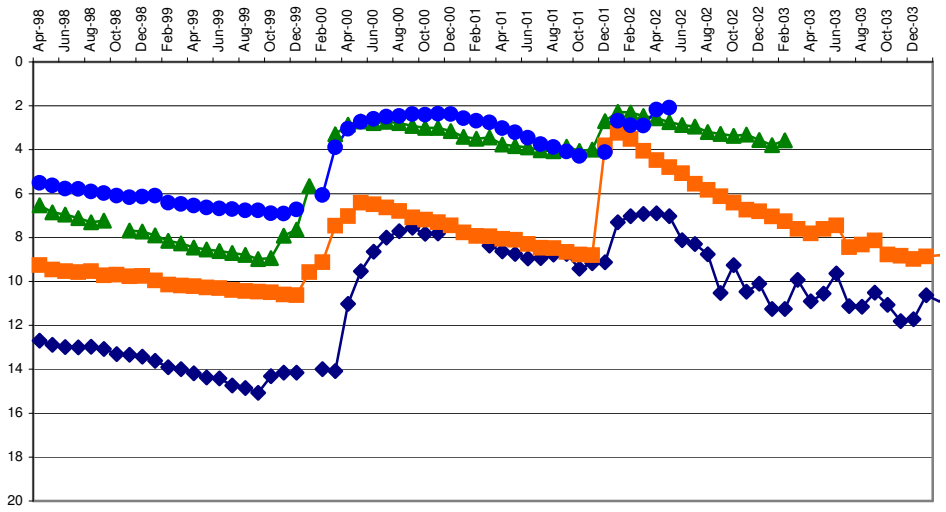
DEPARTMENT OF WATER AFFAIRS AND FORESTRY
LIMPOPO REGION
WATER RESOURCE MANAGEMENT

STATUS REPORT ON MONITORING & GROUNDWATER LEVEL TRENDS FEBRUARY 2008 – FEBRUARY 2009



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APRIL 2009

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1) EXECUTIVE SUMMARY

Groundwater levels

Water level values for 1 February 2008 (corresponding time last year), 1 November 2008 (Start of the past wet season) and 1 February 2009 (Midway through the wet season) were used for comparison in this report. The Stations in the Kruger National Park is done bi-annually and was not visited in February.

- Active stations to visit = 161
- Stations visited and accessed = 153.
- Stations inaccessible due to wet conditions = 6
- Other access problems = 2

Comparison of water levels with the previous quarter: (November 2008 to February 2009)
Stations with data for the whole period available = 145 (90% of stations)

	No of stations	% of stations	Average
Water level down more than 1 m	1	0.7%	
Water level down less than 1m	48	33.1%	-0.19 m
Higher water levels more than 1m	37	25.5%	3.1 m
Higher water levels less than 1m	58	40%	0.44 m
No difference in water level	1	0.7%	
Total	**138**	**100%**	**0.88m**

The above figures reflect the water level behavior from the start to midway of the current rainy season. At this stage of the season indication of recharge should hopefully be evident, the magnitude depending on the amount of rain received, the distribution patterns and the intensities of events. From the figures it is clear that a measure of recharge did reach the aquifers in some places with 65.5 % of stations with data indicating a rise. Of these, 37 stations (25.5%) indicate a rise in excess of 1m while 58 stations (40%) indicate a rise of less than 1m.
A decline in water level is indicated at 49 Stations (33.8%) of which only 1 indicates a decline of more than 1m. The situation at 1 station is unchanged. Overall an average gain of 0.88m was recorded for all stations since the beginning of the wet season.

Comparison of water levels with the corresponding time last year: (February 2008 to February 2009)
Stations with data for the whole period available = 134 (83.2% of stations)

Data for the whole year is available for 134 stations, of these, 102 (76%) indicates lower water levels while 32 (23.8%) indicate higher water levels. The water levels at 3 of the stations with higher water levels represent pumping levels and should be discarded leaving 29 with real rise in water level. That being done, an overall average decline of -0.44m was recorded over the past year.

It can be seen that, although some recharge is indicated for the past quarter, it is thus far generally less than the decline since the last rainy season, resulting in more stations having lower levels than the corresponding time last year.

Water levels in general are still indicating a slow declining trend. For stations with longer-term data this is especially notable since the last major recharge event in 2000-2001 and may partly be ascribed to normal decline after reaching exceptional highs. The trend is continuing for an extended period now despite some varying seasonal recharge. This is interpreted as part of a normal long-term cycle of lesser and major recharge periods. Comparison with long-term data where available indicate that levels are mostly still above the worst recorded. Average levels are at, or even below long-term averages in some drainage's.

48% (77) of active monitoring stations and ± 90% of stations with long-term data are located in the A6 and A7 drainages. Evaluation of this data indicates that the difference between the maximum and minimum average recorded is 6.2m, in else, the difference between the "best" and "worst" cases on record.
The depth to major water interception would generally be the best indicator of a critical level. This information is unfortunately not available for most of these old stations and therefore the maximum recorded is considered in this case to represent the critical level. This maximum represent the levels at the end of the extended drought throughout the 80`s to the mid 90`s when widespread water shortages were experienced in the Limpopo.

Current average water levels are 3.68m below the minimum, and 2.47m above the maximum recorded. Corresponding behavior by more recent water level trends with that displayed in other drainages where no long-term data exists, support the extrapolation of the long-term to other areas as well.
Although the median between "best" and "worst" has been exceeded, the situation is considered not to be one of serious concern. The fact that trends are tending towards the critical should however be noted and monitored.

As noted in previous reports, aquifer management is of utmost importance, especially in the current situation. Trends as discussed above represent the relatively natural conditions as far still possible and will include the influence of the combined abstraction over large areas. Localized conditions may differ greatly depending on various factors with abstraction patterns being the most important. The local effect of abstraction coupled to the regional that is already declining may serve to increase the local rate of decline dramatically, especially as water levels get lower. The importance of monitoring at aquifer level can not be over emphasized. Aquifer monitoring and management is the responsibility of the user or service provider. Adherence to this is of utmost importance to ensure sustainable use.

One area has drawn attention for some time now and again warrant special mentioning. Looking at ***MAP 4****, it can be seen that varying recharge can be noted for the region. What is clearly noticeable is the apparent lack of recharge in the lower reaches of the A9 Drainage. The opposite, namely a concentration of stations with lower water levels is more pronounced. The situation as depicted on MAP 5 highlights this more clearly for virtually the whole of A9 drainage. This area, especially the North eastern part, is relative arid, very densely populated and virtually totally dependent on groundwater. The area in Question falls within the jurisdiction of the Mutale-Masisi and Thoyandou local municipalities.*

Monitoring network

Extension of the monitoring network is still ongoing and 4 new stations were equipped with loggers the past month. Progress is slowed by lack of funds for the drilling section. The position of current and planned stations is depicted in **MAP 1**.

9 New stations still have to be registered on the National database. The Kruger Park stations also still have to be registered.
Project monitoring at Matlala and Tshitale is continuing. **MAP 2**
Monitoring of the NGWQMP boreholes continues. **MAP 3**
Field verification of possible boreholes for inclusion in the National Groundwater Quality network has been completed for the areas where government or communal equipped boreholes can be used and 27 sites were visited and verified. Planning of a sampling program to test the suitability of the selected sites was completed the end of December 2008. Field verification of control sampling boreholes was done but sampling was halted due to laboratory problems and a lack of funds.

2) STATUS OF MONITORING NETWORK

The Limpopo Province's Groundwater Level Monitoring Network currently consists of 195 active monitoring stations, including 34 in the KNP **(Map 1)**

153 Stations were visited during February 2009. 8 Stations could not be accessed for various reasons. 12 Additional new stations are currently planned of which 2 are already drilled but not yet equipped. Some network gaps identified will be addressed this year. Problems with access to some sites were solved but some are still a challenge and are receiving attention.

9 Of the newly drilled boreholes still have to be registered on the National database

No progress on the phase 2 upgrading of existing stations due to budget constraints.

The following project stations are monitored, 25 at Matlala, 4 at Tshitale and 16 at Taaibosch (Monitored by Head Office). **(Map 2)**

Regional and Head Office jointly service a total of 55 stations for the National Groundwater Quality Program in the Limpopo Province which is sampled bi-annually. **(Map 3)**

Sampling to verify the suitability of selected sites for extension of the National Groundwater Quality Monitoring network is on hold due to budget constraints and laboratory problems.

3) DATA COLLECTION, EVALUATION AND REPORTING

Data was collected during February 2009 with the value for 1 February representing midway of the past rainy season. Comparisons were drawn between 1 February 2008, (Corresponding period the previous year) 1 November 2008 (Beginning of the wet season) and 1 February 2009 (Midway of the past wet season) **(Maps 4 & 5)**

4) LIMPOPO WATER MANAGEMENT AREA.

The area consists of secondary drainage areas A4, A5, A6, A7 and A8.

4.1 A4 Drainage Area. (Matlabas, Mokolo Rivers)

There are now 9 newly equipped stations in this drainage but very limited time series data is available so far. 2 Boreholes are still to be drilled.

Comparison with previous levels:

November 2008 to February 2009 (beginning to midway of the wet season)
Data for 6 stations is available, 4 of which indicate a slight rise and 2 declining a bit. **(GRAPS 1-2)**

4.2 A5 Drainage Area. (Lephalale River)

There are 8 active stations. A5N0001, as well as 3 additional project boreholes around it, could still not be equipped yet due to access problems.

Very little fluctuation at most stations **(GRAPH 3)**

Comparison with previous levels:

November 2008 to February 2009 (beginning to midway of the wet season)
Some recharge at 3 stations with 2 declining **(GRAPH 4)**

February 2008 to February 2009
3 Of the 4 stations with data indicate declining levels the past year **(GRAPHS 5 & 6)**

4.3 A6 Drainage Area. (Nile, Sterk, Mogalakwena & Dorps Rivers)

There are 39 monitoring stations in this drainage.
Some recharge since the start of the season but not at all stations. **(GRAPH 7)**

Comparison with previous levels:

November 2008 to February 2009 (beginning to midway of the wet season)
Data for 33 stations is available. 12 Stations (36.4%) have lower levels and 21 stations (63.6%) indicate higher water levels. Overall an average rise of 0.92m was recorded for the period. **(GRAPHS 8 & 10)**

February 2008 to February 2009
Data for the whole year is available for 31 stations. 24 Stations (77.4%) indicate lower water levels than February last year and 7 stations (22.6%) indicate a rise in water levels. An overall decline of 0.02m was recorded over the past year **(GRAPH 9 & 10)**

Current average water levels are slightly above the long-term average values and 2.39m higher than the maximum average recorded, **(GRAPH 11)**

4.4 A7 Drainage Area. (Sand, Blood, Diep, Hout, Dwars & Brak Rivers)

There are 38 monitoring stations in this drainage.
Trends compare well with that of the A6 drainage with little noticeable recharge evident since the start of the wet season. **(GRAPH 12)**

Comparison with previous levels:

November 2008 to February 2009 (beginning to midway of the wet season)
Data is available for 37 stations of which 26 stations (70.3%) indicate higher water levels, while 11 stations (29.7%) indicate lower water levels. Overall a rise of 1.1m was recorded over this period **(GRAPHS 13&15).**

February 2008 to February 2009
Data is available for 34 stations, 21 (61.8%) Indicate lower water levels, average -0.55m. 13 Stations (38.2%) indicate higher water levels, average 0.7m. Overall a decline of -0.07m was recorded for the period **(GRAPHS 14&15)**.

Current average water levels are lower than the long-term average but 2.5m above the lowest average recorded **(GRAPH 16).**

4.5 A8 Drainage Area ((Nwanedzi, Nzhelele Rivers)

11 Stations are monitored in this area but as for the previous reports, the data for the artesian station was not used as it is still overflowing.

Very little fluctuation in water levels the past year **(GRAPH 17)**

Comparison with previous levels:

November 2008 to February 2009 (beginning to midway of the wet season)
9 Stations with data, 1 station indicates a declining water level and 8 rising levels, average 0.42m **(GRAPHS 18 & 20)**.

February 2008 to February 2009
6 Stations indicate lower water levels, average -0.46m, and 3 higher water levels **(GRAPHS 19 & 20)**.

An overall average decline of -0.27m was recorded over the past year **(GRAPH 20)**

5) LEVHUVHU-LETABA WATER MANAGEMENT AREA.

The area consists of secondary drainage areas A9, B8 & B9.

5.1 A9 Drainage Area. (Mutale, Levhuvhu Rivers)

This drainage has 18 monitoring stations.

Only 1 station indicates a considerable rise in water level **(GRAPH 21).**

Comparison with previous levels:

November 2008 to February 2009 (beginning to midway of the wet season)
Data is available for all 18 stations of which 10 indicate lower water levels; average -0.33m with 8 indicating higher water levels. If the value for A9N0009 is discarded, the average rise is 0.34m (**GRAPHS 22&24**).

February 2008 to February 2009
17 Stations (94.4%) indicate lower water levels, average -1.46m and 1 station indicate a higher water level (**GRAPHS 23&24**).

Overall an average decline of 0.85m was recorded over the area the past year.

5.2 B8 Drainage Area. (Groot, Middel & Klein Letaba Rivers)

14 Stations are monitored in this drainage.

The same general slow decline over the past year **(GRAPH 25).**

Comparison with previous levels:

November 2008 to February 2009 (beginning to midway of the wet season)
Data is available for all 14 stations and 6 stations indicate lower water levels, average -0.2m, 8 stations indicate higher water levels, average 0.57m **(GRAPHS 26&28)**

February 2008 to February 2009
All 14 Stations indicate lower water levels, average -0.61m (**GRAPHS 27&28)**

5.3 B9 Drainage Area. (Shingwidzi, Mphongolo Rivers)

4 Stations in this drainage
No real recharge evident so far **(GRAPH 29)**

Comparison with previous levels:

November 2008 to February 2009 (beginning to midway of the wet season)
2 Rising water levels and 2 declining **(GRAPHS 30 & 32).**

February 2008 to February 2009
All stations have lower water levels than the corresponding time last year, average -0.77m **(GRAPHS 31 & 32)**

6) OLIFANTS WATER MANAGEMENT AREA.

The part of this Water Management Area within the Limpopo Province mostly consists of the B3, B5 & B7 secondary drainage areas.

6.1 B3 Drainage Area. (Elands, Gotwane Rivers (Springbok flats area)

3 Stations are monitored in this area.

Considerable rise in water levels except at B3N0022 **(GRAPH 33)**

Comparison with previous levels:

November 2008 to February 2009 (beginning to midway of the wet season)
2 Stations indicate higher levels and 1 lower **(GRAPH 34)**

February 2008 to February 2009
All Stations indicate higher water levels (**GRAPH 35)**

Despite the rising water levels at B3N0001 and B3N0012, the current water levels are still far below long-term average and is a reason for concern for some years now (**GRAPH 36)**

6.2 B5 Drainage Area. (Olifants, Nkumpi Rivers)

7 Stations are monitored in this drainage.

As in other drainages, very slight rise at some stations **(GRAPH 37)**

Comparison with previous levels:

November 2008 to February 2009 (beginning to midway of the wet season)
All 7 Stations indicate higher water levels.B5N0055 reflects direct pumping effects of a new production borehole and was not used in averaging. The average rise at the other 6 stations is 0.78m. **(GRAPHS 38 & 39)**

February 2008 to February 2009
5 Stations indicate a decline with 2 indicating rising water levels **GRAPHS 39 & 40)**

Current average water levels are above the lowest average recorded **(GRAPH 40)**

6.3 B7 Drainage Area (Olifants, Selati, Klaserie, Makhutswi Rivers)

8 Stations are monitored in this drainage.

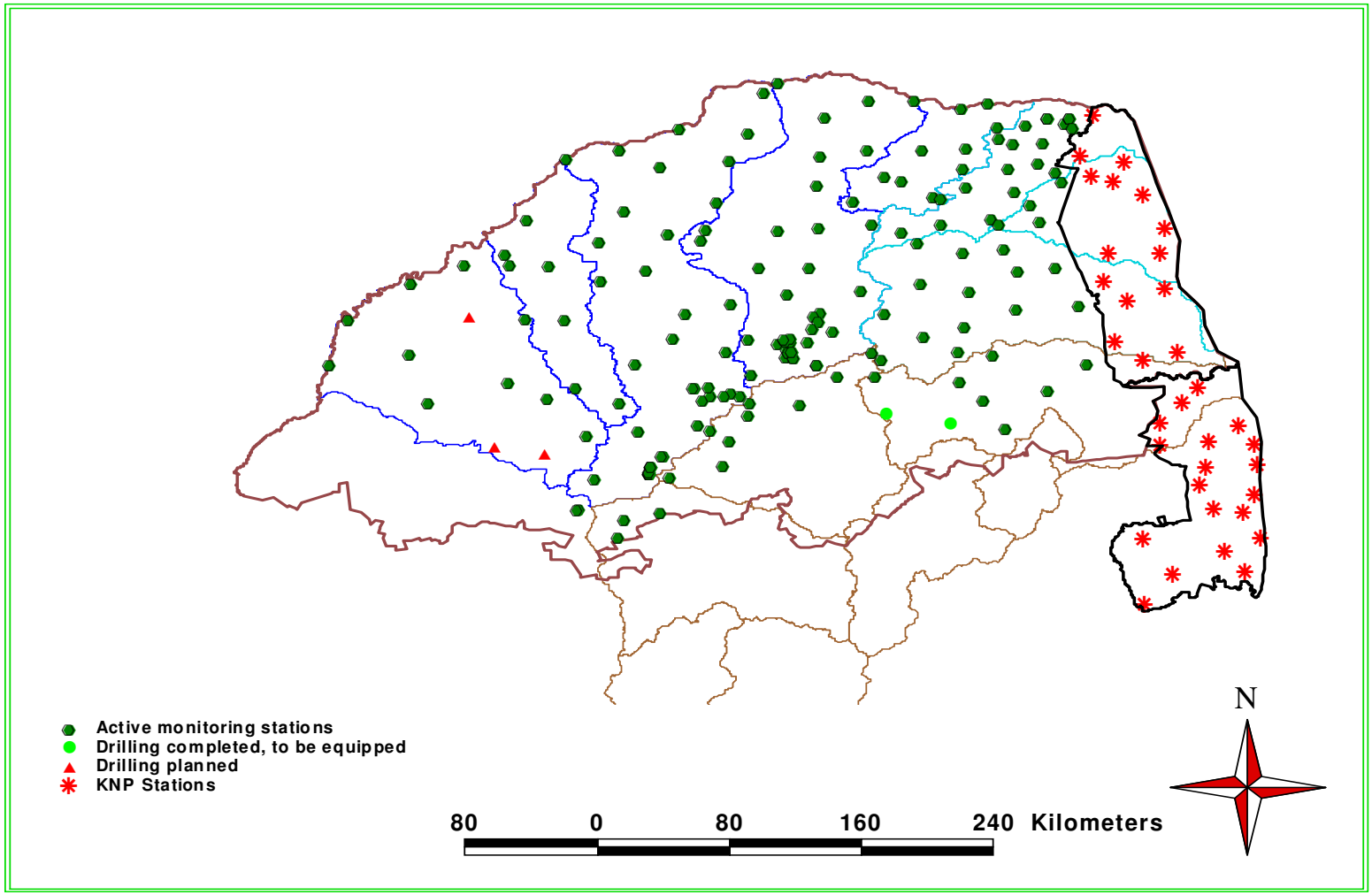
Trends is similar to that of the other drainages **(GRAPH 42)**

Comparison with previous levels:

November 2008 to February 2009 (beginning to midway of the wet season)
2 stations indicate lower water levels; and 5 higher, average 0.47m **(GRAPHS 43 & 45)**

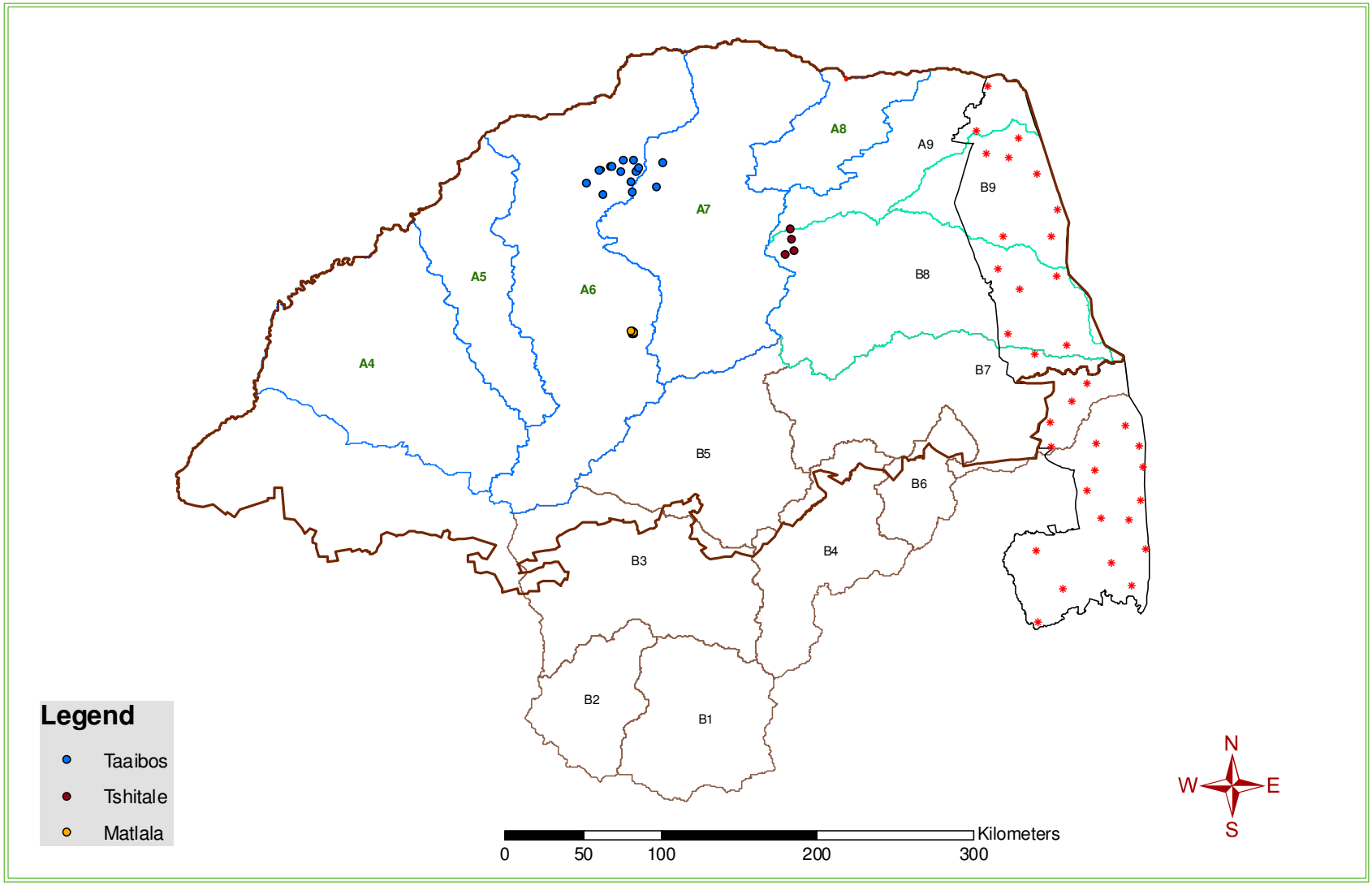
February 2008 to February 2009
7 Stations indicate lower water levels; average -0.94m and 1 higher **(GRAPHS 44 & 45)**.

Limpopo Groundwater Monitoring
Positions of active and planned stations



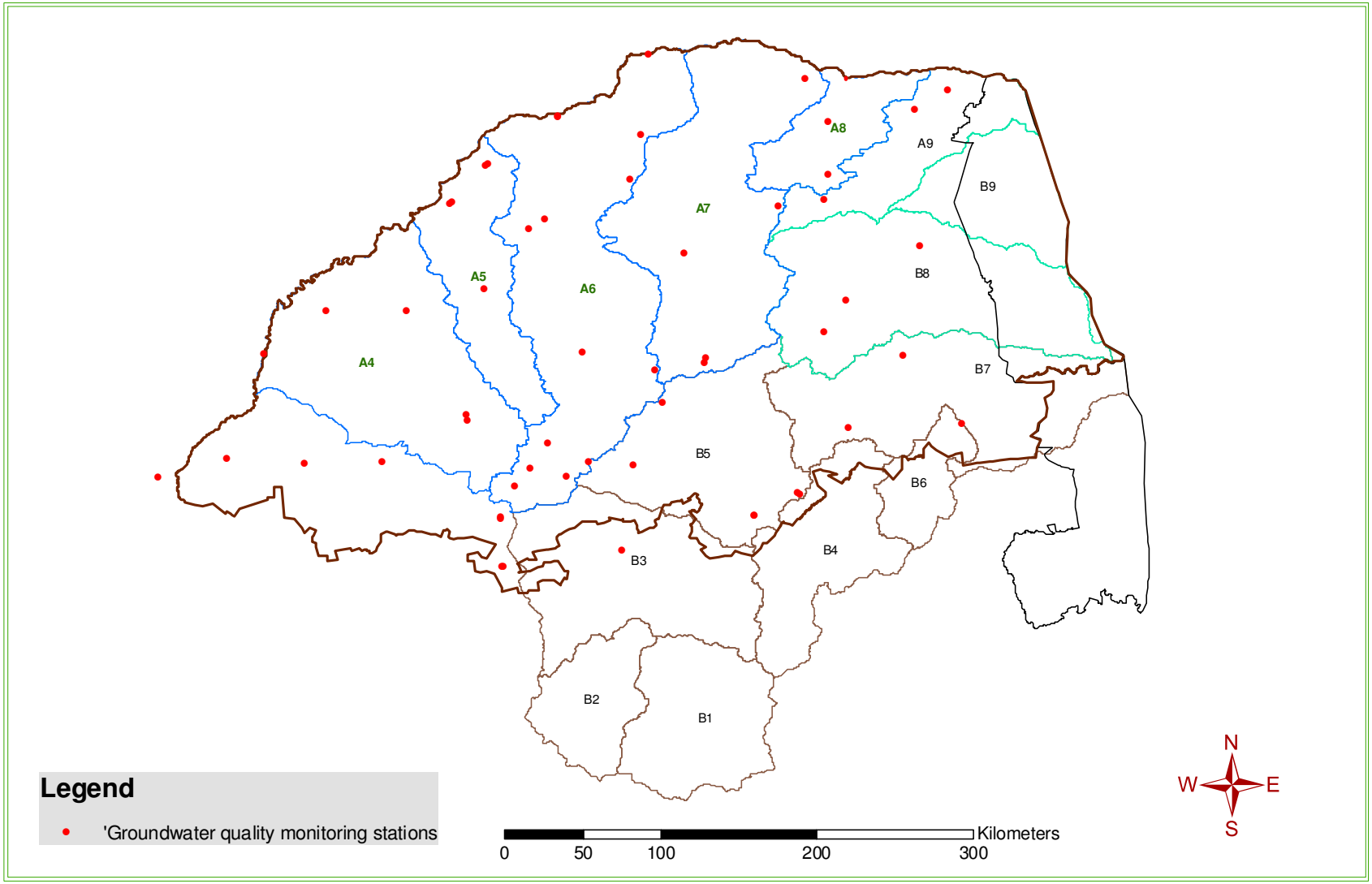
MAP 1

Limpopo Groundwater Monitoring:
Positions of project monitoring stations



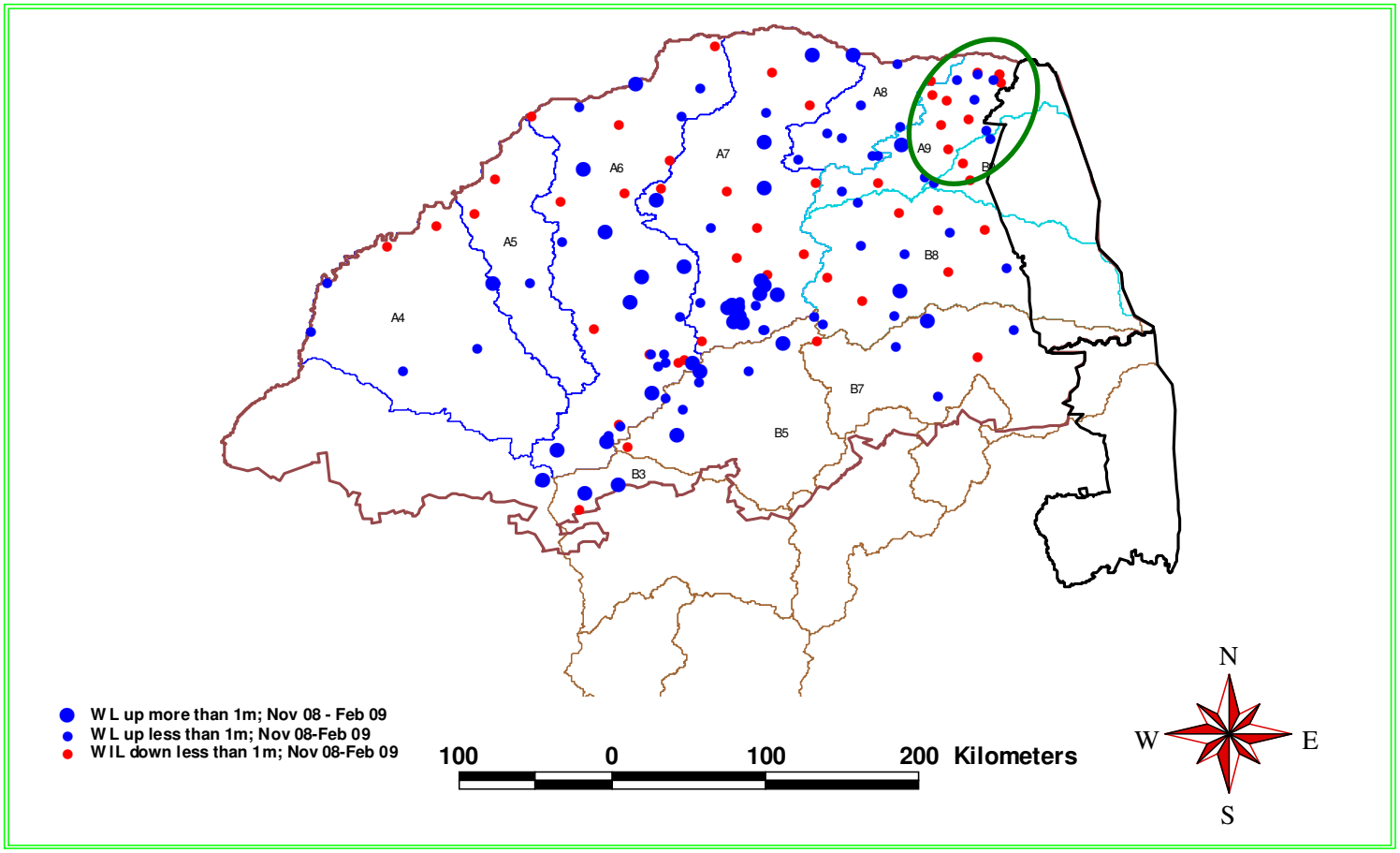
MAP 2

Limpopo Groundwater Monitoring:
Positions of goundwater quality monitoring stations



