

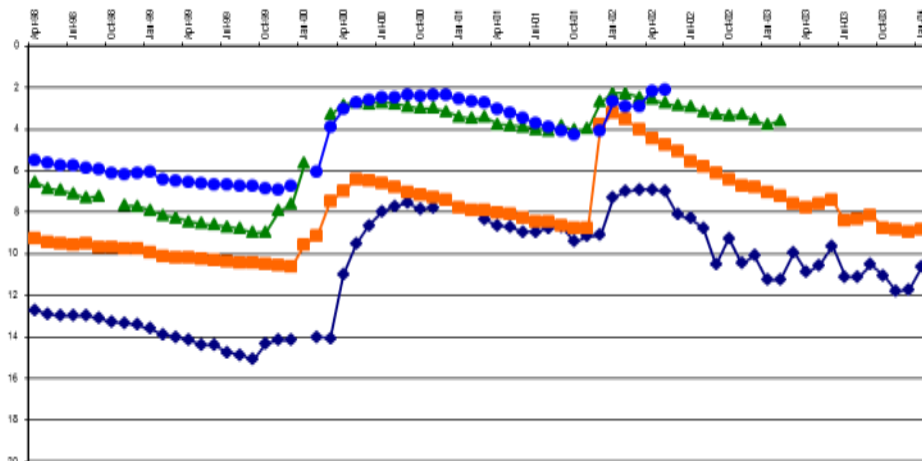


water & sanitation

Department:  
Water and Sanitation  
REPUBLIC OF SOUTH AFRICA

## LIMPOPO REGION

### QUARTERLY STATUS REPORT ON GROUNDWATER LEVEL TRENDS



# Table of Contents

<b>1</b>	<b>BACKGROUND.....</b>	<b>5</b>
<b>2</b>	<b>GROUNDWATER LEVELS.....</b>	<b>5</b>
2.1	DIFFERENCE IN GROUNDWATER LEVELS; 1 JULY TO 31 DECEMBER 2017 .....	5
2.2	DIFFERENCE IN GROUNDWATER LEVELS; 31 DECEMBER 2016 TO 31 DECEMBER 2017	6
<b>3</b>	<b>GROUNDWATER LEVEL TRENDS IN THE DIFFERENT SECONDARY DRAINAGE AREAS... 6</b>	<b>6</b>
3.1	DRAINAGE AREA A4 .....	6
3.2	DRAINAGE AREA A5 .....	7
3.3	DRAINAGE AREA A6 .....	7
3.4	DRAINAGE AREA A7 .....	7
3.5	DRAINAGE AREA A8 .....	7
3.6	DRAINAGE AREA A9 .....	7
3.7	DRAINAGE AREA B3 .....	8
3.8	DRAINAGE AREA B4 .....	8
3.9	DRAINAGE AREA B5 .....	8
3.10	DRAINAGE AREA B7 .....	8
3.11	DRAINAGE AREA B8 .....	8
3.12	DRAINAGE AREA B9 .....	8
<b>4</b>	<b>LONG-TERM PERSPECTIVE.....</b>	<b>8</b>
<b>5</b>	<b>EFFECTS OF COMBINED OR SINGE POINT OVER ABSTRACTION .....</b>	<b>9</b>
<b>6</b>	<b>RAINFALL .....</b>	<b>9</b>
6.1.1	PERCENTAGE OF NORMAL RAINFALL; JULY 2017 TO JANUARY 2018.....	9
<b>7</b>	<b>IMPORTANCE OF GROUNDWATER MONITORING AND RESOURCE MANAGEMENT .....</b>	<b>9</b>
<b>8</b>	<b>ACKNOWLEDGEMENTS .....</b>	<b>9</b>

## LIST OF FIGURES

<i>Figure 1: Distribution of the groundwater level monitoring network.....</i>	10
<i>Figure 2: Distribution of stations with lower or higher water level; 1 July to 31 December 2017 .....</i>	10
<i>Figure 3: Distribution of stations with lower or higher water levels; 31 December 2016 to 31 December 2017 .....</i>	10
<i>Figure 4: Groundwater level trends in the upper recharge part of the A4 drainage area .....</i>	10
<i>Figure 5: Groundwater level trend in the lower storage and discharge parts of the A4 drainage area</i>	10
<i>Figure 6: Groundwater level trends in the upper part of the A5 drainage.....</i>	10
<i>Figure 7: Groundwater level trends in the lower parts of the A5 drainage .....</i>	10
<i>Figure 8: Groundwater level trends in the southern and central parts of the A6 drainage .....</i>	10
<i>Figure 9: Groundwater level trends in the north western part of the discharge area of the A6 drainage .....</i>	10
<i>Figure 10: Groundwater level trends in the north eastern part of the discharge area of the A6 drainage .....</i>	10
<i>Figure 11: Example of groundwater level trends in the A7 drainage.....</i>	10
<i>Figure 12: Groundwater level trends in the A8 drainage .....</i>	10
<i>Figure 13: Groundwater level trends in the southern part of the A 9 drainage.....</i>	10
<i>Figure 14: Groundwater level trends in the northern part of the A9 drainage .....</i>	10
<i>Figure 15: Groundwater level trends in the B3 drainage .....</i>	10
<i>Figure 16: Groundwater level trend at B4 Nebo .....</i>	10
<i>Figure 17: Groundwater level trends in the B5 drainage .....</i>	10
<i>Figure 18: Groundwater level trends in the B7 drainage .....</i>	10
<i>Figure 19: Groundwater level trends in the B81 drainage .....</i>	10
<i>Figure 20: Groundwater level trends in the B82 drainage .....</i>	10
<i>Figure 21: Groundwater level trends in the B9 drainage .....</i>	10
<i>Figure 22: Long-term groundwater level trends in the A6 drainage. ....</i>	10
<i>Figure 23: Long and short-term groundwater level trends in the A7 drainage .....</i>	10
<i>Figure 24: Long-term trends in the B5 drainage .....</i>	10
<i>Figure 25: Example of the impact of over abstraction with no resource management in place .....</i>	10
<i>Figure 26: Percentage of normal rainfall for the season July 2017 to January 2018 .....</i>	10
<i>Figure 27: Seasonal prediction of rainfall probability .....</i>	10

## LIST OF TABLES

Table 1: Summary of monitoring stations with lower or higher water levels; 1 July to 31 December 2017.....	5
Table 2: Summary of monitoring stations with lower or higher groundwater levels; 31 December 2016 to 31 December 2017 .....	6

## **SUMMARY**

A lack of continuous data, due to failing instrumentation, resulted in such numerous gaps in data points for the required dates, that compilation of a report on the overall status was not possible. To resolve this, use of interpolation had to be made to fill the data gaps.

A report for the quarter July to September 2017 could not be produced, therefore the period covered in this report is the six months from July to December 2017, with December being the midpoint of the wet season. Only 12% of the monitoring stations indicated higher groundwater levels at this point with the average rise of 0.35m indicating that no significant recharge occurred yet. Taken into account that below normal rainfall was recorded over the province this can be expected. Lower water levels were recorded at 88% of the stations with an average decline of 0.9m. Compared to the same time the previous year 72% currently have lower water levels.

Despite the number of stations indicating lower water levels and steady declines for the past two to three years, historical long-term data indicates that the general status in areas of limited impact is still good. The constant declining groundwater levels for up to ten years noted in some areas are a matter of concern. The reason for this is not clear as no long-term data is available in those areas to better evaluate the situation. Over abstraction and the absence of resource management are resulting in some serious localised declines in groundwater levels.

Monitoring data forms the basis for evaluating resource status, compilation of resource information, decision making and ultimately resource management. Functionality of the Limpopo groundwater monitoring network is unfortunately deteriorating fast due to instrument failure and challenges in procurement of replacement instruments.

## 1 BACKGROUND

The report normally discusses groundwater level trends and status for the previous quarter. As no report was compiled for the period July to September 2017, that period is included so that this report covers the period July to December 2017 which represent the period midway through the dry season to midway through the wet season. Comparison is made between groundwater levels as recorded for 1 July and 31 December 2017 as well as 31 December 2016 and 31 December 2017. Groundwater level trends are discussed per secondary drainage area. The distribution of the groundwater level monitoring network is illustrated by (FIGURE 1)

Large-scale instrumentation failure and challenges in replacement of defect instruments result in a large number of monitoring boreholes lacking data for the dates in question. This lack of data seriously affects the accurate evaluation of the current status of the resource. The limited availability of continues data necessitated using data interpolation to obtain data points for the dates in question. This method can however not be applied in all instances. It was only applied where some data points were available on both sides of the missing data and could be fit into the trend displayed graphically.

## 2 GROUNDWATER LEVELS

Differences in groundwater levels for monitoring stations with data available for the selected dates is summarised below.

### 2.1 DIFFERENCE IN GROUNDWATER LEVELS; 1 JULY TO 31 DECEMBER 2017

Data for both dates are available, after interpolation, for 93.8% of monitoring stations monitored. Dry season decline as well as the lack of recharge for the first part of the wet season can be noted by the 87.85% of stations with lower groundwater levels for this period. The water levels at only 12.15% are still higher (TABLE 1).

The distribution of stations with lower or higher groundwater levels from 1 July to 31 December 2017 are indicated by (FIGURE 2)

**Table 1: Summary of monitoring stations with lower or higher water levels; 1 July to 31 December 2017**

1 July to 31 December 2017			
Total stations visited	193		
With data	181 Stations	93.8%	
Water level	Number of stations	Average(m)	%
Down	159 Stations	-0.93	87.85%
Up	22 Stations	0.35	12.15%
No change	Stations		0.00%
No Data	Stations		0.00%
<b>Total</b>	<b>181</b>		<b>100.00%</b>

## 2.2 DIFFERENCE IN GROUNDWATER LEVELS; 31 DECEMBER 2016 TO 31 DECEMBER 2017

With less than 40% data availability for the required dates, data interpolation was heavily relied upon to get data for the relevant points in time. Lower groundwater levels than the corresponding time last year was recorded at 72.63% of stations with available data. The average decline is 1.71 meter and higher levels were recorded at 27.37% of the monitoring stations (**TABLE 2**).

The distribution of monitoring stations with higher or lower groundwater levels from 31 December 2016 to 31 December 2017 is illustrated by (**FIGURE 3**)

**Table 2: Summary of monitoring stations with lower or higher groundwater levels; 31 December 2016 to 31 December 2017**

31 December 2016 to 31 December 2017			
Total stations visited	193		
With data	179 Stations	92.7%	
Water level	Number of stations	Average(m)	%
Down	130 Stations	-1.71	72.63%
Up	49 Stations	1.79	27.37%
No change	Stations		0.00%
No Data	Stations		0.00%
<b>Total</b>	<b>179</b>		<b>100.00%</b>

## 3 GROUNDWATER LEVEL TRENDS IN THE DIFFERENT SECONDARY DRAINAGE AREAS

As noted above, a large number of data points are interpolated points, Care was however taken that such points fits the overall trend over the period with no sudden deviations displayed on a graph. The serious lack of continuous data leaves no other option to enable compilation of a report.

### 3.1 DRAINAGE AREA A4

Groundwater levels in the upper recharge parts of the drainage characteristically indicate very definite seasonal fluctuations around a mean. Since January 2015 however a marked decline in groundwater levels related to a lack of seasonal recharge can be noted (**FIGURE 4**)

The situation in the lower storage and discharge parts of the drainage differs completely. Groundwater levels in these areas are generally stable with a slight underlying decline in the trends. Only the two stations in the drainage of the Matlabas River indicates some occasional recharge (**FIGURE 5**)

### **3.2 DRAINAGE AREA A5**

Similar to the A4 drainage, are two distinct different trends displayed by groundwater levels in this drainage. Stable groundwater levels with seasonal fluctuations are also indicated in the upper parts but the decline here is notable since 2014 already (**FIGURE 6**)

The constant decline with little to no recharge indicated for the lower parts are much more pronounced in this drainage and becoming a matter of concern (**FIGURE 7**)

### **3.3 DRAINAGE AREA A6**

The A6 drainage is large and groundwater levels trends can vary considerably in the area. Except for two major trends similar to that of the A5 and A4 as noted above can a third trend also be identified. A major recharge event occurred in the north eastern discharge part of the drainage early in 2013 that reversed the downward trend for some time and groundwater levels are still returning to the pre-recharge levels. (**FIGURES 8 to 10**)

Groundwater levels in the southern and central parts of the A6 drainage area display stable conditions with seasonal fluctuation around a mean (**FIGURE 8**)

Groundwater level trends in the north western part of the discharge area are, as for the adjoining part of the A5 drainage becoming a matter of concern due to the constant decline over years (**FIGURE 9**)

Groundwater level trends in the north eastern part of the discharge area are still displaying the affect of good recharge that occurred in 2013 (**FIGURE 10**)

### **3.4 DRAINAGE AREA A7**

As the A6, covers the A7 drainage a large area with varying groundwater level trends. The general trend of groundwater levels in the A7 drainage area however indicates stable conditions with normal seasonal fluctuations but the decline since 2014 to 2015 can also be noted here. An example is illustrated by (**FIGURE 11**)

### **3.5 DRAINAGE AREA A8**

Stable groundwater levels with normal seasonal fluctuations are characteristic of the area. The groundwater status in this drainage is considered the most un-impacted of the secondary drainages in the Limpopo Water Management Area (**FIGURE 12**)

### **3.6 DRAINAGE AREA A9**

In the southern parts of the drainage groundwater levels displayed stable water levels with a slight underlying decline at some and normal seasonal fluctuations at all of them before 2014. Since 2014 a marked decline is also notable here (**FIGURE 13**)

Groundwater level declines were reversed for a time by good recharge early in 2013 in the northern parts of the A9 drainage. After this the decline resumed again (**FIGURE 14**)

### **3.7 DRAINAGE AREA B3**

Two of the three monitoring stations in this drainage are indicating heavily impacted conditions while the groundwater level at the third, B3 De Kuil is the opposite, **(FIGURE 15)**.

