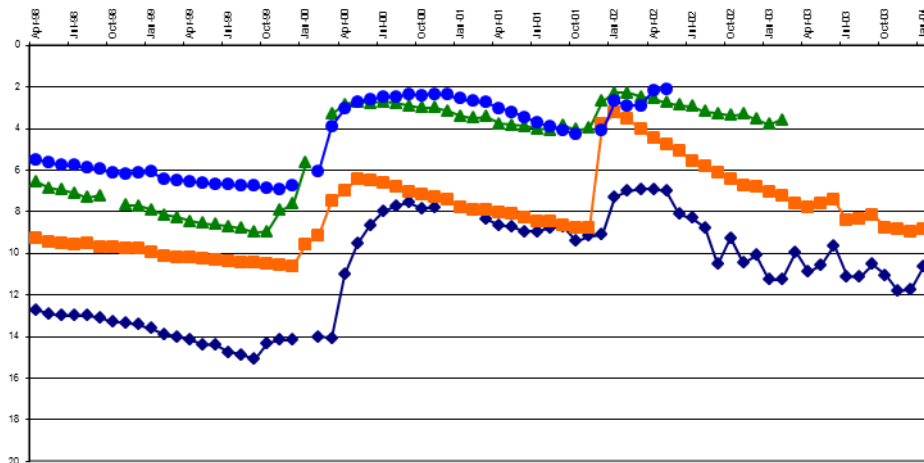


LIMPOPO REGION

QUARTERLY STATUS REPORT ON GROUNDWATER LEVEL TRENDS



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**DIRECTORATE
PLANNING AND INFORMATION
DECEMBER 2015**

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TABLE OF CONTENTS

SUMMARY

- 1. BACKGROUND**
- 2. GROUNDWATER LEVELS**
 - 2.1 DIFFERENCE IN GROUNDWATER LEVELS; SEPTEMBER 2014 TO SEPTEMBER 2015**
 - 2.2 PERCENTAGE OF MONITORING STATIONS WITH LOWER WATER LEVELS SEPTEMBER TO SEPTEMBER OVER THE PAST EIGHT YEARS**
- 3. COMPARISON OF THE ANNUAL GROUNDWATER LEVELS AT THE END OF SEPTEMBER IN THE DIFFERENT SECONDARY DRAINAGE AREAS**
 - 3.1 DRAINAGE A4**
 - 3.2 DRAINAGE A5**
 - 3.3 DRAINAGE A6**
 - 3.4 DRAINAGE A7**
 - 3.5 DRAINAGE A8**
 - 3.6 DRAINAGE A9**
 - 3.7 DRAINAGE B3**
 - 3.8 DRAINAGE B5**
 - 3.9 DRAINAGE B7**
 - 3.10 DRAINAGE B8**
 - 3.11 DRAINAGE B9**
- 4. LONG-TERM PERSPECTIVE**
 - 4.1 LONG-TERM GROUNDWATER LEVEL TREND AT A7 STERKLOOP PUMP STATION**
- 5. AREAS POSSIBLY AT RISK DURING DROUGHT SITUATION**
- 6. SEASONAL FORECAST**
- 7. IMPORTANCE OF GROUNDWATER MONITORING AND RESOURCE MANAGEMENT**
- 8. ACKNOWLEDGEMENTS**

LIST OF MAPS

MAP 1: DISTRIBUTION OF GROUNDWATER MONITORING NETWORK STATIONS IN LIMPOPO

MAP 2: DIFFERENCE IN GROUNDWATER LEVELS; END OF SEPTEMBER 2014 TO END OF SEPTEMBER 2015

MAP 3: DECLINE IN WATER LEVELS END OF SEPTEMBER 2014 TO END OF SEPTEMBER 2015

**MAP 4: AVERAGE ANNUAL DECLINE IN IN GROUNDWATER LEVELS AT MONITORING STATIONS INDICATING A
CONSTANT DECLINE WITH NO APPARENT RECHARGE OVER THREE TO SEVEN YEARS**

LIST OF GRAPHS

**GRAPH 1: PERCENTAGE MONITORING STATIONS INDICATING LOWER GROUNDWATER LEVELS THAN THE
CORRESPONDING TIME THE PREVIOUS YEAR OVER THE PAST EIGHT SEASONS**

GRAPH 2: A4 DRAINAGE; COMPARISON OF ANNUAL GROUNDWATER LEVELS AT THE END OF SEPTEMBER

**GRAPH 3: ANNUAL GROUNDWATER LEVELS AT THE END OF SEPTEMBER AT SOME STATIONS IN THE A4
DRAINAGE**

GRAPH 4: A5 DRAINAGE; COMPARISON OF ANNUAL GROUNDWATER LEVELS AT THE END OF SEPTEMBER

**GRAPH 5: COMPARISON OF ANNUAL GROUNDWATER LEVEL AT THE END OF SEPTEMBER AT STATION A5
SETATENG**

GRAPH 6: A6 DRAINAGE; COMPARISON OF ANNUAL GROUNDWATER LEVELS AT THE END OF SEPTEMBER

**GRAPH 7: COMPARISON OF ANNUAL GROUNDWATER LEVEL AT THE END OF SEPTEMBER AT STATION A6
TOLWE**

GRAPH 8: A7 DRAINAGE; COMPARISON OF ANNUAL GROUNDWATER LEVELS AT THE END OF SEPTEMBER

**GRAPH 9: COMPARISON OF ANNUAL GROUNDWATER LEVEL AT THE END OF SEPTEMBER AT STATIONS A7
BEAULY AND A7 LANGJAN**

GRAPH 10: A8 DRAINAGE; COMPARISON OF ANNUAL GROUNDWATER LEVELS AT THE END OF SEPTEMBER

**GRAPH 11: COMPARISON OF ANNUAL GROUNDWATER LEVEL AT THE END OF SEPTEMBER AT STATION A8
MABVETE**

GRAPH 12: A9 DRAINAGE; COMPARISON OF ANNUAL GROUNDWATER LEVELS AT THE END OF SEPTEMBER

**GRAPH 13: COMPARISON OF ANNUAL GROUNDWATER LEVEL AT THE END OF SEPTEMBER AT STATIONS A9
TSHILAMUSI 2 AND A9 TSHIKUYA 2**

GRAPH 14: B3 DRAINAGE; COMPARISON OF ANNUAL GROUNDWATER LEVELS AT THE END OF SEPTEMBER

**GRAPH 15: COMPARISON OF ANNUAL GROUNDWATER LEVEL AT THE END OF SEPTEMBER AT STATIONS B3
DE KUIL 2, B3 SETTLERS 2, B3 SETTLERS AND B3 TUINPLAAS**

GRAPH 16: B5 DRAINAGE; COMPARISON OF ANNUAL GROUNDWATER LEVELS AT THE END OF SEPTEMBER

**GRAPH 17: COMPARISON OF ANNUAL GROUNDWATER LEVEL AT THE END OF SEPTEMBER AT STATIONS B5
DITHLOPANENG, B5 ELANDSKRAAL, B5 MAOLOLO, B5 MMATSEKELE AND B5 MARULANENG**

GRAPH 18: B7 DRAINAGE; COMPARISON OF ANNUAL GROUNDWATER LEVELS AT THE END OF SEPTEMBER

**GRAPH 19: COMPARISON OF ANNUAL GROUNDWATER LEVEL AT THE END OF SEPTEMBER AT STATIONS B7
MICA, B7 THE WILLOWS 2 AND B7 RUBBERVALE**

GRAPH 20: B8 DRAINAGE; COMPARISON OF ANNUAL GROUNDWATER LEVELS AT THE END OF SEPTEMBER

GRAPH 21: COMPARISON OF ANNUAL GROUNDWATER LEVEL AT THE END OF SEPTEMBER AT STATIONS B8 SIKHUNYANE, B8 SEKGOPO AND B8 VUHELI

GRAPH 22: B9 DRAINAGE; COMPARISON OF ANNUAL GROUNDWATER LEVELS AT THE END OF SEPTEMBER

GRAPH 23: COMPARISON OF ANNUAL GROUNDWATER LEVEL AT THE END OF SEPTEMBER AT STATION B9 HALAHALA

GRAPH 24; GROUNDWATER LEVEL TIME SERIES OF A7 STERKLOOP PUMP STATION

GRAPH 25: GROUNDWATER LEVEL TREND AT STATION B8 SEKGOPO

LIST OF FIGURES

FIGURE 1: SOUTH AFRICAN WEATHER SERVICES SEASONAL FORECAST

LIST OF TABLES

TABLE 1: DIFFERENCE IN GROUNDWATER LEVELS: SEPTEMBER 2014 TO SEPTEMBER 2015

SUMMARY

The report reflects the status at the end of the hydrological year. Due to the drought conditions currently experienced the focus is more on declining groundwater levels, comparison with the status at corresponding periods the past few years and possible risk areas. Groundwater levels at 79.56% of stations monitored have declined over the past year, end of September to end of September. Very limited to no recharge occurred the previous wet season. There is a marked start in decline since August 2014 at a large number of stations. Despite this, the groundwater levels at the majority of stations are relatively stable over the medium term displaying seasonal fluctuations with even some rising levels. The current declining trends are mostly considered as a normal cycle and not a real concern at this point in time as comparison with long-term data indicating a still healthy status at most stations. Except for the start of decline since August 2014 the effect of the drought has not impacted significantly yet at most stations. If the dry weather prevails the situation may change rapidly.

Some stations concentrated in three clearly recognisable areas have been characterised by very little to no recharge for some years now. These areas are considered to be the areas most at risk to drought conditions and should be closely monitored. A high probability exists in these areas that boreholes may fail due to uncontrolled abstraction

Forecasts as provided by the South African Weather Services indicate 40 to 50% probability of below normal rainfall for the rest of the season. Resource management is of critical importance, especially in view of the already dry conditions and the current predictions.

1. BACKGROUND

The months July to September represents the 4th quarter of the hydrological year which is the second half of the dry season. Comparison is drawn between the current situation and the corresponding time the previous year as well as the situation over the past eight years in the different secondary drainage areas. A better perspective on the current status is provided by the long-term trend displayed at one of the monitoring stations. Considering the limited recharge the previous season as well as the current dry conditions the report focus more on declining trends than stable ones.

The distribution of the monitoring network is illustrated by **MAP 1**.

2. GROUNDWATER LEVELS

2.1. DIFFERENCE IN GROUNDWATER LEVELS; SEPTEMBER 2014 TO SEPTEMBER 2015

The groundwater levels at the majority of monitoring stations, 79.56%, are currently lower than that of the corresponding time last year. This is mainly due to limited recharge the previous season. Detail on the difference in groundwater levels over the past year is presented in table 1 below. The distribution of monitoring stations with higher or lower groundwater levels is illustrated by **MAP 2**. An indication of the amount of decline experienced at the different stations is indicated on **MAP3**. The map also gives an indication of the areas most affected by the limited recharge.

Sept 2014 to September 2015

Total	188	Stations

With data	181	Stations	96.3%
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Water level			Average(m%)	
Down	144	Stations	1.1	79.56%
Up	32	Stations	0.44	17.68%
Not considered due to pumping effects	5	Stations	3.5	2.76%
No Data	7	Stations		100.00%

TABLE 1

2.2 PERCENTAGE OF MONITORING STATIONS WITH LOWER WATER LEVELS SEPTEMBER TO SEPTEMBER OVER THE PAST EIGHT YEARS

Predominantly lower or higher groundwater levels from year to year is a normal trend and mostly depend on recharge the previous wet season as well as the specific time of the year that comparison is made. Most monitoring stations in Limpopo have data for the past seven to eight years and this period was selected to draw comparisons **TABLE 2** below. From the table it can be noted that the situation improved from 2007-2008 up to 2009-2010 where after the percentage with lower water levels increased to 85.5% for the period September 2011 to September 2012. Limited recharge could be noted for the 2011-2012 wet season. The 2012-2013 wet season, especially the latter part, resulted in very good recharge in many areas. The result is clear by the percentage displayed for 2012-2013 as well as 2013-2014. Limited or virtually no recharge the previous wet season resulted in the majority currently having lower groundwater levels than last year the same time. The large percentage of stations with lower levels on a

year basis does not necessarily indicate a reason for concern and the current situation needs to be compared to historic long-term trends. The data is graphically presented by **GRAPH 1**.

SEPT. TO SEPT	% LOWER	AVERAGE LOWER (m)
2007-2008	62.8%	0.41
2008-2009	52.1%	0.25
2009-2010	41.8%	0.48
2010-2011	56.0%	0.69
2011-2012	85.5%	0.99
2012-2013	40.5%	1.09
2013-2014	35.6%	0.95
2014-2015	79.6%	1.1

TABLE 2

3 COMPARISON OF THE ANNUAL GROUNDWATER LEVELS AT THE END OF SEPTEMBER IN THE DIFFERENT SECONDARY DRAINAGE AREAS

The groundwater levels at different stations within each secondary drainage area at the end of September were compared as indication of the current status with regard to previous years.

3.1 DRAINAGE A4 (GRAPH 2)

Four stations, of which A4 Mokolo Poer se Loop is the most pronounced, are normally characterised by large seasonal fluctuations and can be noted on the graph. There is generally very little fluctuation between the yearly levels and most of the stations indicate stable levels around a mean. A slight declining trend is however displayed by three stations and is illustrated by **GRAPH 3**. The declines at A4 Lephale and A4 Stockpoort are slow may be a normal long-term trend while that at A4 Mokolo End may be part of a larger affected area which will be discussed under **ITEM 5**.

3.2 DRAINAGE A5 (GRAPH 4)

The groundwater level trends at a number of stations in this drainage indicate a constant decline but at a variable rate. The most pronounce decline can be noted for A5 Setateng and is illustrated by **GRAPH 5**. Groundwater level trends at these stations are considered to be part of the impacted area mentioned above to be discussed later in the report.

Stable conditions with levels seasonally fluctuating around a mean to slowly rising trends are indicated for the rest of the drainage.

3.3 DRAINAGE A6 (GRAPH 6)

There are a large number of monitoring stations in this drainage and the groundwater levels at the majority indicate stable conditions. An area in the North West part of the drainage is however characterised by constant declining groundwater levels and virtually no seasonal; recharge and form part of the area mentioned for discussion later on. The trend displayed by the station most affected by the decline, A6 Tolwe, is illustrated by **GRAPH 7**.

3.4 DRAINAGE A7 (GRAPH 8)

As with the A6 drainage, are the majority of groundwater levels fluctuating seasonally around a mean. Some slow rises as well as some slow declines are present. The 2013-2014 wet seasons resulted in widespread but varying recharge and a number of trends indicate a slow return after that. Only two stations indicate notable declines, both are seriously impacted by nearby pumping affecting the area. The declines are illustrated by **GRAPH 9**.

3.5 DRAINAGE A8 (GRAPH 10)

Except for station A8 Mabvete, are all groundwater level trends in this drainage displaying either a stable or rising trend. The reason for the constant decline is not clear. No pumping effects can be noted on the graph and no large scale abstraction in the area could be identified and the decline may be due to lack of a suitable recharge event for some years. Some recharge did occur in the 2013-2014 season but not sufficient for recovery. A major event may be needed **GRAPH 11**.

3.6 DRAINAGE A9 (GRAPH 12)

Groundwater levels in this drainage were mostly declining steadily until the 2013-2014 season when reasonable good recharge occurred but unfortunately in some cases not enough for the groundwater levels to recover fully. Levels are declining again after that but no immediate concern is raised. The area is prone to drought and should be monitored as prolonged lack of recharge may alter the situation fast. Typical trend in the area is illustrated by **GRAPH 13**.

3.7 DRAINAGE B3 (GRAPH 14)

There are only four monitoring stations in this drainage of which three are heavily impacted by pumping and not much could be said about the current status of groundwater in the area in general. The area has been characterised for years by alternating periods of dewatering and recovery. Groundwater levels have been declining steadily over the past 4-5 years **GRAPH 15**.

3.8 DRAINAGE B5 (GRAPH 16)

Yearly groundwater levels at the end of September indicate very little fluctuation. Levels in this drainage generally indicate no real external impact with normal seasonal fluctuations and an underlying slow declining trend which is regarded as a natural trend **GRAPH 17**.

3.9 DRAINAGE B7 (GRAPH 18)

All groundwater levels in the drainage tend to indicate stable to rising conditions for some years but a decline can be noted at some stations since the end of 2014. This is ascribed to the limited recharge the past season. Typical yearly trend is illustrated by **GRAPH 19**. The continuous rise at station B7 Mica has been dramatic for some years.

3.10 DRAINAGE B8 (GRAPH 20)

Two types of groundwater level trends can be noted in the drainage, a stable fluctuating one in the southern part and a declining trend in the northern part. No concern is currently raised for the southern part but the decline in the north may become one if the current dry weather persists. An example of the declining trends is illustrated by **GRAPH 21**. The fast decline at B7 Sikhunyane since September 2014

seems to be related to accelerated abstraction for the village. The groundwater level here should be closely monitored.

