

# Preston New Road

## Groundwater monitoring

March 2017

Operators are required to submit baseline monitoring data to us prior to shale gas exploration taking place. The type and period of monitoring required depends on the risks from specific site activities and the local hydrogeology. All monitoring must be carried out by companies accredited by our Monitoring Certification Scheme (MCerts).

### Preston New Road monitoring

In winter 2016, Cuadrilla completed the first five months of groundwater quality sampling from four shallow groundwater monitoring boreholes on the perimeter of well pad.

The information supplied will allow us to compare the water quality from pre development of the site (background) with the continuous monthly monitoring that is required throughout the progression of construction, drilling, hydraulic fracturing and completion of the 4 deep boreholes proposed on this site. Appendix 1 shows a map of the borehole locations.

### Results

Cuadrilla tested the samples taken for a wide range of substances, as required by the permit. The full list of substances and the results of the analysis can be seen in appendices 2 and 3.

We have included an assessment sheet with an initial interpretation of the data below. This is not our complete assessment. The results showed that the water quality for the shallow aquifers is as we would have expected for shallow groundwater in this location; which might be affected by agriculture. Groundwater in this location is not used for drinking water.

The data shows

- Naturally occurring Barium at values that exceed Drinking Water Standards (DWS)\*
- Total Dissolved Iron is seen in excess of the Environmental Quality Standard (EQS)\* which is commonly found in the near surface waters in this area.
- Ammonia (NH4) is found higher than the EQS in the lower aquifer
- Gasoline Range Organics (GRO) exceed the levels of detection in both aquifers, and is probably a result of farming activities in the area.
- Natural background values of dissolved methane are seen in the lower aquifer borehole 1.

The below ground shallow aquifer is divided into an upper (A) and lower (B) horizon. Borehole 3 was not sampled until September due to sampling response issues relating to the design of the borehole.

### Future monitoring

Cuadrilla will be sampling these holes monthly as required under the Permit conditions, with the information being forwarded to the Environment Agency every 3 months. The sampling programme will be reviewed regularly and can be adjusted if we think we need to change the monitoring frequency. Ad hoc samples may be taken during site inspections if required.

We will regularly update our Citizen Space page with the monitoring results.

- DWS – standards that are set to protect public health.
- EQS – presence of substances in surface water identified as priority substances based on their risk to the environment.

# Environment Agency Assessment sheet

Background monitoring is needed to get a picture of the environment around the site before any drilling takes place. The table below shows the maximum and minimum values recorded during the sampling period. Each of the substances were assessed as a comparison to those covered by EQS and DWS. Where levels exceed the standards in these results it doesn't represent a breach of permit. Groundwater in this location is not used for drinking water. The standards are included to provide a reference only.

This data will help us to identify any changes in the future.

|                         | EQS/DWS | Units | Upper (A)   | Lower (B)     |
|-------------------------|---------|-------|-------------|---------------|
| Aluminium               | 200     | µg/l  | 20          | 20            |
| Antimony                | 5       | µg/l  | 2           | 2             |
| Arsenic                 | 50      | µg/l  | 2.5 – 11.8  | 2.5 – 18.8    |
| Barium                  | 100     | µg/l  | 40 - 237    | 51 - 332      |
| Beryllium               | N/A     | µg/l  | 0.5         | 0.5           |
| Boron                   | 2000    | µg/l  | 25 -57      | 33 -50        |
| Cadmium                 | N/A     | µg/l  | 0.5         | 0.5           |
| Calcium                 | N/A     | µg/l  | 109.7 - 123 | 100.5 – 122.8 |
| Chromium T              | 50      | µg/l  | 1.5         | 1.5           |
| Cobalt                  | N/A     | µg/l  | 2           | 2             |
| Copper                  | 28      | µg/l  | 7           | 7 - 22        |
| TD Iron                 | 1000    | µg/l  | 20 - 2012   | 20 - 3472     |
| Lead                    | 250     | µg/l  | 5           | 5             |
| Lithium                 | N/A     | µg/l  | 8 - 18      | 7 - 17        |
| Magnesium               | N/A     | µg/l  | 32.1 – 38.4 | 31.4 – 37.8   |
| Mercury                 | 1       | µg/l  | 1           | 1             |
| Nickel                  | 200     | µg/l  | 2           | 2 - 5         |
| Potassium               | N/A     | mg/l  | 1.6 – 3.2   | 1.7 – 3.7     |
| Selenium                | 10      | µg/l  | 3           | 3             |
| Silver                  | N/A     | µg/l  | 5           | 5             |
| Sodium                  | 200     |       | 25.5 – 42.3 | 25.1 – 53.1   |
| Strontium               | N/A     | µg/l  | 219 -565    | 264 - 635     |
| Vanadium                | 60      | µg/l  | 1.5         | 1.5           |
| Zinc                    | N/A     | µg/l  | 0 - 33      | 0 - 28        |
|                         |         |       |             |               |
| Fluoride                | 1500    | mg/l  | 0.3         | 0.3           |
| Bromide                 | N/A     | mg/l  | 0.05 – 0.14 | 0.05 – 0.14   |
| Chloride                | N/A     | mg/l  | 24.6 – 82.6 | 43.2 – 63.8   |
| Nitrate NO <sub>3</sub> | 50000   | mg/l  | 0.2 – 40.3  | 0.2 – 2.9     |
| Nitrate NO <sub>2</sub> | 500     | mg/l  | 0.02 – 0.7  | 0.02 – 0.11   |
|                         |         |       |             |               |
| NH <sub>4</sub>         | 0.1     | mg/l  | 0.03 – 0.06 | 0.03 – 0.41   |
|                         |         |       |             |               |
| Methane                 | N/A     | mg/l  | 0.01 – 0.02 | 0.01 – 1.66   |
| Acrylamide              | N/A     | µg/l  | 50          | 50            |
|                         |         |       |             |               |
| GRO C4-C12              |         | µg/l  | 10 - 101    | 10 - 97       |
|                         |         |       |             |               |



Drinking Water Standards

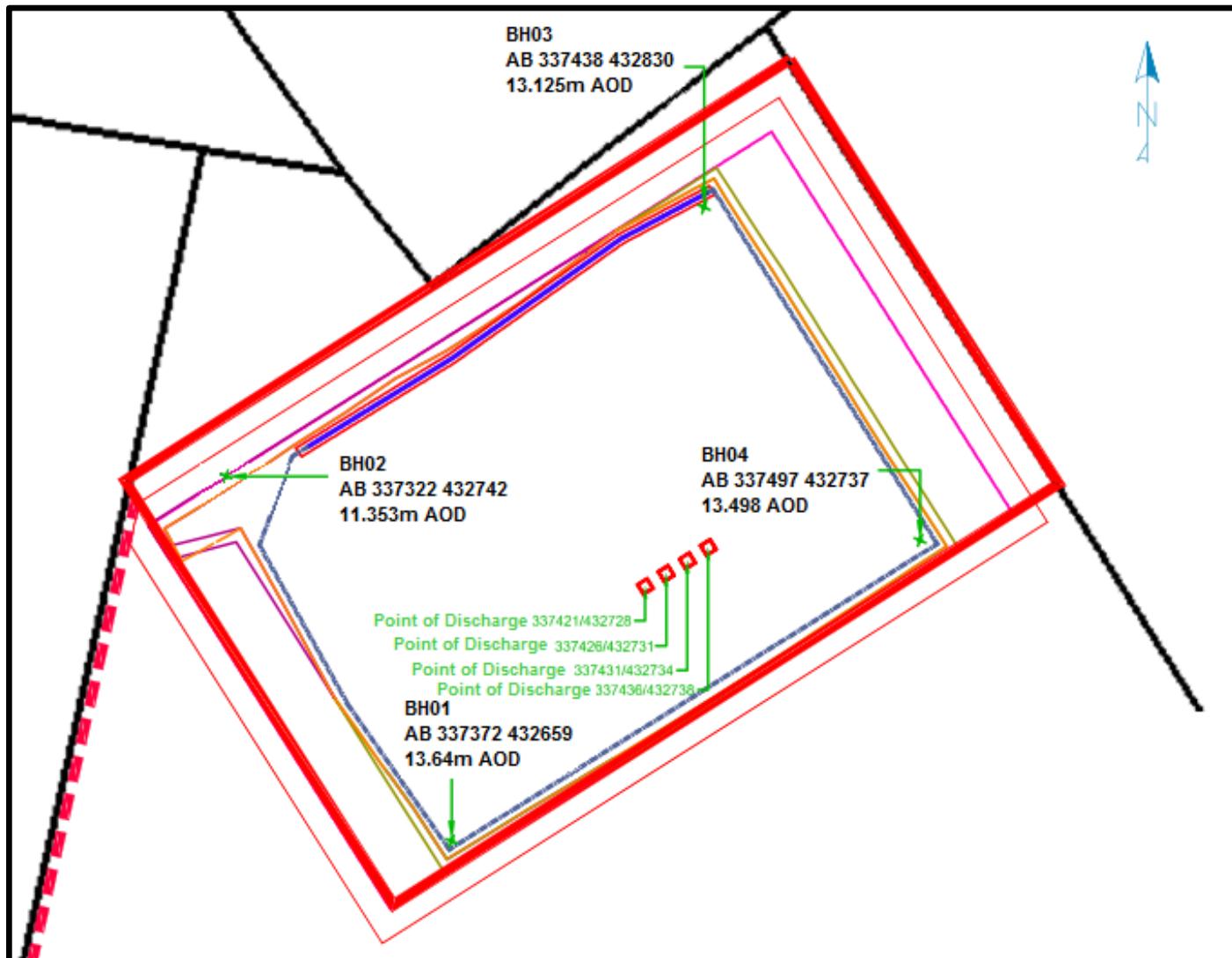


Environmental Quality Standards



Exceeded standards

## Appendix 1 – Borehole locations



## **Appendix 2 – Determinants required by environmental permit**

The Operator shall undertake at least 3 samples of groundwater from each monitoring borehole and 3 samples of surface water. Sampling, as a minimum, must include the parameters listed below and shall be carried out monthly over a minimum period of 3 months prior to the commencement of the drilling of injection wells. The results of the groundwater and surface water monitoring shall be submitted to the Environment Agency.

| Parameter                               | Parameter  |
|---|--|
| Acrylamide                              | Dissolved Ethane   |
| Alkalinity (Total) as CaCO <sub>3</sub> | Dissolved Methane  |
| Ammoniacal Nitrogen as N                | Fluoride   |
| Arsenic                                 | Iron (Total)   |
| Aluminium                               | Lead   |
| Antimony                                | Lithium  |
| Barium                                  | Magnesium  |
| Beryllium                               | Mercury  |
| BOD (settled)                           | Nickel   |
| Boron                                   | Nitrate as NO <sub>3</sub>   |
| Bromide                                 | Nitrite as NO <sub>2</sub>   |
| $\delta^{13}\text{C-CH}_4$              | pH   |
| $\delta^{13}\text{C-CO}_2$              | Potassium  |
| Cadmium                                 | Salinity   |
| Calcium                                 | Selenium   |
| Carbon Dioxide                          | Silver   |
| Chloride                                | Sodium   |
| Chromium (Total)                        | Strontium  |
| Cobalt                                  | TPH including Benzene, DRO (nC <sub>10</sub> to nC <sub>24</sub> ), GRO (nC <sub>5</sub> to nC <sub>10</sub> ), m/p Xylenes, o Xylene, MTBE, Toluene, Xylene, Ethyl Benzene. |
| COD (settled)                           | Total dissolved solids   |
| Copper                                  | Total suspended solids   |
| Dissolved Butane                        | Vanadium   |
| Dissolved Propane                       | Zinc   |

## **Cuadrilla sampling results**

You can view Cuadrilla's raw data below. In this you will notice that for some parameters the same figure is duplicated across each sample period. These indicate that the substance in the sample is below the detectable limit.