### **3.8 DRAINAGE AREA B4**

Groundwater level trend at the only monitoring station in this drainage is affected by nearby abstraction and indicate clear fluctuations related to this. A slight declining trend is displayed over time with a decline of  $\pm 2\text{m}$  over 12 years. **(FIGURE 16)**

### **3.9 DRAINAGE AREA B5**

Groundwater level trends in this drainage also indicate a general stable trend for some years followed by a decline since 2014. Some recharge can be noted in early 2017 but levels are still declining **(FIGURE 17)**

### **3.10 DRAINAGE AREA B7**

The widely occurring trend of seasonal fluctuations with a marked decline since 2014 is present here as well except at B7Namakgale and B7Tshebeng where the decline is absent. **(FIGURE 18)**

### **3.11 DRAINAGE AREA B8**

Contrary to other drainage areas where different groundwater level trends can usually be linked to the upper recharge and lower discharge areas of a drainage in the b8 drainage it is linked to the two tertiary drainages., B82 and B81. Trends in the B81 indicate stable seasonal fluctuation over time with a decline since 2014 **(FIGURE 19)** In contrast, groundwater level trends in the B82 drainage display a constant decline with little to no fluctuation. The groundwater levels in this area is a cause for concern **(FIGURE 20)**

### **3.12 DRAINAGE AREA B9**

The four monitoring stations in this drainage all display a constant declining trend despite indications of some seasonal recharge **(FIGURE 21)**

## **4 LONG-TERM PERSPECTIVE**

To evaluate the significance of the decline in groundwater levels over the past two to three years, the current situation has to be compared to historical trends. Some figures illustrating trends where data is available over the long-term is included for this reason.

Long-term trends in the A6 Drainage indicate that despite the recent decline in groundwater levels the current situation is still good compared to historical lows **(FIGURE 22)**

The same is indicated by trends in the A7 and B5 drainages when comparing short-term trends with that in the long-term **(FIGURES 23 & 24)**

## **5 EFFECTS OF COMBINED OR SINGE POINT OVER ABSTRACTION**

Above indications from long-term data unfortunately does not mean that the status of the resource is excellent everywhere but gives a general indication of the situation where impact is limited. As noted above, some areas of concern does exist and the reasons for the continuous declines in those areas are not readily apparent but may be related to the combined total impact of long-term abstraction over a very large area. Localised impacts of over abstraction or “mining” of groundwater is much more easily recognisable (**FIGURE 25**)

## **6 RAINFALL**

### **6.1.1 PERCENTAGE OF NORMAL RAINFALL; JULY 2017 TO JANUARY 2018**

Early season rainfall was unfortunately again very disappointing this year and the effect, or lack of it, on groundwater can be noted. Below normal rainfall was recorded over most of the province (**FIGURE 26**)

## **7 IMPORTANCE OF GROUNDWATER MONITORING AND RESOURCE MANAGEMENT**

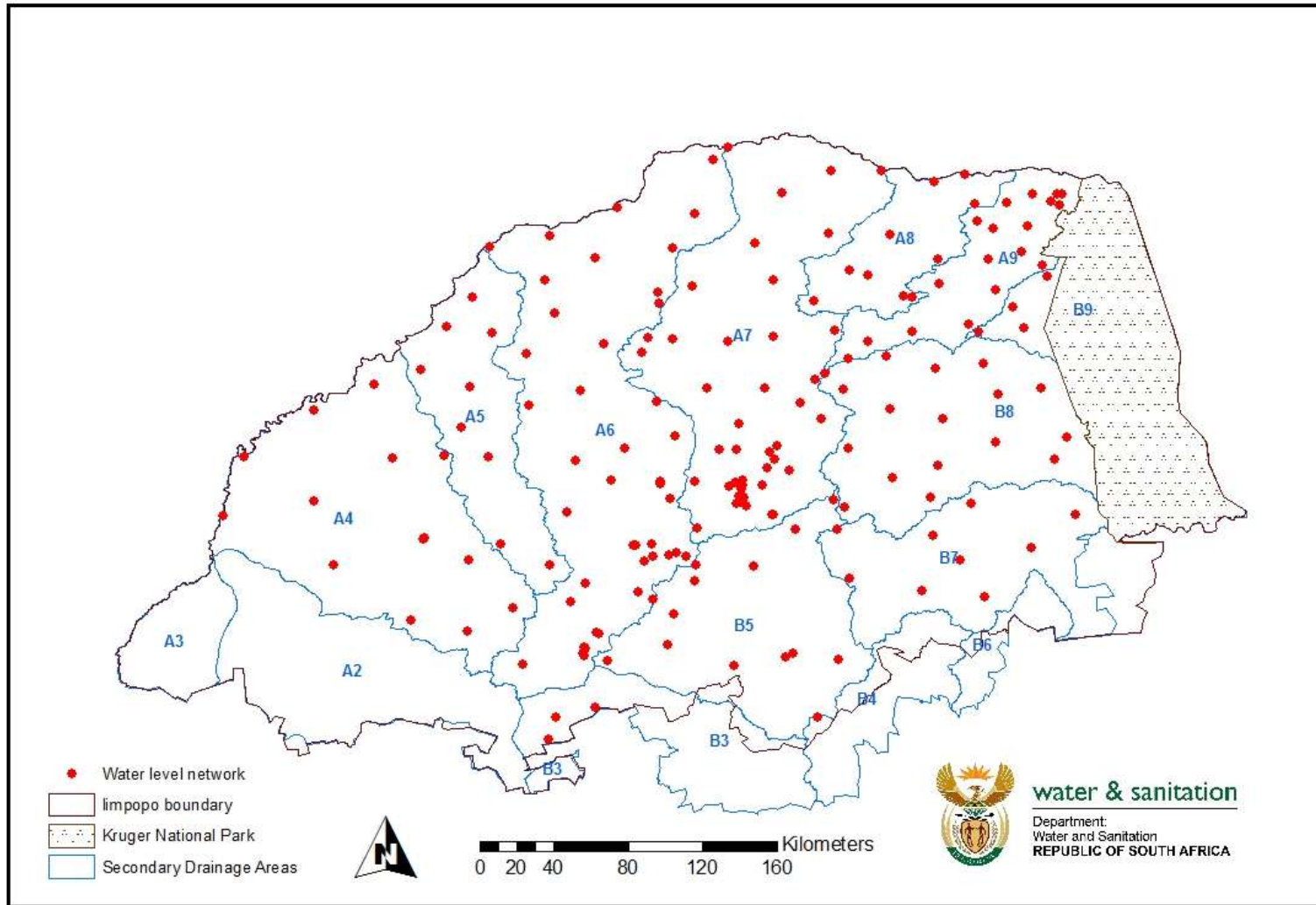
Climate conditions, especially the past three years, has again emphasised the critical importance of our groundwater resources, not only in Limpopo but also for the rest of South Africa. The importance of sound resource management to achieve sustainable use, especially during times of adverse climatic conditions, cannot be over emphasised.

Limpopo monitoring data frequently reveal areas of unsustainable mining of groundwater resources with no indication of resource management. Production boreholes regularly fail due to lack of management and consequences are always severe.

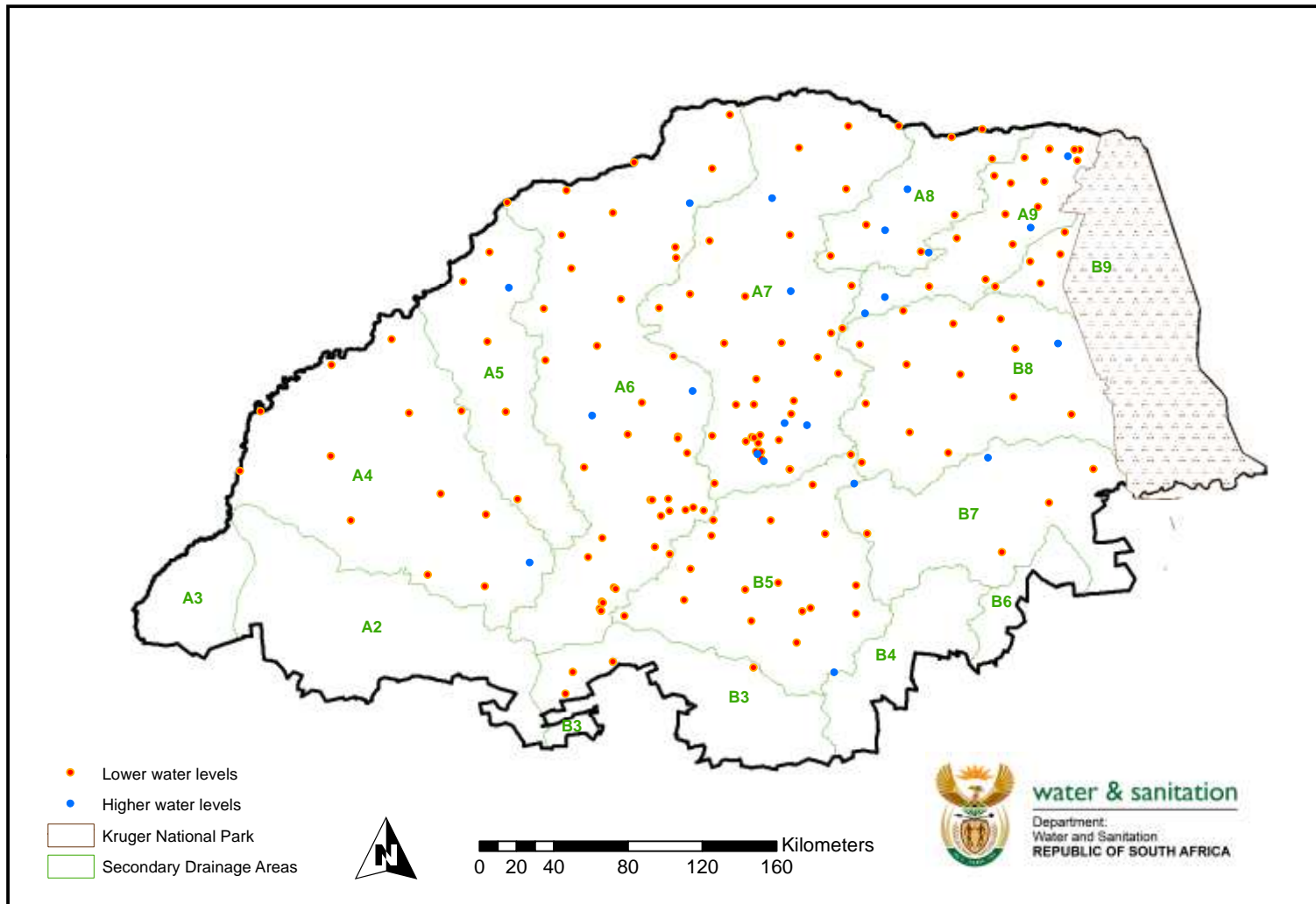
## **8 ACKNOWLEDGEMENTS**

South African Weather Services: <http://www.weathersa.co.za>:

