

Three Kings Quarry

29 May 2017 – Site Liaison Group Meeting

Site Monitoring Report



May 2017 Site Monitoring Report

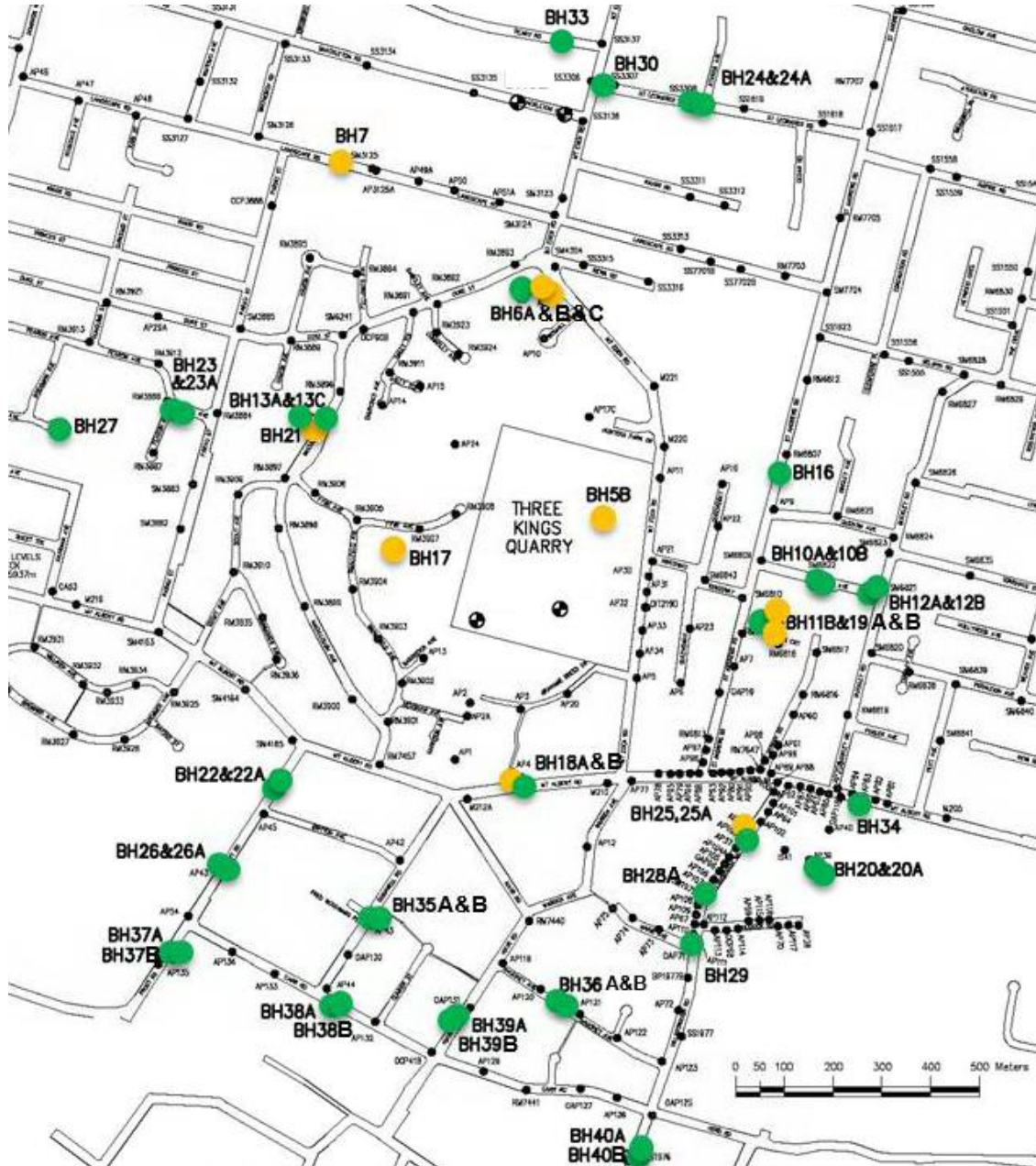
This Site Monitoring Report is a summary of environmental monitoring data collected since the last Site Liaison Group meeting and includes:

- Groundwater Level Monitoring Results
- Groundwater Chemistry Monitoring Results
 - Air Quality Monitoring Results
 - Noise Monitoring
 - Precise Level Survey

Groundwater Level Monitoring

- Dewatering of Three Kings Quarry commenced in March 1999
- Groundwater levels within Three Kings Quarry have been held above RL34m since October 2002
- Groundwater levels are currently being measured monthly in 51 boreholes and piezometers located in and around Three Kings Quarry
- Groundwater levels are generally following seasonal trends

Borehole Location Plan with April 2017 Groundwater Levels Included



LEGEND

- 34 – 36 RL m
- 36 – 45 RL m
- >45 RL m

Groundwater Chemistry Monitoring

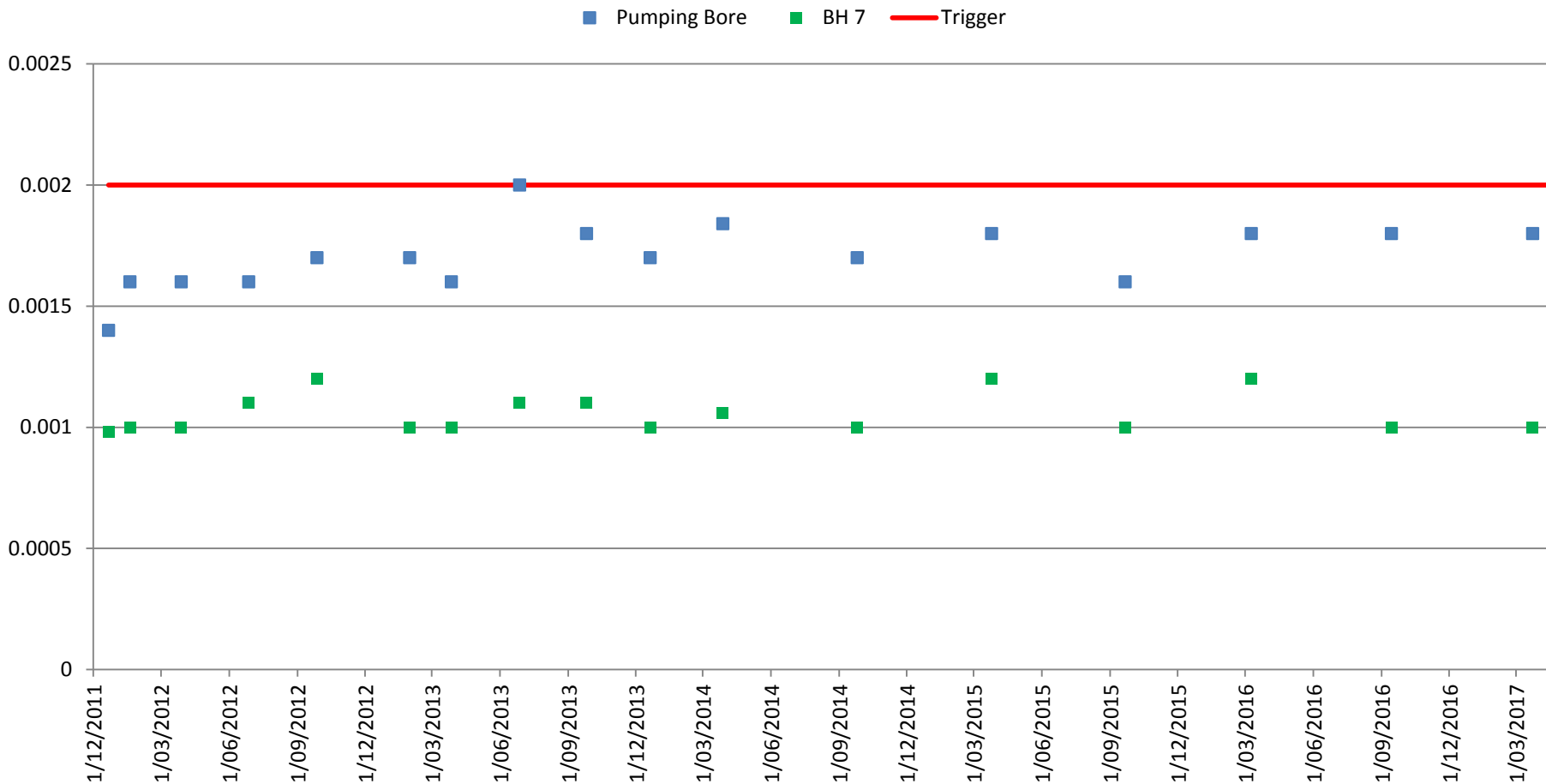
- Monitoring of Groundwater Chemistry commenced in December 2011 following the granting of Resource Consents to fill Three Kings Quarry.
- Samples were taken at three monthly intervals from the Pumping Bore within Three Kings Quarry and from BH 7 on Landscape Road for analysis of a suite of chemical parameters for the first 2 years of monitoring.
- Following 2 years of monitoring, samples for chemical analysis are required to be taken at 6 monthly intervals from the Pumping Bore within Three Kings Quarry and from BH 7 on Landscape Road (March and September).
- Results from the March 2017 monitoring round have been received since the last SLG meeting. All parameters were less than the trigger limits with the exception of Zinc in BH7. BH7 currently has no direct groundwater link to Three Kings Quarry. Auckland Council and Watercare were notified of the trigger exceedance.

