correct, with no need for a substantive review as they were reviewed by industry specialists at the time of publication.
- The coefficients representing the relative contribution of labour, plant, materials and fuel cost components were assumed to be valid as these were developed in the 2010 report, which followed a rigorous methodology (CoGTA, 2010).
- Construction costs have escalated in line with the escalation indices and therefore represent a fair indication of current construction costs.

The following key limitations are noted:

- Calculated prices exclude VAT and professional services fees.
- Asset depreciation is not considered.

- Model validation through a comparison between the modelled prices and the actual prices in the market was not carried out.
- Regional price variances between Gauteng and other provinces were obtained using the Building for Economic Research (BER) Building Cost Report Quarterly analysis of building costs.

1.4 Purpose

This document serves as a guideline to provide first order cost estimates for the different infrastructure service delivery options in South Africa. The document is useful for provincial and national government departments in ascertaining the veracity of project prices submitted for business plan approvals and for municipalities to ascertain the acceptability of engineer's estimate.

2 GENERAL CONSIDERATIONS IN INFRASTRUCTURE PLANNING

2.1 Planning for infrastructure delivery.

The provision of infrastructure for communities should follow the Framework for Infrastructure Delivery and Procurement Management (FIDPM). This is primarily focused on governance decision making points, as well as alignment and functions to support good management of infrastructure delivery and procurement processes. The Infrastructure Delivery Management System (IDMS) refers to a management system that guides, directs, and enables infrastructure delivery in the public sector (National Treasury, 2019).

The Infrastructure Delivery Management (IDM) processes comprise portfolio, programme, operations, maintenance, and project management processes (National Treasury, 2019). The portfolio, programme, operations, and maintenance stages of a project operate in a cyclical pattern and have distinct deliverables at their ends that must be approved before moving onto the next stage. The project management stage on the other hand is linear, composed of the completion of various stages of a project from start to finish (National Treasury, 2019).

The detailed information on the key stage deliverables, policy guidelines, and definitions with regard to planning and delivery of infrastructure can be found in the Framework for Infrastructure Delivery and Procurement Management document (National Treasury, 2019). This is important local context in the use of this document.

2.2 The Expanded Public Works Programme.

The Expanded Public Works Programme (EPWP) was formerly introduced in 2003 with the objectives to create employment, develop local infrastructure to address regional disparities, and to provide basic services (Hlatshwayo, 2017). The EPWP programme was also introduced in order to address the skills shortage experienced in post-apartheid South Africa, with the aim to realize a more equitable society. The construction industry is one of the biggest contributors to the EPWP goals as large amounts of human labour replace machinery.

The EPWP programme should be implemented in accordance with the Phase IV guidelines in order to realise the targets set within the guidelines. The EPWP Phase IV targets are as shown in the tables below.

Table 1: Showing the Full Time Equivalent (FTE) Phase IV targets per sector per year.

	Infrastructure	Environment	Social	Non-State	Total
2019/20	114,069	78,807	115,462	148,185	456,523
2020/21	117,785	80,814	117,353	148,115	464,068
2021/22	121,277	82,576	118,193	156,622	478,667
2022/23	124,687	84,445	119,149	156,622	484,903
2023/24	128,452	86,421	120,347	156,622	491,842
Total	606,269	413,063	590,504	766,167	2,376,003

(Department of Public Works and Infrastructure, 2019)

Table 2: Showing the Full Time Equivalent (FTE) Phase IV targets per sphere of government per year.

	Municipal	Provincial	National	Total
2019/20	88,277	163,577	204,669	456,523
2020/21	89,147	168,519	206,401	464,068
2021/22	89,853	172,045	216,769	478,667
2022/23	90,419	175,850	218,634	484,903
2023/24	91,248	180,039	220,555	491,842
Total	448,944	860,030	1,067,029	2,376,003

(Department of Public Works and Infrastructure, 2019)

Demographic targeting has been used in the EPWP phase IV guidelines in order to ensure broader participation of vulnerable groups in South Africa. This has set the targets for participation as 60% for women, 55% for youth between 16 years and 35 years, and 2% for persons with disabilities (Department of Public Works and Infrastructure, 2019). Further guidelines to the successful implementation of the EPWP programme are shown in (Department of Public Works and Infrastructure, 2019).

It is critical that the infrastructure practitioner understands that infrastructure is an enabler of economic growth and development. This is particularly important in the South African context where the government has set itself the goal of reducing unemployment, inequality and poverty; *inter alia*, through an infrastructure build programme. The practical outworking of this is that the infrastructure practioner has the obligation of proposing solutions and developing infrastructure in a manner that optimises the project contribution to the broader national objectives. The difference between optimising project contribution to broader objectives and maximising the contribution is cost competitivity; every effort must be made to ensure that projects remain cost competitive while achieving other objectives (this is optimisation). Prescribing how this ought to be undertaken in every instance is neither practical nor appropriate.

3 METHOD

3.1 Price escalation

For the purpose of this study, the bill of quantities and prices developed in the 2009 guideline were assumed to be correct since they were widely accepted by industry professionals over the past decade. The December 2020 prices were then calculated as follows:

I) The major cost influencing factors were first identified. These were labour, fuel, plant, and materials. The relevant indices that affect the labour, fuel, plant, and materials were then identified as follows:

- **The Consumer Price Index (CPI).**
  Since this is based on a representative consumer basket, it was applied to the labour components of the project costing. This was assumed to be a good index to use for the escalation of the cost of labour since the CPI could be obtained for each of the provinces in South Africa. This in turn allowed for the incorporation of price differences across provinces within the labour market.
- **The Producer Price Index (PPI).**
  This measures changes in the average price of a basket of inputs commonly purchased by producers (AKCAY, 2011). It was applied to the fuel cost components of the projects, under the coke, petroleum products – Diesel section.
- **The Contract Price Adjustment Provisions (CPAP) Work Groups and Selected Materials Indices.**
  This was applied to the plant and material cost components of the infrastructure provisions.

II) The indices were then converted to the same base year which was chosen as 2016. This was conveniently chosen because most of the extensive indices available at the Stats SA website already had a base year of 2016 (Time series data – Excel and ASCII format | Statistics South Africa, n.d.).

III) The Contract Price Adjustment Factors (CPAF) for each of the relevant industries were then calculated using the formula stated below.

$$CPAF = (1 - x)\left[\frac{aL_T}{L_0} + \frac{bP_T}{P_0} + \frac{cM_T}{M_0} + \frac{dF_T}{F_0} - 1\right] \quad - \text{Eqn (1)}$$

Where x= Proportion of cost that is not subject to adjustment. Usually taken as 0.15.

a,b,c,d are the coefficients determined by the engineer. They represent the proportionate value of labour, plant, material, and fuel respectively in overall project cost estimation.

L is the Labour index determined from the CPI using the 2016 base year. Since the prices are to be escalated to the 2020 prices, L_T denotes the labour index for December 2020 with base year= 2016 while L_0 denotes the labour index for August 2009 with base year= 2016.

P is the Plant index determined from the CPAP using the 2016 base year. P_T denotes the plant index for December 2020 with base year = 2016 while P_0 denotes the plant index for August 2009 with base year= 2016.

M is the Materials index determined from the CPAP using 2016 base year. M_T denotes the materials index for December 2020 with base year= 2016 while M_0 denotes the materials index for August 2009 with base year= 2016.

F is the Fuel index determined from the PPI using 2016 base year. F_T denotes the fuel index for December 2020 with base year= 2016 while F_0 denotes the fuel index for August 2009 with base year= 2016.

IV) Once the CPAF was calculated, the escalated price in 2020 was determined by:

$$Escalated\ price = (1 + CPAF) * (Price\ in\ 2009) \quad - \text{Eqn (2)}$$

V) The Building Cost Report, quarterly analysis on building costs, was then used to obtain percentages that account for price differences between the different provinces in South Africa and Gauteng. The BER index was derived based on an analysis of accepted tender prices (Snyman and Lemboe, 2020). This percentage difference was obtained by using the following formula:

$$Percentage\ price\ difference = \left(\frac{Index_{Province\ in\ question}}{Index_{Gauteng}} - 1\right) \times 100 \quad - \text{Eqn (3)}$$

VI) This percentage price difference was then applied to the escalated 2020 prices in order to account for regional variances in the prices of different components. The following formula was used:

$$Unit\ costs = \left(1 + \frac{Percentage\ price\ difference}{100}\right) \times (Escalated\ price) \quad - \text{Eqn (4)}$$

VII) The subtotal of the costs of the components was then obtained from:

$$Subtotal = (Unit\ costs \times Quantity) \quad - \text{Eqn (5)}$$

VIII) A suitable construction margin was then chosen to reflect the prevailing market conditions in the construction industry. For the purposes of this study, a construction margin of 15% was considered adequate to reflect the highly competitive tendering process. The total price was then calculated from:

$$Total = \left(1 + \frac{Construction\ margin}{100}\right) \times (Subtotal) \quad - \text{Eqn (6)}$$

IX) The total prices for each component of the infrastructure assets were then summed to obtain a total price for the infrastructure asset, before incorporating a factor to account for preliminary and general fees to obtain the total cost, prior to the inclusion of VAT and professional services fees. The formula to obtain total costs is as follows:

$$Total\ cost = (\sum Totals) \times (1 + \frac{Preliminary\ \&\ general}{100}) \quad - \text{Eqn (7)}$$

3.2 Additional Cost Influencing Factors.

The following additional factors significantly influence the cost of infrastructure development and are project specific (SALGA, 2015).

- Topography
- Location
- Distance from economic centres
- Developmental status (number of settlements and densities)
- Loss of economy of scale
- Soil parameters

In the following tables the municipal classification utilised is as follows:

- Metros (Category A municipalities),
- B1- Secondary cities,
- B2- Large towns,
- B3- Small towns,
- B4- Mostly rural,
- C1- Districts (District municipalities that are not water service providers),
- and C2- Districts (District municipalities that are water service providers) (SALGA, 2015).

Table 3: Showing the cost influencing factor index for distance from economic centre and loss of economy of scale.

Cost influencing factor on operation and maintenance		Distance from main economic centre			Loss of economy of scale		
Service	Cost element	A (%)	B1 (%)	B2-4 C1-2 (%)	A (%)	B1-2 (%)	B3-4 C1-2 (%)
Electricity	Bulk purchase	0	0	0	0	0	0
	Contracted services	0	5	10	0	2	5
	Employee-related costs	0	0	0	0	2	5
	Insurance	0	0	0	0	0	0
	Other expenditure (loose tools & overheads)	0	5	10	0	2	5
	Other materials	0	5	10	0	2	5
	Rent of facilities and equipment	0	5	0	0	2	5
	Operations, repairs, and maintenance	0	5	10	0	2	5
	Transportation costs	0	5	10	0	2	5
	Energy costs	0	0	0	0	0	0
Refuse	Bulk purchase	0	0	0	0	0	0
	Contracted services	0	5	10	0	2	5
	Employee-related costs	0	5	0	0	2	5
	Insurance	0	0	0	0	0	0
	Other expenditure (loose tools & overheads)	0	5	10	0	2	5

	Other materials	0	5	10	0	2	5
	Rent of facilities and equipment	0	5	0	0	2	5
	Operations, repairs, and maintenance	0	5	10	0	2	5
	Transportation costs	0	5	10	0	2	5
	Energy costs	0	2	0	0	2	5
Sanitation	Bulk purchase	0	5	10	0	0	0
	Contracted services	0	5	10	0	2	5
	Employee-related costs	0	5	0	0	2	5
	Insurance	0	0	0	0	0	0
	Other expenditure (loose tools & overheads)	0	5	10	0	2	5
	Other materials	0	5	0	0	2	5
	Rent of facilities and equipment	0	5	0	0	2	5
	Operations, repairs, and maintenance	0	5	10	0	2	5
	Transportation costs	0	5	10	0	2	5
	Energy costs	0	5	10	0	2	5
Water	Bulk purchase	0	0	0	0	0	0
	Contracted services	0	5	10	0	2	5
	Employee-related costs	0	5	0	0	2	5
	Insurance	0	0	0	0	0	0

	Other expenditure (loose tools & overheads)	0	5	10	0	2	5
	Other materials	0	5	10	0	2	5
	Rent of facilities and equipment	0	5	0	0	2	5
	Operations, repairs, and maintenance	0	5	10	0	2	5
	Transportation costs	0	0	10	0	2	5
	Energy costs	0	0	0	0	0	0
Roads & Stormwater	Bulk purchase	0	0	0	0	0	0
	Contracted services	0	5	10	0	2	5
	Employee-related costs	0	5	0	0	2	5
	Insurance	0	0	0	0	0	0
	Other expenditure (loose tools & overheads)	0	5	10	0	2	5
	Other materials	0	5	10	0	2	5
	Rent of facilities and equipment	0	5	0	0	2	5
	Operations, repairs, and maintenance	0	5	10	0	2	5
	Transportation costs	0	0	10	0	2	5
	Energy costs	0	0	0	0	0	0

(SALGA, 2015).

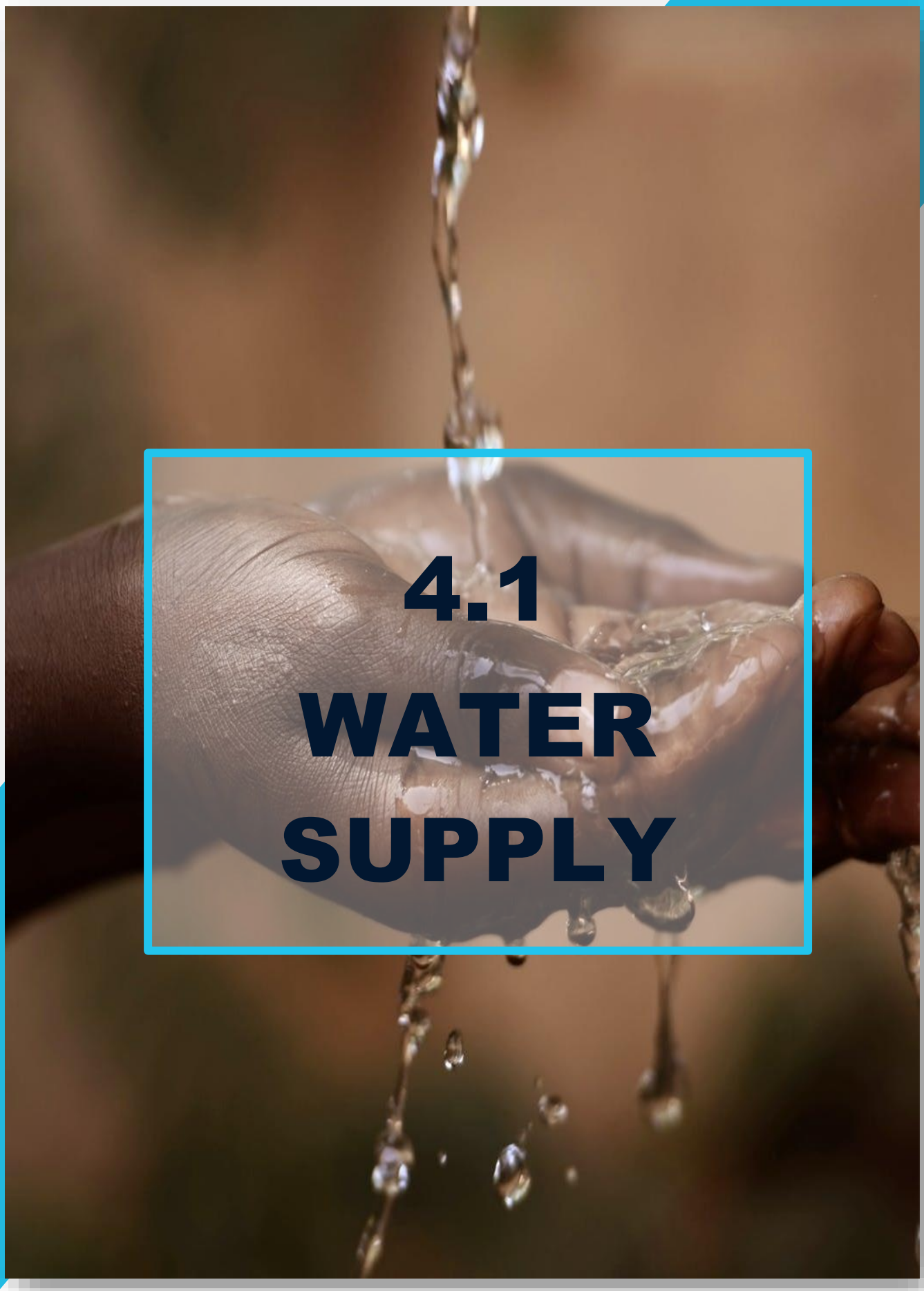
Table 4: Showing the cost influencing factor index for topography and location (SALGA, 2015).

Cost influencing factor on operation and maintenance		Topography			Location	
Service	Cost element	Flat (%)	Rolling (%)	Mountainous (%)	Coastal (%)	Inland (%)
Electricity	Bulk purchase	0	0	0	0	0
	Contracted services	0	2	4	0	0
	Employee-related costs	0	2	4	0	0
	Insurance	0	0	0	0	0
	Other expenditure (loose tools & overheads)	0	0	0	0	0
	Other materials	0	0	0	0	0
	Rent of facilities and equipment	0	0	0	0	0
	Operations, repairs, and maintenance	0	0	5	0	0
	Transportation costs	0	5	10	0	0
	Energy costs	0	0	2	0	0
Refuse	Bulk purchase	0	0	0	0	0
	Contracted services	0	5	10	0	0
	Employee-related costs	0	2	5	0	0
	Insurance	0	0	0	0	0
	Other expenditure (loose tools & overheads)	0	0	0	0	0
	Other materials	0	0	0	0	0

	Rent of facilities and equipment	0	0	0	0	0
	Operations, repairs, and maintenance	0	0	0	0	0
	Transportation costs	0	5	10	0	0
	Energy costs	0	0	0	0	0
Sanitation	Bulk purchase	0	0	0	-2	0
	Contracted services	0	0	5	0	0
	Employee-related costs	0	2	5	0	0
	Insurance	0	0	0	0	0
	Other expenditure (loose tools & overheads)	0	0	0	0	0
	Other materials	0	0	0	0	0
	Rent of facilities and equipment	0	0	0	0	0
	Operations, repairs, and maintenance	3	2	7	4	0
	Transportation costs	0	3	6	0	0
	Energy costs	3	2	0	0	0
Water	Bulk purchase	0	0	0	0	0
	Contracted services	0	0	5	0	0
	Employee-related costs	0	2	5	0	0
	Insurance	0	0	0	0	0
	Other expenditure (loose tools & overheads)	0	0	0	0	0

	Other materials	0	0	0	0	0
	Rent of facilities and equipment	0	0	0	0	0
	Operations, repairs, and maintenance	0	5	10	4	0
	Transportation costs	0	3	6	0	0
	Energy costs	0	5	10	0	0
Roads & Stormwater	Bulk purchase	0	0	0	0	0
	Contracted services	0	0	5	0	0
	Employee-related costs	0	2	5	0	0
	Insurance	0	0	0	0	0
	Other expenditure (loose tools & overheads)	0	0	0	0	0
	Other materials	0	0	0	0	0
	Rent of facilities and equipment	0	0	0	0	0
	Operations, repairs, and maintenance	0	5	10	4	0
	Transportation costs	0	3	6	0	0
	Energy costs	0	0	0	0	0

RESULTS



4.1 WATER SUPPLY

4 RESULTS

General Assumptions (Adapted from DWS, 2016)

Unit costs represent typical and not site-specific costs. This section builds on the definitions outlined below:

Population size is categorized as follows:

- 0 to 1000 people;
- 1000 to 5000 people;
- 5000 to 20 000 people;
- 20 000 to 50 000 people; and
- More than 50 000 people.

Housing density is categorised as follows:

- Low population housing density;
- Moderate population housing density; and
- High population housing density.

The average house occupancy is taken as three people per household, using the STATS SA 2016 data. The STATS SA 2016 Community Survey presents a more detailed breakdown that should be used for each province and or area, this will be updated with the Census 2022 data in the next edition.

Service levels and water consumption (add 15% to 25% bulk and 20% to 30% reticulation losses):

- Communal taps – 25 litres per person per day (Lpcd);
- Yard connection – 80 Lpcd; and
- House connection – 220 Lpcd.

Soil hardness and excavation characteristics are as below:

- Soft soil (no ripping or blasting);
- Moderate hardness soil (10% ripping and no blasting); and
- Hard soil (15% ripping and 5% blasting).

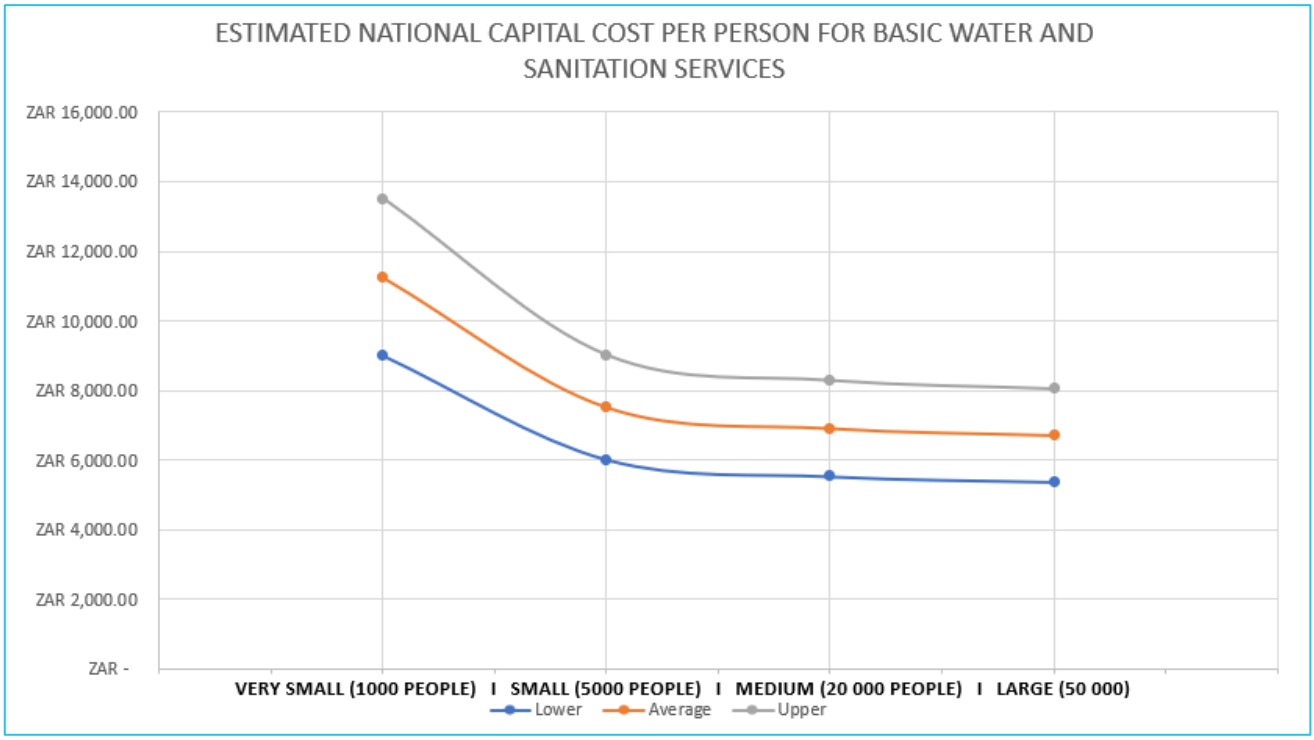
Topography and pumping requirements are defined as follows:

- Low speed / Low head (1450 rpm; average of 90m head); and
- High speed / high head (2900 rpm; average of 150m head).

No provision has been made for:

- Special structures e.g. river and road crossings;
- Extreme soil condition (e.g. hard rock or really poor soil) or topography;
- New access roads, land acquisition, servitudes or relocation of people; and
- Costs associated with compliance to National Water Act, National Environmental Management Act and any other project specific legislation.

From the above it is clear that these costs can only be used as guiding estimates with a margin of deviation allowed for. The table below shows the expected variation across scheme sizes, by showing typical minimum, average and upper limit costs. Much of the data used is for Metros and municipalities with large towns; it is therefore expected that the costs for rural water supply schemes will be near the upper limit. The deviation is expected to be 20% from the average, for all water and sanitation services, for rural water and sanitation infrastructure the deviation can reach up to 30%.



4.1 Water Supply

4.1.1 DEFINITION

Water supply services include the process of abstraction of water from the source, conveyance, treatment to an acceptable quality, storage, and distribution to consumers. The administrative arrangements necessary to ensure the provision of adequate water supply services such as health, hygiene, water related awareness, measurement of consumption, associated billing, collection of revenue, and customer care are covered in the definition of water supply services.

Water supply infrastructure is divided into bulk water supply infrastructure, connector infrastructure and distribution infrastructure.

On 28 July 2010, the United Nations General Assembly explicitly recognized access to clean water and sanitation services as a basic human right through resolution 64/292 (Human right to water and sanitation | International Decade for Action 'Water for Life' 2005-2015, 2021). It is the responsibility of the local government within the municipality to ensure the fulfilment of this right through adequate fund allocation, commissioning of projects, supervision of works to completion, operation, and maintenance of the facilities.

4.1.2 BULK WATER SUPPLY INFRASTRUCTURE

4.1.2.1 Boreholes

A borehole is a hole drilled into the ground to reach a subsurface layer that contains ground water. The purpose of this hole is to enable lowering of groundwater abstraction equipment such as pumps, motors and pipes that enable the pumping of groundwater to the surface (Cooperative Governance and Traditional Affairs, 2010).

The costs developed in this guideline are for the conceptual stage of the project, not the tender preparation stage. As a result, some cost components like depreciation of equipment and idle costs are not included in the costs developed in the tables below. They are, however, very important costing aspects to be considered in the detailed costing stage. The tables below show the expected maximum costs in Rand per meter depth for the most common borehole diameters per province per settlement location, developed based on the zero-based costing approach using the same bill of quantities as that used in the 2010 document, as these were widely accepted by industry professionals.

Table 5: Bulk Water supply- Boreholes (165mm ID hole)

Province	Shallow 50m-Semi rural (100km radius) R/meter	Shallow 50m-Deep rural (250 km radius) R/meter	Deep 200m-Semi rural (100km radius) R/meter	Deep 200m-Deep rural (250km radius) R/meter
Gauteng	2,139	2,322	1,100	1,100
Limpopo	2,146	2,329	1,104	1,104
North West	2,131	2,312	1,096	1,096
Free state	2,147	2,330	1,104	1,104
KwaZulu Natal	2,136	2,318	1,099	1,099
Mpumalanga	2,133	2,315	1,099	1,097
Northern Cape	2,135	2,317	1,098	1,098
Western Cape	2,154	2,338	1,108	1,108
Eastern Cape	2,147	2,330	1,104	1,104

2009 Costs escalated to 2020 prices.

Table 6: Bulk Water supply- Boreholes (208mm ID hole)

Province	Shallow 50m- Semi rural (100km radius) R/meter	Shallow 50m- Deep rural (250 km radius) R/meter	Deep 200m- Semi rural (100km radius) R/meter	Deep 200m- Deep rural (250km radius) R/meter
Gauteng	2,139	2,322	1,040	1,202
Limpopo	2,146	2,329	1,043	1,205
North West	2,131	2,312	1,035	1,197
Free state	2,147	2,330	1,043	1,206
KwaZulu Natal	2,136	2,318	1,038	1,200
Mpumalanga	2,133	2,315	1,037	1,198
Northern Cape	2,135	2,317	1,037	1,199
Western Cape	2,154	2,338	1,047	1,210
Eastern Cape	2,147	2,330	1,043	1,206

2009 Costs escalated to 2020 prices.

The prices given exclude VAT and professional fees and are for boreholes that are operated by electrically driven pumps.

4.1.2.2 Raw water storage dams

Dams are provided on rivers when the flow during dry months is insufficient to meet the water requirements of the population, hence necessitating the need for additional storage (Cooperative Governance and Traditional Affairs, 2010).

The choice and location of a dam is dependent on a number of factors including the type of project for which the facility is constructed, local geology, materials to be used and local topography.

Factors affecting the cost of the dam are:

- Storage required.
- Founding conditions.
- Materials used to construct the dam.
- Topography.
- Valley shape.
- Length of the dam.
- Spillway requirements.

The table below shows the capital costs excluding preliminary & general, VAT, and professional services for different types and scheme sizes of surface water dams. These should only be used for very high-level estimation purposes as the variances, when compared to recently completed projects were outside the 30% range. More research on a more suitable estimation method is required.

Table 7: Showing the capital costs of different types and scheme sizes of surface water dams (use not recommended as variance is greater than 30%).

Material & Element		Scheme size			
		Very small (1000 people) (R)	Small (5000 people) (R)	Medium (20000 people) (R)	Large (50000 people) (R)
		30,000 m^3	120,000 m^3	500,000 m^3	1,200,000 m^3
Earth-fill	**Dam-Wall**	1,530,494	3,556,586	10,520,462	21,613,502
	Spillway	310,958	793,911	2,203,721	4,256,365
Earth-fill sum		1,841,452	4,350,497	12,724,182	25,869,867
Rock-fill	**Dam-Wall**	1,464,302	3,874,868	10,704,473	22,457,126
	Spillway	355,823.5	780,823	2,775,714	4,776,045
Rock-fill sum		1,820,125	4,655,691	13,480,187	27,233,172
Roll-crete	**Dam-Wall**	1,987,519	5,636,619	16,436,708	35,645,020

	Spillway	12,690.8	17,259	28,427	33,504
Roll-crete sum		2,000,209	5,653,878	16,465,134	35,678,525

2009 Costs escalated to 2020 prices.

4.1.3 WATER TREATMENT WORKS.

Different water sources have an influence on the quality of available water. The intended final use of the water, along with the quality at the water source, determine the choice of water treatment technology to be used to produce water of potable quality.

Biological constituents of water are easier to remove by boiling, bleaching or chlorination while physical constituents like turbidity require more expensive treatment processes (Cooperative Governance and Traditional Affairs, 2010).

Water soluble chemicals such as arsenic, calcium, iron, magnesium, manganese, and zinc are removed by conventional treatment processes that involve the addition of flocculation agents that precipitate the chemical compounds and allow them to be removed from the water by physical means such as filtration (Cooperative Governance and Traditional Affairs, 2010).

Advanced treatment is required to remove chlorides, fluorides, sulphates, potassium, and sodium. Advanced treatment involves methods such as reverse osmosis and ion exchange. These treatment options are very expensive and require specialist personnel for appropriate implementation (Cooperative Governance and Traditional Affairs, 2010).

4.1.3.1 Cost influencing factors.

Major project cost influencing factors are:

- Project size. The larger the project, the higher the total cost of the treatment plant, but if the population to be served increases, then there will be a lower cost per household due to economy of scale effects where the long run average costs of implementing and running the treatment plant are in terminal decrease as the population to be served increases.
- Location. The greater the distance from economic centres, the higher the operation and maintenance costs.

- Topography. Hilly and mountainous terrains make delivery of package treatment plants more expensive.
- Specialist contractors. These have considerable expertise and hence are expensive to hire.
- Treatment processes involved.

Table 8: Showing average capital cost of water treatment works in Rands.

