# 3. WATER SERVICES ASSET MANAGEMENT

| Table 3.1: Master Plan for Water Services Asset Management | | |
|---|---|---|
| **Section** | **Master Plan** | **Yes / No** |
| General Information | Is there a Master Plan that addresses this problem? | Yes |
| | Does this Plan address this problem 100%? | Yes |
| Operation | Is there a Master Plan that addresses this problem? | Yes |
| | Does this Plan address this problem 100%? | Yes |
| Functionality Observation | Is there a Master Plan that addresses this problem? | Yes |
| | Does this Plan address this problem 100%? | Yes |
| Asset Assessment Spectrum | Is there a Master Plan that addresses this problem? | Yes |
| | Does this Plan address this problem 100%? | Yes |
| Water and Sanitation Schemes | Is there a Master Plan that addresses this problem? | Yes |
| | Does this Plan address this problem 100%? | Yes |

## 3.1 GENERAL INFORMATION

### 3.1.1 Asset Management Plan

Bitou Municipality will develop an infrastructure maintenance plan that is linked to an integrated asset management system to ensure preventative maintenance. Depreciation, repairs and maintenance as well as the acquisition of assets will all increase collectively to ensure efficient and effective budgeting. This will entail the review of the current budgeting strategy and process as well as expenditure and management systems to ensure efficient and effective service delivery in line with Bitou Municipality priorities. It will require the review of revenue management systems in order to maximise revenue generation possibilities and improve revenue performance. The cash and debt management strategies and practices will have to be reviewed and internal controls and delegations regarding financial management should be re-assessed. Asset management through an integrated infrastructure and asset management plan must also be implemented. The review of governance practices in the Supply Chain Management practices should be done and proper controls and risk management practices should be implemented.

An Asset Management Plan (AMP) to ensure efficient, effective and optimal management, operation and maintenance of all assets, which includes treatment plants, reservoirs, structures, buildings, pipelines, sites, etc. The purpose of the AMP is to:

- Ensure the operation and maintenance functions are well planned.
- Demonstrate responsible management.
- Justify and communicate funding requirements.
- Service provisioning complies with regulatory requirements.

An AMP normally includes the following:

- documents the nature, extent, age, utilisation, condition, performance and value of the infrastructure work;
- identifies existing and target levels of service, as well as expected changes in demand;
- identifies the life-cycle management needs of the infrastructure (development, renewal, operations and maintenance);
- assesses capital and operational budget needs; and
- identifies infrastructure asset management improvement needs.

Bitou Municipality needs to differentiate between budget allocated towards the operation and maintenance of the water and sewerage infrastructure and the budget allocated towards the replacement of the water and sewerage infrastructure. A budget of approximately 2% of the total asset value per annum should be allocated towards the replacement of the existing water and sewerage infrastructure. In the case of operations and maintenance of the system, a budget of approximately 1% to 2% of the value of the system is typically required to ensure that the system remains in good condition.

A proxy for asset consumption can be considered the level of depreciation each asset incurs on an annual basis. Preserving the investment in existing infrastructure needs to be considered a significant strategy in ensuring the future sustainability of infrastructure and the Municipality's revenue base.

It is important for Bitou Municipality to develop an AMP from their Asset Register. The objective of an AMP is to support the achievement of the strategic goals of the Municipality and facilitate prudent technical and financial decision-making. It is also a vehicle for improved internal communication and to demonstrate to external stakeholders the Municipality's ability to effectively manage its existing infrastructure as well as the new infrastructure to be developed over the next 20 years.

Priority should be given to rehabilitating existing infrastructure as this generally makes best use of financial resources and can achieve an increased in (operational) services level coverage's most rapidly. The preparation of maintenance plans and the allocation of sufficient funding for maintenance are required to prevent the development of a large condition backlog.

It is essential for Bitou Municipality to protect their assets by ensuring that an appropriate maintenance and rehabilitation plan (AMP) is developed and implemented. This plan must be based on the principle of preventative maintenance in order to ensure that, as far as this is practical, damage to assets is prevented before it occurs. Bitou Municipality must ensure that the maintenance and rehabilitation plan is part of the WSDP and that the plan is implemented. Assets must be rehabilitated and / or replaced before the end of their economic life and the necessary capital funds must be allocated for this purpose.

### 3.1.2 Disaster Management Plan

Bitou Municipality's 2019 Disaster Risk Assessment included the following risks and the risk reduction recommendations.

**Table 3.1.2.1: Disaster risks and risk reduction recommendations**

| Hazard | Risk Category | Risk Reduction Recommendations |
|---|---|---|
| Animal Diseases | Medium | • Improve early warning systems.<br>• Improve awareness during Thusong visits. |
| Human Diseases | Medium | • Identify high risk areas subject to the outbreak of epidemics.<br>• Continue with intensive health interventions.<br>• Continue with a structured and comprehensive multi-disciplinary and multi-sectoral strategy and plan that addresses the problem of substance (alcohol and drug) abuse in high risk areas.<br>• Develop a strategy aimed at combating women abuse and domestic violence within the municipality.<br>• Strengthen disaster mitigation in hospital facilities.<br>• Increase infectious disease capacity and infrastructure.<br>• Increase youth access to contraceptive and reproductive health care services.<br>• A structured programme based on the needs identified in the remote areas to recruit, train and equip volunteers to assist with area based first aid posts. |
| Wildfires | High | • Defensible space for the future.<br>• A provincial and / or district standard of permits and database for prescribed burning is compiled.<br>• Agricultural developments are planned from the outset to incorporate fire-scaping in defensible spaces, fire-resistant structures, and fire spread patterns into their design.<br>• Incentivize farmers to join FPAs<br>• Adhere to building codes.<br>• Develop and implement an alien invasive clearance and management strategy.<br>• Ensure firebreaks are prepared in high-risk zones.<br>• Firebreaks and well maintained to ensure that there is little or no vegetation on them without causing any erosion.<br>• Early warning strategies to wildland fires be revised and updated. |

**Table 3.1.2.1: Disaster risks and risk reduction recommendations**

| Hazard | Risk Category | Risk Reduction Recommendations |
|---|---|---|
| | | • Maintain and update an accessible Alien Invasive Species list within municipality.<br>• Plan for high-risk periods.<br>• Establish a satellite fire station in areas disadvantages by poor response times.<br>• Delineate buffer zones for alien grass invasion.<br>• SCFPA optimize their investments in constructing and maintaining firebreaks in relation to the value of protected assets.<br>• Reduce the number of human-caused wildfires by promoting safe behavior when using fire.<br>• Organized Agriculture actively participates and utilizes the impact of recent fires as a platform to recruit more members.<br>• Accelerate access to spatial information.<br>• Improve knowledge of stack burning.<br>• Raising awareness and training of both landowners and agri-workers.<br>• Capable managers are employed and skilled to supervise local WoF teams.<br>• Wooden Houses needs to be prevented especially along wildfire-urban interfaces.<br>• 800m Urban Interface needs to be mapped for all area to determine areas in need of fire-scaping.<br>• The forestry industry continues to adopt practices and cultivars that minimize risk. |
| Regional Sea-level Rise | Medium | • Maintenance and sustainable use of resources and infrastructure occurs.<br>• Insurance Market Correction.<br>• A systematic approach to assessing and responding to coastal vulnerability, risks and damage is developed between District and Local Municipality.<br>• Delineate and promulgate coastal development setback lines that mitigate against impacts and reduce risks, and incorporate these into Municipal SDFs.<br>• Rehabilitate dunes and beaches.<br>• Prepare and implement architectural and urban design guidelines for coastal towns.<br>• Improve future coastal modelling.<br>• Expand and effectively manage a system of coastal protected areas. |
| Coastal erosion | Medium | • Implement dune rehabilitation plans.<br>• Enforce the coastal buffer zone.<br>• Limit the extension of existing footprints and volumes of structures already in the risk zones.<br>• Develop and implement an estuarine management programme for Keurbooms/Bitou and Groot River Estuary.<br>• Implement a coastal education drive.<br>• Additional activities in River Estuaries (Keurbooms / Bitou, Piesang and Groot River) are aligned with the River EMPs.<br>• Establish an overall conservancy institution for the biodiversity conservation of the coastal corridor.<br>• Enable spatial integration and investment in and protection of, coastal assets.<br>• Keurboom/Bitou, Piesang and Groot River Estuary breaching protocols are developed.<br>• Promote sustainable coastal livelihoods among traditional fishing communities in the Western Cape.<br>• Identify and develop opportunities for work creation in integrated coastal development and management. |
| Storm Surges | High | • Host a public and private coastal education drive.<br>• Raise awareness amongst recreational users.<br>• Requirements of the ICM Act are included in the Bitou Municipality SDF and IDP revisions. |
| Severe Weather (Strong winds) | Medium | • Strengthen physical planning measures.<br>• Improve engineering and construction measures.<br>• Institute and enforce fines for nonadherence to building codes.<br>• Develop awareness training and workshops in high risk areas. |
| Seismic Activity | Medium | • The Provincial Seismic Hazard Preparedness Plan is updated.<br>• A risk assessment and awareness raising of high-risk areas is conducted. |
| Tsunami | Medium | • Develop standardized and coordinated tsunami hazard and risk assessment for the coastal region.<br>• Further investigate Tsunami risks for Bitou Municipality.<br>• Identify coastal areas vulnerable to tsunami inundation.<br>• Tsunami evacuation routes are clearly sign-posted. |
| Drought | Medium | • Revisit policies that hamper the building of new catchment dams.<br>• Diversify farming activities and, where possible, complement with non-farming activities e.g. agri-tourism and agri-processing.<br>• Foster and strengthen community participation in planning and implementation of drought management and mitigation actions.<br>• Improve accuracy of seasonal weather forecasts.<br>• Augment water supplies.<br>• Strengthen Management Plans for areas of biodiversity. |

**Table 3.1.2.1: Disaster risks and risk reduction recommendations**

| Hazard | Risk Category | Risk Reduction Recommendations |
|---|---|---|
| | | • Safeguard inland water and coastal water resources and manage the sustainable use of water.<br>• Promote conservation agriculture.<br>• Improve water demand management through drought periods. |
| Floods (Stormwater-related / Coastal / Riverine / Flash / Landslides (Debris Flow)) | High | • Strengthen management and institutional measures.<br>• Redesign of stormwater norms and standards.<br>• Structural measures are planned for high risk areas.<br>• Implement a comprehensive Stormwater Management Plan.<br>• Improve non-structural measures.<br>• Improve physical planning measures.<br>• Improve awareness raising.<br>• Improve disaster preparedness.<br>• Identify critical infrastructure exposed to flooding and establish Contingency Planning.<br>• Enforce legal restrictions on Infrastructure placement.<br>• Improve disaster relief funding.<br>• Restoration of wetlands and riparian zones reduces flooding risk.<br>• Participate in the development and implementation of a River Maintenance Management Plan for river(s) flows. |
| Electrical Supply Disruption | Medium | • Source funding to improve institutional management.<br>• Prepare policy for sighting and approval of renewable energy projects.<br>• Research climate change projections to improve the operational preparedness of electricity grids.<br>• Improve Physical Planning Measures.<br>• Strengthen Societal Measures.<br>• Address Human Settlements and electricity needs in a changing climate.<br>• Address Bitou Municipality's energy consumption and management.<br>• Reduce risks associated with energy supply.<br>• Regulate the format of municipal accounts in more specific terms.<br>• Enhance saving opportunities within the built environment.<br>• Pursue energy diversification and energy efficiency to transition to a low carbon, sustainable energy future, and delink economic growth from energy use. |
| Sewerage and Waste Removal | Medium | • Promote waste separation at source throughout urban settlements.<br>• Rehabilitation of closed landfill sites.<br>• Implement a policy for informal reclaimers.<br>• Capacitate management and institutional measures.<br>• Improve Waste Reporting and Data Management.<br>• Develop a densification plan.<br>• Develop a comprehensive Stormwater Master Plan.<br>• Continue with public cleansing initiatives.<br>• Promote and provide guidance on waste-to-energy opportunities.<br>• Improve the maintenance and sustainable use of agricultural and ecological resources and infrastructure.<br>• Improve Waste Management facilities at informal settlements.<br>• On-going Public Awareness and Education campaign regarding Waste Minimization.<br>• Bitou Municipality quantifies prevention.<br>• Post Collection Recovery rolled out.<br>• Conduct a feasibility study of a post Collection Composting.<br>• Garden Waste and Builders' Rubble.<br>• Manage tyres.<br>• Sanitation improves due to compliance of WWTWs.<br>• Address inadequate capacities of sewer pump stations and sewer drainage networks.<br>• Extension of Basic Services in Informal Areas.<br>• Continue with maintenance and upgrade of sewage systems.<br>• Address industrial effluent in sewage system. |
| Water supply disruption | Medium | • Improve physical planning measures.<br>• Monitor and prevent water resources pollution (estuaries and marine).<br>• Water resource protection is based on a participatory approach.<br>• Implement a multi-pronged water management strategy.<br>• The value of water resources is recognized from an economic point of view and the social and environmental benefits of the resource are understood.<br>• Research and forecast the requirements for bulk infrastructure in order to meet future demands.<br>• Develop agricultural water demand management programmes, focusing on agricultural areas.<br>• Reconsider the National Water Policy Review proposal to abolish WUAs.<br>• Specialised monitoring of aquatic ecosystems. |

**Table 3.1.2.1: Disaster risks and risk reduction recommendations**

| Hazard | Risk Category | Risk Reduction Recommendations |
|---|---|---|
| | | • Integrate protection of aquatic ecosystems.<br>• Strengthen integrated catchment management.<br>• Update the Sustainable Water Plan with new climate change-related information and plans.<br>• Protection of water resources through classification of the resource.<br>• Strengthen assurance of equitable water access that incorporates climate change considerations.<br>• More effective aquifer management is implemented.<br>• Streamline Data Sharing.<br>• Create a centralized reporting mechanism and spatial capturing of invasive species along sensitive catchment areas.<br>• WC/WDM is a pre-requisite for undertaking further development of new water supply schemes.<br>• Increase station density to better characterize spatial variability.<br>• Improve infrastructure refurbishment.<br>• Alien invasive species clearing strategy for water catchment areas.<br>• Continue addressing the lack of suitable qualified technical staff.<br>• Implementation of water conservation and demand management at municipal level.<br>• Track Meteorological and other Parameters to better understand variability. |
| Civil Unrest | High | • Provide development support to the vulnerable.<br>• Stimulate the local economy.<br>• Address housing backlogs.<br>• Create a skills database.<br>• Settlement policies.<br>• Develop dedicated human settlement legislation.<br>• Identify areas to cluster public facilities.<br>• Informal settlements / affordable housing areas are upgraded.<br>• Manage migration as efficient and effectively as possible.<br>• Integrate the spatial component of bulk infrastructure master plans, public transport plans and housing / human settlement plans into one SDF, prepared at the appropriate scale (e.g. regional, district or local municipal). |
| Structural Fires | High | • Install an affordable, networked fire detector system in informal settlements.<br>• Implement an awareness and education programme.<br>• Prepare a policy for the densification of settlements.<br>• Address staff and skills shortages.<br>• Improve physical planning measures.<br>• Strengthen engineering and construction measures.<br>• Improve access to funding.<br>• Ensure building compliance to fire safety standards.<br>• Lightning conductors as a prerequisite to thatch roof structures. |
| Aircraft Incidents | Medium | • Establish a permanent fire station at Plettenberg Bay Airport.<br>• Upgrade Plettenberg Airport. |
| Road Accidents | High | • Improve landscaping.<br>• Strengthen physical planning measures.<br>• Improve engineering and construction measures.<br>• Research impact of climate change on road infrastructure.<br>• Improve the road network.<br>• Address operational development priorities.<br>• Source funds to establish or improve Law enforcement divisions.<br>• Improve understanding and mitigation of GHG emissions. |
| Hazmat Incidents | High | • Improve law enforcement.<br>• Improve physical planning measures.<br>• Strengthen engineering and construction measures.<br>• Improve management and institutional measures.<br>• Strengthen capacity to manage hazardous substance disposal and improve response to disaster events in relation to the spillage of hazardous substances.<br>• Employ economic measures.<br>• Implementation of higher order waste minimization techniques should be implemented to minimize waste generation. |
| Marine Pollution / Ocean Spill at Sea | Medium | • Early warning system is improved to inform stakeholders.<br>• Research, monitor and implement climate change adaptation measures.<br>• Implement pollution control and waste management measures in order to prevent, minimize and strictly control harmful discharges into coastal ecosystems.<br>• Develop and implement water quality improvement programmes for prioritised coastal areas. |
| Air pollution | Low | • Improve residential air pollution.<br>• Town and transport planning. |

