MANTSOPA LOCAL MUNICIPALITY

PRELIMINARY DESIGN REPORT FOR THE LADYBRAND BULK WATER SUPPLY:

INCREASING STORAGE CAPACITY AND

OPTIMISING THE WATER RETICULATION NETWORK FOR LADYBRAND / MANYATSENG

REPORT NO : **R-F0239-PDR-R4**

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Revision Schedule

Revision Number	Date	Description	Author
1	08 June 2020	Reduction of Scope: Reservoir and associated works only. Removal of Bulk Supply Line	L.T. CHAMANE
2	26 June 2020	Reduction of Design Life: Design life reduced from 2040 to 2025.	L.T. CHAMANE
3	29 October 2020	Increase of Design life back to 2040. Increase scope to solve all water problems in Ladybrand / Manyatseng	L.B.F. AMBROSE
4	10 November 2020	12.1 COST ESTIMATE: Cost Comparison between a single Concrete Reservoir and the four Steel Storage Tanks.	L.T. CHAMANE

EXECUTIVE SUMMARY

FLAGG Consulting Engineers has been appointed by Mantsopa Local Municipality (MLM) for the upgrading of the existing bulk water supply and associated works for Ladybrand and Manyatseng. The appointment consists of the following:

a) New 12 Mℓ Reservoir (4 x 3Mℓ steel reservoirs) and appurtenances to meet the 48-hour storage requirement.

b) A new Bulk Water Supply line (with Air Valve chambers and Scour Valve chambers provided along the route of the pipeline) from Ladybrand Hospital to Manyatseng.
   - 1480m long, 355mmØ class 16 diameter dedicated bulk supply pipeline from the new 12Mℓ reservoir to the existing 250mmØ dedicated line (at the Valve Control Room) supplying the existing 3.5Mℓ reservoir in Manyatseng. The dedicated supply line will solve the problem of the reservoirs that are not able to fill up due to the existing supply line being connected to the network at several places.

c) A new bulk water supply line connecting from the Ladybrand High Pressure reservoir supply pipeline to Mauersnek residential area.
   - 150m long 160mm class 12 pipeline will be required for this connection. The installatio of this short connection will resolve the low pressure problems currently being experienced in Mauersnek

d) Modification of pipework's at Ladybrand sandstone low pressure reservoir.

e) Upgrading the Pressure Reducing Valves in Ladybrand and Manyatseng to reduce water losses due to unnecessary high network pressures.

f) Installation of a new telemetry system for the bulk water system in Ladybrand.

Ladybrand and Manyatseng rely on their raw water supply from the Caledon River extraction point. The Caledon River has demonstrated over the last few years to be a seasonal source of raw water supply and thus cannot sustainably/continuously supply the raw water demand of Ladybrand and Manyatseng.

The current (2020) water demand for Ladybrand and Manyatseng is 9.46 Mℓ/day. The future (2040) water demand for Ladybrand and Manyatseng is 11.03 Mℓ/day.

The main purpose of this project is to resolve the lack of storage capacity that meets the 48-hour requirement for MLM to ensure long term water security for Ladybrand and Manyatseng, and water supply to areas that are going without water for several days. This will be achieved by implementing the above scope of works to the required engineering standards to ensure a project life cycle of at least 20 years.

The Works (construction cost + professional fees) for

- Option 1 (4 x 3 Mℓ steel reservoirs) are estimated to cost **R 48 545 904.47.**
- Option 2 (1 x 12 Mℓ concrete reservoir) are estimated to cost **R 44 923 222.81.**

Due to the specialised nature of the works, an established contractor with applicable experience will be contracted for the construction of the works. The contractor will however be required to comply with RDP objectives and will have to submit proposals in this regard at tender stage. The proposals should include provision for the employment of local subcontractors on both a conventional subcontract basis and a management contractor basis to create the maximum scope for employment opportunities.

1. INTRODUCTION

1.1 PURPOSE AND TERMS OF REFERENCE

FLAGG Consulting Engineers (Pty) Ltd has been appointed by Mantsopa Local Municipality to prepare this Preliminary Design Report for the Ladybrand Bulk Water Supply.

The appointment requires the following services to be rendered:

- Preparation of the PDR for the project.
- Detail design of Ladybrand Bulk Water Supply and appurtenant works.
- Preparation of tender documents, contract documents and working drawings.
- The monitoring of the construction phase.
- Submission of “as-built” drawings.

The project is situated in Ladybrand adjacent to the R26, Free State, South Africa; its geographical coordinates are: **29°11'37.64"S, 27°27'23.07"E.**

1.2 POPULATION

The population figures where derived from previous census records and from information supplied by municipal authorities.