Element	Scheme Size			
	Very small (R)	**Small (R)**	**Medium (R)**	**Large (R)**
	30 kl/day	**160 kl/day**	**600 kl/day**	**1,600 kl/day**
Package plant	600,554	2,199,129	3,742,581	9,254,910
Conventional	861,869	2,944,892	4,604,337	9,736,036
Advanced Treatment	2,059,870	5,628,378	5,367,267	11,169,718

Costs from 2009 DWA Cost benchmarks escalated to 2020 prices.

4.1.3.2 Treatment process costs.

The curves to determine the costs for the different treatment processes for different plant capacities are obtained from the WATCOST model that compiled data from different consulting engineers. The costs obtained using the curves should be escalated to the relevant year for each treatment process using suitable Contract Price Adjustment Factors (CPAFs).

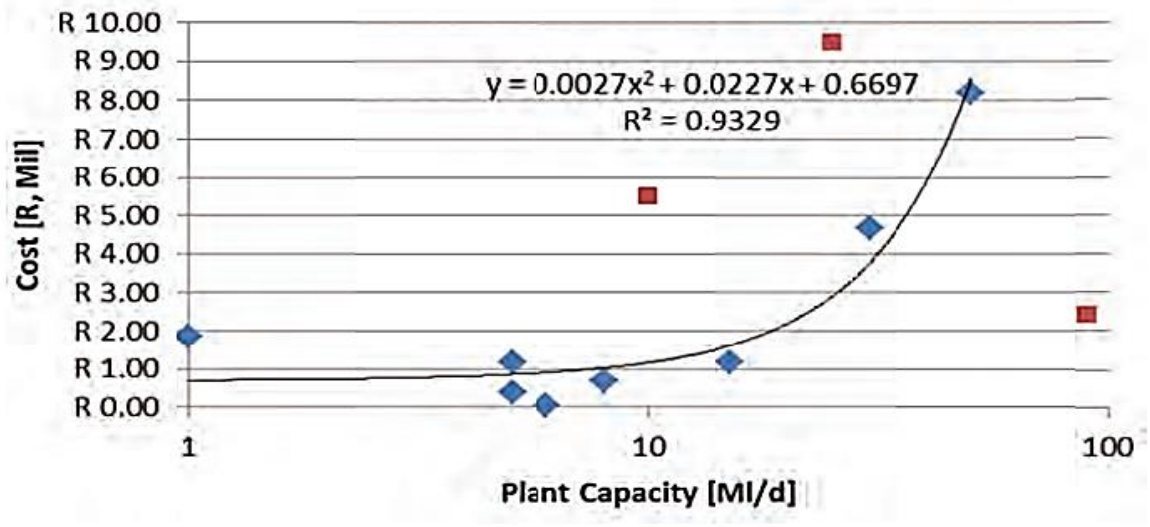


Figure 1: Showing the capital cost curve for inlet distribution works less than 50ML/day (Swartz et al., 2013).

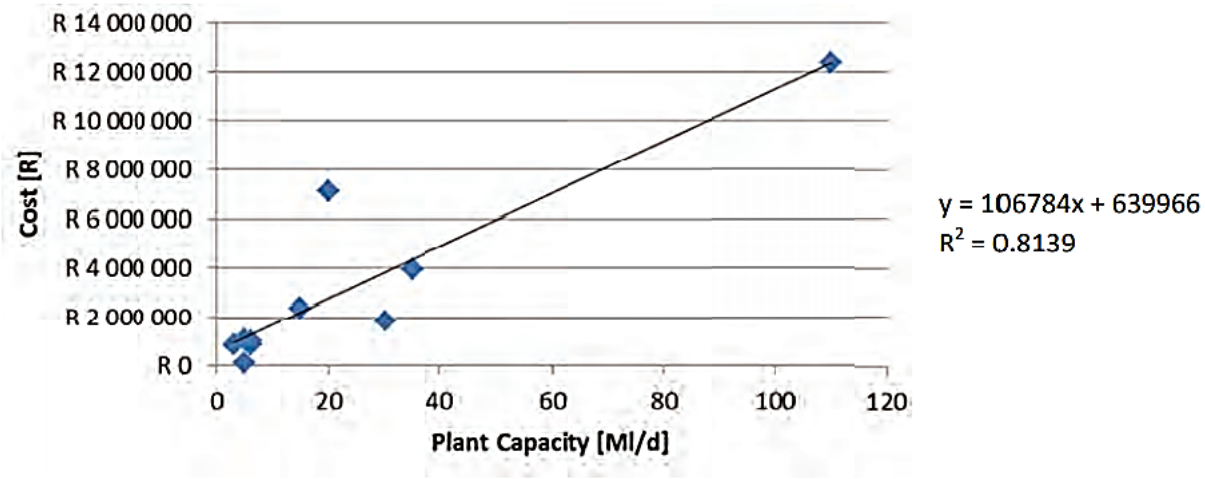


Figure 2: Showing the capital cost curve for flocculation for different plant capacities (Swartz et al., 2013).

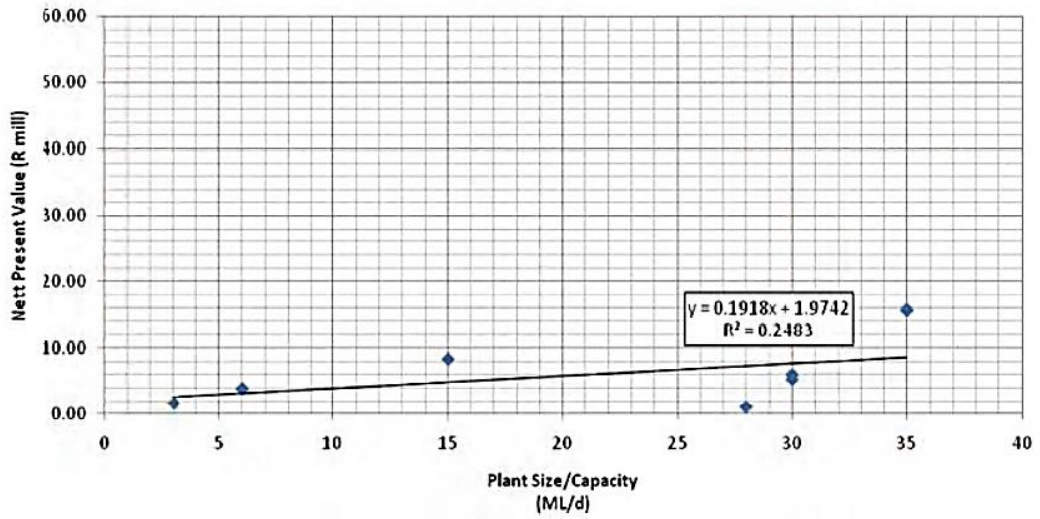


Figure 3: Showing the capital cost curve for phase separation (Swartz et al., 2013).

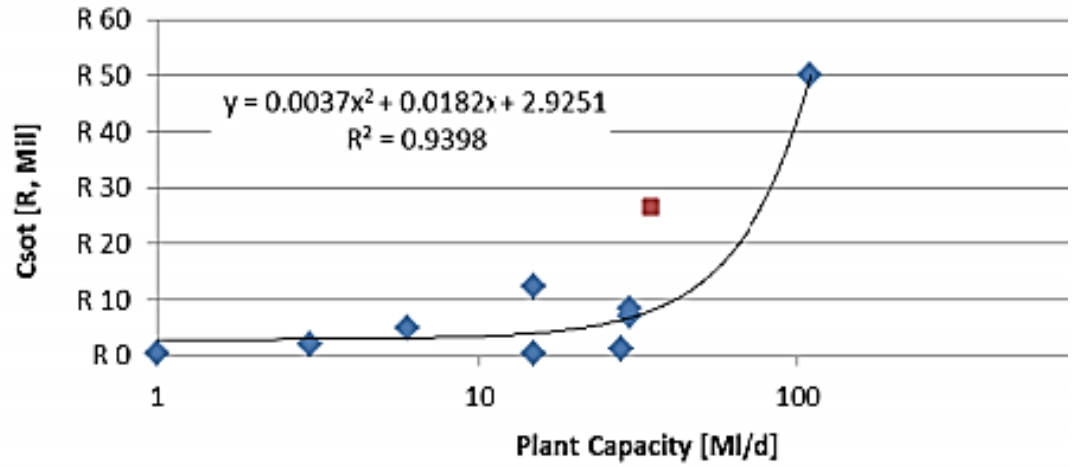


Figure 4: Showing the capital cost curve for primary sedimentation (Swartz et al., 2013).

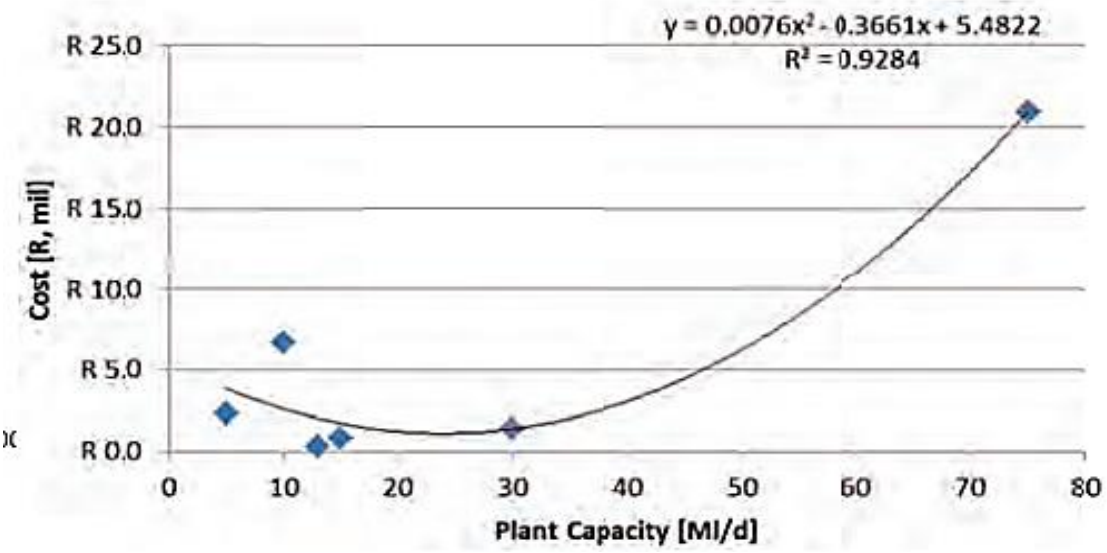


Figure 5: Showing the capital cost curve for clarification (Swartz et al., 2013).

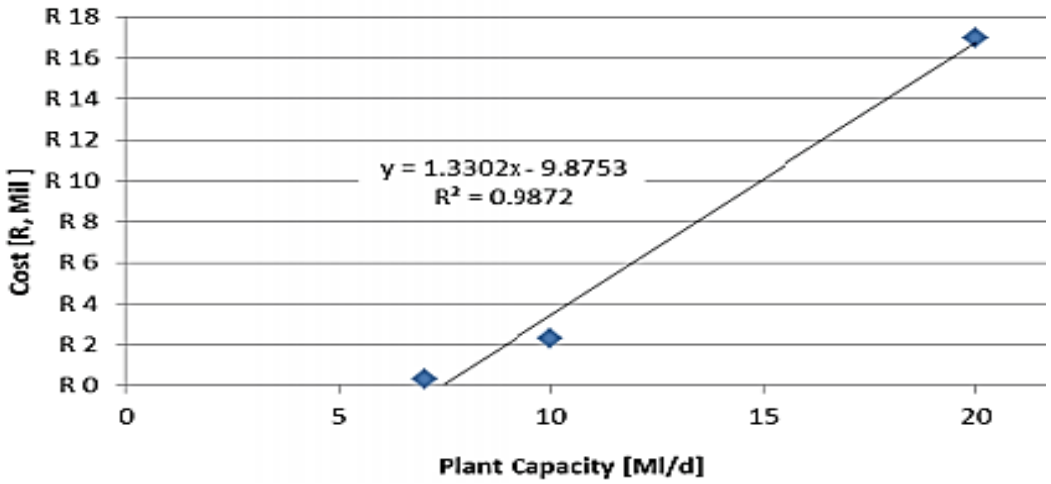


Figure 6: Showing the capital curve for pulsator clarifiers (Swartz et al., 2013).

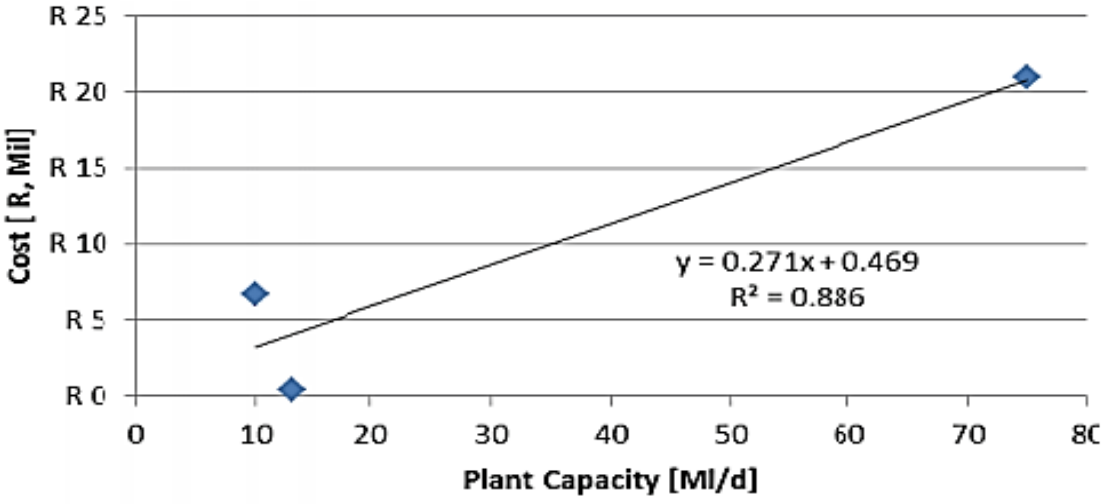


Figure 7: Showing the capital cost curve for clari-flocculation (Swartz et al., 2013).

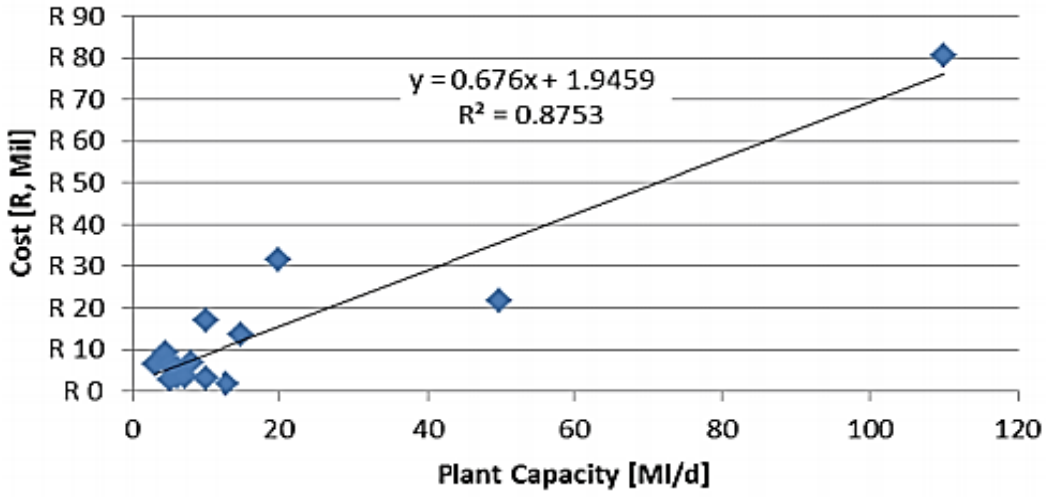


Figure 8: Showing the capital cost curve for rapid gravity filters (Swartz et al., 2013).

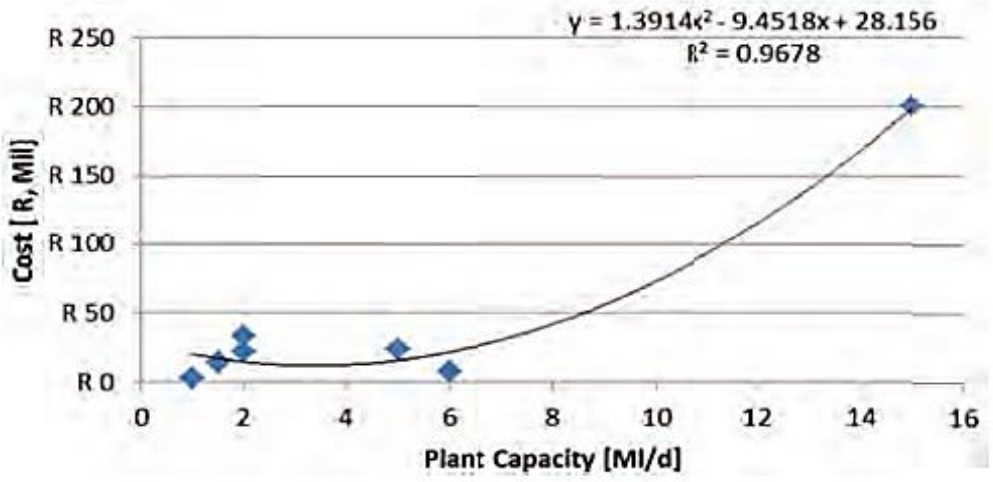


Figure 9: Showing the capital cost curves for reverse osmosis (Swartz et al., 2013).

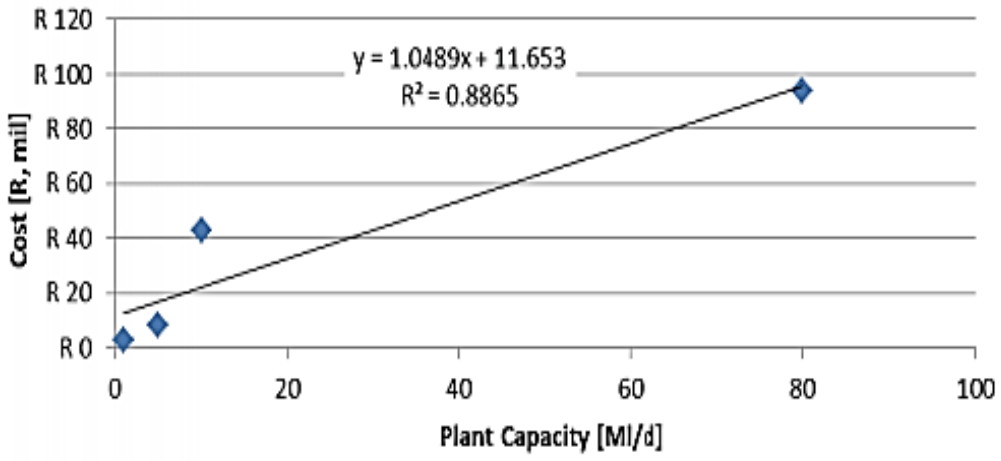


Figure 10: Showing the capital cost curve for ultra-filtration (Swartz et al., 2013).

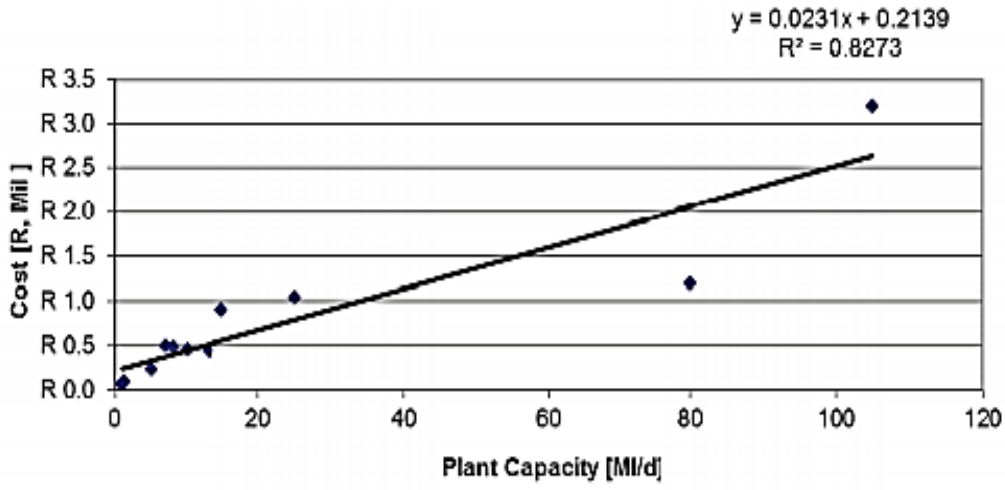


Figure 11: Showing the capital cost curve for chlorination (Swartz et al., 2013).

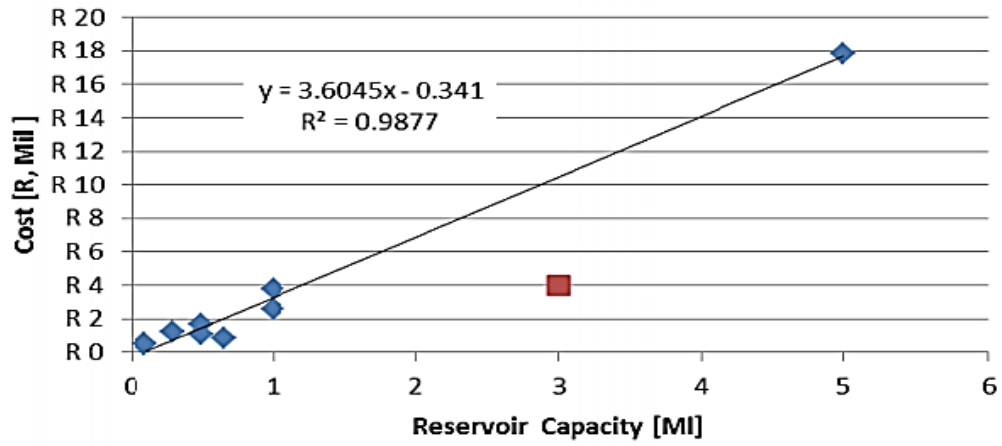


Figure 12: Showing the capital cost curve for reservoirs (Swartz et al., 2013).

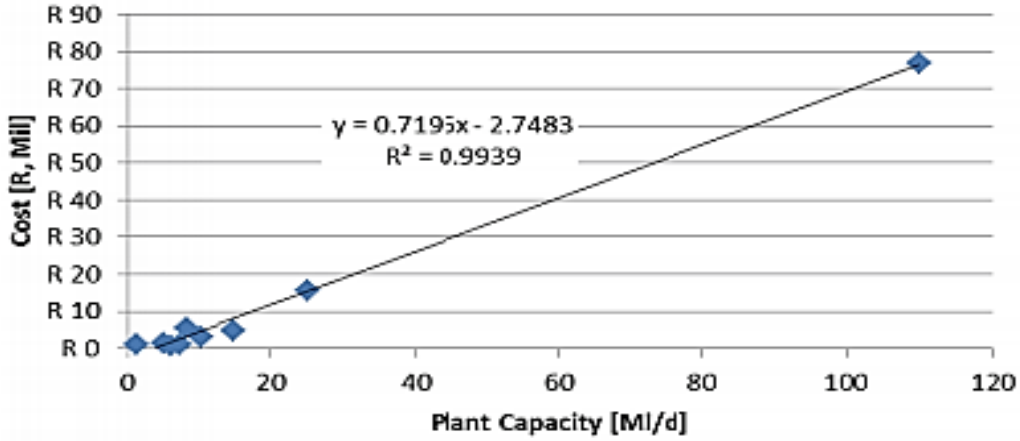


Figure 13: Showing the capital cost curve for preliminary and general for all water treatment plant capacities (Swartz et al., 2013).

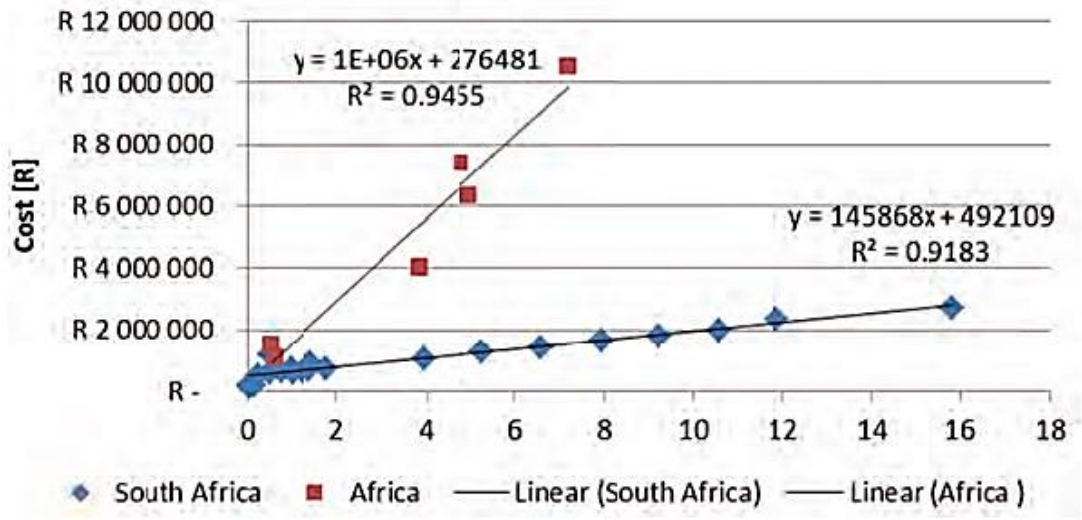


Figure 14: Showing the capital cost curves for package treatment plants (Swartz et al., 2013).

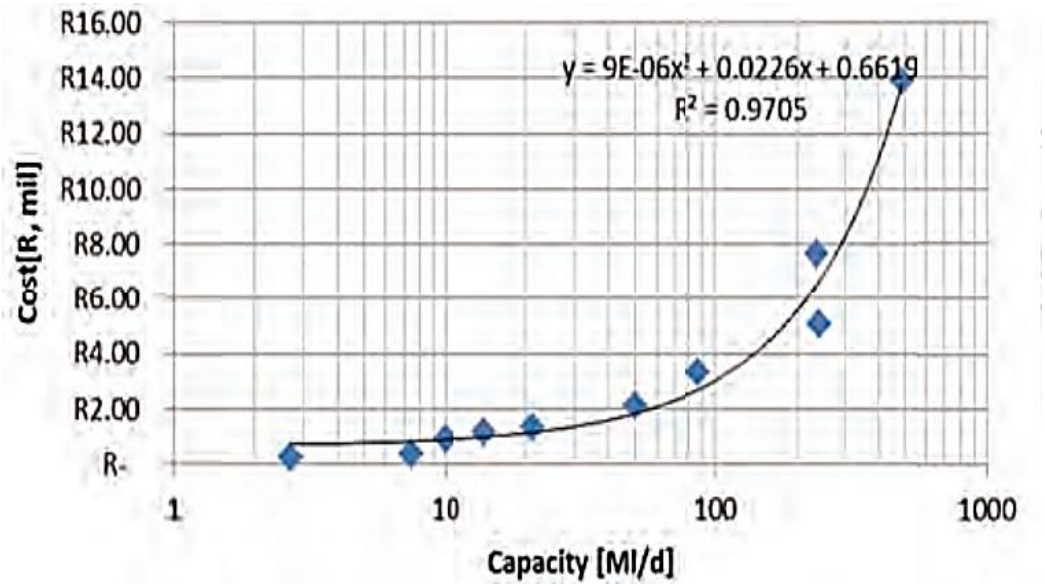


Figure 15: Showing the operations cost curve for chemicals (Swartz et al., 2013).

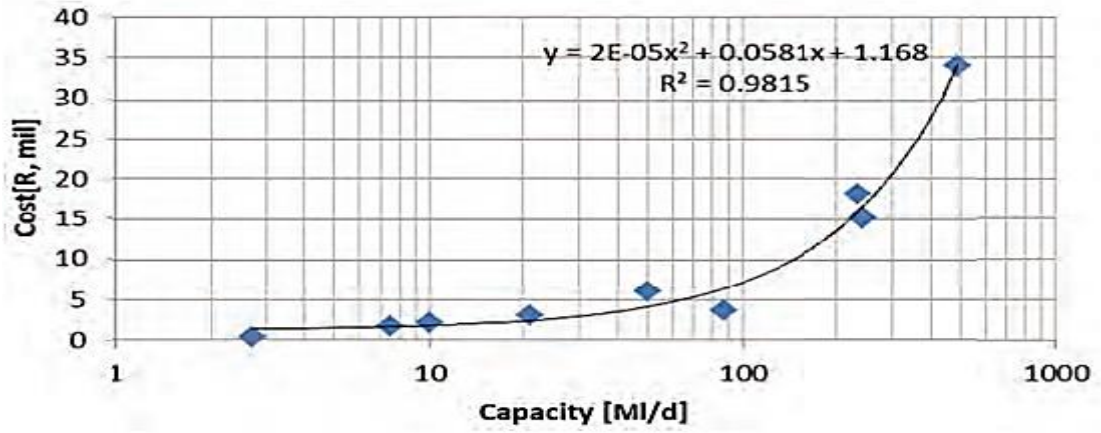


Figure 16: Showing the operations cost curve for electricity (Swartz et al., 2013).

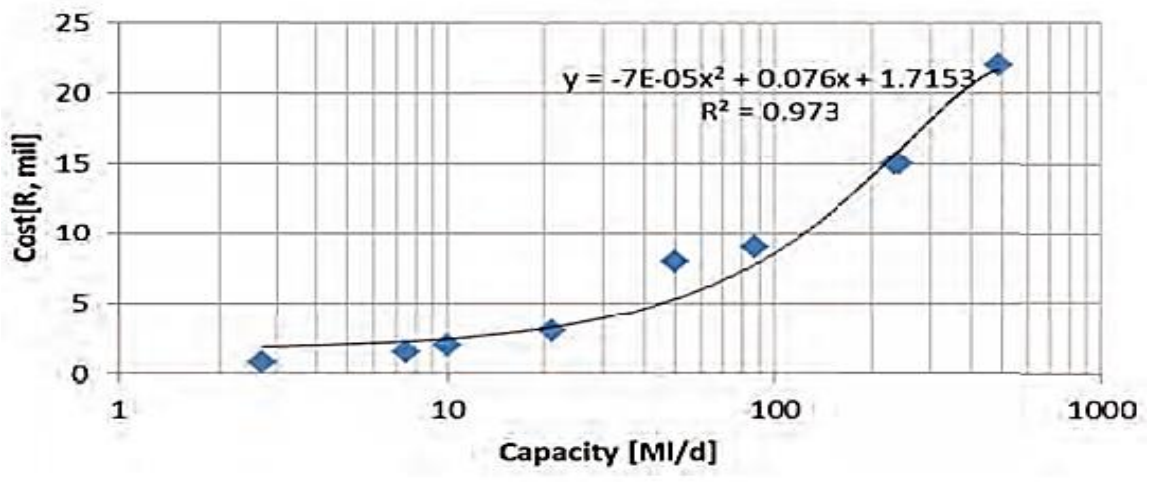


Figure 17: Showing the operations cost curve for maintenance of different treatment plant capacities (Swartz et al., 2013).

4.1.4 CONNECTOR SERVICES.

4.1.4.1 Reservoirs.

Reservoirs are used to store water from treatment facilities and enable gravity feeding of the distribution networks. They can also be used for hydraulic purposes to reduce the load on the network and hence keep pipe sizes and classes small. In addition to this, they balance fluctuating water demand in the distribution area against output from the source.