3.11 DRAINAGE B9 (GRAPH 22)

Three of the four stations located in this drainage indicate a steady decline and one seasonal fluctuating groundwater level. The declining trend displayed at B9 Halahala serves as an example **GRAPH 23**.

4 LONG-TERM PERSPECTIVE

4.1 LONG-TERM GROUNDWATER LEVEL TREND AT A7 STERKLOOP PUMP STATION (GRAPH 24)

Groundwater level data since 1974 is available for this station which provides a good perspective on the current situation with that historically. As mentioned above, evaluating the current status by comparison in the short-term of one to even eight to ten years may lead to incorrect deductions. From graph 24 it can be seen that the groundwater level is currently lower than the previous year. The inset chart demonstrates the yearly levels for the corresponding period used in the above graphs for the secondary drainages and the trend corresponds well with some of the declines noted above. The trend displayed on the main graph however indicates that the current status is good despite the current declining trend.

Good correlation in medium to short-term trends with other stations where only short-term data is available, suggest that the status there may also still be good despite the recent declining trends. Continued monitoring is essential to recognise challenges that may arise in time.

5 AREAS POSSIBLY AT RISK DURING DROUGHT SITUATION (MAP 4)

Analysis of the time series monthly data lead to a number of stations selected as “possible at risk” if dry conditions persist for some time. Not only were the declining trends considered but also any apparent recharge. Despite some stations indicating a slight decline they were included due to an apparent total lack of any recharge. Similar rainfall events that resulted in notable recharge in other areas did not seem to have any effect here. Coupled to that there seem to be a definite combined impact from abstraction in some instances which is compounding the effect. It is not known what type of event is needed for recharge but it would seem that a major rainfall event will be needed.

One area is indicated around Baltimore, Setateng, and Tom Burke on map 4. This area is subjected to irrigation abstraction.

The second area south of Alldays in the Kromhoek area is a small area but heavily impacted by irrigation as well as communal water supply abstraction.

The third area comprises of the northern part of the B8 drainage mentioned and starts from Sekgopo and Mailaskop in the south west to Giyani and further north past the Malumulele area to Greenfarm and Halahala. Groundwater use in this area is mostly for domestic use.

The groundwater trend at B8 Sekgopo serves as example **GRAPH 25**. Some good rainfall occurred in the area during this time period but little recharge can be noted. Forecast of the trend line indicates that if the conditions as experienced since 2004 prevail, the water level will reach the water strike depth or “critical level” within less than two and a half years. Should conditions worsen from that experienced into a prolonged drought the rate of decline may increase rapidly.

6 SEASONAL FORECAST (FIGURE 1)

Figure 1 produced by the South African Weather Services indicate that the forecast for the rest of the wet season is not encouraging. Limpopo almost entirely features in the “below normal” forecast side with the prediction at this stage being around 40 to 50% chance of below normal rainfall for the rest of the season.

7 IMPORTANCE OF GROUNDWATER MONITORING AND RESOURCE MANAGEMENT

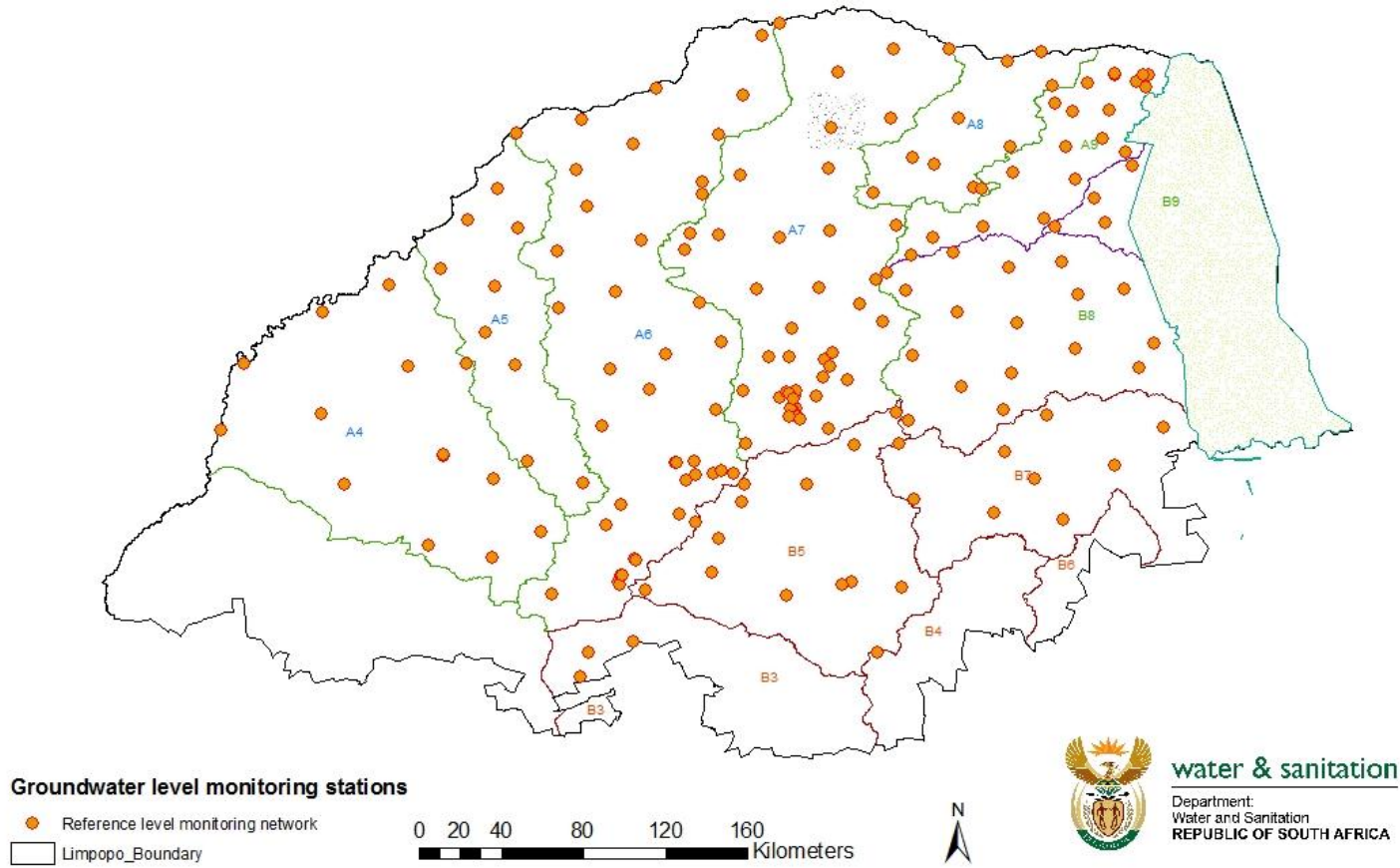
The trend displayed for station A7 Langjan as an example (**GRAPH 9**) clearly indicates that the abstraction cannot be sustainable in the long term. In such a situation the status of the resource can only be assessed by water level monitoring without which resource management decisions is impossible. Users will only become aware of the problem when the resource fails and it is too late to take steps to rectify it.

8 ACKNOWLEDGEMENTS

Forecast figures:

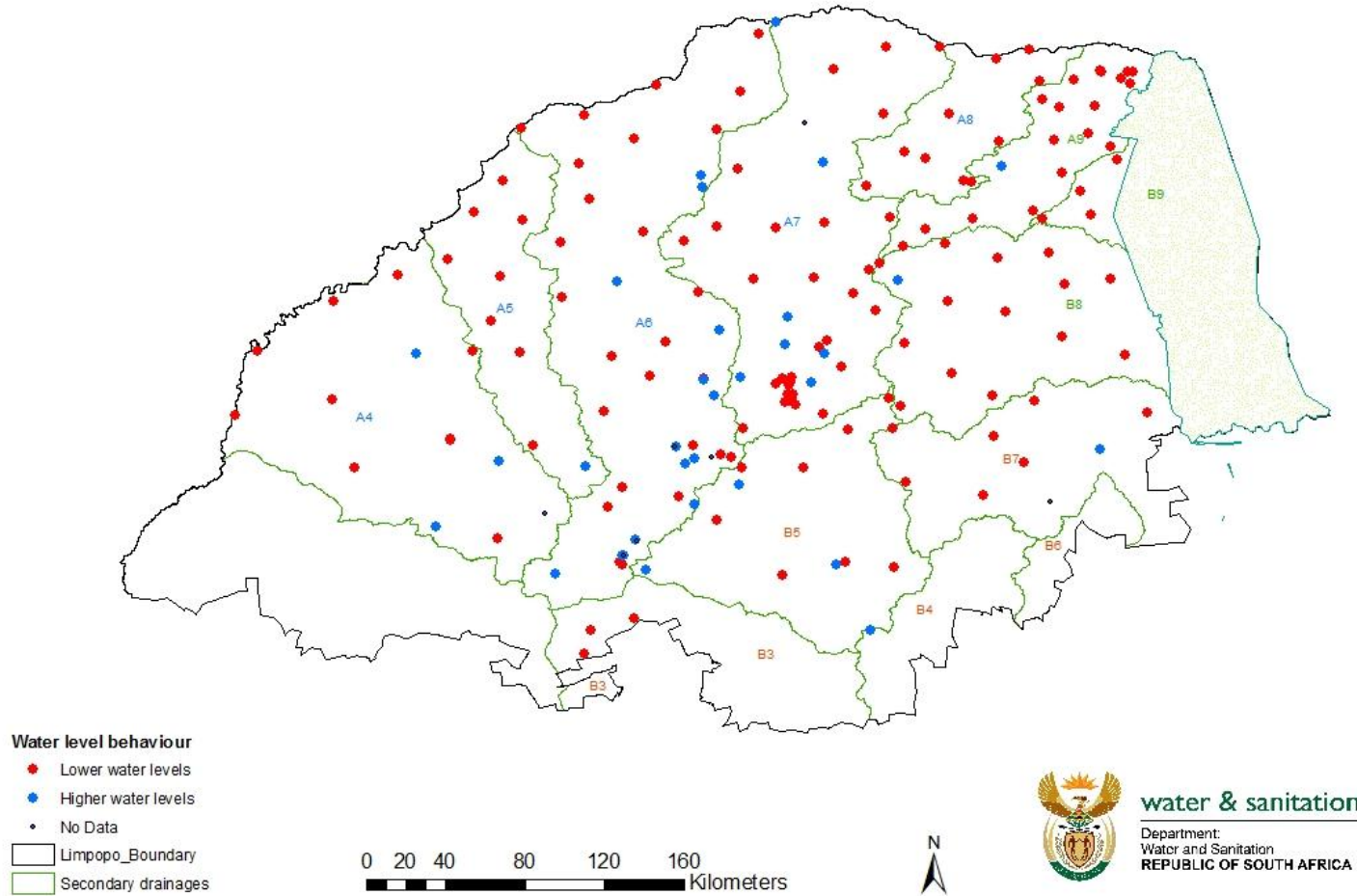
South African Weather Services: (<http://www.weathersa.co.za/home/seasonal>)

Distribution of Limpopo groundwater level monitoring stations



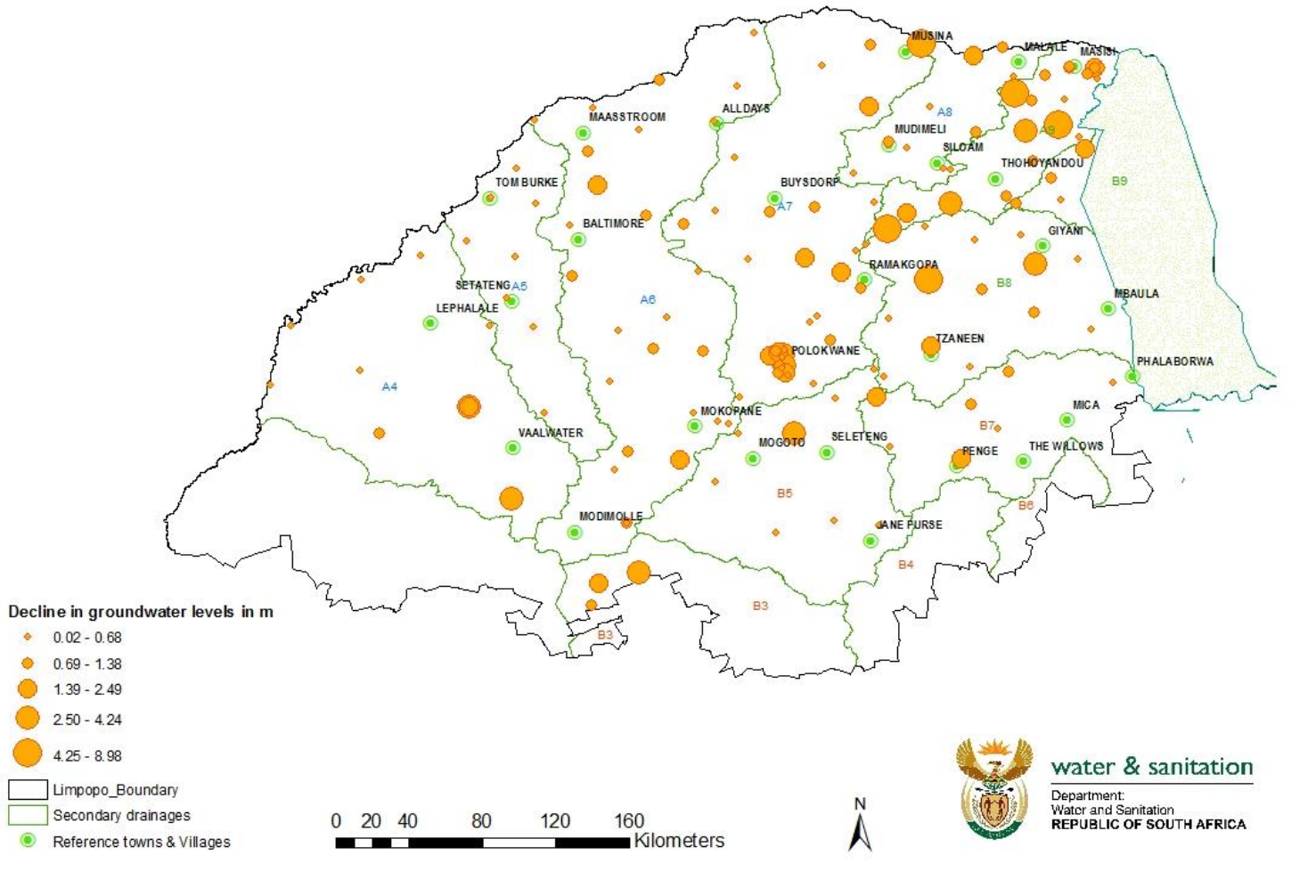
MAP 1

Difference in groundwater levels; end of September 2014 to end of September 2015;



MAP 2

Decline in groundwater levels; end of September 2014 to end of September 2015;



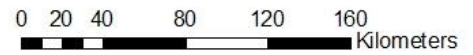
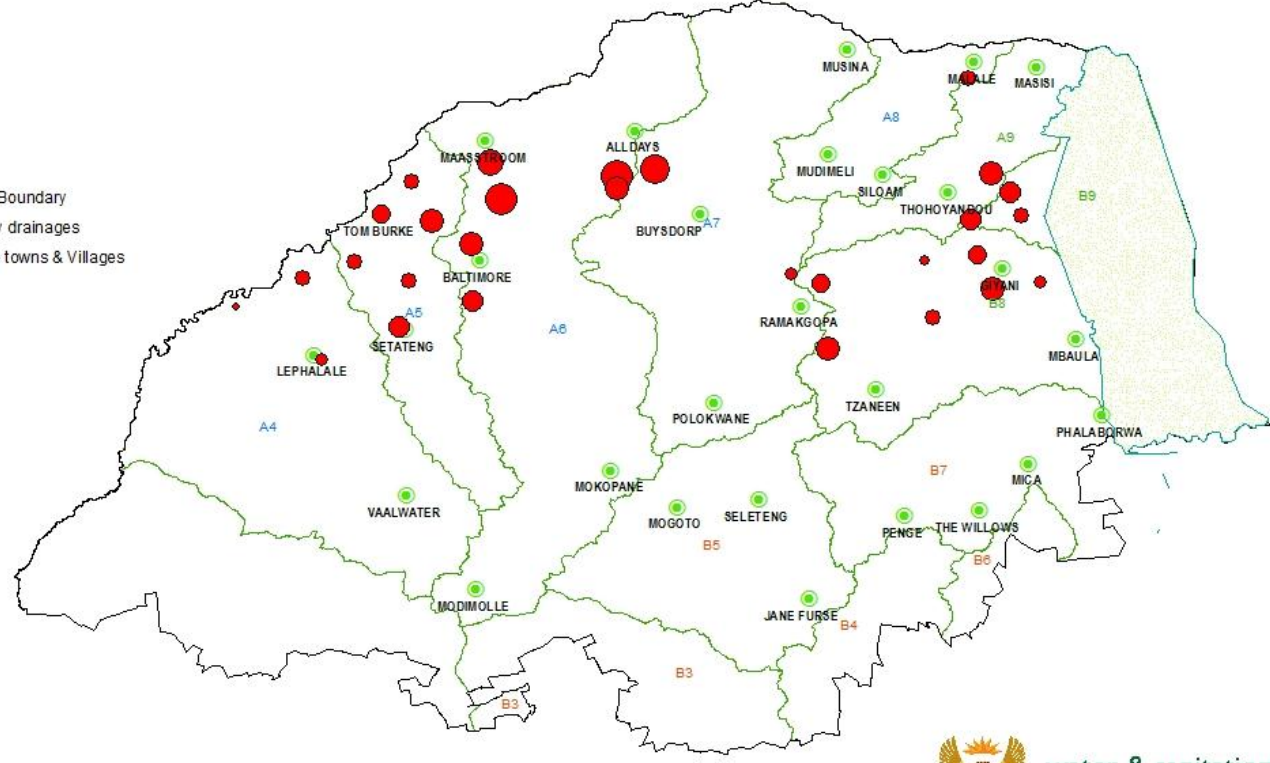
MAP 3