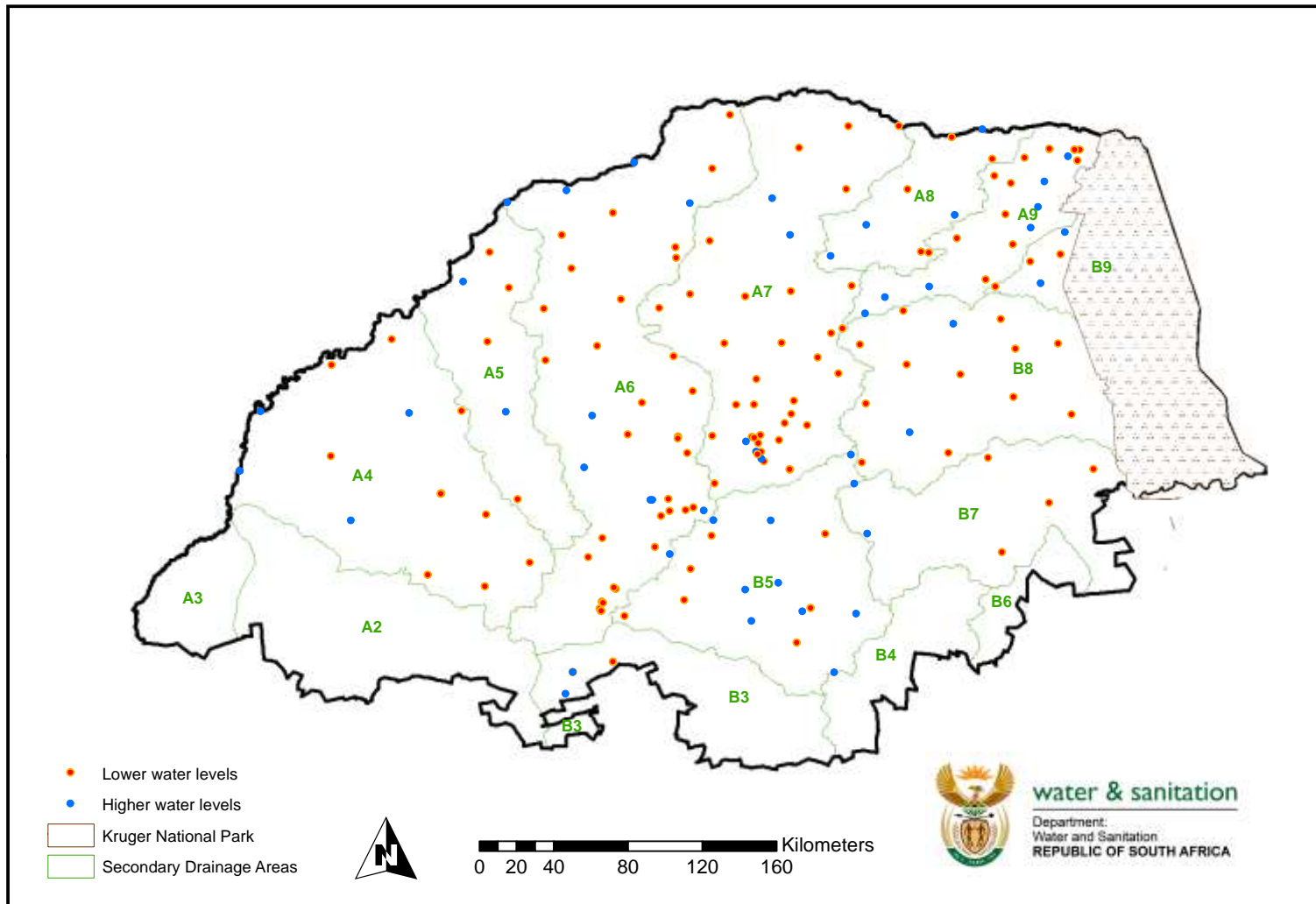
- Percentage of normal rainfall



**Figure 1: Distribution of the groundwater level monitoring network**



**Figure 2: Distribution of stations with lower or higher water level; 1 July to 31 December 2017**



**Figure 3: Distribution of stations with lower or higher water levels; 31 December 2016 to 31 December 2017**

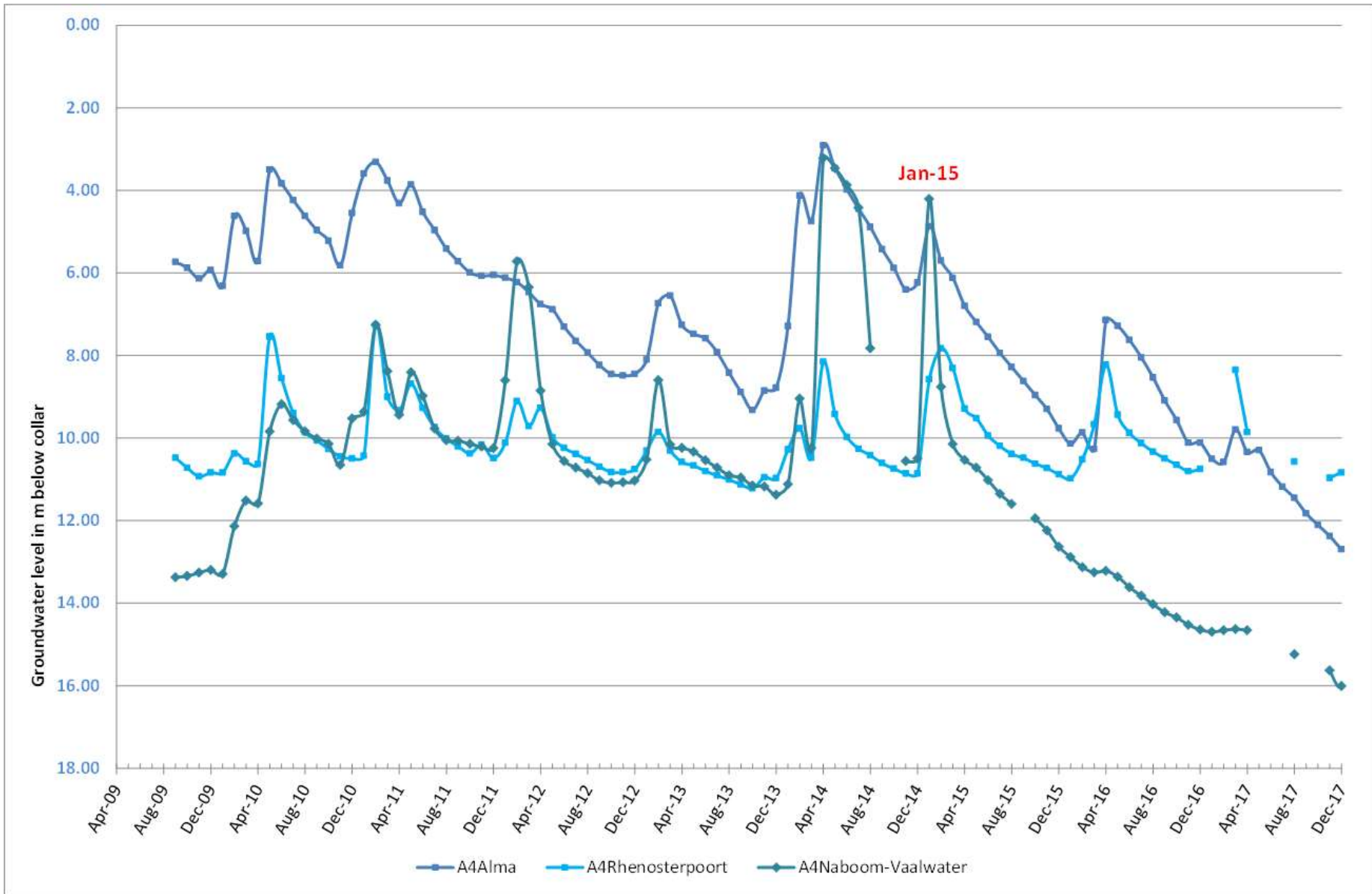


Figure 4: Groundwater level trends in the upper recharge part of the A4 drainage area

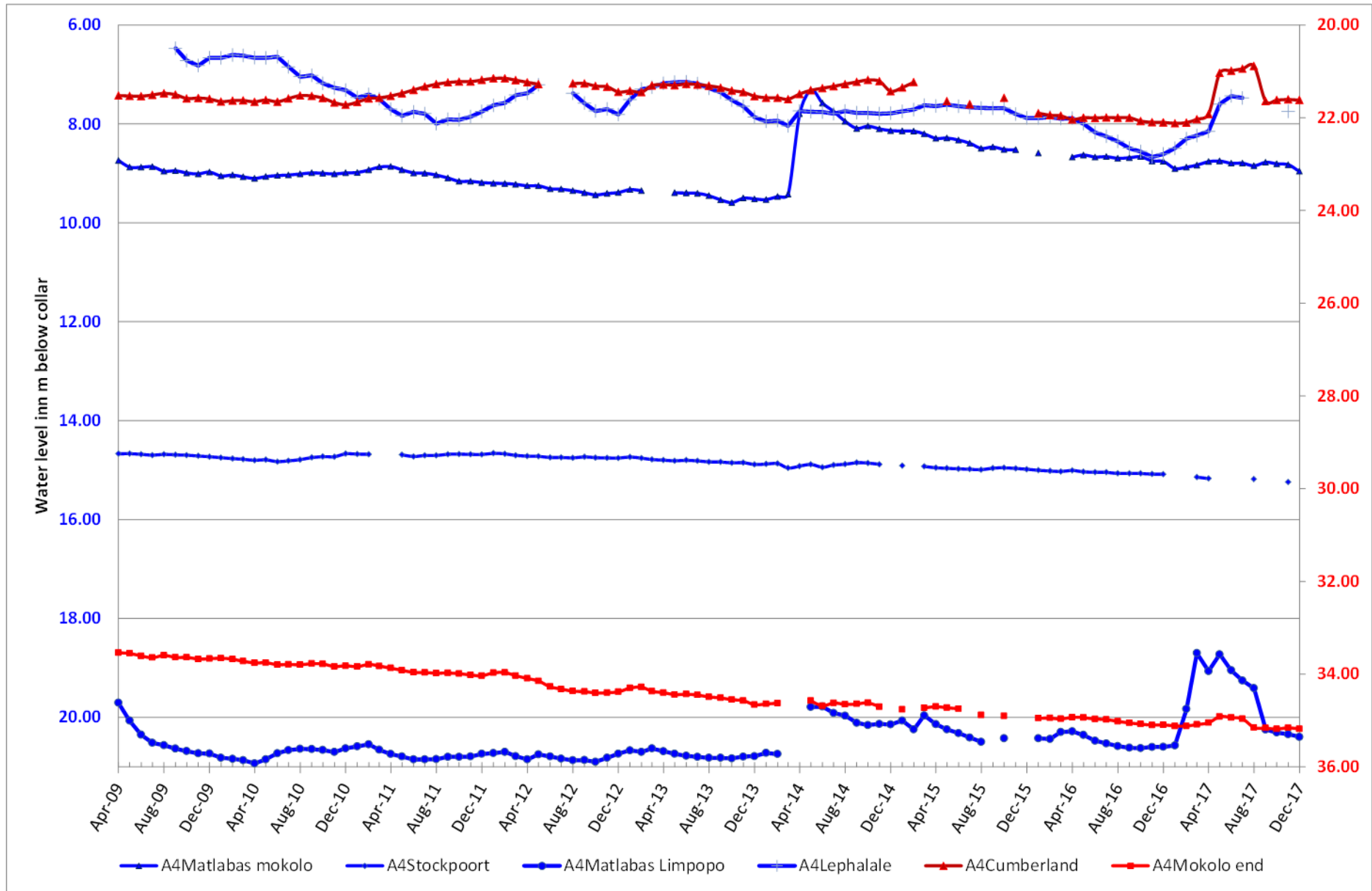
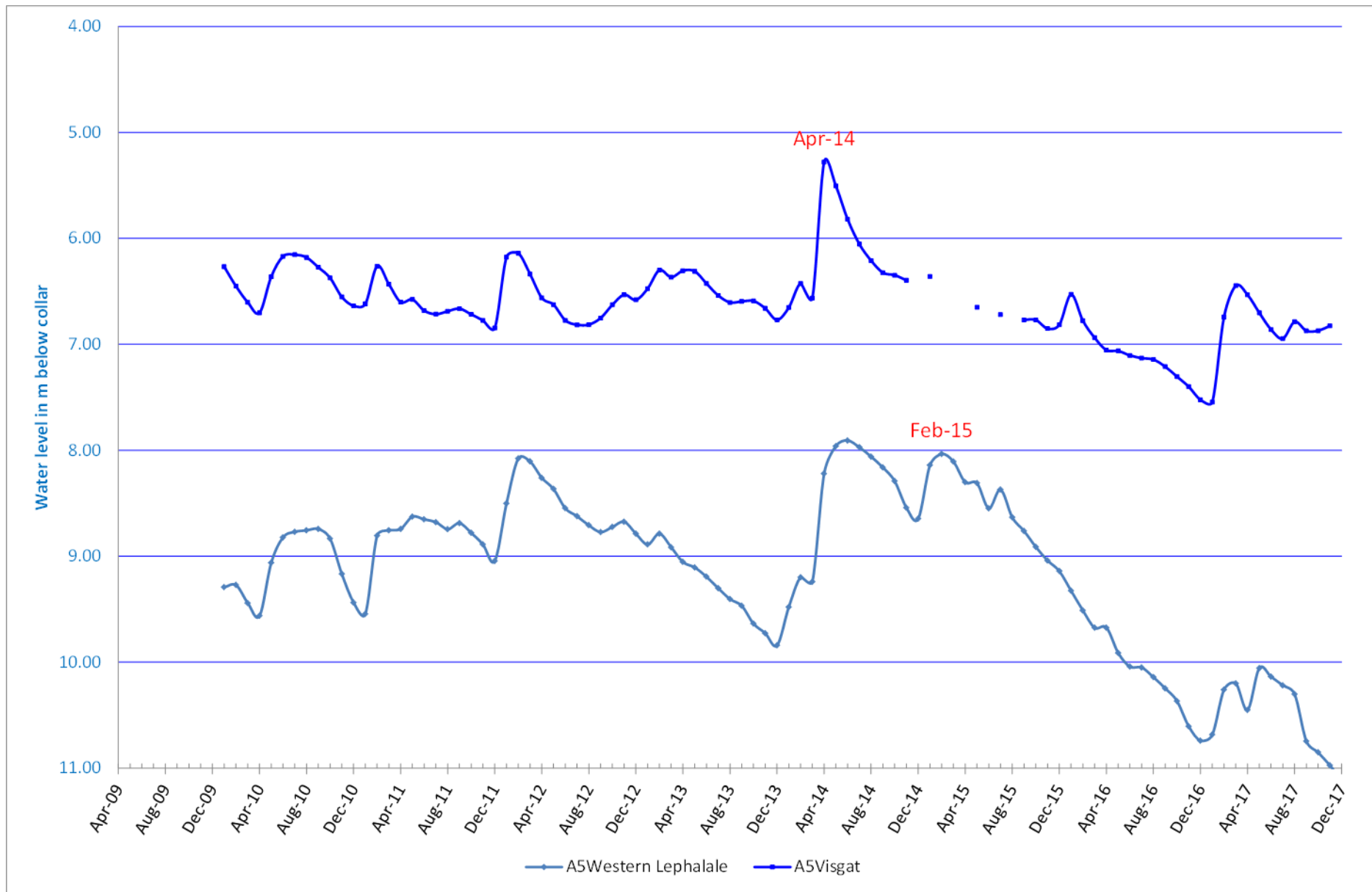


Figure 5: Groundwater level trend in the lower storage and discharge parts of the A4 drainage area



**Figure 6: Groundwater level trends in the upper part of the A5 drainage**



**Figure 7: Groundwater level trends in the lower parts of the A5 drainage**

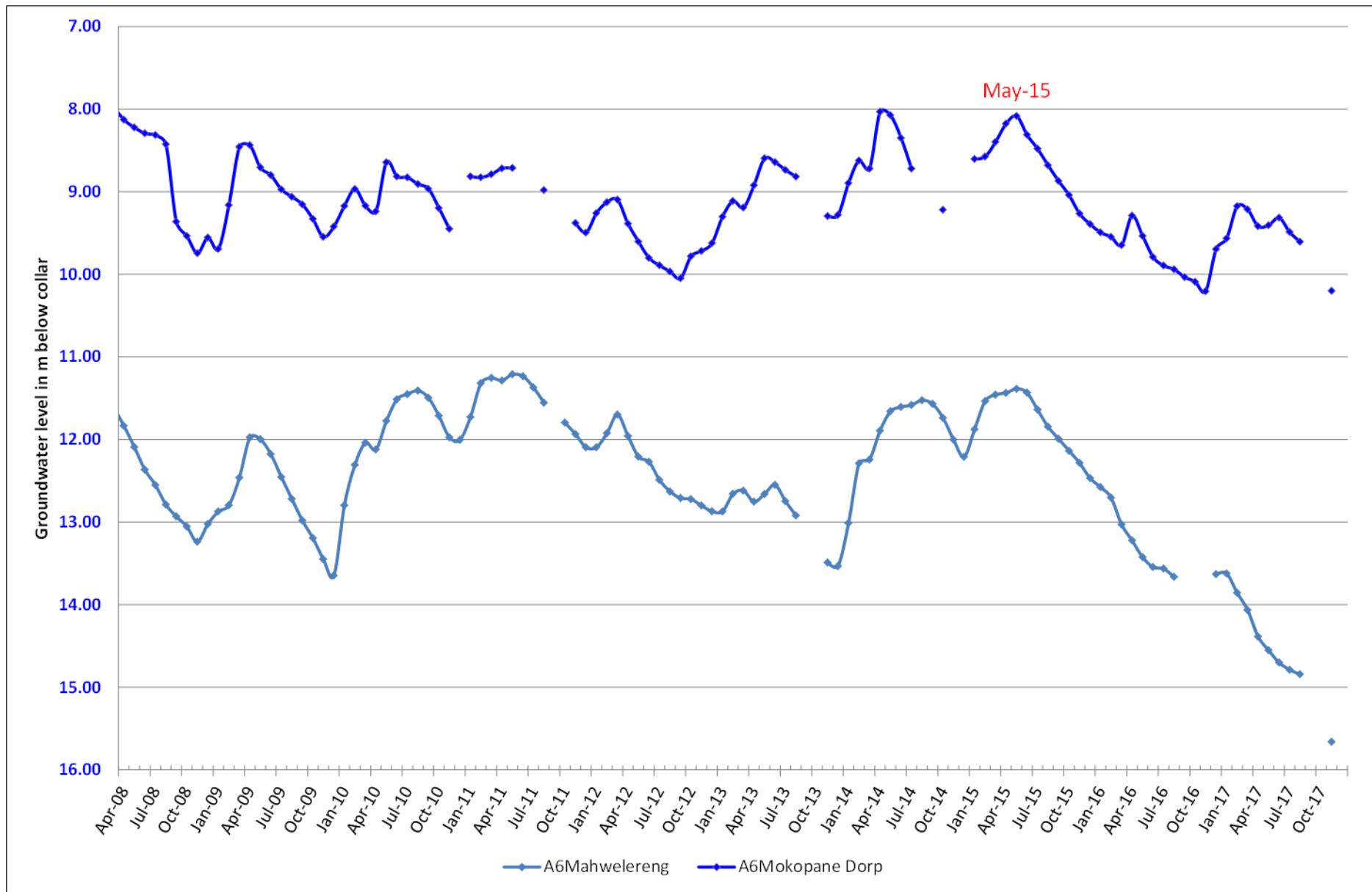


Figure 8: Groundwater level trends in the southern and central parts of the A6 drainage