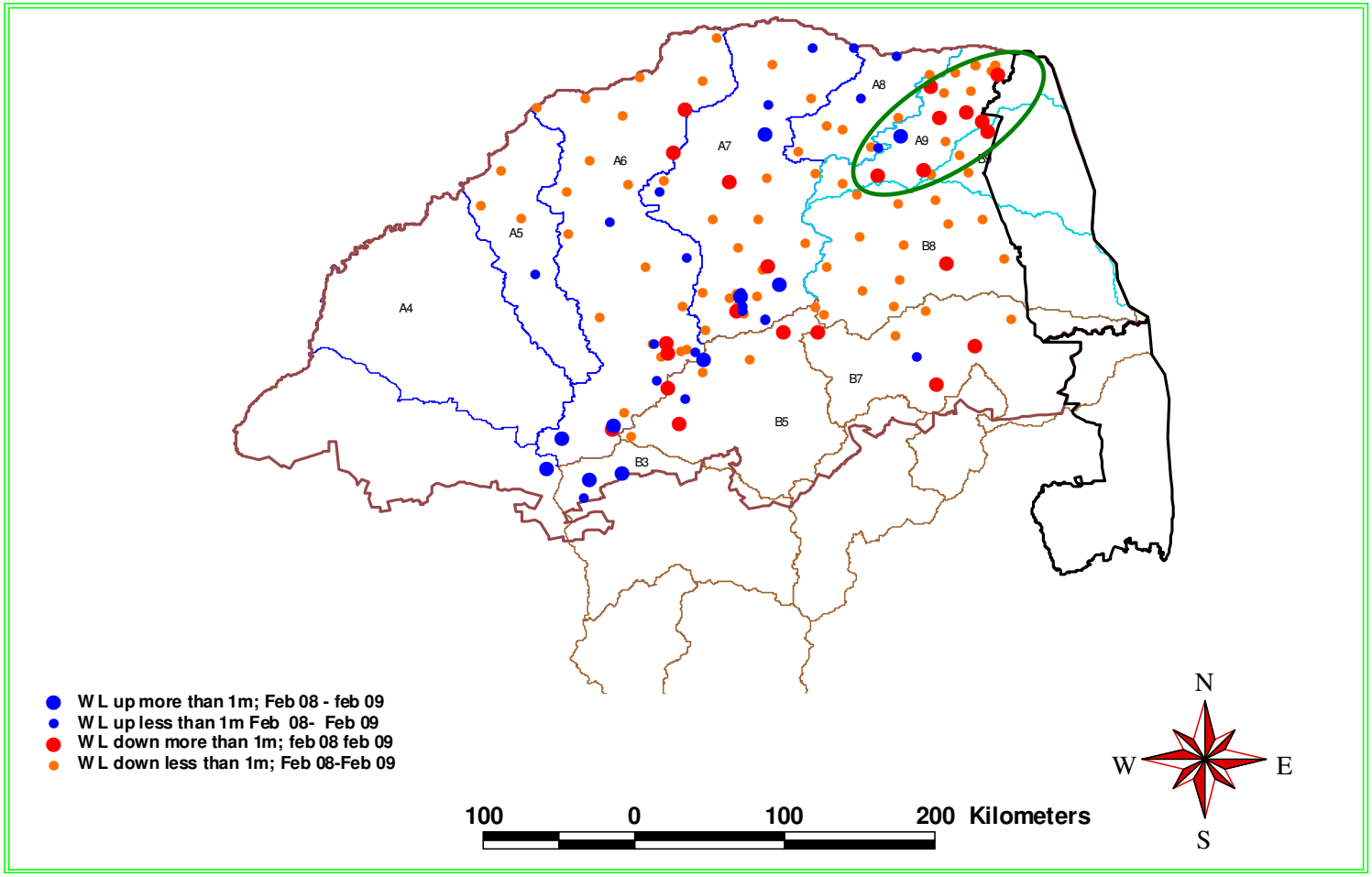
MAP 3

Limpopo Groundwater Monitoring
Difference in water levels;
November 2008 to February 2009

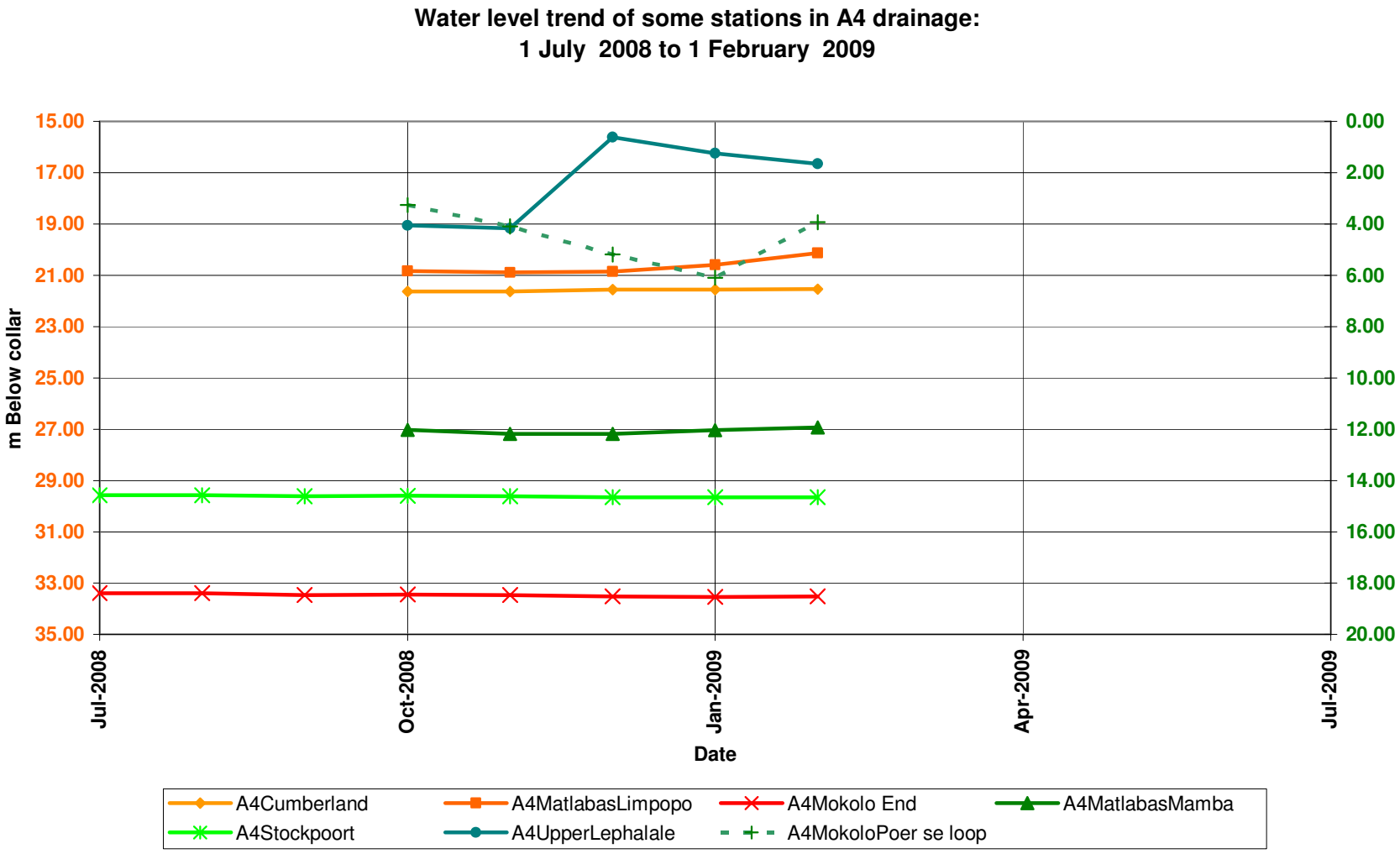


MAP 4

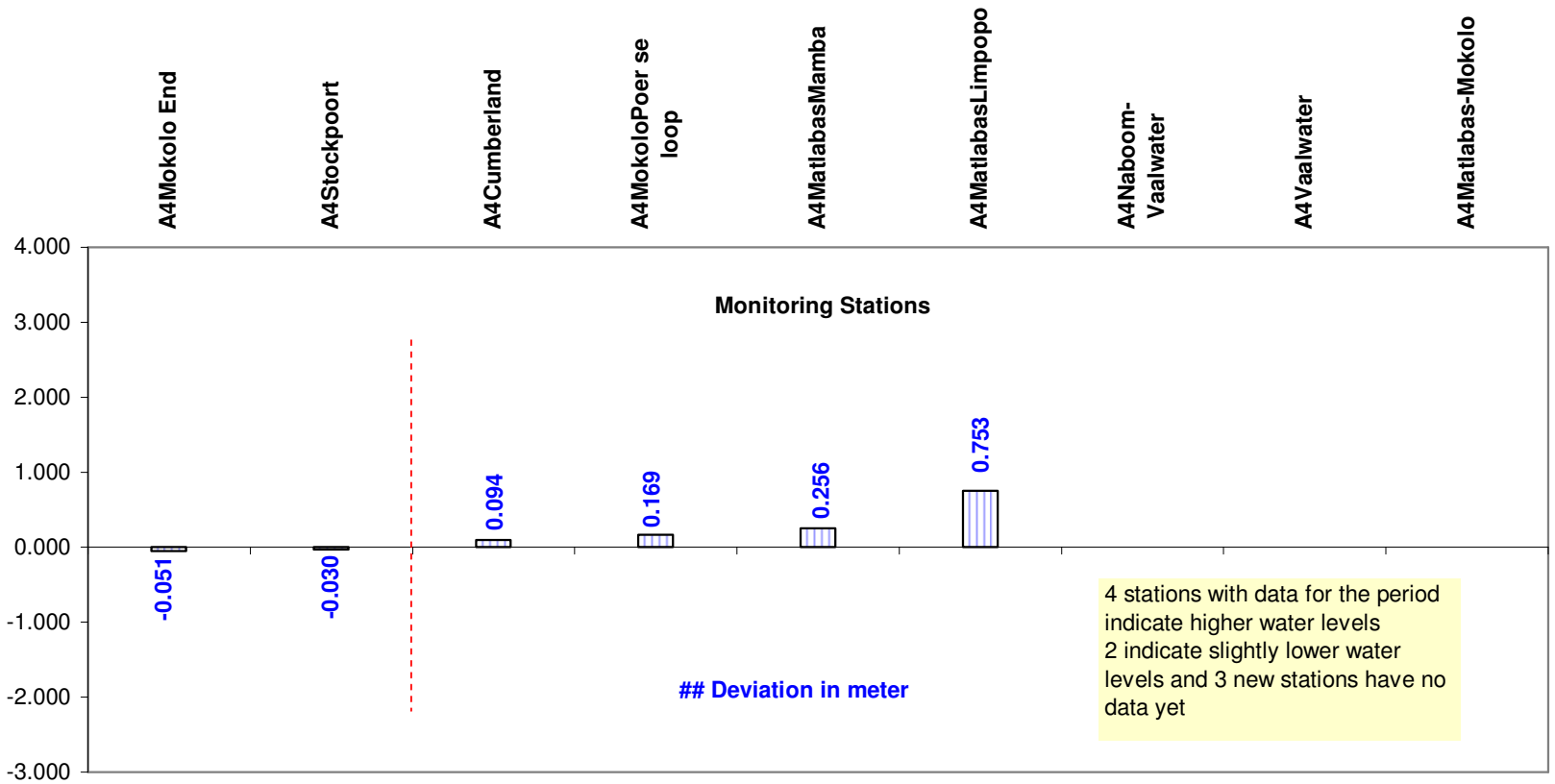
Limpopo Groundwater Monitoring
Difference in water levels
February 08 to February 09



MAP 5

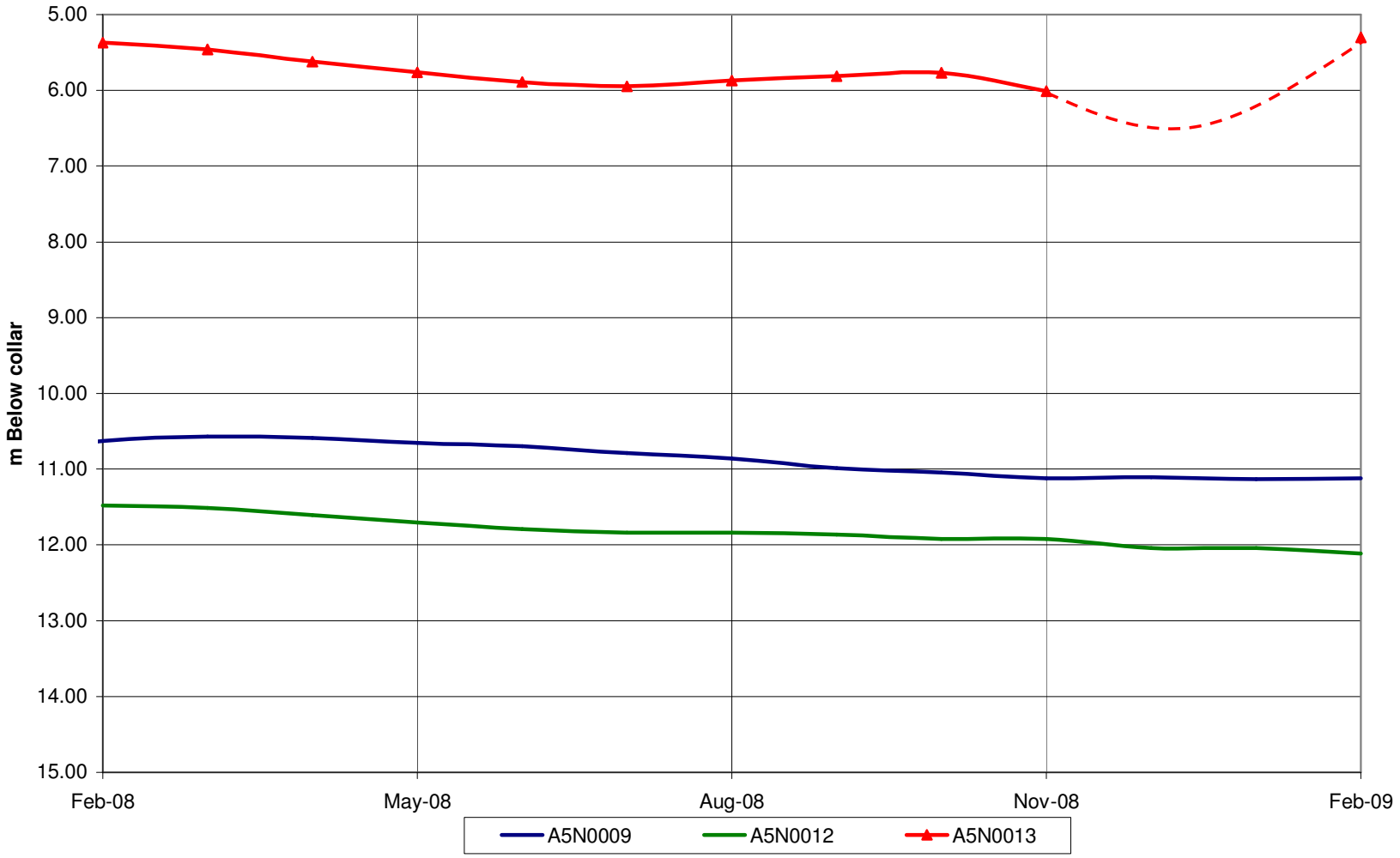

Water level trend of some stations in A4 drainage:
1 July 2008 to 1 February 2009
m Below collar
15.00
17.00
19.00
21.00
23.00
25.00
27.00
29.00
31.00
33.00
35.00
0.00
2.00
4.00
6.00
8.00
10.00
12.00
14.00
16.00
18.00
20.00
Jul-2008
Oct-2008
Jan-2009
Apr-2009
Jul-2009
Date
A4Cumberland
A4MatlabasLimpopo
A4Mokolo End
A4MatlabasMamba
A4Stockpoort
A4UpperLephalale
A4MokoloPoer se loop

GRAPH 1

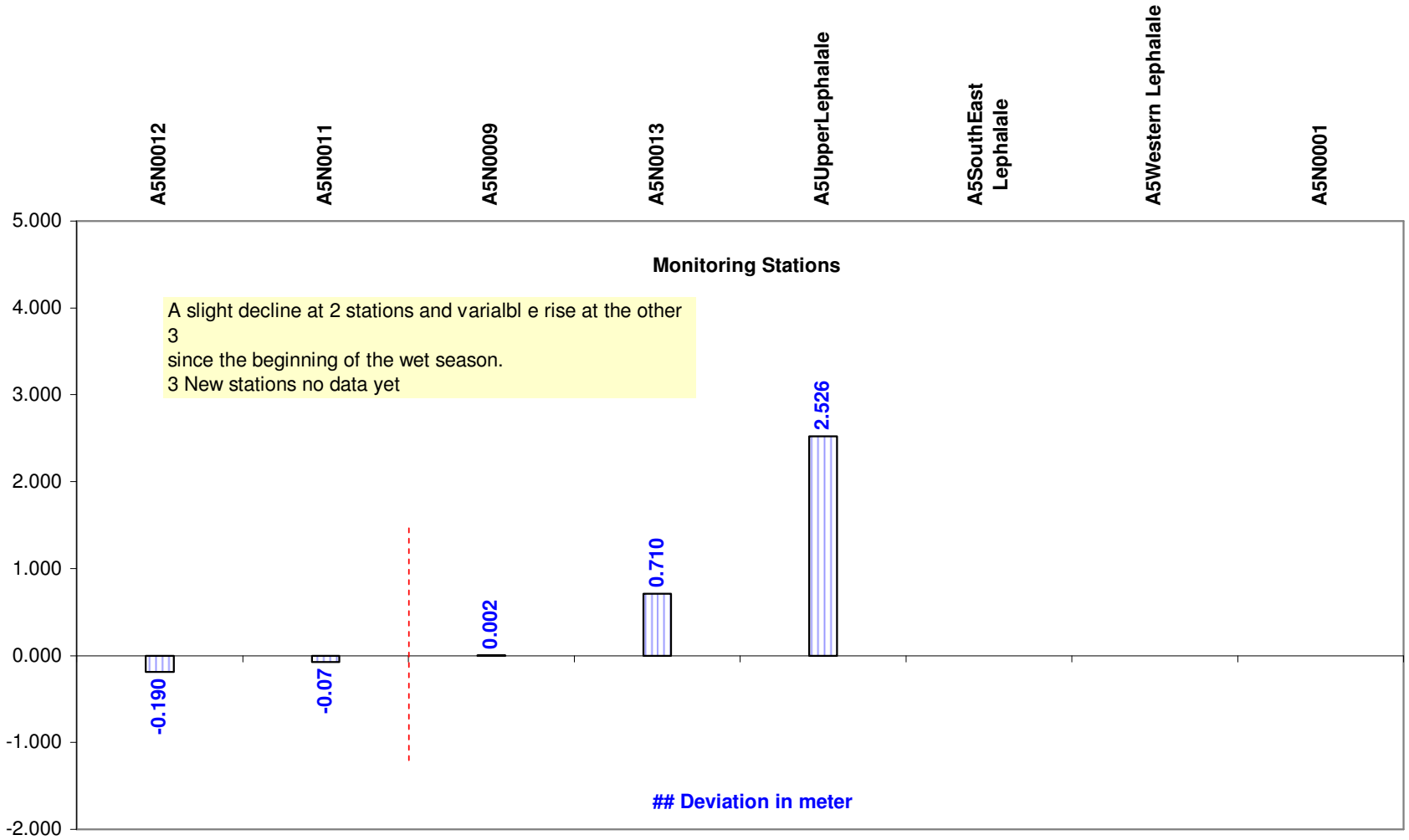

A4 DRAINAGE AREA
Deviation of water levels: 1 November 2008 to 1 February 2009
A4Mokolo End
A4Stockpoort
A4Cumberland
A4MokoloPoer se loop
A4MatlabasMamba
A4MatlabasLimpopo
A4Naboom-Vaalwater
A4Vaalwater
A4Matlabas-Mokolo
4.000
3.000
2.000
1.000
0.000
-1.000
-2.000
-3.000
Monitoring Stations
-0.051
-0.030
0.094
0.169
0.256
0.753
Deviation in meter
4 stations with data for the period indicate higher water levels
2 indicate slightly lower water levels and 3 new stations have no data yet

GRAPH 2

Comparison of water level trends at some stations in A5 drainage: 1 February 2008 to 1 February 2009

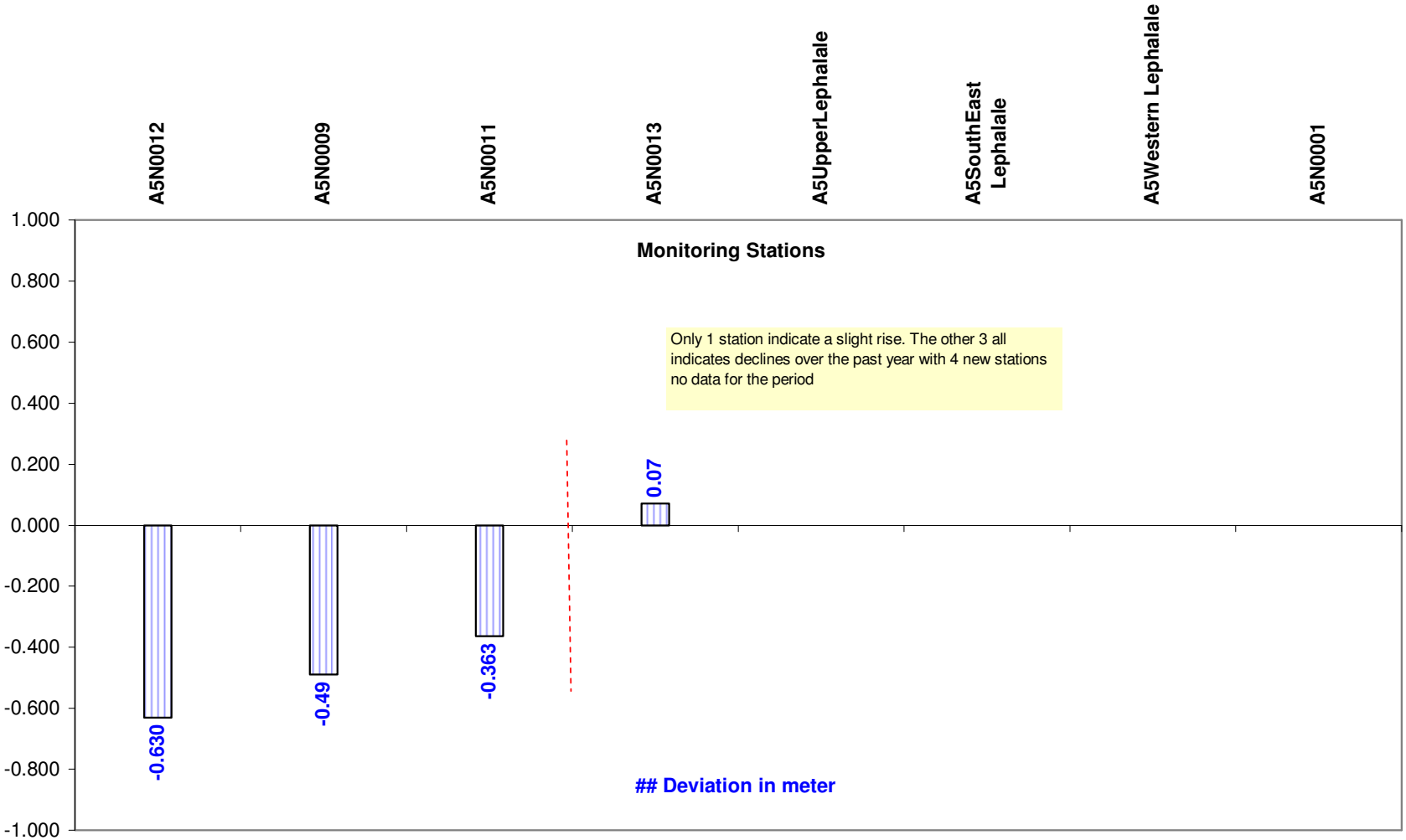


GRAPH 3

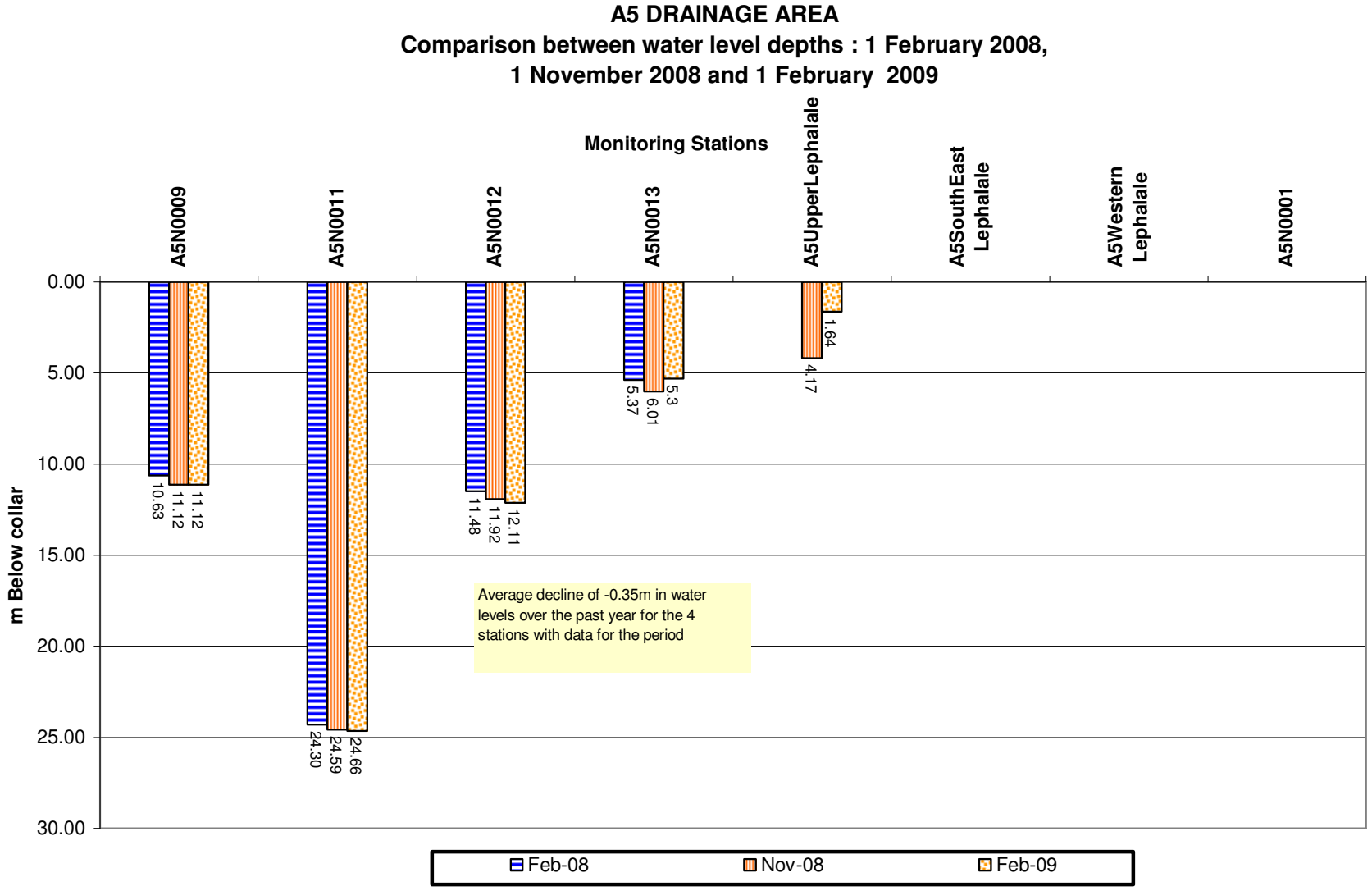

A5 DRAINAGE AREA
Deviation of water levels: 1 November 2008 to 1 February 2009
A5N0012
A5N0011
A5N0009
A5N0013
A5UpperLephalale
A5SouthEast Lephalale
A5Western Lephalale
A5N0001
5.000
4.000
3.000
2.000
1.000
0.000
-1.000
-2.000
Monitoring Stations
A slight decline at 2 stations and varialbl e rise at the other 3
since the beginning of the wet season.
3 New stations no data yet
-0.190
-0.07
0.002
0.710
2.526
Deviation in meter