Service reservoirs are normally placed at the highest points within the development, with the exact location depending on the hydraulic pressure requirement. Various materials such as polyethylene, bricks, steel, concrete and reinforcing mesh can be used in construction.

The design of the reservoir depends on the specified industry design criteria, scheme requirements, and the specifications given by the municipality (Cooperative Governance and Traditional Affairs, 2010). The choice of building materials depends on the availability of funds and the expected lifespan of the reservoirs.

Table 9: Reservoirs- Cost Effective Usage (Cooperative Governance and Traditional Affairs, 2010).

Material	Cost effective usage based on reservoir capacity
Polyethylene reservoirs	<50 kl

	10-15-year lifespan
Steel reservoirs	50 to 500 kl 20-25-year lifespan
Brick reservoirs	50 to 500 kl 20-30-year lifespan
Concrete reservoirs	>500 kl >50-year lifespan

The major reservoir cost influencing factors include:

- Location and elevation
- Capacity
- Material and construction method
- Excavation and founding conditions.

Table 10: Showing the costs in Rand for various material options for ground reservoirs for different scheme sizes.

Material	Scheme size			
	Very small (R)	Small (R)	Medium (R)	Large (R)
	60 kl	300 kl	1300 kl	3200 kl
Brick	238,046	920,013	3,153,006	6,719,520
Concrete	253,302	873,266	4,164,378	5,391,393
Steel	222,396	946,677	3,542,759	7,969,435
PE	157,263	686,087	2,889,522	7,076,048

Costs from 2009 DWA cost benchmarks escalated to 2020 prices.

Table 11: Showing the range of maintenance costs in Rand per annum per household for various material options for ground reservoirs for different scheme sizes.

Material	Scheme size			
	Very small (R)	Small (R)	Medium (R)	Large (R)
	60 kl	300 kl	1300 kl	3200 kl
Brick	47.6	36.8	31.5	26.9
Concrete	25.3	17.5	13.5	10.8
Steel	66.7	56.8	53.1	47.8
PE	31.4	27.4	28.9	28.3

Costs from 2009 DWA cost benchmarks escalated to 2020 prices.

Table 12: Showing the range of operation costs in Rand per annum per household for various material options for ground reservoirs for different scheme sizes.

Material	Scheme size			
	Very small (R)	Small (R)	Medium (R)	Large (R)
	60 kl	300 kl	1300 kl	3200 kl
Brick	22.0	4.4	1.1	0.4
Concrete	22.0	4.4	1.1	0.4
Steel	22.0	4.4	1.1	0.4
PE	22.0	4.4	1.1	0.4

Costs from 2009 DWA cost benchmarks escalated to 2020 prices.

Table 13: Showing the range of costs in Rand for various material options for elevated reservoirs for different scheme sizes (indicative sampling indicates these are outside 30% range, actual supplier costs should be used).

Material	Scheme size			
	Very small (R)	Small (R)	Medium (R)	Large (R)
	32 kl	159 kl	635 kl	1588 kl
Steel	284,728	501,134	1,312,660	2,935,710
Concrete	711,813	1,252,829	3,281,803	7,339,266
PE	183,379	681,860	2,551,166	6,289,778

Costs from 2009 DWA cost benchmarks escalated to 2020 prices.

Table 14: Showing the range of maintenance costs in Rand per annum per household for various material options for elevated reservoirs for different scheme sizes.

Material	Scheme size			
	Very small (R)	Small (R)	Medium (R)	Large (R)
	32 kl	159 kl	635 kl	1588 kl
Steel	106.8	37.6	24.6	22.0
Concrete	85.4	30.1	19.7	17.6
PE	183.4	136.4	127.6	125.8

Costs from 2009 DWA cost benchmarks escalated to 2020 prices.

Table 15: Showing the range of operation costs in Rand per annum per household for various material options for elevated reservoirs for different scheme sizes.

Material	Scheme size			
	Very small (R)	Small (R)	Medium (R)	Large (R)
	32 kl	159 kl	635 kl	1588 kl
Steel	22.0	4.4	1.1	0.44
PE	44.0	8.8	2.2	0.88

Costs from 2009 DWA cost benchmarks escalated to 2020 prices.

4.1.4.2 Pump stations.

These are used to fill high elevated reservoirs, increase the pressure of water being conveyed, and to increase rate of supply to existing systems.

Pump stations combine a wide range of expertise from different fields of engineering such as civil engineering, mechanical engineering, and electrical engineering.

The following general factors have the greatest impact on the cost of pump stations:

- **Power supply:** Whether pumps are mechanically or electrically driven.

- **Capacity:** Pump capacity is mainly influenced by its ability to provide sufficient water supply. The required capacity of the pumpstation determines the size of the pumpstation and the energy requirement (Cooperative Governance and Traditional Affairs, 2010).
- **Other factors:** These include the required pump duty, operating head, and the cost of the pump house building.

Table 16: Showing the capital cost in Rand per household for a diesel pump station (low speed: 1450rpm, low head <90m) per scheme size (single pump only, duty standby is acceptable engineering norm).

Element	Scheme size			
	Very small (R/hh)	Small (R/hh)	Medium (R/hh)	Large (R/hh)
	2kW	8kW	33kW	82kW
Mechanical pump	51.1	33.9	23.9	18.9
Energy source	144.8	42.9	23.7	19.9
Pump pipework	46.5	31.6	22.6	18.2
Total per household	242.4	108.4	70.2	57

DWA Cost benchmark 2009 escalated to 2020 prices.

Table 17: Showing the capital cost in Rand per household for a diesel pumphouse building per scheme size (alternative approaches may be more practical).

Material	Scheme size				
	Very small	Small	Medium	Large	Large
	1NoPS (R/hh)	1NoPS (R/hh)	1NoPS (R/hh)	1NoPS (R/hh)	2NoPS (R/hh)
Prefabricated zinc	709.9	142	35.5	14.2	28.4
Brick	1,325.2	265	66.3	26.5	53.0
Concrete	1,610.2	322	80.5	32.2	64.4
Average pumphouse building cost per household	1,215.1	243	60.8	24.3	48.6

DWA Cost benchmark 2009 escalated to 2020 prices.

Table 18: Showing the maintenance cost in Rand per household for a diesel pump station per scheme size (per annum).

Element	Scheme size			
	Very small (1000 people) (R/hh)	Small (5000 people) (R/hh)	Medium (20000 people) (R/hh)	Large (50000 people) (R/hh)
Energy source	23.2	6.9	3.8	3.2
Mechanical pump	5.1	3.4	2.4	1.9
Pump pipework	0.5	0.3	0.2	0.2
Total per household	28.7	10.6	6.4	5.3

DWA Cost benchmark 2009 escalated to 2020 prices.

Table 19: Showing the operation cost in Rand per household for a diesel pump station per scheme size (per annum).

Element	Scheme size			
	Very small (1000 people) (R/hh)	Small (5000 people) (R/hh)	Medium (20000 people) (R/hh)	Large (50000 people) (R/hh)
Diesel	192.2	164.4	160	158.5

DWA Cost benchmark 2009 escalated to 2020 prices.

Table 20: Showing the capital cost in Rand per household for an electrically driven pump station (low speed: 1450rpm, low head <90m) per scheme size (a more practical estimation approach is appropriate).

Element	Scheme size			
	Very small (1000 people)	Small (5000 people)	Medium (20000 people)	Large (50000 people)
	1kW (R/hh)	4kW (R/hh)	17kW (R/hh)	42kW (R/hh)
Mechanical pump	31.8	18.2	11.3	8.2
Pump switchgear	77.9	20.4	9.6	7.4
Energy source	99.1	25.1	11.0	8.6
Pump pipework	28.2	19.2	13.8	11.0
Total	237.0	82.8	45.7	35.2

DWA Cost benchmark 2009 escalated to 2020 prices.

Table 21: Showing the capital cost per household for an electrically driven pumphouse building per scheme size (other estimation techniques may be more appropriate).

Material	Scheme size				
	Very small	Small	Medium	Large	Large
	1NoPS (R/hh)	1NoPS (R/hh)	1NoPS (R/hh)	1NoPS (R/hh)	2NoPS (R/hh)
Prefabricated zinc	709.9	142	35.5	14.2	28.4
Brick	1,325.2	265	66.3	26.5	53.0
Concrete	1,610.2	322	80.5	32.2	64.4
Average pumphouse building cost per household	1,215.1	243	60.8	24.3	48.6

DWA Cost benchmark 2009 escalated to 2020 prices.

Table 22: Showing the maintenance cost per household for an electrically driven pump station per scheme size.

Element	Scheme size			
	Very small (1000 people) (R/hh)	Small (5000 people) (R/hh)	Medium (20000 people) (R/hh)	Large (50000 people) (R/hh)
Energy Source	15.9	4.0	1.8	1.4
Pump switch gear	12.5	3.3	1.5	1.2
Mechanical pump	3.2	1.8	1.1	0.8
Pump pipework	0.3	0.2	0.1	0.1
Total	31.8	9.3	4.6	3.5

DWA Cost benchmark 2009 escalated to 2020 prices.

Table 23: Showing the operation cost per household for an electrically driven pump station per scheme size.

Element	Scheme size			
	Very small (1000 people) (R/hh)	Small (5000 people) (R/hh)	Medium (20000 people) (R/hh)	Large (50000 people) (R/hh)
Diesel	132.1	39.6	23.5	20.5

DWA Cost benchmark 2009 escalated to 2020 prices.

Table 24: Showing the capital cost per household for a diesel pump station (high speed: 2900rpm, high head >90m) per scheme size.

Element	Scheme size			
	Very small (1000 people)	Small (5000 people)	Medium (20000 people)	Large (50000 people)
	3kW (R/hh)	14kW (R/hh)	54kW (R/hh)	136kW (R/hh)
Mechanical pump	74.8	49.7	34.9	27.7
Energy source	156.4	54.4	35.3	31.5
Pump pipework	68.5	46.6	33.4	26.8
Total	299.7	150.7	103.6	86.0

DWA Cost benchmark 2009 escalated to 2020 prices.

Table 25: Showing the capital cost per household for a diesel pumphouse building per scheme size.

Material	Scheme size				
	Very small	Small	Medium	Large	Large
	1NoPS (R/hh)	1NoPS (R/hh)	1NoPS (R/hh)	1NoPS (R/hh)	2NoPS (R/hh)
Prefabricated zinc	709.9	142	35.5	14.2	28.4
Brick	1,325.2	265	66.3	26.5	53.0
Concrete	1,610.2	322	80.5	32.2	64.4
Avg. pumphouse building cost per household	1,215.1	243	60.8	24.3	48.6

DWA Cost benchmark 2009 escalated to 2020 prices.

Table 26: Showing the maintenance cost per household for a diesel pump station per scheme size.

Element	Scheme size			
	Very small (1000 people) (R/hh)	Small (5000 people) (R/hh)	Medium (20000 people) (R/hh)	Large (50000 people) (R/hh)
Energy Source	25.0	8.7	5.6	5.0
Mechanical pump	7.5	5.0	3.5	2.8
Pump pipework	0.7	0.5	0.3	0.3
Total	33.2	14.1	9.5	8.1

DWA Cost benchmark 2009 escalated to 2020 prices.

Table 27: Showing the operation cost per household for a diesel pump station per scheme size.

Element	Scheme size			
	Very small (1000 people) (R/hh)	Small (5000 people) (R/hh)	Medium (20000 people) (R/hh)	Large (50000 people) (R/hh)
Diesel	297.9	270.0	264.2	262.7

DWA Cost benchmark 2009 escalated to 2020 prices.

Table 28: Showing the capital cost per household for an electrically driven pump station (low speed: 2900rpm, high head >90m) per scheme size.

Element	Scheme size			
	Very small (1000 people)	Small (5000 people)	Medium (20000 people)	Large (50000 people)
	1kW (R/hh)	7kW (R/hh)	28kW (R/hh)	130kW (R/hh)
Mechanical pump	143.8	73.8	41.5	40.5
Pump switch gear	81.9	24.4	13.6	19.9
Energy source	103.5	29.4	15.6	29.3
Pump pipework	41.6	28.3	20.3	25.9
Total	370.8	155.8	91.0	115.6

DWA Cost benchmark 2009 escalated to 2020 prices.

Table 29: Showing the capital cost per household for an electrically driven pumphouse building per scheme size.

Material	Scheme size				
	Very small	Small	Medium	Large	Large
	1NoPS (R/hh)	1NoPS (R/hh)	1NoPS (R/hh)	1NoPS (R/hh)	2NoPS (R/hh)
Prefabricated zinc	709.9	142	35.5	14.2	28.4
Brick	1,325.2	265	66.3	26.5	53.0
Concrete	1,610.2	322	80.5	32.2	64.4
Average pumphouse building cost per household	1,215.1	243	60.8	24.3	48.6

DWA Cost benchmark 2009 escalated to 2020 prices.

Table 30: Showing the maintenance cost per household for an electrically driven pump station per scheme size.

Element	Scheme size			
	Very small (1000 people) (R/hh)	Small (5000 people) (R/hh)	Medium (20000 people) (R/hh)	Large (50000 people) (R/hh)
Energy source	16.6	4.7	2.5	4.7
Pump Switchgear	13.1	3.9	2.2	3.2
Mechanical pump	14.4	7.4	4.2	4.1
Pump pipework	0.4	0.3	0.2	0.3
Total	44.5	16.3	9.0	12.2

DWA Cost benchmark 2009 escalated to 2020 prices.

Table 31: Showing the operation cost per household for an electrically driven pump station per scheme size.

Element	Scheme size			
	Very small (1000 people) (R/hh)	Small (5000 people) (R/hh)	Medium (20000 people) (R/hh)	Large (50000 people) (R/hh)
Diesel	143.8	51.4	35.2	55.8

DWA Cost benchmark 2009 escalated to 2020 prices.

4.1.4.3 Supply pipelines

Bulk supply pipelines convey water from the source or pump station to the service reservoirs. They are sometimes also used to convey water from the service reservoirs to the edges of the villages they serve (Cooperative Governance and Traditional Affairs, 2010). Pipelines can be made of different materials such as uPVC, mPVC, HDPE, steel, glass reinforced plastic, and fibre cement. The choice of pipeline material to be used is highly

dependent on the quality of water available at the source and the cost of the pipeline material. Consequently, in South Africa, uPVC pipes are the most widely used pipes for water reticulation and bulk water supply.

The cost of supply pipelines is mainly dependant on:

- Pipe size
- Pipe class
- Pipe material
- Soil conditions
- Topography
- Labour

Significant costs are incurred when crossing roads and rivers and these need to be considered separately. Similarly, costs incurred in trench excavation in hard rock material also form a significant cost parameter. Extensive geological surveys need to be conducted to reveal the ground conditions adequately in order to avoid these unforeseen significant expenses and in some cases, appropriate machinery will need to be rented.

Table 32: Showing the capital cost per scheme size for Concrete (fibre-cement) pipeline.

Element	Scheme size			
	Very small (1000 people)	Small (5000 people)	Medium (20000 people)	Large (50000 people)
	5km (R)	8km (R)	17km (R)	32km (R)
Soft soil excavation	291,838.8	640,331.9	3,702,116.5	10,211,780.7
Moderate soil hardness (10% ripping)	379,391.3	832,432.0	4,791,766.1	13,275,316.1
Hard soil excavation (15% ripping, 5% blasting)	466,942.4	892,457.2	5,897,558.2	16,338,850.0
Average capital cost	379,391.3	832,432.0	4,791,766.1	13,275,316.1
Average capital cost per km	75,877.1	104,053.1	281,868.6	414,853.4

DWA Cost benchmark 2009 escalated to 2020 prices.

Table 33: Showing the maintenance cost per household for a Concrete pipeline per scheme size.

Element	Scheme size			
	Very small (1000 people) (R/hh)	Small (5000 people) (R/hh)	Medium (20000 people) (R/hh)	Large (50000 people) (R/hh)
Soft soil excavation	14.6	6.4	9.2	10.2
Moderate soil hardness (10% ripping)	19.0	8.3	12.0	13.3
Hard soil excavation (15% ripping, 5% blasting)	23.3	10.2	14.7	16.3
Average maintenance cost	19.0	8.3	12.0	13.3

DWA Cost benchmark 2009 escalated to 2020 prices.

Table 34: Showing the operation cost per household for a Concrete pipeline per scheme size.

Element	Scheme size			
	Very small (1000 people) (R/hh)	Small (5000 people) (R/hh)	Medium (20000 people) (R/hh)	Large (50000 people) (R/hh)
Soft soil excavation	22.0	7.0	3.7	2.8
Moderate soil hardness (10% ripping)	22.0	7.0	3.7	2.8
Hard soil excavation (15% ripping, 5% blasting)	22.0	7.0	3.7	2.8
Average operation cost	22.0	7.0	3.7	2.8

DWA Cost benchmark 2009 escalated to 2020 prices.

Table 35: Showing the capital cost per scheme size for uPVC pipeline.

Element	Scheme size			
	Very small (1000 people)	Small (5000 people)	Medium (20000 people)	Large (50000 people)
	5km (R)	8km (R)	17km (R)	32km (R)
Soft soil excavation	554,390.7	983,751.8	3,388,507.4	8,405,716.7
Moderate soil hardness (10% ripping)	720,708.3	1,278,876.4	4,405,059.3	10,927,432.0
Hard soil excavation (15% ripping, 5% blasting)	887,024.5	1,574,002.3	5,421,611.2	13,449,145.9
Average capital cost	720,708.3	1,278,876.4	4,405,059.3	10,927,432.0
Average capital cost per km	144,141.7	159,859.2	259,120.9	341,482.8

DWA Cost benchmark 2009 escalated to 2020 prices.

Table 36: Showing the unit costs for bulk water connector supply for different uPVC pipe diameters.

Province	110mm (R/meter)	160mm (R/meter)	250mm (R/meter)	315mm (R/meter)
Limpopo	496	619	1,005	1,385
Gauteng	460	569	918	1,268
North West	490	610	988	1,363
Free State	487	603	971	1,345
KwaZulu Natal	484	603	980	1,349
Mpumalanga	428	532	859	1,182
Northern Cape	502	627	1,017	1,403
Western Cape	541	674	1,095	1,513
Eastern Cape	494	614	996	1,374

DWA Cost benchmark 2009 escalated to 2020 prices.

Table 37: Showing the maintenance cost per household for uPVC pipelines per scheme size.

Element	Scheme size			
	Very small (1000 people) (R/hh)	Small (5000 people) (R/hh)	Medium (20000 people) (R/hh)	Large (50000 people) (R/hh)
Soft soil excavation	27.7	9.8	8.5	8.4
Moderate soil hardness (10% ripping)	36.0	12.8	11.0	10.9
Hard soil excavation (15% ripping, 5% blasting)	44.3	15.7	13.6	13.4
Average maintenance cost	36.0	12.8	11.0	10.9

DWA Cost benchmark 2009 escalated to 2020 prices.

Table 38: Showing the operation cost per household for uPVC pipelines per scheme size.

Element	Scheme size			
	Very small (1000 people) (R/hh)	Small (5000 people) (R/hh)	Medium (20000 people) (R/hh)	Large (50000 people) (R/hh)
Soft soil excavation	22.0	7.0	3.7	2.8
Moderate soil hardness (10% ripping)	22.0	7.0	3.7	2.8
Hard soil excavation (15% ripping, 5% blasting)	22.0	7.0	3.7	2.8
Average operation cost	22.0	7.0	3.7	2.8

DWA Cost benchmark 2009 escalated to 2020 prices.

Table 39: Showing the capital cost per scheme size for steel pipelines.

Element	Scheme size			
	Very small (1000 people)	Small (5000 people)	Medium (20000 people)	Large (50000 people)
	5km (R)	8km (R)	17km (R)	32km (R)
Soft soil excavation	1,128,347.5	2,154,413.3	7,997,314.4	18,689,576.6
Moderate soil hardness (10% ripping)	1,466,851.4	2,800,737.0	10,396,508.2	24,296,449.5
Hard soil excavation (15% ripping, 5% blasting)	1,805,355.2	3,447,060.6	12,795,701.9	29,903,322.3
Average capital cost	1,466,851.4	2,800,737.0	10,396,508.2	24,296,449.5
Average capital cost per km	193,370.9	350,092.7	611,558.6	759,264.0

DWA Cost benchmark 2009 escalated to 2020 prices.

Table 40: Showing the maintenance cost per household for steel pipelines per scheme size.

Element	Scheme size			
	Very small (1000 people) (R/hh)	Small (5000 people) (R/hh)	Medium (20000 people) (R/hh)	Large (50000 people) (R/hh)
Soft soil excavation	56.4	21.5	20.0	18.7
Moderate soil hardness (10% ripping)	73.3	28.0	26.0	24.3
Hard soil excavation (15% ripping, 5% blasting)	90.3	34.5	32.0	29.9
Average maintenance cost	73.3	28.0	26.0	24.3

DWA Cost benchmark 2009 escalated to 2020 prices.

Table 41: Showing the operation cost per household for steel pipelines per scheme size.

Element	Scheme size			
	Very small (1000 people) (R/hh)	Small (5000 people) (R/hh)	Medium (20000 people) (R/hh)	Large (50000 people) (R/hh)
Soft soil excavation	22.0	7.0	3.7	2.8
Moderate soil hardness (10% ripping)	22.0	7.0	3.7	2.8
Hard soil excavation (15% ripping, 5% blasting)	22.0	7.0	3.7	2.8
Average operation cost	22.0	7.0	3.7	2.8

DWA Cost benchmark 2009 escalated to 2020 prices.

Table 42: Showing the capital cost per scheme size for GRP pipelines.

Element	Scheme size			
	Very small (1000 people)	Small (5000 people)	Medium (20000 people)	Large (50000 people)
	5km (R)	8km (R)	17km (R)	32km (R)
Soft soil excavation	902,678.3	1,723,530.3	6,397,850.9	14,951,661.9
Moderate soil hardness (10% ripping)	1,173,480.5	2,240,589.3	8,317,205.9	19,437,159.3
Hard soil excavation (15% ripping, 5% blasting)	1,444,284.2	2,757,648.2	10,236,562.4	23,922,658.2
Average capital cost	1,173,480.5	2,240,589.3	8,317,205.9	19,437,159.3
Average capital cost per km	234,695.8	280,073.8	489,246.9	607,411.5

DWA Cost benchmark 2009 escalated to 2020 prices.

Table 43: Showing the maintenance cost per household per scheme size for a GRP pipeline.

Element	Scheme size			
	Very small (1000 people) (R/hh)	Small (5000 people) (R/hh)	Medium (20000 people) (R/hh)	Large (50000 people) (R/hh)
Soft soil excavation	45.1	17.2	16.0	15.0
Moderate soil hardness (10% ripping)	58.7	22.4	20.8	19.4
Hard soil excavation (15% ripping, 5% blasting)	72.2	27.6	25.6	23.9
Average maintenance cost	58.7	22.4	20.8	19.4

DWA Cost benchmark 2009 escalated to 2020 prices.

Table 44: Showing the operation cost per household for GRP pipelines per scheme size.

Element	Scheme size			
	Very small (1000 people) (R/hh)	Small (5000 people) (R/hh)	Medium (20000 people) (R/hh)	Large (50000 people) (R/hh)
Soft soil excavation	22.0	7.0	3.7	2.8
Moderate soil hardness (10% ripping)	22.0	7.0	3.7	2.8
Hard soil excavation (15% ripping, 5% blasting)	22.0	7.0	3.7	2.8
Average operation cost	22.0	7.0	3.7	2.8

DWA Cost benchmark 2009 escalated to 2020 prices.

4.1.4.4 Water distribution service delivery options and unit costs.

Table 45: Showing the unit costs for residential water supply per province.

Province	Communal standpipe (R/ standpipe)	Yard Taps (R/yard tap)	5000l yard tanks (R/ yard tank)	Roof tanks (R/roof tank)	House connections (R/household)
Limpopo	2,842	1,944	25,079	2,884	4,142
Gauteng	2,576	1,742	23,003	2,567	3,792
North West	2,773	1,887	24,635	2,812	4,071
Free State	2,716	1,839	24,098	2,705	3,998
KwaZulu Natal	2,773	1,895	24,710	2,819	4,044
Mpumalanga	2,504	1,720	22,583	2,431	3,555
Northern Cape	2,895	1,989	25,702	2,920	4,186
Western Cape	3,013	2,043	26,527	3,128	4,499
Eastern Cape	2,813	1,902	24,824	2,834	4,102

DWA Cost benchmark 2009 escalated to 2020 prices.

Table 46: Showing the unit maintenance costs for various options of residential water supply per household density.

Element	Material	Household density (houses per hectare)		
		5	15	40
House connection	Hard soil excavation (15% ripping; 5% blasting)	R 3,288.9	R 1,819.5	R 1,155.0
	Moderate soil hardness (10% ripping)	R 2,672.3	R 1,478.4	R 938.4
	Soft soil excavation	R 2,055.6	R 1,137.2	R 721.8
Yard connection	Hard soil excavation (15% ripping; 5% blasting)	R 2,158.5	R 1,178.9	R 735.8
	Moderate soil hardness (10% ripping)	R 1,753.8	R 957.8	R 597.9
	Soft soil excavation	R 1,349.0	R 736.8	R 459.9
Street tap	Hard soil excavation (15% ripping; 5% blasting)	R 719.8	R 352.4	R 186.3
	Moderate soil hardness (10% ripping)	R 584.8	R 286.4	R 151.4
	Soft soil excavation	R 449.9	R 220.3	R 116.4

DWA Cost benchmark 2009 escalated to 2020 prices.

Table 47: Showing the unit operation costs for various options of residential water supply per household density.

Element	Household density (houses per hectare)		
	5	**15**	**40**
House connection	R 5,494.3	R 5,494.3	R 5,494.3
Yard connection	R 2,113.2	R 2,113.2	R 2,113.2
Street tap	R 1,267.9	R 1,267.9	R 1,267.9
Total	R 8,875.4	R 8,875.4	R 8,875.4

DWA Cost benchmark 2009 escalated to 2020 prices.

4.1.4.5 Metering.

Metering, is essential in order to determine the number of households receiving free basic water and to accurately bill the households within the municipalities that use an amount of water in excess of the free basic water limit. Regulations require that:

- The quantity of water to be supplied to every user connection must be metered (Cooperative Governance and Traditional Affairs, 2010).
- A water meter must be supplied to every user connection (Cooperative Governance and Traditional Affairs, 2010).
- Water meter sizes should comply with the Trade Meteorology Act, 2018 (Department of Trade and Industry, 2018).
- A meter greater in size than the one specified by the Trade Meteorology Act, 2018, shall be deemed at any one of the specified flow rates when tested.

Metering costs can increase by as much as 40% in the event that training, meter management systems, and tokens are included.

Table 48: Showing the unit costs for domestic water supply meters per province.

Province	Domestic meters (15mm) (R)	Domestic meters (25mm) (R)	Domestic meters pre-paid (15mm) prepaid (R)
Limpopo	3,566	4,293	4,614
Gauteng	3,204	3,866	4,167
North West	3,482	4,193	4,509
Free state	3,362	4,053	4,363
KwaZulu Natal	3,491	4,204	4,520
Mpumalanga	3,049	3,682	3,975
Northern Cape	3,605	4,339	4,661
Western Cape	3,845	4,622	4,958
Eastern Cape	3,509	4,226	4,544

DWA Cost benchmark 2009 escalated to 2020 prices.

4.1.4.6 Management cost factors.

Additional cost influencing factors include:

- Institutional and social development.
- Professional fees
- Preliminary & general
- Contingencies
- VAT at 15%

4.1.4.7 Service planning considerations.

- Mixed service levels. It is important to have a range of services available on offer to consumers of a given municipality. This allows access to a given type of service based on the household's ability to pay, without encouraging them to migrate to different

regions in search of affordable service. When consumers are given the option of more convenient modes of service delivery, many experience an increase in willingness to pay as they opt for more convenience (Department of Water Affairs and Forestry, 2007).

- Importance of flow restriction. This is important as it allows people who cannot afford to pay more to have access to a basic supply of water. If flow is not limited, metering and billing is required in order to ensure that costs to provide water to the population do not exceed the municipality and local population's ability to pay for the service (Department of Water Affairs and Forestry, 2007).
- Metering. As mentioned previously, it is essential that unrestricted systems are metered. This reduces excessive water use and ensures that the volume of water being used is consistent with what the local authorities have budgeted to provide free of charge. The additional amount of water supplied needs to be known for accurate billing. If the excess water is not billed accurately, this could affect the long-term financial stability of the municipality as a whole. Installation of meters should be done after consultation with local authorities in order to ensure that the meters installed are accepted by the relevant communities (Department of Water Affairs and Forestry, 2007). Metering can be used in conjunction with measures such as rising block tariffs or credit control in order to accommodate the Free Basic Water policy, as well as adequately charge households using an amount of water in excess of the one provided free of charge.
- Appropriate design standards. This ensures that an acceptable quality of service is delivered to consumers, while keeping the costs down.

4.2 SANITATION SERVICES

4.2 Sanitation services.

4.2.1 DEFINITION.

These refer to the safe collection, storage, removal, treatment, and disposal of human, domestic, and industrial wastewater. It falls under the responsibility of the municipality to provide the necessary organizational framework to ensure appropriate health, hygiene, sanitation related awareness, operation, and maintenance of sanitation systems, monitoring of the quality and quantity of domestic and industrial discharge, billing and finally revenue collection for the sanitation services rendered.

4.2.2 PURPOSE.

Act 108 of the 1996 South African constitution realises the fact that everyone has a right to an environment that is not harmful to their health or well-being. Sanitation infrastructure should thus be safe, reliable, private, protected from the weather, ventilated, keep bad smells to the minimum, and be easy to keep clean. It should also enable safe and appropriate treatment, and removal of human waste and wastewater in a manner that minimizes the risk of spread of sanitation-related diseases.

These facilities must be situated where physical security can be guaranteed at all times of the day and night. Safe sanitation also requires adequate hygiene education and promotion (Human right to water and sanitation | International Decade for Action 'Water for Life' 2005-2015, 2014).

4.2.3 GEOGRAPHICAL CONTEXT.

The geographical context has impact on the type of sanitation service provided. The geographical location impacts on a number of layers such as physical location, topography, site access, water resource availability, population settlement pattern, and density.

4.2.4 SERVICE DELIVERY OPTIONS AND UNIT COSTS.

The costs displayed in the following tables for the different municipalities represent the maximum expected costs for the different service delivery options. These costs exclude VAT and professional services fees. The fees quoted in the tables simplify cost comparison and the process of budget allocation for the municipalities.

Table 49: Showing unit costs for domestic sanitation in the different provinces of South Africa.

Province	VIP toilets (single pit, fixed top structure)	VIP toilets (double pit, fixed top structure)	VIP toilets (single pit, movable top structure)	VIP toilets (double pit, movable top structure)	Onsite UDS	Septic tanks	Full water borne sanitation
	R/hh	R/hh	R/hh	R/hh	R/hh	R/hh	R/hh
Limpopo	11,986	11,997	12,304	12,852	10,914	16,975	13,422
Gauteng	10,844	10,894	11,126	11,613	9,902	15,569	12,256
Northwest	11,712	11,744	12,036	12,570	10,680	16,702	13,270
Free state	11,548	11,569	11,833	12,347	10,571	16,802	13,514
KwaZulu Natal	11,771	11,799	12,092	12,627	10,738	16,819	13,377
Mpumalanga	10,502	10,474	10,675	11,136	9,554	14,881	11,817
Northern Cape	12,195	12,167	12,485	13,039	11,093	17,208	13,562
Western Cape	12,734	12,798	13,162	13,756	11,615	18,126	14,357
Eastern Cape	11,801	11,834	12,128	12,666	10,762	16,830	13,372

DWA Cost benchmark 2009 escalated to 2020 prices.

