4. SYSTEMS ENERGY ANALYSIS

4.1 Overview

Recent IMP developments have identified a need to focus attention on the regional connections between water and energy infrastructure. The energy efficiency of water supply cannot be optimised unless the impact of infrastructure, on energy use, is understood. With this in mind, an analysis of energy use is provided in this section and shows the energy "cost" of regional and local water supply.

Umgeni Water's operational area consists of the following systems which are discussed in detail in **Section 6**:

- Upper Mgeni (**Section 6.2.1**)
- Lower Mgeni (**Section 6.2.2**)
- Mkhomazi (Ixopo) (**Section 6.3**)
- South Coast (**Section 6.4**)
- North Coast (**Section 6.5**)

This section focuses on the period July 2015 to June 2016 and for areas where information was not available, the closest full year cycle was used. The Spring Grove inter-basin transfer to Midmar Dam was not included in the analysis as the Trans-Caledon Tunnel Authority (TCTA), the implementing agent for DWS was responsible for the power and pumping costs for the analysis period. The responsibility for settling the power and pumping costs is in the process of being handed over to Umgeni Water and once this is transferred it will be included into the Upper Mgeni System. Values indicated in this section are an indication of power use and some values have been averaged due to the lack of available meter readings.

Figure 4.1 indicates the power usage per system. An average of 156 MWh is used across all systems within Umgeni Water to produce approximately 450 000 Mℓ per annum. The two systems with the highest power usage are the Upper and Lower Mgeni systems and their combined systems account for 89.9% of water produced and 88.6% of total power usage. The majority of water produced by these systems supplies the uMgungundlovu and eThekwini municipalities with a smaller percentage being supplied to the southern coastal area.

Energy Intensity graphs have been compiled to compare the different systems and is an indication of the rate at which power is consumed to produce water i.e. kWh per Kℓ. This will be used as a comparison across the different infrastructure components and systems to compare power usage.

Figure 4.2 represents the different power intensity rates for the Umgeni Water systems. The average energy requirement is 0.34 kWh/kℓ. The North Coast and the Upper Mgeni systems are above the average requirement with the North Coast being approximately 2.5 times the average.