**Table 3.1.2.1: Disaster risks and risk reduction recommendations**

| Hazard | Risk Category | Risk Reduction Recommendations |
|---|---|---|
| | | • Pursue greater cooperation with agricultural authorities to address shared environmental priorities related to air quality management.<br>• Strengthen institutional functions.<br>• Increase licensing of listed activities.<br>• Ambient air quality data is continuously monitored.<br>• Update the emissions inventory regularly so as to ensure that the data remains current.<br>• Intensify efforts to manage trans-boundary air pollution.<br>• Strengthen capacity in air quality management within the Building Control section.<br>• Compile an emissions inventory for Bitou Municipality.<br>• Improve education and awareness.<br>• Motor vehicle emissions. |
| Alien Invasive Species (Vegetative) | High | • Delineate riparian zones according to the DWS policy.<br>• Fund alien clearing projects.<br>• Ensure that the management of IAPs is consistent with the relevant legislation.<br>• Facilitate the development of a protocol to inform prioritization decisions based on scientific research findings.<br>• Targeted clearing secures the ecological flow requirements of the rivers and estuaries.<br>• Prevent new IAPs establishing or spreading through early detection and rapid response.<br>• Maintain and update an accessible endemic species list.<br>• Guidelines for future monitoring projects to assess for the efficacy of rotenone treatments with regard to removing alien fish, and for monitoring the responses by macro-invertebrates and fish to these treatments.<br>• Collaboration between government departments is ensured by means of appropriate institutions, agreements and / or joint decision-making mechanisms.<br>• Investigate possible alternative uses for biomass such as for energy or building materials. |
| Reducing Environmental Vulnerability: Biodiversity Protection | High | • Source funding for long-term climate change research projects.<br>• Implement conservation plan for protected and critical biodiversity areas (terrestrial, forest and aquatic).<br>• Include landowners in biodiversity protection.<br>• Honey bee populations are protected.<br>• Support aquaculture farming without compromising the conservation of indigenous fish species.<br>• Avifauna is monitored.<br>• Develop a conservation plan for coastal areas.<br>• Awareness and education on the importance of habitat protection.<br>• Improve institutional capacity.<br>• Apply indicators to assess and monitor ecosystem health.<br>• Improve endangered and endemic animal conservation.<br>• Apply unmanned aerial vehicle in monitoring programmes.<br>• Manage invasive alien species before it impacts on indigenous biodiversity and ecosystem functioning escalates.<br>• A comprehensive fish conservation plan for the WCP with clear goals and project plans is developed.<br>• Research climate change impacts on insects.<br>• Improve wetland status.<br>• Protect the Estuaries (Bitou/Keurboom, Groot and Piesang).<br>• Support and market the diversification for farming development.<br>• Improve spatial risk mapping of predation. |
| Climate Change | High | • Develop user-friendly sources of information on climate change.<br>• Mainstreaming climate change into municipal planning through the Garden Route District Municipality Climate Change Response Framework.<br>• Strengthen spatial information on climate change.<br>• Climate risk management is integrated into all local planning and regulatory processes.<br>• Reduce CHG emissions.<br>• Strengthen climate data and services.<br>• Improve institutional capacity at municipal level.<br>• Planning stresses urban infrastructure as central to the protection of assets amongst poor and food insecure communities.<br>• Implement a simple and effective mechanism to raise adequate finance for climate change response projects.<br>• Development of DAFF's fisheries climate change adaptation plan.<br>• Promote and expand conservation agriculture.<br>• Integrate climate change into joint disaster planning and strengthen disaster relief mechanisms.<br>• Lead strategic research partnerships.<br>• Climate-proof future projects. |

| Table 3.1.2.1: Disaster risks and risk reduction recommendations | | |
|---|---|---|
| **Hazard** | **Risk Category** | **Risk Reduction Recommendations** |
| | | • Increase ecological infrastructure to slow, spread and sink water run-off.<br>• Water related infrastructure responses.<br>• Replace retrofit/upgrade infrastructure.<br>• Environmental planning, conservation and management.<br>• Relocate infrastructure.<br>• Environmental rehabilitation.<br>• Improve municipal open space management.<br>• Risk and vulnerability mapping.<br>• Pollution management.<br>• Improve public environmental awareness and coordination.<br>• Health management.<br>• Water management to improve water security and disaster preparedness. |

### 3.1.3 Untreated Effluent Management Plan

There are no known untreated effluent discharged to the environment, as indicated under Section 3.1.3 of Topic 3 of the Administration, Information and Comprehensive Overview Report. The $W_2$RAP includes Management Procedures and Incident Response and Emergency Protocols, which are discussed in more detail under Section 6.3 of Topic 6.

## 3.2 FUTURE WATER AND SEWERAGE INFRASTRUCTURE REQUIREMENTS

The 2018/2019 Annual Report list the following challenges for water provision and sanitation reticulation.

| Table 3.2.1: Challenges for water provision and sanitation reticulation | |
|---|---|
| **Challenge** | **Action to address** |
| **Water Provision** | |
| Pipe breaks / bursts | See Topic 5 |
| Water Losses | See Topic 5 |
| **Sanitation Reticulation** | |
| Load shedding by Eskom | The extensive and higher-level load-shedding by Eskom during the third quarter of 2018/2019 meant that an operating plan had to be put into place, to ensure that facilities (pump stations, WTWs and WWTWs) remained in operation. This required back-up generating power to be installed at some key sites, however this resulted in additional challenges for an already limited staff component and operating budget that will have to be investigated and budgeted for within the 2019/2020 financial year. |
| Public unrest | Public unrest because of service delivery in the third quarter of the 2018/2019 year resulted in disruption of services and some damage due to flooding of equipment as a result thereof, however the Municipality is currently investigating and trying to find an amicable solution to these issues. |
| Vandalism and security for key sites | Although good strides have been made in addressing the security of key sites, this remains a challenge and the Municipality's commitment to address this is ongoing. |

The Water and Sewer Master Plans (2020) for the various distribution and drainage systems in Bitou Municipality's Management Area recommends upgrades of the water and sewerage infrastructure to the values indicated in the tables below in the foreseeable future in order to accommodate development and population growth according to the SDF.

| Table 3.2.2: Summary of the future water infrastructure requirements for Bitou Municipality, as included in the 2020 Water Master Plan | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Scheme** | **Bulk Pipelines** | **Water PS** | **Reservoirs** | **Internal Reticulation** | **WDM** | **WTW** | **Total** |
| Plettenberg Bay | R91 952 000 | R33 389 000 | R93 845 000 | R88 571 000 | R1 069 000 | - | **R308 826 000** |
| Kurland | R21 697 000 | R4 908 000 | R10 304 000 | R10 449 000 | - | R9 317 000 | **R56 675 000** |
| Natures Valley | - | - | R5 040 000 | R706 000 | - | - | **R5 746 000** |
| Harkerville | - | - | - | R100 000 | - | - | **R100 000** |
| **Total** | **R113 649 000** | **R38 297 000** | **R109 189 000** | **R99 826 000** | **R1 069 000** | **R9 317 000** | **R371 347 000** |

Note: Costs include P&G's, Contingencies & Fees, but exclude EIA studies, registration of servitudes and/or land acquisition and VAT.

**Table 3.2.3: Summary of the future sewer infrastructure requirements for Bitou Municipality, as included in the 2020 Sewer Master Plan**

| Scheme | Sewer Pipelines | Sewer PS | Total |
|---|---|---|---|
| Plettenberg Bay | R186 736 000 | R35 379 000 | **R222 115 000** |
| Kurland | R3 124 000 | R2 368 000 | **R5 492 000** |
| **Total** | **R189 860 000** | **R37 747 000** | **R227 607 000** |

Note: Costs include P&G's, Contingencies & Fees, but exclude EIA studies, registration of servitudes and/or land acquisition and VAT.

### 3.2.1 Groundwater infrastructure (Boreholes)

Bitou Municipality is responsible for the operation and maintenance of a number of production and monitoring boreholes in their Management Area. It is therefore critical for Bitou Municipality to monitor on a monthly basis (at least) the static water level (i.e. the level prior to commencement of pumping for the day) in each of their production and monitoring boreholes and the volume of water abstracted. Water quality samples also need to be taken on a seasonal or yearly basis. The daily rainfall for the area should also be recorded. This monitoring data should be processed, analysed and reported on by an experienced hydrogeologist in order to ascertain whether the resource is being sustainably utilised or whether groundwater mining is taking place. Managing groundwater for water supply purposes should have the following three main functions:

- Ensure that the aquifer is used optimally: The aquifer should not be over-pumped as that would negatively impact on its long-term sustainable yield or on the environment. It also means that if the aquifer is being under-utilised, this will become known.

- Ensure that the water quality in the aquifer is not negatively affected: This may be as a result of high abstraction from the aquifer, or from poor groundwater protection (from latrines, animal enclosures, etc.).

- Optimise borehole pumping rates so that the pumping equipment operates efficiently: Pumping rates are frequently set too high and this cause unnecessarily high pumping heads, a waste of energy, and at times, pump failure.

An additional function, which is usually captured in the first two points, is to ensure that environmental integrity is maintained. It is important for Bitou Municipality to focus on aquifer protection, groundwater monitoring and wellfield management, in order to ensure the sustainable use of the groundwater resources. The table below gives an overview of the key groundwater management functions.

**Table 3.2.1.1: Key groundwater management functions**

| Activity | Responsible Person | Skills and qualifications required | Resources, tools and equipment | Remarks |
|---|---|---|---|---|
| Measuring and recording of water levels. | Pump operator | Literacy, numeracy, trained in taking water levels | Dip meter, ruler, log book, pen. | Done as part of operators' regular O&M activities. |
| Measuring and recording abstraction | Pump operator | Literacy, numeracy, trained in reading water meters. | Log book, pen | Done as part of operators' regular O&M activities. |
| Providing data to the authority that is responsible for water supply on a regular basis. | Pump operator and pump operator supervisor | Literacy, numeracy, keeping records. | Postal service or public transport. | Including as part of the reporting requirements of the pump operator. |
| Taking water samples | The authority that is responsible for water supply. | Trained in taking water samples, driving license. | Transport, sample bottles, cooler box. | Sampling routine defined by sampling plan. |
| Sending water samples for testing. | The authority that is responsible for water supply. | Keeping records. | Transport to laboratory | Sent to nearest accredited laboratory. |
| Defining the monitoring requirements of an individual borehole. | Technical manager of operations or hydrogeologist. | Hydrogeological degree or diploma, experience of | Reports and records on borehole, monitoring data. | |

| Table 3.2.1.1: Key groundwater management functions | | | | |
|---|---|---|---|---|
| **Activity** | **Responsible Person** | **Skills and qualifications required** | **Resources, tools and equipment** | **Remarks** |
| | | hydrogeological conditions. | | |
| Ensuring that boreholes are equipped with piezometer tubes for measuring water levels and water meters for measuring abstraction. | The authority that is responsible for water supply. | Project management | In house technical staff, suppliers, contractors, specifications. | |
| Ensuring that operators have the equipment and skills to do monitoring. | The authority that is responsible for water supply. | Project management | Trainers, suppliers, specifications. | |
| Monitoring the pump operator's competence to collect and record data. | Pump operator supervisor | Staff supervision, knowledge of pump operators' tasks. | Transport | Done as part of the supervision of O&M activities. |
| Processing data collected at the local level | Data clerk | Data capture, record keeping, filing, trained in operating software. | Computer, spreadsheet or groundwater management software, files. | Maintains an electronic and physical record of data. |
| Studying water level, water quality and abstraction data on a regular basis. | Technical manager of operations. | Technical training, operations experience. | Project files, monitoring data | Done as part of the management of O&M |
| Revising pumping recommendations, and adjusting the monitoring requirements. Ensuring the recommendations are carried out and monitoring the implementation of the recommendations. | Technical manager with hydrogeologist as required. | Technical training, operations experience. | Reports and records on borehole, monitoring data, operational information. | Ongoing management of operations and groundwater resources. |
| Reporting to council and pump operator, providing summary data to the CMA. | Data clerk with supervision from technical manager. | Training in operating software. | Computer, spreadsheet or groundwater management software, printer. | Summary data defined by license (frequency, what data, form of data) |

Detail information regarding the groundwater sources is available under Sections 3 of the Administration, Information and Comprehensive Overview Report. **The recommended daily, weekly, monthly and six monthly O&M activities, as included under Section 4.1.1, are to be implemented by Bitou Municipality for their boreholes.**

### 3.2.2 Surface water infrastructure (Abstraction Points)

Section 6.1 of Topic 6 gives an overview of the years in which the annual water requirement is likely to exceed the total registration volumes or yields from the various resources.

| Table 3.2.2.1: Current raw water storage capacity available, the current water requirements of the towns and number of days for which storage is available. | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Scheme** | **Raw water storage capacity available (Ml)** | **Water usage for the last three years (AADD, Ml/d)** | | | **Number of days for which storage capacity is available if full** | | |
| | | **16/17** | **17/18** | **18/19** | **16/17** | **17/18** | **18/19** |
| Plettenberg Bay | 2 060 x 55% = 1 133 | 8.448 | 9.781 | 10.300 | 134 | 116 | 110 |
| Kurland | - | 0.471 | 0.517 | 0.537 | - | - | - |
| Natures Valley | - | 0.132 | 0.155 | 0.209 | - | - | - |

**The preventative maintenance activities, as included under Section 4.1.2, are to be implemented by Bitou Municipality for their surface water infrastructure.**

### 3.2.3 Bulk water pipeline infrastructure

Based on the most likely land-use development scenario, it will be necessary to upgrade the following bulk water pipelines:

