Status Quo and Limitations

The current demand off the Upper Mgeni System is approximately 284 Ml/day. **Figure 5.11** illustrates the distribution of this demand between the three WSAs.

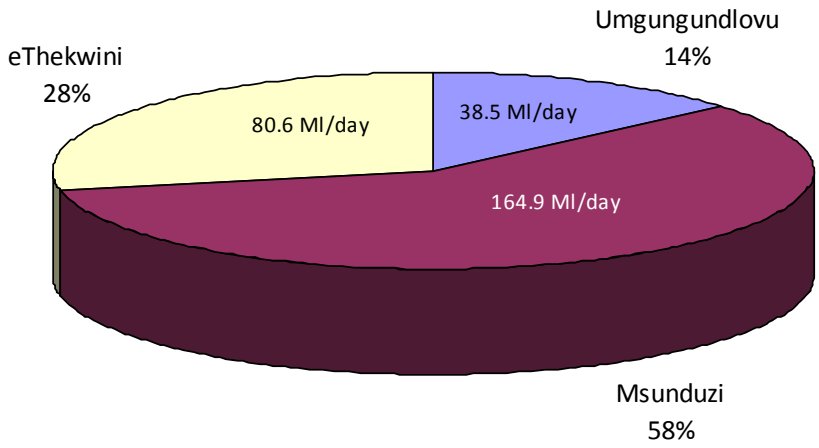

Figure 5.11 Distribution of Demands per Upper Mgeni WSAs (October 2010).

Figures 5.5 and **5.17** illustrate, schematically, the Upper Mgeni system in its current configuration and the current demands being placed on the network. These schematics should be referred to when reading this Section.

Over recent years eThekwini Municipality has put considerable effort into optimising the operation of its distribution systems that are served by the Lower Mgeni System. Amongst other things, this has led to them implementing new infrastructure in order to undertake a significant load shifting exercise.

eThekwini Municipality's Western Aqueduct project, which is expected to be fully commissioned in 2014, will represent the most significant of these load-shifting operations. The intention is for those areas currently being served under pumping from the Lower Mgeni System (viz. from Durban Heights WTP) to be transferred onto the Upper Mgeni System, to be served under gravity from Midmar WTP via the Western Aqueduct (WA). These areas include Greater Inanda, KwaDabeka, Mt Moriah and Pinetown South. Further to this, eThekwini Municipality plans to link the WA into their Northern Aqueduct thereby extending this supply to the municipality's northern areas as far as the Dube Trade Port development zone. Whilst this measure will free up additional capacity within the Lower Mgeni System that can be redirected elsewhere within the Municipality, it does place considerable additional load on much of Umgeni Water's infrastructure in the Upper Mgeni System, including the '57, '61 and '251 Pipeline systems, Midmar WTP, and ultimately on the water resources available from Midmar Dam (**Section 4.4.4**). The recent augmentation of the '57 Pipeline was undertaken in order to provide sufficient capacity in this portion of the supply network to meet the required demands of the WA.

Once Phase 2 of the Mooi-Mgeni Transfer Scheme (MMTS-2) has been commissioned in 2013 (**Section 4.4.4.9**), the 99% assured yield of the Mgeni System, at Midmar Dam, will increase from 322.5 Ml/day (117.7 million m^3/annum) to 476.2 Ml/day (173.8 million m^3/annum). However, even an increased yield at Midmar Dam will be insufficient to support

the imposition of the proposed full Western Aqueduct load shift for any significant period of time, and further water resource developments will be required to serve the increasing demand of eThekwini Municipality.

After the implementation of MMTS-2, further water resource developments within the Mooi-Mgeni system are not considered to be beneficial. One water resource option that is currently being investigated is the Mkomazi Water Project (MWP) (**Section 4.4.6**) which would transfer raw water from the Mkomazi River to a WTP in the adjacent catchment, with potable water then being supplied to the Umlaas Road area to feed into the '57 Pipeline and subsequently into the WA. The MWP is currently only entering the detailed feasibility investigation stage and therefore the very earliest that it is envisaged that the scheme could be completed and operational is 2022.