GRAPH 4

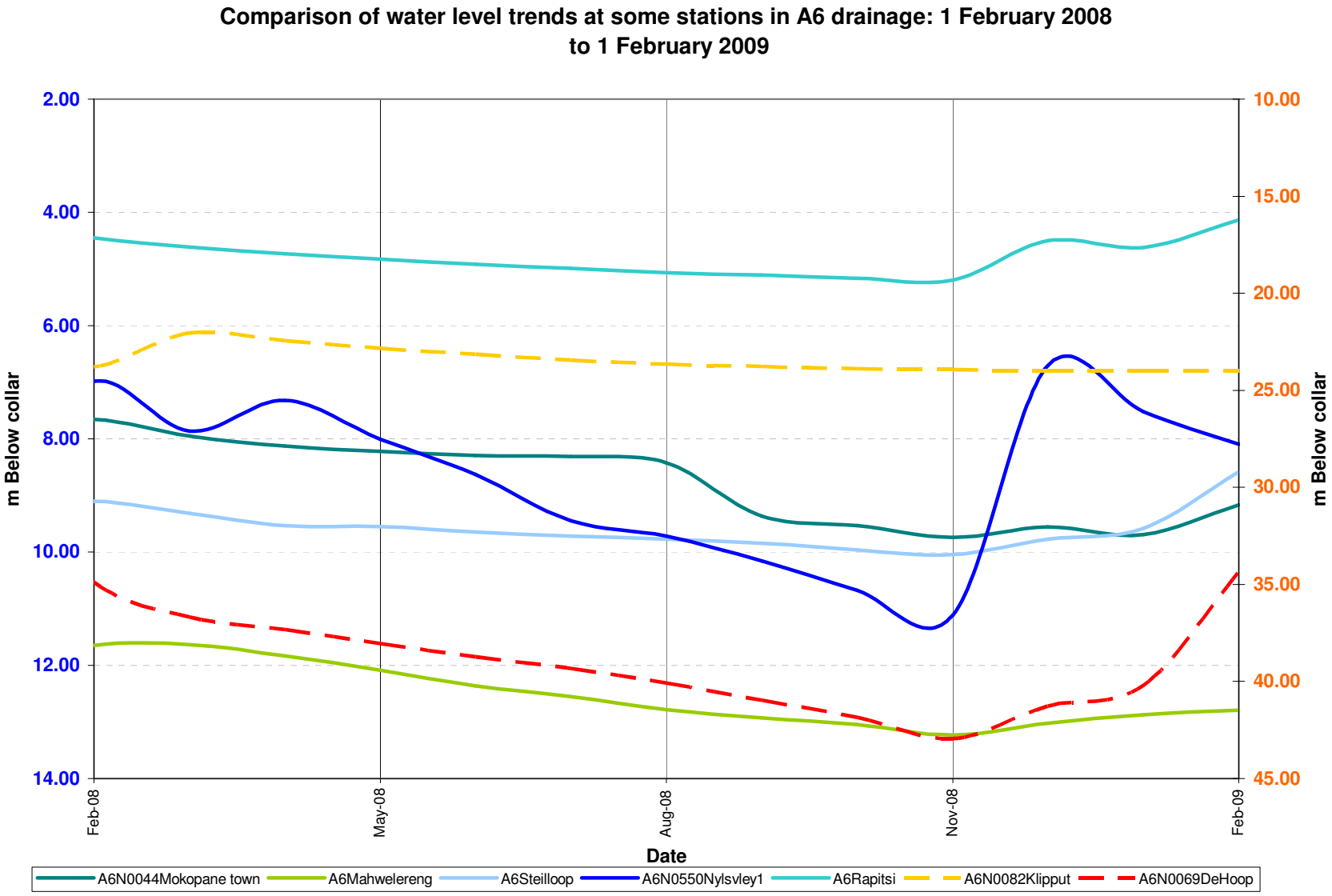
A5 DRAINAGE AREA
Deviation of water levels: 1 February 2008 to 1 February 2009



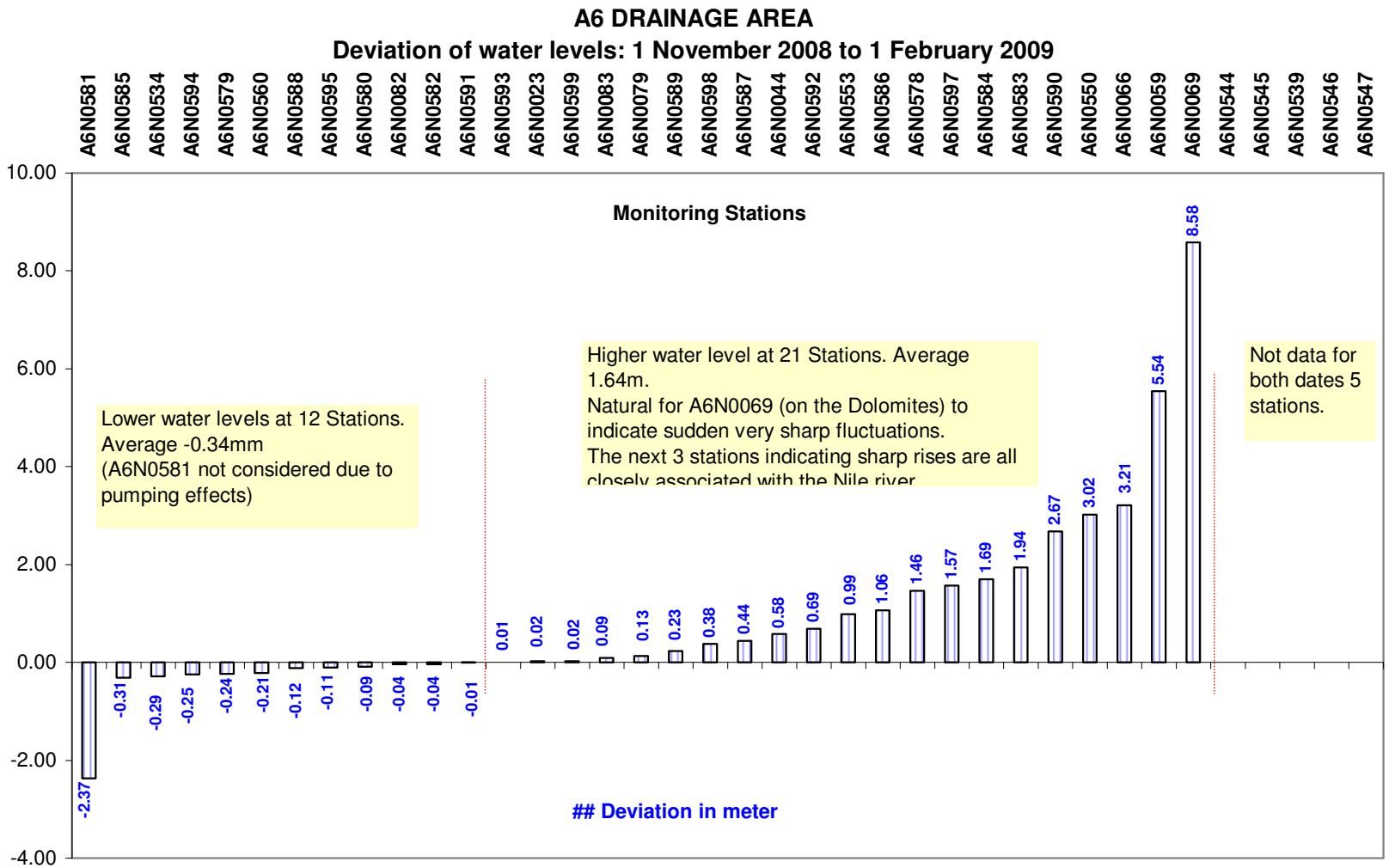
GRAPH 5


A5 DRAINAGE AREA
Comparison between water level depths : 1 February 2008,
1 November 2008 and 1 February 2009
Monitoring Stations
A5N0009
A5N0011
A5N0012
A5N0013
A5UpperLephalale
A5SouthEast Lephalale
A5Western Lephalale
A5N0001
m Below collar
0.00
5.00
10.00
15.00
20.00
25.00
30.00
10.63
11.12
11.12
24.30
24.59
24.66
11.48
11.92
12.11
5.37
6.01
5.3
4.17
1.64
Average decline of -0.35m in water levels over the past year for the 4 stations with data for the period
Feb-08
Nov-08
Feb-09

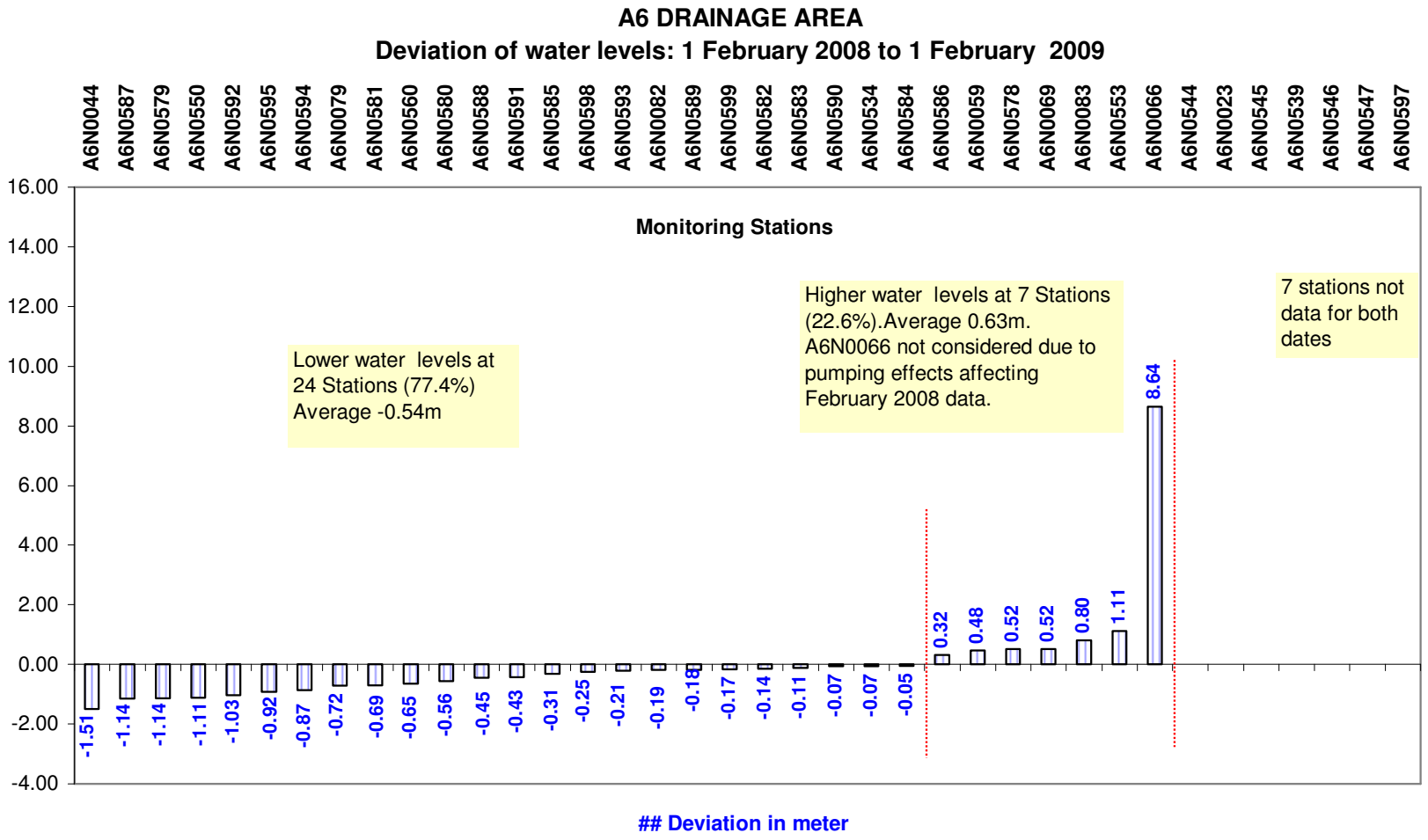
GRAPH 6


Comparison of water level trends at some stations in A6 drainage: 1 February 2008 to 1 February 2009
2.00
4.00
6.00
8.00
10.00
12.00
14.00
m Below collar
10.00
15.00
20.00
25.00
30.00
35.00
40.00
45.00
m Below collar
Feb-08
May-08
Aug-08
Nov-08
Feb-09
Date
A6N0044Mokopane town
A6Mahwelereng
A6Steilloop
A6N0550Nylsvley1
A6Rapitsi
A6N0082Klipput
A6N0069DeHoop

GRAPH 7

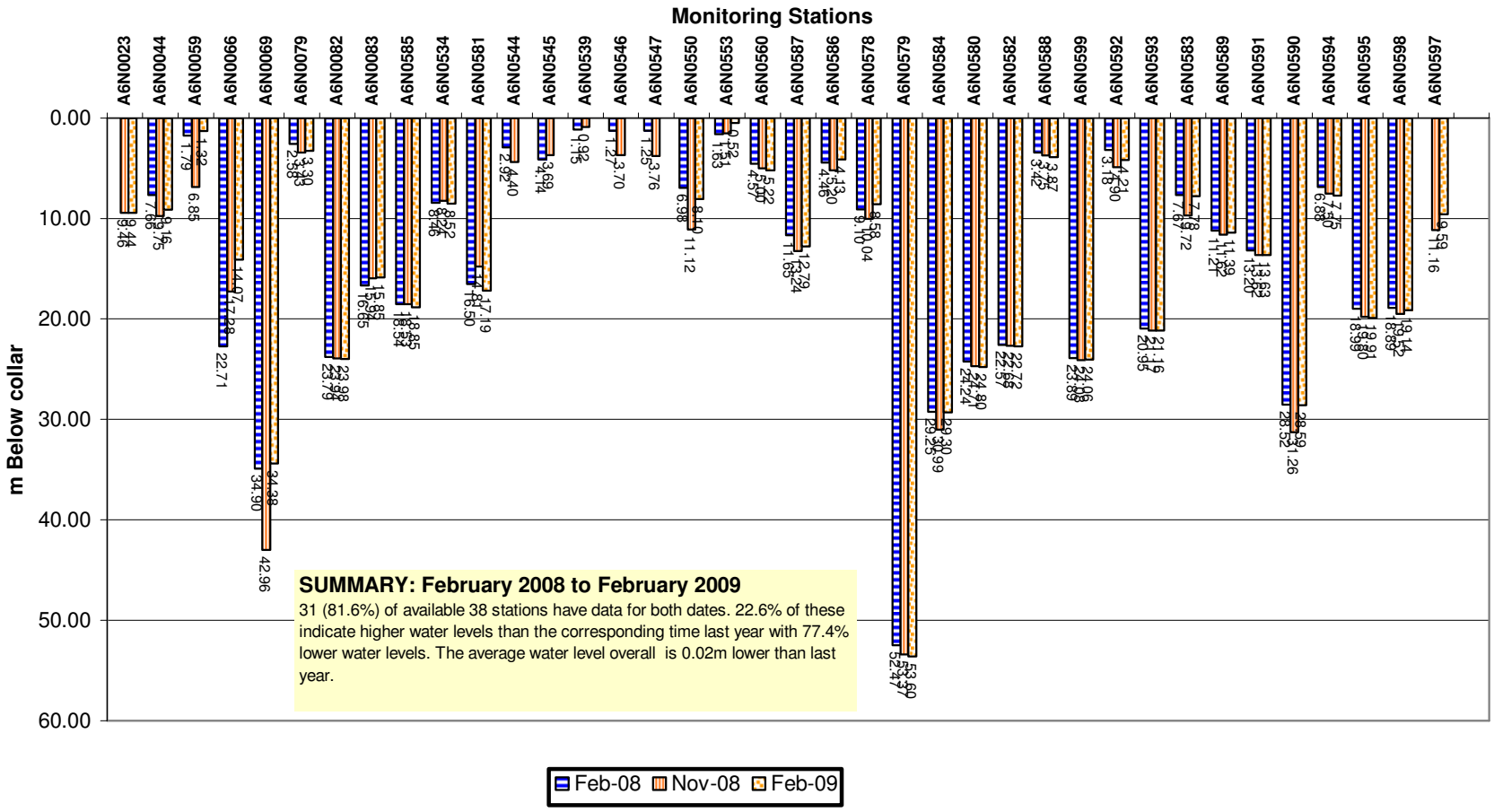

A6 DRAINAGE AREA
Deviation of water levels: 1 November 2008 to 1 February 2009
A6N0581 A6N0585 A6N0534 A6N0594 A6N0579 A6N0560 A6N0588 A6N0595 A6N0580 A6N0082 A6N0582 A6N0591 A6N0593 A6N0023 A6N0599 A6N0083 A6N0079 A6N0589 A6N0598 A6N0587 A6N0044 A6N0592 A6N0553 A6N0586 A6N0578 A6N0597 A6N0584 A6N0583 A6N0590 A6N0550 A6N0066 A6N0059 A6N0069 A6N0544 A6N0545 A6N0539 A6N0546 A6N0547
10.00
8.00
6.00
4.00
2.00
0.00
-2.00
-4.00
Monitoring Stations
Lower water levels at 12 Stations. Average -0.34mm (A6N0581 not considered due to pumping effects)
Higher water level at 21 Stations. Average 1.64m.
Natural for A6N0069 (on the Dolomites) to indicate sudden very sharp fluctuations.
The next 3 stations indicating sharp rises are all closely associated with the Nile river
Not data for both dates 5 stations.
-2.37 -0.31 -0.29 -0.25 -0.24 -0.21 -0.12 -0.11 -0.09 -0.04 -0.04 -0.01 0.01 0.02 0.02 0.09 0.13 0.23 0.38 0.44 0.58 0.69 0.99 1.06 1.46 1.57 1.69 1.94 2.67 3.02 3.21 5.54 8.58
Deviation in meter

GRAPH 8


A6 DRAINAGE AREA
Deviation of water levels: 1 February 2008 to 1 February 2009
A6N0044 A6N0587 A6N0579 A6N0550 A6N0592 A6N0595 A6N0594 A6N0079 A6N0581 A6N0560 A6N0580 A6N0588 A6N0591 A6N0585 A6N0598 A6N0593 A6N0082 A6N0589 A6N0599 A6N0582 A6N0583 A6N0590 A6N0534 A6N0584 A6N0586 A6N0059 A6N0578 A6N0069 A6N0083 A6N0553 A6N0066 A6N0544 A6N0023 A6N0545 A6N0539 A6N0546 A6N0547 A6N0597
16.00
14.00
12.00
10.00
8.00
6.00
4.00
2.00
0.00
-2.00
-4.00
Monitoring Stations
Lower water levels at 24 Stations (77.4%) Average -0.54m
Higher water levels at 7 Stations (22.6%).Average 0.63m. A6N0066 not considered due to pumping effects affecting February 2008 data.
7 stations not data for both dates
-1.51 -1.14 -1.14 -1.11 -1.03 -0.92 -0.87 -0.72 -0.69 -0.65 -0.56 -0.45 -0.43 -0.31 -0.25 -0.21 -0.19 -0.18 -0.17 -0.14 -0.11 -0.07 -0.07 -0.05 0.32 0.48 0.52 0.52 0.80 1.11 8.64
Deviation in meter

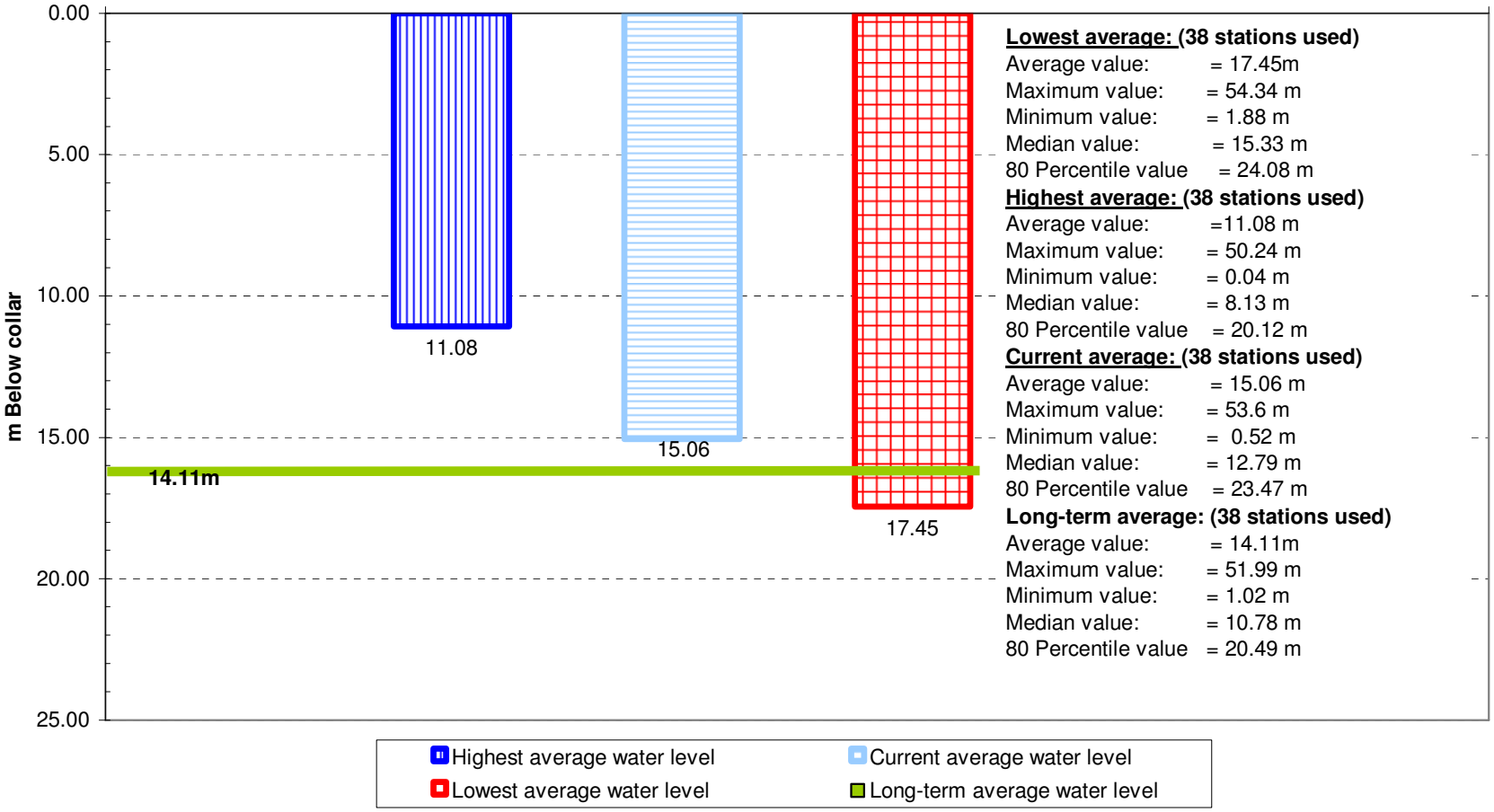
GRAPH 9

A6 DRAINAGE AREA
Comparison between water level depths: 1 February 2008, 1 November 2008, and 1 February 2009