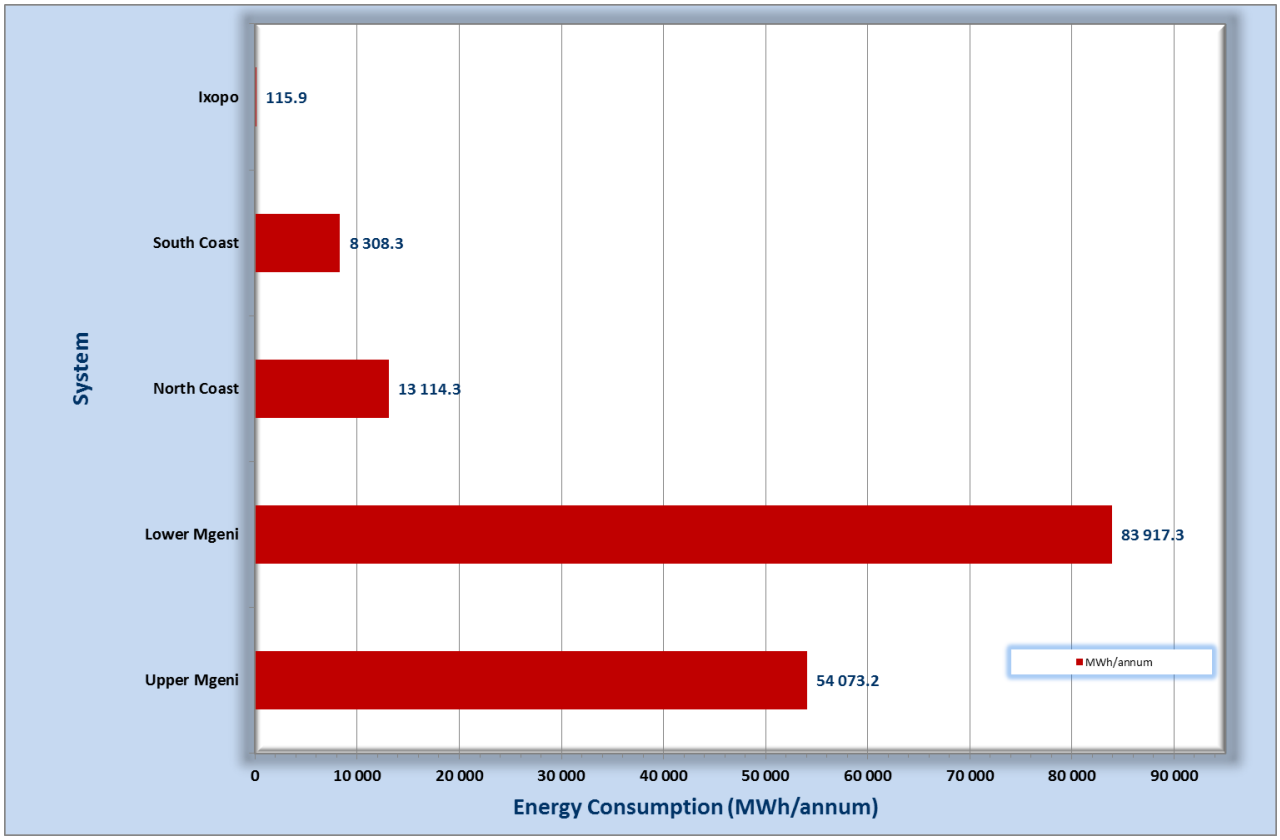

Figure 4.1 Total Energy Consumption for Umgeni Water Systems 2015/16.

