Jacobs

Memorandum

Level 7, 177 Pacific Highway
North Sydney NSW 2060 Australia
PO Box 632 North Sydney
NSW 2059 Australia
T +61 2 9928 2100
F +61 2 9928 2444
www.jacobs.com

Subject	**SPR38 and SPR1302 Trigger Investigation**	**Project Name**	Springvale Groundwater Monitoring
Attention	Natalie Gardiner	**Project No.**	IA132000
From	Quan Bui		
Date	13 January 2021		
Copies to			

1. Introduction

This memorandum, prepared by Jacobs (Australia) Pty Ltd (Jacobs), provides notification and review of observed stepped piezometric pressure declines in aquifers above the Mount York Claystone (MYC), as observed at Vibrating Wire Piezometers (VWPs) SPR38 and SPR1302. This has been reported as a piezometric head change in accordance with the Water Management Plan Trigger Action Response Plan (TARP).

Vibrating wire piezometer sites SPR38 and SPR1302 are monitoring locations specified in the Water Management Plan. Springvale has followed the TARP process of the Swamp Monitoring Program as required under the Water Management Plan TARP.

Whilst there are no trigger levels assigned for VWPs in either the SMP or WMP for LW424-427, the SMP for LW424-427 outlines investigative measures for instances of trigger level exceedance and these have been adopted to investigate the observed stepped piezometric pressure declines at SPR38 and SPR1302. The measures include a series of checks to discern non-mining impacts from mining related impacts. This memorandum documents investigation of the observed pressure declines following an 8 week monitoring period, subsequent to the time that the initial pressure declines were observed. The investigation is undertaken in general accordance with the trigger action response plan (TARP) (Chart 1, 2 and 3) of the SMP for LW424-27 (Centennial Coal, 2018).

Anomalous stepped piezometric pressure declines at sensors located above the Mount York Claystone aquitard were observed in mid-October 2020. Springvale were notified of the occurrence by Jacobs on the 25th November 2020, following scheduled monitoring and subsequent data verification.

2. Background

Relevant groundwater monitoring locations are shown in Figure 2.1, including VWPs SPR38 and SPR1302.