Groundwater Chemistry Results

The following figure show all the results for Arsenic since the commencement of sampling.

All results are in g/m³ unless otherwise stated.

Arsenic

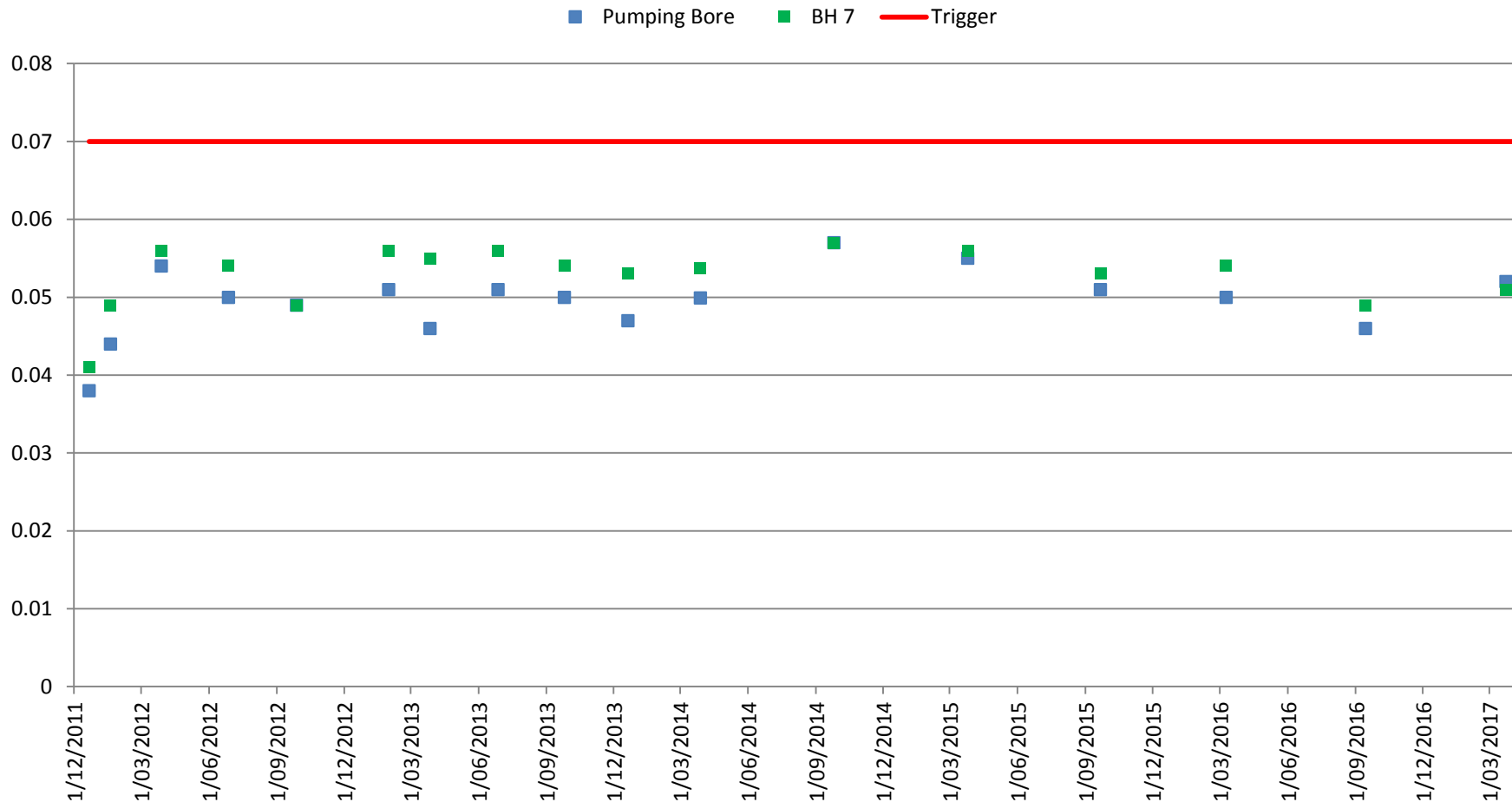


Groundwater Chemistry Results

The following figure show all the results for the Boron since the commencement of sampling.

All results are in g/m³ unless otherwise stated.

Boron

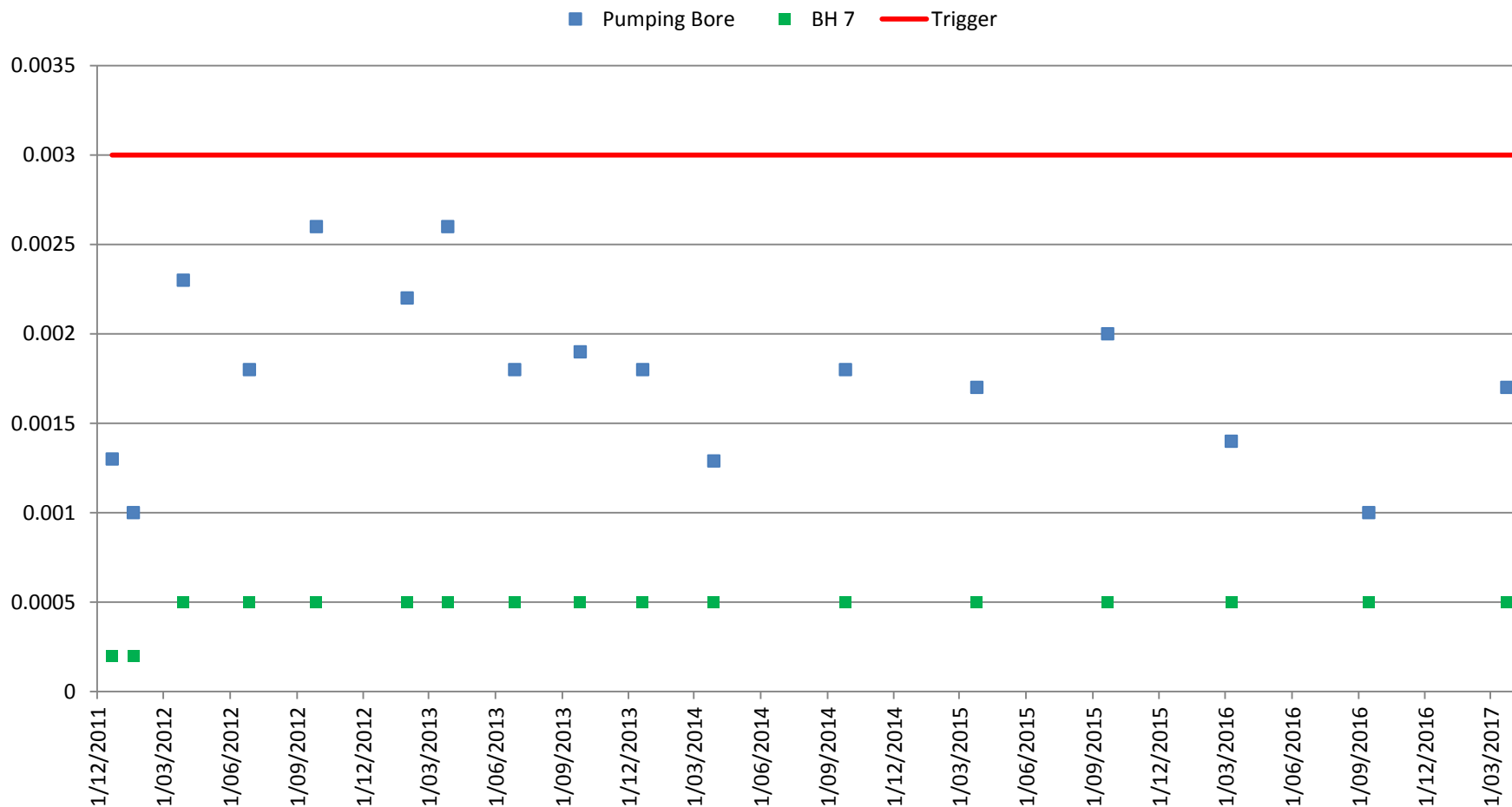


Groundwater Chemistry Results

The following figure show all the results for the Copper since the commencement of sampling.