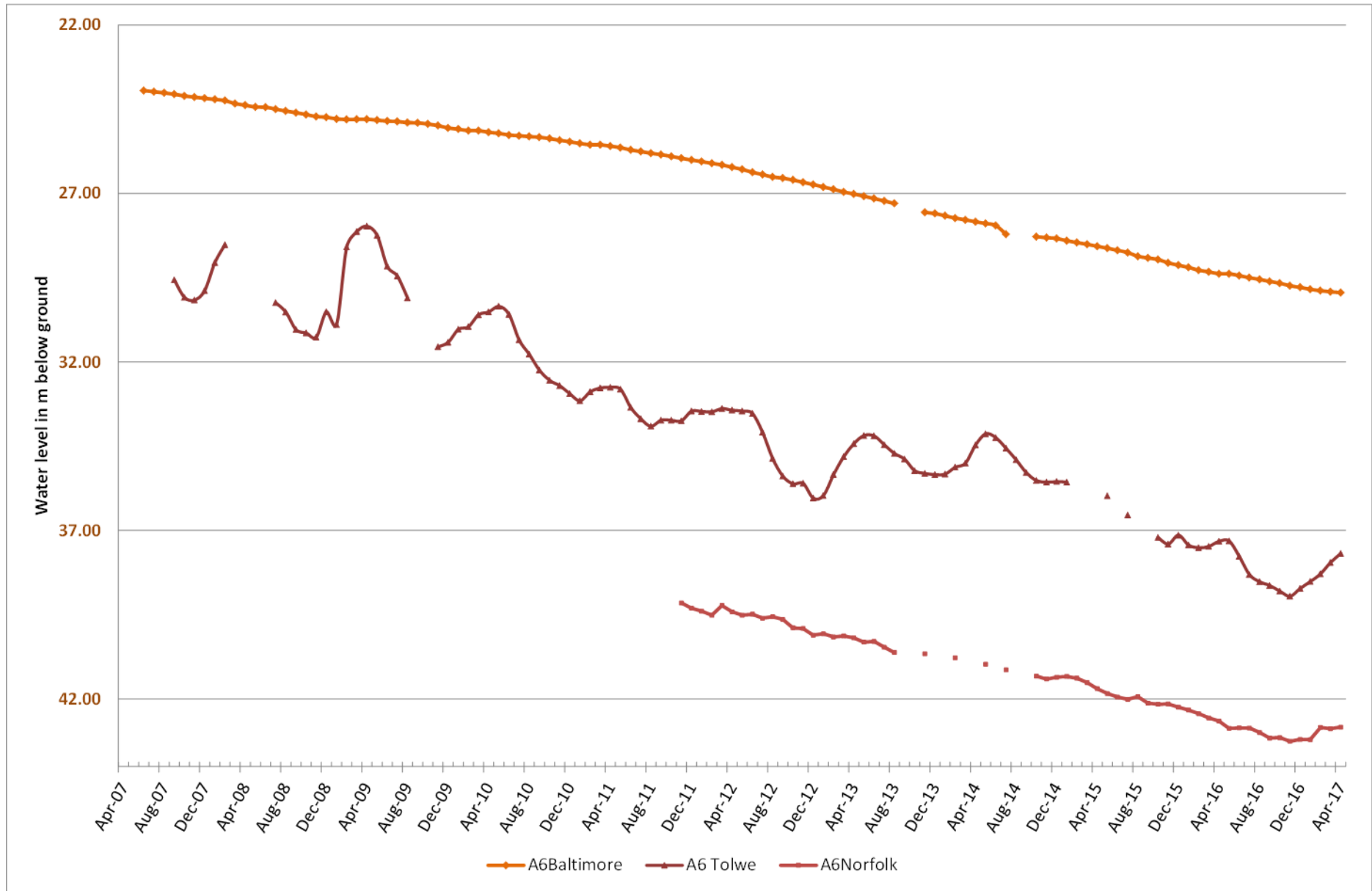


Figure 9: Groundwater level trends in the north western part of the discharge area of the A6 drainage

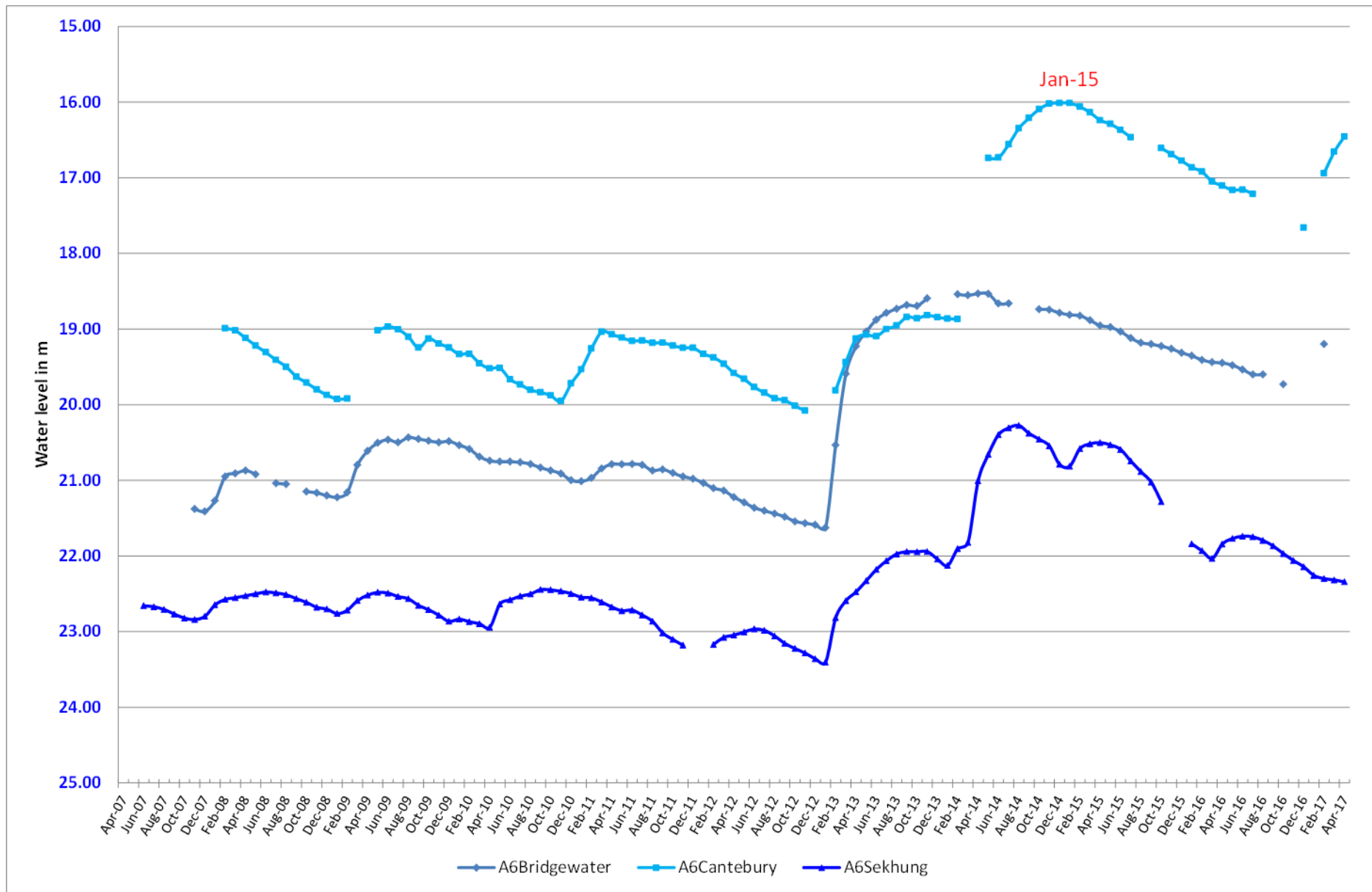


Figure 10: Groundwater level trends in the north eastern part of the discharge area of the A6 drainage