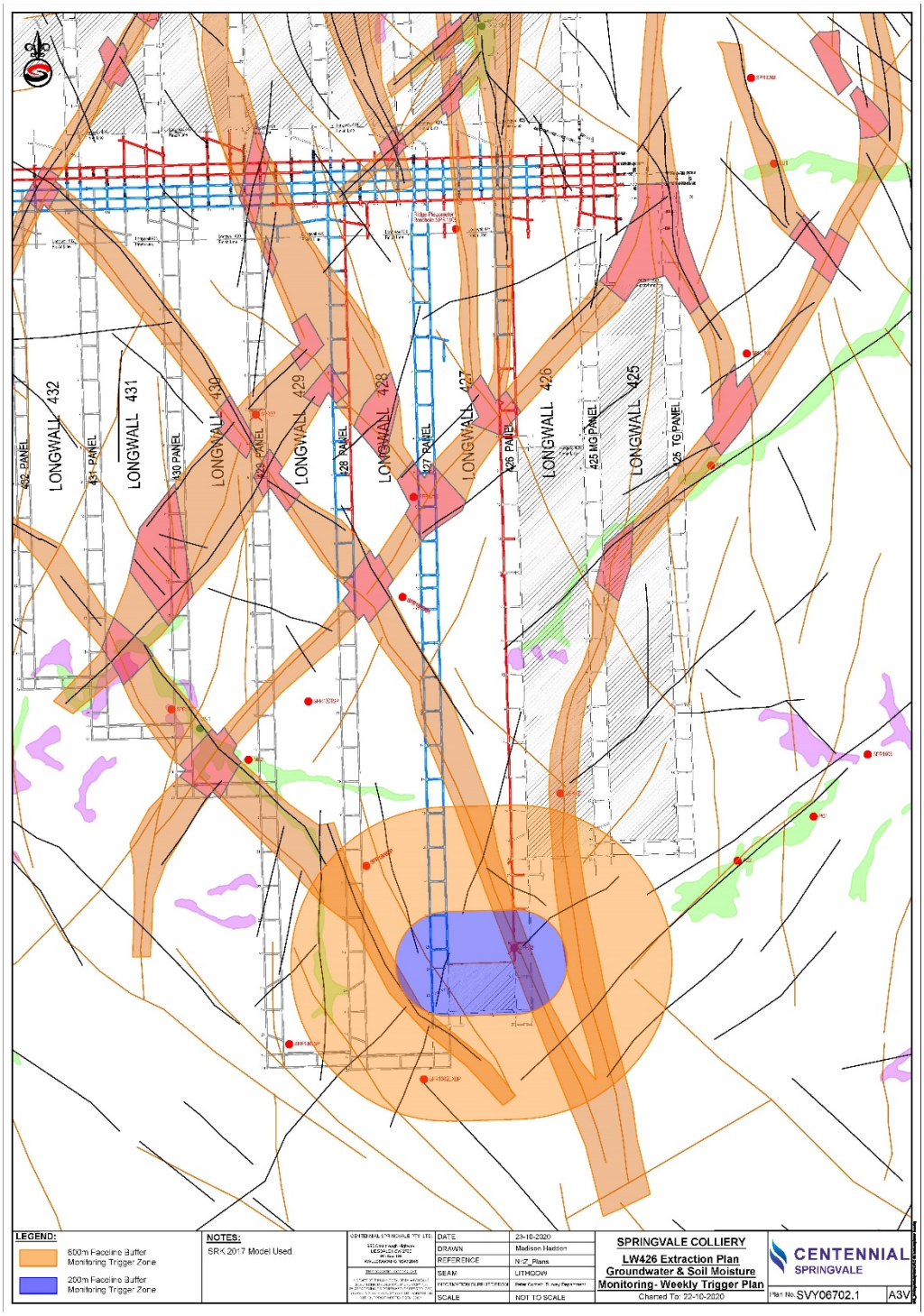

Figure 2.1: Groundwater monitoring locations

2.1 Vibrating Wire Piezometer installation and Monitoring Details

The Mount York Claystone layer separates the perched (Burralow Formation) and shallow (Bankswall Sandstone Formation) aquifer systems from the deep (Burra-Moko, Caley and Illawarra Coal formations) aquifer systems. It is believed to be an effective aquitard with an average thickness of 20m.

The Bankswall Sandstone formation and the Burralow formation, which are located above the Mount York Claystone aquitard are aquifers of note. The monitoring of the shallow aquifer systems gives insights into the propagation of subsidence impacts above the Mount York Claystone.

2.1.1 SPR38

SPR38 is located above the tailgate roadway of LW427 (Figure 2.1). It monitors multiple formations from the Bankswall Sandstone down to the Marangaroo Formation beneath the Lithgow seam. The Bankswall Sandstone formation is monitored by the upper three sensors located at 80m, 100m and 135m below ground level.

SPR38 was installed in October 2015 and is monitored by eight sensors. Data is downloaded monthly.

2.1.2 SPR1302

SPR1302 is located approximately 100m south of LW427 over an unmined section (Figure 2.1). It monitors multiple formations from just below the Mount York Claystone (MYC) down to the Lithgow seam. SPR1302 does not include monitoring above the Mount York claystone but it does monitor the upper section of the Burra-Moko Head formation, immediately below the MYC at a depth of 200m below ground level.

SPR1302 was installed in December 2013 and is monitored by five sensors. Data is downloaded monthly.

2.2 Mining Period

Mining in LW427 commenced on 28 September 2020 with the longwall face advancing northward.

2.3 Initial Notification to Centennial of Occurrence

Groundwater data was downloaded routinely (typical monthly interval) and subsequently processed by Jacobs in early November 2020. An abnormal piezometric pressure decline in the upper aquifer was observed to occur at SPR38 in late October 2020 and Centennial was notified on 25th November 2020. A corresponding decline was observed at SPR1302 at the base of the MYC.