**Table 3.2.3.1: Future bulk water pipelines required**

| Scheme | Recommended bulk water pipelines |
|---|---|
| Plettenberg Bay | Feeder mains that require upgrading<br>• It is proposed that the Archiewood and Brackenridge reservoirs are supplied in future with water only through the existing 200/250 mm Ø pipeline that currently supplies the Town Tower reservoir with water from the Plettenberg Bay WTP. This will alleviate pressure on the so-called "Kwanokuthula" pipeline and consequently improve bulk water supply to the Kwanokuthula East (Lower) reservoir. It is proposed that the 200 mm Ø section of this pipeline between the Plettenberg Bay WTP and the Town Tower reservoir is increased to a 315 mm Ø pipeline (item BPW.B1).<br>• Upgrading of the 100 mm Ø feeder main between the Town Tower reservoir and the Town Lower & Upper towers (item BPW.B24).<br>• The existing 200 mm Ø section of the so-called "Kwanokuthula" rising main (between the New Horizon reservoirs and the Kwanokuthula East (Lower) reservoirs) should be reinforced with a new 315 mm Ø rising main when supply from the Plettenberg Bay WTP pump station to Kwanokuthula reached capacity (item BPW.B27).<br>• Upgrading of the feeder main to the Kwanokuthula West (Upper) tower(s) when the proposed second 500 Kl tower is constructed (part of item BPW.B63).<br>• Upgrading of the feeder main to the Kwanokuthula East (Lower) pump station (item BPW.B29).<br>• Upgrading of the 200 mm Ø bulk pipe from the WTP PS to the Town reservoir A (item BPW.B77).<br>• Upgrading of the 90 mm Ø feeder main to Wittedrift reservoir (item BPW.B71).<br>• Upgrading of the bulk system from the Town reservoirs A & C to the Matjiesfontein reservoir. This bulk system comprises of 4 discreet sections, i.e. section 1 (150 & 315 mm Ø pipelines from the Town reservoirs to opposite the Turtle Creek Golf Estate where the 315 mm Ø pipeline ends), section 2 (150 mm Ø pipeline from opposite the Turtle Creek Golf Estate to the draw-off to Wittedrift & Green Valley at the Rietvlei Road), section 3 (150 mm Ø pipeline along the N2 from the Rietvlei Road to before the bridge over the Keurbooms River) and section 4 (200 mm Ø pipeline from the bridge over the Keurbooms River to the Matjiesfontein reservoir). It is proposed that section 2 of this bulk system is reinforced with a new 355 mm Ø pipeline (item BPW.B39), section 3 with a new 355 mm Ø pipeline (item BPW.B67) and section 4 with a parallel 315 mm Ø pipeline (item BPW.B47).<br>• The existing 250 & 300 mm Ø rising mains from the Plettenberg Bay WTP to the Brakkloof reservoir should be augmented when supply problems to the Brakkloof reservoir are experienced. It is proposed that the "old" 300 mm Ø AC pipe is replaced with a new 450/400 mm Ø pipeline (item BPWB17). The "old" 300 mm Ø should then be utilized as a dedicated supply pipe to transfer potable water from the desalination plant to the Brakkloof and Town reservoirs.<br>• Upgrading of the 100 mm Ø feeder main between the Kranshoek reservoir and the Kranshoek towers (upgrading of this pipeline is currently in progress).<br>• Upgrading of the 200 mm Ø bulk pipe from the Bitou desalination plant to the existing 300 mm Ø bulk pipeline between the Plettenberg Bay WTP and the Brakkloof reservoir (item BPW.B37).<br>New feeder mains required<br>• Commission the rising main from the so-called "New Horizon" pipeline towards the Kwanokuthula West (Upper) reservoir and tower (item BPW.B59).<br>• New 200 mm Ø feeder main from the Archiewood reservoir reticulation network to the proposed Ganse Valley Estate (item BPW13.3).<br>• New 200 mm Ø feeder main from the Town PRV 4 reticulation network to the proposed Roodefontein Golf Estate (item BPW1.17).<br>• New 160 mm Ø feeder main from the existing Green Valley bulk PS to the proposed higher lying Green Valley reservoir (item BPW.B73).<br>• New feeder main to the proposed Green Valley booster pump station.<br>• New 200 mm Ø feeder main from the bulk system between the Town reservoirs and Matjiesfontein to the proposed Hanglip Golf Estate (item BPW.B45).<br>• New 110 mm Ø rising main from the Keurboomstrand Lower reservoir to the proposed Keurboomstrand Upper reservoir (item BPW.B50).<br>• New feeder main to proposed Keurboomstrand Upper booster pump station.<br>• New feeder main to the proposed Goose Valley booster pump station.<br>• New 315 mm Ø rising main between Roodefontein Lower and Upper reservoirs (item BPW.B5).<br>• New 200 mm Ø raw water pipeline from the Kwanokuthula East reservoir site to the Plettenberg Bay WTP (item BPW.B11).<br>• New 200 mm Ø feeder main from the New Horizon PS to the proposed New Horizon Tower (item BPW10.3) |
| Kurland | • New 200 mm Ø feeder main from the Matjiesfontein reservoir to the proposed Matjiesfontein Upper reservoir (item BKW.B3.1).<br>• New 160 mm Ø feeder main from the Matjiesfontein Upper reservoir to the existing Kurland bulk system (item BKW.B3.2).<br>A 3.0 km 160 mm Ø section of the bulk system between Kurland and Plettenberg Bay has already been constructed (from Kurland along the N2 towards Plettenberg Bay). It is proposed that item BKW.B3.2 connect |

| Table 3.2.3.1: Future bulk water pipelines required | |
|---|---|
| **Scheme** | **Recommended bulk water pipelines** |
| | to this pipeline (on the southern side) and that the northern side of this pipeline is connected to the existing 200 mm Ø supply pipeline from the Kurland reservoirs to the Kurland reticulation network.<br>The existing 200 mm Ø pipe (that is currently part of the reticulation network) should then be transferred to the bulk system (after item BKW1.3 is implemented). |
| Natures Valley | No feeder mains require upgrading in the future. |

**Table 3.2.3.2: Cost of future bulk water supply pipelines required**

| Scheme | New feeder mains that are proposed or existing feeder mains that require upgrading in the future (Master Plan Item) | Project | Year | Diameter (mm) | Length (m) | Estimated Cost (VAT Excl.) |
|---|---|---|---|---|---|---|
| Plettenberg Bay | 35 l/s FCV to install (BPW.B2) | PRJ-BPW-002 | 2021 | 150 | - | R233 000 |
| | Dedicated bulk supply pipeline to Kwanokuthula Upper Reservoir (BPW.B59) | PRJ-BPW-002 | 2021 | 315 | 3 | R62 000 |
| | Pipeline when FDA P100 develops (BPW.B73) | PRJ-BPW-006 | 2021 | 160 | 766 | R1 072 000 |
| | Inter-connection pipe to improve bulk water supply to Keurboomstrand (BPW.B40) | PRJ-BPW-007 | 2021 | 160 | 31 | R76 000 |
| | Pipeline when existing bulk supply to Keurboomstrand reservoir nears capacity (BPW.B48.2) | PRJ-BPW-057 | 2023 | 200 | 10 | R60 000 |
| | Pipeline to reinstate New Horizon PS when FDA P35 develops (BPW10.2) | PRJ-BPW-008 | 2023 | 280 | 6 | R72 000 |
| | Pipeline when future New Horizon PS is constructed (BPW10.3) | PRJ-BPW-008 | 2023 | 280 | 26 | R131 000 |
| | Pipeline when New Horizons Tower is constructed (BPW10.5) | PRJ-BPW-008 | 2023 | 280 | 23 | R120 000 |
| | Pipeline when FDA P35 develops (BPW10.6) | PRJ-BPW-008 | 2023 | 250 | 44 | R157 000 |
| | Pipeline to rezone high lying areas of New Horizon reservoir to New Horizon Tower (BPW10.7) | PRJ-BPW-008 | 2023 | 200 | 13 | R65 000 |
| | Valve to insert and close to rezone high lying areas of New Horizon reservoir to New Horizon Tower (BPW10.8a) | PRJ-BPW-008 | 2023 | 200 | - | R117 000 |
| | Valve to insert and close to rezone high lying areas of New Horizon reservoir to New Horizon Tower (BPW10.8b) | PRJ-BPW-008 | 2023 | 160 | - | R110 000 |
| | Valve to insert and close to rezone high lying areas of New Horizon reservoir to New Horizon Tower (BPW10.9a) | PRJ-BPW-008 | 2023 | 160 | - | R117 000 |
| | Valve to insert and close to rezone high lying areas of New Horizon reservoir to New Horizon Tower (BPW10.9b) | PRJ-BPW-008 | 2023 | 200 | - | R117 000 |
| | Valve to insert and close to rezone high lying areas of New Horizon reservoir to New Horizon Tower (BPW10.10) | PRJ-BPW-008 | 2023 | 110 | 17 | R42 000 |
| | Pipeline to augment bulk water supply to Keurboomstrand (BPW.B39.1) | PRJ-BPW-009 | 2025 | 355 | 925 | R3 725 000 |
| | Pipeline to augment bulk water supply to Keurboomstrand (BPW.B39.2) | PRJ-BPW-009 | 2025 | 160 | 30 | R75 000 |
| | Pipeline to reduce demand on Kwanokuthula system (BPW.B21.1) | PRJ-BPW-011 | 2025 | 23 | 280 | R128 000 |
| | Valve to insert and close to reduce demand on Kwanokuthula system (BPW.B21.2) | PRJ-BPW-011 | 2025 | 250 | - | R138 000 |
| | 8 l/s FCV to install to reduce demand on Kwanokuthula system (BPW.B22) | PRJ-BPW-011 | 2025 | 80 | - | R175 000 |
| | New dedicated supply to Roodefonteon Upper reservoir (BPW.B5) | PRJ-BPW-013 | 2025 | 315 | 2 207 | R7 095 000 |
| | Inter-connection pipeline to utilise old 150 mm pipeline as supply to Kranshoek reservoir (BPW.B33) | PRJ-BPW-013 | 2025 | 160 | 14 | R53 000 |
| | New bulk pipeline when bulk supply to Wittedrift & Green Valley reaches capacity (BPW.B71) | PRJ-BPW-014 | 2025 | 200 | 5 261 | R9 264 000 |
| | New bulk pipeline when supply problems to towers are experienced (BPW.B24) | PRJ-BPW-024 | 2025 | 160 | 10 | R47 000 |
| | Valve to insert and close (Emergency connection between towers) (BPW.B19) | PRJ-BPW-026 | 2025 | 315 | - | R156 000 |
| | Bulk supply line to connect borehole to existing borehole network (BPW.B12.1) | PRJ-BPW-046 | 2025 | 110 | 849 | R865 000 |
| | Bulk pipeline to augment bulk water supply to Kwanokuthula (including N2-crossing) (BPW.B27.1) | PRJ-BPW-048 | 2025 | 315 | 1 079 | R3 184 000 |
| | Bulk pipeline to augment bulk water supply to Kwanokuthula (including N2-crossing) (BPW.B27.2) | PRJ-BPW-048 | 2025 | 400 | 52 | R337 000 |
| | Pipeline when existing bulk supply to Matjiesfontein reservoir nears capacity (BPW.B67) | PRJ-BPW-015 | 2030 | 355 | 2 670 | R10 612 000 |
| | Pipeline to reinforce bulk supply from desalination plant to the existing bulk system (BPW.B37) | PRJ-BPW-047 | 2030 | 315 | 732 | R2 388 000 |

**Table 3.2.3.2: Cost of future bulk water supply pipelines required**

| Scheme | New feeder mains that are proposed or existing feeder mains that require upgrading in the future (Master Plan Item) | Project | Year | Diameter (mm) | Length (m) | Estimated Cost (VAT Excl.) |
|---|---|---|---|---|---|---|
| | New feeder main for Kwanokuthula West pump station (BPW.B29) | PRJ-BPW-019 | 2035 | 400 | 30 | R252 000 |
| | Connection pipeline to Kwanokuthula Upper bulk pipeline when item BPW.B31 is implemented (BPW.B64) | PRJ-BPW-019 | 2035 | 315 | 62 | R251 000 |
| | Connection pipeline to Kwanokuthula Upper bulk pipeline when item BPW.B31 is implemented (BPW.B66a) | PRJ-BPW-019 | 2035 | 315 | 10 | R86 000 |
| | Valve to insert and close when connection pipeline to Kwanokuthula Upper bulk pipeline is established (BPW.B66b) | PRJ-BPW-019 | 2035 | 315 | - | R156 000 |
| | New dedicated supply pipeline to new Keurboomstrand Upper Reservoir (BPW.B50) | PRJ-BPW-034 | 2035 | 110 | 943 | R958 000 |
| | New pipeline when FDAs P83 – P87 are developed (BPW.B97a) | PRJ-BPW-042 | 2035 | 160 | 2 133 | R2 596 000 |
| | Alternative supply pipeline to Keurboomstrand from the proposed Matjiesfontein Upper reservoir (BPW.B97b) | PRJ-BPW-042 | 2035 | 110 | 478 | R498 000 |
| | PRV to install to reduce high static pressures when FDAs P84 to P87 develop (BPW.B98) | PRJ-BPW-042 | 2035 | 80 | - | R175 000 |
| | 6 l/s FCV to install to sustain pressure in upstream bulk system (BPW.B99) | PRJ-BPW-042 | 2035 | 80 | - | R175 000 |
| | Construct raw bulk line to Bitou WTP (BPW.B11) | PRJ-BPW-051 | 2035 | 200 | 4 927 | R8 679 000 |
| | Connect boreholes to raw water reservoir (BPW.B12.2) | PRJ-BPW-051 | 2035 | 250 | 103 | R294 000 |
| | New pipeline when existing bulk supply to Matjiesfontein reservoir nears capacity (BPW.B47) | PRJ-BPW-022 | 2040 | 315 | 2 792 | R8 961 000 |
| | New pipeline when supply problems to Brakkloof Reservoir occur (BPW.B17.1) | PRJ-BPW-025 | 2040 | 400 | 3 881 | R15 389 000 |
| | New pipeline when supply problems to Brakkloof Reservoir occur (BPW.B17.2) | PRJ-BPW-025 | 2040 | 450 | 1 328 | R5 316 000 |
| | 20 l/s FCV to install to sustain pressure in network when Roodefontein Golf Estate sump is constructed (BPW1.18) | PRJ-BPW-056 | 2040 | 100 | - | R205 000 |
| | Upgrade existing bulk pipeline to meet ultimate demand (When FDA P059 develops) (BPW.B1) | PRJ-BPW-054 | 2045 | 315 | 814 | R2 650 000 |
| | 33 l/s FCV to install when FDA P59 develops (BPW13.4) | PRJ-BPW-055 | 2045 | 150 | - | R233 000 |
| | Pipeline when FDA P70 develops (BPW.B45) | PRJ-BPW-041 | 2050 | 200 | 2 083 | R3 693 000 |
| | 32 l//sFCV to install when FDA P70 develops (BPW.B92) | PRJ-BPW-041 | 2050 | 100 | - | R205 000 |
| | Pipeline when pumps are upgraded from 50 L/s to 100 L/s (BPW.B77) | PRJ-BPW-052 | 2050 | 315 | 105 | R387 000 |
| | **Sub Total** | | | | | **R91 952 000** |
| Kurland | New pipeline when WTW nears capacity (BKW.B4) | PRJ-BKW-004 | 2025 | 200 | 3 080 | R8 332 000 |
| | New pipeline when WTW nears capacity (BKW.B7) | PRJ-BKW-005 | 2030 | 160 | 5 977 | R12 535 000 |
| | Pipeline to utilise existing gravity feed as part of the bulk system (BKW.B8.1) | PRJ-BKW-005 | 2030 | 160 | 352 | R771 000 |
| | Valve to close / Pipe to disconnect | PRJ-BKW-005 | 2030 | 200 | - | - |
| | Valve to close / Pipe to disconnect | PRJ-BKW-005 | 2030 | 200 | - | - |
| | Pipeline to utilise existing gravity feed as part of the bulk system (BKW.B8.4) | PRJ-BKW-005 | 2030 | 160 | 12 | R59 000 |
| | **Sub Total** | | | | | **R21 697 000** |
| Natures Valley | - | - | - | - | - | - |
| | **Sub Total** | | | | | - |
| **Total** | | | | | | **R113 649 000** |

**The recommended maintenance activities for the bulk water pipelines, as included under Section 4.1.3, to be implemented by Bitou Municipality.**

### 3.2.4 Water Treatment Works infrastructure

The table below gives a summary of the existing capacities and current flows at each of the WTWs (Ml/d).

**Table 3.2.4.1: Existing capacities and flows at each of the WTWs (Ml/d)**

| WTW | Existing Hydraulic Capacity | Peak Month Average Daily Flow | Average Daily Flow 2018/2019 | Required Treatment Capacity (1.5 x $AADD_{10yr}$) | 2018/2019 Water Quality Failures (SANS0214:2015) |
|---|---|---|---|---|---|
| Plettenberg Bay | 27.000 | 10.997 (Dec) | 9.624 | 18.658 | - |
| Desalination | 2.000 | 1.971 (Jan) | 1.634 * | 2.000 | - |
| Kurland | 0.600 | 0.573 (Nov) | 0.537 | 0.935 | - |
| Natures Valley | 1.000 | 0.430 (Dec) | 0.209 | 0.364 | - |

Note: * Calculated over period December 2018 to April 2019.

**It can be noted from the above table that the existing hydraulic capacities of all the WTWs are adequate, except for the Kurland WTW.** There were also no water quality failures during the last financial year and the current treatment processes and operational procedures at the WTWs are therefore adequate. Some of the equipment at the WTWs however require refurbishment as indicated in Table 3.2.4.3.