Average annual decline in groundwater levels at monitoring stations indicating a constant decline with no apparent recharge over 3 to 7 years

Average annual decline in m

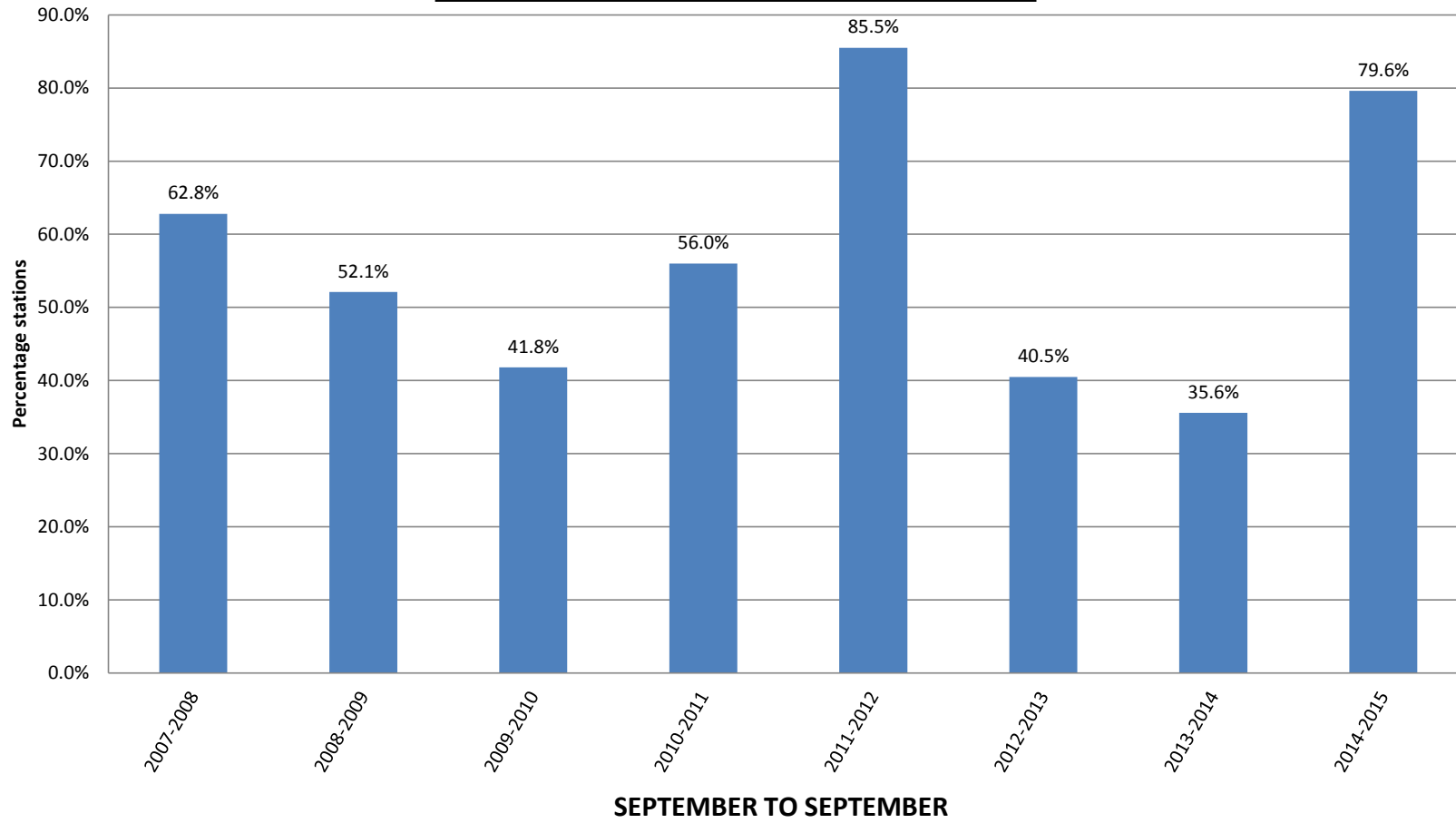
- Average
- 0.1
 - 0.25
 - 0.5
 - 0.75
 - 1