With Midmar Dam's yield then being fixed after MMTS-2, it is deemed prudent that all future bulk distribution infrastructure upgrades within the Upper Mgeni System (Midmar WTP - Umlaas Road) be limited to the water resources capacity that Midmar Dam can support (bearing in mind that Midmar Dam must also contribute to the water resource requirements downstream of it).

As mentioned in **Section 5.2.1.1**, only 330 Ml/day is available through the '61 System at World's View Reservoir. Significant infrastructure costs will need to be incurred to overcome this hydraulic constraint, and taking into account the water resource constraint mentioned above, this upgrade is not considered practical. The maximum available at Umlaas Road Reservoir, not taking into account upstream demand is 375 Ml/day. This is made up of 330 Ml/day from the '61 Pipeline and 45 Ml/day from the '53 Pipeline.

Hence, the water available to meet demands downstream of Umlaas Road Reservoir is limited until such time as the MWP is commissioned. Further to this, the available water will decrease over time as the demands upstream of the Umlaas Road Reservoir increase.

Figure 5.12 illustrates the volume that will be available to supply the WA at the eThekwini Municipality sales point (Point M).

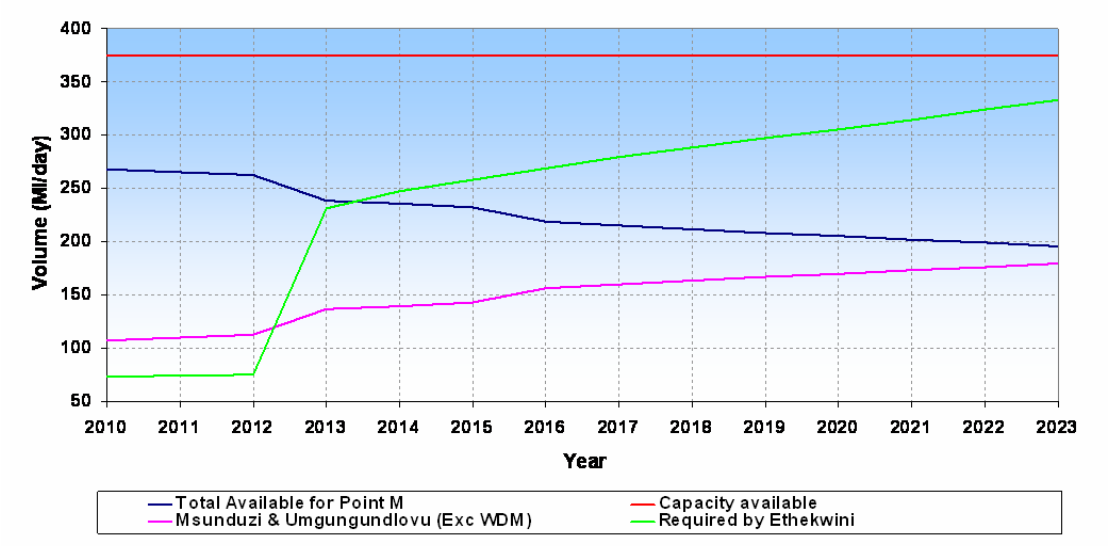

Figure 5.12 Supply Available for the Western Aqueduct.

eThekwini Municipality's current demand from Umlaas Road Reservoir is 74 Ml/day. Once commissioned in 2014, the WA will place an immediate additional demand of 156 Ml/day on the Upper Mgeni System based on a full load transfer of the Inanda, KwaDabeka, Pinetown South and Mt Moriah areas.

The expected demands and available supply for the WA is shown in **Table 5.24.**

Table 5.24 Demand and Supply at Point M.

Year	Required at Point M (Ml/day)	Available for Point M (Ml/day)
2010	74	267.6
2014	247.8	235.7
2020	305.8	205.4
2022	323.7	198.9
2025	339.7	350*

* Availability is assumed – dependant on infrastructure for MWP Phase 1

Based on the supply constraints mentioned above and assuming that these are the only constraints, the amount of water available from the Upper Mgeni System to supply eThekwini Municipality is estimated to be 235.7 Ml/day in 2014 and 198.9 Ml/day in 2022. Thereafter the supply constraints will be removed with the commissioning of the MWP.

The full WA load shift requirement will therefore not be able to be accommodated by the Upper Mgeni system for the entire period up until the MWP is commissioned.