The WTWs to be upgraded in Bitou Municipality are summarised in the table below:

**Table 3.2.4.2: WTWs to be upgraded in the future**

| WTW | Short, Medium, Long Term | Estimated Cost (Vat Excluded) |
|---|---|---|
| Upgrade capacity of Kurland WTW from 0.6 Ml/d to 1.2 Ml/d | Short | R9 317 000 |

Key issues to be addressed at the WTWs, as identified during the WSDP inspection process, are as follows:

- Plettenberg Bay WTW:
  - Lime dosing equipment needs refurbishment at both inlets. Pump control panel not working effectively (Wiring and speed control). Only one of the two lime cones are working, valve of the one is broken and therefore not in use. Lime feeder for the final water is not working.
  - Endress Hauser inline pH monitoring is not working.
  - Only one of the two coagulant dosing pumps at the second inlet is working, no standby.
  - Chlorine dosing building: No light fittings in the one room. Scales are not working. Chlorine gas detector is not working, which urgently needs to be repaired. Some lose wires in the control panel in the chlorine building.
  - DAF unit: Only one of the pumps can be used, because one of the check valves was removed for repairs.
  - Five large sand filters: The automatic vales do not always open and sometimes need to be operated manually.
  - Nine small sand filters: One of the filters is not working.
- Plettenberg Bay Desalination WTW: No items were identified.
- Kurland WTW: Capacity of plant is insufficient to meet future water treatment requirements. No other items were identified during the site inspection.
- Natures Valley WTW: Final water pump station at WTW needs refurbishment.

The table below gives an overview of the recommended improvements for the WTWs in Bitou Municipality's Management Area, as identified during the WSDP inspection.

| Table 3.2.4.3: Recommended improvements for the WTWs as identified during the WSDP inspection. | | |
|---|---|---|
| **Scheme** | **Recommendations** | **Estimated Cost (Vat Excluded)** |
| Plettenberg Bay | Refurbish lime dosing equipment at both inlets. | R250 000 |
| | Refurbish pH inline monitoring equipment. | R85 000 |
| | Repair second coagulant dosing pump at the second inlet. | R25 000 |
| | Refurbish chlorine dosing equipment (Leak gas detector, Scales, etc.) | R70 000 |
| | Replace check valve for pump at DAF unit. | R10 000 |
| | Refurbish filter units. | R80 000 |
| Desalination Plant | - | - |
| Kurland | - | - |
| Natures Valley | Refurbish final water PS at WTW. | R1 200 000 |
| **Total** | | **R1 720 000** |

**The recommended O&M activities for the WTWs, as included under Section 4.1.4, are to be implemented by Bitou Municipality.**

### 3.2.5 Water pump stations

Key issues to be addressed at the water pump stations, as identified through the WSDP inspection process, are as follows:

- Most of the water pump stations are operated manually, because of problems with the SCADA system.
- Weekly maintenance inspections are required for all the water PSs (Items to be checked indicated under Section 4.1.5).
- Weekly and quarterly maintenance inspections are required of all the water PSs by an electrician (Items to be checked indicated under Section 4.1.5).
- New Horizon Small PS: Pump is in for repairs.
- Town Tower High and Low reservoir PS: Only two of the four pumps are working.
- Kwanokuthula PS No.1: Two of the motors were removed and the PS is currently not in use.
- Roodefontein raw water PS: PS is not secure, because the door was broken off.

Based on the most likely land-use development scenario, it will be necessary for the following water pump stations:

Plettenberg Bay pump stations that require upgrade:

- A back-up pump is proposed for the existing High Lift pump at the Plettenberg WTW PS in order to improve the redundancy of the supply to New Horizon and Kwanokuthula West (Upper) reservoirs (item BPW.B58).
- Upgrading of the Kwanokuthula East (Lower) PS in order to improve supply to the Kwanokuthula East (Lower) tower (item BPW.B18) and to the Kwanokuthula West (Upper) reservoir (item BPW.B31).
- Upgrading of the Kwanokuthula West (Upper) PS in order to augment supply to the Kwanokuthula West (Upper) tower when the proposed second 500 kl Upper tower is constructed (item BPW.B60).
- Upgrading of the pumps at the Plettenberg WTP that pumps to the Town Tower and Brackenridge reservoirs is proposed if supply problems are experienced when FDA P59 develops (item BPW.B32).
- Upgrading of the pumps at the Town Tower reservoir pumping to the Town Lower & Upper towers is proposed if supply problems are experience (item BPW.B23).
- Upgrading of the pumps at the WTP PS that pump towards the Town reservoir A (item BPW.B76).
- Upgrading of the Green Valley pump station (item BPW.B72).

- Upgrading of the pumps at the Plettenberg WTP that pumps to the Brakkloof reservoir (item BPW.B16).
- Upgrading of the pumps at the Brakkloof PS that pumps to the Quarry reservoir (item BPW.B9).
- Upgrading of the Kranshoek reservoir to Kranshoek towers pump station (this project is currently in progress).
- Upgrading of the pumps at the Bitou desalination plant bulk PS (item BPW.B36).

Plettenberg Bay new pump stations required:

- New booster pump station to Wittedrift (item BPW.B41a).
- Upgrading of the booster pumps to Wittedrift when required (BPW.B41b)
- New Green Valley booster pump station (item BPW.B75).
- A new booster pump station to augment bulk water supply to Matjiesfontein reservoir (item BPW.B100). This pump station should only be constructed after sections 2, 3 & 4 of the bulk system from the Town reservoirs to the Matjiesfontein reservoir is implemented.
- Decommission the existing booster pumps (inside the pipeline) towards the Keurboomstrand reservoir (item BPW.B48.3) and replace with a new pump station (item BPW.B48.1).
- New pump station at Keurboomstrand reservoir to proposed Keurboomstrand Upper reservoir (item BPW.B49).
- New Keurboomstrand Upper booster pump station (item BPW.B52).
- New pump station at proposed Roodefontein Lower reservoir to proposed Roodefontein Upper reservoir (item BPW.B4).
- New Goose Valley booster pump station (item BPW.B35).
- New pump station on the New Horizon reservoir site for the proposed New Horizon tower (item BPW10.1)

Plettenberg Bay new pump stations required: Private Developers

- New pump station to supply bulk water from the Archiewood reservoir zone to the proposed Ganse Valley Estate reservoir (item BPW13.5). This is seen as private infrastructure for the cost of the developer of FDA P59.
- New pump station to supply bulk water from the Town PRV 4 zone to the proposed Roodefontein Golf Estate reservoir (item BPW1.19). This is seen as private infrastructure for the cost of the developer of FDA P11.
- New pump station to supply bulk water to the proposed Hanglip Golf Estate reservoir (item BPW.B93). This is seen as private infrastructure for the cost of the developer of FDA P70.

Kurland new pump stations required:

- New pump station to supply bulk water from the Matjiesfontein reservoir to the proposed Matjiesfontein Upper reservoir (item BKW.B3).
- New pump station to supply bulk water from the Matjiesfontein Upper reservoir to the Kurland reservoirs (item BKW.B6).

Natures Valley new pump stations required: No future pump stations are required.

**Table 3.2.5.1: Future water pump stations required**

| Scheme | Recommendations included in the Water Master Plan (Master Plan Item) | Project | Year | Capacity (l/s) | Head (m) | Estimated Cost (VAT Excl.) |
|---|---|---|---|---|---|---|
| Plettenberg Bay | New PS to augment bulk water supply to Wittedrift & Green Valley (after item BPW.B40 is implemented)(BPW.B41a) | PRJ-BPW-006 | 2021 | 7 | 55 | R2 023 000 |
| | Upgrade Green Valley PS when FDA P100 develops (BPW.B72) | PRJ-BPW-006 | 2021 | 15 | 75 | R1 886 000 |
| | New Green Valley booster PS when FDA P100 develops (BPW.B75) | PRJ-BPW-012 | 2023 | 20 | 25 | R1 879 000 |
| | New PS when existing bulk supply to Keurboomstrand reservoir nears capacity (BPW.B48.1) | PRJ-BPW-057 | 2023 | 15 | 55 | R1 851 000 |
| | Decommission existing booster pumps (inside pipeline) when existing bulk supply to Keurboomstrand reservoir nears capacity (BPW.B48.3) | PRJ-BPW-057 | 2023 | 10 | 35 | R216 000 |
| | New PS when FDA P35 develops (BPW10.1) | PRJ-BPW-008 | 2023 | 80 | 25 | R2 822 000 |
| | New PS at proposed Roodefontein lower reservoir to proposed Roodefontein Upper reservoir (when Roodefontein Upper reservoir is constructed) (BPW.B4) | PRJ-BPW-013 | 2025 | 90 | 60 | R3 342 000 |
| | Upgrade PS at the Town Tower reservoir pumping to Town Lower and Upper Towers (Ultimate requirement 16 l/s, upgrade if required) (BPW.B23) | PRJ-BPW-024 | 2025 | 16 | 20 | R239 000 |
| | Upgrade Kwanokuthula East (Lower) PS (Reduce pumping requirements to higher tower) (BPW.B18) | PRJ-BPW-026 | 2025 | 60 | 15 | R580 000 |
| | Upgrade Kwanokuthula West (Upper) PS when supply to Upper tower reaches capacity (BPW.B60) | PRJ-BPW-018 | 2030 | 175 | 16.5 | R922 000 |
| | Upgrade existing Brakkloof PS when existing bulk supply to Quarry reservoir nears capacity (BPW.B9) | PRJ-BPW-037 | 2030 | 25 | 35 | R575 000 |
| | Upgrade existing PS at Desalination Plant (Upgrade pump capacity to 7 Ml/d) (BPW.B36) | PRJ-BPW-047 | 2030 | 85 | 130 | R2 296 000 |
| | Upgrade existing Kwanokuthula East (Lower) PS when supply problems to Upper reservoir occur (BPW.B31) | PRJ-BPW-019 | 2035 | 85 | 30 | R865 000 |
| | Install backup pump for Highlift PS at Plettenberg Bay WTW for supply to New Horison and Kwanokuthula (BPW.B58) | PRJ-BPW-019 | 2035 | 100 | 122 | R1 658 000 |
| | New PS at Keurboomstrand reservoir when new Keurboomstrand Upper reservoir is constructed (BPW.B49) | PRJ-BPW-034 | 2035 | 10 | 90 | R1 795 000 |
| | Upgrade PS at Plettenberg Bay WTW that pump to Brakkloof reservoir when supply problems to Brakkloof reservoir occur (BPW.B16) | PRJ-BPW-025 | 2040 | 165 | 50 | R1 826 000 |
| | New Goose Valley booster PS when higher lying erven of FDA P60 develops (BPW.B35) | PRJ-BPW-033 | 2040 | 17 | 45 | R1 861 000 |
| | New Keurboomstrand Upper booster PS when FDAs P83 & P84 develop (BPW.B52) | PRJ-BPW-034 | 2040 | 15 | 30 | R1 808 000 |
| | 25m³ @ 33m TWL Pump Sump when FDA P11 develops (Cost to developer) | PRJ-BPW-056 | 2040 | - | - | - |
| | 25m³ @ 34m TWL Pump Sump to install when FDA P59 develops. New sump for Ganse Valley Estate (BPW13.5) | PRJ-BPW-055 | 2045 | - | - | - |
| | Upgrade pump to augment bulk water supply to Wittedrift & Green Valley (After item BPW.B71 is implemented) (BPW.B41b) | PRJ-BPW-049 | 2045 | 20 | 25 | R340 000 |
| | Upgrade PS at Plettenberg Bay WTW that pump to the Town Tower and Brackenridge reservoirs (Ultimate requirement 95 l/s, upgrade if required) (BPW.B32) | PRJ-BPW-054 | 2045 | 95 | 65 | R740 000 |
| | New PS when existing bulk supply to Matjiesfontein reservoir nears capacity (BPW.B100) | PRJ-BPW-050 | 2050 | 95 | 25 | R3 068 000 |
| | Upgrade pumps at Plettenberg Bay WTW that pump to Reservoir A when supply problems to Town reservoirs are experienced (BPW.B76) | PRJ-BPW-052 | 2050 | 100 | 10 | R797 000 |
| | 25m³ @ 6m TWL Pump Sump for Hangklip Estate (Cost to developer) (BPW.B93) | PRJ-BPW-050 | 2050 | - | - | - |
| | **Sub Total** | | | | | **R33 389 000** |
| Kurland | New PS when existing bulk supply to Kurland WTP nears capacity (BKW.B3) | PRJ-BKW-004 | 2025 | 30 | 200 | R2 630 000 |
| | New PS when existing bulk supply to Kurland WTP nears capacity (BKW.B6) | PRJ-BKW-004 | 2030 | 20 | 200 | R2 278 000 |
| | **Sub Total** | | | | | **R4 908 000** |
| Natures Valley | - | - | - | - | - | - |
| | **Sub Total** | | | | | **-** |
| **Total** | | | | | | **R38 297 000** |

**The recommended O&M activities for the water pump stations, as included under Section 4.1.5, are to be implemented by Bitou Municipality.**

### 3.2.6 Reservoir infrastructure

Key issues to be addressed at the reservoirs, as identified during the WSDP inspection process, are as follows:

- The levels of most of the reservoirs are controlled through visual inspections, because of problems with the SCADA system. This result in additional operational costs and increase the workload of the operational personnel.
- The reservoir covers are not locked and adequately secured at most of the reservoirs.
- A large number of the reservoir valve chambers are without covers or the existing covers are broken. Some of the chambers are also under water and the chambers are not adequately maintained.
- There is a lack of maintenance done on the reservoir valves.
- The Kwanokuthula old tower is not in use, because it is leaking.
- The following reservoir sites are not yet adequately fenced and secured.
  - New Horizon reservoirs.
  - Goose Valley reservoir (Fence was stolen).
  - Wittedrift reservoir (Fence was vandalised).
  - Natures Valley reservoir.

The condition of most of the reservoirs in Bitou Municipality's Management Area is good. New security fences were also recently installed at some of the reservoirs to reduce possible vandalism. Bitou Municipality's overall storage factors of the reservoirs for the various systems for 2018/2019, based on 1 x PDD (24 hours storage capacity), are 3.18 for Plettenberg Bay, 2.60 for Kurland and 0.67 for Natures Valley. The Water Master Plan indicates the total reservoir storage capacity for Plettenberg Bay as 128 h x AADD, for Kurland as 156 h x AADD and for Nature's Valley as 84 h x AADD.

Even though the town's overall storage capacity might be adequate there might be some distribution zones within the town's network with inadequate storage capacity, as identified through the Water Master Planning process (2020) and indicated below.

Plettenberg Bay reservoirs required:

- Additional reservoir storage capacity of 3.500 Ml and additional capacity at the Upper tower of 0.500 Ml are proposed at the existing Kwanokuthula West (Upper) reservoir site to accommodate future developments (items BPW.B62 & BPW.B63). The reservoir and tower will be required when the water demand for the Kwanokuthula West (Upper) tower zone exceeds 2 000 Kl/d.
- It is proposed that a new 500 kl tower with a proposed TWL of 210 m a.s.l. (item BPW.10.4) is constructed in order to accommodate FDAs P35 & P91. This new tower will also be required to provide sufficient pressure to the higher lying erven in New Horizon.
- Additional reservoir storage capacity of 3.500 Ml is proposed at the existing Kwanokuthula East (Lower) reservoir site to accommodate future developments (item BPW.B28). The reservoir will be required when the water demand for the Kwanokuthula East (Lower) reservoir and tower zones exceeds 1 500 Kl/d.
- It is proposed that the existing Green Valley reservoirs and elevated tank are replaced with a new higher lying 1.250 Ml reservoir (item BPW.B74, TWL of 138 m a.s.l.). The existing reservoirs and elevated tank can be decommissioned.
- When additional storage capacity is required for the Matjiesfontein reservoir zone, a new 2.000 Ml reservoir should be constructed at the existing Matjiesfontein reservoir site (item BPW.B53).

- A new 0.600 Ml Keurboomstrand Upper reservoir (item BPW.B51) with a TWL of 160 m a.s.l. is proposed for the future Keurboomstrand Upper reservoir zone and the Keurboomstrand Upper booster zone.
- A new 3.500 Ml Roodefontein Lower reservoir with a TWL of 175 m a.s.l. is proposed for the future Roodefontein Lower zone (item BPW.B3).
- A new 7.000 Ml Roodefontein Upper reservoir with a TWL of 215 m a.s.l. is proposed for the future Roodefontein Upper zone (item BPW.B6). Construction of this reservoir can be phased.
- A new 1.000 Ml raw water reservoir (item BPW.B10) is proposed on the Kwanokuthula East reservoir site to collect raw water from the Kwanokuthula well field. The safe yield of the boreholes is ± 3.5 Ml/d (balancing volume of the reservoir is ± 7 hours x the safe yield of the boreholes). A more detailed study will however be required regarding the size (and requirement) of the raw water storage reservoir and if the quality of the raw water is such that it can be blend with the potable water from the Kwanokuthula East reservoir.

