REPUBLIC OF NAMBIA

MINISTRY OF AGRICULTURE, WATER AND FORESTRY

DIRECTORATE OF WATER RESOURCE MANAGEMENT

DIVISION GEOHYDROLOGY

06 October 2016

STAMPRIET ALLOCATION REPORT

Author: Gettie Mulokoshi

Contents

1. INTRODUCTION

Stampriet is a pproximately 71 000 km^2. The Auob Aquifer has the highest potential, followed by the Kalahari Aquifer, while the Nossob Aquifer shows the lowest potential. Groundwater in each aquifer flows from NW to SE and it was estimated that it takes several thousand years to flow through the whole basin. The major recharge into the basin occurs via direct rainfall feeding the rivers and fractures as well as the karstic sinkholes that are situated on the rim of the basin. Recharge via these features and structures feed the Kalahari Aquifer directly and this amounts to **105 x 10^6 m^3/a** in an average rainfall per year and **1.550 x 10^6 m^3/a** during an exceptional rainfall event (on average 1/50 years). Recharge into the Auob Aquifer via the Kalahari Aquifer and the Kalkrand Basalts does occur but this is mainly during the exceptional rainfall events. Recharge into the Nossob Aquifer is negligible and most of the resource in the Nossob Aquifer can be regarded as fossil water.Under average rainfall conditions, the water level of the Kalahari Aquifer decreases by 5cm/a on average. Even though a 1/50 year heavy rainfall event does reverse the drawdown to some degree for a limited period, it does not prevent the longer term water-level decline under the present conditions.Groundwater recharge volume is up to 0.5% of total rainfall during a normal rainfall event and 3% during a 1/50 year heavy rainfall event. Most of the rainfall is lost by evapotransipration. This is exacerbated by the large amount of alien vegetation and attention should be paid to solving this problem. Of the total groundwater abstracted from the Basin, approximately one half of the volume of $15x10^6$ m^3/a is used for irrigation ($6.88x10^6$ m^3/a). Approximately 78% of the total irrigation use is concentrated in the Stampriet area. Of the groundwater abstraction from the Basin annually, 66% is from the Kalahari aquifer, 33% from the Auob Aquifer and only 1% from the Nossob Aquifer respectively.

2. JICA RECOMMENDATIONS

Farmers who intend to operate irrigation farming over one hectare or more have to get permission for the water allocation from DWAF. At present (2002) 54 irrigation permits where approved for

commercial farms in the Stampriet Basin amounting 8.27 Mm^3/a. Although the total irrigation water use is **6.87 Mm^3/a** , an excessive water use is practiced illegally at 9 farms.Present (2002) groundwater use in the basin amounts to 15 Mm^3/a (domestic 2.4 Mm^3/a, stock watering 5.7 Mm^3/a and irrigation 6.9 Mm^3/a

Reduction target of groundwater extraction

According to the groundwater simulation results, a 50% reduction of the current irrigation water use is required to sustain the groundwater level. However, an immediate reduction by half the current use is not practical. Therefore, as the first step, a 30% reduction should be reasonable target for the control of groundwater extraction.

Action Plan

- Awareness of sustainable groundwater use
- Observation of water extraction volume.
- Review of the Permit system
- Reduction of irrigation area
- Conversion of cultivation crops
- Voluntary reduction by water users
- Application of efficient irrigation method
- Pricing of groundwater

Although the plan targets the entire Basin area, serious drawdown is observed in the limited area around Stampriet area this area is tentatively called the Special Groundwater Monitoring Area. GW monitoring should give special attention to this area, while still covering the entire area of the basin.

3. STAMPRIET DWAF PERMIT ALLOCATIONS (2016)

- A total of 103 farms have been allocated abstraction permits (amount doubled from 2002)

- 11 833 040 m^3/a has been allocated
- 65 valid licenses
- 38 expired licenses, no formal cancellation has been received. There is a chance irrigation continues.