Midmar Water Treatment Plant

The demand placed on the plant over the past few years is presented in **Figure 5.13**. Forecast sales are shown on the same figure.

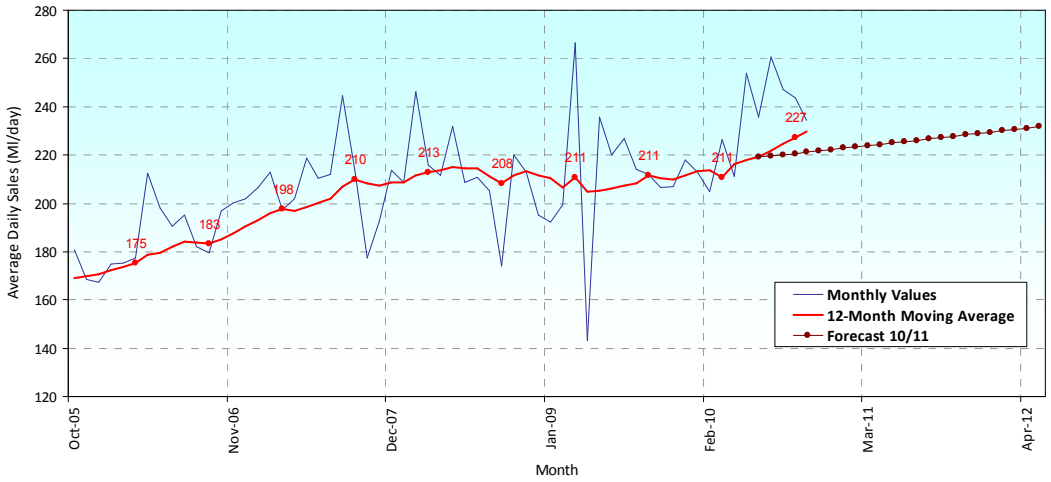

Figure 5.13 Water demand from Midmar WTP

An analysis of daily historical production (November 2009 to October 2010) of the Midmar WTP is presented in **Figure 5.14**. It shows that for 65% of the time the WTP was being operated above the optimal operating capacity and for 11% of the time the WTP was operated at above design capacity.

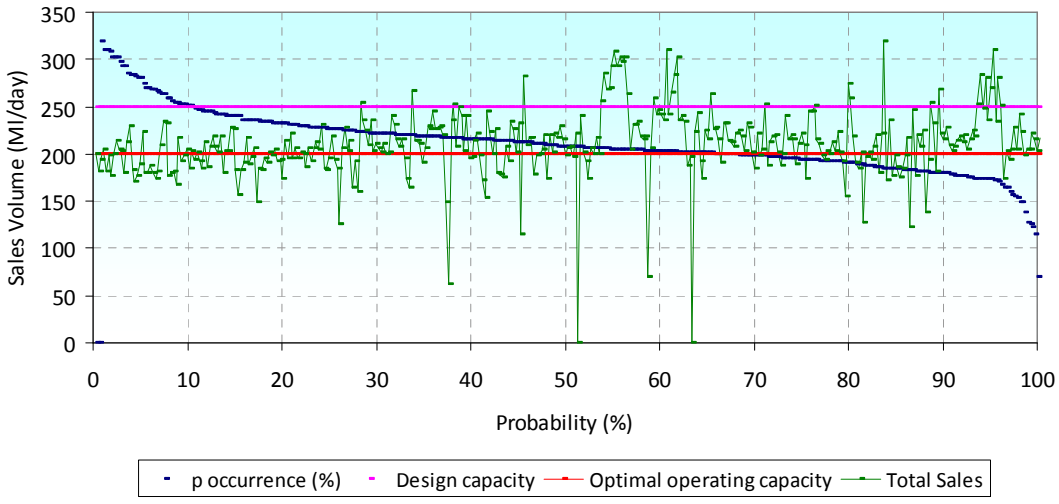

Figure 5.14 Analysis of historical production at Midmar WTP (November 2009 to October 2010).

With the imminent implementation of the load transfer of the WA demand onto the Upper Mgeni System, it is imperative that the capacity of Midmar WTP be upgraded to match the available yield once MMTS-2 has been implemented. Without this upgrade, Umgeni Water will not be able to accommodate even a partial load shift from 2014. The design of Midmar WTP, fortunately, lends itself to an upgrade to 375 Ml/day without major civil construction, as the clarifiers were already upgraded to this capacity during 2003 (**Section 7.5**).