All results are in g/m³ unless otherwise stated.

Copper

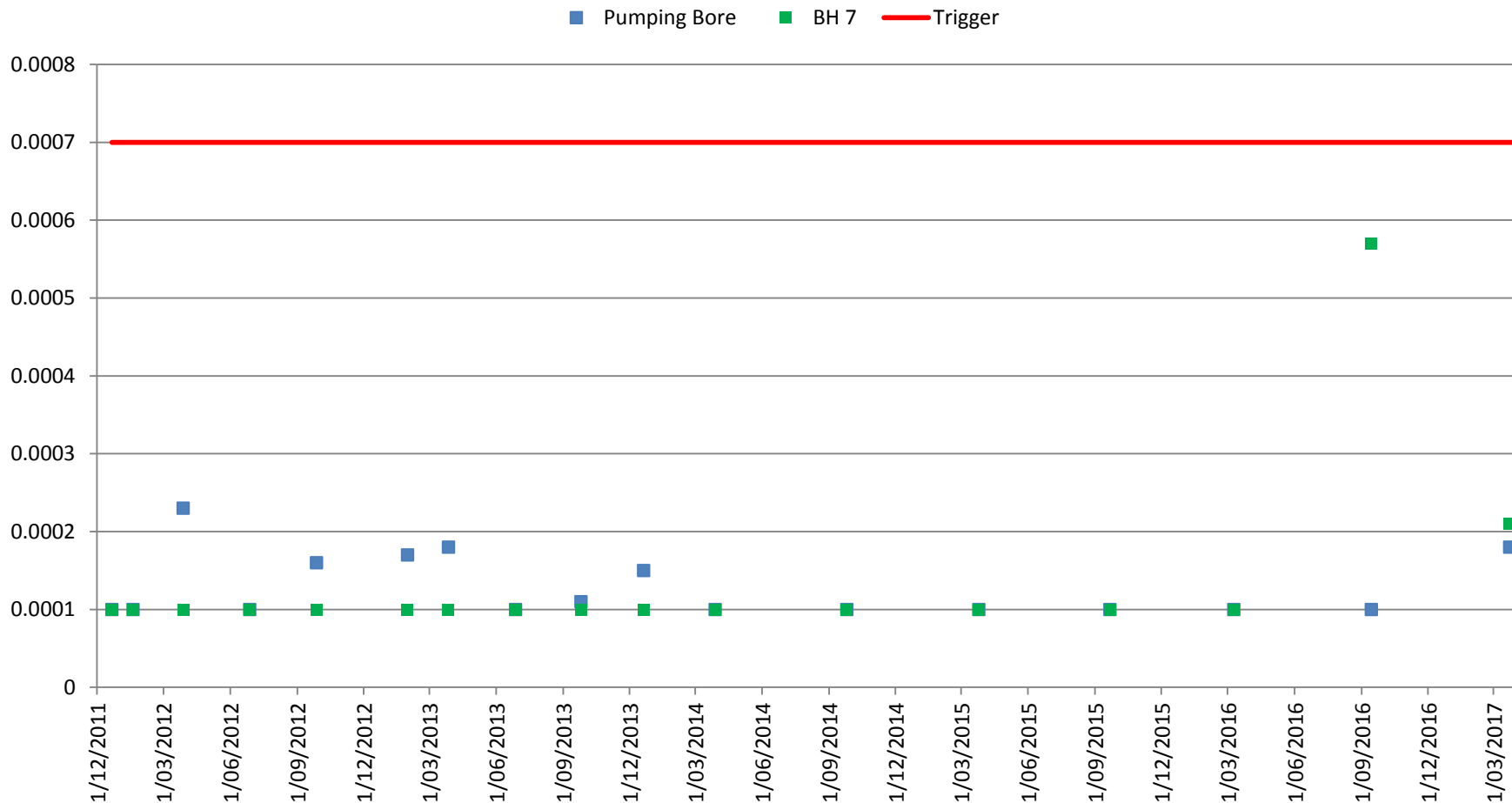


Groundwater Chemistry Results

The following figure show all the results for the Lead since the commencement of sampling.

All results are in g/m³ unless otherwise stated.

Lead

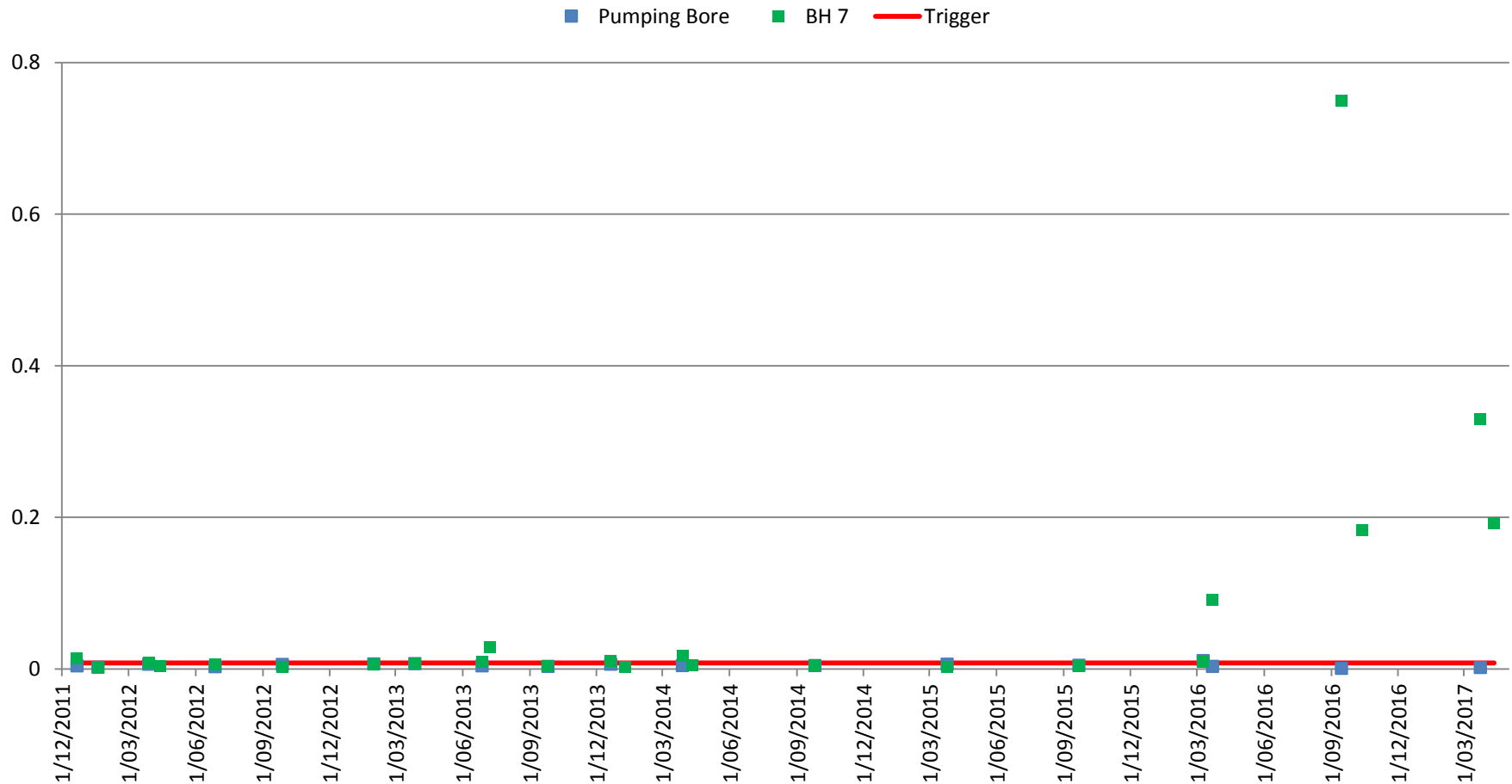


Groundwater Chemistry Results

The following figure show all the results for the Zinc since the commencement of sampling.

All results are in g/m³ unless otherwise stated.