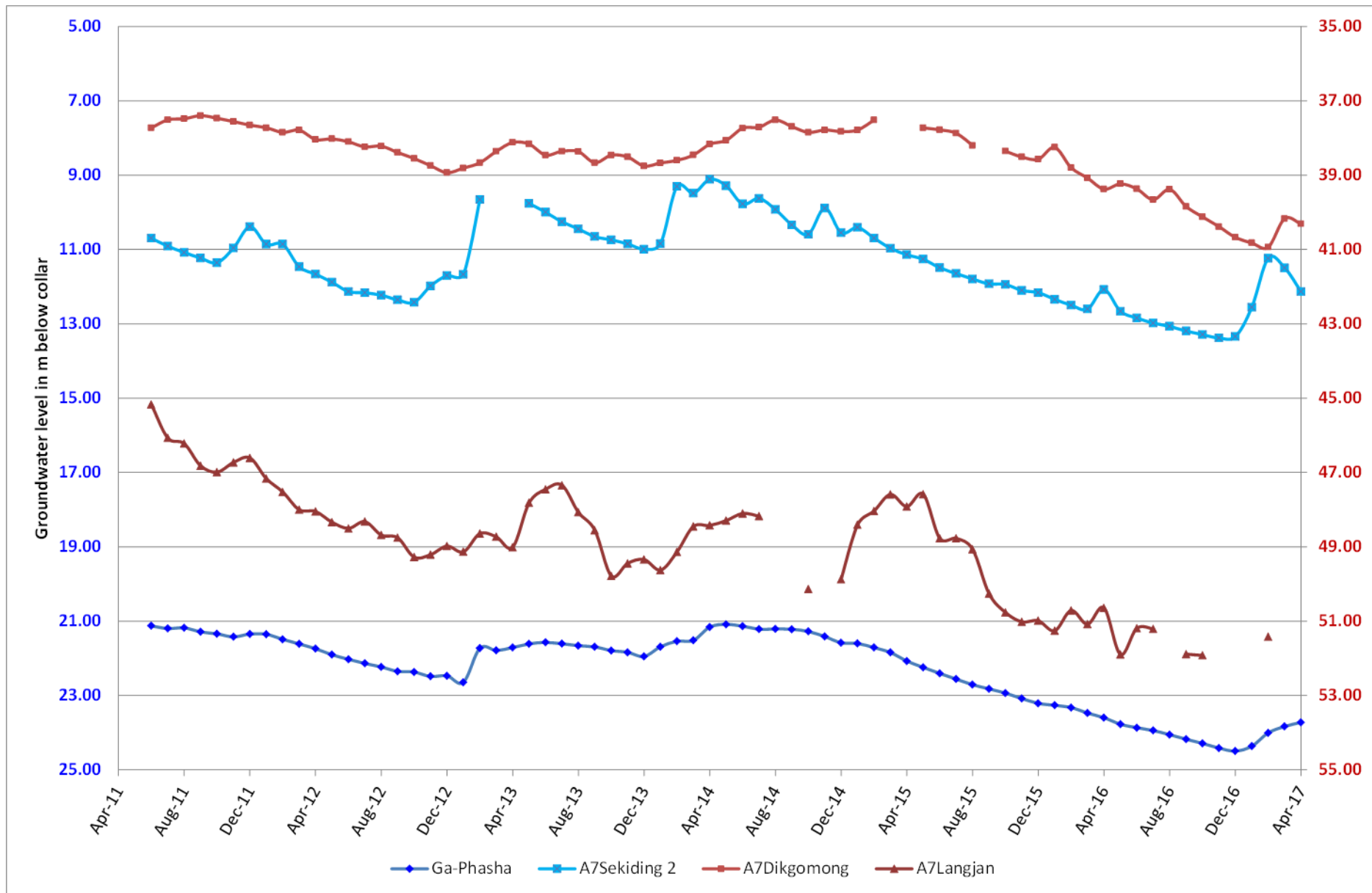


Figure 11: Example of groundwater level trends in the A7 drainage

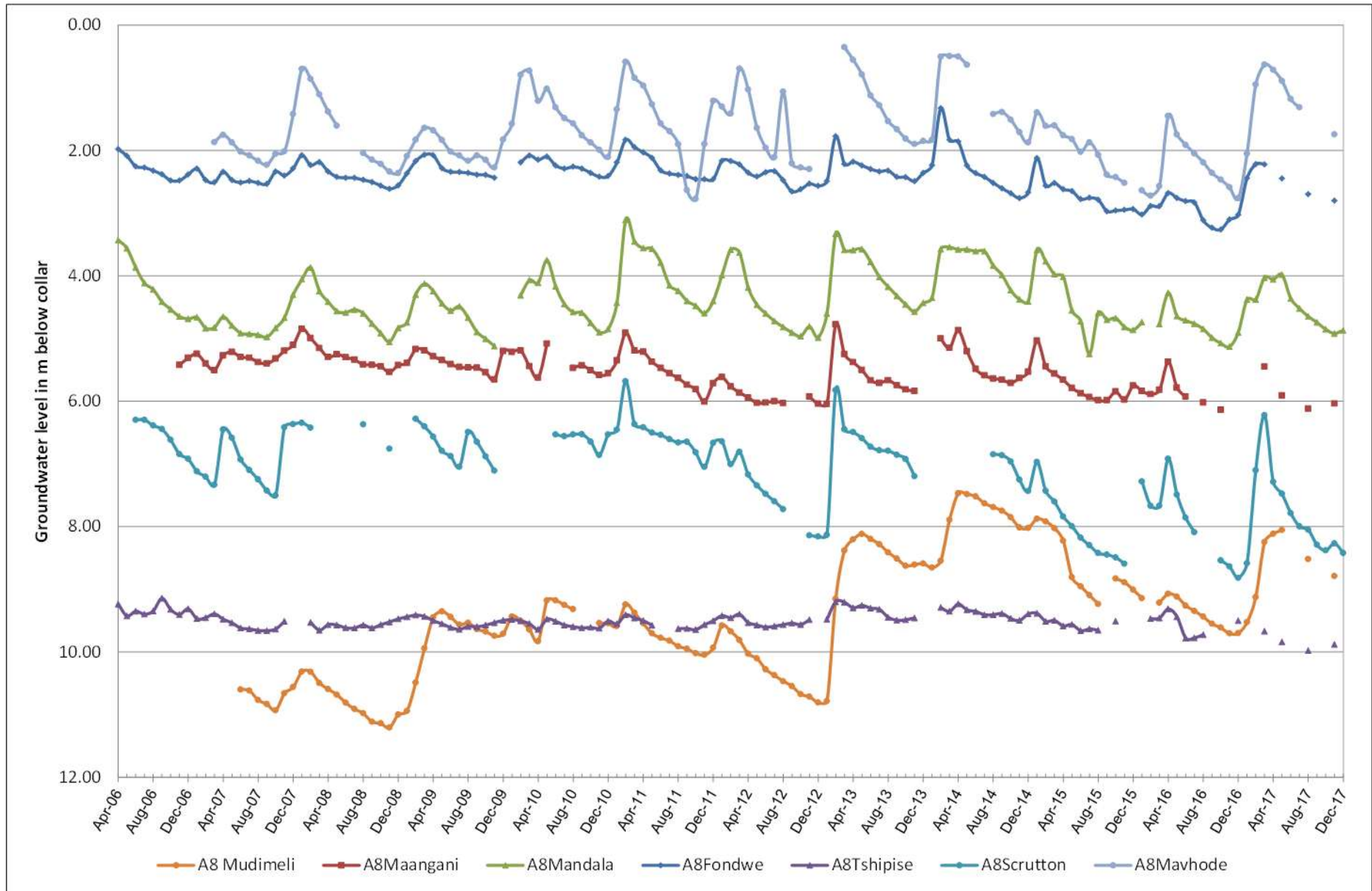


Figure 12: Groundwater level trends in the A8 drainage

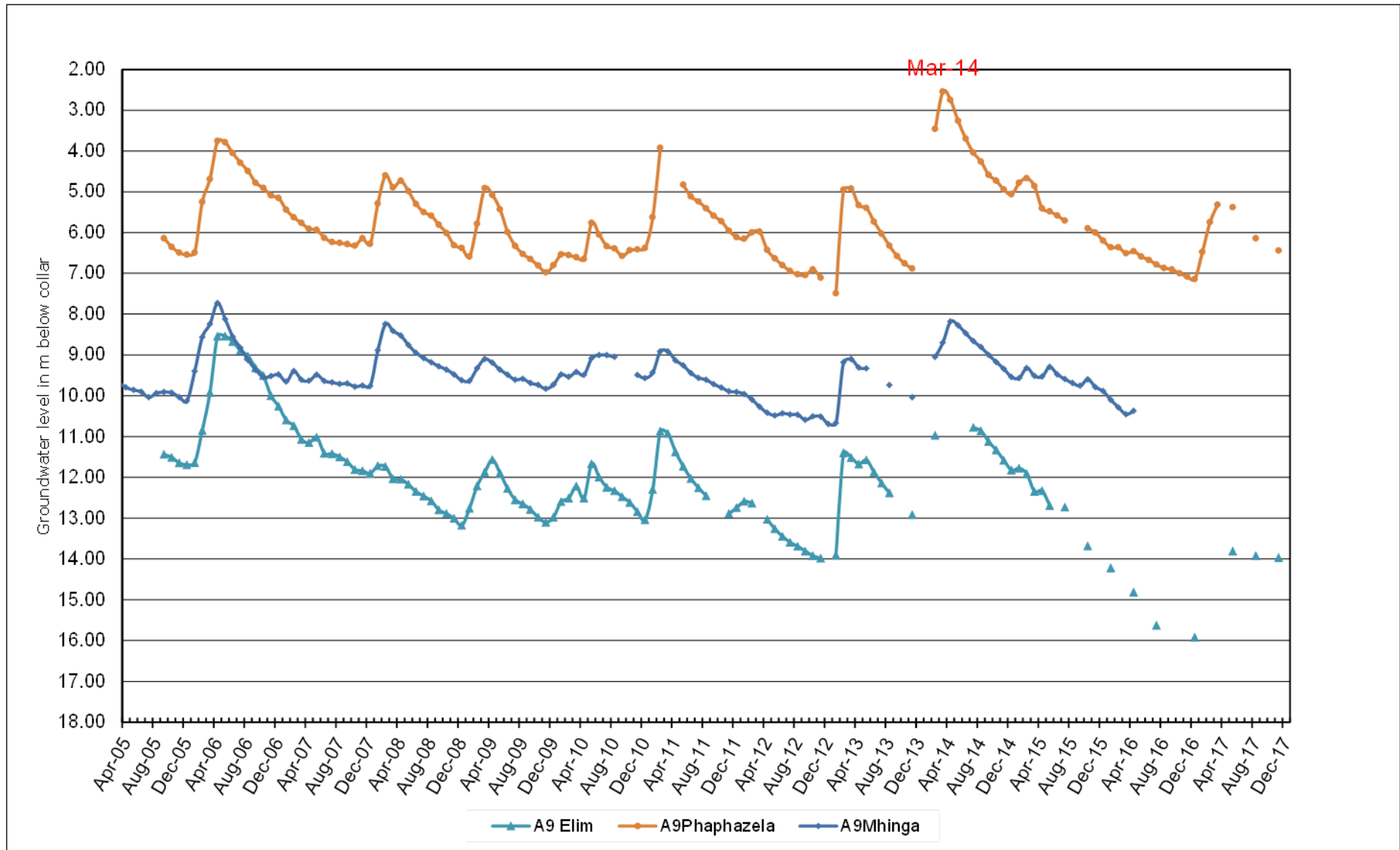


Figure 13: Groundwater level trends in the southern part of the A 9 drainage

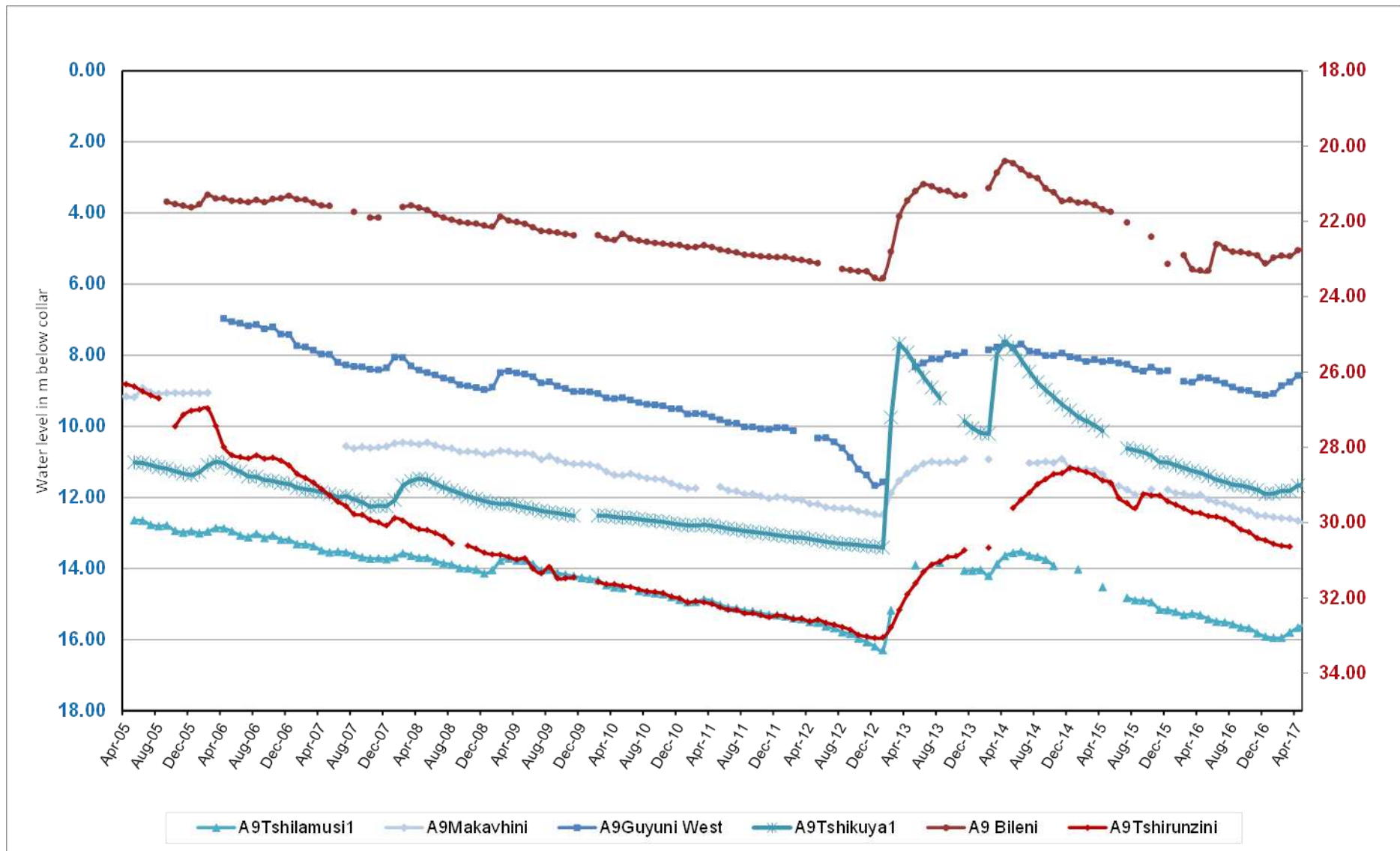


Figure 14: Groundwater level trends in the northern part of the A9 drainage

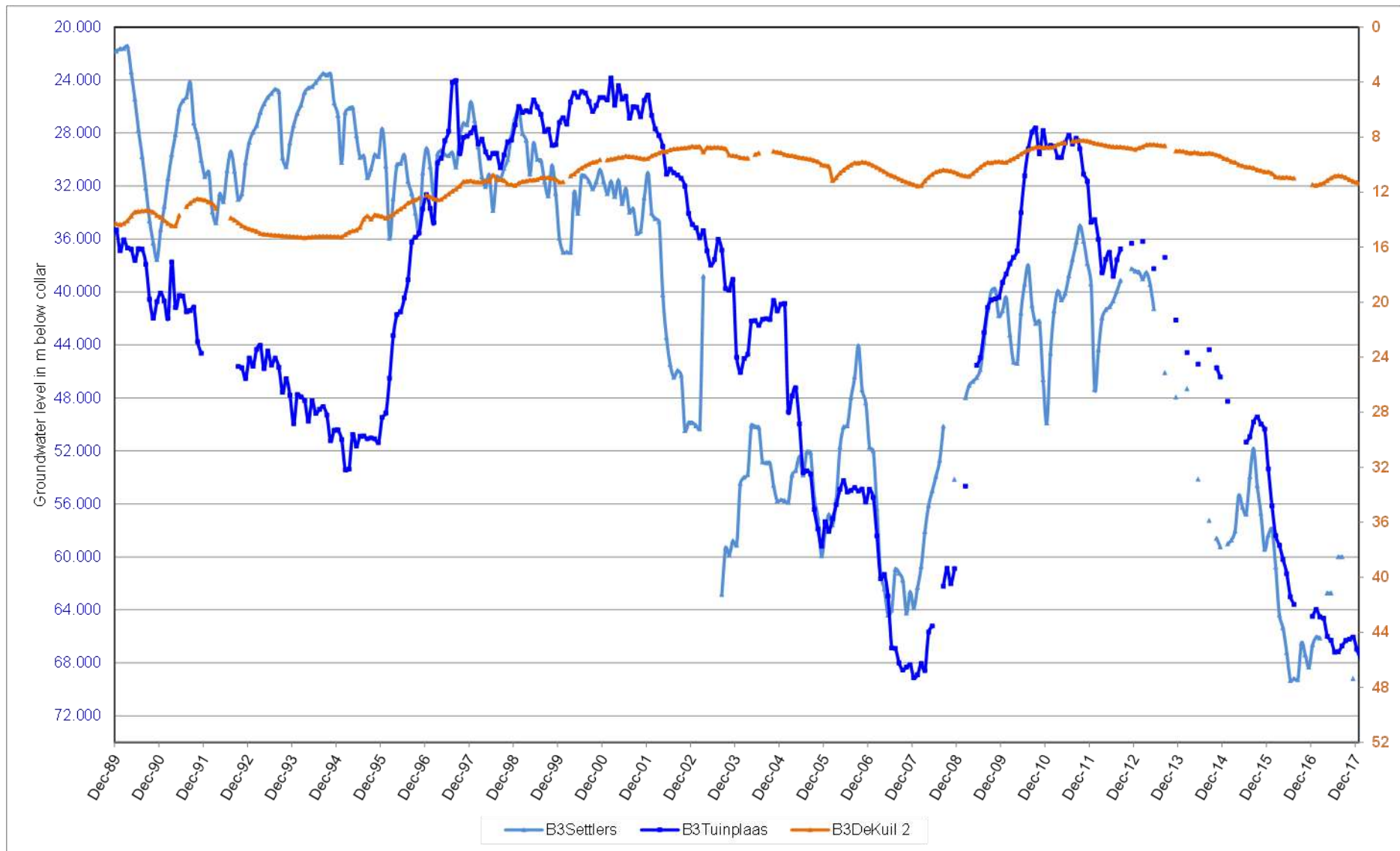
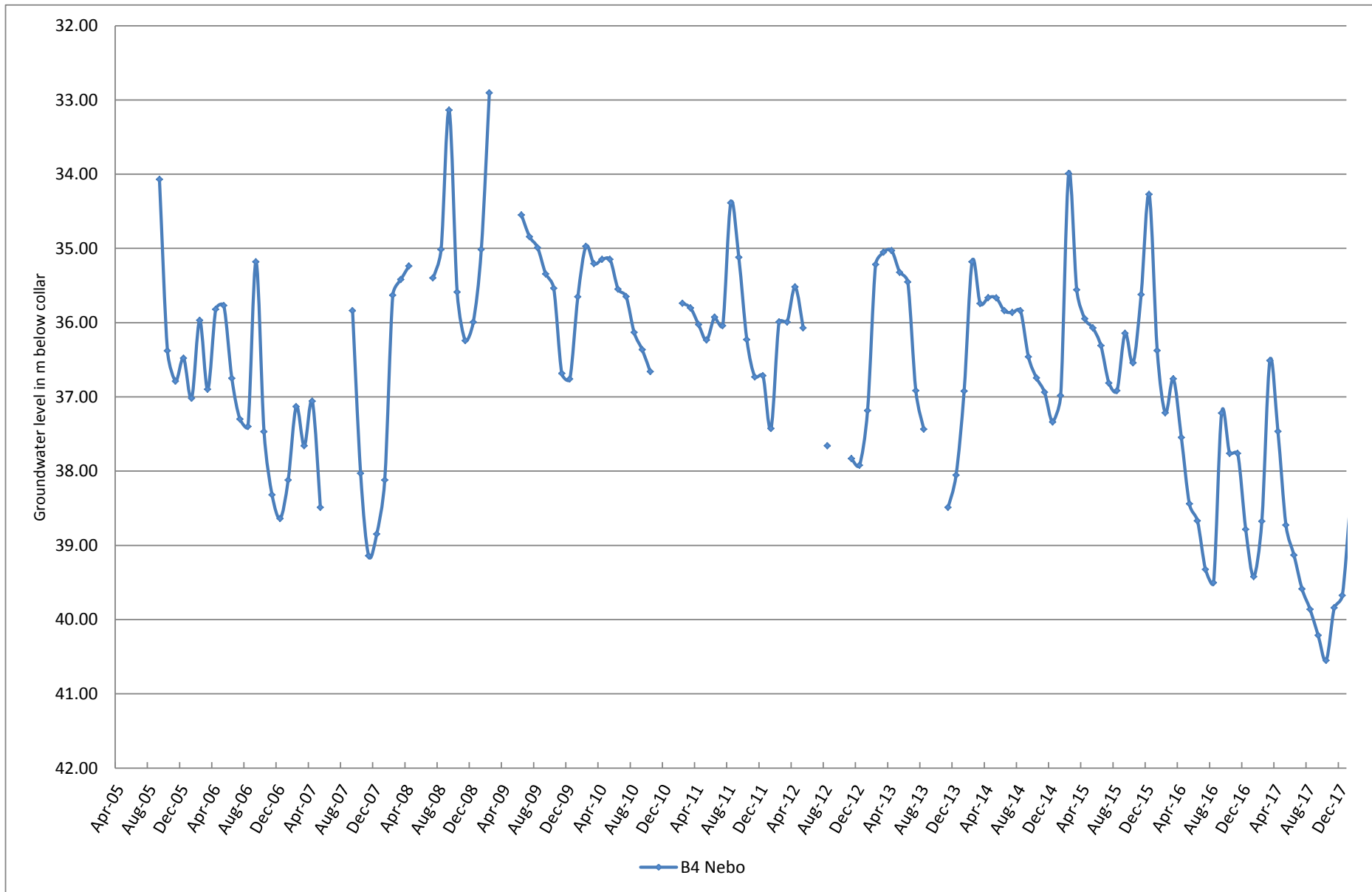