Howick-North Sub-System

Mill Falls Pump Station to Howick-North Reservoirs

The pumps at Mill Falls and the pipeline to the reservoir were recently upgraded.

The Howick Reservoir zone has seen substantial residential development over the recent years and this is reflected in the13% increase in demand in 2007 and 6% in 2008. This growth has levelled off to 2% in 2009 and 2010.

Howick is currently undergoing a sustained period of housing development growth, which has led to an increased demand for water. Furthermore, new developments are currently being implemented, or are planned, for sites located above the command elevation of Howick North's reservoirs. Interim measures are currently being put in place by developers to boost pressure to supply such developments.

The extent to which storage at the Howick Reservoir Complex needs to be increased is dependant on whether it remains a terminal reservoir, serving its existing supply area or whether it becomes a distribution reservoir with its existing supply zone and a supply to the proposed high level reservoir.

Under the current operating conditions, the reservoir functions as a terminal reservoir. With the current demand at 4.1 Ml/day, the reservoir does not have enough storage to meet its 48 hour storage requirement. A new reservoir, at a higher level is proposed, to supply future developments. This reservoir, which needs to be constructed by Umgungundlovu District Municipality, will be supplied from the Howick-North Reservoir. The Howick-North Reservoir will therefore become a distribution reservoir. The determination of the storage requirement at Howick Reservoir is indicated in **Table 2.25**.

Table 5.25 Storage Requirement at Howick Reservoir.

Reservoir Function	Demand (Ml/day)	Time (days)	Required Storage (Ml)
Reticulation	7.4	1.5	11.1
Distribution	3.0	0.625	1.9
TOTAL STORAGE REQUIREMENT			**13.0**

Howick-West Sub-System

Mill Falls Pump Station to Howick-West Reservoir

The pump and pipeline to Howick-West Reservoir have adequate capacity to serve the long-term demands from Howick-West Reservoir.

Howick-West Reservoir to Groenekloof Reservoir

The Howick-West Reservoir serves as a distribution reservoir with bulk supply lines to Groenekloof and Mpophomeni reservoirs, and with direct supply into the Howick-West reticulation network. Under the current supply volumes, the required capacity of the reservoir is indicated in **Table 5.26**.

Table 5.26 Current capacity requirement for Howick West Reservoir.

Reservoir Function	Demand (Ml/day)	Time (hours)	Required Storage (Ml)
Reticulation	5.1	36	7.7
Distribution	28.7	15	17.9
TOTAL STORAGE REQUIREMENT			**25.6**

The current capacity of 16.5 Ml is below the 25.6 Ml that is required to serve current demand.

Water is pumped from the Howick-West Reservoir to Mpophomeni Reservoir (an Umgungundlovu District Municipality reservoir). There are off-takes from this pumping main. This has the effect of continuously changing the system curve which affects the duty point of the pumps.

uMngeni Local Municipality has planned a 1500 unit low cost housing development adjacent to Mpophomeni. An additional pipeline from the Howick-West Reservoir to Mpophomeni will be required to serve this development.

Groenekloof Reservoir Supply

The Groenekloof Reservoir serves as a balancing reservoir for Vulindlela, Sweetwaters and Blackridge. The current demand out of Groenkloof Reservoir is 21 Ml/day. This demand is expected to increase to 34 Ml/day by 2030 when 24 Ml of storage will be required (**Section 7.8**). The current reservoir capacity is expected to be over-allocated by 2015.

Blackridge Reservoir Supply

The current demand from the Blackridge Reservoir is about 2 Ml/day. The capacity of the reservoir is 2.2 Ml. The reservoir functions as a terminal reservoir which should have 48 hours of storage. The reservoir should therefore be upgraded to minimise risk.

Midmar WTP to Umlaas Road Sub-System

'251 Pipeline: Midmar WTP to D.V. Harris Off-Take

Due to limiting head conditions in the upper portion of the '251 Pipeline, the maximum flow obtainable through this pipeline is 330 Ml/day. Augmentation of all pipeline elements downstream of the '251 Pipeline should therefore be based on a maximum available flow of 330 Ml/day.