- Limpopo_Boundary
- Secondary drainages
- Reference towns & Villages

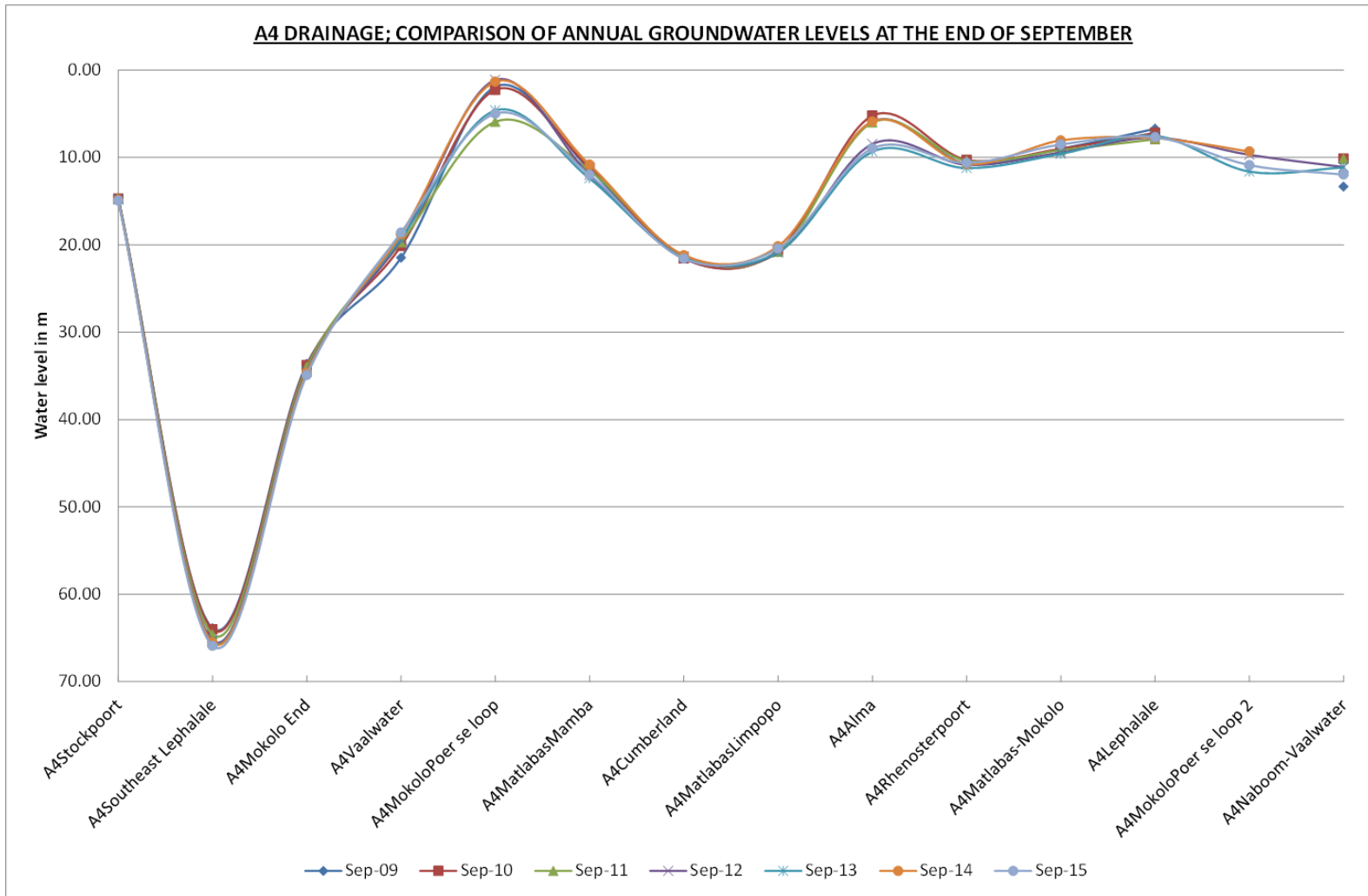


MAP 4

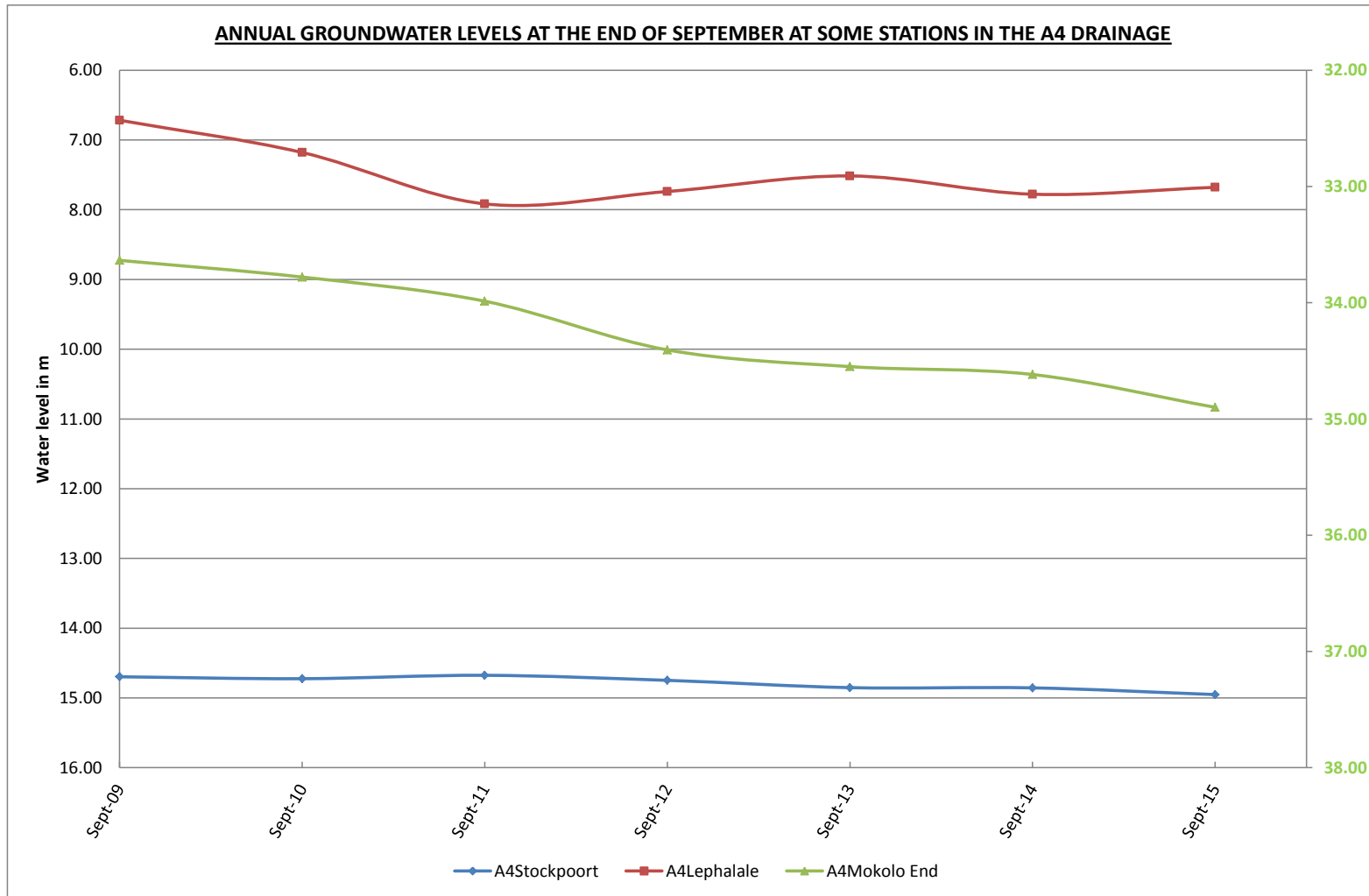
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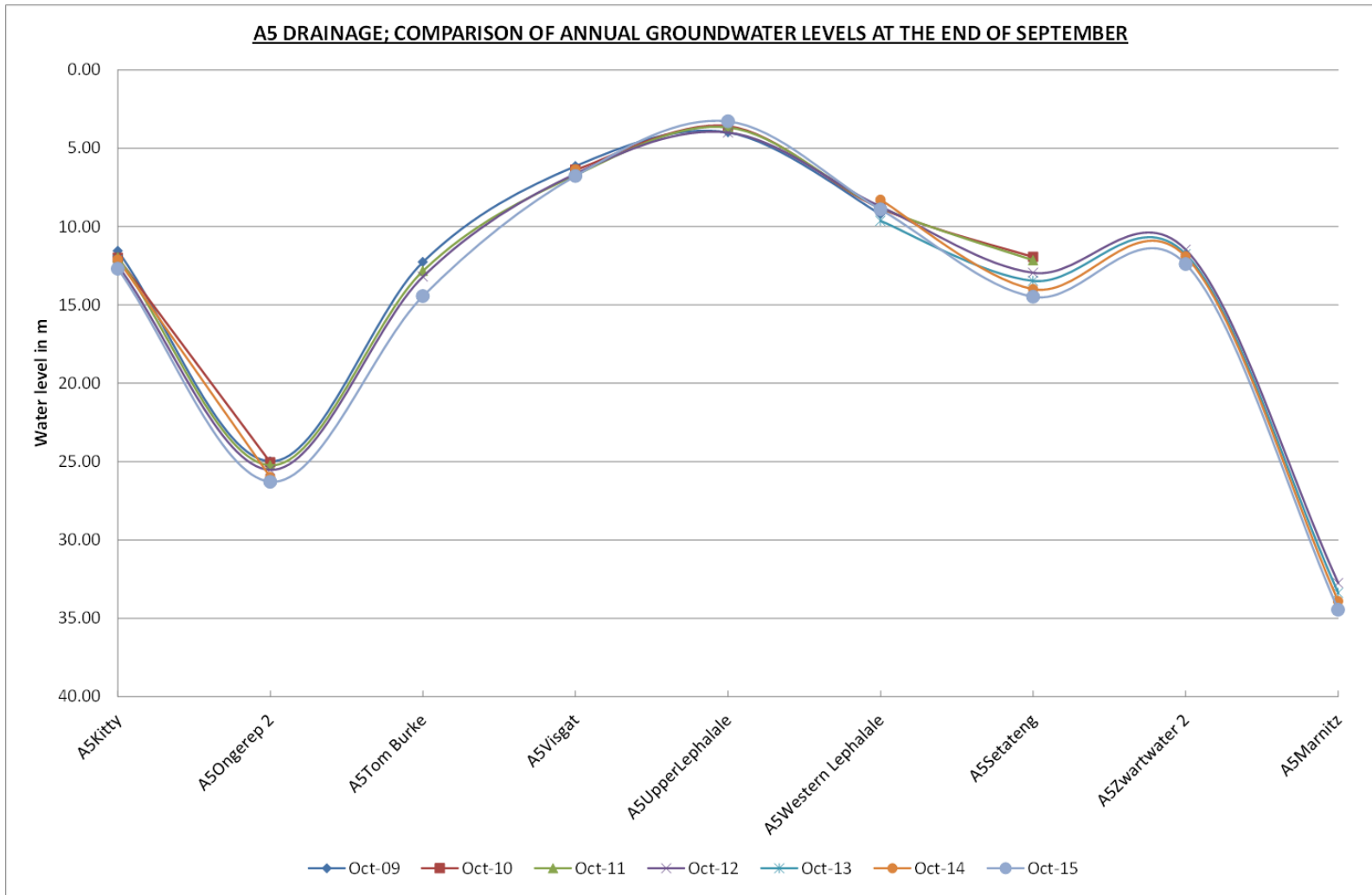
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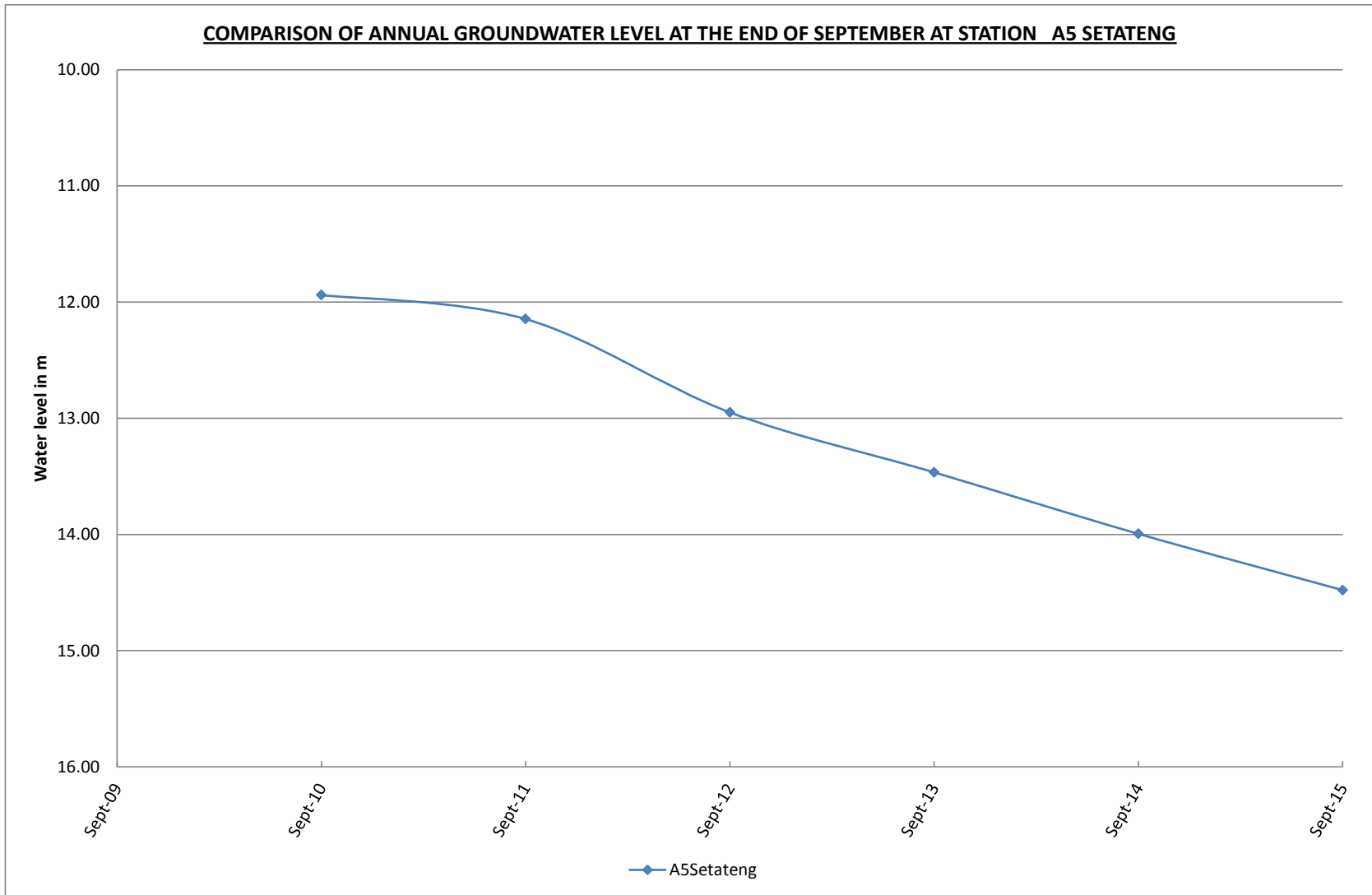
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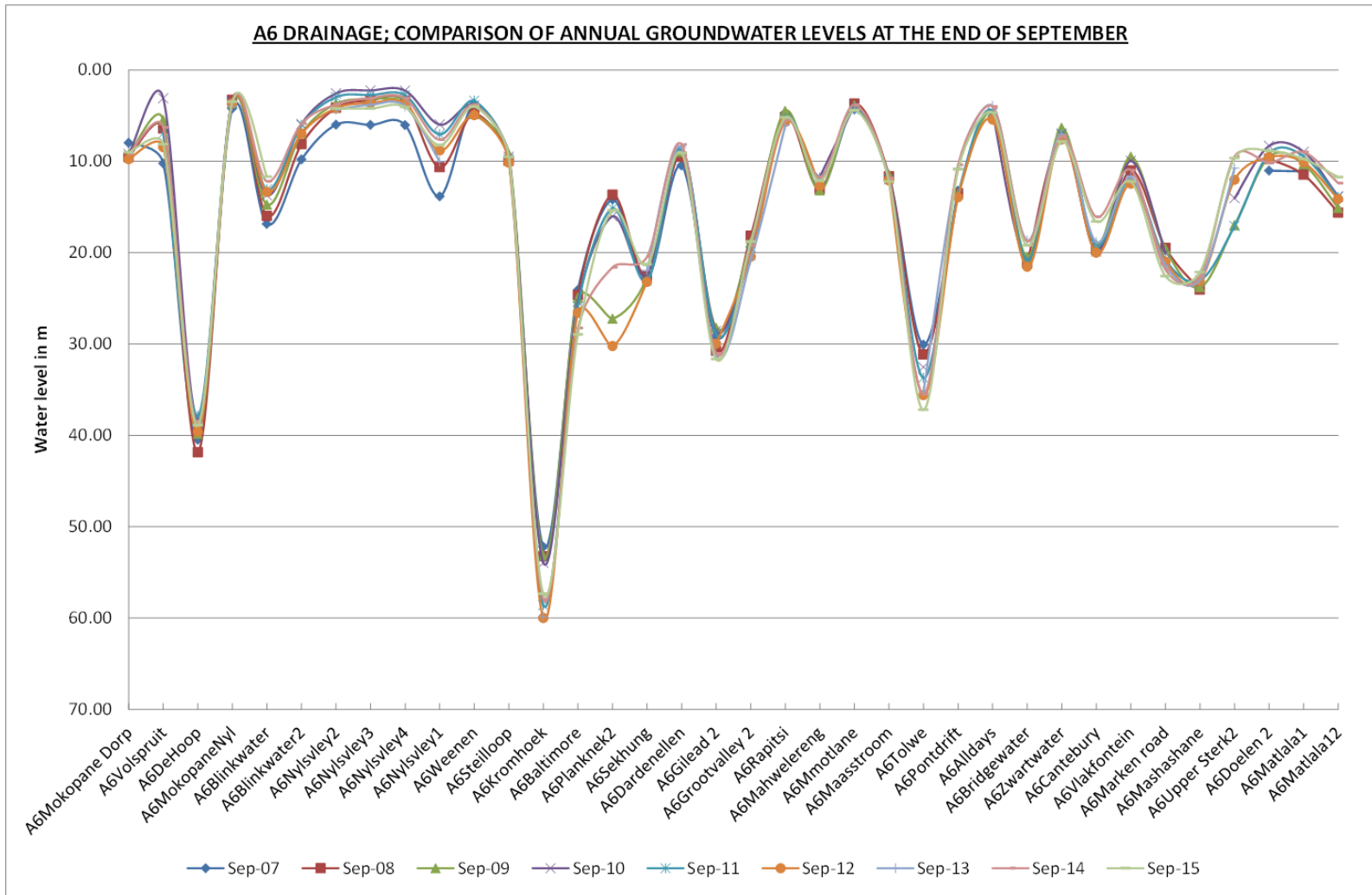