Zinc



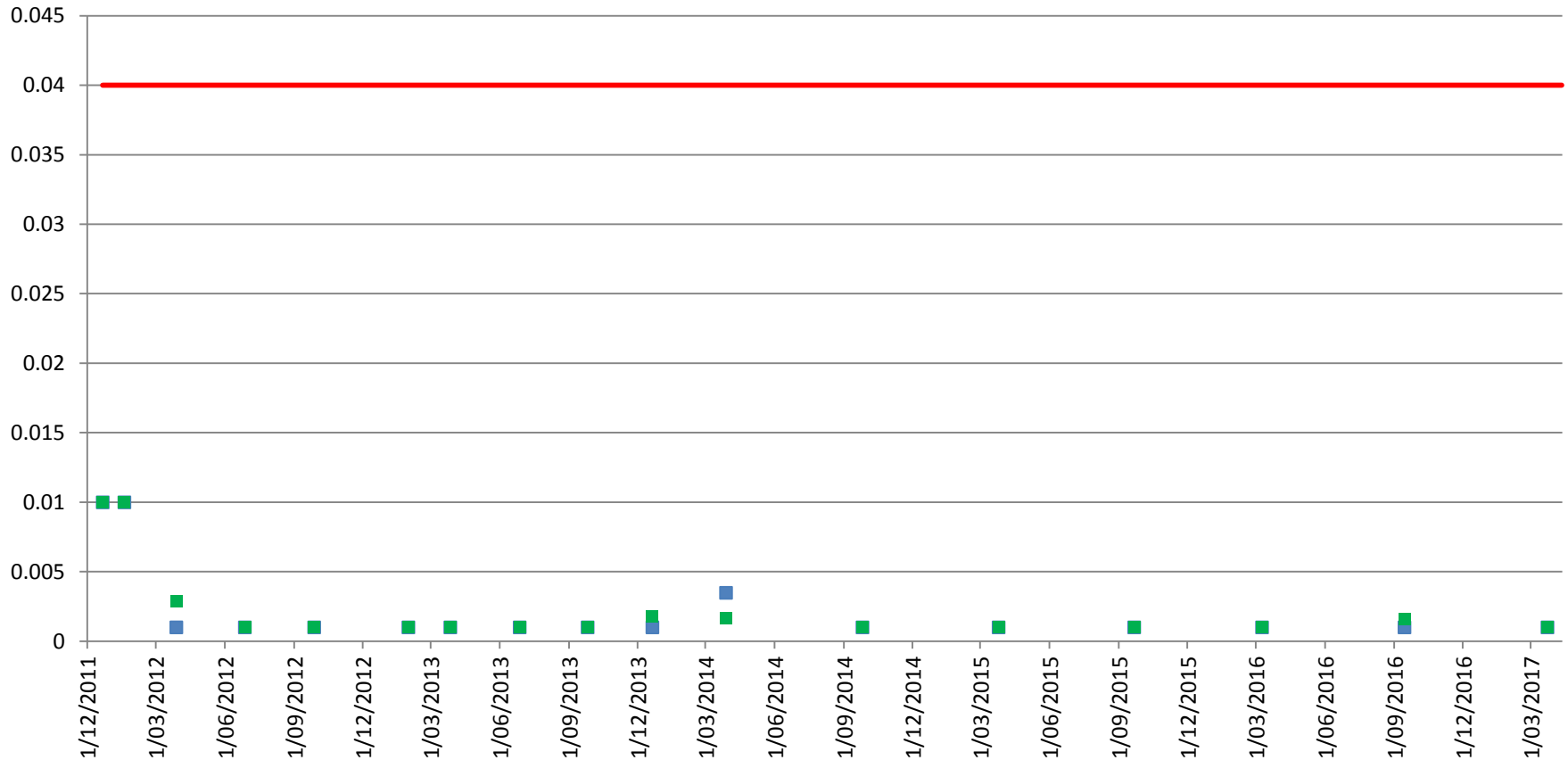
Groundwater Chemistry Results

The following figure show all the results for the Cyanide since the commencement of sampling.

All results are in g/m³ unless otherwise stated.

Cyanide

■ Pumping Bore ■ BH 7 — Trigger

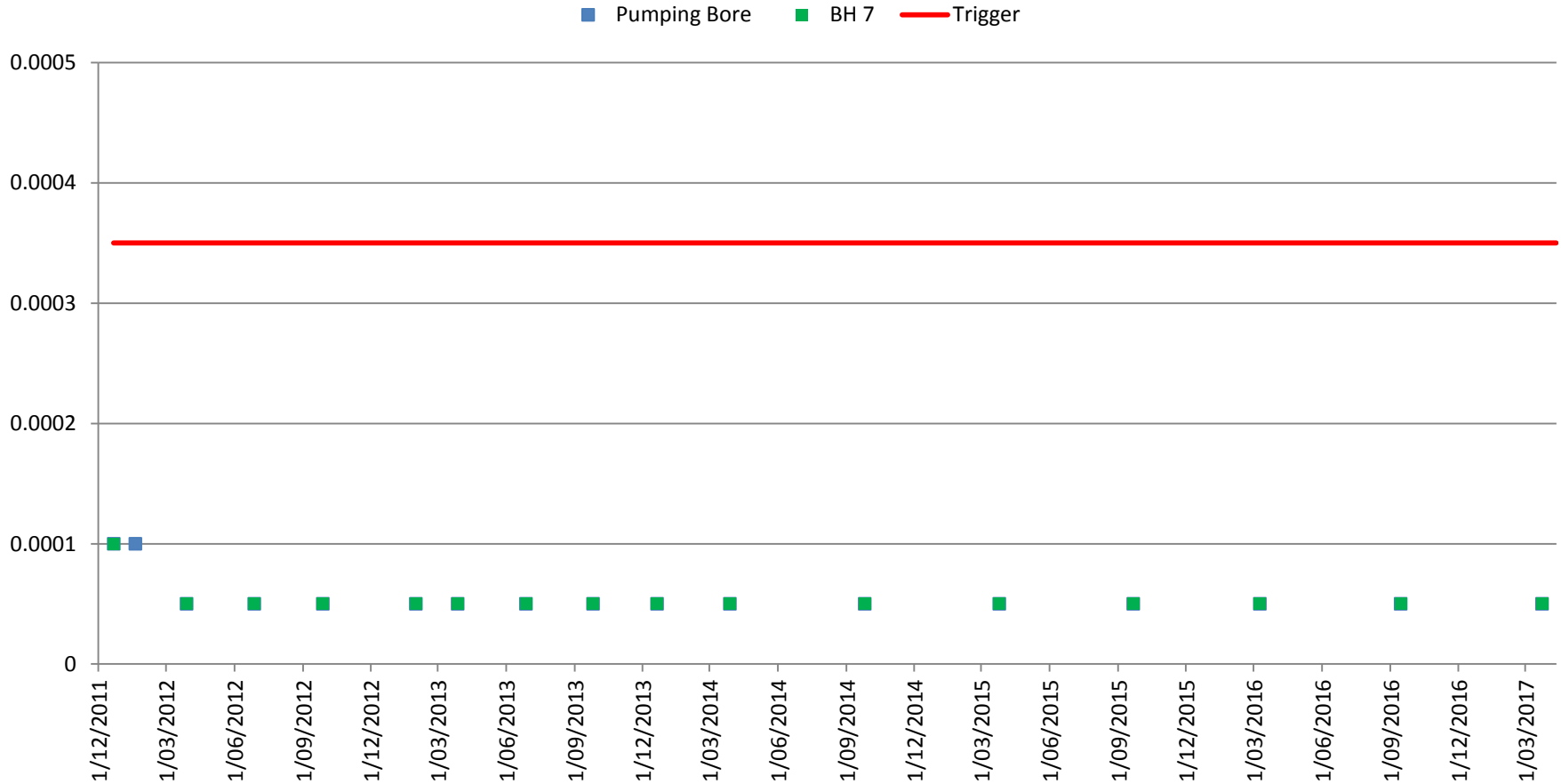


Groundwater Chemistry Results

The following figure show all the results for BaP(eq) since the commencement of sampling.

All results are in g/m³.