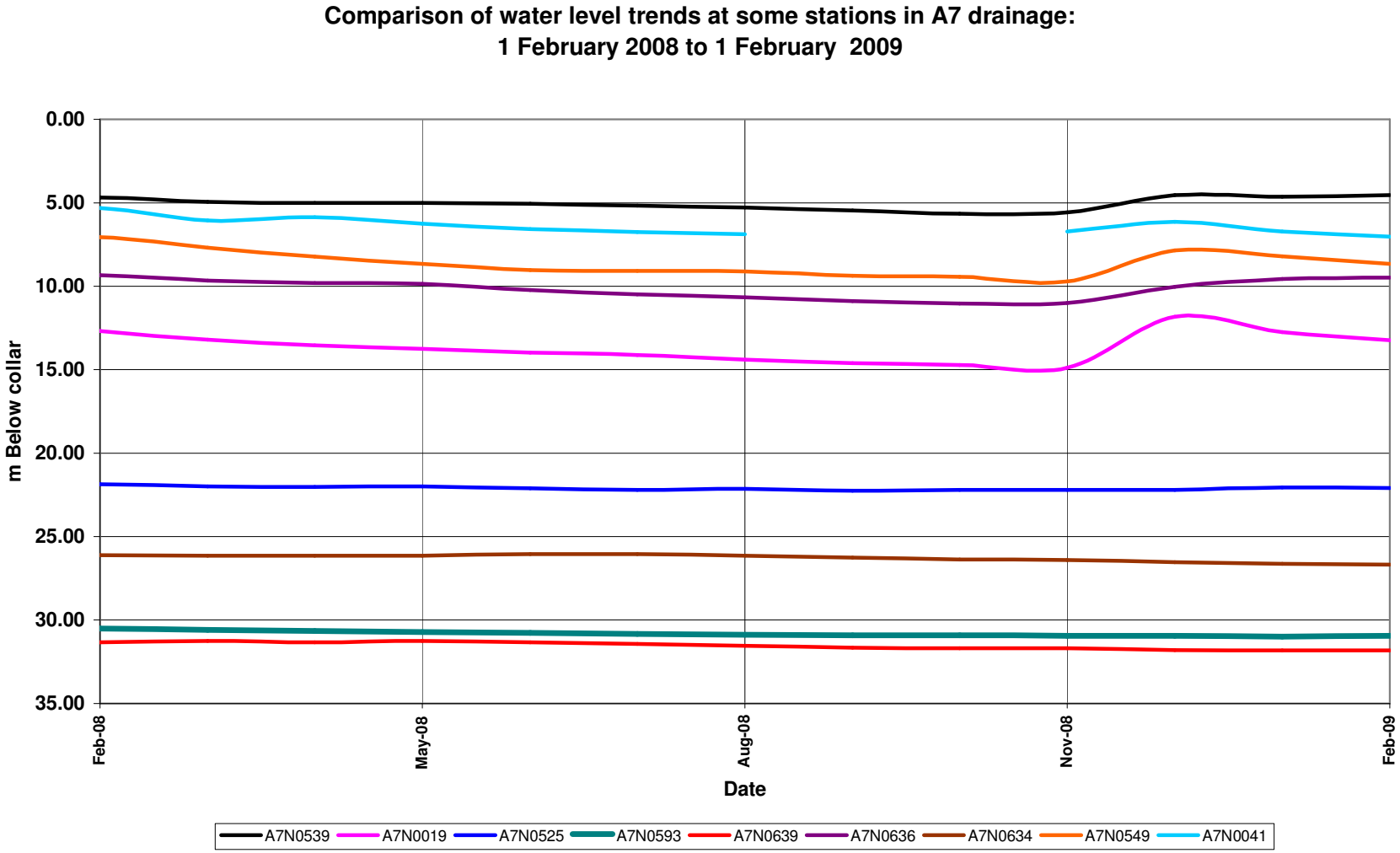


GRAPH 10

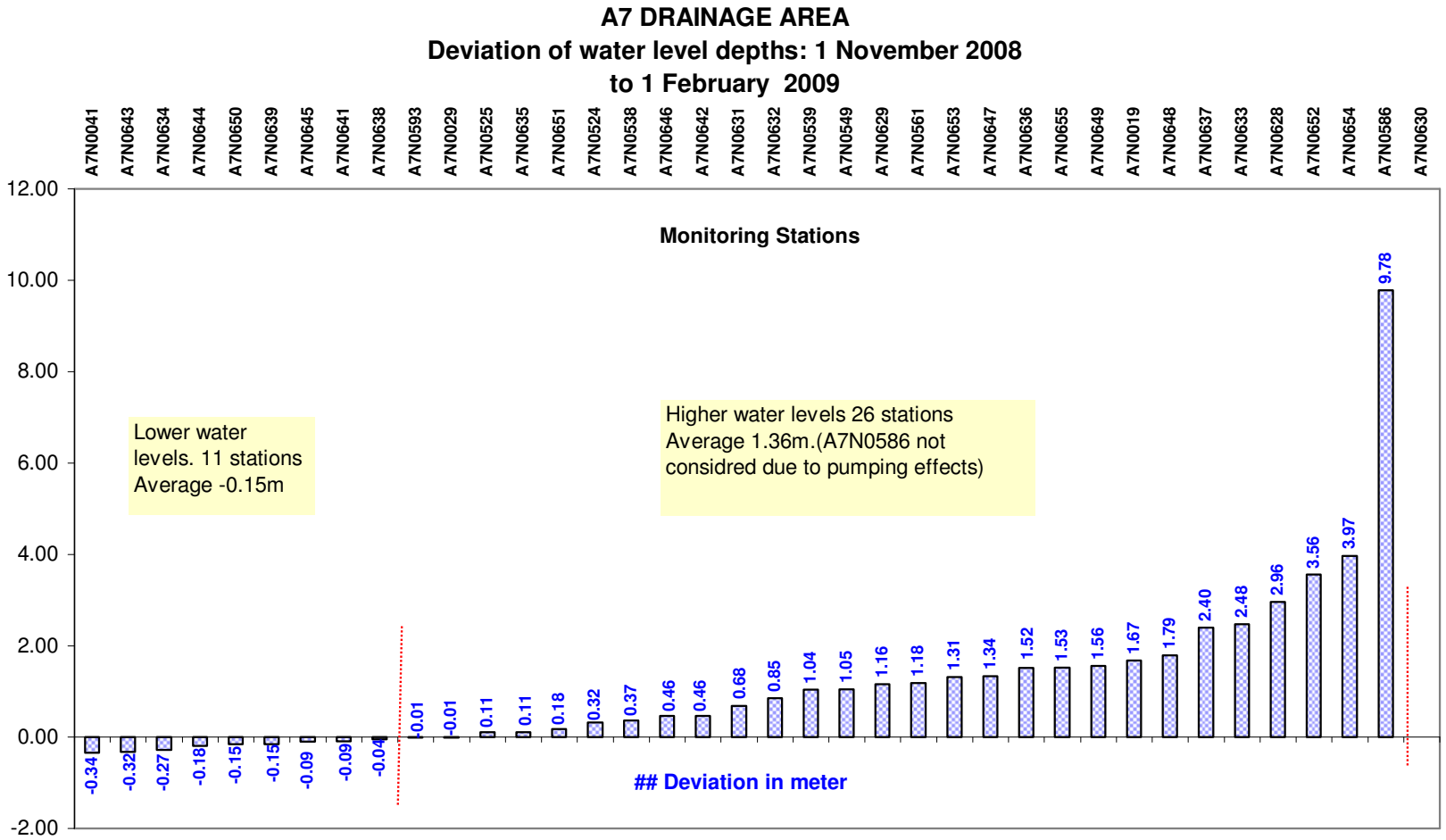
A6 DRAINAGE AREA
Comparison of average current water level depths with highest, lowest & long-term average water level depths recorded



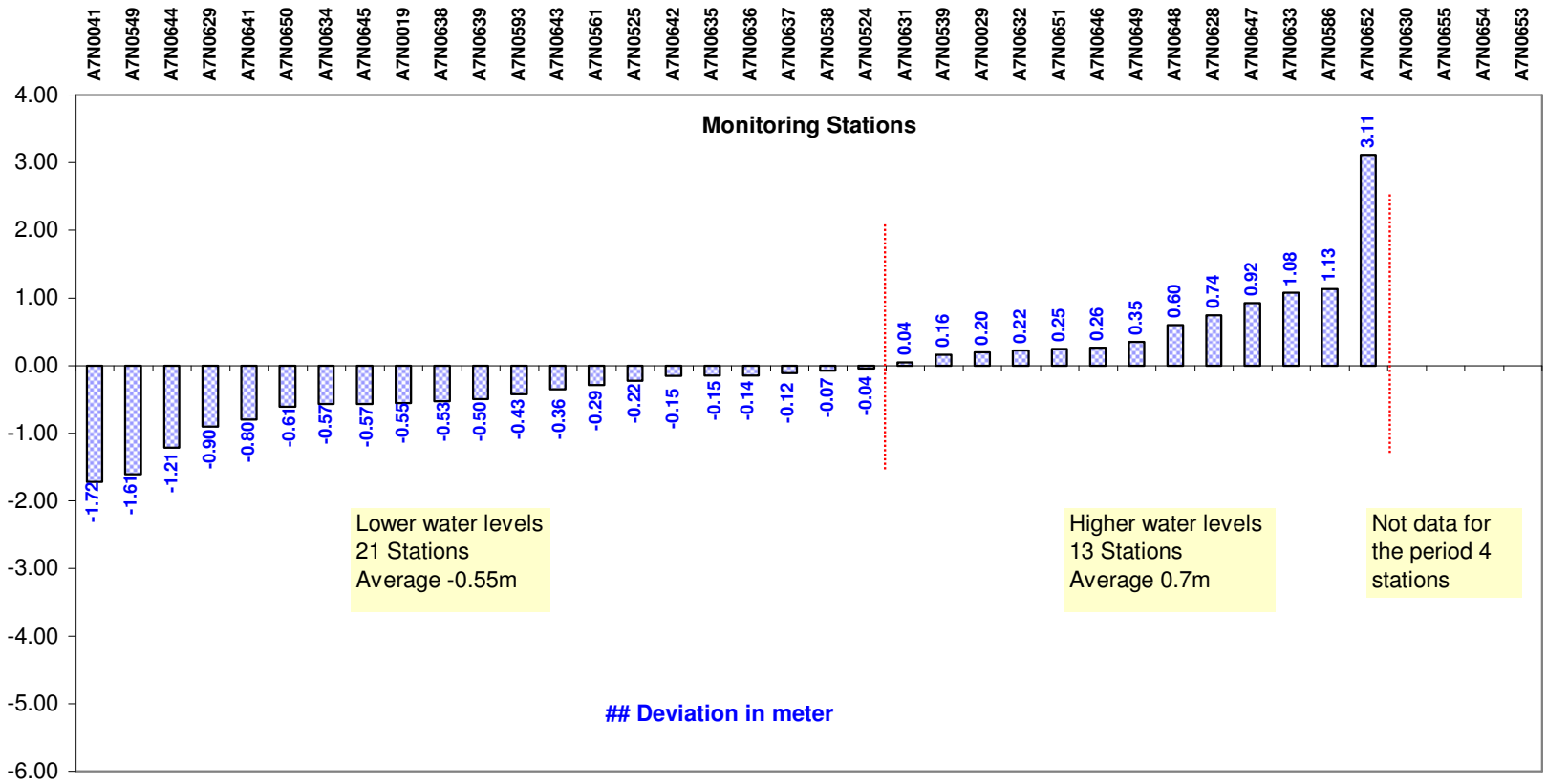
GRAPH 11


Comparison of water level trends at some stations in A7 drainage:
1 February 2008 to 1 February 2009
0.00
5.00
10.00
15.00
20.00
25.00
30.00
35.00
m Below collar
Feb-08
May-08
Aug-08
Nov-08
Feb-09
Date
A7N0539
A7N0019
A7N0525
A7N0593
A7N0639
A7N0636
A7N0634
A7N0549
A7N0041

GRAPH 12

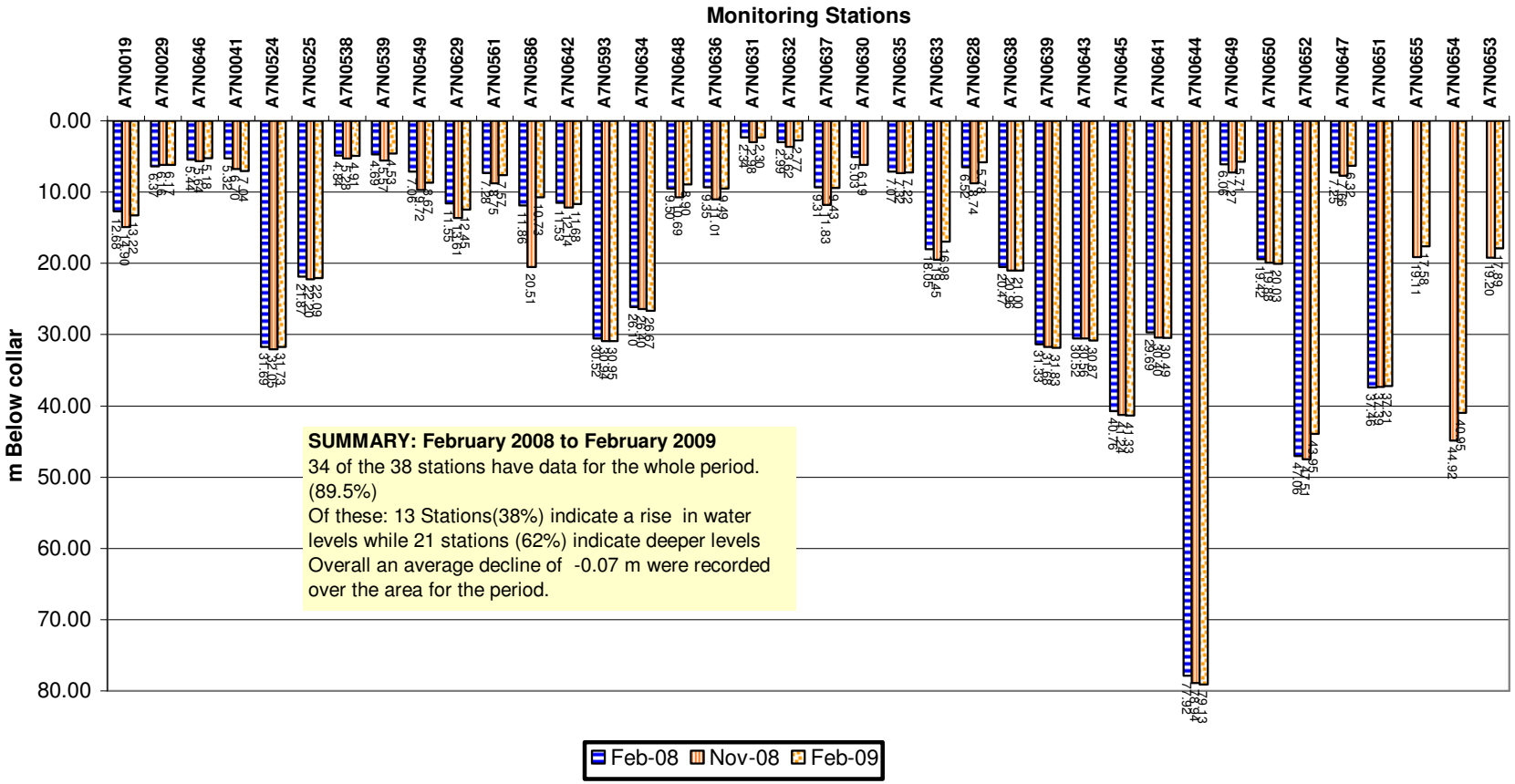

A7 DRAINAGE AREA
Deviation of water level depths: 1 November 2008
to 1 February 2009
A7N0041 A7N0643 A7N0634 A7N0644 A7N0650 A7N0639 A7N0645 A7N0641 A7N0638 A7N0593 A7N0029 A7N0525 A7N0635 A7N0651 A7N0524 A7N0538 A7N0646 A7N0642 A7N0631 A7N0632 A7N0539 A7N0549 A7N0629 A7N0561 A7N0653 A7N0647 A7N0636 A7N0655 A7N0649 A7N0019 A7N0648 A7N0637 A7N0633 A7N0628 A7N0652 A7N0654 A7N0586 A7N0630
12.00
10.00
8.00
6.00
4.00
2.00
0.00
-2.00
Monitoring Stations
Lower water levels. 11 stations Average -0.15m
Higher water levels 26 stations Average 1.36m.(A7N0586 not considred due to pumping effects)
-0.34 -0.32 -0.27 -0.18 -0.15 -0.15 -0.09 -0.09 -0.04 0.01 -0.01 0.11 0.11 0.18 0.32 0.37 0.46 0.46 0.68 0.85 1.04 1.05 1.16 1.18 1.31 1.34 1.52 1.53 1.56 1.67 1.79 2.40 2.48 2.96 3.56 3.97 9.78
Deviation in meter

GRAPH 13

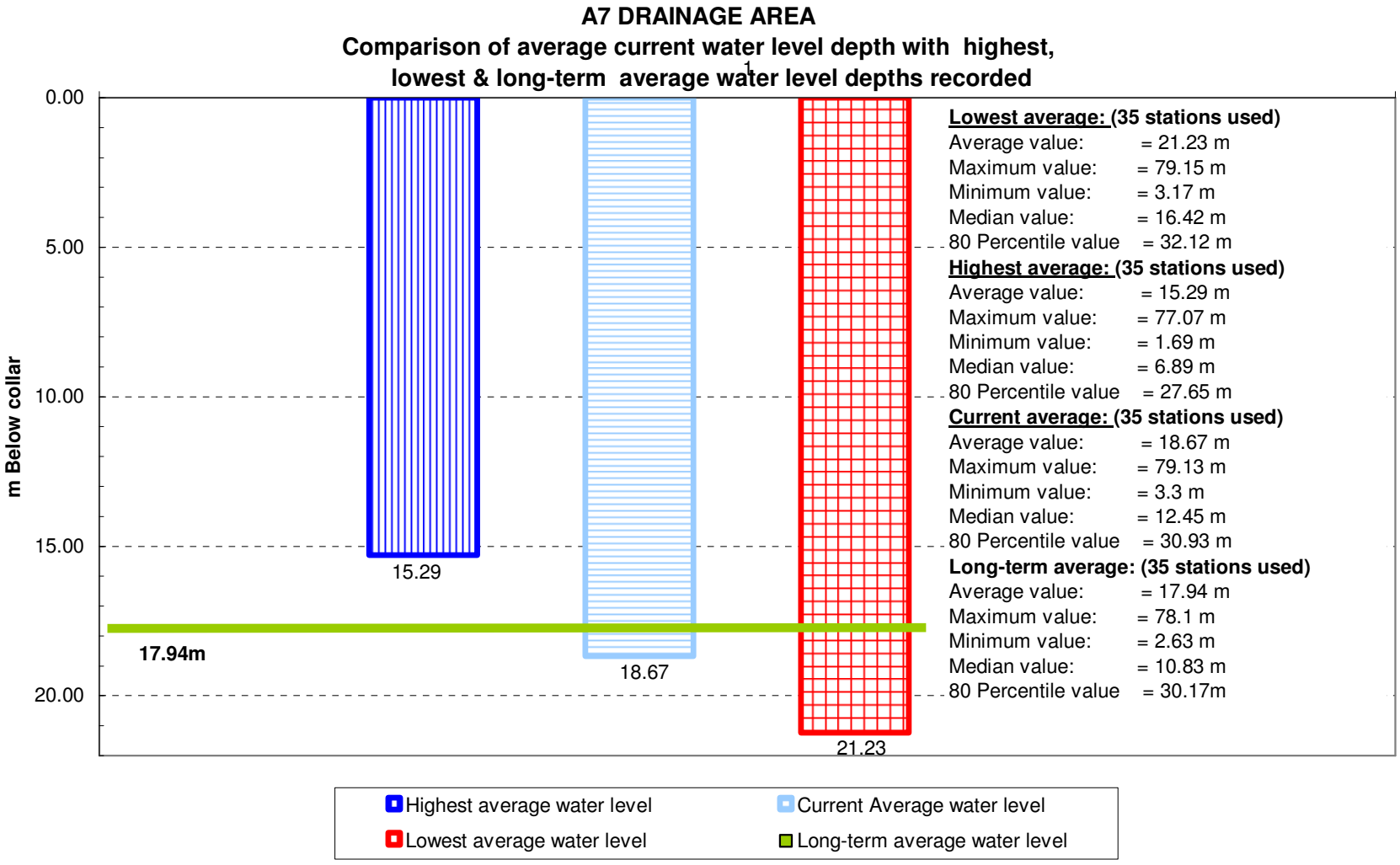

A7 DRAINAGE AREA
Deviation of water level depths: 1 February 2008 to 1 February 2009
A7N0041 A7N0549 A7N0644 A7N0629 A7N0641 A7N0650 A7N0634 A7N0645 A7N0019 A7N0638 A7N0639 A7N0593 A7N0643 A7N0561 A7N0525 A7N0642 A7N0635 A7N0636 A7N0637 A7N0538 A7N0524 A7N0631 A7N0539 A7N0029 A7N0632 A7N0651 A7N0646 A7N0649 A7N0648 A7N0628 A7N0647 A7N0633 A7N0586 A7N0652 A7N0630 A7N0655 A7N0654 A7N0653
4.00
3.00
2.00
1.00
0.00
-1.00
-2.00
-3.00
-4.00
-5.00
-6.00
Monitoring Stations
-1.72 -1.61 -1.21 -0.90 -0.80 -0.61 -0.57 -0.57 -0.55 -0.53 -0.50 -0.43 -0.36 -0.29 -0.22 -0.15 -0.15 -0.14 -0.12 -0.07 -0.04 0.04 0.16 0.20 0.22 0.25 0.26 0.35 0.60 0.74 0.92 1.08 1.13 3.11
Lower water levels
21 Stations
Average -0.55m
Higher water levels
13 Stations
Average 0.7m
Not data for
the period 4
stations
Deviation in meter

GRAPH 14

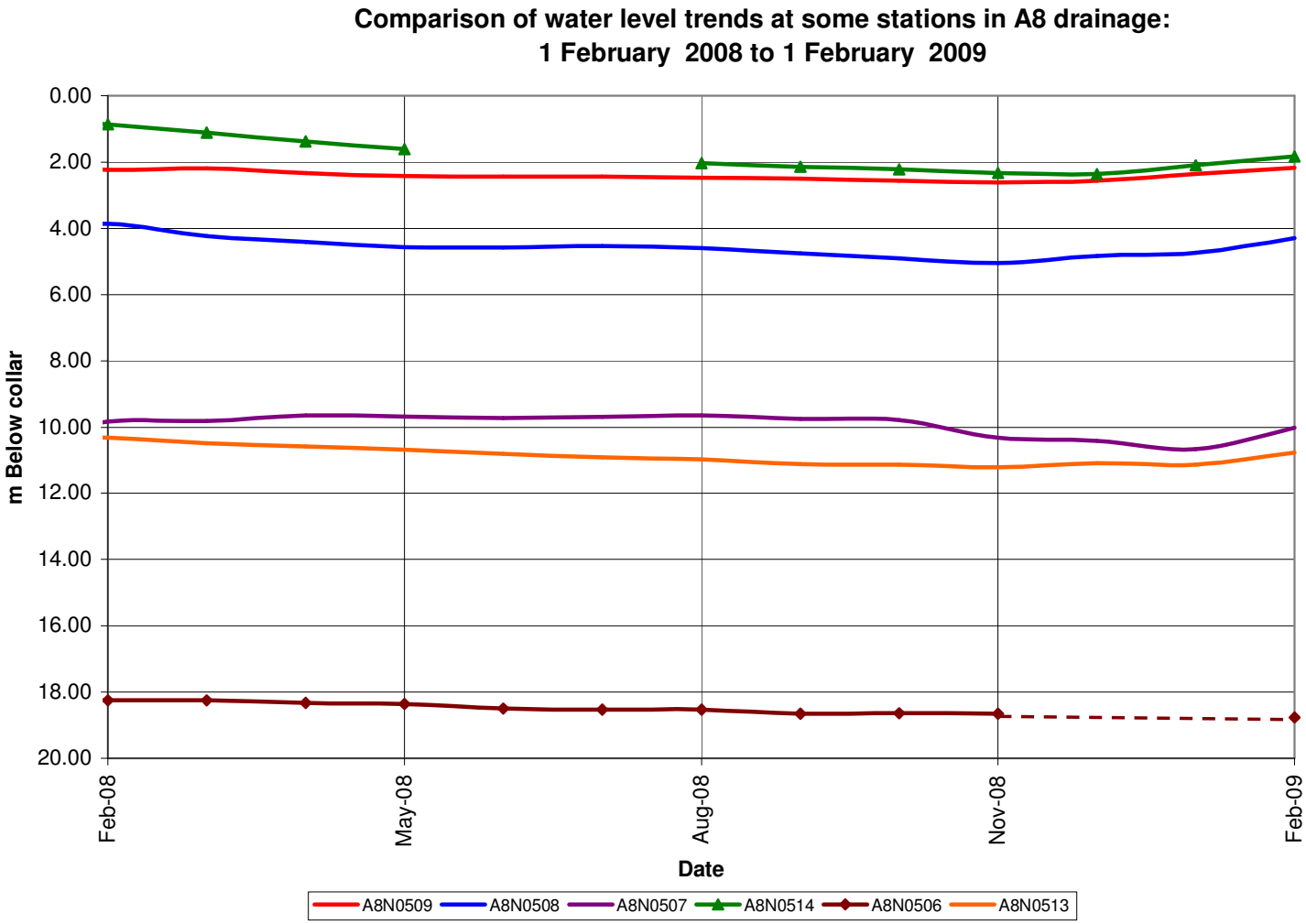
A7 DRAINAGE AREA
Comparison between water level depths: 1 February 2008,
1 November 2008 and 1 February 2009



GRAPH 15

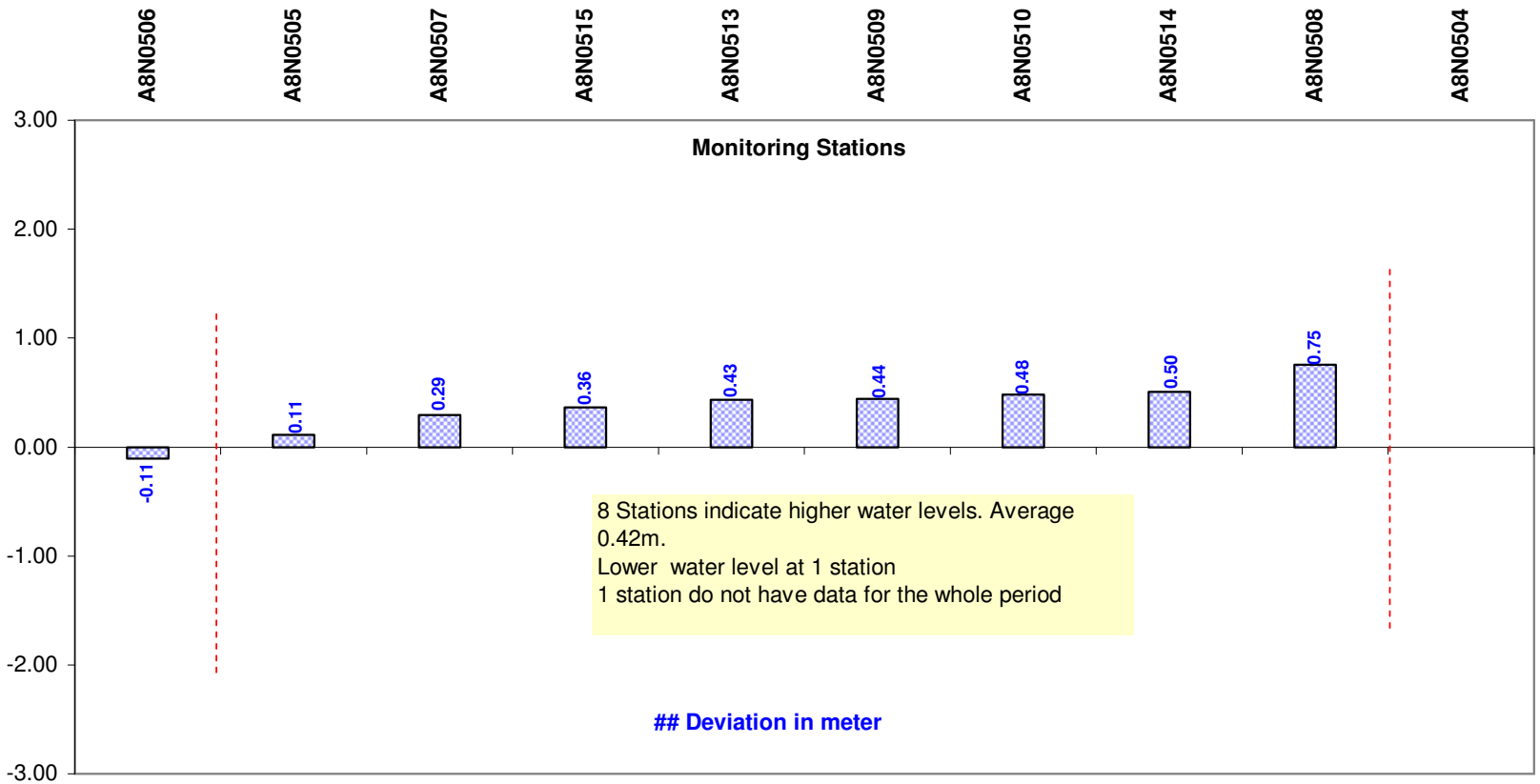

A7 DRAINAGE AREA
Comparison of average current water level depth with highest,
lowest & long-term average water level depths recorded
m Below collar
0.00
5.00
10.00
15.00
20.00
15.29
18.67
21.23
17.94m
Lowest average: (35 stations used)
Average value: = 21.23 m
Maximum value: = 79.15 m
Minimum value: = 3.17 m
Median value: = 16.42 m
80 Percentile value = 32.12 m
Highest average: (35 stations used)
Average value: = 15.29 m
Maximum value: = 77.07 m
Minimum value: = 1.69 m
Median value: = 6.89 m
80 Percentile value = 27.65 m
Current average: (35 stations used)
Average value: = 18.67 m
Maximum value: = 79.13 m
Minimum value: = 3.3 m
Median value: = 12.45 m
80 Percentile value = 30.93 m
Long-term average: (35 stations used)
Average value: = 17.94 m
Maximum value: = 78.1 m
Minimum value: = 2.63 m
Median value: = 10.83 m
80 Percentile value = 30.17m
Highest average water level
Current Average water level
Lowest average water level
Long-term average water level

GRAPH 16


Comparison of water level trends at some stations in A8 drainage:
1 February 2008 to 1 February 2009
m Below collar
0.00
2.00
4.00
6.00
8.00
10.00
12.00
14.00
16.00
18.00
20.00
Feb-08
May-08
Aug-08
Nov-08
Feb-09
Date
A8N0509
A8N0508
A8N0507
A8N0514
A8N0506
A8N0513