### Appendix 3 – Groundwater sampling results July – December 2016

#### Borehole 1A (upper)

| Permit Number                 | EPR/AB3101MW                      | Operator    | Cuadrilla Bowland Limited |        |        |        |        |        |        |        |        |        |        |        |        |        |             |
|-------------------------------|-----------------------------------|-------------|---------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|-------------|
| Facility                      | Preston New Road Exploration Site | Form Number | Groundwater 1             |        |        |        |        |        |        |        |        |        |        |        |        |        |             |
| <b>BH01 (A)</b>               |                                   |             |                           |        |        |        |        |        |        |        |        |        |        |        |        |        |             |
| Substance/ Parameter          | Units                             | Test Method | Trigger Level             | Jul-16 | Aug-16 | Sep-16 | Oct-16 | Nov-16 | Dec-16 | Jan-17 | Feb-17 | Mar-17 | Apr-17 | May-17 | Jun-17 | Jul-17 | Uncertainty |
| Dissolved Aluminium #         | ug/l                              | TM30/PM14   | TBC                       | 20     | 20     | 20     | 20     | 20     | 20     |        |        |        |        |        |        |        | 0.00        |
| Dissolved Antimony #          | ug/l                              | TM30/PM14   | TBC                       | 2      | 2      | 2      | 2      | 2      | 2      |        |        |        |        |        |        |        | 0.00        |
| Dissolved Arsenic #           | ug/l                              | TM30/PM14   | TBC                       | 2.5    | 2.5    | 2.5    | 2.5    | 2.8    | 2.5    |        |        |        |        |        |        |        | 0.10        |
| Dissolved Barium #            | ug/l                              | TM30/PM14   | TBC                       | 127    | 141    | 156    | 175    | 237    | 179    |        |        |        |        |        |        |        | 30.94       |
| Dissolved Beryllium           | ug/l                              | TM30/PM14   | TBC                       | 0.5    | 0.5    | 0.5    | 0.5    | 0.5    | 0.5    |        |        |        |        |        |        |        | 0.00        |
| Dissolved Boron               | ug/l                              | TM30/PM14   | TBC                       | 37     | 28     | 34     | 33     | 36     | 42     |        |        |        |        |        |        |        | 3.72        |
| Dissolved Cadmium #           | ug/l                              | TM30/PM14   | TBC                       | 0.5    | 0.5    | 0.5    | 0.5    | 0.5    | 0.5    |        |        |        |        |        |        |        | 0.00        |
| Dissolved Calcium #           | mg/l                              | TM30/PM14   | TBC                       | 118.8  | 121.5  | 121    | 118.5  | 122    | 118.1  |        |        |        |        |        |        |        | 1.36        |
| Total Dissolved Chromium #    | ug/l                              | TM30/PM14   | TBC                       | 1.5    | 1.5    | 1.5    | 1.5    | 1.5    | 1.5    |        |        |        |        |        |        |        | 0.00        |
| Dissolved Cobalt #            | ug/l                              | TM30/PM14   | TBC                       | 2      | 2      | 2      | 2      | 2      | 2      |        |        |        |        |        |        |        | 0.00        |
| Dissolved Copper #            | ug/l                              | TM30/PM14   | TBC                       | 7      | 7      | 7      | 7      | 7      | 7      |        |        |        |        |        |        |        | 0.00        |
| Total Dissolved Iron #        | ug/l                              | TM30/PM14   | TBC                       | 20     | 20     | 178    | 134    | 253    | 127    |        |        |        |        |        |        |        | 72.70       |
| Dissolved Lead #              | ug/l                              | TM30/PM14   | TBC                       | 5      | 5      | 5      | 5      | 5      | 5      |        |        |        |        |        |        |        | 0.00        |
| Dissolved Lithium             | ug/l                              | TM30/PM14   | TBC                       | 13     | 12     | 9      | 8      | 10     | 11     |        |        |        |        |        |        |        | 1.50        |
| Dissolved Magnesium #         | mg/l                              | TM30/PM14   | TBC                       | 37     | 37     | 38.4   | 37.3   | 38.1   | 36.8   |        |        |        |        |        |        |        | 0.53        |
| Dissolved Mercury #           | ug/l                              | TM30/PM14   | TBC                       | 1      | 1      | 1      | 1      | 1      | 1      |        |        |        |        |        |        |        | 0.00        |
| Dissolved Nickel #            | ug/l                              | TM30/PM14   | TBC                       | 2      | 2      | 2      | 2      | 2      | 2      |        |        |        |        |        |        |        | 0.00        |
| Dissolved Potassium #         | mg/l                              | TM30/PM14   | TBC                       | 3.2    | 2.8    | 2.7    | 2.6    | 3.2    | 2.5    |        |        |        |        |        |        |        | 0.24        |
| Dissolved Selenium #          | ug/l                              | TM30/PM14   | TBC                       | 3      | 3      | 3      | 3      | 3      | 3      |        |        |        |        |        |        |        | 0.00        |
| Dissolved Silver              | ug/l                              | TM30/PM14   | TBC                       | 5      | 5      | 5      | 5      | 5      | 5      |        |        |        |        |        |        |        | 0.00        |
| Dissolved Sodium #            | mg/l                              | TM30/PM14   | TBC                       | 34.6   | 33.2   | 33.1   | 31.9   | 33.3   | 30.9   |        |        |        |        |        |        |        | 1.02        |
| Dissolved Strontium           | ug/l                              | TM30/PM14   | TBC                       | 271    | 246    | 251    | 254    | 248    | 236    |        |        |        |        |        |        |        | 9.25        |
| Dissolved Vanadium #          | ug/l                              | TM30/PM14   | TBC                       | 1.5    | 1.5    | 1.5    | 1.5    | 1.5    | 1.5    |        |        |        |        |        |        |        | 0.00        |
| Dissolved Zinc #              | ug/l                              | TM30/PM14   | TBC                       | 0      | 3      | 3      | 3      | 33     | 3      |        |        |        |        |        |        |        | 10.04       |
| EPH (C8-C40) #                | ug/l                              | TM5/PM30    | TBC                       | 10     | 10     | 10     | 10     | 10     | 10     |        |        |        |        |        |        |        | 0.00        |
| GRO (>C4-C8) #                | ug/l                              | TM36/PM12   | TBC                       | 10     | 10     | 10     | 87     | 10     | 10     |        |        |        |        |        |        |        | 25.15       |
| GRO (>C8-C12) #               | ug/l                              | TM36/PM12   | TBC                       | 10     | 10     | 10     | 14     | 10     | 10     |        |        |        |        |        |        |        | 1.31        |
| GRO (>C4-C12) #               | ug/l                              | TM36/PM12   | TBC                       | 10     | 10     | 10     | 101    | 10     | 10     |        |        |        |        |        |        |        | 29.73       |
| MTBE #                        | ug/l                              | TM31/PM12   | TBC                       | 5      | 5      | 5      | 5      | 5      | 5      |        |        |        |        |        |        |        | 0.00        |
| Benzene #                     | ug/l                              | TM31/PM12   | TBC                       | 5      | 5      | 5      | 5      | 5      | 5      |        |        |        |        |        |        |        | 0.00        |
| Toluene #                     | ug/l                              | TM31/PM12   | TBC                       | 5      | 5      | 5      | 5      | 5      | 5      |        |        |        |        |        |        |        | 0.00        |
| Ethylbenzene #                | ug/l                              | TM31/PM12   | TBC                       | 5      | 5      | 5      | 5      | 5      | 5      |        |        |        |        |        |        |        | 0.00        |
| m/p-Xylene #                  | ug/l                              | TM31/PM12   | TBC                       | 5      | 5      | 5      | 5      | 5      | 5      |        |        |        |        |        |        |        | 0.00        |
| o-Xylene #                    | ug/l                              | TM31/PM12   | TBC                       | 5      | 5      | 5      | 5      | 5      | 5      |        |        |        |        |        |        |        | 0.00        |
| Fluoride                      | mg/l                              | TM27/PM0    | TBC                       | 0.3    | 0.3    | 0.3    | 0.3    | 0.3    | 0.3    |        |        |        |        |        |        |        | 0.00        |
| Bromide                       | mg/l                              | TM27/PM0    | TBC                       | 0.07   | 0.05   | 0.09   | 0.16   | 0.05   | 0.1    |        |        |        |        |        |        |        | 0.03        |
| Chloride #                    | mg/l                              | TM38/PM0    | TBC                       | 63.4   | 65.5   | 64.5   | 64.9   | 64.5   | 66.1   |        |        |        |        |        |        |        | 0.74        |
| Nitrate as NO3 #              | mg/l                              | TM38/PM0    | TBC                       | 20     | 35.8   | 40.3   | 33.7   | 36.6   | 39.6   |        |        |        |        |        |        |        | 5.95        |
| Nitrite as NO2 #              | mg/l                              | TM38/PM0    | TBC                       | 0.7    | 0.1    | 0.03   | 0.05   | 0.03   | 0.02   |        |        |        |        |        |        |        | 0.21        |
| Ammoniacal Nitrogen as NH4 #  | mg/l                              | TM38/PM0    | TBC                       | 0.04   | 0.06   | 0.06   | 0.05   | 0.06   | 0.04   |        |        |        |        |        |        |        | 0.01        |
| Dissolved Ethene #            | ug/l                              | TM25/PM0    | TBC                       | 1      | 1      | 1      | 1      | 1      | 1      |        |        |        |        |        |        |        | 0.00        |
| Dissolved Ethane #            | ug/l                              | TM25/PM0    | TBC                       | 1      | 1      | 1      | 1      | 1      | 1      |        |        |        |        |        |        |        | 0.00        |
| Dissolved Butane              | ug/l                              | TM25/PM0    | TBC                       | 2      | 2      | 2      | 2      | 2      | 2      |        |        |        |        |        |        |        | 0.00        |
| Dissolved Propane             | ug/l                              | TM25/PM0    | TBC                       | 2      | 2      | 2      | 2      | 2      | 2      |        |        |        |        |        |        |        | 0.00        |
| Dissolved Methane             | mg/l                              | GC-IRMS     | TBC                       | 0.01   | 0.01   | 0.01   | 0.02   | 0.02   | 0.02   |        |        |        |        |        |        |        | 0.00        |
| Dissolved Carbon Dioxide      | mg/l                              | GC-IRMS     | TBC                       | 32.7   | 30.9   | 36.3   | 47.9   | 27.9   | 37.23  |        |        |        |        |        |        |        | 5.59        |
| δ13C - CH4                    | ppm ‰. VPDB                       | GC-IRMS     | TBC                       | 0      | 0      | 0      | 0      | 0      | 0      |        |        |        |        |        |        |        | 0.00        |
| δ13C - CO2                    | ppm ‰. VPDB                       | GC-IRMS     | TBC                       | -22.18 | -23.4  | -25.76 | -23.98 | -31.81 | -29.2  |        |        |        |        |        |        |        | 2.98        |
| Total Alkalinity as CaCO3 #   | mg/l                              | TM75/PM0    | TBC                       | 350    | 354    | 340    | 352    | 250    | 354    |        |        |        |        |        |        |        | 32.93       |
| Acrylamide                    | ug/l                              | TM103/PM59  | TBC                       | 50     | 50     | 50     | 50     | 50     | 50     |        |        |        |        |        |        |        | 0.00        |
| Laurylamine                   | ug/l                              | TM103/PM59  | TBC                       | 50     | 50     | 50     | 50     | 50     | 50     |        |        |        |        |        |        |        | 0.00        |
| Hydroxyethyl ethylene diamine | ug/l                              | TM103/PM59  | TBC                       | 50     | 50     | 50     | 50     | 50     | 50     |        |        |        |        |        |        |        | 0.00        |
| Myristyl dimethylamine        | ug/l                              | TM103/PM59  | TBC                       | 50     | 50     | 50     | 50     | 50     | 50     |        |        |        |        |        |        |        | 0.00        |
| Octyldimethylamine            | ug/l                              | TM103/PM59  | TBC                       | 50     | 50     | 50     | 50     | 50     | 50     |        |        |        |        |        |        |        | 0.00        |
| para phenylene diamine        | ug/l                              | TM103/PM59  | TBC                       | 50     | 50     | 50     | 50     | 50     | 50     |        |        |        |        |        |        |        | 0.00        |
| BOD (Settled) #               | mg/l                              | TM58/PM0    | TBC                       | 1      | 1      | 1      | 1      | 2      | 1      |        |        |        |        |        |        |        | 0.33        |
| COD (Settled) #               | mg/l                              | TM57/PM0    | TBC                       | 7      | 7      | 7      | 8      | 13     | 7      |        |        |        |        |        |        |        | 1.92        |
| pH #                          | pH units                          | TM73/PM0    | TBC                       | 7.56   | 7.7    | 7.74   |        |        |        |        |        |        |        |        |        |        |             |