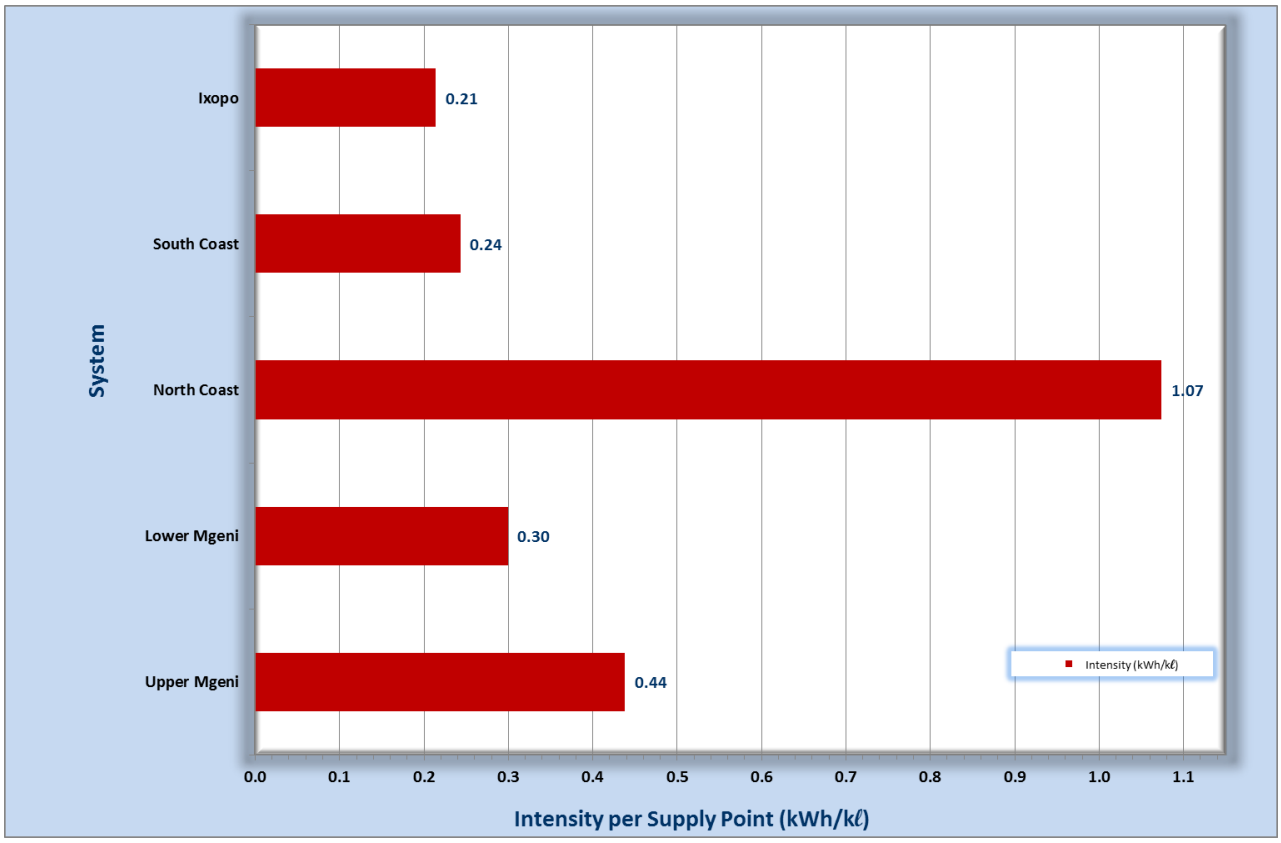

Figure 4.2 Energy requirement to treat water in Umgeni Water Systems 2015/16.

4.2 Energy Usage per Infrastructure Component

The analysis is further broken down per Umgeni Water's individual infrastructure components (mainly WTP's and Pump Stations) across the area of supply (**Figure 4.3**).

As shown in **Figure 4.3** and **Figure 4.4**, the largest power consumers across all the Umgeni Water systems is the Wiggins High Lift Pump Station with an annual consumption of approximately 22 000 MWh per annum followed by Inanda Pump Station, Durban Heights Shaft Pumps and Mearns Pump Station.

4.3 Energy Intensity per Supply Point

To further illustrate the power intensity usage across Umgeni Waters Supply area, the energy requirement was further analysed per supply point and is illustrated in **Figure 4.5**. This graph provides an indicative cost per kilolitre in terms of energy usage from source to supply point.

Figure 4.5 indicates the most expensive points of supply, in terms of energy usage, throughout all Umgeni Water's supply areas. The average energy requirement is 1.2 kWh/kℓ and 16 of the 49 supply points are supplied at a rate above the average.

The highest energy requirement per kilolitre of water supplied is the Midmar to Vulindlela Reservoir 5 with an energy requirement of 5.33 kWh/kℓ followed by the supply to Ndwedwe Reservoir 5 from Hazelmere WTP.