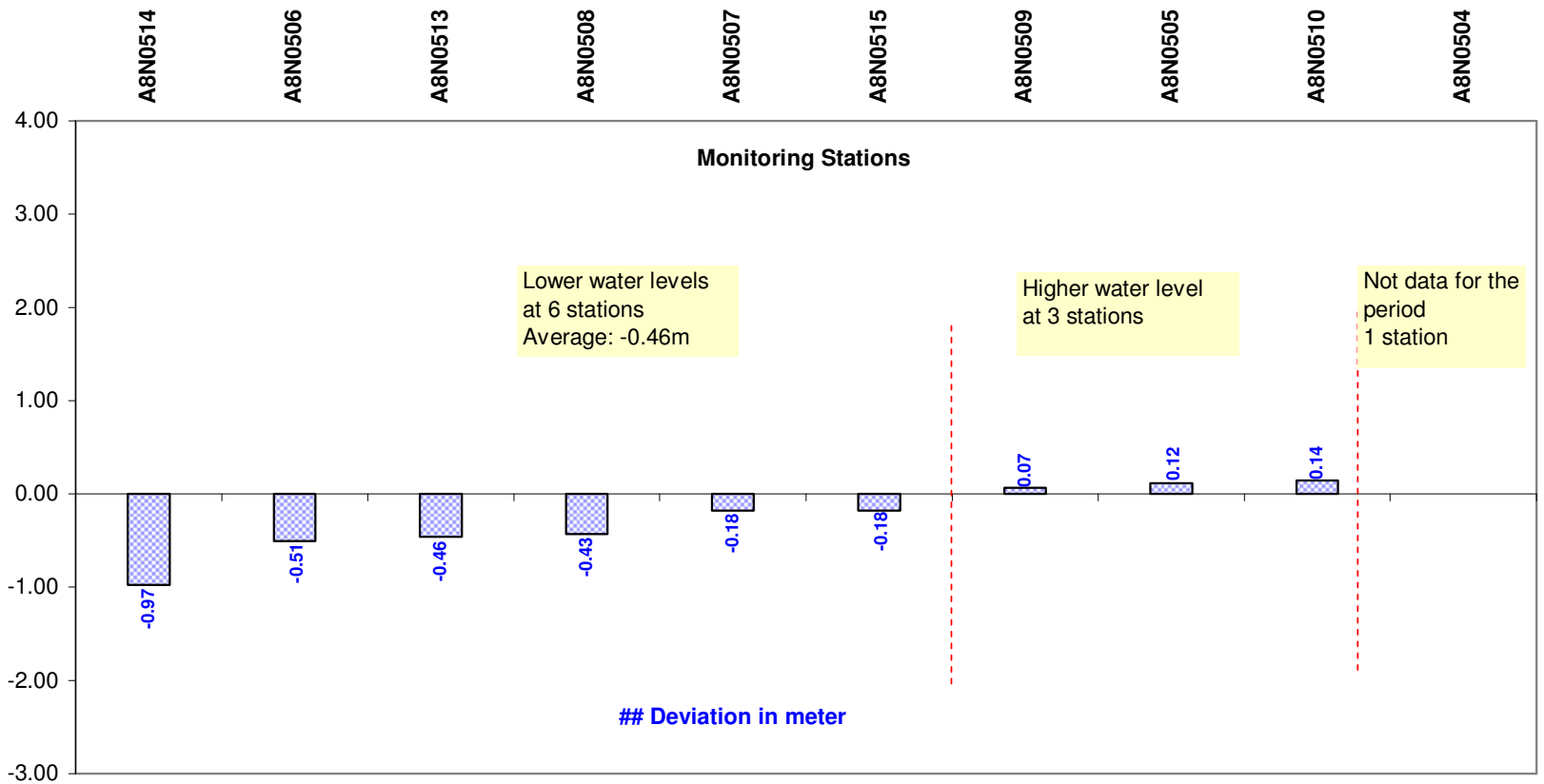
GRAPH 17

A8 DRAINAGE AREA
Deviation of water level depths: 1 November 2008 to 1 February 2009

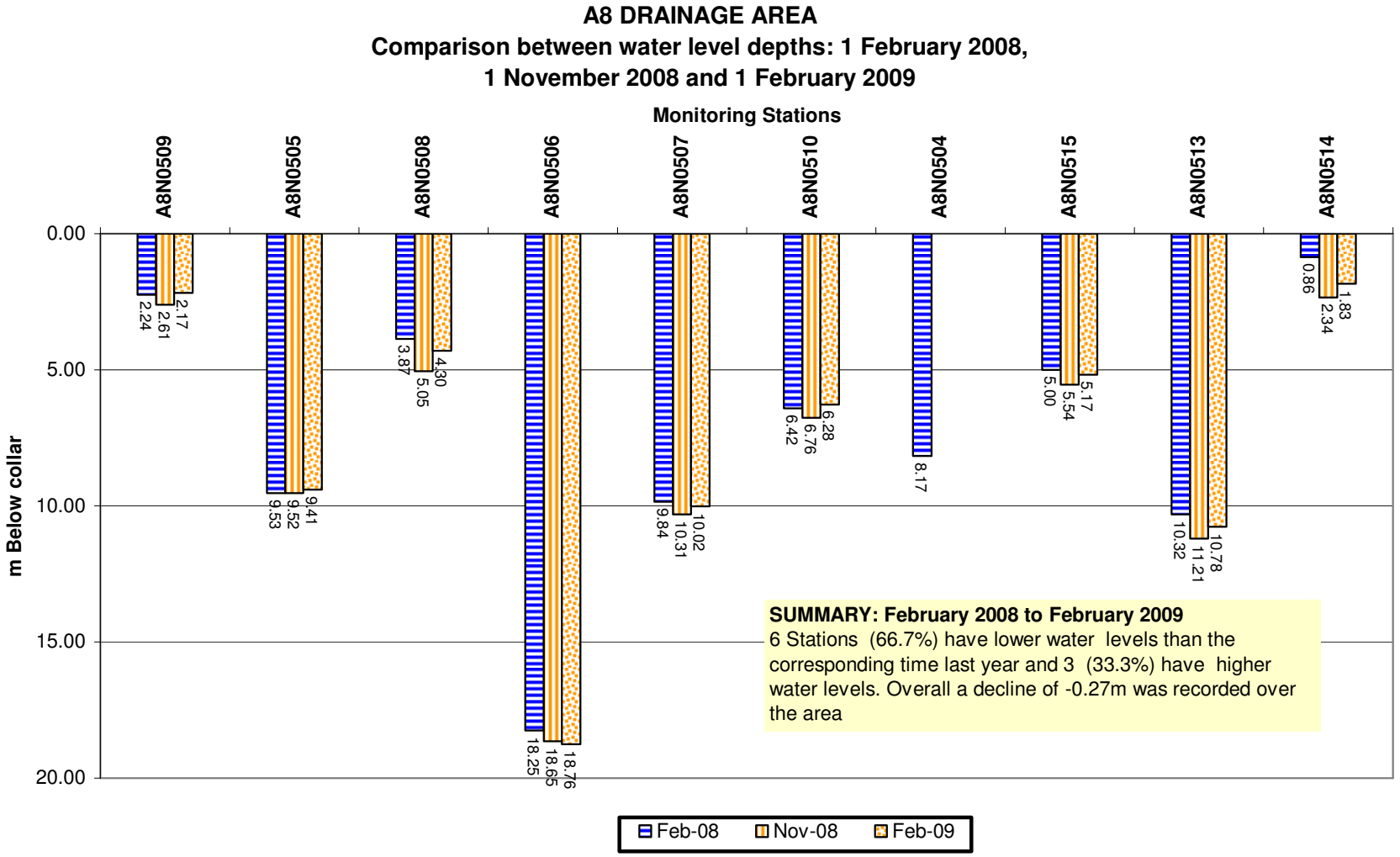


GRAPH 18

A8 DRAINAGE AREA
Deviation of water levels: 1 February 2008 to 1 February 2009

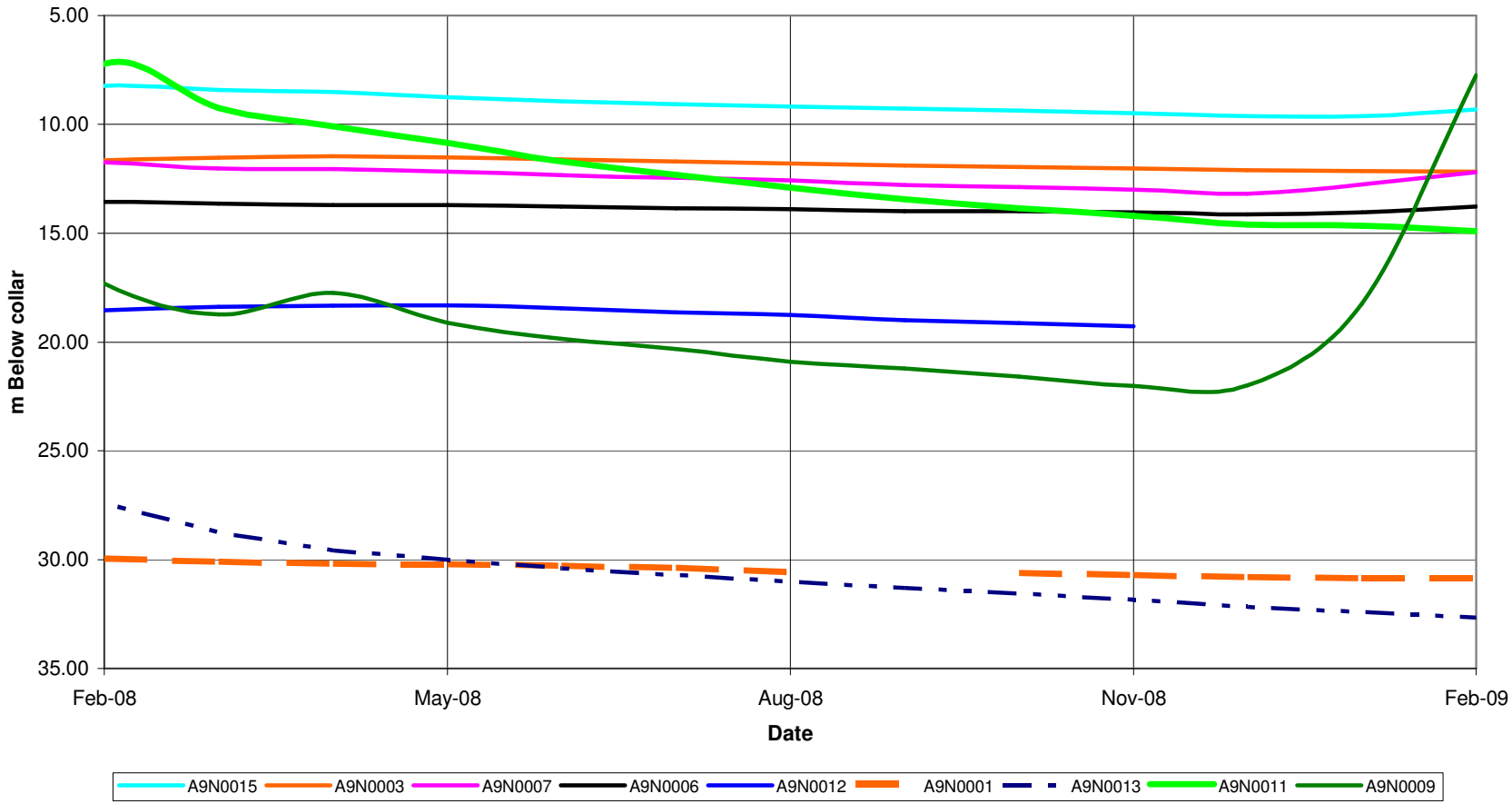


GRAPH 19


A8 DRAINAGE AREA
Comparison between water level depths: 1 February 2008,
1 November 2008 and 1 February 2009
Monitoring Stations
A8N0509
A8N0505
A8N0508
A8N0506
A8N0507
A8N0510
A8N0504
A8N0515
A8N0513
A8N0514
m Below collar
0.00
5.00
10.00
15.00
20.00
2.24
2.61
2.17
9.53
9.52
9.41
3.87
5.05
4.30
18.25
18.65
18.76
9.84
10.31
10.02
6.42
6.76
6.28
8.17
5.00
5.54
5.17
10.32
11.21
10.78
0.86
2.34
1.83
SUMMARY: February 2008 to February 2009
6 Stations (66.7%) have lower water levels than the corresponding time last year and 3 (33.3%) have higher water levels. Overall a decline of -0.27m was recorded over the area
Feb-08
Nov-08
Feb-09

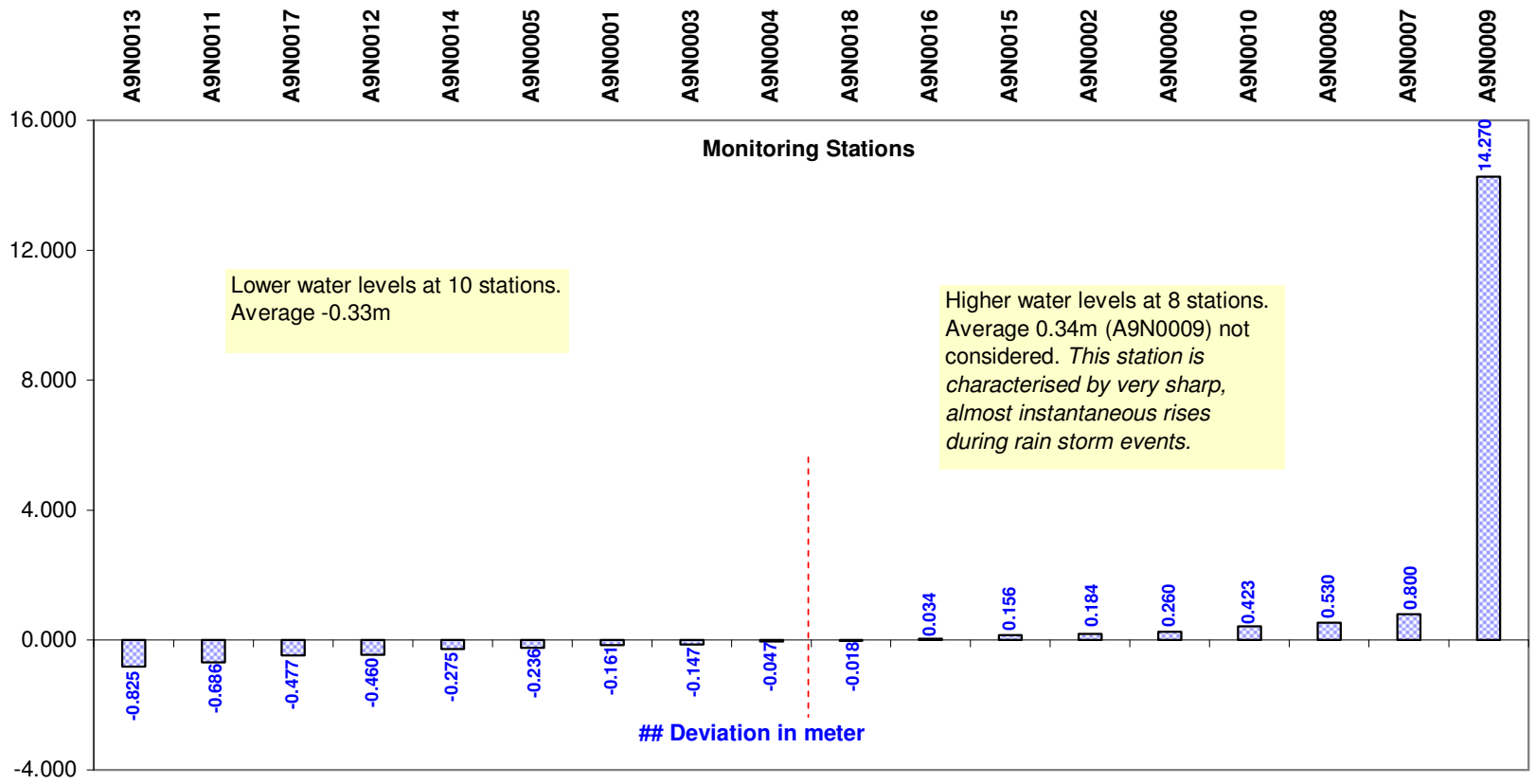
GRAPH 20

Comparison of water level trends at some stations in A9 drainage :
1 February 2008 to 1February 2009

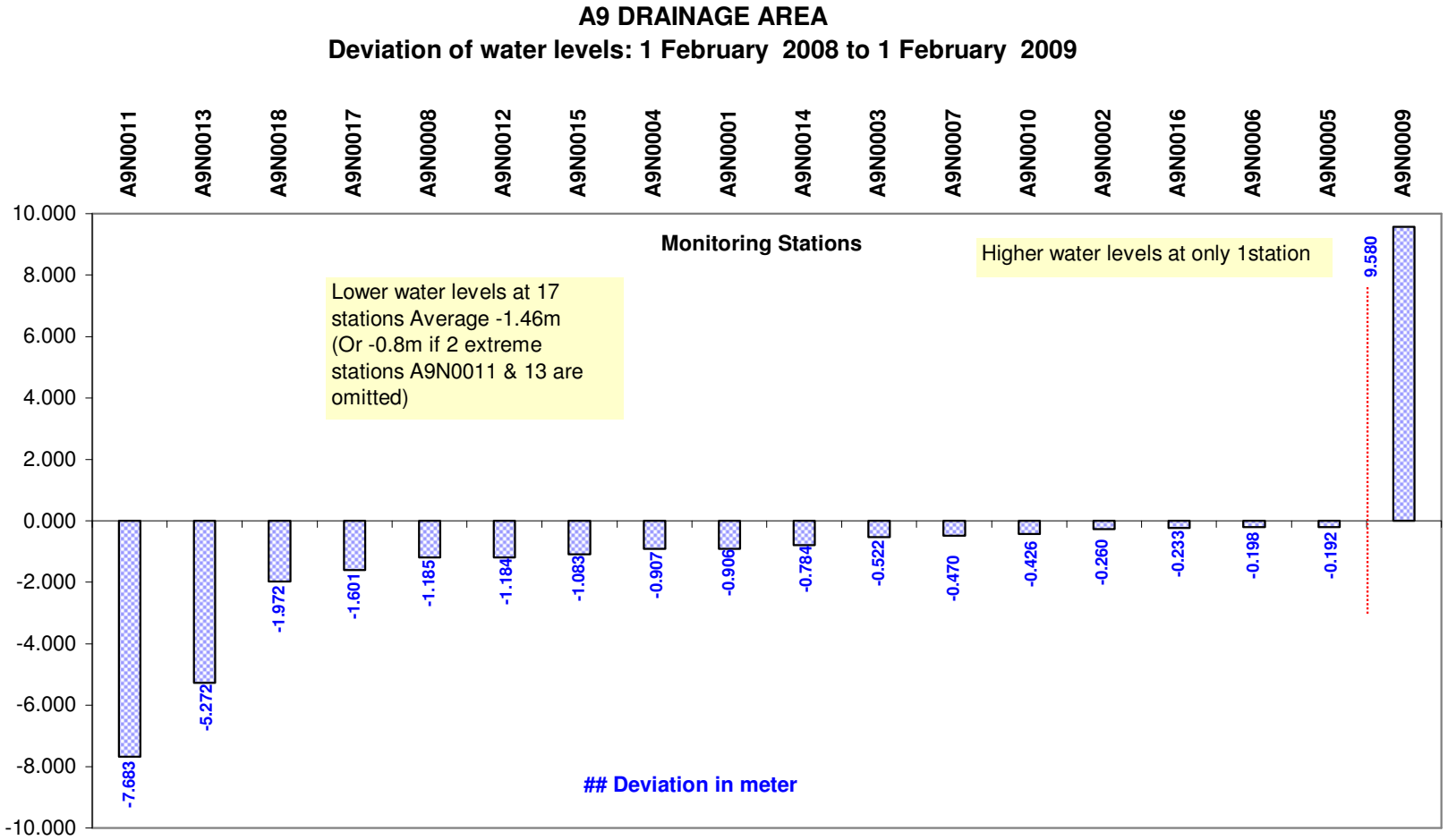


GRAPH 21

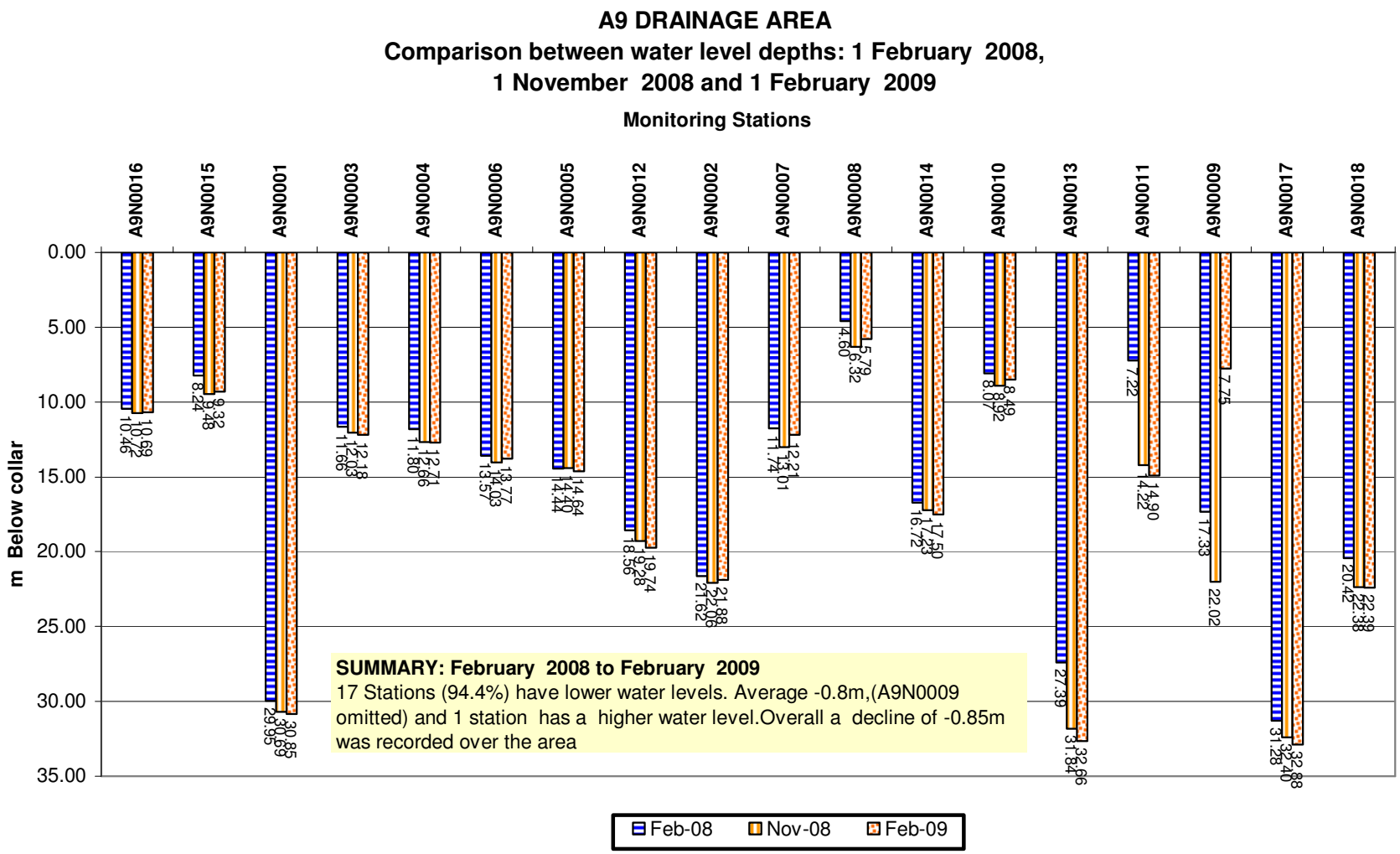
A9 DRAINAGE AREA
Deviation of water levels: 1 November 2008 to 1 February 2009



GRAPH 22

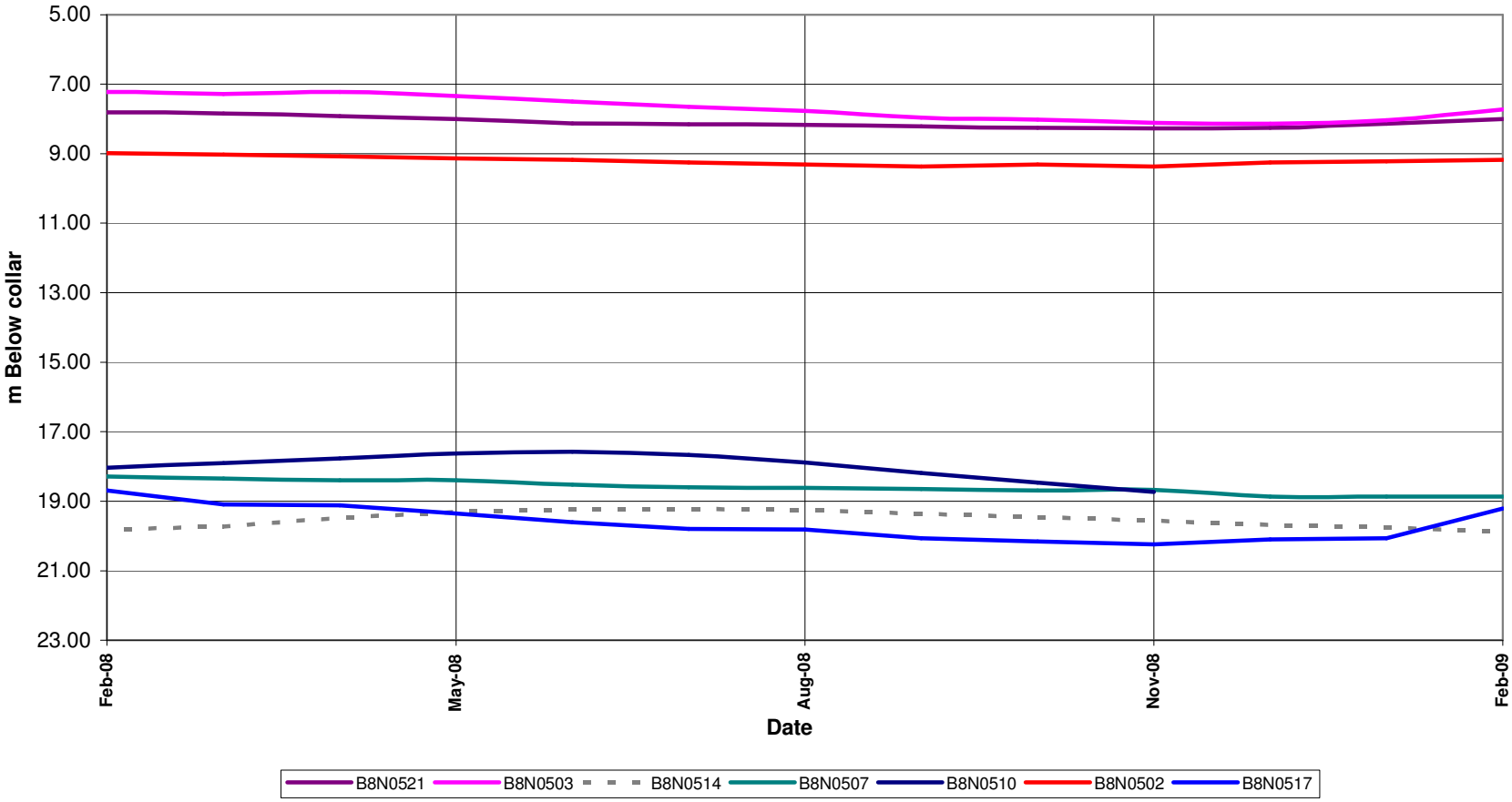

A9 DRAINAGE AREA
Deviation of water levels: 1 February 2008 to 1 February 2009
A9N0011
A9N0013
A9N0018
A9N0017
A9N0008
A9N0012
A9N0015
A9N0004
A9N0001
A9N0014
A9N0003
A9N0007
A9N0010
A9N0002
A9N0016
A9N0006
A9N0005
A9N0009
10.000
8.000
6.000
4.000
2.000
0.000
-2.000
-4.000
-6.000
-8.000
-10.000
Monitoring Stations
Lower water levels at 17 stations Average -1.46m (Or -0.8m if 2 extreme stations A9N0011 & 13 are omitted)
Higher water levels at only 1station
9.580
-7.683
-5.272
-1.972
-1.601
-1.185
-1.184
-1.083
-0.907
-0.906
-0.784
-0.522
-0.470
-0.426
-0.260
-0.233
-0.198
-0.192
Deviation in meter

