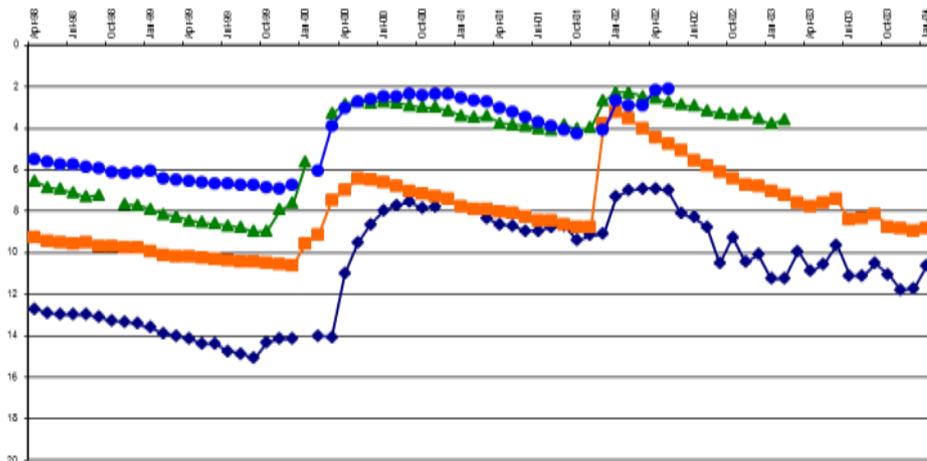


LIMPOPO REGION

QUARTERLY STATUS REPORT ON GROUNDWATER LEVEL TRENDS



H VERSTER

DIRECTORATE
PLANNING AND INFORMATION MANAGEMENT
MARCH 2017

Data collection~ and processing* assisted by:

P F TSHELANE~*

E RAMOBA~*

D A TLEANE~

T P SEAKAMELA~

TABLE OF CONTENTS

SUMMARY

- 1. BACKGROUND**
- 2. GROUNDWATER LEVELS**
 - 2.1 DIFFERENCE IN GROUNDWATER LEVELS; 1 OCTOBER TO 31 DECEMBER 2016**
 - 2.2 DIFFERENCE IN GROUNDWATER LEVELS 31 DECEMBER 2015 TO 31 DECEMBER 2016**
- 3. GROUNDWATER LEVEL TRENDS 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. RAINFALL**
 - 4.1 PERCENTAGE OF NORMAL RAINFALL; JULY TO DECEMBER 2016**
 - 4.2 PERCENTAGE OF NORMAL RAINFALL; JANUARY 2017**
- 5. IMPORTANCE OF GROUNDWATER MONITORING AND RESOURCE MANAGEMENT**
- 6. ACKNOWLEDGEMENTS**

LIST OF MAPS

MAP 1: DISTRIBUTION OF THE GROUNDWATER LEVEL MONITORING NETWORK IN LIMPOPO

MAP 2: DISTRIBUTION OF MONITORING STATIONS USED FOR WATER LEVEL STATISTICS IN THE REPORT

MAP 3: GROUNDWATER LEVEL TRENDS; 1 OCTOBER TO 31 DECEMBER 2016

MAP 4: GROUNDWATER LEVEL TRENDS; 31 DECEMBER 2015 TO 31 DECEMBER 2016

MAP 5: DISTRIBUTION OF MONITORING STATIONS USED FOR COMPILATION OF TREND GRAPHS

LIST OF GRAPHS

GRAPH 1: GROUNDWATER LEVEL TRENDS IN THE UPPER REACHES OF THE A4 DRAINAGE

GRAPH 2: GROUNDWATER LEVEL TRENDS IN LOWER REACHES OF THE A4 DRAINAGE

GRAPH 3: GROUNDWATER LEVEL TRENDS IN THE UPPER REACHES OF THE A5 DRAINAGE

GRAPH 4: GROUNDWATER LEVEL TRENDS IN THE LOWER REACHES OF THE A5 DRAINAGE

GRAPH 5: GROUNDWATER LEVEL TRENDS IN THE SOUTHERN TO CENTRAL PARTS A6 DRAINAGE

GRAPH 6: GROUNDWATER LEVEL TRENDS IN THE NORTH EASTERN PART OF THE A6 DRAINAGE

GRAPH 7: GROUNDWATER LEVEL TRENDS IN THE NORTH WESTERN PART OF THE A6 DRAINAGE

GRAPH 8: GENERAL GROUNDWATER LEVEL TRENDS IN THE A7 DRAINAGE

GRAPH 9: GENERAL GROUNDWATER LEVEL TRENDS IN THE A8 DRAINAGE

GRAPH 10: GROUNDWATER LEVEL TRENDS IN THE SOUTHERN PART OF THE A9 DRAINAGE

GRAPH 11: GROUNDWATER LEVEL TRENDS IN THE CENTRAL PART OF THE A9 DRAINAGE

GRAPH 12: GROUNDWATER LEVEL TRENDS IN THE NORTHERN PART OF THE A9 DRAINAGE

GRAPH 13: GROUNDWATER LEVEL TRENDS IN THE B3 DRAINAGE

GRAPH 14: GENERAL GROUNDWATER LEVEL TRENDS IN THE B5 DRAINAGE

GRAPH 15: GENERAL GROUNDWATER LEVEL TRENDS IN THE B7 DRAINAGE

GRAPH 16: GROUNDWATER LEVEL TRENDS IN THE SOUTHERN PART (GREAT LETABA RIVER DRAINAGE) OF THE B8 DRAINAGE

GRAPH 17: GROUNDWATER LEVEL TRENDS IN THE NORTHERN PART (MIDDEL AND KLEIN LETABA RIVER DRAINAGES) OF THE B8 DRAINAGE

GRAPH 18: GROUNDWATER LEVEL TRENDS IN THE B9 DRAINAGE

LIST OF FIGURES

FIGURE 1: PERCENTAGE OF NORMAL RAINFALL FOR THE SEASON JULY TO DECEMBER 2016

FIGURE 2: PERCENTAGE OF NORMAL RAINFALL FOR JANUARY 2017

LIST OF TABLES

TABLE 1: DIFFERENCE IN GROUNDWATER LEVELS; 1 OCTOBER TO 31 DECEMBER 2016

TABLE 2: DIFFERENCE IN GROUNDWATER LEVELS; 31 DECEMBER 2015 TO 31 DECEMBER 2016

SUMMARY

The status of groundwater as discussed in the report represents the situation at the end of the first quarter of the hydrological year, 31 December 2016, midway through the wet season. The lack of recharge due to the dry conditions experienced the past two years is evident throughout the province. Rains were received late in the quarter and recharge is mostly not notable yet or very limited. Groundwater levels at 77.5% of stations with data for the whole year are lower than the corresponding time last year. Comparison of current levels with historical levels where available, indicates that the current situation is, despite the two-year dry period, still well above critical level.

According to information from the South African Weather services, most of Limpopo received above normal rainfall during January 2017 and recharge may still result in an improvement in the groundwater level situation during the second quarter. Forecast for normal to above normal rainfall for the second quarter is however not favourable.

Local deviations from the general situation occur at a number of localities where groundwater is being over exploited. In such areas the lack of resource management has led to critical low water levels and even failing of supply boreholes.

Although the status of the groundwater resources as far as quantity is concerned is still considered to be healthy, should protection and sound management of the resource still be a high priority. The past two dry season's impact, especially on surface water resources, has again emphasised the importance of groundwater. The drought has not been broken yet and current forecasts are not favourable for the remaining part of the rainy season, which stresses the fact that our resources need to be utilised with care and managed effectively.

1. BACKGROUND

The groundwater level status as reflected in the report represents the status at 31 December 2016, which is the end of the 1st quarter of the hydrological year, midway through the wet season. Groundwater level data was collected during February and March 2017. Groundwater level trends are discussed per secondary drainage area. The distribution of the monitoring network is illustrated by **MAP 1**.

2. GROUNDWATER LEVELS

Data availability for specific dates depend on various factors and a very low availability are indicated for the periods discussed. Analysis indicates the following for the period October to December 2016:

- Stations not accessible due to locked gates or field conditions: 1.6%
- Vandalised stations: 3.1%
- Stations where only hand measurements are normally taken: 4.7%
- Stations without electronic loggers due to instrument shortage: 17.6%
- Stations with data not yet available on the database at the time of extraction: 18.1%

Total no data:	45.1%
With data:	<u>54.9%</u>
Total:	100%

The distribution of stations with data is illustrated by (**MAP 2**)

2.1 DIFFERENCE IN GROUNDWATER LEVELS; 1 OCTOBER TO 31 DECEMBER 2016 (TABLE 1)

Data for both dates are only available for 54.9% of monitoring stations. Of these, 44 stations (41.51%) indicate some rise in the water level. Although precipitation mostly occurred late in the quarter indications are that limited recharge started to reach the groundwater table. Lack of recharge at the end of the quarter is most prominent in the A4, A5, A6 and lower reaches of the A7 and A9 drainages (**MAP 3**)

1 October to 31 December 2016	
Total stations visited	193

With data	106 Stations	54.9%
-----------	--------------	-------

Water level	Number of stations	Average(m)	%
Down	61 Stations	0.35	57.55%
Up	44 Stations	0.40	41.51%
No change	1 Stations		0.94%
No Data	87 Stations		
Total	193		100.00%

TABLE 1

**2.2 DIFFERENCE IN GROUNDWATER LEVELS; 31 DECEMBER 2015 TO 31 DECEMBER 2016
(TABLE 2)**

Lower groundwater levels than the corresponding time last year is present at 77.48% of stations with data for both dates. The average decline is 1.53m.

The distribution of monitoring stations with higher or lower groundwater levels is illustrated by **MAP 4**

31 December 2015 to 31 December 2016	
Total stations visited	193

With data	111 Stations	57.5%
-----------	--------------	-------

Water level	Number of stations	Average(m)	%
Down	86 Stations	-1.53	77.48%
Up	24 Stations	1.37	21.62%
No change	1 Stations		0.90%
No Data	82 Stations		
Total	193		100.00%

TABLE 2

3 GROUNDWATER LEVEL TRENDS IN THE DIFFERENT SECONDARY DRAINAGE AREAS

The positions of monitoring stations used for discussion of trend graphs are indicated on **(MAP 5)**

3.1 DRAINAGE AREA A4

No recharge is evident in the upper reaches, or recharge area, of this drainage for the first quarter of the season yet. The lack of recharge the past two seasons is very notable and the groundwater level decline over this period is prominent, especially at station A4Alma. Current water levels do not raise any concern yet and considered to represent a healthy status. **(GRAPH 1)**

Groundwater levels in the lower reaches, or discharge area, of the A4 drainage displays vey little seasonal fluctuations but indicate stable conditions for some years now. A good rainfall event in March 2014 indicated a little recharge at only one station, A4Matlabas Limpopo. **(GRAPH 2)**

3.2 DRAINAGE AREA A5

A stable condition with normal seasonal fluctuation is indicated by the water levels in the upper reaches, or recharge area, of the A5 drainage but the effect of no recharge the past two seasons is also notable here **(GRAPH 3)**

Normal local seasonal rainfall does not seem to have a great effect on groundwater levels in the lower reaches of the A5 drainage. Despite some small fluctuations, indicate the general trend

over the six years of monitoring in the drainage a constant decline. The recharge mechanism for the area with regard to recharge area and magnitude of precipitation is not known but a major event is apparently needed. Unfortunately the lack of long-term data makes a reliable evaluation of the current status very difficult (**GRAPH 4**).

3.3 DRAINAGE AREA A6

Groundwater levels in the southern to central part of the A6 drainage also display the two year decline but comparison with historical levels indicate a still healthy status (**GRAPH 5**).

In the north eastern part of the A6 drainage water levels indicated stable conditions up to January 2013 when a high rainfall event in the area caused a considerable rise in groundwater levels in the area. Water levels are still returning from this high and considered to represent a healthy status (**GRAPH 6**)

The situation in the north western part of the drainage however are displaying a constant decline similar to that displayed in the adjacent part of the A5 drainage and a need for a major recharge event is indicated by the current status (**GRAPH 7**)

3.4 DRAINAGE AREA A7

Comparisons of historical and current groundwater levels indicate a healthy status in general for the A7 drainage, despite the declining trend the past two years (**GRAPH 8**)

3.5 DRAINAGE AREA A8

Stable groundwater levels with normal seasonal fluctuations characterise the situation in the A8 drainage and the status is considered healthy (**GRAPH 9**)

3.6 DRAINAGE AREA A9

Sudden large fluctuations in groundwater levels can be noted in the southern part of the A9 drainage. The situation changed dramatically since 2014 after which the water levels declined very steeply due to the lack of recharge (**GRAPH 10**)

The central mountainous part of the A9 drainage is the major recharge area and groundwater levels are also prone to sudden large rises followed by declines due to normal outflow. The two year decline can also be noted here but not as prominent as to the south. The current status is considered healthy in this part (**GRAPH 11**)

The last notable recharge event in the lower reaches of the Mutale River drainage occurred in January 2013 after which the groundwater levels, characterised by a steady decline, continued the decline and good recharge is needed in this area (**GRAPH 12**)

3.7 DRAINAGE AREA B3

There are only four monitoring stations in the B3 drainage. Groundwater levels in parts of this drainage are highly impacted and it is impossible to come to any conclusions on the status of groundwater in the drainage as a whole. The groundwater status around Tuinplaas and Settlers has long been a matter of concern and continue to be so. The difference in groundwater level

trends at these stations and that of B5 De Kuil 2 which is un-impacted is clear to see **(GRAPH 13)**

3.8 DRAINAGE AREA B5

Comparisons of current to long-term trends indicate a healthy status for most of the B5 drainage. **(GRAPH 14)**

One exception exists at the town of Roedtan where uncontrolled abstraction has led to a decline in excess of 60 meter in the local groundwater level. The time series graph (A7 Byzonderheid 2) was included in some previous reports to illustrate the effect of a total lack of resource management.

3.9 DRAINAGE AREA B7

Groundwater levels in this drainage indicate stable conditions with normal seasonal fluctuations but the two-year decline is also apparent. The groundwater level status is still considered to be healthy **(GRAPH 15)**

3.10 DRAINAGE AREA B8

In the southern part of the B8 drainage, drained by the Great Letaba River, groundwater levels display stable conditions with regular seasonal fluctuations **(GRAPH 16)**. The groundwater level status is also still considered to be healthy in this area.