Table 1.2.1: Ladybrand / Manyatseng population

Town Desciption	Projected Growth Rate	Census	Projected				
		2011	2020	2025	2030	2035	2040
Ladybrand	0.5%	4218	4412	4523	4637	4754	4874
Manyatseng	1.5%	21598	24695	26603	28659	30874	33260
TOTAL		**25816**	**29107**	**31127**	**33297**	**35629**	**38135**

The projected population figures were derived using growth rates of 0.5% for Ladybrand and 1.5% for Manyatseng. The growth figures used are well below the recommended growth figures in the “RDP Rural Water Supply Design Criteria Guidelines” of Department of Water Affairs, due to the low growth in the area in recent times.

Table 1.2.2: Ladybrand / Manyatseng stand count

Town Desciption	Projected Growth Rate	Estimated stands in Year					
		2011	2020	2025	2030	2035	2040
Ladybrand	0.1%	2117	2136	2147	2158	2168	2179
Manyatseng	0.75%	5326	5696	5913	6138	6372	6615
TOTAL		**7443**	**7833**	**8060**	**8296**	**8540**	**8794**

The projected stand figures were derived using growth rates of 0.1% for Ladybrand and 0.75% for Manyatseng. The growth figures used are well below the recommended growth figures in the “RDP Rural Water Supply Design Criteria Guidelines” of Department of Water Affairs, due to the low growth in the area in recent times. The average household size is 3.47 (2011) and projected 4.34 (2040).

2. OBJECTIVES

The project will consist of upgrading the bulk water supply of Ladybrand and Manyatseng. Mantsopa LM had outlined the following objectives during the consultant's tender:

- To ensure sustainability in provision of potable water.
- To improve bulk water reticulation of the scheme.
- To improve bulk water storage for the area.
- To monitor the construction process of the proposed solutions.
- To ensure compliance with all relevant regulations prior, during and on completion of construction.
- To transfer skills in aspects of operation and maintenance of water reticulation.

3. CURRENT STATUS QUO OF THE PROJECT AREA

3.1 EXISTING BULK WATER SUPPLY SYSTEM

The location of the main elements of the existing bulk water supply system of Ladybrand Water Extraction works is shown on **Drawings F0239-A100** and the bulk water supply schematic layout.

3.1.1 Raw Water Source

Ladybrand / Manyatseng obtains raw water from one source only namely, the Caledon River. Ladybrand's Caledon river extraction point is located approximately 150km upstream of the Welbedacht Dam Wall.

Raw water is extracted from the Caledon River with submersible pumps. At the Intake Tower, two pump sets, one duty and one standby, deliver 450 kℓ/hr via a 300mmΦ diameter pipeline to the Genoa Water Purification Works. Alternatively, water is abstracted from the Caledon River and stored in the Cathcart's Drift Dam. At Cathcart's Drift Dam 2x pumps deliver raw water to a buffer reservoir, which in turn supplies the Genoa Water Purification Works via a 300mmΦ diameter pipeline.

3.1.2 Raw water Pipeline

There are two existing raw water pipelines; one from the Caledon River Intake Tower to Genoa WTW is a 300mmØ pipeline, and another from Cathcart's Drift Dam is a 300mmØ pipeline.

3.1.3 Water Purification Works

The Genoa water purification plant receives water from the two sources referenced in 3.1.1 above. The plant has a capacity of 10.8 Mℓ/day. The current water demand for Ladybrand / Manyatseng is 9.46 Mℓ/day. The capacity of the plant is currently adequate to meet the current demand and the future demand (11.03 Mℓ/day; Year 2040)

3.1.4 Existing Storage Capacity

Purified water is pumped to the two Low-Pressure Reservoirs (1.2 Mℓ Concrete and 1.364 Mℓ Sandstone) which are situated at the most southern part of Ladybrand. The two low-pressure reservoirs have a pump station between them which pumps up to the High-Pressure Reservoir (3 Mℓ). The two low-pressure reservoirs distribute water to Ladybrand low pressure area. The high-pressure reservoir supplies Manyatseng Reservoir via a 250mmØ pipeline, Ladybrand high pressure area and a portion of Manyatseng. The Valve Control Room also receives water from the high-pressure reservoir and distributes

to areas of Manyatseng and the Lusaka Reservoir (0.5 Mℓ). The total required storage capacity (48 hours) for Ladybrand / Manyatseng is **18.91 Mℓ** currently (2020) and **22.06 Mℓ** future (2040). The capacity of the reservoirs is inadequate to meet the current and future water storage requirements.