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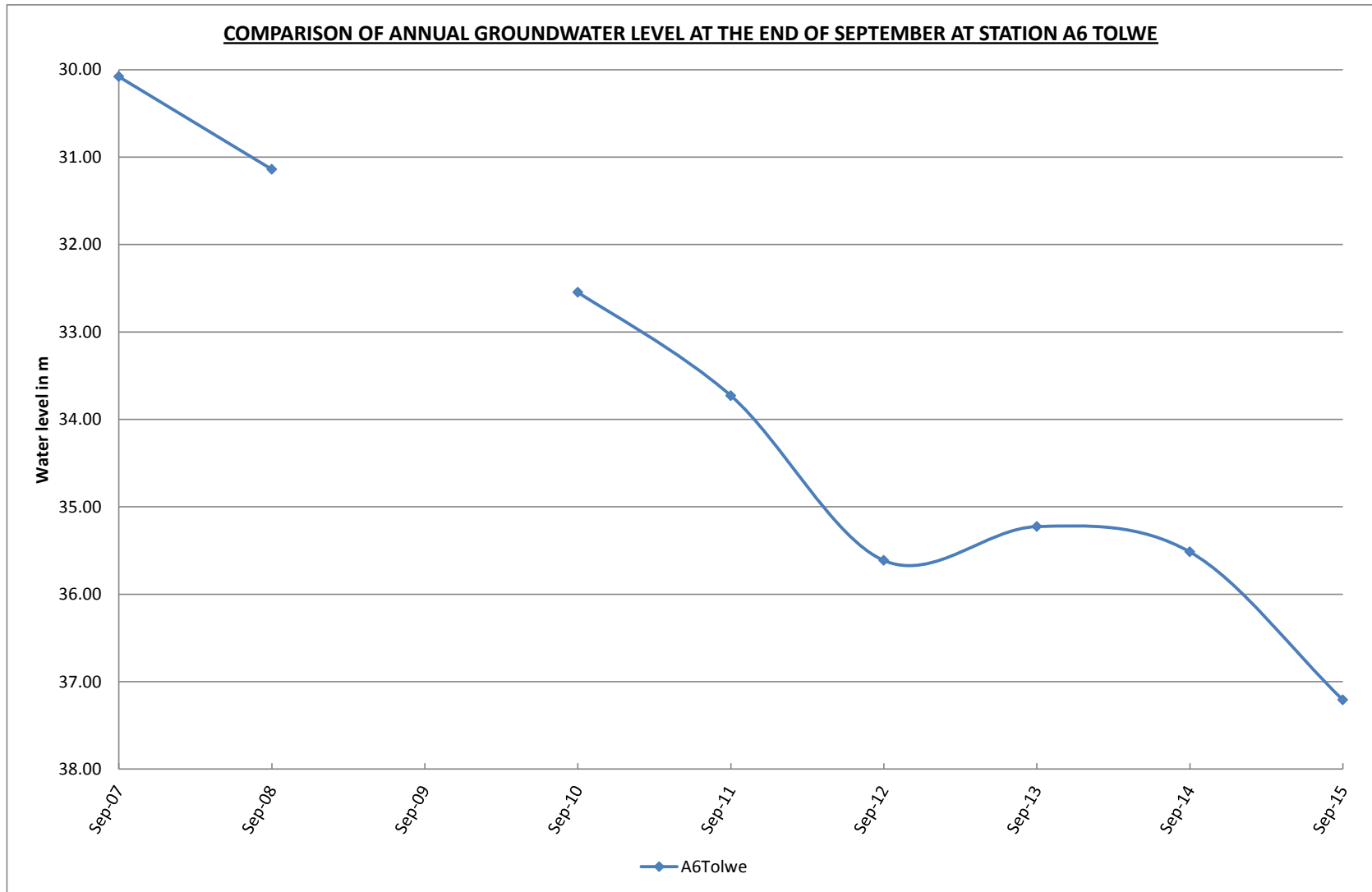
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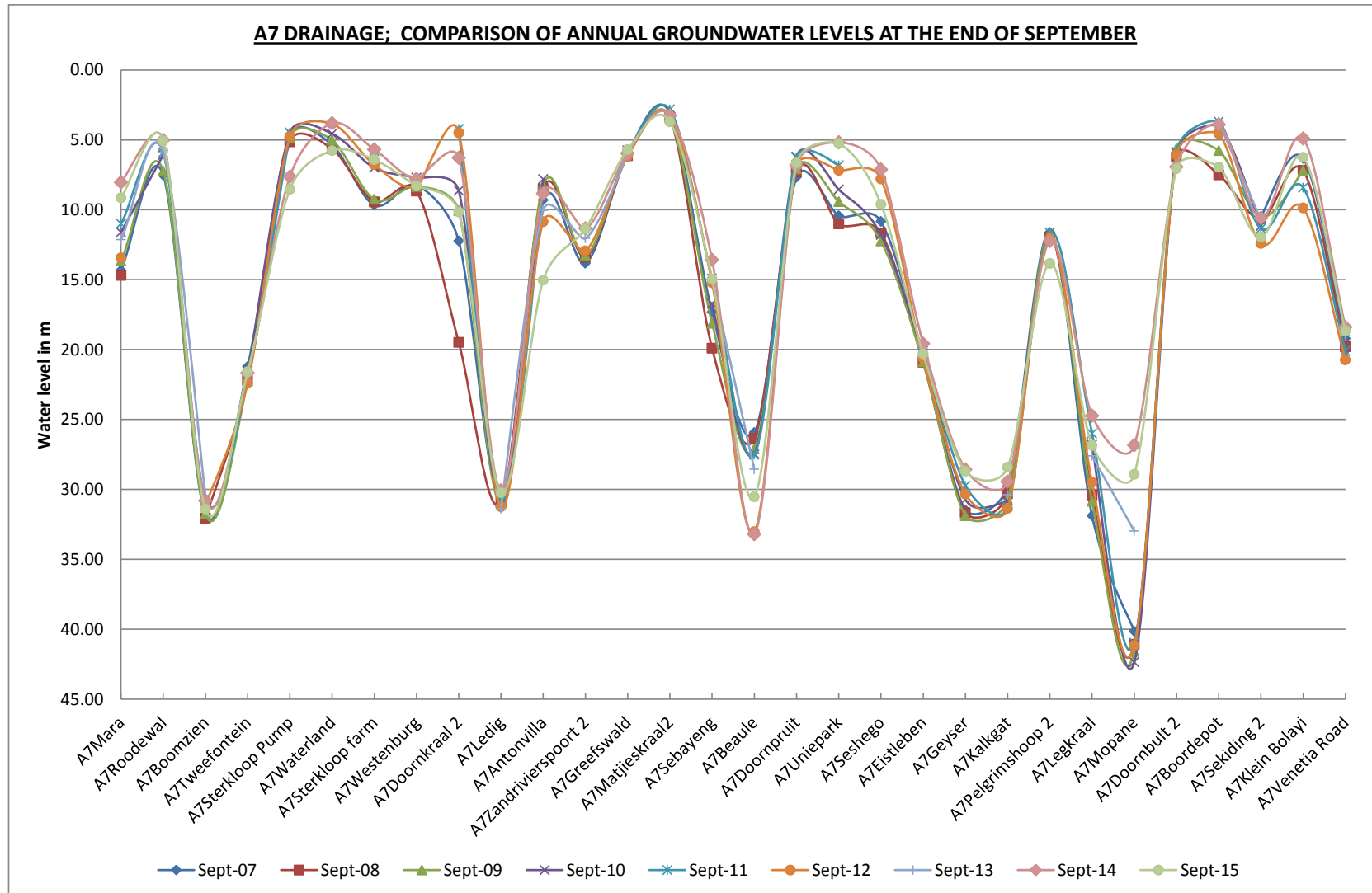
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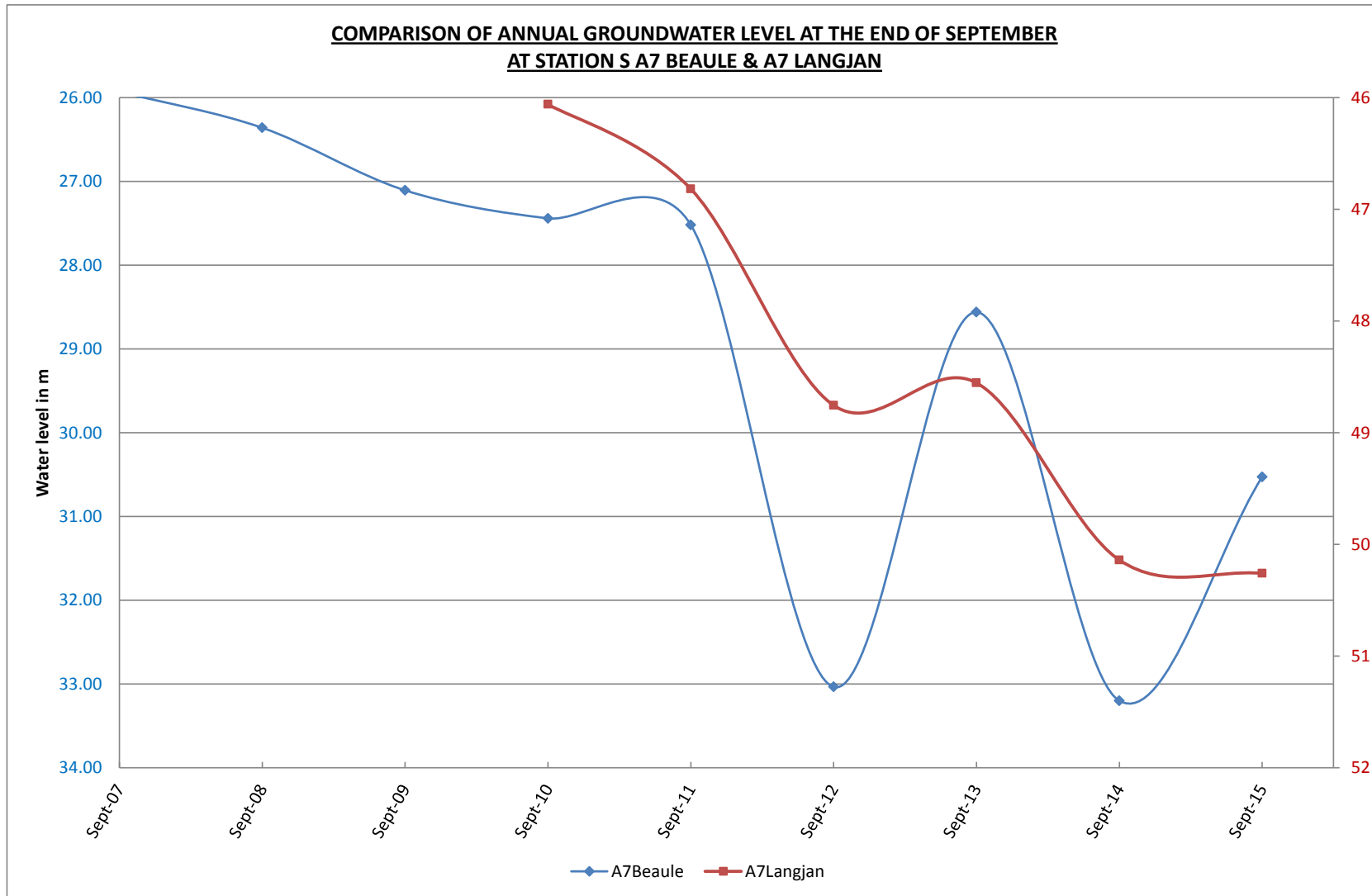
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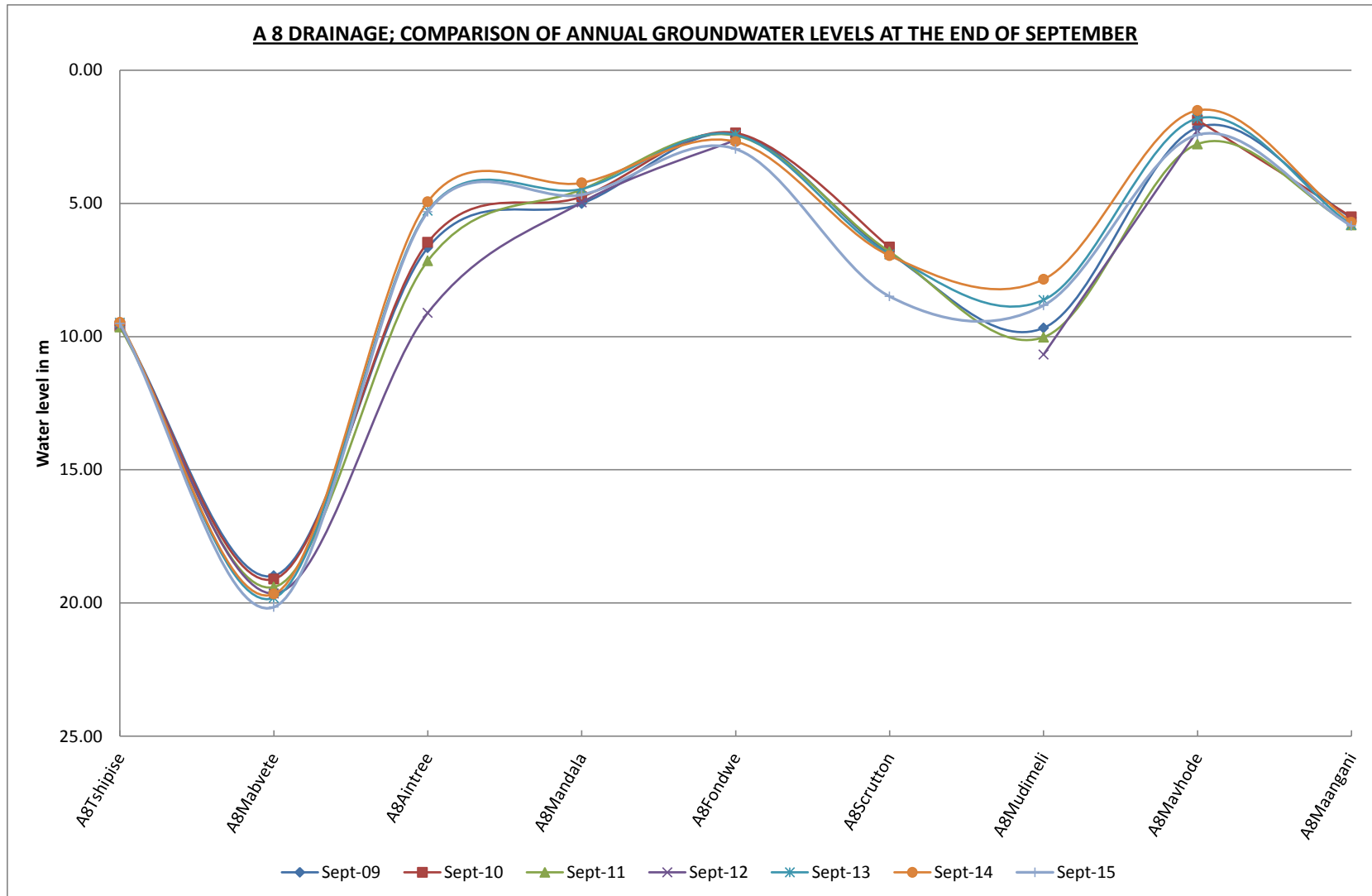
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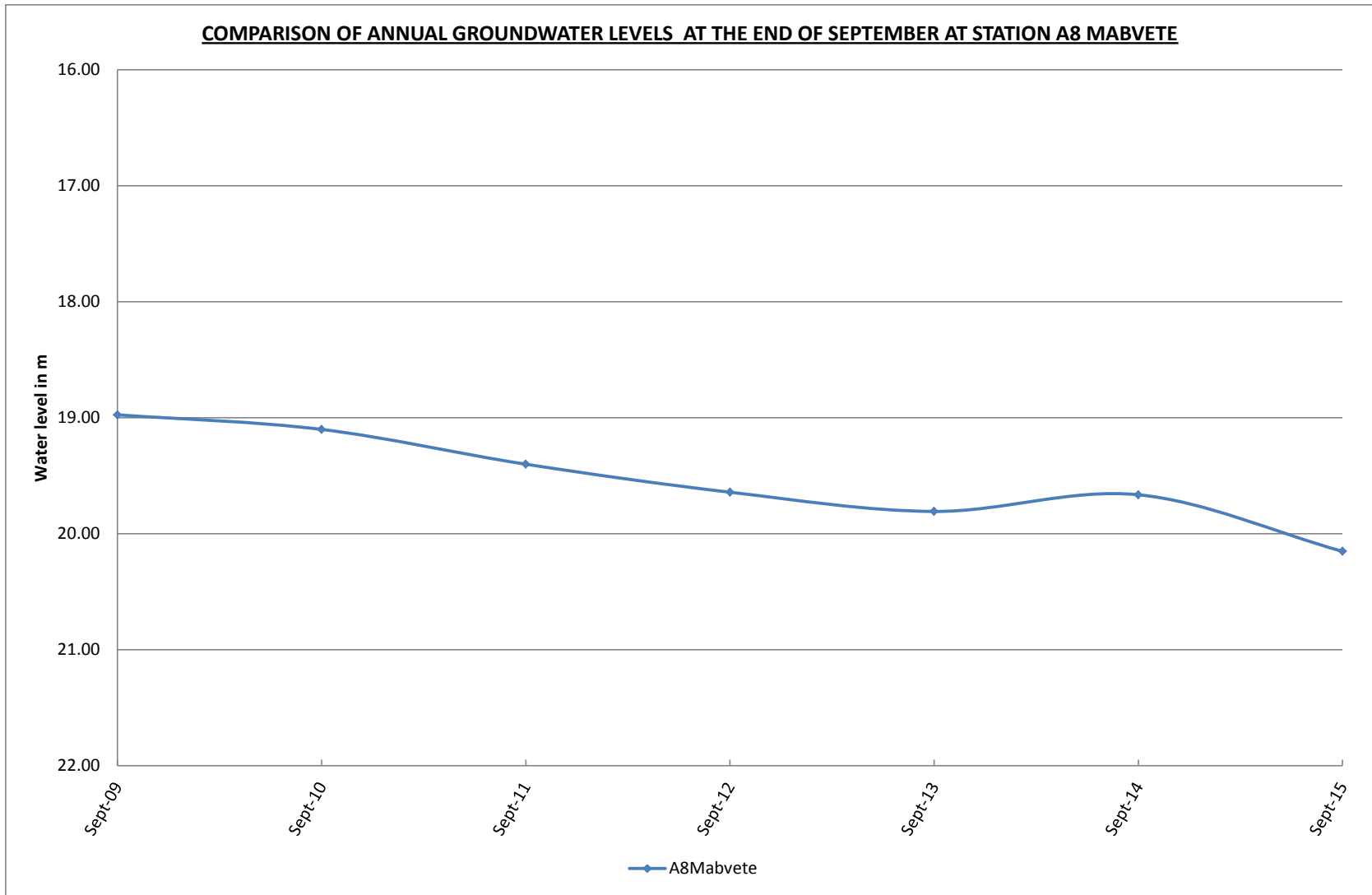