### Appendix 3 – Groundwater sampling results July – December 2016

#### Borehole 1B (lower)

| Permit Number                           | EPR/AB3101MW                      | Operator    | Cuadrilla Bowland Limited |        |        |        |        |        |        |        |        |        |        |        |        |        |             |
|---|-----------------------------------|-------------|---------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|-------------|
| Facility                                | Preston New Road Exploration Site | Form Number | Groundwater 1             |        |        |        |        |        |        |        |        |        |        |        |        |        |             |
| <b>BH01 (B)</b>                         |                                   |             |                           |        |        |        |        |        |        |        |        |        |        |        |        |        |             |
| Substance/ Parameter                    | Units                             | Test Method | Trigger Level             | Jul-16 | Aug-16 | Sep-16 | Oct-16 | Nov-16 | Dec-16 | Jan-17 | Feb-17 | Mar-17 | Apr-17 | May-17 | Jun-17 | Jul-17 | Uncertainty |
| Dissolved Aluminium <sup>#</sup>        | ug/l                              | TM30/PM14   | TBC                       | 20     | 20     | 20     | 20     | 20     | 20     |        |        |        |        |        |        |        | 0.00        |
| Dissolved Antimony <sup>#</sup>         | ug/l                              | TM30/PM14   | TBC                       | 2      | 2      | 2      | 2      | 2      | 2      |        |        |        |        |        |        |        | 0.00        |
| Dissolved Arsenic <sup>#</sup>          | ug/l                              | TM30/PM14   | TBC                       | 2.5    | 2.5    | 2.5    | 2.5    | 4.3    | 5      |        |        |        |        |        |        |        | 0.91        |
| Dissolved Barium <sup>#</sup>           | ug/l                              | TM30/PM14   | TBC                       | 86     | 99     | 246    | 241    | 234    | 332    |        |        |        |        |        |        |        | 76.19       |
| Dissolved Beryllium                     | ug/l                              | TM30/PM14   | TBC                       | 0.5    | 0.5    | 0.5    | 0.5    | 0.5    | 0.5    |        |        |        |        |        |        |        | 0.00        |
| Dissolved Boron                         | ug/l                              | TM30/PM14   | TBC                       | 42     | 33     | 39     | 41     | 48     | 46     |        |        |        |        |        |        |        | 4.26        |
| Dissolved Cadmium <sup>#</sup>          | ug/l                              | TM30/PM14   | TBC                       | 0.5    | 0.5    | 0.5    | 0.5    | 0.5    | 0.5    |        |        |        |        |        |        |        | 0.00        |
| Dissolved Calcium <sup>#</sup>          | mg/l                              | TM30/PM14   | TBC                       | 112.1  | 107    | 110.1  | 102.1  | 100.5  | 102.3  |        |        |        |        |        |        |        | 3.81        |
| Total Dissolved Chromium <sup>#</sup>   | ug/l                              | TM30/PM14   | TBC                       | 1.5    | 1.5    | 1.5    | 1.5    | 1.5    | 1.5    |        |        |        |        |        |        |        | 0.00        |
| Dissolved Cobalt <sup>#</sup>           | ug/l                              | TM30/PM14   | TBC                       | 2      | 2      | 2      | 2      | 2      | 2      |        |        |        |        |        |        |        | 0.00        |
| Dissolved Copper <sup>#</sup>           | ug/l                              | TM30/PM14   | TBC                       | 22     | 7      | 7      | 7      | 7      | 7      |        |        |        |        |        |        |        | 4.90        |
| Total Dissolved Iron <sup>#</sup>       | ug/l                              | TM30/PM14   | TBC                       | 435    | 20     | 3472   | 1904   | 383    | 238    |        |        |        |        |        |        |        | 1081.53     |
| Dissolved Lead <sup>#</sup>             | ug/l                              | TM30/PM14   | TBC                       | 5      | 5      | 5      | 5      | 5      | 5      |        |        |        |        |        |        |        | 0.00        |
| Dissolved Lithium                       | ug/l                              | TM30/PM14   | TBC                       | 12     | 16     | 8      | 7      | 11     | 10     |        |        |        |        |        |        |        | 2.56        |
| Dissolved Magnesium <sup>#</sup>        | mg/l                              | TM30/PM14   | TBC                       | 34.8   | 35.6   | 37.8   | 35.7   | 35.7   | 35.2   |        |        |        |        |        |        |        | 0.83        |
| Dissolved Mercury <sup>#</sup>          | ug/l                              | TM30/PM14   | TBC                       | 1      | 1      | 1      | 1      | 1      | 1      |        |        |        |        |        |        |        | 0.00        |
| Dissolved Nickel <sup>#</sup>           | ug/l                              | TM30/PM14   | TBC                       | 3      | 2      | 2      | 2      | 2      | 2      |        |        |        |        |        |        |        | 0.33        |
| Dissolved Potassium <sup>#</sup>        | mg/l                              | TM30/PM14   | TBC                       | 3.7    | 2.5    | 2.3    | 2.4    | 2.3    | 2      |        |        |        |        |        |        |        | 0.48        |
| Dissolved Selenium <sup>#</sup>         | ug/l                              | TM30/PM14   | TBC                       | 3      | 3      | 3      | 3      | 3      | 3      |        |        |        |        |        |        |        | 0.00        |
| Dissolved Silver                        | ug/l                              | TM30/PM14   | TBC                       | 5      | 5      | 5      | 5      | 5      | 5      |        |        |        |        |        |        |        | 0.00        |
| Dissolved Sodium <sup>#</sup>           | mg/l                              | TM30/PM14   | TBC                       | 39.7   | 43.6   | 46.3   | 51.1   | 53.1   | 40.4   |        |        |        |        |        |        |        | 4.42        |
| Dissolved Strontium                     | ug/l                              | TM30/PM14   | TBC                       | 486    | 267    | 349    | 292    | 264    | 285    |        |        |        |        |        |        |        | 68.14       |
| Dissolved Vanadium <sup>#</sup>         | ug/l                              | TM30/PM14   | TBC                       | 1.5    | 1.5    | 1.5    | 1.5    | 1.5    | 1.5    |        |        |        |        |        |        |        | 0.00        |
| Dissolved Zinc <sup>#</sup>             | ug/l                              | TM30/PM14   | TBC                       | 0      | 3      | 3      | 3      | 5      | 7      |        |        |        |        |        |        |        | 1.88        |
| EPH (C8-C40) <sup>#</sup>               | ug/l                              | TM5/PM30    | TBC                       | 10     | 10     | 10     | 10     | 10     | 10     |        |        |        |        |        |        |        | 0.00        |
| GRO (>C4-C8) <sup>#</sup>               | ug/l                              | TM36/PM12   | TBC                       | 10     | 10     | 10     | 60     | 10     | 10     |        |        |        |        |        |        |        | 16.33       |
| GRO (>C8-C12) <sup>#</sup>              | ug/l                              | TM36/PM12   | TBC                       | 51     | 10     | 10     | 37     | 10     | 10     |        |        |        |        |        |        |        | 14.49       |
| GRO (>C4-C12) <sup>#</sup>              | ug/l                              | TM36/PM12   | TBC                       | 51     | 10     | 10     | 97     | 10     | 10     |        |        |        |        |        |        |        | 28.89       |
| MTBE <sup>#</sup>                       | ug/l                              | TM31/PM12   | TBC                       | 5      | 5      | 5      | 5      | 5      | 5      |        |        |        |        |        |        |        | 0.00        |
| Benzene <sup>#</sup>                    | ug/l                              | TM31/PM12   | TBC                       | 5      | 5      | 5      | 5      | 5      | 5      |        |        |        |        |        |        |        | 0.00        |
| Toluene <sup>#</sup>                    | ug/l                              | TM31/PM12   | TBC                       | 5      | 5      | 5      | 5      | 5      | 5      |        |        |        |        |        |        |        | 0.00        |
| Ethylbenzene <sup>#</sup>               | ug/l                              | TM31/PM12   | TBC                       | 5      | 5      | 5      | 5      | 5      | 5      |        |        |        |        |        |        |        | 0.00        |
| m/p-Xylene <sup>#</sup>                 | ug/l                              | TM31/PM12   | TBC                       | 5      | 5      | 5      | 5      | 5      | 5      |        |        |        |        |        |        |        | 0.00        |
| o-Xylene <sup>#</sup>                   | ug/l                              | TM31/PM12   | TBC                       | 5      | 5      | 5      | 5      | 5      | 5      |        |        |        |        |        |        |        | 0.00        |
| Fluoride                                | mg/l                              | TM27/PM0    | TBC                       | 0.3    | 0.3    | 0.3    | 0.3    | 0.3    | 0.3    |        |        |        |        |        |        |        | 0.00        |
| Bromide                                 | mg/l                              | TM27/PM0    | TBC                       | 0.09   | 0.1    | 0.09   | 0.1    | 0.05   | 0.11   |        |        |        |        |        |        |        | 0.02        |
| Chloride <sup>#</sup>                   | mg/l                              | TM38/PM0    | TBC                       | 48.9   | 63.8   | 56.5   | 48.8   | 46.5   | 55.3   |        |        |        |        |        |        |        | 5.19        |
| Nitrate as NO3 <sup>#</sup>             | mg/l                              | TM38/PM0    | TBC                       | 0.2    | 2.9    | 0.2    | 1.6    | 1.3    | 1.6    |        |        |        |        |        |        |        | 0.81        |
| Nitrite as NO2 <sup>#</sup>             | mg/l                              | TM38/PM0    | TBC                       | 0.02   | 0.11   | 0.02   | 0.02   | 0.02   | 0.02   |        |        |        |        |        |        |        | 0.03        |
| Ammoniacal Nitrogen as NH4 <sup>#</sup> | mg/l                              | TM38/PM0    | TBC                       | 0.41   | 0.05   | 0.07   | 0.12   | 0.09   | 0.07   |        |        |        |        |        |        |        | 0.11        |
| Dissolved Ethene <sup>#</sup>           | ug/l                              | TM25/PM0    | TBC                       | 1      | 1      | 1      | 1      | 1      | 1      |        |        |        |        |        |        |        | 0.00        |
| Dissolved Ethane <sup>#</sup>           | ug/l                              | TM25/PM0    | TBC                       | 1      | 1      | 1      | 1      | 1      | 1      |        |        |        |        |        |        |        | 0.00        |
| Dissolved Butane                        | ug/l                              | TM25/PM0    | TBC                       | 2      | 2      | 2      | 2      | 2      | 2      |        |        |        |        |        |        |        | 0.00        |
| Dissolved Propane                       | ug/l                              | TM25/PM0    | TBC                       | 2      | 2      | 2      | 2      | 2      | 2      |        |        |        |        |        |        |        | 0.00        |
| Dissolved Methane                       | mg/l                              | GC-IRMS     | TBC                       | 0.01   | 0.01   | 0.02   | 0.74   | 1.66   | 1.26   |        |        |        |        |        |        |        | 0.58        |
| Dissolved Carbon Dioxide                | mg/l                              | GC-IRMS     | TBC                       | 20.1   | 25.5   | 34.4   | 47.9   | 38.4   | 35.01  |        |        |        |        |        |        |        | 7.82        |
| δ13C - CH4                              | ppm ‰ VPDB                        | GC-IRMS     | TBC                       | 0      | 0      | -56.68 | -57.85 | -59.5  |        |        |        |        |        |        |        |        | 25.43       |
| δ13C - CO2                              | ppm ‰ VPDB                        | GC-IRMS     | TBC                       | -22.65 | -23    | -28.49 | -24.87 | -32.14 | -30.1  |        |        |        |        |        |        |        | 3.15        |
| Total Alkalinity as CaCO3 <sup>#</sup>  | mg/l                              | TM75/PM0    | TBC                       | 510    | 354    | 406    | 408    | 416    | 408    |        |        |        |        |        |        |        | 40.65       |
| Acrylamide                              | ug/l                              | TM103/PM59  | TBC                       | 50     | 50     | 50     | 50     | 50     | 50     |        |        |        |        |        |        |        | 0.00        |
| Laurylamine                             | ug/l                              | TM103/PM59  | TBC                       | 50     | 50     | 50     | 50     | 50     | 50     |        |        |        |        |        |        |        | 0.00        |
| Hydroxyethyl ethylene diamine           | ug/l                              | TM103/PM59  | TBC                       | 50     | 50     | 50     | 50     | 50     | 50     |        |        |        |        |        |        |        | 0.00        |
| Myristyl dimethylamine                  | ug/l                              | TM103/PM59  | TBC                       | 50     | 50     | 50     | 50     | 50     | 50     |        |        |        |        |        |        |        | 0.00        |
| Octyldimethylamine                      | ug/l                              | TM103/PM59  | TBC                       | 50     | 50     | 50     | 50     | 50     | 50     |        |        |        |        |        |        |        | 0.00        |
| para phenylene diamine                  | ug/l                              | TM103/PM59  | TBC                       | 50     | 50     | 50     | 50     | 50     | 50     |        |        |        |        |        |        |        | 0.00        |
| BOD (Settled) <sup>#</sup>              | mg/l                              | TM58/PM0    | TBC                       | 2      | 1      | 15     | 5      | 5      | 3      |        |        |        |        |        |        |        | 4.06        |
| COD (Settled) <sup>#</sup>              | mg/l                              | TM57/PM0    | TBC                       | 7</    |        |        |        |        |        |        |        |        |        |        |        |        |             |