Table 3.1.4: List of the reservoirs in Ladybrand / Manyateseng

Reservoir	Material	Coordinates S	Coordinates E	Capacity in Mℓ
Town High Pressure	Concrete	29° 12' 20.64"	27° 27' 03.91"	3.000
Town Low Pressure 2	Concrete	29° 12' 12.00"	27° 27' 09.95"	1.200
Town Low Pressure 1	Sandstone	29° 12' 11.39"	27° 27' 08.73"	1.364
Lushoff	Sandstone	29° 10' 48.03"	27° 25' 27.44"	0.500
Lusaka	Steel	29° 09' 17.80"	27° 28' 04.04"	0.500
Manyatseng	Concrete	29° 10' 04.46"	27° 28' 33.33"	3.500
Combined Storage				**10.064**

3.1.5 Clean Water Distribution Networks

The clean water distribution network for Ladybrand consists mostly of AC pipes, and the clean water distribution network for Manyatseng consists mostly of uPVC pipes. Because most of the pipes in Ladybrand town are old Asbestos Cement pipes it may be worthwhile to institute a gradual pipe replacement programme as well.

There are Low-Pressure Zones under peak conditions in the water reticulation network. The low-pressure areas are identified on drawing F0239-A100.

4. METHODOLOGY

The approach followed to identify the infrastructure required for this project is a systematic approach of identifying the client's needs combined with demand calculations and hydraulic modelling.

4.1 DEMAND CALCULATIONS

The demand calculated by Mantsopa LM as indicated in their original business plan submission dated 25 March 2020 was based on a desktop study and Mantsopa LM did not have all the information available to them to accurately calculate the demand. Our demand calculations below thus differs from the original business plan. The demand calculations were discussed at a meeting held at MLM's offices on 29 Oct 2020 and the figures below was accepted as the correct demand figures for Ladybrand / Manyatseng.

4.1.1 Demand Calculations based on population

The demand calculations below are derived on the following design figures and assumptions:

- Average Annual Daily demand (AADD):
  - High Income: 250 l/capita/day
  - Low Income: 80 l/capita/day
- Water treatment losses: 10% of domestic demand.
- Water conveyance losses: 10% of domestic demand.
- Summer peak factor: 1.5

Table 4.1.1.1: Projected daily consumption (Mℓ/day) 2020

Town Description	Population	AADD / Stand (ℓ/c/day)	AADD (Mℓ/day)	AADD (Mℓ/day)
Ladybrand Residential	4412	250	1.10	1.99
Manyatseng Residential	24695	80	1.98	3.56
Bulk consumer - Office, Shops	-	**15%**	0.46	0.83
Bulk consumer - School, Hospitals	-	**15%**	0.46	0.83
Bulk consumer - Municipal	-	**10%**	0.31	0.55
TOTAL			**4.31**	**7.76**

Table 4.1.1.2: Projected daily consumption (Mℓ/day) 2040

Town Description	Population	AADD / Stand (ℓ/c/day)	AADD (Mℓ/day)	AADD (Mℓ/day)
Ladybrand Residential	4874	250	1.22	2.19
Manyatseng Residential	33260	80	2.66	4.79
Bulk consumer - Office, Shops	-	**15%**	0.58	1.05
Bulk consumer - School, Hospitals	-	**15%**	0.58	1.05
Bulk consumer - Municipal	-	**10%**	0.39	0.70
TOTAL			**5.43**	**9.78**

Table 4.1.1.3: Projected yearly consumption (Mℓ/day) 2011 - 2040

YEAR	AADD (Mℓ/day)	AADD PEAK (Mℓ/day)	AAMD (Mℓ/month)	AAMD PEAK (Mℓ/month)	AAYD (Mℓ/annum)
2011	3.895	7.011	140.230	217.356	2201.610
2020	4.310	7.758	155.157	240.493	2435.962
2025	4.563	8.213	164.256	254.596	2578.813
2030	4.833	8.699	173.985	269.676	2731.557
2035	5.122	9.220	184.391	285.805	2894.931
2040	5.431	9.776	195.524	303.062	3069.726

From table 4.1.1.1 and 4.1.1.2 shows that current Peak demand (2020) for Ladybrand and Manyatseng combined is 7.76 Mℓ/day. The future (Year 2040) Peak demand is 9.78 Mℓ/day.

4.1.2 Demand Calculations based on Stand Count

The demand calculations below are derived on the following design figures and assumptions:

- Average Annual Daily demand (AADD):
  - High Income: 1250 l/erf/day
  - Low Income: 560 l/erf/day
- Water treatment losses: 10% of domestic demand.
- Water conveyance losses: 10% of domestic demand.
- Summer peak factor: 1.5

Table 4.1.2.1: Projected daily consumption (Mℓ/day) 2020

Town Description	No of Stands	AADD / Stand (ℓ/stand/day)	AADD (Mℓ/day)	AADD (Mℓ/day)
Ladybrand Residential	2104	1250	2.63	4.73
Ladybrand Business	30	3500	0.11	0.19
Ladybrand Educational	2	2500	0.01	0.01
Manyatseng Residential	5607	560	3.14	5.65
Manyatseng Business	87	3500	0.31	0.55
Manyatseng Educational	4	2500	0.01	0.02
TOTAL			**6.20**	**11.15**