4.2.4.1 Community Development Costs.

The costs associated with the community development assuming three house-to-house peer education visits are escalated for each component from the 2009 costs to the 2020 costs and are shown as follows:

Table 50: Showing the community development costs associated with provision of sanitation related services.

Province	Costs (R)
Limpopo	655
Gauteng	653
North West	650
Free State	655
Kwazulu Natal	652
Mpumalanga	651
Northern Cape	651
Western Cape	657
Eastern Cape	655

DWA Cost benchmark 2009 escalated to 2020 prices.

4.2.5 CONNECTOR SERVICES: SEWERAGE INFRASTRUCTURE.

Connector services are used to convey sewage from the domestic households to the wastewater treatment facilities. Sewer pipelines are buried below the ground to protect them from surface loads and are usually several kilometres long, in a manner similar to water supply pipelines and stormwater pipelines.

The cost of sewer pipelines is mainly determined by:

- Pipe size

- Pipe class
- Pipe material
- Excavation conditions
- Access
- Topography
- Labour availability, etc

Additional costs incurred in the construction of sewerage pipelines include bush clearing, markers, and servitudes. These additional costs constitute approximately 1% of the total pipeline cost and should be accounted for. Exceptional costs incurred when crossing roads and rivers need to be separately considered and accounted for as well, as these are site specific (Cooperative Governance and Traditional Affairs, 2010).

Table 51: Showing unit costs of uPVC sewer pipelines (poor correlation with sampled projects, expect high deviations).

Province	75mm	90mm	110mm	160mm	250mm	315mm	400mm	500mm
	R/m	R/m	R/m	R/m	R/m	R/m	R/m	R/m
Limpopo	469	479	485	554	850	1,017	1,204	1,413
Gauteng	451	460	466	527	790	939	1,106	1,291
North West	468	479	485	552	840	1,003	1,186	1,389
Free State	482	491	497	562	840	996	1,172	1,367
KwaZulu Natal	454	464	470	538	827	990	1,173	1,377
Mpumalanga	409	418	423	481	731	871	1,029	1,205
Northern Cape	474	485	491	561	860	1,029	1,219	1,430
Western Cape	517	528	535	610	931	1,112	1,315	1,541
Eastern Cape	472	482	488	556	847	1,011	1,195	1,140

DWA Cost benchmark 2009 escalated to 2020 prices.

Table 52: Showing cost of bulk wastewater reticulation.

Item	Very small	Small	Medium	Large	Cluster
Sewage outflow (kl/erf)	0.6	0.7	0.5	0.8	0.6
Stands/ 1Ml/ day Flow	1,667	1,429	1,250	1,250	1,667
Cost/ Ml/ day (R)	6,603,750	6,603,750	6,603,750	6,603,750	6,603,750
Cost/ stand (excluding cost of top structure) (R)	3,961	4,621	5,283	5,283	3,961

2009 Costs escalated to 2020 costs using appropriate CPAF.

4.2.6 BULK SERVICES: SEWERAGE INFRASTRUCTURE.

These consist of mainly sewage pump stations and treatment works.

4.2.6.1 Sewage pump stations.

For the most part, gravity sewage reticulation is preferred, however, in cases where a gravity connection to municipal sewers cannot be envisaged, pumped sewage can be used. Sewer pump stations should be as simple as possible, and as far as possible from existing residential areas to minimise community impact through noise, odours, and spillages in the event of pump failure. Reasonable considerations should be made in order to minimise pollution of the environment through wastewater overflows and spillages except under the most extreme circumstances (Cooperative Governance and Traditional Affairs, 2010).

The following considerations should be made when locating the pumpstations:

- Minimum negative impact to the environment,
- Minimum user inconvenience in terms of noise level, operation, and maintenance,
- Minimum event impact if anything goes wrong,
- Must be above the 1:50-year flood line and preferably above the 1:100-year flood line of any watercourse to prevent being submerged in the event of a flood (Cooperative Governance and Traditional Affairs, 2010).

Pumps should be designed to handle the peak flow conditions, with at least one reserve pump and generator. Each pump should be capable of handling the peak flow conditions. Each pump should be able to empty the sump plus handle average inflow in less than 30 minutes (Cooperative Governance and Traditional Affairs, 2010). The table below shows the unit costs of wastewater pump stations.

Pump station type	Cost type	Element	Scheme size			
			Very small (1000 people) (R)	Small (5000 people) (R)	Medium (20000 people) (R)	Large (50000 people) (R)
			2kW	8kW	33kW	82kW
Diesel Driven (Low speed, 1450 rpm, <90m head)	Capital cost per household	Mechanical pump	60.3	40.0	28.2	22.3
		Energy source	170.9	50.6	28.0	23.5
		Pump pipework	54.9	37.3	26.7	21.5
		Total capital cost per household	286.0	127.9	82.9	67.2
	Building cost depending on type of structure	Prefabricated/ zinc	837.7	167.5	41.9	16.8
		Brick	1563.7	312.7	78.2	31.3
		Concrete	1900.1	380.0	95.0	38.0
	Maintenance cost per household	Energy source	27.3	8.1	4.5	3.8
		Mechanical pump	6.0	4.0	2.8	2.2
		Pump pipework	0.6	0.4	0.3	0.2
		Total maintenance cost per household	33.9	12.5	7.6	6.2
	Operating cost	Diesel	226.8	193.9	188.7	187.0

Pump station type	Cost type	Element	Scheme size			
			Very small (1000 people) (R)	Small (5000 people) (R)	Medium (20000 people) (R)	Large (50000 people) (R)
			2kW	8kW	33kW	82kW
Electrical Driven (Low speed, 1450 rpm, <90m head)	Capital cost per household	Mechanical pump	37.5	21.5	13.3	9.7
		Pump switchgear	91.9	24.1	11.3	8.8
		Energy source	116.9	29.6	13.0	10.1
		Pump pipework	33.3	22.6	16.2	13.0
		Total capital cost per household	279.6	97.7	53.9	41.6
	Building cost depending on type of structure	Prefabricated/ zinc	837.7	167.5	41.9	16.8
		Brick	1563.7	312.7	78.2	31.3
		Concrete	1900.1	380.0	95.0	38.0
	Maintenance cost per household	Energy source	18.7	4.7	2.1	1.6
		Pump switchgear	14.7	3.8	1.8	1.4
		Mechanical pump	3.7	2.1	1.3	1.0
		Pump pipework	0.3	0.2	0.2	0.1
		Total maintenance cost per household	37.5	10.9	5.4	4.1
	Operating cost per household	Electricity	155.8	46.8	27.7	22.5

2009 Costs escalated to 2020 prices.

4.2.6.2 Conventional Wastewater Treatment Plants.

When wastewater arrives at the treatment plants, it needs to be screened to remove inorganic solids such as stones, plastics, and the like. It then needs to pass through de-gritters to remove sand and grit. The screened wastewater then undergoes primary and secondary treatment in which processes are undertaken to biologically treat the wastewater. The water is then treated to the prescribed standards and disposed of in a nearby river, watercourse, or sea outfall. Sludge is then treated as well and disposed of accordingly (Cooperative Governance and Traditional Affairs, 2010).

Sludge treatment processes include gravity settlement and thickening, aerobic digestion, anaerobic digestion, conditioning, and dewatering. Treated sludge is ultimately disposed of in the following ways:

- Agricultural use,
- Landfills and land reclamation,
- Marine disposal,
- And Incineration (Cooperative Governance and Traditional Affairs, 2010).

The table below shows the wastewater treatment plant costs per household for various scheme sizes.

Table 53: Showing the total cost of conventional wastewater treatment plants per household per scheme size (significant variations to be expected due to complexity of treatment).

Element	Scheme size			
	Very small (1000 people)	Small (5000 people)	Medium (20000 people)	Large (50000 people)
	300 kl/day	1,000 kl/day	6,000 kl/day	10,000 kl/day
Civil works	9,094 R/hh	6,062 R/hh	7,794 R/hh	5,196 R/hh
Electrical equipment	1,818 R/hh	1,212 R/hh	1,558 R/hh	1,039 R/hh
Mechanical equipment	2,728 R/hh	1,818 R/hh	2,338 R/hh	1,558 R/hh
Pipework	1,516 R/hh	1,011 R/hh	1,299 R/hh	866 R/hh
Total	15,156 R/hh	10,104 R/hh	12,989 R/hh	8,660 R/hh

2009 Costs escalated to 2020 prices.

Table 54: Showing the maintenance cost per household for conventional wastewater treatment plants.

Element	Scheme size			
	Very small (1000 people)	Small (5000 people)	Medium (20000 people)	Large (50000 people)
	300 kl/day	1000 kl/day	6000 kl/day	10000 kl/day
Civil works	27 R/hh	18 R/hh	23 R/hh	16 R/hh
Electrical equipment	22 R/hh	15 R/hh	19 R/hh	12 R/hh
Mechanical equipment	39 R/hh	26 R/hh	34 R/hh	22 R/hh
Pipework	2 R/hh	1 R/hh	1 R/hh	1 R/hh
Total	90 R/hh	60 R/hh	77 R/hh	51 R/hh

2009 Costs escalated to 2020 prices.

Table 55: Showing the operation costs per household for conventional wastewater treatment plants.

Element	Scheme size			
	Very small (1000 people)	Small (5000 people)	Medium (20000 people)	Large (50000 people)
	300 kl/day	1,000 kl/day	6,000 kl/day	10,000 kl/day
Civil works	0 R/hh	0 R/hh	0 R/hh	0 R/hh
Electrical equipment	282 R/hh	188 R/hh	282 R/hh	188 R/hh
Mechanical equipment	169 R/hh	113 R/hh	169 R/hh	113 R/hh
Pipework	113 R/hh	75 R/hh	113 R/hh	75 R/hh
Total	564 R/hh	376 R/hh	564 R/hh	376 R/hh

2009 Costs escalated to 2020 prices.

Table 56: Showing the unit typical costs (R/Ml) of wastewater treatment plants per province in South Africa (Table to be used with caution, specialist input necessary).

Province	Type of treatment			
		Primary and secondary treatment	Primary, secondary, and tertiary treatment with nutrient removal	Primary, secondary, tertiary, and advanced treatment removal of suspended solids
Limpopo	Min	R 9,935,440	R 13,661,230	R 14,903,160
	Max	R 11,039,377	R 15,179,145	R 16,559,066
	Ave	R 10,487,409	R 14,420,187	R 15,731,112
Gauteng	Min	R 8,182,689	R 11,251,197	R 12,274,033
	Max	R 9,091,876	R 12,501,331	13,637,816
	Ave	R 8,637,284	R 11,876,265	R 12,955,924
North West	Min	R 9,640,146	R 13,255,200	R 14,460,218
	Max	R 10,711,272	R 14,727,999	16,066,908
	Ave	10,175,708	R 13,991,599	R 15,263,563
Free State	Min	R 8,602,229	R 11,828,065	R 12,903,343
	Max	R 9,558,032	R 13,142,294	R 14,337,048
	Ave	R 9,080,131	R 12,485,180	R 13,620,196
KwaZulu Natal	Min	R 7,961,057	R 10,946,452	R 11,941,585

	Max	R 8,845,618	R 12,162,725	R 13,268,427
	Ave	R 8,403,337	R 11,554,589	R 12,605,006
Mpumalanga	Min	R 9,539,993	R 13,117,491	R 14,309,989
	Max	R 10,599,993	R 14,574,989	R 15,899,988
	Ave	R 10,069,993	R 13,846,239	R 15,104,989
Northern Cape	Min	R 10,460,161	R 14,382,720	R 15,690,240
	Max	R 11,622,401	R 15,980,801	R 17,433,601
	Ave	R 11,041,281	R 15,181,761	R 16,561,920
Western Cape	Min	R 9,618,471	R 13,225,398	R 14,427,707
	Max	R 10,687,191	R 14,694,887	R 16,030,785
	Ave	R 10,152,830	R 13,960,143	R 15,229,246
Eastern Cape	Min	R 8,278,473	R 11,382,899	R 12,417,709
	Max	R 9,198,303	R 12,647,666	R 13,797,454
	Ave	R 8,738,388	R 12,015,283	R 13,107,581
National	**Ave**	**R 9,643,451**	**R 13,259,745**	**R 14,465,176**

2009 Costs escalated to 2020 prices.

The table above is simplistic as there are a wide range of choices in technology at each of the treatment stages, caution should be exercised when using the table. The key point to note is that the more advanced the treatment, the higher the CAPEX and OPEX and this should be carefully considered.

4.2.6.3 Package Treatment Plants.

For package treatment plants, delivery, installation, commissioning, and prerequisite site works are included in the costing in order to allow cost comparisons with activated sludge works and ponds. Delivery, installation, and commissioning of package plants typically amounts to about 10%, while prerequisite works amount to about 5% of the plant standalone price (Cooperative Governance and Traditional Affairs, 2010).

Table 57: Showing the unit costs per kl for package wastewater treatment plants in the different provinces of South Africa.

Province	Type of treatment			
	Range	20 kl- 50kl (R/kl)	50 kl- 100kl (R/kl)	500 kl- 1 Ml (R/kl)
Limpopo	Min	R 7,093	R 6,180	R 5,375
	Max	R 25,304	R 13,354	R 10,846
	Ave	R 16,199	R 9,767	R 8,110
Gauteng	Min	R 4,886	R 5,102	R 4,437
	Max	R 20,892	11,026	R 8,954
	Ave	R 12,890	R 8,064	R 6,696
North West	Min	R 5,722	R 4,979	R 4,330
	Max	R 24,614	R 12,990	R 10,549
	Ave	R 12,054	R 8,429	R 5,990
Free State	Min	R 6,165	R 5,364	R 4,667
	Max	R 21,962	R 11,593	R 9,414

	Ave	R 14,064	R 8,478	R 7,041
KwaZulu Natal	Min	R 6,391	R 5,561	R 4,836
	Max	R 22,765	R 12,016	R 9,758
	Ave	R 14,578	R 8,788	R 7,297
Mpumalanga	Min	R 7,092	R 6,178	R 5,374
	Max	R 25,297	R 13,351	R 10,842
	Ave	R 16,195	R 9,765	R 8,108
Northern Cape	Min	R 7,496	R 6,523	R 5,673
	Max	R 26,706	R 14,095	R 11,447
	Ave	R 17,102	R 10,308	R 8,560
Western Cape	Min	R 6,894	R 5,997	R 5,218
	Max	R 24,556	R 12,962	R 10,525
	Ave	R 15,725	R 9,480	R 7,871
Eastern Cape	Min	R 5,991	R 5,213	R 4,534
	Max	R 21,346	R 11,264	R 9,148
	Ave	R 13,669	R 8,239	R 6,842
National	Ave	**R 14,719**	**R 9,035**	**R 7,390**

2009 Costs escalated to 2020 prices.

4.3 PUBLIC TRANSPORT

4.3 Public Transport

4.3.1 INTRODUCTION.

Buses and minibus taxis are two of the most common means of public transportation used in South Africa. Bus shelters and taxi ranks provide important holding areas, boarding, and alighting points for passengers within the different municipalities in the country (Cooperative Governance and Traditional Affairs, 2010). It is thus important to ensure adequate safety of public transport users at these points through the provision of appropriate infrastructure.

4.3.2 PURPOSE.

The infrastructure provided aims to provide:

- Effective and safe passenger boarding points,
- Shelter for the commuters from the elements,
- Health and welfare comforts like access to ablution facilities and market stalls (Cooperative Governance and Traditional Affairs, 2010).

4.3.3 PUBLIC TRANSPORT INFRASTRUCTURE SERVICE OPTIONS & UNIT COSTS.

Table 58: Showing unit costs of public transport infrastructure.

Province	Bus shelters for bus ranks	Bus shelters for streets	Paved sidewalk	Gravel sidewalk
	R/sqm	R/sqm	R/sqm	R/sqm
Limpopo	3,561	3,561	258	160
Gauteng	3,327	3,354	243	150
North West	3,054	3,054	221	137
Free State	3,495	3,495	253	157
KwaZulu Natal	3,276	3,306	239	148
Mpumalanga	3,492	3,492	253	157
Northern Cape	3,542	3,542	256	159
Western Cape	3,754	3,754	272	168
Eastern Cape	3,822	3,822	277	171

2009 Costs escalated to 2020 prices.

4.4 EMERGENCY SERVICES

4.4 Emergency services.

These are mainly with regards to firefighting services and disaster preparedness and management.

4.4.1 DEFINITION.

Matters concerning the protection of people and the environment from significant danger, injury, damage, or harm fall under the umbrella of public safety. Such damage could occur in events of natural disasters and it is the duty of the local authorities to provide adequate protection for citizens from these events. In response to the need to have adequate safety, bodies such as the police, fire, and emergency medical services have been set up.

The term disaster management refers to the continuous, integrated, multi-sectorial, and multi-disciplinary process of planning and implementation of measures aimed at:

- Reducing risk of disasters,
- Mitigating severity of disasters,
- Emergency preparedness,
- Rapid response to disaster,
- Post disaster recovery and rehabilitation (Cooperative Governance and Traditional Affairs, 2010).

4.4.2 GEOGRAPHICAL CONTEXT.

Emergency services are dependent on the area in terms of settlement pattern, topography, physical and economic activities, and extent of development. Areas are then classified according to the likelihood of occurrence of a disaster prior to planning for the delivery of adequate services to deal with such disasters if they occur (Cooperative Governance and Traditional Affairs, 2010).

4.4.3 EMERGENCY SERVICES.

4.4.3.1 Firefighting services.

The main aim is to prevent fire and to protect life and property in the event of a fire. The two essential parts of firefighting services include the provision of adequate water supply and an efficient fire service.

4.4.3.2 Disaster management facilities.

The minimum requirements needed to ensure the proper functioning of municipal, provincial and district disaster management centres are:

- A disaster operation centre for facilitation of disaster risk management planning and operations and multidisciplinary strategic management of disaster operations,
- An integrated information management and communication system,
- A central communications centre, including the establishment of a 24-hour communication facility,
- Media and information service that allows for two-way communication within communities and amongst individuals,
- An education, training, and research facility,
- Adequate office accommodation, and facilities for operational personnel (Cooperative Governance and Traditional Affairs, 2010).

4.4.5 EMERGENCY SERVICES UNIT COSTS.

Table 59: Showing the unit costs of emergency services infrastructure.

Province	Offices for staff	Small conference room	Ablution facilities	Small kitchen
	R/sqm	R/sqm	R/sqm	R/sqm
Limpopo	6,630	6,507	7,121	7,735
Gauteng	6,245	6,129	6,707	7,285
North West	5,686	5,581	6,107	6,634
Free State	6,508	6,387	6,990	7,592
KwaZulu Natal	6,156	6,042	6,612	7,182

Mpumalanga	6,502	6,382	6,984	7,586
Northern Cape	6,595	6,473	7,083	7,694
Western Cape	6,990	6,860	7,507	8,155
Eastern Cape	7,116	6,985	7,643	8,302

2009 Costs escalated to 2020 prices.

4.5 STREET LIGHTING

4.5 Street/ Community Lighting.

4.5.1 DEFINITION

Eskom is accountable for the generation and distribution of bulk electricity, however the Systems Act (Act No.32 of 2000) institutes municipalities as the service authorities. Therefore, municipalities are responsible for distributing electricity in their areas of jurisdiction liable to the legislation and regulation by the provincial and national government.

4.5.2 PURPOSE

The aim of street lighting is to ensure that the community members move safely and easily at night. Furthermore, it acts as a protective measure to protect the public and the local authority's land.

4.5.3 GEOGRAPHICAL CONTEXT

Street lighting can only be provided where development has occurred due to the requirement of presence of the electrical reticulation service to ease the installation of streetlights. Therefore, street lighting is mainly a feature of urban areas.

4.5.4 STREET LIGHTS SERVICE DELIVERY OPTIONS & UNIT COSTS

The unit costs for the provision of high mast lighting and street lighting are provided below:

Table 60: Shows the unit costs in Rand for the various options of Street / Community Lighting, as calculated by escalating the Industry Guide 2010-unit costs to December 2020 equivalent - detailed breakdown of component costs is as depicted in Appendix 2:

Street / Community Lighting		
Province	**R / streetlight**	**R / high mast light**
Limpopo	13,002.7	352,993.3
Gauteng	11,771.1	319,563.7
North West	12,299.1	333,892.0
Free State	12,977.7	352,322.1
KwaZulu Natal	12,564.0	341,093.6
Mpumalanga	12,568.3	341,209.4
Northern Cape	12,134.7	329,425.0
Western Cape	13,308.4	361,296.4
Eastern Cape	12,353.9	335,355.2

2009 Costs escalated to 2020 prices.

4.6 SOLID WASTE DISPOSAL

4.6 Solid waste disposal.

4.6.1 BASIC LEVEL OF SERVICE

Basic solid waste disposal is defined as the most suitable waste removal service level in accordance with local conditions. In medium density settlements central collection points might be befitting, while kerbside removal will be appropriate for high density settlements.

4.6.2 LEVEL OF SERVICE OPTIONS (COLLECTION)

It is the responsibility of local authorities to make sure that a basic level of service to the communities they represent is provided. Collection may be performed by the local government, a local authority, a conventional contractor, or an aspiring businessman. Therefore, multiple variables have to be taken into account when choosing the best plan to handle solid waste for a neighbourhood, all of which influence the management and dismantling of waste options.

The options include:

- Basic: Household transfer to communal collection points; refuse in collection points is then transported to licensed landfill sites.
- Intermediate: Organized transfer to communal collection points; refuse in collection points is transported to lincensed landfill sites.
- Full: Kerb-side collection to licensed licensed landfill sites once a week.

4.6.2.1 Household transfer to communal skips (Basic level of service)

Individual household must bring their own solid waste to the communal collection point in their neighbourhood where skips are provided. The skips are then transferred to a landfill site where they are discharged by the municipality, or the contractor hired by the municipality. This basic service option ranges between: R15 – R27/month/household.

Table 61: Solid Waste Disposal – Household Transfer to Communal Skips

Advantages	Disadvantages
• **Affordable operating cost**	• In areas where distance between communal collection point and the settlement is long, residents dump their refuse waste in the streets.
• **Effortless system**	• The communal collection points may be untidy and unsanitary.

4.6.2.2 Organized transfer to communal skips (Intermediate level of service)

Contractors are hired to collect the household waste door-to-door in the area and transport it to a communal collection point by hand/bicycle-carts/truck. The waste is then transported to a landfill site by either the municipality or another contractor. This intermediate service option ranges between: R24-R31/month/household.

Table 62: Solid Waste Disposal – Organised transfer to Communal Skip

Advantages	Disadvantages
• **Favourable for households.**	• Contractor may be unskilled and require training and supervision.
• **Opportunity for job creation for locals**	• The communal collection points may be untidy and unsanitary.

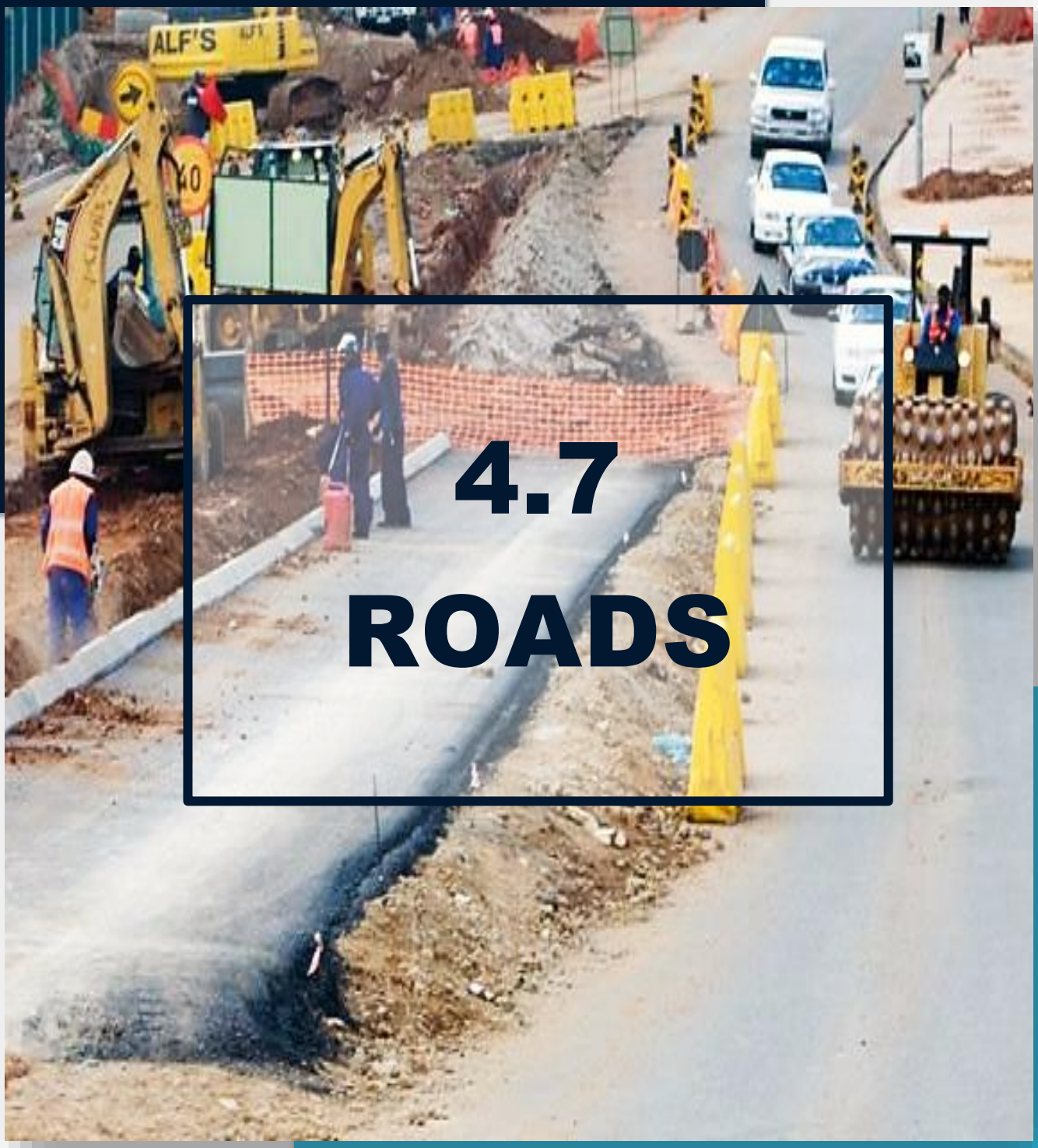
4.6.2.3 Kerb-side collection (Full level of service)

This level of service regarded as the superlative mechanism for waste collection in greater part of the more advanced communities. The household waste is collected from the kerbside by the aid of specially designed collection compactor vehicles and conveyed directly to final disposal points or via transfer station. The kerb-side collection service is

carried out once or twice a week. The full-service ranges between: R98 – R119/month/household, bin rental at R10 – 16/month.

Table 63: Solid Waste Disposal – Kerb side collection

Advantages	Disadvantages
• **Favourable for households**	• Pricier option
• **Does not require storage of waste at communal collection points**	• Needs a considerable expenditure in specialized equipment/vehicles.



4.7 ROADS

4.7 Roads

4.7.1 INTRODUCTION

Roads are divided into the RIFSA Functional Road Classification System, with only Classes 3 to 5 being relevant to municipal roads. Costs are differentiated between types of road (paved, gravel, graded) with stormwater drainage included in road costs (culverts and open drains alongside road). Any additional piped stormwater costs are applied to the basic road costs.

4.7.2 ROADS - SERVICE DELIVERY OPTIONS & UNIT COSTS

Table 64: National average unit Costs per km for different types of Roads.

With stormwater	National Average Cost price per km of road
Graveled roads (width 4.5 - 6 meters)	R 625,000
Chip and Spray (width 4.5 - 6 meters)	R 5,512,000
Paved/Sealed (6 meters wide)	R 7,734,000

2009 Costs escalated to 2020 prices.

Table 65: Unit costs per km of different road types in the different provinces of South Africa.

Infrastructure: Roads					
Province	Unpaved Gravel Rural	Unpaved Gravel Urban	Paving Blocks Urban	Paved Chip and Spray Urban	Paved Bitumen Premix Urban
	R/km	R/km	R/km	R/km	R/km
Gauteng	713,700	635,236	5,261,067	5,447,636	6,934,455
Eastern Cape	812,320	722,815	5,983,345	6,195,527	7,886,467
Limpopo	756,938	673,721	5,575,775	5,773,504	7,349,262
Free State	742,776	661,116	5,471,105	5,665,122	7,211,299
KwaZulu Natal	702,711	625,455	5,182,462	5,366,244	6,830,848
Mpumalanga	742,321	660,710	5,476,020	5,670,212	7,217,778
Northern Cape	777,411	691,943	5,734,127	5,937,471	7,557,980
North West	649,014	577,501	4,788,972	4,958,799	6,312,200
Western Cape	797,572	709,886	5,869,724	6,077,877	7,736,707

2009 Costs escalated to 2020 prices.

4.8 STORM WATER

4.8 Stormwater

4.8.1 DEFINITION.

Stormwater is the accumulation of rain and other forms of precipitation after it has fallen and the consequential flow/runoff from higher to lower ground in the process of reaching streams and rivers.

4.8.2 PURPOSE OF STORMWATER INFRASTRUCTURE.

The purpose of providing stormwater infrastructure is to manage the volume, flow velocity and direction of accumulated stormwater. Run-off water must be controlled to acceptable levels in order to minimize the damaging effect that stormwater may have on the environment, property and other existing infrastructure.

The volume of stormwater encountered is dependent on rainfall. Stormwater is expressed in terms of re-occurrence/ return period.

Uncontrolled stormwater severely impacts access and therefore is closely linked and planned with road construction. Stormwater is also being increasingly seen as an alternative source of water, through stormwater harvesting and other innovations.