### Appendix 3 – Groundwater sampling results July – December 2016

#### Borehole 2A (upper)

|                              |                                   |             |                           |        |        |        |        |        |        |        |        |        |        |        |        |        |             |
|------------------------------|-----------------------------------|-------------|---------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|-------------|
| Permit Number                | EPR/AB3101MW                      | Operator    | Cuadrilla Bowland Limited |        |        |        |        |        |        |        |        |        |        |        |        |        |             |
| Facility                     | Preston New Road Exploration Site | Form Number | Groundwater 1             |        |        |        |        |        |        |        |        |        |        |        |        |        |             |
| <b>BH02 (A)</b>              |                                   |             |                           |        |        |        |        |        |        |        |        |        |        |        |        |        |             |
| Substance/ Parameter         | Units                             | Test Method | Trigger Level             | Jul-16 | Aug-16 | Sep-16 | Oct-16 | Nov-16 | Dec-16 | Jan-17 | Feb-17 | Mar-17 | Apr-17 | May-17 | Jun-17 | Jul-17 | Uncertainty |
| Dissolved Aluminium #        | ug/l                              | TM30/PM14   | TBC                       | 20     | 20     | 20     | 20     | 20     | 20     |        |        |        |        |        |        |        | 0.00        |
| Dissolved Antimony #         | ug/l                              | TM30/PM14   | TBC                       | 2      | 2      | 2      | 2      | 2      | 2      |        |        |        |        |        |        |        | 0.00        |
| Dissolved Arsenic #          | ug/l                              | TM30/PM14   | TBC                       | 2.5    | 2.5    | 2.5    | 2.5    | 4      | 2.5    |        |        |        |        |        |        |        | 0.49        |
| Dissolved Barium #           | ug/l                              | TM30/PM14   | TBC                       | 89     | 92     | 89     | 97     | 83     | 91     |        |        |        |        |        |        |        | 3.66        |
| Dissolved Beryllium          | ug/l                              | TM30/PM14   | TBC                       | 0.5    | 0.5    | 0.5    | 0.5    | 0.5    | 0.5    |        |        |        |        |        |        |        | 0.00        |
| Dissolved Boron              | ug/l                              | TM30/PM14   | TBC                       | 41     | 37     | 42     | 41     | 46     | 46     |        |        |        |        |        |        |        | 2.74        |
| Dissolved Cadmium #          | ug/l                              | TM30/PM14   | TBC                       | 0.5    | 0.5    | 0.5    | 0.5    | 0.5    | 0.5    |        |        |        |        |        |        |        | 0.00        |
| Dissolved Calcium #          | mg/l                              | TM30/PM14   | TBC                       | 119.9  | 118.5  | 118.2  | 116.9  | 115.6  | 110    |        |        |        |        |        |        |        | 2.81        |
| Total Dissolved Chromium #   | ug/l                              | TM30/PM14   | TBC                       | 1.5    | 1.5    | 1.5    | 1.5    | 1.5    | 1.5    |        |        |        |        |        |        |        | 0.00        |
| Dissolved Cobalt #           | ug/l                              | TM30/PM14   | TBC                       | 2      | 2      | 2      | 2      | 2      | 2      |        |        |        |        |        |        |        | 0.00        |
| Dissolved Copper #           | ug/l                              | TM30/PM14   | TBC                       | 7      | 7      | 7      | 7      | 7      | 7      |        |        |        |        |        |        |        | 0.00        |
| Total Dissolved Iron #       | ug/l                              | TM30/PM14   | TBC                       | 20     | 20     | 20     | 20     | 20     | 20     |        |        |        |        |        |        |        | 0.00        |
| Dissolved Lead #             | ug/l                              | TM30/PM14   | TBC                       | 5      | 5      | 5      | 5      | 5      | 5      |        |        |        |        |        |        |        | 0.00        |
| Dissolved Lithium            | ug/l                              | TM30/PM14   | TBC                       | 18     | 14     | 14     | 12     | 14     | 12     |        |        |        |        |        |        |        | 1.75        |
| Dissolved Magnesium #        | mg/l                              | TM30/PM14   | TBC                       | 36.2   | 36.2   | 36.5   | 36     | 35.1   | 33.5   |        |        |        |        |        |        |        | 0.90        |
| Dissolved Mercury #          | ug/l                              | TM30/PM14   | TBC                       | 1      | 1      | 1      | 1      | 1      | 1      |        |        |        |        |        |        |        | 0.00        |
| Dissolved Nickel #           | ug/l                              | TM30/PM14   | TBC                       | 2      | 2      | 2      | 2      | 2      | 2      |        |        |        |        |        |        |        | 0.00        |
| Dissolved Potassium #        | mg/l                              | TM30/PM14   | TBC                       | 2.9    | 2.8    | 2.8    | 2.9    | 2.8    | 2.5    |        |        |        |        |        |        |        | 0.12        |
| Dissolved Selenium #         | ug/l                              | TM30/PM14   | TBC                       | 3      | 3      | 3      | 3      | 3      | 3      |        |        |        |        |        |        |        | 0.00        |
| Dissolved Silver             | ug/l                              | TM30/PM14   | TBC                       | 5      | 5      | 5      | 5      | 5      | 5      |        |        |        |        |        |        |        | 0.00        |
| Dissolved Sodium #           | mg/l                              | TM30/PM14   | TBC                       | 28.9   | 27.6   | 28.1   | 27.6   | 27     | 25.5   |        |        |        |        |        |        |        | 0.92        |
| Dissolved Strontium          | ug/l                              | TM30/PM14   | TBC                       | 341    | 325    | 340    | 347    | 332    | 346    |        |        |        |        |        |        |        | 6.80        |
| Dissolved Vanadium #         | ug/l                              | TM30/PM14   | TBC                       | 1.5    | 1.5    | 1.5    | 1.5    | 1.5    | 1.5    |        |        |        |        |        |        |        | 0.00        |
| Dissolved Zinc #             | ug/l                              | TM30/PM14   | TBC                       | 0      | 3      | 3      | 3      | 3      | 3      |        |        |        |        |        |        |        | 0.98        |
|                              |                                   |             |                           |        |        |        |        |        |        |        |        |        |        |        |        |        |             |
| EPH (C8-C40) #               | ug/l                              | TM5/PM30    | TBC                       | 10     | 10     | 10     | 10     | 10     | 10     |        |        |        |        |        |        |        | 0.00        |
|                              |                                   |             |                           |        |        |        |        |        |        |        |        |        |        |        |        |        |             |
| GRO (>C4-C8) #               | ug/l                              | TM36/PM12   | TBC                       | 10     | 10     | 10     | 10     | 10     | 10     |        |        |        |        |        |        |        | 0.00        |
| GRO (>C8-C12) #              | ug/l                              | TM36/PM12   | TBC                       | 10     | 10     | 10     | 10     | 10     | 10     |        |        |        |        |        |        |        | 0.00        |
| GRO (>C4-C12) #              | ug/l                              | TM36/PM12   | TBC                       | 10     | 10     | 10     | 10     | 10     | 10     |        |        |        |        |        |        |        | 0.00        |
| MTBE #                       | ug/l                              | TM31/PM12   | TBC                       | 5      | 5      | 5      | 5      | 5      | 5      |        |        |        |        |        |        |        | 0.00        |
| Benzene #                    | ug/l                              | TM31/PM12   | TBC                       | 5      | 5      | 5      | 5      | 5      | 5      |        |        |        |        |        |        |        | 0.00        |
| Toluene #                    | ug/l                              | TM31/PM12   | TBC                       | 5      | 5      | 5      | 5      | 5      | 5      |        |        |        |        |        |        |        | 0.00        |
| Ethylbenzene #               | ug/l                              | TM31/PM12   | TBC                       | 5      | 5      | 5      | 5      | 5      | 5      |        |        |        |        |        |        |        | 0.00        |
| m/p-Xylene #                 | ug/l                              | TM31/PM12   | TBC                       | 5      | 5      | 5      | 5      | 5      | 5      |        |        |        |        |        |        |        | 0.00        |
| o-Xylene #                   | ug/l                              | TM31/PM12   | TBC                       | 5      | 5      | 5      | 5      | 5      | 5      |        |        |        |        |        |        |        | 0.00        |
|                              |                                   |             |                           |        |        |        |        |        |        |        |        |        |        |        |        |        |             |
| Fluoride                     | mg/l                              | TM27/PM0    | TBC                       | 0.3    | 0.3    | 0.3    | 0.3    | 0.3    | 0.3    |        |        |        |        |        |        |        | 0.00        |
| Bromide                      | mg/l                              | TM27/PM0    | TBC                       | 0.06   | 0.14   | 0.09   | 0.14   | 0.05   | 0.07   |        |        |        |        |        |        |        | 0.03        |
|                              |                                   |             |                           |        |        |        |        |        |        |        |        |        |        |        |        |        |             |
| Chloride #                   | mg/l                              | TM38/PM0    | TBC                       | 52.6   | 52.7   | 51.6   | 51.9   | 24.6   | 52.3   |        |        |        |        |        |        |        | 9.03        |
| Nitrate as NO3 #             | mg/l                              | TM38/PM0    | TBC                       | 9.3    | 29.3   | 30.9   | 24.1   | 36.3   | 27.3   |        |        |        |        |        |        |        | 7.38        |
| Nitrite as NO2 #             | mg/l                              | TM38/PM0    | TBC                       | 0.02   | 0.02   | 0.02   | 0.02   | 0.02   | 0.02   |        |        |        |        |        |        |        | 0.00        |
| Ammoniacal Nitrogen as NH4 # | mg/l                              | TM38/PM0    | TBC                       | 0.03   | 0.03   | 0.03   | 0.03   | 0.03   | 0.03   |        |        |        |        |        |        |        | 0.00        |
|                              |                                   |             |                           |        |        |        |        |        |        |        |        |        |        |        |        |        |             |
| Dissolved Ethene #           | ug/l                              | TM25/PM0    | TBC                       | 1      | 1      | 1      | 1      | 1      | 1      |        |        |        |        |        |        |        | 0.00        |
| Dissolved Ethane #           | ug/l                              | TM25/PM0    | TBC                       | 1      | 1      | 1      | 1      | 1      | 1      |        |        |        |        |        |        |        | 0.00        |
| Dissolved Butane             | ug/l                              | TM25/PM0    | TBC                       | 2      | 2      | 2      | 2      | 2      | 2      |        |        |        |        |        |        |        | 0.00        |
| Dissolved Propane            | ug/l                              | TM25/PM0    | TBC                       | 2      | 2      | 2      | 2      | 2      | 2      |        |        |        |        |        |        |        | 0.00        |
|                              |                                   |             |                           |        |        |        |        |        |        |        |        |        |        |        |        |        |             |
| Dissolved Methane            | mg/l                              | GC-IRMS     | TBC                       | 0.01   | 0.01   | 0.01   | 0.02   | 0.02   | 0.02   |        |        |        |        |        |        |        | 0.00        |
| Dissolved Carbon Dioxide     | mg/l                              | GC-IRMS     | TBC                       | 27.9   | 32.7   | 33.7   | 39.9   | 33.3   | 34.48  |        |        |        |        |        |        |        | 3.07        |
| δ13C - CH4                   | ppm ‰. VPDB                       | GC-IRMS     | TBC                       | 0      | 0      | 0      | 0      | 0      | 0      |        |        |        |        |        |        |        | 0.00        |
| δ13C - CO2                   | ppm ‰. VPDB                       | GC-IRMS     | TBC                       | -23.45 | -21.8  | -24.87 | -23.11 | -31.77 | -28.1  |        |        |        |        |        |        |        | 3.00        |
|                              |                                   |             |                           |        |        |        |        |        |        |        |        |        |        |        |        |        |             |
| Total Alkalinity as CaCO3 #  | mg/l                              | TM75/PM0    | TBC                       | 322    | 326    | 322    | 320    | 340    | 324    |        |        |        |        |        |        |        | 5.85        |
|                              |                                   |             |                           |        |        |        |        |        |        |        |        |        |        |        |        |        |             |
| Acrylamide                   | ug/l                              | TM103/PM59  | TBC                       | 50     | 50     | 50     | 50     | 50     | 50     |        |        |        |        |        |        |        | 0.00</td    |