Table 4.1.2.2: Projected daily consumption (Mℓ/day) 2040

Town Description	No of Stands	AADD / Stand (ℓ/stand/day)	AADD (Mℓ/day)	AADD (Mℓ/day)
Ladybrand (High Cost)	2146	1250	2.68	4.83
Ladybrand Business	30	3500	0.11	0.19
Ladybrand Educational	2	2500	0.01	0.01
Manyatseng (Low Cost)	6510	560	3.65	6.56
Manyatseng Business	107	3500	0.37	0.67
Manyatseng Educational	5	2500	0.01	0.02
TOTAL			**6.83**	**12.29**

Table 4.1.2.3: Projected yearly consumption (Mℓ/day) 2011 - 2040

YEAR	AADD (Mℓ/day)	AADD PEAK (Mℓ/day)	AAMD (Mℓ/month)	AAMD PEAK (Mℓ/month)	AAYD (Mℓ/annum)
2011	5.942	10.695	213.904	331.551	3358.288
2020	6.197	11.154	223.081	345.775	3502.367
2025	6.346	11.422	228.440	354.082	3586.510
2030	6.500	11.700	233.995	362.693	3673.728
2035	6.660	11.988	239.754	371.619	3764.144
2040	6.826	12.286	245.725	380.874	3857.883

From table 4.1.2.1 and 4.1.2.2 shows current Peak demand (2020) for Ladybrand and Manyatseng combined is **11.15 Mℓ/day**. The future (Year 2040) Peak demand is **12.29 Mℓ/day**.

4.1.3 Comparing different Demand Calculations

The table below compares the demand calculations based on census population figures and current stand counts.

Table 4.2.3: Projected yearly consumption (Mℓ/day) 2011 - 2040

YEAR	a) Population AADD PEAK (Mℓ/day)	b) Stand Count AADD PEAK (Mℓ/day)	Differential (Mℓ/day)	Average (a&b) Demand (Mℓ/day)
2011	7.011	10.695	3.684	8.853
2020	7.758	11.154	3.396	9.456
2025	8.213	11.422	3.209	9.817
2030	8.699	11.700	3.001	10.199
2035	9.220	11.988	2.768	10.604
2040	9.776	12.286	2.510	11.031

4.3 HYDRAULIC MODELLING

A 'Civil Designer' hydraulic model was compiled to simulate the flow in the new and existing pipelines. The new pumps and existing pumps were also simulated to determine a suitable size and capacity for the pumps. Reservoir capacity and retention periods were also analysed. The hydraulic model is currently only at preliminary stage, and substantive work is still required to balance the actual flows with modelled flows. This will be done during detail design stage. However, the preliminary model did point out obvious shortcomings in the current water system.

5. IDENTIFICATION OF THE PROBLEM

The problem in Ladybrand/Manyatseng is:

- A lack of storage capacity that meets the 48-hour requirement.
- Areas are going without water for either a few hours, a day or several days. This is due to the bulk water pipeline to Manyatseng not have the required capacity to supply these areas.
- Two reservoirs are not receiving water due to a problem with the pipelines supplying the reservoirs.
- The reticulation is impacting on the ability to fill up the larger concrete reservoir in Manyatseng.
- The bulk water pipelinie to Manyatseng does not have the required capacity to supply the peak demand of Manyatseng and fill the reservoir of Manyatseng.

The preliminary model for the water network indicates that the low-pressure areas in Mauersnek arise due to the High-Pressure Reservoir (3Mℓ) being too small to keep up with the peak demand for Ladybrand and Manyatseng. Mauersnek is also currently supplied from the low-pressure reservoir. A new bulk water connection from the high-pressure reservoir in Ladybrand to Mauersnek will alleviate the pressure and supply problems for this area.

At peak demand for Ladybrand and Manyatseng the Town High Pressure Reservoir (3Mℓ) empties before it can supply water to Manyatseng Reservoir (3.5 Mℓ). Additional water storage is required to alleviate the storage problem. But the storage is part of a bigger problem. The bulk supply line from Ladybrand high pressure reservoir to Manyatsend does not have the required capacity to supply the demand. A project was recently completed where a bulk supply line was constructed from the high pressure reservoir to Ladybrand Hospital. A future connection point as provided to extend this line to Manyatseng. The installation of this line will resolve the pressure problem in Thabong Ext8, 9 & 10, Marikana, Mandela Park and Palamenteng.

The Lusaka Reservoir (0.5 Mℓ) also has difficulty filling up due to its supply line being drawn off at the Valve Control Room to supply areas of Manyatseng. This problem will be resolved by the installation of the above bulk pipeline (Hospital to Manyatseng) and by increasing the reservoir capacity already mentioned above.