Clarendon Reservoir

The current demand from Clarendon Reservoir is about 17 Ml/day. The capacity of the reservoir is 25 Ml. The reservoir functions as a terminal reservoir which should have 48 hours of storage. The reservoir should therefore be upgraded to minimise risk.

'61 Pipeline: D.V. Harris to World's View Reservoir

This section of pipeline has been recently augmented to accommodate the maximum flow of 330 Ml/day.

The Worlds View reservoir has two 45 Ml compartments and the current throughput is in the order of 138 Ml/day. The reservoir functions as a bulk reservoir which should have 15 hours of storage which equates to 86.25 Ml. The reservoir is therefore adequate to meet

its current demands. However, with the expected growth in demand in Msunduzi and the WA load shift, increased storage may be required if demand increased above 180 Ml/day.

'61 Pipeline: World's View Reservoir to ED2

The dedicated pipeline serving The Msunduzi Municipality has sufficient capacity to satisfy the growing average annual daily demand (AADD). For a peak flow of 1.3 x AADD the pipeline could reach its capacity by 2030. However, with the proposed interlinking of the two '61 pipelines and the anticipated relief from the '61 Pipeline of the WA demand in 2022, the current pipeline capacity is considered adequate.

'61 Pipeline: ED2 to Umlaas Road Reservoir

The ED4 off-take to Edendale comes off the 800mm diameter '61 Pipeline. The Msunduzi Municipality intends expanding its low income housing in the Shenstone/Ambleton area. These developments will be supplied with potable water from the ED4 off-take. It is therefore expected that the increase in demand at this point will be in the region of 3% annually over the next 10 years. Further downstream of the ED4 take-off is the proposed tie-in to the proposed Richmond pipeline. Once commissioned, this pipeline will place a further demand of 11 Ml/day (year 2020) on this section of pipeline.

The existing 800 mm diameter pipeline between ED4 and Umlaas Road has several constrictions (down to 600 mm and 400 mm diameter) along its length that restrict its throughput considerably. The supply to Umlaas Road is further restricted to 77 Ml/day due to inlet constraints at the reservoir inlet. In order to accommodate a portion of the WA load shift until such time as the proposed MWP (**Section 7.1**) comes on line, it will be necessary to both remove all the constrictions in the existing pipeline and install a new pipeline. This will ensure that the total volume that can be supplied by the system is fully utilised.

Based on the current demand at Umlaas Road Reservoir, the AADD flow in this section of pipeline is 40 Ml/day (50 Ml/day peak flow). The pipeline will not be able to accommodate the WA load shift in 2014 when it will be required to convey about 200 Ml/day through to Umlaas Road Reservoir.

Ashburton Supply

The average flow in this pipeline is currently 2.5 Ml/day. This system has sufficient capacity for the foreseeable future.

Thornville / Hopewell Supply

The average flow in this pipeline is currently 2.5 Ml/day. This system has sufficient capacity for the foreseeable future.

'53 Pipeline: D. V. Harris WTP to Umlaas Road Reservoir

This pipeline currently supplies up to 45 Ml/day to Umlaas Road Reservoir. This pipeline has an operational history of frequent bursts and caution has to be taken to not exceed the "safe load carrying capacity" of 45 Ml/day.

Umlaas Road Sub-System

The current demand at Umlaas Road Reservoir is 86Ml/day. This equates to 12 hour available storage. In 2014 when the WA load is applied, the available storage will reduce to 5 hours. The reservoir serves primarily as a distribution reservoir, supplying reservoirs in Mkambatini and eThekwini. **Table 5.27** indicates projected 2020 demand from the reservoir together with the storage requirements.

Table 5.27 Storage Requirements at Umlaas Road Reservoir.

Reservoir Function	Demand (Ml/day)	Time (hours)	Required Storage (Ml)
Reticulation	4.5	36	7
Distribution	241.5	12	121
TOTAL STORAGE REQUIREMENT			**128**

Ideally, 83 Ml of additional storage will be required. However, much of this storage will become redundant when MWP comes on line.

The inlet configuration at the reservoir needs to be upgraded to ensure that the maximum volume that will become available from the augmented '61 Pipeline can be transferred into the Umlaas Road Reservoir.