GRAPH 23

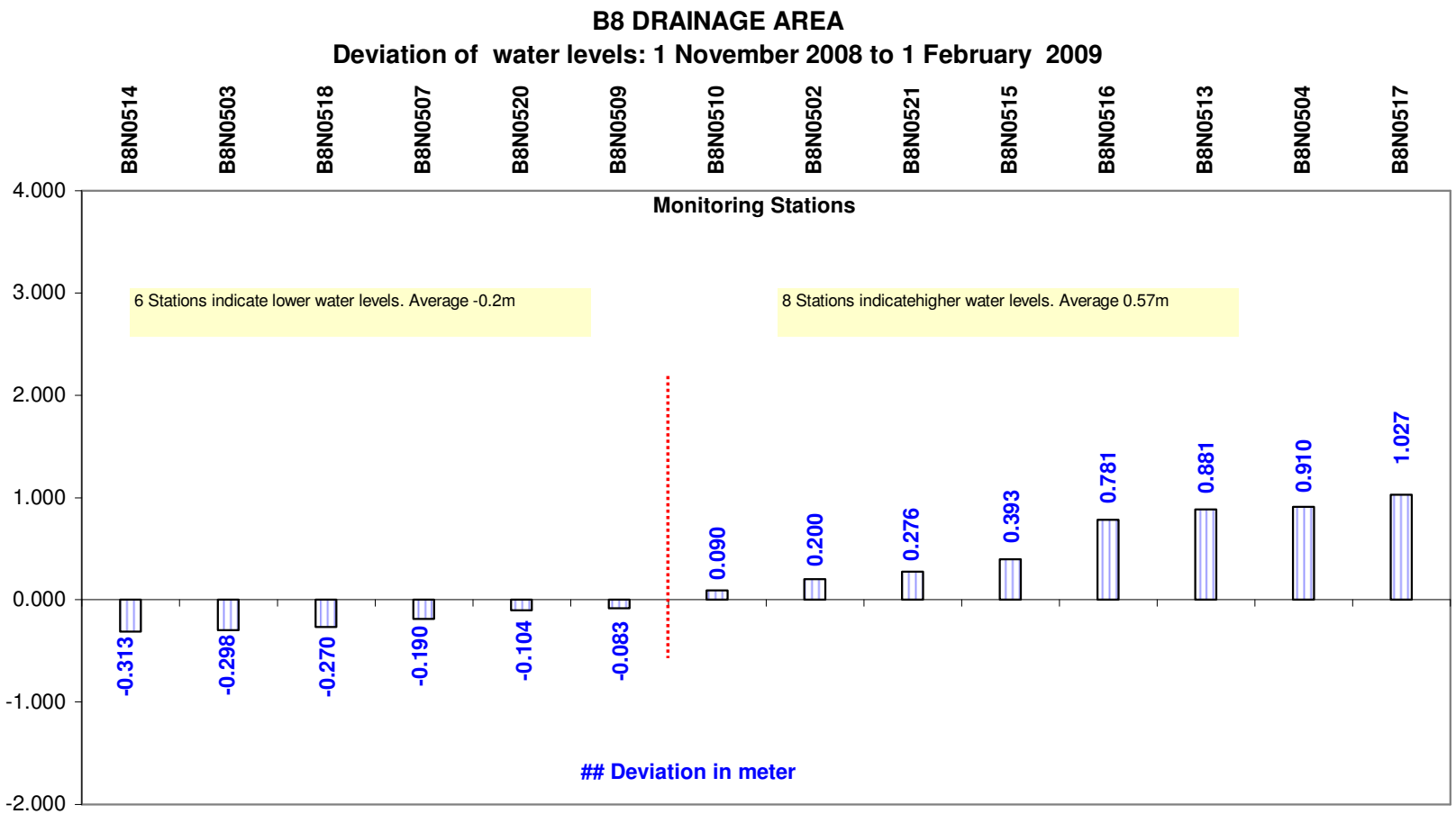

A9 DRAINAGE AREA
Comparison between water level depths: 1 February 2008,
1 November 2008 and 1 February 2009
Monitoring Stations
m Below collar
0.00
5.00
10.00
15.00
20.00
25.00
30.00
35.00
A9N0016
A9N0015
A9N0001
A9N0003
A9N0004
A9N0006
A9N0005
A9N0012
A9N0002
A9N0007
A9N0008
A9N0014
A9N0010
A9N0013
A9N0011
A9N0009
A9N0017
A9N0018
10.46
10.69
8.24
9.32
29.95
30.85
11.66
12.18
11.80
12.71
13.57
13.77
14.44
14.64
18.56
19.74
21.62
21.88
11.74
12.21
4.80
5.79
16.72
17.50
8.07
8.49
27.39
31.84
32.66
7.22
14.22
14.90
17.33
22.02
7.75
31.28
32.40
32.88
20.42
22.38
22.39
SUMMARY: February 2008 to February 2009
17 Stations (94.4%) have lower water levels. Average -0.8m,(A9N0009 omitted) and 1 station has a higher water level.Overall a decline of -0.85m was recorded over the area
Feb-08
Nov-08
Feb-09

GRAPH 24

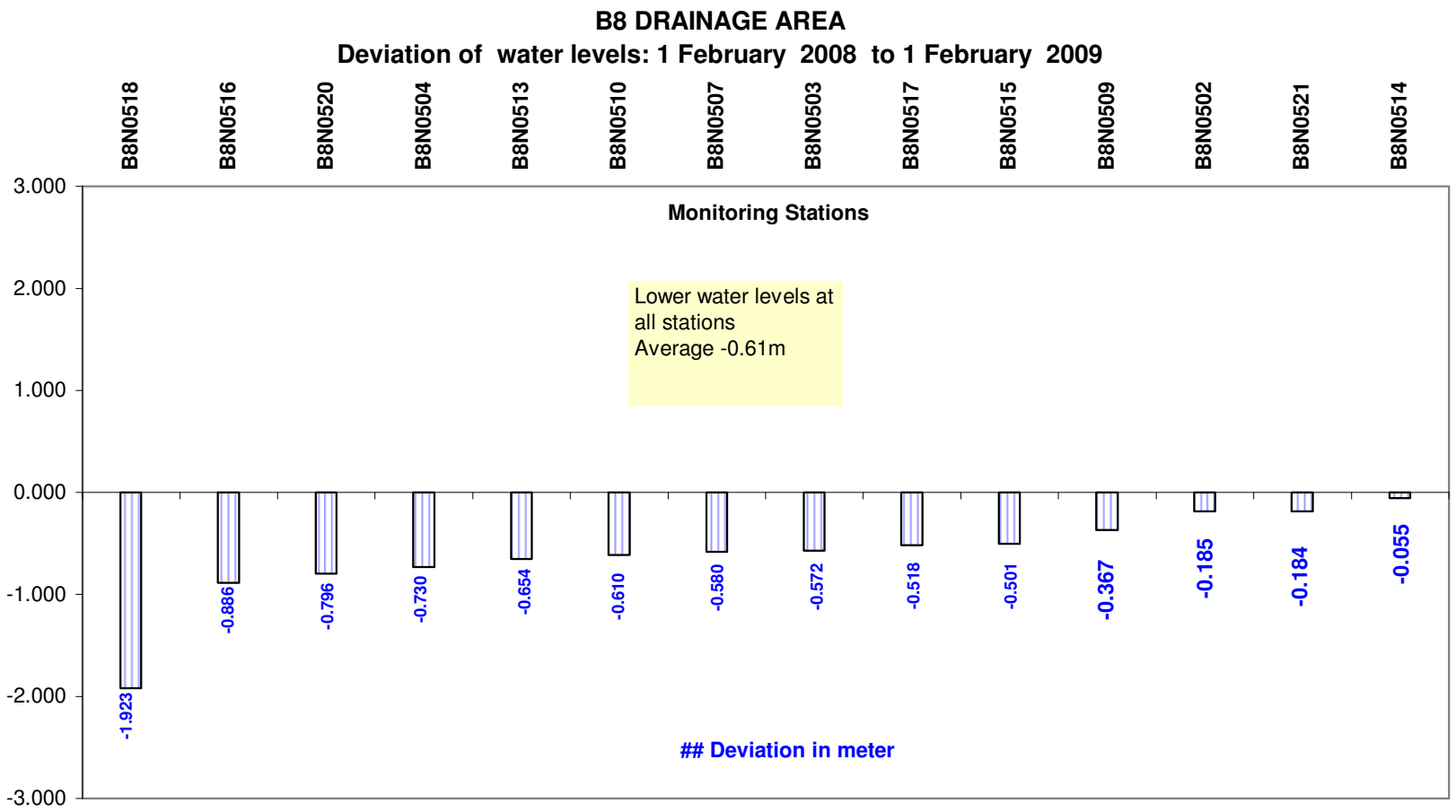
Comparison of water level trends at some stations in B8 drainage:
1 February 2008 to 1 February 2009



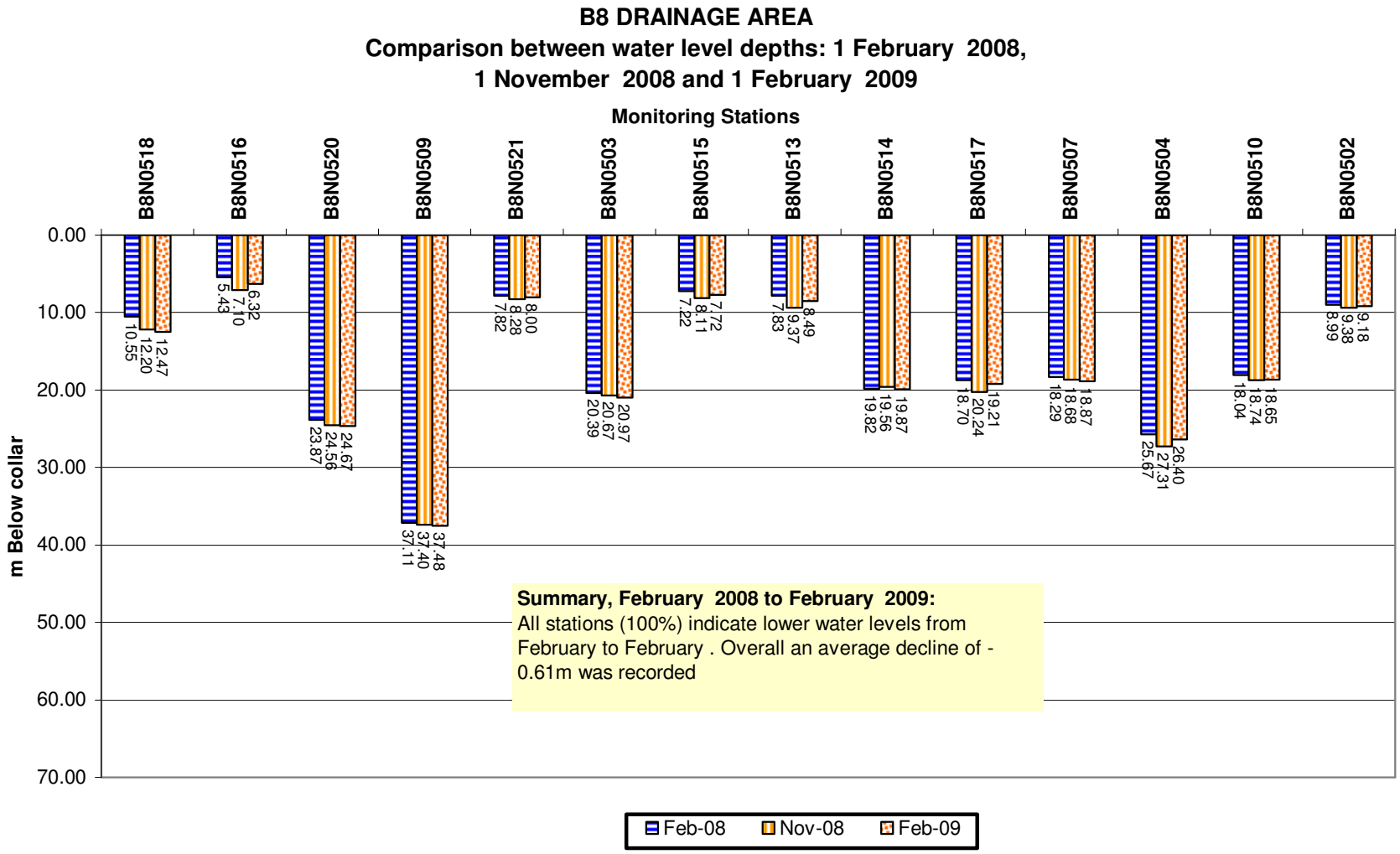
GRAPH 25


B8 DRAINAGE AREA
Deviation of water levels: 1 November 2008 to 1 February 2009
B8N0514
B8N0503
B8N0518
B8N0507
B8N0520
B8N0509
B8N0510
B8N0502
B8N0521
B8N0515
B8N0516
B8N0513
B8N0504
B8N0517
4.000
3.000
2.000
1.000
0.000
-1.000
-2.000
Monitoring Stations
6 Stations indicate lower water levels. Average -0.2m
8 Stations indicatehigher water levels. Average 0.57m
-0.313
-0.298
-0.270
-0.190
-0.104
-0.083
0.090
0.200
0.276
0.393
0.781
0.881
0.910
1.027
Deviation in meter

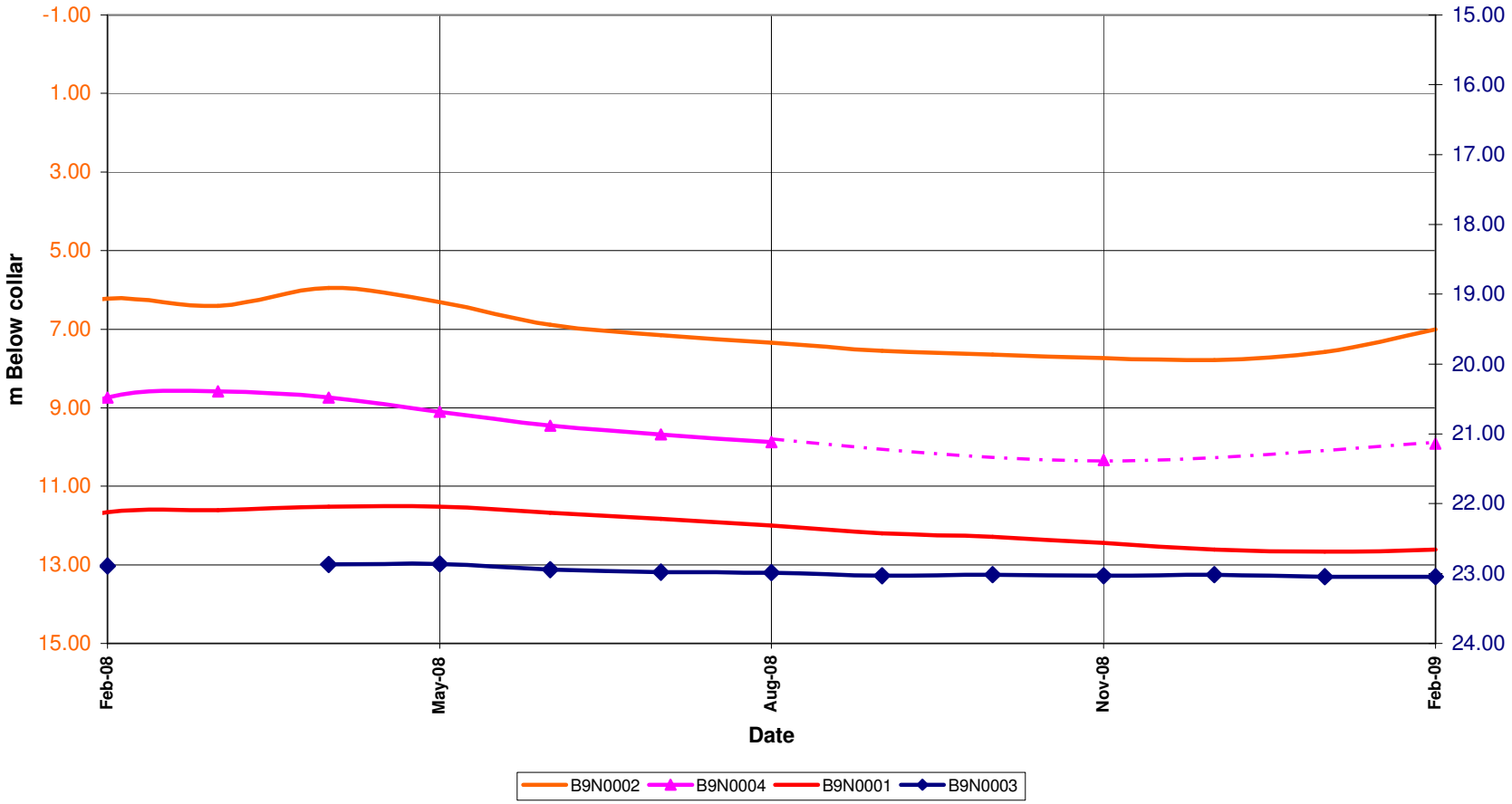
GRAPH 26


B8 DRAINAGE AREA
Deviation of water levels: 1 February 2008 to 1 February 2009
B8N0518
B8N0516
B8N0520
B8N0504
B8N0513
B8N0510
B8N0507
B8N0503
B8N0517
B8N0515
B8N0509
B8N0502
B8N0521
B8N0514
3.000
2.000
1.000
0.000
-1.000
-2.000
-3.000
Monitoring Stations
Lower water levels at all stations
Average -0.61m
-1.923
-0.886
-0.796
-0.730
-0.654
-0.610
-0.580
-0.572
-0.518
-0.501
-0.367
-0.185
-0.184
-0.055
Deviation in meter

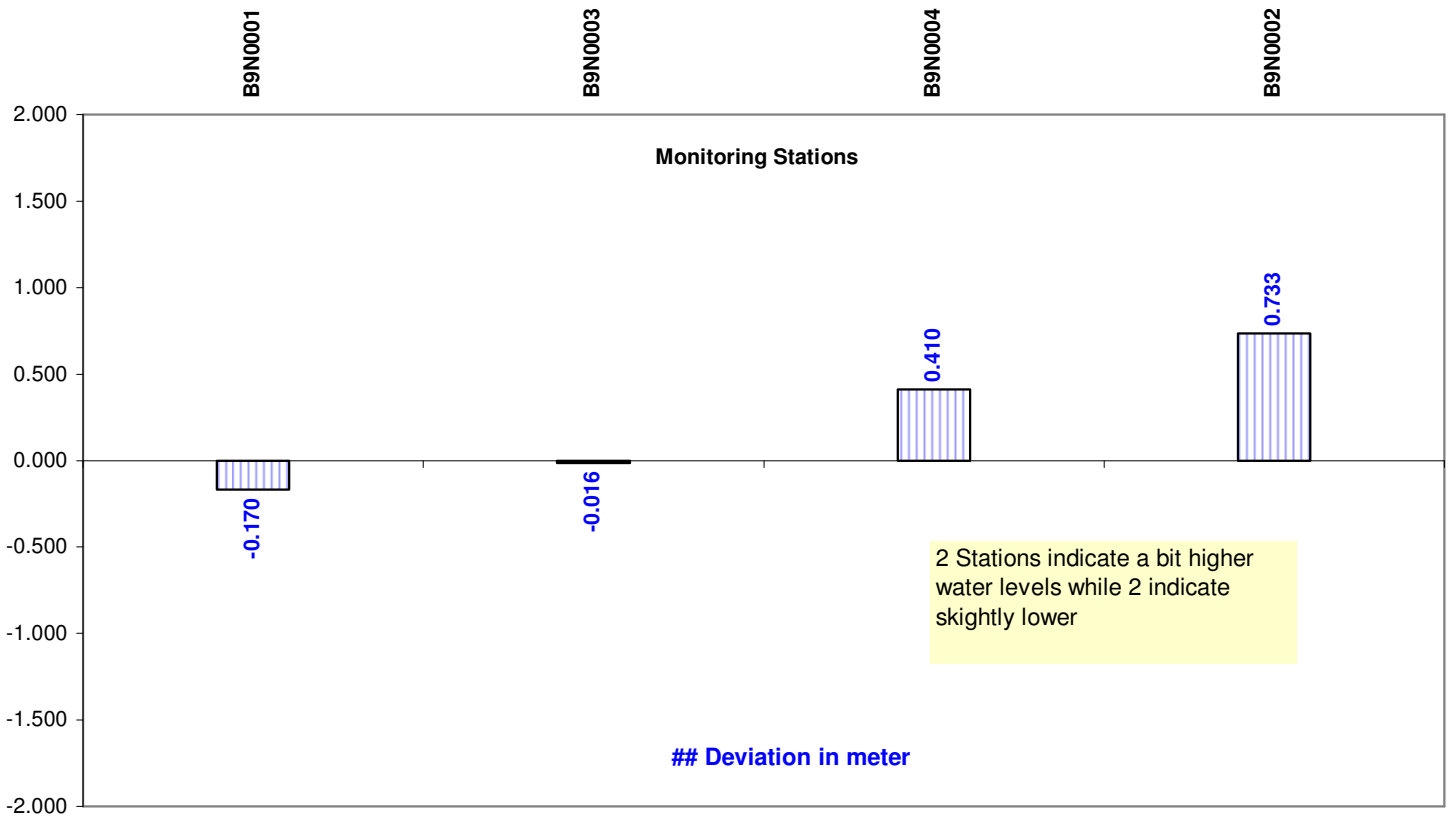
GRAPH 27


B8 DRAINAGE AREA
Comparison between water level depths: 1 February 2008,
1 November 2008 and 1 February 2009
Monitoring Stations
B8N0518
B8N0516
B8N0520
B8N0509
B8N0521
B8N0503
B8N0515
B8N0513
B8N0514
B8N0517
B8N0507
B8N0504
B8N0510
B8N0502
m Below collar
0.00
10.00
20.00
30.00
40.00
50.00
60.00
70.00
10.55
12.20
12.47
5.43
7.10
6.32
23.87
24.56
24.67
37.11
37.40
37.48
7.82
8.28
8.00
20.39
20.67
20.97
7.22
8.11
7.72
7.83
9.37
8.49
19.82
19.56
19.87
18.70
20.24
19.21
18.29
18.68
18.87
25.67
27.31
26.40
18.04
18.74
18.65
8.99
9.38
9.18
Summary, February 2008 to February 2009:
All stations (100%) indicate lower water levels from February to February . Overall an average decline of -0.61m was recorded
Feb-08
Nov-08
Feb-09

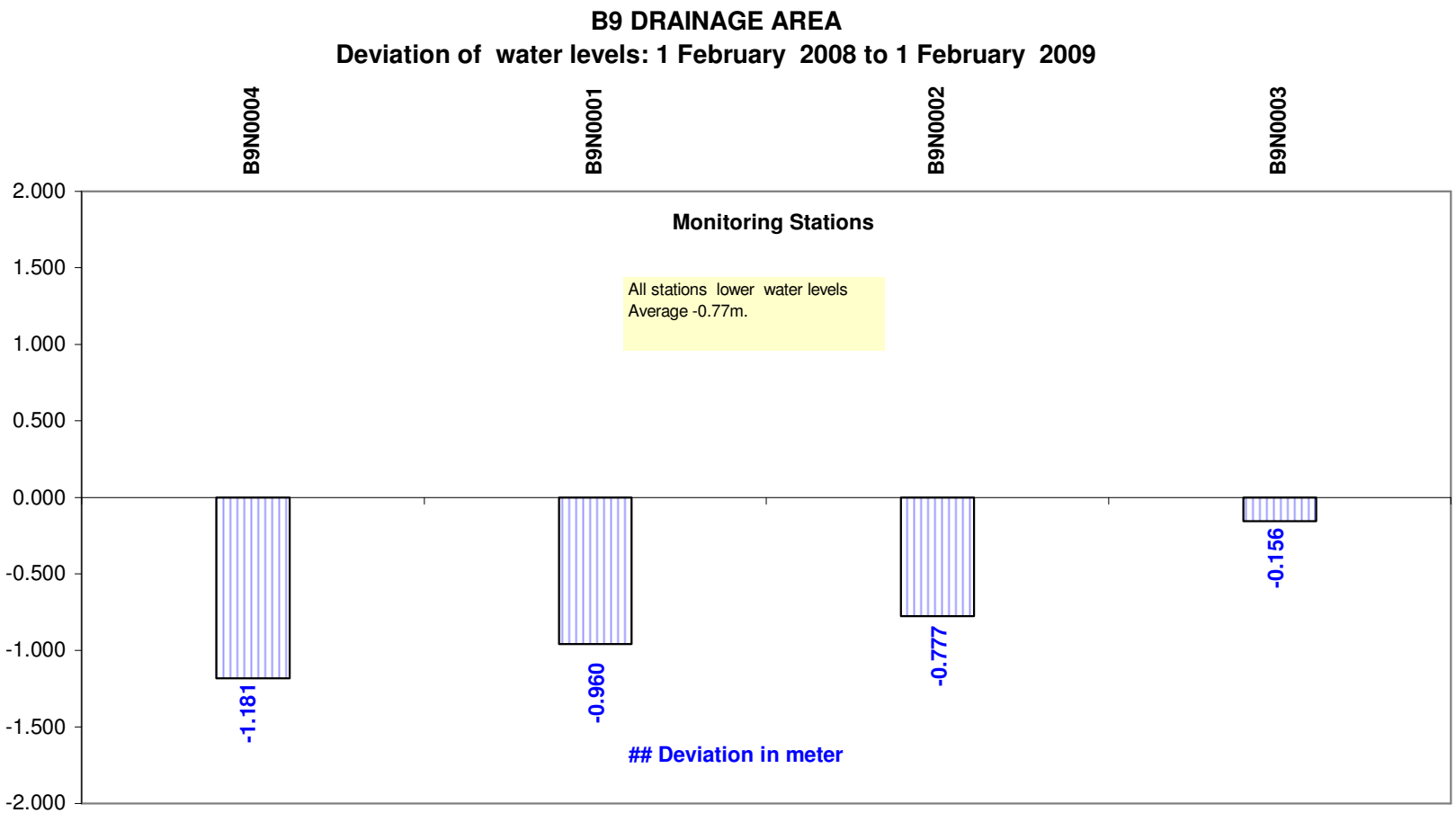
GRAPH 28


Comparison of water level trends of stations in B9 drainage:
1 February 2008 to 1 February 2009
m Below collar
-1.00
1.00
3.00
5.00
7.00
9.00
11.00
13.00
15.00
15.00
16.00
17.00
18.00
19.00
20.00
21.00
22.00
23.00
24.00
Feb-08
May-08
Aug-08
Nov-08
Feb-09
Date
B9N0002
B9N0004
B9N0001
B9N0003

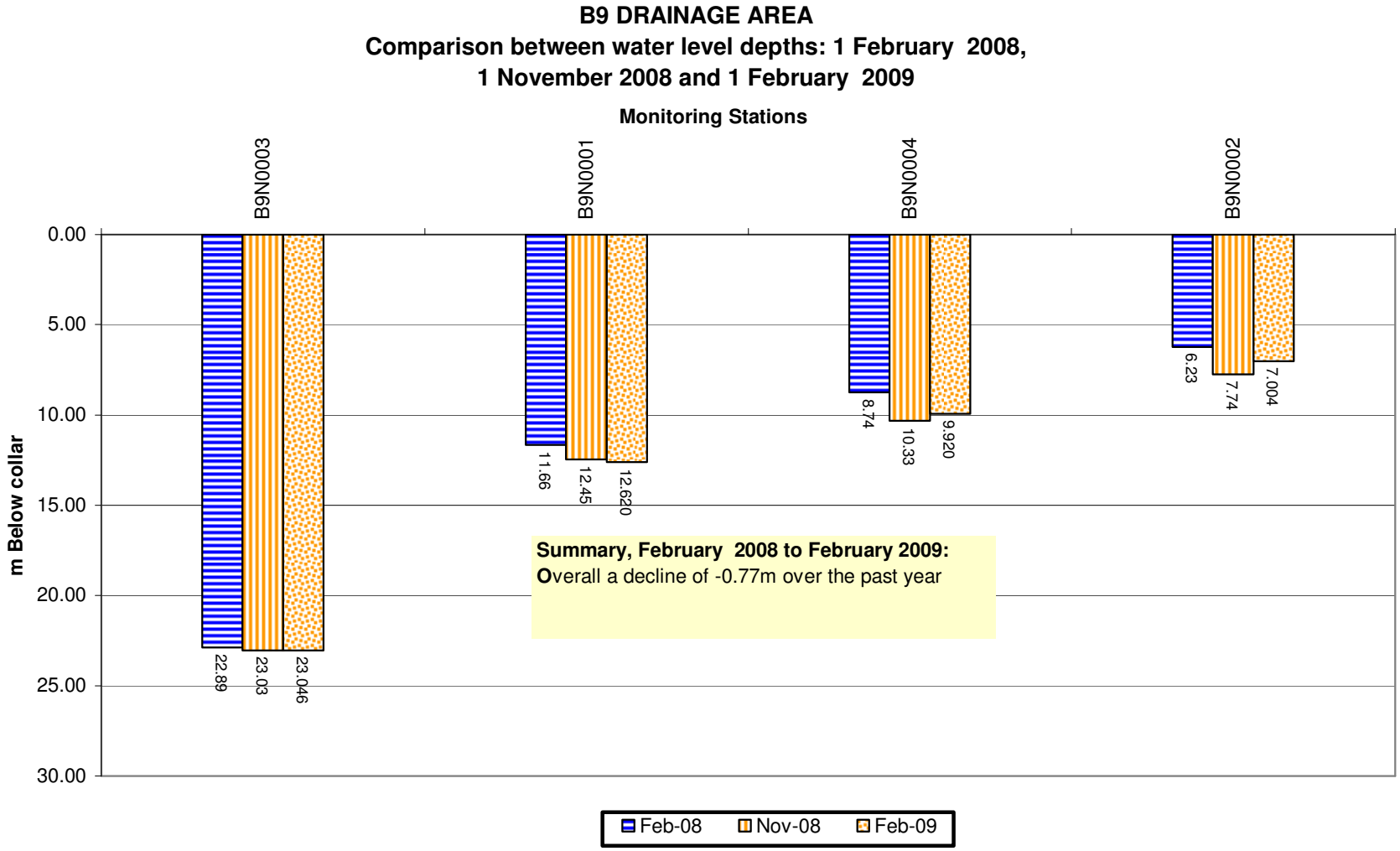
GRAPH 29


B9 DRAINAGE AREA
Deviation of water levels: 1 November 2008 to 1 February 2009
B9N0001
B9N0003
B9N0004
B9N0002
2.000
1.500
1.000
0.500
0.000
-0.500
-1.000
-1.500
-2.000
Monitoring Stations
-0.170
-0.016
0.410
0.733
2 Stations indicate a bit higher water levels while 2 indicate skightly lower
Deviation in meter