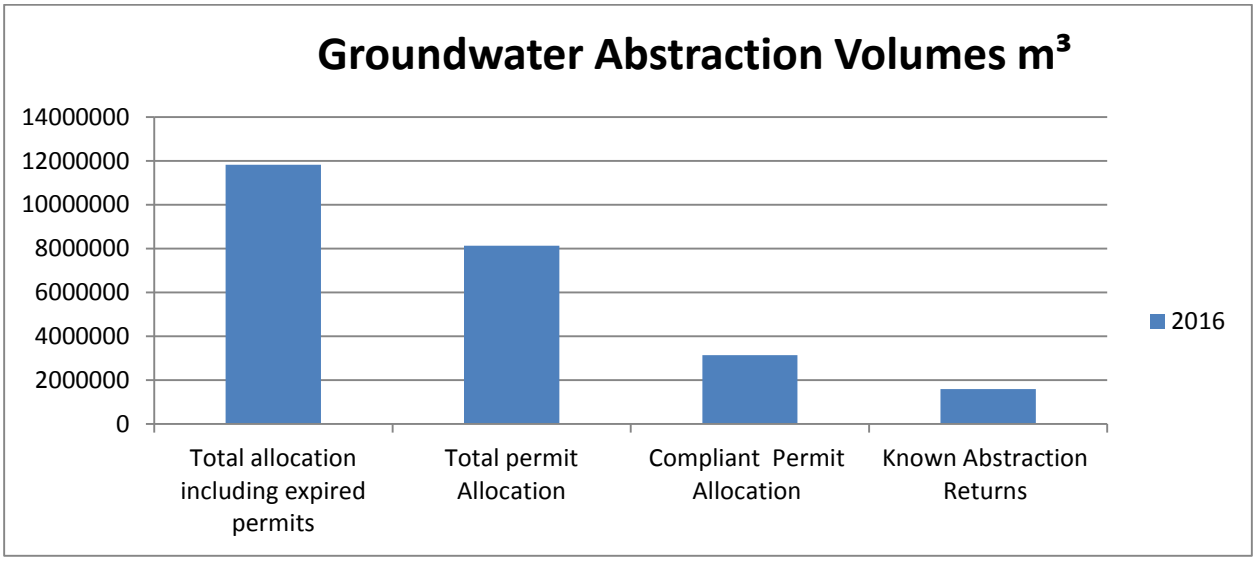

Figure 1: Groundwater abstraction volumes 2016

The total allocation refers to the all the valid permits issued by Law Administration, as well as all the expired permits (validity period passed) and no legal cancellation of permit has been received. Amongst these farmers some have been visited and confirmed that irrigation continues although the renewal was never submitted.

Total permit allocation refers to all the valid permits issues by Law Administration.

Compliant Permit Allocation refers to the applicants that have started sending in their monthly abstraction returns. The volumes refer to the permit allocation from Law admin, not the amount abstracted by the permit holder.

Known Abstraction Returns refers to the permit holders that send in monthly returns. However not all these permit holders have submitted complete returns. The volumes indicated are those received, not necessarily total volumes abstracted by the permit holders as some months no returns are received. One can thus assume this value to be much higher than indicated.