3. Centennial Actions Following Notification

The approved SMP TARP Charts 1 to 3 are attached to this letter for reference.

SMP TARP Chart 2 requires that "*If a trigger level or exceedance is identified the following Management Measures are to be carried out within 2 months*":

- *Check anomalous data for accuracy.*
- *Determine whether similar triggers were activated at reference sites.*
- *Identify anthropogenic/ natural impacts responsible.*
- *Review monitoring result in the light of any abnormal weather conditions.*
- *Was active mining within 600 m?*
- *Was there evidence of mining related impacts?*

SMP TARP Chart 3 requires additional investigation to:

- Check exceedances of secondary performance indicators (any significant change in groundwater level not related to recent meteorological conditions or any significant change in groundwater level relative to groundwater level behaviour at reference sites during the same period). This section is covered in Chart 2.
- Check for anthropogenic or natural causes of the anomalous data. This section is covered in Chart 2.
- Carry out field inspections to determine extent and causes.
- Consider additional or more frequent monitoring.

Centennial have implemented relevant Management Measures required under Chart 2 and 3 within the required timeframe. A six month trigger Investigation follow up will review the current conditions in light of new data.

4. Vibrating Wire Piezometer hydrograph response summary

4.1 SPR38

Figure 4.1 present the hydrograph of SPR38 with the vertical dotted line representing the start of LW427. Based on VWP data at SPR38, the upper aquifer above the Mount York Claystone at this location was first observed to depressurise from 20th October 2020. The response occurred when LW427 was within 50m of SPR38. Based on data up to 1 December 2020, compared to the pressures before the decline, Sensor #1 has recorded a 14m decrease and has become unsaturated, so the full magnitude of the pressure decline at Sensor #1 cannot be assessed; Sensor #2 has recorded a 31m decrease in pore pressure; Sensor #3 has recorded a 45m decrease, Sensor #4 has recorded a 35m decrease, Sensor #5 has been unsaturated since installation, Sensor #6 was unsaturated since 2019 under LW425; and communication was lost with Sensors #7 and #8. It is noted that pressures at Sensor #4 have stabilised and pressure declines at Sensors #2 and #3 have slowed.

Previously, a depressurisation response was observed at SPR38 in the lower three sensors close the Lithgow seam during the heading development for LW427 in April 2019. This was a direct response to the headings passing very close to the sensors and not a widespread mining response. No other sensors were affected in this period.