'57 Pipeline

The existing 800mm diameter pipeline has been decommissioned. The pipeline was subjected to high velocities which resulted in the delamination of the bitumen lining along sections of the pipeline. This impacted on the quality of the water supplied to eThekwini Municipality. The combined capacity of the 1000mm diameter and the new 1600mm diameter is 485 Ml/day which is sufficient to satisfy the future demands of the WA.

Eston/Umbumbulu Pipeline

The capacity of this pipeline is restricted to 15 Ml/day due to the ground level profile along the pipeline route. The flow is restricted to ensure that the hydraulic grade line is at least 20 m above a high point at Stoney Ridge. The current flow in this pipeline is 8.6 Ml/day. Umgungundlovu District Municipality plans to supply the Greater Eston area with potable water from this pipeline. The scheme will be implemented in phases and an initial demand of 2 Ml/day is expected by 2013. This, together with the natural growth in Umbumbulu, will mean that the flow in this pipeline could reach 9 Ml/day by 2020 and 11 Ml/day by 2030.

Lion Park Pipeline

The current demand on this pipeline is in the order of 2Ml/day. The pipeline has sufficient capacity (3 Ml/day) to meet the anticipated growth of this demand into the foreseeable future.

Umgeni Water is currently constructing a new pipeline from an off-take on the Lion Park Pipeline to serve the Manyavu community (**Section 7.4.12**). This will place an additional demand on the system. The Manyavu demand is expected to grow to 2 Ml/day by 2040. When the Manyavu Pipeline is commissioned in 2011, the Lion Park Pipeline will be operating close to its capacity, and augmentation will need to be considered in the future.

D.V. Harris Water Treatment Plant

It is anticipated that D.V. Harris WTP could reach its operating capacity of 110 Ml/day by 2020. The demand on the plant is made up of supply to the The Msunduzi and uMshwathi municipalities, as well as the 45 Ml/day allocated for Umlaas Road Reservoir via the '53 pipeline. While Clarendon can be supplied from Midmar WTP, the current operating rule is to supply Clarendon Reservoir from D.V. Harris WTP to maximise the availability on the '251 pipeline to serve the Umlaas Road Sub-System. When the MWP is commissioned (expected to be 2022), Clarendon could revert to being supplied from Midmar WTP, thereby relieving D.V. Harris WTP. The demand on the plant will be reduced further when the '53 pipeline is decommissioned, which will occur with the commissioning of the MWP.

The demand placed on the plant over the past few years is presented in **Figure 5.15.** Expected sales over the next year are also shown in the same figure.

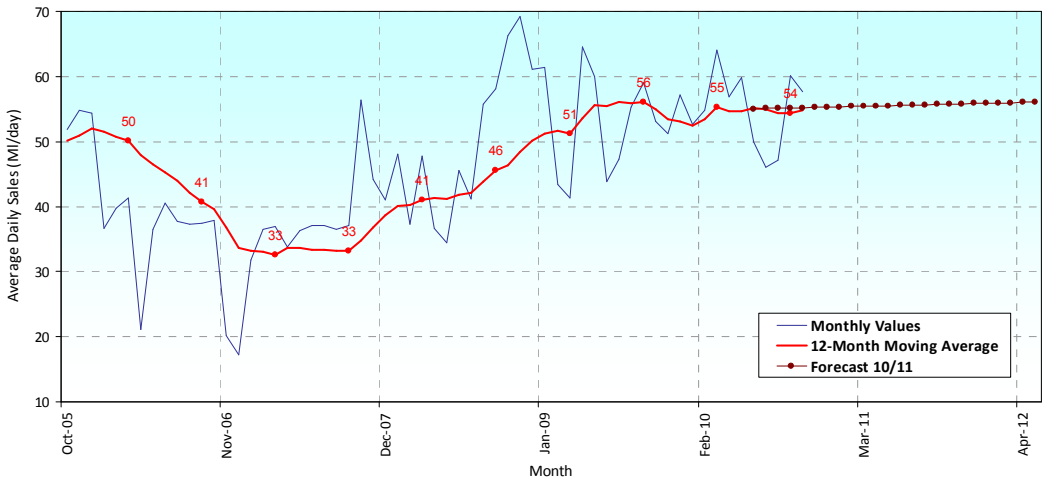

Figure 5.15 Water demand from D. V. Harris WTP.