6. SCOPE OF WORK FOR THE PROJECT

6.1 NEW 12 ML RESERVOIR (4 x 3Ml STEEL RESERVOIRS)

The demand calculations for the current and future water storage scenario in Ladybrand / Manyatseng is shown in Table 6.1.1 and Table 6.1.2 below:

Table 6.1.1 – Current available storage per reservoir

Reservoir name	Supply area	Existing Capacity (Mℓ)	AADD (Mℓ/day)	48h Storage required (Mℓ)	Storage Backlog (Mℓ)
Town Low Pressure 1	Ladybrand	1.364	9.46	18.91	**8.85**
Town Low Pressure 2	Ladybrand	1.200			
Town High Pressure	Ladybrand	3.000			
Lushoff	Ladybrand	0.500			
Lusaka	Manyatseng	0.500			
Manyatseng	Manyatseng	3.500			
		10.064			

Note: The above demand calculation includes a summer peak factor of 1,5 and water losses of 20%.

Table 6.1.2 – Future available storage per reservoir

Reservoir name	Supply area	Existing Capacity (Mℓ)	AADD (Mℓ/day)	48h Storage required (Mℓ)	Storage Backlog (Mℓ)
Town Low Pressure 1	Ladybrand	1.364	11.03	22.06	**12.0**
Town Low Pressure 2	Ladybrand	1.200			
Town High Pressure	Ladybrand	3.000			
Lushoff	Ladybrand	0.500			
Lusaka	Manyatseng	0.500			
Manyatseng	Manyatseng	3.500			
		10.064			

Note: The above demand calculation includes a summer peak factor of 1,5 and water losses of 10%.

From the tables above it can be seen that the current water storage capacity for Ladybrand / Manyatseng is insufficient to cater for its current and future supply to the areas. It is recommended that a new **12Mℓ** reservoir be constructed to cater for the future water demand to the year 2040. The increased capacity from the new reservoir will help supply the Platberg and Mauersnek areas which are currently experiencing water supply issues.

Mantsopa LM indicated to FLAGG that they would prefer the reservoir be constructed with steel tanks instead of reinforced concrete. The largest steel reservoir tank on the market is a 3Ml reservoir. Thus, to resolve the bulk water storage problems in Manyatseng, 4 x 3Ml reservoir are required to be constructed.

6.2 INTERCONNECTING PIPEWORK

Interconnecting pipework on the project will consist of connecting the 4 new steel reservoirs to the existing reservoir. This will consist of the following:

- 4 x separate feeder lines from the existing reservoir to the new reservoirs.
- 4 x separate supply lines from the new reservoirs to the existing high-pressure supply pipeline.

- 4 x separate scour and overflow pipelines for each reservoir.

Further to the above minor modifications will be done at the low-level reservoirs to prevent the 1 low level reservoir from being fed directly from the WTP pumps. This will result in only 1 reservoir acting as a sump for the pump station at the low-pressure reservoirs. The second low pressure reservoir will be fed from the high-pressure reservoir.

6.3 NEW BULK PIPELINES

There are two new bulk pipeline that will be required for the project.

- Pipeline 1 - The bulk pipeline will be a 250mmØ dedicated supply line from Ladybrand Hospital to the existing 250mmØ dedicated line (at the Valve Control Room) supplying the 3.5 Mℓ reservoir in Manyatseng. The dedicated supply line will solve the problem of the Manyatseng and Lusaka reservoirs that are not able to fill up due to the existing supply line being connected to the network at several places.
  - The total length of the pipeline is summarised below:
  - 355mmØ u-PVC class 16 – Total length = 1480m.
- Pipeline 2 - The bulk pipeline will be a new bulk connection from the Ladybrand high pressure reservoir to Mauersnek. The pipe line will solve the low pressure and water supply problem in Mauersnek.
  - The total length of the pipeline is summarised below:
  - 160mmØ u-PVC class 12 – Total length = 150m.

6.4 AIR VALVE AND SCOUR VALVE CHAMBERS

Air valve chambers and scour valve chambers will be provided along the route of the pipeline as the topography dictates. The maximum spacing between air valve chambers shall be 1000m to allow sufficient ventilation of the pipeline.

A typical drawing for the air valve chamber is shown on **Drawing F0239-G100.**
A typical drawing for the scour valve chamber is shown on **Drawing F0239-G101.**

Table 6.3.1: Design parameters and design standards for air and scour valve chambers

DESCRIPTION OF DESIGN PARAMETERS	CATEGORY/APPLICATION	PROPOSED DESIGN STANDARD
Spacing of air valves	All areas	Any 1000 m length of pipeline needs to be ventilated by providing air valve chambers. Air valve chambers shall also be provided at all high points along the pipeline route.
Spacing of scour valves	All areas	Scour valve chambers shall be provided at all low points along the pipeline route.