4.8.3 STORMWATER SERVICE DELIVERY OPTIONS & UNIT COSTS.

Table 66: Unit Costs - Stormwater

Infrastructure: Stormwater							
Province	**Unlined rural (R/km)**	**Lined (R/km)**	**Pipe culverts (R/km)**	**Box culverts (R/km)**	**Dewatering (R/km)**	**Gabions (R/m³)**	**Reno mattresses R/m³**
Gauteng	347.4	1,153.1	5,442.8	25,671.4	567.3	2,012.8	2,618.8
Eastern Cape	395.1	1,311.4	6,173.2	29,116.5	643.5	2,272.8	2,959.0
Limpopo	368.2	1,222.0	5,745.6	27,142.4	599.8	2,123.8	2,764.1
Free State	361.3	1,199.1	5,644.6	26,623.8	586.4	2,084.6	2,712.7
KwaZulu Natal	342.2	1,135.8	5,367.7	25,317.1	559.5	1,986.0	2,583.8
Mpumalanga	361.6	1,200.2	5,677.9	26,780.4	591.8	2,096.5	2,728.3
Northern Cape	378.6	1,256.7	5,941.9	28,025.5	619.4	2,190.4	2,851.3
North West	316.2	1,095.0	4,969.3	23,438.0	518.0	1,844.2	2,398.2
Western Cape	387.6	1,286.4	6.040.4	28,430.1	629.6	2,225.5	2,897.2

2009 Costs escalated to 2020 prices.

ANALYSIS OF RESULTS

5 ANALYSIS OF RESULTS.

5.1 Regional variation.

From the calculated results, it was observed that there were significant price differences in the infrastructure asset components across the different provinces under consideration. The data on hand suggested that the price differences were mainly as a result of:

- Difference in level of competition between different material and plant suppliers across the country. This has an effect because there is a tendency of suppliers to reduce their margins in market situations where there is tough competition in order to optimise sales. As the market competitiveness across the different provinces is different, it is expected that the unit costs of the same item might be different as one moves from one province to another.
- The difference in levels of availability of skilled labour across the different provinces of South Africa, coupled with the inflation of the price of a representative basket of market commodities in a non-uniform manner across all provinces has led to equally non-uniform Contract Price Adjustment Factors (CPAF) across the provinces. This implies that even if there was a case where the unit cost of a given commodity was the same across all provinces in the base year, the escalated cost would differ across the different provinces to reflect this non-uniform change in the labour index.
- Regional disparities with regard to access to local suppliers of asset components also contributes to price differences.
- The other source of difference is the cost of transportation of materials whose suppliers are only present in well-resourced provinces.

5.2 Implication of results.

5.2.1 LOCAL GOVERNMENT EQUITABLE SHARE ALLOCATION.

Local Government (the 257 municipalities) is entitled to an equitable share of nationally collected revenue in order to ensure the provision of basic services (Fanoe and Kenyon,

2015). This equitable share is allocated using the Local Government Equitable Share (LGES) formula across the different municipalities of South Africa. This LGES formula is given by:

$$\boldsymbol{LGES} = \boldsymbol{BS} + \big((\boldsymbol{I} + \boldsymbol{CS}) \times \boldsymbol{RA}\big) \pm \boldsymbol{C} \quad - \text{Eqn (8)}$$

Where BS= Basic services component

I= Institutional component

CS= Community services component

RA= Revenue Adjustment factor

C= Correction Factor

(Fanoe and Kenyon, 2015).

The BS component accounts for the free delivery of free basic services that include water, sanitation, waste disposal, and electricity, while the second part of the equation accounts for institutional administrative costs and community services for municipalities that have not showcased the required capacity to generate this revenue on their own.

The price difference of the different infrastructure asset components across different provinces implies that there will be a significant effect on the outputs from the LGES allocation. This is because the BS component is now expected to vary according to both the number of indigent households in the municipalities and also according to the unit prices of the different asset components across the provinces in the country. Historically, the BS component would only vary according to the number of indigent households within the municipality as prices of provision of a complete suite of basic services were assumed to be constant across all municipalities in the nation (Fanoe and Kenyon, 2015). The data obtained however, suggests that this is not true as there are notable variables from one province to another. Research needs to be undertaken to ascertain the effect of intra-provincial differences.

Factoring the interprovincial infrastructure cost variances would make the LGES more equitable; increasing the probably of municipalities fulfilling their basic service obligations, as the subsidy would be more cost-reflective.

5.2.2 INDIGENT HOUSEHOLDS.

The household growth within a municipality has a great effect on the capital, operation, and maintenance funding needs to ensure provision of basic services to the indigent households. The Equitable Share formula is based on the number of indigent households as well as the cost of provision of these services per household; it is therefore critical to not only have credible data with regard to the number of indigent households in the municipality, but also the cost of basic services. This guide aims to contribute towards improving the credibility of data for the cost of provision of these basic services; while growth figures should be applied to the 2011 census in order to get an indication of the current number of indigent households within a municipality and backlogs associated with the provision of a given service (SALGA, 2015).

5.2.3 LIFE-CYCLE COSTING.

Life-Cycle costing refers to the aggregation of costs during the life cycle of an offering (Kambanou, 2020). When considering the long term economic, social, or environmental viability of a project during its design life; it is important to consider the entire life cycle of the infrastructure put in place. The life-cycle costing method using Net Present Values (NPVs) aims to aid decision makers in determining the viability of proposed projects in order to compare different alternatives and get a measure of the most value-for-money (read: optimal) investment.

The formula used to calculate the NPV is:

$$\boldsymbol{NPV} = \left(\sum_{\boldsymbol{t=1}}^{\boldsymbol{T}} \frac{\boldsymbol{C_t}}{\boldsymbol{(1+r)^t}}\right) - \boldsymbol{C_0} \quad - \text{Eqn (9)}$$

Where C_t = Net cash inflow

r= Discount rate

C_0= Initial total investment

(Net Present Value, 2021).

In using this formula, it is important to have a reliable source of data. Chapters within this document estimate the capital cost needs for different infrastructure projects excluding

professional service fees and VAT. Once these professional services and VAT fees are added to the initial developed capital costs, along with a fee for miscellaneous expenses, the total initial investment, C_0 can be obtained.

Using historical data from similarly conducted projects, along with consultation of the relevant industry professionals, reliable estimates of cash inflow from the communities where the projects are implemented can be obtained. These are compared with the annual operation and maintenance costs in the implemented project in order to obtain the net cash inflow, C_t.

After consultation with economists, a suitable discount rate is chosen. Due to the large capital investments involved with municipal infrastructure projects, the financial viability of a project is very sensitive to changes in the discount rate. Adequate consideration is required in order to select a rate that is representative of the prevailing conditions.

The data obtained is then entered into the formula and a NPV value is obtained. In the context of the above description of the parameters, this NPV will only give an indication of the financial viability of the project. It can, however, be extended to describe the viability of other important sustainability aspects of a project such as environmental sustainability, where an adequate monetary value could be assigned to positive and negative environmental impacts. The same assessment can also be done for social impacts of the project.

Comparing NPVs of different aspects of the project can then enable selection of the most economically, socially, and environmentally viable project.

6 CONCLUSIONS

6.1 Conclusions

From the analysis, it was noted that there are significant price differences across the different provinces in South Africa. These price differences across the different provinces have an impact on fund allocation for the provision of basic services to the different municipalities in the country. It was noted that for a truly equitable allocation of these funds for basic services, it is important to give due consideration to these price differences.

It was also observed that the provision of basic services to communities serves as a large base for employment creation within the benefiting communities. These activities should continuously be guided by the latest EPWP implementation guidelines in order to keep in line with national goals.

6.2 Recommendations.

In recognition of the sizeable impact that price differences across the different provinces have on the equitable basic service delivery across the country, further research has to be conducted with the aim of creating a dedicated index to show the price differences across provinces for construction related inputs.

In addition to the defined basic level of service, emphasis has to be placed upon the involvement (as far as practically possible) of community members in the selection of the method of delivery of this basic service so as to develop solutions that are socially accepted by the members of the community.

Surveys need to be carried out in order to validate the prices modelled using the methodology applied in the development of this guideline. The process of model validation will legitimize the applied method.

Security of infrastructure during construction and at operation has become very costly with the rise in vandalism and theft. This cost can no longer be considered negligible and needs to be quantified (and reduced where possible), work must be undertaken in this area.

7 REFERENCE LIST

1. AKCAY, S., 2011. The Causal Relationship between Producer Price Index and Consumer Price Index: Empirical Evidence from Selected European Countries. *International Journal of Economics and Finance*, 3(6).
2. Cooperative Governance and Traditional Affairs, 2010. *Municipal Infrastructure an Industry Guide to Infrastructure Service Delivery Levels and Unit Costs*. Pretoria: Cooperative Governance and Traditional Affairs.
3. Danert, K., Luutu, A. and Carter, R., 2010. Costing and Pricing A Guide for Water Well Drilling Enterprises Rural Water Supply Network Field Note 2010-6 Cost-Effective Boreholes 2. *Rural Water Supply Network*, [online] Available at: <https://www.researchgate.net/publication/266119129_Costing_and_Pricing_A_Guide_for_Water_Well_Drilling_Enterprises_Rural_Water_Supply_Network_Field_Note_2010-6_Cost-Effective_Boreholes_2> [Accessed 20 January 2021].
4. Department of Trade and Industry, 2018. *Notice in Terms of Section 38(1) Of the Legal Metrology Act*. Pretoria: Ministry of Trade and Industry.
5. Department of Water Affairs, 2009. Cost Benchmarks: Typical Unit Cost for Water Services Development Projects: A Guide for Local Authorities. Pretoria.
6. Department of Water and Sanitation, 2016. Cost Benchmark for Water Services Projects : A Guide for Water Services Authorities and Providers on Typical Unit Costs for Water Supply and Sanitation Projects. Pretoria.
7. Designingbuildings.co.uk. 2021. *Net Present Value*. [online] Available at: <https://www.designingbuildings.co.uk/wiki/Net_Present_Value#:~:text=NPV%20is%20a%20standard%20measure,and%20operating%20and%20maintenance%20models> [Accessed 30 January 2021].
8. Kambanou, M., 2020. Life Cycle Costing: Understanding How It Is Practised and Its Relationship to Life Cycle Management—A Case Study. *Sustainability*, 12(8), p.3252.
9. SALGA, 2015. *Costing of Municipal Services to Inform DORA Allocations*. Pretoria: SALGA.

10. Solid waste management. (n.d.). [online]. Available at: https://www.csir.co.za/sites/default/files/Documents/Chapter_011_Vol_IIsolid_waste.pdf.
11. Swartz, C., Thompson, P., Maduray, P., Offringa, G. and Mwiinga, G., 2013. *Capital Cost Curve for Inlet Distribution Works of Less Than 50ML/D*. [image] Available at: <http://www.wrc.org.za/wp-content/uploads/mdocs/TT%20552-13.pdf> [Accessed 20 January 2021].
12. Swartz, C., Thompson, P., Maduray, P., Offringa, G. and Mwiinga, G., 2013. *Capital Cost Curve for flocculation*. [image] Available at: <http://www.wrc.org.za/wp-content/uploads/mdocs/TT%20552-13.pdf> [Accessed 20 January 2021].
13. Swartz, C., Thompson, P., Maduray, P., Offringa, G. and Mwiinga, G., 2013. *Capital Cost Curve for phase separation*. [image] Available at: <http://www.wrc.org.za/wp-content/uploads/mdocs/TT%20552-13.pdf> [Accessed 20 January 2021].
14. Swartz, C., Thompson, P., Maduray, P., Offringa, G. and Mwiinga, G., 2013. *Capital Cost Curve for primary sedimentation*. [image] Available at: <http://www.wrc.org.za/wp-content/uploads/mdocs/TT%20552-13.pdf> [Accessed 20 January 2021].
15. Swartz, C., Thompson, P., Maduray, P., Offringa, G. and Mwiinga, G., 2013. *Capital Cost Curve for clarification*. [image] Available at: <http://www.wrc.org.za/wp-content/uploads/mdocs/TT%20552-13.pdf> [Accessed 20 January 2021].
16. Swartz, C., Thompson, P., Maduray, P., Offringa, G. and Mwiinga, G., 2013. *Capital Cost Curve for pulsator clarifiers*. [image] Available at: <http://www.wrc.org.za/wp-content/uploads/mdocs/TT%20552-13.pdf> [Accessed 20 January 2021].
17. Swartz, C., Thompson, P., Maduray, P., Offringa, G. and Mwiinga, G., 2013. *Capital Cost Curve for clariflocculation*. [image] Available at: <http://www.wrc.org.za/wp-content/uploads/mdocs/TT%20552-13.pdf> [Accessed 20 January 2021].
18. Swartz, C., Thompson, P., Maduray, P., Offringa, G. and Mwiinga, G., 2013. *Capital Cost Curve for rapid gravity filters*. [image] Available at: <http://www.wrc.org.za/wp-content/uploads/mdocs/TT%20552-13.pdf> [Accessed 20 January 2021].

19. Swartz, C., Thompson, P., Maduray, P., Offringa, G. and Mwiinga, G., 2013. *Capital Cost Curve for reverse osmosis*. [image] Available at: <http://www.wrc.org.za/wp-content/uploads/mdocs/TT%20552-13.pdf> [Accessed 20 January 2021].
20. Swartz, C., Thompson, P., Maduray, P., Offringa, G. and Mwiinga, G., 2013. *Capital Cost Curve for ultra-filtration*. [image] Available at: <http://www.wrc.org.za/wp-content/uploads/mdocs/TT%20552-13.pdf> [Accessed 20 January 2021].
21. Swartz, C., Thompson, P., Maduray, P., Offringa, G. and Mwiinga, G., 2013. *Capital Cost Curve for chlorination*. [image] Available at: <http://www.wrc.org.za/wp-content/uploads/mdocs/TT%20552-13.pdf> [Accessed 20 January 2021].
22. Swartz, C., Thompson, P., Maduray, P., Offringa, G. and Mwiinga, G., 2013. *Capital Cost Curve for reservoirs*. [image] Available at: <http://www.wrc.org.za/wp-content/uploads/mdocs/TT%20552-13.pdf> [Accessed 20 January 2021].
23. Swartz, C., Thompson, P., Maduray, P., Offringa, G. and Mwiinga, G., 2013. *Capital cost curves for preliminary & general*. [image] Available at: <http://www.wrc.org.za/wp-content/uploads/mdocs/TT%20552-13.pdf> [Accessed 20 January 2021].
24. Swartz, C., Thompson, P., Maduray, P., Offringa, G. and Mwiinga, G., 2013. *Capital cost curves for package treatment plants*. [image] Available at: <http://www.wrc.org.za/wp-content/uploads/mdocs/TT%20552-13.pdf> [Accessed 20 January 2021].
25. Swartz, C., Thompson, P., Maduray, P., Offringa, G. and Mwiinga, G., 2013. *Operations cost curves for chemicals*. [image] Available at: <http://www.wrc.org.za/wp-content/uploads/mdocs/TT%20552-13.pdf> [Accessed 20 January 2021].
26. Swartz, C., Thompson, P., Maduray, P., Offringa, G. and Mwiinga, G., 2013. *Operations cost curves for electricity*. [image] Available at: <http://www.wrc.org.za/wp-content/uploads/mdocs/TT%20552-13.pdf> [Accessed 20 January 2021].
27. Swartz, C., Thompson, P., Maduray, P., Offringa, G. and Mwiinga, G., 2013. *Operating cost curve for maintenance*. [image] Available at:

<http://www.wrc.org.za/wp-content/uploads/mdocs/TT%20552-13.pdf> [Accessed 20 January 2021].

28. *The State of Basic Service Delivery in South Africa: In-Depth Analysis of the Community Survey 2016 Data*.
29. Un.org. 2014. *Human Right to Water and Sanitation | International Decade for Action 'Water for Life' 2005-2015*. [online] Available at: <https://www.un.org/waterforlifedecade/human_right_to_water.shtml> [Accessed 20 January 2021].
30. World Bank. 2015. *Water Supply and Sanitation in South Africa: Turning Finance into Services For 2015 And Beyond*. [online] Openknowledge.worldbank.org. Available at: <https://openknowledge.worldbank.org/handle/10986/17752> [Accessed 20 January 2021].

8 APPENDICES

8.1 Appendix 1: Calculation of Contract Price Adjustment Factors.

Table 67: Showing calculation of Contract Price Adjustment Factors.

CONTRACT TYPE	CALC'S DETAIL	EC	FS	GT	KZN	LIM	MP	NC	NW	WC	PLANT INDEX	MATERIAL INDEX	FUEL INDEX
Index Base Year: Dec 2016 = 100	**Base Costs Aug 2009**	67.3	67.3	69.0	68.8	67.4	69.0	69.2	69.0	68.2	76.9	81.0	61.4
	Current Costs Nov 2020	116.1	116.1	116.9	115.6	116.0	115.1	115.9	114.5	119.7	116.0	120.6	109.7
	Index Ratio	1.7251	1.7251	1.6942	1.6802	1.7211	1.6681	1.6749	1.6594	1.7551	1.5085	1.4889	1.7866
1. Earthworks (with Culverts and Drainage)	**Coeff**	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.5	0.20	0.15
	Coeff X Ratio	0.2588	0.2588	0.2541	0.2520	0.2582	0.2502	0.2512	0.2489	0.2633	0.7542	0.2978	0.2680
	Esc Factor	0.4920	0.4920	0.4880	0.4862	0.4914	0.4847	0.4855	0.4836	0.4958			
2. General Civil Engineering Work - 2/3 Earthworks; 1/3 Concrete	**Coeff**	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.55	0.05
	Coeff X Ratio	0.3450	0.3450	0.3388	0.3360	0.3442	0.3336	0.3350	0.3319	0.3510	0.3017	0.8189	0.0893
	Esc Factor	0.4717	0.4717	0.4664	0.4641	0.4710	0.4620	0.4632	0.4605	0.4768			
3. Concrete Work	**Coeff**	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.10	0.45	0.05
	Coeff X Ratio	0.6900	0.6900	0.6777	0.6721	0.6884	0.6672	0.6699	0.6638	0.7021	0.1508	0.6700	0.0893
	Esc Factor	0.5102	0.5102	0.4997	0.4949	0.5088	0.4908	0.4931	0.4879	0.5204			
4. Roadworks													
4.1 Roadwork	**Coeff**	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.35	0.35	0.10

	Coeff X Ratio	0.3450	0.3450	0.3388	0.3360	0.3442	0.3336	0.3350	0.3319	0.3510	0.5280	0.5211	0.1787
	Esc Factor	0.4868	0.4868	0.4816	0.4792	0.4862	0.4772	0.4783	0.4757	0.4919			
4.2 Concrete Structures	**Coeff**	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.10	0.45	0.05
	Coeff X Ratio	0.6900	0.6900	0.6777	0.6721	0.6884	0.6672	0.6699	0.6638	0.7021	0.1508	0.6700	0.0893
	Esc Factor	0.5102	0.5102	0.4997	0.4949	0.5088	0.4908	0.4931	0.4879	0.5204			
4.3 Township Roads and Services	**Coeff**	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.25	0.45	0.10
	Coeff X Ratio	0.3450	0.3450	0.3388	0.3360	0.3442	0.3336	0.3350	0.3319	0.3510	0.3771	0.6700	0.1787
	Esc Factor	0.4852	0.4852	0.4799	0.4776	0.4845	0.4755	0.4766	0.4740	0.4903			
4.4 Premix Surfacing and Rehabilitation	**Coeff**	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.60	0.10
	Coeff X Ratio	0.2588	0.2588	0.2541	0.2520	0.2582	0.2502	0.2512	0.2489	0.2633	0.2263	0.8933	0.1787
	Esc Factor	0.4735	0.4735	0.4695	0.4678	0.4730	0.4662	0.4671	0.4651	0.4773			
5. Water and Sewerage Reticulation, Reservoirs and Engineering Work	**Coeff**	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.55	0.05
	Coeff X Ratio	0.3450	0.3450	0.3388	0.3360	0.3442	0.3336	0.3350	0.3319	0.3510	0.3017	0.8189	0.0893
	Esc Factor	0.4717	0.4717	0.4664	0.4641	0.4710	0.4620	0.4632	0.4605	0.4768			

8.2 Appendix 2: Cost breakdown example Gauteng

General water supply **GAUTENG**

Standpipes & communal taps

Description	Unit	Qty	Rate (2009)	CPAF	Escalated price (2020)	Difference from Gauteng prices (%)	Unit costs	Sub total	Construction Margin (%)	Total
25 mm Garden tap	no	1	193.02	0.4664	283.044528	0	283.04	283.045	15	325.5012072
150mm x 25mm galv. Threaded pipe	no	1	6.61	0.4664	9.692904	0	9.6929	9.6929	15	11.1468396
25mm galv. Elbow	no	2	6.34	0.4664	9.296976	0	9.297	18.594	15	21.3830448
1200mm x 25mm galv. Threaded pipe	no	1	47.93	0.4664	70.284552	0	70.285	70.2846	15	80.8272348
Description	**Unit**	**Qty**	**Rate (2009)**	**CPAF**	**Escalated price (2020)**	**Difference from Gauteng prices (%)**	**Unit costs**	**Sub total**	**Construction Margin (%)**	**Total**
25mm x 32mm compression male adapter	no	2	12.06	0.4664	17.684784	0	17.685	35.3696	15	40.6750032
110mm x 32mm saddle	no	1	99.03	0.4664	145.217592	0	145.22	145.218	15	167.0002308
50mm PVC trap	no	1	23.9	0.4664	35.04696	0	35.047	35.047	15	40.304004
50mm 45 degree elbow	no	1	4.14	0.4664	6.070896	0	6.0709	6.0709	15	6.9815304
50mm PVC pipe	m	3	9.01	0.4664	13.212264	0	13.212	39.6368	15	45.5823108
32mm hdpe pipe	m	15	8.32	0.4664	12.200448	0	12.2	183.007	15	210.457728
1.2m 110mm uPVC pipe to standpipe	no	1	24.02	0.4664	35.222928	0	35.223	35.2229	15	40.5063672

19mm concrete stone to drain	m^3	1	198.19	0.4664	290.625816	0	290.63	290.626	15	334.2196884
Description	**Unit**	**Qty**	**Rate (2009)**	**CPAF**	**Escalated price (2020)**	**Difference from Gauteng prices (%)**	**Unit costs**	**Sub total**	**Construction Margin (%)**	**Total**
Concrete to plinth complete	m3	0.2	820.67	0.4664	1203.430488	0	1203.4	240.686	15	276.7890122
Budem to drain	m2	6	16.82	0.4664	24.664848	0	24.665	147.989	15	170.1874512
Excavation to trench and drain	m3	2	18.02	0.4664	26.424528	0	26.425	52.8491	15	60.7764144
Labour man days	no	3	78.07	0.4664	114.481848	0	114.48	343.446	15	394.9623756
Supervision	no	0.3	144.14	0.4664	211.366896	0	211.37	63.4101	15	72.92157912
									Total	2300.222022
Preliminary & general	%	12								276.0266426
									Total cost	**2576.248664**

General water supply **GAUTENG**

Yard tap

Description	Unit	Qty	Rate (2009)	CPAF	Escalated price (2020)	Difference from Gauteng prices (%)	Unit costs	Sub total	Construction Margin (%)	Total
25mm Garden tap	no	1	193.02	0.4664	283.044528	0	283.04	283.045	15	325.5012072
150mm x 25mm galv. Threaded pipe	no	1	6.61	0.4664	9.692904	0	9.6929	9.6929	15	11.1468396
25mm galv. Elbow	no	2	3.57	0.4664	5.235048	0	5.235	10.4701	15	12.0406104
1200mm x 25mm galv. Threaded pipe	no	1	47.93	0.4664	70.284552	0	70.285	70.2846	15	80.8272348
25mm x 32mm compression male adaptor	no	2	12.06	0.4664	17.684784	0	17.685	35.3696	15	40.6750032
Description	**Unit**	**Qty**	**Rate (2009)**	**CPAF**	**Escalated price (2020)**	**Difference from Gauteng prices (%)**	**Unit costs**	**Sub total**	**Construction Margin (%)**	**Total**
110mm x 32mm saddle	no	1	99.03	0.4664	145.217592	0	145.22	145.218	15	167.0002308
32mm HDPE pipe	m	15	8.32	0.4664	12.200448	0	12.2	183.007	15	210.457728
1.2m 110mm uPVC pipe to standpipe	no	1	63.2	0.4664	92.67648	0	92.676	92.6765	15	106.577952
Concrete to plinth	m3	0.2	820.67	0.4664	1203.430488	0	1203.4	240.686	15	276.7890122
Excavation to trench	m3	0	0	0.4664	0	0	0	0	15	0
Labour man days	no	2	78.07	0.4664	114.481848	0	114.48	228.964	15	263.3082504
Supervision	no	0.25	144.14	0.4664	211.366896	0	211.37	52.8417	15	60.7679826
									Total	1555.092051
Preliminary & general	%	12								186.61104
									Total cost	1741.703097

General water supply **GAUTENG**

5000l Yard tank

Description	Unit	Qty	Rate (2009)	CPAF	Escalated price (2020)	Difference from Gauteng prices (%)	Unit costs	Sub total	Construction Margin (%)	Total
25mm Garden tap	no	1	193.02	0.4664	283.044528	0	283.04	283.045	15	325.5012072
150mm x 25mm galv. Threaded pipe	no	1	6.61	0.4664	9.692904	0	9.6929	9.6929	15	11.1468396
25mm galv. Barrel nipple	no	1	2.49	0.4664	3.651336	0	3.6513	3.65134	15	4.1990364
5000l Jojo tank	no	1	3423.23	0.4664	5019.824472	0	5019.8	5019.82	15	5772.798143
Concrete to foundation	m3	1.2	820.67	0.4664	1203.430488	0	1203.4	1444.12	15	1660.734073
Concrete bricks to stand	no	1100	1.27	0.4664	1.862328	0	1.8623	2048.56	15	2355.84492
Brick force	m	40	0.72	0.4664	1.055808	0	1.0558	42.2323	15	48.567168
Cement to brickwork	no	5	57.65	0.4664	84.53796	0	84.538	422.69	15	486.09327
Building sand	m3	1.5	336.32	0.4664	493.179648	0	493.18	739.769	15	850.73489
Backfill material	m3	7.5	102.1	0.4664	149.71944	0	149.72	1122.9	15	1291.3301
Concrete to slab	m3	0.6	820.67	0.4664	1203.430488	0	1203.4	722.058	15	830.36703
Reinforcing mesh to slab	m2	6	27.39	0.4664	40.164696	0	40.165	240.988	15	277.13640
Gage 8 galv. Wire to tie down tank	m	38	5.95	0.4664	8.72508	0	8.7251	331.553	15	381.28599
Excavation to foundation	m3	1	50.45	0.4664	73.97988	0	73.98	73.9799	15	85.076862
Labour man days	no	32	78.07	0.4664	114.481848	0	114.48	3663.42	15	4212.9320

Supervision	no	8	144.14	0.4664	211.366896	0	211.37	1690.94	15	1944.575443
									Total	20538.323
Preliminary & General	%	12								2464.5988
									Total cost	23002.92228

General water supply

GAUTENG

House connection with water meter

Description	Unit	Qty	Rate (2009)	CPAF	Escalated price (2020)	Difference from Gauteng prices (%)	Unit costs	Sub total	Construction Margin (%)	Total
15mm boxed tap stop valve complete	no	1	1547.36	0.4664	2269.048704	0	2269	2269.05	15	2609.40601
15mm x 25mm compression male adaptor	no	3	9.43	0.4664	13.828152	0	13.828	41.4845	15	47.7071244
75mm x 25mm saddle	no	1	36.87	0.4664	54.066168	0	54.066	54.0662	15	62.1760932
15mm HDPE pipe	no	18	3.34	0.4664	4.897776	0	4.8978	88.16	15	101.3839632
25mm compression end cap.	no	1	10.89	0.4664	15.969096	0	15.969	15.9691	15	18.3644604
Excavation to trench and drain	m	5	26.42	0.4664	38.742288	0	38.742	193.711	15	222.768156
Labour man days	no	2	78.07	0.4664	114.481848	0	114.48	228.964	15	263.3082504
Supervision	no	0.25	144.14	0.4664	211.366896	0	211.37	52.8417	15	60.7679826
									Total	3385.88204
Preliminary & General	%	12								406.3058448
									Total cost	3792.187885

Bulk water supply **GAUTENG**

Cost/m from municipal water supply

110mm supply

Quantities to 1000m

Description	Unit	Qty	Rate (2009)	CPAF	Escalated price (2020)	Difference from Gauteng prices (%)	Unit costs	Sub total	Construction Margin (%)	Total
Clear & grub	m2	2000	1.5	0.4664	2.1996	0	2.1996	4399.2	15	5059.08
Removal of topsoil	m2	2000	2.82	0.4664	4.135248	0	4.1352	8270.5	15	9511.0704
Trench excavation	m	1000	27.63	0.4664	40.516632	0	40.517	40516.6	15	46594.126
Bedding & backfill	m3	520	57.65	0.4664	84.53796	0	84.538	43959.7	15	50553.700
160mm uPVC class 12 pipe	m	1000	132.83	0.4664	194.781912	0	194.78	194782	15	223999.19
Description	**Unit**	**Qty**	**Rate (2009)**	**CPAF**	**Escalated price (2020)**	**Difference from Gauteng prices (%)**	**Unit costs**	**Sub total**	**Construction Margin (%)**	**Total**
160mm 90 degree bend	no	8	432.41	0.4664	634.086024	0	634.09	5072.69	15	5833.5914
160mm flanged valve (Rsi)	no	1	2391.46	0.4664	3506.836944	0	3506.8	3506.84	15	4032.862486
160mm flanged adaptors	no	7	243.46	0.4664	357.009744	0	357.01	2499.07	15	2873.928439
Bolts & gasket sets	no	4	90.08	0.4664	132.093312	0	132.09	528.373	15	607.6292352
Anchor blocks	m3	5	820.67	0.4664	1203.430488	0	1203.4	6017.15	15	6919.725306
Air valve 50mm double orifice	no	1	4203.97	0.4664	6164.701608	0	6164.7	6164.7	15	7089.406849
160mm x 50mm flanged T	no	1	422.7	0.4664	619.84728	0	619.85	619.847	15	712.824372

1000mm x 50mm galv. Threaded pipe	no	1	134.53	0.4664	197.274792	0	197.27	197.275	15	226.8660108
Description	**Unit**	**Qty**	**Rate (2009)**	**CPAF**	**Escalated price (2020)**	**Difference from Gauteng prices (%)**	**Unit costs**	**Sub total**	**Construction Margin (%)**	**Total**
Air valve chamber	no	1	1778.88	0.4664	2608.54963	0	2608.5	2608.55	15	2999.8320
Valve chamber complete	no	1	594.56	0.4664	871.862784	0	871.86	871.863	15	1002.6422
Testing	m	1000	6.01	0.4664	8.813064	0	8.8131	8813.06	15	10135.023
Labour man days	no	220	78.07	0.4664	114.481848	0	114.48	25186	15	28963.907
Supervision	no	16	144.14	0.4664	211.366896	0	211.37	3381.87	15	3889.1508
									Total	411004.56
Preliminary & general	%	12								49320.547
									Total cost	460325.1145
									Cost per meter	460.3251145