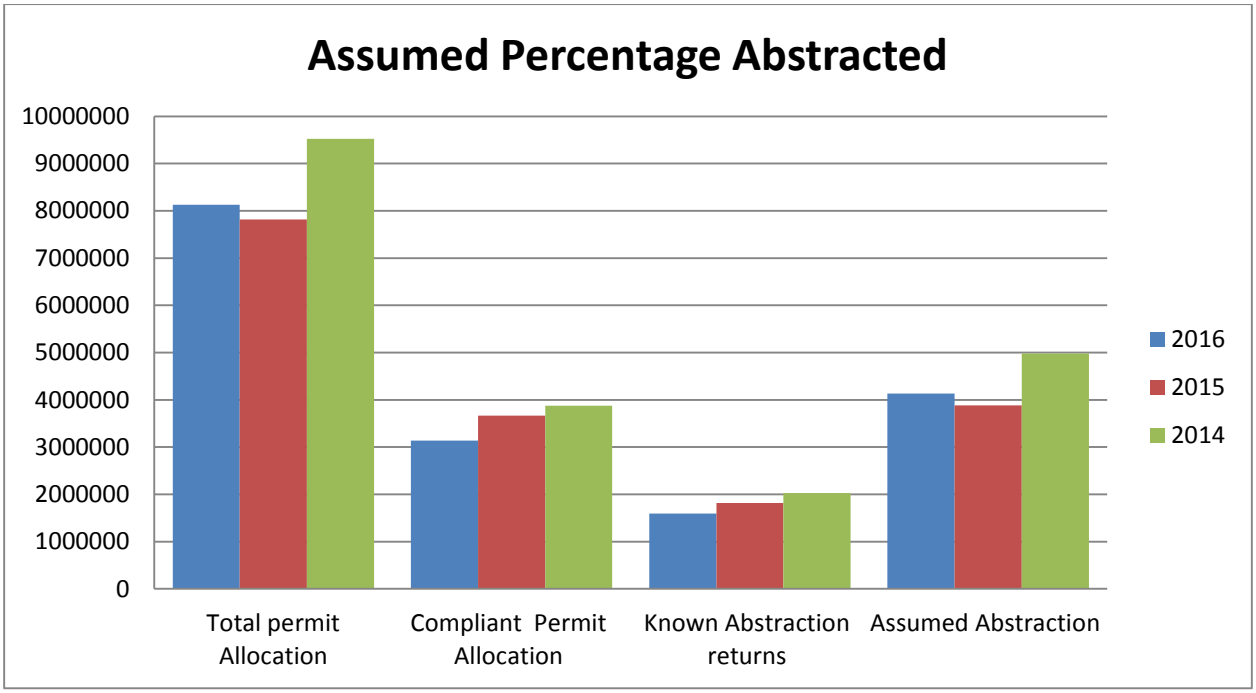

Figure 2: Groundwater abstraction 2014-2016

Assumed percentage used was calculated as follows:

Known Abstraction returns / Compliant Permit allocation x 100 = ***x***

(***x*** xTotal permit allocation)/100 = Assumed abstraction

However this method has a huge level of uncertainty and assumptions:

- Assumed that the known abstraction returns are complete for all the months.
- Assumed that all the other permit holders use the same percentage of the quota allocated to them as the complaint permit holders.
- This method does not take into consideration all illegal abstractions.

Hence one can conclude that the assumed abstraction is higher than indicated on the graph.

For 2016 11 833 040 m^3/a has been allocated for 103 permit holders, of which only 23 permit holders are complying, hence 77 % non compliance for Stampriet for 2016.

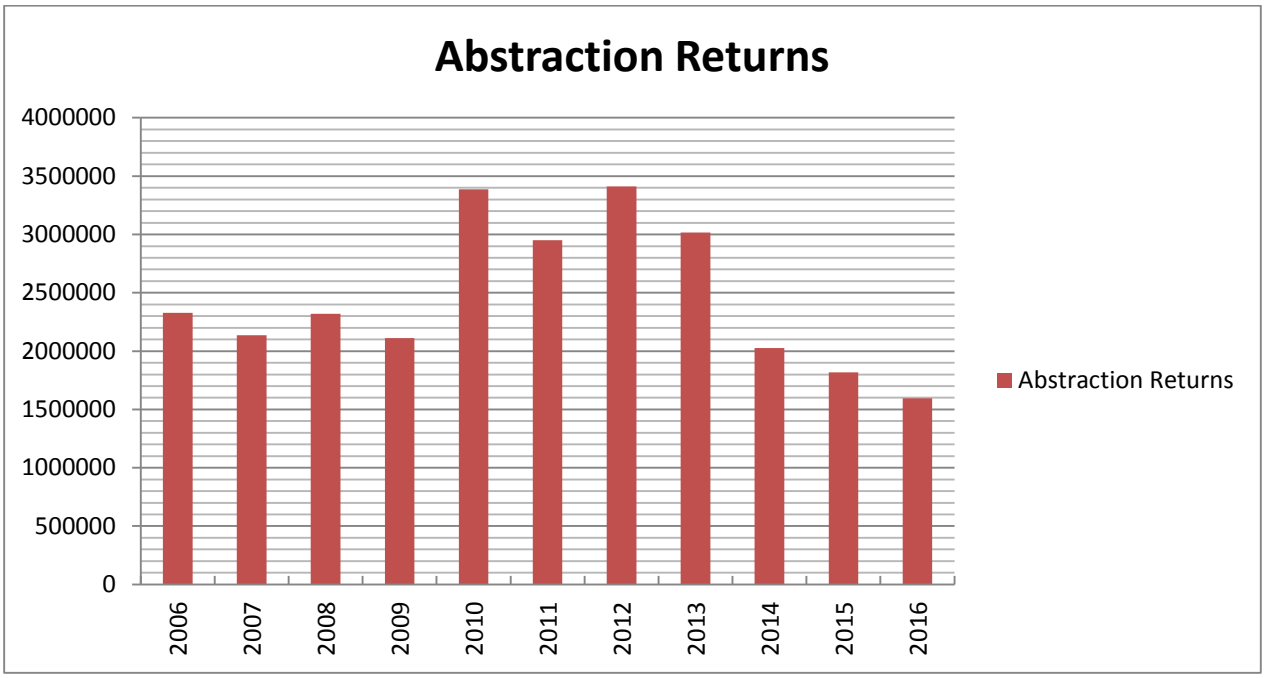

Figure 3: Abstraction returns

During 2010 to 2013 a good number of abstraction returns have been submitted; however there has been a decline in abstraction return submissions from 2014 to present.