6.5 TELEMETREY AND MONITORING SYSTEM

A new telemetry system is proposed as part of this project. The telemetry system will be able to display and control the following bulk water infrastructure:

1. Raw water pumps Catchcard dams: (Pumps running yes/no; xxx l/s pumping rate, pump pressure).
2. Catchcard dam (Level indicator)

3. Raw water pumps WTP (Pumps running yes/no; xxx l/s pumping rate, pump pressure).
4. Clean Water Pumps WTP (Pumps running yes/no; xxx l/s pumping rate, pump pressure)
5. Booster Pumps Ladybrand (Pumps running yes/no; xxx l/s pumping rate, pump pressure)
6. All reservoirs (Level indicator, overflow indicator)

The above system will alert the municipality when obvious errors are present in the system and to react quickly to maintenance problems that could potentially be very costly if felt unattended. This will help the municipality to further prevent water losses which form part of a critical component of WC/WCDM.

6.6 UPGRADE EXISTING PRV"s

Ladybrand has numerous PRV's which serves a very important function. Very high pressures are present in many parts of the existing network due to the high location of the high-pressure reservoir in Ladybrand. Many of the existing PRV's are no longer working resulting in higher than normal water consumption by residents due to the high pressures. Further more any water losses and leakages are accentuated by the high pressures in the network. The PRV's are thus a critical component from a WC/WDM perspective and needs to be replaced as part of this project.

7. DESIGN CRITERIA

The design standard for this civil engineering infrastructure that will apply is the *Guidelines for Human Settlement Planning and Design* compiled by CSIR (Building and Construction Technology) under the patronage of the Department of Housing (Red book – revision 1 August 2003).

7.1 Design parameters and design standards

Table 7.1: Design parameters and design standards for water supply

DESCRIPTION OF DESIGN PARAMETERS	CATEGORY/APPLICATION	PROPOSED DESIGN STANDARD
Water demand	High income - Residential	1250 l / erf / day
	Low income - Residential	560 l / erf / day
	Industrial	5000 l / erf / day
Peak factors	Summer peak	1.5
	Daily peak	3.0
Hydraulic design	Friction coefficient C (Hazen Williams)	140
	Maximum velocity	2,5 m/s
	Minimum velocity	0,6 m/s
	Minimum Slope	1:500
Spacing of air valves	All areas	Any 1000 m length of pipeline needs to be ventilated by providing air valve chambers. Air valve chambers shall also be provided at all high points along the pipeline route.
Spacing of scour valves	All areas	Scour valve chambers shall be provided at all low points along the pipeline route.

7.2 LAYOUT

The proposed layout plan for the new works is shown on **Drawing F0239-A100.**

7.3 GENERAL DETAILS

The general details for the project are shown on **Drawing F0239-A100**

8. EXISTING SERVICES IMPACTED BY THE PROJECT

It is reasonable to expect to encounter services in the area where the reservoir will be constructed. Similarly, expect to encounter services along the routes of the new 355mmØ dedicated supply line from the new 12Ml reservoir to the existing 3.0Ml reservoir in Manyatseng. Wayleave applications will be applied for at all relevant stakeholders to ensure that no services are damaged, or that existing services that might require relocation are planned for ahead of construction.

9. MATERIALS INVESTIGATION

A Geotechnical Engineer will perform the geotechnical investigation and provide a report detailing the ground conditions of the project site. High quantities of rock are expected because of the visible rock outcrop and hard rock formations. Allowance in the cost estimate has been made for 95% hard rock excavation due to the visible rock formations at the site location.

9.1 BLASTING OF HARD ROCK NEAR EXISTING STRUCTURE

Rock excavation may be required for the new structure. The risk of damaging the existing structure due to blasting in close vicinity has been considered. The contractor will be required to break all rocks with an excavator and hydraulic rock breaker (pecker). Where rock is too hard for the pecker, hydraulic splitting will be considered as an alternative option. Blasting of hard rock will not be permitted under this project.

10. SURVEY AND STAKING

The survey and staking of the reservoir site and the water pipelines will be done in order to enable the detail design and will facilitate the smooth implementation of the project for the preferred contractor.

11. DETAIL DESIGN

The detail design, documentation and working drawings for the project will commence following approval of the scope presented in this preliminary design report.