Bulk water supply **GAUTENG**

Cost/m from municipal water supply

160mm supply

Quantities to 1000m

Description	Unit	Qty	Rate (2009)	CPAF	Escalated price (2020)	Difference from Gauteng prices (%)	Unit costs	Sub total	Construction Margin (%)	Total
Clear & grub	m2	2000	1.5	0.4664	2.1996	0	2.1996	4399.2	15	5059.08
Removal of topsoil	m2	2000	2.82	0.4664	4.135248	0	4.1352	8270.5	15	9511.0704
Trench excavation	m	1000	27.63	0.4664	40.516632	0	40.517	40516.6	15	46594.126
Bedding & backfill	m3	520	57.65	0.4664	84.53796	0	84.538	43959.7	15	50553.700
200mm uPVC class 12 pipe	m	1000	185.29	0.4664	271.709256	0	271.71	271709	15	312465.64
200mm 90-degree bend	no	8	694.92	0.4664	1019.03068	0	1019	8152.25	15	9375.0823
200mm flanged valve (Rsi)	no	1	3643.04	0.4664	5342.15385	0	5342.2	5342.15	15	6143.4769
200mm flanged adaptors	no	7	361.36	0.4664	529.898304	0	529.9	3709.29	15	4265.6813
Bolts & gasket sets	no	4	114.11	0.4664	167.330904	0	167.33	669.324	15	769.72215
Anchor blocks	m3	6	820.67	0.4664	1203.43048	0	1203.4	7220.58	15	8303.6703
Air valve 50mm double orifice	no	1	4303.97	0.4664	6311.34160	0	6311.3	6311.34	15	7258.0428
200mm x 50mm flanged T	no	1	549.54	0.4664	805.845456	0	805.85	805.845	15	926.72227
1000mm x 50mm galv. Threaded pipe	no	1	134.53	0.4664	197.274792	0	197.27	197.275	15	226.86601
Air valve chamber	no	1	1778.88	0.4664	2608.549632	0	2608.5	2608.55	15	2999.8320
Valve chamber complete	no	1	594.56	0.4664	871.862784	0	871.86	871.863	15	1002.6422
Testing	m	1000	6.01	0.4664	8.813064	0	8.8131	8813.06	15	10135.023

Labour man days	no	220	78.07	0.4664	114.481848	0	114.48	25186	15	28963.907
Supervision	no	16	144.14	0.4664	211.366896	0	211.37	3381.87	15	3889.150886
									Total	508443.4423
Preliminary & general	%	12								61013.21307
									Total cost	569456.6553
									Cost per m	569.4566553

Bulk water supply **GAUTENG**

Cost/m from municipal water supply

250mm supply

Quantities to 1000m

Description	Unit	Qty	Rate (2009)	CPAF	Escalated price (2020)	Difference from Gauteng prices (%)	Unit costs	Sub total	Construction Margin (%)	Total
Clear & grub	m2	2000	1.5	0.4664	2.1996	0	2.1996	4399.2	15	5059.08
Removal of topsoil	m2	2000	2.82	0.4664	4.135248	0	4.1352	8270.5	15	9511.0704
Trench excavation	m	1000	37.24	0.4664	54.608736	0	54.609	54608.7	15	62800.046
Bedding & backfill	m3	680	57.65	0.4664	84.53796	0	84.538	57485.8	15	66108.684
250mm uPVC class 12 pipe	m	1000	342.32	0.4664	501.978048	0	501.98	501978	15	577274.75
250mm 90-degree bend	no	8	954.9	0.4664	1400.26536	0	1400.3	11202.1	15	12882.441
250mm flanged valve (Rsi)	no	1	6426.06	0.4664	9423.17438	0	9423.2	9423.17	15	10836.650
250mm flanged adaptors	no	7	678.64	0.4664	995.157696	0	995.16	6966.1	15	8011.0194
Bolts & gasket sets	no	4	75.07	0.4664	110.082648	0	110.08	440.331	15	506.38018

Anchor blocks	m3	6	820.67	0.4664	1203.43048	0	1203.4	7220.58	15	8303.6703
Air valve 50mm double orifice	no	1	4203.97	0.4664	6164.701608	0	6164.7	6164.7	15	7089.406849
250mm x 50mm flanged T	no	1	733.17	0.4664	1075.120488	0	1075.1	1075.12	15	1236.388561
1000mm x 50mm galv. Threaded pipe	no	1	134.53	0.4664	197.274792	0	197.27	197.275	15	226.8660108
Air valve chamber	no	1	1778.88	0.4664	2608.54963	0	2608.5	2608.55	15	2999.8320
Valve chamber complete	no	1	594.56	0.4664	871.862784	0	871.86	871.863	15	1002.6422
Testing	m	1000	6.01	0.4664	8.813064	0	8.8131	8813.06	15	10135.023
Labour man days	no	240	78.07	0.4664	114.481848	0	114.48	27475.6	15	31596.990
Supervision	no	18	144.14	0.4664	211.366896	0	211.37	3804.6	15	4375.2947
									Total	819956.24
										98394.749
									Total cost	918350.99
									Cost per m	918.35099

Preliminary & general	%	12

Bulk water supply **GAUTENG**

Cost/m from municipal water supply

315mm supply

Quantities to 1000m

Description	Unit	Qty	Rate (2009)	CPAF	Escalated price (2020)	Difference from Gauteng prices (%)	Unit costs	Sub total	Construction Margin (%)	Total
Clear & grub	m2	2000	1.5	0.4664	2.1996	0	2.1996	4399.2	15	5059.08
Removal of topsoil	m2	2000	2.82	0.4664	4.135248	0	4.1352	8270.5	15	9511.0704
Trench excavation	m	1000	61.88	0.4664	90.740832	0	90.741	90740.8	15	104351.9568
Bedding & backfill	m3	960	57.65	0.4664	84.53796	0	84.538	81156.4	15	93329.90784
315mm uPVC class 12 pipe	m	1000	458.99	0.4664	673.062936	0	673.06	673063	15	774022.3764
315mm 90-degree bend	no	8	3325.94	0.4664	4877.15841	0	4877.2	39017.3	15	44869.857
315mm flanged valve (Rsi)	no	1	7275.26	0.4664	10668.44126	0	10668	10668.4	15	12268.70745
315mm flanged adaptors	no	7	675.04	0.4664	989.878656	0	989.88	6929.15	15	7968.5231
Bolts & gasket sets	no	4	180.17	0.4664	264.201288	0	264.2	1056.81	15	1215.3259
Anchor blocks	m3	12	820.67	0.4664	1203.430488	0	1203.4	14441.2	15	16607.340
Air valve 50mm double orifice	no	1	3267.08	0.4664	4790.84611	0	4790.8	4790.85	15	5509.4730
315mm x 50mm flanged T	no	1	2378.24	0.4664	3487.451136	0	3487.5	3487.45	15	4010.568806
1000mm x 50mm galv. Threaded pipe	no	1	91.53	0.4664	134.219592	0	134.22	134.22	15	154.3525308
Air valve chamber	no	1	1969.86	0.4664	2888.60270	0	2888.6	2888.6	15	3321.8931
Valve chamber complete	no	1	714.67	0.4664	1047.9920	0	1048	1047.99	15	1205.1909

Testing	m	1000	8.41	0.4664	12.332424	0	12.332	12332.4	15	14182.287
Labour man days	no	240	78.07	0.4664	114.481848	0	114.48	27475.6	15	31596.990
Supervision	no	14	144.14	0.4664	211.366896	0	211.37	2959.14	15	3403.0070
									Total	1132587.9
										135910.54
									Total cost	1268498.4
									Cost per m	1268.4984

Preliminary & general	%	12

Meters **Gauteng**

Domestic meters (15mm)

Description	Unit	Qty	Rate (2009)	CPAF	Escalated price (2020)	Difference from Gauteng prices (%)	Unit costs	Sub total	Construction Margin (%)	Total
15 mm boxed Kent water meter complete	no	1	1546.36	0.4664	2267.582304	0	2267.6	2267.58	15	2607.71965
Labour man days	no	1	78.07	0.4664	114.481848	0	114.48	114.482	15	131.6541252
Supervision	no	0.5	144.14	0.4664	211.366896	0	211.37	105.683	15	121.5359652
									Total	2860.90974
										343.3091688
									Total cost	3204.218909

Preliminary & general	%	12

Meters **Gauteng**

Domestic meters (25mm)

Description	Unit	Qty	Rate (2009)	CPAF	Escalated price (2020)	Difference from Gauteng prices (%)	Unit costs	Sub total	Construction Margin (%)	Total
25 mm boxed Kent water meter complete	no	1	1824.52	0.4664	2675.476128	0	2675.5	2675.48	15	3076.797547
Labour man days	no	1	78.07	0.4664	114.481848	0	114.48	114.482	15	131.6541252
Supervision	no	1	144.14	0.4664	211.366896	0	211.37	211.367	15	243.0719304
									Total	3451.523603
Preliminary & general	%	12								414.1828323
									Total cost	3865.706435

Domestic meters prepaid **Gauteng**

Domestic meters (15mm)

Description	Unit	Qty	Rate (2009)	CPAF	Escalated price (2020)	Difference from Gauteng prices (%)	Unit costs	Sub total	Construction Margin (%)	Total
15mm prepaid Kent water meter	no	1	1906.2	0.4664	2795.25168	0	2795.3	2795.25	15	3214.539432
Labour man days	no	2	78.07	0.4664	114.481848	0	114.48	228.964	15	263.3082504
Supervision	no	1	144.14	0.4664	211.366896	0	211.37	211.367	15	243.0719304
									Total	3720.919613
Preliminary & general	%	12								446.5103535

Total cost	4167.429966

Bulk water supply **Gauteng**

Boreholes- Shallow 50m- Semi rural (100km radius)

Description	Unit	Qty	Rate (2009)	CPAF	Escalated price (2020)	Difference from Gauteng prices (%)	Unit costs	Sub total	Construction Margin (%)	Total
Divine water- Position of Hole	ea	1	9239.49	0.4664	13548.7881	0	13549	13548.8	15	15581.106
Drill Hole to 50m	m	50	180.17	0.4664	264.201288	0	264.2	13210.1	15	15191.574
Supply and fit borehole lining (PVC)	m	50	230.99	0.4664	338.723736	0	338.72	16936.2	15	19476.614
Install pump, Motor, Cabling, Control panel	ea	1	30028.3	0.4664	44033.54311	0	44034	44033.5	15	50638.574
Transport to site and return	km	200	18.02	0.4664	26.424528	0	26.425	5284.91	15	6077.6414
									Total cost	106965.51
									Cost per m depth	2139.3102

Labour man days & supervision included in drilling rate

Preliminary & general included in provided rates

Boreholes- Shallow 50m- Deep rural (250 km radius) **Gauteng**

165mm ID Hole

Description	Unit	Qty	Rate (2009)	CPAF	Escalated price (2020)	Difference from Gauteng prices (%)	Unit costs	Sub total	Construction Margin (%)	Total
Divine Water- Position of Hole	ea	1	9239.49	0.4664	13548.7881	0	13549	13548.8	15	15581.106
Drill hole to 50m	m	50	180.17	0.4664	264.201288	0	264.2	13210.1	15	15191.574
Supply and fit borehole lining (PVC)	m	50	230.99	0.4664	338.723736	0	338.72	16936.2	15	19476.614
Install pump, motor, cabling, control panel	ea	1	30028.3	0.4664	44033.54311	0	44034	44033.5	15	50638.574
Transport to and from site	km	500	18.02	0.4664	26.424528	0	26.425	13212.3	15	15194.103
									Total cost	116081.97
									Cost per m depth	2321.6394

Labour man days & supervision included in drilling rate

Preliminary & general included in provided rates

Boreholes- Deep 200m- Semi Rural (100km radius)

Gauteng

165mm ID hole

Description	Unit	Qty	Rate (2009)	CPAF	Escalated price (2020)	Difference from Gauteng prices (%)	Unit costs	Sub total	Construction Margin (%)	Total
Divine Water- Position of Hole	ea	1	9239.49	0.4664	13548.7881	0	13549	13548.8	15	15581.10636
Drill hole to 200m	m	200	180.17	0.4664	264.201288	0	264.2	52840.3	15	60766.29624
Supply and fit borehole lining (PVC)	m	200	230.99	0.4664	338.723736	0	338.72	67744.7	15	77906.45928
Install pump, motor, cabling, control panel	ea	1	30028.3	0.4664	44033.54311	0	44034	44033.5	15	50638.57458
Transport to and from site	km	500	18.02	0.4664	26.424528	0	26.425	13212.3	15	15194.103
									Total cost	220086.54
									Cost per m depth	1100.4327

Labour man days & supervision included in drilling rate

Preliminary & general included in provided rates

Boreholes- Deep 200m- Deep Rural (250km radius) **Gauteng**

165mm ID hole

Description	Unit	Qty	Rate (2009)	CPAF	Escalated price (2020)	Difference from Gauteng prices (%)	Unit costs	Sub total	Construction Margin (%)	Total
Divine Water- Position of Hole	ea	1	9239.49	0.4664	13548.78814	0	13549	13548.8	15	15581.10636
Drill hole to 200m	m	200	180.17	0.4664	264.201288	0	264.2	52840.3	15	60766.29624
Supply and fit borehole lining (PVC)	m	200	230.99	0.4664	338.723736	0	338.72	67744.7	15	77906.45928
Install pump, motor, cabling, control panel	ea	1	30028.3	0.4664	44033.54311	0	44034	44033.5	15	50638.57458
Transport to and from site	km	500	18.02	0.4664	26.424528	0	26.425	13212.3	15	15194.103
									Total	220086.54
									Cost per m depth	1100.4327

Labour man days & supervision included in drilling rate

Preliminary & general included in provided rates

Bulk Water Supply

Boreholes-Shallow 50m- Semi Rural (100km radius) **Gauteng**

208 mm ID hole

Description	Unit	Qty	Rate (2009)	CPAF	Escalated price (2020)	Difference from Gauteng prices (%)	Unit costs	Sub total	Construction Margin (%)	Total
Divine Water- Position of Hole	ea	1	9239.49	0.4664	13548.78814	0	13549	13548.8	15	15581.10636
Drill hole to 200m	m	50	180.17	0.4664	264.201288	0	264.2	13210.1	15	15191.57406
Supply and fit borehole lining (PVC)	m	50	230.99	0.4664	338.723736	0	338.72	16936.2	15	19476.61482
Install pump, motor, cabling, control panel	ea	1	30028.3	0.4664	44033.54311	0	44034	44033.5	15	50638.57458
Transport to and from site	km	200	18.02	0.4664	26.424528	0	26.425	5284.91	15	6077.6414
									Total	106965.51
									Cost per m depth	2139.310225

Labour man days & supervision included in drilling rate

Preliminary & general included in provided rates

Boreholes-Shallow 50m- Deep Rural (250km radius) **Gauteng**

208 mm ID hole

Description	Unit	Qty	Rate (2009)	CPAF	Escalated price (2020)	Difference from Gauteng prices (%)	Unit costs	Sub total	Construction Margin (%)	Total
Divine Water- Position of Hole	ea	1	9239.49	0.4664	13548.78814	0	13549	13548.8	15	15581.10636
Drill hole to 200m	m	50	180.17	0.4664	264.201288	0	264.2	13210.1	15	15191.57406
Supply and fit borehole lining (PVC)	m	50	230.99	0.4664	338.723736	0	338.72	16936.2	15	19476.61482
Install pump, motor, cabling, control panel	ea	1	30028.3	0.4664	44033.54311	0	44034	44033.5	15	50638.57458
Transport to and from site	km	500	18.02	0.4664	26.424528	0	26.425	13212.3	15	15194.103
									Total	116081.97
									Cost per m depth	2321.639468

Labour man days & supervision included in drilling rate

Preliminary & general included in provided rates

Boreholes-Deep 200m- Semi Rural (100km radius) **Gauteng**

208 mm ID hole

Description	Unit	Qty	Rate (2009)	CPAF	Escalated price (2020)	Difference from Gauteng prices (%)	Unit costs	Sub total	Construction Margin (%)	Total
Divine Water- Position of Hole	ea	1	9239.49	0.4664	13548.78814	0	13549	13548.8	15	15581.10636
Drill hole to 200m	m	200	180.17	0.4664	264.201288	0	264.2	52840.3	15	60766.29624
Supply and fit borehole lining (PVC)	m	200	230.99	0.4664	338.723736	0	338.72	67744.7	15	77906.45928
Install pump, motor, cabling, control panel	ea	1	30028.3	0.4664	44033.54311	0	44034	44033.5	15	50638.57458
Transport to and from site	km	100	18.02	0.4664	26.424528	0	26.425	2642.45	15	3038.8207
									Total	207931.26
									Cost per m depth	1039.656286

Labour man days & supervision included in drilling rate

Preliminary & general included in provided rates

Boreholes-Deep 200m- Deep Rural (250km radius) **Gauteng**

208 mm ID hole

Description	Unit	Qty	Rate (2009)	CPAF	Escalated price (2020)	Difference from Gauteng prices (%)	Unit costs	Sub total	Construction Margin (%)	Total
Divine Water- Position of Hole	ea	1	9239.49	0.4664	13548.78814	0	13549	13548.8	15	15581.10636
Drill hole to 200m	m	200	240.23	0.4664	352.273272	0	352.27	70454.7	15	81022.85256
Supply and fit borehole lining (PVC)	m	200	230.99	0.4664	338.723736	0	338.72	67744.7	15	77906.45928
Install pump, motor, cabling, control panel	ea	1	30028.3	0.4664	44033.54311	0	44034	44033.5	15	50638.57458
Transport to and fro site	km	500	18.02	0.4664	26.424528	0	26.425	13212.3	15	15194.103
									Total cost	240343.09
									Cost per m depth	1201.715482

Labour man days & supervision included in drilling rate

Preliminary & general included in provided rates

General water supply **GAUTENG**

Roof tank

Description	Unit	Qty	Rate (2009)	CPAF	Escalated price (2020)	Difference from Gauteng prices (%)	Unit costs	Sub total	Construction Margin (%)	Total
Roof tank	ea	1	1522	0.4664	2231.8608	0	2231.9	2231.86	15	2566.6399

VIP toilets or equivalent (single pit fixed top structure) **GAUTENG**

Substructure- single pit

Description	Unit	Qty	Rate (2009)	CPAF	Escalated price (2020)	Difference from Gauteng prices (%)	Unit costs	Sub total	Construction Margin (%)	Total
Substructure- single pit										
Concrete bricks	brick	320	2.29	0.4664	3.35806	0	3.358056	1074.578	15	1235.765
Mortar sand	m3	0.3	268.04	0.4664	393.054	0	393.0539	117.9162	15	135.6036
Cement	bag	2	72.55	0.4664	106.387	0	106.3873	212.7746	15	244.6908
Superstructure- fixed										
Concrete bricks	brick	480	2.29	0.4664	3.35806	0	3.358056	1611.867	15	1853.647
Mortar sand	m3	1	268.04	0.4664	393.054	0	393.0539	393.0539	15	452.0119
Concrete to floors	m3	1	592.65	0.4664	869.062	0	869.062	869.062	15	999.4213
Cement	bag	4	72.55	0.4664	106.387	0	106.3873	425.5493	15	489.3817
Corrugated iron (0.67m width x 1.8m length)	m	3	81.26	0.4664	119.16	0	119.1597	357.479	15	411.1008
Timber wall plates	m	2	36	0.4664	52.7904	0	52.7904	105.5808	15	121.4179
Timber trusses	m	3	54.73	0.4664	80.2561	0	80.25607	240.7682	15	276.8834
Timber brandering	m	3	0	0.4664	0	0	0	0	15	0
Reinforcing Mesh Ref 113	m2	2	55.39	0.4664	81.2239	0	81.2239	162.4478	15	186.815

Steel door frames	ea	1	162.4	0.4664	238.143	0	238.1434	238.1434	15	273.8649
Steel doors	ea	1	315	0.4664	461.916	0	461.916	461.916	15	531.2034
Breeze bricks	ea	2	24	0.4664	35.1936	0	35.1936	70.3872	15	80.94528
Hinges	ea	2	37.85	0.4664	55.5032	0	55.50324	111.0065	15	127.6575
Brick force	m	25	0.5	0.4664	0.7332	0	0.7332	18.33	15	21.0795
3.5mm wire- roof ties	kg	0.1	110	0.4664	161.304	0	161.304	16.1304	15	18.54996
Fixtures										
Precast toilet pedestal	ea	1	195.85	0.4664	287.194	0	287.1944	287.1944	15	330.2736
Seat cover	ea	1	48.95	0.4664	71.7803	0	71.78028	71.78028	15	82.54732
110mm PVC wall brackets	ea	4	13.5	0.4664	19.7964	0	19.7964	79.1856	15	91.06344
PVC pipe 110mm	m	3	36.9	0.4664	54.1102	0	54.11016	162.3305	15	186.6801
Aluminium 110mm fly screen	ea	1	18	0.4664	26.3952	0	26.3952	26.3952	15	30.35448
Hand washing facility	ea	1	97.22	0.4664	142.563	0	142.5634	142.5634	15	163.9479
Labour										
Labour excavation	m3	3	60	0.4664	87.984	0	87.984	263.952	15	303.5448
Labour lining	person days	1	102.51	0.4664	150.321	0	150.3207	150.3207	15	172.8688
Labour build top structure and roof	person days	3	102.51	0.4664	150.321	0	150.3207	450.962	15	518.6063

Labour found and floor	person days	2	102.51	0.4664	150.321	0	150.3207	300.6413	15	345.7375
Labour fixtures	person days	1	102.51	0.4664	150.321	0	150.3207	150.3207	15	172.8688
									Total	9858.531
Preliminary & General	%	10								985.8531
									Total cost	10844.38

Community Development

Community liaison, builder and quality assessor training and record keeping	person days	1	150	0.4664	219.96	0	219.96	219.96	0	219.96
Health, hygiene and user education materials	user material pack	1	100	0.4664	146.64	0	146.64	146.64	0	146.64
Health, hygiene and user education training	person days	0.5	150	0.4664	219.96	0	219.96	109.98	0	109.98
Peer education house to house visits (x3)	visit	3	40	0.4664	58.656	0	58.656	175.968	0	175.968
									Total cost community dev.	652.548

VIP Toilets or equivalent (double pit fixed top structure) **GAUTENG**

Description	Unit	Qty	Rate (2009)	CPAF	Escalated price (2020)	Difference from Gauteng prices (%)	Unit costs	Sub total	Construction Margin (%)	Total
Substructure- double pit										
Concrete bricks	brick	380	2.29	0.4664	3.35806	0	3.358056	1276.061	15	1467.47
Mortar sand	m3	1	268.04	0.4664	393.054	0	393.0539	393.0539	15	452.0119
Cement	bag	3	72.55	0.4664	106.387	0	106.3873	319.162	15	367.0363
Superstructure- fixed										
Concrete bricks	brick	480	2.29	0.4664	3.35806	0	3.358056	1611.86	15	1853.647
Mortar sand	m3	0.5	268.04	0.4664	393.054	0	393.0539	196.52	15	226.006
Concrete to floors	m3	0.6	592.65	0.4664	869.062	0	869.062	521.4372	15	599.6528
Cement	bag	4	72.55	0.4664	106.387	0	106.3873	425.549	15	489.381
Corrugated iron (0.67m width x 1.8m length)	m	3	81.26	0.4664	119.16	0	119.1597	357.479	15	411.100
Timber wall plates	m	2	36	0.4664	52.7904	0	52.7904	105.580	15	121.417
Timber trusses	m	3	54.73	0.4664	80.2561	0	80.25607	240.7682	15	276.883
Timber brandering	m	3	0	0.4664	0	0	0	0	15	0
Reinforcing mesh ref 113	m2	2	55.39	0.4664	81.2239	0	81.2239	162.4478	15	186.815
Steel door frames	ea	1	162.4	0.4664	238.143	0	238.1434	238.1434	15	273.864
Steel doors	ea	1	315	0.4664	461.916	0	461.916	461.916	15	531.203

Breeze bricks	ea	2	24	0.4664	35.1936	0	35.1936	70.3872	15	80.94528
Hinges	ea	2	37.85	0.4664	55.5032	0	55.50324	111.0065	15	127.6575
Brick force	m	25	0.5	0.4664	0.7332	0	0.7332	18.33	15	21.0795
3.5mm wire- roof ties	kg	0.1	110	0.4664	161.304	0	161.304	16.1304	15	18.54996
Fixtures										
Precast toilet pedestal	ea	1	195.85	0.4664	287.194	0	287.1944	287.1944	15	330.2736
Seat cover	ea	1	48.95	0.4664	71.7803	0	71.78028	71.78028	15	82.54732
110mm PVC wall brackets	ea	4	13.5	0.4664	19.7964	0	19.7964	79.1856	15	91.06344
PVC pipe 110mm	m	3	36.9	0.4664	54.1102	0	54.11016	162.3305	15	186.6801
Aluminium 110mm fly screen	ea	1	18	0.4664	26.3952	0	26.3952	26.3952	15	30.35448
Hand washing facility	ea	1	97.22	0.4664	142.563	0	142.5634	142.5634	15	163.9479
Labour										
Labour excavation	m3	3	60	0.4664	87.984	0	87.984	263.952	15	303.5448
Labour lining	person days	1	102.51	0.4664	150.321	0	150.3207	150.3207	15	172.8688
Labour build top structure and roof	person days	3	102.51	0.4664	150.321	0	150.3207	450.962	15	518.6063
Labour found and floor	person days	2	102.51	0.4664	150.321	0	150.3207	300.6413	15	345.7375
Labour fixtures	person days	1	102.51	0.4664	150.321	0	150.3207	150.3207	15	172.8688
									Total	9903.217

Preliminary and general	%	10								

	990.3217
Total cost	10893.54

Community development										
Community liaison, builder and quality assessor training and record keeping	person days	1	150	0.4664	219.96	0	219.96	219.96	0	219.96
Health, hygiene and user education materials	user material pack	1	100	0.4664	146.64	0	146.64	146.64	0	146.64
Health, hygiene and user education training	person days	0.5	150	0.4664	219.96	0	219.96	109.98	0	109.98
Peer education house to house visits (x3)	visit	3	40	0.4664	58.656	0	58.656	175.968	0	175.968

Total cost com. Dev.	652.548

VIP toilets or equivalent (single pit movable top structure) **Gauteng**

Description	Unit	Qty	Rate (2009)	CPAF	Escalated price (2020)	Difference from Gauteng prices (%)	Unit costs	Sub total	Construction Margin (%)	Total
Substructure- single pit										
Concrete bricks	brick	320	2.29	0.4664	3.35806	0	3.358056	1074.578	15	1235.765
Mortar sand	m3	0.3	268.04	0.4664	393.054	0	393.0539	117.9162	15	135.6036
Cement	bag	2	72.55	0.4664	106.387	0	106.3873	212.7746	15	244.6908
Superstructure- movable										
Prefabricated top structure (all incl. walls, roof, door)	unit	1	2878	0.4664	4220.3	0	4220.299	4220.299	15	4853.344
Mortar sand	m3	0.7	268.04	0.4664	393.054	0	393.0539	275.1377	15	316.4084
Concrete to floors	m3	0.6	592.65	0.4664	869.062	0	869.062	521.4372	15	599.6528
Cement	bag	4	72.55	0.4664	106.387	0	106.3873	425.5493	15	489.3817
Reinforcing mesh ref 113	m2	2	55.39	0.4664	81.2239	0	81.2239	162.4478	15	186.815
Fixtures										
Precast toilet pedestal	ea	1	195.85	0.4664	287.194	0	287.1944	287.1944	15	330.2736
Seat cover	ea	1	48.95	0.4664	71.7803	0	71.78028	71.78028	15	82.54732
110 mm PVC wall brackets	ea	4	13.5	0.4664	19.7964	0	19.7964	79.1856	15	91.06344
PVC pipe 110 mm	m	3	36.9	0.4664	54.1102	0	54.11016	162.3305	15	186.6801
Aluminium 110mm fly screen	ea	1	18	0.4664	26.3952	0	26.3952	26.3952	15	30.35448
Hand washing facility	ea	1	97.22	0.4664	142.563	0	142.5634	142.5634	15	163.9479
Labour										

Labour excavation	m3	3	60	0.4664	87.984	0	87.984	263.952	15	303.5448
Labour lining	person days	1	102.51	0.4664	150.321	0	150.3207	150.3207	15	172.8688
Labour build top structure and roof	person days	1	102.51	0.4664	150.321	0	150.3207	150.3207	15	172.8688
Labour found and floor	person days	2	102.51	0.4664	150.321	0	150.3207	300.6413	15	345.7375
Labour fixtures	person days	1	102.51	0.4664	150.321	0	150.3207	150.3207	15	172.8688
									Total	10114.42
Preliminary & general	%	10								1011.442
									Total cost	11125.86

Community Development										
Community liaison, builder and quality assessor training and record keeping	person days	1	150	0.4664	219.96	0	219.96	219.96	0	219.96
Health, hygiene and user education materials	user material pack	1	100	0.4664	146.64	0	146.64	146.64	0	146.64
Health, hygiene and user education training	person days	0.5	150	0.4664	219.96	0	219.96	109.98	0	109.98
Peer education house to house visits	visit	3	40	0.4664	58.656	0	58.656	175.968	0	175.968
									Total comm. dev. cost	652.548

VIP toilets or equivalent (double pit movable top structure) **Gauteng**

Description	Unit	Qty	Rate (2009)	CPAF	Escalated price (2020)	Difference from Gauteng prices (%)	Unit costs	Sub total	Construction Margin (%)	Total
Substructure- double pit										
Concrete bricks	brick	380	2.29	0.4664	3.35806	0	3.358056	1276.061	15	1467.47
Mortar sand	m3	0.5	268.04	0.4664	393.054	0	393.0539	196.5269	15	226.006
Cement	bag	3	72.55	0.4664	106.387	0	106.3873	319.162	15	367.0363
Superstructure- movable										
Prefabricated top structure (all incl. walls, roof, door)	unit	1	2878	0.4664	4220.3	0	4220.299	4220.299	15	4853.344
Mortar sand	m3	0.7	268.04	0.4664	393.054	0	393.0539	275.1377	15	316.4084
Concrete to floors	m3	0.6	592.65	0.4664	869.062	0	869.062	521.4372	15	599.6528
Cement	bag	4	72.33	0.4664	106.065	0	106.0647	424.2588	15	487.8977
Reinforcing mesh ref 113	m2	2	55.39	0.4664	81.2239	0	81.2239	162.4478	15	186.815
Fixtures										
Precast toilet pedestal	ea	1	195.85	0.4664	287.194	0	287.1944	287.1944	15	330.2736
Seat cover	ea	1	48.95	0.4664	71.7803	0	71.78028	71.78028	15	82.54732
110mm PVC wall brackets	ea	4	13.5	0.4664	19.7964	0	19.7964	79.1856	15	91.06344
PVC pipe 110mm	m	3	36.9	0.4664	54.1102	0	54.11016	162.3305	15	186.6801
Aluminium 110mm fly screen	ea	1	18	0.4664	26.3952	0	26.3952	26.3952	15	30.35448
Hand washing facility	ea	1	97.22	0.4664	142.563	0	142.5634	142.5634	15	163.9479
Labour										

Labour excavation	m3	3	60	0.4664	87.984	0	87.984	263.952	15	303.5448
Labour lining	person days	1	102.51	0.4664	150.321	0	150.3207	150.3207	15	172.8688
Labour build top structure and roof	person days	1	102.51	0.4664	150.321	0	150.3207	150.3207	15	172.8688
Labour found and floor	person days	2	102.51	0.4664	150.321	0	150.3207	300.6413	15	345.7375
Labour fixtures	person days	1	102.51	0.4664	150.321	0	150.3207	150.3207	15	172.8688
									Total	10557.39
Preliminary & general	%	10								1055.739
									Total cost	11613.12

Community development										
Community liaison, builder and quality assessor training and record keeping	person days	1	150	0.4664	219.96	0	219.96	219.96	0	219.96
Health, hygiene and user education materials	user material pack	1	100	0.4664	146.64	0	146.64	146.64	0	146.64
Health, hygiene and user education training	person days	0.5	150	0.4664	219.96	0	219.96	109.98	0	109.98
Peer education house to house visits	visit	3	40	0.4664	58.656	0	58.656	175.968	0	175.968
									Total comm. Dev. Cost	652.548