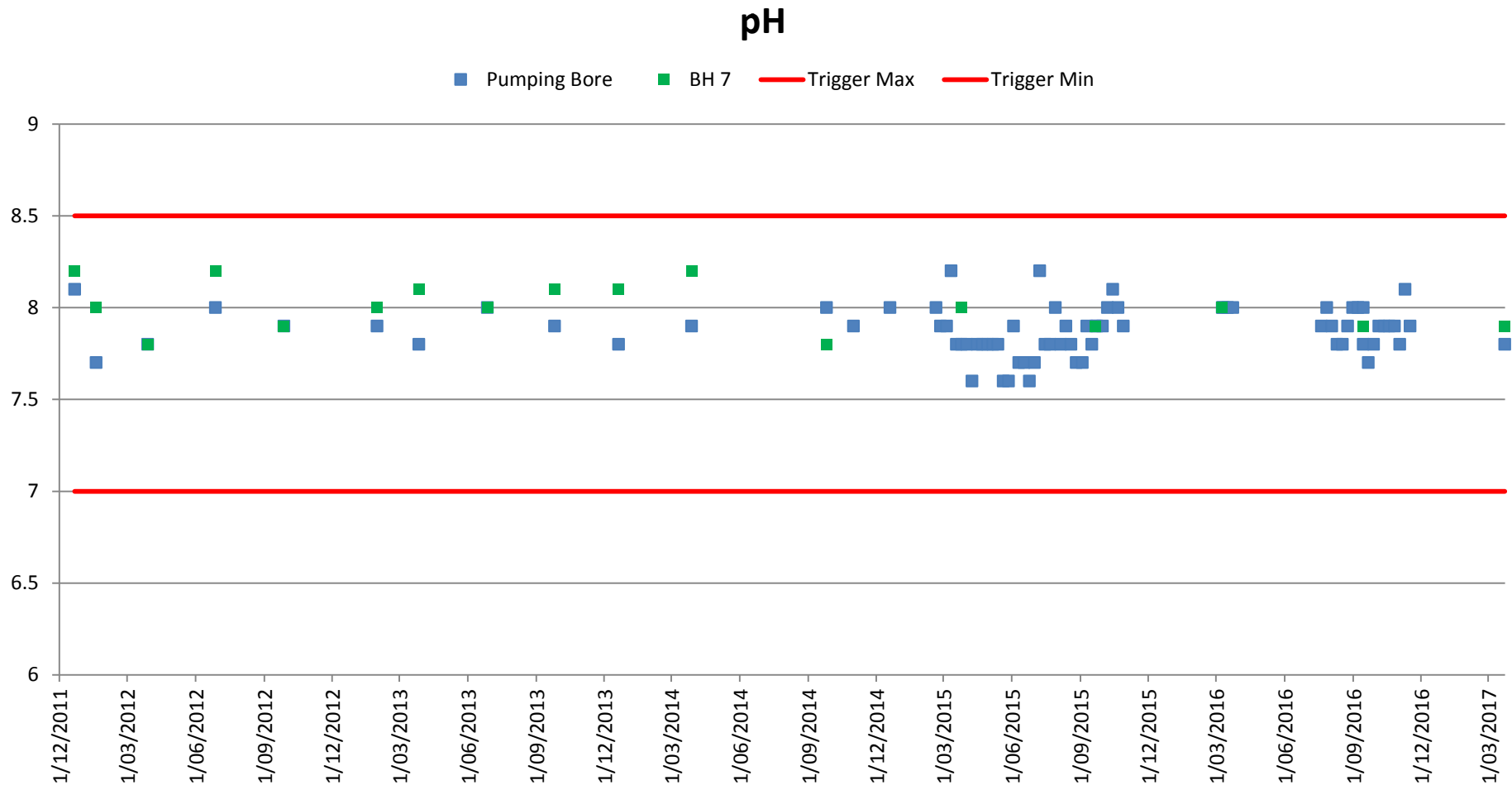
BaP (eq)



Groundwater Chemistry Results

The following figure show all the results for pH since the commencement of sampling.

All results are in pH Units

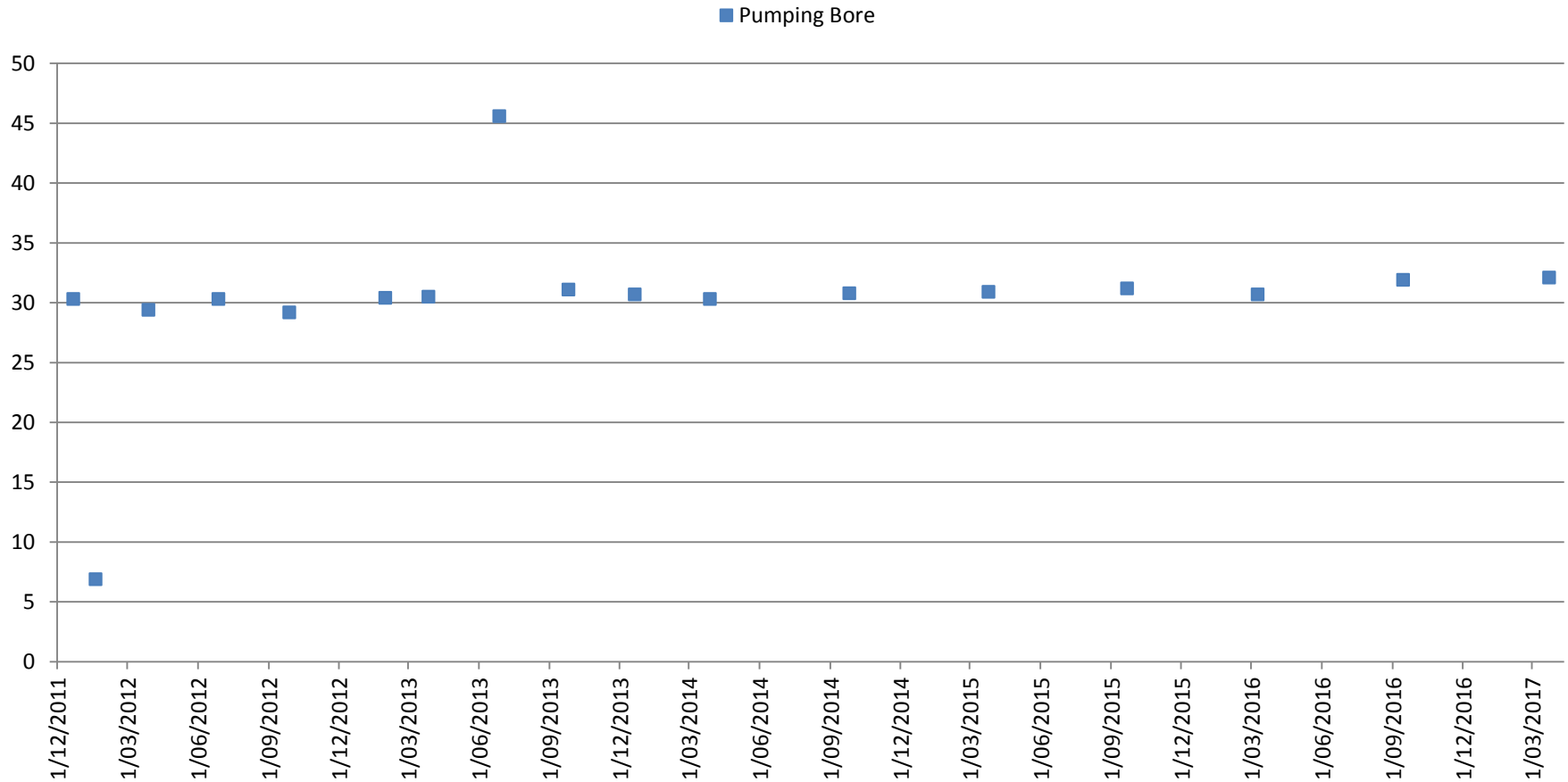


Groundwater Chemistry Results

The following figure show all the results for EC since the commencement of sampling.

All results are in mS/m.