### Appendix 3 – Groundwater sampling results July – December 2016

#### Borehole 2B (lower)

|   |                                   |             |                           |       |       |        |        |        |       |  |  |  |  |  |  |  |  |        |
|---|-----------------------------------|-------------|---------------------------|-------|-------|--------|--------|--------|-------|--|--|--|--|--|--|--|--|--------|
| Permit Number                           | EPR/AB3101MW                      | Operator    | Cuadrilla Bowland Limited |       |       |        |        |        |       |  |  |  |  |  |  |  |  |        |
| Facility                                | Preston New Road Exploration Site | Form Number | Groundwater 1             |       |       |        |        |        |       |  |  |  |  |  |  |  |  |        |
| <b>BH02 (B)</b>                         |                                   |             |                           |       |       |        |        |        |       |  |  |  |  |  |  |  |  |        |
| Substance / Parameter                   |                                   |             |                           |       |       |        |        |        |       |  |  |  |  |  |  |  |  |        |
| Units                                   |                                   |             |                           |       |       |        |        |        |       |  |  |  |  |  |  |  |  |        |
| Dissolved Aluminium <sup>#</sup>        | ug/l                              | TM30/PM14   | TBC                       | 20    | 20    | 20     | 20     | 20     | 20    |  |  |  |  |  |  |  |  | 0.00   |
| Dissolved Antimony <sup>#</sup>         | ug/l                              | TM30/PM14   | TBC                       | 2     | 2     | 2      | 2      | 2      | 2     |  |  |  |  |  |  |  |  | 0.00   |
| Dissolved Arsenic <sup>#</sup>          | ug/l                              | TM30/PM14   | TBC                       | 2.5   | 2.5   | 7.8    | 15.9   | 17.7   | 15.2  |  |  |  |  |  |  |  |  | 5.52   |
| Dissolved Barium <sup>#</sup>           | ug/l                              | TM30/PM14   | TBC                       | 54    | 58    | 63     | 68     | 61     | 66    |  |  |  |  |  |  |  |  | 4.13   |
| Dissolved Beryllium                     | ug/l                              | TM30/PM14   | TBC                       | 0.5   | 0.5   | 0.5    | 0.5    | 0.5    | 0.5   |  |  |  |  |  |  |  |  | 0.00   |
| Dissolved Boron                         | ug/l                              | TM30/PM14   | TBC                       | 50    | 42    | 46     | 48     | 48     | 50    |  |  |  |  |  |  |  |  | 2.41   |
| Dissolved Cadmium <sup>#</sup>          | ug/l                              | TM30/PM14   | TBC                       | 0.5   | 0.5   | 0.5    | 0.5    | 0.5    | 0.5   |  |  |  |  |  |  |  |  | 0.00   |
| Dissolved Calcium <sup>#</sup>          | mg/l                              | TM30/PM14   | TBC                       | 120.3 | 122.1 | 123.2  | 121.3  | 121.6  | 112.5 |  |  |  |  |  |  |  |  | 3.10   |
| Total Dissolved Chromium <sup>#</sup>   | ug/l                              | TM30/PM14   | TBC                       | 1.5   | 1.5   | 1.5    | 1.5    | 1.5    | 1.5   |  |  |  |  |  |  |  |  | 0.00   |
| Dissolved Cobalt <sup>#</sup>           | ug/l                              | TM30/PM14   | TBC                       | 2     | 2     | 2      | 2      | 2      | 2     |  |  |  |  |  |  |  |  | 0.00   |
| Dissolved Copper <sup>#</sup>           | ug/l                              | TM30/PM14   | TBC                       | 7     | 7     | 7      | 7      | 7      | 7     |  |  |  |  |  |  |  |  | 0.00   |
| Total Dissolved Iron <sup>#</sup>       | ug/l                              | TM30/PM14   | TBC                       | 20    | 20    | 965    | 1130   | 936    | 880   |  |  |  |  |  |  |  |  | 401.30 |
| Dissolved Lead <sup>#</sup>             | ug/l                              | TM30/PM14   | TBC                       | 5     | 5     | 5      | 5      | 5      | 5     |  |  |  |  |  |  |  |  | 0.00   |
| Dissolved Lithium                       | ug/l                              | TM30/PM14   | TBC                       | 16    | 17    | 14     | 13     | 16     | 14    |  |  |  |  |  |  |  |  | 1.24   |
| Dissolved Magnesium <sup>#</sup>        | mg/l                              | TM30/PM14   | TBC                       | 35.1  | 36.1  | 37.4   | 36     | 35.3   | 33.1  |  |  |  |  |  |  |  |  | 1.14   |
| Dissolved Mercury <sup>#</sup>          | ug/l                              | TM30/PM14   | TBC                       | 1     | 1     | 1      | 1      | 1      | 1     |  |  |  |  |  |  |  |  | 0.00   |
| Dissolved Nickel <sup>#</sup>           | ug/l                              | TM30/PM14   | TBC                       | 3     | 2     | 2      | 2      | 2      | 2     |  |  |  |  |  |  |  |  | 0.33   |
| Dissolved Potassium <sup>#</sup>        | mg/l                              | TM30/PM14   | TBC                       | 2     | 2     | 1.8    | 2      | 2.1    | 1.8   |  |  |  |  |  |  |  |  | 0.10   |
| Dissolved Selenium <sup>#</sup>         | ug/l                              | TM30/PM14   | TBC                       | 3     | 3     | 3      | 3      | 3      | 3     |  |  |  |  |  |  |  |  | 0.00   |
| Dissolved Silver                        | ug/l                              | TM30/PM14   | TBC                       | 5     | 5     | 5      | 5      | 5      | 5     |  |  |  |  |  |  |  |  | 0.00   |
| Dissolved Sodium <sup>#</sup>           | mg/l                              | TM30/PM14   | TBC                       | 29.9  | 29.6  | 30.1   | 29.5   | 29.3   | 27    |  |  |  |  |  |  |  |  | 0.90   |
| Dissolved Strontium                     | ug/l                              | TM30/PM14   | TBC                       | 591   | 579   | 608    | 635    | 594    | 598   |  |  |  |  |  |  |  |  | 15.38  |
| Dissolved Vanadium <sup>#</sup>         | ug/l                              | TM30/PM14   | TBC                       | 1.5   | 1.5   | 1.5    | 1.5    | 1.5    | 1.5   |  |  |  |  |  |  |  |  | 0.00   |
| Dissolved Zinc <sup>#</sup>             | ug/l                              | TM30/PM14   | TBC                       | 0     | 28    | 8      | 3      | 3      | 3     |  |  |  |  |  |  |  |  | 8.30   |
| EPH (C8-C40) <sup>#</sup>               | ug/l                              | TM5/PM30    | TBC                       | 10    | 10    | 10     | 10     | 10     | 10    |  |  |  |  |  |  |  |  | 0.00   |
| GRO (>C4-C8) <sup>#</sup>               | ug/l                              | TM36/PM12   | TBC                       | 10    | 10    | 10     | 33     | 10     | 10    |  |  |  |  |  |  |  |  | 7.51   |
| GRO (>C8-C12) <sup>#</sup>              | ug/l                              | TM36/PM12   | TBC                       | 10    | 10    | 10     | 10     | 10     | 10    |  |  |  |  |  |  |  |  | 0.00   |
| GRO (>C4-C12) <sup>#</sup>              | ug/l                              | TM36/PM12   | TBC                       | 10    | 10    | 10     | 33     | 10     | 10    |  |  |  |  |  |  |  |  | 7.51   |
| MTBE <sup>#</sup>                       | ug/l                              | TM31/PM12   | TBC                       | 5     | 5     | 5      | 5      | 5      | 5     |  |  |  |  |  |  |  |  | 0.00   |
| Benzene <sup>#</sup>                    | ug/l                              | TM31/PM12   | TBC                       | 5     | 5     | 5      | 5      | 5      | 5     |  |  |  |  |  |  |  |  | 0.00   |
| Toluene <sup>#</sup>                    | ug/l                              | TM31/PM12   | TBC                       | 5     | 5     | 5      | 5      | 5      | 5     |  |  |  |  |  |  |  |  | 0.00   |
| Ethylbenzene <sup>#</sup>               | ug/l                              | TM31/PM12   | TBC                       | 5     | 5     | 5      | 5      | 5      | 5     |  |  |  |  |  |  |  |  | 0.00   |
| m/p-Xylene <sup>#</sup>                 | ug/l                              | TM31/PM12   | TBC                       | 5     | 5     | 5      | 5      | 5      | 5     |  |  |  |  |  |  |  |  | 0.00   |
| o-Xylene <sup>#</sup>                   | ug/l                              | TM31/PM12   | TBC                       | 5     | 5     | 5      | 5      | 5      | 5     |  |  |  |  |  |  |  |  | 0.00   |
| Fluoride                                | mg/l                              | TM27/PM0    | TBC                       | 0.3   | 0.3   | 0.3    | 0.3    | 0.3    | 0.3   |  |  |  |  |  |  |  |  | 0.00   |
| Bromide                                 | mg/l                              | TM27/PM0    | TBC                       | 0.12  | 0.14  | 0.08   | 0.14   | 0.05   | 0.13  |  |  |  |  |  |  |  |  | 0.03   |
| Chloride <sup>#</sup>                   | mg/l                              | TM38/PM0    | TBC                       | 50.9  | 51    | 50.1   | 49.9   | 48.3   | 50.5  |  |  |  |  |  |  |  |  | 0.79   |
| Nitrate as NO3 <sup>#</sup>             | mg/l                              | TM38/PM0    | TBC                       | 0.2   | 0.5   | 0.2    | 0.2    | 0.2    | 0.2   |  |  |  |  |  |  |  |  | 0.10   |
| Nitrite as NO2 <sup>#</sup>             | mg/l                              | TM38/PM0    | TBC                       | 0.02  | 0.02  | 0.02   | 0.02   | 0.02   | 0.02  |  |  |  |  |  |  |  |  | 0.00   |
| Ammoniacal Nitrogen as NH4 <sup>#</sup> | mg/l                              | TM38/PM0    | TBC                       | 0.06  | 0.06  | 0.05   | 0.04   | 0.04   | 0.04  |  |  |  |  |  |  |  |  | 0.01   |
| Dissolved Ethene <sup>#</sup>           | ug/l                              | TM25/PM0    | TBC                       | 1     | 1     | 1      | 1      | 1      | 1     |  |  |  |  |  |  |  |  | 0.00   |
| Dissolved Ethane <sup>#</sup>           | ug/l                              | TM25/PM0    | TBC                       | 1     | 1     | 1      | 1      | 1      | 1     |  |  |  |  |  |  |  |  | 0.00   |
| Dissolved Butane                        | ug/l                              | TM25/PM0    | TBC                       | 2     | 2     | 2      | 2      | 2      | 2     |  |  |  |  |  |  |  |  | 0.00   |
| Dissolved Propane                       | ug/l                              | TM25/PM0    | TBC                       | 2     | 2     | 2      | 2      | 2      | 2     |  |  |  |  |  |  |  |  | 0.00   |
| Dissolved Methane                       | mg/l                              | GC-IRMS     | TBC                       | 0.01  | 0.01  | 0.01   | 0.02   | 0.02   | 0.02  |  |  |  |  |  |  |  |  | 0.00   |
| Dissolved Carbon Dioxide                | mg/l                              | GC-IRMS     | TBC                       | 47.9  | 27.3  | 29.8   | 39.4   | 32.5   | 33.65 |  |  |  |  |  |  |  |  | 5.99   |
| δ13C - CH4                              | ppm ‰ VPDB                        | GC-IRMS     | TBC                       | 0     | 0     | 0      | 0      | 0      | 0     |  |  |  |  |  |  |  |  | 0.00   |
| δ13C - CO2                              | ppm ‰ VPDB                        | GC-IRMS     | TBC                       | -22.6 | -23.5 | -25.19 | -23.59 | -32.45 | -27.5 |  |  |  |  |  |  |  |  | 2.95   |
| Total Alkalinity as CaCO3 <sup>#</sup>  | mg/l                              | TM75/PM0    | TBC                       | 350   | 338   | 338    | 336    | 348    | 350   |  |  |  |  |  |  |  |  | 5.32   |
| Acrylamide                              | ug/l                              | TM103/PM59  | TBC                       | 50    | 50    | 50     | 50     | 50     | 50    |  |  |  |  |  |  |  |  | 0.00   |
| Laurylamine                             | ug/l                              | TM103/PM59  | TBC                       | 50    | 50    | 50     | 50     | 50     | 50    |  |  |  |  |  |  |  |  | 0.00   |
| Hydroxyethyl ethylene diamine           | ug/l                              | TM103/PM59  | TBC                       | 50    | 50    | 50     | 50     | 50     | 50    |  |  |  |  |  |  |  |  | 0.00   |
| Myristyl dimethylamine                  | ug/l                              | TM103/PM59  | TBC                       | 50    | 50    | 50     | 50     | 50     | 50    |  |  |  |  |  |  |  |  | 0      |