Onsite- Urine diversion **Gauteng**

Description	Unit	Qty	Rate (2009)	CPAF	Escalated price (2020)	Difference from Gauteng prices (%)	Unit costs	Sub total	Construction Margin (%)	Total
Substructure										
Concrete bricks	brick	200	2.29	0.4664	3.35806	0	3.358056	671.6112	15	772.3529
Mortar sand	m3	0.3	268.04	0.4664	393.054	0	393.0539	117.9162	15	135.6036
Cement	bag	2	72.55	0.4664	106.387	0	106.3873	212.7746	15	244.6908
Superstructure										
Concrete bricks	brick	480	2.29	0.4664	3.35806	0	3.358056	1611.867	15	1853.647
Mortar sand	m3	0.7	268.04	0.4664	393.054	0	393.0539	275.1377	15	316.4084
Concrete to floors	m3	0.8	592.65	0.4664	869.062	0	869.062	695.2496	15	799.537
Cement	bag	4	72.55	0.4664	106.387	0	106.3873	425.5493	15	489.3817
Corrugated iron (0.67m width x 1.8m length)	m	3	81.26	0.4664	119.16	0	119.1597	357.479	15	411.1008
Timber wall plates	m	2	36	0.4664	52.7904	0	52.7904	105.5808	15	121.4179
Timber trusses	m	3	54.73	0.4664	80.2561	0	80.25607	240.7682	15	276.8834
Timber brandering	m	3	0	0.4664	0	0	0	0	15	0
Reinforcing mesh ref 113	m2	2	55.39	0.4664	81.2239	0	81.2239	162.4478	15	186.815
Steel door frames	ea	1	162.4	0.4664	238.143	0	238.1434	238.1434	15	273.8649
Steel doors	ea	1	315	0.4664	461.916	0	461.916	461.916	15	531.2034
Floor slab frame	ea	1	0	0.4664	0	0	0	0	15	0
Breeze bricks	ea	2	24	0.4664	35.1936	0	35.1936	70.3872	15	80.94528
Hinges	ea	2	37.85	0.4664	55.5032	0	55.50324	111.0065	15	127.6575

Brick force	m	25	0.5	0.4664	0.7332	0	0.7332	18.33	15	21.0795
3.5mm wire- roof ties	kg	0.1	110	0.4664	161.304	0	161.304	16.1304	15	18.54996
Fixtures										
Precast toilet pedestal	ea	1	195.85	0.4664	287.194	0	287.1944	287.1944	15	330.2736
Seat cover	ea	1	48.95	0.4664	71.7803	0	71.78028	71.78028	15	82.54732
110mm PVC wall brackets	ea	4	13.5	0.4664	19.7964	0	19.7964	79.1856	15	91.06344
PVC pipe 110mm	m	3	36.9	0.4664	54.1102	0	54.11016	162.3305	15	186.6801
25mm HDPE piping	m	8	3.84	0.4664	5.63098	0	5.630976	45.04781	15	51.80498
Access cover	ea	1	82	0.4664	120.245	0	120.2448	120.2448	15	138.2815
Aluminium 110mm fly screen	ea	1	18	0.4664	26.3952	0	26.3952	26.3952	15	30.35448
Hand washing facility	ea	1	70	0.4664	102.648	0	102.648	102.648	15	118.0452
Labour										
Labour excavation	m3	1	60	0.4664	87.984	0	87.984	87.984	15	101.1816
Labour UDS chamber and drainage	person days	1	102.51	0.4664	150.321	0	150.3207	150.3207	15	172.8688
Labour build top structure and roof	person days	3	102.51	0.4664	150.321	0	150.3207	450.962	15	518.6063
Labour found and floor	person days	2	102.51	0.4664	150.321	0	150.3207	300.6413	15	345.7375
Labour fixtures	person days	1	102.51	0.4664	150.321	0	150.3207	150.3207	15	172.8688
									Total	9001.452
Preliminary & general	%	10								900.1452
									Total cost	9901.598

Community development										
Community liaison, builder and quality assessor training and record keeping	person days	1	150	0.4664	219.96	0	219.96	219.96	0	219.96
Health, hygiene and user education materials	user material pack	1	100	0.4664	146.64	0	146.64	146.64	0	146.64
Health, hygiene and user education training	person days	0.5	150	0.4664	219.96	0	219.96	109.98	0	109.98
Peer education house to house visits	visit	3	40	0.4664	58.656	0	58.656	175.968	0	175.968
									Total comm. Dev. Cost	652.548

Onsite Septic Tank **Gauteng**

Description	Unit	Qty	Rate (2009)	CPAF	Escalated price (2020)	Difference from Gauteng prices (%)	Unit costs	Sub total	Construction Margin (%)	Total
Substructure										
Concrete bricks	brick	350	2.29	0.4664	3.35806	0	3.358056	1175.32	15	1351.618
Mortar sand	m3	1.5	268.04	0.4664	393.054	0	393.0539	589.5808	15	678.0179
Plaster sand	m3	1.5	161.13	0.4664	236.281	0	236.281	354.4215	15	407.5848
Cement	bag	4	72.55	0.4664	106.387	0	106.3873	425.5493	15	489.3817
Superstructure										
Concrete bricks	brick	480	2.29	0.4664	3.35806	0	3.358056	1611.867	15	1853.647
Mortar sand	m3	0.7	268.04	0.4664	393.054	0	393.0539	275.1377	15	316.4084
Plaster sand	m3	0.7	161.13	0.4664	236.281	0	236.281	165.3967	15	190.2062
Concrete to floors	m3	0.75	693.58	0.4664	1017.07	0	1017.066	762.7993	15	877.2192
Cement	bag	4	72.55	0.4664	106.387	0	106.3873	425.5493	15	489.3817
Corrugated iron (0.67m width x 1.8m length)	m	3	133.13	0.4664	195.222	0	195.2218	585.6655	15	673.5153
Timber wall plates	m	2	36	0.4664	52.7904	0	52.7904	105.5808	15	121.4179
Timber trusses	m	3	54.73	0.4664	80.2561	0	80.25607	240.7682	15	276.8834
Timber brandering	m	3	0	0.4664	0	0	0	0	15	0
Reinforcing mesh ref 113	m2	2	55.39	0.4664	81.2239	0	81.2239	162.4478	15	186.815
Steel door frames	ea	1	59.82	0.4664	87.72	0	87.72005	87.72005	15	100.8781
Steel doors	ea	1	315	0.4664	461.916	0	461.916	461.916	15	531.2034
Floor slab frame	ea	1	0	0.4664	0	0	0	0	15	0

Breeze bricks	ea	2	24	0.4664	35.1936	0	35.1936	70.3872	15	80.94528
Hinges	ea	2	0	0.4664	0	0	0	0	15	0
Brick force	m	25	0.5	0.4664	0.7332	0	0.7332	18.33	15	21.0795
3.5mm wire- roof ties	kg	0.1	110	0.4664	161.304	0	161.304	16.1304	15	18.54996
Plumbing water										
110mm saddle	ea	1	89.7	0.4664	131.536	0	131.5361	131.5361	15	151.2665
Plason male adaptor	ea	2	13.28	0.4664	19.4738	0	19.47379	38.94758	15	44.78972
Galv. 15mm bend	ea	1	4.61	0.4664	6.7601	0	6.760104	6.760104	15	7.77412
Galv. 15mm T	ea	1	3.92	0.4664	5.74829	0	5.748288	5.748288	15	6.610531
Galv. 15mm 1700mm pipe	ea	1	59.86	0.4664	87.7787	0	87.7787	87.7787	15	100.9455
Galv. 15mm 400mm pipe	ea	1	16.26	0.4664	23.8437	0	23.84366	23.84366	15	27.42021
15mm brass stop valve	ea	1	82.95	0.4664	121.638	0	121.6379	121.6379	15	139.8836
Garden tap	ea	1	51.97	0.4664	76.2088	0	76.20881	76.20881	15	87.64013
HDPE pipe	m	6	3.92	0.4664	5.74829	0	5.748288	34.48973	15	39.66319
Handwashing facility	ea	1	97.22	0.4664	142.563	0	142.5634	142.5634	15	163.9479
Plumbing sewer										
Cistern	ea	1	245.95	0.4664	360.661	0	360.6611	360.6611	15	414.7602
Pan	ea	1	156.74	0.4664	229.844	0	229.8435	229.8435	15	264.3201
Toilet seat	ea	1	44.97	0.4664	65.944	0	65.94401	65.94401	15	75.83561
Concrete basin	ea	1	0	0.4664	0	0	0	0	15	0
Ballcock valve	ea	1	30.42	0.4664	44.6079	0	44.60789	44.60789	15	51.29907
PVC pipe 50mm	m	3	15.91	0.4664	23.3304	0	23.33042	69.99127	15	80.48996

PVC pipe 110mm	m	3	47.61	0.4664	69.8153	0	69.8153	209.4459	15	240.8628
2-way 50mm vent valve	ea	1	21.3	0.4664	31.2343	0	31.23432	31.23432	15	35.91947
PVC bend vent and serv.	ea	1	52.49	0.4664	76.9713	0	76.97134	76.97134	15	88.51704
Hose bib	ea	1	49	0.4664	71.8536	0	71.8536	71.8536	15	82.63164
Concrete gully	ea	1	398.66	0.4664	584.595	0	584.595	584.595	15	672.2843
PVC gully	ea	1	76.95	0.4664	112.839	0	112.8395	112.8395	15	129.7654
PVC gully trap	ea	1	154.96	0.4664	227.233	0	227.2333	227.2333	15	261.3183
110 PVC T	ea	1	54.66	0.4664	80.1534	0	80.15342	80.15342	15	92.17644
50mm bends	ea	1	67.01	0.4664	98.2635	0	98.26346	98.26346	15	113.003
110mm 45 deg. Bend	ea	1	44.67	0.4664	65.5041	0	65.50409	65.50409	15	75.3297
Rodding eye	ea	1	44.06	0.4664	64.6096	0	64.60958	64.60958	15	74.30102
110 x 50 red T	ea	1	53.86	0.4664	78.9803	0	78.9803	78.9803	15	90.82735
Labour										
Labour excavation	m3	5	60	0.4664	87.984	0	87.984	439.92	15	505.908
Labour build septic tank	person days	2	101.5	0.4664	148.84	0	148.8396	297.6792	15	342.3311
Labour build top structure and roof	person days	3	101.5	0.4664	148.84	0	148.8396	446.5188	15	513.4966
Labour found and floor	person days	2	101.5	0.4664	148.84	0	148.8396	297.6792	15	342.3311
Labour fixtures	person days	1	101.5	0.4664	148.84	0	148.8396	148.8396	15	171.1655
									Total	14153.57
Preliminary & general	%	10								1415.357

Total cost	15568.92

Community development										
Community liaison, builder and quality assessor training and record keeping	person days	1	150	0.4664	219.96	0	219.96	219.96	0	219.96
Health, hygiene and user education materials	user material pack	1	100	0.4664	146.64	0	146.64	146.64	0	146.64
Health, hygiene and user education training	person days	0.5	150	0.4664	219.96	0	219.96	109.98	0	109.98
Peer education house to house visits	visit	3	40	0.4664	58.656	0	58.656	175.968	0	175.968
									Total comm. Dev. Cost	652.548

Onsite full flush **Gauteng**

Description	Unit	Qty	Rate (2009)	CPAF	Escalated price (2020)	Difference from Gauteng prices (%)	Unit costs	Sub total	Construction Margin (%)	Total
Superstructure										
Concrete bricks	brick	480	2.29	0.4664	3.35806	0	3.358056	1611.867	15	1853.647
Mortar sand	m3	1	268.04	0.4664	393.054	0	393.0539	393.0539	15	452.0119
Plaster sand	m3	1	161.13	0.4664	236.281	0	236.281	236.281	15	271.7232
Concrete to floors	m3	0.3	693.58	0.4664	1017.07	0	1017.066	305.1197	15	350.8877
Cement	bag	4	72.55	0.4664	106.387	0	106.3873	425.5493	15	489.3817
Corrugated iron (0.67m width x 1.8m length)	m	3	133.13	0.4664	195.222	0	195.2218	585.6655	15	673.5153
Timber wall plates	m	2	36	0.4664	52.7904	0	52.7904	105.5808	15	121.4179
Timber trusses	m	3	54.73	0.4664	80.2561	0	80.25607	240.7682	15	276.8834
Timber brandering	m	3	0	0.4664	0	0	0	0	15	0
Reinforcing mesh ref 113	m2	2	55.39	0.4664	81.2239	0	81.2239	162.4478	15	186.815
Steel door frames	ea	1	135	0.4664	197.964	0	197.964	197.964	15	227.6586
Steel doors	ea	1	315	0.4664	461.916	0	461.916	461.916	15	531.2034
Floor slab frame	ea	1	0	0.4664	0	0	0	0	15	0
Breeze bricks	ea	2	24	0.4664	35.1936	0	35.1936	70.3872	15	80.94528
Hinges	ea	2	0	0.4664	0	0	0	0	15	0
Brick force	m	25	0.5	0.4664	0.7332	0	0.7332	18.33	15	21.0795
3.5mm wire- roof ties	kg	0.1	110	0.4664	161.304	0	161.304	16.1304	15	18.54996
Plumbing water										

110mm saddle	ea	1	121.72	0.4664	178.49	0	178.4902	178.4902	15	205.2637
Plason male adaptor	ea	2	30.84	0.4664	45.2238	0	45.22378	90.44755	15	104.0147
Galv. 15mm bend	ea	1	7.75	0.4664	11.3646	0	11.3646	11.3646	15	13.06929
Galv. 15mm T	ea	1	5.53	0.4664	8.10919	0	8.109192	8.109192	15	9.325571
Galv. 15mm 1700mm pipe	ea	1	71.93	0.4664	105.478	0	105.4782	105.4782	15	121.2999
Galv. 15mm 400mm pipe	ea	1	23.24	0.4664	34.0791	0	34.07914	34.07914	15	39.19101
15mm brass stop valve	ea	1	94.06	0.4664	137.93	0	137.9296	137.9296	15	158.619
Garden tap	ea	1	56.38	0.4664	82.6756	0	82.67563	82.67563	15	95.07698
HDPE pipe	m	6	14.41	0.4664	21.1308	0	21.13082	126.7849	15	145.8027
Handwashing facility	ea	1	89.17	0.4664	130.759	0	130.7589	130.7589	15	150.3727
Plumbing sewer										
Cistern	ea	1	354.1	0.4664	519.252	0	519.2522	519.2522	15	597.1401
Pan	ea	1	154.92	0.4664	227.175	0	227.1747	227.1747	15	261.2509
Toilet seat	ea	1	44.26	0.4664	64.9029	0	64.90286	64.90286	15	74.63829
Ballcock valve	ea	1	30.42	0.4664	44.6079	0	44.60789	44.60789	15	51.29907
PVC pipe 50mm	m	3	15.91	0.4664	23.3304	0	23.33042	69.99127	15	80.48996
PVC pipe 110mm	m	3	47.61	0.4664	69.8153	0	69.8153	209.4459	15	240.8628
2-way 50mm vent valve	ea	1	21.3	0.4664	31.2343	0	31.23432	31.23432	15	35.91947
PVC bend vent and serv.	ea	1	52.49	0.4664	76.9713	0	76.97134	76.97134	15	88.51704
Hose bib	ea	1	49	0.4664	71.8536	0	71.8536	71.8536	15	82.63164
Concrete gully	ea	1	398.66	0.4664	584.595	0	584.595	584.595	15	672.2843
PVC gully	ea	1	76.95	0.4664	112.839	0	112.8395	112.8395	15	129.7654

PVC gully trap	ea	1	154.96	0.4664	227.233	0	227.2333	227.2333	15	261.3183
110 PVC T	ea	1	54.66	0.4664	80.1534	0	80.15342	80.15342	15	92.17644
50mm bends	ea	1	67.01	0.4664	98.2635	0	98.26346	98.26346	15	113.003
110mm 45 deg. Bend	ea	1	44.67	0.4664	65.5041	0	65.50409	65.50409	15	75.3297
Rodding eye	ea	1	44.06	0.4664	64.6096	0	64.60958	64.60958	15	74.30102
110 x 50 red T	ea	1	53.86	0.4664	78.9803	0	78.9803	78.9803	15	90.82735
Labour										
Labour excavation	m3	5	60	0.4664	87.984	0	87.984	439.92	15	505.908
Labour pipework	person days	1	101.5	0.4664	148.84	0	148.8396	148.8396	15	171.1655
Labour build top structure and roof	person days	3	101.5	0.4664	148.84	0	148.8396	446.5188	15	513.4966
Labour found and floor	person days	2	101.5	0.4664	148.84	0	148.8396	297.6792	15	342.3311
Labour fixtures	person days	1	101.5	0.4664	148.84	0	148.8396	148.8396	15	171.1655
									Total	11323.58
										1132.358
									Total cost	12455.93

Preliminary & general	%	10

Community development										
Community liaison, builder and quality assessor training and record keeping	person days	1	150	0.4664	219.96	0	219.96	219.96	0	219.96
Health, hygiene and user education materials	user material pack	1	100	0.4664	146.64	0	146.64	146.64	0	146.64
Health, hygiene and user education training	person days	0.5	150	0.4664	219.96	0	219.96	109.98	0	109.98
Peer education house to house visits	visit	3	40	0.4664	58.656	0	58.656	175.968	0	175.968
									Total comm. Dev. Cost	652.548

Bulk wastewater supply

Cost/m from municipal supply **Gauteng** **BOQ based on 1000m length** **Assuming trench excavation depth of 1.6m**

75mm supply

Description	Unit	Qty	Rate (2009)	CPAF	Escalated price (2020)	Difference from Gauteng prices (%)	Unit costs	Sub total	Construction Margin (%)	Total
Clear & grub	m2	2000	1.82	0.4664	2.66885	0	2.668848	5337.696	15	6138.35
Removal of topsoil	m2	2000	3.44	0.4664	5.04442	0	5.044416	10088.83	15	11602.16
Trench excavation (machine)	m	1000	57.58	0.4664	84.4353	0	84.43531	84435.31	15	97100.61
Bedding & backfill	m3	1105	61.38	0.4664	90.0076	0	90.00763	99458.43	15	114377.2
75mm PVC sewer pipe	m	1000	25.12	0.4664	36.836	0	36.83597	36835.97	15	42361.36
Concrete to manhole base	no	3	1077.15	0.4664	1579.53	0	1579.533	4738.598	15	5449.388
Concrete to benching	no	4	1077.15	0.4664	1579.53	0	1579.533	6318.131	15	7265.851
Starter ring	ea	13	551.98	0.4664	809.423	0	809.4235	10522.51	15	12100.88
1000mm dia x 500 mm m/h ring	ea	39	709.69	0.4664	1040.69	0	1040.689	40586.89	15	46674.92
Manhole cover	ea	13	346.96	0.4664	508.782	0	508.7821	6614.168	15	7606.293
Manhole lid	ea	13	181.37	0.4664	265.961	0	265.961	3457.493	15	3976.116
Testing	m	1000	7.89	0.4664	11.5699	0	11.5699	11569.9	15	13305.38
Labour	person days	220	102.51	0.4664	150.321	0	150.3207	33070.55	15	38031.13

Supervision	person days	16	145.58	0.4664	213.479	0	213.4785	3415.656	15	3928.005
									Total	409917.6
Preliminary & general	%	10								40991.76
									Total cost	450909.4
									Cost per m	450.9094

Bulk wastewater supply

Cost/m from municipal supply **Gauteng** **BOQ based on 1000m length**

90mm supply

Description	Unit	Qty	Rate (2009)	CPAF	Escalated price (2020)	Difference from Gauteng prices (%)	Unit costs	Sub total	Construction Margin (%)	Total
Clear & grub	m2	2000	1.82	0.4664	2.66885	0	2.668848	5337.696	15	6138.35
Removal of topsoil	m2	2000	3.44	0.4664	5.04442	0	5.044416	10088.83	15	11602.16
Trench excavation (machine)	m	1000	57.58	0.4664	84.4353	0	84.43531	84435.31	15	97100.61
Bedding & backfill	m3	1105	61.38	0.4664	90.0076	0	90.00763	99458.43	15	114377.2
90mm PVC sewer pipe	m	1000	30.12	0.4664	44.168	0	44.16797	44167.97	15	50793.16
Concrete to manhole base	no	3	1077.15	0.4664	1579.53	0	1579.533	4738.598	15	5449.388
Concrete to benching	no	4	1077.15	0.4664	1579.53	0	1579.533	6318.131	15	7265.851
Starter ring	ea	13	551.98	0.4664	809.423	0	809.4235	10522.51	15	12100.88
1000mm dia x 500 mm m/h ring	ea	39	709.69	0.4664	1040.69	0	1040.689	40586.89	15	46674.92
Manhole cover	ea	13	346.96	0.4664	508.782	0	508.7821	6614.168	15	7606.293
Manhole lid	ea	13	181.37	0.4664	265.961	0	265.961	3457.493	15	3976.116
Testing	m	1000	7.89	0.4664	11.5699	0	11.5699	11569.9	15	13305.38
Labour	person days	220	102.51	0.4664	150.321	0	150.3207	33070.55	15	38031.13

Supervision	person days	16	145.58	0.4664	213.479	0	213.4785	3415.656	15	3928.005
									Total	418349.4
Preliminary & general	%	10								41834.94
									Total cost	460184.4
									Cost per m	460.1844

Bulk wastewater supply

Cost/m from municipal supply **Gauteng** **BOQ based on 1000m length**

110mm supply

Description	Unit	Qty	Rate (2009)	CPAF	Escalated price (2020)	Difference from Gauteng prices (%)	Unit costs	Sub total	Construction Margin (%)	Total
Clear & grub	m2	2000	1.82	0.4664	2.66885	0	2.668848	5337.696	15	6138.35
Removal of topsoil	m2	2000	3.44	0.4664	5.04442	0	5.044416	10088.83	15	11602.16
Trench excavation (machine)	m	1000	57.58	0.4664	84.4353	0	84.43531	84435.31	15	97100.61
Bedding & backfill	m3	1105	61.38	0.4664	90.0076	0	90.00763	99458.43	15	114377.2
110mm PVC sewer pipe	m	1000	33.12	0.4664	48.5672	0	48.56717	48567.17	15	55852.24
Concrete to manhole base	no	3	1077.15	0.4664	1579.53	0	1579.533	4738.598	15	5449.388
Concrete to benching	no	4	1077.15	0.4664	1579.53	0	1579.533	6318.131	15	7265.851
Starter ring	ea	13	551.98	0.4664	809.423	0	809.4235	10522.51	15	12100.88

1000mm dia x 500 mm m/h ring	ea	39	709.69	0.4664	1040.69	0	1040.689	40586.89	15	46674.92
Manhole cover	ea	13	346.96	0.4664	508.782	0	508.7821	6614.168	15	7606.293
Manhole lid	ea	13	181.37	0.4664	265.961	0	265.961	3457.493	15	3976.116
Testing	m	1000	7.89	0.4664	11.5699	0	11.5699	11569.9	15	13305.38
Labour	person days	220	102.51	0.4664	150.321	0	150.3207	33070.55	15	38031.13
Supervision	person days	16	145.58	0.4664	213.479	0	213.4785	3415.656	15	3928.005
									Total	423408.5
Preliminary & general	%	10								42340.85
									Total cost	465749.4
									Cost per m	465.7494

Bulk wastewater supply

Cost/m from municipal supply **Gauteng** **BOQ based on 1000m length**

160mm supply

Description	Unit	Qty	Rate (2009)	CPAF	Escalated price (2020)	Difference from Gauteng prices (%)	Unit costs	Sub total	Construction Margin (%)	Total
Clear & grub	m2	2000	1.82	0.4664	2.66885	0	2.668848	5337.696	15	6138.35
Removal of topsoil	m2	2000	3.44	0.4664	5.04442	0	5.044416	10088.83	15	11602.16
Trench excavation (machine)	m	1000	57.58	0.4664	84.4353	0	84.43531	84435.31	15	97100.61
Bedding & backfill	m3	1105	61.38	0.4664	90.0076	0	90.00763	99458.43	15	114377.2
160mm PVC sewer pipe	m	1000	66.24	0.4664	97.1343	0	97.13434	97134.34	15	111704.5
Concrete to manhole base	no	3	1077.15	0.4664	1579.53	0	1579.533	4738.598	15	5449.388
Concrete to benching	no	4	1077.15	0.4664	1579.53	0	1579.533	6318.131	15	7265.851
Starter ring	ea	13	551.98	0.4664	809.423	0	809.4235	10522.51	15	12100.88
1000mm dia x 500 mm m/h ring	ea	39	709.69	0.4664	1040.69	0	1040.689	40586.89	15	46674.92
Manhole cover	ea	13	346.96	0.4664	508.782	0	508.7821	6614.168	15	7606.293
Manhole lid	ea	13	181.37	0.4664	265.961	0	265.961	3457.493	15	3976.116
Testing	m	1000	7.89	0.4664	11.5699	0	11.5699	11569.9	15	13305.38
Labour	person days	220	102.51	0.4664	150.321	0	150.3207	33070.55	15	38031.13
Supervision	person days	16	145.58	0.4664	213.479	0	213.4785	3415.656	15	3928.005
									Total	479260.8
Preliminary & general	%	10								47926.08

Total cost	527186.8
Cost per m	527.1868

Bulk wastewater supply

Cost/m from municipal supply **Gauteng** **BOQ based on 1000m length**

250mm supply

Description	Unit	Qty	Rate (2009)	CPAF	Escalated price (2020)	Difference from Gauteng prices (%)	Unit costs	Sub total	Construction Margin (%)	Total
Clear & grub	m2	2000	1.82	0.4664	2.66885	0	2.668848	5337.696	15	6138.35
Removal of topsoil	m2	2000	3.44	0.4664	5.04442	0	5.044416	10088.83	15	11602.16
Trench excavation (machine)	m	1000	57.58	0.4664	84.4353	0	84.43531	84435.31	15	97100.61
Bedding & backfill	m3	1105	61.38	0.4664	90.0076	0	90.00763	99458.43	15	114377.2
250mm PVC sewer pipe	m	1000	208.18	0.4664	305.275	0	305.2752	305275.2	15	351066.4
Concrete to manhole base	no	3	1077.15	0.4664	1579.53	0	1579.533	4738.598	15	5449.388
Concrete to benching	no	4	1077.15	0.4664	1579.53	0	1579.533	6318.131	15	7265.851
Starter ring	ea	13	551.98	0.4664	809.423	0	809.4235	10522.51	15	12100.88
1000mm dia x 500 mm m/h ring	ea	39	709.69	0.4664	1040.69	0	1040.689	40586.89	15	46674.92
Manhole cover	ea	13	346.96	0.4664	508.782	0	508.7821	6614.168	15	7606.293
Manhole lid	ea	13	181.37	0.4664	265.961	0	265.961	3457.493	15	3976.116
Testing	m	1000	7.89	0.4664	11.5699	0	11.5699	11569.9	15	13305.38

Labour	person days	220	102.51	0.4664	150.321	0	150.3207	33070.55	15	38031.13
Supervision	person days	16	145.58	0.4664	213.479	0	213.4785	3415.656	15	3928.005
									Total	718622.7
Preliminary & general	%	10								71862.27
									Total cost	790485
									Cost per m	790.485

Bulk wastewater supply

Cost/m from municipal supply **Gauteng** **BOQ based on 1000m length**

315mm supply

Description	Unit	Qty	Rate (2009)	CPAF	Escalated price (2020)	Difference from Gauteng prices (%)	Unit costs	Sub total	Construction Margin (%)	Total
Clear & grub	m2	2000	1.82	0.4664	2.66885	0	2.668848	5337.696	15	6138.35
Removal of topsoil	m2	2000	3.44	0.4664	5.04442	0	5.044416	10088.83	15	11602.16
Trench excavation (machine)	m	1000	57.58	0.4664	84.4353	0	84.43531	84435.31	15	97100.61
Bedding & backfill	m3	1105	61.38	0.4664	90.0076	0	90.00763	99458.43	15	114377.2
300mm PVC sewer pipe	m	1000	288.18	0.4664	422.587	0	422.5872	422587.2	15	485975.2
Concrete to manhole base	no	3	1077.15	0.4664	1579.53	0	1579.533	4738.598	15	5449.388
Concrete to benching	no	4	1077.15	0.4664	1579.53	0	1579.533	6318.131	15	7265.851
Starter ring	ea	13	551.98	0.4664	809.423	0	809.4235	10522.51	15	12100.88
1000mm dia x 500 mm m/h ring	ea	39	709.69	0.4664	1040.69	0	1040.689	40586.89	15	46674.92
Manhole cover	ea	13	346.96	0.4664	508.782	0	508.7821	6614.168	15	7606.293
Manhole lid	ea	13	181.37	0.4664	265.961	0	265.961	3457.493	15	3976.116
Testing	m	1000	7.89	0.4664	11.5699	0	11.5699	11569.9	15	13305.38
Labour	person days	220	102.51	0.4664	150.321	0	150.3207	33070.55	15	38031.13

Supervision	person days	16	145.58	0.4664	213.479	0	213.4785	3415.656	15	3928.005
									Total	853531.5
Preliminary & general	%	10								85353.15
									Total cost	938884.7
									Cost per m	938.8847

Bulk wastewater supply

Cost/m from municipal supply **Gauteng** **BOQ based on 1000m length**

400mm supply

Description	Unit	Qty	Rate (2009)	CPAF	Escalated price (2020)	Difference from Gauteng prices (%)	Unit costs	Sub total	Construction Margin (%)	Total
Clear & grub	m2	2000	1.82	0.4664	2.66885	0	2.668848	5337.696	15	6138.35
Removal of topsoil	m2	2000	3.44	0.4664	5.04442	0	5.044416	10088.83	15	11602.16
Trench excavation (machine)	m	1000	57.58	0.4664	84.4353	0	84.43531	84435.31	15	97100.61
Bedding & backfill	m3	1105	61.38	0.4664	90.0076	0	90.00763	99458.43	15	114377.2
400mm PVC sewer pipe	m	1000	378.18	0.4664	554.563	0	554.5632	554563.2	15	637747.6
Concrete to manhole base	no	3	1077.15	0.4664	1579.53	0	1579.533	4738.598	15	5449.388
Concrete to benching	no	4	1077.15	0.4664	1579.53	0	1579.533	6318.131	15	7265.851
Starter ring	ea	13	551.98	0.4664	809.423	0	809.4235	10522.51	15	12100.88
1000mm dia x 500 mm m/h ring	ea	39	709.69	0.4664	1040.69	0	1040.689	40586.89	15	46674.92

Manhole cover	ea	13	346.96	0.4664	508.782	0	508.7821	6614.168	15	7606.293
Manhole lid	ea	13	181.37	0.4664	265.961	0	265.961	3457.493	15	3976.116
Testing	m	1000	7.89	0.4664	11.5699	0	11.5699	11569.9	15	13305.38
Labour	person days	220	102.51	0.4664	150.321	0	150.3207	33070.55	15	38031.13
Supervision	person days	16	145.58	0.4664	213.479	0	213.4785	3415.656	15	3928.005
									Total	1005304
Preliminary & general	%	10								100530.4
									Total cost	1105834
									Cost per m	1105.834