An analysis of daily historical production (November 2009 to October 2010) for the D.V. Harris WTP is presented in **Figure 5.16**. The figure shows that 28% of the time the WTP was being operated above the optimal operating capacity and for 2% of the time (5 days) the WTP was operated at above design capacity.

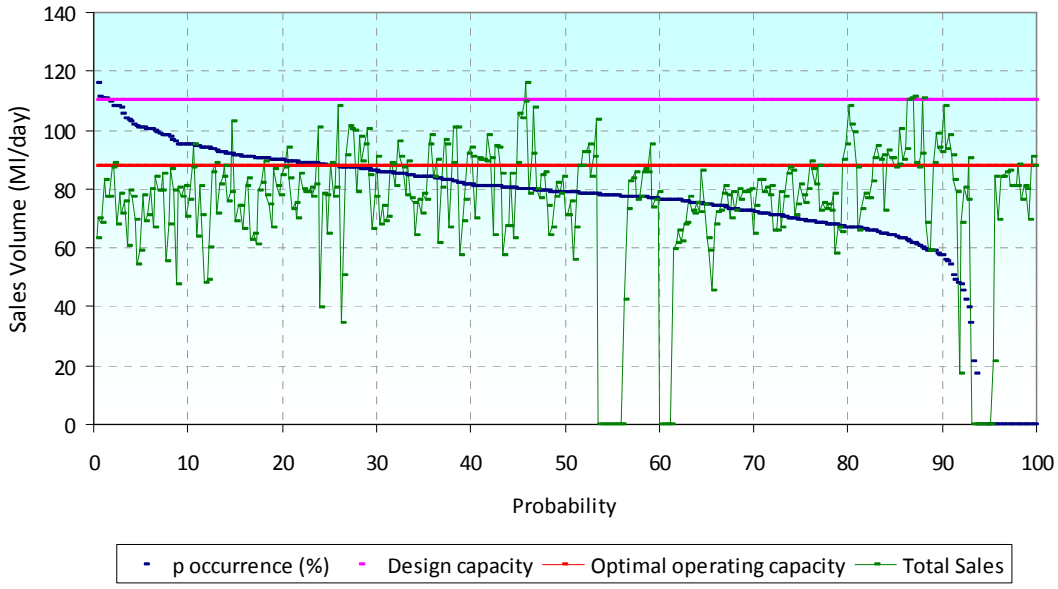

Figure 5.16 Analysis of historical production at D.V. Harris WTP (November 2009 to October 2010).

Wartburg Sub-System

Msunduzi Supply

The current supply to Msunduzi is approximately 30 Ml/day. Besides infill residential development, no major developments are planned that will impact substantially on the storage requirement at Claridge Reservoir.

'69 Pipeline: Claridge Reservoir to Wartburg Reservoir

In 2008 planning was undertaken to supply Efaye and Ozwathini from the Wartburg system. However, with the proposed Ozwathini Bulk Water Supply Scheme (**Section 7.31**), it is anticipated that Ozwathini will only require a supply from the Wartburg System around 2030. Additional groundwater is being sourced for Efaye. Assuming that Efaye and Ozwathini will be supplied by these alternative sources, then the initial upgrade (Phase 1) of the '69 Pipeline needs to be sized to cater for demands up to 2030.

The maximum flow that this pipeline can accommodate is 8.5 Ml/day, while the current demand is 8.0 Ml/day. Flows in this section of pipeline are driven primarily by the growth in demand at Bruyns Hill Reservoir which serves Swayimana. To accommodate future growth, the '69 Pipeline will need to be upgraded. In 2015, this demand is expected to increase to 10.5 Ml/day.

Wartburg Reservoir to Bruyns Hill Reservoir

The Wartburg Reservoir functions primarily as a bulk reservoir for Bruyns Hill and Cool Air Reservoir. To function as a bulk reservoir, it should have 15 hours of the AADD supply to Cool Air and Bruyns Hill Reservoirs.

Currently the demand is approximately 5.6 Ml/day which equates to about 9 hours of storage. The storage capacity at Wartburg Reservoir will have to be increased to satisfy current and future demand.