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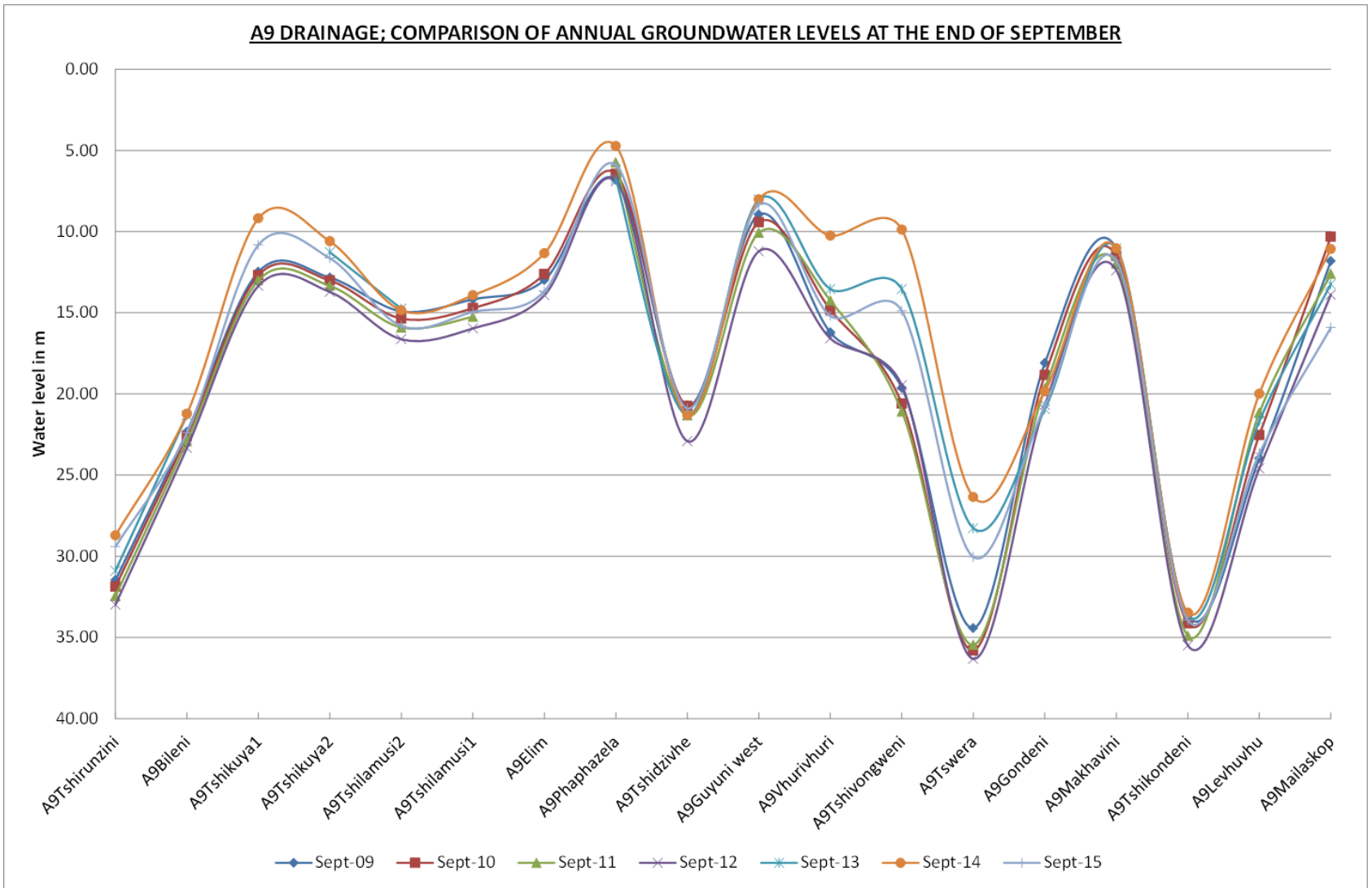
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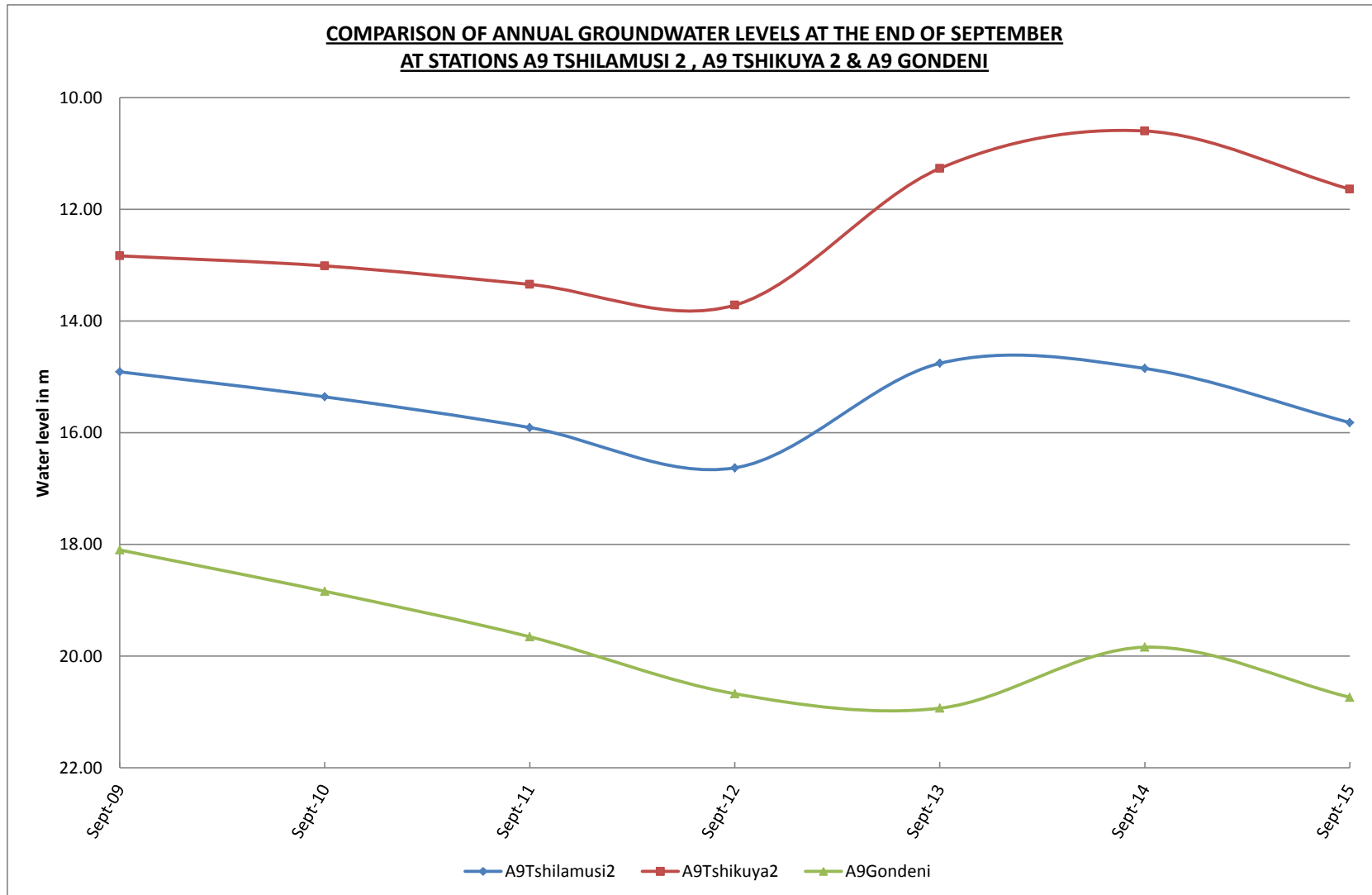
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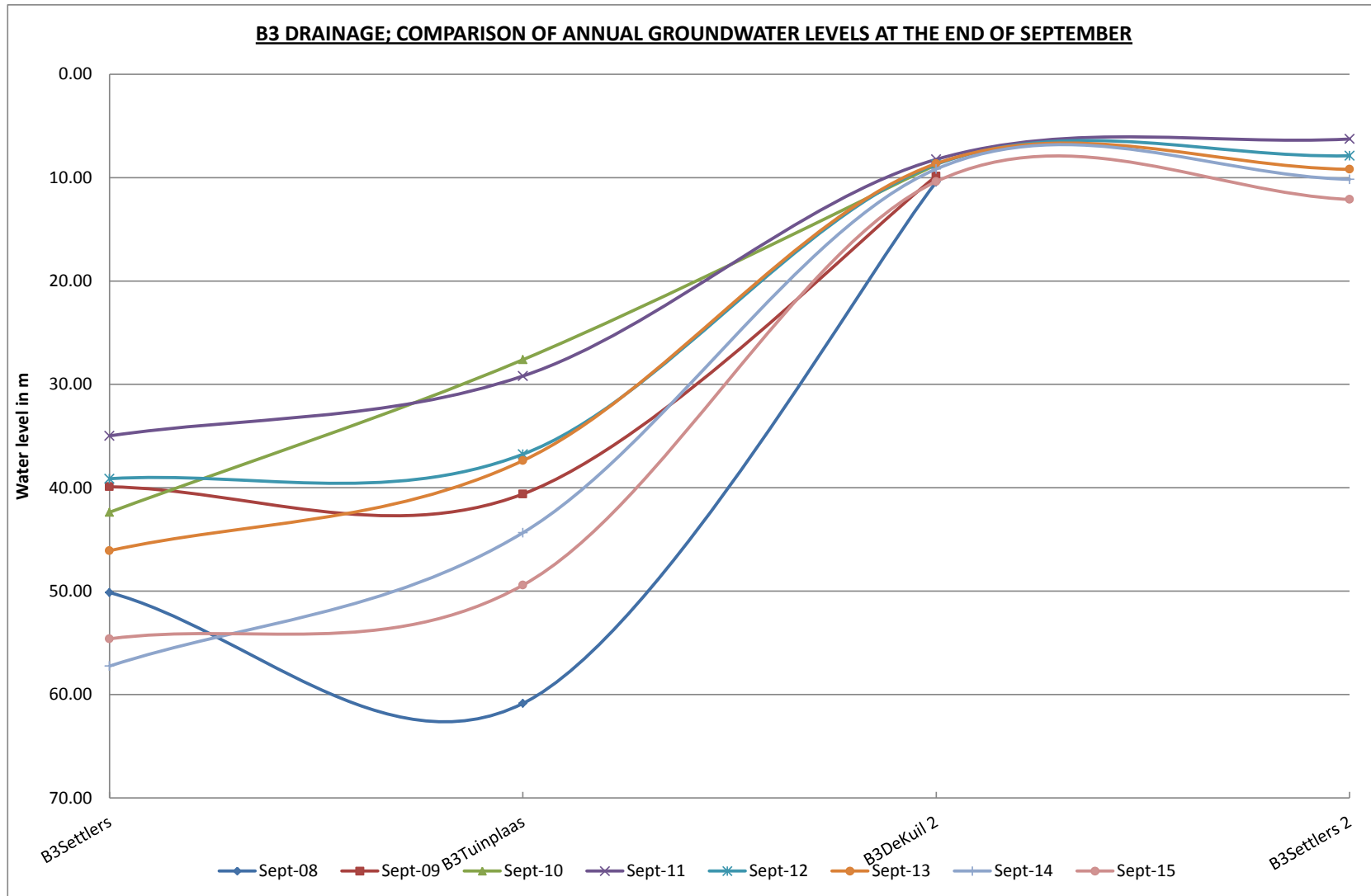
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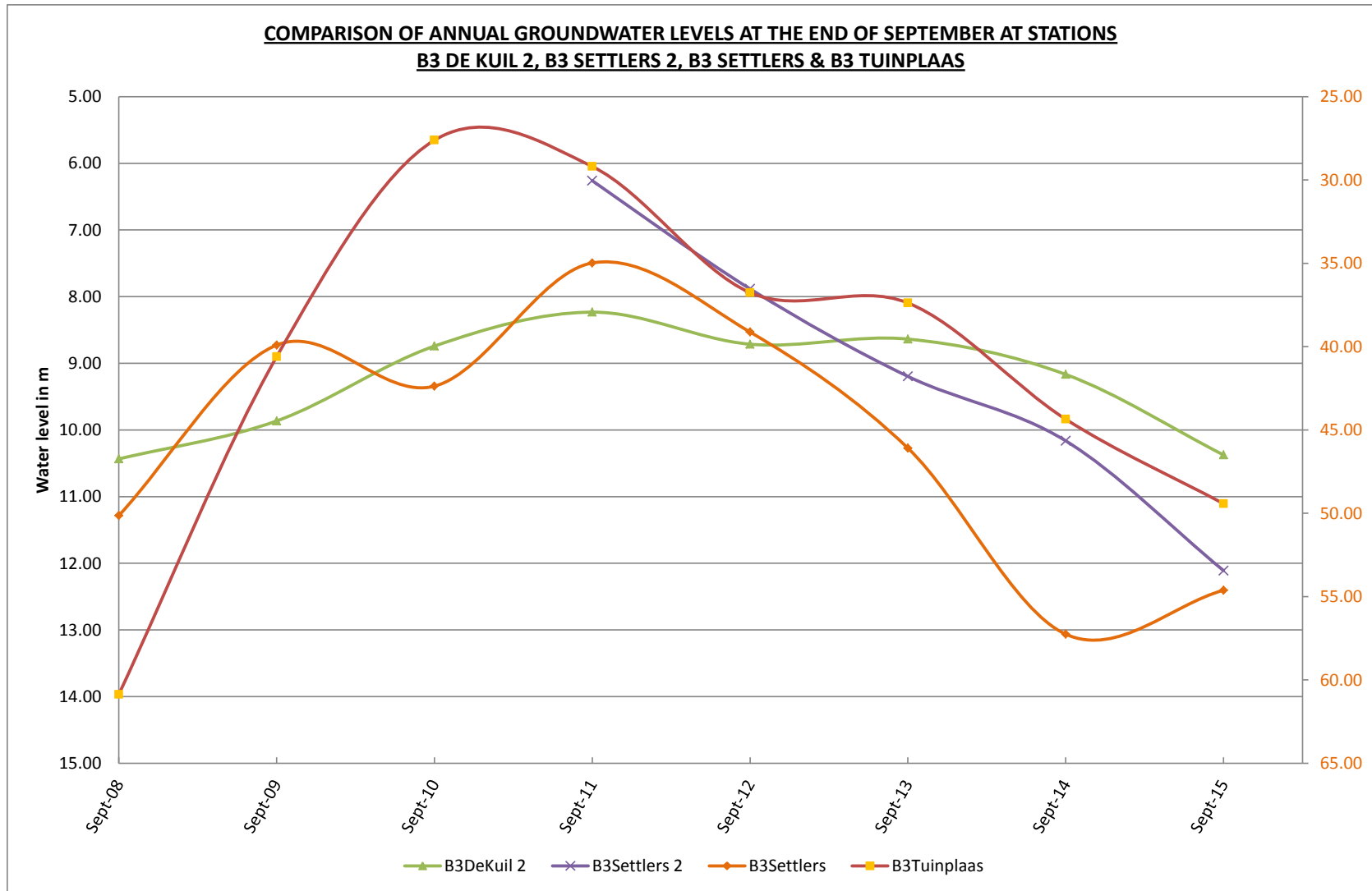
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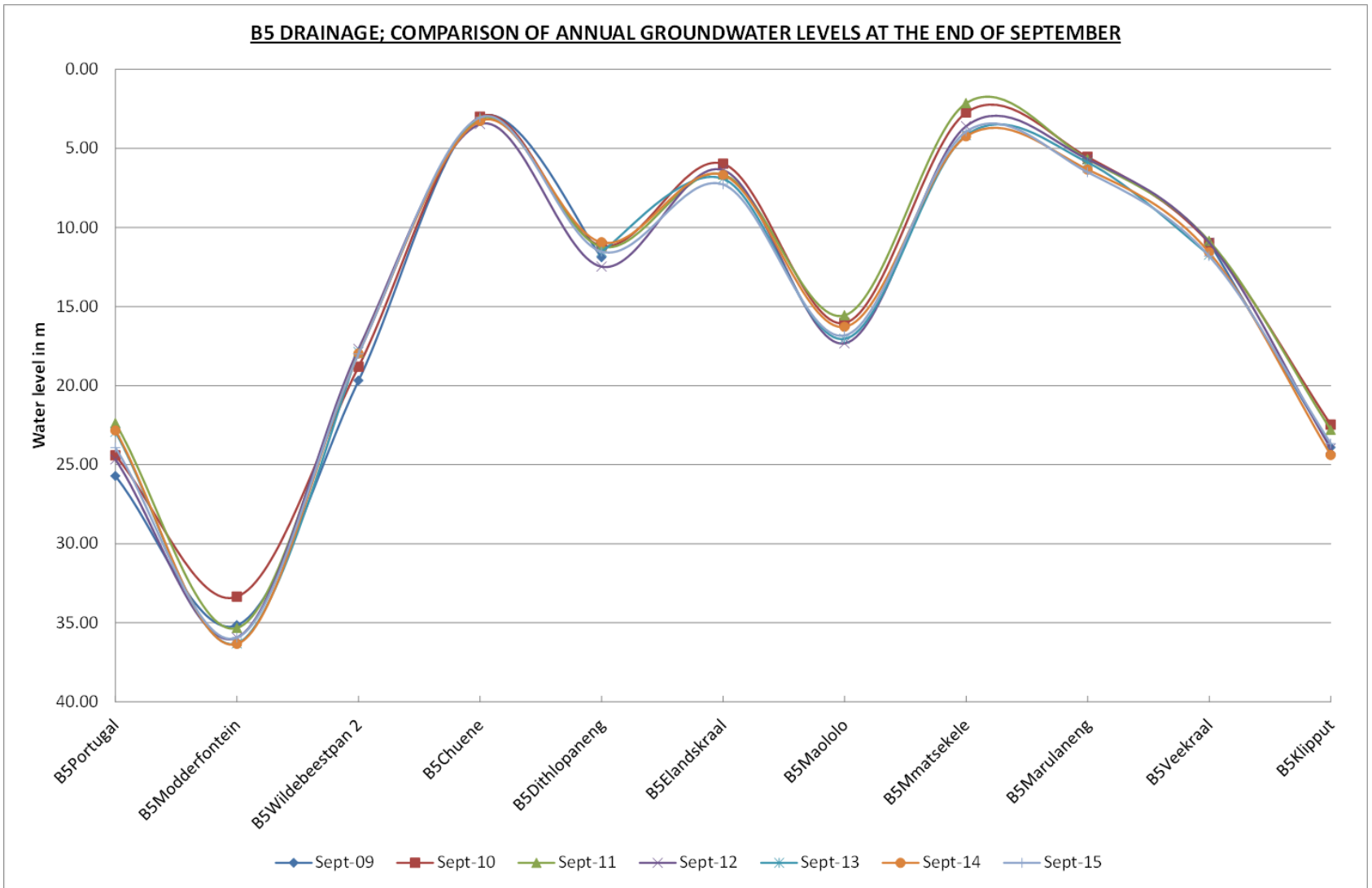
GRAPH 13