Groundwater level trends in the northern part drained by the Middle and Klein Letaba Rivers differ completely and is characterised by a constant decline with no apparent seasonal recharge for over ten years and is a matter for concern **(GRAPH 17)**

3.11 DRAINAGE AREA B9

Despite some small seasonal fluctuations at some stations are all water levels in the B9 drainage indicating a constant decline similar to that in the adjacent part of the B8 drainage discussed above **(GRAPH 18)**

4 RAINFALL

4.1 PERCENTAGE OF NORMAL RAINFALL; JULY TO DECEMBER 2016 (FIGURE 1)

From figure 1, compiled by the South African Weather Services it can be seen that most of the Limpopo province received normal to above normal rainfall for the season up to December 2016. Most rain however occurred late in this period and no notable contribution to groundwater can be noted yet.

4.2 PERCENTAGE OF NORMAL RAINFALL; JANUARY 2017 (FIGURE 2)

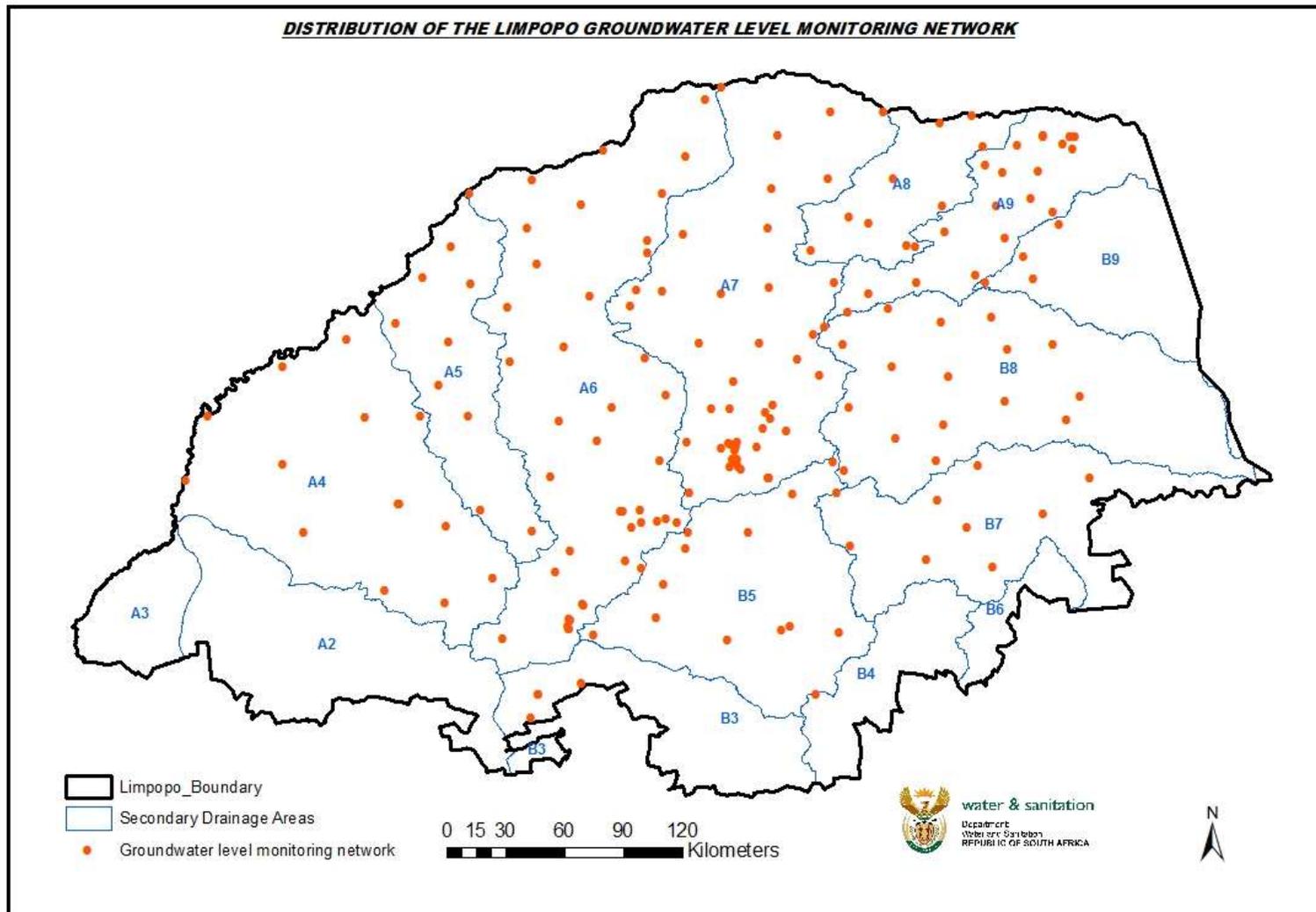
Figure 2, indicate that most of the Province received above normal rainfall in January 2017 and it may hopefully lead to an improvement in the groundwater situation in time.

5 IMPORTANCE OF GROUNDWATER MONITORING AND RESOURCE MANAGEMENT

The impact of the recent drought, which has not been completely broken yet, on especially surface water resources, has again served to emphasise the importance of groundwater resources. As with any resource, sustainable use can only be attained through effective management of the resource. Monitoring is the cornerstone of groundwater management.

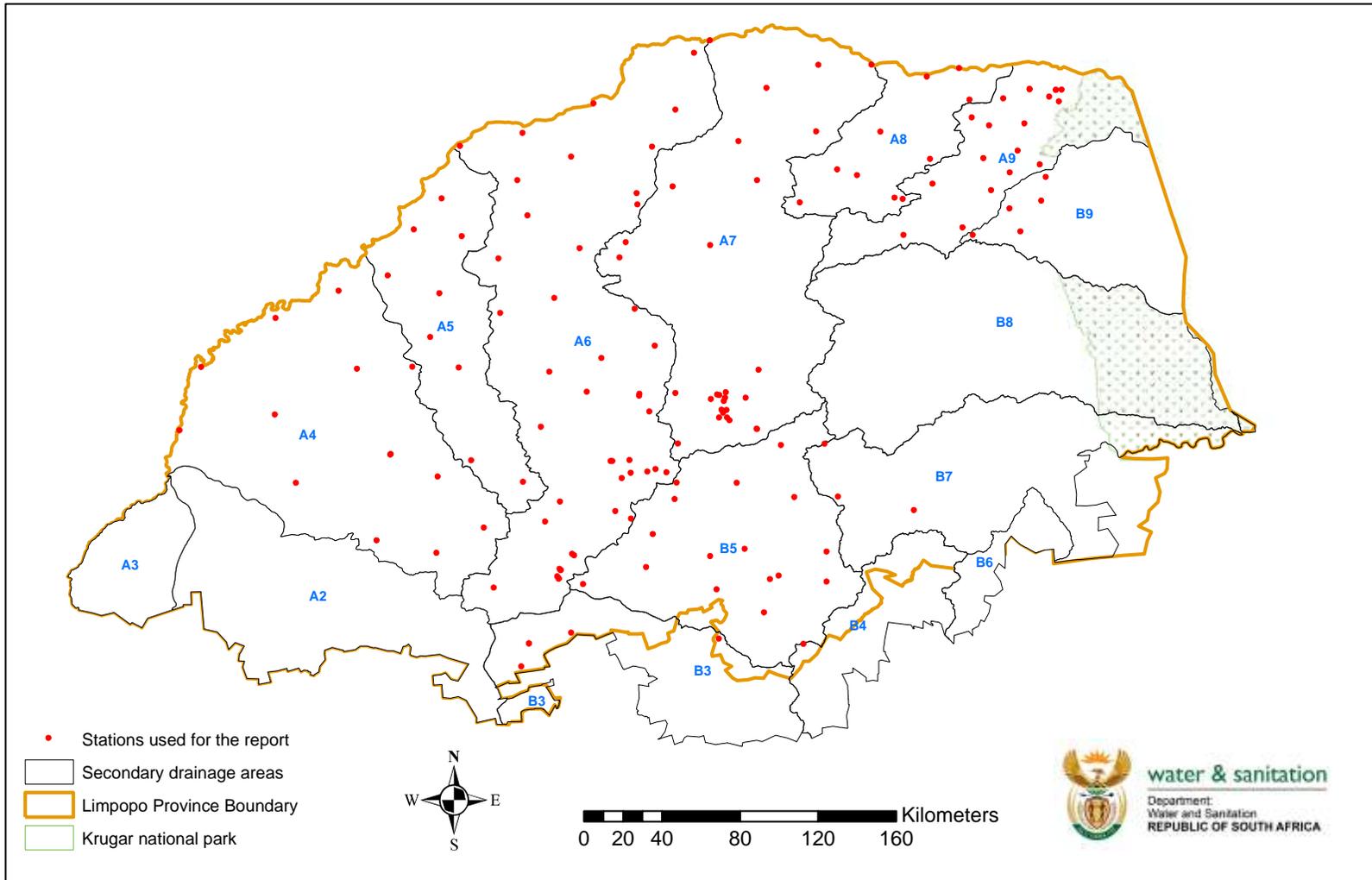
6 ACKNOWLEDGEMENTS

Percentage of normal rainfall: South African Weather Services: <http://www.weathersa.co.za>