Bulk waste water supply

Cost/m from municipal supply **Gauteng** **BOQ based on 1000m length**

500mm supply

Description	Unit	Qty	Rate (2009)	CPAF	Escalated price (2020)	Difference from Gauteng prices (%)	Unit costs	Sub total	Construction Margin (%)	Total
Clear & grub	m2	2000	1.82	0.4664	2.66885	0	2.668848	5337.696	15	6138.35
Removal of topsoil	m2	2000	3.44	0.4664	5.04442	0	5.044416	10088.83	15	11602.16
Trench excavation (machine)	m	1000	57.58	0.4664	84.4353	0	84.43531	84435.31	15	97100.61
Bedding & backfill	m3	1105	61.38	0.4664	90.0076	0	90.00763	99458.43	15	114377.2
500mm PVC sewer pipe	m	1000	478.18	0.4664	701.203	0	701.2032	701203.2	15	806383.6
Concrete to manhole base	no	3	1077.15	0.4664	1579.53	0	1579.533	4738.598	15	5449.388
Concrete to benching	no	4	1077.15	0.4664	1579.53	0	1579.533	6318.131	15	7265.851
Starter ring	ea	13	551.98	0.4664	809.423	0	809.4235	10522.51	15	12100.88
1000mm dia x 500 mm m/h ring	ea	39	709.69	0.4664	1040.69	0	1040.689	40586.89	15	46674.92
Manhole cover	ea	13	346.96	0.4664	508.782	0	508.7821	6614.168	15	7606.293
Manhole lid	ea	13	181.37	0.4664	265.961	0	265.961	3457.493	15	3976.116
Testing	m	1000	7.89	0.4664	11.5699	0	11.5699	11569.9	15	13305.38
Labour	person days	220	102.51	0.4664	150.321	0	150.3207	33070.55	15	38031.13

Supervision	person days	16	145.58	0.4664	213.479	0	213.4785	3415.656	15	3928.005
									Total	1173940
Preliminary & general	%	10								117394
									Total cost	1291334
									Cost per m	1291.334

STREET AND COMMUNITY LIGHTING
Street lighting:- Excludes internal Reticulation (Assume it exists)

Description	Unit	Qty	Rate (2009)	CPAF	Escalated GP Rate (2020)	Prov Rate	Prov rate	Subtotal	Construction margin %	Total
Overhead Network										
Struts	ea	6	1,158.66	0.479	1714.701	0	1714.7	10288.2	incl. in rate	10288.2
Install Bundle Conductors and Equipment	ea	298	70.73	0.479	104.6733	0	104.67	31192.6	incl. in rate	31192.7
LV Bundle Conductors	m	4,309	57.88	0.479	85.65661	0	85.657	369094.	incl. in rate	369094
SIMIL IPC connectors to ESKOM Specs	ea	664	62.96	0.479	93.1745	0	93.175	61867.8	incl. in rate	61867.9
Termination of Cables/ABC	ea	322	7.24	0.4799	10.71448	0	10.714	3450.061	incl. in rate	3450.06
Excavations										
Trenches and Poles	ea	179	107.1	0.4799	158.4973	0	158.5	28371.01	incl. in rate	28371
Hard Excavation	m3	38	589.47	0.4799	872.3567	0	872.36	33149.55	incl. in rate	33149.6
Street Lighting										
Mark Positions, Supple and erect pole	ea	179	491.97	0.4799	728.0664	0	728.07	130323.9	incl. in rate	130324
LV pole mounted circuit breaker, brackets	ea	322	540.83	0.4799	800.3743	0	800.37	257720.5	incl. in rate	257721
Luminaires	ea	322	1,618.16	0.4799	2394.715	0	2394.7	771098.2	incl. in rate	771098
Labour man days (included in rates)	ea	0	0	0.4799	0	0	0	0	incl. in rate	0
Supervision (included in rates and in P&G	ea	0	0	0.4799	0	0	0	0	incl. in rate	0
			Percentage						total	1696556

Preliminary & General	%	15.09%

	256010
Total cost	1952567

High Mast Lighting :- Excluded internal Reticulation (Assume it exists)
High Mast

Description	Unit	Qty	Rate (2009)	CPAF	Escalated GP Rate (2020)	Prov Rate	Prov rate	Subtotal	Construction margin %	Total
Complete incl foundation and Luminaires	ea	1	137,861.29	0.4799	204020.9	0	204021	204020.9	incl. in rate	204021
Labour to construct and erect	m/day	565	85.45	0.4799	126.4575	0	126.46	71448.46	incl. in rate	71448.5
Labour man days (included in rates)	ea	0	0	0.4799	0	0	0	0	incl. in rate	0
Supervision (included in rates and n P&G	ea	0	0	0.4799	0	0	0	0	incl. in rate	0
									total	275469
		Percentage								20660.2
Preliminary & General	%	7.5							Total cost	296130

Roads **GAUTENG**

Unpaved Gravel Rural

Description	Unit	Qty	Rate (2009)	CPAF	Escalated price (2020)	Difference from Gauteng prices (%)	Escalated Provincial Rate (2020)	Sub total	Construction Margin (%)	Total
Roadbed										
Clear and Grub	m2	28800	3.84	0.4816	5.69	0%	5.69	163,853.11	Incl. in rate	163,853.11
Strip and Remove Topsoil	m3	4320	28.30	0.4816	41.93	0%	41.93	181,134.49	Incl. in rate	181,134.49
Roadbed preparation and Compaction	m3	3240	27.80	0.4816	41.19	0%	41.19	133,450.68	Incl. in rate	133,450.68
Rectification, treatment of faulty roadbed	m3	650	51.38	0.4816	76.12	0%	76.12	49,481.00	Incl. in rate	49,481.00
Cut to Fill	m3	1200	47.75	0.481	70.75	0%	70.75	84,895.68	Incl. in rate	84,895.68
Cut to Spoil (Soft, Medium. Hard, Boulders)	m3	3050	80.78	0.4816	119.68	0%	119.68	365,035.13	Incl. in rate	365,035.13
Borrow to Fill from off-site sources	m3	4600	56.33	0.4816	83.46	0%	83.46	383,909.23	Incl. in rate	383,909.23
Subbase/Gravel Wearing course										
Construct gravel layers ex borrowpit	m3	2900	53.13	0.4816	78.72	0%	78.72	228,280.48	Incl. in rate	228,280.48
Constr. Gravel wearing course ex borrowpit	m3	3200	53.13	0.4816	78.72	0%	78.72	251,895.71	Incl. in rate	251,895.71
Mixing, Blending materials ex 2 borrowpits	m3	2500	17.08	0.4816	25.31	0%	25.31	63,264.32	Incl. in rate	63,264.32
Overhaul	m3/km	15250	11.39	0.4816	16.88	0%	16.88	257,350.22	Incl. in rate	257,350.22
Remove oversized material	m3	250	80.84	0.482	119.77	0%	119.77	29,943.14	Incl. in rate	29,943.14
Road Signage										

Supply and erect road signs as needed	ea	26	831.45	0.482	1,231.8	0%	1,231.88	32,028.78	Incl. in rate	32,028.78
Labour man days (included in rates)	ea	0				0%			Incl. in rate	
Supervisions (included in rates and in P&G)	ea	0				0%			Incl. in rate	
									Total	2,224,521.9
Preliminary & General	%	15.5%								344,800.0
									Total cost	2,569,322.9
									Unit cost to 1 km	713,700.79

Roads **GAUTENG**

Unpaved Gravel Urban

Description	Unit	Qty	Rate (2009)	CPAF	Escalated price (2020)	Difference from Gauteng prices (%)	Escalated Provincial Rate (2020)	Sub total	Construction Margin (%)	Total
Roadbed										
Clear and Grub	m2	65000	0.59	0.4816	0.87	0%	0.87	56,819.36	Incl. in rate	56,819.36
Strip and Remove Topsoil	m3	4065	25.70	0.4816	38.08	0%	38.08	154,783.49	Incl. in rate	154,783.49
Roadbed preparation and Compaction	m3	4065	29.94	0.4816	44.36	0%	44.36	180,319.76	Incl. in rate	180,319.76
Rectification, treatment of faulty roadbed	m3	50	312.10	0.4816	462.41	0%	462.41	23,120.37	Incl. in rate	23,120.37

Cut to Fill	m3	300	54.68	0.4816	81.01	0%	81.01	24,304.17	Incl. in rate	24,304.17
Cut to Spoil (Soft, Medium. Hard, Boulders)	m3	300	65.21	0.4816	96.62	0%	96.62	28,984.54	Incl. in rate	28,984.54
Borrow to Fill from off-site sources	m3	100	78.78	0.4816	116.72	0%	116.72	11,672.04	Incl. in rate	11,672.04
Subbase/Gravel Wearing course										
Construct gravel layers ex comm sources	m3	4065	200.20	0.4816	296.62	0%	296.62	1,205,745.34	Incl. in rate	1,205,745.34
Verges										
Trim, shape and roll verges	m2	38818	7.08	0.4816	10.49	0%	10.49	407,190.26	Incl. in rate	407,190.26
Topsoiling of verge areas	m2	38818	7.08	0.4816	10.49	0%	10.49	407,190.26	Incl. in rate	407,190.26
Road Signage										
Supply and erect road signs as needed	ea	20	1,035.82	0.4816	1,534.67	0%	1,534.67	30,693.42	Incl. in rate	30,693.42
Labour man days (included in rates)	ea	0				0%	-	-	Incl. in rate	-
Supervisions (included in rates and in P&G)	ea	0				0%	-	-	Incl. in rate	-

	Total	2,530,823.01
		645,359.87
	Total cost	3,176,182.88
	Unit cost to 1 km	635,236.58

Preliminary & General	%	25.5%

GAUTENG

Roads

Paving Blocks Urban

Description	Unit	Qty	Rate (2009)	CPAF	Escalated price (2020)	Difference from Gauteng prices (%)	Unit costs	Sub total	Construction Margin (%)	Total
Roadbed										
Clear and Grub	m2	27000	0.58	0.4695	0.85	0%	0.85	23,012.37	Incl. in rate	23,012.37
Strip and Remove Topsoil	m3	4049	21.52	0.4695	31.62	0%	31.62	128,044.12	Incl. in rate	128,044.12
Roadbed preparation and Compaction	m3	2110	20.17	0.4695	29.64	0%	29.64	62,540.01	Incl. in rate	62,540.01
Cut to Road Fill	m3	4159	42.36	0.4695	62.25	0%	62.25	258,889.52	Incl. in rate	258,889.52
Cut to Spoil (Soft, Medium. Hard, Boulders)	m3	2428	24.89	0.4695	36.58	0%	36.58	88,806.18	Incl. in rate	88,806.18
Construct Selected Layer	m3	2110	143.90	0.4695	211.46	0%	211.46	446,182.82	Incl. in rate	446,182.82
Subbase										
Construct Layer material ex comm sources	m3	2110	175.00	0.4695	257.16	0%	257.16	542,612.88	Incl. in rate	542,612.88
Base										

Construct Layer material ex comm sources	m3	0	217.88	0.4695	320.17	0%	320.17		Incl. in rate	
Block Pavers										
80mm interlocking blocks, incl 25mm sand bed, cutting and locking up	m2	11696	143.75	0.4695	211.24	0%	211.24	2,470,670.35	Incl. in rate	2,470,670.35
Kerbing										
Edging strips	m	83	105.92	0.4695	155.65	0%	155.65	12,918.90	Incl. in rate	12,918.90
Kerbing and Channelling straight	m	3459	152.51	0.4695	224.11	0%	224.11	775,208.41	Incl. in rate	775,208.41
Kerbing and Channelling curves	m	478	176.53	0.4695	259.41	0%	259.41	123,998.38	Incl. in rate	123,998.38
Accommodation of Existing Services										
Constructing of layer works at services	m3	472	201.74	0.4695	296.46	0%	296.46	139,927.67	Incl. in rate	139,927.67
Verges										
Trim, shape and roll verges	m2	16621	6.06	0.4695	8.91	0%	8.91	148,012.83	Incl. in rate	148,012.83
Topsoiling of verge areas	m2	16621	6.06	0.4695	8.91	0%	8.91	148,012.83	Incl. in rate	148,012.83
Road Signage										
Supply and erect road signs as needed	ea	26	1,008.71	0.4695	1,482.30	0%	1,482.30	38,539.78	Incl. in rate	38,539.78
Road safety Barriers	ea	68	423.66	0.4695	622.57	0%	622.57	42,334.65	Incl. in rate	42,334.65
Labour man days (included in rates)	ea	0				0%	-	-	Incl. in rate	-

Supervisions (included in rates and in P&G)	ea	0

Preliminary & General	%	25.5%

Total	5,449,711.68
	1,389,676.48
Total cost	6,839,388.16
Unit cost to 1 km	5,261,067.82

GAUTENG

Roads

Paved Chip and Spray Urban

Description	Unit	Qty	Rate (2009)	CPAF	Escalated price (2020)	Difference from Gauteng prices (%)	Unit costs	Sub total	Construction Margin (%)	Total
Roadbed										
Clear and Grub	m2	27000	0.57	0.4695	0.84	0.00%	0.84	22,615.61	Incl. in rate	22,615.61
Strip and Remove Topsoil	m3	4049	21.49	0.4695	31.58	0.00%	31.58	127,865.62	Incl. in rate	127,865.62
Roadbed preparation and Compaction	m3	2110	20.14	0.4695	29.60	0.00%	29.60	62,446.99	Incl. in rate	62,446.99
Cut to Road Fill	m3	4159	42.30	0.4695	62.16	0.00%	62.16	258,522.82	Incl. in rate	258,522.82
Cut to Spoil (Soft, Medium. Hard, Boulders)	m3	2428	24.85	0.4695	36.52	0.00%	36.52	88,663.46	Incl. in rate	88,663.46

Construct Selected Layer	m3	2110	143.69	0.4695	211.15	0.00%	211.15	445,531.68	Incl. in rate	445,531.68
Subbase										
Construct Layer material ex comm sources	m3	2110	154.42	0.4695	226.92	0.00%	226.92	478,801.60	Incl. in rate	478,801.60
Base										
Construct Layer material ex comm sources	m3	1441	217.57	0.4695	319.72	0.00%	319.72	460,715.24	Incl. in rate	460,715.24
Asphalt Base and Surfacing										
Prime Coat Bitumen	m2	11696	9.17	0.4695	13.48	0.00%	13.48	157,607.28	Incl. in rate	157,607.28
Chip and Spray	m2	11696	46.96	0.4695	69.01	0.00%	69.01	807,114.29	Incl. in rate	807,114.29
Kerbing										
Edging strips	m	83	105.76	0.4695	155.41	0.00%	155.41	12,899.39	Incl. in rate	12,899.39
Kerbing and Channelling straight	m	3459	152.29	0.4695	223.79	0.00%	223.79	774,090.15	Incl. in rate	774,090.15
Kerbing and Channelling curves	m	478	176.27	0.4695	259.03	0.00%	259.03	123,815.75	Incl. in rate	123,815.75
Accommodation of Existing Services				0.4695	-	0.00%	-	-	Incl. in rate	-
Constructing of layer works at services	m3	472	201.45	0.4695	296.03	0.00%	296.03	139,726.53	Incl. in rate	139,726.53
Verges										
Trim, shape and roll verges	m2	16621	6.05	0.4695	8.89	0.00%	8.89	147,768.58	Incl. in rate	147,768.58

Topsoiling of verge areas	m2	16621	6.05	0.4695	8.89	0.00%	8.89	147,768.58	Incl. in rate	147,768.58
Road Signage										
Supply and erect road signs as needed	ea	26	841.02	0.4695	1,235.88	0.00%	1,235.88	32,132.85	Incl. in rate	32,132.85
Road safety Barriers	ea	68	353.23	0.4695	519.07	0.00%	519.07	35,296.86	Incl. in rate	35,296.86
Labour man days (included in rates)	ea	0			-	0%	-	-	Incl. in rate	-
Supervisions (included in rates and in P&G)	ea	0			-	0%	-	-	Incl. in rate	-
										1,102,462.74
Preliminary & General	%	25.5%							Total cost	5,425,846.02
									Unit cost to 1 km	5,447,636.57

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Roads

Paved Bitumen Premix Urban

Description	Unit	Qty	Rate (2009)	CPAF	Escalated price (2020)	Difference from Gauteng prices (%)	Unit costs	Sub total	Construction Margin (%)	Total
Roadbed										
Clear and Grub	m2	27000	0.57	0.4695	0.84	0.00%	0.84	22,615.61	Incl. in rate	22,615.61

Strip and Remove Topsoil	m3	4049	21.49	0.4695	31.58	0.00%	31.58	127,865.62	Incl. in rate	127,865.62
Roadbed preparation and Compaction	m3	2110	20.14	0.4695	29.60	0.00%	29.60	62,446.99	Incl. in rate	62,446.99
Cut to Road Fill	m3	4159	42.30	0.4695	62.16	0.00%	62.16	258,522.82	Incl. in rate	258,522.82
Cut to Spoil (Soft, Medium. Hard, Boulders)	m3	2428	24.85	0.4695	36.52	0.00%	36.52	88,663.46	Incl. in rate	88,663.46
Construct Lower Selected Layer	m3	2110	137.66	0.4695	202.29	0.00%	202.29	426,834.79	Incl. in rate	426,834.79
Construct Upper Selected Layer	m3	2110	143.69	0.4695	211.15	0.00%	211.15	445,531.68	Incl. in rate	445,531.68
Subbase										
Construct Layer material ex comm sources	m3	2110	154.92	0.4695	227.65	0.00%	227.65	480,351.92	Incl. in rate	480,351.92
Base				0.4695	-	0.00%	-	-	Incl. in rate	-
Construct Layer material ex comm sources	m3	1441	217.57	0.4695	319.72	0.00%	319.72	460,715.24	Incl. in rate	460,715.24
Asphalt Base and Surfacing										
Prime Coat Bitumen	m2	11696	9.17	0.4695	13.48	0.00%	13.48	157,607.28	Incl. in rate	157,607.28
Bitumen Premix 40 mm	m2	11696	58.73	0.4695	86.30	0.00%	86.30	1,009,408.48	Incl. in rate	1,009,408.48
Kerbing										
Edging strips	m	83	105.76	0.4695	155.41	0.00%	155.41	12,899.39	Incl. in rate	12,899.39

Kerbing and Channelling straight	m	3459	152.29	0.4695	223.79	0.00%	223.79	774,090.15	Incl. in rate	774,090.15
Kerbing and Channelling curves	m	478	176.27	0.4695	259.03	0.00%	259.03	123,815.75	Incl. in rate	123,815.75
Accommodation of Existing Services										
Constructing of layer works at services	m3	472	201.45	0.4695	296.03	0.00%	296.03	139,726.53	Incl. in rate	139,726.53
Verges										
Trim, shape and roll verges	m2	16621	6.05	0.4695	8.89	0.00%	8.89	147,768.58	Incl. in rate	147,768.58
Topsoiling of verge areas	m2	16621	6.05	0.4695	8.89	0.00%	8.89	147,768.58	Incl. in rate	147,768.58
Road Signage										
Supply and erect road signs as needed	ea	26	1,007.25	0.4695	1,480.15	0.00%	1,480.15	38,484.00	Incl. in rate	38,484.00
Road safety Barriers	ea	68	423.05	0.4695	621.67	0.00%	621.67	42,273.69	Incl. in rate	42,273.69
Labour man days (included in rates)	ea	0				0.00%	-	-	Incl. in rate	-
Supervisions (included in rates and in P&G)	ea	0							Total	4,967,390.57
										1,266,684.60

Preliminary & General	%	25.5%

	Total cost	6,234,075.17
	Unit cost to 1km	6,934,455.13

Stormwater

Unlined (Rural)

Description	Unit	Qty	Rate (2009)	CPAF	Escalated price (2020)	Difference from Gauteng prices (%)	Unit costs	Sub total	Construction Margin (%)	Total
Side Drains										
Clear and Grub	m2	14400	3.94	0.4880	5.86	0.00%	5.86	84,423.17	Incl. in rate	84,423.17
Strip and Remove Topsoil	m3	2160	26.48	0.4880	39.40	0.00%	39.40	85,108.84	Incl. in rate	85,108.84
Cut to Spoil (Soft, Medium. Hard, Boulders)	m3	2700	80.08	0.4880	119.16	0.00%	119.16	321,729.41	Incl. in rate	321,729.41
Trimming Side Drains to Profile, Compact	m	7200	26.48	0.4880	39.40	0.00%	39.40	283,696.13	Incl. in rate	283,696.13
Construct Mitre Drains where required	m	200	52.97	0.4880	78.82	0.00%	78.82	15,763.87	Incl. in rate	15,763.87
Construct Scour Protection (steep sections)	ea	150	431.18	0.4880	641.60	0.00%	641.60	96,239.38	Incl. in rate	96,239.38
Levelling Verges	m	7200	18.28	0.4880	27.20	0.00%	27.20	195,844.61	Incl. in rate	195,844.61
Labour man days (included in rates)	ea	0				0.00%	-		Incl. in rate	
Supervisions (included in rates and in P&G)	ea	0							Total	1,082,805.40
										167,834.84
Preliminary & General	%	15.5%							Total cost	1,250,640.24
									Unit cost to 1 km	347.40

Stormwater

Lined

Description	Unit	Qty	Rate (2009)	CPAF	Escalated price (2020)	Difference from Gauteng prices (%)	Unit costs	Sub total	Construction Margin (%)	Total
Side Drains										
Clear and Grub	m2	14400	3.69	0.4880	5.49	0.00%	5.49	79,066.37	Incl. in rate	79,066.37
Strip and Remove Topsoil	m3	2160	24.49	0.4880	36.44	0.00%	36.44	78,712.82	Incl. in rate	78,712.82
Cut to Spoil (Soft, Medium. Hard, Boulders)	m3	2700	74.07	0.4880	110.22	0.00%	110.22	297,583.63	Incl. in rate	297,583.63
Trimming Side Drains to Profile, Compact	m	7200	24.49	0.4880	36.44	0.00%	36.44	262,376.06	Incl. in rate	262,376.06
Concrete Lining to Side Drains	m2	12960	136.74	0.4880	203.47	0.00%	203.47	2,636,959.80	Incl. in rate	2,636,959.80
Construct Mitre Drains where required	m	200	188.71	0.4880	280.80	0.00%	280.80	56,160.10	Incl. in rate	56,160.10
Levelling Verges	m	7200	17.10	0.4880	25.44	0.00%	25.44	183,202.56	Incl. in rate	183,202.56
					-	0.00%	-	-	Incl. in rate	-
Labour man days (included in rates)	ea	0			-	0.00%	-	-	Incl. in rate	-
Supervisions (included in rates and in P&G)	ea	0							Total	3,594,061.33
										557,079.51
Preliminary & General	%	15.5%							Total cost	4,151,140.84
									Unit cost to 1 km	1,153.09

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Stormwater

Pipe Culverts

Description	Unit	Qty	Rate (2009)	CPAF	Escalated price (2020)	Difference from Gauteng prices (%)	Unit costs	Sub total	Construction Margin (%)	Total
Trenches for Pipe Culverts										
Excavate all Material, backfill and compact	m	1238	100.51	0.4997	150.73	0.00%	150.73	186,609.74	Incl. in rate	186,609.74
Excavate unsuitable material and spoil	m3	20	257.86	0.4997	386.71	0.00%	386.71	7,734.25	Incl. in rate	7,734.25
Excavation Ancillaries										
Make up deficiency in backfill material	m3	14	229.49	0.4997	344.17	0.00%	344.17	4,818.33	Incl. in rate	4,818.33
Particular Item										
Shore excavated Trench	m	24	1,218.38	0.4997	1,827.20	0.00%	1,827.20	43,852.91	Incl. in rate	43,852.91
Bedding										
Supply of bedding ex comm source	m3	1248	203.44	0.4997	305.10	0.00%	305.10	380,763.51	Incl. in rate	380,763.51
Pipes										
Supply and Lay Class 100 D	m	1367	664.76	0.4997	996.94	0.00%	996.94	1,362,817.76	Incl. in rate	1,362,817.76
Manholes and Catchpits										
Manholes and catchpits to particular specs	ea	28	13,640.73	0.4997	20,457.00	0.00%	20,457.00	572,796.08	Incl. in rate	572,796.08
Headwalls to Pipe Culverts	m2	12	3,615.63	0.4997	5,422.36	0.00%	5,422.36	65,068.32	Incl. in rate	65,068.32
Erosion Protection										
Gabions, Reno Mattress, Stone Pitching	m2	235	324.48	0.4997	486.62	0.00%	486.62	114,356.32	Incl. in rate	114,356.32
Geotextile	m2	114	12.18	0.4997	18.27	0.00%	18.27	2,082.36	Incl. in rate	2,082.36

Labour man days (included in rates)	ea	0			-	0.00%			Incl. in rate	-
Supervisions (included in rates and in P&G)	ea	0							Total	2,740,899.59
										698,929.40
Preliminary & General	%	25.5%							Total cost	3,439,828.99
									Unit cost to 1km	5,442.77

GAUTENG

Stormwater

Box Culverts

Description	Unit	Qty	Rate (2009)	CPAF	Escalated price (2020)	Difference from Gauteng prices (%)	Unit costs	Sub total	Construction Margin (%)	Total
Trenches for Box Culverts										
Excavate all Material, backfill and compact	m	9904	121.19	0.4997	181.75	0.00%	181.75	1,800,038.56	Incl. in rate	1,800,038.56
Excavate unsuitable material and spoill	m3	20	257.86	0.4997	386.71	0.00%	386.71	7,734.25	Incl. in rate	7,734.25
Excavation Ancillaries										
Make up deficiency in backfill material	m3	14	229.49	0.4997	344.17	0.00%	344.17	4,818.33	Incl. in rate	4,818.33
Particular Item										
Shore excavated Trench	m	24	1,218.38	0.4997	1,827.20	0.00%	1,827.20	43,852.91	Incl. in rate	43,852.91
Bedding										
Cast Concrete Binding	m3	3120	1,031.43	0.4997	1,546.84	0.00%	1,546.84	4,826,126.98	Incl. in rate	4,826,126.98
Boxes										
Supply and Place 1500 x 1500 mm Sections	m	1367	2,826.36	0.4997	4,238.69	0.00%	4,238.69	5,794,292.09	Incl. in rate	5,794,292.09
Wingwalls to Box Culverts	m2	30	3,615.63	0.4997	5,422.36	0.00%	5,422.36	162,670.81	Incl. in rate	162,670.81

Erosion Protection										
Gabions, Reno Mattress, Stone Pitching	m2	588	324.48	0.4997	486.62	0.00%	486.62	286,134.12	Incl. in rate	286,134.12
Geotextile	m2	114	12.18	0.4997	18.27	0.00%	18.27	2,082.36	Incl. in rate	2,082.36
Labour man days (included in rates)	ea	0			-	0.00%			Incl. in rate	
Supervisions (included in rates and in P&G)	ea	0							Total	12,927,750.41
										3,296,576.36
Preliminary & General	%	25.5%							Total cost	16,224,326.77
									Unit cost to 1km	25,671.40

Stormwater

Dewatering

Description	Unit	Qty	Rate (2009)	CPAF	Escalated price (2020)	Difference from Gauteng prices (%)	Unit costs	Sub total	Construction Margin (%)	Total
Subsoil Drains										
Clear and Grub	m2	30	3.62	0.4997	5.43	0.00%	5.43	162.87	Incl. in rate	162.87
Strip and Remove Topsoil	m3	5	24.10	0.4997	36.14	0.00%	36.14	180.71	Incl. in rate	180.71
Trenches for Subsoil Drains				0.4997	-	0.00%	-	-	Incl. in rate	-
Excavate all Material, backfill and compact	m	10	100.51	0.4997	150.73	0.00%	150.73	1,507.35	Incl. in rate	1,507.35
Excavate unsuitable material and spoill	m3	1	257.86	0.4997	386.71	0.00%	386.71	386.71	Incl. in rate	386.71
Excavation Ancillaries										
Make up deficiency in backfill material	m3	1	229.49	0.4997	344.17	0.00%	344.17	344.17	Incl. in rate	344.17
Bedding										

Supply of bedding ex comm source	m3	6	203.44	0.4997	305.10	0.00%	305.10	1,830.59	Incl. in rate	1,830.59
Pipes										
Supply and Lay Findrain 110 mm	m									
Geotextile Bidim U24 wrapping	m2	5	14.42	0.4997	21.63	0.00%	21.63	108.13	Incl. in rate	108.13
Labour man days (included in rates)	ea	0	-	0.4997	-	0.00%	-	-	Incl. in rate	-
Supervisions (included in rates and in P&G)	ea	0							Total	4,520.53
										1,152.74
Preliminary & General	%	25.5%							Total cost	5,673.27
									Unit cost to 1 km	567.33

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Stormwater

Gabions

Description	Unit	Qty	Rate (2009)	CPAF	Escalated price (2020)	Difference from Gauteng prices (%)	Unit costs	Sub total	Construction Margin (%)	Total
Foundation trench excavation and backfilling										
Excavate material	m3	0.2	83.58	0.4664	122.56	0.00%	122.56	24.51	Incl. in rate	24.51
Surface bed preperation of bedding of gabions	m2	2	14.00	0.4664	20.53	0.00%	20.53	41.06	Incl. in rate	41.06
Gabions										

Gabions (2.0 x 1.0 x 1.0) PVC coated gabion boxes. 2.7 mm diameter galvanised wire, to SANS 1580 incl rock infill	m3	2	1,013.50	0.4664	1,486.20	0.00%	1,486.20	2,972.39	Incl. in rate	2,972.39
Geo Textile (Filter Fabric - Bidim)	m2	2	16.92	0.4664	24.81	0.00%	24.81	49.62	Incl. in rate	49.62
Labour man days (included in rates)	ea	0.5	120.00		120.00	0.00%	120.00	60.00	Incl. in rate	60.00
Supervisions (included in rates and in P&G)	ea	0.5	120.00		120.00	0.00%	120.00	60.00	Incl. in rate	60.00
									Total	3,207.59
										817.93
Preliminary & General	%	25.5%							Total cost	4,025.52
									Unit cost to 1km	2,012.76

Stormwater

Reno Mattresses

Description	Unit	Qty	Rate (2009)	CPAF	Escalated price (2020)	Difference from Gauteng prices (%)	Unit costs	Sub total	Construction Margin (%)	Total
Foundation trench excavation and backfilling										
Excavate material	m3	0.1	83.58	0.4664	122.56	0.00%	122.56	12.26	Incl. in rate	12.26
Surface bed preparation of bedding of gabions	m2	1	14.00	0.4664	20.53	0.00%	20.53	20.53	Incl. in rate	20.53
Gabions					-	0.00%	-	-	Incl. in rate	-
Reno Mattresses (3.0 x 1.0 x 0.3) PVC coated. 2.7 mm diameter galvanised wire, to SANS 1580 incl rock infill	m3	1	1,166.67	0.4664	1,710.80	0.00%	1,710.80	1,710.80	Incl. in rate	1,710.80
Geo Textile (Filter Fabric - Bidim)	m2	3	16.92	0.4664	24.81	0.00%	24.81	74.43	Incl. in rate	74.43
					-	0.00%	-	-	Incl. in rate	-
Labour man days (included in rates)	ea	0.25	120.00		120.00	0.00%	120.00	30.00	Incl. in rate	30.00
Supervisions (included in rates and in P&G)	ea	0.25	120.00		120.00	0.00%	120.00	30.00	Incl. in rate	30.00
									Total	1,878.03
										478.90
Preliminary & General	%	25.5%							Total cost	2,356.92
									Unit cost to 1km	2,618.80

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