12. PROJECT IMPLEMENTATION

12.1 COST ESTIMATE

The cost estimate is as set out in **Table 12.1.1 and Table 12.1.2** below:

TABLE 12.1.1: COST ESTIMATE (OPTION 1: 4 x 3 Mℓ STEEL RESERVOIRS)

DESCRIPTION	AMOUNT
SECTION 1: PRELIMINARY AND GENERAL	4 469 279.01
SECTION 2: RESERVOIRS	18 611 233.00
SECTION 3: VALVE CHAMBER AND SCOUR BOX	861 576.17
SECTION 4: BULK WATER PIPELINES	6 280 812.92
SECTION 5: TELEMETRY AND MONITORING SYSTEM	1 911 000.00
SECTION 6: INTERCONNECTING PIPEWORK	1 340 571.28
SECTION 7: UPGRADE PRV's	790 000.00
SUBTOTAL A	34 264 472.38
ADD 10% CONTINGENCIES	3 426 447.24
SUBTOTAL B	37 690 919.62
PROFESSIONAL FEES (12%)	4 522 910.35
SUBTOTAL C	42 213 829.97
ADD 15% VAT	6 332 074.50
TOTAL	**48 545 904.47**

TABLE 12.1.2: COST ESTIMATE (OPTION 2: 1 x 12 Mℓ CONCRETE RESERVOIR)

DESCRIPTION	AMOUNT
SECTION 1: PRELIMINARY AND GENERAL	4 469 279.01
SECTION 2: RESERVOIRS	16 858 629.37
SECTION 3: VALVE CHAMBER AND SCOUR BOX	861 576.17
SECTION 4: BULK WATER PIPELINES	6 280 812.92
SECTION 5: TELEMETRY AND MONITORING SYSTEM	1 911 000.00
SECTION 6: INTERCONNECTING PIPEWORK	536 228,51
SECTION 7: UPGRADE PRV's	790 000,00
SUBTOTAL A	31 707 525,98
ADD 10% CONTINGENCIES	3 170 752,60
SUBTOTAL B	34 878 278,58
PROFESSIONAL FEES (12%)	4 185 393,43
SUBTOTAL C	39 063 672,01
ADD 15% VAT	5 859 550,80
TOTAL	**44 923 222,81**

Tables 12.1.1 and 12.1.2 represent a cost comparison between the four (4) 3 Mℓ Steel Storage Tanks and a Single 12 Mℓ Concrete Reservoir:

- The cost estimate for 4 x 3 Mℓ Steel Storage Tanks is R18,611,233.00 + R1,340,571.28 for the Interconnecting Pipework. A total of R19,951,804.28 (excl. VAT)
- The cost estimate for 1 x 12 Mℓ Concrete Reservoir is R16,858,629.37 + R536,228.51 for Interconnecting Pipework. A total of R 17,394,857.88 (excl. VAT).

12.2 PROJECT TIME FRAME AND FINANCIAL YEAR EXPENDITURE

The specific construction components of this project allow it to be completed in a shorter than normal time frame. The following time frames will be required for each individual component:

1. 4 x Steel Reservoir: 4 months construction period (Very easy and fast to install compared to R.C.)
2. Valve chamber and scour box: 2 months
3. Bulk water pipelines: 5 months
4. Interconnecting pipework: 3 months
5. Upgrade PRV's: 1 month
6. Telemetry and monitoring: 2 months.
7. Testing and commission 1 month

Most of the above work can be constructed concurrently. The total project will be able to be completed in 6 months. If the contractor is appointed in January 2021, the project will be completed by June 2021. This will allow all the funds to spend in the current Financial Year.

12.3 PROJECT PHASING

The cost estimate shown in section 12.1 amounting **R 49 458 323.66** is for the full scope of work. Mantsopa LM has already put out a tender for a portion of the scope to speed up expenditure in this financial year. Mantsopa LM plans to go out on tender for the remaining portion of the works in November 2020 as soon as the additional scope of works is approved by DWS. The scope of works for the two projects will be separated as follows:

Phase 1 scope of work:

- 2 x 3 Mℓ reservoir and appurtenant works.
- Valve chamber and scour boxes for the associated reservoirs.
- Interconnecting pipework for the reservoirs.

DESCRIPTION	AMOUNT
SECTION 1: PRELIMINARY AND GENERAL	1 561 003.53
SECTION 2: RESERVOIRS	9 305 616.50
SECTION 3: VALVE CHAMBER AND SCOUR BOX	430 788.08
SECTION 4 : INTERCONNECTING PIPEWORK	670 285.64
SUBTOTAL A	**11 967 693.76**
ADD 10% CONTINGENCIES	1 196 769.38
SUBTOTAL B	**13 164 463.14**
PROFESSIONAL FEES (12%)	1 579 735.58
SUBTOTAL C	**14 744 198.71**
ADD 15% VAT	2 211 629.81
TOTAL	**16 955 828.52**

Phase 2 scope of work

- 2 x 3Ml reservoir and appurtenant works.
- Valve chamber and scour boxes for the associated reservoirs.
- Interconnecting pipework for the reservoirs.
- Bulk water pipelines.
- Telemetry and monitoring system.
- Upgrade PRV's