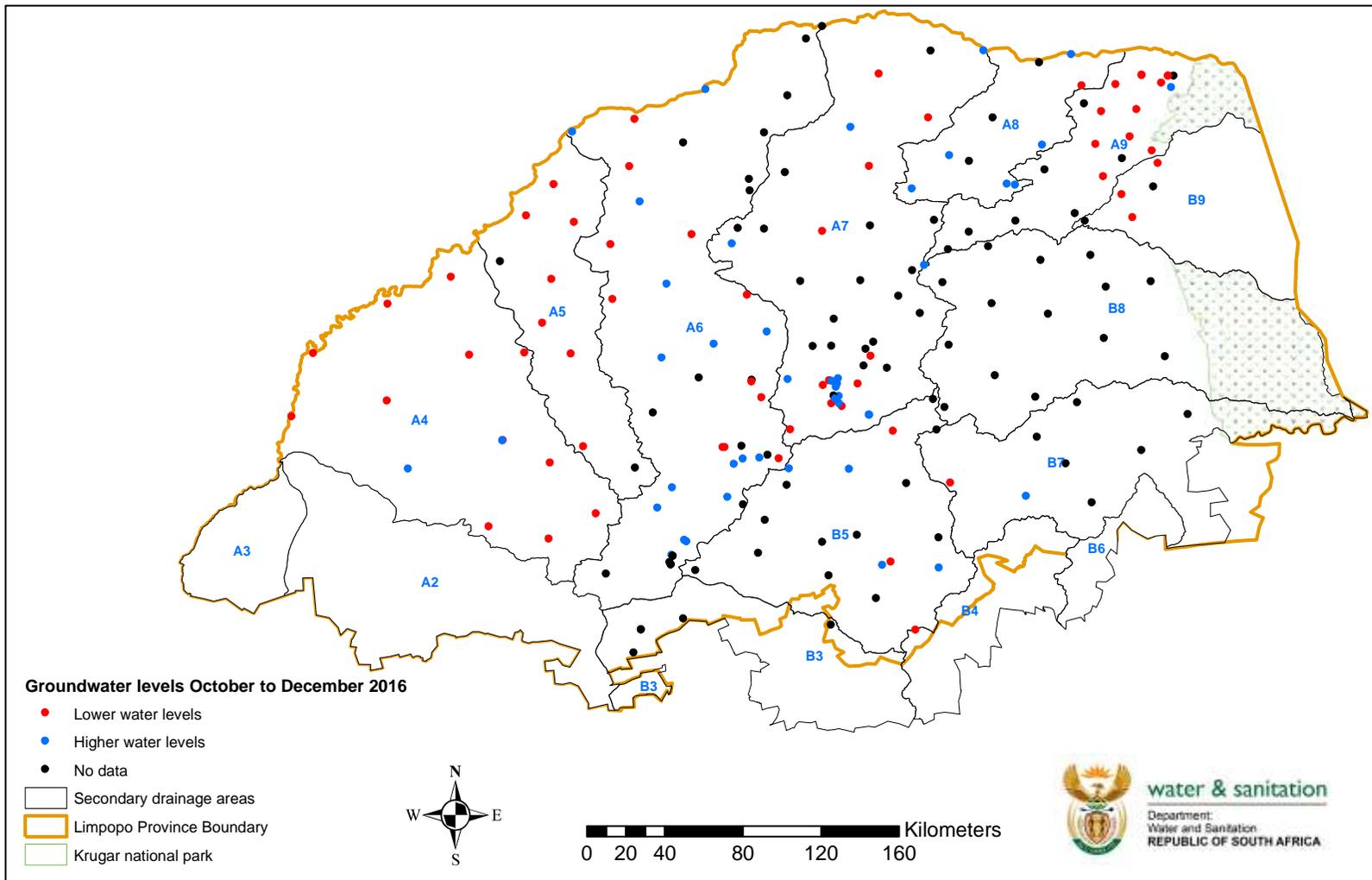
MAP 1

Distribution of stations used for the report



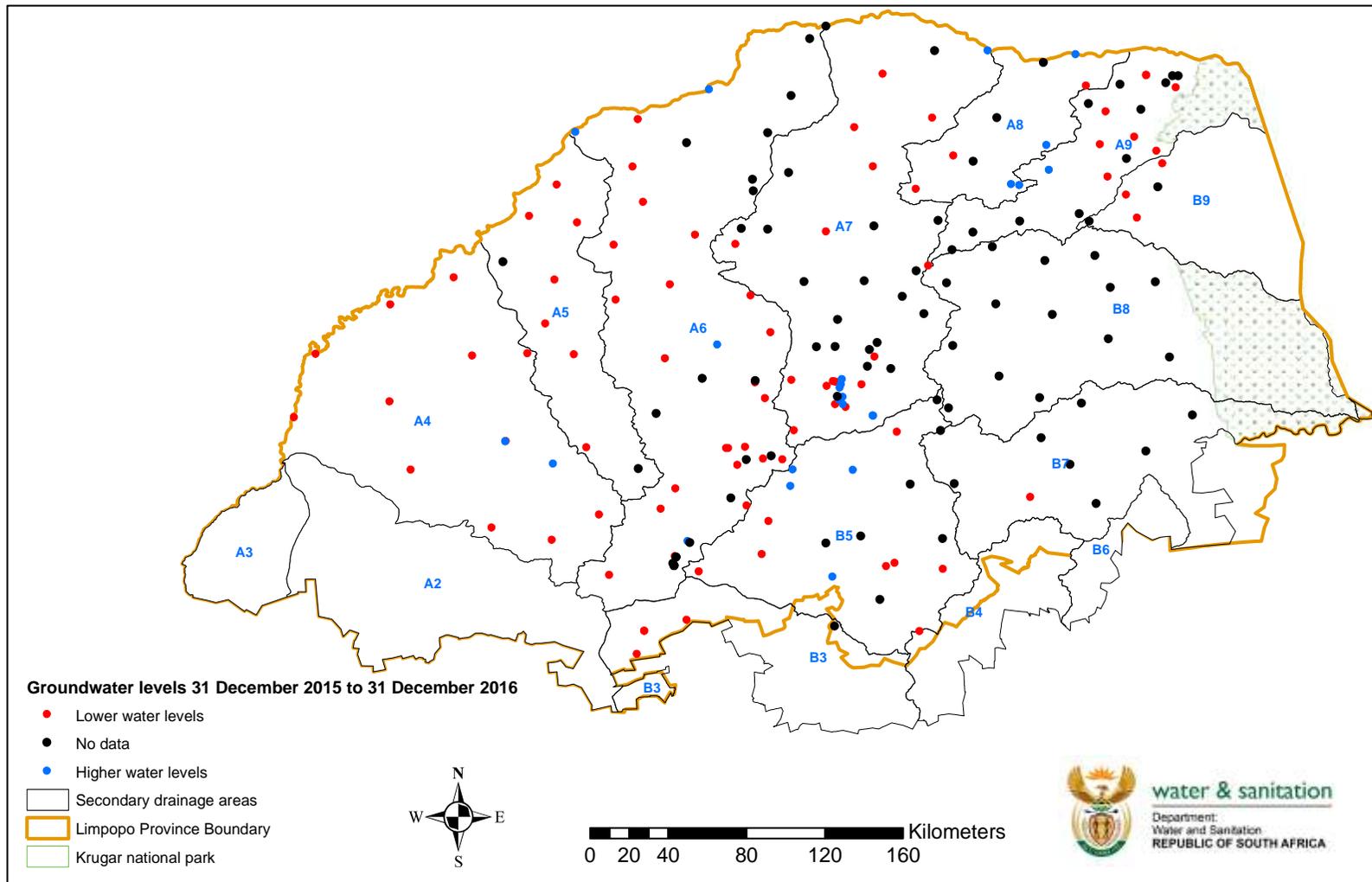
MAP 2

Groundwater level trends; 1 October to 31 December 2016



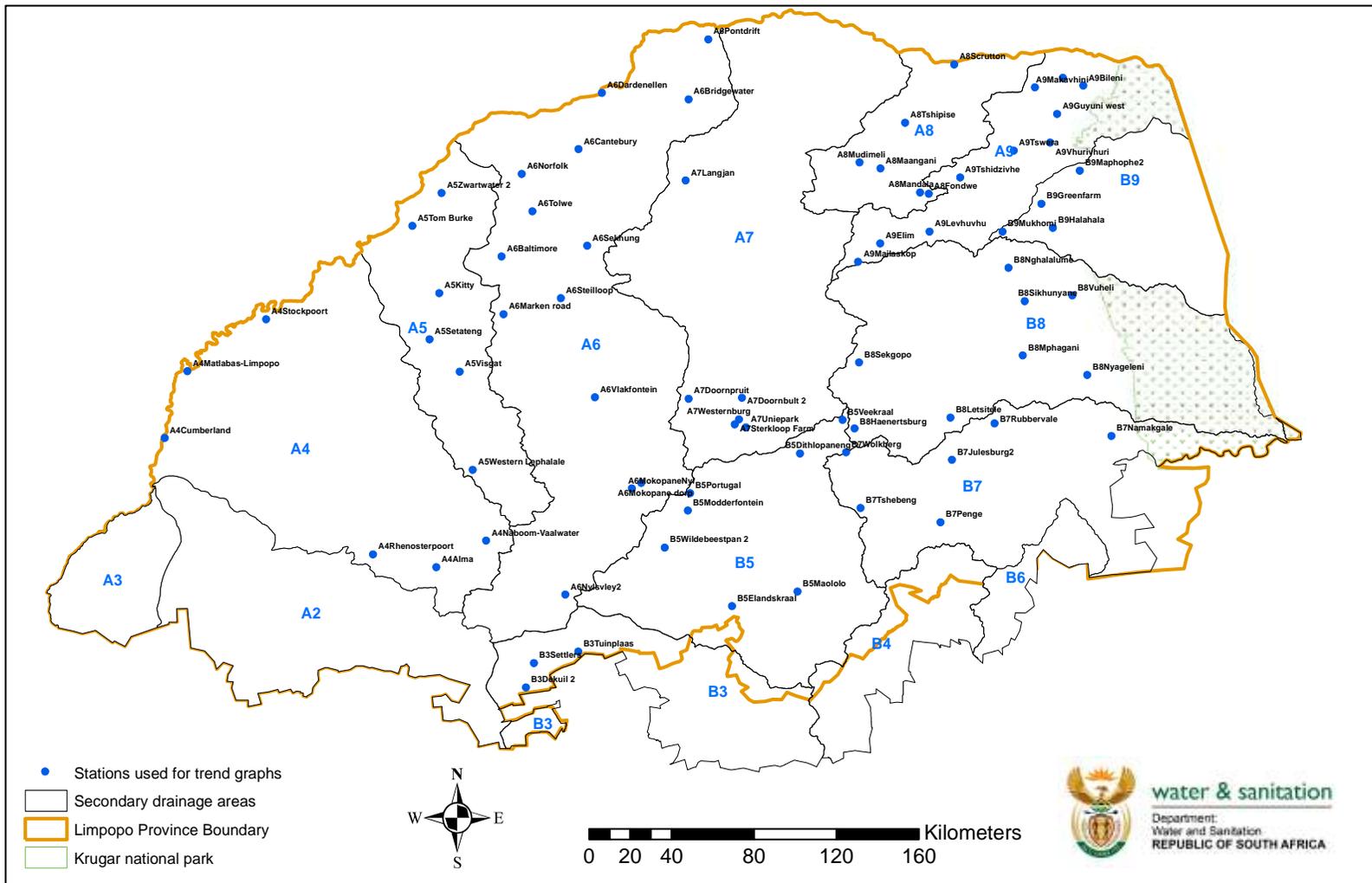
MAP 3

Groundwater level trends; 31 December 2015 to 31 December 2016

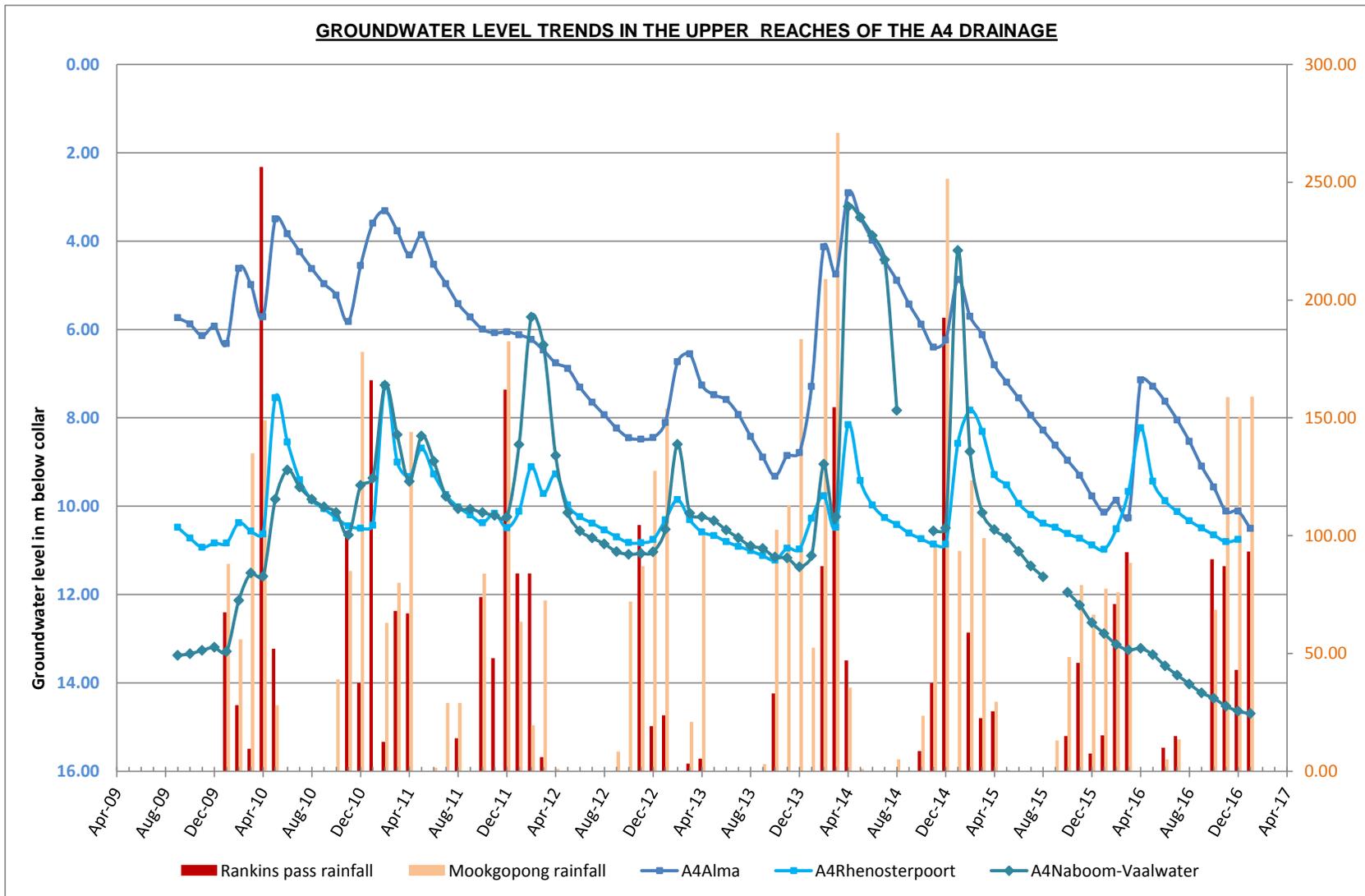


MAP 4

Distribution of monitoring stations used for compilation of trend graphs

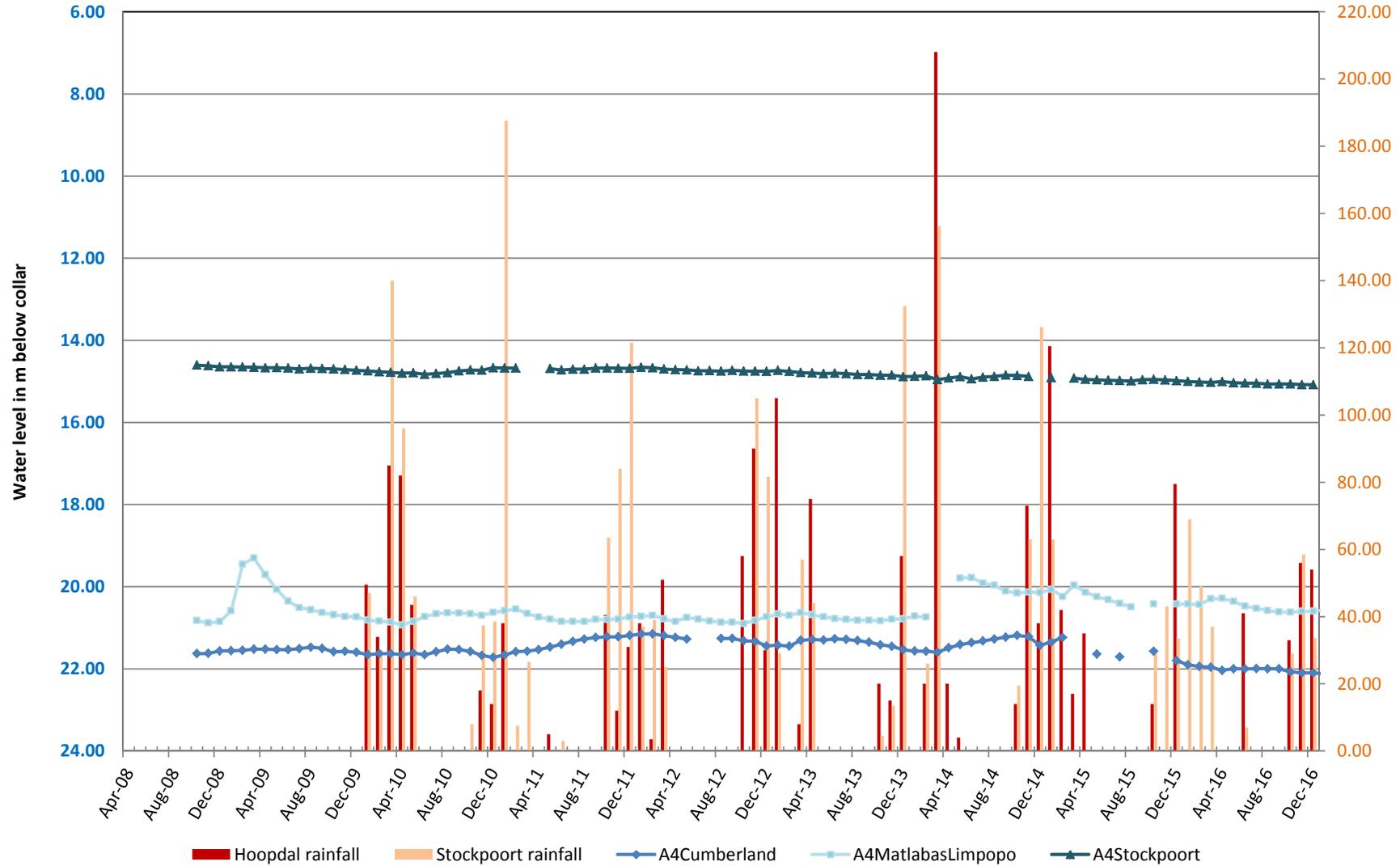