Electrical Conductivity

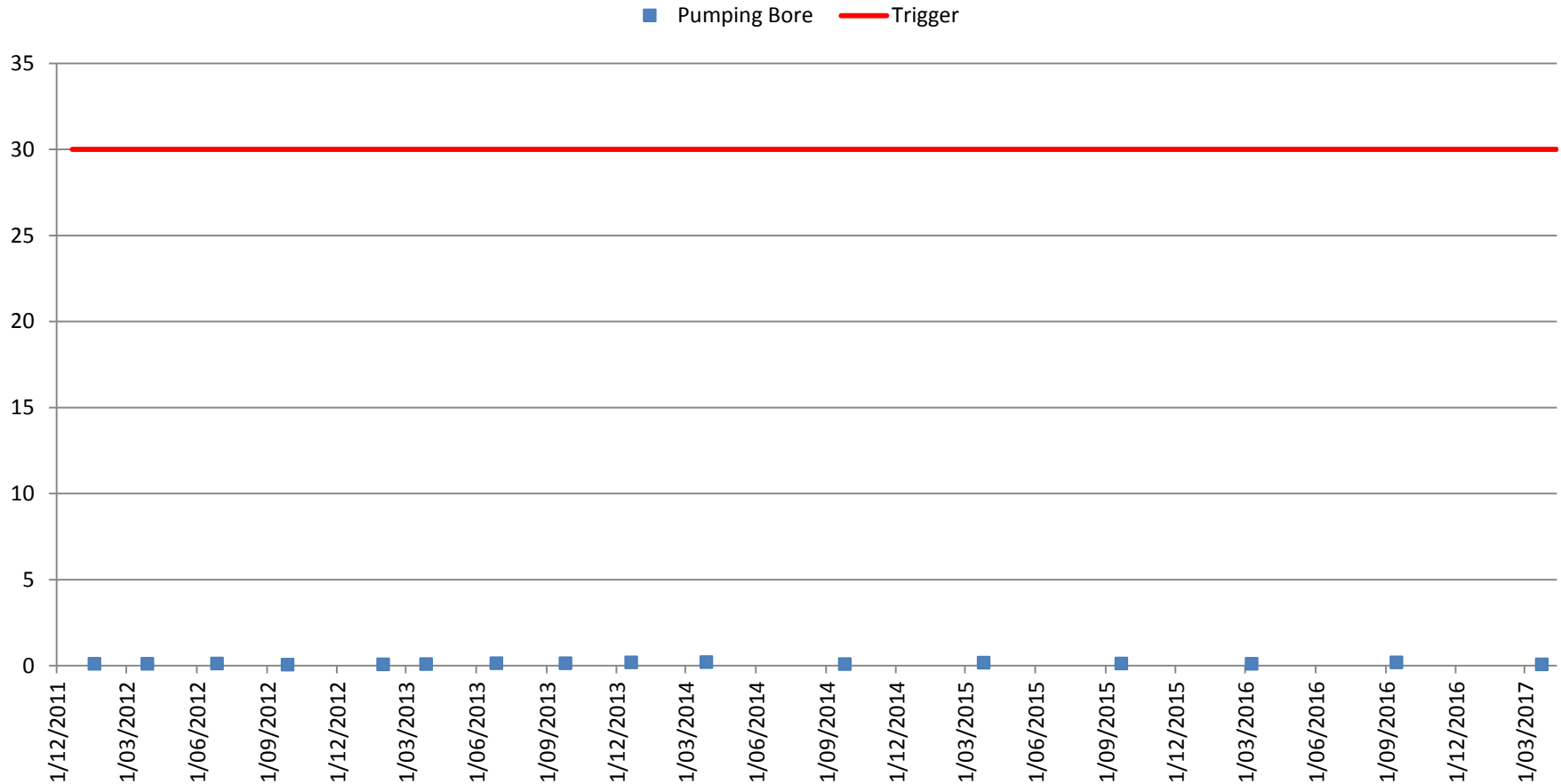


Groundwater Chemistry Results

The following figure show all the results for Turbidity since the commencement of sampling.

All results are in NTU.

Turbidity

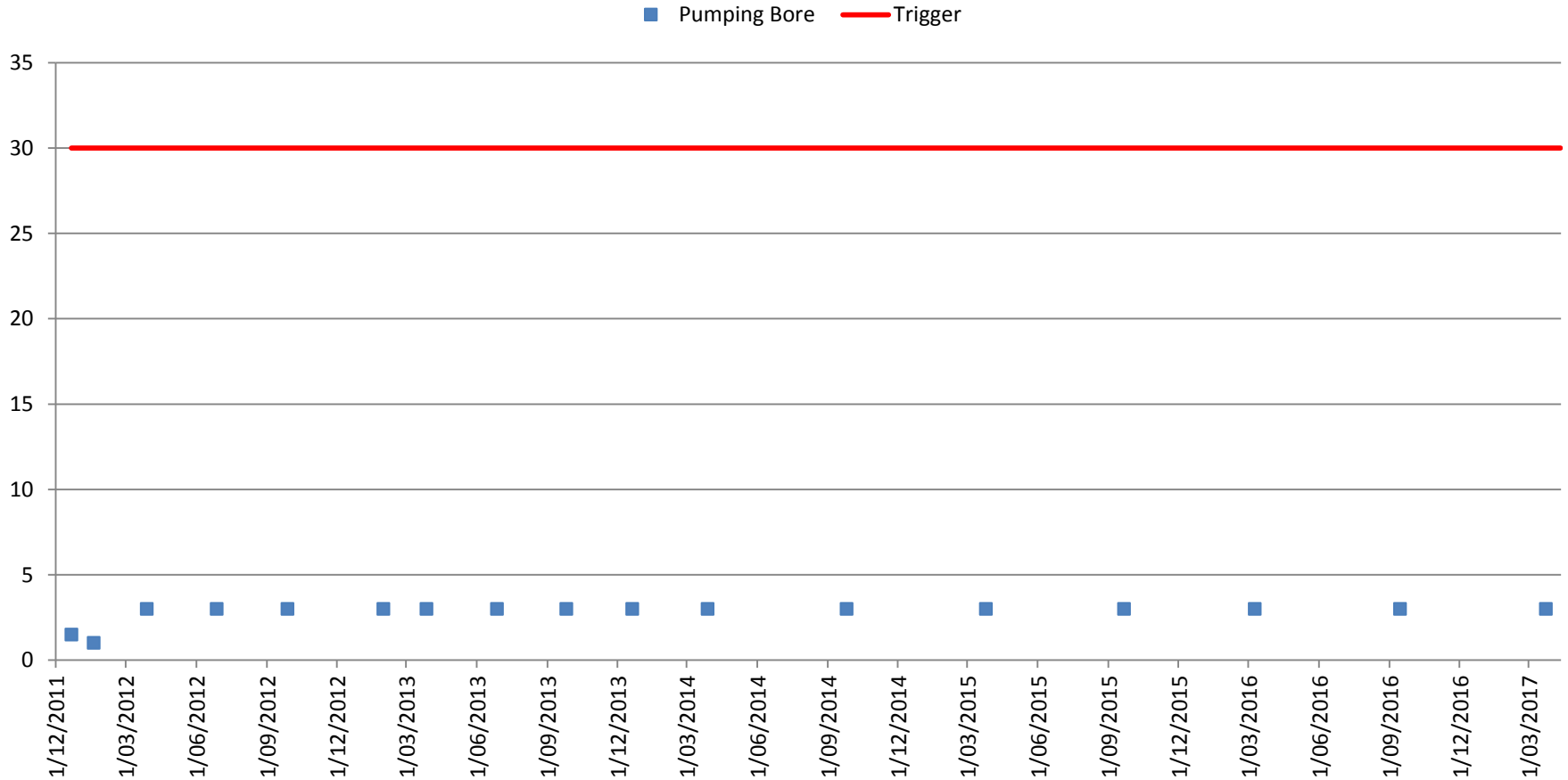


Groundwater Chemistry Results

The following figure show all the results for TSS since the commencement of sampling.

All results are in g/m³.