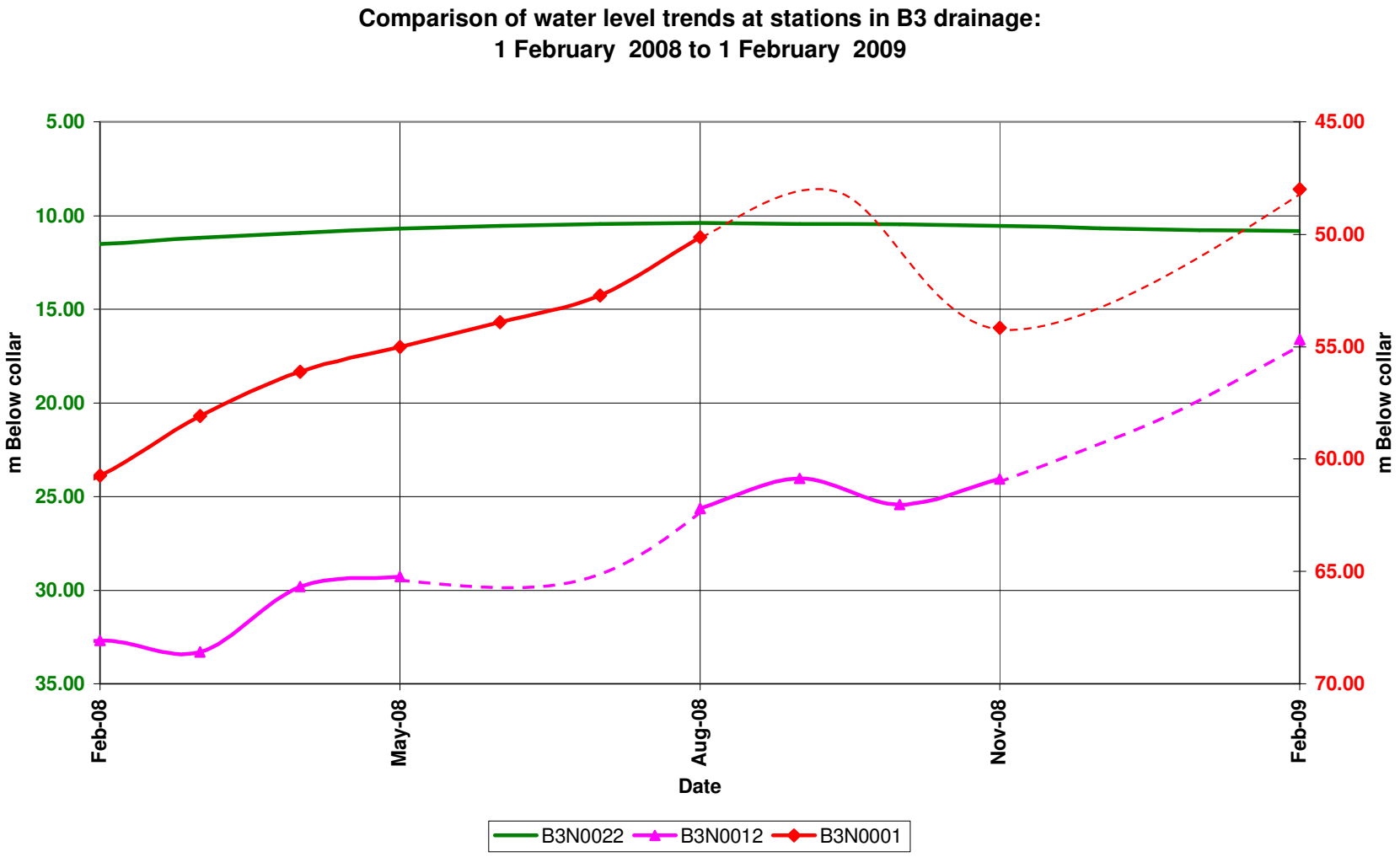
GRAPH 30


B9 DRAINAGE AREA
Deviation of water levels: 1 February 2008 to 1 February 2009
B9N0004
B9N0001
B9N0002
B9N0003
2.000
1.500
1.000
0.500
0.000
-0.500
-1.000
-1.500
-2.000
Monitoring Stations
All stations lower water levels
Average -0.77m.
-1.181
-0.960
-0.777
-0.156
Deviation in meter

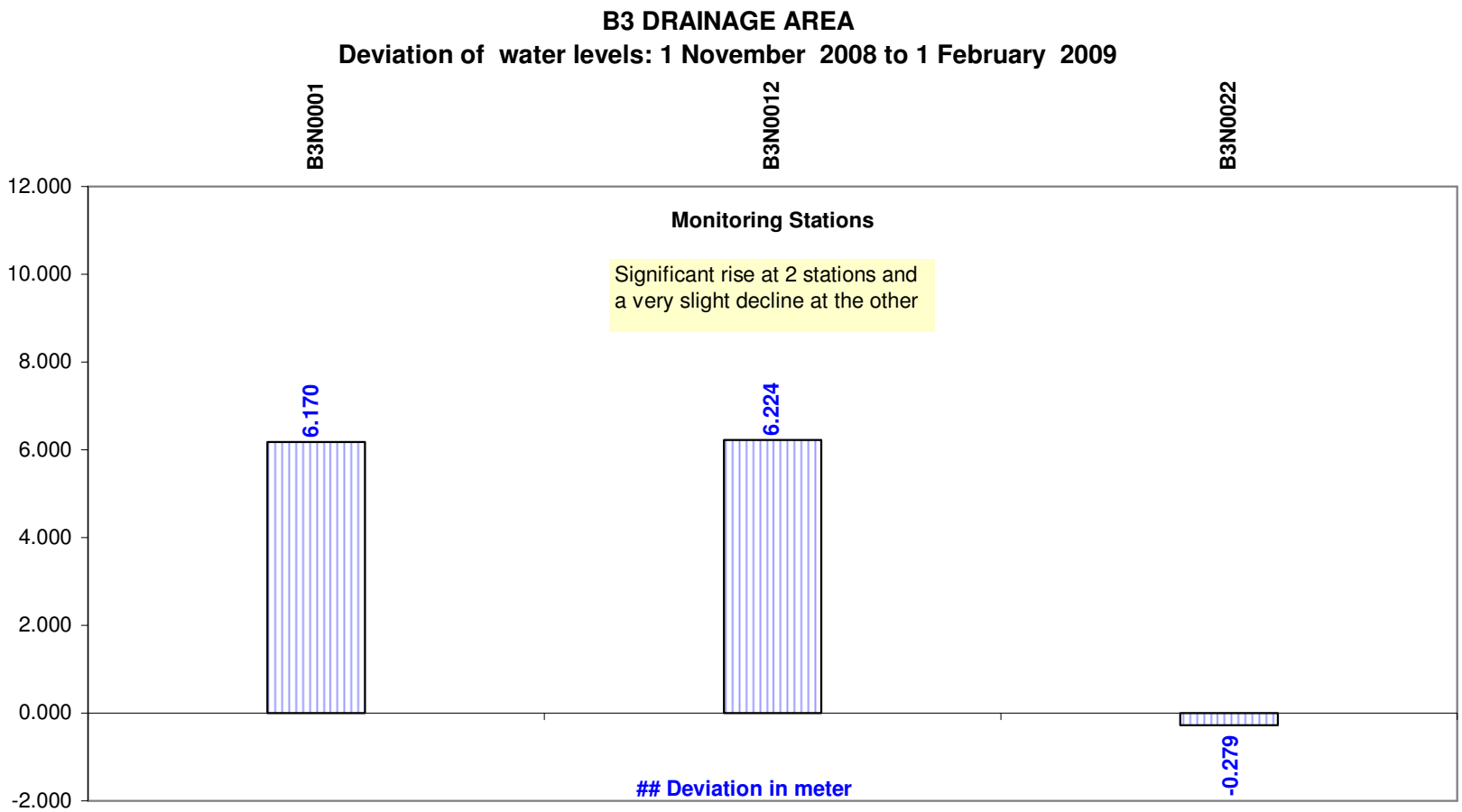
GRAPH 31


B9 DRAINAGE AREA
Comparison between water level depths: 1 February 2008,
1 November 2008 and 1 February 2009
Monitoring Stations
B9N0003
B9N0001
B9N0004
B9N0002
m Below collar
0.00
5.00
10.00
15.00
20.00
25.00
30.00
22.89
23.03
23.046
11.66
12.45
12.620
8.74
10.33
9.920
6.23
7.74
7.004
Summary, February 2008 to February 2009:
Overall a decline of -0.77m over the past year
Feb-08
Nov-08
Feb-09

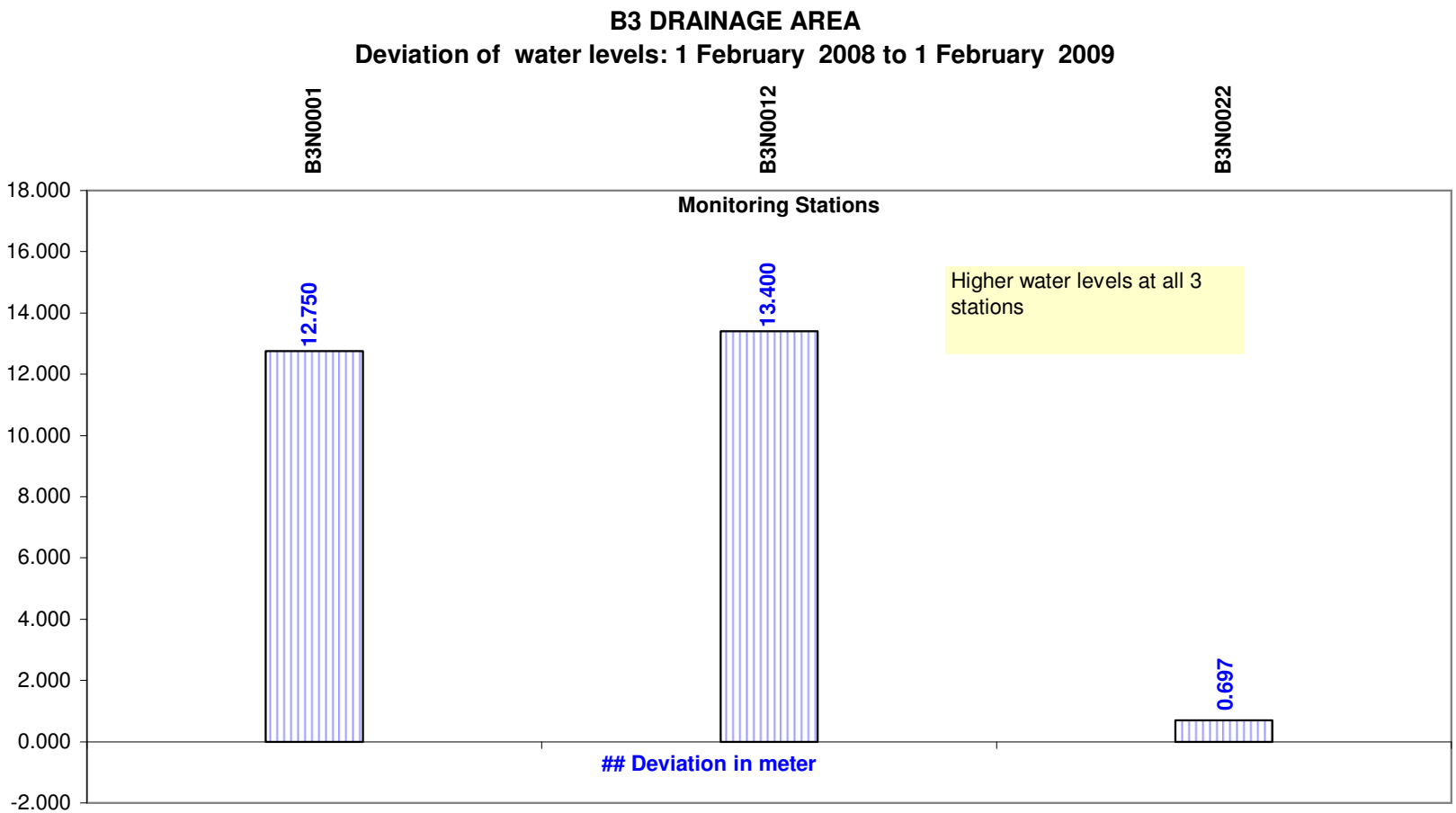
GRAPH 32


Comparison of water level trends at stations in B3 drainage:
1 February 2008 to 1 February 2009
5.00
10.00
15.00
20.00
25.00
30.00
35.00
m Below collar
45.00
50.00
55.00
60.00
65.00
70.00
m Below collar
Feb-08
May-08
Aug-08
Nov-08
Feb-09
Date
B3N0022
B3N0012
B3N0001

GRAPH 33

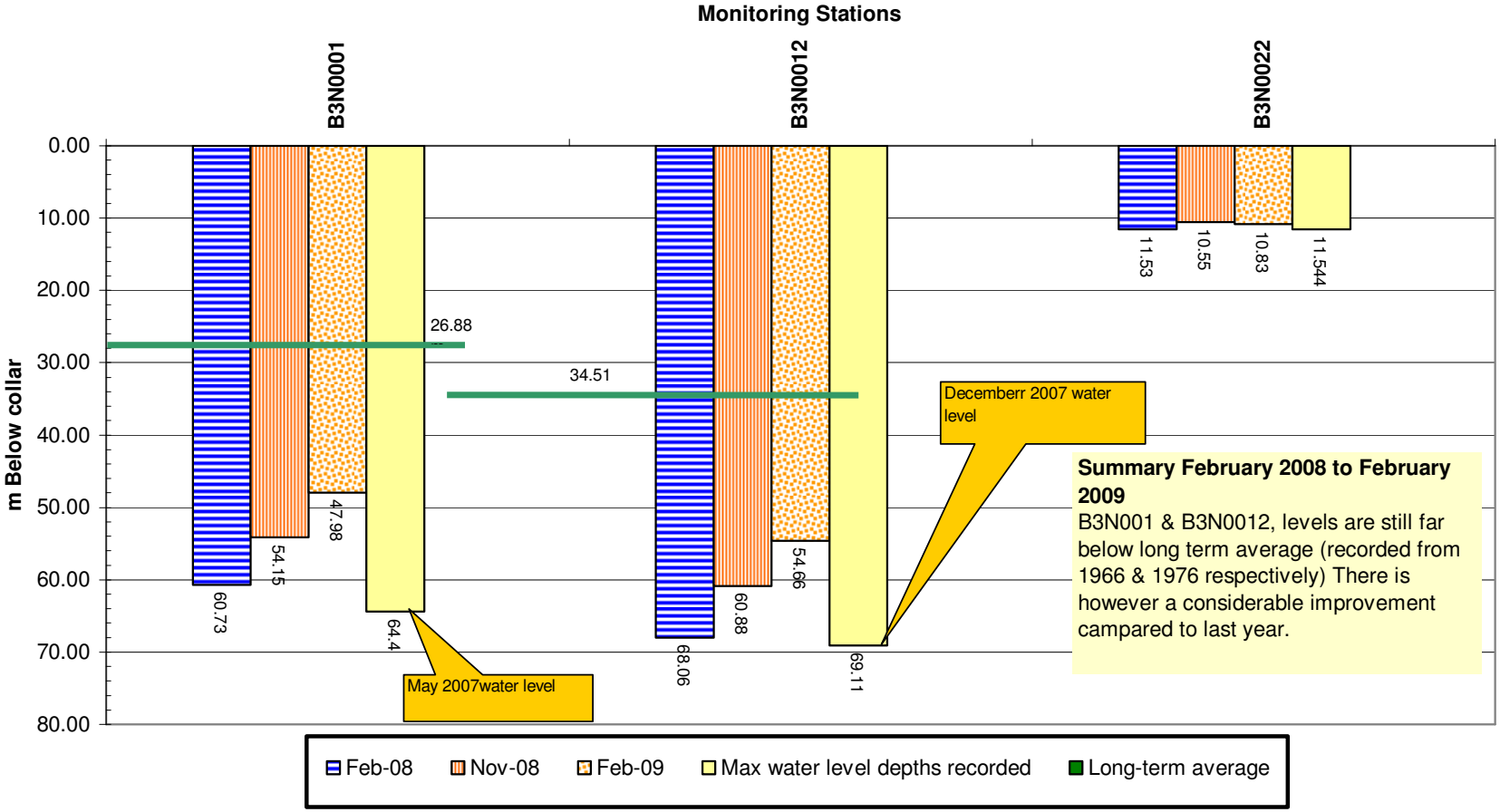

B3 DRAINAGE AREA
Deviation of water levels: 1 November 2008 to 1 February 2009
B3N0001
B3N0012
B3N0022
12.000
10.000
8.000
6.000
4.000
2.000
0.000
-2.000
Monitoring Stations
Significant rise at 2 stations and
a very slight decline at the other
6.170
6.224
-0.279
Deviation in meter

GRAPH 34


B3 DRAINAGE AREA
Deviation of water levels: 1 February 2008 to 1 February 2009
B3N0001
B3N0012
B3N0022
18.000
16.000
14.000
12.000
10.000
8.000
6.000
4.000
2.000
0.000
-2.000
Monitoring Stations
12.750
13.400
0.697
Higher water levels at all 3 stations
Deviation in meter

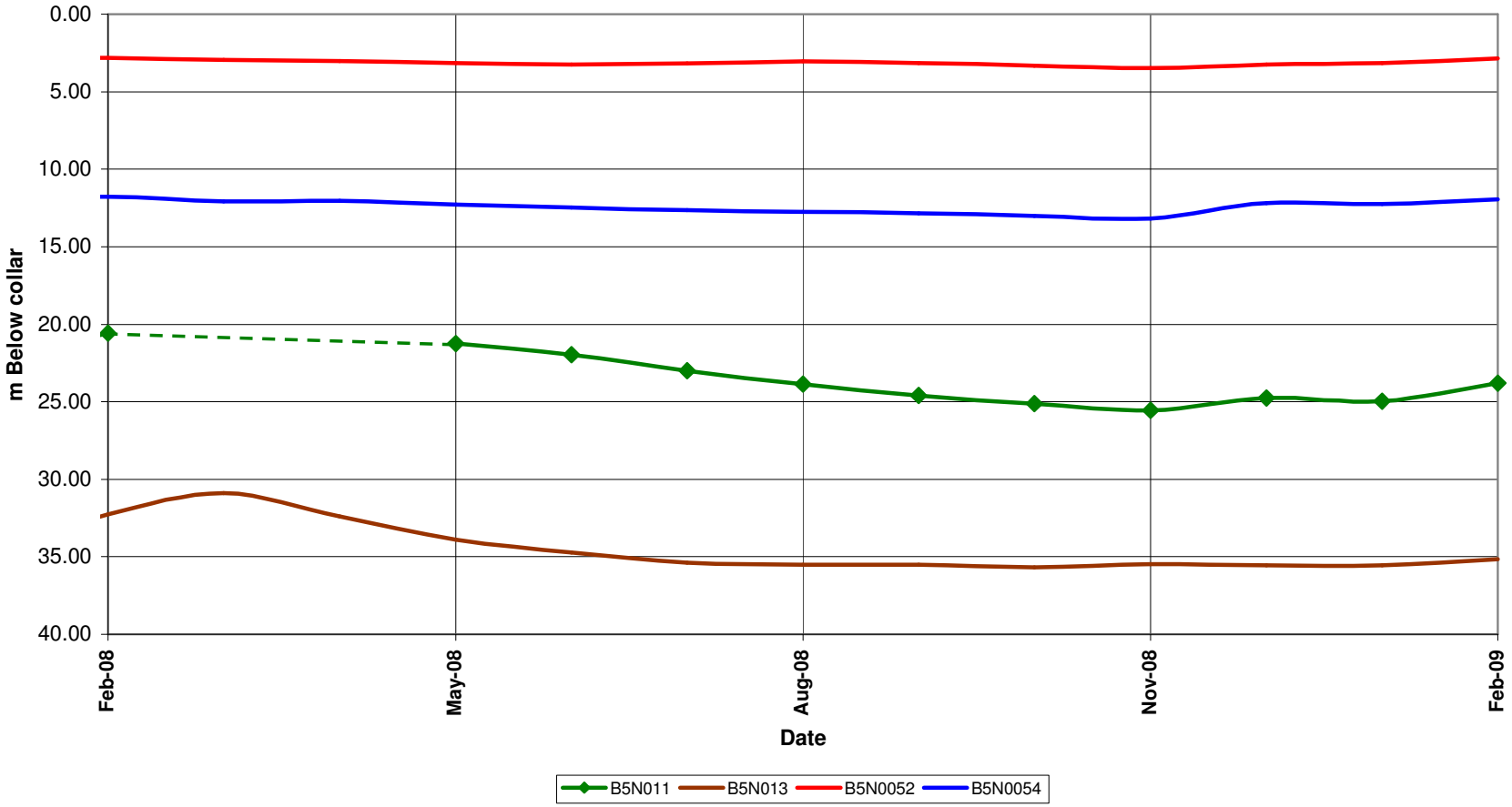
GRAPH 35

B3 DRAINAGE AREA
Comparison between water level depths: 1 February 2008
1 November 2008, 1 February 2009 and maximum depths recorded

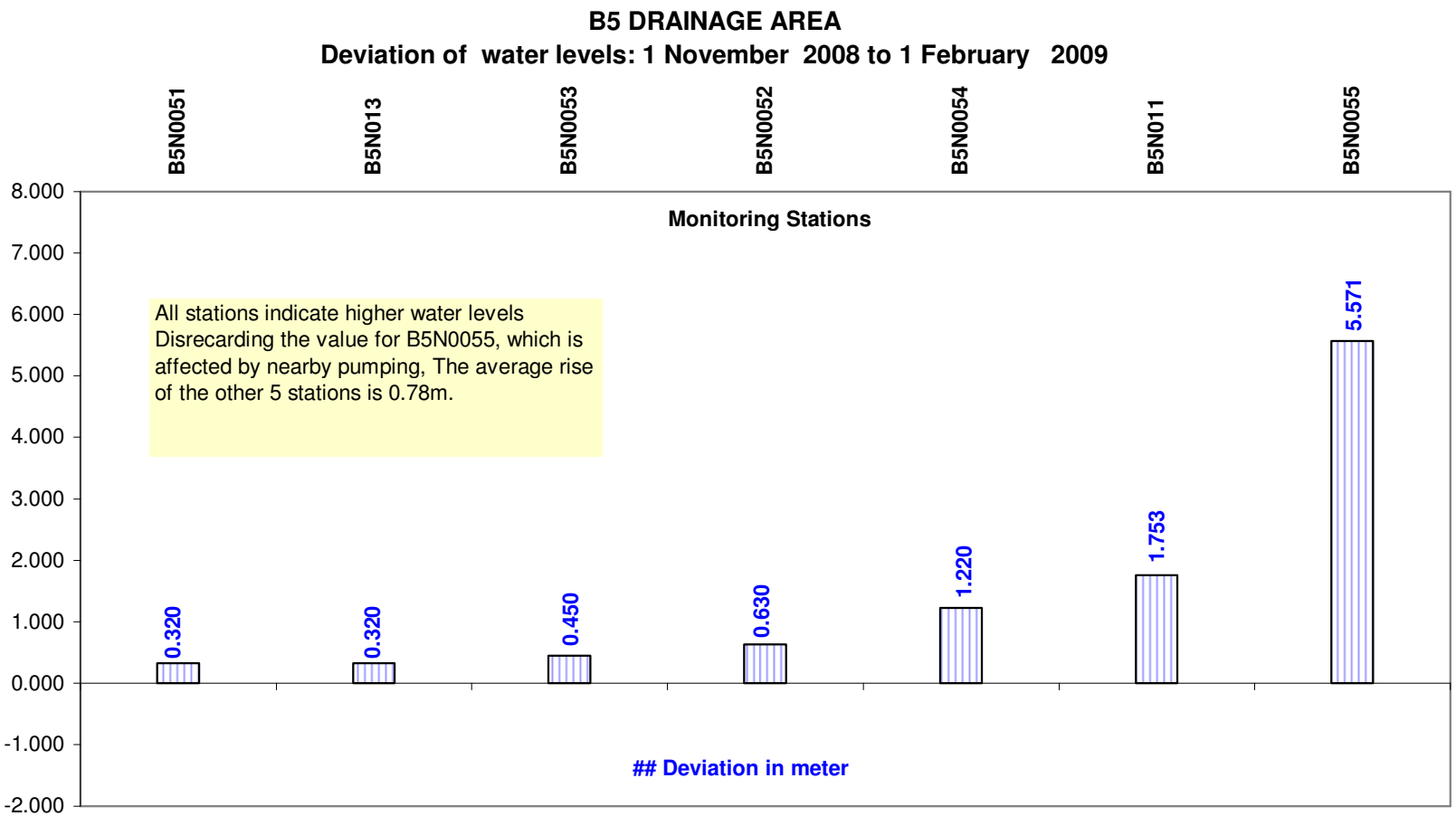


GRAPH 36

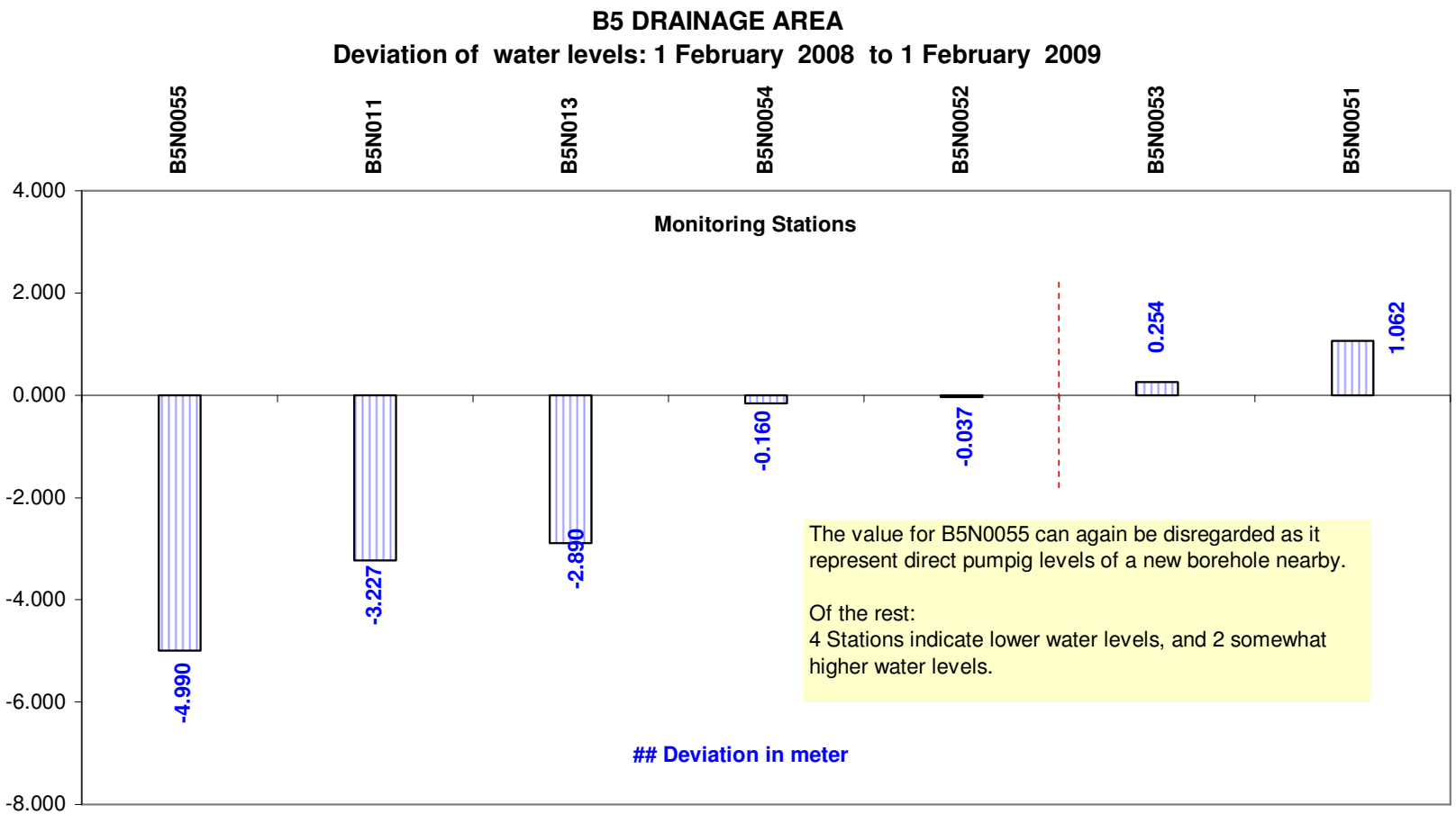
Comparison of water level trends at stations in B5 drainage:
1 February 2008 to 1 February 2009