Figure 15: Groundwater level trends in the B3 drainage



**Figure 16: Groundwater level trend at B4 Nebo**

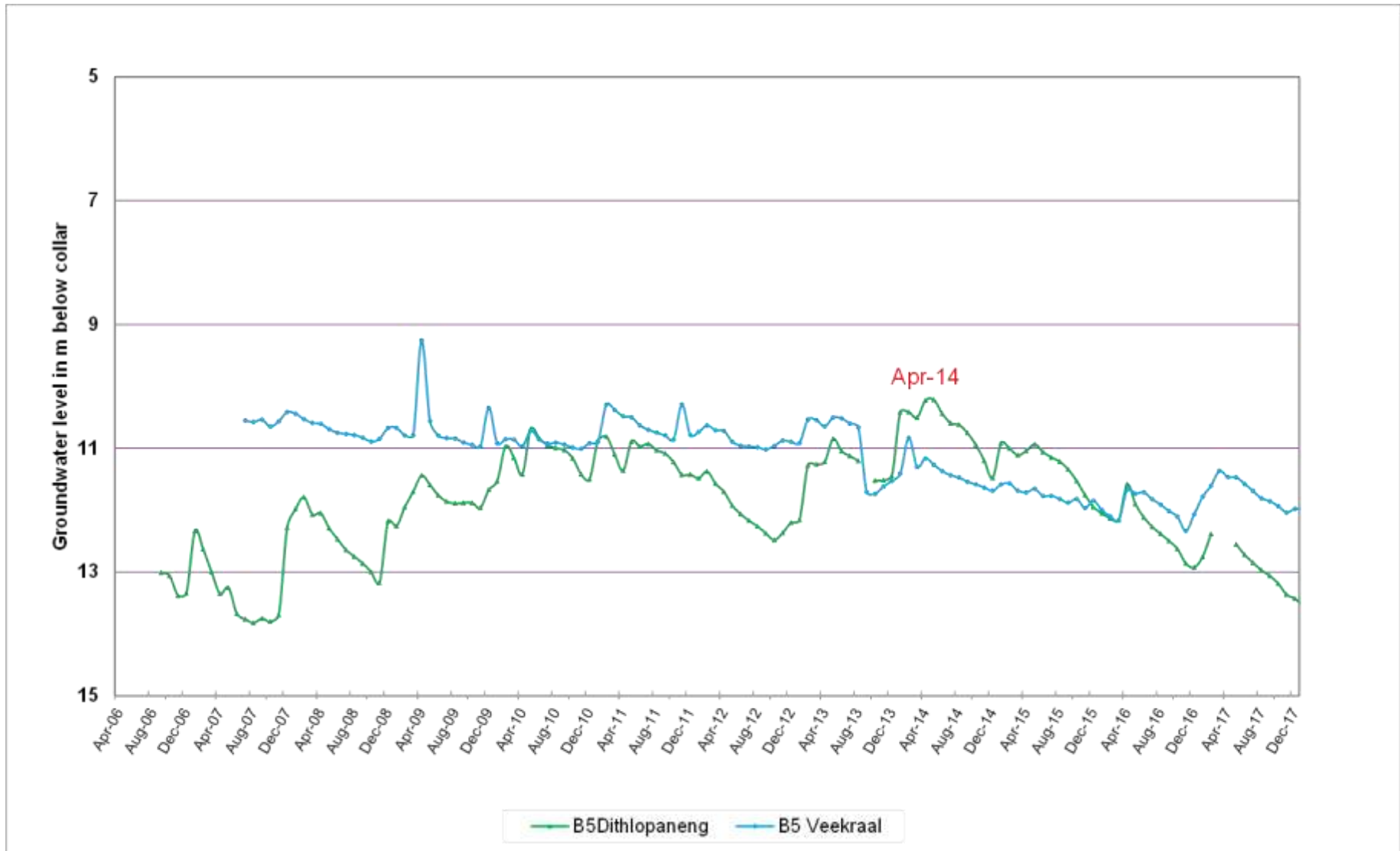


Figure 17: Groundwater level trends in the B5 drainage

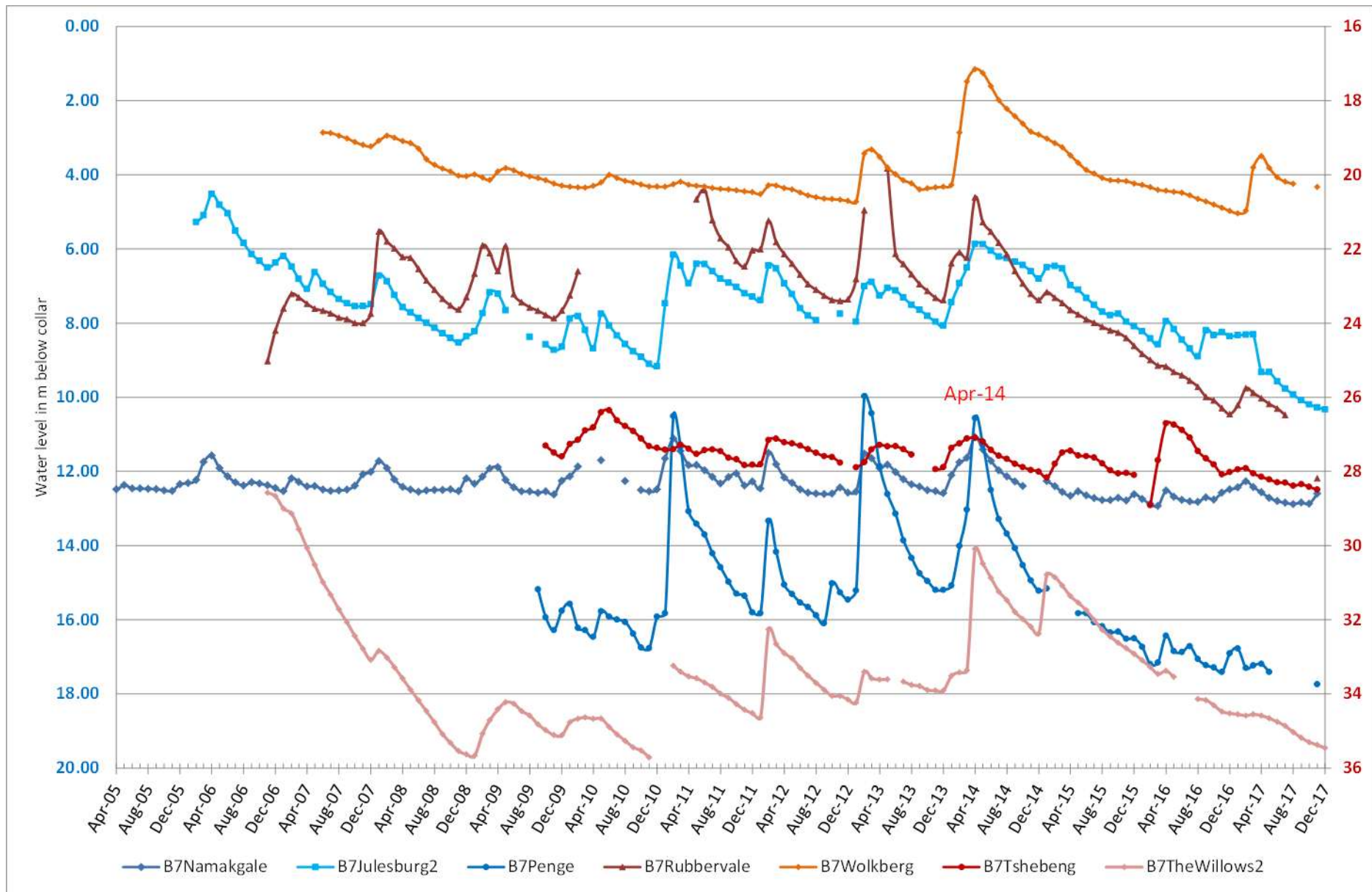


Figure 18: Groundwater level trends in the B7 drainage

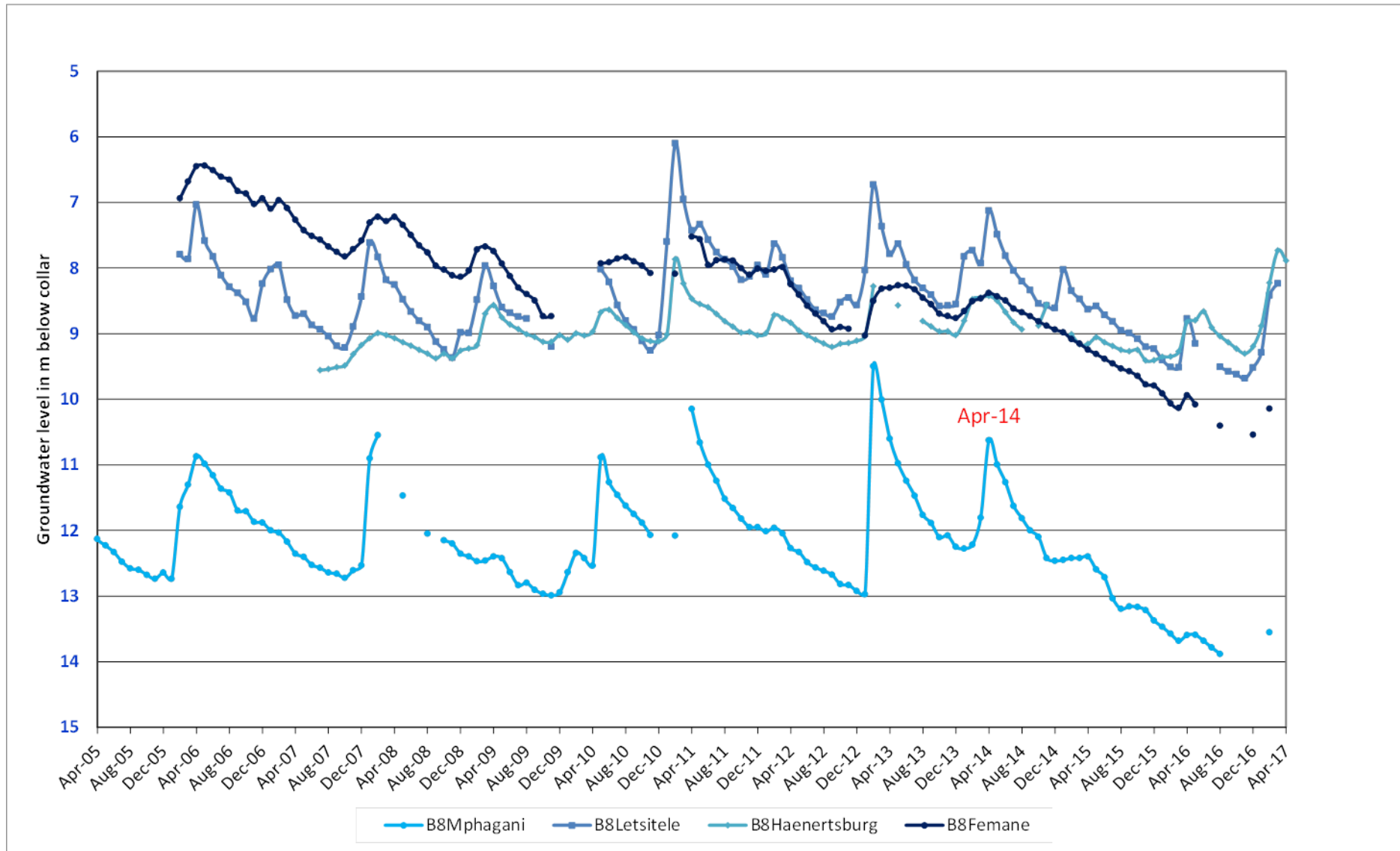