Plettenberg Bay reservoirs required: Private Developers

- A new 2.800 Ml reservoir (item BPW13.6) with a TWL of 140 m a.s.l. is proposed for the proposed Ganse Valley Golf Estate (future area P59). This reservoir should be filled through a pump station and accompanying rising main from a sump with a controlled inflow in order to sustain the pressure in the upstream reticulation network. This is seen as private infrastructure for the cost of the developer of future area P59.
- A new 1.600 Ml reservoir (item BPW1.23) with a TWL of 135 m a.s.l. is proposed for the proposed Roodefontein Golf Estate (FDA P11). This reservoir should be filled from a sump with a controlled inflow in order to sustain the pressure in the upstream reticulation network. This is seen as private infrastructure for the cost of the developer of FDA P11.
- A new 2.800 Ml reservoir (item BPW.B94) with a TWL of 185 m a.s.l. is proposed for the proposed Hanglip Golf Estate (future area P70). This reservoir should be filled through a pump station and accompanying rising main from a sump with a controlled inflow in order to sustain the pressure in the upstream bulk supply system. This is seen as private infrastructure for the cost of the developer of future area P70.

Kurland reservoir required:

- A new 1.500 Ml reservoir (item BKW.B9) is proposed at the existing Kurland reservoir site in order to augment reservoir storage capacity. This reservoir will be required when the AADD for Kurland exceeds 750 kl/d.
- A new 0.600 Ml balancing reservoir is however proposed on the bulk system from the Matjiesfontein reservoir to Kurland, i.e. the proposed Matjiesfontein Upper reservoir with a TWL of 217 m a.s.l. (item BKW.B5).

Natures Valley reservoir required:

- A new 1.000 Ml reservoir is proposed at the existing Nature's Valley reservoir site to replace the existing 0.600 Ml reservoir (item BNW.B1).

Based on the most likely land-use development scenario, it will be necessary for the construction of the following new reservoirs.

**Table 3.2.6.1: Future reservoir storage capacities required**

| Scheme | Recommendations included in the Water Master Plan (Master Plan Item) | Project | Year | Capacity (Ml) | Estimated Cost (VAT Excl.) |
|---|---|---|---|---|---|
| Plettenberg Bay | New reservoir for Roodefontein Lower zone (BPW.B3) | PRJ-BPW-001 | 2021 | 3.500 | R11 920 000 |
| | New reservoir storage capacity for Green Valley when FDA P100 develops (BPW.B74) | PRJ-BPW-006 | 2021 | 1.250 | R5 921 000 |
| | Construct water tower when FDA P35 develops (BPW10.4) | PRJ-BPW-008 | 2023 | 0.500 | R7 980 000 |
| | New reservoir for Roodefontein Upper zone (can be phased) (BPW.B6) | PRJ-BPW-013 | 2025 | 7.000 | R19 502 000 |
| | New Kwanokuthula West reservoir when existing reservoir storage volume nears capacity (BPW.B62) | PRJ-BPW-018 | 2030 | 3.500 | R11 920 000 |
| | New Kwanokuthula West water tower when existing tower storage volume nears capacity (BPW.B63) | PRJ-BPW-018 | 2030 | 0.500 | R7 980 000 |
| | New reservoir required for Kwanokuthula East when existing storage nears capacity (BPW.B28) | PRJ-BPW-017 | 2035 | 3.500 | R11 920 000 |
| | New Keurboomstrand Upper reservoir when FDA P83 - P87 develop (BPW.B51) | PRJ-BPW-034 | 2035 | 0.600 | R3 654 000 |
| | Construct Kwanokuthula East raw water reservoir (BPW.B10) | PRJ-BPW-051 | 2035 | 1.000 | R5 040 000 |
| | New reservoir when FDA P11 develops (Cost to developer) (BPW1.23) | PRJ-BPW-056 | 2040 | 1.600 | - |
| | New Matjiesfontein reservoir required when existing storage nears capacity (BPW.B53) | PRJ-BPW-023 | 2045 | 2.000 | R8 008 000 |
| | New reservoir for Ganse Valley Estate (Cost to developer) (BPW13.6) | PRJ-BPW-055 | 2045 | 2.800 | - |
| | New reservoir for Hangklip Estate (Cost to developer) (BPW.B94) | PRJ-BPW-041 | 2050 | 2.800 | - |
| | **Sub Total** | | | | **R93 845 000** |
| Kurland | New reservoir when existing storage capacity nears capacity (BKW.B9) | PRJ-BKW-006 | 2025 | 1.500 | R6 650 000 |
| | New reservoir when Kurland WTP nears capacity (Reservoir to serve dual purpose, see PRJ-BPW-042) (BKW.B5) | PRJ-BKW-004 | 2025 | 0.600 | R3 654 000 |
| | **Sub Total** | | | | **R10 304 000** |
| Natures Valley | Replace existing reservoir (PNW.B1) | PRJ-BNW-002 | 2022 | 1.000 | R5 040 000 |
| | **Sub Total** | | | | **R5 040 000** |
| **Total** | | | | | **R109 189 000** |

**The recommended O&M activities for the reservoirs, as included under Section 4.1.6, are to be implemented by Bitou Municipality.**

## 3.2.7 Water reticulation infrastructure

Based on the most likely land-use development scenario, it will be necessary for the following water reticulation infrastructure.

**Table 3.2.7.1: Future water reticulation infrastructure required**

| Scheme | Recommendations included in the Water Master Plan | Master Plan Items | Project | Year | Estimated Cost (VAT Excl.) |
|---|---|---|---|---|---|
| Plettenberg Bay | Green Valley bulk supply upgrades - Phase 1 | BPW21.1, BPW21.2, BPW21.3 & BPW21.4 | PRJ-BPW-006 | 2021 | R1 415 000 |
| | Plettenberg Bay network upgrades - Priority | BPW1.22, BPW3.1, BPW3.2, BPW3.3, BPW3.4, BPW6.3, BPW19.1, BPW19.2 | PRJ-BPW-007 | 2021 | R1 127 000 |
| | Development related infrastructure: Wittedrift (Priority) | BPW15.1, BPW15.1 | PRJ-BPW-040 | 2021 | R872 000 |
| | Development related infrastructure: Kwanokuthula (Short term) | BPW8.8, BPW8.9, BPW8.13, BPW8.14, BPW8.15, BPW9.1, BPW9.7 | PRJ-BPW-010 | 2022 | R7 806 000 |
| | Roodefontein Upper reservoir and bulk supply infrastructure | BPW5.1, BPW5.2, BPW5.6a, BPW5.6b, BPW5.6c, BPW5.6d, BPW5.6e, BPW5.7 | PRJ-BPW-013 | 2025 | R11 764 000 |

**Table 3.2.7.1: Future water reticulation infrastructure required**

| Scheme | Recommendations included in the Water Master Plan | Master Plan Items | Project | Year | Estimated Cost (VAT Excl.) |
|---|---|---|---|---|---|
| | Development related infrastructure: Goose Valley reservoir zone | BPW14.1 | PRJ-BPW-033 | 2025 | R725 000 |
| | Kwanokuthula Upper storage capacity augmentation | BPW8.1 | PRJ-BPW-018 | 2030 | R2 264 000 |
| | Development related infrastructure: Archiewood & Brackenridge reservoirs | BPW13.1, BPW13.2 | PRJ-BPW-031 | 2030 | R1 728 000 |
| | Development related infrastructure: Kwanokuthula (Longer term) | BPW11.10 | PRJ-BPW-035 | 2030 | R975 000 |
| | Development related infrastructure: Roodefontein reservoirs | BPW4.1, BPW5.8, BPW5.10 | PRJ-BPW-038 | 2030 | R12 550 000 |
| | Development related infrastructure: Town PRV 4 zone | BPW1.10, BPW1.12, BPW1.14, BPW1.15, BPW1.16, BPW1.20, BPW1.21 | PRJ-BPW-039 | 2030 | R6 050 000 |
| | Development related infrastructure: Kwanokuthula (Medium term) | BPW8.16, BPW9.2, BPW9.3 | PRJ-BPW-020 | 2035 | R2 505 000 |
| | Plettenberg Bay network upgrades - Longer term | BPW1.13, BPW3.5, BPW3.6 | PRJ-BPW-021 | 2035 | R2 644 000 |
| | Development related infrastructure: Goose Valley reservoir zone | BPW14.4 | PRJ-BPW-033 | 2035 | R1 332 000 |
| | Development related infrastructure: Kwanokuthula (Longer term) | BPW9.4, BPW9.5, BPW9.6 | PRJ-BPW-035 | 2035 | R6 583 000 |
| | Development related infrastructure: Matjiesfontein reservoir zone | BPW16.1 | PRJ-BPW-036 | 2035 | R3 244 000 |
| | Development related infrastructure: Quarry reservoir zone | BPW6.1 | PRJ-BPW-037 | 2035 | R379 000 |
| | Development related infrastructure: Roodefontein reservoirs | BPW4.4, BPW5.11, BPW5.9 | PRJ-BPW-038 | 2035 | R10 080 000 |
| | Development related infrastructure: Wittedrift (Longer term) | BPW15.3 | PRJ-BPW-053 | 2035 | R379 000 |
| | Development related infrastructure: Archiewood & Brackenridge reservoirs | BPW7.1, BPW7.2, BPW13.3 | PRJ-BPW-031 | 2040 | R2 789 000 |
| | Development related infrastructure: Brakkloof reservoir zone | BPW2.2, BPW2.3 | PRJ-BPW-032 | 2040 | R613 000 |
| | Development related infrastructure: Goose Valley reservoir zone | BPW14.2 | PRJ-BPW-033 | 2040 | R403 000 |
| | Development related infrastructure: Matjiesfontein reservoir zone | BPW16.2 | PRJ-BPW-036 | 2040 | R964 000 |
| | Development related infrastructure: Quarry reservoir zone | BPW6.2 | PRJ-BPW-037 | 2040 | R926 000 |
| | Development related infrastructure: Roodefontein reservoirs | BPW4.2a, BPW4.2b, BPW4.2c, BPW4.3, BPW4.5, BPW4.6 | PRJ-BPW-038 | 2040 | R4 318 000 |
| | Development related infrastructure: Roodefontein Golf Estate | BPW1.17 | PRJ-BPW-056 | 2040 | R1 723 000 |
| | Development related infrastructure: Keurboomstrand | BPW17.1 | PRJ-BPW-034 | 2045 | R279 000 |
| | Development related infrastructure: Kwanokuthula (Longer term) | BPW8.17 | PRJ-BPW-035 | 2045 | R1 198 000 |
| | Development related infrastructure: Matjiesfontein reservoir zone | BPW16.3 | PRJ-BPW-036 | 2045 | R302 000 |
| | Development related infrastructure: Goose Valley reservoir zone | BPW14.3 | PRJ-BPW-033 | 2050 | R634 000 |
| | **Sub Total** | | | | **R88 571 000** |
| Kurland | Kurland network upgrade | BKW1.1, BKW1.2 & BKW1.3 | PRJ-BKW-001 | 2021 | R9 044 000 |
| | Development related infrastructure: Kurland | BKW2.1 | PRJ-BKW-003 | 2023 | R1 405 000 |
| | **Sub Total** | | | | **R10 449 000** |
| Natures Valley | Natures Valley network upgrades | BNW1.1, BNW1.2 | PRJ-BNW-001 | 2023 | R706 000 |
| | **Sub Total** | | | | **R706 000** |
| Harkerville | Establish Harkerville & Forest View hydraulic water models | BHW.1.1 | PRJ-BHW-001 | 2021 | R100 000 |
| | **Sub Total** | | | | **R100 000** |
| **Total** | | | | | **R99 826 000** |

The Water Master Plan indicated the following Water Demand Management infrastructure requirements.

| Table 3.2.7.2: Future water demand management infrastructure required | | | | | |
|---|---|---|---|---|---|
| **Scheme** | **Recommendations included in the Water Master Plan** | **Master Plan Items** | **Project** | **Year** | **Estimated Cost (VAT Excl.)** |
| Plettenberg Bay | Town PRV 4 zone: Alteration of zone boundaries & improvement of network conveyance & redundancy | BPW1.1, BPW1.4, BPW1.5, BPW1.24 & BPW1.25 | PRJ-BPW-003 | 2021 | R367 000 |
| | Brakkloof reservoir zone: Alteration of zone boundaries | BPW2.1, BPW2.4, BPW2.5, BPW2.6a, BPW2.6b, BPW2.7a, BPW2.7b, BPW2.8a, BPW2.8b, BPW2.8c, BPW2.8d, BPW2.8e, BPW2.8f & BPW2.9 | PRJ-BPW-004 | 2021 | R497 000 |
| | Development related infrastructure: Archiewood & Brackenridge reservoirs | BPW20.1 | PRJ-BPW-031 | 2045 | R205 000 |
| | **Sub Total** | | | | **R1 069 000** |
| Kurland | - | - | - | - | - |
| | **Sub Total** | | | | **-** |
| Natures Valley | - | - | - | - | - |
| | **Sub Total** | | | | **-** |
| **Total** | | | | | **R1 069 000** |

**The recommended maintenance activities for the water reticulation networks and fittings, as included under Section 4.1.3, are to be implemented by Bitou Municipality.**

## 3.2.8 Bulk sewer pipeline and sewer drainage network infrastructure

The 2018/2019 Annual Report indicated that the Municipality experienced a high number of sewer blockages. The actions of the Municipality to address these blockages include the following:

- Daily monitoring of “hotspots” for blockages is underway;
- Community awareness programmes; and
- Consideration of use of screens in sewer systems is being researched.

Based on the most likely land-use development scenario, it will be necessary for the following bulk sewer pipeline and sewer drainage network infrastructure.

| Table 3.2.8.1: Future bulk sewer pipeline and sewer drainage network infrastructure required | | | | | |
|---|---|---|---|---|---|
| **Scheme** | **Recommendations included in the Water Master Plan** | **Master Plan Items** | **Project** | **Year** | **Estimated Cost (VAT Excl.)** |
| Plettenberg Bay gravity mains | 1 108m x 200mm dia. upgrade existing gravity when overflow problems occur (Investigate first) | BPS5.1 | PRJ-BPS-013 | 2021 | R3 671 000 |
| | 213m x 250mm dia. upgrade existing gravity when overflow problems occur (Investigate first) | BPS5.2 | PRJ-BPS-013 | 2021 | R887 000 |
| | 436m x 160mm dia. new gravity when FDAs P31d, P31e, P32 and P33 develop | BPS25.1 | PRJ-BPS-010 | 2021 | R752 000 |
| | 267m x 200mm dia. new gravity when FDAs P31c, P31d, P31e, P32, P33 and P34 develop | BPS25.2 | PRJ-BPS-010 | 2021 | R540 000 |
| | 667m x 250mm dia. new gravity when FDAs P31c, P31d, P31e, P32, P33 and P34 develop | BPS25.3 | PRJ-BPS-010 | 2021 | R1 472 000 |
| | 127m x 160mm dia. upgrade existing gravity when FDA P31b develops | BPS25.4 | PRJ-BPS-010 | 2021 | R471 000 |
| | 510m x 250mm dia. upgrade existing gravity when overflow problems occur (Investigate first) | BPS25.5 | PRJ-BPS-022 | 2021 | R1 965 000 |
| | 373m x 250mm dia. upgrade existing gravity when overflow problems occur (Investigate first) | BPS25.6 | PRJ-BPS-022 | 2021 | R1 468 000 |
| | 223m x 250mm dia. upgrade existing gravity when overflow problems occur (Investigate first) | BPS25.7 | PRJ-BPS-022 | 2021 | R926 000 |
| | 57m x 250mm dia. upgrade existing gravity when overflow problems occur (Investigate first) | BPS25.8 | PRJ-BPS-022 | 2021 | R323 000 |
| | 50m x 315mm dia. upgrade existing gravity when FDAs P31b and P90 develop | BPS25.9 | PRJ-BPS-010 | 2021 | R337 000 |
| | 3m x 400mm dia. upgrade existing gravity when overflow problems occur (Investigate first) | BPS25.10 | PRJ-BPS-010 | 2021 | R157 000 |