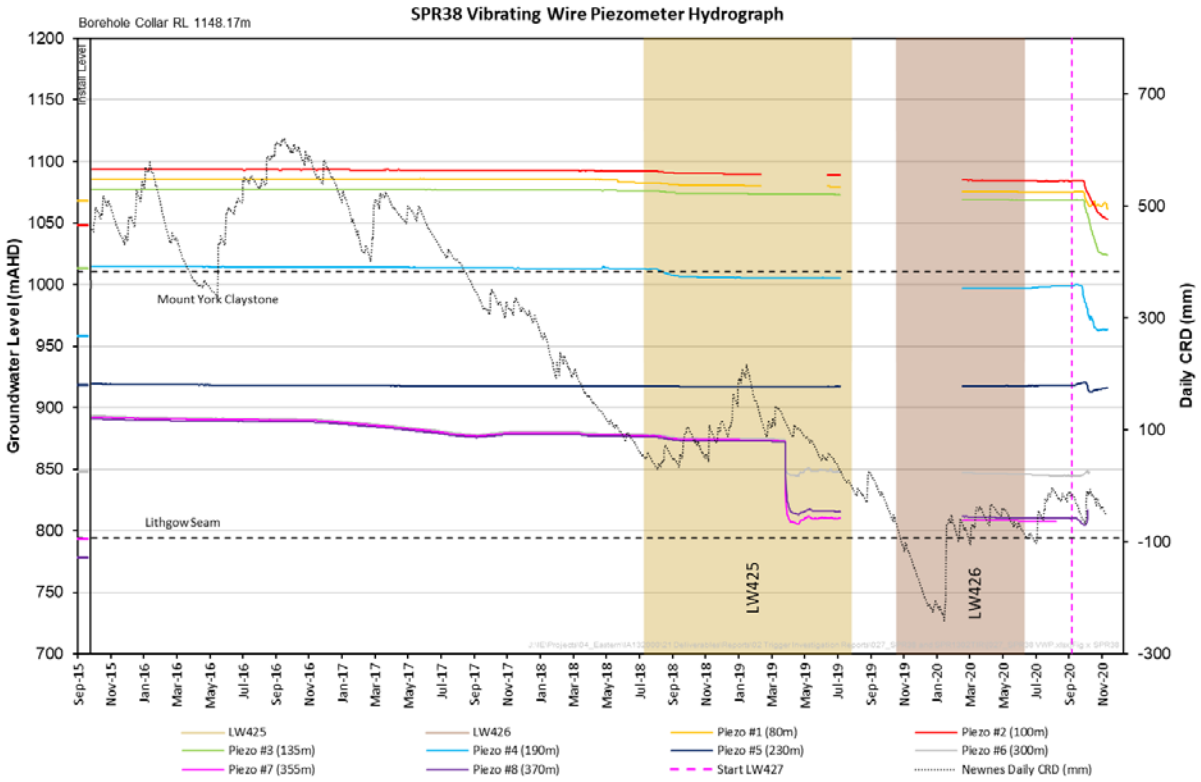

Figure 4.1: SPR38 Hydrograph

4.2 SPR1302

Figure 4.2 present the hydrograph of SPR1302 with the vertical line representing the start of LW427. Depressurisation of the upper sensor located just below the Mount York Claystone was observed on 16 October 2020. The response occurred after LW427 was at its closest point to SPR1302 and as it was moving away. The upper (Sensor #5) has recorded a decline of 14.4m since the observation was made. The decline has appeared to stabilise and is currently recording stable pore pressures.

Previously, SPR1302 has recorded depressurisation responses during the extraction LW425 between April and September 2019 and during LW426 in April 2020 in the lowest two sensors located close to the Lithgow seam. Both these longwalls were over 600m away from SPR1302 when these observations were made.