Figure 19: Groundwater level trends in the B81 drainage

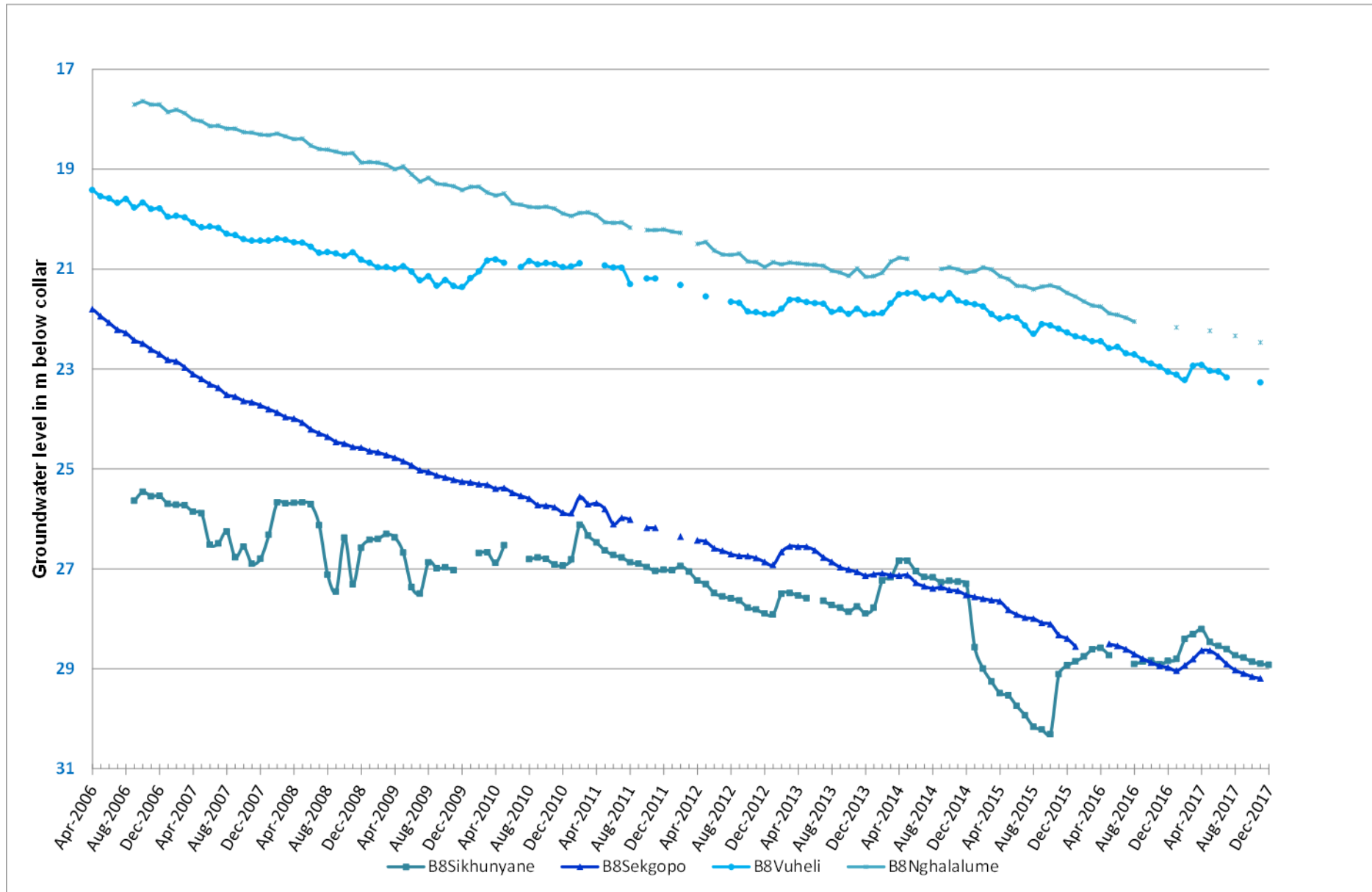


Figure 20: Groundwater level trends in the B82 drainage

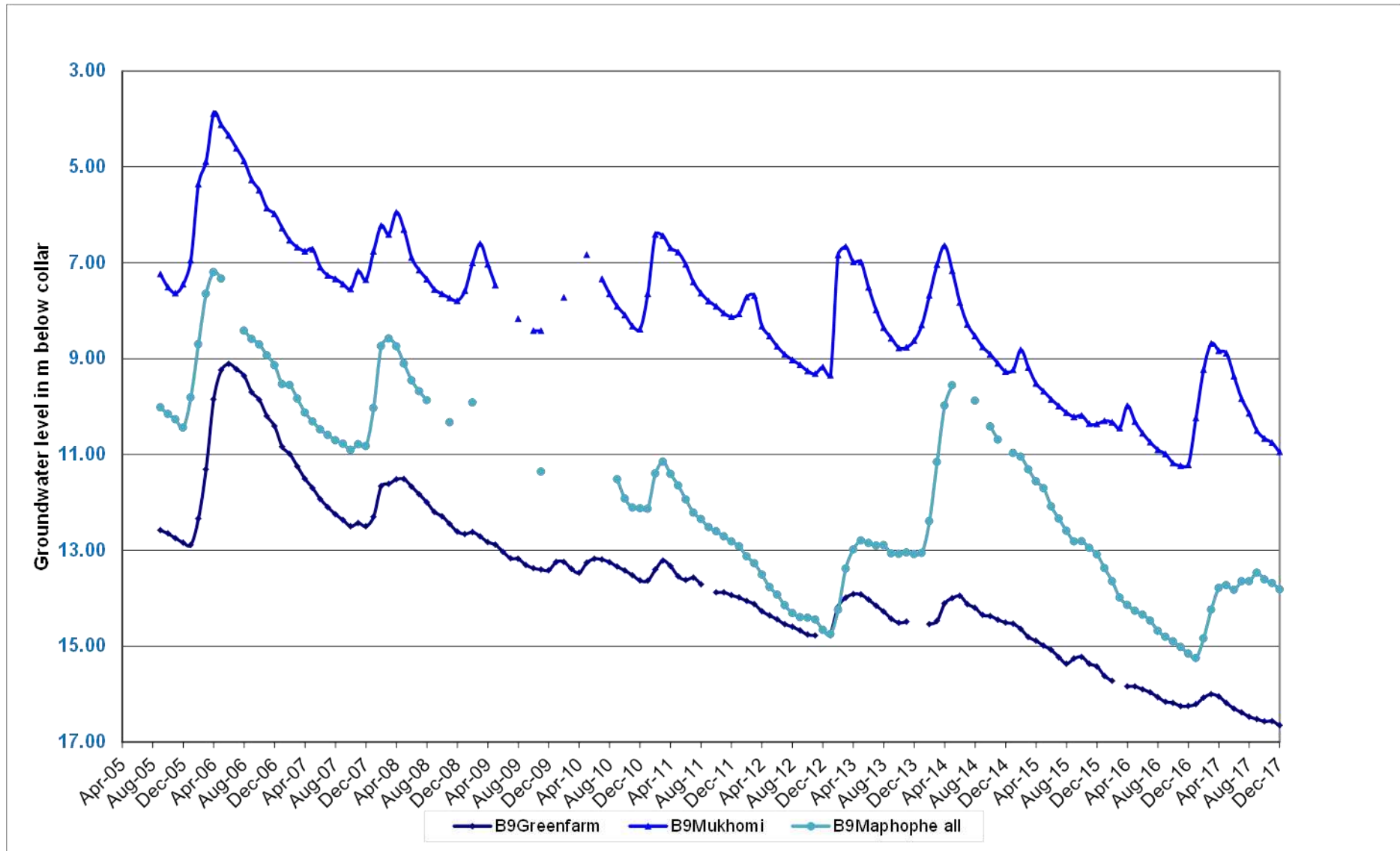


Figure 21: Groundwater level trends in the B9 drainage

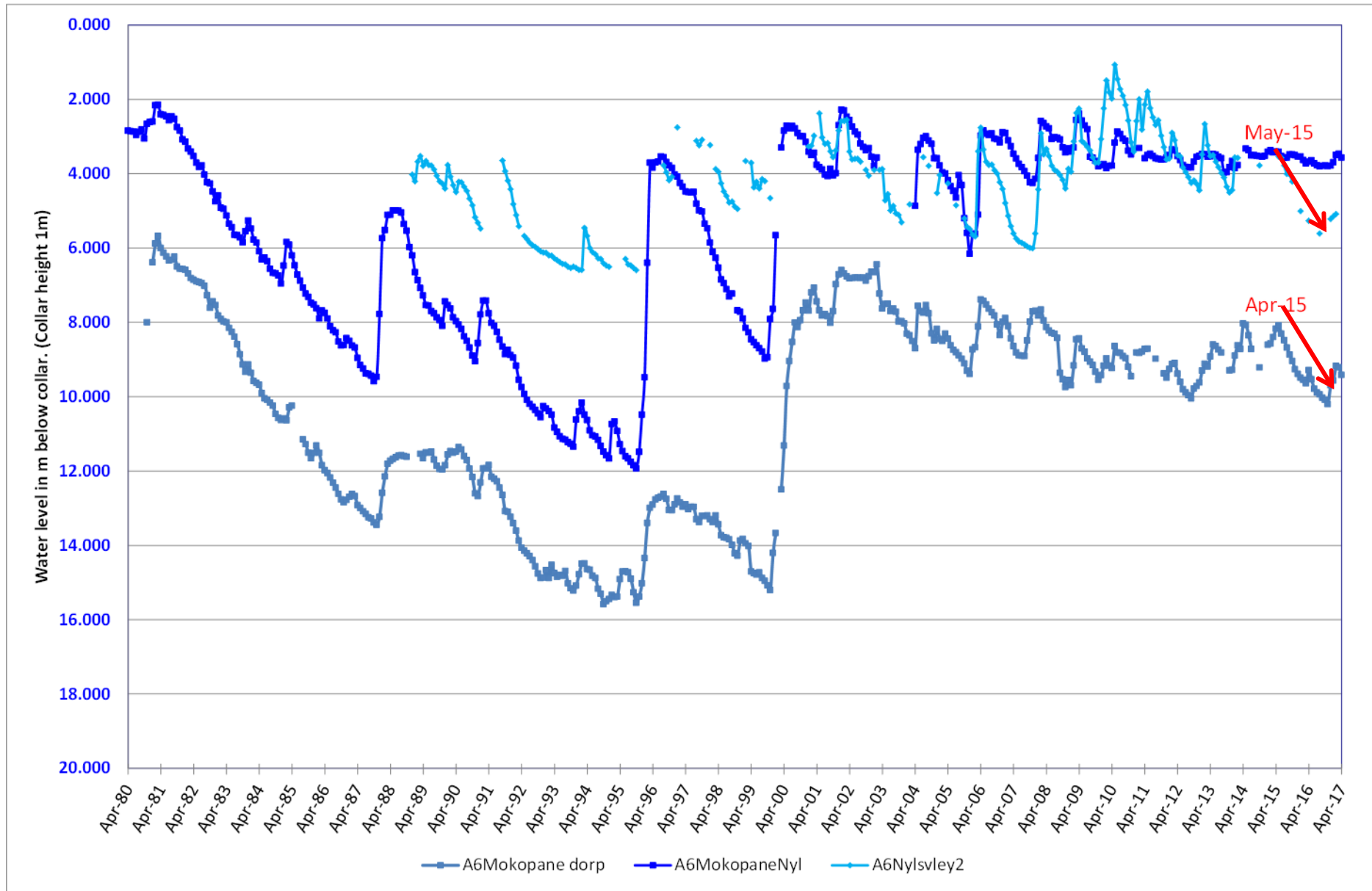


Figure 22: Long-term groundwater level trends in the A6 drainage.