GRAPH 37

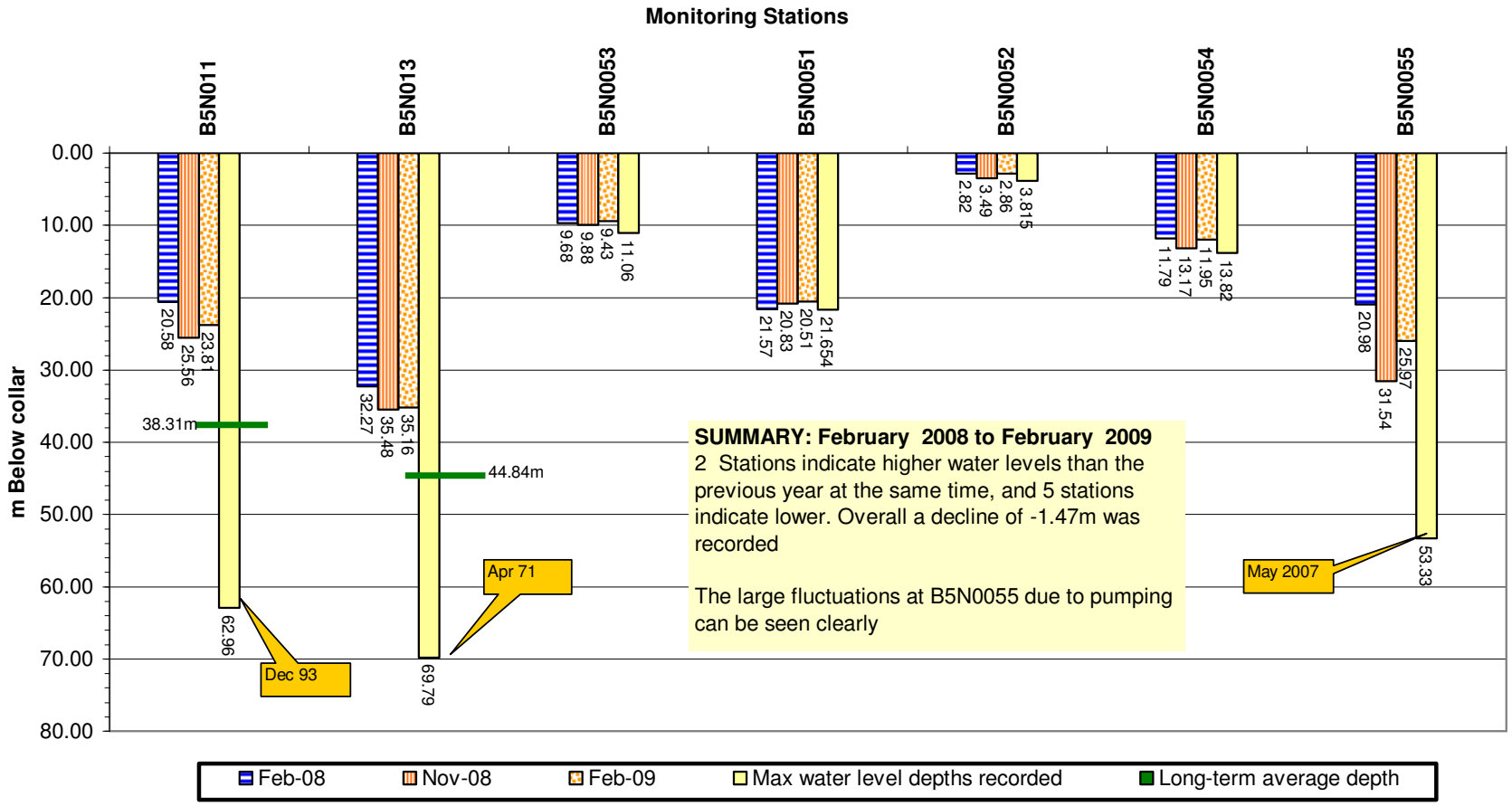

B5 DRAINAGE AREA
Deviation of water levels: 1 November 2008 to 1 February 2009
B5N0051
B5N013
B5N0053
B5N0052
B5N0054
B5N011
B5N0055
8.000
7.000
6.000
5.000
4.000
3.000
2.000
1.000
0.000
-1.000
-2.000
Monitoring Stations
All stations indicate higher water levels
Disrecarding the value for B5N0055, which is affected by nearby pumping, The average rise of the other 5 stations is 0.78m.
0.320
0.320
0.450
0.630
1.220
1.753
5.571
Deviation in meter

GRAPH 38

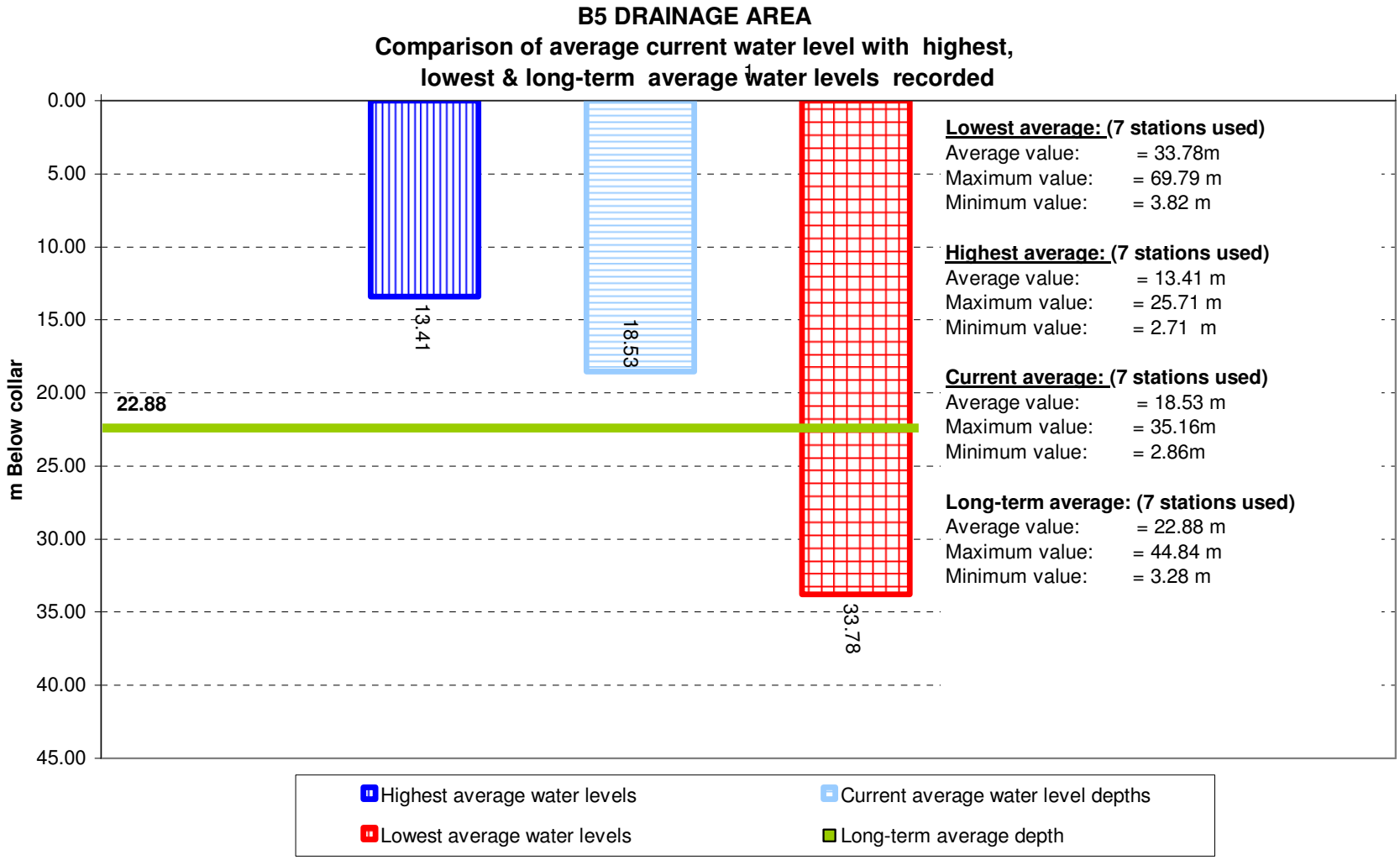

B5 DRAINAGE AREA
Deviation of water levels: 1 February 2008 to 1 February 2009
B5N0055
B5N011
B5N013
B5N0054
B5N0052
B5N0053
B5N0051
4.000
2.000
0.000
-2.000
-4.000
-6.000
-8.000
Monitoring Stations
-4.990
-3.227
-2.890
-0.160
-0.037
0.254
1.062
The value for B5N0055 can again be disregarded as it represent direct pumpig levels of a new borehole nearby.
Of the rest:
4 Stations indicate lower water levels, and 2 somewhat higher water levels.
Deviation in meter

GRAPH 39

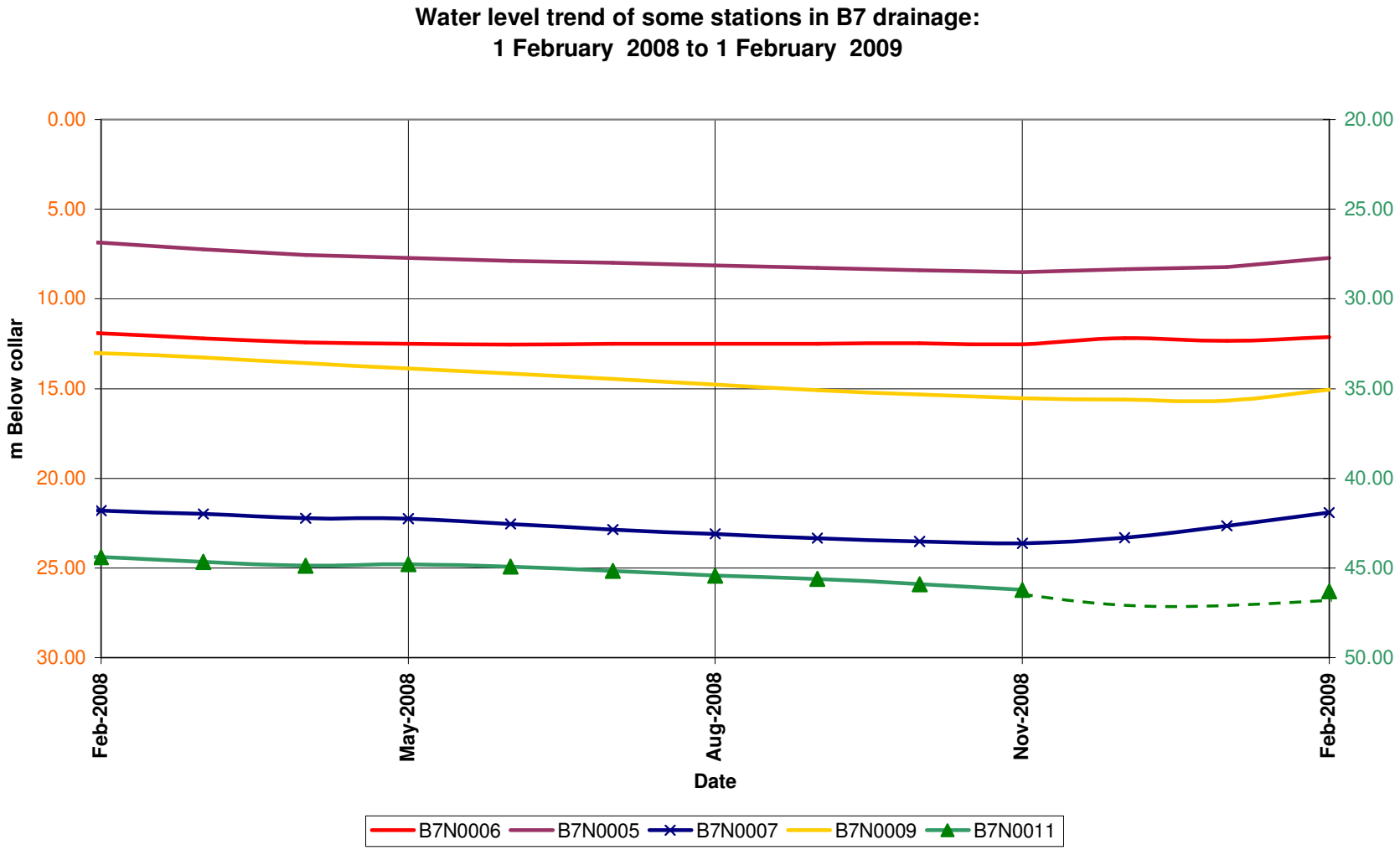
B5 DRAINAGE AREA
Comparison between water level depths: 1 February 2008,
1 November 2008 , 1 February 2009 and maximum depths recorded



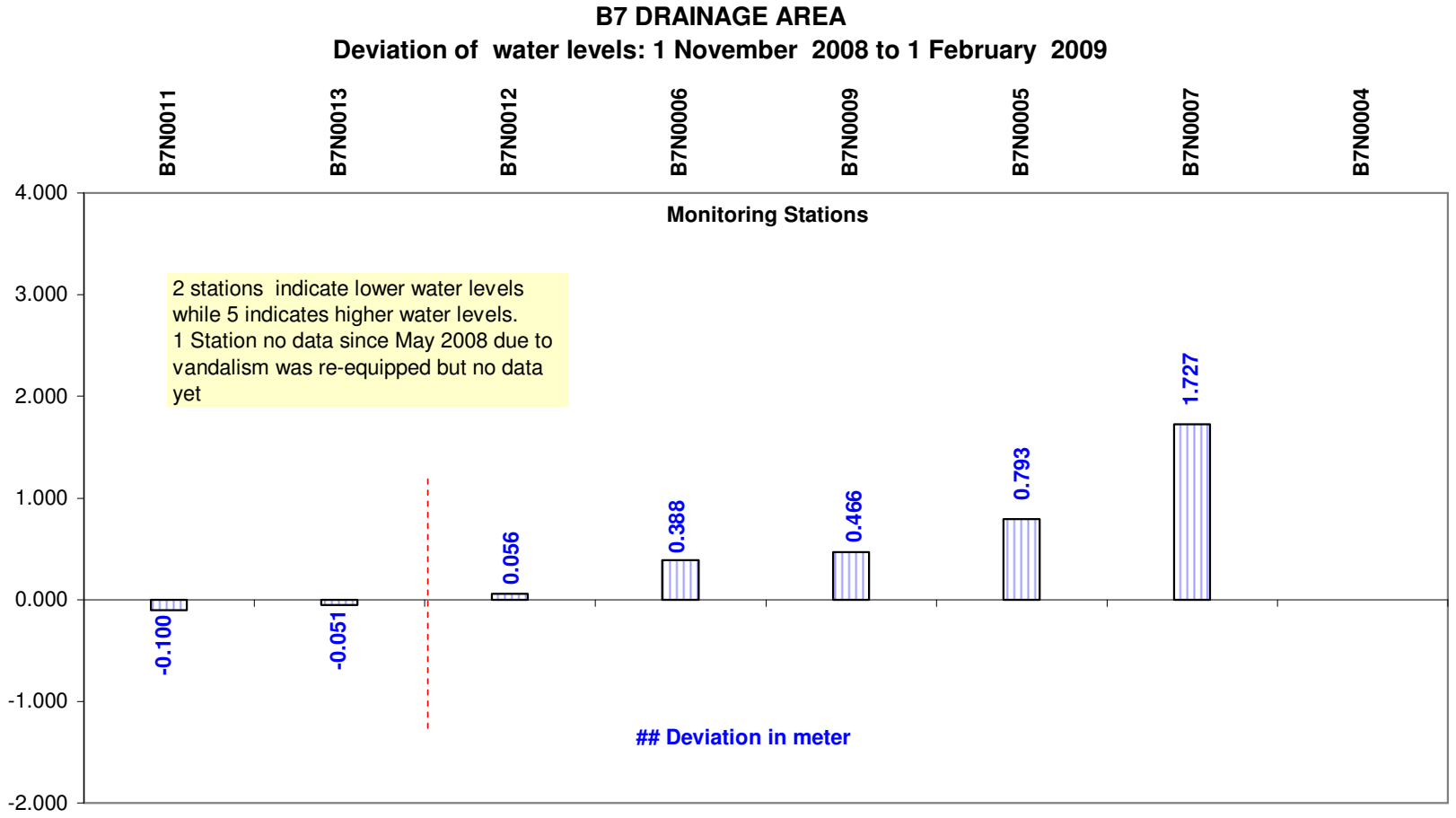
GRAPH 40


B5 DRAINAGE AREA
Comparison of average current water level with highest,
lowest & long-term average water levels recorded
m Below collar
0.00
5.00
10.00
15.00
20.00
25.00
30.00
35.00
40.00
45.00
22.88
13.41
18.53
33.78
Lowest average: (7 stations used)
Average value: = 33.78m
Maximum value: = 69.79 m
Minimum value: = 3.82 m
Highest average: (7 stations used)
Average value: = 13.41 m
Maximum value: = 25.71 m
Minimum value: = 2.71 m
Current average: (7 stations used)
Average value: = 18.53 m
Maximum value: = 35.16m
Minimum value: = 2.86m
Long-term average: (7 stations used)
Average value: = 22.88 m
Maximum value: = 44.84 m
Minimum value: = 3.28 m
Highest average water levels
Current average water level depths
Lowest average water levels
Long-term average depth

GRAPH 41

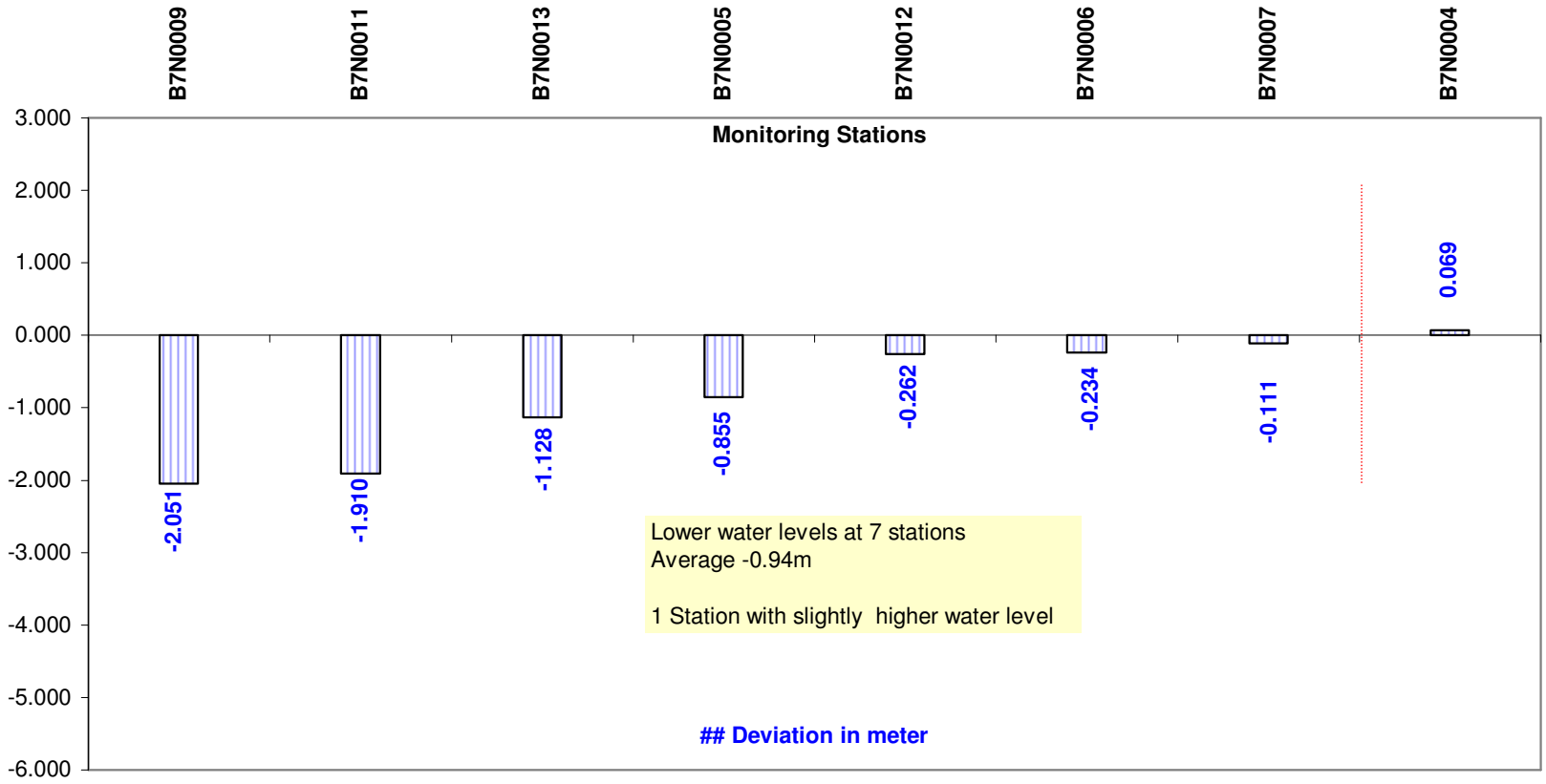

Water level trend of some stations in B7 drainage:
1 February 2008 to 1 February 2009
m Below collar
0.00
5.00
10.00
15.00
20.00
25.00
30.00
20.00
25.00
30.00
35.00
40.00
45.00
50.00
Feb-2008
May-2008
Aug-2008
Nov-2008
Feb-2009
Date
B7N0006
B7N0005
B7N0007
B7N0009
B7N0011

GRAPH 42

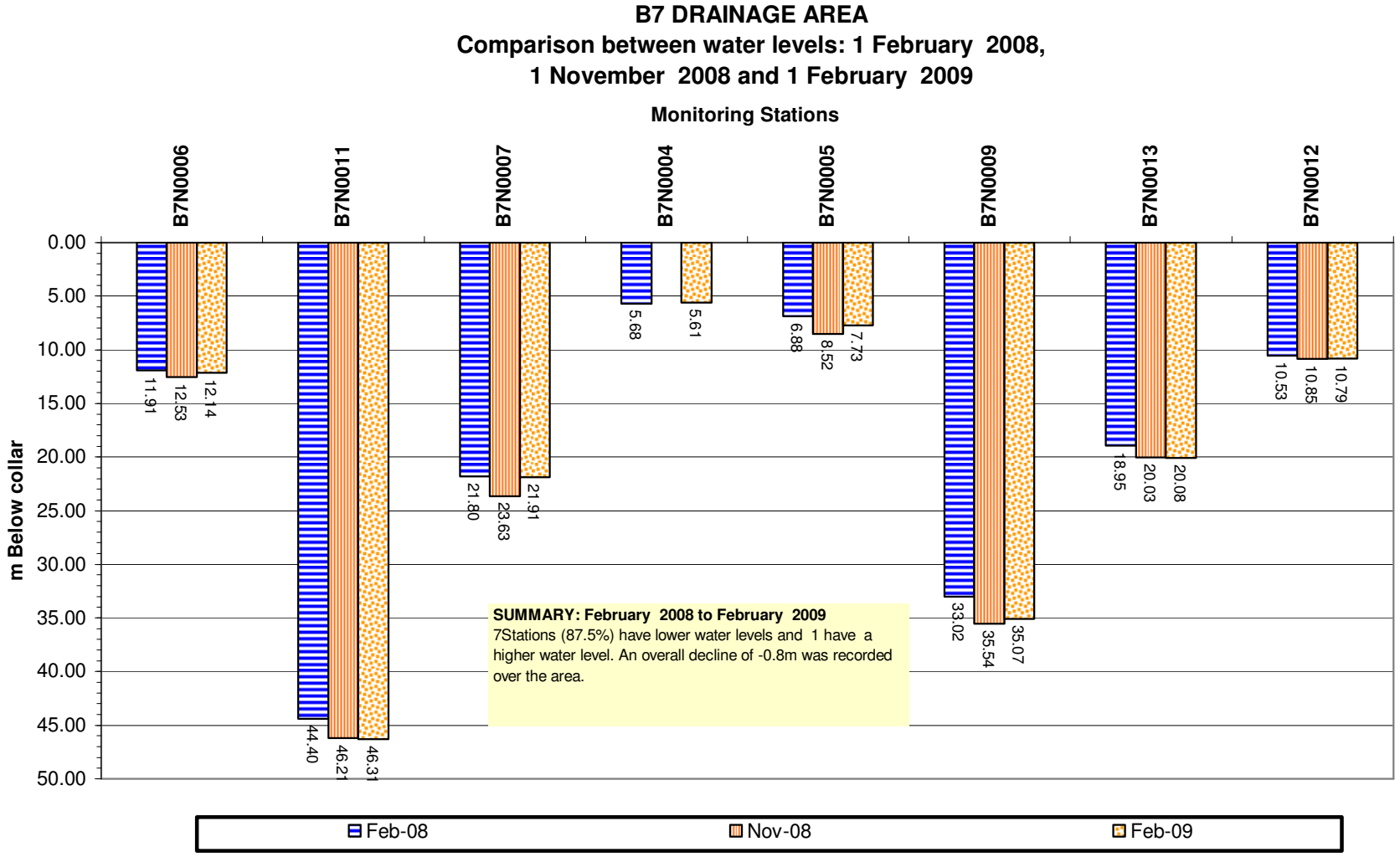

B7 DRAINAGE AREA
Deviation of water levels: 1 November 2008 to 1 February 2009
B7N0011
B7N0013
B7N0012
B7N0006
B7N0009
B7N0005
B7N0007
B7N0004
4.000
3.000
2.000
1.000
0.000
-1.000
-2.000
Monitoring Stations
2 stations indicate lower water levels while 5 indicates higher water levels.
1 Station no data since May 2008 due to vandalism was re-equipped but no data yet
-0.100
-0.051
0.056
0.388
0.466
0.793
1.727
Deviation in meter

GRAPH 43

B7 DRAINAGE AREA
Deviation of water levels: 1 February 2008 to 1 February 2009



GRAPH 44


B7 DRAINAGE AREA
Comparison between water levels: 1 February 2008,
1 November 2008 and 1 February 2009
Monitoring Stations
m Below collar
0.00
5.00
10.00
15.00
20.00
25.00
30.00
35.00
40.00
45.00
50.00
B7N0006
B7N0011
B7N0007
B7N0004
B7N0005
B7N0009
B7N0013
B7N0012
11.91
12.53
12.14
44.40
46.21
46.31
21.80
23.63
21.91
5.68
5.61
6.88
8.52
7.73
33.02
35.54
35.07
18.95
20.03
20.08
10.53
10.85
10.79
SUMMARY: February 2008 to February 2009
7Stations (87.5%) have lower water levels and 1 have a higher water level. An overall decline of -0.8m was recorded over the area.
Feb-08
Nov-08
Feb-09

GRAPH 45