## Appendix 3 – Groundwater sampling results July – December 2016

### Borehole 3 CMT 1 (upper)

| Permit Number                           | EPR/AB3101MW                      | Operator    | Cuadrilla Bowland Limited |             |             |        |        |        |        |        |        |        |        |        |        |        |             |
|---|-----------------------------------|-------------|---------------------------|-------------|-------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|-------------|
| Facility                                | Preston New Road Exploration Site | Form Number | Groundwater 1             |             |             |        |        |        |        |        |        |        |        |        |        |        |             |
| <b>BH03 (CMT 1)</b>                     |                                   |             |                           |             |             |        |        |        |        |        |        |        |        |        |        |        |             |
| Substance/ Parameter                    | Units                             | Test Method | Trigger Level             | Jul-16      | Aug-16      | Sep-16 | Oct-16 | Nov-16 | Dec-16 | Jan-17 | Feb-17 | Mar-17 | Apr-17 | May-17 | Jun-17 | Jul-17 | Uncertainty |
| Dissolved Aluminium <sup>#</sup>        | ug/l                              | TM30/PM14   | TBC                       | Not Sampled | Not Sampled | 20     | 20     | 20     | 20     |        |        |        |        |        |        |        | 0.00        |
| Dissolved Antimony <sup>#</sup>         | ug/l                              | TM30/PM14   | TBC                       | Not Sampled | Not Sampled | 2      | 2      | 2      | 2      |        |        |        |        |        |        |        | 0.00        |
| Dissolved Arsenic <sup>#</sup>          | ug/l                              | TM30/PM14   | TBC                       | Not Sampled | Not Sampled | 4      | 9.3    | 11.2   | 11.8   |        |        |        |        |        |        |        | 3.48        |
| Dissolved Barium <sup>#</sup>           | ug/l                              | TM30/PM14   | TBC                       | Not Sampled | Not Sampled | 40     | 44     | 43     | 46     |        |        |        |        |        |        |        | 2.45        |
| Dissolved Beryllium                     | ug/l                              | TM30/PM14   | TBC                       | Not Sampled | Not Sampled | 0.5    | 0.5    | 0.5    | 0.5    |        |        |        |        |        |        |        | 0.00        |
| Dissolved Boron                         | ug/l                              | TM30/PM14   | TBC                       | Not Sampled | Not Sampled | 56     | 56     | 54     | 57     |        |        |        |        |        |        |        | 1.23        |
| Dissolved Cadmium <sup>#</sup>          | ug/l                              | TM30/PM14   | TBC                       | Not Sampled | Not Sampled | 0.5    | 0.5    | 0.5    | 0.5    |        |        |        |        |        |        |        | 0.00        |
| Dissolved Calcium <sup>#</sup>          | mg/l                              | TM30/PM14   | TBC                       | Not Sampled | Not Sampled | 119.1  | 119.6  | 118.1  | 109.7  |        |        |        |        |        |        |        | 4.57        |
| Total Dissolved Chromium <sup>#</sup>   | ug/l                              | TM30/PM14   | TBC                       | Not Sampled | Not Sampled | 1.5    | 1.5    | 1.5    | 1.5    |        |        |        |        |        |        |        | 0.00        |
| Dissolved Cobalt <sup>#</sup>           | ug/l                              | TM30/PM14   | TBC                       | Not Sampled | Not Sampled | 2      | 2      | 2      | 2      |        |        |        |        |        |        |        | 0.00        |
| Dissolved Copper <sup>#</sup>           | ug/l                              | TM30/PM14   | TBC                       | Not Sampled | Not Sampled | 7      | 7      | 7      | 7      |        |        |        |        |        |        |        | 0.00        |
| Total Dissolved Iron <sup>#</sup>       | ug/l                              | TM30/PM14   | TBC                       | Not Sampled | Not Sampled | 2012   | 590    | 425    | 402    |        |        |        |        |        |        |        | 758.87      |
| Dissolved Lead <sup>#</sup>             | ug/l                              | TM30/PM14   | TBC                       | Not Sampled | Not Sampled | 5      | 5      | 5      | 5      |        |        |        |        |        |        |        | 0.00        |
| Dissolved Lithium                       | ug/l                              | TM30/PM14   | TBC                       | Not Sampled | Not Sampled | 12     | 12     | 14     | 14     |        |        |        |        |        |        |        | 1.13        |
| Dissolved Magnesium <sup>#</sup>        | mg/l                              | TM30/PM14   | TBC                       | Not Sampled | Not Sampled | 35.3   | 34.9   | 34.1   | 32.1   |        |        |        |        |        |        |        | 1.40        |
| Dissolved Mercury <sup>#</sup>          | ug/l                              | TM30/PM14   | TBC                       | Not Sampled | Not Sampled | 1      | 1      | 1      | 1      |        |        |        |        |        |        |        | 0.00        |
| Dissolved Nickel <sup>#</sup>           | ug/l                              | TM30/PM14   | TBC                       | Not Sampled | Not Sampled | 2      | 2      | 2      | 2      |        |        |        |        |        |        |        | 0.00        |
| Dissolved Potassium <sup>#</sup>        | mg/l                              | TM30/PM14   | TBC                       | Not Sampled | Not Sampled | 1.9    | 2.1    | 2.1    | 1.8    |        |        |        |        |        |        |        | 0.15        |
| Dissolved Selenium <sup>#</sup>         | ug/l                              | TM30/PM14   | TBC                       | Not Sampled | Not Sampled | 3      | 3      | 3      | 3      |        |        |        |        |        |        |        | 0.00        |
| Dissolved Silver                        | ug/l                              | TM30/PM14   | TBC                       | Not Sampled | Not Sampled | 5      | 5      | 5      | 5      |        |        |        |        |        |        |        | 0.00        |
| Dissolved Sodium <sup>#</sup>           | mg/l                              | TM30/PM14   | TBC                       | Not Sampled | Not Sampled | 32.4   | 31.9   | 31.6   | 28.9   |        |        |        |        |        |        |        | 1.54        |
| Dissolved Strontium                     | ug/l                              | TM30/PM14   | TBC                       | Not Sampled | Not Sampled | 565    | 564    | 543    | 550    |        |        |        |        |        |        |        | 10.57       |
| Dissolved Vanadium <sup>#</sup>         | ug/l                              | TM30/PM14   | TBC                       | Not Sampled | Not Sampled | 1.5    | 1.5    | 1.5    | 1.5    |        |        |        |        |        |        |        | 0.00        |
| Dissolved Zinc <sup>#</sup>             | ug/l                              | TM30/PM14   | TBC                       | Not Sampled | Not Sampled | 3      | 3      | 3      | 3      |        |        |        |        |        |        |        | 0.00        |
| EPH (C8-C40) <sup>#</sup>               | ug/l                              | TM5/PM30    | TBC                       | Not Sampled | Not Sampled | 10     | 10     | 10     | 10     |        |        |        |        |        |        |        | 0.00        |
| GRO (>C4-C8) <sup>#</sup>               | ug/l                              | TM36/PM12   | TBC                       | Not Sampled | Not Sampled | 10     | 39     | 10     | 10     |        |        |        |        |        |        |        | 14.21       |
| GRO (>C8-C12) <sup>#</sup>              | ug/l                              | TM36/PM12   | TBC                       | Not Sampled | Not Sampled | 10     | 18     | 10     | 10     |        |        |        |        |        |        |        | 3.92        |
| GRO (>C4-C12) <sup>#</sup>              | ug/l                              | TM36/PM12   | TBC                       | Not Sampled | Not Sampled | 10     | 57     | 10     | 10     |        |        |        |        |        |        |        | 23.03       |
| MTBE <sup>#</sup>                       | ug/l                              | TM31/PM12   | TBC                       | Not Sampled | Not Sampled | 5      | 5      | 5      | 5      |        |        |        |        |        |        |        | 0.00        |
| Benzene <sup>#</sup>                    | ug/l                              | TM31/PM12   | TBC                       | Not Sampled | Not Sampled | 5      | 5      | 5      | 5      |        |        |        |        |        |        |        | 0.00        |
| Toluene <sup>#</sup>                    | ug/l                              | TM31/PM12   | TBC                       | Not Sampled | Not Sampled | 5      | 5      | 5      | 5      |        |        |        |        |        |        |        | 0.00        |
| Ethylbenzene <sup>#</sup>               | ug/l                              | TM31/PM12   | TBC                       | Not Sampled | Not Sampled | 5      | 5      | 5      | 5      |        |        |        |        |        |        |        | 0.00        |
| m/p-Xylene <sup>#</sup>                 | ug/l                              | TM31/PM12   | TBC                       | Not Sampled | Not Sampled | 5      | 5      | 5      | 5      |        |        |        |        |        |        |        | 0.00        |
| o-Xylene <sup>#</sup>                   | ug/l                              | TM31/PM12   | TBC                       | Not Sampled | Not Sampled | 5      | 5      | 5      | 5      |        |        |        |        |        |        |        | 0.00        |
| Fluoride                                | mg/l                              | TM27/PM0    | TBC                       | Not Sampled | Not Sampled | 0.3    | 0.3    | 0.3    | 0.3    |        |        |        |        |        |        |        | 0.00        |
| Bromide                                 | mg/l                              | TM27/PM0    | TBC                       | Not Sampled | Not Sampled | 0.11   | 0.14   | 0.05   | 0.12   |        |        |        |        |        |        |        | 0.04        |
| Chloride <sup>#</sup>                   | mg/l                              | TM38/PM0    | TBC                       | Not Sampled | Not Sampled | 55.5   | 45.2   | 53.9   | 56.6   |        |        |        |        |        |        |        | 5.08        |
| Nitrate as NO3 <sup>#</sup>             | mg/l                              | TM38/PM0    | TBC                       | Not Sampled | Not Sampled | 0.2    | 9.6    | 0.4    | 0.2    |        |        |        |        |        |        |        | 4.57        |
| Nitrite as NO2 <sup>#</sup>             | mg/l                              | TM38/PM0    | TBC                       | Not Sampled | Not Sampled | 0.02   | 0.02   | 0.02   | 0.02   |        |        |        |        |        |        |        | 0.00        |
| Ammoniacal Nitrogen as NH4 <sup>#</sup> | mg/l                              | TM38/PM0    | TBC                       | Not Sampled | Not Sampled | 0.03   | 0.03   | 0.04   | 0.04   |        |        |        |        |        |        |        | 0.01        |
| Dissolved Ethene <sup>#</sup>           | ug/l                              | TM25/PM0    | TBC                       | Not Sampled | Not Sampled | 1      | 1      | 1      | 1      |        |        |        |        |        |        |        | 0.00        |
| Dissolved Ethane <sup>#</sup>           | ug/l                              | TM25/PM0    | TBC                       | Not Sampled | Not Sampled | 1      | 1      | 1      | 1      |        |        |        |        |        |        |        | 0.00        |
| Dissolved Butane                        | ug/l                              | TM25/PM0    | TBC                       | Not Sampled | Not Sampled | 2      | 2      | 2      | 2      |        |        |        |        |        |        |        | 0.00        |
| Dissolved Propane                       | ug/l                              | TM25/PM0    | TBC                       | Not Sampled | Not Sampled | 2      | 2      | 2      | 2      |        |        |        |        |        |        |        | 0.00        |
| Dissolved Methane                       | mg/l                              | GC-IRMS     | TBC                       | Not Sampled | Not Sampled | 0.01   | 0.02   | 0.02   | 0.02   |        |        |        |        |        |        |        | 0.00        |
| Dissolved Carbon Dioxide                | mg/l                              | GC-IRMS     | TBC                       | Not Sampled | Not Sampled | 27.6   | 29.8   | 25.5   | 30.07  |        |        |        |        |        |        |        | 2.09        |
| δ13C - CH4                              | ppm ‰ VPDB                        | GC-IRMS     | TBC                       | Not Sampled | Not Sampled | 0      | 0      | 0      | 0      |        |        |        |        |        |        |        | 0.00        |
| δ13C - CO2                              | ppm ‰ VPDB                        | GC-IRMS     | TBC                       | Not Sampled | Not Sampled | -27.62 | -25.41 | 29.16  | -29    |        |        |        |        |        |        |        | 27.72       |
| Total Alkalinity as CaCO3 <sup>#</sup>  | mg/l                              | TM75/PM0    | TBC                       | Not Sampled | Not Sampled | 324    | 348    | 348    | 342    |        |        |        |        |        |        |        | 11.13       |
| Acrylamide                              | ug/l                              | TM103/PM59  | TBC                       | Not Sampled | Not Sampled | 50     | 50     | 50     | 50     |        |        |        |        |        |        |        | 0.00        |
| Laurylamine                             | ug/l                              | TM103/PM59  | TBC                       | Not Sampled | Not Sampled | 50     | 50     | 50     | 50     |        |        |        |        |        |        |        | 0.00        |
| Hydroxyethyl ethylene diamine           | ug/l                              | TM103/PM59  | TBC                       | Not Sampled | Not Sampled | 50     | 50     | 50     | 50     |        |        |        |        |        |        |        | 0.00        |
| Myristyl dimethylamine                  | ug/l                              | TM103/PM59  | TBC                       | Not Sampled | Not Sampled | 50     | 50     | 50     | 50     |        |        |        |        |        |        |        | 0.00        |
| Octyldimethylamine                      | ug/l                              | TM103/PM59  | TBC                       | Not Sampled | Not Sampled | 50     | 50     | 50     | 50     |        |        |        |        |        |        |        | 0.00        |
| para Phenylene diamine                  | ug/l                              | TM103/PM59  | TBC                       | Not Sampled | Not Sampled | 50     | 50     | 50     | 50     |        |        |        |        |        |        |        | 0.00        |
| BOD (Settled) <sup>#</sup>              | mg/l                              | TM58/PM0    | TBC                       | Not Sampled | Not Sampled | 2      | 1      | 1      | 1      |        |        |        |        |        |        |        |             |