DESCRIPTION	AMOUNT
SECTION 1: PRELIMINARY AND GENERAL	2 908 275.47
SECTION 2: RESERVOIRS	9 305 616.50
SECTION 3: VALVE CHAMBER AND SCOUR BOX	430 788.08
SECTION 4 : BULK WATER PIPELINES	6 280 812.92
SECTION 5 : TELEMETRY AND MONITORING SYSTEM	1 911 000.00
SECTION 6 : INTERCONNECTING PIPEWORK	670 285.64
SECTION 7: UPGRADE PRV's	790 000.00
SUBTOTAL A	22 296 778.62
ADD 10% CONTINGENCIES	2 229 677.86
SUBTOTAL B	24 526 456.48
PROFESSIONAL FEES (12%)	2 943 174.78
SUBTOTAL C	27 469 631.26
ADD 15% VAT	4 120 444.69
TOTAL	**31 590 075.94**

PHASE 1 Total – R 16,955,828.52
PHASE 2 Total – R 31,590,075.94
TOTAL – R 48,545,904.46

13. STATUTORY & LEGAL REQUIREMENTS

All necessary statutory & legal requirements in terms of the Upgrade of the Bulk Water Supply Infrastructure should be complied with and will be addressed by required other specialist consulting firms.

13.1 ENVIRONMENTAL IMPACT ASSESSMENT (EIA)

Environmental Authorisation (EA) may be required for the Construction of a Water Pipeline at the river crossing. FLAGG will source three quotations from specialist consultants for an Environmental Impact Assessment (EIA) to determine whether the proposed construction activity qualifies for a Basic Assessment Report (BAR) in terms of the following Regulations:

1.1. Regulation 983, Listing Notice 1 (BAR), Activity 9: The development of infrastructure exceeding 1000 metres in length for the bulk transportation of water.

1.2. Regulation 983, Listing Notice 1 (BAR), Activity 12: The development of infrastructure or structures with a physical footprint of 100m2 or more.

1.3. In terms of Section 38(1) of the National Heritage Recourses Act, 1999 (Act 25 of 1999) Subject to the provisions of subsections (7), (8) and (9), any person who intends to undertake a development categorised as –

(a) the construction of a pipeline or other similar form of linear development or barrier exceeding 300m in length; Must at the very earliest stages of initiating such a development, notify the responsible heritage resources authority and furnish it with details regarding the location, nature and extent of the proposed development.

13.2 ENVIRONMENTAL MANAGEMENT PLAN

The Environmental Management Plan (EMP) listing allowable activities on the project site will be compiled and the contractor will have to adhere to all the requirements of the EMP. A sub consultant will be appointed to conduct monthly inspection to ensure that the contractor adheres to the EMP.

13.3 WATER USE LICENSE AGREEMENT (WULA)

A Water Use License Agreement (WULA) is not required for this project.

13.4 WAYLEAVES

FLAGG will attempt to establish the position of the existing underground and above ground infrastructure through the submission of wayleaves to all relevant stakeholders. It must however be noted that the information provided by stakeholders in many cases are not accurate or precise and damages to existing infrastructure is sometimes inevitable.

13.5 SOCIAL ENVIRONMENT

13.5.1 Socio-economic Opportunity Maximisation

The potential number of SMME's or BEE enterprises that stand to benefit either directly or indirectly from the implementation of the project is unclear at this stage. The possibility exists to use the project as an opportunity for the training of upcoming contractors. Numerous temporary job opportunities would be created as part of the construction phase of the project.

14. CONCLUSION

This Preliminary Design Report (PDR) provides a suitable long-term solution to resolve the water issues currently being experienced in Ladybrand / Manyatseng.

The construction of a new 12 Mℓ Reservoir (4 x 3Mℓ reservoirs) and appurtenances will meet the 48-hour storage requirement, and increased capacity from the new reservoir will help supply all the areas which are currently experiencing water supply issues. The Works are estimated to cost:

- Option 1 (4 x 3 Mℓ steel reservoirs) R 48 545 904.47.
- Option 2 (1 x 12 Mℓ concrete reservoir) R 44 923 222.81.

The construction of the new bulk pipelines will bring much needed relief to the low-pressure areas of Thabong Ext8, 9 & 10, Marikana, Mandela Park and Palamenteng and the area of Mauersnek.

The implementation of this project will provide long term sustainability for the water supply of the town of Ladybrand. Mantsopa LM should procure the necessary funding for the complete scope of works indicated above.

We trust you find this PDR to your approval and remain available to discuss any questions in this regard.

Yours faithfully,

(Electronic submission)

LBF AMBROSE Pr Tech Eng, PrCPM

DIRECTOR

ANNEXURE A:

DRAWINGS