**Table 3.2.8.1: Future bulk sewer pipeline and sewer drainage network infrastructure required**

| Scheme | Recommendations included in the Water Master Plan | Master Plan Items | Project | Year | Estimated Cost (VAT Excl.) |
|---|---|---|---|---|---|
| | 666m x 355mm dia. upgrade existing gravity (Existing MIG application) | BPS27.4A | PRJ-BPS-010 | 2021 | R2 450 000 |
| | 619m x 355mm dia. upgrade existing gravity (Existing MIG application) | BPS27.4B | PRJ-BPS-010 | 2021 | R2 286 000 |
| | 640m x 355mm dia. upgrade existing gravity (Existing MIG application) | BPS27.4C | PRJ-BPS-010 | 2021 | R2 362 000 |
| | 1970m x 250mm dia. new gravity when FDA P35 develops | BPS27.11 | PRJ-BPS-023 | 2021 | R4 238 000 |
| | 693m x 160mm dia. upgrade existing gravity when FDA P100 develops (Investigate first) | BPS32.2 | PRJ-BPS-006 | 2021 | R1 483 000 |
| | 523m x 160mm dia new gravity when FDA P100 develops | BPS32.3 | PRJ-BPS-006 | 2021 | R1 092 000 |
| | 873m x 200mm dia. upgrade existing gravity when FDA P100 develops (Investigate first) | BPS32.4 | PRJ-BPS-006 | 2021 | R2 077 000 |
| | 432m x 250mm dia. upgrade existing gravity when FDA P100 develops (Investigate first) | BPS32.5 | PRJ-BPS-006 | 2021 | R1 241 000 |
| | 864m x 160mm dia. new gravity when FDA P100 develops | BPS46.3 | PRJ-BPS-016 | 2021 | R1 772 000 |
| | 85m x 315mm dia. upgrade existing gravity when overflow problems occur (Investigate first) | BPS4.1 | PRJ-BPS-008 | 2022 | R484 000 |
| | 48m x 400mm dia. upgrade existing gravity when overflow problems occur (Investigate first) | BPS4.2 | PRJ-BPS-008 | 2022 | R390 000 |
| | 502m x 315mm dia. upgrade existing gravity when overflow problems occur | BPS12.5 | PRJ-BPS-008 | 2022 | R2 248 000 |
| | 50m x 200mm dia. upgrade existing gravity when overflow problems occur (Investigate first) | BPS12.6 | PRJ-BPS-008 | 2022 | R272 000 |
| | 344m x 355mm dia. upgrade existing gravity when overflow problems occur (Investigate first) | BPS12.7 | PRJ-BPS-008 | 2022 | R1 725 000 |
| | 360m x 525mm dia. upgrade existing gravity when overflow problems occur (Investigate first) | BPS12.8 | PRJ-BPS-008 | 2022 | R2 470 000 |
| | 114m x 525mm dia. upgrade existing gravity when overflow problems occur (Investigate first) | BPS12.9 | PRJ-BPS-008 | 2022 | R904 000 |
| | 142m x 675mm dia. upgrade existing gravity when overflow problems occur | BPS27.12 | PRJ-BPS-020 | 2022 | R1 521 000 |
| | 68m x 200mm dia. upgrade existing gravity when overflow problems occur (Investigate first) | BPS20.1 | PRJ-BPS-009 | 2023 | R329 000 |
| | 8m x 400mm dia. upgrade existing gravity when overflow problems occur (Investigate first) | BPS20.2 | PRJ-BPS-009 | 2023 | R185 000 |
| | 33m x 315mm dia. upgrade existing gravity when overflow problems occur (Investigate first) | BPS21.1 | PRJ-BPS-009 | 2023 | R265 000 |
| | 210m x 400mm dia. upgrade existing gravity when overflow problems occur (Investigate first) | BPS21.2 | PRJ-BPS-009 | 2023 | R1 226 000 |
| | 2 229m X 250mm dia. new gravity when future Wittedrift PS1 is constructed | BPS51.3 | PRJ-BPS-058 | 2023 | R5 870 000 |
| | 958m x 250mm dia. new gravity when future Wittedrift PS2 is constructed | BPS51.6 | PRJ-BPS-058 | 2023 | R2 556 000 |
| | 14m x 250mm dia. new gravity to divert flow from old Wittedrift PS when new Wittedrift PS and downstream infrastructure has been constructed | BPS51.7 | PRJ-BPS-058 | 2023 | R93 000 |
| | 27m x 160mm dia. new gravity to diververt flow and decommission pump station when Wittedrift PS and downstream infrastructure has been constructed | BPS51.8 | PRJ-BPS-058 | 2023 | R104 000 |
| | 1 333m x 160mm dia. new gravity when FDAs P5 and P7 develop | BPS11.1 | PRJ-BPS-014 | 2025 | R2 191 000 |
| | 918m x 160mm dia. new gravity when FDAs P5 and P7 develop | BPS11.2 | PRJ-BPS-014 | 2025 | R1 525 000 |
| | 422m x 200mm dia. new gravity when FDAs P5 and P7 develop | BPS11.3 | PRJ-BPS-014 | 2025 | R823 000 |
| | 1062m x 250mm dia. new gravity when FDAs P5 and P7 develop | BPS11.4 | PRJ-BPS-014 | 2025 | R2 310 000 |
| | 190m x 315mm dia. new gravity when FDAs P5 and P7 develop | BPS11.5 | PRJ-BPS-014 | 2025 | R550 000 |
| | 20m x 400mm dia. new gravity when FDAs P5, P7 and P8 develop | BPS11.7 | PRJ-BPS-034 | 2025 | R136 000 |
| | 270m x 160mm dia. new gravity when FDAs P27 and P30 develop | BPS26.1 | PRJ-BPS-055 | 2025 | R484 000 |
| | 357m x 200mm dia. new gravity when FDAs P27, P29 and P30 develop | BPS26.2 | PRJ-BPS-055 | 2025 | R705 000 |
| | 633m x 250mm dia. new gravity when FDAs P27, P29 and P30 develop | BPS26.3 | PRJ-BPS-055 | 2025 | R1 401 000 |
| | 950m x 160mm dia. new gravity when FDAs P27 and P30 develop | BPS26.4 | PRJ-BPS-055 | 2025 | R1 576 000 |
| | 336m x 200mm dia. new gravity when FDAs P27, P28 and P30 develop | BPS26.5 | PRJ-BPS-055 | 2025 | R667 000 |
| | 104m x 315mm dia. new gravity when FDAs P27, P28, P29 and P30 develop | BPS26.6 | PRJ-BPS-055 | 2025 | R328 000 |
| | 86m x 400mm dia. new gravity when FDAs P27, P28, P29 and P30 develop | BPS26.7 | PRJ-BPS-055 | 2025 | R350 000 |
| | 247m x 160mm dia. new gravity when FDA P27 develops | BPS26.13 | PRJ-BPS-055 | 2025 | R447 000 |
| | 194m x 160mm dia. new gravity when FDA P60 develops | BPS28.1 | PRJ-BPS-025 | 2025 | R362 000 |
| | 284m x 160mm dia. new gravity when FDA P104 develops | BPS37.7 | PRJ-BPS-053 | 2025 | R616 000 |

**Table 3.2.8.1: Future bulk sewer pipeline and sewer drainage network infrastructure required**

| Scheme | Recommendations included in the Water Master Plan | Master Plan Items | Project | Year | Estimated Cost (VAT Excl.) |
|---|---|---|---|---|---|
| | 60m x 200mm dia. upgrade existing gravity when overflow problems occur (Investigate first) | BPS2.1 | PRJ-BPS-031 | 2030 | R301 000 |
| | 130m x 160mm dia. new gravity when FDA P47 develops | BPS16.1 | PRJ-BPS-040 | 2030 | R259 000 |
| | 242m x 160mm dia. new gravity when FDA P45 develops | BPS17.1 | PRJ-BPS-039 | 2030 | R439 000 |
| | 289m x 200mm dia. new gravity when FDA P27 develops | BPS26.10 | PRJ-BPS-056 | 2030 | R581 000 |
| | 51m x 825mm dia. upgrade existing gravity when overflow problems occur (Investigate first) | BPS27.1 | PRJ-BPS-003 | 2030 | R894 000 |
| | 135m x 400mm dia. upgrade existing gravity when overflow problems occur (Investigate first) | BPS27.2 | PRJ-BPS-003 | 2030 | R839 000 |
| | 67m x 600mm dia. upgrade existing gravity when overflow problems occur (Investigate first) | BPS27.3 | PRJ-BPS-003 | 2030 | R692 000 |
| | 296m X 160mm dia. new gravity when FDAs P78 and P79 develop | BPS39.2 | PRJ-BPS-015 | 2030 | R526 000 |
| | 318m x 160mm dia. new gravity when FDAs P78, P79 and P80 develop | BPS39.3 | PRJ-BPS-015 | 2030 | R562 000 |
| | 1 860m x 250mm dia. new gravity to accommodate future areas in Kranshoek region (Implement when Kranshoek bulk outfall sewer reaches capacity) | BPS12.11 | PRJ-BPS-033 | 2035 | R4 005 000 |
| | 1 374m x 315mm dia. new gravity to accommodate future areas in Kranshoek region (Implement when Kranshoek bulk outfall sewer reaches capacity) | BPS12.12 | PRJ-BPS-033 | 2035 | R3 586 000 |
| | 1 289m x 400mm dia. new gravity to accommodate future areas in Kranshoek region (Implement when Kranshoek bulk outfall sewer reaches capacity) | BPS12.13 | PRJ-BPS-033 | 2035 | R4 288 000 |
| | 3 035m x 600mm dia. new gravity to accommodate future areas in Kranshoek region (Implement when Kranshoek bulk outfall sewer reaches capacity) | BPS12.14 | PRJ-BPS-002 | 2035 | R14 145 000 |
| | 1 244m x 400mm dia. new gravity when existing bulk sewer can no longer accommodate flow from future areas P5, P7 and P8 | BPS12.17 | PRJ-BPS-032 | 2035 | R4 139 000 |
| | 446m X 160mm dia. new gravity when future areas P24 and P25 develops | BPS13.6 | PRJ-BPS-042 | 2035 | R767 000 |
| | 276m X 160mm dia. new gravity when FDA P78 develops | BPS39.1 | PRJ-BPS-015 | 2035 | R495 000 |
| | 1 037m X 160mm dia. new gravity. Option dependent on when PRJ-BPS-002 is implemented (Cost to developer) | BPS50.1 | PRJ-BPS-018 | 2035 | - |
| | 92m x 160mm dia. new gravity. Option dependent on when PRJ-BPS-002 is implemented (Cost to developer) | BPS50.2 | PRJ-BPS-018 | 2035 | - |
| | 521m x 250mm dia. new gravity to accommodate future areas in Kranshoek region (Implement when Kranshoek bulk outfall sewer reaches capacity) | BPS12.10 | PRJ-BPS-036 | 2036 | R1 163 000 |
| | 347m x 200mm dia. new gravity when FDA P8 develops | BPS11.6 | PRJ-BPS-014 | 2040 | R688 000 |
| | 499m x 250mm dia. new gravity when FDA P11 develops | BPS13.2 | PRJ-BPS-042 | 2040 | R1 115 000 |
| | 290m x 250mm dia. new gravity when FDAs P11 and P22 develop | BPS13.3 | PRJ-BPS-042 | 2040 | R672 000 |
| | 14m x 250mm dia. new gravity when FDAs P11, P22, P24 and P25 develop | BPS13.4 | PRJ-BPS-042 | 2040 | R87 000 |
| | 455m x 160mm dia. new gravity when FDA P25 develops | BPS13.5 | PRJ-BPS-042 | 2040 | R781 000 |
| | 71m x 160mm dia. new gravity when FDA P64 and P65 develop | BPS31.2 | PRJ-BPS-030 | 2040 | R164 000 |
| | 162m x 160mm dia. new gravity when FDAs P76 and P77 develop | BPS37.1 | PRJ-BPS-053 | 2040 | R311 000 |
| | 374m x 160mm dia. new gravity when FDAs P75, P76 and P77 develop | BPS37.2 | PRJ-BPS-053 | 2040 | R651 000 |
| | 248m x 200mm dia. new gravity when FDAs P71, P75, P76 and P77 develop | BPS37.3 | PRJ-BPS-052 | 2040 | R505 000 |
| | 6m x 160mm dia. new gravity to divert flow when future gravity sewer line is constructed. PS can be abandoned. | BPS37.8 | PRJ-BPS-052 | 2040 | R62 000 |
| | 146m x 160mm dia. new gravity when FDAs P83 and P84 develop | BPS39.5 | PRJ-BPS-015 | 2040 | R285 000 |
| | 93m x 200mm dia. upgrade existing gravity when overflow problems occur | BPS39.6 | PRJ-BPS-015 | 2040 | R404 000 |
| | 370m x 160mm dia. new gravity when FDA P83 develops | BPS39.4 | PRJ-BPS-015 | 2045 | R645 000 |
| | 371m x 160mm dia. new gravity when FDA P64 develops | BPS31.1 | PRJ-BPS-030 | 2050 | R647 000 |
| | 307m x 160mm dia. new gravity when FDA P73 develops | BPS37.4 | PRJ-BPS-053 | 2050 | R544 000 |
| | **Sub Total** | | | | **R112 325 000** |
| Plettenberg Bay rising mains | 862m x 250mm dia. upgrade existing rising when Kwanokuthula PS1 is upgraded | BPS25.12 | PRJ-BPS-010 | 2021 | R2 955 000 |
| | 699m x 90mm dia. new rising when future PS 23 is constructed | BPS46.2 | PRJ-BPS-016 | 2021 | R654 000 |
| | 490m x 200mm dia. upgrade existing rising when PS 8 requires upgrading (Investigate first) | BPS4.4 | PRJ-BPS-008 | 2022 | R1 373 000 |