## **Appendix 3 – Groundwater sampling results July – December 2016**

## Borehole 3 CMT 5 (lower)

### Appendix 3 – Groundwater sampling results July – December 2016

#### Borehole 4A (upper)

| Permit Number                 | EPR/AB3101MW                      | Operator    | Cuadrilla Bowland Limited |        |        |        |        |           |        |        |        |        |        |        |        |        |             |
|-------------------------------|-----------------------------------|-------------|---------------------------|--------|--------|--------|--------|-----------|--------|--------|--------|--------|--------|--------|--------|--------|-------------|
| Facility                      | Preston New Road Exploration Site | Form Number | Groundwater 1             |        |        |        |        |           |        |        |        |        |        |        |        |        |             |
| <b>BH04 (A)</b>               |                                   |             |                           |        |        |        |        |           |        |        |        |        |        |        |        |        |             |
| Substance/ Parameter          | Units                             | Test Method | Trigger Level             | Jul-16 | Aug-16 | Sep-16 | Oct-16 | Nov-16    | Dec-16 | Jan-17 | Feb-17 | Mar-17 | Apr-17 | May-17 | Jun-17 | Jul-17 | Uncertainty |
| Dissolved Aluminium #         | ug/l                              | TM30/PM14   | TBC                       | 20     | 20     | 20     | 20     | 20        | 20     |        |        |        |        |        |        |        | 0.00        |
| Dissolved Antimony #          | ug/l                              | TM30/PM14   | TBC                       | 2      | 2      | 2      | 2      | 2         | 2      |        |        |        |        |        |        |        | 0.00        |
| Dissolved Arsenic #           | ug/l                              | TM30/PM14   | TBC                       | 2.5    | 2.5    | 2.5    | 2.5    | 3         | 2.5    |        |        |        |        |        |        |        | 0.16        |
| Dissolved Barium #            | ug/l                              | TM30/PM14   | TBC                       | 130    | 134    | 133    | 146    | 123       | 130    |        |        |        |        |        |        |        | 6.07        |
| Dissolved Beryllium           | ug/l                              | TM30/PM14   | TBC                       | 0.5    | 0.5    | 0.5    | 0.5    | 0.5       | 0.5    |        |        |        |        |        |        |        | 0.00        |
| Dissolved Boron               | ug/l                              | TM30/PM14   | TBC                       | 35     | 25     | 30     | 31     | 34        | 37     |        |        |        |        |        |        |        | 3.43        |
| Dissolved Cadmium #           | ug/l                              | TM30/PM14   | TBC                       | 0.5    | 0.5    | 0.5    | 0.5    | 0.5       | 0.5    |        |        |        |        |        |        |        | 0.00        |
| Dissolved Calcium #           | mg/l                              | TM30/PM14   | TBC                       | 123    | 120.8  | 120.3  | 120.6  | 119.9     | 112.8  |        |        |        |        |        |        |        | 2.79        |
| Total Dissolved Chromium #    | ug/l                              | TM30/PM14   | TBC                       | 1.5    | 1.5    | 1.5    | 1.5    | 1.5       | 1.5    |        |        |        |        |        |        |        | 0.00        |
| Dissolved Cobalt #            | ug/l                              | TM30/PM14   | TBC                       | 2      | 2      | 2      | 2      | 2         | 2      |        |        |        |        |        |        |        | 0.00        |
| Dissolved Copper #            | ug/l                              | TM30/PM14   | TBC                       | 7      | 7      | 7      | 7      | 7         | 7      |        |        |        |        |        |        |        | 0.00        |
| Total Dissolved Iron #        | ug/l                              | TM30/PM14   | TBC                       | 20     | 20     | 20     | 20     | 20        | 20     |        |        |        |        |        |        |        | 0.00        |
| Dissolved Lead #              | ug/l                              | TM30/PM14   | TBC                       | 5      | 5      | 5      | 5      | 5         | 5      |        |        |        |        |        |        |        | 0.00        |
| Dissolved Lithium             | ug/l                              | TM30/PM14   | TBC                       | 15     | 12     | 9      | 9      | 8         | 10     |        |        |        |        |        |        |        | 2.07        |
| Dissolved Magnesium #         | mg/l                              | TM30/PM14   | TBC                       | 37.2   | 37.3   | 37.4   | 36.3   | 36        | 34.4   |        |        |        |        |        |        |        | 0.92        |
| Dissolved Mercury #           | ug/l                              | TM30/PM14   | TBC                       | 1      | 1      | 1      | 1      | 1         | 1      |        |        |        |        |        |        |        | 0.00        |
| Dissolved Nickel #            | ug/l                              | TM30/PM14   | TBC                       | 2      | 2      | 2      | 2      | 2         | 2      |        |        |        |        |        |        |        | 0.00        |
| Dissolved Potassium #         | mg/l                              | TM30/PM14   | TBC                       | 1.7    | 1.7    | 1.6    | 1.7    | 1.8       | 1.6    |        |        |        |        |        |        |        | 0.06        |
| Dissolved Selenium #          | ug/l                              | TM30/PM14   | TBC                       | 3      | 3      | 3      | 3      | 3         | 3      |        |        |        |        |        |        |        | 0.00        |
| Dissolved Silver              | ug/l                              | TM30/PM14   | TBC                       | 5      | 5      | 5      | 5      | 5         | 5      |        |        |        |        |        |        |        | 0.00        |
| Dissolved Sodium #            | mg/l                              | TM30/PM14   | TBC                       | 42.3   | 40.2   | 40.7   | 39.8   | 40.4      | 37.5   |        |        |        |        |        |        |        | 1.25        |
| Dissolved Strontium           | ug/l                              | TM30/PM14   | TBC                       | 236    | 220    | 232    | 227    | 219       | 225    |        |        |        |        |        |        |        | 5.33        |
| Dissolved Vanadium #          | ug/l                              | TM30/PM14   | TBC                       | 1.5    | 1.5    | 1.5    | 1.5    | 1.5       | 1.5    |        |        |        |        |        |        |        | 0.00        |
| Dissolved Zinc #              | ug/l                              | TM30/PM14   | TBC                       | 0      | 4      | 5      | 3      | 3         | 3      |        |        |        |        |        |        |        | 1.34        |
| EPH (C8-C40) #                | ug/l                              | TM5/PM30    | TBC                       | 10     | 10     | 10     | 10     | 10        | 10     |        |        |        |        |        |        |        | 0.00        |
| GRO (>C4-C8) #                | ug/l                              | TM36/PM12   | TBC                       | 10     | 10     | 10     | 31     | 10        | 10     |        |        |        |        |        |        |        | 6.86        |
| GRO (>C8-C12) #               | ug/l                              | TM36/PM12   | TBC                       | 10     | 10     | 10     | 10     | 10        | 10     |        |        |        |        |        |        |        | 0.00        |
| GRO (>C4-C12) #               | ug/l                              | TM36/PM12   | TBC                       | 10     | 10     | 10     | 31     | 10        | 10     |        |        |        |        |        |        |        | 6.86        |
| MTBE #                        | ug/l                              | TM31/PM12   | TBC                       | 5      | 5      | 5      | 5      | 5         | 5      |        |        |        |        |        |        |        | 0.00        |
| Benzene #                     | ug/l                              | TM31/PM12   | TBC                       | 5      | 5      | 5      | 5      | 5         | 5      |        |        |        |        |        |        |        | 0.00        |
| Toluene #                     | ug/l                              | TM31/PM12   | TBC                       | 5      | 5      | 5      | 5      | 5         | 5      |        |        |        |        |        |        |        | 0.00        |
| Ethylbenzene #                | ug/l                              | TM31/PM12   | TBC                       | 5      | 5      | 5      | 5      | 5         | 5      |        |        |        |        |        |        |        | 0.00        |
| m/p-Xylene #                  | ug/l                              | TM31/PM12   | TBC                       | 5      | 5      | 5      | 5      | 5         | 5      |        |        |        |        |        |        |        | 0.00        |
| o-Xylene #                    | ug/l                              | TM31/PM12   | TBC                       | 5      | 5      | 5      | 5      | 5         | 5      |        |        |        |        |        |        |        | 0.00        |
| Fluoride                      | mg/l                              | TM27/PM0    | TBC                       | 0.3    | 0.3    | 0.3    | 0.3    | 0.3       | 0.3    |        |        |        |        |        |        |        | 0.00        |
| Bromide                       | mg/l                              | TM27/PM0    | TBC                       | 0.11   | 0.08   | 0.09   | 0.14   | 0.05      | 0.12   |        |        |        |        |        |        |        | 0.03        |
| Chloride #                    | mg/l                              | TM38/PM0    | TBC                       | 81.9   | 82.6   | 80.9   | 82     | 79.6      | 83.2   |        |        |        |        |        |        |        | 1.03        |
| Nitrate as NO3 #              | mg/l                              | TM38/PM0    | TBC                       | 7.4    | 33.4   | 34.5   | 28.4   | 30.3      | 31.8   |        |        |        |        |        |        |        | 8.12        |
| Nitrite as NO2 #              | mg/l                              | TM38/PM0    | TBC                       | 0.07   | 0.02   | 0.02   | 0.02   | 0.02      | 0.02   |        |        |        |        |        |        |        | 0.02        |
| Ammoniacal Nitrogen as NH4 #  | mg/l                              | TM38/PM0    | TBC                       | 0.04   | 0.03   | 0.03   | 0.03   | 0.03      | 0.03   |        |        |        |        |        |        |        | 0.00        |
| Dissolved Ethene #            | ug/l                              | TM25/PM0    | TBC                       | 1      | 1      | 1      | 1      | 1         | 1      |        |        |        |        |        |        |        | 0.00        |
| Dissolved Ethane #            | ug/l                              | TM25/PM0    | TBC                       | 1      | 1      | 1      | 1      | 1         | 1      |        |        |        |        |        |        |        | 0.00        |
| Dissolved Butane              | ug/l                              | TM25/PM0    | TBC                       | 2      | 2      | 2      | 2      | 2         | 2      |        |        |        |        |        |        |        | 0.00        |
| Dissolved Propane             | ug/l                              | TM25/PM0    | TBC                       | 2      | 2      | 2      | 2      | 2         | 2      |        |        |        |        |        |        |        | 0.00        |
| Dissolved Methane             | mg/l                              | GC-IRMS     | TBC                       | 0.01   | 0.01   | 0.01   | 0.02   | No Result | 0.02   |        |        |        |        |        |        |        | 0.00        |
| Dissolved Carbon Dioxide      | mg/l                              | GC-IRMS     | TBC                       | 31.7   | 28     | 38.3   | 47.8   | No Result | 43.17  |        |        |        |        |        |        |        | 7.10        |
| δ13C - CH4                    | ppm %. VPDB                       | GC-IRMS     | TBC                       | 0      | 0      | 0      | 0      | No Result | 0      |        |        |        |        |        |        |        | 0.00        |
| δ13C - CO2                    | ppm %. VPDB                       | GC-IRMS     | TBC                       | -24.66 | -23.8  | -25.18 | -25.01 | No Result | -29.1  |        |        |        |        |        |        |        | 1.80        |
| Total Alkalinity as CaCO3 #   | mg/l                              | TM75/PM0    | TBC                       | 342    | 346    | 346    | 348    | 360       | 358    |        |        |        |        |        |        |        | 5.81        |
| Acrylamide                    | ug/l                              | TM103/PM59  | TBC                       | 50     | 50     | 50     | 50     | 50        | 50     |        |        |        |        |        |        |        | 0.00        |
| Laurylamine                   | ug/l                              | TM103/PM59  | TBC                       | 50     | 50     | 50     | 50     | 50        | 50     |        |        |        |        |        |        |        | 0.00        |
| Hydroxyethyl ethylene diamine | ug/l                              | TM103/PM59  | TBC                       | 50     | 50     | 50     | 50     | 50        | 50     |        |        |        |        |        |        |        | 0.00        |
| Myristyl dimethylamine        | ug/l                              | TM103/PM59  | TBC                       | 50     | 50     | 50     | 50     | 50        | 50     |        |        |        |        |        |        |        | 0.00        |
| Octyldimethylamine            | ug/l                              | TM103/PM59  | TBC                       | 50     | 50     | 50     | 50     | 50        | 50     |        |        |        |        |        |        |        | 0.00        |
| para phenylene diamine        | ug/l                              | TM103/PM59  | TBC                       | 50     | 50     | 50     | 50     | 50        | 50     |        |        |        |        |        |        |        | 0.00        |
| BOD (Settled) #               | mg/l                              | TM58/PM0    | TBC                       | 1      | 1      | 1      | 1      | 1         | 1      |        |        |        |        |        |        |        | 0.00        |
| COD (Settled) #               | mg/l                              | TM57/PM0    | TBC                       | 7      | 7      | 7      | 14     | 7         | 15     |        |        |        |        |        |        |        | 3.11        |
| pH #                          | pH units                          | TM73/PM0    | TBC                       | 7.59   | 7.8    | 7.56   | 7.67   | 7.41      | 7      |        |        |        |        |        |        |        |             |