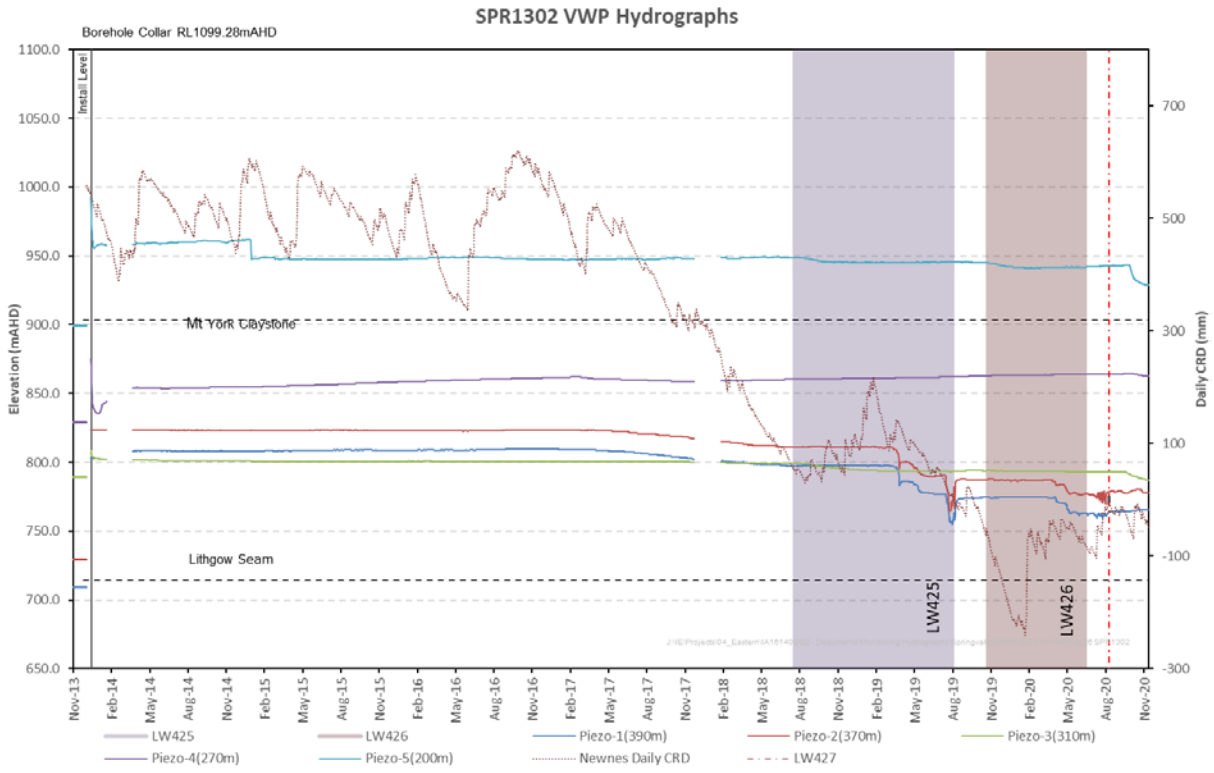

Figure 4.2: SPR1302 Hydrograph

5. Summary of Actions Conducted (SMP TARP LW424-427)

5.1 Check anomalous Data for Accuracy

The data collected from the loggers was reviewed. The continuous decline and the similar observations at other sensors do not indicate the data is erroneous.

5.2 Determine whether similar triggers were activated at reference sites

In the LW424-427 SMP (Centennial Coal 2018) reference sites are those sites that will not be encroached upon by the area of disturbance (AOD) or occur within the trigger investigation area (TIA). Details of reference Vibrating Wire Piezometers are as follows:

- **AP10PR** –. There are nine sensors covering the shallow Bankswall Sandstone formation down to the Lithgow Seam. Monitoring began at AP10PR in May 2010.
- **SPR37 –** Located above the LW429 header in an area that is currently unmined. There are eight sensors covering the shallow Bankswall Sandstone formation down to the Lithgow seam. Monitoring began at SPR37 in June 2010.

At AP10PR, the two upper sensors monitor the Bankswall Sandstone Formation. Sensor #9 located 44mbgl in the Bankswall sandstone recorded stable pore pressures, fluctuating less than 0.14m between the start and end of the period. Sensor #8 located 72mbgl in the Bankswall sandstone also recorded stable pore pressures fluctuating less than 0.13m in the period.

At SPR37, the upper 3 sensors monitor the Bankswall Sandstone formation. Sensors #8, #7 and #6 are installed at depths of 100m, 135m and 165m respectively. Sensors #8 and #7 recorded less than a 0.4m fluctuation in this period. Sensor #6 is recording erroneous data.

In summary, both reference sites displayed stable pore pressures over the period from 20 October 2020 to 1 December 2020.