MAP 5



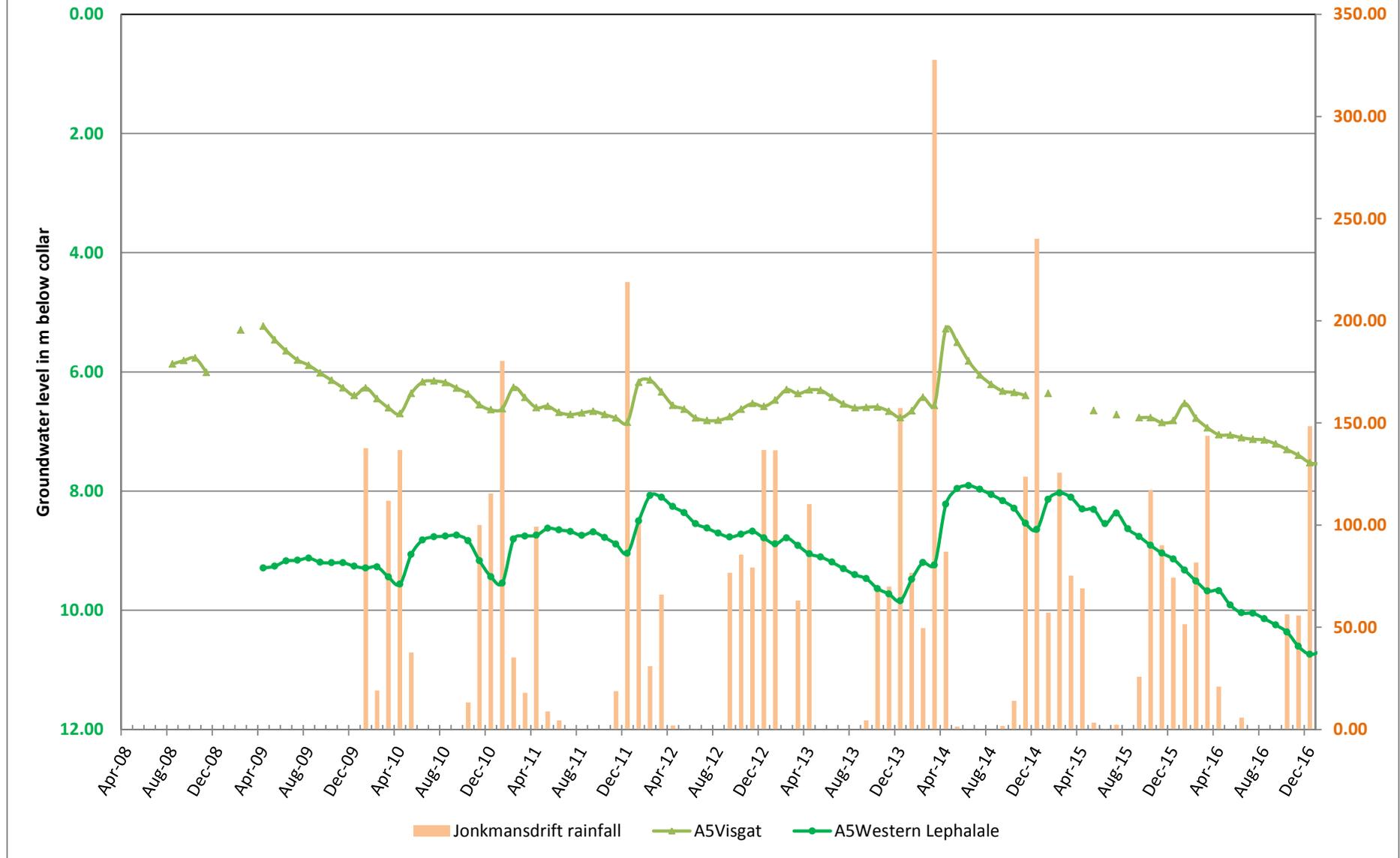
GRAPH 1

GROUNDWATER LEVEL TRENDS IN THE LOWER REACHES OF THE A 4 DRAINAGE



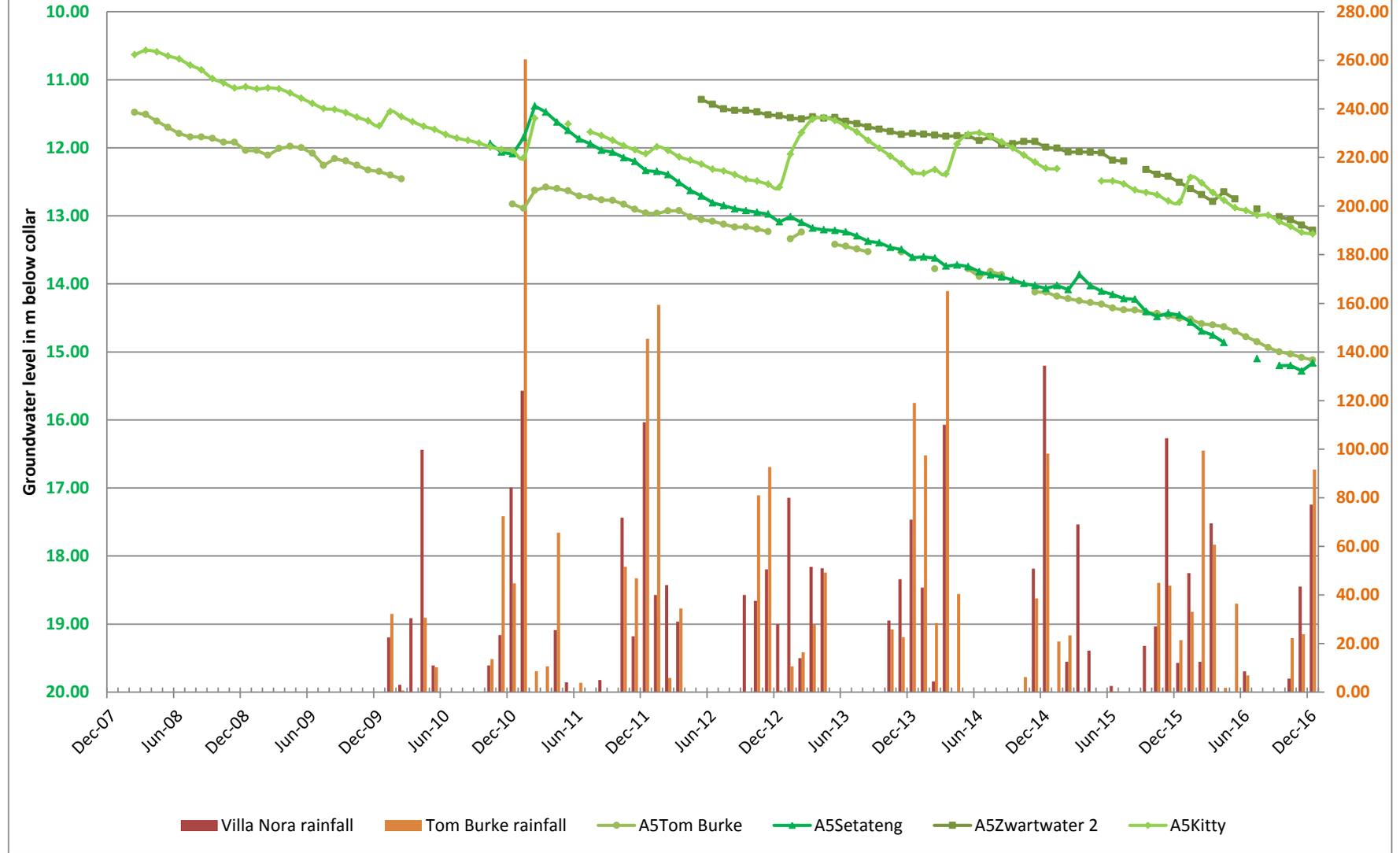
GRAPH 2

GROUNDWATER LEVEL TRENDS IN THE UPPER REACHES OF THE A5 DRAINAGE



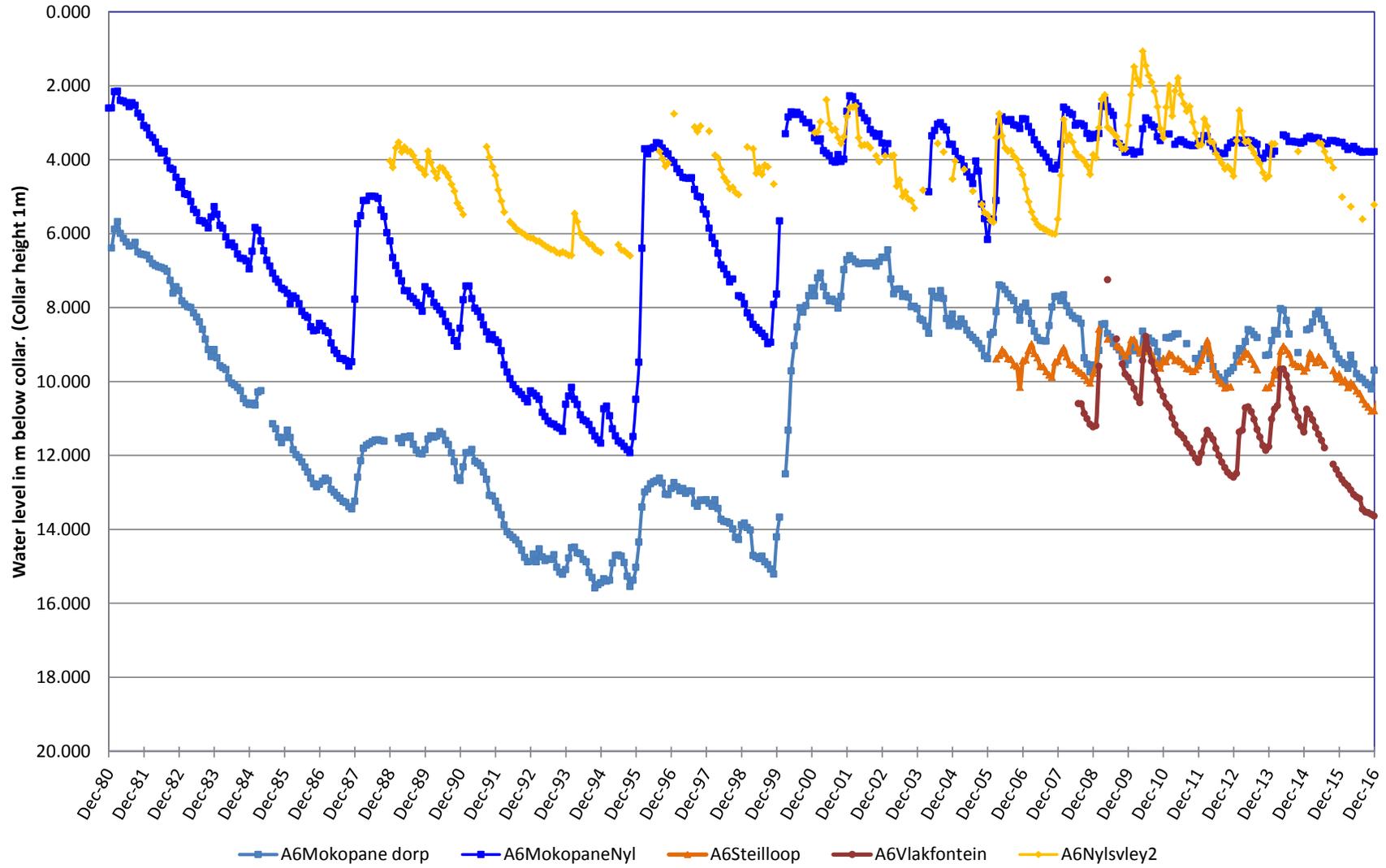
GRAPH 3

GROUNDWATER LEVEL TRENDS IN THE LOWER REACHES OF THE A5 DRAINAGE



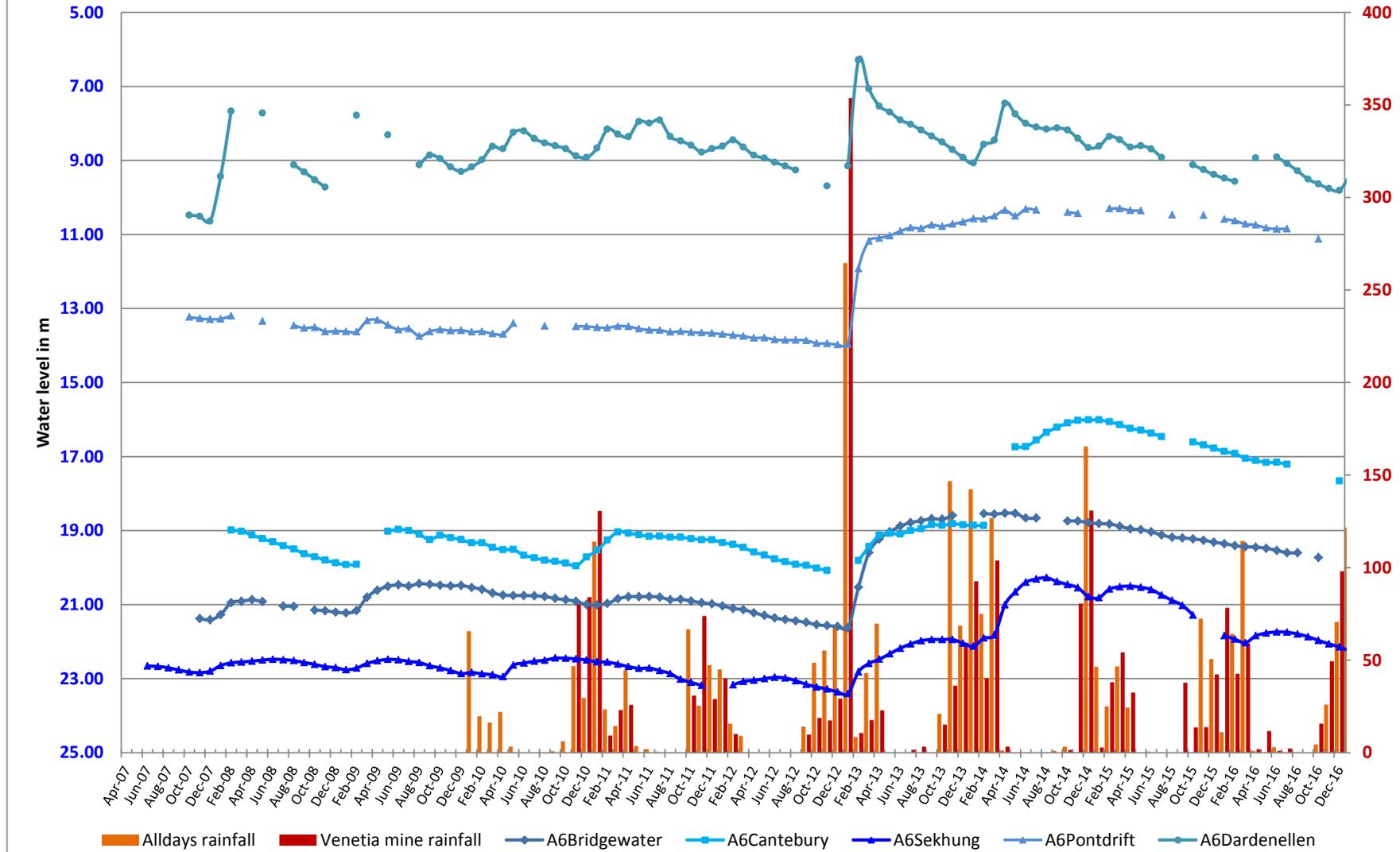
GRAPH 4

GROUNDWATER LEVEL TRENDS IN THE SOUTHERN TO CENTRAL PARTS OF THE A6 DRAINAGE