### Appendix 3 – Groundwater sampling results July – December 2016

#### Borehole 4B (lower)

|                               |                                   |             |                           |        |        |        |        |        |        |        |        |        |        |        |        |        |             |  |
|-------------------------------|-----------------------------------|-------------|---------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|-------------|--|
| Permit Number                 | EPR/AB3101MW                      | Operator    | Cuadrilla Bowland Limited |        |        |        |        |        |        |        |        |        |        |        |        |        |             |  |
| Facility                      | Preston New Road Exploration Site | Form Number | Groundwater 1             |        |        |        |        |        |        |        |        |        |        |        |        |        |             |  |
| <b>BH04 (B)</b>               |                                   |             |                           |        |        |        |        |        |        |        |        |        |        |        |        |        |             |  |
| Substance/ Parameter          | Units                             | Test Method | Trigger Level             | Jul-16 | Aug-16 | Sep-16 | Oct-16 | Nov-16 | Dec-16 | Jan-17 | Feb-17 | Mar-17 | Apr-17 | May-17 | Jun-17 | Jul-17 | Uncertainty |  |
| Dissolved Aluminium #         | ug/l                              | TM30/PM14   | TBC                       | 20     | 20     | 20     | 20     | 20     | 20     |        |        |        |        |        |        |        | 0.00        |  |
| Dissolved Antimony #          | ug/l                              | TM30/PM14   | TBC                       | 2      | 2      | 2      | 2      | 2      | 2      |        |        |        |        |        |        |        | 0.00        |  |
| Dissolved Arsenic #           | ug/l                              | TM30/PM14   | TBC                       | 2.5    | 2.5    | 17.1   | 18.6   | 18.8   | 16.7   |        |        |        |        |        |        |        | 6.36        |  |
| Dissolved Barium #            | ug/l                              | TM30/PM14   | TBC                       | 90     | 74     | 68     | 72     | 60     | 66     |        |        |        |        |        |        |        | 8.19        |  |
| Dissolved Beryllium           | ug/l                              | TM30/PM14   | TBC                       | 0.5    | 0.5    | 0.5    | 0.5    | 0.5    | 0.5    |        |        |        |        |        |        |        | 0.00        |  |
| Dissolved Boron               | ug/l                              | TM30/PM14   | TBC                       | 46     | 43     | 44     | 43     | 45     | 46     |        |        |        |        |        |        |        | 1.10        |  |
| Dissolved Cadmium #           | ug/l                              | TM30/PM14   | TBC                       | 0.5    | 0.5    | 0.5    | 0.5    | 0.5    | 0.5    |        |        |        |        |        |        |        | 0.00        |  |
| Dissolved Calcium #           | mg/l                              | TM30/PM14   | TBC                       | 121.3  | 122.1  | 122.1  | 121.2  | 121.7  | 111.4  |        |        |        |        |        |        |        | 3.37        |  |
| Total Dissolved Chromium #    | ug/l                              | TM30/PM14   | TBC                       | 1.5    | 1.5    | 1.5    | 1.5    | 1.5    | 1.5    |        |        |        |        |        |        |        | 0.00        |  |
| Dissolved Cobalt #            | ug/l                              | TM30/PM14   | TBC                       | 2      | 2      | 2      | 2      | 2      | 2      |        |        |        |        |        |        |        | 0.00        |  |
| Dissolved Copper #            | ug/l                              | TM30/PM14   | TBC                       | 7      | 7      | 7      | 7      | 7      | 7      |        |        |        |        |        |        |        | 0.00        |  |
| Total Dissolved Iron #        | ug/l                              | TM30/PM14   | TBC                       | 20     | 20     | 3340   | 1921   | 1115   | 1076   |        |        |        |        |        |        |        | 1005.31     |  |
| Dissolved Lead #              | ug/l                              | TM30/PM14   | TBC                       | 5      | 5      | 5      | 5      | 5      | 5      |        |        |        |        |        |        |        | 0.00        |  |
| Dissolved Lithium             | ug/l                              | TM30/PM14   | TBC                       | 14     | 14     | 14     | 12     | 14     | 14     |        |        |        |        |        |        |        | 0.65        |  |
| Dissolved Magnesium #         | mg/l                              | TM30/PM14   | TBC                       | 36.1   | 35.9   | 36.6   | 35.5   | 35.6   | 33.2   |        |        |        |        |        |        |        | 0.95        |  |
| Dissolved Mercury #           | ug/l                              | TM30/PM14   | TBC                       | 1      | 1      | 1      | 1      | 1      | 1      |        |        |        |        |        |        |        | 0.00        |  |
| Dissolved Nickel #            | ug/l                              | TM30/PM14   | TBC                       | 3      | 2      | 2      | 2      | 2      | 2      |        |        |        |        |        |        |        | 0.33        |  |
| Dissolved Potassium #         | mg/l                              | TM30/PM14   | TBC                       | 3      | 2.1    | 1.9    | 2      | 2.1    | 1.7    |        |        |        |        |        |        |        | 0.36        |  |
| Dissolved Selenium #          | ug/l                              | TM30/PM14   | TBC                       | 3      | 3      | 3      | 3      | 3      | 3      |        |        |        |        |        |        |        | 0.00        |  |
| Dissolved Silver              | ug/l                              | TM30/PM14   | TBC                       | 5      | 5      | 5      | 5      | 5      | 5      |        |        |        |        |        |        |        | 0.00        |  |
| Dissolved Sodium #            | mg/l                              | TM30/PM14   | TBC                       | 35.8   | 29.1   | 28.4   | 27.1   | 27.8   | 24.9   |        |        |        |        |        |        |        | 2.96        |  |
| Dissolved Strontium           | ug/l                              | TM30/PM14   | TBC                       | 525    | 532    | 568    | 559    | 531    | 559    |        |        |        |        |        |        |        | 14.68       |  |
| Dissolved Vanadium #          | ug/l                              | TM30/PM14   | TBC                       | 1.5    | 1.5    | 1.5    | 1.5    | 1.5    | 1.5    |        |        |        |        |        |        |        | 0.00        |  |
| Dissolved Zinc #              | ug/l                              | TM30/PM14   | TBC                       | 0      | 13     | 3      | 3      | 3      | 3      |        |        |        |        |        |        |        | 3.59        |  |
| EPH (C8-C40) #                | ug/l                              | TM5/PM30    | TBC                       | 10     | 10     | 10     | 10     | 10     | 10     |        |        |        |        |        |        |        | 0.00        |  |
| GRO (>C4-C8) #                | ug/l                              | TM36/PM12   | TBC                       | 10     | 10     | 10     | 27     | 10     | 10     |        |        |        |        |        |        |        | 5.55        |  |
| GRO (>C8-C12) #               | ug/l                              | TM36/PM12   | TBC                       | 10     | 10     | 10     | 10     | 10     | 10     |        |        |        |        |        |        |        | 0.00        |  |
| GRO (>C4-C12) #               | ug/l                              | TM36/PM12   | TBC                       | 10     | 10     | 10     | 27     | 10     | 10     |        |        |        |        |        |        |        | 5.55        |  |
| MTBE #                        | ug/l                              | TM31/PM12   | TBC                       | 5      | 5      | 5      | 5      | 5      | 5      |        |        |        |        |        |        |        | 0.00        |  |
| Benzene #                     | ug/l                              | TM31/PM12   | TBC                       | 5      | 5      | 5      | 5      | 5      | 5      |        |        |        |        |        |        |        | 0.00        |  |
| Toluene #                     | ug/l                              | TM31/PM12   | TBC                       | 5      | 5      | 5      | 5      | 5      | 5      |        |        |        |        |        |        |        | 0.00        |  |
| Ethylbenzene #                | ug/l                              | TM31/PM12   | TBC                       | 5      | 5      | 5      | 5      | 5      | 5      |        |        |        |        |        |        |        | 0.00        |  |
| m/p-Xylene #                  | ug/l                              | TM31/PM12   | TBC                       | 5      | 5      | 5      | 5      | 5      | 5      |        |        |        |        |        |        |        | 0.00        |  |
| o-Xylene #                    | ug/l                              | TM31/PM12   | TBC                       | 5      | 5      | 5      | 5      | 5      | 5      |        |        |        |        |        |        |        | 0.00        |  |
| Fluoride                      | mg/l                              | TM27/PM0    | TBC                       | 0.3    | 0.3    | 0.3    | 0.3    | 0.3    | 0.3    |        |        |        |        |        |        |        | 0.00        |  |
| Bromide                       | mg/l                              | TM27/PM0    | TBC                       | 0.1    | 0.07   | 0.08   | 0.13   | 0.05   | 0.11   |        |        |        |        |        |        |        | 0.02        |  |
| Chloride #                    | mg/l                              | TM38/PM0    | TBC                       | 46.4   | 45.3   | 44     | 44.9   | 43.2   | 45.5   |        |        |        |        |        |        |        | 0.91        |  |
| Nitrate as NO3 #              | mg/l                              | TM38/PM0    | TBC                       | 0.2    | 0.6    | 0.2    | 0.2    | 0.2    | 0.2    |        |        |        |        |        |        |        | 0.13        |  |
| Nitrite as NO2 #              | mg/l                              | TM38/PM0    | TBC                       | 0.02   | 0.02   | 0.02   | 0.02   | 0.02   | 0.02   |        |        |        |        |        |        |        | 0.00        |  |
| Ammoniacal Nitrogen as NH4 #  | mg/l                              | TM38/PM0    | TBC                       | 0.16   | 0.06   | 0.03   | 0.05   | 0.04   | 0.05   |        |        |        |        |        |        |        | 0.04        |  |
| Dissolved Ethene #            | ug/l                              | TM25/PM0    | TBC                       | 1      | 1      | 1      | 1      | 1      | 1      |        |        |        |        |        |        |        | 0.00        |  |
| Dissolved Ethane #            | ug/l                              | TM25/PM0    | TBC                       | 1      | 1      | 1      | 1      | 1      | 1      |        |        |        |        |        |        |        | 0.00        |  |
| Dissolved Butane              | ug/l                              | TM25/PM0    | TBC                       | 2      | 2      | 2      | 2      | 2      | 2      |        |        |        |        |        |        |        | 0.00        |  |
| Dissolved Propane             | ug/l                              | TM25/PM0    | TBC                       | 2      | 2      | 2      | 2      | 2      | 2      |        |        |        |        |        |        |        | 0.00        |  |
| Dissolved Methane             | mg/l                              | GC-IRMS     | TBC                       | 0.01   | 0.01   | 0.01   | 0.02   | 0.02   | 0.06   |        |        |        |        |        |        |        | 0.02        |  |
| Dissolved Carbon Dioxide      | mg/l                              | GC-IRMS     | TBC                       | 25.5   | 23.8   | 28.4   | 36.5   | 36.4   | 36.94  |        |        |        |        |        |        |        | 4.84        |  |
| δ13C - CH4                    | ppm ‰. VPDB                       | GC-IRMS     | TBC                       | 0      | 0      | 0      | 0      | 0      | 0      |        |        |        |        |        |        |        | 0.00        |  |
| δ13C - CO2                    | ppm ‰. VPDB                       | GC-IRMS     | TBC                       | -23.48 | -23    | -26.97 | -24.95 | -33.47 | -28    |        |        |        |        |        |        |        | 3.09        |  |
| Total Alkalinity as CaCO3 #   | mg/l                              | TM75/PM0    | TBC                       | 460    | 376    | 336    | 352    | 336    | 350    |        |        |        |        |        |        |        | 37.79       |  |
| Acrylamide                    | ug/l                              | TM103/PM59  | TBC                       | 50     | 50     | 50     | 50     | 50     | 50     |        |        |        |        |        |        |        | 0.00        |  |
| Laurylamine                   | ug/l                              | TM103/PM59  | TBC                       | 50     | 50     | 50     | 50     | 50     | 50     |        |        |        |        |        |        |        | 0.00        |  |
| Hydroxyethyl ethylene diamine | ug/l                              | TM103/PM59  | TBC                       | 50     | 50     | 50     | 50     | 50     | 50     |        |        |        |        |        |        |        | 0.00        |  |
| Myristyl dimethylamine        | ug/l                              | TM103/PM59  | TBC                       | 50     | 50     | 50     | 50     | 50     | 50     |        |        |        |        |        |        |        | 0.00        |  |
| Octyldimethylamine            | ug/l                              | TM103/PM59  | TBC                       | 50     | 50     | 50     | 50     | 50     | 50     |        |        |        |        |        |        |        | 0.00        |  |
| para phenylene diamine        | ug/l                              | TM103/PM59  | TBC                       | 50     | 50     | 50     | 50     | 50     | 50     |        |        |        |        |        |        |        | 0.00        |  |
| BOD (Settled) #               | mg/l                              | TM58/PM0    | TBC                       | 1      | 1      | 3      | 1      | 1      | 1      |        |        |        |        |        |        |        | 0.65        |  |
| COD (Settled) #               | mg/l                              | TM57/PM0    | TBC                       | 23     | 7      | 7      | 9      | 12     | 15     |        |        |        |        |        |        |        | 4.92        |  |
| pH #                          | pH units                          | TM73/PM0    | TBC                       | 7.58   |        |        |        |        |        |        |        |        |        |        |        |        |             |  |