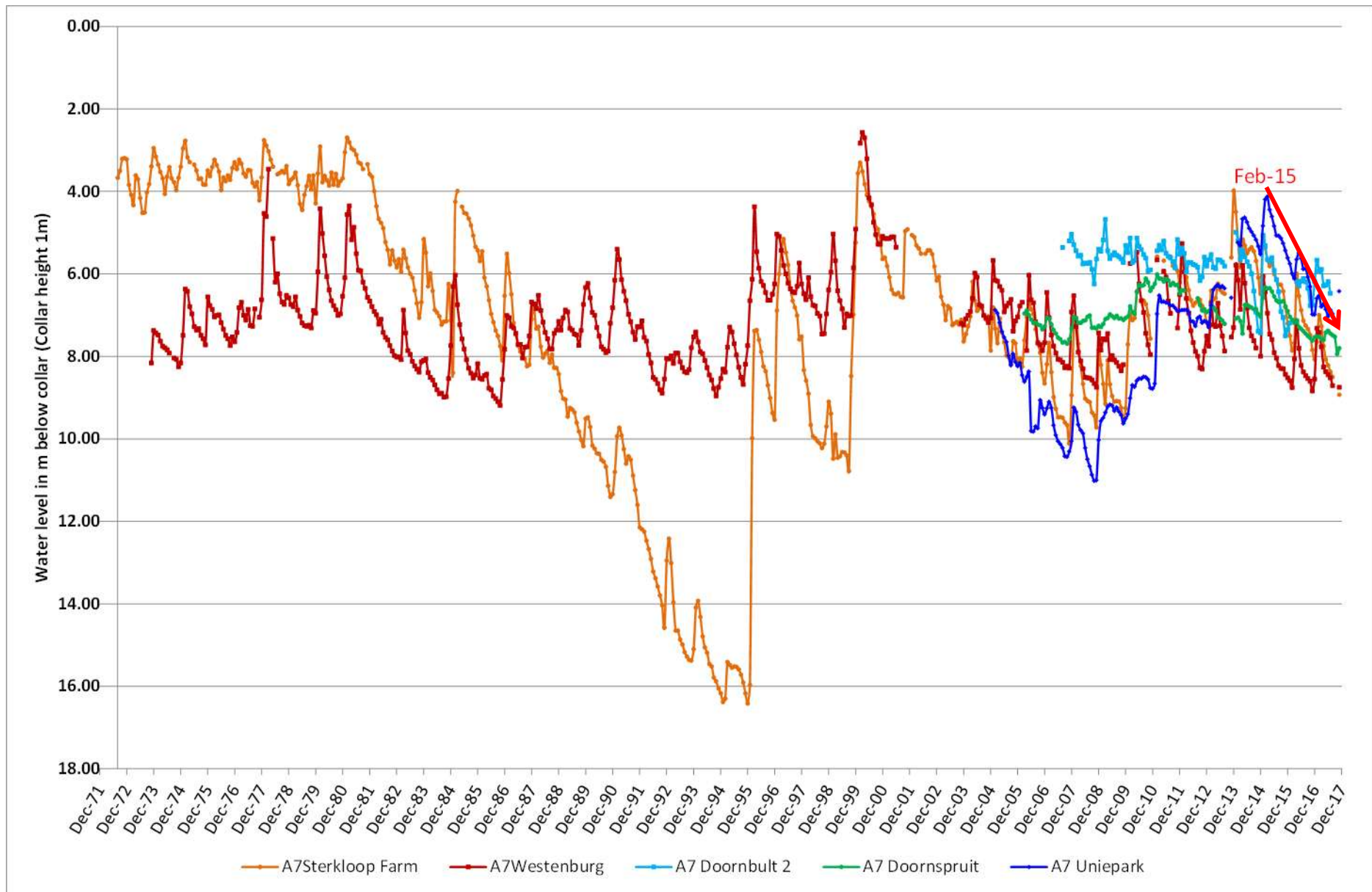


Figure 23: Long and short-term groundwater level trends in the A7 drainage

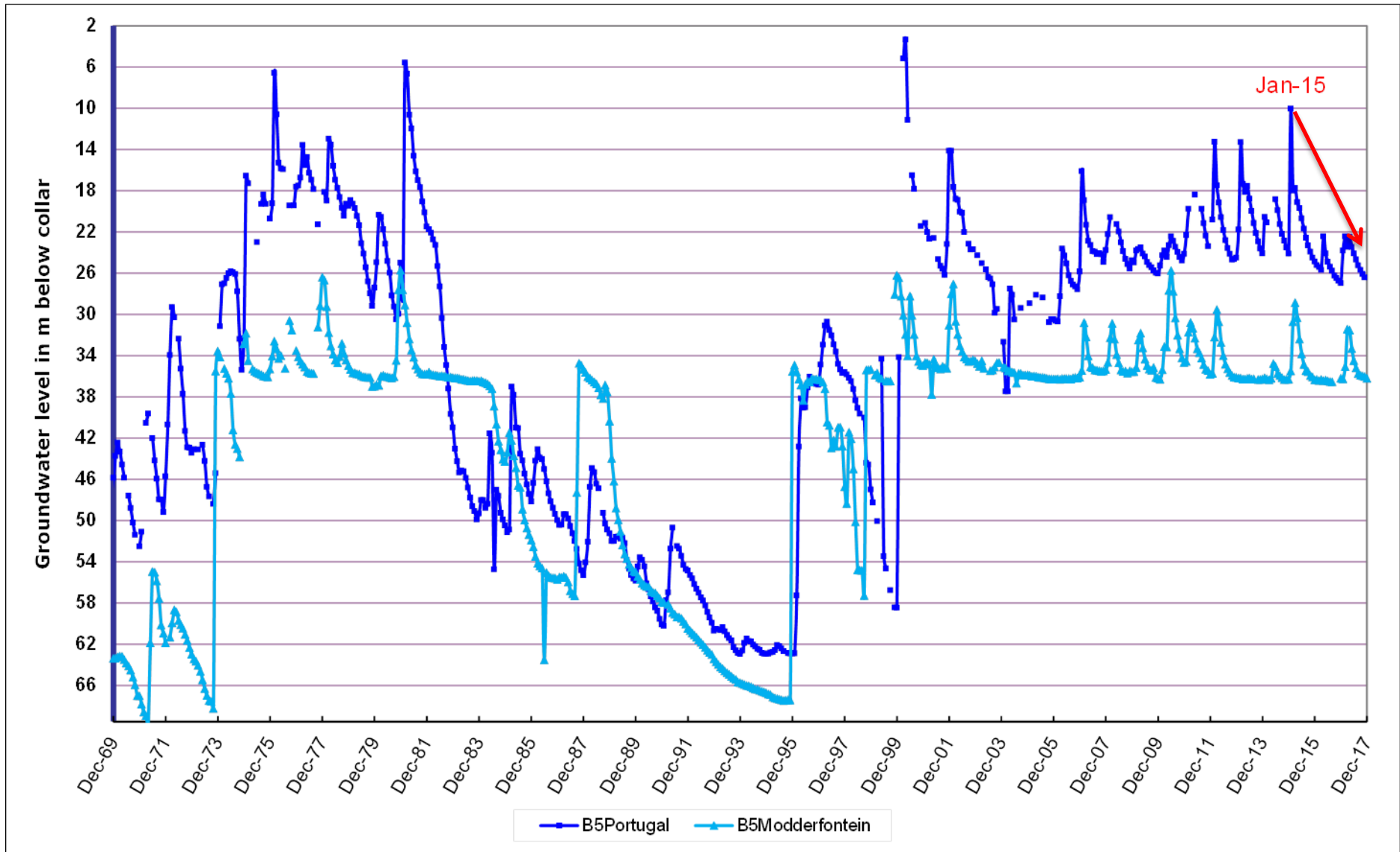


Figure 24: Long-term trends in the B5 drainage

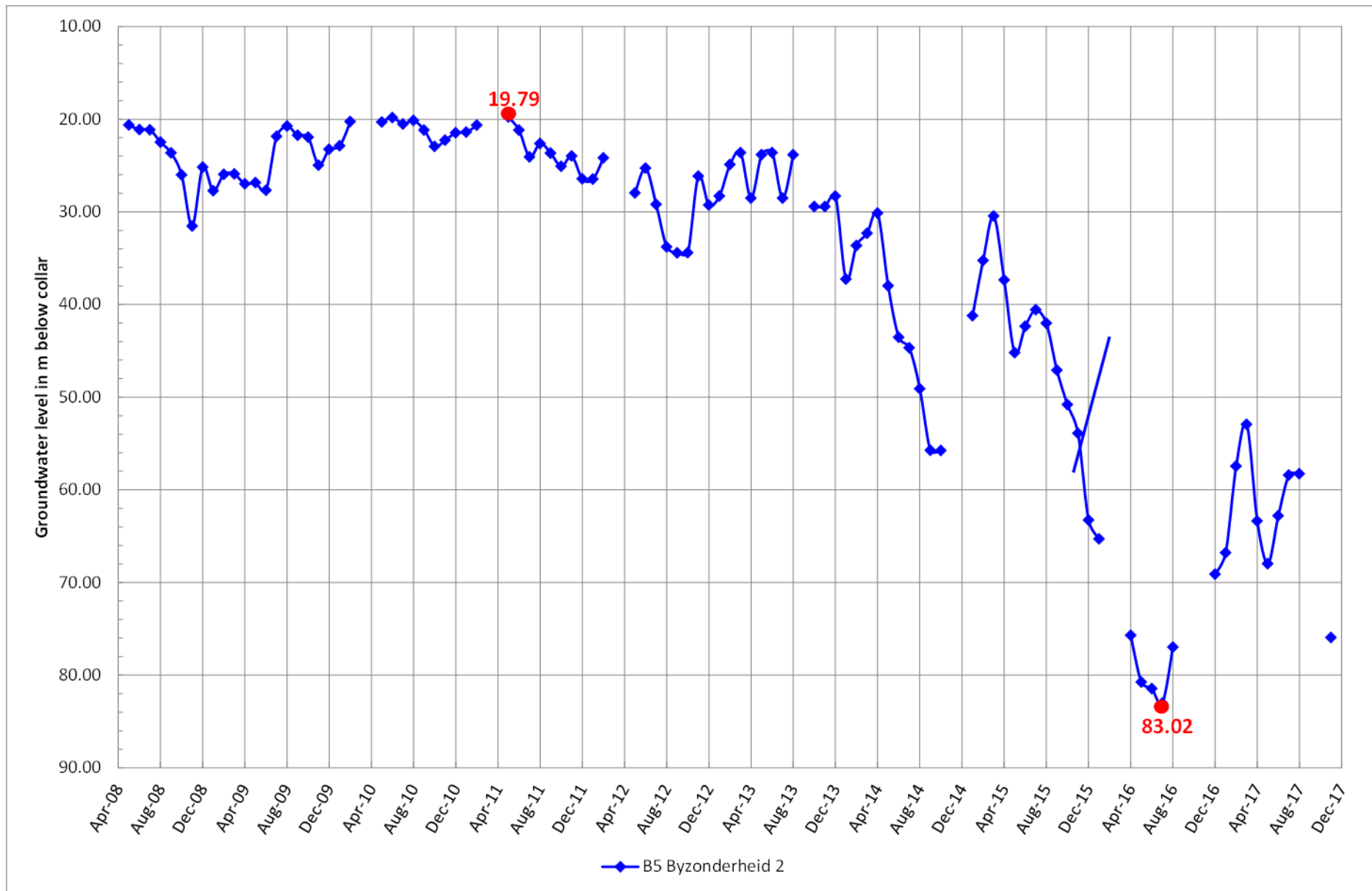
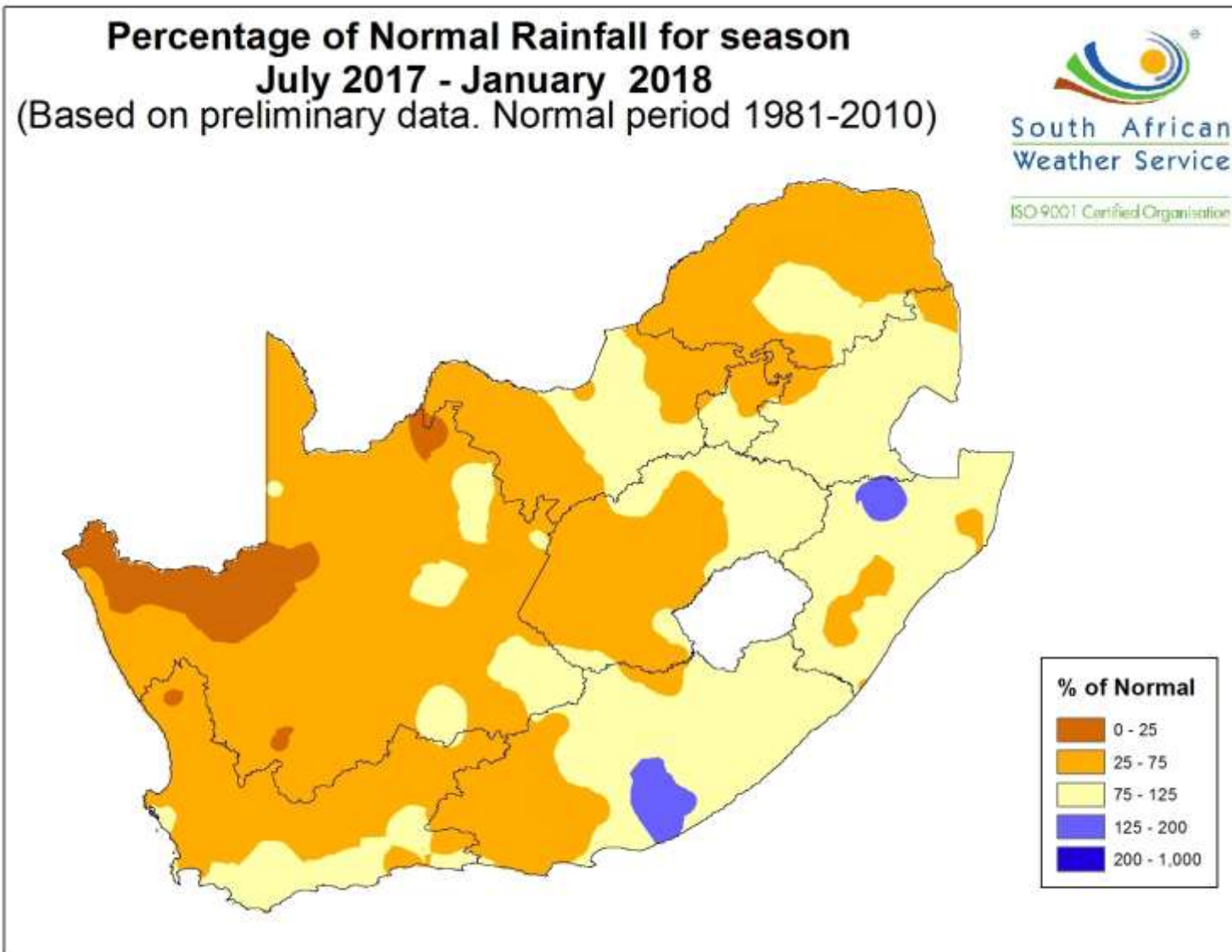


Figure 25: Example of the impact of over abstraction with no resource management in place



*Figure 26: Percentage of normal rainfall for the season July 2017 to January 2018*