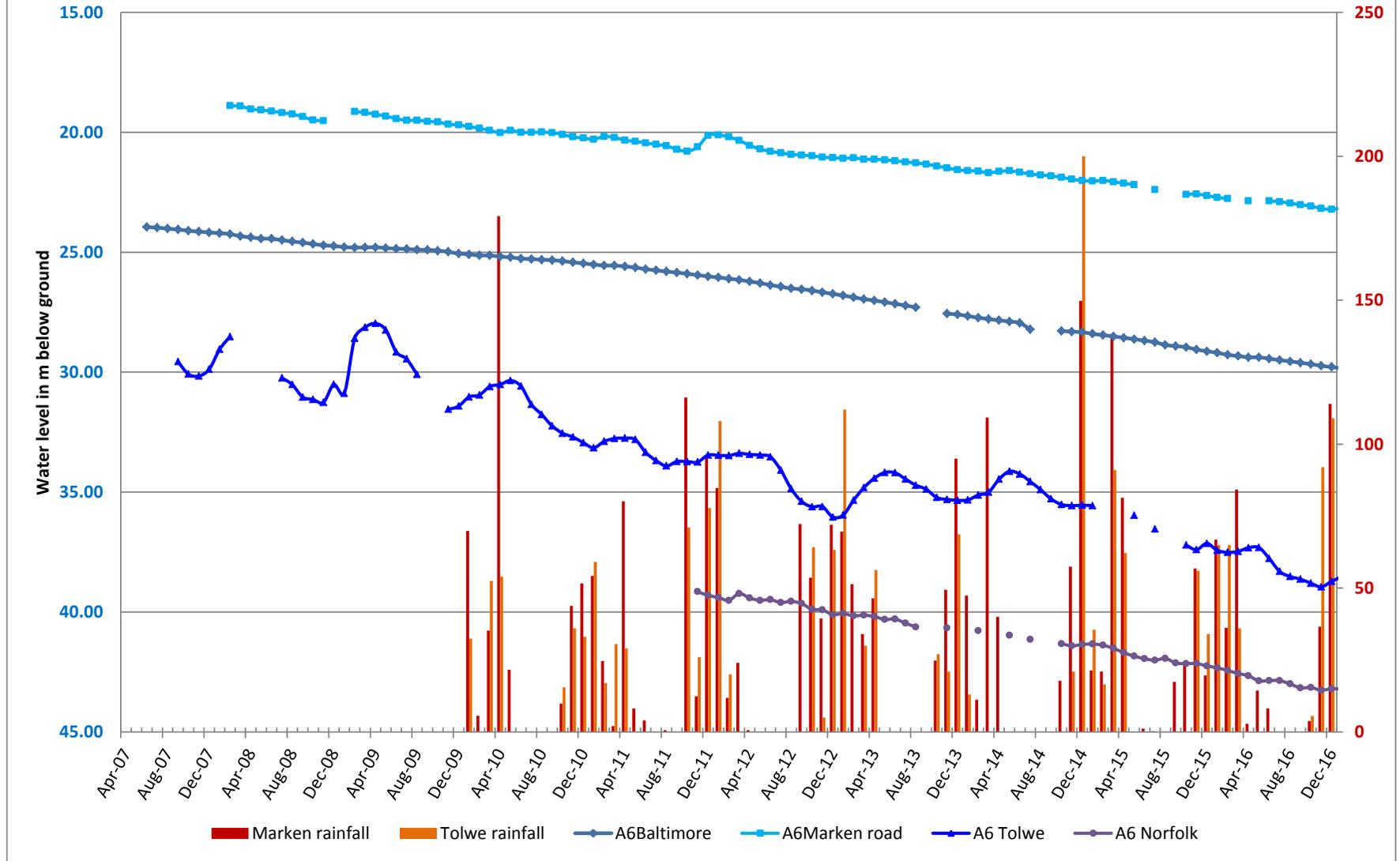
GRAPH 5

GROUNDWATER LEVEL TRENDS IN THE NORTH EASTERN PART OF THE A6 DRAINAGE



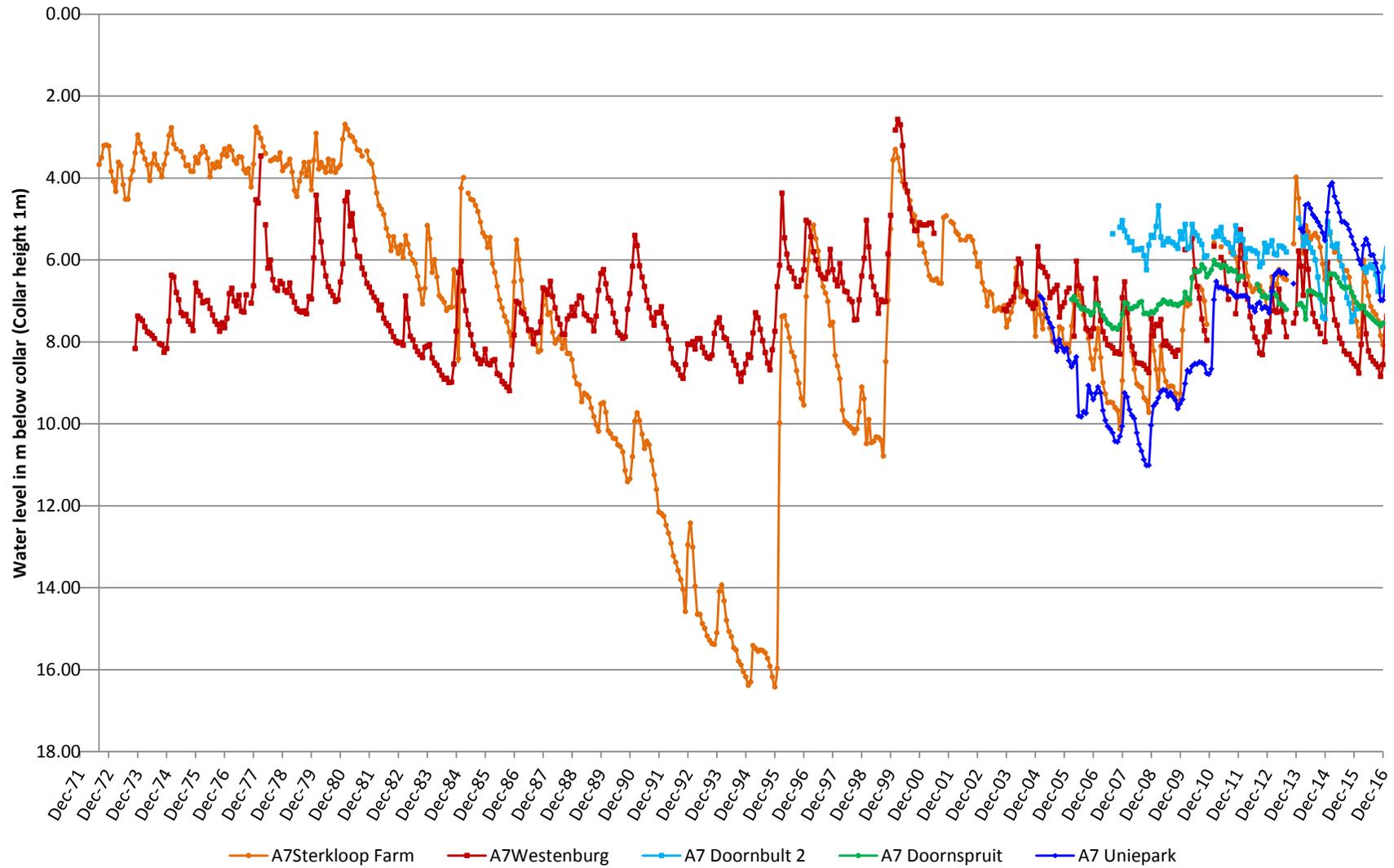
GRAPH 6

GROUNDWATER LEVEL TRENDS IN THE NORTH WESTERN PART OF THE A6 DRAINAGE



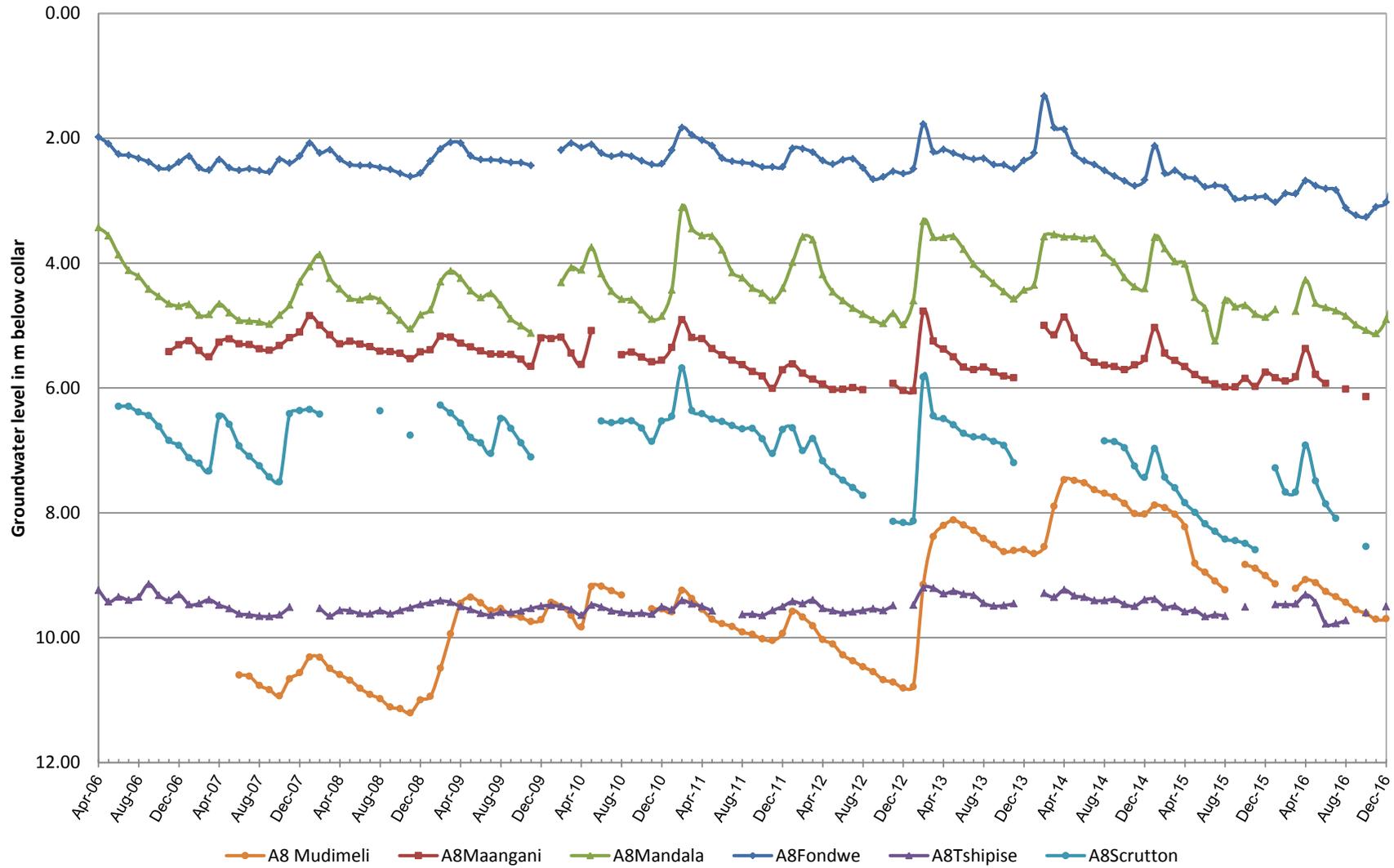
GRAPH 7

GENERAL GROUNDWATER LEVEL TRENDS IN THE A7 DRAINAGE



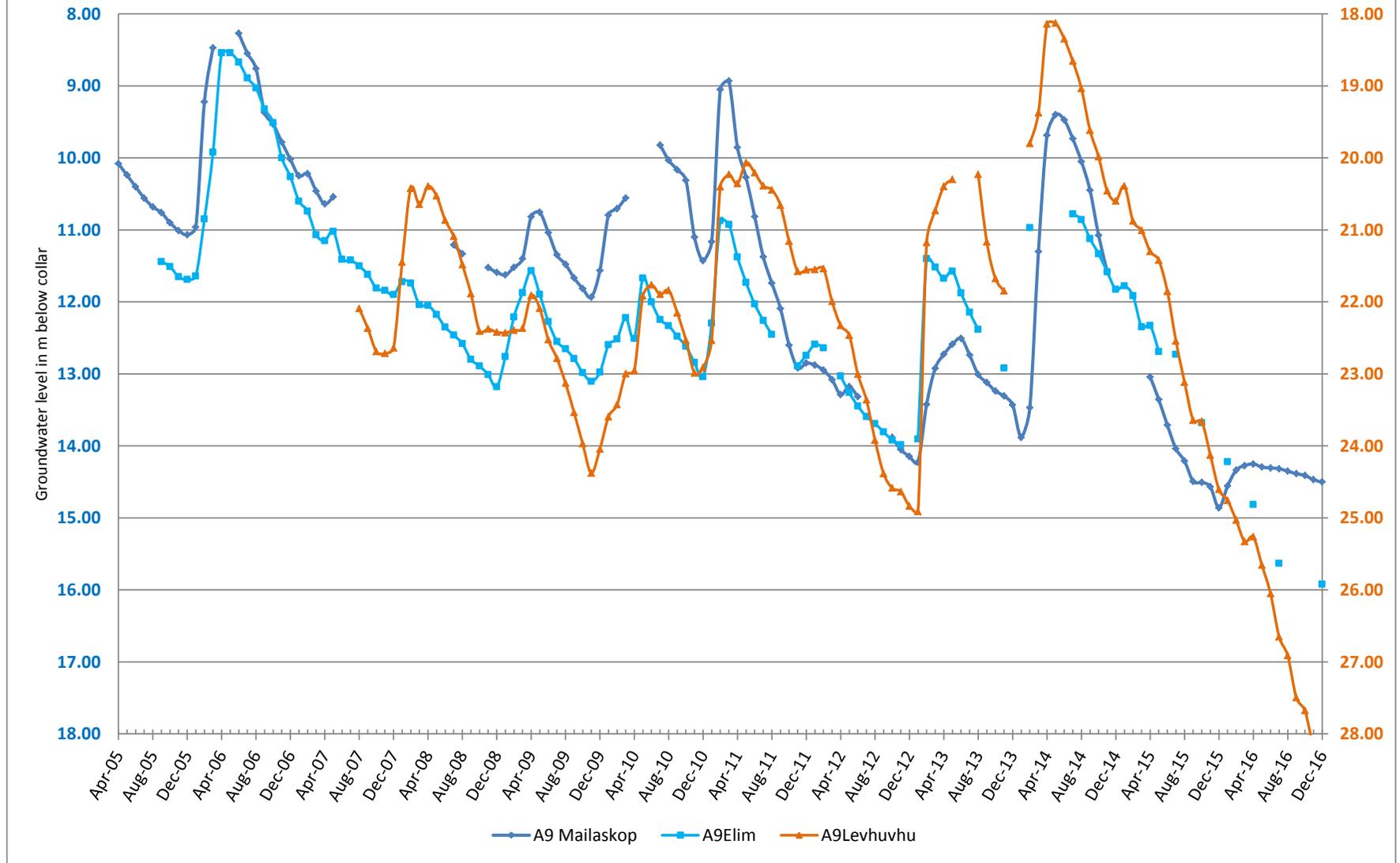
GRAPH 8

GENERAL GROUNDWATER LEVEL TRENDS IN THE A8 DRAINAGE



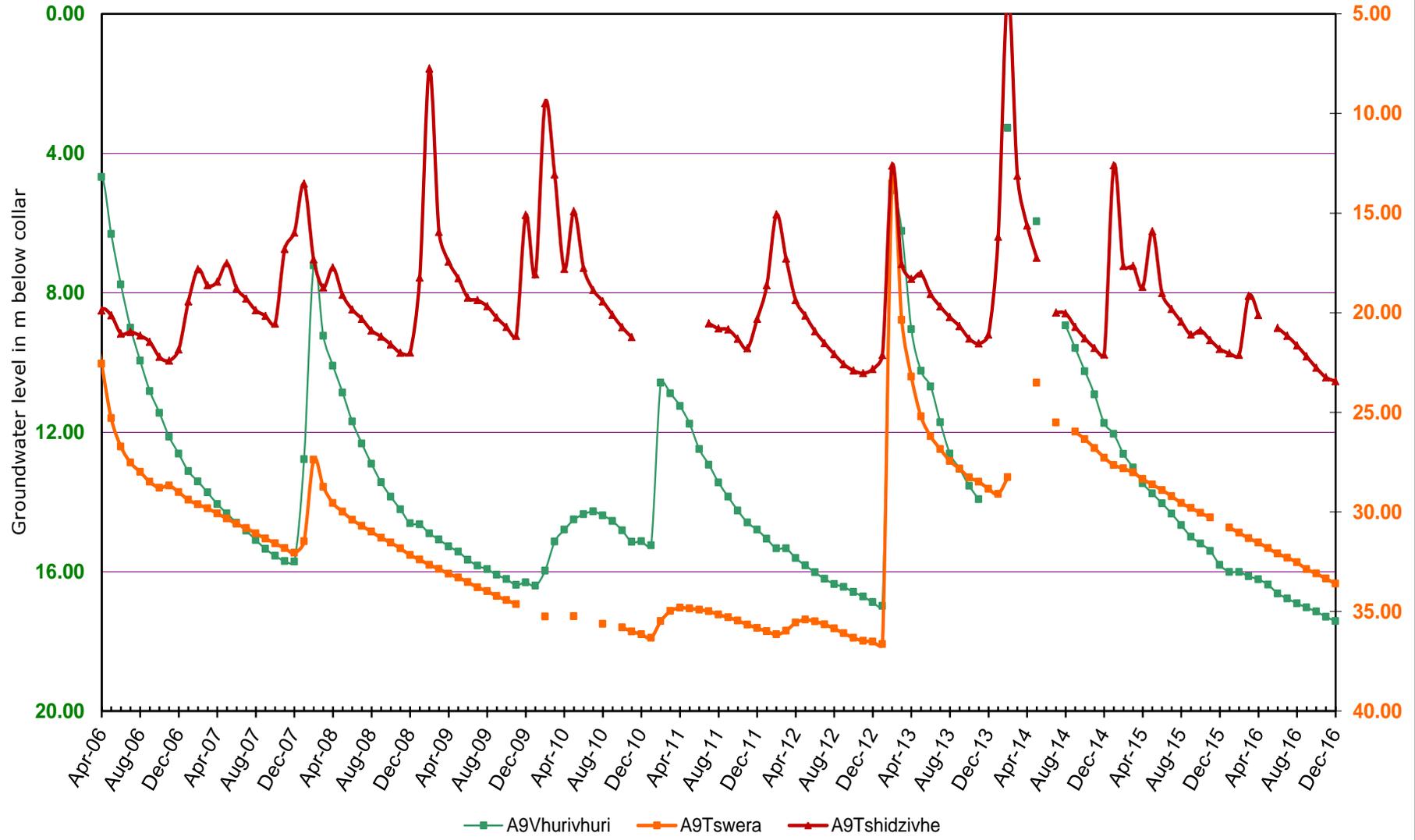