Total Suspended Solids

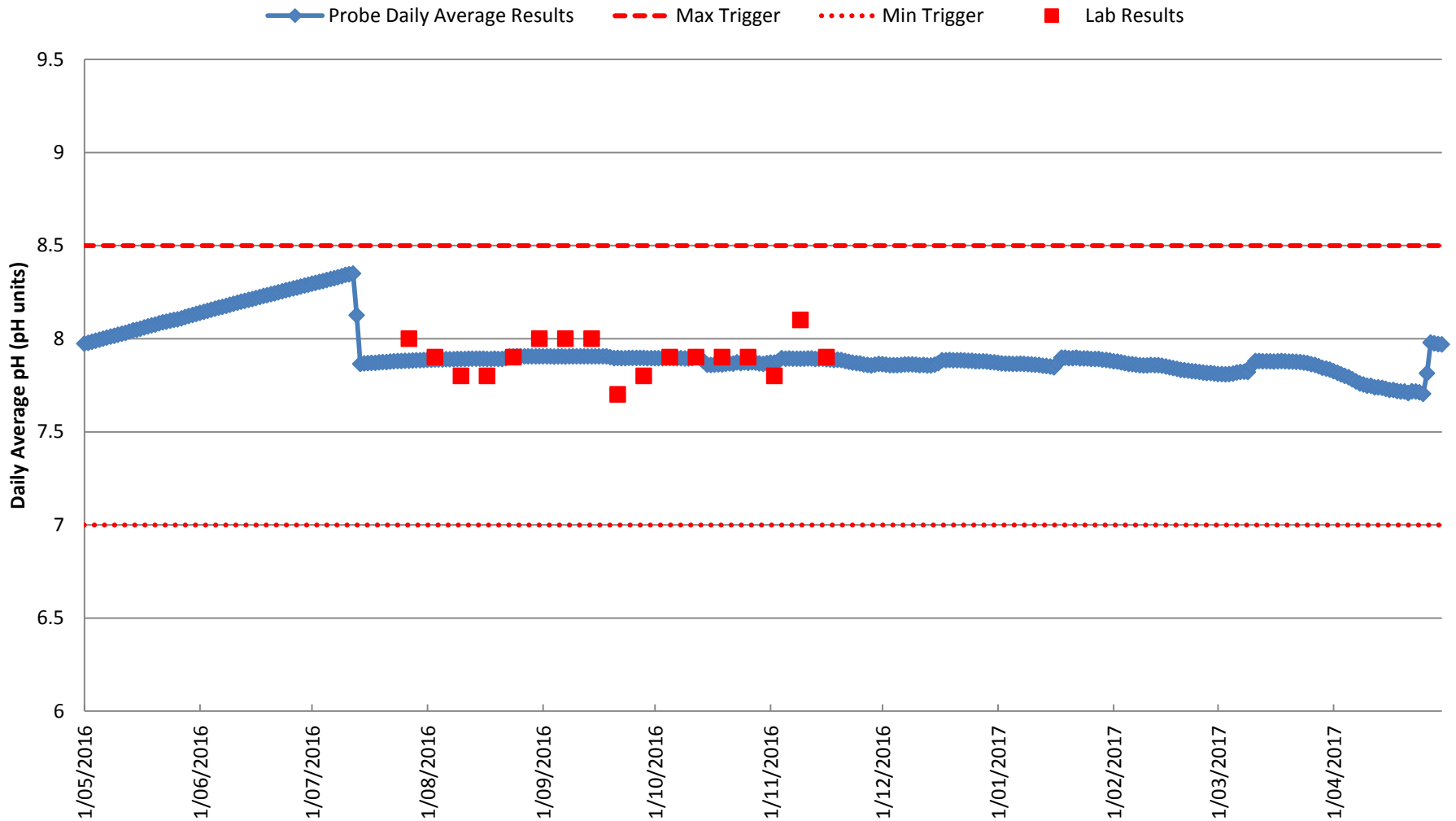


Continuous Groundwater Quality Monitoring

- Continuous monitoring of electrical conductivity and pH is required to be undertaken in the Three Kings Quarry pumping bore.
- Historically, the pH probe in particular showed an undesirable downward trend following calibration, therefore a weekly water sample was taken and sent to Hill Laboratories Ltd for analysis of pH & EC
- New pH & EC probes were installed at the Three Kings Quarry pumping bore in August 2015.
- An upward drift in pH was recorded from January 2016 to July 2016. The electrode was replaced in July 2016 and is showing much more consistent results.
- The downward spike in the EC recorded in October 2016 was investigated and found to be a result of too high a flow in the sampling vessel.

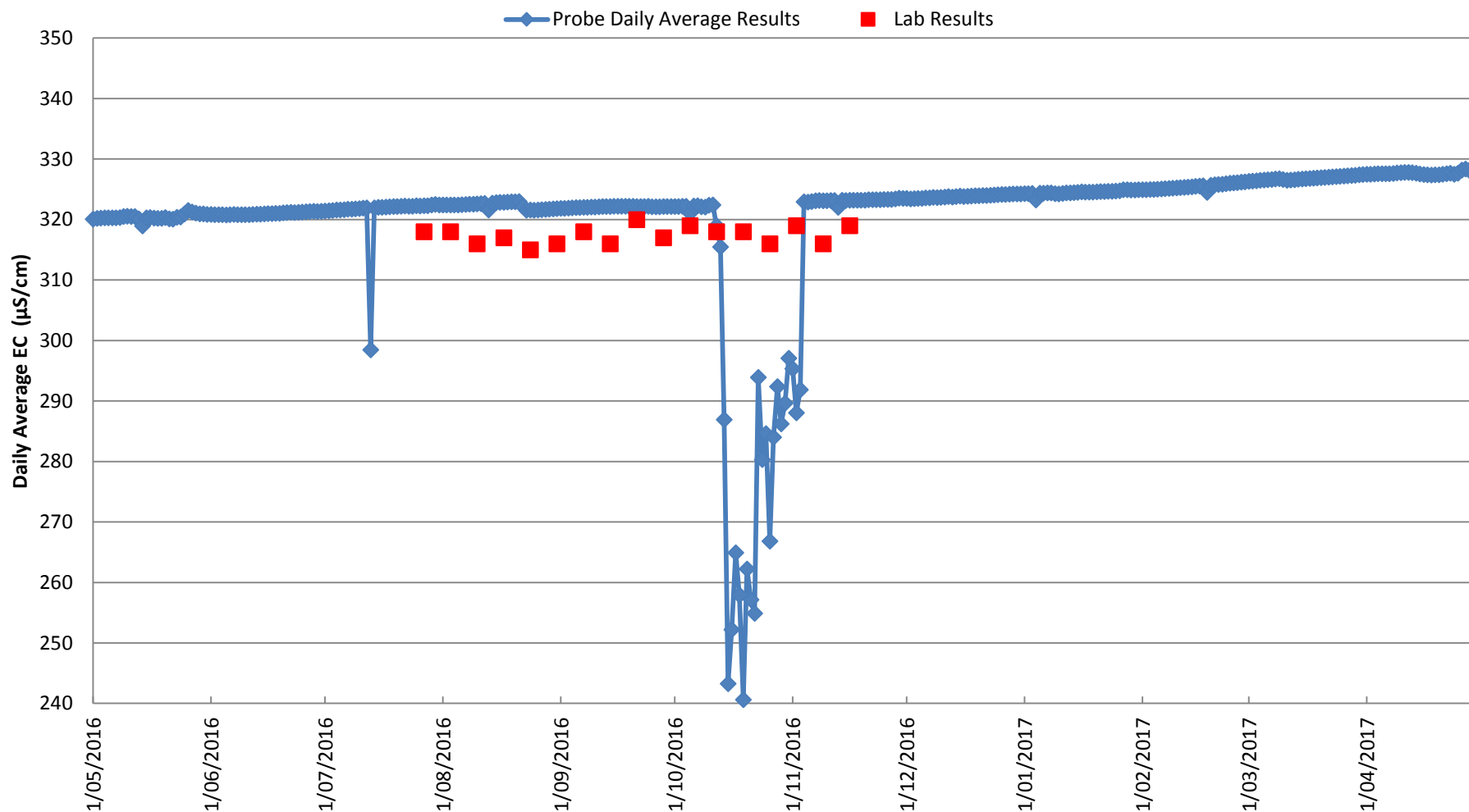
Continuous Groundwater Quality Monitoring