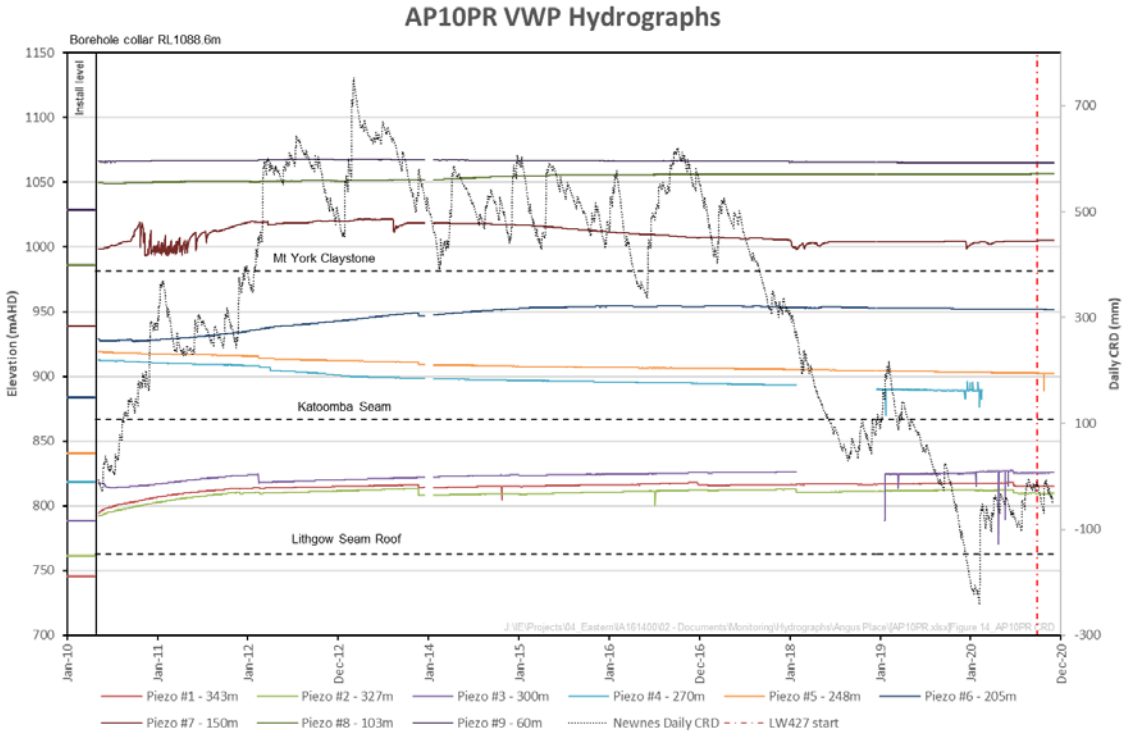

Figure 5.1: AP10PR hydrograph

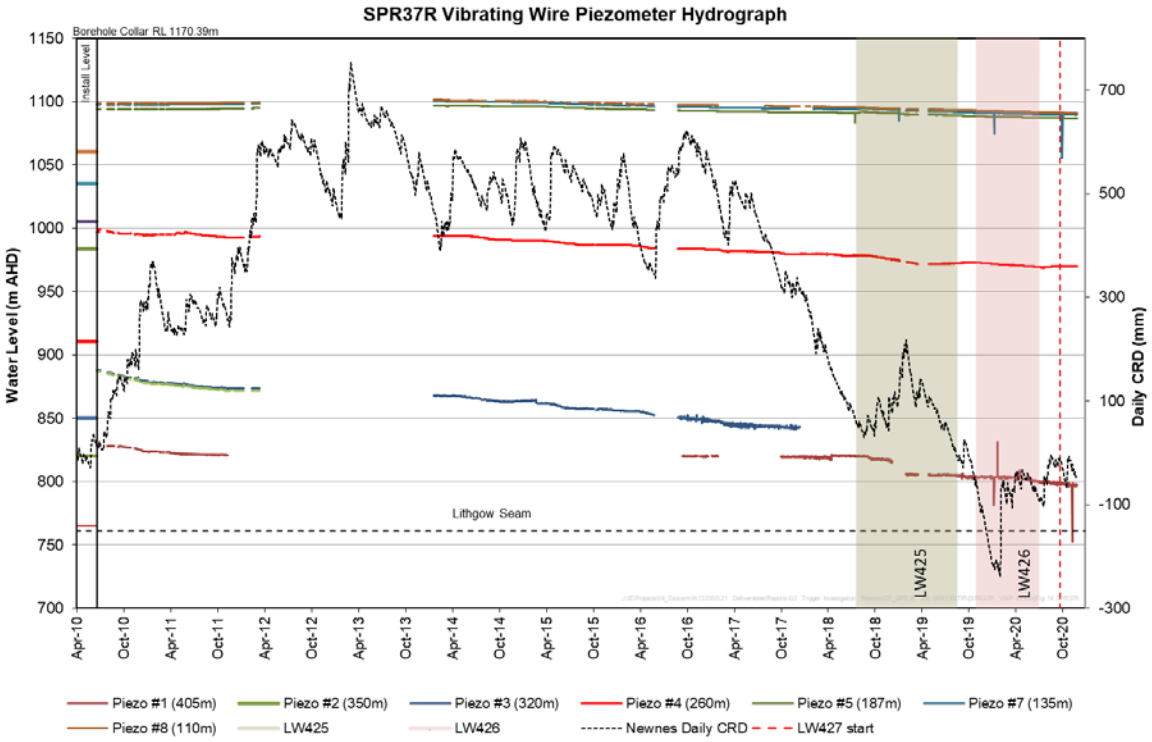

Figure 5.2: SPR37 hydrograph

5.3 Identify Anthropogenic/ Natural impacts responsible?

No other anthropogenic or natural impacts have been identified.

Natural groundwater level movements in the aquifers in the Newnes plateau are generally very slow and subdued. It is highly unlikely that the observed stepped pressure declines are due to natural causes.

5.4 Review monitoring result in the light of any abnormal weather conditions

There have been no abnormal weather conditions. The recent Gospers Mountain Bushfire in 2019/2020 would not have had a significant impact on the deeper groundwater levels.

5.5 Was active mining within 600m

At SPR38, the longwall face was encroaching and active mining was approximately 50m away when the observations were made

At SPR1302, the longwall face was moving away and active mining was approximately 500m away when the observations were made.

5.6 Was there evidence of mining related impacts

It is apparent that the observed declines are a direct response to longwall subsidence. The timing and position of the longwalls has a clear correspondence to the piezometric pressure changes and these pressure declines were not observed at the reference sites. The piezometric pressure declines are consistent with the impacts from mining from previous longwalls.

At SPR38, the piezometric pressure declines are still continuing at Sensor #2 and #3. It is noted that the stabilisation of pressures at Sensor #4 would indicate that the decline was due to fracture dilation and bed separation as opposed to connective fracturing. Mining is still in close vicinity to SPR38 and it will take some time before groundwater pressures stabilise and a conclusion is drawn.