GRAPH 9

GROUNDWATER LEVEL TRENDS IN THE SOUTHERN PART OF THE A9 DRAINAGE



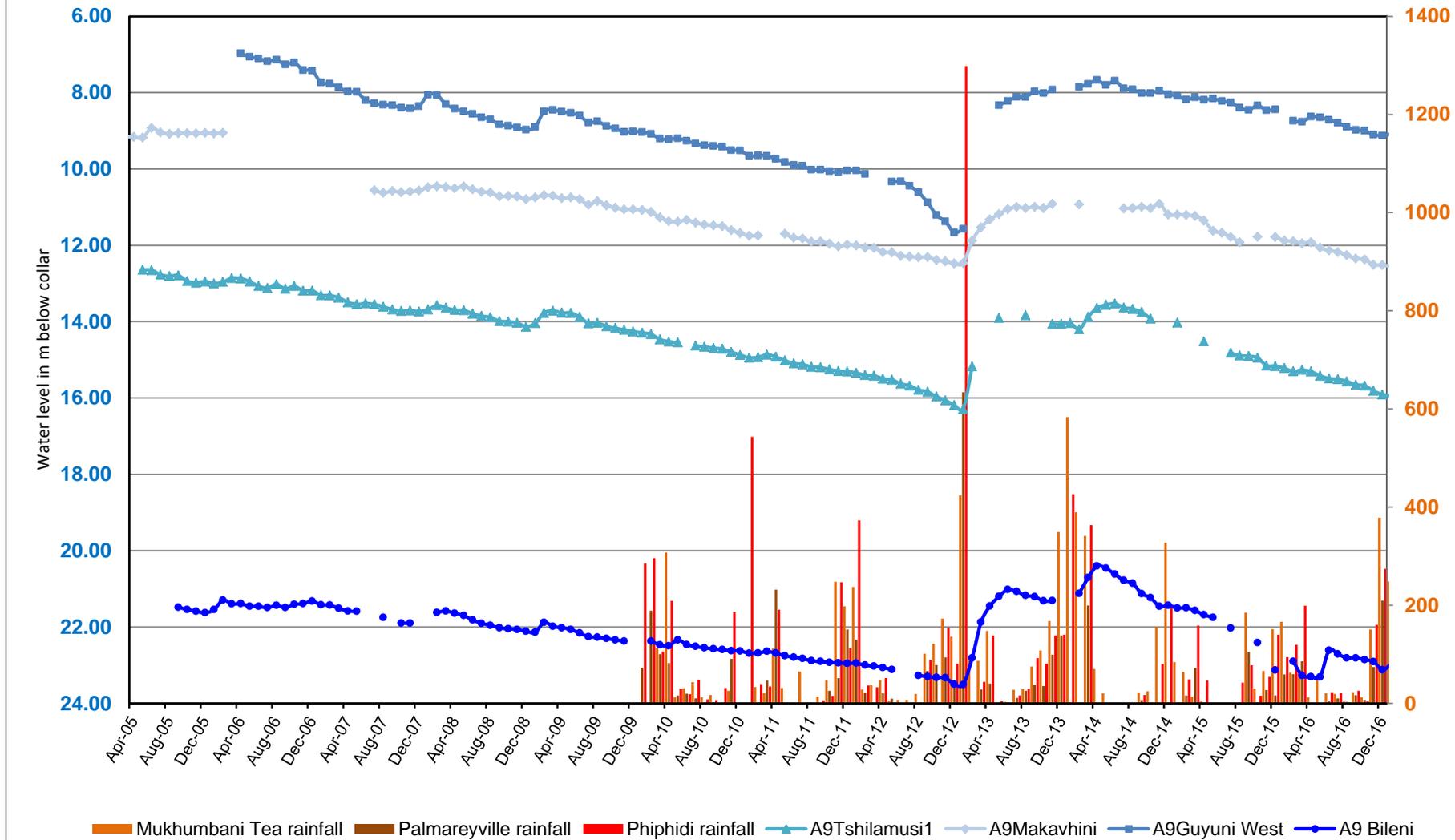
GRAPH 10

GROUNDWATER LEVEL TRENDS IN THE CENTRAL PART OF THE A9 DRAINAGE



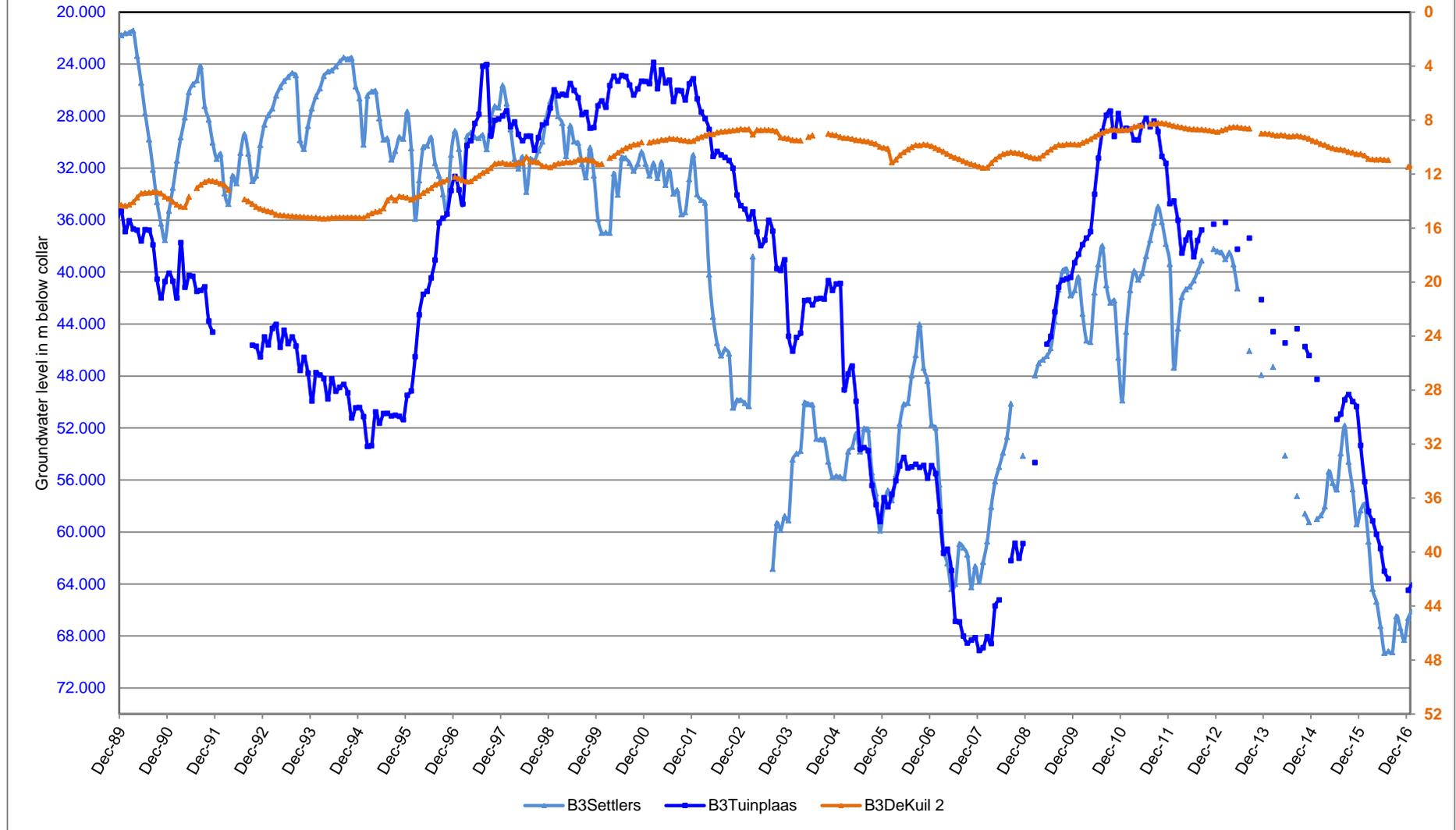
GRAPH 11

GROUNDWATER LEVEL TRENDS IN THE NORTHERN PART OF THE A9 DRAINAGE



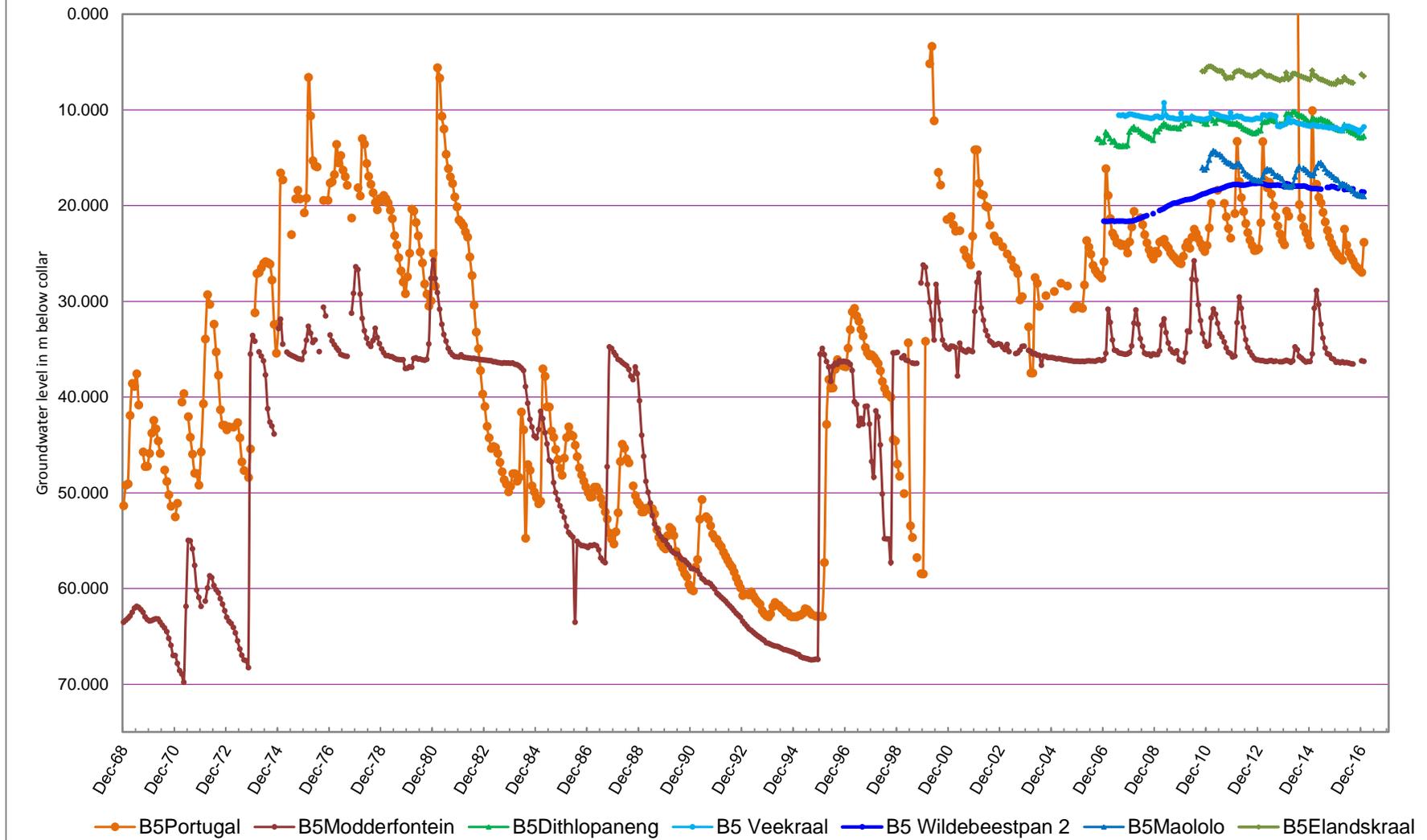
GRAPH 12

GROUNDWATER LEVEL TRENDS IN THE B3 DRAINAGE



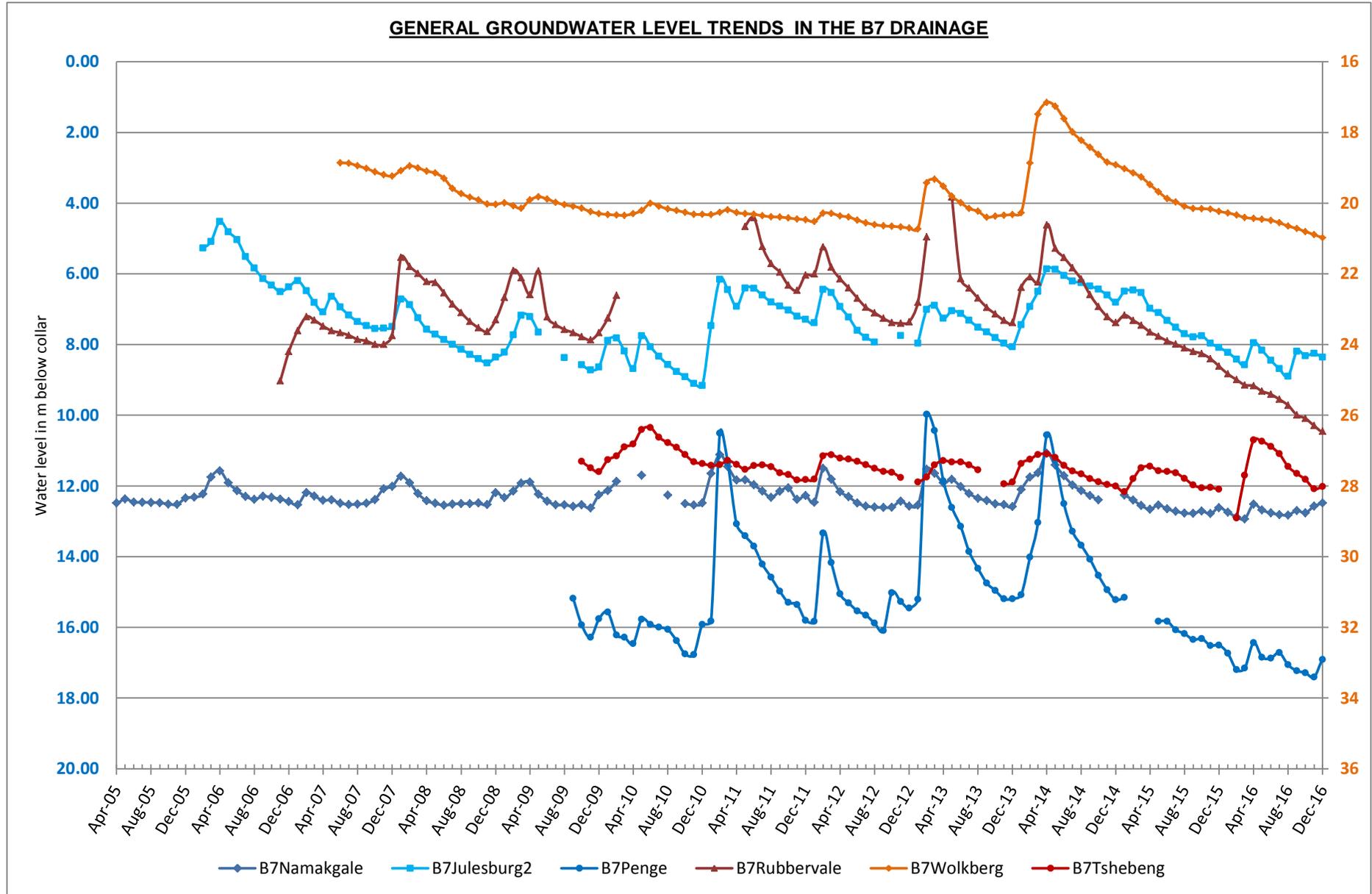
GRAPH 13