GRAPH 14

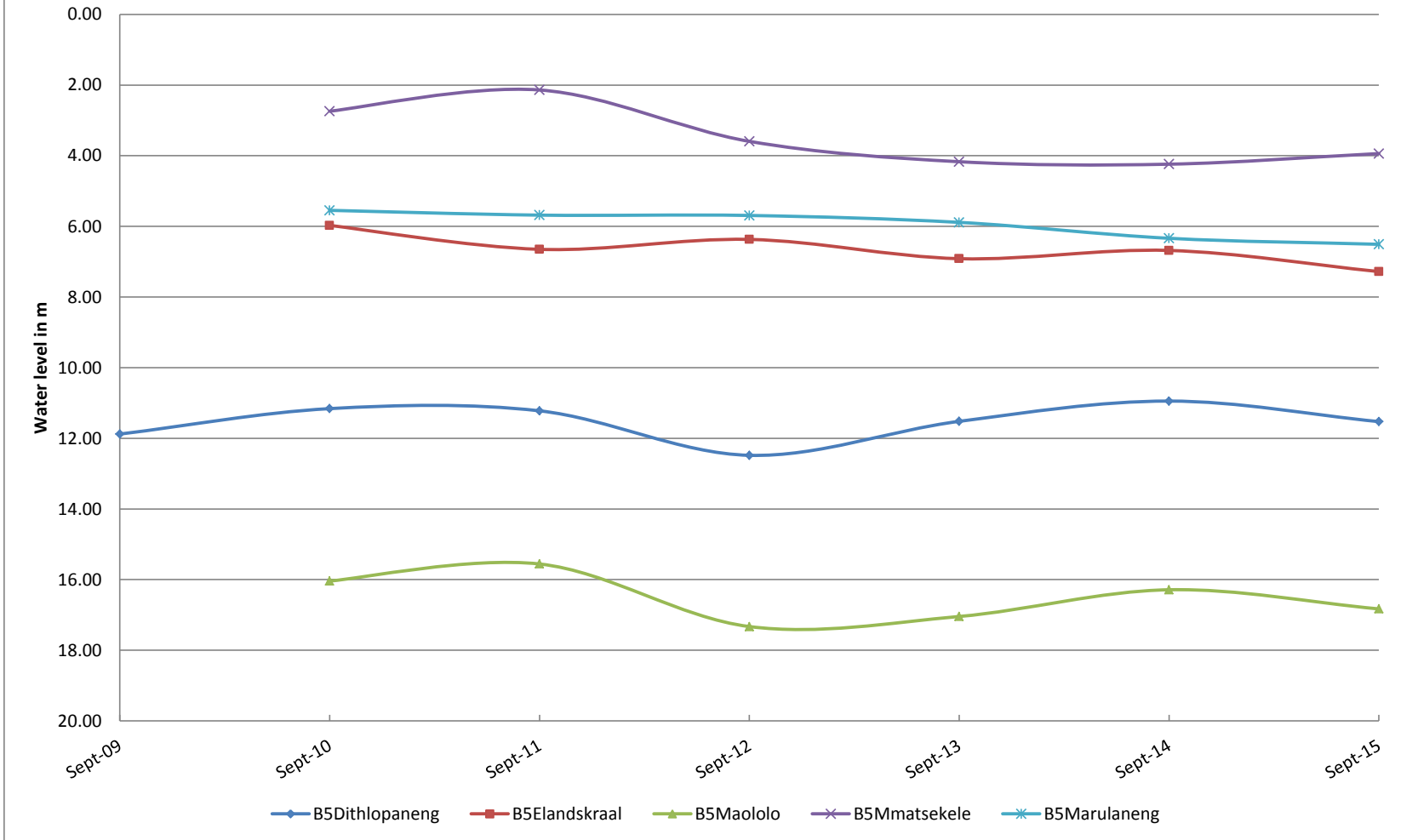


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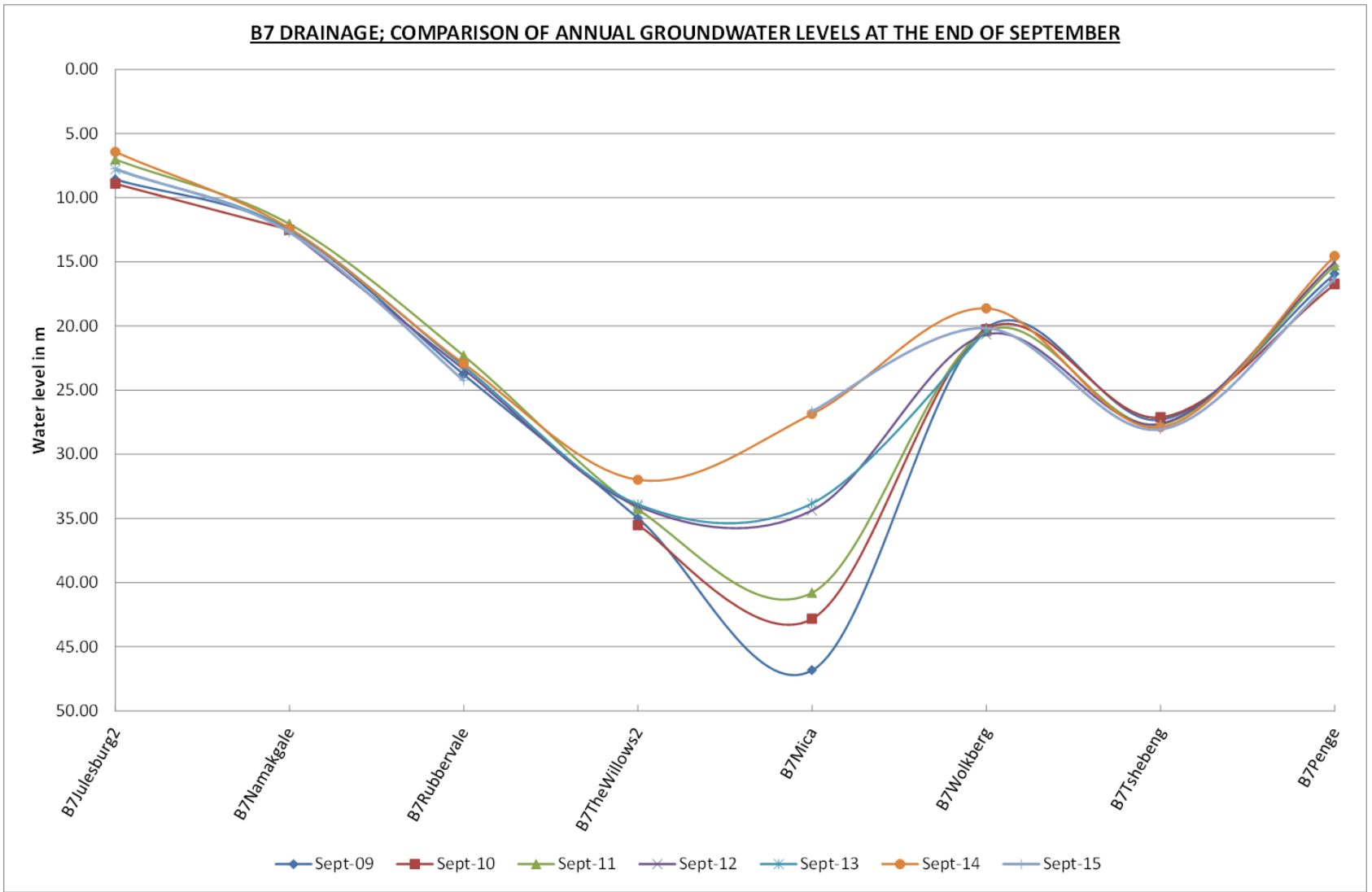


GRAPH 16

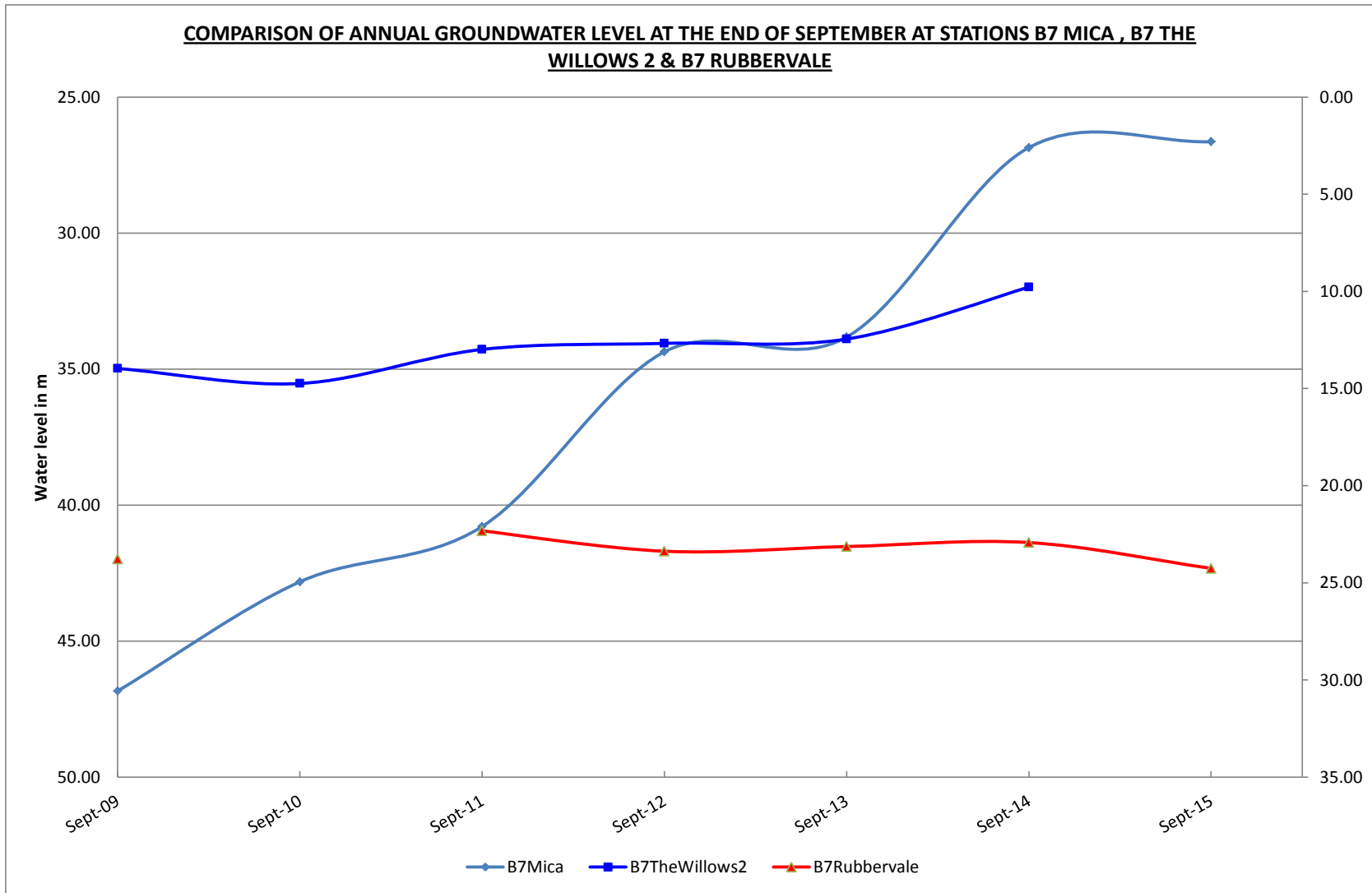
COMPARISON OF ANNUAL GROUNDWATER LEVELS AT THE END OF SEPTEMBER AT STATIONS B5 DITHLOPANENG, B5 ELANDSKRAAL, B5 MAOLOLO, B5 MMATSEKELE & B5MARULANENG



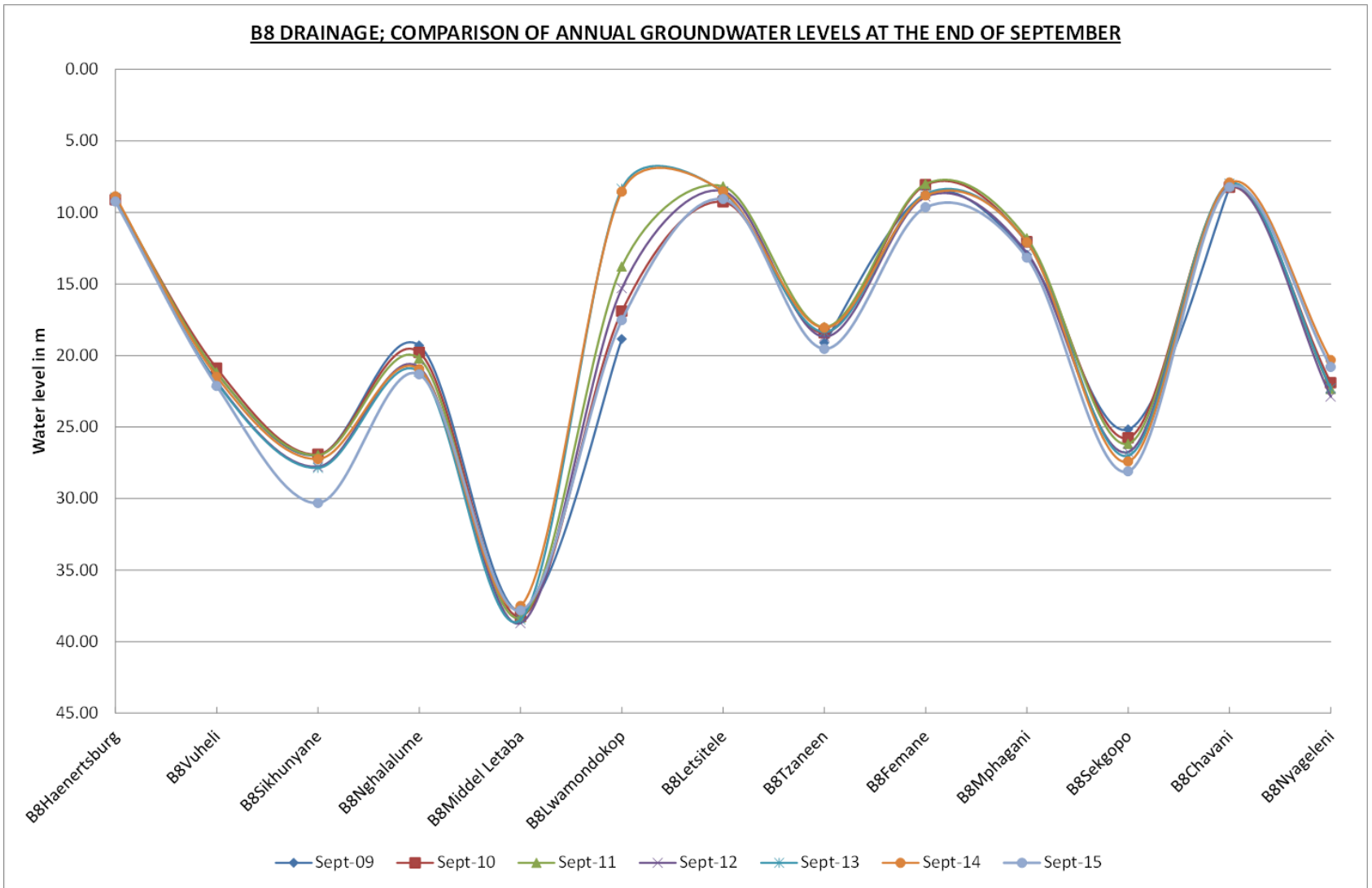
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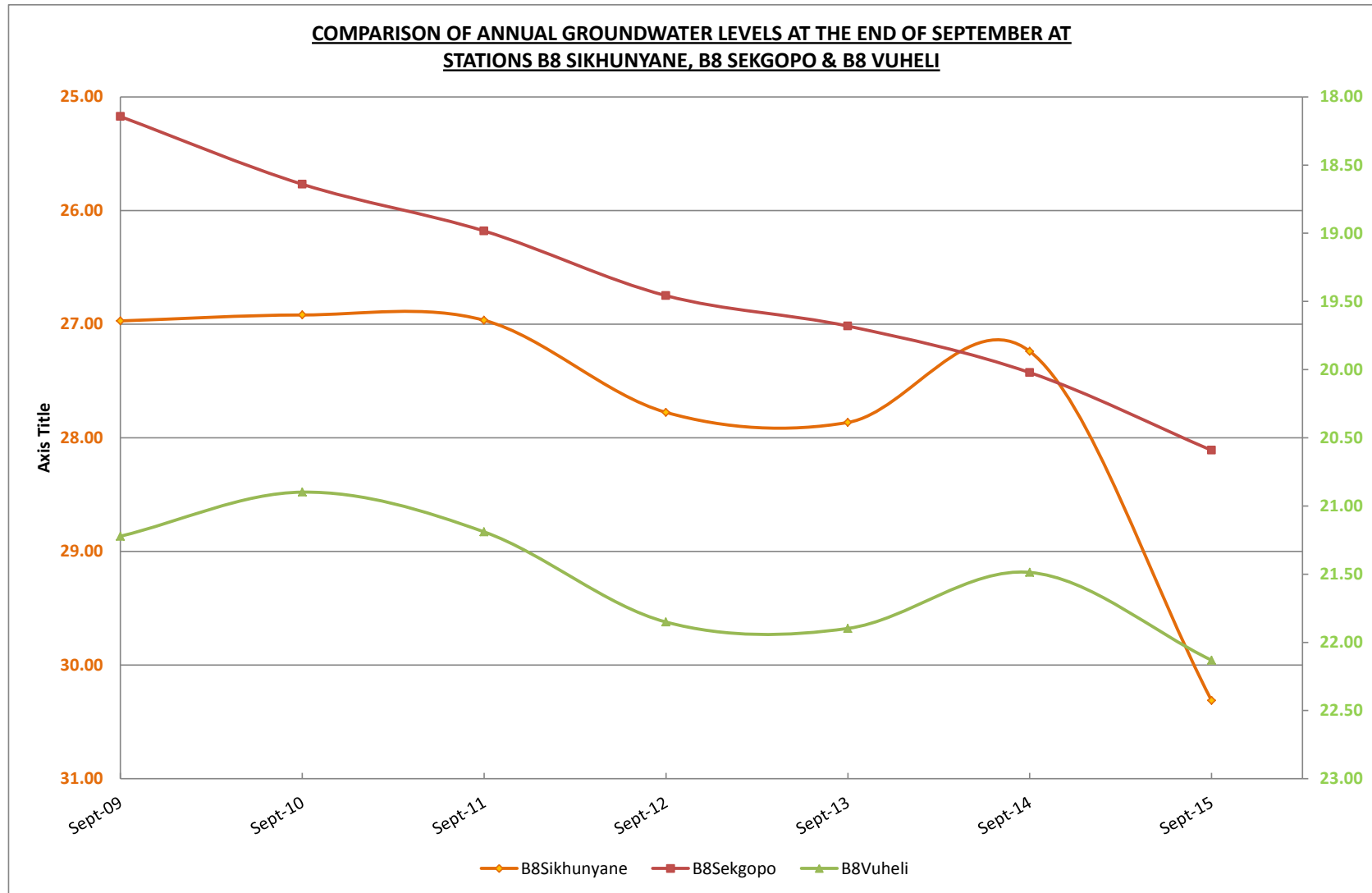
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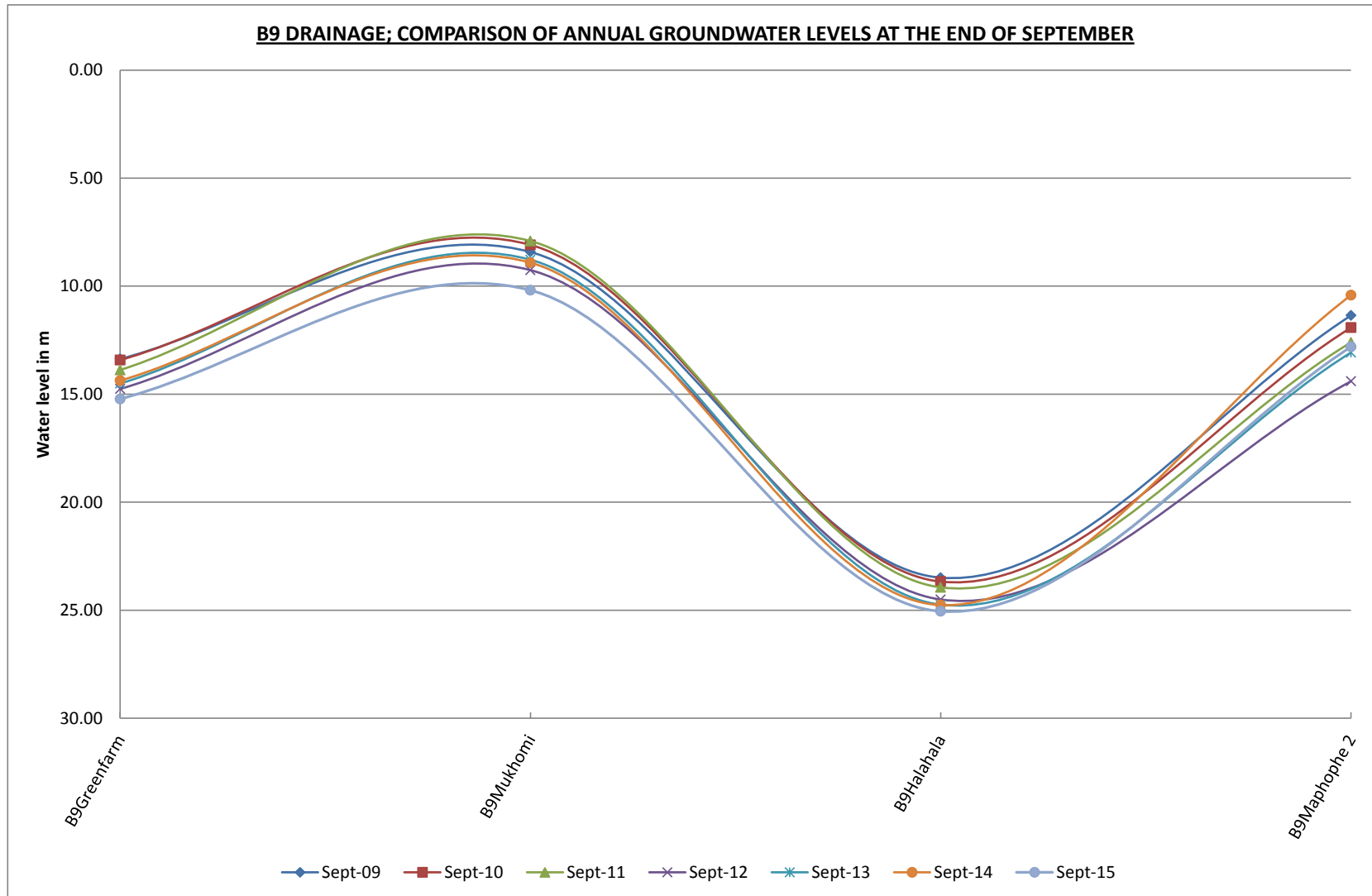
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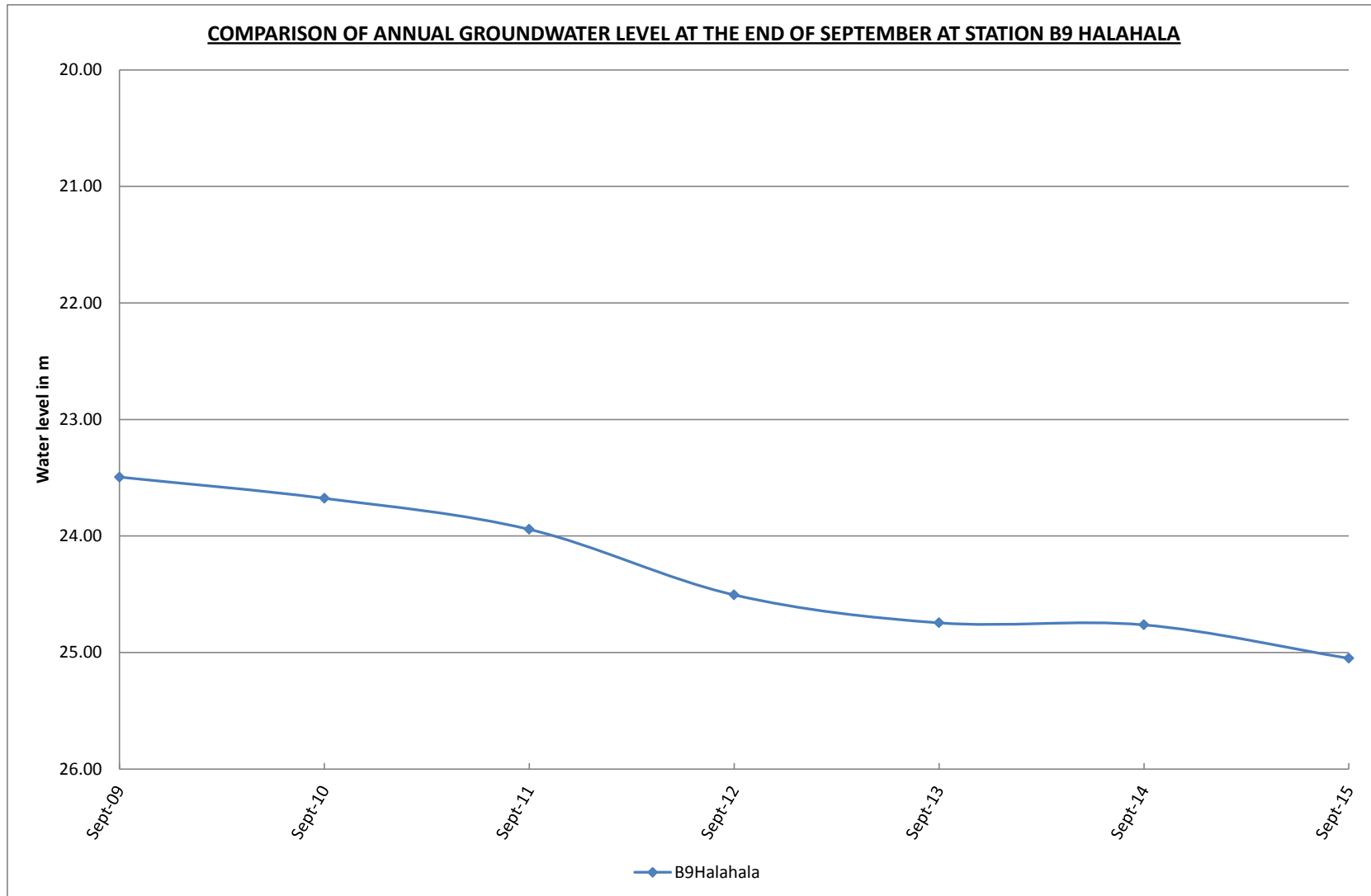
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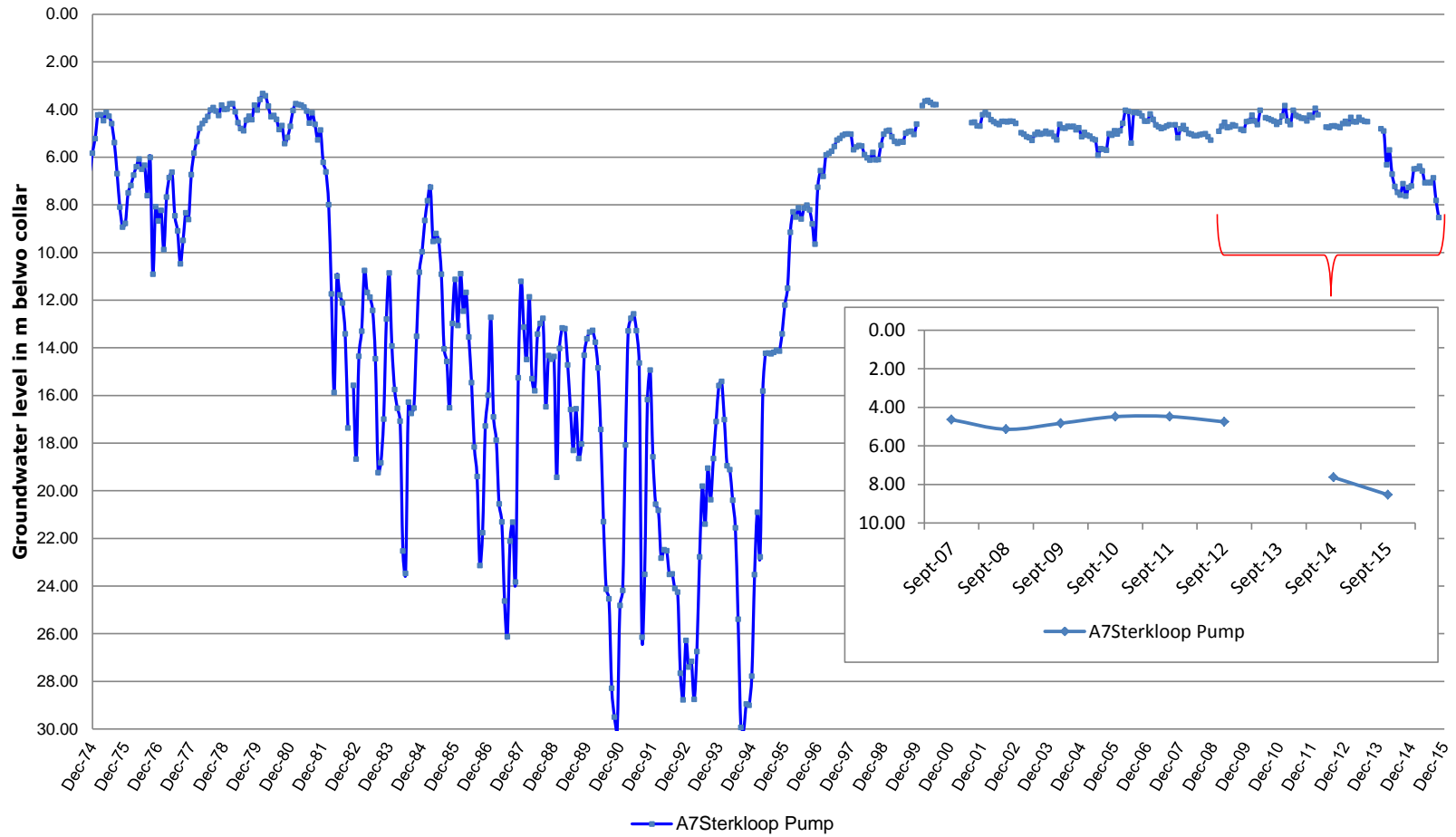