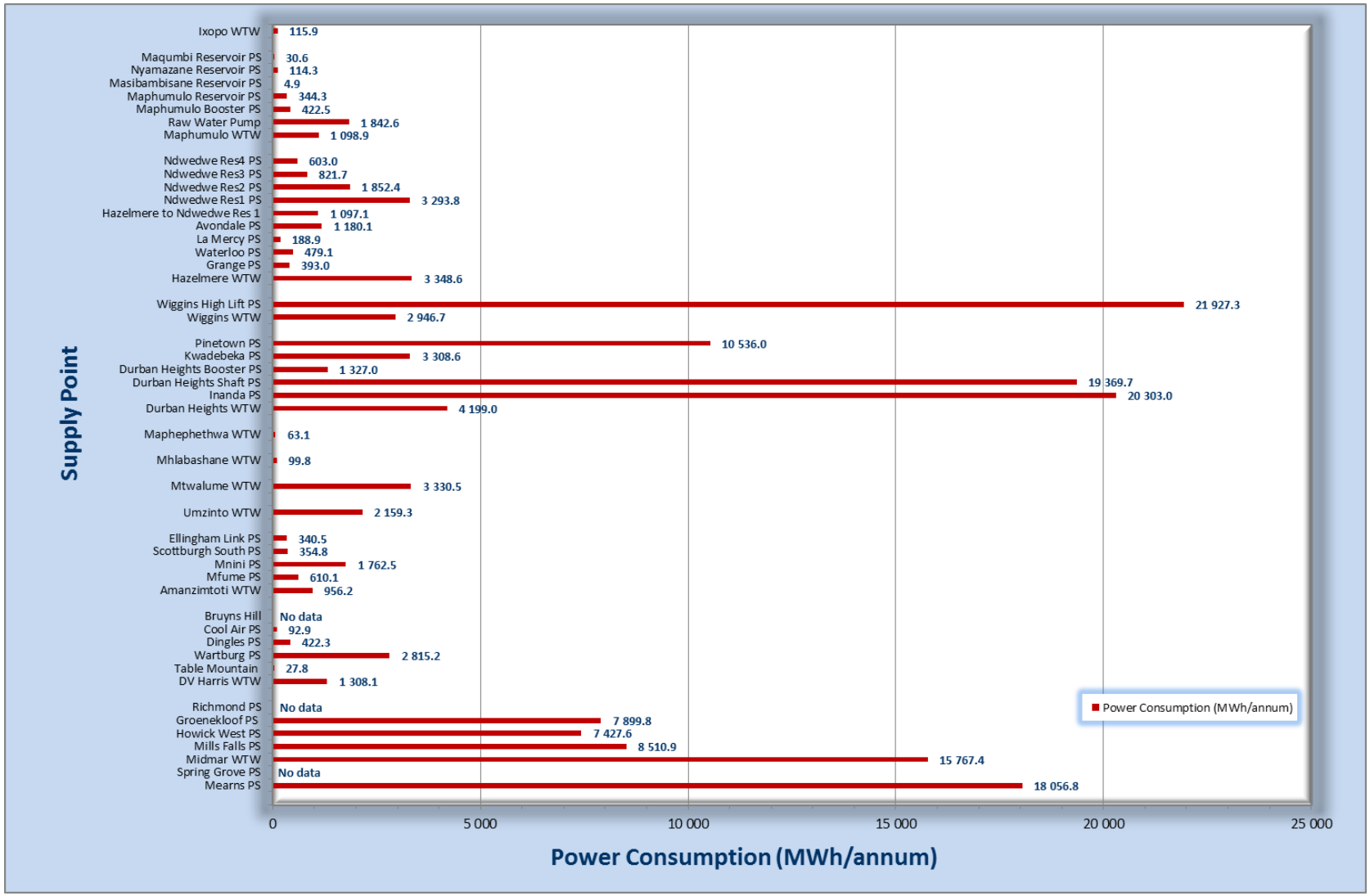

Figure 4.3 Annual Power Usage Comparison Umgeni Water Installations.