4. IRRIGATION FARMS AND MONITORING DATA

Geohydrological studies, amongst others, require collection of water level data from numerous wells throughout the year to obtain the extent of fluctuation in groundwater table, functional wells that are pumped regularly cannot be used for water level monitoring and data collection.

Sustainable yield of an aquifer refers to the total quantity of water it can yield i.e. total number of wells it can support without causing any unacceptable lowering of the regional water table over a long period. The yield of an aquifer eventually depends upon its size, permeability and annual recharge received by the same. Ideally, the quantity of water extracted annually from an aquifer should be less than or equal to the quantity of water received by the aquifer annually through recharge. If more water is extracted every year, naturally, the water table would start falling eventually turning the yield of the aquifer unsustainable and thus reducing the yields of the existing wells. Water table undergoes a seasonal fluctuation following a natural cycle. Water table rises during rainy season due to recharge received from rainfall and falls back during summer season due to lack of recharge and continuing extraction of groundwater. Groundwater in Stampriet is falling (receding or declining) this means that the annual groundwater extraction exceeds the annual groundwater recharge. The excess water extracted in such a situation comes from the groundwater dead storage built up over many years and hence the over-extraction is known as groundwater mining.

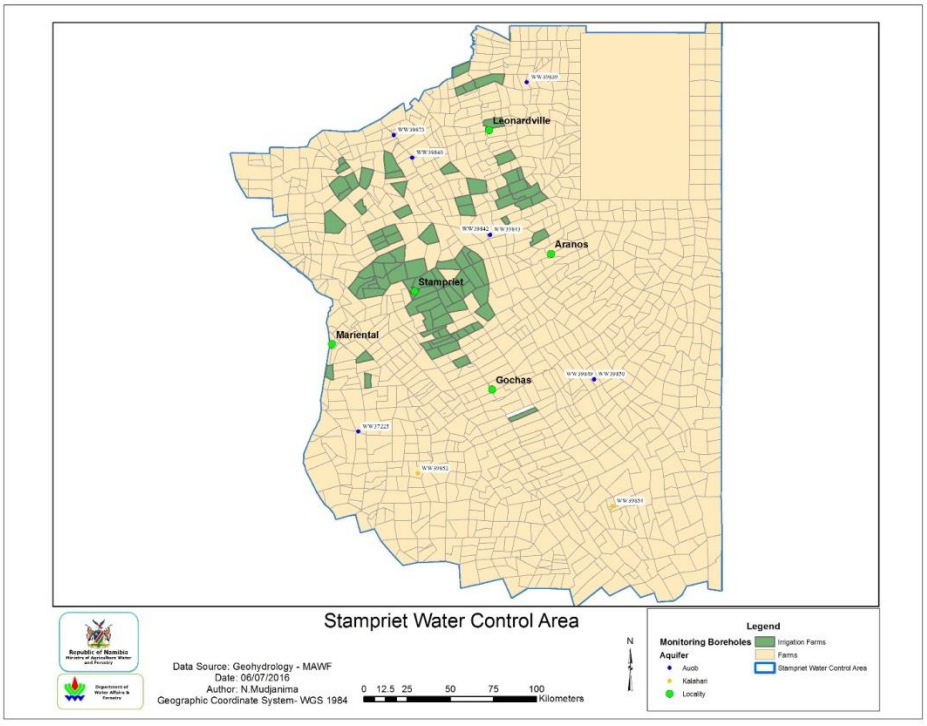

Figure 4: Irrigation farms and Monitoring boreholes

4.1Auob Aquifer

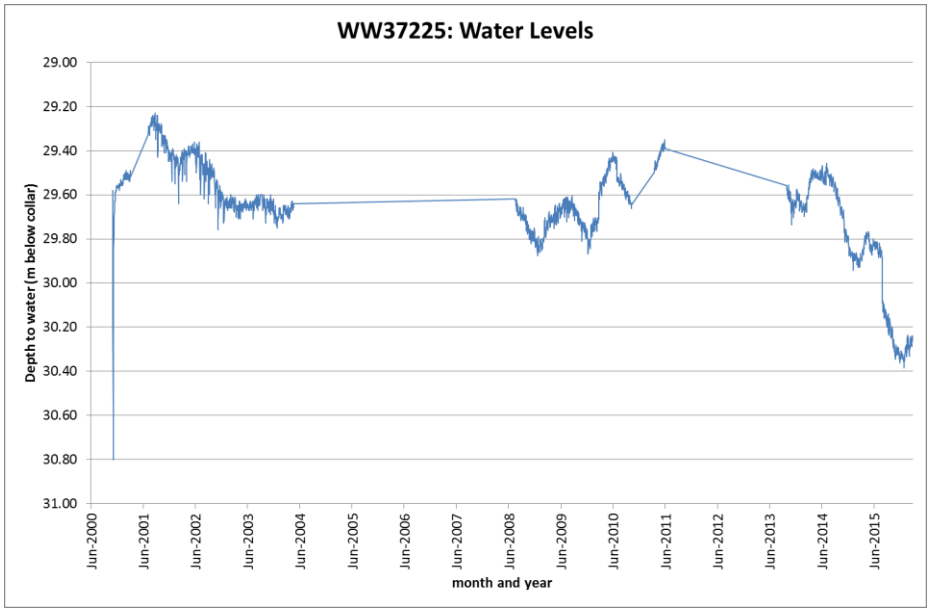

Figure 5: WW37225

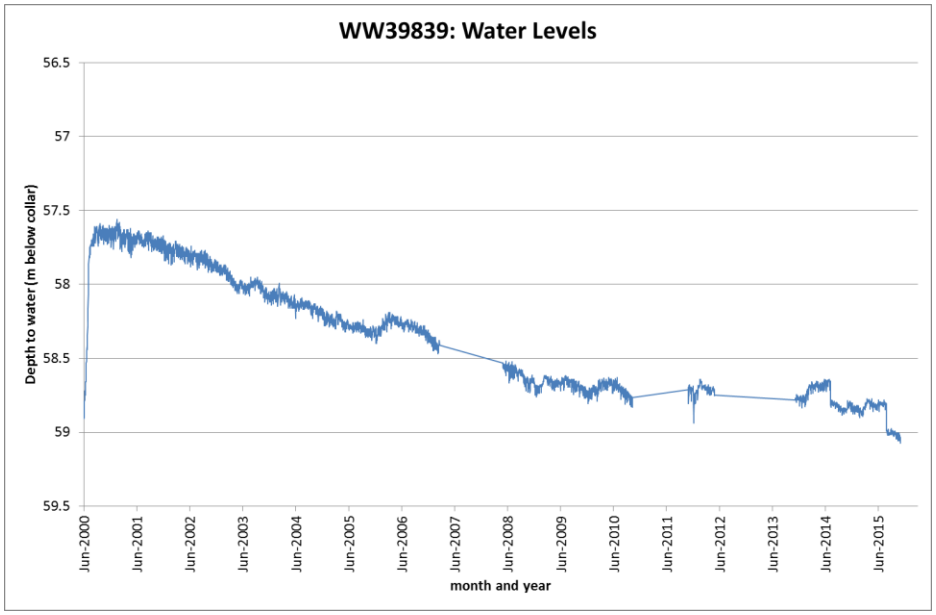

Figure 6: WW39839

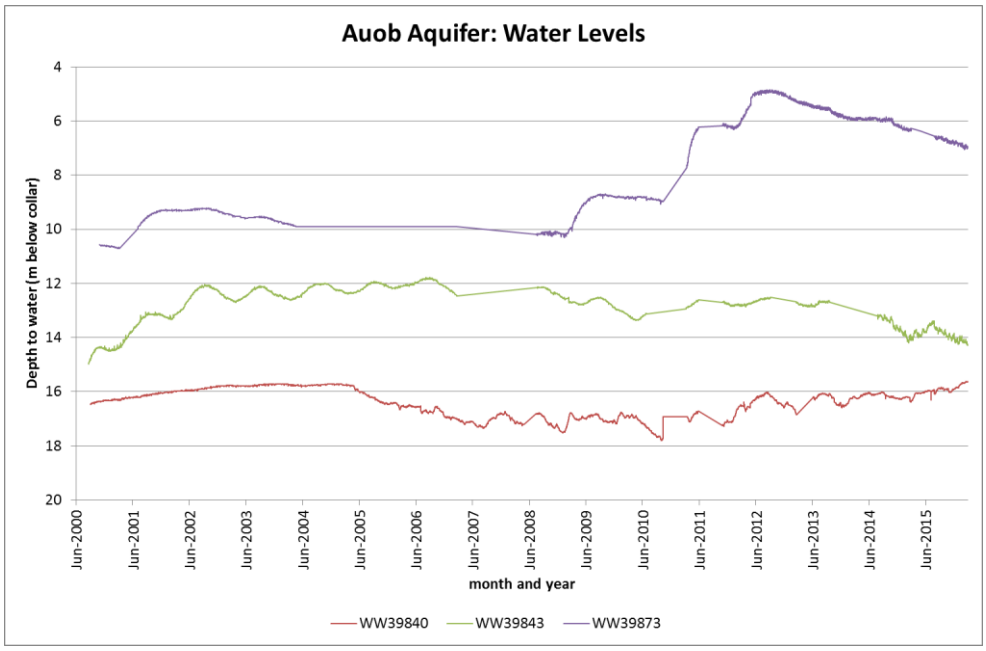

Figure 7:WW39840, WW39843 and WW39873

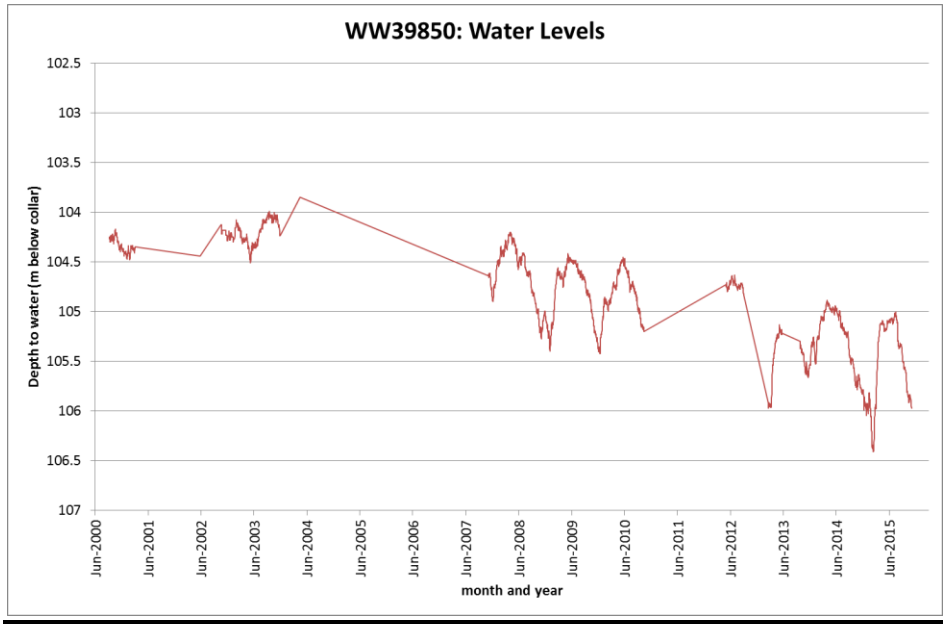

Figure 8: WW39850

4.2 Kalahari Aquifer