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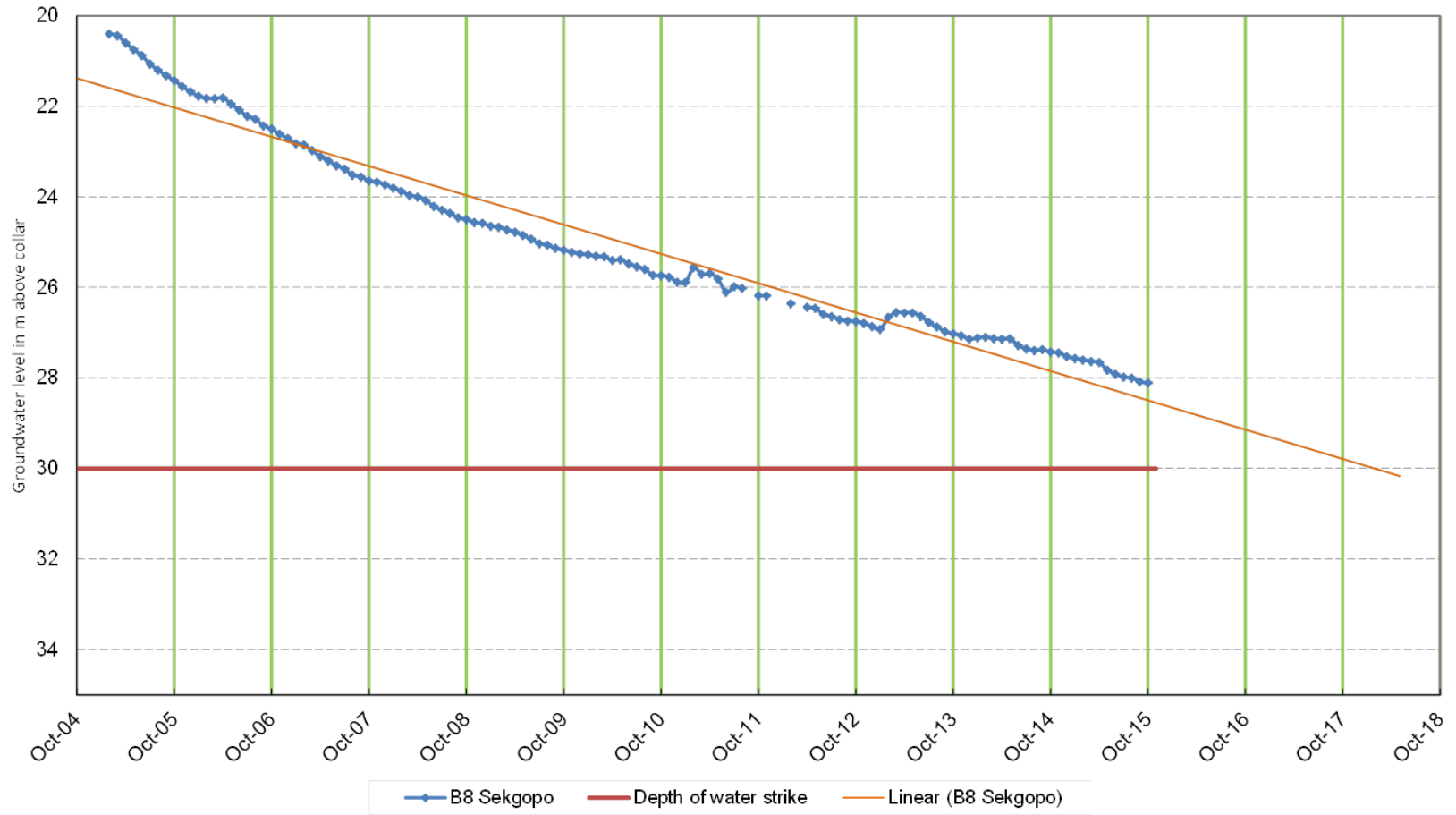
GRAPH 23

GROUNDWATER LEVEL TIME SERIES OF A7 STERKLOOP PUMP STATION



GRAPH 24

GROUNDWATER LEVEL TREND AT STATION B8 SEKGOPO



GRAPH 25

SOUTH AFRICAN WEATHER SERVICES SEASONAL FORECAST

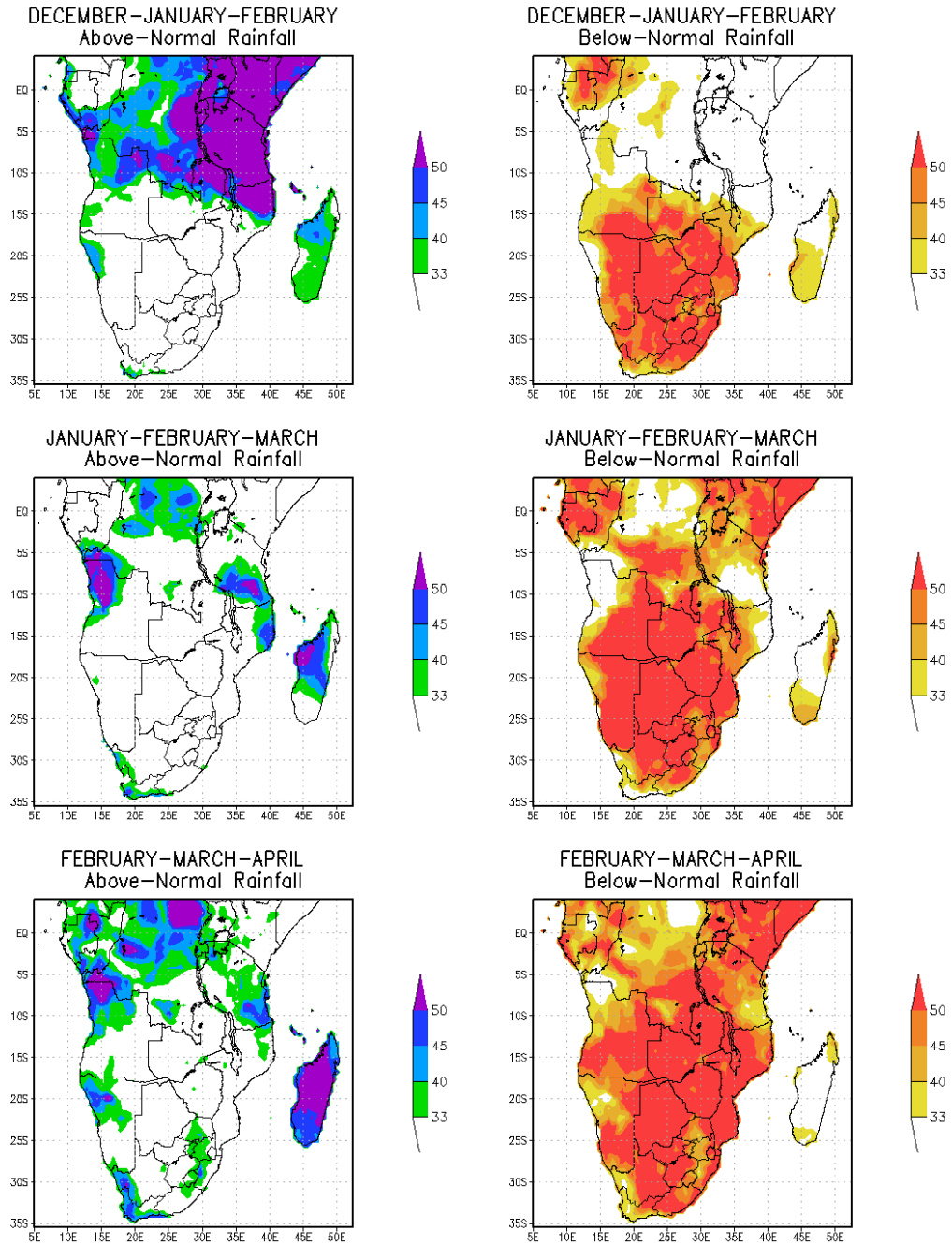


FIGURE 1