At SPR1302, the response is consistent with groundwater re-equilibration resulting from bed separation and increased storage above LW427. At this point in time, vertical fracturing from the goaf and deep drainage to the deeper aquifer is not evident

5.7 Carry out field inspections to determine extent and causes

A field assessment and data download were carried out in December 2020. There were no recent faults with either VWP systems.

5.8 Consider additional or more frequent monitoring

The current monitoring program is considered adequate as data is logged continuously at daily intervals.

6. Conclusion

Actions have been carried out according to Chart 2 of the LW424-427 SMP.

In October 2020, the upper aquifers at SPR38 and SPR1302 have displayed anomalous stepped declines in piezometric pressures while LW427 was within 600m of the sites.

SPR38 shows significant depressurisation, most likely due to fracture dilation and bed separation caused by subsidence. Piezometric pressures at several sensors at SPR38 are still in decline.

At SPR1302, the hydrograph shows groundwater pressures have re-equilibrated with subsided formations located above LW427. There is no evidence of continued decline associated with vertical fracturing or deep drainage at this point in time.

7. Proposed Action Plan

The following actions are recommended:

- Continued monitoring as per Chart 3 of the SMP for LW424-7
- Monitor groundwater extraction rates from the Springvale mine.

8. References

Centennial Coal . (2017). *Subsidence interactions with geological fault zones and groundwater systems at Springvale Mine.*

Centennial Coal. (2018). *Swamp Monitoring Program for LW424 to LW427.*