GENERAL GROUNDWATER LEVEL TRENDS IN THE B5 DRAINAGE



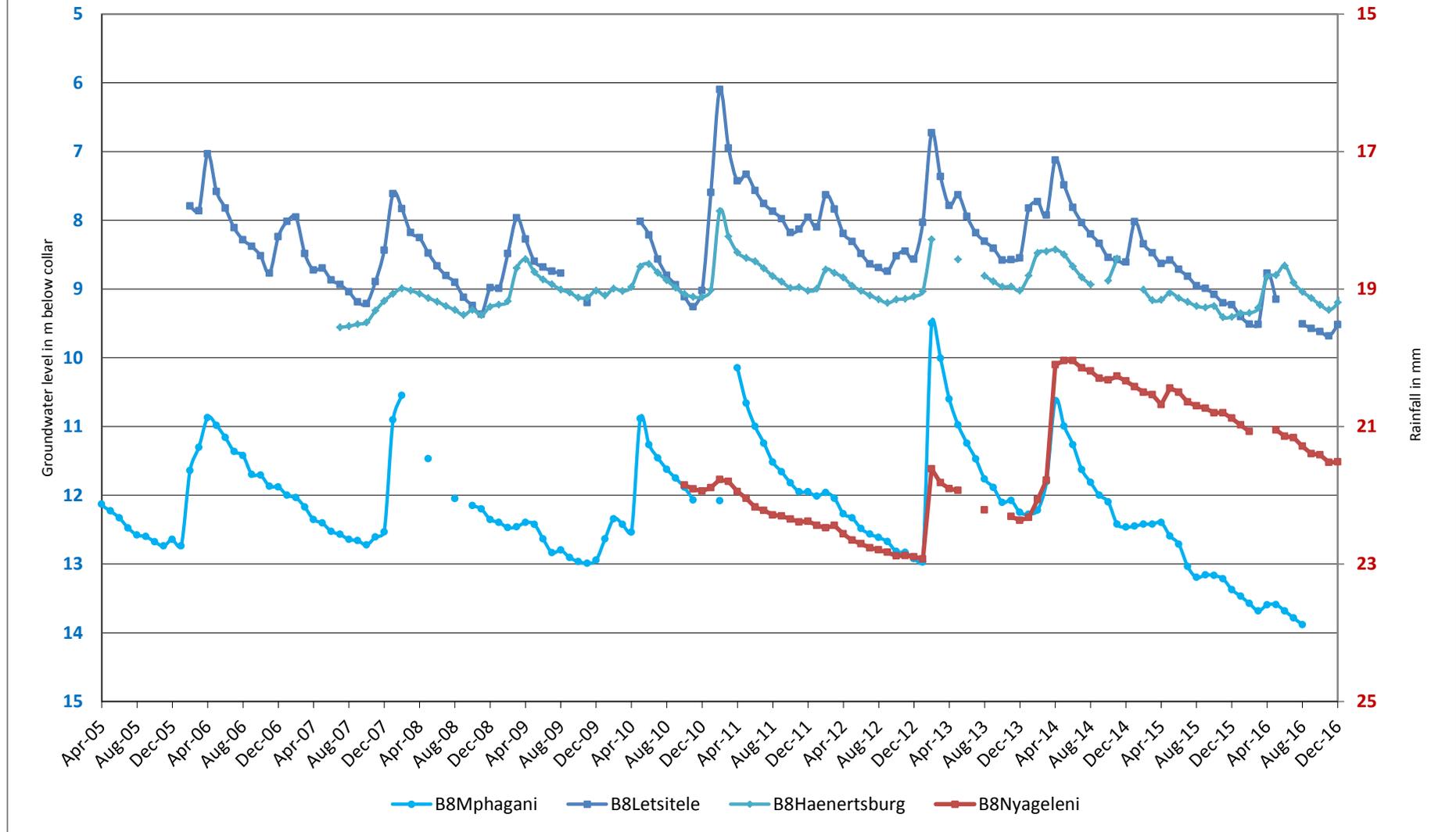
GRAPH 14

GENERAL GROUNDWATER LEVEL TRENDS IN THE B7 DRAINAGE



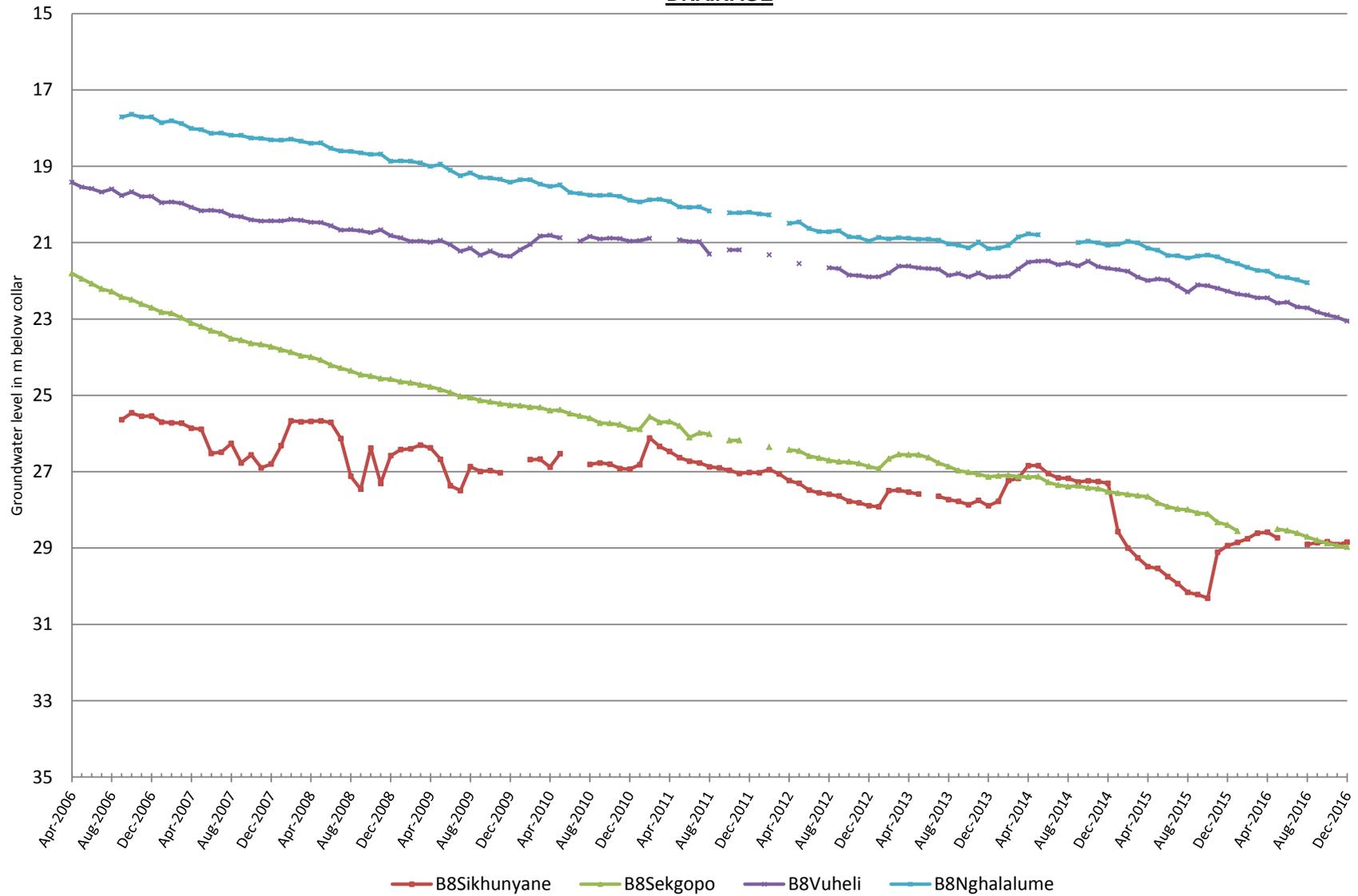
GRAPH 15

GROUNDWATER LEVEL TRENDS IN THE SOUTHERN PART (GREAT LETABA RIVER DRAINAGE) OF THE B8 DRAINAGE



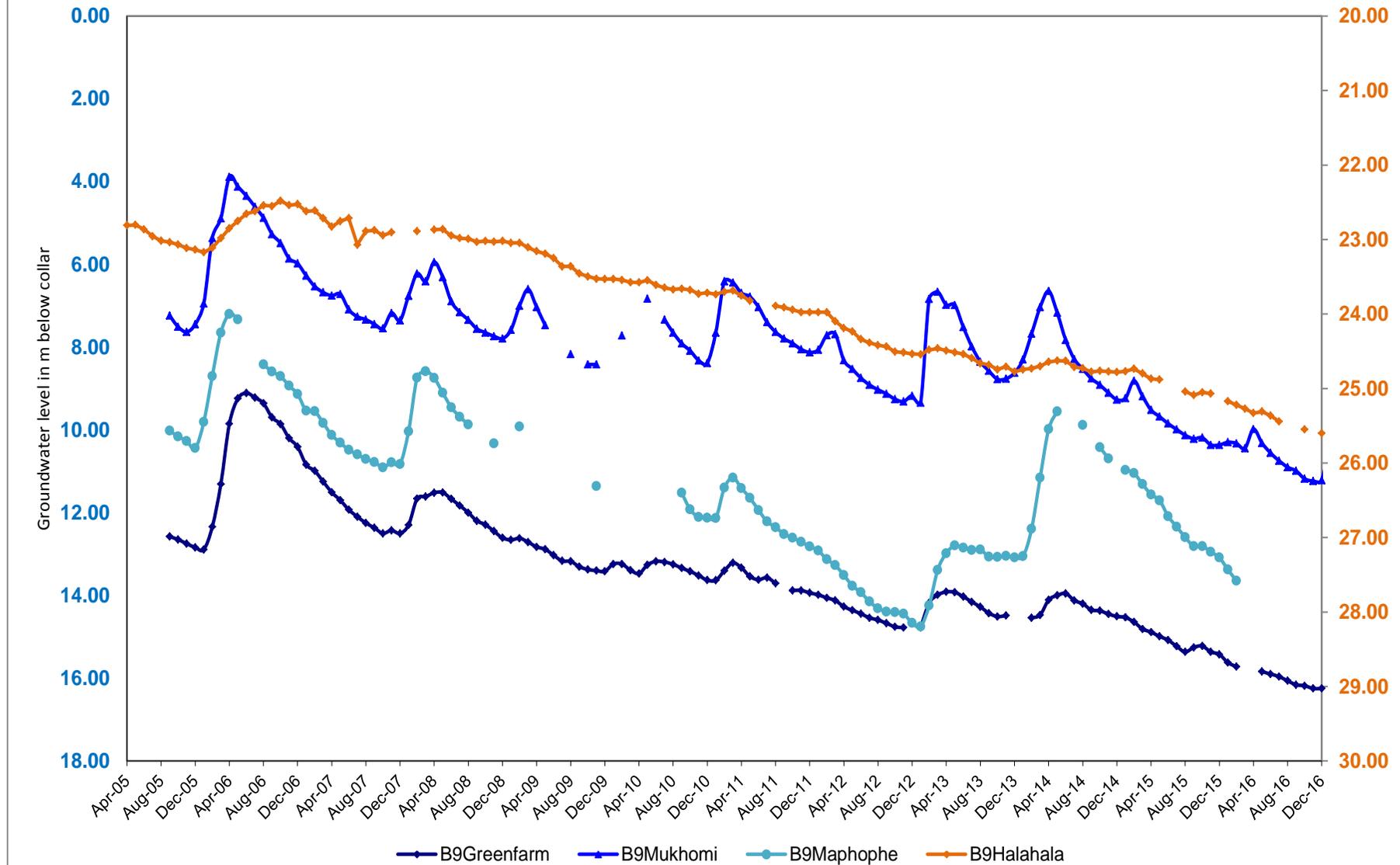
GRAPH 16

GROUNDWATER LEVEL TRENDS IN THE NORTHERN PART (MIDDEL & KLEIN LETABA RIVER DRAINAGES) OF THE B8 DRAINAGE



GRAPH 17