**Table 3.2.8.1: Future bulk sewer pipeline and sewer drainage network infrastructure required**

| Scheme | Recommendations included in the Water Master Plan | Master Plan Items | Project | Year | Estimated Cost (VAT Excl.) |
|---|---|---|---|---|---|
| | 5761m x 355mm dia. upgrade existing rising when Aventura PS overflows due to existing rising main capacity | BPS34.2 | PRJ-BPS-020 | 2022 | R22 822 000 |
| | 1502m x 200mm dia. new rising when future Wittedrift PS1 is constructed | BPS51.2 | PRJ-BPS-058 | 2023 | R2 654 000 |
| | 940m x 200mm dia. new rising when future Wittedrift PS 2 is constructed | BPS51.5 | PRJ-BPS-058 | 2023 | R1 669 000 |
| | 1230m x 250mm dia. new rising when future PS2 is constructed (Rising main can be linked to Kranshoek bulk as interim solution) | BPS11.9 | PRJ-BPS-034 | 2025 | R2 909 000 |
| | 1011m x 250mm dia. new rising when Ladywood PS1 is constructed (Includes N2 road crossing) | BPS26.9 | PRJ-BPS-054 | 2025 | R2 396 000 |
| | 1197m x 110mm dia. new rising when future PS9 is constructed | BPS28.3 | PRJ-BPS-025 | 2025 | R1 198 000 |
| | 315m x 90mm dia. new rising when future PS11 is constructed | BPS30.2 | PRJ-BPS-029 | 2025 | R302 000 |
| | 657m x 90mm dia. new rising when future PS 18 is constructed | BPS92.2 | PRJ-BPS-024 | 2025 | R615 000 |
| | 416m x 90mm dia. new rising when future PS 3 is constructed (Cost to developer) | BPS14.2 | PRJ-BPS-047 | 2030 | - |
| | 468m x 600mm dia. upgrade existing rising main when pump upgrade is implemented (BPS17.2) | BPS17.3 | PRJ-BPS-003 | 2030 | R4 351 000 |
| | 842m x 90mm dia. new rising when future PS5 is constructed (Cost to developer) | BPS18.2 | PRJ-BPS-048 | 2030 | - |
| | 106m x 90mm dia. new rising when future PS6 is constructed (Cost to developer) | BPS19.2 | PRJ-BPS-049 | 2030 | - |
| | 213m x 160mm dia. new rising when Ladywood PS2 is constructed | BPS26.12 | PRJ-BPS-056 | 2030 | R308 000 |
| | 1124m x 90mm dia. new rising when Ladywood PS3 is constructed | BPS26.15 | PRJ-BPS-057 | 2030 | R1 043 000 |
| | 470m x 160mm dia. new rising when future PS12 is constructed. N2 crossing required. | BPS31.4 | PRJ-BPS-028 | 2030 | R656 000 |
| | 269m x 90mm dia. new rising when future PS20 is constructed (Cost to developer) | BPS43.2 | PRJ-BPS-044 | 2030 | - |
| | 841m x 550mm dia. upgrading existing rising when pump upgrade is implemented (BPS12.15) | BPS12.16 | PRJ-BPS-038 | 2035 | R6 521 000 |
| | 859m x 550mm dia. upgrade existing rising main when pump upgrade is implemented (BPS13.7) | BPS13.8 | PRJ-BPS-037 | 2035 | R6 646 000 |
| | 561m x 600mm dia. upgrade existing rising main when pump upgrade is implemented (BPS16.2) | BPS16.3 | PRJ-BPS-037 | 2035 | R5 033 000 |
| | 927m x 90mm dia. new rising when future PS8 is constructed (Cost to developer) | BPS24.2 | PRJ-BPS-046 | 2035 | - |
| | 949 x 90mm dia. new rising when future PS10 is constructed (Cost to developer) | BPS29.2 | PRJ-BPS-027 | 2035 | - |
| | 598m x 200mm dia. new rising main from Kranshoek PS4 to new Kranshoek bulk sewer in order to created additional capacity in the existing downstream infrastructure. | BPS12.18 | PRJ-BPS-036 | 2036 | R1 070 000 |
| | 570m x 110mm dia. new rising when future PS4 is constructed (Cost to developer) | BPS15.2 | PRJ-BPS-041 | 2040 | - |
| | 829m x 160mm dia. upgrade existing rising when Sanderlings PS is upgraded (Investigate first) | BPS35.2 | PRJ-BPS-050 | 2040 | R1 920 000 |
| | 503m x 90mm dia. new rising when future PS14 is constructed (Cost tot developer) | BPS36.2 | PRJ-BPS-051 | 2040 | - |
| | 636m x 110mm dia. new rising when future PS15 is constructed | BPS37.6 | PRJ-BPS-052 | 2040 | R643 000 |
| | 1680m x 355mm dia. new rising including river-crossing (Existing 200mm dia. rising main is in a poor condition and should be replaced) | BPS38.2 | PRJ-BPS-004 | 2040 | R6 673 000 |
| | 1032m x 90mm dia. new rising when future PS17 is constructed (Cost to developer) | BPS42.2 | PRJ-BPS-012 | 2040 | - |
| | 368m x 90mm dia. new rising when future PS21 is constructed (Cost to developer) | BPS44.2 | PRJ-BPS-026 | 2040 | - |
| | 640mm x 90mm dia. new rising when future PS22 is constructed (Cost to developer) | BPS45.2 | PRJ-BPS-026 | 2040 | - |
| | 1544m x 90mm dia. new rising when future PS7 is constructed (Cost to developer) | BPS23.2 | PRJ-BPS-045 | 2045 | - |
| | 221m x 90mm dia. new rising when future PS 16 is constructed (Cost to developer) | BPS11.11 | PRJ-BPS-035 | 2045 | - |
| | 2119m x 200mm dia. new rising when future PS13 is constructed (Cost to developer) | BPS33.2 | PRJ-BPS019 | 2050 | - |
| | 804m x 110mm dia new rising when future PS1 is constructed (Cost to developer) | BPS7.2 | PRJ-BPS-043 | 2050 | - |
| | **Sub Total** | | | | **R74 411 000** |
| | 606m x 250mm dia new gravity | BKS2.3 | PRJ-BKS-003 | 2021 | R1 636 000 |

| Table 3.2.8.1: Future bulk sewer pipeline and sewer drainage network infrastructure required | | | | | |
|---|---|---|---|---|---|
| **Scheme** | **Recommendations included in the Water Master Plan** | **Master Plan Items** | **Project** | **Year** | **Estimated Cost (VAT Excl.)** |
| Kurland gravity mains and network | **Sub Total** | | | | **R1 636 000** |
| Kurland rising mains | 1084m x 160mm dia new rising | BKS2.2 | PRJ-BKS-003 | 2021 | R1 488 000 |
| | Abandon existing rising main when future Kurland PS K1 is implemented | BKS.B3 | PRJ-BKS-003 | 2021 | - |
| | **Sub Total** | | | | **R1 488 000** |
| **Total** | | | | | **R189 860 000** |

**The recommended O&M activities for the bulk and sewer drainage networks, as included under Section 4.1.9, to be implemented by Bitou Municipality.**

## 3.2.9 Sewer pump stations

Based on the most likely land-use development scenario, it will be necessary for the following new sewer pump stations, as well as upgrading of the existing sewer pump stations:

| Table 3.2.9.1: Future sewer pump stations required | | | |
|---|---|---|---|
| **Town** | **Recommendations included in the Sewer Master Plan** | **Year** | **Estimated Cost (VAT Excl.)** |
| Plettenberg Bay | Upgrade Kranshoek PS 3 to 3.5 l/s (Investigate first) (BPS5.5) | 2021 | R24 000 |
| | New 3.5 l/s PS when FDA-P100 develops (BPS46.1) | 2021 | R1 055 000 |
| | Upgrade Kwanokuthula PS 1 to 62 l/s (Required to accommodate future developments) (BPS25.11) | 2021 | R820 000 |
| | Upgrade existing PS to 12 l/s to accommodate future demand (Investigate first) (BPS25.13) | 2021 | R24 000 |
| | Upgrade PS to 5 l/s if required (Investigate first) (BPS25.14) | 2021 | R24 000 |
| | Upgrade Wittedrift PS to 12 l/s when FDA-P100 develops (BPS32.1) | 2021 | R442 000 |
| | Upgrade PS8 to 35 l/s when PS overflows (Investigate first) (BPS4.3) | 2022 | R641 000 |
| | Downgrade PS3 to 30 l/s when downstream PS2 or sewer overflows (BPS20.3) | 2023 | R217 000 |
| | New 20 l/s future Wittedrift PS1 (Required to accommodate ultimate demand. Alternative to pumping to Aventura PS) (BPS51.1) | 2023 | R1 955 000 |
| | New 25 l/s future Wittedrift PS2 (Required when future Wittedrift PS1 is constructed) (BPS51.4) | 2023 | R2 104 000 |
| | New 10 l/s Future PS 9 (Required for FDA P58 and P60) (BPS28.2) | 2025 | R1 658 000 |
| | New 5 l/s Future PS 11 (Required for FDA P67 and P68) (BPS30.1) | 2025 | R1 508 000 |
| | New 3.5 l/s pump station when FDA-P91 & P92 develop (BPS92.1) | 2025 | R1 055 000 |
| | New 40 l/s future PS 2 when FDA P5, P7, P8 develop (BPS11.8) | 2025 | R2 542 000 |
| | New 55 l/s future Ladywood PS 1 when FDA P27, P28, P29 and P30 develop (BPS26.8) | 2025 | R2 974 000 |
| | New 14 l/s future Ladywood PS 2 when FDA P27 develop (BPS26.11) | 2030 | R1 777 000 |
| | New 4 l/s future Ladywood PS 3 when FDA P27 develop (BPS26.14) | 2030 | R1 206 000 |
| | New 3.5 l/s PS when FDA-P51 develop (Cost to the developer) (BPS43.1) | 2030 | - |
| | New 3.5 l/s PS when FDA-P21 develop (Cost to the developer) (BPS14.1) | 2030 | - |
| | New 3.5 l/s PS when FDA-P20 develop (Cost to the developer) (BPS18.1) | 2030 | - |
| | New 3.5 l/s PS when FDA-P19 develop (Cost to the developer) (BPS19.1) | 2030 | - |
| | New 13 l/s future PS P12 when FDA P64, P65, P66, P67, P68 develop (BPS31.3) | 2030 | R1 748 000 |
| | Downgrade PS10 to 7 l/s - Only required if downstream sewer overflows (Investigate first) (BPS3.1) | 2030 | R159 000 |
| | Upgrade Piesang Valley PS 18 to 305 l/s (BPS17.2) | 2030 | R2 333 000 |
| | Upgrade Piesang Valley PS 20 to 288 l/s (BPS13.7) | 2035 | R2 333 000 |
| | Upgrade Piesang Valley PS 19 to 300 l/s (BPS16.2) | 2035 | R2 333 000 |
| | Upgrade Piesang Valley PS 5 to 250 l/s (BPS12.15) | 2035 | R2 138 000 |
| | New 3.5 l/s PS when FDA-P34 develop (Cost to the developer) (BPS24.1) | 2035 | - |
| | New 3.5 l/s PS when FDA-P68 develop (Cost to the developer) (BPS29.1) | 2035 | - |
| | New 3.5 l/s PS when FDA-P77 develop (Cost to the developer) (BPS36.1) | 2040 | - |
| | New 10 l/s future PS P15 when FDA P71, P73, P75, P76, P77 develop (BPS37.5) | 2040 | R1 658 000 |
| | Upgrade Matjiesfontein PS to 70 l/s (BPS38.1) | 2040 | R880 000 |
| | New 7 l/s PS when FDA-P46 develop (Cost to the developer) (BPS15.1) | 2040 | - |
| | New 4 l/s PS when FDA-P11 develop (Cost to the developer) (BPS42.1) | 2040 | - |

| Table 3.2.9.1: Future sewer pump stations required | | | |
|---|---|---|---|
| **Town** | **Recommendations included in the Sewer Master Plan** | **Year** | **Estimated Cost (VAT Excl.)** |
| | New 3.5 l/s PS when FDA-P60 develop (Cost to the developer) (BPS44.1) | 2040 | - |
| | New 4.5 l/s PS when FDA-P60 develop (Cost to the developer) (BPS45.1) | 2040 | - |
| | Upgrade Sanderlings PS to 14 l/s when FDA-P71 develop (Investigate first) (BPS35.1) | 2040 | R24 000 |
| | New 3.5 l/s PS when FDA-P33 develop (Cost to the developer) (BPS23.1) | 2045 | - |
| | New 3.5 l/s PS when FDA-P10 develop (Cost to the developer) (BPS11.10) | 2045 | - |
| | Upgrade Aventura PS to 120 l/s (BPS34.1) | 2050 | R1 244 000 |
| | New 25 l/s PS when FDA-P70 develop (Cost to the developer) (BPS33.1) | 2050 | - |
| | New 8.5 l/s PS when FDA-P15 develop (Cost to the developer) (BPS7.1) | 2050 | - |
| | Upgrade PS H3 to 20 l/s when FDA P15 develops (BPS8.1) | 2050 | R503 000 |
| | **Sub Total** | | **R35 379 000** |
| Kurland | New 25 l/s Kurland PS K1 when future area P96 develops. Existing Kurland PS1 can be abandoned and flow diverted to new PS (BKS.2.1). | 2021 | R2 104 000 |
| | Decommission PS when future Kurland PS K1 is implemented (BKS.B2) | 2025 | R216 000 |
| | Upgrade PS to 3.5 l/s if required. Verify existing PS capacity and dia. of rising main first (BKS.B4) | 2025 | R24 000 |
| | Upgrade PS to 3.5 l/s if required. Verify existing PS capacity and dia. of rising main first (BKS.B5) | 2025 | R24 000 |
| | **Sub Total** | | **R2 368 000** |
| **Total** | | | **R37 747 000** |

**The recommended O&M activities for the sewer pump stations, as included under Section 4.1.8, to be implemented by Bitou Municipality.**

### 3.2.10 Waste Water Treatment Works

The table below gives a summary of the existing capacities and current flows at each of the WWTWs (Ml/d).

| Table 3.2.10.1: Existing capacities, flows and required future flows for the two WWTWs (Ml/d) | | | | | |
|---|---|---|---|---|---|
| **WWTW** | **Existing Hydraulic Capacity** | **Peak Month Average Daily Flow** | **Average Daily Flow (2018 – 2019)** | **Required Treatment Capacity (10 Year projected flow)** | **Final Effluent Compliance for 2018/2019** |
| Plettenberg Bay (Gansevlei) | 9.000 | 4.387 (Sep) | 3.690 | 7.328 | Microbiological: 100.0%<br>Chemical: 99.2%<br>Physical: 100.0% |
| Kurland | 0.500 | 0.321 (Jun) | 0.309 | 0.461 | Microbiological: 100.0%<br>Chemical: 97.1%<br>Physical: 98.7% |

Bitou Municipality review on an annual basis the capacity and suitability of their WWTWs to meet the requirements of the authorisations and downstream users for the quality of the final effluent being discharged to the receiving water bodies. When the water quality requirements for the final effluent becomes stricter and / or when the inflow to the WWTW has increased to such an extent that the capacity of the plant needs to be increase, then the Municipality appoints reputed consulting engineering firms to undertake feasibility studies to perform technical and economical evaluation of the different options available for upgrading or extending the capacity of the treatment works.

**The Plettenberg Bay (Gansevlei) WWTW**: The WWTW has sufficient capacity to treat the existing and future short to medium term projected flow to the works. An upgrade will only be required within the next 10 – 15 years.

**The Kurland WWTW**: The WWTW has sufficient capacity to treat the existing and future short to medium term projected flow to the works. An upgrade will only be required within the next 10 – 15 years.

The WWTWs to be upgraded in Bitou Municipality are summarised in the table below:

| Table 3.2.10.2: WWTWs to be upgraded in the future | | |
|---|---|---|
| **WWTW** | **Short, Medium, Long Term** | **Estimated Cost (Vat Excluded)** |
| Upgrade Plettenberg Bay WWTW | Long | R32 300 000 |
| Upgrade Kurland WWTW to 1.15 ML/day | Long | R17 251 000 |

Key issues to be addressed at the WTWs, as identified during the WSDP inspection process, are as follows:

- Plettenberg Bay (Gansevlei) WWTW:
  - Inlet works: Mechanical wash screen compactor is not working.
  - Anaerobic and Anoxic Reactors: Mixers are not working.
  - Aeration: Additional floating aerator for periods of high ammoniac trip the power.
  - RAS PS: Only two of the three pumps are working.
  - PS for the return of effluent from the emergency storage pond needs to be refurbished.
  - Disinfection: Chlorine scales are not working. Chlorine gas detector is not working.
  - Flow metering: Final effluent flow meter is not working.
- Kurland WWTW: Sump for the treated effluent is required for the re-use pump station (irrigation).