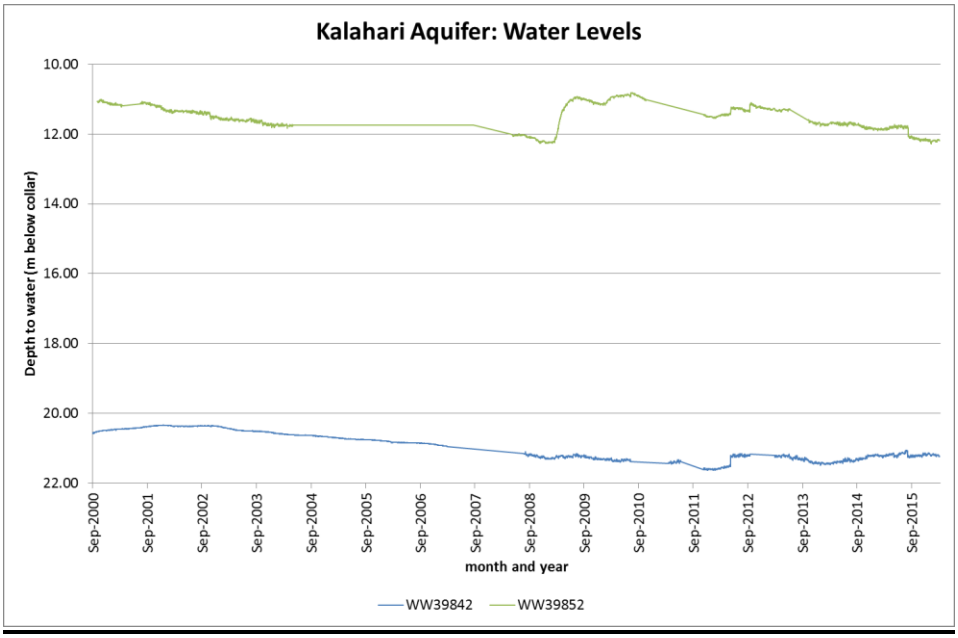

Figure 9: WW39842 and WW39852

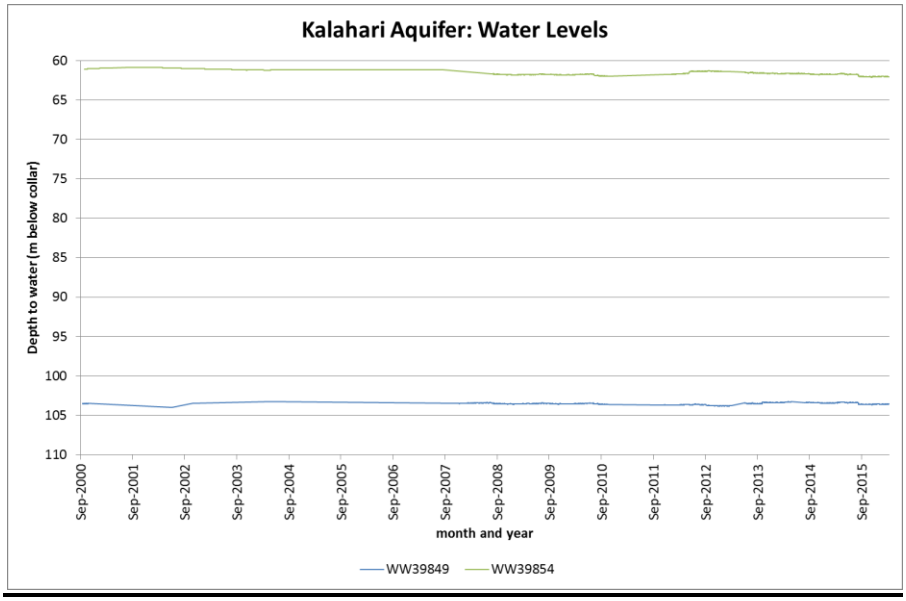

Figure 10: WW39849 and WW39854

5. CONCLUSIONS

The Geohydrology Division came to a decision to reject all new applications as well as increases for abstraction of groundwater in the Stampriet basin, due to the alarming groundwater level decline and huge quota allocation. There is no doubt that at the present level of groundwater extraction, the water table in Stamprietwould continue to fall. The moratorium on new applications as well as increases for abstraction of groundwater in the Stampriet basin is logical and helpful and at best would stabilize the present level of extraction. The prime cause of over-exploitation is the rising demand for groundwater. For sustainable utilization of groundwater, only that much water should be extracted which is replenished every year by rainfall through groundwater recharge. To achieve this, we must either reduce our groundwater extraction (demand side management) or increase recharge to the extent possible by adapting artificial recharge measures (supply side management). Else, the groundwater table will continue to fall.

Phase II of the GGRETA project has been approved, of which one of the Outcomes is to **improve resource knowledge and monitoring based on recognition of the importance and vulnerability of transboundary groundwater resources**. The duration of this phase is June 2016 – December 2018.

During Phase II:

- Conceptual model will be revised.
- Joint harmonized modern multi-purpose aquifer monitoring database will be developed.

In order to assist in this study, the Geohydrology division identified that the volumes allocated for abstraction are extremely high, and 77% of permit holders are non-compliant. This makes it impossible to regulate and sustainably manage the aquifer. The Geohydrology Division is exercising great caution in giving out new permits. Every application will be dealt with differently considering the economic inputs.