GROUNDWATER LEVEL TRENDS IN THE B9 DRAINAGE



GRAPH 18

Rainfall (mm) for season July 2016 - December 2016

(Based on preliminary data, The number of stations vary depending on the data availability)



South African
Weather Service

ISO 9001 Certified Organisation

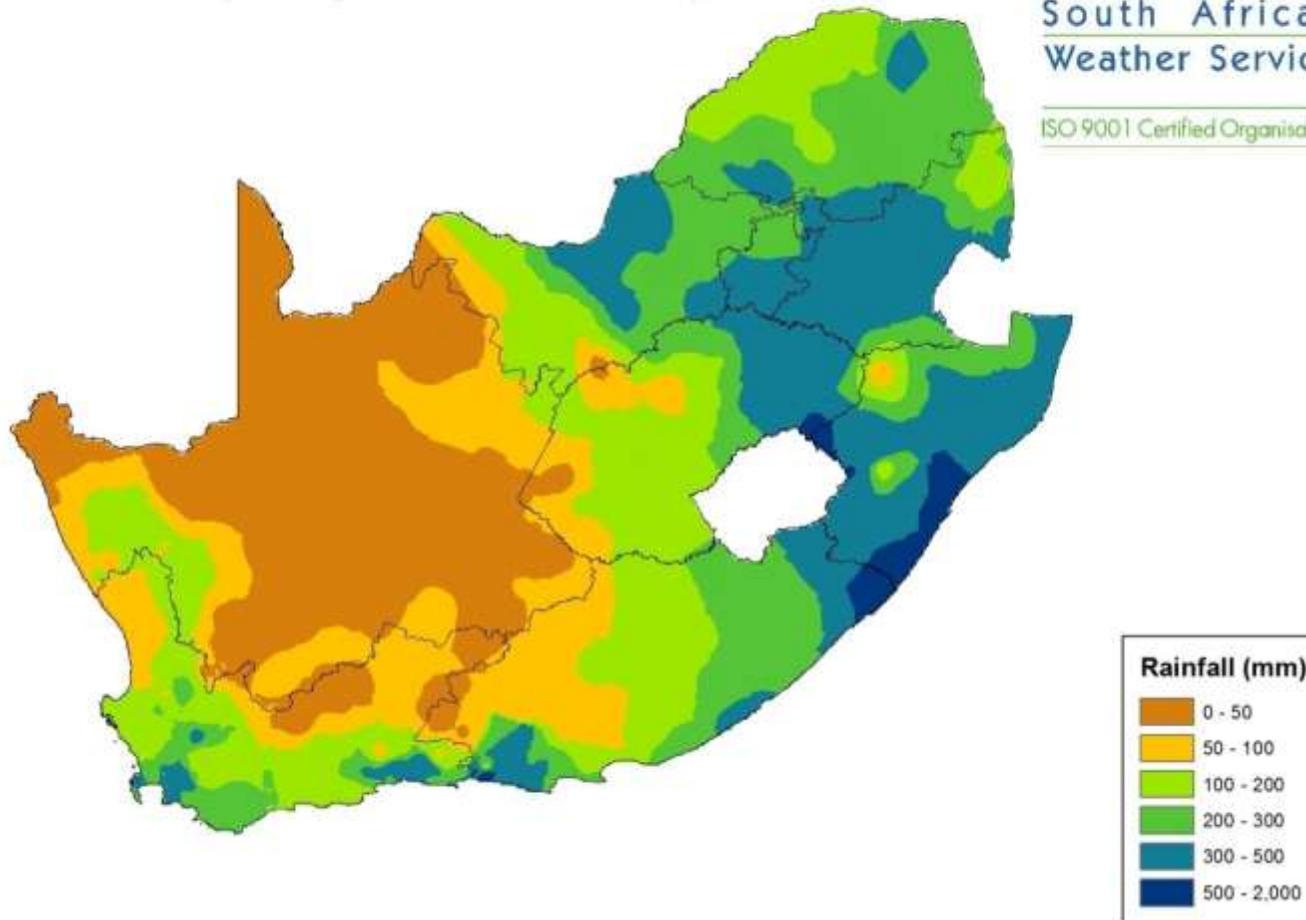


FIGURE 1

Rainfall (mm) for January 2017 (Based on preliminary data)



South African
Weather Service

ISO 9001 Certified Organisation

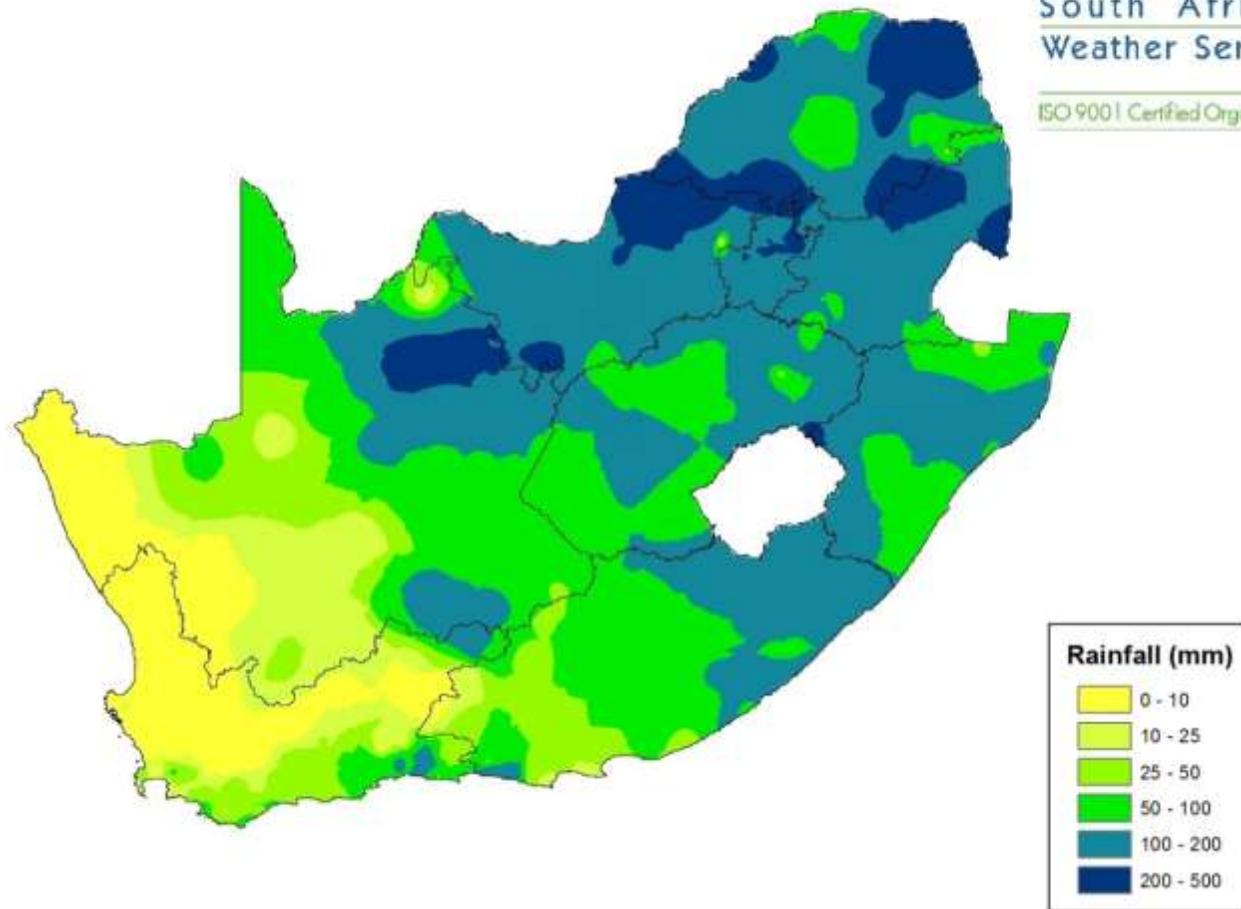


FIGURE 2