The table below gives an overview of the recommended improvements for the WWTWs in Bitou Municipality's Management Area, as taken from the $W_2$RAP and identified during the WSDP inspection:

| Table 3.2.10.3: Recommended improvements for the two WWTWs as included in the $W_2$RAP and identified during the WSDP inspection. | | |
|---|---|---|
| **Component** | **Improvement Plan** | **Estimated Cost (Vat Excluded)** |
| **Plettenberg Bay WWTW** | | |
| WWTW | New gensets are required for all electrical equipment. | R472 500 |
| Inlet works | Mechanical wash screen compactor needs to be refurbished. | R200 000 |
| Anaerobic and Anoxic Reactors | Mechanical mixers are not working and need to be refurbished. | R75 000 |
| Aerobic Reactor | Refurbish additional floating aerator for periods of high ammoniac (Trip the power). | R30 000 |
| Pump Stations | Refurbish one RAS pump currently not working. | R35000 |
| | PS for the return of effluent from the emergency storage pond needs to be refurbished. | R500 000 |
| Disinfection | Refurbish chlorine dosing equipment (Scales, Gas leak detector, etc.) | R70 000 |
| Flow metering | Repair final effluent flow meter (Calibration) | R10 000 |
| **Sub Total** | | **R1 212 500** |
| **Kurland WWTW** | | |
| Final effluent | Install sump for the final treated effluent for the re-use pump station (irrigation) | R30 000 |
| **Sub Total** | | **R30 000** |
| **Total** | | **R1 242 500** |

**The recommended O&M activities for the WWTWs, as included under Section 4.1.10, are to be implemented by Bitou Municipality.**

## 3.3 WATER AND SANITATION SCHEMS

### 3.3.1 Water Schemes

Based on the most likely land-use development scenario, the following future water reticulation infrastructure components will be necessary:

**Table 3.3.1.1: Future water reticulation infrastructure required**

**Plettenberg Bay**

**Proposed distribution zones**

- The boundaries between the existing Brakkloof reservoir zone and the Town PRV 4 zone are adjusted in order to improve network conveyance and redundancy.
- The Town PRV 4 zone, supplied with water from the Town Reservoirs, is increased to include future development areas P18 to P24.
- The boundaries between the existing Brakkloof reservoir zone and the Whale Rock reservoir zone are adjusted. It is proposed that the existing Whale Rock reservoir zone is augmented with water from the Quarry reservoir zone through a PRV (at the position of the old decommissioned Quarry BPT). Future development areas P16 & P17 are accommodated within the existing Whale Rock reservoir zone.
- The Brakkloof reservoir zone is increased to include the lower lying areas of future development area P14.
- The Quarry reservoir zone is increased to include future development areas P13 & P15 as well as the higher lying areas of future area P14.
- Two new zones are proposed for the future development areas between Kranshoek and the Quarry reservoir, viz. the new Roodefontein Upper and Lower reservoir zones. It is proposed that the Roodefontein Upper reservoir zone supplies the future development areas P4 - P6, P97, P98 and the higher lying areas of future area P7, while the Roodefontein Lower reservoir zone supplies the lower lying areas of future development area P7 as well as future areas P8, P10 and P12.
- The boundary of the Kranshoek tower zone is adjusted so that the higher lying area to the north of the zone is incorporated in the proposed Roodefontein Upper reservoir zone.
- The boundary of the Town Upper tower zone is increased to accommodate future development area P51.
- The boundary of the Archiewood and Brackenridge reservoir zone is increased to accommodate future development areas P25, P40, P52, P53, P101, P102 and the lower lying erven of area P94.
- A new Archiewood PRV 2 zone is proposed for when future development area P43 develops, supplied with water from the Archiewood reservoir through a new PRV.
- A new Piesang Valley PRV zone is proposed for when future development area P46 develops, supplied with water from the Archiewood reservoir through a new PRV.
- It is proposed that the existing Kwanokuthula tower zone (which is currently supplied with water only from the Upper tower because the Lower tower has a leak) is supplied in future from only the Upper tower. An emergency valve (to be closed) is proposed between the supply from the Lower tower and the existing Kwanokuthula network. The zone boundary of the Kwanokuthula Upper tower zone is increased to accommodate future areas P31 - P35 & P90.
- A new Kwanokuthula reservoir zone (supplied from the existing Kwanokuthula East (Lower) reservoirs) is proposed for the lower lying areas of future development areas P27 & P28 as well as future area P26.
- A new Kwanokuthula Lower tower zone (supplied from the existing Kwanokuthula East (Lower) tower) is proposed for the higher lying areas of future development areas P27 & P28 as well as future areas P29 & P30.
- A new tower (proposed New Horizon tower) is proposed next to the existing New Horizon reservoirs in order to accommodate future development areas P35 & P91. It is proposed that the higher lying erven in New Horizon (that is currently accommodated within the New Horizon reservoir zone) is incorporated in the proposed New Horizon tower zone. This will improve the low static pressure that exists currently within the higher lying erven in New Horizon.
- The boundary of the New Horizon reservoir zone is increased to accommodate future development areas P36, P44, P45 and P47 - P50, P92 and the higher lying erven of area P94.
- A new Goose Valley booster zone is proposed for the higher lying areas of future development area P60.
- The boundary of the Goose Valley reservoir zone is increased to accommodate future development areas P56, P58, the lower lying areas of P60 as well as future areas P64 - P69.
- The boundary of the Matjiesfontein reservoir zone is increased to accommodate future development areas P71 - P82 & P104.
- A new Keurboomstrand Upper reservoir zone (supplied from the existing Keurboomstrand reservoir) is proposed for future development areas P85 - P87.
- A new Keurboomstrand Upper booster zone (supplied from the proposed Keurboomstrand Upper reservoir) is proposed for future development areas P83 & P84.
- Three new distribution zones are proposed for the Hanglip, Roodefontein and Ganse Valley Estates.
- The boundary of the Wittedrift reservoir zone is increased to accommodate future development areas P61 - P63 & P99.
- A new Green Valley booster zone is proposed for when the higher lying future area P100 develops in Green Valley. It is proposed that this booster zone is supplied with water from a new Green Valley reservoir.
- It is proposed that the existing Green Valley reservoirs and elevated tank are decommissioned and that the existing Green Valley reservoir and tower zones are supplied from the new Green Valley reservoir when it is commissioned. Two new PRV's are proposed to reduce static pressures at the lower lying erven when these erven are incorporated within the proposed new Green Valley reservoir zone.
- Future area P54 should be accommodated within the existing Town Reservoir zone and future area P55 within the existing Town PRV 1 zone.

| Table 3.3.1.1: Future water reticulation infrastructure required |
|---|
| **Proposed future system and required works**<br>• The most significant upgrades of the existing distribution system is the alteration of the existing zone boundaries between the Town PRV 4, Brakkloof reservoir, Whale Rock reservoir, Kwanokuthula tower and New Horizon reservoir zones in order to improve operation of the existing system.<br>• The alteration of the existing zone boundaries between the Town PRV 4, Brakkloof reservoir and Whale Rock reservoir zones will improve network conveyance and redundancy in the system.<br>• The alteration of the zone boundary of the New Horizon reservoir zone together with the implementation of the New Horizon tower zone will improve the low static pressures that is currently experienced in the higher lying erven of the New Horizon reservoir zone.<br>• A new PRV is proposed at the position of the existing Quarry BPT (that is decommissioned) in order to improve the capacity of the existing system to provide fire flow to Robberg Estate and Whale Rock Beach.<br>• A number of distribution pipelines are also required to reinforce water supply within the Plettenberg Bay distribution network and supply future development areas when they develop. |
| **Kurland** |
| **Proposed distribution zones**<br>• The only change to the existing distribution zone is that the existing boundary of the existing zone is increased to accommodate future development areas. |
| **Proposed future system and required works**<br>• A new bulk supply pipeline from the Kurland reservoirs to the town is proposed in order to reinforce water supply to the Kurland network. The implementation of this project will improve low water pressures in Kurland that are currently experienced during periods of high demand.<br>• Upgrading of the existing Kurland distribution network is proposed in order to accommodate housing developments on Erf 562. |
| **Natures Valley** |
| **Proposed distribution zones**<br>• There are no changes to the existing distribution zones of Natures Valley. |
| **Proposed future system and required works**<br>• Two reinforcement pipelines are proposed to improve the conveyance in the network. |

The water master plan figures and tables are included in Annexure A.

## 3.3.2 Sanitation Schemes

Based on the most likely land-use development scenario, the following further sewer reticulation infrastructure components will be necessary:

| Table 3.3.2.1: Future sewer reticulation infrastructure required |
|---|
| **Plettenberg Bay** |
| • The boundaries of the existing drainage areas in Plettenberg Bay are increased to accommodate proposed future development areas that fall within these drainage areas.<br>• The main outfall sewer that gravitates to Kranshoek PS 1 should be upgraded if overflow problems occur.<br>• A new main outfall sewer (items BPS12.10 - BPS12.14) is proposed for future development areas P4, P6, the northern areas of P7, P10, P12, P13 & P14. This outfall sewer should gravitate to the existing Piesang Valley 5 PS. It is proposed that flow from the Kranshoek PS 4 is in future diverted to this new bulk sewer (through the implementation of master plan item BPS12.18) in order to create additional capacity in the existing bulk sewer between Kranshoek and the Piesang Valley PS 5.<br>• A new internal pump station and rising main should be constructed for the southern portion of future area P10 that cannot gravitate to the proposed Kranshoek bulk sewer.<br>• A new Future PS P2 drainage area is proposed for the future development areas P5, P8, P9 and the southern areas of P7. A new pump station and rising main should be constructed for this drainage area that discharges into the drainage area of the Piesang Valley 5 PS (discharges into the proposed new bulk sewer from Kranshoek through master plan items BPS11.9 & BPS12.17).<br>• A new internal pump station (Future PS P17) and rising main should be constructed for the southern portion of future area P11 that cannot gravitate in a northern direction towards the Piesang Valley PS 20.<br>• The option should be investigated to in future (after the new Kranshoek bulk sewer is constructed) abandon the proposed Future PS P17 and Brackenridge pump stations 1, 2 & 3 and divert flow from the upstream drainage areas to the proposed Kranshoek bulk sewer.<br>• A new Future PS P1 drainage area is proposed for future development area P15. A new pump station and rising main should be constructed for this drainage area that discharges into PS H3. When overflow problems occur at PS H3, the pumps should be upgraded according to the sewer master plan.<br>• The main outfall sewer that gravitates to PS 11 should be upgraded if overflow problems occur.<br>• PS 10 should be downsized to a capacity of 7 l/s if overflow problems occur between PS 9 and PS 10.<br>• If overflow problems occur at the main outfall sewer that drains towards PS 8, this outfall sewer should be upgraded. When overflow problems occur at PS 8, the pumps should be upgraded to a capacity of 35 l/s and the rising main upgraded to a |

**Table 3.3.2.1: Future sewer reticulation infrastructure required**

diameter of 200 mm. If overflow problems occur in the main gravity outfall sewer into which the rising main of PS 8 discharges, this outfall sewer should be upgraded according to the master plan.

- When the Piesang Valley 5 pumping station reaches capacity the pump station should be upgraded to a capacity of 250 l/s and the existing rising main replaced with a new dedicated 500 mm diameter rising main that discharges into the Piesang Valley 20 PS (alternatively the existing 350 mm rising main can be reinforced with a new 350 mm diameter parallel rising main).
- A new Future PS P3 drainage area is proposed for future development area P21. A new pump station and rising main should be constructed for this drainage area that discharges into the drainage area of the Piesang Valley 20 PS.
- New main outfall sewers are proposed for future development areas P11 & P22 - P25. These outfall sewers should gravitate to the existing Piesang Valley 20 PS. When the Piesang Valley 20 pumping station reaches capacity the pump station should be upgraded to a capacity of 290 l/s and the existing rising main replaced with a new 500 mm diameter rising main (alternatively the existing 350 mm rising main can be reinforced with a new 355 mm diameter parallel rising main).
- A new Future PS P4 drainage area is proposed for future development area P46. A new pump station and rising main should be constructed for this drainage area that discharges into the Piesang Valley 19 PS. When the Piesang Valley 18 pumping station is upgraded, the Piesang Valley 19 and 20 pump stations should be upgraded to a capacity of 300 l/s and their existing rising mains replaced with new 600 mm diameter rising mains (alternatively the existing 350 mm diameter rising mains should be reinforced with new 400 mm diameter parallel rising mains.
- New outfall sewers are proposed for future development areas P45 & P47 that gravitates to the Piesang Valley 18 & 19 pump stations.
- A new Future PS P20 drainage area is proposed for future development area P51. A new pump station and rising main should be constructed for this drainage area that discharges into the drainage area of PS1a.
- New Future PS P5 and P6 drainage areas are proposed for future development areas P19 & P20. New pump stations and rising mains should be constructed for these drainage areas that discharge into the drainage area of PS 4.
- If overflow problems occur at the main outfall sewers that drain towards PS 2 & 3, these outfall sewers should be upgraded.
- New Future PS P7 and P8 drainage areas are proposed for future development areas P33 & P34. New pump stations and rising mains should be constructed for these drainage areas that discharge into the drainage area of Kwanokuthula PS 1. New outfall sewers and pipe reinforcements are proposed for the Kwanokuthula PS 1 drainage area when future development areas P31 - P34 develops. When the Kwanokuthula PS 1 reaches capacity the pump station should be upgraded to a capacity of 62 l/s and the rising main upgraded to a diameter of 250 mm.
- Upgrading is proposed of the existing bulk sewer downstream of the Kwanokuthula PS 1 (master plan items BPS27.4A, B & C). This will be required in order to accommodate additional housing projects in Kwanokuthula as well as the future Ladywood development.
- A new Ladywood drainage area is proposed for future development areas P27 - P30. A new Ladywood PS 1 with a capacity of 55 l/s and rising main should be constructed for this drainage area that discharges into the Ganse Valley WWTW Gravity drainage area.
- A new so-called “Ebenhaezer” bulk sewer is proposed in order to accommodate future development area P35.
- A new Future PS P18 drainage area is proposed for future development areas P91 & P92. A new pump station and rising main should be constructed for this drainage area that discharges into the proposed Ebenhaezer bulk sewer.
- A new Future PS P9 drainage area is proposed for future development areas P58 & P60. A new pump station and rising main should be constructed for this drainage area that discharges into the Gansevlei WWTW.
- New Future PS P10, P11 and P12 drainage areas are proposed for future development areas P64 - P68. Future PS P12 should pump to Future PS P11, Future PS P11 to Future PS P10 and Future PS P10 to the existing Goose Valley Main PS.
- When the proposed housing development in Green Valley (future area P100) starts to develop it is proposed that the existing sewer infrastructure between the development and the Wittedrift PS is upgraded and that the Wittedrift PS is upgraded to a capacity of 12 l/s.
- The proposed capacity of 12 l/s for the Wittedrift PS is at the upper limit of what can be pumped to the Aventura PS through the 7,0 km 125 mm diameter rising main between the Wittedrift and Aventura pump stations.
- It is proposed that when the upgraded Wittedrift PS reaches capacity (as additional areas in Wittedrift and Green Valley develops) the rising main to Aventura is abandoned and new bulk infrastructure is constructed in order to pump directly from Wittedrift to the Gansevlei WWTW (see project BPS-058).
- A new Future PS P13 with a capacity of 25 l/s and a rising main that discharges into the Aventura PS is proposed for future development area P70.
- The capacity of the Aventura PS is currently limited to 32 l/s due to the capacity of the downstream 5,8 km rising main. It is proposed that the existing 200 mm diameter rising main is upgraded to a 355 mm diameter rising main. This will improve the capacity of the Aventura PS from 32 l/s to 78 l/s.
- When the Aventura PS reaches capacity in future as development of upstream developments commence, it is proposed that the pumps in the pump station are upgraded to a capacity of 120 l/s.
- When future development area P71 develops the Sanderlings PS and rising main should be upgraded to a capacity of 14 l/s and a diameter of 160 mm.
- New Future PS P14 and P15 drainage areas are proposed for future development areas P71 - P77. Future PS P14 should pump to the drainage area of Future PS P15 and Future PS P15 to the existing Matjiesfontein PS. It is proposed that the existing Plettenberg Manor PS is decommission and sewage from the upstream drainage area is diverted to the proposed Future PS P15.
- When the Matjiesfontein PS reaches capacity it should be upgraded to a capacity of 70 l/s. The existing 200 mm diameter rising main is in a bad state of repair and should be replaced with a new 315 mm diameter rising main.
- New outfall sewers are proposed for future development areas P78 - P80, P83 & P84 in the Keurboomstrand Main drainage area.

| Table 3.3.2.1: Future sewer reticulation infrastructure required |
|---|
| **Kurland** |
| • The existing Kurland PS 1 drainage area is increased to accommodate future development area P95 to the north of Kurland that fall within this drainage area.<br>• A new Future PS K1 drainage area is proposed for future development area P96 (± 1 500 erven on a portion of Erf 562 to the south of Kurland). A new pump station and rising main to the Kurland WWTW should be constructed for this purpose.<br>• No layout information was available for future development area P96, but from the topographical information it seems that it will be possible to abandon the existing Kurland pump station 1 in future (after the proposed Future PS K1 is constructed) and re-direct flow from the upstream drainage area to the Future PS K1.<br>• It is therefore proposed that when future area P96 develops Future PS K1 should be constructed on a site downstream of future area P96 and Kurland PS 1 so that the total flow from future area P96 and the existing Kurland PS 1 drainage area can gravitate towards the proposed PS (see project BKS-003).<br>• The option should also be investigated to abandon the Kurland PS 2 and re-direct flow from the upstream drainage area towards the proposed Future PS K1. |
| **Natures Valley** |
| • There is currently no sewer network in Natures Valley and the existing erven are serviced through septic tanks. No provision is made in the sewer master plan to service these erven with a waterborne sanitation system in the future. This option should however be investigated. |

The proposed future sewer pump stations are also indicated on the schematic layouts in Annexure C of the Administration, Information and Comprehensive Overview Report. The sewer master plan figures and tables are included in Annexure A.