Average Daily pH Graph



Continuous Groundwater Quality Monitoring

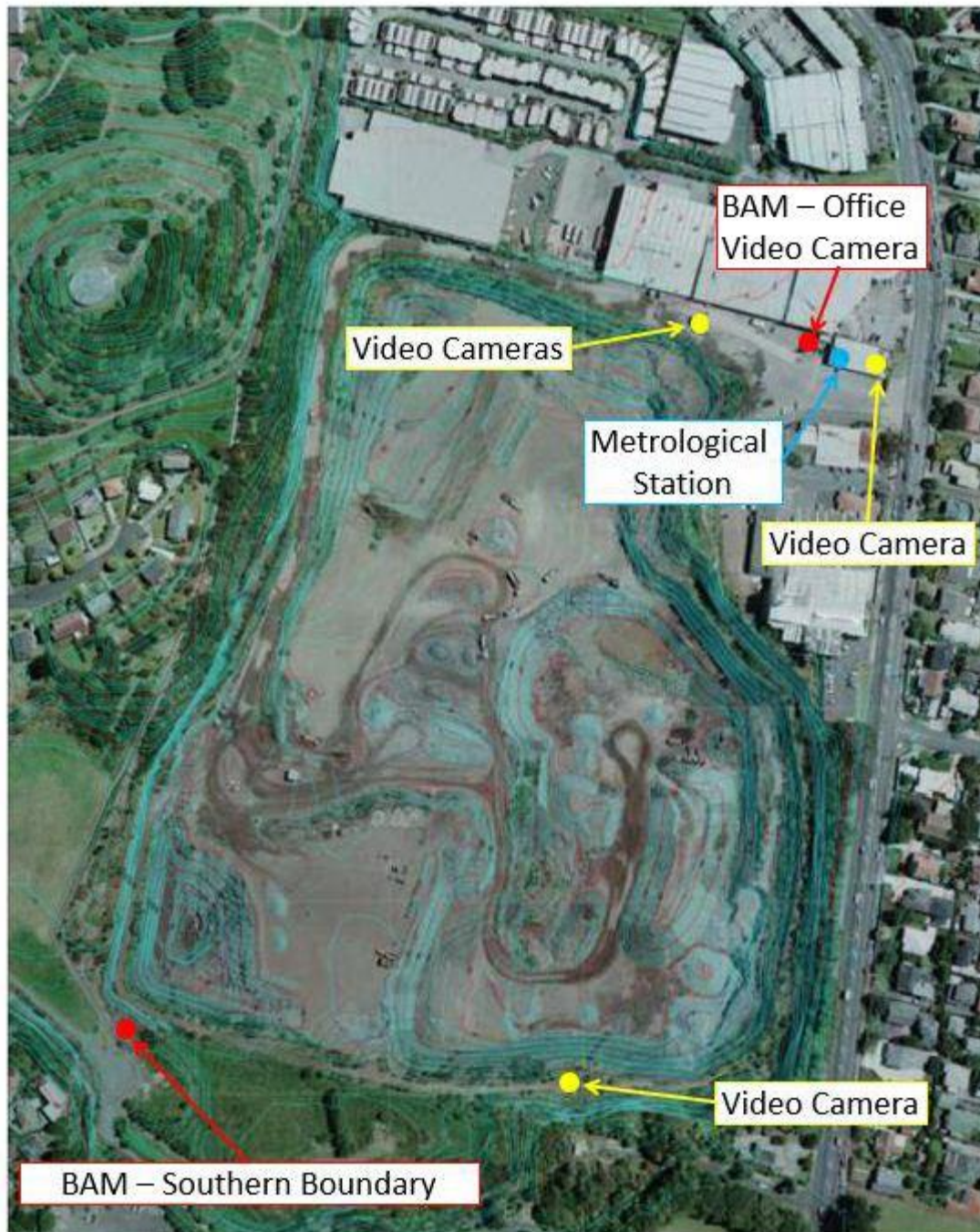
Average Daily EC Graph



Air Quality Monitoring

- Air Quality Monitoring equipment at Three Kings Quarry consists of two Continuous Real Time Beta Attenuation Monitors (BAM), time lapse video cameras and a metrological station
- The BAM monitor located on the roof of the site office has been operating since April 2008. A second BAM monitor was commissioned in April 2012 in the south-western corner of Three Kings Quarry
- The Air Discharge Consent for Three Kings Quarry was renewed in February 2015.
- The air quality trigger was changed from 80 micrograms per cubic metre as a 24hour average (all results) to 60 micrograms per cubic metre as a 24hour average as measured by the BAM units.

Air Quality Monitoring Equipment



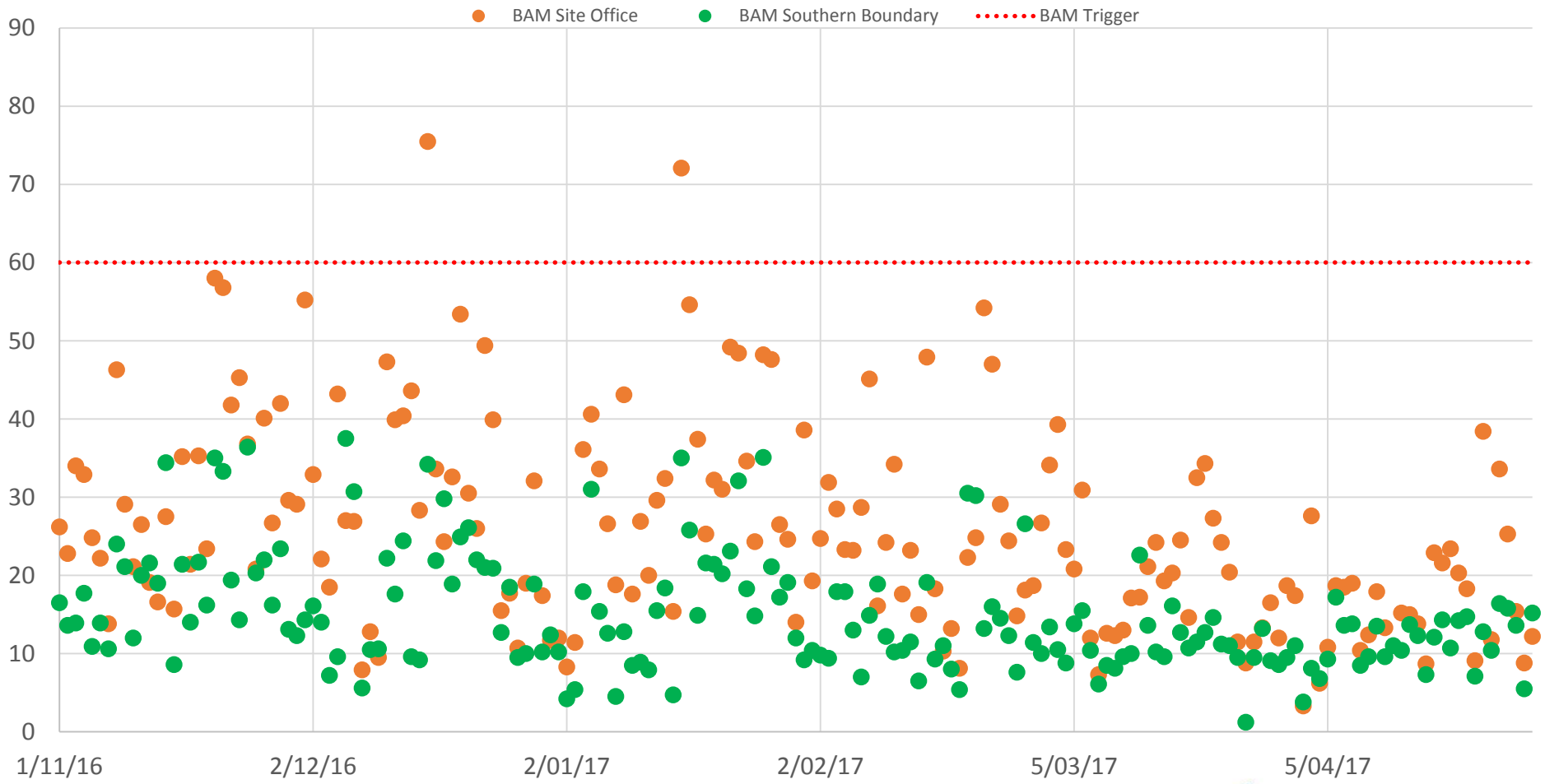
Air Quality Monitoring Results

- Continuous air quality monitoring results recorded since the last SLG meeting have been less than 40 micrograms per cubic meter as a 24 hour average
- No air quality triggers have been recorded since the last SLG meeting.

Air Quality Monitoring Results

The following figure shows air monitoring results from 1st November 2016 to 30th April 2017.

All results are in $\mu\text{g}/\text{m}^3$.



Noise Monitoring

- To ensure that the noise performance standards set in the District Plan and consents authorising filling are met, monitoring on two representative occasions per year is undertaken.
- The District Plan requires that the noise from the quarry and fill operations shall not exceed $L_{A10}55\text{dBA}$ at or within the boundary of any residential property
- The next round of noise monitoring will be undertaken in June 2017

Soakage Infrastructure ASCNMP

- As part of our filling operation, we will be undertaking soakage infrastructure works in the area indicated in red. The works involve the handling, sorting and stockpiling of rock and concrete to fill the quarry and to construct a soakage hole, enabling stormwater discharge to ground.
- In order to avoid, remedy and mitigate any adverse noise effects from the project, an Activity Specific Construction Noise Management Plan (ASCNMP) has been implemented
- The expected duration of this activity was October 2016 to June 2017 during daytime hours 8:00am – 4:00pm, Mon-Sat. Works have not yet commenced.
- The relevant noise limits for construction occurring during these hours is 70dB L_{Aeq} and 85dB L_{amax}
- You can find a copy on our website: www.threekingsquarry.co.nz under the “Management Plans & Regulatory Structure” tab.
- Alternatively, please contact Angela Klein on 027 504 3624 or angela.klein@gbcwinstone.co.nz.



Precise Level Survey

- A precise level survey of survey marks surrounding Three King Quarry is undertaken annually
- The 2017 precise level survey was undertaken in March-April 2017
- The survey marks extend from Dominion Road to the Royal Oak roundabout, from Watling Street to Carr Road.
- Results have not been received at the time this report was prepared.

**Thank you - that concludes the
May 2017 Monitoring Report**