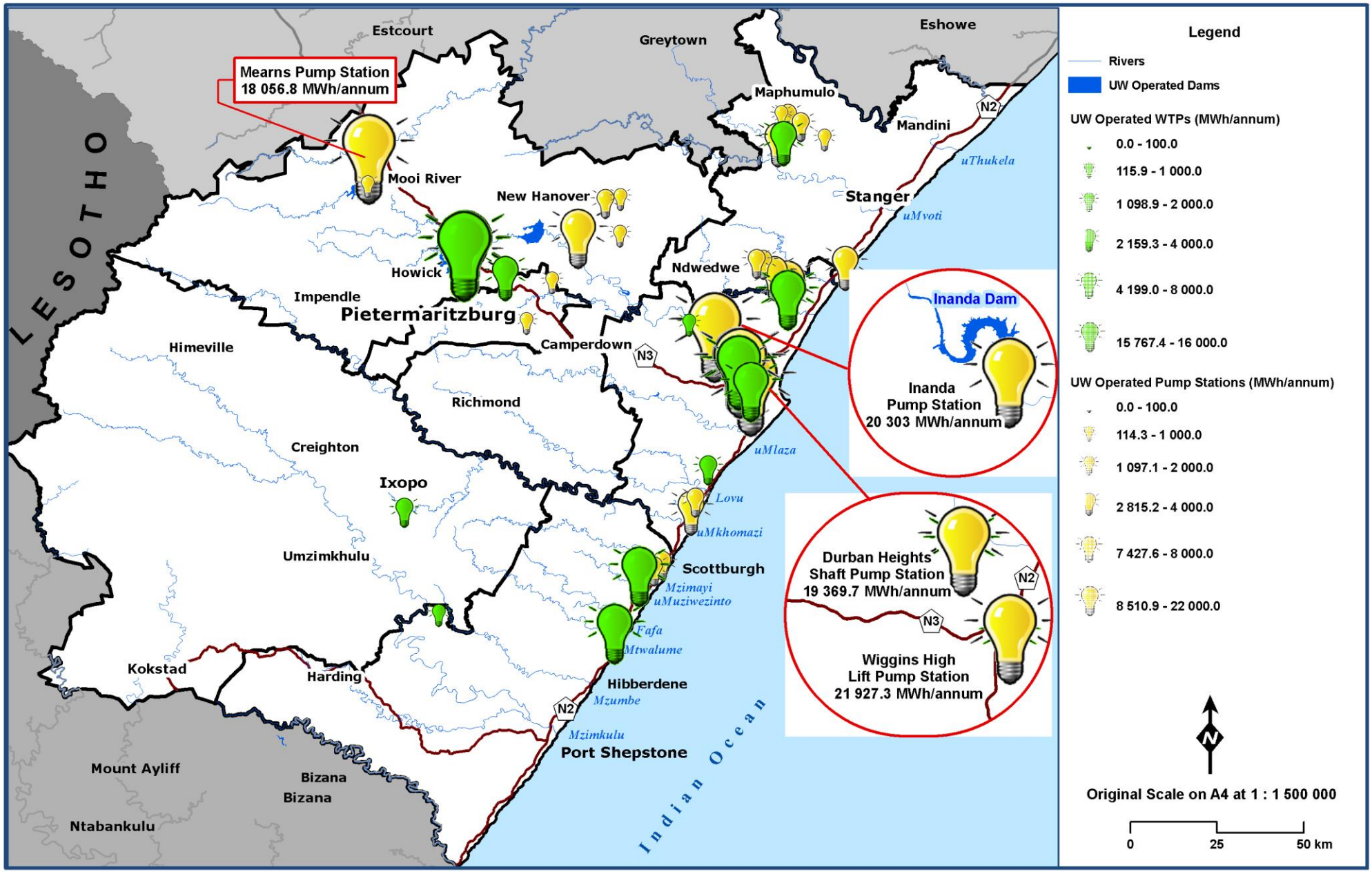

Figure 4.4 Distribution of the highest energy consumers.

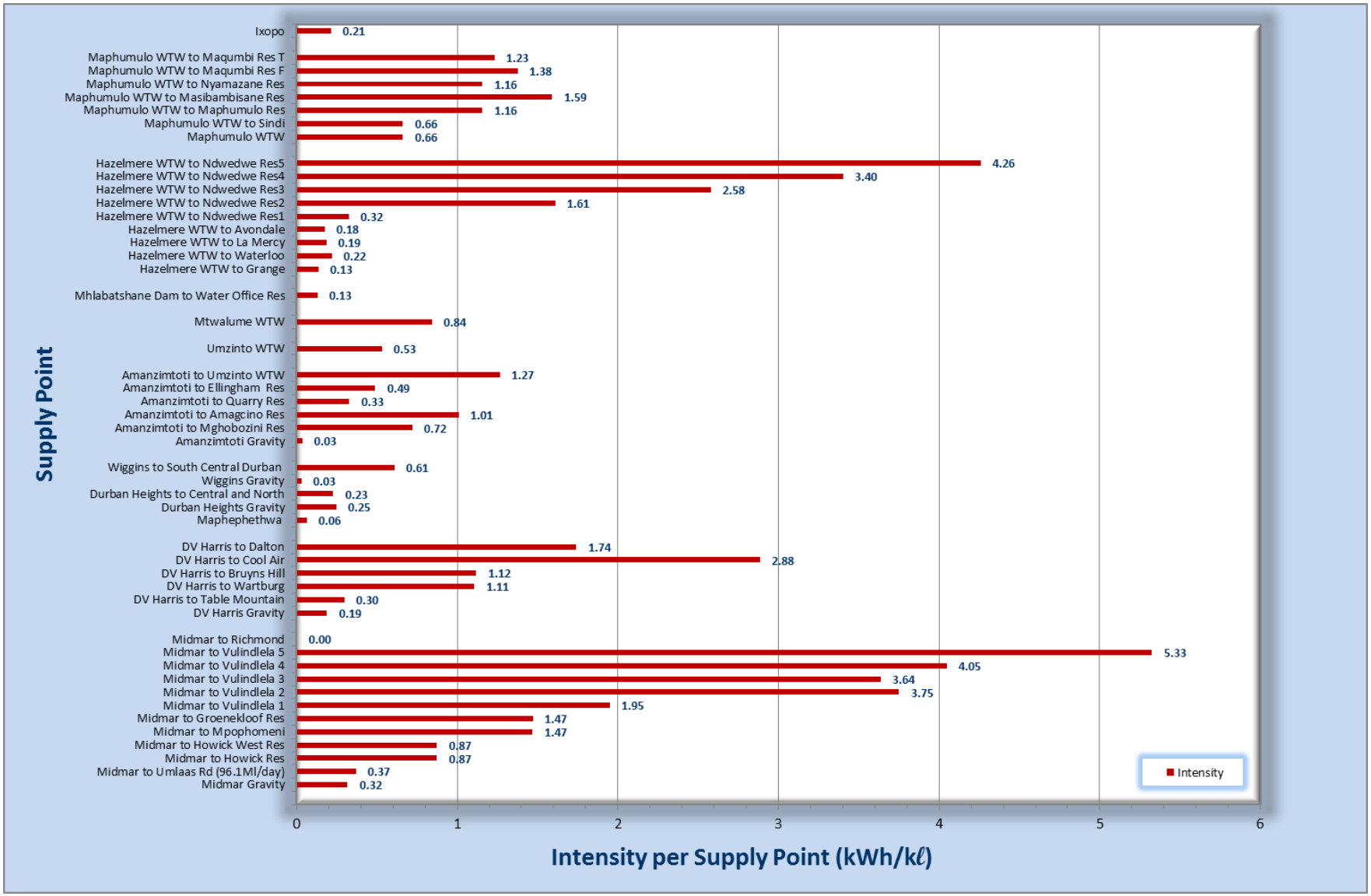

Figure 4.5 Annual Energy Requirement per Supply Point.

4.4 Observations and Recommendations

The two most energy intensive systems in the Umgeni Water supply area are the supply to the Vulindlela area from Midmar Dam and the supply to the Ndwedwe area from the Hazelmere Dam.

Apart from Durban Heights WTP, the highest energy use per annum is from the high lift pump stations that deliver raw water to the systems.

Monitoring of the energy usage throughout the organisation is conducted by the Operations Division and detailed records are kept in the majority of the areas.

Certain installations, such as Hazelmere WTP, receive a consolidated billing account. This cannot be used to accurately measure the cost of supply to the various areas supplied by this WTP.

The following recommendations are made to better monitor and improve the energy usage throughout the supply area:

- Electrical and flow meters be installed and monitored in all Umgeni Water's pump stations.
- The electrical meters can be used as check meters as there is no means to currently verify the readings supplied by the power suppliers.
- Monitoring of the energy usage will provide an early warning sign to mechanical wear on pumps and maintenance can be planned timeously.
- Umgeni Water can also investigate the use of power saving technology to reduce its carbon footprint and operational costs.